January 29, 2024

To Toyota Industries Corporation

Investigation Report
(Published Version)

Special Investigation Committee

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I. Background Leading Up to the Investigation and Overview of the Investigation

Part 1. Background Leading Up to the Investigation

In the second half of 2020, Toyota Industries Corporation ("**Toyota Industries**") submitted an application to the United Stated Environmental Protection Agency ("**EPA**") for annual certification for 2021 of gasoline and LPG[1] engines for industrial vehicles to be installed on forklifts and other vehicles in the U.S. market.[2] After submitting this application, Toyota Industries received an inquiry from the EPA concerning the data used in the certification application and responded, but in the process of responding, Toyota Industries discovered that there were doubts concerning the deterioration durability testing data[3] submitted to the EPA when the company obtained U.S. certification in the past and concerning deterioration durability testing methods. In response, Toyota Industries engaged outside attorneys to investigate gasoline and LPG engines for industrial vehicles for the U.S. market. Later, the outside attorneys expanded the scope of the investigation to include gasoline and LPG engines for industrial vehicles for the Japanese market, and further sequentially expanded the scope to diesel engines for industrial vehicles for both the U.S. and Japanese markets.

As a result of the investigation conducted by the outside attorneys, the possibility of violations of domestic laws and regulations was confirmed in relation to domestic emissions certification applications for diesel engines for industrial vehicles for the domestic market as well as applications for gasoline and LPG engines. The particulars of those potential violations were: the calculation of deterioration correction values[4] using estimated values without using the actual measured values of each component of emissions and setting the engine operating conditions required for that testing by partially modifying the engine control unit software ("**ECU Software**") in deterioration durability testing of 1KD Engines and 1ZS Engines, which are diesel engines for industrial vehicles for the Japanese market; and replacing parts during testing and failing to use the actual measured values of

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1 Abbreviation for Liquefied Petroleum Gas.

2 Under the U.S. system, it is necessary to apply for certification every year, but in cases where there are no changes to specifications, it is sufficient to submit the deterioration factors submitted when applying in the first year or at the time of the most recent model update. Accordingly, Toyota Industries submitted the deterioration factors that it submitted when it applied for certification in the past.

3 Deterioration durability testing is testing to confirm how much the emissions performance of an engine changes (how much it deteriorates) with the passage of operating time by operating the engine for a specified number of hours and measuring the emissions component values at each measurement time. For details, see II, Part 2-5 below.

4 Deterioration correction values are the differences between the emission values of an engine after deterioration (after a specified number of operating hours) and the emission values of the engine before deterioration. In the emissions certification applications for engines, the deterioration correction values calculated on the basis of the results of deterioration durability testing must be submitted. For details, see II, Part 2-4 and 5 below.

each component of the emissions when calculating the deterioration correction values in the deterioration durability testing of the 4Y Engine, which was a gasoline and LPG engine for industrial vehicles for the Japanese market. In response to this, Toyota Industries announced on March 17, 2023 that the possibility of violations of domestic laws and regulations had been confirmed. In light of the severity of the said conduct, Toyota Industries established the Special Investigation Committee ("**Committee**"), which is made up of independent outside experts with no interests in Toyota Industries, to elucidate the full details of this incident, analyze the fundamental causes, and compile measures to prevent any reoccurrence.

Part 2. Investigation System

The composition of the Committee is as follows.

Chairperson: Hiroshi Inoue (lawyer, certified fraud examiner and former superintending prosecutor of the Fukuoka High Public Prosecutors Office)

Member: Makoto Shimamoto (Advisor of Yamaha Motor Co., Ltd.)

Member: Haruka Matsuyama (lawyer)

Each member has no interests in Toyotas Industries and performed the investigation from an objective and neutral perspective.

In addition, attorney Satoshi Hirao and twelve other attorneys from the law firm of Nishimura & Asahi (Gaikokuho Kyodo Jigyo) ("**Nishimura & Asahi**") assisted the investigation by the Committee.

Part 3. Scope of the Investigation

The scope of the investigation that Toyota Industries entrusted to the Committee was determination of the existence of any improper conduct relating to domestic emissions certification of engines developed and produced by Toyota Industries, the particulars of any improper conduct, analysis of the causes, and recommendation of measures to prevent reoccurrence.

Engines for industrial vehicles developed and produced by Toyota Industries obtained emissions certification not only in Japan, but also in the U.S. and EU, but the scope of the investigation by the Committee was limited to improper conduct relating to emissions certification in Japan. The reason for this was that, with respect to emissions certification in the U.S. and EU, foreign authorities conducted investigations and voluntary reporting etc. to foreign authorities were made prior to or in parallel with the investigation by the Committee, and attorneys in each country engaged by Toyota Industries are responding, and consequently, there were concerns that under these circumstances, a deliberate investigation by the Committee of the facts relating to emissions certification in the U.S. and EU and disclosure of the results could interfere with the investigations and so on by the respective authorities in accordance with the legal systems of each country. That said, as discussed below, there are examples of acquisition of domestic emissions certification premised on emissions certification in the U.S. and EU, and the Committee decided that in such cases, it would conduct necessary investigations of conduct relating to emissions certification in the U.S. and EU to the extent such certification related to emissions certification in Japan.

When investigating the engines, the Committee did not limit its investigation to models that are currently in production, but included in the scope all engines for industrial vehicles that received certification after emission regulations for engines for industrial vehicles in general were tightened and the Tier 2 Regulations, which make mandatory the implementation of deterioration durability testing when applying for domestic certification, came into effect (application started on October 1, 2006). The scope of the Committee's investigation is whether there was any improper conduct relating to engines for industrial vehicles, and thus, the objective emissions performance of engines for industrial vehicles (i.e., whether the said engines for industrial vehicles have performance that satisfies the domestic emission regulations) is outside the scope of the investigation.[5]

Furthermore, Toyota Industries developed and produced not just engines for industrial vehicles, but also engines for automobiles for Toyota Motor Corporation ("**Toyota Motors**"),[6] and consequently, the Committee included in the scope of its investigation the issue of whether there was any impropriety in relation to emissions certification in Japan in relation to engines for automobiles. With regard to engines for automobiles, however, it was confirmed that Toyota Motors performed deterioration durability testing before obtaining automobile type designation, etc.[7] Toyota Motors performed deterioration durability testing of automobiles with the engines installed and that Toyota Industries did not perform any testing relating to emissions certification including deterioration durability testing.

On the other hand, during the process of the Committee's investigation, it was discovered that Toyota Industries performed some of the measurements of maximum output values stated in the table

5 As discussed below, as a result of Toyota Industries re-performing deterioration durability testing to confirm the emissions performance of some engines for industrial vehicles within the scope of the Committee's investigation (the 1KD Engine, 1ZS Engine, and 2020 1KD Engine for construction machinery), it was discovered that the emission values exceeded the regulation values specified in laws and regulations. In response to this, the Committee analyzed the technological causes of why the emissions performance of the said engines did not satisfy the regulations so that it could elucidate the reasons why this fact was not discovered through testing at the time of application for certification or inspections in the mass production stage (see Part 4-1(3), 2(3), and 5(3) below). However, these analyses were premised on the deterioration durability testing re-performed by Toyota Industries and the results obtained from technological verification of the test results, and the Committee did not independently verify the accuracy or reliability of such verification and so on.

6 Toyota Industries currently develops and produces diesel engines for automobiles and also produces gasoline engines for automobiles. Toyota Industries developed gasoline engines for automobiles until August 2007.

7 Apart from the automobile type designation, Toyota Motors had obtained device type designation of carbon monoxide, etc. emissions control devices for some of its engines for automobiles.

of specifications[8] submitted to the authorities when Toyota Motors obtained type designation for automobiles, etc., and when measuring maximum output values, there were instances where the fuel injection amounts were modified. Because of this, the Committee decided to confirm whether there was any improper conduct, such as modification of fuel injection amounts, for those engines that Toyota Industries currently produces concerning which Toyota Industries measured the maximum output values stated in table of specifications.

Regarding automobile type designation, etc., of the items stated in the table of specifications, the Committee confirmed that Toyota Industries performed the measurements only for the maximum output values and there were no other items for which Toyota Industries performed the measurements.

Part 4. Overview of the Investigation

1 Collection and examination of relevant materials

The Committee gathered materials currently in existence in Toyota Industries relating to engines for industrial vehicles and engines for automobiles for the domestic market and examined the content of those materials. The relevant materials included, for example, organizational charts, internal rules, meeting materials, data relating to emissions performance, documents relating to applications for domestic certification, and documents relating to quality assurance and quality control systems.

Attorneys from Nishimura & Asahi conducted a partial investigation of the facts relating to this matter before establishment of the Committee. The Committee took possession of relevant materials that had previously been collected and records of interviews conducted by the attorneys from Nishimura & Asahi and received a briefing on the interim investigation results. The Committee examined some of these relevant materials as well, confirmed facts relating to impropriety, and analyzed the causes.

2 Interviews of concerned persons and forensic investigation

(1) Interviews

Starting on March 17, 2023, the Committee conducted interviews (including written questions and answers) of 72 persons related to Toyota Industries.

A summary thereof is as follows.

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8 The “**table of specifications**” refers to a document to be submitted as an attachment at the time of vehicle type designation, etc., application, in which structure, equipment and performance of an automobile are stated (Vehicle Type Designation Regulations, Article 3, Paragraph 2, Item 1). The values stated in the table of specifications are called “**specification values**.”

Toyota Industries officers (including former officers): Six persons
Toyota Industries Engine Division employees: 53 persons
Toyota Industries Toyota Material Handling Company employees: 11 persons
Toyota Industries Head Office function employees: Two persons

(2) Forensic investigation

The outside attorneys engaged by Toyota Industries to conduct investigation of gasoline and LPG engines for industrial vehicles for the U.S. market and diesel engines for industrial vehicles for the U.S. market performed preservation work for data stored on PCs (26 units), email servers, and file servers used by officers and employees within the scope of the investigation.

Of the data preserved by the outside attorneys referenced above before the Committee's investigation, data relating to 35 officers and employees involved in development work for engines for industrial vehicles for the domestic market were searched using keywords, and a data review was performed.

Furthermore, as stated in Part 3 above, improper conduct relating to the measurement of maximum output values of engines for automobiles was discovered in the process of the Committee's investigation, and therefore, the Committee preserved the data of three additional officers and employees who were involved in the development work for engines for automobiles and performed a data review.

3 Establishment of reporting hotline

On March 31, 2023, the Committee established an email address for receiving reports and on the same day informed all current employees in the Toyota Industries Engine Division and Toyota Material Handling Company. The reporting hotline received a total of 52 reports, and the Committee conducted necessary investigations based on the details of those reports.

4 Examination of responses to questionnaires conducted by Toyota Industries

Before establishment of the Committee, Toyota Industries periodically and from time to time conducted various questionnaires relating to compliance, quality, and so on. The Committee obtained the results of and relevant materials relating to the following surveys, examined those materials, and conducted necessary investigations based on the results: (i) quality awareness survey,[9] (ii) employee compliance awareness survey,[10] (iii) employee awareness survey,[11] and (iv) work risk survey questionnaire.[12]

5 Reference date for investigations conducted by the Committee

The Committee was established on March 17, 2023. The reference date for the Committee's investigation report ("**Reference Date**") is January 29, 2024.

The investigation results in Section II below summarize the facts and so on discovered as a result of the Committee's investigation up to the Reference Date, and if new facts and the like are subsequently discovered, the Committee's conclusions and so on are subject to change.

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9 The quality awareness survey is a questionnaire survey conducted by the Quality Management Dept. from 2015 to 2018. The Quality Management Dept. conducted the quality awareness survey on all employees for the purposes of ascertaining the current status of quality awareness companywide, using the information in quality awareness raising activities companywide and in business divisions, and understanding the conduct required of each individual to enhance quality by having them respond to the quality awareness survey questionnaire.

10 The employee compliance awareness survey is a questionnaire survey conducted by the Compliance Subcommittee since 2018. The Compliance Subcommittee was established as a sub-organization of the CSR Committee, which was established under the direct authority of the president of Toyota Industries, to carry out inter-organizational compliance measures in business divisions and affiliated companies. The Compliance Subcommittee had implemented a variety of measures to raise employee awareness of compliance and ensure rigorous compliance since before 2018 and conducted the employee compliance awareness survey on approximately 1400 employees randomly selected from the entire workforce to determine whether those measures had any effect, whether there were any excesses or deficiencies in those measures, and so on.

11 The employee awareness survey is a questionnaire survey conducted once annually by the Human Resources Dept. since 2008. The Human Resources Dept. conducts the employee awareness survey on all employees for the purpose of using the results for the improvement of various measures including enhancement of the workplace skills of each workplace and human resource development by determining the current status of employee awareness and workplace conditions.

12 The work risk survey questionnaire is a questionnaire survey conducted by the Audit Dept. in 2022. After issues relating to certification in the U.S. were confirmed in 2021, the Audit Dept. identified product regulation and certification as key risks to be confirmed in 2022 audits. The Audit Dept. then conducted an operational risk survey questionnaire on approximately 800 employees in Toyota Material Handling Company and the Engine Division.

II. Investigation Results

Part 1. Overview of Toyota Industries

1 Overview of current business

Basic information concerning Toyota Industries as set forth below.

Business purposes	Manufacture and sale of textile machinery, industrial vehicles, automobiles, and automobile parts, etc.
Capital	80.4 billion yen (as of March 31, 2023)
No. of employees	74,887 (as of March 31, 2023)
Net sales	3,379.8 billion yen (fiscal year ended March 31, 2023)
Operating income	169.9 billion yen (fiscal year ended March 31, 2023)
Pre-tax profit	262.9 billion yen (fiscal year ended March 31, 2023)
Net profit	192.8 billion yen (fiscal year ended March 31, 2023)
Group companies	Tokyo Co., Ltd., Izumi Machine Mfg. Co., Ltd., and others

Toyota Industries' business is broadly divided into the textile machinery business, industrial vehicle business, automobile business, engine business, compressor business, electronics business, and battery business.

The textile machinery business is the founding business of the company. Sakichi Toyoda, the founder of the Toyota Group, established Toyoda Automatic Loom Works, Ltd. in 1926 to manufacture and sell the automatic loom (the Model G loom) that he invented, and this company became the origin of Toyota Industries (and by extension, the Toyota Group). Today, Toyota Industries manufactures and sells looms, spinning machines, fiber quality inspection equipment, and so on. Toyota Industries has the leading market share in the global market for air jet looms (2021 fiscal year).

Company building at the time of foundation

Model G Loom

Toyota Industries was established as a manufacturer of automatic looms, but later the company expanded into other business fields, leading to the development of its current business portfolio.

The industrial vehicle business was launched in 1956. Toyota Industries manufactures and sells industrial vehicles including forklifts and automatic loader/unloaders used in factories and warehouses, towing tractors used at airports and so on, and shovel loaders and other equipment used at construction sites. Toyota Industries has the leading market share in the global market for forklifts (2021 fiscal year).

Forklift

Loader/unloader

Towing tractor

Shovel loader

The automobile business has a long history, and its origins go back to the establishment of the Automobile Division in 1933 to manufacture automobiles. This led to the completion of a prototype of the Model A1 large passenger car in 1935, and in 1937, the Automobile Division was spun off and Toyota Motor Company, Ltd. (currently Toyota Motor Corporation) was established. In this way, the automobile manufacturing and sales business was transferred to Toyota Motors, but Toyota Industries continues to develop and manufacture some Toyota Motors brand automobiles under contract from Toyota Motors.

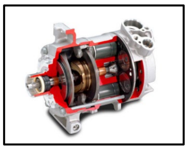
The engine business has a similarly long history. Toyota Industries successfully developed an automobile engine known as the Model A engine in 1934 and later manufactured and sold engines. Today, Toyota Industries manufactures and sells engines used in industrial vehicles as well as engines used in Toyota Motors automobiles. The majority of the engines used in industrial vehicles are used in Toyota Industries industrial vehicles, but some engines are sold externally and are used in industrial vehicles manufactured by outside customers. In addition, Toyota Industries manufactures and sells engines for ships, gas heat pumps (“**GHP**”), combined heat and power (“**CHP**”) systems, and engines for generators as a part of its engine business. Furthermore, the Engine Division manufactures constituent components of engines including turbochargers, camshafts, and various cast products.

1ZS Engine

1KD Engine

4Y Engine

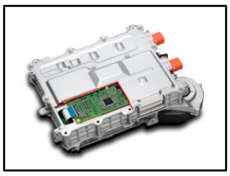
1FS Engine



Compressor

The compressor business was launched in 1960. Toyota Industries manufactures and sells air conditioning compressors for use in automobiles. Toyota Industries holds the world’s top market share for automotive air conditioner compressors (2021 fiscal year).

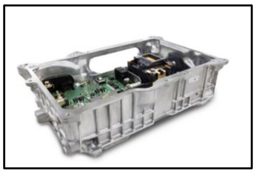
The electronics business is the business of manufacturing and selling electronics products for automobiles. The electronics business was started in 1987, when electronic components that had until that time been developed in each business division were consolidated in the newly-established Electronic Business Office. Toyota Industries manufactures and sells automotive electronic components such as onboard chargers, AC inverters for automobiles, and DC-DC converters.



Onboard charger

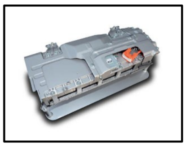
1500 W AC inverter

400 W AC inverter



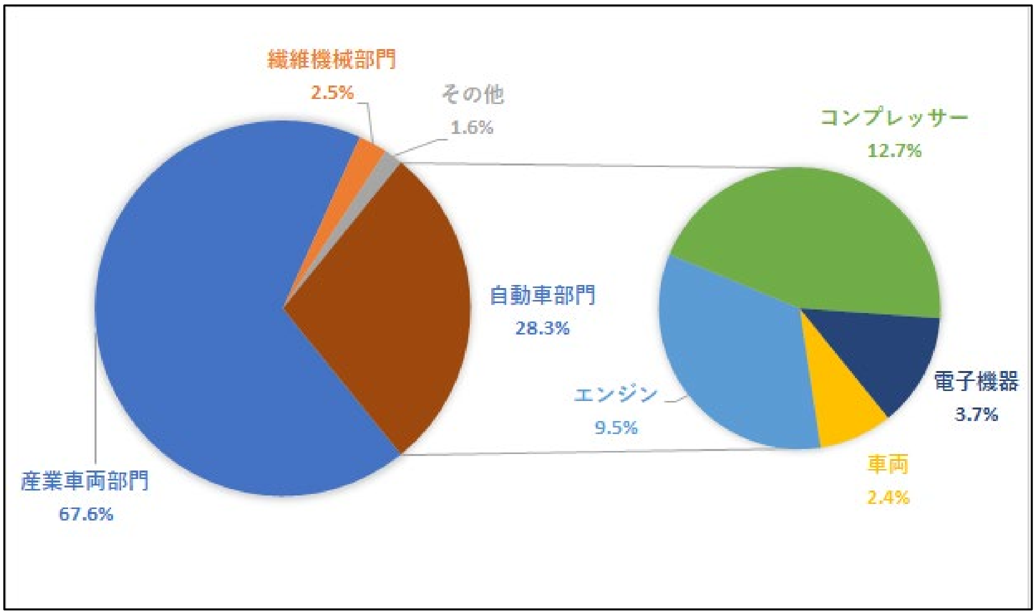
DC-DC converter

The battery business is a new business that was launched in 2021, and as one might expect, it is a business for automobiles. Toyota Industry currently manufactures and sells batteries for Toyota Motors hybrid automobiles.



Battery

Toyota Industries' segment sales (including subsidiaries) for the fiscal year ended March 2023 are as indicated below.[13]

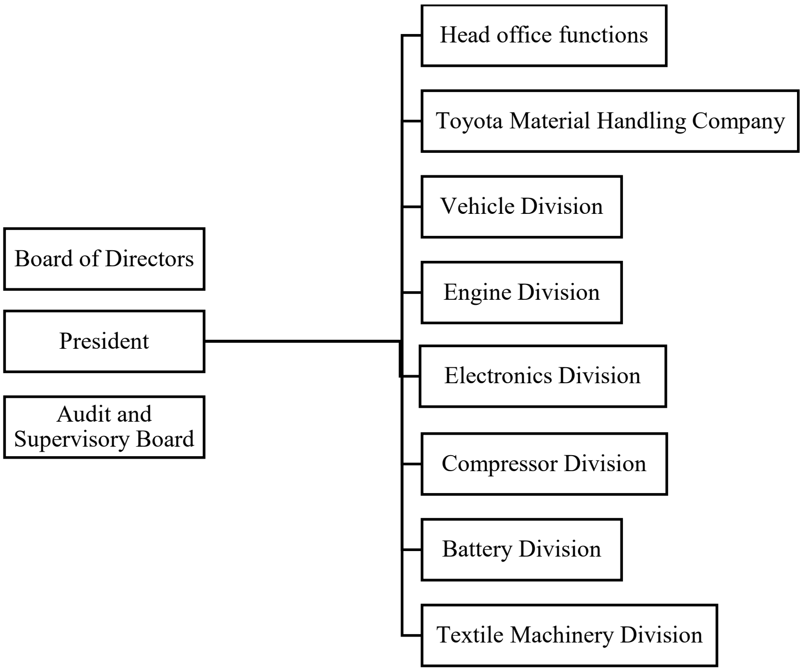


Left Diagram, from top clockwise:	Right Diagram, from top clockwise:
Textile Machinery Business 2.5% Other 1.6% Automobile Business 28.3% Industrial Vehicle Business 67.6%	Compressors 12.7% Electronic Devices 3.7% Vehicles 2.4% Engines 9.5%

13 In the pie chart, "other" constitutes primarily the sales of Toyota Industries subsidiaries including ground transportation services.

2 Organizational overview of Toyota Industries

An overview of Toyota Industries' organization is shown in the diagram below.



As stated above in 1, Toyota Industries' business is broadly divided into the textile machinery business, industrial vehicle business, automobile business, engine business, compressor business, electronics business, and battery business, and business divisions and business offices responsible for each business have been established. Toyota Material Handling Company (sometimes referred to as "**TMHC**"[14]) is an internal company of Toyota Industries that handles the industrial vehicles business.[15]

Like many companies that adopt a business divisions system, at Toyota Industries, each business division is independently responsible for its own profit and loss, and the results of a business division are evaluated based on its respective profit and loss.

3 Overview of the forklift business

As stated in 2 above, TMHC, which is an internal company, performs manufacture and sale of forklifts. Toyota Industries also manufactures in-house the main engines that are used in forklifts. Engines are manufactured by the Engine Division, and TMHC manufactures and sells forklifts using

14 "L&F" in Japanese, which refers to logistics and forklifts.

15 TMHC is Toyota Industries' sole internal company, but its organizational positioning is no different from that of other business divisions, and it is positioned as one business division.

engines supplied by the Engine Division.

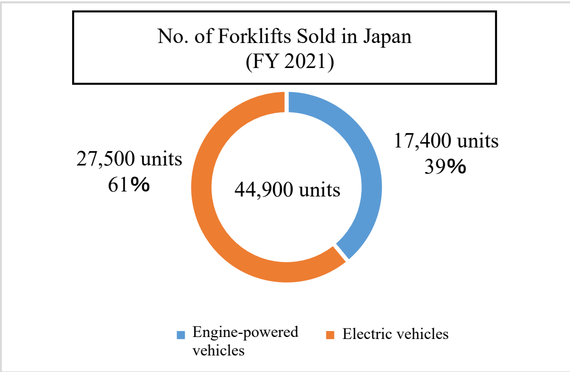
The main forklift engines currently manufactured in Japan are organized in the table below.

Engine Type	Model	No. of cylinders	Displacement	Max. output
Gasoline engine LPG engine Gasoline/LPG combined engine[16]	4Y	In-line 4 cylinders	2.2 L	32 kW 38 kW 44 kW
	1FS	In-line 4 cylinders	3.7 L	65 kW
Diesel engine	1ZS	In-line 3 cylinders	1.8 L	40 kW 41 kW
	1KD	In-line 4 cylinders	3.0 L	55 kW

In the history of the forklift business, a major turning point occurred in 2001 with the integration of manufacturing and sales. That is, until 2001, forklift development and manufacturing were performed by Toyota Industries, but product planning, marketing activities, and sales were performed by Toyota Motors. In 2001, however, a decision was made to transfer the product planning, marketing activity, and sales functions that had been performed by Toyota Motors until then to Toyota Industries with the aim of achieving more efficient business operations by integrating forklift product planning, development, production, marketing activities, and sales. In conjunction with this, TMHC was established as an internal company of Toyota Industries. TMHC is responsible for product planning, marketing activities, and sales as well as development and manufacturing of forklift bodies (referred to as "**Lift Truck**" in Toyota Industries), and a considerable number of officers and employees who formerly worked in forklift planning, marketing activities, and sales at Toyota Motors work transferred to TMHC.

[16] A gasoline engine refers to an engine that uses gasoline as fuel, an LPG engine refers to an engine that uses LPG as fuel, and a gasoline/LPG engine refers to an engine that uses both gasoline and LPG as fuel. The fundamental structures of gasoline engines, LPG engines, and gasoline/LPG engines are the same, and only the fuel supply systems are different (a gasoline engine has a gasoline fuel supply system, and LPG engine has an LPG fuel supply system, and a gasoline/LPG engine has a gasoline fuel supply system and an LPG fuel supply system). For this reason, the engine model names are the same. The 4Y Engine can use both gasoline and LPG as fuel and can also use compressed natural gas (CNG) as fuel (below, gasoline engines, LPG engines, and gasoline/LPG engines are collectively referred to as "**gasoline engines**").

In addition to forklifts powered by an engine (engine-powered vehicles), Toyota Industries also manufactures and sells forklifts powered by an electric motor (electric vehicles). The electrification of forklift power supplies has advanced further than automobiles, and in fiscal 2021, electric forklifts accounted for approximately 60% of all forklift sales in Japan. Although it is necessary to promote electrification to achieve carbon neutrality, there will also continue to be demand for engine-powered vehicles at worksites where high output is required or where there are issues with electric power supply, and Toyota Industries continues to manufacture engine-powered vehicles.



4 Overview of the Engine Division

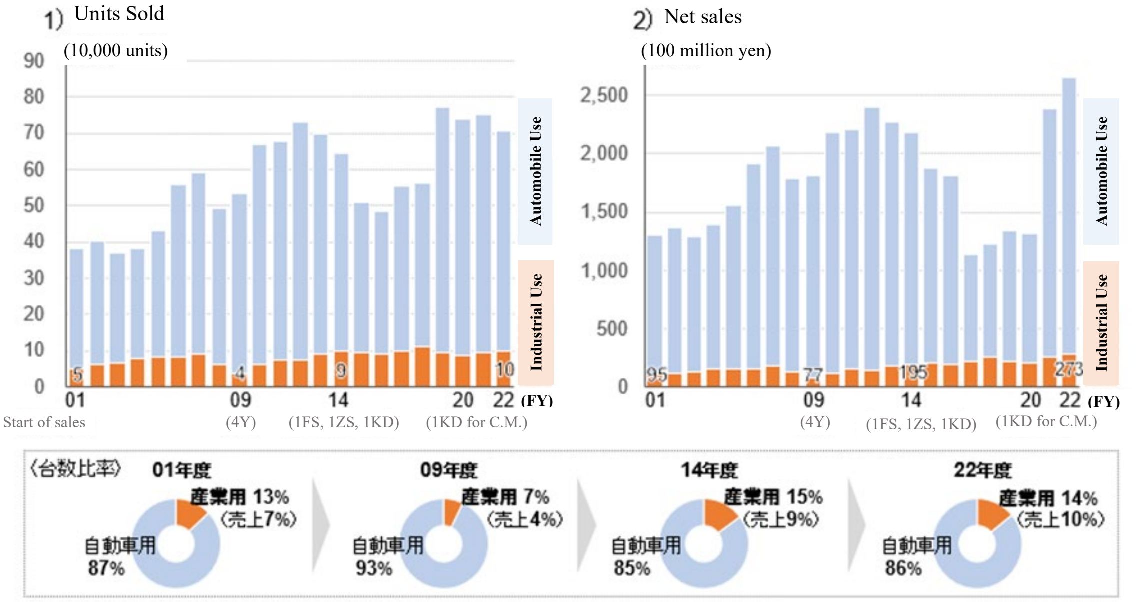
(1) Business overview of the Engine Division

The Engine Division manufactures engines installed in forklifts and other industrial vehicles as well as engines for automobiles used with Toyota Motors automobiles. In addition, the Engine Division manufactures and sells engines for ships, engines for GHP, engines for CHP, engines for generators, engines for pressure washers, and engines for other products (within Toyota Industries, engines other than automotive engines are referred to as “industrial engines”).

Automotive engines constitute the core of the engine business.

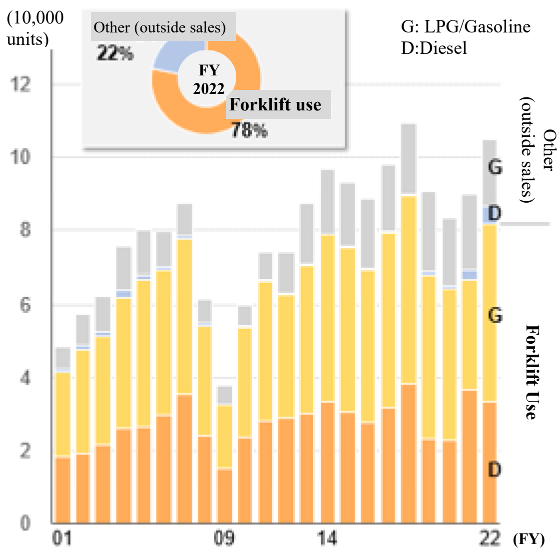
The figures below show changes in automotive engine and industrial engine sales volumes and net sales, but automotive engines account for the bulk of both metrics.

As stated above, sales of the industrial vehicle business, i.e., TMHC, account for more than 60% of Toyota Industries’ total net sales and can accurately be referred to as the backbone of Toyota Industries, but looking at the sales of the Engine Division, industrial engines account for only about 10% of net sales and do not have a large presence.



Percentage of Units	Translation from left to right:			
Year	FY 2001	FY 2009	FY 2014	FY 2022
Orange	**Industrial use 13%** (Sales 7%)	**Industrial use 7%** (Sales 4%)	**Industrial use 15%** (Sales 9%)	**Industrial use 14%** (Sales 10%)
Blue	Automobile use 87%	Automobile use 93%	Automobile use 85%	Automobile use 86%

Industrial engines are broadly divided into forklift engines for TMHC (some engines are also used on industrial vehicles other than forklifts, such as shovel loaders, manufactured by TMHC[17]) and other industrial engines. Other industrial engines are sold to external clients, and therefore, they are also referred to as "engines for outside sales" or "general-purpose engines."



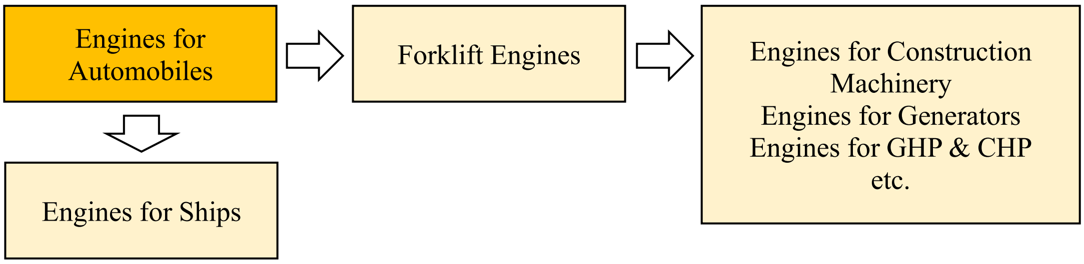
Changes in the number of industrial engines sold are shown in the figure to the right. Approximately 80% of industrial engines are Forklift Engines.

Here, the engine business can be summarized as follows from the perspective of expanding the product lineup.

First, automotive engines constitute the core of the engine business. Also, Toyota Industries

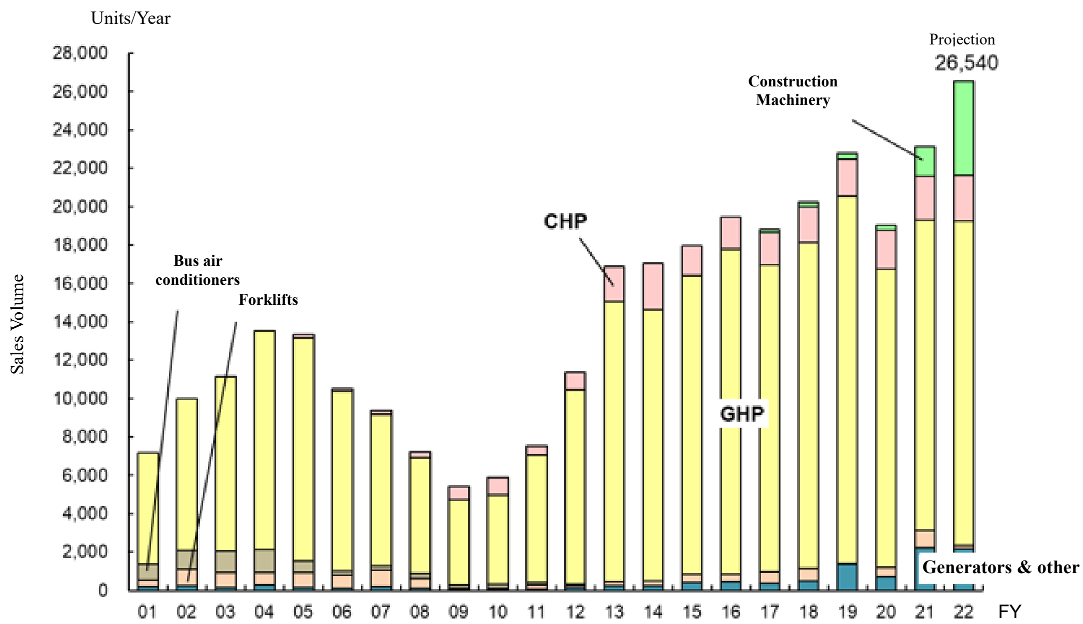
17 Specifically, the 2007 4Y Engine is used on shovel loaders, the 2007 1DZ Engine is used on shovel loaders and skid steer loaders, the 2009 4Y Engine is used on shovel loaders, the 1ZS Engine is used on shovel loaders, and the 2020 4Y Engine is used on shovel loaders. These engines for industrial vehicles other than forklifts are the same as the engines used on forklifts. In this report, these engines including those used on industrial vehicles other than forklifts specified above are referred to as "**Forklift Engines**".

develops Forklift Engines and engines for ships on the basis of the technologies and know-how accumulated in the automotive engines business. Furthermore, Toyota Industries develops engines for construction machinery and engines for generators, GHP, and CHP systems on the basis of the technology and know-how accumulated from forklift engines.



This lineup expansion of the engines for outside sales based on the technology and know-how gained from Forklift Engines have been a trend in the industrial engine business in recent years. The diesel engine for construction machinery ("**1KD Engine for Construction Machinery**") regarding which improper conduct was recently discovered is an engine for outside sales (general-purpose engine) that was developed based on the 1KD Engine for forklifts.

Changes in the number of engines for outside sales (general purpose engines) sold are shown in the figure below.



As shown above, the bulk of the engines for outside sales (general-purpose engines) were engines for GHP, but sales of the 1KD Engine for Construction Machinery started in 2017 and are increasing.

(2) Organizational overview of the Engine Division

The Engine Division comprises the Engineering Dept. No. 1, Engineering Dept. No. 2, Quality Assurance Dept., Regulation Certification & Administration Dept., and other departments. The total number of employees is approximately 3200.

Engineering Dept. No. 1 and Engineering Dept. No. 2 are responsible for engine development. Previously, the Engineering Dept. was not divided into two and was a single department, but for the reason discussed below, it was split up in September 2021 and development operations relating to diesel engines for automobiles and engines for industrial vehicles were divided, with preliminary development work, design work concerning diesel engines for automobiles, and design, calibration, and control work concerning diesel engines for industrial vehicles assigned to Engineering Dept. No. 1, and calibration work and control work concerning diesel engines for automobiles assigned to Engineering Dept. No. 2.[18]

Preliminary design work refers to the development of advanced technology that can be applied to both engines for automobiles and engines for industrial vehicles. Design work is the work of designing engines. Engine calibration work is the work of setting Control Parameters to optimal values for the purpose of controlling engine fuel consumption, exhaust, output and so on. Control work is the work of developing engine control unit systems ("**ECU**").

When explained from the perspective of emission regulations, engine calibration work and control work are closely related. Personnel in charge of control work create formulas for engine control, and personnel in charge of engine calibration work determine the specific values that will be applied to those formulas. For example, a method referred to as EGR[19], which after combustion recirculates a portion of the exhaust gas into the engine cylinders in addition to fresh air from outside ("**Fresh Air**"), is adopted on diesel engines in some cases as a means of reducing the generation of nitrogen oxides (hereinafter, sometimes referred to as "**NOx**").[20] Personnel in charge of control work create a formula to adjust the amount of exhaust gas that is recirculated into the engine cylinders, and personnel in

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18 Later, starting in January 2023, tasks were divided on a functional axis including design, calibration, and control, rather than according to the automotive engine and industrial engine categories; Engineering Dept. No. 2 was put in charge of calibration and control and Engineering Dept. No. 1 was put in charge of design and other development work.

19 EGR is an abbreviation for exhaust gas recirculation.

20 Exhaust gas does not contain oxygen (even if it does contain oxygen, the amount is minute), and therefore, if after combustion a portion of the exhaust gas is recirculated into the cylinders with Fresh Air, the amount of oxygen decreases, and the combustion efficiency declines. When the combustion efficiency declines, the amount of NOx produced decreases (nitrogen has a low activity level, but at high temperatures, activity increases and the nitrogen combines with oxygen to form NOx, but recirculating a portion of the exhaust gas to the cylinders reduces that amount of oxygen, and the amount of NOx generated is curbed), but the amount of particulate matter (sometimes referred to as "**PM**") increases. EGR is a method of reducing the NOx generated, but separate measures to address the increase in PM are needed.

charge of engine calibration work determine the specific values to apply to that formula so that the diesel engine will comply with the anticipated NOx specifications (e.g., values such as how much exhaust gas will be recirculated into the cylinders at what volume of intake air; referred to as "**Control Parameters**"). By determining the Control Parameters, the emissions performance of the engine is set.

The reason why Engineering Dept. No. 1 and Engineering Dept. No. 2 were established in September 2021 was that on June 1 of that year, the main organization for development of diesel engines for automobiles was switched from Toyota Motors to Toyota Industries. Previously, Toyota Industries had developed diesel engines for automobiles only under the direction and supervision of Toyota Motors as a contract developer of Toyota Motors, but on June 1, 2021, Toyota Industries executed a drawing etc. transfer agreement with Toyota Motors on relating to diesel engines for automobiles, and thereafter, ownership rights and intellectual property rights to design drawings for engines developed by Toyota Industries belonged to Toyota Industries and Toyota Industries began independent development of diesel engines for automobiles. With this, Toyota Industries split the Engineering Dept. and established Engineering Dept. No. 2 as an organization that specialized in engine calibration work and control work concerning diesel engines for automobiles with the objective of reinforcing engine calibration work and control work concerning diesel engines for automobiles. Specifically, personnel in Engineering Offices that had worked on engine calibration work and control work concerning diesel engines for automobiles were augmented and the level of the office was raised to become the Engineering Dept. No. 2.

In addition, after the U.S. authorities commenced investigations relating to U.S. certification applications Toyota Industries established the Regulation Certification Office in March 2021 within the Engine Division to specialize in work including legal interpretation, negotiations with authorities, and organizing certification testing ("**Regulation Certification Work**"), and in September of that year the Regulation Certification Office was upgraded to the Regulation Certification & Administration Dept. A total of 24 employees work in the Regulation Certification & Administration Dept.,[21] and the General Manager was seconded from Toyota Motors.

Until September 2021, a department responsible for design work[22] (hereinafter, sometimes referred to as the "**Design Group**," regardless of whether before or after the department name changes), a

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21 In conjunction with the upgrade of the Regulation Certification Office to the Regulation Certification & Administration Dept., the number of employees was increased by five (two employees transferred from the Quality Assurance Dept. and three employees transferred from the Development Office classified as Engineering Dept. No. 1).

22 The department responsible for design is divided into groups, and the group names varied depending on the time. For example, around 2013, when the 1KD Engine was developed, the department responsible for designing the 1KD Engine was called the Engineering Office No. 3 SD3G.

department responsible for engine calibration work[23] (hereinafter, sometimes referred to as the "**Engine Calibration Group**," regardless of whether before or after the department name changes), and a department responsible for control work[24] (hereinafter, sometimes referred to as the "**Control System Development Office**," regardless of whether before or after the department name changes) existed under the Engineering Office of the Engineering Dept., and also, there were organizations that performed preliminary development and other work as well as laboratory departments[25] (hereinafter, sometimes referred to as the "**Laboratory Section**," regardless of whether before or after the department name changes) responsible for testing and other similar work such as operating engines on the Measurement Benches and measuring the emission component values, as described below. In addition, until March 2021, there was no specialized organization that focused on Regulation Certification Work, and consequently, the Engine Calibration Group performed Regulation Certification Work.

The Design Group and Engine Calibration Group were under the control of Group Managers (at times, also called Group Leaders), and multiple working groups were established under the group manager, and a Working Group Leader managed each working group.

Until January 2023, the organization of the Engine Division was also divided from the perspective of the automotive engine and industrial engine categories, and there were separate engineering offices responsible for automotive engine design, calibration, and control and for industrial engine design, calibration and control.[26]

Currently, the Engine Division has two business sites in Japan: the Hekinan Plant, which began operations in 1982, and the Higashichita Plant, which began operations in 2000. Of these, the Hekinan Plant mainly develops and produces automotive engines and industrial engines,[27] and the

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23 The department responsible for engine calibration work is divided into groups, and the group names varied depending on the time. For example, around 2013, when the 1KD Engine was developed, the department responsible for engine calibration work relating to the 1KD Engine was called the Engineering Office No. 3 SD2G.

24 The department responsible for control work is divided into groups, and the group names varied depending on the time. For example, around 2013, when the 1KD Engine was developed, the department responsible for control work relating to the 1KD Engine was called the Control System Engineering Office C2G.

25 The laboratory department name varied depending on the time. For example, around 2013, when the 1KD Engine was developed, it was known as the Laboratory Section.

26 Since January 2023, the Engineering Dept. has been organized along a function axis such as design, calibration, and control, rather than according to the automotive engine and industrial engine categories.

27 In addition, turbochargers are developed and produced at the Hekinan Plant.

Higashichita Plant mainly produces automotive engines.[28, 29]

5 Overview of TMHC

(1) Business Overview of TMHC

TMHC engages in the business of industrial vehicle development, manufacture and sales, with a focus on forklifts. It also engages in forklift sales financing, value chain business including sales of components such as forklift attachments and spare parts and provision of after-sales service, and logistics solutions business including planning and development of logistics equipment and systems. In recent years, the breakdown of sales in each business has been approximately 40% from the development, manufacture and sale of industrial vehicles, approximately 40% from the value chain business, and approximately 20% from the logistics solution business.

The number of forklifts produced each year (including production at overseas sites) has increased substantially as a result of expansion of overseas production sites, acquisition of major forklift manufacturers in Europe and the U.S., and other factors. Production volume in fiscal 2022 was approximately 2.5 times higher than in fiscal 2001, when the integration of manufacturing and sales was implemented.

(2) Organizational overview of TMHC

TMHC comprises the Global Product Planning Dept., Product Development Dept., Regulation Certification Dept., and other departments.

An explanation of the departments involved in forklift development within TMHC is as follows. First, in the forklift planning stage, each organization of TMHC prepares a quality requirements form from their respective perspectives and the Sales Research & Planning Dept. compiles and organizes them and proposes a product plan. Later, the Global Product Planning Dept. receives the product plan proposal from the Sales Research & Planning Dept., incorporates the plan into product specifications, and determines the new product catalogue specifications and sales points.

Next, the Engineering Office of the Product Development Dept. performs the concrete product design work. The Engineering Office of the Product Development Dept. is divided into groups according to the vehicles handled, and the KS2 and KS4 Groups are involved in vehicles equipped

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28 In addition, cast products are developed and produced and gasoline turbochargers are produced at the Higashichita Plant.

29 In addition, a wholly-owned subsidiary under the Engine Division (Izumi Machine Mfg. Co., Ltd.) produces cam shafts and turbo charger parts. Overseas sites include Toyota Industry Kunshan in China and Toyota Industries Engine India Pvt. Ltd. in India.

with engines. The KS2 Group is responsible for the layout design of the vehicle as a whole, and with respect to the engine, is responsible for designing the mounting position of the engine and portions known as the intake and exhaust systems. The KS4 Group is the organization that determines the engine specifications, such as the engine output necessary for the planned performance. It issues an external procurement request form to the Engine Division and requests that the Engine Division design the engine. The Engine Group of the Engineering Office, the Engineering Dept. at TMHC that was involved in the development of the 2007 4Y Engine and the 2009 4Y Engine was the predecessor of the KS4 Group. The KS4 Group also serves as TMHC's liaison with the Engine Division.

In addition, ES Engineering Office No. 1 of the Product Development Dept. was responsible for ECU development on the vehicle side. The ECU on the vehicle side is separate from the engine ECU, but since information is exchanged between the two ECUs, information is shared with the Engine Division as necessary.

Also, the Regulation Certification Dept. is the department responsible for obtaining vehicle certification, identifying and confirming compliance with product-related laws and regulations, and so on. In January 2023, the Regulation Certification Dept. was upgraded from the Regulation Certification Office of the Global Product Planning Dept.[30] to a department. The background to the upgrade was a request to reinforce regulatory compliance systems in response to the commencement of an investigation relating to applications for U.S. certification.

6 Overview of meeting bodies involved in engine development

(1) Management Conference

The Management Conference is a meeting body whose objectives are to confirm the status of work progress and share information among divisions, offices, and functions. In principle, the Management Conference meets monthly with extraordinary meetings held as necessary.

Participants in the Management Conference include the chairman, president, vice presidents, managing officers, executives, and full-time corporate auditors as well as officers and employees nominated by the president. At the Management Conference, company-wide sales, the status of achievement of profit plans, the status of business execution in each department and office, and other matters were reported and confirmed.

[30] The name has changed over the years: the name was the Technical Administration Office of the Engineering Dept. until June 2017; and then was the Technical Administration Office of the Global Product Planning Dept. until June 2022.

(2) Management Committee

The Management Committee is a Toyota Industries management body that deliberates on important management matters.

The Management Committee comprises directors in the vice president level and higher and persons nominated by the president. Extraordinary meetings are held as necessary. The purpose of the Management Committee is to conduct prior deliberations on matters to be decided by the president and matters subject to resolutions of the Board of Directors. Specifically, the Management Committee deliberates on significant matters relating to the company (vision, management policies, etc.), matters relating to management strategies (medium-term management plans, large investments, M&A, large-scale organizational changes, etc.), significant matters relating to business divisions (priority issues, medium-term business plans, annual plans, etc.), and other significant management issues that affect the entire company.

(3) Business Execution Conference

The Business Execution Conference is a management body that deliberates on important management matters of Toyota Industries.

Participants in the Business Execution Conference include the president and vice presidents as well as the directors responsible for management planning and human resources departments and officers involved in business divisions. The conference holds meeting as necessary. The purpose of the Business Execution Conference is to deliberate on issues and policies relating to business divisions, and specific matters include confirmation of annual plans and their implementation status, priority issues of business divisions, confirmation of the progress of medium-term business plans, and other significant matters relating to business divisions selected by the president or General Manager of the Corporate Planning Dept.

(4) Engine Committee

The Engine Committee is a body that deliberates on engine selection and engine specifications before the start of development of engines for forklifts and other industrial vehicles. The Engine Committee participants include the officers responsible for TMHC and the Engine Division as well as officers and employees from the TMHC product planning and engine engineering departments and other relevant departments and officers and employees from the Engine Division departments responsible for planning and industrial vehicle engine development and other relevant departments. Resolutions of the Engine Committee are adopted with the consent of the officers responsible for TMHC and the officer with authority over the Engine Division.

7 Overview of organizations relating to quality control

(1) Head Office Quality Management Dept.

At Toyota Industries, each division has a Quality Assurance Dept., and the Quality Management Dept. (until January 2023, the Quality Control Dept.)[31] was established as a head office function and has provided organizational development support relating to quality throughout the Toyota Industries Group with the aim of achieving the "Quality Vision,"[32] the company's principles on quality. In response to the series of improper conduct recently discovered, Toyota Industries has started taking action to reinforce its governance systems relating to quality.

An overview of the organizational development support operations that the Quality Management Dept. previously performed will first be provided, and then the status of measures for reinforcing governance systems relating to quality will be explained.

Toyota Industries had a policy of formulating a Quality Guideline that clarified priority action items for the relevant fiscal year and implementing the Quality Guideline throughout the entire Group with the aim of achieving its Quality Vision. The Quality Management Dept. performed coordination work in the preparation of the Quality Guideline.

Specifically, the Quality Management Dept. gathered issues and opinions submitted in the process of individual divisions carrying out quality assurance activities, and the heads of the quality assurance departments of each division discussed those issues and opinions at the Quality Assurance General Managers Conference. The Quality Management Dept. then formulated the Quality Policy based on the results of deliberations by the Quality Assurance Dept. General Managers Conference, obtained approval from the officer responsible for the Quality Management Dept., the Quality Assurance Dept. General Managers Conference, and the president, and finalized the details. The Quality Guideline was also reported to the Board of Directors.

The Quality Management Dept. also held meetings of the Quality Assurance Dept. General Managers Conference, in which the heads of the quality assurance departments of each division participated, and participated as an observer in the Division Quality Assurance Conferences held by each division to confirm the status of implementation of the Quality Guideline by each division and

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[31] As discussed below, in conjunction with the reinforcement of quality audits and control functions of business divisions in response to the series of improper conduct recently discovered, the Quality Control Dept. was renamed the Quality Management Dept. in January 2023. Hereinafter, referred to as the "**Quality Management Dept.**" regardless of whether before or after the name change.

[32] Toyota Industries defines its Quality Vision as follows: "Each and every member of the Toyota Industries Group performs their own work from the perspective of customers at their workplaces and positions to supply appealing products and services that exceed the expectations of customers around the world, with safe and reliable quality."

identify issues and the like concerning implementation of quality assurance activities. Measures and the like to address the issues identified by the Quality Management Dept. were discussed and investigated at the Quality Function Conference, which was chaired by the officer responsible for the Quality Management Dept. and was attended by the officers responsible for the Quality Assurance Dept. of each division, General Managers of each division, and others.

In addition, the Quality Management Dept. supports the development of rules and guidelines relating to quality assurance by each division, plans and supports quality training and QC circle activities for employees, and conducts quality audits and so on of trading partners to support the development of enhanced quality assurance systems in the Toyota Industries Group.

In response to the series of improper conduct that were recently discovered, Toyota Industries decided to investigate means of increasing the efficiency of organizational support provided to the divisions as described above and has commenced efforts to reinforce quality-related governance systems by having the Quality Management Dept. perform quality audits of individual divisions in order to reinforce management and supervisory functions for each division.

Specifically, the Quality Management Dept. analyzes quality-related risks, and based on those risks, monitors quality audits performed by the Quality Assurance Dept. of each division to perform its management and supervisory functions over the Quality Assurance Dept. of each division. In addition, the Quality Management Dept. plans to directly monitor the departments of each division subject to audits with respect to significant quality risk items. Furthermore, these quality audits by the Quality Management Dept. will be performed from a third-party perspective that is independent of the divisions while receiving support from the Audit Dept. and outside experts. Also, although previous quality audits by Quality Assurance Dept. of each division were conducted from the perspective of whether operations were conducted in accordance with rules, there are plans to conduct audits in the future that include the perspective of whether the rules themselves are appropriate and comply with laws and regulations.

(2) Overview of the Quality Assurance Dept.[33] of the Engine Division

The organizational system of the Quality Assurance Dept. of the Engine Division (the "**Quality Assurance Dept.**") varied at different times, but generally, it comprised (i) a department responsible for quality assurance operations including production preparations for new products and quality assurance for mass produced products, (ii) a department responsible for responding to internal and external audits and the audit operations of the QMS Secretariat and other bodies, and (iii) a department

[33] The Quality Assurance Dept. of the Engine Division was renamed the Global Quality Assurance Dept. on June 1, 2004, and on January 1, 2010, the Quality Assurance Dept. name was restored. Hereinafter, the department is referred to as the Quality Assurance Dept. regardless of the period.

responsible for quality control operations including inspection and management of testing and experiment equipment and inspecting and confirming the quality of various parts.

The Engine Division produced engines at the Hekinan Plant and the Higashichita Plant, and departments responsible for quality assurance work and departments responsible for quality control work were established at each plant.

Changes in the organizational system of the Quality Assurance Dept. are shown in the table below.

	① Quality assurance work	② Audit work	③ Quality control work
Before 2008	Hekinan Group No. 1 Hekinan Group No. 2 Higashichita Group	Audit Group	Inspection Office
January 1, 2008	Hekinan Quality Assurance Office Higashichita Quality Assurance Office	↓	Hekinan Quality Assurance Office Quality Section Higashichita Quality Assurance Office Quality Section
February 1, 2009	↓	Quality Audit Office	↓
January 1, 2016	↓	↓	Audit Office Hekinan Quality Section Higashichita Quality Section
January 1, 2023	Quality Control Office	Quality Audit Office	Quality Section

(3) Internal audits by the Head Office Audit Dept.

Toyota Industries established the Audit Dept. as an internal audit organization, and in addition to establishing and auditing the operational status of internal control systems to ensure the reliability of financial reports in accordance with the Financial Instruments and Exchange Act, the department conducts internal audits of all Toyota Industry divisions and consolidated subsidiaries under the direction of the representative director. The results of internal audits are reported to the responsible officers and the full-time corporate auditors on a monthly basis and reported to the representative director quarterly. An overview of the internal audits conducted by the Audit Dept. is provided below.

The Audit Dept. mainly conducts periodic audits and topic-based audits. The specific method of conducting periodic audits is as follows: The Audit Dept. instructs each organization to conduct a self-inspection each year, and each organization conducts a self-inspection. The inspection items for self-inspections vary slightly depending on the year, but in general, the scope of the inspection covers items relating to management systems to determine if there are any deficiencies in internal approval procedures and expense requests and whether internal rules are periodically reviewed. When the Audit Dept. later conducts internal audits of each organization, it confirmed management systems based on the self-inspection sheets prepared by the said organization. Audit plans are prepared such that each organization is subject to audit at least once every three years.

In addition, the Audit Dept. performed risk analysis based on problems that arose at other companies or within Toyota Industries or the status of amendment of laws and so on, and based on the results, determined audit topics with approval from the representative director, and implemented topic-based audits of the relevant organizations. In fact, in response to the discovery of improprieties relating to automobile certification applications at other companies, in fiscal 2016, the engineering departments of all Toyota Industries divisions were subject to audits to determine whether applications for public certification were made in the course of business, and in cases where applications for public certification were made, audits were conducted concerning the level of risk that improper conduct would occur.

During these topic-based audits, however, the Audit Dept. conducted interviews of the person in charge of each division concerning whether applications for public certification had been made and the application methods and reviewed application documents as necessary, but was unable to accurately determine the risk that the series of improper conduct recently discovered would have occurred. As a result, an in-depth audit concerning emissions certification applications by the Engine Division was not conducted, and the audit did not lead to any measures that could contribute to the discovery of the improper conduct.

8 Overview of risk management systems

Toyota Industries' risk management systems and changes to those systems are described below.

Toyota Industries established a risk management system as a part of its corporate governance systems in 2008. Risk management is conducted primarily by the Corporate Code of Conduct Committee (renamed the CSR Committee in June 2009), which is a management-level committee, the Crisis Subcommittee, Internal Control Promotion Conference, and the Information Security Subcommittee, which are subordinate bodies. Each subcommittee is tasked with developing and thoroughly informing personnel about internal rules and guidelines concerning risk prevention measures and risk management.[34] In response, the Internal Control Office, Corporate Planning Dept., which is the secretariat of the Internal Control Promotion Conference, created a risk catalog summarizing assessments of the details of anticipated specific risks and their scores, preventive measures, measures to prevent expansion after the occurrence of a risk, recovery measures, the

[34] The responsibilities of each body were as follows: the Crisis Subcommittee was responsible for responding to emergencies such as disasters; the Internal Control Promotion Conference was responsible for compliance and related issues (labor, quality, the environment, and others), and the Information Security Subcommittee was responsible for information systems and confidentiality management related matters.

department in charge of the risk, and so on.[35] The divisions that were primarily responsible for each risk and head office functional divisions were to incorporate risk management activity policies into their annual activity policies and medium-term plans and carry out preventive and other matters within their day-to-day operations. In addition, the Corporate Code of Conduct Committee and function-specific committees (e.g., the Environmental Committee concerning environmental risks and the Export Trade Control Committee concerning export trade risks) were tasked with assessing and following up on the status of measures by each responsible division according to the risk items.

Under the system described above, however, analysis, assessment, preventive measures, and so on concerning individual specific risks were left up to the divisions and head office functional divisions made responsible for them, and assessment of the specific measures taken by the divisions and head office functional divisions was performed by the respective function-specific committees, and as a result, there were problems including an inability to organize company-wide risks or evaluate measures from a company-wide perspective. In fact, the Internal Control Office, Corporate Planning Dept. identified company-wide risks in 2008, but subsequently, identification of company-wide risks and reevaluation and so on were not performed.[36] Also, Toyota Industries had a Crisis Emergency Response Manual (later renamed the Risk Response Manual) that was established in 2001 as internal rules relating to risk management, but this was a manual relating to emergency responses following the occurrence of a risk, and no internal rules relating to risk management during non-emergency times were established until May 2022.

Later, the Corporate Governance Code of the Tokyo Stock Exchange was revised in 2021, making it clear that, in relation to risk management systems operated by the Board of Directors, a company-wide risk management system covering the entire group should be appropriately established and its operational status should be appropriately audited. In response to this revision, Toyota Industries reviewed and updated its risk management system in 2021. Under the updated system, the CSR Committee was given risk management functions, and a Risk supervisor was appointed within the CSR Committee as the person with responsibility for gathering information on company-wide risks and implementing company-wide risk management measures.[37] The CSR Committee and Risk supervisor designated "priority risks" as company-wide risks from among the risks identified by the individual divisions and so on, and the individual divisions were tasked with formulating countermeasures against these priority risks in collaboration with functional divisions. Also, an annual

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35 The risk catalog does not describe risks unique to the Engine Division, but lists "product development failure (function or quality)" as a risk that could arise in an individual division and gives "failure to achieve regulation values, etc. (certification non-compliance)" as a specific example.

36 However, it seems that when selecting audit topics for each fiscal year, the Audit Division also conducted screening and assessment of risk items.

37 The Risk supervisor was the chairperson of the CSR Committee, and the Representative Director and Vice President of Toyota Industries at the time was appointed the first Risk supervisor.

risk management activity cycle was established, making it clear that risk management activities from the previous fiscal year are to be reviewed, new risks and unaddressed risks are to be identified, priority risks are to be designated, and so on annually.

Later, the Risk Response Manual was revised in May 2022, and there have now been clear provisions concerning the updated risk management system described above in internal rules as well.[38] Furthermore, in June 2023, the Risk Management Office was newly established within the head office as a dedicated organization to promote compliance and oversee and manage risks.

9 Overview of compliance training for employees

(1) Status of compliance training

In June 2009, Toyota Industries renamed the Corporate Code of Conduct Committee the CSR Committee and established the Compliance Subcommittee as a subcommittee of the CSR Committee. Later, the Compliance Subcommittee was put in charge of conducting compliance measures in general including internal compliance training. The Compliance Subcommittee was made up of the heads of departments responsible for individual laws and regulations (departments in charge of laws and regulations)[39] and was tasked with conducting training, disseminating information, and so on relating to compliance.

The main initiatives relating to compliance training[40] undertaken by the Compliance Subcommittee were as described below. First, Toyota Industries established its Employee Code of Conduct in 1998 and formulated the Company and Employee Conduct Guidebook, a revised version of the code, in

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38 The Risk Response Manual, revised in May 2022, was divided into an Emergency Response Volume and Non-Emergency Volume. The former was a manual on responding to risks, while the latter described the risk management system following the 2021 review.

39 Specifically, the Legal Dept., Audit Dept., General Administration Dept., IT Dept., Human Resources Dept., Accounting Dept., Purchasing Dept., Health and Safety Promotion Dept., Environmental Dept., Intellectual Property Dept., and Logistics Dept.

40 Compliance (legal compliance) training included training on individual laws and regulations and internal rules and work procedures based on those laws and regulations and ethics training to raise awareness of compliance in the broad sense, but compliance referenced in this section refers primarily to the latter, i.e., ethics training.

November 2006,[41] and immediately after establishment of the Compliance Subcommittee, a companywide compliance workplace meeting was held to comprehensively re-inform personnel. After that, the meeting was held each year for the purpose of instilling awareness of compliance among employees. The Company and Employee Conduct Guidebook mentioned above was again revised in 2014 and distributed as the Employee Code of Conduct in pamphlet form to all employees.

Toyota Industries had for some time also conducted compliance training at the time of hiring and at the time of promotion, and around 2014, the Company launched an e-learning system for compliance training. E-learning enables all employees to view video educational materials and PowerPoint presentations via an internal information system. The training content included training on individual laws and regulations as well as ethics training with titles such as "compliance," "preventing inappropriate conduct," and "enhancing sensitivity to risks." This type of e-learning was well received by employees, and there were calls to expand and enhance the content, and consequently, mini-tests to confirm the level of understanding of the e-learning educational content were added in 2020.

Furthermore, employee compliance awareness surveys have been conducted once every three years since 2018 to confirm and assess the effects of these compliance-related measures.[42]

(2) Status of quality training

Separate from compliance training at Toyota Industries, the Head Office Quality Management Dept. conducts quality training for employees in collaboration with individual divisions and other organizations. The quality training is made up of rank-specific programs organized according to an employee's rank, years of employment, and other factors, and it is mandatory for all employees to take a course on the fundamentals of quality control within several years of joining the company. In

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41 The Guidebook provides, for example, (i) as a specific conduct guideline relating to legal compliance, "We will comply with domestic and foreign laws and the spirit of those laws, not engage in any unlawful activities, and not engage in any behavior that violates ethics or social common sense. In the workplace, we will educate one another so that all employees act in accordance with laws, regulations, ethics, and social common sense"; and (ii) as a specific conduct guideline relating to product development, "To ensure product quality including product durability, reliability, safety, and environmental friendliness, we will conduct reviews in each development stage pursuant to a design review system to identify problems, work to resolve problems without putting them off, and use everyone's wisdom to build in quality. In addition, we will reliably carry out decisions as decided in manufacturing processes, will not release defective products to subsequent processes, and will undertake comprehensive measures to build in quality in our own processes."

42 In the employee compliance awareness survey conducted in 2021, 99.6% of respondents answered that they were aware of the existence of the Employee Code of Conduct and 95.3% answered that they were aware of the corporate ethics hotline (discussed below). In response to the question, "Do you believe that your workplace has an environment of compliance and that you can work with reassurance?", 97.4% of respondents answered "I think so" or "I think so to some degree." Also, in the employee compliance awareness survey conducted in 2018, in response to the question, "Do you believe that in your workplace, compliance is given greater priority than improving results?", 73% of respondents answered "I think so" or "I think so to some degree," while 4% answered "I don't think so" or "I don't think so to some degree."

addition, employees can take specialized classes on quality control according to their area of work. Also, when employees are promoted to a high-level rank (a personnel classification within Toyota Industries), the training conducted for newly-promoted personnel always includes programs relating to quality training, and those programs re-instill an awareness of "Quality First," one of Toyota Industry's fundamental principles, and specifies that the roles and so on required of each qualification in order to achieve quality first.[43] These various training programs also present examples of problems relating to quality that occurred at other companies and teach participants that quality problems can give rise to serious consequences for the company and its stakeholders.

In addition to this training and so on, Toyota Industries also distributes a Quality Control Textbook to all administrative and technical employees. The Quality Control Textbook is an educational material on quality control prepared by Toyota Industries based on the details of quality control examination,[44] and the educational content of the training and so on described above is based on the Quality Control Textbook.

It seems that the fundamental quality control educational system at Toyota Industries was largely established around the 1980s. In-house educational materials on quality control were prepared starting around the 1980s, and with the start of quality control examination in 2005, Toyota Industries consolidated its existing in-house educational materials, incorporated content relating to quality control examination, and prepared the current Quality Control Textbook around 2008.

(3) Status of training relating to deterioration durability testing and certification

As discussed below, emission regulations for industrial vehicle engines started to be established in earnest around 2003, and starting with the regulations that were enacted in 2006 and later, implementation of deterioration durability testing became mandatory for engines used on special motor vehicles when applying for domestic certification. At the time, however, Toyota Industries did not conduct education or training for officers and employees to respond to the tightening of emission regulations.

43 For example, roles required of each rank for quality control include quality maintenance and management by Team Leader class personnel, change point management in relation to quality by Group Leader class personnel, and prevention of quality-related problems by Assistant Manager class personnel.

44 Quality control examinations or inspections relating to quality control conducted by the Japanese Standards Association and the Union of Japanese Scientists and Engineers and Certified by the Japanese Society for Quality Control.

10 Overview of internal reporting systems

(1) Overview of internal reporting systems

In response to heightened social awareness concerning corporate ethics and compliance, Toyota Industries established the Corporate Ethics Consultation Hotline in 2003 as an internal reporting and consultation hotline available to Toyota Industries employees and others.[45, 46]

The Corporate Ethics Consultation Hotline is a hotline for addressing concerns regarding violations of laws and regulations and compliance and consultations relating to corporate ethics and the like from employees and others.[47] The hotline is operated by corporate ethics consultation hotline personnel from the Audit Dept. serving as the secretariat, in accordance with the Corporate Ethics Consultation Hotline Operating Rules established in 2003, and the General Manager of the Audit Dept. is responsible for its operation.

The Corporate Ethics Consultation Hotline comprises two types of hotline: An internal consultation hotline for which secretariat personnel respond to consultations, and an external consultation hotline,[48] for which an attorney affiliated with an outside law firm appointed by the secretariat responds to consultations. In cases where the attorney responsible for the external consultation hotline receives a consultation, the attorney communicates with the secretariat via the corporate ethics consultation hotline of the Legal Dept.

When the secretariat receives a consultation or is contacted through the external consultation hotline or internal consultation hotline, a determination is made whether an investigation is necessary and if so, the department responsible for the investigation and investigating personnel are appointed and a request for an investigation is made. After the investigation is completed, the secretariat receives a

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45 The direct trigger leading to establishment of the Corporate Ethics Consultation Hotline is believed to be revision of the Charter of Corporate Behavior by the Japan Business Federation (Keidanren) on October 15, 2002. Article 9 of the revised Charter of Corporate Behavior provides, “Top management shall recognize that it is their role to realize the spirit of this Charter and shall take the initiative to ensure that everyone concerned is thoroughly informed. In addition, top management shall continuously monitor opinions from inside and outside the company, establish effective internal systems, and ensure strict corporate ethics.” One example of a specific action plan listed is the establishment of a corporate ethics helpline (consultation hotline) (Keidanren Charter of Corporate Behavior Implementation Guidance (version 3), p. 45).

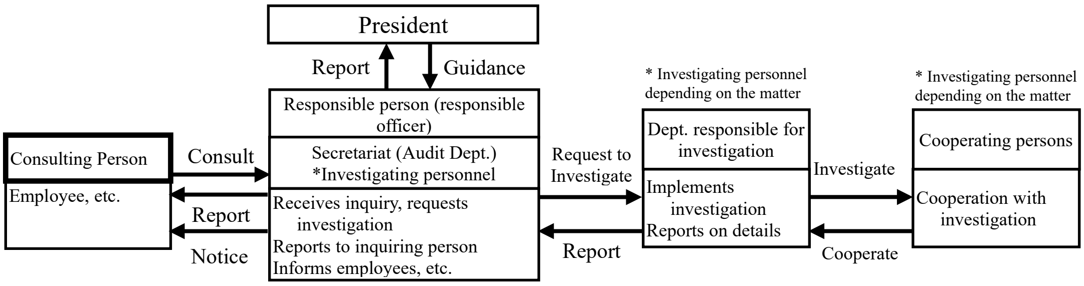
46 Toyota Industries has established various other consultation hotlines for employees and others including consultation hotlines for workplace and work related-issues (examples of consultation matters include “problems and concerns in the workplace or in work, power harassment, etc.”). These consultation hotlines have been established in each division, plant general affairs departments, and labor policy offices of human resources departments.

47 The "employees and others" who can use the Corporate Ethics Consultation Hotline includes officers, employees (contract employees, fixed-term re-hired employees, part-time employees, seconded employees, and temporary employees) and former employees who left the Company within one year.

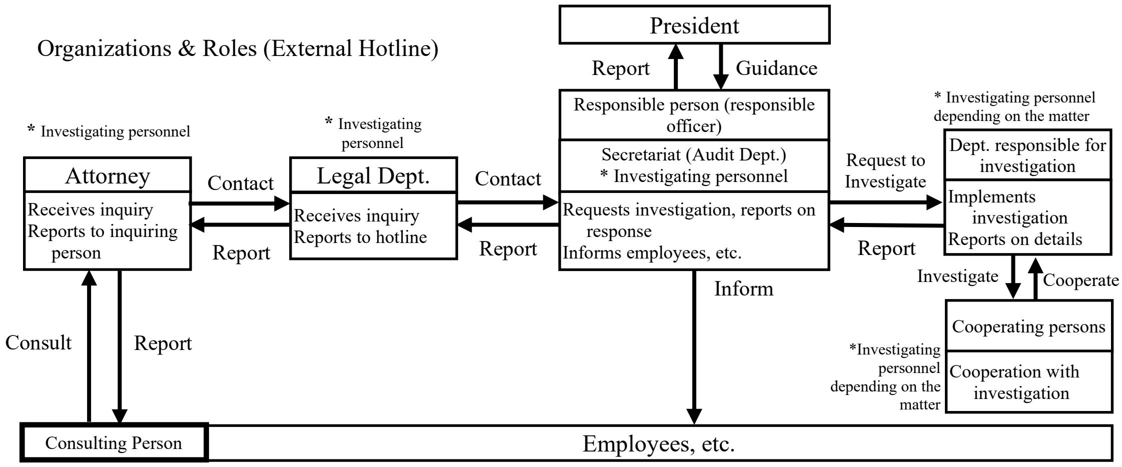
48 The current external consultation hotline is operated by a law firm located in Nagoya City.

report on the investigation results from the department responsible for the investigation, and if there was conduct in violation of compliance requirements, corrective measures and measures to prevent reoccurrence are taken, and in the case of a serious compliance violation, a report is made to the president and relevant officers. In addition, if corrective measures are taken, the secretariat notifies the consulting person that the measures were taken, and if no violation was found, the secretariat notifies the consulting person to that effect (if the consultation was received via the external reporting hotline, the responsible attorney reports to the consulting person).

Organizations & Roles (Internal Hotline)



Organizations & Roles (External Hotline)



(2) Status of reports to the Corporate Ethics Consultation Hotline

From 2003 to the end of February 2023, a total of 1193 reports were made to the Corporate Ethics Consultation Hotline, including 149 to the internal consultation hotline and 1044 to the external consultation hotline. The bulk of these reports were consultations relating to labor-management or ethics (such as harassment), and only one matter was categorized as a consultation relating to quality.[49]

49 The said matter was a consultation to the internal reporting hotline concerning the inspection of products for which processing was outsourced. The investigation reached the conclusion that there was no improper conduct, and a report to this effect was made to an officer. This internal report was unrelated to the improper conduct concerning emissions recently discovered.

The Audit Dept. or Legal Dept. periodically[50] report to the president or responsible director concerning the status of reports to the Corporate Ethics Consultation Hotline (numbers and details of reports, etc.). These reports also explained that “the bulk of reports made to the Corporate Ethics Consultation Hotline were consultations concerning personnel and labor-management matters (employee treatment, workplace environment, interpersonal environment, etc.) and there were no reports concerning serious impropriety.”

Part 2. Emission Regulations for Industrial Vehicle Engines

1 Overview of emission regulations

The history of emission regulations for automotive engines is old. Regulation of gasoline engines concerning the concentration of carbon monoxide (referred to as “**CO**”) started in 1966, and in 1973, regulations concerning hydrocarbons (referred to as “**HC**”) and NOx were added to those concerning CO for gasoline engines. In addition, regulations concerning CO, HC, NOx and PM for diesel engines were enacted in 1974, and emission regulations applicable to automotive engines have been tightened year-by-year.

In contrast to this, the history of emission regulations for industrial vehicle engines is relatively shallow.

The Ministry of Land, Infrastructure, Transport and Tourism enacted emission regulations for industrial vehicle engines on October 8, 1991, and the designation system for construction machinery with emission countermeasures started pursuant to the Guidelines for Designation of Construction Machinery with Emission Countermeasures, which came into effect on January 1, 1992. This designation system was not a system pursuant to statute but had the nature of administrative guidance by the Ministry of Land, Infrastructure, Transport and Tourism with the aim of improving workplace environments at construction sites and the atmospheric environment. Under this system, the ministry established Technical Guidelines for Construction Machinery specifying technical standards for construction machinery believed to be desirable when performing construction work, and construction machinery that received designation was permitted to display a label to the effect that it had received designation (the Technical Guidelines for Construction Machinery specified standard values for CO, HC, and NOx, but did not specify a standard value for PM). Later, the use of construction machinery with emission countermeasures for projects ordered directly by the Ministry became the general rule starting in 1998.

In response to the Fourth Report of the Central Environment Council issued in November 2000, the Ministry of Land, Infrastructure, Transport and Tourism on August 3, 2001 partially amended Safety

[50] Reports were made monthly until fiscal 2009 and were made annually starting in fiscal 2010.

Standards for Road Transport Vehicles ("**Safety Standards**"), and emission regulations for diesel engines installed on large-sized special motor vehicles and small-sized special motor vehicles[51] under the Road Transport Vehicle Act ("**Vehicle Act**"), that is to say, special motor vehicles[52, 53] that drive on public roads, came into effect on October 1, 2003 ("**Tier 1 Regulations**").

Later, the Sixth Report of the Central Environment Committee issued in June 2003 indicated that subjecting not just diesel engines, but also those special motor vehicles equipped with gasoline engines with engine rated output of 19 kW or more but less than 560 kW, to emission regulations would be appropriate, as special motor vehicles overall accounted for a high percentage of contributions to emissions. In response, the Ministry revised the Public Notice on Details of the Safety Standards ("**Public Notice on Details**") and so on, expanding the application of emission regulations to special motor vehicles equipped with gasoline engines that drive on public roads effective December 2, 2005.

Also, in response to the recommendation in the Sixth Report of the Central Environment Committee referenced above that emissions relating to special motor vehicles be tightened, the Off-Road Act was enacted on May 25, 2005, and subsequently on March 28, 2006, as subordinate legislation providing specific regulation values, etc. for said Act, the Regulations for Enforcement of the Act on Regulation, Etc. of Emissions From Non-road Special Motor Vehicles ("**Regulations for Enforcement of the Off-Road Act**") and the Public Notice Stipulating Necessary Matters for Emission Regulations on Non-Road Special Motor Vehicles ("**Public Notice on the Off-Road Act**") were established. As a result, emission regulations were expanded in stages according to on the rated output to special motor vehicles equipped with diesel engines and gasoline engines that do not operate on public roads starting on October 1, 2006 ("**Tier 2 Regulations**"). Furthermore, implementation of deterioration durability testing became mandatory for engines installed on special motor vehicles when applying for domestic

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51 "Large-sized special motor vehicles" refer to vehicles such as forklifts and shovel loaders set forth in Appended Table No. 1 to the Road Transport Vehicle Act Enforcement Regulations ("**Vehicle Act Enforcement Regulations**") that are other than small-sized special motor vehicles; and "small-sized special motor vehicles" refer to vehicles such as forklifts and shovel loaders set forth in the same table, with a vehicle size not exceeding 4.70 meters in length, 1.70 meters in width, and 2.80 meters in height and a maximum speed of 15 kilometers or less per hour (Article 3 of the Vehicle Act; Article 2 and Appended Table No. 1 of the Vehicle Act Enforcement Regulations).

52 Special motor vehicles are motor vehicles with a special shape or structure for special applications; there are many different types of special motor vehicles, including forklifts, shovel loaders, agricultural tractors, and so on. With respect to their relationship with the concept under law, generally speaking, the term "special motor vehicles" is used as a collective term for large-sized special motor vehicles and small-sized special motor vehicles under the Vehicle Act and "non-road vehicles" under the Act on Regulation, Etc. of Emissions from Non-Road Vehicles ("**Off-Road Act**"). This Report hereinafter also calls large-sized special motor vehicles, small-sized special motor vehicles and non-road vehicles collectively as "special motor vehicles."

53 Because the definition of non-road vehicles excludes motor vehicles that drive on public roads (Article 2, Paragraph 1, proviso of the Off-Road Act), "Special Motor Vehicles that drive on public roads" refer to large-sized special motor vehicles and small-sized special motor vehicles under the Vehicle Act.

certification starting with the Tier 2 Regulations. The regulation values[54] for each component of emissions under the Tier 2 Regulations are set forth in the following table.

Tier 2 Regulations

Special Motor Vehicle Type	Rated Output	CO (g/kWh)	NMHC (g/kWh)	NOx (g/kWh)	PM (g/kWh)	Black smoke (%) or Idling CO (%) & HC (ppm)	Timing of Start of Application
Diesel	19kW or more but less than 37 kW	5.00 (6.50)	1.00 (1.33)	6.00 (7.98)	0.40 (0.53)	40	October 1, 2007
	37 kW or more but less than 56 kW	5.00 (6.50)	0.70 (0.93)	4.00 (5.32)	0.30 (0.40)	35	October 1, 2008
	56 kW or more but less than 75 kW	5.00 (6.50)	0.70 (0.93)	4.00 (5.32)	0.25 (0.33)	30	October 1, 2008
	75 kW or more but less than 130 kW	5.00 (6.50)	0.40 (0.53)	3.60 (4.79)	0.20 (0.27)	25	October 1, 2007
	130 kW or more but less than 560 kW	3.50 (4.55)	0.40 (0.53)	3.60 (4.79)	0.17 (0.23)	25	October 1, 2006

Special Motor Vehicle Type	Rated Output	CO (g/kWh)	HC (g/kWh)	NOx (g/kWh)	PM (g/kWh)	Black smoke (%) or Idling CO (%) & HC (ppm)	Timing of Start of Application
Gasoline & LPG	19 kW or more but less than 560 kW	20.0 (26.6)	0.60 (0.80)	0.60 (0.80)		CO: 1 HC: 500	October 1, 2007

In response to the January 2008 Ninth Report of the Central Environment Committee specifying a policy of tightening emission regulations relating to diesel engines installed on special motor vehicles, the Public Notice on Details, etc., the Regulations for Enforcement of the Off-Road Act and the Public Notice on the Off-Road Act were amended on March 18, 2010. As a result of these amendments, phased application of new regulations ("**Tier 3 Regulations**") started on October 1, 2011 according to rated output. Under the Tier 3 Regulations, emission regulations applicable to diesel engines installed in special motor vehicles were tightened. For example, the PM regulation values were tightened 88% to 93% compared to under the previous regulations. The regulation values for each component of emissions of diesel engines under the Tier 3 Regulations are as set forth in the table below.

54 In the table, the values listed in the columns for the emission components, i.e., CO, non-methane hydrocarbons (referred to as "**NMHC**"), HC, NOx, and PM, are average values, and the figures in parentheses are maximum values (the same applies below).

Tier 3 Regulations

Special Motor Vehicle Type	Rated Output	CO (g/kWh)	NMHC (g/kWh)	NOx (g/kWh)	PM (g/kWh)	Black smoke (%)	Timing of Start of Application
Diesel	19 kW or more but less than 37 kW	5.0 (6.5)	0.7 (0.9)	4.0 (5.3)	0.03 (0.04)	25	October 1, 2013
	37 kW or more but less than 56 kW	5.0 (6.5)	0.7 (0.9)	4.0 (5.3)	0.025 (0.033)	25	October 1, 2013
	56 kW or more but less than 75 kW	5.0 (6.5)	0.19 (0.25)	3.3 (4.4)	0.02 (0.03)	25	October 1, 2012
	75 kW or more but less than 130 kW	5.0 (6.5)	0.19 (0.25)	3.3 (4.4)	0.02 (0.03)	25	October 1, 2012
	130 kW or more but less than 560 kW	3.5 (4.6)	0.19 (0.25)	2.0 (2.7)	0.02 (0.03)	25	October 1, 2011

In light of the January 2008 Ninth Report of the Central Environment Committee and the August 2012 Eleventh Report of the Central Environment Committee, on January 20, 2014, the Public Notice on Details, etc., the Regulations for Enforcement of the Off-Road Act and the Public Notice on the Off-Road Act were again amended. As a result of these amendments, phased application of new regulations ("**Tier 4 Regulations**") started on October 1, 2014 according to rated output. Under the Tier 4 Regulations, emission regulations applicable to diesel engines installed on special motor vehicles were tightened. Specifically, the NOx regulation values for engines with rated output of 56 kW or more but less than 75 kW, 75 kW or more but less than 130 kW, and 130 kW or more but less than 560 kW were tightened. The regulation values for each component of emissions of diesel engines under the Tier 4 Regulations are as set forth in the table below.

Tier 4 Regulations

Special Motor Vehicle Type	Rated Output	CO (g/kWh)	NMHC (g/kWh)	NOx (g/kWh)	PM (g/kWh)	Optical-absorption coefficient (m^{-1})	Timing of Start of Application
Diesel	19 kW or more but less than 37 kW	5.0 (6.5)	0.7 (0.9)	4.0 (5.3)	0.03 (0.04)	0.50	October 1, 2016
	37 kW or more but less than 56 kW	5.0 (6.5)	0.7 (0.9)	4.0 (5.3)	0.025 (0.033)	0.50	October 1, 2016
	56 kW or more but less than 75 kW	5.0 (6.5)	0.19 (0.25)	0.4 (0.53)	0.02 (0.03)	0.50	October 1, 2015
	75 kW or more but less than 130 kW	5.0 (6.5)	0.19 (0.25)	0.4 (0.53)	0.02 (0.03)	0.50	October 1, 2015
	130 kW or more but less than 560 kW	3.5 (4.6)	0.19 (0.25)	0.4 (0.53)	0.02 (0.03)	0.50	October 1, 2014

Currently, the Tier 4 Regulations apply to diesel engines installed in special motor vehicles. With respect to gasoline engines installed on special motor vehicles, no changes to the regulatory details have been made since the Tier 2 Regulations.

It should be noted that there are no regulations concerning fuel consumption (tax benefits, subsidies, or the like for vehicles with certain fuel consumption performance) applicable to engines for industrial vehicles in the domestic market, and Toyota Industries does not publish fuel efficiency in its catalogs.

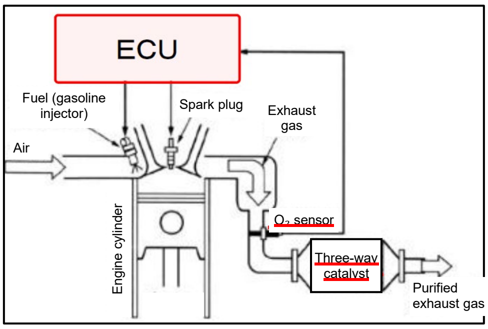
2 Carbon monoxide, etc. emissions control devices

A statutory system has been established for designation of device types that pass inspection of the functions of engines and devices that satisfy the regulation values relating to emission regulations. Such devices refer to “emissions control devices for automobile soot and smoke, gases with offensive odor, toxic gas, and so on” specified in Article 41, Paragraph 1, Item 12 of the Vehicle Act that are “devices that reduce carbon monoxide, hydrocarbon and nitrogen oxide or carbon monoxide, hydrocarbon, nitrogen oxide, particulate matter and graphite in emissions emitted from exhaust pipes into the atmosphere” and are known as “carbon monoxide, etc. emissions control devices.”[55] Carbon monoxide, etc. emissions control devices are a concept under the Vehicle Act and are called “non-road vehicle emissions control devices”[56] under the Off-Road Act; however, no legal distinction is made below, and the foregoing are called carbon monoxide, etc. emissions control devices.

Regulation values are specified for CO, HC, and NOx in relation to gasoline engines, and regulation values are specified for CO, NMHC, NOx, and PM in relation to diesel engines.

Carbon monoxide, etc. emissions control devices are devices that reduce these regulated substances in emissions to limit emissions to within the regulation values. That said, this term does not refer to a single device, but refers to the overall mechanism for reducing regulated substances in emissions by means such as reducing emissions from the engine itself and post-treatment using catalysts and other methods.

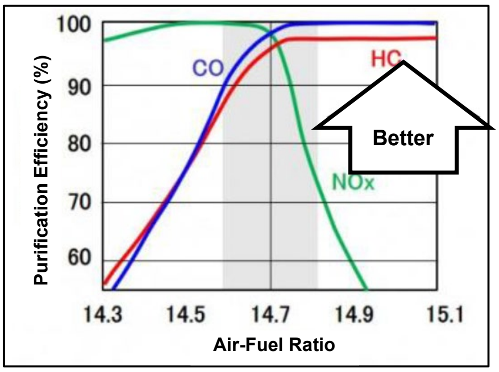
The figure on the right shows an example of a gasoline engine fuel and exhaust systems. As shown in the figure, the exhaust of a gasoline engine is purified by a catalyst known as a three-way catalyst. The three-way catalyst is a catalyst that can simultaneously purify CO, HC, and NOx, which are regulated substances of gasoline engines.



[55] Vehicle Act, Article 41, Paragraph 1, Item 12 and Article 75-3, Paragraph 1; Device Type Designation Regulations, Article 2, Item 18

[56] Off-Road Act, Article 2, Paragraph 2 and the Regulations for Enforcement of the Off-Road Act, Article 1

The purification rate of a three-way catalyst varies depending on the air-fuel ratio (the value equal to the mass of air divided by the mass of fuel at the time of combustion), but as shown in the figure, the manner of change is different for CO, HC, and NOx, and when the three regulated substances are taken into consideration, the points with the best purification efficiency become limited. Because of this, an O2 sensor continuously monitors the air-fuel ratio in the emissions of a gasoline engine and an ECU adjusts the fuel injection amount and other factors to maintain the air-fuel ratio at a level where the purification efficiency of the three-way catalyst is the best.



The exhaust system of a diesel engine is more complex compared to that of a gasoline engine. The reason why the exhaust system is complex is related to the establishment of PM regulations applicable to diesel engines.

The main component of PM is soot that is generated when fuel is combusted under low-air conditions. To control the generation of PM, it is necessary to combust the fuel with an adequate amount of air.

Currently, PM is not a regulated substance for gasoline engines for the reasons described below. First, in a gasoline engine, the fuel and air enter the combustion chamber in a pre-mixed state,[57] and this mixture is ignited by a spark plug and combusted. By adopting this method, there is sufficient time for the fuel and air to mix before detonation, and it is possible for the spark plug to ignite a uniform mixture. As a result, the fuel can be combusted after securing a sufficient amount of air, and the generation of PM can be controlled.

In contrast, in the case of a diesel engine, the fuel is spontaneously ignited by using the heat of compression that is generated when air is compressed. The fuel is injected into the combustion chamber by an injector at the stage when the air in the combustion chamber is compressed.

This method does not allow for the fuel and air to adequately mix in advance, and there are areas within the combustion chamber where there is sufficient air and other areas where there is insufficient air, which makes PM more likely to be generated. For this reason, PM is regulated in relation to diesel engines.

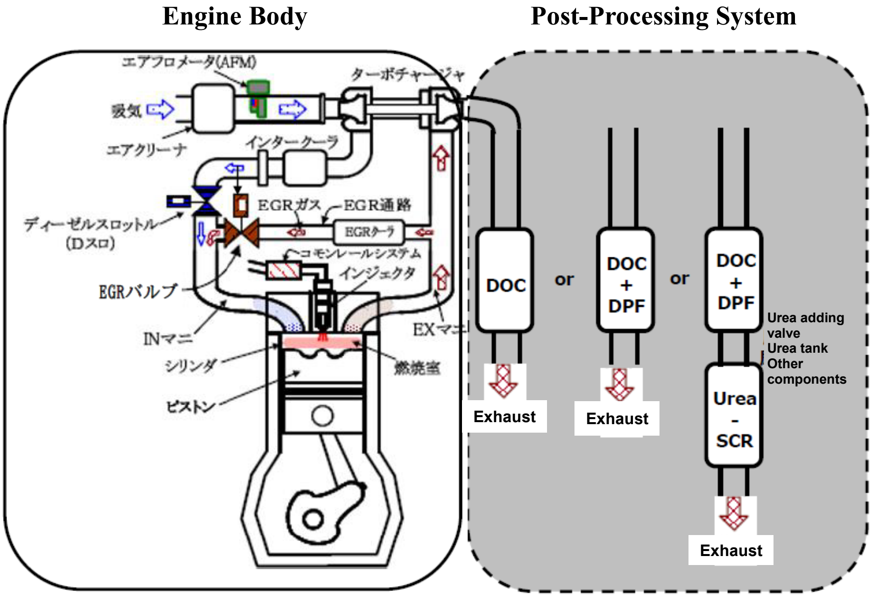
A difficult problem that arises when responding to PM regulations is the fact that PM reduction and NOx reduction are in a trade-off relationship with one another. In other words, the higher the combustion temperature, the more that PM generation can be controlled, but NOx is more likely to be

57 Injecting fuel into the intake pipe and inserting a mixture of intake air and fuel into the combustion chamber (port injection engine) in this way is common on gasoline engines for industrial vehicles. On the other hand, in the case of engines for automobiles, only air is taken into the intake pipe and gasoline is injected into the combustion chamber (direct injection engine).

generated at high temperatures. Because of this, it is not easy to reduce both PM and NOx at the same time.

The exhaust systems of diesel engines are built premised on this trade-off relationship between PM and NOx.

The figure below shows an example of an exhaust system of a diesel engine.



DOC : Diesel Oxidation Catalyst（酸化触媒）
DPF : Diesel Particulate Filter（PMを捕集するフィルター）
Urea-SCR : Urea-Selective Catalytic Reduction（NOx還元触媒）

Left figure, left side labels from top:	Left figure, center labels from top:	Left figure, right side labels from top:
• Air flow meter (AFM) • Air • Air cleaner • Diesel throttle • EGR valve • Intake manifold • Cylinder • Piston	• Intercooler • EGR gas • Common rail system • Injector	• Turbo charger • EGR path • EGR cooler • EX manifold • Combustion chamber

Gasoline engines are able to purify all regulated substances using a three-way catalyst, but diesel engines reduce regulated substances using multiple mechanisms.

In the figure above, the EGR valve is a device that recirculates exhaust gas that was discharged from the combustion chamber to the intake side and sends it back into the combustion chamber. When exhaust gas is again sent into the engine combustion chamber, the nitrogen concentration in the combustion chamber decreases and the combustion temperature decreases, which makes it possible to reduce the concentration of NOx in the exhaust gas, but as mentioned above, when the combustion temperature is decreased, PM increases. Consequently, a separate system for reducing PM is necessary.

Therefore, for example, a post-processing device known as a DPF[58] is added to collect PM and reduce the amount of PM discharged. When the amount of PM collected exceeds a certain volume, measures such as "regeneration" are used; that is, the amount of fuel injected is increased and the exhaust temperature is raised to burn off the collected PM and restore the performance of the filter.

In addition, a turbocharger or other device can be used to increase the air flow to the engine, thereby reducing the amount of PM, and the increase in NOx resulting from the increase in air flow and higher combustion temperature is addressed by adopting methods such as removal using SCR, a type of post-processing device.[59]

3 Overview of the certification system for engines for industrial vehicles

(1) Relationship, etc. between engine certification under the Vehicle Act and engine certification under the Off-Road Act

As discussed in 1 above, engine emission regulations are provided by the Vehicle Act and the Off-Road Act, and both laws stipulate that, if emission component values of the motor vehicles or engines subject to the regulations does not meet the regulation values, the foregoing may not be used.[60] The question of which law regulates a certain industrial vehicle engine is determined by which law applies to the special motor vehicle in which said engine is installed. In other words, engines installed in special motor vehicles that drive on public roads are regulated by the emissions regulations provided by the Vehicle Act, and engines installed in non-road special motor vehicles (large-sized special motor vehicles and small-sized special motor vehicles, etc.) are regulated by the emissions regulations

58 DPF is an abbreviation for diesel particulate filter.

59 SCR is an abbreviation for selective catalytic reduction. The fundamental concept of SCR is to detoxify regulated substances by adding a reducing agent to emissions. For example, by adding urea aqueous solution as a reducing agent to emissions, the ammonia (NH3 through hydrolysis) obtained undergoes a chemical reaction with NOx to generate harmless nitrogen (N2) and water (H2O); SCR that adopts this method is referred to as urea SCR).

60 More precisely, the Vehicle Act provides that motor vehicles with carbon monoxide, etc. emissions control devices that do not satisfy the emission regulation values "shall not be used for operation" (meaning shall not be driven on public roads) (Vehicle Act, Article 41, Paragraph 1, Item 12; the Safety Standards, Article 31, Paragraphs 8 and 2; Public Notice on Details, Article 41, Paragraph 1), and the Off-Road Act provides that non-road vehicles that do not satisfy the emissions regulation values "shall not be used" (Off-Road Act, Article 17, Paragraph 1. Label indicating compliance with the standards, Ibid. Article 12, Paragraphs 1 and 2, Article 11, Paragraphs 1 and 2. To obtain the label indicating compliance with the standards, a type notification must be filed for non-road vehicles equipped with a non-road engine that received type designation (Off-Road Act, Article 10, Paragraph 1), and to receive type designation for a non-road engine, the emissions regulation values (Public Notice of the Off-Road Act, Article 2, Paragraph 1, Items 1 and 2) provided by the technical standards for non-road engines (Vehicle Act, Article 5; Regulations for Enforcement of the Off-Road Act, Article 2, Paragraph 1, Item 1) need to be satisfied (Off-Road Act, Article 6, Paragraphs 1 and 3).

provided by the Off-Road Act.[61, 62]

Accordingly, when obtaining certification for an engine for industrial vehicles, if the special motor vehicle in which the engine is installed (i) falls under a motor vehicle that drives on public roads, engine certification under the Vehicle Act (namely, device type designation for carbon monoxide, etc. emissions control devices[63]) shall be obtained, and if such vehicle (ii) falls under a non-road special motor vehicle, engine certification under the Off-Road Act (namely, non-road engine[64] type designation[65]) shall be obtained, in principle.

However, if device type designation for carbon monoxide, etc. emissions control devices under the Vehicle Act is obtained, the engine in question will be regarded as an engine that has received type designation for non-road engines under the Off-Road Act ("non-road engines with type designation"[66]).[67] Accordingly, if, for any given engine, device type designation for carbon monoxide, etc. emissions control devices under the Vehicle Act has been obtained, there is no need to additionally obtain type designation for non-road engines under the Off-Road Act when installing such engine in a non-road vehicle.

For the foregoing reason, Toyota Industries has made it a policy to obtain engine certification under the Vehicle Act for engines for industrial vehicles; and for each of the engines for industrial vehicles for which improprieties have been found, device type designation for carbon monoxide, etc. emissions control devices under the Vehicle Act had been obtained (in light of the foregoing, in this Report, the term "**domestic certification**" is generally used to refer to device type designation for carbon

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61 Although the applicable law may be different (the Vehicle Act or the Off-Road Act), the emission regulation values provided by these laws are the same. For the emission regulation values under the Vehicle Act, the Public Notice on Details, Article 41, Paragraph 1, Item 13 (for gasoline engines) and Item 15 (for diesel engines); for the emission regulation values under the Off-Road Act, Public Notice of the Off-Road Act, Article 2, Paragraph 1, Item 1 (for gasoline engines) and Item 2 (for diesel engines).

62 The reason the emission regulations framework is provided by two different laws as shown above, as discussed in 1 above, is that the emission regulations initially applied only to motor vehicles that drive on public roads that were regulated by the Vehicle Act, but subsequently, when the Tier 2 Regulations expanded the applicable scope to certain vehicles that don't drive on public roads (non-road vehicles), a law, the Off-Road Act, separate from the Vehicle Act was established.

63 Vehicle Act, Article 75-3, Paragraph 1

64 "Non-road engines" refer to engines installed in non-road vehicles and non-road vehicle emissions control devices installed as an integral part of such engines (Off-Road Act, Article 2, Paragraph 2; Regulations for Enforcement of the Off-Road Act, Article 1).

65 Off-Road Act, Article 6, Paragraph 1

66 Refer to the Off-Road Act, Article 6, Paragraph 5.

67 Off-Road Act, Article 6, Paragraph 7. Engines that are regarded under this Paragraph as non-road engines with type designation are limited to engines that have received device type designation as carbon monoxide, etc. emissions control devices that comply with emissions regulations for large-sized special motor vehicles and small-sized special motor vehicles (Regulations for Enforcement of the Off-Road Act, Article 4; Public Notice of the Off-Road Act, Article 6).

monoxide, etc. emissions control devices under the Vehicle Act). Accordingly, the matter at issue in this Investigation is device type designation for carbon monoxide, etc. emissions control devices under the Vehicle Act, and for this reason, an explanation is provided below for an overview of the system thereof and the certification obtainment procedures, etc.

(2) Overview, etc. of the system for device type designation of carbon monoxide, etc. emissions control devices

A. Examination of compliance with Safety Standards and the vehicle type certification system

Article 41, Paragraph 1 of the Vehicle Act provides that motor vehicles must be equipped with devices that comply with the Safety Standards or else they shall not be used for operation, and these devices include carbon monoxide, etc. emissions control devices.[68] Ideally, to determine whether carbon monoxide, etc. emissions control devices comply with the Safety Standards, an examination should be performed when motor vehicles equipped with these devices undergo new registration and new inspection. In other words, to have a vehicle be used for operation, it must be registered in the automobile registration file ("new registration"),[69] and the person seeking new registration[70] must simultaneously request both new registration and new inspection[71] and present one of each such vehicle (actual vehicle) for which registration is sought to undergo new inspection conducted by the Minister of Land, Infrastructure, Transport and Tourism.[72] Whether such vehicle (including carbon monoxide, etc. emissions control device) complies with the Safety Standards will be examined during this new registration and new inspection process.[73]

However, motor vehicles, having the same and uniform structure, equipment and performance, are normally mass-produced, and it would be not easy, nor efficient, to have each of all such mass-produced motor vehicles undergo new inspection by the Minister of Land, Infrastructure, Transport

68 Carbon monoxide, etc. emissions control devices are included in "emission control devices for automobile soot and smoke, gases with offensive odor, toxic gas, and so on" specified in Article 41, Paragraph 1, Item 12 of the Vehicle Act (see Vehicle Act, Article 75-3, Paragraph 1; Device Type Designation Regulations, Article 2, Item 18).

69 Vehicle Act, Article 4

70 Because new registration is a procedure for vehicle ownership, the person who performs the procedure is the vehicle owner (Vehicle Act, Article 7, Paragraph 1, proviso). In contrast, new inspection is a procedure performed to ensure the safety, etc. of a vehicle before operation, and thus the person who performs the procedure is the vehicle operator (Vehicle Act, Article 59, Paragraph 1, proviso).

71 Vehicle Act, Article 59, Paragraph 2

72 Vehicle Act, Article 59, Paragraph 1, proviso (with respect to presentation of vehicles, additionally Article 7, Paragraph 1, proviso of the Act)

73 Vehicle Act, Article 8, Item 2, Article 60, Paragraph 1, first sentence

and Tourism and examine their compliance with the Safety Standards. Thus, the Vehicle Act provides the vehicle type certification system to streamline new inspection. As discussed below, the vehicle type certification system includes (i) the vehicle type designation system, (ii) the new vehicle notification system, and (iii) the system for type certification of light motors, etc. not subject to inspection, and vehicles that have obtained such certification do not need to undergo actual new inspection or are eligible for simplified procedures thereof. If device type designation for carbon monoxide, etc. emissions control devices has been obtained, partly simplified procedures will be available when certification of (i) to (iii) above is to be obtained.

An overview of each vehicle type certification system and the relationship between each system and device type designation (the position of device type designation in each system) are explained below.

B. Vehicle type designation system

(a) Overview

The vehicle type designation system refers to a system in which, upon application by a vehicle manufacturer, etc.,[74] the Minister of Land, Infrastructure, Transport and Tourism[75] determines whether said manufacturer's vehicles comply with the Safety Standards and whether there is uniformity,[76] and then designates the type of the motor vehicles.[77] With respect to vehicles that have received vehicle type designation, the vehicle manufacturer, etc., which had filed application for such designation, will perform inspection of compliance with the Safety Standards ("completion inspection") on each of the vehicles it has produced, and then a completion inspection certificate is issued and granted.[78] This eliminates the need for the vehicle owner carrying out new registration to

74 Regarding applicants, Vehicle Type Designation Regulations, Article 2; Vehicle Type Designation Implementation Guidelines, Part 1-1

75 It is stipulated that the Minister of Land, Infrastructure, Transport and Tourism has the administrative affairs concerning vehicle type designation and device type designation, etc. for examining whether vehicles and special devices, etc. comply with the Safety Standards performed by the National Agency for Automobile and Land Transport Technology ("**NALTEC**") (Vehicle Act, Article 75-5, Paragraph 1). In light of this, NALTEC has stipulated "Facility Examination Affairs Rules" as rules for performing such examination affairs, (Act on the National Agency for Automobile and Land Transport Technology, Article 13, Paragraph 1, Article 12, Item 1), and performs examination pursuant thereto. The body that actually performs examinations and other administrative affairs under the Vehicle Type Designation System and other systems of the Automobile Type Approval System is NALTEC's National Traffic Safety and Environment Laboratory, Automobile Type Approval Test Department ("**Automobile Type Approval Test Department**").

76 Vehicle Act, Article 75-3, Paragraph 2

77 Vehicle Act, Article 75, Paragraph 1

78 Vehicle Act, Article 75, Paragraph 4

present the actual vehicle and undergo examination of compliance with the Safety Standards[79] and to undergo actual new inspection.[80]

In other words, the vehicle type designation system is a system where, instead of individually examining compliance with the Safety Standards of mass-produced vehicles through new inspection, (i) the Minister of Land, Infrastructure, Transport and Tourism examines compliance with the Safety Standards of a sample of vehicles presented by an automaker at the time of vehicle type designation application and verifies that even with mass production, the uniformity of performance levels and safety of the vehicles is ensured, and (ii) the automaker that has obtained vehicle type designation individually confirms, through completion inspection, compliance with the Safety Standards for each of the motor vehicles it has produced, and the system has the objective of streamlining new inspections.

(b) Relationship with device type designation

After an application for vehicle type designation is filed, determinations will be made as to whether the structure, devices and performance of the motor vehicles pertaining to the application comply with the Safety Standards, etc.,[81] and in such determinations, the devices that have already received device type designation are regarded as being in compliance with the Safety Standards,[82] and therefore, there is no need to have said devices once again examined about their compliance with the Safety Standards.

Accordingly, in a case where an engine manufacturer has obtained, for engines it developed, device type designation for carbon monoxide, etc. emissions control devices, it is not necessary for a vehicle manufacturer, etc. that purchases said engine and manufactures motor vehicles, when applying for vehicle type designation for said vehicles, to receive a determination once again whether said engines are in compliance with the Safety Standards, and thus partially simplified vehicle type designation examination will be available.

C New vehicle notification system

(a) Overview

The new vehicle notification system is a system set forth in the Vehicle Type Approval Implementation Guidelines ("**Approval Implementation Guidelines**"), Exhibit 2 "New Vehicle Handling Guidelines." While it is necessary for the operator of a vehicle with new vehicle notification

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79 Vehicle Act, Article 7, Paragraph 3, Item 2

80 Vehicle Act, Article 59, Paragraph 4, Article 7, Paragraph 3, Item 2

81 Vehicle Act, Article 75, Paragraph 3, first sentence

82 Vehicle Act, Article 75, Paragraph 3, second sentence

("vehicles with new notification") to present the actual vehicle and have it undergo new inspection, during such new inspection, (i) examination will be performed with reference to the table of specifications that the manufacturer, etc. has submitted for new vehicle notification,[83] and furthermore (ii) the parts of the structure and devices of the vehicle presented that is the same as the structure and devices of the vehicle with new notification will be treated as being in compliance with the technical standards, etc. applied to new inspection,[84] and thus examination may be simplified in new inspection.

(b) Relationship with device type designation

As part of new vehicle notification, it is necessary for a vehicle manufacturer, etc. to submit a "written review" stating the result of its review of whether the new vehicle subject to notification complies with the rules of the Safety Standards;[85] but one exception involves devices that have already received device type designation; the manufacturer may omit, in its written review, the results of its review concerning compliance with the Safety Standards.[86]

Accordingly, as with the case of vehicle type designation (B(b) above), if device type designation has been obtained for a carbon dioxide, etc. emissions control device on an engine developed by the engine manufacturer, partially simplified new vehicle notification procedures will be available for manufacturers, etc. of vehicles with new notifications.

D Type certification of light motors, etc. not subject to inspection (small-sized special motor vehicles)

(a) Overview

As discussed in A above, pursuant to Article 41, Paragraph 1 of the Vehicle Act, unless a vehicle has devices in compliance with the Safety Standards, such vehicle may not be used for operation, and in principle, whether said vehicle is in compliance with the Safety Standards is examined during new registration and new inspection. However, with respect to small-sized special motor vehicles, although

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83 When the table of specifications is used as a reference during an examination, items to be examined in documents, etc. that are the same as those in the table of specifications and free of any damage that might impair their functions are treated as being in compliance with the standards (Facility Examination Affairs Rules, Part 4, 4-12-2(4)(i)).

84 Facility Examination Affairs Rules, Part 4, 4-12-2(4)(ii)

85 New Vehicle Handling Guidelines, Part 2, Paragraph 1, second sentence, Attachment 3(8)

86 New Vehicle Handling Guidelines, Attachment 3(8)

Article 41, Paragraph 1 of the Vehicle Act is applicable,[87] new registration in a motor vehicle registration file is not required to put them into operation,[88] and it is also not necessary to undergo a new inspection.[89, 90] For this reason, when placing a small-sized special motor vehicle into operation, the responsibility of verifying its compliance with the Safety Standards lies only with the operator of said small-sized special motor vehicle.

With respect to this point, there is a system for a manufacturer, etc. to verify that small-sized special motor vehicles comply with the Safety Standards, which is the type certification system for light motors, etc. not subject to inspection.[91] A manufacturer, etc. of light motors, etc. not subject to inspection, by submitting documents, etc. that clarify that light motors, etc. not subject to inspection comply with the Safety Standards,[92] is able to receive certification from the Minister of Land, Infrastructure, Transport and Tourism for the type of light motors, etc. not subject to inspection.[93] Then, the manufacturer, etc. which has obtained the certification performs inspection of whether each of the light motors, etc. not subject to inspection that it has produced complies with the Safety Standards ("Shipment Inspection").[94] This establishes a framework in which whether each of the light motors, etc. not subject to inspection that have been produced complies with the Safety Standards is verified prior to shipment by the manufacturer, etc.

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87 The "motor vehicles" in Article 41 of the Vehicle Act have no specific limitations and therefore include all vehicles, including small-sized special motor vehicles, that are provided in Article 3 of the Vehicle Act and Article 2 and Attachment 1 of the Regulations for Enforcement of the Vehicle Act.

88 Article 4 of the Vehicle Act excludes small-sized special motor vehicles from the scope of "motor vehicles" that cannot be put into operation unless they have been registered in a vehicle registration file.

89 The scope of "motor vehicles" that must undergo new inspection are (i) unregistered motor vehicles provided in Article 4 of the Vehicle Act, (ii) light motors other than light motors not subject to inspection and (iii) small-sized two-wheel motor vehicles (Vehicle Act, Article 59, Paragraph 1), and do not include small-sized special motor vehicles.

90 The reason it was decided that small-sized special motor vehicles do not need to undergo new registration or new inspection when being put into operation is that, because small-sized special motor vehicles are primarily used for transport between work sites and rarely drive on public roads, a determination was made that the vehicle operator is responsible for ensuring compliance with the Safety Standards.

91 The term "light motors, etc. not subject to inspection" is a collective name for light motors not subject to inspection, small-sized special motor vehicles and motorbikes (Regulations for Enforcement of the Vehicle Act, Article 62-3, Paragraph 1).

92 Regulations for Enforcement of the Vehicle Act, Article 62-3, Paragraph 3

93 Regulations for Enforcement of the Vehicle Act, Article 62-3, Paragraph 1

94 Regulations for Enforcement of the Vehicle Act, Article 62-3, Paragraph 5; Approval Implementation Guidelines, Attachment 3 "Type certification guidelines for motors for light motors, etc. not subject to inspection and motorbikes" ("**Certification Guidelines**"), Part 6-1(2)

(b) Relationship with device type designation

As with the case of new vehicle notifications (C(b) above), when applying for type certification for a light motor, etc. not subject to inspection, it is necessary for the applicant manufacturer, etc. to submit a written review stating the outcome of its review of whether the light motor, etc. not subject to inspection pertaining to the notification relating to the application complies with the Safety Standards,[95] but as an exception, with respect to devices that have already received device type designation, the results of a review of their compliance with the Safety Standards may be omitted in the written review,[96] and moreover submission of attachment documents relating to said devices may be omitted as well.[97]

Accordingly, as with the cases of vehicle type designation (B(b) above) and new vehicle notifications (C(b)), if an engine manufacturer has already obtained device type designation for a carbon monoxide, etc. emissions control device for engines that it developed, the manufacturer, etc. of light motors, etc. not subject to inspection will be eligible for partially simplified type certification procedures for the light motors, etc. not subject to inspection.

4 Procedures, etc. for device type designation of carbon monoxide, etc. emissions control devices

The particulars of procedures, etc. for device type designation of a carbon monoxide, etc. emissions control device are specified in the Device Type Designation Regulations, the Device Type Implementation Guidelines, and the "Device Type Designation Standards of Carbon Monoxide, etc. Emissions Control Devices"[98] of Attachment 21 to the Device Type Implementation Guidelines ("**Designation Standards**"). Below, procedures, etc. for device type designation of carbon monoxide,

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95 Certification Guidelines, Part 2, Attachment 3(7)

96 Explanatory note to Certification Guidelines, Attachment 3(7)

97 Certification Guidelines, Part 13

98 Device Type Designation Implementation Guidelines, Article 8, Paragraph 54.

etc. emission control devices to be installed on special motor vehicles are explained.[99]

(1) Application

A manufacturer, etc. who files an application for a device type designation of carbon monoxide, etc. emissions control device to be installed on special motor vehicles must (i) submit an application and attached documents to the Ministry of Land, Infrastructure, Transport and Tourism and the Automobile Type Approval Test Department,[100] and (ii) present to the Automobile Type Approval Test Department[101] a special motor vehicle on which a carbon monoxide, etc. emission control device has been installed.[102]

Among the attached documents that are to be submitted, "documents evidencing the durability of the carbon monoxide, etc. emissions control device to which the application pertains" ("**Durability Documents**") are included;[103] the Durability Documents must state matters such as the deterioration correction values, and the methods of stating, etc. must be in accordance with the Approval Implementation Guidelines Supplementary Rule 7 "Long Distance Driving Implementation Guidelines, etc." ("**Long Distance Implementation Guidelines**")[104] Accordingly, when applying for a device type designation of a carbon monoxide, etc. emission control device, the manufacturer, etc.

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99 Although Vol. II of the Designation Standards specify procedures etc. that apply to carbon monoxide, etc. emissions control devices to be installed on large-sized special motor vehicles, they do not directly specify procedures etc. that apply to carbon monoxide, etc. emissions control devices to be installed on small-sized special motor vehicles. However, if the carbon monoxide, etc. emissions control device under application can be installed not only on small-sized special vehicles but on large-sized special motor vehicles as well, Vol. II of the Designation Standards will apply, and thus, in practice, procedures, etc. for device type designation of carbon monoxide, etc. emission control devices to be installed on not only large-sized special motor vehicles but also on small-sized special motor vehicles will be carried out pursuant to Vol. II of the Designation Standards. Accordingly, hereinafter, procedures, etc. for device type designation will be explained pursuant to Vol. II of the Designation Standards without any distinction between large-sized special motor vehicles and small-sized special motor vehicles.

100 Regarding applications, Device Type Designation Regulations, Article 4, Paragraph 1; regarding attached documents, Device Type Designation Regulations, Article 4, Paragraph 2 and Designation Standards Vol. II, 3. Regarding application destination, Device Type Designation Implementation Guidelines, No. 1, Paragraph 1 and Designation Standards Vol. II, 3.2.

101 Note that under the provisions of Designation Standards Vol. II, 4.1, submission is to NALTEC's National Traffic Safety and Environment Laboratory.

102 Device Type Designation Regulations, Article 4, Paragraph 1 and Designation Standards Vol. II, 4.1.

103 Designation Standards Vol. II, 3.2, Attachment 2-1, 4.(2)-2; Attachment 4-1 (Gasoline Engines); and Attachment 5-1 (Diesel Engines). Note that if a vehicle type designation application regarding large-sized special motor vehicles installed with such a device is to be filed concurrently with an application for a device type designation of carbon monoxide, etc. emission control device, it is necessary to present the vehicle (actual car) which has completed durability operation, and submission of Durability Documents will not be necessary (Designation Standards Vol. II, 4.1, 4.2, and Attachment 2-1, 4.(2), 1).

104 Designation Standards Vol. II, Attachment 4-1, Note 1 and Attachment 5-1, Note 1.

must perform deterioration durability testing pursuant to the Long Distance Implementation Guidelines, etc.[105] in advance, and calculate the deterioration correction values, etc. stated in the Durability Documents[106] (an overview of deterioration durability testing is explained in 5 below).

(2) Testing

After an application for device type designation for a carbon monoxide, etc. emissions control device is accepted, emission measurement testing of the carbon monoxide, etc. emissions control device presented by the manufacturer, etc. will be performed in the presence of the Automobile Type Approval Test Department[107] ("**Witness Test**").[108]

Different methods for measuring emissions during Witness Tests are specified for gasoline engines and diesel engines. That is, for emissions testing of gasoline engines, it is required that the engine be operated using the method specified in the "Seven-Mode Cycle Test Method for Gasoline and LPG

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105 If driving of a vehicle is to be implemented pursuant to "driving requirements" of a special motor vehicle, the Long Distance Implementation Guidelines are to be in accordance with (i) "driving requirements for motor vehicles to be presented to the National Agency for Automobile and Land Transport Designation under Article 3, Paragraph 1 of the Vehicle Type Designation Regulations, motor vehicles specified by the Minister of Land, Infrastructure, Transport and Tourism and documents specified by the Minister of Land, Infrastructure, Transport and Tourism under Paragraph 4 of said Article (Ministry of Transport Notification No. 331 of 1983)" ("**Public Notice on Durability for Long Distance Driving**") and (ii) the Designation Standards, as well as the (iii) Approval Implementation Guidelines Supplementary Rule 7-7, "Long Distance Driving (4) Implementation Guidelines" in the case of gasoline engines, and Approval Implementation Guidelines Supplementary Rule 7-9, "Long Distance Driving (5) Implementation Guidelines" in the case of diesel engines (Long Distance Implementation Guidelines 1.(4) for gasoline engines, and Long Distance Implementation Guidelines 1.(5) for diesel engines). Accordingly, deterioration durability testing must also be implemented pursuant to (i) the Public Notice on Durability for Long Distance Driving, (ii) the Designation Standards, and (iii) the Approval Implementation Guidelines Supplementary Rules 7-7 or 7-9.

106 Because the method of stating the deterioration correction values, etc. in the Durability Documents is to be "in accordance with the Long Distance Implementation Guidelines (Designation Standards, Vol. II, Attachment 4-1, Note 1, Attachment 5-1, Note 1), the method of calculating the deterioration correction values, etc. to be stated in the Durability Document is to be in accordance with the provisions that specify the method of calculating the deterioration correction value, etc. in the Long Distance Implementation Guidelines, namely, Long Distance Implementation Guidelines Supplementary Rule 7-8 "Guidelines for Entering Driving Implementation Completion Certificate and Standards Conformity Certificate of the Motor Vehicle Under Application (4)" for gasoline engines, and the Long Distance Implementation Guidelines Supplementary Rule 7-10, "Guidelines for Entering Driving Implementation Completion Certificate and Standards Conformity Certificate of the Motor Vehicle Under Application (5)" for diesel engines.

107 As already discussed, administration of examinations of the device type designation is to be carried out by NALTEC as entrusted by the Minister of Land, Infrastructure, Transport and Tourism (Vehicle Act, Article 75-5), and the Automobile Type Approval Test Department will perform the examinations for device type designation, etc.

108 A Witness Test often measures emissions by using an engine after the completion of the break-in operation. The break-in operation time for engines to be installed on special motor vehicles is 100 hours or more (Approval Implementation Guidelines, Supplementary Rule 7-2 "Long Distance Driving Emission Value Handling Guidelines" 3.).

Special Motor Vehicles" of Attachment 103 to the Public Notice on Details ("**7-Mode Method**") and the emissions measured.[109] Operating an engine using the 7-Mode Method means, in general, operating the engine under the operating conditions specified in Table 6 of Attachment 103 to the Public Notice on Details described below.[110]

Operating Conditions Specified in Table 6 of Attachment 103 to the Public Notice on Details

Operating Mode	Operating Conditions		Minimum Operating Time (min)	Weight Factor (WF)
	Engine Rotation Speed (min)	Engine Load Rate (%)		
1	Rated rotation speed	25	5	0.06
2	Intermediate rotation speed	100	5	0.02
3	Intermediate rotation speed	75	5	0.05
4	Intermediate rotation speed	50	5	0.32
5	Intermediate rotation speed	25	5	0.30
6	Intermediate rotation speed	10	5	0.10
7	Idling rotation speed	0	5	0.15

On the other hand, for emissions testing of diesel engines, it is required that the engine be operated and the emission measurements be taken using the eight-mode cycle test method for diesel special motor vehicles and the NRTC mode specified in Attachment 43 "Diesel Special Motor Vehicles Emission Measurement Method" to the Public Notice on Details ("**8-Mode Method**").[111] Operating an engine using the 8-Mode Method means, in general, operating the engine under the operating conditions of the discrete test cycle or operating the engine under the operating conditions of the RMC test cycle specified in Appendix 1 of Attachment 43 to the Public Notice on Details.[112]

Operating Conditions Specified in Appendix 1 of Attachment 43 to the Public Notice on Details

- Discrete Test Cycle

[109] Designation Standards Vol. II, 6. Note that it is also specified that emission values calculated using the 7-Mode Method are the standard for the emission regulation value of gasoline engines. (See Article 41, Paragraph 1, Item (13) of the Public Notice on Details.)

[110] 10.1 of Attachment 103 to the Public Notice on Details.

[111] Designation Standards, Vol. II, 6. The regulatory value for diesel engine emissions is also stipulated as the emissions value measured using the 8-Mode Method and the NRTC mode method as the standard (see Public Notice on Details, Article 41, Paragraph 1, Item 15).

[112] 7.4 of Attachment 43 to the Public Notice on Details.

Mode Number	Engine Rotation Speed	Torque (%)	Weight Factor
1	Rated rotation speed	100	0.15
2	Rated rotation speed	75	0.15
3	Rated rotation speed	50	0.15
4	Rated rotation speed	10	0.1
5	Intermediate rotation speed	100	0.1
6	Intermediate rotation speed	75	0.1
7	Intermediate rotation speed	50	0.1
8	Idling rotation speed	―	0.15

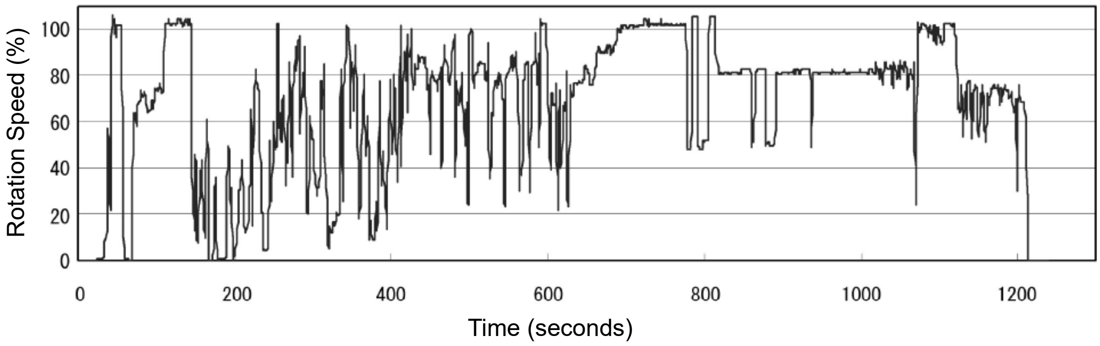
- RMC Test Cycle

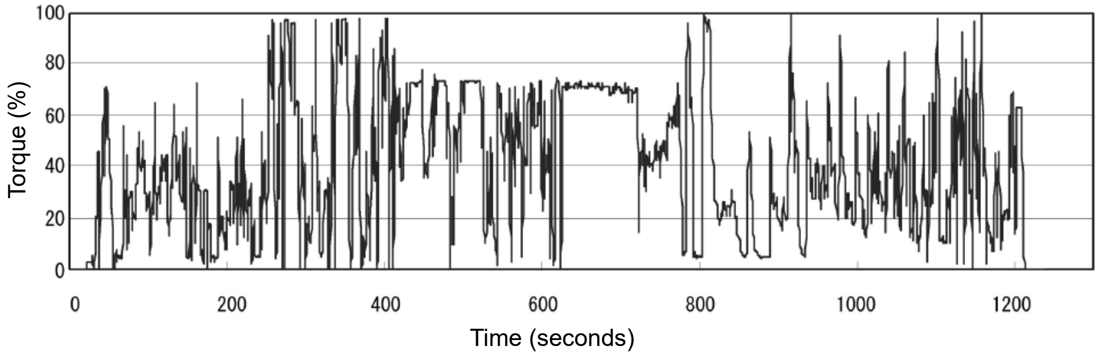
RMC Mode	Mode Time (s)	Engine Rotation Speed	Torque (%)
1a Steady state	126	Warm up idle rotation speed	0
1b Transition	20	Straight-line transition	Straight-line transition
2a Steady state	159	Intermediate rotation speed	100
2b Transition	20	Intermediate rotation speed	Straight-line transition
3a Steady state	160	Intermediate rotation speed	50
3b Transition	20	Intermediate rotation speed	Straight-line transition
4a Steady state	162	Intermediate rotation speed	75
4b Transition	20	Straight-line transition	Straight-line transition
5a Steady state	246	Rated rotation speed	100
5b Transition	20	Rated rotation speed	Straight-line transition
6a Steady state	164	Rated rotation speed	10
6b Transition	20	Rated rotation speed	Straight-line transition
7a Steady state	248	Rated rotation speed	75
7b Transition	20	Rated rotation speed	Straight-line transition
8a Steady state	247	Rated rotation speed	50
8b Transition	20	Straight-line transition	Straight-line transition
9 Steady state	128	Warm up idle rotation speed	0

Also, operating an engine using the NRTC mode method and taking emission measurements means, in general, operating the engine so that the engine rotation speed per second and torque[113] are as specified in Appendix 1 of Attachment 43 to the Public Notice on Details. The engine rotation speed per second and torque specified in Appendix 1 of Attachment 43 to the Public Notice on Details are as indicated below.[114]

113 Torque means the force generated around a fixed rotating shaft (in the case of an engine, the crankshaft), and is one of the factors needed to calculate engine output (engine output (kW) is calculated on the basis of torque (Nm) and the engine rotation speed (rpm)).

114 7.4.2. of Attachment 43 to the Public Notice on Details.





At Toyota Industries, when operating a diesel engine using the NRTC mode method, reproducing the engine rotations per second and torque specified in Appendix 1 of Attachment 43 to the Public Notice on Details was referred to as "following (reproducing) the test (operating) mode" and by other descriptions.

(3) Determinations

On the basis of the results of emission measurements during Witness Tests, a determination is made as to whether the carbon monoxide, etc. emissions control device under application complies with the Safety Standards. Specifically, the total of the emission values measured in the Witness Tests and the deterioration correction values described in the Durability Documents must not exceed the regulation values.[115]

[115] Designation Standards, Vol. II, 7.; Approval Implementation Guidelines Supplementary Rule 7-2, 3.

5 Deterioration durability testing

(1) Overview

Deterioration durability testing for engine emissions is testing to confirm how much the performance of an engine equipped with a carbon monoxide, etc. emissions control device changes (how much it deteriorates) with the passage of operating time by operating the engine for a specified number of operating hours[116, 117] or more and measuring the emissions component values at each measurement time. The deterioration correction values are the differences between the emission values after deterioration (after a specified number of operating hours) and the emission values before deterioration,[118] and are calculated on the basis of the results of deterioration durability testing. As mentioned in 4(2)(3) above, in Witness Tests, a pre-deterioration engine is operated and emission measurements are taken to determine if the totals of the emission values and the deterioration correction values stated in the Durability Documents are within the regulation values.[119]

(2) Implementation method, etc.

There are two methods of operating an engine in deterioration durability testing: one is to operate the engine while it is mounted on a piece of equipment called an engine dynamometer (commonly called a "**bench**"),[120] and the other is to install the engine in a motor vehicle and actually drive it;[121]

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116 Although terms such as "number of driving hours" and "driving time" are used in the Long Distance Implementation Guidelines, Public Notice on Durability for Long Distance Driving, etc., as described below, Toyota Industries conducts deterioration durability testing by "operating" the engine on an engine dynamometer, rather than by actually "driving" the engine in the vehicle under application. Accordingly, in this report, the terms "number of operating hours," "operating time," etc. are used instead of "number of driving hours," "driving time," etc., respectively.

117 The driving requirements for large-sized special motor vehicles are stipulated according to the number of hours of operation (number of driving hours). Meanwhile, the driving requirements for motor vehicles other than large-sized special motor vehicles are stipulated according to the number of kilometers driven, not the number of operating hours (Article 1 of the Public Notice on Durability for Long Distance Driving).

118 More precisely, the pre-deterioration emission values refer to the emission values after the break-in period has ended and are referred to as "**initial values**." The initial values used to calculate the deterioration correction values are the estimated emission values at 100 hours of operation or the measured emission values at 100 or more hours of operation (Approval Implementation Guidelines Supplementary Rule 7-8, 1.(7)E; Ibid. Supplementary Rule 7-10, 1.(7)E).

119 In contrast, emission regulations in the U.S. and Europe mainly use a deterioration factor (a numerical value that expresses the degree to which emission performance deteriorates with the passage of operating time), and the emission values before deterioration are multiplied by the deterioration factor to determine if they meet the regulation values.

120 Approval Implementation Guidelines Supplementary Rule 7-7, 3.1; Ibid. Supplementary Rule 7-9, 3.1.

121 Approval Implementation Guidelines Supplementary Rule 7-7, 3.2; Ibid. Supplementary Rule 7-9, 3.2.

at Toyota Industries, deterioration durability testing is performed using the former method. Specifically, with regard to engines for deterioration durability testing, (1) operation is started on a bench called a "Durability Test Bench," (2) when the predetermined number of operating hours for emission measurement is reached, the engine is moved to another bench called a "Measurement Bench" and emission measurement is performed, and (3) the engine is returned to the Durability Test Bench and operated until the number of operating hours for the next emission measurement. Deterioration durability testing is performed by repeating this process until the specified number of operating hours is reached.

According to Article 1 of the Public Notice on Durability for Long Distance Driving, the number of operating hours required for deterioration durability testing is 5000 hours or more for large-sized gasoline special motor vehicles, 5000 hours or more for large-sized diesel special motor vehicles with a rated output of 19 kW or more but less than 37 kW, and 8000 hours or more for 37 kW or more but less than 560 kW.[122] When such an operating hour is reached, a final emission measurement is conducted. However, the Long Distance Implementation Guidelines allow the final emission measurement to be conducted when the number of operating hours for the deterioration durability testing reaches a certain number of hours, and the emission values for the number of operating hours specified in Article 1 of the Public Notice on Durability for Long Distance Driving are to be obtained by extrapolation[123] on the basis of the results of emission measurements up to that point.[124] To summarize, the number of operating hours required for deterioration durability testing is shown in the table below.

122 Article 1 of the Public Notice on Durability for Long Distance Driving.

123 With regard to the method of extrapolation, see the Long Distance Implementation Guidelines, 1.(2).

124 With regard to gasoline special motor vehicles, see Approval Implementation Guidelines Supplementary Rule 7-7, 5.1, proviso, and with respect to diesel special motor vehicles, see Ibid. Supplementary Rule 7-9, 5.1, proviso, and Table 3.

Motor vehicles	Number of operating hours specified in Article 1 of the Public Notice on Durability for Long Distance Driving	Number of operating hours when extrapolation method is applied
Large-sized gasoline special motor vehicles	5000 hours	1670 hours[125]
Large-sized diesel special motor vehicles (19 kW or more but less than 37 kW)	5000 hours	1670 hours
Large-sized diesel special motor vehicles (or more but less than 560 kW)	8000 hours	2670 hours

With regard to the specific measurement times for emission measurements during the deterioration durability testing, the first emission measurement is required within 250 operating hours for gasoline engines[126] and within 125 operating hours for diesel engines.[127] The second and subsequent emission measurements are taken at approximately equally spaced intervals from the initial measurement time to the final measurement time.[128]

The method of measuring emissions in deterioration durability testing is the same as in Witness Tests, and the 7-Mode Method for gasoline engines and the 8-Mode Method and NRTC mode method for diesel engines are used to operate the engines for emission measurements.[129]

125 Strictly speaking, it is "at least 1/3" (Approval Implementation Guidelines Supplementary Rule 7-7, 5.1, proviso) of the number of operating hours (5000 hours) specified in Article 1 of the Public Notice on Durability for Long Distance Driving, which is approximately 1667 hours; however, in the reference mode showing an example of operation, the number is set at 1670 hours (Table B in the Attachment (related to Supplementary Rule 7-7) to Approval Implementation Guidelines).

126 Approval Implementation Guidelines Supplementary Rule 7-7, 5.1.

127 Approval Implementation Guidelines Supplementary Rule 7-9, 5.1.

128 Approval Implementation Guidelines Supplementary Rule 7-7, 5.1; Ibid. Supplementary Rule 7-9, 5.1. In order to be able to say that the emission measurements are taken at "approximately equally spaced intervals," the number of segments must be at least three, and the length of the emission measurement period must be within ±10% of the number of driving hours in each segment.

129 Approval Implementation Guidelines Supplementary Rule 7-7, 5.1; Ibid. Supplementary Rule 7-9, 5.1.

(3) Engines used, etc.

The engine used for deterioration durability testing must have "the same structure, equipment, and performance"[130] as the vehicle engine and emission reduction equipment of the motor vehicle for which the device type designation is being applied for, that is, the same specifications as the engine to be mass produced after obtaining the device type designation.

For the duration of deterioration durability testing, parts relating to emissions performance shall not be replaced, except for parts that are to be replaced periodically.[131] Therefore, in principle, deterioration durability testing is expected to be performed on the same engine with the same parts.[132]

(4) Calculation of deterioration correction values

After deterioration durability testing is completed, the deterioration correction values are calculated using a predetermined formula[133] on the basis of the results of the emission measurements at each measurement time.

If the carbon monoxide, etc. emissions control device under application has already been certified in the U.S. or Europe, the deterioration correction values calculated using the predetermined formula on the basis of the deterioration factor calculated when the device was certified can be included in the Durability Documents.[134] That is, if a carbon monoxide, etc. emissions control device has already been certified in the U.S. or Europe prior to domestic certification, the deterioration factor calculated at the time of U.S. or European certification can be used in the application for domestic certification, and there is no need to redo deterioration durability testing in accordance with domestic laws and regulations.

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130 Approval Implementation Guidelines Supplementary Rule 7-7, 2.; Ibid. Supplementary Rule 7-9, 2.

131 Approval Implementation Guidelines Supplementary Rule 7-7, 4.2; Ibid. Supplementary Rule 7-9, 4.2.

132 However, in unavoidable cases, parts other than periodically replaced parts may be replaced after recording the details of maintenance (Approval Implementation Guidelines Supplementary Rule 7-7, 4.1; Ibid. Supplementary Rule 7-9, 4.1). In this case, the replacement parts must be kept for the duration of the device type designation application so that they can be presented to the Ministry of Land, Infrastructure, Transport and Tourism and the Automobile Type Approval Test Department. (Approval Implementation Guidelines Supplementary Rule 7-7, 4.2, proviso; Ibid. Supplementary Rule 7-9, 4.2, proviso).

133 Approval Implementation Guidelines Supplementary Rule 7-8, 1.(7)D(a)(c)(d); Ibid. Supplementary Rule 7-10, 1.(7)D(a)(c)(d)

134 However, for gasoline engines, this is limited to those certified in the U.S. For gasoline engines, see Approval Implementation Guidelines Supplementary Rule 7-8, 1.(7)D(b) and 2.(5); for diesel engines, see Ibid. Supplementary Rule 7-10, 1.(7)D(b) and 2.(5).

Part 3. Toyota Industries' Engine Development and Emissions Certification Acquisition Processes

At Toyota Industries, engine development and acquisition of certification for emissions were performed according to the following processes.

It should be noted that the engine development system was changed substantially by the revision of the Design Review Rules, which are internal rules, on June 30, 2021. Below is an explanation of the engine development process and so on premised on the development system in place at the time that the improper conduct occurred, i.e., up to June 30, 2021, followed by an explanation of the changes made by the revision of the Design Review Rules on that date.

Also, the engine development and emissions certification acquisition processes for engines for industrial vehicles such as forklifts and those for engines for automobiles for Toyota Motors were significantly different in the period up to June 30, 2021, and accordingly, in this section, first the engine development and emissions certification acquisition processes for engines for industrial vehicles are explained, and then the engine development and emissions certification acquisition processes for engines for automobiles are explained by means of comparison.

1 Engine development and emissions certification acquisition processes for engines for industrial vehicles

The development process for engines for industrial vehicles was generally as described below.

First, specific development targets including engine performance[135] and price are set based on specifications required by the customer and then a prototype was manufactured. Also, a test of engine performance, referred to as a "development test," is performed on the prototype to confirm the status of achievement of the development targets. Development of prototypes and implementation of development tests are conducted repeatedly[136] to identify and address problems and approach the development targets.

Once the prototype achieved the development targets, a prototype which has the same specifications as the mass production engine ("**Mass Production-Equivalent Engine**") is produced and development testing is conducted to confirm the status of achievement of the development targets. The Mass Production-Equivalent Engine is initially produced off the manufacturing line, and after confirming the status of achievement of the development targets by performing development testing, Mass Production-Equivalent Engines are manufactured using the actual manufacturing line and

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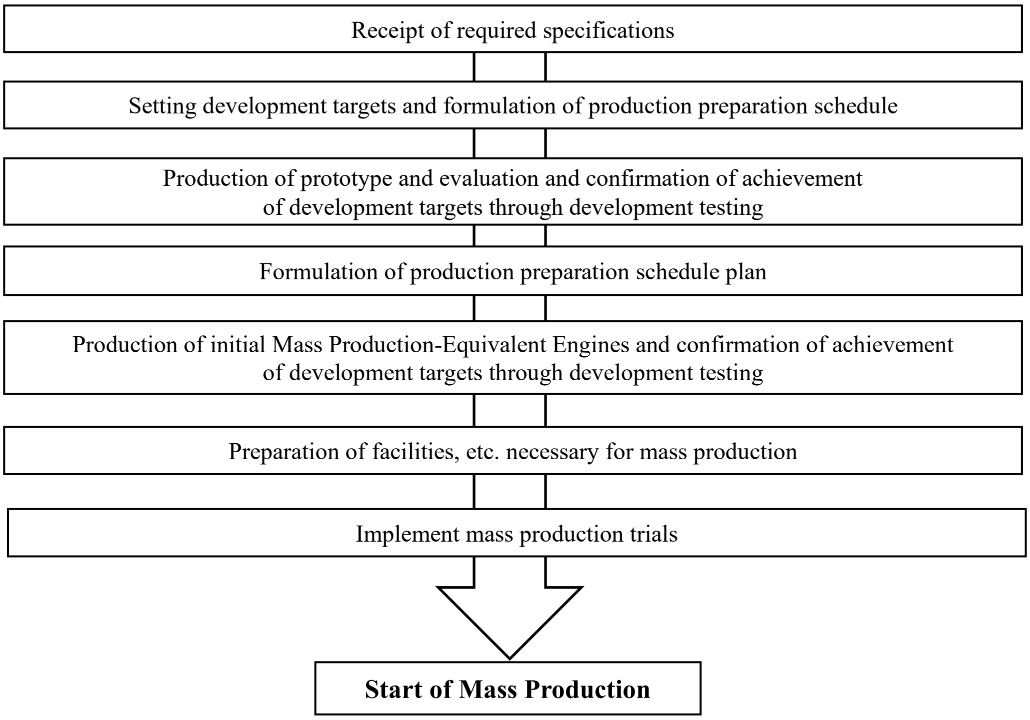
135 Output, torque performance, fuel efficiency, exhaust, durability, noise performance, etc.

136 The number of times the prototype production and development testing were performed varied depending on the scale of development.

development testing is performed to confirm the status of achievement of development targets.



In addition, a certification application is filed in parallel with development.

The processes relating to development of engines for industrial vehicles and acquisition of certification in relation to emissions are explained in more concrete detail below.

(1) Overview of the development process for engines for industrial vehicles

The development process for engines for industrial vehicles is stipulated in the New Product Development Rules and the Design Review Rules.[137] These rules divide the industrial vehicle engine development process into a number of phases and provide that when proceeding to the next phase, a deliberative meeting known as design review (referred to as "**DR**")[138] is to be held. During DR, the review items specified in the rules indicated above are reviewed, and in cases where the review

137 The New Product Development Rules and the Design Review Rules were established on April 1, 1985 and were subsequently revised multiple times, but during the period before June 30, 2021, there were no significant changes to the specifics of the development process. The explanation below is based on the rules in effect in 2013 at the time of development of the 1KD Engine.

138 The participants in DR meetings are the heads of all departments of the Engine Division.

committee chairperson[139] makes a determination that the criteria for transition to the next phase (referred to as the "**Transition Criteria**") are satisfied, approval for transition to the next phase is granted. The classification titles, purposes, and main items reviewed for each DR are described below.

Classification Title	DR Purpose and Main Review Items
Sales product plan review	Confirm the customer requirements, review the new sales product plan, and approve acceptance of the order and the start of development.
Product plan review	Review the appropriateness of the development targets and production preparation schedule plan and approve the start of production of prototypes.
Prototype design review	Review the prototype drawings.
Mass production transition review	Review the status of achievement of development targets by the prototype and approve the start of preparations for mass production.
Mass production design review	Review the status of achievement of development targets by the initial Mass Production-Equivalent Engines and approve the start of mass production preparations using a production line.
Production preparation review	Review the appropriateness of the production preparation schedule plan and make a determination on the start of preparations for mass production. Next, review the status of preparations for mass production and approve mass production trial.
Production transition review	Confirm the status of achievement of the development targets by the mass production trial, review the appropriateness of the production plan for after the start of mass production, and approve the start of mass production.

139 At Toyota Industries, the person who serves as committee chairperson of each DR is determined based on the business novelty (such as whether the engine to be developed will be delivered to a new customer), development expenses, and investment amount. The persons who served as committee chairpersons of each DR have changed over the times and has varied depending on the business novelty and business expenses, but in the case of the 1KD Engine, the General Manager of the Engine Division served as chairperson at all DR meetings.

The details of the development process varied depending on the engine.[140, 141] Below is an explanation premised on the development process pursuant to the Design Review Rules in effect in 2013 at the time of development of the 1KD Engine.

A. Receipt of specification requirements to setting development targets

Before starting engine development, the Engineering Office of the Engineering Dept., the Engine Division (referred to as the "**Engineering Office of the Engineering Dept.**")[142] receives the specification requirements setting forth the specific engine performance from TMHC.[143] Later, at DR, the possibility of developing an engine with the specified performance is reviewed based on the engine performance indicated in the specification requirements, and if the committee chairperson determines that engine development is possible, the commencement of engine development is approved.

Subsequently, evaluations are conducted repeatedly through prototype production and development testing, and prototypes are meticulously produced.

Specifically, after the Design Group prepares the detailed design, an initial prototype is produced using existing engines and components, the Engine Calibration Group performs development testing regarding emissions performance and investigates whether development of an engine with the performance stated in the specification requirements is technologically possible, each department within the Engine Division makes trial calculations of the cost of in-house production, the cost of components ordered from outside the company and development expenses, and based on the results of those trial calculations, the Business Planning Dept. investigates whether the project could be profitable. In parallel with these investigations, the Sales Dept. negotiates with TMHC on performance

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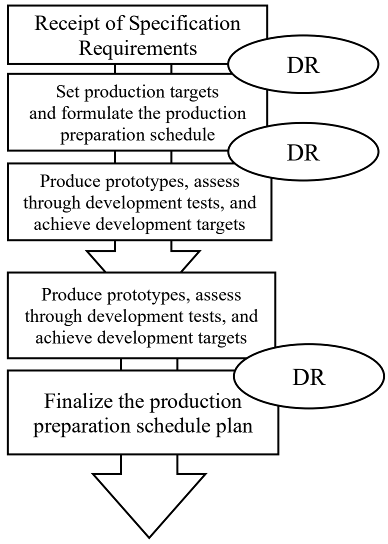
140 Until June 30, 2021, product development ranks from A to C were assigned to each engine, and the DR meetings held varied depending on the product development rank. Under the Design Review Rules, product development rank A was assigned to engines sold to new customers, engines that required large-scale changes to facilities due to changes in the displacement volume or number of cylinders, and engines for installation on machines for new applications; product development rank B was assigned to engines that require medium-scale changes to facilities due to enhanced performance or responses to exhaust regulations and engines with changes to the displacement volume or number of cylinders the but that could be produced using existing facilities; and product development rank C was assigned to engines that require small-scale changes to facilities, primarily due to changes in components. The engines in question in this matter that were categorized as product development rank A were the 1KD Engine, 1ZS Engine, 1FS Engine, and 2016 1KD Engine for Construction Machinery, the engine that was categorized as product development rank B was the 2020 1KD Engine for Construction Machinery, and the engines categorized as product development rank C were the 2007 4Y Engine, 1FZ Engine, and 2007 1DZ Engine.

141 As stated below in Part 4-3(1)C, in the case of the 2009 4Y Engine, the scope of development was limited to reducing the cost of the catalysts and development expenses were low, so DR meetings were not held.

142 As stated above in Part 1-4(2), the Engineering Office of the Engineering Dept. included the Design Group, Engine Calibration Group, and Control System Engineering Office.

143 In the case of a general-purpose engine, the specification requirements were received from outside customers. This also applies below in instances where TMHC is indicated.

and prices (prices for transactions between business divisions as a basis for determining the profit and loss of each division), and the development targets are finalized. In addition, the Control Office of the Production Control Dept. holds meetings with all of the departments in the Engine Division and formulates a production preparation schedule plan in preparation for mass production.[144] At the DR meeting held after that, the appropriateness of the development targets and production preparation schedule plan are reviewed, and if the chairperson of the review committee determines that they are appropriate, the start of more full-scale production of prototypes is approved (in cases where the production targets were determined to be inappropriate, production of the initial prototypes and negotiations with TMHC are again conducted; the same applies below).



B. Production and assessment of prototypes

The Design Group produces full-scale prototype design drawings and produces prototypes based on the design drawings. The Engine Calibration Group conducts development testing relating to emissions performance on the prototypes and assesses whether the prototypes achieve the development targets. Following that, DR is held, and the appropriateness of the assessment results is reviewed, and if a determination is made the prototypes could achieve the development targets, the start of preparations for mass production is approved.

C. Finalization of the production preparation schedule plan and preparations for mass production

To prepare for mass production, the Production Control Dept. first works to finalize the production preparation schedule plan. In many instances, revisions are made to the production preparation schedule plan in light of the status of progress of development up to that time, and then the content is finally finalized.

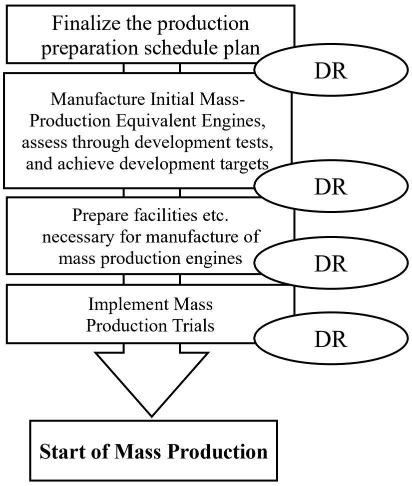
The Design Group prepares design drawings for mass production engines and manufactures the initial Mass Production-Equivalent Engines ("**Initial Mass Production-Equivalent Engines**") based on those design drawings, and the Engine Calibration Group conducts development testing concerning emissions performance. The Initial Mass Production-Equivalent Engines are different from the Mass Production-Equivalent Engines and are produced off the production line. After testing emissions performance, DR is held, the status of achievement of the target targets is reviewed, and if a

144 The production preparation schedule plan is a plan of work necessary before the start of mass production.

determination is made that the development targets can be achieved, the chairperson of the review committee approves the start of preparations for mass production on the production line. At this stage, the Control Parameters relating to emissions performance applicable to the formulas for engine control are largely finalized.

The Production Engineering Dept. and the Manufacturing Dept. procure the dies, processing machinery, cutting instruments, and so on needed for manufacture of mass production engines and prepare manuals and the like. Later, DR is held, the status of preparations is confirmed and reviewed, and if a determination that preparations are adequate, the chairperson of the review committee approves trial mass production on the actual production line.

The Production Control Dept. formulates the manufacturing plan for Mass Production-Equivalent Engines, and pursuant to instructions from that department, the Manufacturing Dept. manufactures the Mass Production-Equivalent Engines. The Quality Assurance Dept. performs confirmation testing of the Mass Production-Equivalent Engines, confirms whether the Mass Production-Equivalent Engines achieved the control standard values[145] based on the results of that testing, and confirms the safety and so on of processes. In parallel with this, the Production Control Dept. formulates a production plan for after the start of mass production. Later, DR is held, where the achievement status of the control standard values is confirmed, the appropriateness of the production plan for the start of mass production is reviewed, and a determination is made that the production systems have been established, and the chairperson of the review committee approves the start of mass production.



(2) Overview of the emissions certification acquisition process for engines for industrial vehicles

The Engine Calibration Group conducted the deterioration durability testing and Witness Tests performed in the presence of the authorities necessary for the acquisition of certification relating to the emissions of engines for industrial vehicles.[146]

The process of obtaining certification relating to the emissions of engines for industrial vehicles is

145 The control standard values indicate control values set based on internal rules to confirm the quality of mass production engines.

146 As discussed below in B, the deterioration durability test and Witness Test of gasoline engines was performed by the TMHC Development Office until the development of the 2007 4Y Engine and was divided between the Engine Calibration Group and the TMHC Development Office until the development of the 1FS Engine.

specified in the Certification Acquisition Guidelines.[147] In response to the discovery of the improper conduct relating to emissions certification, in July 2022 Toyota Industries established a standardized schedule relating to the acquisition of certification for the purpose of reinforcing the certification acquisition process, but until then, there was no clear indication of in which development stage the procedures for acquisition of certification should be implemented.

The specific processes for the acquisition of certification relating to emissions differed for diesel engines and gasoline engines. Overviews of those processes are provided below. In this section, the process for acquiring domestic certification in relation to emissions is explained.

A. Diesel engines

Generally, the Engine Calibration Group[148] confirms whether an application for domestic certification relating to emissions is necessary in a stage by the time the development targets were finalized[149] and shares the results of its confirmation with the Engineering Office of the Engineering Dept. at TMHC (referred to as the "**TMHC Engineering Office**") and the Technical Administration Office of the Engineering Dept. at TMHC (referred to as the "**TMHC Technical Administration Office**").[150]

In cases where the Engine Calibration Group determines that an application for certification is necessary,[151] the Engine Calibration Group prepares a plan for deterioration durability testing and confirms the details with the TMHC Engineering Office and TMHC Technical Administration Office. During the same time period, the Engine Calibration Group prepares a plan relating to the Witness Test, confirms the details with the TMHC Engineering Office and TMHC Technical Administration Office,[152] and submits the plan to the Automobile Type Approval Test Department and obtains

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147 The Certification Acquisition Guidelines were established on January 30, 2009 and were later revised on October 10, 2014.

148 After establishment of the Regulation Certification Office and the Regulation Certification & Administration Department in 2021, these departments provided support for the confirmation of whether an application for domestic certification was necessary and for certification applications, provided explanations to the authorities, and performed other tasks.

149 As stated above, there were no provisions on the certification acquisition process in the New Product Development Rules and Design Review Rules, and the relationship with DR was not clear. Here, which processes that were frequently implemented in which stage of DR are explained.

150 In the case of an engine not intended for TMHC, however, information is not shared with the TMHC Engineering Office and TMHC Technical Administration Office.

151 For example, in the case where the design of an existing engine is modified and the Automobile Type Approval Test Department determines that the content of an existing application is not changed, an application for certification will not be needed.

152 In the case of an engine not intended for TMHC, however, the Witness Test plan is not confirmed by the TMHC Engineering Office and TMHC Technical Administration Office.

approval from the Division.

Later, the Design Group prepares an engine for use in deterioration durability testing, and the Engine Calibration Group commences operating the engine on a Durability Test Bench. Regarding the timing when the deterioration durability testing is started, it is generally started during the period from around the time of DR, when the sales product plan is reviewed, to around the time of DR, when the transition to mass production is reviewed.

The Engine Calibration Group operates the engine on the Durability Test Bench until the operating time at which the emissions values to be measured are reached and then takes the measurements on the Measurement Bench. Later, the Engine Calibration Group calculates the deterioration correction values based on the measurement results and prepares the Durability Documents.

The Engine Calibration Group also prepares a certification application and submits the application to the Automobile Type Approval Test Department with the Durability Documents attached.

In addition, the Design Group prepares an engine for the Witness Test and performs the Witness Test in the presence of the Automobile Type Approval Test Department.

Then, after confirming whether the engine complies with the Safety Standards for a designated device, the Automobile Type Approval Test Department makes a decision on approval and reports to the Type Approval and Recall Division[153] of the Road Transport Bureau[154] of the Ministry of Land, Infrastructure, Transport and Tourism. Later, the Type Approval and Recall Division of the Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism makes an approval decision.

B. Gasoline engines

For gasoline engines, the process for obtaining certification relating to emissions is not substantially different from that for diesel engines in the basics. That said, in the case of a gasoline engine, the process differs from that concerning diesel engines in that initially, TMHC participates substantially in the work relating to acquisition of certification and later, work relating to the acquisition of certification gradually became the responsibility of the Engine Division.

The Industrial Vehicle Division, the predecessor department of TMHC, performed development of gasoline engines in the past (compared to diesel engines, there are few components that require design modification of an engine for automobiles, and consequently, the Industrial Vehicle Division

153 Until July 1, 2011, a report was made to the Laboratory Section, Technical Safety Department, Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, and that department made the approval decision.

154 This is the name at that time. According to organizational changes in the Ministry of Land, Infrastructure, Transport and Tourism dated October 1, 2023, the Road Transport Bureau became the “Logistics and Road Transport Bureau.”

performed development, rather than be Engine Division; later, however, the Engine Division was tasked with manufacturing gasoline engines after the development). Starting around 2000, however, the fuel supply systems for gasoline engines installed on industrial vehicles were changed from carburetors to electronically-controlled fuel injection devices with the goal of increasing engine output and response. The TMHC Engineering Office previously had little experience handling electronically-controlled fuel injection devices, and with the changes to fuel injection devices, development and deterioration durability testing took longer than in the past. In addition, at that time, the TMHC Engineering Office had trouble keeping up with work due to a shortage of personnel, and it became difficult for the TMHC Engineering Office alone to perform engine development. In response, starting with the 2007 4Y Engine, development of which started around November 2004, the Engineering Office of the Engineering Dept., which had knowledge concerning electronically-controlled fuel injection devices as a result of its development of engines for automobiles for Toyota Motors, was put in charge of engine development. Furthermore, implementation of deterioration durability testing was divided between the TMHC Engineering Office and the Engineering Office of the Engineering Dept., and following discussions by the two departments, a decision was to be made on which department would run engines on Durability Test Benches and take measurements on Measurement Benches. TMHC remained in charge of calculating deterioration correction values and filing applications for certification.

For the 1FS Engine, development of which started around April 2011, the Engineering Office of the Engineering Dept. performed engine development, implementation of deterioration durability testing, and calculation of deterioration correction values. Also, a determination was made that there would be advantages from the perspectives of reducing employee travel time and performing effective bench management by consolidating Durability Test Benches and Measurement Benches at the Hekinan Plant, the site of the Engineering Office of the Engineering Dept., and from around April to around July 2013,[155] the Durability Test Benches and Measurement Benches for testing gasoline engines that had been installed at the Takahama Plant, the site of the TMHC Engineering Office, were all relocated to the site of the Engineering Office of the Engineering Dept. at the Hekinan Plant. Accordingly, the TMHC Engineering Office became no longer involved in deterioration durability testing thereafter.

Also, starting with development of the 1FS Engine, the Engineering Office of the Engineering Dept. was also tasked with filing certification applications based on the belief that it would be better for the department that performed deterioration durability testing to also file domestic certification applications.

155 Specifically, following the completion of deterioration durability testing of the 1FS Engine around February 2013, the Durability Test Benches and Measurement Benches for gasoline engines were transferred from the TMHC Development Office to the Engineering Office of the Engineering Dept.

2 Engine development and emissions certification acquisition processes for engines for automobiles

The Toyota Industries Engine Division developed and manufactured [156] diesel engines for automobiles and manufactured gasoline engines for automobiles[157] for Toyota Motors.

Overviews of the development process and emissions certification acquisition process for engines for automobiles prior to June 30, 2021 are provided below.

(1) Overview of the development process for engines for automobiles

Development of engines for automobiles was performed through close collaboration between Toyota Industries and Toyota Motors. The Engineering Office of the Engineering Dept. of Toyota Industries prepared materials on the status of development and submitted them to the department responsible for development at Toyota Motors about once per week. In addition, the Engineering Office of the Engineering Dept. were audited by the Toyota Motors department responsible for audits immediately before holding the development gate conference discussed below. Specifically, personnel from the Engineering Office of the Engineering Dept. of Toyota Industries visited Toyota Motors at the time of audits, submitted development testing data to the Toyota Motors audit department, and submitted raw data[158] in accordance with requests from the Toyota Motors audit department.[159]

The status of development of engines for automobiles by Toyota Industries was managed within Toyota Motors in accordance with Toyota Motors's development process. Toyota Motors's development process is divided into a number of development phases, and when proceeding to the next development phase, Toyota Motors held a conference called a development gate conference with the engineers in charge from Toyota Industries in attendance. At the development gate conference, the specified review items for each development gate were reviewed, and if the chairperson[160] determined

156 Until June 1, 2021, there were instances where the Engine Division did not perform manufacturing and performed only development.

157 Until August 2007, the Engine Division performed development of gasoline engines for automobiles for Toyota Motors, but did not perform development in or after September 2007.

158 Before audits were conducted, personnel from the Development Office of the Engineering Dept. output raw data from development tests relating primarily to emissions performance (e.g., data on NOx, PM, and other emissions, data relating to variations in emissions, etc.) from the measurement system and brought it to the audits.

159 At the time of audits, when requested by the Toyota Motors Audit Department to submit raw data that they had not brought, engineers in charge from the Engineering Office of the Engineering Dept. sent the raw data requested at the time of the audit to the Toyota Motors audit department by email at a later time.

160 The position of the person who served as chairperson of the development gate conference varied depending on the time, but as of January 2015, for example, it was the Toyota Motors General Manager of the Engine Management Department.

that the Transition Criteria to the next development phase were satisfied, transition to the next development phase was approved.

As in the case of engines for industrial vehicles, development at Toyota Industries is conducted in accordance with the New Product Development Rules and Design Review Rules, and when proceeding to the next development process, DR is conducted,[161] and if a determination is made that the Transition Criteria for the next development process are satisfied, the chairperson of the review committee approves the transition to the next process. Also, although not expressly stated in the rules, approval of transition to the next development phase at a development gate conference held by Toyota Motors is conditioned on approval of transition to the next process at a DR meeting held at Toyota Industries. It should be noted that the processes in Toyota Industry's development process are not identical to Toyota Motors's development phases, and the timing when a DR meeting is held does not correspond to the timing when a development gate conference is held. Because of this, the transition to the next process was approved at DR meetings only after it was confirmed that the transition to the next development phase had been approved at the immediately-preceding development gate conference.[162]

(2) Overview of the emissions certification acquisition process for engines for automobiles

As discussed in (1) above, development of engines for automobiles is performed through close collaboration by Toyota Industries and Toyota Motors, and at the stage when it is expected that the emissions performance of a particular engine will achieve the development targets, Toyota Industries obtains instructions from Toyota Motors, manufactures engines for use in deterioration durability testing, and provides them to Toyota Motors, but the subsequent deterioration durability testing,[163] filing of an application for certification with the authorities, and the Witness Test are all performed independently by Toyota Motors.

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161 However, in cases where Toyota Industries performed only development of engines for automobiles and did not perform manufacturing, DR meetings were not held.

162 Specifically, at the DR that reviewed the appropriateness of the development targets, the DR that reviewed the details of the prototype design drawings, the DR that reviewed the appropriateness of the production preparation schedule plan, and the DR that confirmed and reviewed the preparation status of dies, processing equipment, cutting instruments, manuals, and so on necessary for production of mass production engines, it is confirmed that the transition to the next development phase had been approved at the Toyota Motors development gate conference held immediately prior to the respective DR meeting.

163 In the case of engines for automobiles, if the total vehicle weight was 3.5 tons or less, measurements are to be taken with the engine installed in the vehicle (Article 41-7 and Attachment 42 of the Public Notice on Details), and if the total vehicle weight is more than 3.5 tons, measurements are to be taken only with the engine and the emissions reduction device (Article 41-5 and Attachment 42 of the Public Notice on Details).

3 Overview of the engine development process after June 30, 2021

Until June 1, 2021, Toyota Industries had a Development Master Outsourcing Agreement with Toyota Motors, and under that agreement, ownership rights and intellectual property rights to design drawings for engines for automobiles developed by Toyota Industries belonged to Toyota Motors. On June 1, 2021, however, Toyota Industries executed a drawing etc. transfer agreement with Toyota Motors, and thereafter, ownership rights and intellectual property rights to design drawings for engines for automobiles developed by Toyota Industries belonged to Toyota Industries. This meant that ownership to development of engines for automobiles transferred from Toyota Motors to Toyota Industries.[164]

As a result, from June 2021, Toyota Industries itself managed the development processes for engines for automobiles based on the New Product Development Rules and Design Review Rules.

In response, the Engine Division made a decision to strengthen engine development processes for engines for industrial vehicles as well as engines for automobiles. On June 30, 2021, the Engine Division revised the Design Review Rules and decided to establish a development process similar to that of Toyota Motors for both engines for industrial vehicles and engines for automobiles.

The main points of change made pursuant to the June 30, 2021 revision of the Design Review Rules are as follows.

Before revision, the rules specified the "responsible department" for each DR review item (in the case of review items relating to quality, the Engineering Dept. was generally the responsible department), and during DR, the respective departments in charge reported on the progress of development with respect to each review item, and the chairperson of the review committee (the chairperson varied depending on the stage of DR, but in many instances, it was the General Manager of the Engine Division) and committee members (the members varied depending on the stage of DR, but included the heads of departments and so on), who are attendees of DR, reviewed the reports.

In contrast, after the revision of the Design Review Rules referenced above, the rules designated as the responsible department a "supervisory department" that is responsible for collecting and reporting information relating to each DR review item and adds a new "decision-making department" that makes determinations concerning the content of the reports from the supervisory department from the perspective of other departments. For example, with regard to review items relating to quality, the Quality Assurance Dept. is specified as the decision-making department. Also, review and confirmation by the Quality Assurance Dept. of the appropriateness of the status of development with regard to the review items relating to quality is a necessary precondition for the chairperson of the

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164 This change was based on a strategy of transferring portions of the Toyota Motors's business to affiliates that had strengths in the respective areas with the objective of reinforcing the competitiveness of the Group as a whole, rather than Toyota Motors alone, by concentrating Group capabilities.

review committee to make a decision regarding the transition to the next development stage during DR.

In this way, the June 30, 2021 revision of Design Review Rules resulted in the adoption of a mechanism of checks by departments other than engineering department in the development process.

In addition, a mechanism was introduced to DR in engineering departments whereby employees of departments other than engineering departments that are not directly involved in the development of the said engine can review the appropriateness of the development processes as “function supervisors” with the intention of reinforcing internal check systems in engineering departments.

The certification acquisition process relating to emissions itself did not change before and after June 30, 2021, and even after June 30, 2021, Toyota Motors performed deterioration durability testing of engines for automobiles, submitted certification applications to the authorities, and performed Witness Tests.

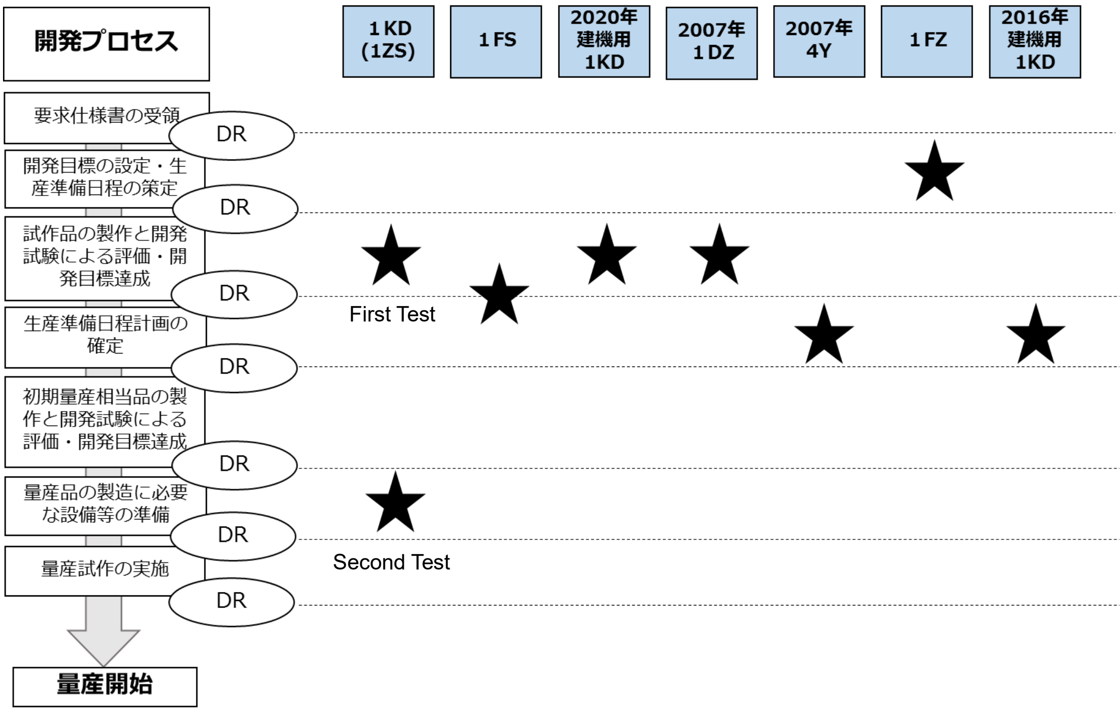
4 Differences in the timing of the start of deterioration durability testing for engines for industrial vehicles and engines for automobiles

As stated above, before June 30, 2021, there were significant differences in whether or not Toyota Motors played a leading role in development of engines for automobiles and engines for industrial vehicles and managed the process, and also in whether Toyota Motors or Toyota Industries was the main party that performed deterioration durability testing and applied for certification.

There were no significant differences between the two types of engines in terms of the processes implemented during development, but there was a major difference in the timing of the start of deterioration durability testing. Deterioration durability testing was started at an earlier time for engines for industrial vehicles compared to engines for automobiles. In other words, deterioration durability testing of engines for automobiles was started around the time when the Control Parameters applicable to the formulas for engine control were generally finalized, but deterioration durability testing of engines for industrial vehicles was started earlier, i.e., during the period from around the time when the sales product plan review meeting was held to around the time that the mass production transition review meeting was held.

The timing of deterioration durability testing of engines for industrial vehicles is shown in the figure below. The stars indicate the timing of the start of deterioration durability testing.[165]

[165] It should be noted that with regard to the 1KD Engine, the first deterioration durability testing did not proceed as expected, and a second deterioration durability test was performed. Also, with regard to the 1ZS Engine, deterioration factors and deterioration correction values that were calculated based on the results of the deterioration durability testing of the 1KD Engine were used for the certification application. In addition, as discussed below, the deterioration durability testing of the 1FZ Engine was started when even a prototype engine had not been produced, and the test was performed using a 1FZ Engine for automobiles, which was the base engine. DR was not conducted for the 2009 4YEngine, and accordingly, is not included in the figure.



Left side figure translation, from top to bottom:	Top of graph, from left to right:
Development Process	
Receipt of required specifications	**1KD (1ZS)**
Setting development targets and formulation of production preparation schedule	**1FS**
Production of prototype and evaluation and confirmation of achievement of development targets through development testing	**2020 1KD for Construction Machinery**
Formulation of production preparation schedule plan	**2007 1DZ**
Production of Initial Mass Production-Equivalent Engines and confirmation of achievement of development targets through development testing	**2007 4Y**
Preparation of facilities, etc. necessary for mass production	**1FZ**
Implement Mass Production Trials	**2016 1KD for Construction Machinery**
Start of Mass Production	

Of course, starting deterioration durability testing itself at an early stage is not necessarily inappropriate. Deterioration durability tests are tests performed to confirm the emissions performance of an engine that will be mass produced after operating for a certain period of time, and therefore, it can be said that even if the testing is performed at a relatively early stage of development, as long as the emissions performance in the driving patterns anticipated by the deterioration durability testing are finalized, there is no particular problem with performing the deterioration durability testing.

Nonetheless, the timing of commencement of the deterioration durability testing of engines for industrial vehicles was early in comparison to testing of engines for automobiles overall. As a result, as discussed below, in the case of the 1KD Engine, for example, the specifications of the injector, which has an impact on emissions performance, were modified during the first deterioration durability test, and in the case of the 2007 4Y Engine, the ECU Software Control Parameters, which also have an impact on the emissions performance, were modified during the deterioration durability test. In this way, because deterioration durability testing was commenced at an early stage, there were instances where the emissions performance of the engines used for the testing under the driving patterns of the deterioration durability testing differed from the emissions performance of the mass production engines, and as a result, it is possible that the deterioration correction values were not properly calculated.

Part 4. Improper Conduct Relating to Engines for Industrial Vehicles Found in the Investigation

Improper conduct relating to engines for industrial vehicle found in the investigation is summarized as follows.

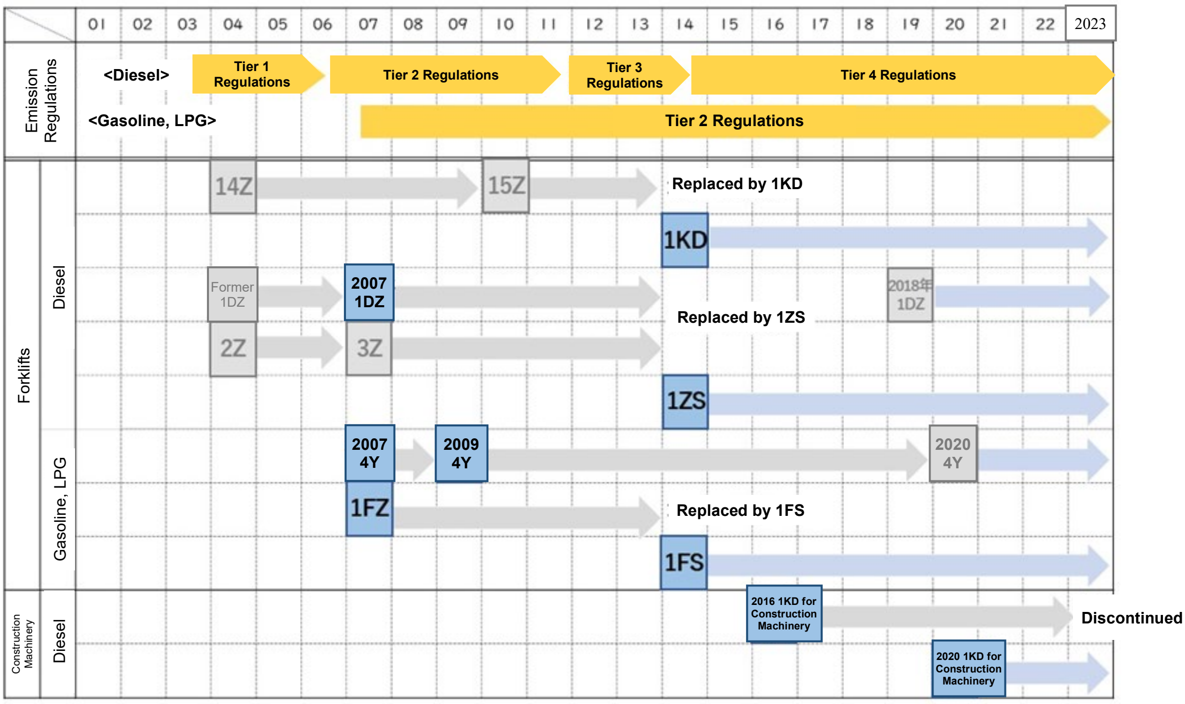
Improper conduct was carried out for both gasoline engines and diesel engines for industrial vehicles. Improper conduct was carried out not only in the development stage but also during sampling inspections after transition to mass production[166].

As a summary of improper conduct at the development stage, we will explain the current model engines still in production at Toyota Industries, and then explain the past model engines of which production was discontinued. Following this, we will explain the summary of improper conduct during sampling inspections after transition to mass production.

The following chart illustrates the statuses of the emission regulations, and the timings of domestic certification obtained for the engines with which improper conduct has been confirmed, and this report deals with the engines shown in blue[167].

166 Regarding automotive engines, it was confirmed that Toyota Motors performed the deterioration durability testing during the process of obtaining the vehicle type designation, etc., and Toyota Industries did not conduct emission certification-related testing including the deterioration durability testing.

167 The Former 1DZ Engine, the 2Z Engine, and the 14Z Engine obtained domestic certification prior to the Tier 2 Regulations that made the deterioration durability testing mandatory in the process of obtaining domestic certification for engines for industrial vehicles, and thus, the Committee excluded these engines from the investigation. Further, in order to obtain domestic certification for the 2020 4Y Engine, the deterioration correction values used for domestic certification for the 2009 4Y Engine were used. The deterioration correction values used for EU certification for the 2007 1DZ Engine were also used for domestic certification for the 3Z Engine and the 15Z Engine that were developed around the same time, and thus, the 3Z Engine and the 15Z Engine did not undergo the deterioration durability testing. Therefore, the Committee excluded the 2020 4Y Engine, the 3Z Engine and the 15Z Engine from the investigation. Meanwhile, the deterioration correction values used for domestic certification for the 1KD Engine were used for domestic certification for the 1ZS Engine that was developed around the same time, but prior to the formation of the Committee, a partial factual investigation carried out by lawyers with Nishimura & Asahi revealed improper conduct at the development stage of the 1ZS Engine, and thus, the Committee included the 1ZS Engine in the investigation.



1 1KD Engine

(1) Overview and development background of the 1KD Engine

A. Overview of the 1KD Engine

The 1KD Engine is an in-line four-cylinder diesel engine with a total displacement of 3.0 liters that uses an electronically-controlled variable-geometry turbocharger[168] and a common rail fuel injection system[169], and does not install a DPF.

In light of the results of the advance consideration, the development of the 1KD Engine began in April 2011 as a new diesel engine for industrial vehicles in compliance with stricter regulations for industrial vehicles scheduled to be enforced from 2013 onward in various countries (the Tier 3

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168 An electronically-controlled variable-geometry turbocharger means a type of turbocharger that is constructed so that the exhaust gas flow blowing into the turbine wheel can be directly controlled by opening/closing (varying) multiple nozzles placed around the turbine wheel by using an electronically-controlled actuator.

169 Common rail fuel injection system means a type of fuel injection device for diesel engines, which is a system for injecting fuel by sending fuel to the rail (pressure accumulator) using a high-pressure pump; accumulating high-pressure fuel at the rail; and optimally setting injection pressure, injection timing, etc. using electronic controls.

Regulations in Japan)[170].

The 1KD Engine was certified in the United States and Japan. Because it was certified in the United States first, the deterioration correction values were calculated based on the deterioration factors which were calculated through the deterioration durability testing and submitted to EPA, and with such deterioration correction values, on June 17, 2014, the engine obtained domestic certification.

As explained in I Part 1 above, Toyota Industries asked outside attorneys to conduct an investigation and conducted the deterioration durability testing of the 1KD Engine again. As the result of the deterioration durability testing, it was revealed the PM values measured using the NRTC mode method after 500 hours of operating the engine and the PM values measured using the 8-Mode Method after 1000 hours of operating the engine exceeded the regulation values set forth by laws and regulations. On March 17, 2023, Toyota Industries publicly announced that it turned out that the PM values of the 1KD Engine would exceed the regulation values set forth by laws and regulations due to deterioration over time; further, Toyota Industries decided to suspend shipment of forklifts equipped with the 1KD Engine. Thereafter, on April 11, 2023, Toyota Industries submitted to the Ministry of Land, Infrastructure, Transport and Tourism a recall notification regarding forklifts equipped with the 1KD Engine.

B. Development system

The Engineering Office of the Engineering Dept., the Engine Division was responsible for development of the 1KD Engine. The Engine Calibration Group was responsible for the deterioration durability testing[171] and calculation of the deterioration correction values based on results of such testing.

C. Background of the 1KD Engine development

The development of the 1KD Engine largely followed the following chronology.

Date	Event
September 30, 2008	The development of an engine with a DPF began by way of diverting the 1KD Engine for automobiles to an engine for industrial vehicles.

170 However, in conjunction with the subsequent public announcement of the content of the Tier 4 Regulations during the course of development, the 1KD Engine eventually obtained domestic certification as a Tier 4 Regulations-compliant model.

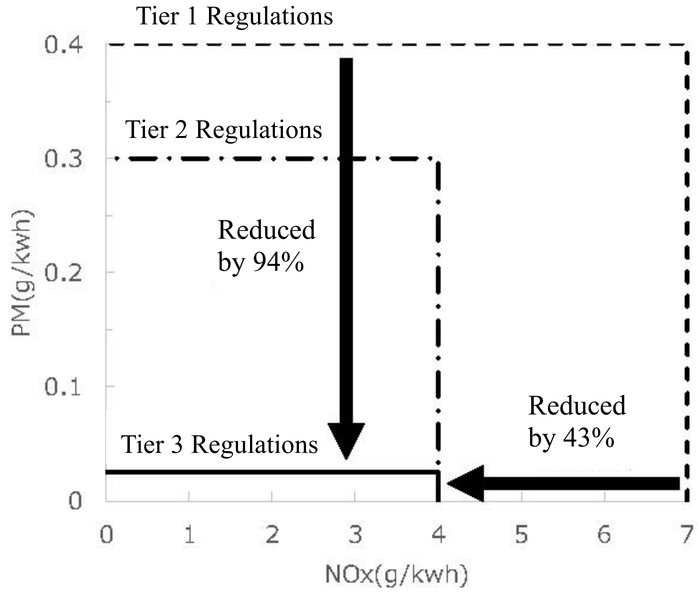
171 When emissions were measured during the deterioration durability testing, the persons in charge at the Laboratory Section primarily ran the engine and measured emission component values upon request from the person in charge at the Engine Calibration Group.

Date	Event
August 6, 2010	The Engine Committee meeting was held. At the meeting, the engine concept was reviewed, and it was decided to adopt a common rail system and not to install a DPF.
December 14, 2010	The Engine Committee meeting was held, at which it was reported that the emission development target values were expected to be achieved. In response to such report, Executive Vice President, Member of the Board[172] requested to move up the mass production launch date from May 2014 to May 2013.
February 25, 2011	The Engine Committee meeting was held, at which it was agreed to move up the mass production launch date to May 2013.
April 5, 2011	DR was held, at which the launch of development was approved.
August 30, 2011	DR was held, at which it was approved to launch the production of prototypes.
Around October 2011	Specifications for installing the engine in industrial vehicles other than forklifts were added to the 1KD Engine specifications.
November 22, 2011	The deterioration durability testing plan was submitted to the EPA.
January 7, 2012	DR was held again, at which it was decided to postpone the mass production launch date to August 2013.
January 25, 2012	The deterioration durability testing using No. 12 prototype engine (“**DF1 of 1KD**”) began.
June 29, 2012	DR was held, at which it was reported that the emissions achieved the development target values. In response to such report, it was approved to proceed with preparation for mass production.
Around August 31, 2012	At DF1 of 1KD, the emission component values were measured after operating the engine for 2700 hours, and the deterioration factors were calculated with the extrapolation method, in which the PM values exceeded the development target value. The testing was suspended (thereafter, DF1 of 1KD was resumed after the injector was cleaned).
September 4, 2012	DR was held, at which the schedule of preparation for mass production was approved.
October 8, 2012	DR was held, at which finalization of the details of the mass production engine drawing was approved.

172 The Executive Vice President, Member of the Board was serving as President of TMHC and an executive of the industrial vehicle-related business, among other positions.

Date	Event
December 13, 2012	The deterioration durability testing using No. 13 prototype engine (an improved version of No. 12 prototype engine in light of the DF1 of 1KD results) ("**DF2 of 1KD**") began.
December 20, 2012	DR was held, at which it was approved to finalize the ECU Software Control Parameter values for the Mass Production-Equivalent Engines.
March 26, 2013	DR was held, at which a mass production trial on the production line was approved.
Around May 2013	By around this point in time at the latest, the device designed to measure the emission component values had broken down, and the PM values could not be measured with such device.
June 4, 2013	The report summarizing the deterioration durability testing results ("**DF Report**") was submitted to the EPA.
July 10, 2013	An application for U.S. certification was made.
July 30, 2013	DR was held, at which the launch of mass production was approved.
August 23, 2013	DF2 of 1KD concluded with the measurement of the emission component values after operating the engine for 3100 hours.
August 29, 2013	U.S. certification was obtained.
December 3, 2013	DF1 of 1KD concluded with the measurement of the emission component values after operating the engine for 8000 hours.
April 8, 2014	It was explained to the Automobile Type Approval Test Department that deterioration correction values would be calculated with the deterioration factors used for application for U.S. certification and be used for application for domestic certification.
April 25, 2014	An application for domestic certification was made.
May 29-May 30, 2014	Witness Test was conducted for the purpose of domestic certification.
June 17, 2014	Domestic certification was obtained.

In Japan, the PM regulation value and the NOx regulation value of diesel engines for industrial vehicles were tightened in stages, from the Tier 1 Regulations to the Tier 2 Regulations. Thereafter, in the Tier 3 Regulations, the regulations were further tightened, e.g., the PM regulation value of diesel engines for industrial vehicles with a rated output of 37kW or more but less than 56kW was lowered by approximately 94%, and the NOx regulation value thereof was lowered by approximately 43%, relative to the respective values under the Tier 1 Regulations, as shown in the diagram below.



In order to comply with tightened regulations of PM and NOx under the Tier 3 Regulations, the 1KD Engine was initially developed as a model equipped with a DPF which is an after-treatment device to collect PM. However, in response to the presentation of an external consulting company, the policy was changed to proceed with developing the same as a model with a common rail system but without a DPF. Thereafter, simplified verifications and simulations using actual engines on hand and theoretical studies were carried out, and it was reported that the model with a common rail system but without a DPF was expected to achieve the emission development target values.

In this regard, the engineer who participated in such verifications, and was subsequently involved in the 1KD Engine development as Group Manager, explained to the Committee that because the verification period was limited to two to three months, and theoretical studies accounted for a large part thereof, verifications could not be conducted with high accuracy. He also states that such verifications merely showed that it "would not be completely infeasible" for emission component values emitted from the model with a common rail system but without a DPF to achieve the regulation values.

However, at the Engine Committee held in December 2010, it was reported by the Engineering Dept. of the Engine Division that the new diesel engine compliant with the Tier 3 Regulations was expected to achieve the emission development target value without a DPF. Given this report, it was decided to proceed with the 1KD Engine development.

At the time of the Engine Committee held in December 2010, the mass production launch date of the 1KD Engine for the U.S. market was scheduled in May 2014, but the Executive Vice President, Member of the Board responsible for the industrial vehicle business requested a change of the mass production launch date to May 2013. Thereafter, as early as February 2011, it was officially decided to set the mass production launch date for the 1KD Engine for the U.S. market in May 2013.

Many people involved argued that such schedule change was unreasonable. For example, the above Group Manager explained to the Committee, “In general, a new engine requires three to four years of development, but because the 1KD Engine was the first engine for industrial vehicles using a common rail system and not using a DPF, I thought a longer development period would be needed. Therefore, I told the Assistant General Manager of the Engineering Office and others that the schedule was unreasonable, but the schedule remained unchanged”. In this regard, the Assistant General Manager, with whom the Group Manager consulted, and the succeeding Assistant General Manager told the Committee that they knew it would be difficult to launch mass production in approximately two years. Nevertheless, those Assistant General Managers did not consult TMHC about the possibility of postponing the mass production launch date of the engine. Those Assistant General Managers explained to the Committee, “I thought that even if I consulted my counterparty at TMHC, it was unlikely that they would accept the postponement of the mass production launch date and that our supervisor at the Engine Division would not provide support even if I asked. Therefore, I did not consult TMHC about the possibility of postponing the mass production launch date”.

Around October 2011, the maximum torque specification of 300/1600 (Nm/min^{-1}) for forklifts (“**Forklift Specifications**”), and the maximum torque specification of 325/1600 (Nm/min^{-1}) for industrial vehicles other than forklifts (“**Wider Sale Specifications**”) were added to the 1KD Engine specifications. It was decided to conduct the deterioration durability testing, from this point forward, using the engine with the Wider Sale Specifications, by deeming it as an engine representing several types of engines with the same specifications, and to study whether the emissions performance would comply with the Tier 3 Regulations. Meanwhile, the ECU Software for the Wider Sale Specifications and the ECU Software for the Forklift Specifications were developed separately.

As of the DR on August 30, 2011 at the latest, the deterioration durability testing was supposed to be conducted twice, and before the ECU Software Control Parameters for the 1KD Engine that affect emission component values were finalized, DF1 of 1KD began using the engine with the Wider Sale Specifications. DF2 of 1KD was subsequently held after making improvements to the engine based on the progress of DF1 of 1KD. However, both at DF1 of 1KD and DF2 of 1KD, deficiencies occurred, and the PM values or NOx values did not attain the development target values. Nevertheless, at the DR on March 26, 2013, it was reported that all of the development targets for the 1KD Engine including the emission component values had been achieved. Meanwhile, the application for U.S. certification was made by using the deterioration factors calculated not based on the data actually measured during the deterioration durability testing, but based on estimated data; further, the application for domestic certification was made by using the deterioration correction values calculated based on said deterioration factors. The engine with the Wider Sale Specifications was also used in the Witness Test; however, in the end, the engine with the Wider Sale Specifications was not mass produced, and only the engine with the Forklift Specifications was mass produced.

(2) Details of improper conduct found in investigation, etc.

A. Deterioration factors used for U.S. certification application were calculated based on estimated data, etc.

(a) Status of DF1 of 1KD

DF1 of 1KD started on January 25, 2012 using a No. 12 prototype engine, and until around August 31, 2012, each emission component value was measured after operating the engine for 0 hours, 500 hours, 1000 hours, 1500 hours, 2250 hours and 2700 hours. Then, the emission component values after operating the engine for 8000 hours were calculated to obtain deterioration factors by applying the extrapolation method to the emission component values after each operating hour above, and it turned out that the PM values exceeded the development target values.

In response to these results, the Engine Calibration Group suspended the testing for DF1 of 1KD as soon as the emission component values were measured after operating the engine for 2700 hours. It was believed that the PM values increased because the amount of fuel injection increased, and thus, the Engine Calibration Group, upon obtaining the Assistant General Manager's approval and via the Design Group, asked the external parts manufacturer to investigate the causes of the fuel injection increase by checking the status of the injector and the like.

As a result of the external parts manufacturer's investigation, it was found that it was estimated that the dry sludge accumulated on the armature (a device attached to the upper part of the injector to adjust fuel injection) delayed the closure of the valve (timing of ending fuel injection), which increased the amount of fuel injected and raised the PM values. In addition, the Engine Calibration Group carried out an investigation into the fuel in order to find the main reason for dry sludge accumulation. Because the dry sludge coincided with the constituent of impurity in the bench test fuel, it was confirmed that the impurity in the bench test fuel was the main reason for the dry sludge accumulation. Further, separately from measures to prevent fuel injection from increasing, the external parts manufacturer proposed to the Engine Calibration Group changing the shape of the armature in order to suppress variations in the amount of fuel injected.

The Engine Calibration Group removed the injector from the No. 12 prototype engine and washed out accumulated dry sludge, changed the shape of the armature, and measured the emission component values of the No. 12 prototype engine again. Then, it was confirmed that the amount of fuel injection decreased, and the PM values were lowered.

As explained in (1)C above, as of the DR on August 30, 2011 at the latest, the deterioration durability testing for the 1KD Engine was supposed to be conducted twice. The reason why the deterioration durability testing was planned to be conducted twice is that it was considered that first, DF1 of 1KD would be conducted, and if no particular issue were found, deterioration factors would be calculated with the DF1 of 1KD results and submitted to the U.S. authorities; however, if any problem occurred at DF1 of 1KD, then DF2 of 1KD would be held after making improvements, and deterioration factors would be calculated with the DF2 of 1KD results and submitted to the U.S. authorities. As explained above, because DF1 of 1KD confirmed that after operating the engine for 2700 hours, the PM values calculated with the extrapolation method exceeded the development target values, the Engine Calibration Group determined that deterioration factors could not be calculated with the DF1 of 1KD results, and thus, DF2 of 1KD was held.

DF1 of 1KD continued for the purpose of examining the reliability etc. of the engine, and eventually on December 3, 2013, was completed with the measurement of the emission component values after operating the engine for 8000 hours.

(b) Status of DF2 of 1KD

DF2 of 1KD began on December 13, 2012 using the No. 13 prototype engine.

The No. 13 engine used for DF2 of 1KD had the common rail pressure and injector specifications that had changed from those of the No. 12 engine used for DF1 of 1KD. At DF2 of 1KD, the NOx values increased because the EGR cooler efficiency was approximately 10% less than that at DF1 of 1KD. This is supposedly because the EGR cooler became clogged. The EGR cooler began clogging after operating the engine for approximately 1000 hours, and its condition gradually worsened until DF2 of 1KD was discontinued after 3100 hours.

In addition, sometime before the measurement of the emission component values after operating the engine for 2350 hours at the latest, the device designed to measure emission component values broke down, and it became impossible to measure PM values with such device; accordingly, a simple measurement device known as “PEMS” was used to measure PM values. At the time Toyota Industries applied for U.S. certification, it notified the EPA that it would measure PM values with a measurement device other than PEMS, and the fact that the measurement was conducted with PEMS was not described in the DF Report, either.

(c) Specific method for calculating deterioration factors on the basis of estimated data etc.

As explained in (a) above, the Engine Calibration Group determined that the DF1 of 1KD results could not be used as source data for calculation of deterioration factors to be submitted to the U.S. authorities, and started DF2 of 1KD. But DF2 of 1KD also experienced problems such as a decline in EGR cooler efficiency and measurement device breakdown. The Group Manager at the Engine Calibration Group concluded around April 2013 that the DF2 of 1KD results could not be used as source data for calculation of deterioration factors to be submitted to the U.S. authorities, either.

However, the Group Manager thought that there was no time to redo the deterioration durability testing as the scheduled mass production launch date was approaching.

On April 25, 2013, the Group Manager sent the Assistant General Manager at the Engineering Office the following email requesting consultation on how to apply for U.S. certification for the 1KD Engine.

> If we comply with the regulations, it is impossible to submit the DF Report at the end of May, and authorization will be delayed, which will affect LO for sure.
> The above is based on the premise that the EPA certification bench is a 203 bench, and the emission values on other benches are not valid.
> If we keep the LO date, the only thing we can do to finalize emission values and DF values at DF2700h is to take the following means, but I don't think those will pass SEA.
>
> ◆ Evaluate exhaust gas with direct *conti* on a 203 bench, and use PEMS values for PM.
> ◆ Substitute everything with emission values measured on a 205 bench.
> I think it is risky for determining DF value because of differences that emerged during cross examination.
> ◆ Estimate 05W DF values from DF1 and past experience and submit a report.
> After restoration of the 203 bench, we will verify.
> I can't make a decision on the alternatives above on my own, and I would like to talk to you about a policy after HORIBA provides its final answer around the second week after the holiday week.
> Personally, I want to deal with this situation with ◆+◆.

*◆ indicates unreadable characters.

According to the email above, the Group Manager is considered to have told the Assistant General Manager that if they choose to comply with the regulations, it would be impossible to submit the DF Report to the EPA by the end of May 2013 which would cause obtainment of U.S. certification to be delayed, which would result in a delay of the mass production launch date (LO date), while he suggested to him that if they choose to keep the scheduled mass production launch date (LO date), the DF Report should be prepared by either (i) adopting the PM values with PEMS, (ii) alternatively using emission values measured with a new Measurement Bench (205 bench) instead of the Measurement Bench (203 bench) used by then, or (iii) estimating deterioration factors on the basis of the DF1 of 1KD results and past experience, and be submitted to the EPA.

The Group Manager told the Committee that the Assistant General Manager did not reply (the forensic investigation conducted by the Committee did not find the Assistant General Manager's reply, either). Without a reply from the Assistant General Manager, thinking that the mass production launch date must be kept, the Group Manager decided to calculate deterioration factors to be submitted to the U.S. authorities with the method which he thought was the most reasonable method, which was, calculating deterioration factors with data estimated on the basis of the DF1 of 1KD results under assumption of no impact of dry sludge accumulation. In this regard, the Assistant General Manager states, “There was no other option but to keep the mass production launch date, and I knew that in order to keep the mass production launch date, it would be necessary to commit some act in breach of the regulations. However, I was hesitant to blatantly instruct the Group Manager via email to keep the mass production launch date, which is why I did not reply to his email”.

The Group Manager decided that from around May 27 to May 30, 2013, on the basis of the DF1 of 1KD results, the PM values after operating the engine for 0 hours, 500 hours, 1000 hours, 1500 hours, 2250 hours and 2700 hours would be estimated on the assumption that no dry sludge accumulated on the injector[173], and that such estimated data would be used as source data for calculation of deterioration factors. Further, he decided to look for DF1 of 1KD results showing the commensurate values as estimated PM values, and to use the CO, HC and NOx values at that time as source data for calculation of deterioration factors. Then, the Group Manager instructed the person in charge to collect data necessary to estimate PM values. After the person in charge provided the data, the Group Manager calculated deterioration factors on the basis of the PM values estimated on the basis of the DF1 of 1KD results and the CO, HC and NOx values found by the above method, wrote down such deterioration factors in the DF Report, and then, with the confirmation of the Assistant General Manager, submitted the DF Report to the EPA on June 4, 2013.

Later, on June 7, 2013, the Group Manager sent the persons in charge the following email.

> I determined the 05W DF values and submitted a report to the EPA.
> -- omitted --
> Regarding emission results after the DF2 durability running for 2350h,
> - An increase in the amount of injection was within the expected range of hard deterioration, and the PM values were also stable.
> - Even with 55% of the EGR cooler efficiency, there was no significant deterioration in NOx values.
> The DF values were determined with good engineering judgment including the results of DF1 6000h etc.
> Please handle the data with care.

The Assistant General Manager did not report to or consult the General Manager of the Engineering Dept., Engine Division regarding the above issue. The Assistant General Manager states, “In the

173 According to the Group Manager’s explanation, the injector from which dry sludge had been removed was mounted onto the engine, and the measurement after operating the engine for 2700 hours was redone, and then, based on the difference between the PM values after operating the engine for 2700 hours obtained after the injector had been cleaned and the PM values after operating the engine for 2,700 hours obtained before the cleaning, he estimated the PM values before operating the engine for 2700 hours which would have been obtained if dry sludge had not been mixed in the bench test fuel.

department where we developed engines for industrial vehicles, the atmosphere was such that even if we consult our superior, we would, in any case, be told to 'Do something.' Accordingly, I did not make any report to the General Manager of the Engineering Dept. because I had halfway given up, thinking that it would be useless to consult the General Manager of the Engineering Dept."

B. ECU Software Control Parameter values were modified.

(a) ECU Software development flow

Not only the Engine Calibration Group but also the Control System Development Office [174] participated in the 1KD Engine ECU Software development, the development proceeding substantially in the following order.

- The Control System Development Office designs a control system which will be the foundation of ECU Software.
- Persons in charge of engine calibration work[175] at the Engine Calibration Group determine the values of Control Parameters which affect the emission component values.
- Persons in charge of control development work[176] at the Engine Calibration Group determine an optimal control system on the basis of the values of Control Parameters determined by the persons in charge of calibration work, and communicate the values of Control Parameters and the control system with the Control System Development Office.
- The Control System Development Office prepares the specifications on the basis of the values of Control Parameters and a control system determined by the Engine Calibration Group, and submits the specifications to and asks an external supplier to create the ECU Software.
- After the external supplier delivers the ECU Software to Toyota Industries, the Engine Calibration Group conducts development tests using the ECU Software.

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174 The Control System Development Office was responsible for considering control systems which are the foundation of ECU Software, preparing the ECU Software specifications on the basis of the Control Parameters and control systems considered by the Engine Calibration Group, and requesting the external supplier to create ECU Software.

175 Engine calibration work means, in light of the control targets such as fuel consumption, emission, output etc. of an engine, setting Control Parameters such as valve timing and fuel injection timing, pressure, quantity, frequency and intervals etc. at optimal values corresponding to engine speed and load by controlling the variable intake system, the cylinder high-pressure direct injection system and the like.

176 Control development work means reflecting Control Parameters set by the Engine Calibration Team in ECU Software, and considering control systems suitable for engine performance (considering how to change engine speed and torque, fuel injection etc. in response to vehicle performance; for example, if a vehicle receives a load at a certain accelerator opening degree (the vehicle drives on a slope, or cargo is place on the vehicle), whether a mechanism to reduce the engine speed or a mechanism to stabilize the engine speed is considered).

- The process above is repeated until the specifications of the engine and the ECU Software are finalized.

(b) Overview of improper conduct

The Approval Implementation Guidelines Supplementary Rules 7-7, 2. and 7-9, 2. set forth that "The test engine … shall have the same structure, equipment, and performance as the vehicle engine and emission reduction device to which…the device type designation application…pertains." Accordingly, under normal circumstances, the ECU Software at the time of the deterioration durability testing[177] ("**ECU Software for Deterioration Durability Test**") and the ECU Software at the time of the Witness Test ("**ECU Software for Witness Test**") need to have capabilities for emission reduction identical to that of the ECU Software used for the mass production engine ("**ECU Software for Mass Production**")[178].

However, the persons in charge modified governor characteristic Control Parameter values[179] for the control system of the 1KD Engine ECU Software for Deterioration Durability Test and ECU Software for Witness Test to values different from those of the ECU Software for Mass Production.

Additionally, the persons in charge also modified the actual injection correction Control Parameter values, the air flow meter characteristic Control Parameter values, the value rate of target EGR Control Parameters, and the target supercharging pressure Control Parameter values of the ECU Software for Witness Test to values different from those of the ECU Software for Mass Production[180].

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177 There were two types of ECU Software used as 1KD Engine ECU Software for Deterioration Durability Test: ECU Software for the engine used for DF1 of 1KD and ECU Software for the engine used for DF2 of 1KD.

178 However, unlike the ECU Software for Mass Production, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test do not require functions (on-board diagnostics (OBD) program etc.) that are linked with the ECU Software installed in vehicles, and thus, such functions are inactive. In particular, the deterioration durability testing and the Witness Test are conducted on a Measurement Bench, and if functions of the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test to be linked to the ECU Software installed in the vehicle are activated during such tests, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test detect errors, and do not operate as intended. Therefore, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test need to deactivate functions to be linked to the ECU Software installed in the vehicle.

179 Governor characteristic Control Parameter values means Control Parameter values for detecting engine speed and automatically adjusting fuel injection amounts to control engine speed to the specifications when a load on the engine changes.

180 In addition to the above, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test also had different values for Control Parameters such as idling speed and fuel pump control, but this report explains in detail differences in Control Parameters which affect emission component values.

a. Governor characteristic Control Parameter values were modified.

The persons in charge modified governor characteristic Control Parameter values for the control system of the ECU Software for Deterioration Durability Test and ECU Software for Witness Test to values different from those of the ECU Software for Mass Production.

Three Working Group Leaders and one person in charge were aware that the control system expected on the Measurement Bench[181] with which the deterioration durability testing and the Witness Test were conducted differed from the control system of the ECU Software for Mass Production, and if the emissions testing was conducted on the Measurement Bench above with the ECU Software for Mass Production, the driving patterns in accordance with the NRTC mode method could not be recreated. The Working Group Leader responsible for control development work consulted the Group Leader, and modified the governor characteristic Control Parameter values for the ECU Software delivered by the external supplier so that it would be consistent with the control system expected on the Measurement Bench and created the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test.

In this regard, the control system of the 1KD Engine ECU Software was the same as that expected on the Measurement Bench at the advanced development stage. However, after the development of the 1KD Engine began, and no later than around DR at the latest, in light of forklift characteristics, it was decided to use a control system for the ECU Software for Mass Production that was different from the control system expected on the Measurement Bench. The person in charge tried to recreate the driving patterns in the NRTC mode method using the said ECU Software for Mass Production on the Measurement Bench, but failed. The person in charge then consulted the Assistant General Manager that if the engine with the ECU Software for Mass Production were to operate on the Measurement Bench, the driving patterns in the NRTC mode method could not be recreated, and for that reason he wanted to conduct the test using the same ECU Software as the control system expected on the Measurement Bench. The Assistant General Manager instructed the person in charge to adjust the hardware and software for the Measurement Bench to be consistent with the control system of the ECU Software for Mass Production, but the person in charge told him that even if the hardware and software of the Measurement Bench were adjusted, the driving patterns in the NRTC mode method could not be recreated using the ECU Software for Mass Production. In response to this, the Assistant General Manager allowed the test using the same ECU Software as the control system expected on the Measurement Bench.

None of Working Group Leaders and persons in charge saw the different governor characteristic Control Parameter values between the ECU Software for Mass Production, and the ECU Software for

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181 The Measurement Bench was placed under control of the Engineering Dept. of the Engine Division of the Hekinan Plant.

Deterioration Durability Test and the ECU Software for Witness Test problematic, and none of them questioned the existence of multiple types of ECU Software.

If the software for the Measurement Bench is updated, it is possible, by using the ECU Software for Mass Production, to recreate the driving patterns in the NRTC mode method; and, in reality, in 2019, the software for the Measurement Bench was updated, whereupon it became possible to recreate the driving patterns in the NRTC Mode using the ECU Software for Mass Production.

In cases where the governor characteristic Control Parameter values are modified, generally, it is possible that the emission component values will also be affected thereby. Therefore, we evaluate that it was improper that, notwithstanding the above possibility, they modified the Control Parameter values for the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test from those for the ECU Software for Mass Production, without confirming that the modification will not specifically affect the emission component values[182].

b. Actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values were modified.

The 1KD Engine ECU Software for Witness Test had actual injection correction[183] Control Parameter values and the air flow meter[184] flow characteristic Control Parameter values[185] that were modified from those of the ECU Software for Mass Production.

In preparation for the Witness Test, the person in charge checked for abnormalities in the fuel injection amount of the 1KD Engine to be used for such test, and found differences in the amount of fuel between a case of a certain amount of fuel injected at once and a case of a certain amount of fuel

182 In cases where any component of an engine, other than components that are periodically replaced, is replaced due to an unavoidable reason during a deterioration durability testing, the replaced component needs to be kept during the period of application for a device type designation so that it might be presented to the Ministry of Land, Infrastructure, Transport and Tourism and the Automobile Type Approval Test Department (Supplementary Provisions 7-7 4.1 and 7-7 4.2 proviso, and Supplementary Provisions 7-9 4.1 and 7-9 4.2 proviso, to the Approval Implementation Guidelines Supplementary Rule 7-7, 4.1 and 4.2 proviso, and Approval Implementation Guidelines Supplementary Rule 7-9, 4.1 and 7-9, 4.2 proviso).

183 Actual injection correction means correction performed to make the actual amount of fuel injected from the injector conform to the injection amount directed by the ECU Software.

184 Air flow meter is a device to measure the amount of Fresh Air taken to the engine.

185 Measurements of Fresh Air by an air flow meter often fluctuate due to the individual variability of air flow meter generated in the production process. Given that measurements of Fresh Air by an air flow meter often fluctuate due to the individual variability of air flow meter, the amount of Fresh Air measured by an air flow meter is corrected by ECU software. Air flow meter flow characteristic Control Parameters decide how much correction will be applied.

injected over multiple times[186] [187]. The person in charge compared the Fresh Air intake amount measured by an external measurement device, and the Fresh Air intake amount measured by an air flow meter of the 1KD Engine to be used for the Witness Test, and found differences therebetween[188].

The actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values for the ECU Software for Mass Production were determined on the basis of the average value of the results of operating engines with multiple air flow meters. Meanwhile, engines manufactured under the mass production process were used in the Witness Test, and the injectors and air flow meters installed in such engines had manufacturing variations, which are typically expected. As explained above, when the ECU Software for Mass Production was used without change, such manufacturing variations caused differences in the amount of fuel between a case of injection of a certain amount of fuel at once and a case of multiple injections, and inconsistencies between the amount of Fresh Air intake measured by the external measurement device and the amount of Fresh Air intake measured by the air flow meter.

Accordingly, the person in charge consulted the Group Manager and other employees thereunder at the Engine Calibration Group, and by modifying the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values for the ECU Software for Witness Test, resolved differences in the amount of fuel between a case of injection of a certain amount of fuel at once and a case of multiple injections, and matched the Fresh Air intake amount measured by the external measurement device with the Fresh Air intake amount measured by the air flow meter.

The person in charge thought that such modification of the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values was necessary to overcome the manufacturing variations and take correct measurements, and thought that it would not cause any problems in relation to regulations.

However, at the time of mass production of engines, it is not common for modifications to be made in the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values each time upon there are, and according to, the manufacturing variations in injectors and air flow meters. Therefore, we evaluate that it was improper that, notwithstanding the above, they modified the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values for the ECU Software for Witness Test from those for the ECU Software for Mass Production.

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186 For example, in a case where 45mm^3 of fuel was injected at once, the total amount of injection was 45mm^3, but in a case where fuel was injected twice, the total amount of injection was 46mm^3.

187 In response to the engine speed, a certain amount of fuel is injected at once or over multiple times.

188 According to the person in charge, the amount of Fresh Air intake measured by an external measurement device is closer to the actual Fresh Air intake amount than the Fresh Air intake amount measured by an air flow meter.

(3) Main reason the emissions performance did not meet the regulations

As described in (1)A above, Toyota Industries conducted the deterioration durability testing of the mass production version of the 1KD Engine again and as a result, it was confirmed that the PM values measured using the NRTC mode method and the 8-Mode Method, respectively, after operating the engine for certain hours, exceeded the regulation values.

As a result of the investigation of the cause thereof by Toyota Industries, it turned out regarding the 1KD Engine that (i) in the case of long hours of operating the engine, the injector deteriorated and resulted in an increase of the amount of fuel injected; and (ii) the mass production engine had higher MTS[189] and a lower maximum injection pressure than the engine used in the Witness Test. These were the causes for the deterioration in the PM values of the mass production engine.

In this regard, the 1KD Engine has a nature according to which, the higher the MTS is, the larger the PM amount tends to be; further, generally speaking, the lower the maximum injection pressure is, the larger the PM amount tends to be. As described in (1)C above, the engine used in the Witness Test was an engine using the Wider Sale Specifications while the mass production engine was using the Forklift Specifications; the engine speed and the maximum injection pressure of MTS using the Wider Sale Specifications were approximately 2200 and 180MPa, whereas those of the MTS using the Forklift Specifications were approximately 2500 and 160MPa.

It is considered that the fact the PM values exceeded the regulation values was not discovered in the Witness Test was because the Witness Test was conducted by using an engine with the Wider Sale Specifications; and because the deterioration correction values were not such that accurately indicate the emissions performance of the 1KD Engine[190].

2 1ZS Engine

(1) Overview and development background of the 1ZS Engine

A. Overview of the 1ZS Engine

The 1ZS Engine is an in-line three-cylinder diesel engine with a total displacement of 1.80 liters

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189 MTS is an abbreviation of the "Maximum Test Speed" and has the same meaning as "denormalizing rotation speed" referred to in 7.7.2.1. of the Attachment 43 to the Public Notice on Details. Specifically, it means the engine speed that is used as the basis in generating the driving patterns for the emissions testing for diesel engines for industrial vehicles.

190 As explained in I Part 3 above, the analysis in this paragraph is based on the deterioration durability testing conducted again by Toyota Industries, and the results obtained from technical verifications of the results of such testing, and the Committee did not independently validate the accuracy or reliability of such verifications etc.

which uses an electronically controlled variable-geometry turbocharger and a common rail fuel injection system, and does not have a DPF.

The development of the 1ZS Engine began in January 2012 as a model with lower output than that of the 1KD Engine, as part of the lineup of new diesel engines for industrial vehicles in compliance with the Tier 3 Regulations[191].

In the application for U.S. certification and domestic certification for the 1ZS Engine, deterioration factors and deterioration correction values calculated based on the results of the 1KD Engine deterioration durability testing were used because the structure/device concerning emission performance was common. Namely, as of June 17, 2014, the 1ZS Engine obtained domestic certification. The Witness Test was conducted using the 1ZS Engine, and the deterioration correction values calculated based on the results of the 1KD Engine deterioration durability testing were applied to the Witness Test results and compliance with the Safety Standards was determined.

As explained in I Part 1 above, Toyota Industries asked external lawyers to conduct an investigation and conducted the deterioration durability testing of the 1ZS Engine again. As the result of the deterioration durability testing, it was revealed the PM values measured using the NRTC mode method and the 8-Mode Method after operating the 1ZS Engine for 2000 hours exceeded the regulation values set forth by laws and regulations. Accordingly, on March 17, 2023, Toyota Industries publicly announced that it turned out that the PM values of the 1ZS Engine would exceed the regulation values set forth by laws and regulations due to deterioration over time; further, Toyota Industries decided to suspend shipment of forklifts equipped with the 1ZS Engine. Thereafter, on April 11, 2023, Toyota Industries submitted to the Ministry of Land, Infrastructure, Transport and Tourism a recall notification regarding forklifts and shovel loaders equipped with the 1ZS Engine.

B. Development system

The Engineering Office of the Engineering Dept., the Engine Division, was responsible for the development of the 1ZS Engine. As in A above, the deterioration factors and deterioration correction values calculated based on the results of the 1KD Engine deterioration durability testing were applied to the 1ZS Engine, and thus, the deterioration durability testing was not performed for the 1ZS Engine.

C. Background of the 1ZS Engine development

The development of the 1ZS Engine largely followed the following chronology.

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191 However, as with the 1KD Engine, in conjunction with the subsequent public announcement of the content of the Tier 4 Regulations during the course of development, the 1ZS Engine eventually obtained domestic certification as a Tier 4 Regulations-compliant model.

Date	Event
October 15, 2010	The advanced development was started as a four-cylinder engine with a total displacement of 2.0 liters using AD Engine for automobiles.
August 6, 2011	The Engine Division proposed to the Executive Vice President, Member of the Board[192] to start developing the engine as a four-cylinder engine with a total displacement of 2.0 liters, based on the results of the advanced development. In response, the Executive Vice President, Member of the Board noted to the Engine Division that the engine might need to be a three-cylinder engine in order to achieve the target sales price.
August 24, 2011	By this date at the latest, the Engine Division reached a conclusion that the engine needed to be a three-cylinder engine with a total displacement of 1.8 liters in order to achieve the target sales price; accordingly, it was agreed with the President of TMHC[193] to adopt such specification.
August 28, 2011	The Engine Division proposed to the Executive Vice President, Member of the Board that the engine should be a three-cylinder engine with a total displacement of 1.8 liters and the Executive Vice President, Member of the Board agreed thereto; accordingly, it was decided to start the development based on the specification above.
January 19, 2012	DR was held, at which it was reported that the development target values were expected to be achieved.
March 8, 2012	DR was held, at which it was not approved to move on to the next step, but it was decided to hold DR (second time) again.
April 23, 2012	DR (second time) was held again, at which it was not approved to move on to the next step, but it was decided to hold DR (third time) again.
May 15, 2012	DR (third time) was held again, at which it was approved to launch the production of prototypes subject to conditions including holding the head office DR[194].

[192] At that time, the Executive Vice President, Member of the Board was serving for the Technical Administration and was also serving as an executive of the industrial vehicle-related business, concurrently.

[193] President is the title of the chief executive at TMHC which is an in-house company.

[194] Head office DR means a DR which is held if it is determined that its sales or any difficulty in development or production preparation may affect the operations of the company, and which is attended also by the relevant officers. The Design Review Rules at the time of development of the 1ZS Engine provided that technical and quality function supervisory officers and officers responsible for business administration, accounting and technology were to be added to attendants in the head office DR.

Date	Event
June 6, 2012	Head office DR was held, at which it was approved to launch the production of prototypes subject to conditions including presenting an outlook for resolution of concerns by no later than June 29, 2012.
July 16, 2012	DR was held, at which it was reported that all the development target values including emissions performance were expected to be achieved. In response, it was approved to proceed with preparation for mass production.
October 16, 2012	DR was held, at which the schedule of preparation for mass production was approved.
February 6, 2013	DR was held, at which it was approved to finalize the details of the mass production engine drawing.
August 5, 2013	DR was held, at which it was approved to finalize the values of Control Parameters for the ECU Software for Mass Production-Equivalent Engines.
August 7, 2013	DR was held, at which it was approved to manufacture engine parts other than PCV[195]-related parts on the production line on an experimental basis.
August 22, 2013	DR was held, at which it was approved to assemble engine parts other than PCV-related parts on the production line on an experimental basis.
October 11, 2013	The follow-up meeting for DR was held, at which it was approved to assemble all engine parts including PCV-related parts on the production line on an experimental basis (experimental engine mass production on the production line).
October, 2013	A report was submitted to the EPA stating that the deterioration factors of the 1KD Engine would be used for application for U.S. certification.
January 7, 2014	An application for U.S. certification was made.
January 17, 2014	DR was held, at which the launch of mass production was approved.
February 6, 2014	U.S. certification was obtained.
April 25, 2014	An application for domestic certification was made with the deterioration correction values of the 1KD Engine.

195 PCV is an abbreviation for positive crankcase ventilation, and means a system to send combustion gas and unburned mixture (blow-by gas), which leaked from the combustion chamber into the crankcase through gaps among piston rings, back with help of negative pressure to the intake side of the engine for recombustion, and at the same time, to forcibly ventilate the inside of the crankcase.

Date	Event
May 27-May 28, 2014	The Witness Test was conducted.
June 17, 2014	Domestic certification was obtained.

The 1ZS Engine is a three-cylinder engine. A four-cylinder engine was considered at the advanced development stage. The Engine Division proposed to the Executive Vice President, Member of the Board to start developing the engine as a four-cylinder engine with a total displacement of 2.0 liters, based on the results of the advanced development. However, the Executive Vice President, Member of the Board noted to the Engine Division that the engine might need to be a three-cylinder engine in order to achieve the target sales price; as a result, it was decided to develop a three-cylinder engine with a total displacement of 1.8 liters.

Many people involved believed that this rendered the development unreasonable. For example, the Group Manager of the Engine Calibration Group said to the Committee, "The Engine Calibration Group was against that change to a three-cylinder engine because a three-cylinder engine had many technical uncertainties such as vibration noise and combustion, and was evidently inferior to a four-cylinder engine in such performance as low-speed torque, low-temperature start-up and fuel economy. The Engine Calibration Group notified TMHC to that effect, but the opinion of the Engine Calibration Group was not accepted". In addition, the person in charge of calibration work for the 1ZS Engine at the Engine Calibration Group said, "After the DR on January 19, 2012, emissions performance was evaluated with an actual engine for the first time, but it became clear that unless the maximum output was set lower than that at the planning stage, the development target PM values would be hardly achieved. However, the then General Manager of the Engineering Dept., the Engine Division did not accept our idea of setting the maximum torque lower than that at the planning stage. For that reason, we continued studies without changing the maximum output, but at least until around DR on July 16, 2012 (before I came to be in charge of another function), the development target PM values were not achieved".

(2) Details of improper conduct found in investigation, etc.

The investigation conducted by the Committee found that the persons in charge modified some Control Parameter values of the ECU Software for Witness Test for the 1ZS Engine to values different from those of the ECU Software for Mass Production.

A. Target EGR rate Control Parameter values were modified.

In preparation for the Witness Test, the person in charge measured the emission component values of the 1ZS Engine, as a result of which the PM values were found to be worse than expected. Accordingly, the person in charge reported at a meeting attended by the Group Manager and other employees thereunder that the PM values were found to be worse than expected, and he consulted with them regarding measures to be taken[196]. As a result, it was decided to modify the target EGR rate Control Parameter values; accordingly, the person in charge modified the target EGR rate Control Parameter values by April 24, 2014 at the latest. More specifically, the target EGR rate of the ECU Software for Witness Test was set lower than the target EGR rate of the ECU Software for Mass Production, whereby more Fresh Air taken into the cylinders and less exhaust gas was taken into the cylinders during the emissions testing using the ECU Software for Witness Test than during the emissions testing using the ECU Software for Mass Production.

This modification of the target EGR rate Control Parameter values was made to decrease the PM values in the Witness Test. It is evaluated to be improper.

B. Governor characteristic Control Parameter values were modified.

Three Working Group Leaders and one person in charge were aware that, as with the 1KD Engine, because the control system on the Measurement Bench used for the Witness Test differed from the control system of the ECU Software for Mass Production, if the emissions testing was conducted on such Measurement Bench using the ECU Software for Mass Production, the driving patterns in the NRTC mode method could not be recreated. As is the case with the 1KD Engine, the Working Group Leader in charge of control development work consulted the Assistant General Manager and others, and modified the value of governor characteristic Control Parameters of the ECU Software delivered by the external supplier so that it would be consistent with the control system expected on the Measurement Bench and created the ECU Software for Witness Test. None of the Working Group Leaders or persons in charge saw it as problematic to modify the governor characteristic Control Parameter values of ECU Software for Witness Test from those of the ECU Software for Mass Production, and none of them questioned the existence of multiple types of ECU Software[197].

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196 No evidence was discovered showing that the person in charge reported to the Assistant General Manager that they caused differences in the target EGR rate Control Parameter values between the ECU Software for Witness Test and the ECU Software for Mass Production.

197 No evidence was discovered showing that the person in charge reported to the Assistant General Manager that they caused differences in the governor characteristic Control Parameter values between the ECU Software for Witness Test and the ECU Software for Mass Production.

C. Actual injection correction Control Parameter values and air flow meter flow characteristic Control Parameter values were modified.

In preparation for the Witness Test, the person in charge checked for abnormalities in the fuel injection amount of the 1ZS Engine to be used for such test, and found differences in the amount of fuel between a case of a certain amount of fuel injected at once and a case of a certain amount of fuel injected over multiple times. He also compared the Fresh Air intake amount measured by an external measurement device, and the Fresh Air intake amount measured by an air flow meter, and found differences therebetween.

As with the 1KD Engine, the person in charge consulted with the Group Manager and other employees thereunder at the Engine Calibration Group, and by modifying the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values for the ECU Software for Witness Test, resolved differences in the amount of fuel between a case of injection of a certain amount of fuel at once and a case of multiple injections, and matched the Fresh Air intake amount measured by the external measurement device with the Fresh Air intake amount measured by the air flow meter[198].

(3) Main reason the emissions performance did not meet the regulations

As described in (1)A above, Toyota Industries conducted the deterioration durability testing of the mass production version of the 1ZS Engine again and as a result, it was confirmed that the PM values measured using the NRTC mode method and the 8-Mode Method, respectively, after certain hours of operating, exceeded the regulation values.

As a result of the investigation of the cause thereof by Toyota Industries, it turned out that in the case of long hours of operating, the injector of the 1ZS Engine deteriorated and resulted in an increase of the amount of fuel injected. This was the cause for the deterioration in the PM values of the mass production engine.

It is considered that the fact the PM values exceeded the regulation values was not discovered in the Witness Test is because the deterioration correction values were not such that accurately indicate the emissions performance of the 1ZS Engine; and because the target EGR rate was lower than that of the

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198 No evidence was discovered showing that the person in charge reported to the Assistant General Manager that they caused differences in the actual injection correction Control Parameter values and the air flow meter flow characteristic Control Parameter values between the ECU Software for Witness Test and the ECU Software for Mass Production.

ECU Software for Mass Production[199].

3 2009 4Y Engine

(1) Overview and development background of 2009 4Y Engine

A. Overview of 2009 4Y Engine

The 2009 4Y Engine is an inline four-cylinder engine with a total displacement of 2.2 liters using gasoline, LPG or CNG (compressed natural gas) as fuel, developed as a cost-reduced model of the 2007 4Y Engine.

The 4Y Engine is an engine that was developed based on an automotive engine and has been installed in forklifts since around 1986, and to comply with the Tier 2 Regulations applied to gasoline engines from October 1, 2007, it underwent a full model change to the 2007 4Y Engine. Thereafter, the 2009 4Y Engine, a cost-reduced model of the 2007 4Y Engine, was developed, and the 2020 4Y Engine, a successor model of the 2009 4Y Engine, was developed after.

As of the Reference Date, Toyota Industries is manufacturing the 2020 4Y Engine, a successor model of the 2009 4Y Engine, but because the emissions performance of the 2020 4Y Engine was considered compatible to that of the 2009 4Y Engine, the deterioration correction value of the 2009 4Y Engine was used when the domestic certification application for 2020 4Y Engine was made[200].

The 2009 4Y Engine was certified in Japan on May 28, 2009.

The 2009 4Y Engine is installed in forklifts as well as shovel loaders.

As explained in I Part 1 above, Toyota Industries asked outside attorney to conduct an investigation, and as a result, it was found that, in relation to the 2009 4Y Engine, there were violations in the procedures and method of deterioration durability testing set forth by laws and regulations. Accordingly, on March 17, 2023, Toyota Industries publicly announced that it turned out that there

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199 As explained in I Part 3 above, the analysis in this paragraph is based on the deterioration durability testing conducted again by Toyota Industries, and the results obtained from technical verifications of the results of such testing, and the Committee did not independently validate the accuracy or reliability of such verifications etc.

200 The difference in emissions performance between the 2009 4Y Engine and the 2020 4Y Engine is that the 2020 4Y Engine added an O2 sensor and increased the metal support capacity of the catalyst for gasoline engines and gasoline-LPG engines. Special Provision (2) for the method of filling in Approval Implementation Guidelines Supplementary Rule 7-8, 2., Form 4 sets forth that if the emission structure and devices (excluding the total displacement amount, the catalyst capacity, and the support capacity) of a vehicle applying for certification are identical to those of a vehicle etc. which has already obtained type certification, and if differences in the total displacement amount, catalyst specifications etc. are limited within a certain range (in case of catalyst, a capacity difference must be less than -15%, and a support capacity difference must be less than -15%), a deterioration correction value of the vehicle which has already obtained type certification can be used. The emission structure of the 2020 4Y Engine is the same as that of 2009 4Y Engine, and the metal support capacity increased from the 2009 4Y Engine; therefore, the deterioration correction values of the 2009 4Y Engine were used.

were violations in relation to the 2020 4Y Engine in the procedures and method of deterioration durability testing set forth by laws and regulations; further, Toyota Industries decided to suspend shipment of forklifts equipped with the 2020 4Y Engine.

B. Development system and work sharing between Engineering Office of Engine Division and TMHC

Regarding the 2009 4Y Engine development system, the Engine Calibration Group of the Engine Division was responsible for the engine calibration work, while the Engine Group of the Engineering Office of the Engineering Dept. of TMHC ("**TMHC Engine Group**") was responsible for the deterioration durability testing[201]. The engine calibration work and the deterioration durability testing for the 2009 4Y Engine were carried out on the bench set in the Takahama Plant where TMHC is based.

As explained in Part 3-1(2)B, gasoline engines for industrial vehicles were conventionally developed by TMHC, which also included the engine calibration work, and the Engine Division was responsible for production. The 2007 4Y Engine was an engine for which an electronically-controlled fuel injection device was adopted at full scale; TMHC had knowledge about a carbureted fuel injection device, but it did not have sufficient knowledge about the electronically-controlled fuel injection device. Thus, the Engineering Office of the Engineering Dept., the Engine Division that had accumulated knowledge about the electronically-controlled fuel injection device through the development of automotive engines came to be in charge of development, including the engine calibration work, of 2007 4Y Engine (however, the TMHC Engine Group was responsible for supervision and procurement of ECU).

Such development system for the 2007 4Y Engine, although some of the persons in charge were shuffled later, remained the same at the time of development of the 2009 4Y Engine.

A deterioration correction value was first approved by the Group Manager and the Assistant General Manager at the Engine Calibration Group in order, the Engine Calibration Group issued a document entitled Technical Memorandum to communicate the calculated deterioration correction value to the TMHC Engine Group as a "proposal", and one person in charge, the Working Group Leaders and the Group Manager at the TMCH Engine Group approved said value in order to finalize the same.

201 When emissions were measured during the deterioration durability testing, the persons in charge at the Laboratory Section primarily operated the engine and measured emission component values upon request from the department responsible.

C. Background of 2009 4Y Engine development

The development of the 2009 4Y Engine largely followed the following chronology.

Date	Event
February 2008	The development of the 2009 4Y Engine began to be considered.
October 29, 2008	The deterioration durability testing began.
Around mid-November 2008	Manufacturing defects were suspected in the catalyst mounted to the engine, and the deterioration durability testing started over.
January 14, 2009	The deterioration durability testing concluded.
March 6, 2009	An application for domestic certification was made.
May 28, 2009	Domestic certification was obtained.

The development of the 2009 4Y Engine began as a cost-reduced model of the 2007 4Y Engine, but such development was under the premise that only the metal support capacity of the catalyst was reduced and that the engine controls would not be modified. The TMHC Engine Group planned to reduce costs by reducing the metal support capacity of the catalyst. Prior to the deterioration durability testing, with help from the Engine Calibration Group, the durability testing up to 500 hours was carried out with a catalyst in which the metal support capacity was reduced in phases from the 2007 4Y Engine, and in light of that test result, the deterioration durability testing was carried out with a catalyst in which the metal support capacity was reduced by 40% from the 2007 4Y Engine.

As explained above, on November 5, 2008, manufacturing defects were suspected in the catalyst mounted to the engine[202], and it was also found that the sum of the HC value and the NOx value[203] included in the emission values measured on November 7 exceeded the regulation values[204]. Through consultation between the TMHC Engine Group and the Engine Calibration Group, it was decided to restart the deterioration durability testing, and emission values were measured at each measurement point within 1000 hours of operating the engine. Under normal circumstances, it would suffice for deterioration correction values to be calculated with the extrapolation method on the basis of the results thus far, but as a reference, emission values were measured after operating the engine for up to 1250

202 This was found when abnormalities occurred in the emission values.

203 The U.S. regulations do not set regulation values for HC and NOx individually, but set regulation values for the sum of the HC value and the NOx value. Application for U.S. certification was planned for the 2009 4Y Engine after domestic certification was obtained; thus, it is considered that the sum of the HC value and the NOx value was checked.

204 The November 10, 2008 weekly report records, "The durability catalyst may have an abnormality given the emission results." Said weekly report was prepared by the Working Group Leader at the Engine Calibration Group, and circulated up to the Group Manager, the Assistant General Manager and the General Manager.

hours[205].

It should be noted that DR was not held for the 2009 4Y Engine. This is because the development goal of the 2009 4Y Engine was only to reduce the catalyst cost, and the development scale was small.

(2) Details of improper conduct found in investigation, etc.

A. Data from the deterioration durability testing was rewritten.

The investigation revealed that the person in charge at the Engine Calibration Group, in calculating deterioration correction values, replaced the emission values actually measured after the engine was operated for 0 hours (actual operating hours; hereinafter in this (2) the same) and 250 hours with the emission values measured during a different test[206]. Regarding the source of the values that were replaced, it is found that the measurement values after 0 hours are consistent with the measurement results after 0 hours when emission values were measured prior to the deterioration durability testing for the purpose of selecting a catalyst.

It is found that the measurement values after 250 hours are consistent with the measurement values after 250 hours in the deterioration durability testing that was separately conducted to apply for U.S. certification.

Given the above, it is considered that to calculate deterioration correction values for the 2009 4Y Engine, the CO values after 0 hours were replaced with the CO values after 0 hours at the time of catalyst selection, and the HC, NOx and CO values after 250 hours were replaced with the HC, NOx and CO values after 250 hours in the deterioration durability testing of the 4Y Engine for U.S. market[207].

It is considered that the values were replaced in such a way because if deterioration correction values had been calculated using raw data, the estimated CO values after 2500 hours would have exceeded the regulation values.

B. O2 sensor with different characteristics was used when the emission values were measured after 750 hours.

The person in charge at the Engine Calibration Group measured emission values after operating the

205 The emission values obtained after operating the engine for 1250 hours are not used for the calculation of deterioration correction values.

206 One of the persons in charge was not involved in the calculation of deterioration correction values.

207 In this regard, the person in charge at the Engine Calibration Group states during the interview that he does not have any recollection of that time, but as explained above, it is obvious from the objective materials at that time that the values after 0 hours and 250 hours were replaced.

engine for 750 hours, and replacing the O2 sensor mounted to the engine with an O2 sensor with different characteristics.

The NOx values worsened more than expected in the deterioration durability testing, and thus, the person in charge at the Engine Calibration Group replaced the O2 sensor with a different O2 sensor (known as a "lower limit sensor")[208] with the characteristic of easily detecting oxygen concentration when measuring emissions after 750 hours. In general, if using a lower limit sensor, measured NOx values decrease, while if using an O2 sensor called an "upper limit sensor" with which detecting oxygen concentration is difficult, measured NOx values increase.

Approval Implementation Guidelines Supplementary Rule 7-7, 4.2 provides that "The test vehicle or test engine shall have the same structure, equipment, and performance as the vehicle engine and emission reduction equipment to which the vehicle type designation application, device type designation application, or type certification application pertains", and based on said provision, it is considered that in principle, the deterioration durability testing is assumed to be conducted with the same engine and the same parts. Therefore, in terms of the 2009 4Y Engine, measuring the emission values after operating the engine for 750 hours, and replacing the O2 sensor mounted to the engine with a different O2 sensor (lower limit sensor) with different characteristics was an act that breached Approval Implementation Guidelines Supplementary Rule 7-7, 4.2.

However, the persons in charge of management of Measurement Bench and calculation of deterioration correction values at the Engine Calibration Group state that they did not think such conduct would violation the laws and regulations.

C. Emission values were measured with a different engine by replacing only the catalyst and the O2 sensor.

The two persons in charge at the Engine Calibration Group responsible for the management of the Measurement Bench and calculation of the deterioration correction values for the 2009 4Y Engine removed only the catalyst and the O2 sensor after operating the engine on the Durability Test Bench, mounted the same catalyst and the same O2 sensor to a different engine main body set on the

[208] The "lower limit sensor" means an O2 sensor which has the same specifications as a O2 sensor but has the characteristic of easily detecting oxygen concentration within the range of the individual differences due to manufacturing variations.

Measurement Bench, and measured emission values[209].

This fact is obvious also from the test plan request form for the deterioration durability testing submitted by the Engine Calibration Group to the department responsible for measurement work indicating “catalyst exchange” as part of the “test preparation” work.

As explained in B above, according to Approval Implementation Guidelines Supplementary Rule 7-7, 4.2, the deterioration durability testing is assumed to be conducted in principle with the same engine and the same parts, and thus, measuring the emission values of the 2009 4Y Engine with a different engine by replacing only the catalyst and the O2 sensor is considered an act that breached Approval Implementation Guidelines Supplementary Rule 7-7, 4.2.

As a mater common to what is explained in B above, it should be noted that the persons in charge at the Engine Calibration Group did not correctly understand the Japanese laws and regulations relating to the deterioration durability testing. One of the persons in charge who was also responsible for the deterioration durability testing in the 2007 4Y Engine development states that because the 2007 4Y Engine first applied for U.S. certification, he was not aware of the Japanese laws and regulations relating to the deterioration durability testing. Further, the deterioration durability testing for the 2009 4Y Engine adhered fundamentally to the deterioration durability testing method for the 2007 4Y Engine, and this person in charge states that he did not confirm the details of the Japanese laws and regulations for that reason.

Another person in charge states that because the 2009 4Y Engine was the first engine for him to take responsibility for the deterioration durability testing, he adhered to the method adopted by the person in charge above who had experience of the 2007 4Y Engine development to conduct the deterioration durability testing, and did not independently confirm related laws and regulations.

D. ECU Software Control Parameter values were modified.

The person in charge modified the governor characteristic Control Parameter values of the ECU Software for Deterioration Durability Testing and the ECU Software for Witness Test to values

209 As explained in 6(2)B(d) below, in the deterioration durability testing for the 2007 4Y Engine, only the catalyst was replaced to measure emission values. For that reason, the person in charge at the Engine Calibration Group of the 2007 4Y Engine states that he thought the catalyst largely contributed to engine deterioration which affects emission values, and even if the components other than the catalyst deteriorated, the impact thereof on emission values may be limited, and thus the measurement of the emission values after deterioration of the catalyst would suffice as the deterioration evaluation of the emission values. Meanwhile, two persons in charge at the Engine Calibration Group of the 2009 4Y Engine state that they decided through discussion to replace the O2 sensor as well because the deterioration of the O2 sensor, as well as the catalyst, may have an impact on emission values.

different from those of the ECU Software for Mass Production[210].

The person in charge at the Engine Calibration Group was aware that because the control mode anticipated by the Measurement Bench on which the Automobile Type Approval Test Department conducts the Witness Test differs from that of the ECU Software for Mass Production, if the emissions testing is conducted with the ECU Software for Mass Production on said Measurement Bench, the engine speed will become unstable. Therefore, the Engine Calibration Group modified the governor characteristic Control Parameter values so as to conform with the control mode anticipated by the Measurement Bench, and created the ECU Software for Deterioration Durability Testing and the ECU Software for Witness Test.

The person in charge states that he did not think it would be problematic to modify the governor characteristic Control Parameter values of the ECU Software for Deterioration Durability Testing and the ECU Software for Witness Test from those of the ECU Software for Mass Production.

E. Other improper conduct

Although emission values were measured three times for each measurement time after operating the engine for 500 hours, 750 hours and 1000 hours, the deterioration correction values were calculated on the basis of only the testing data of two measurements[211].

Allowing such practice enables the arbitrary manipulation of deterioration correction values, and thus, using only some of the values for certification application is considered to violate Japanese laws and regulations.

However, the person in charge at the Engine Calibration Group who was responsible for calculation of deterioration correction values states that he did not think calculating deterioration correction values with only some of the data measured in the deterioration durability testing was an act not permitted by law while he was aware that a reduction in the quantity of data may fluctuate deterioration correction values.

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210 In terms of the 2020 4Y Engine, Toyota Industries also compared the details of the ECU Software for Mass Production and those of the ECU Software for Witness Test, and it was found that the governor characteristic Control Parameter values of the ECU Software for Mass Production differ from those of the ECU Software for Witness Test.

211 Two persons in charge at the Engine Calibration Group consulted and decided, prior to initiating the deterioration durability testing, to use the testing data of two measurements to calculate the deterioration correction values although emission values were measured three times. This is because when the 2007 4Y Engine, the predecessor of the 2009 4Y Engine, was in development, emission values were measured twice, but there was noticeable variability in the testing data, and some of the measurement values exceeded the application values; therefore, it was decided for the 2009 4Y Engine to measure emission values three times, and use the testing data of the two measurements with less variability.

(3) Status of reporting to Managers, etc.

A. Engine Calibration Group

The Assistant General Manager of the Engine Calibration Group and the Group Manager state that they were not aware that an act in violation of laws and regulations was being carried out. In this regard, the person in charge at the Engine Calibration Group verbally reported to the Working Group Leaders and the Group Manager on a daily basis, or reported in writing such as weekly reports etc. The weekly reports were circulated among the Working Group Leaders, the Group Manager and the Assistant General Manager, and the Group Manager approved the test plan request form. However, because documents etc. at that time were not sufficiently retained, and the memory of the people involved is foggy, it could not be clarified whether the person in charge reported to his manager each act of improper conduct in (2) above.

The Assistant General Manager and the Group Manager state, “I have experience engaging in the development work of engines for industrial vehicles, but have never been involved in the deterioration durability testing work, and therefore, left work relating to the deterioration durability testing entirely to the person in charge”, “In my understanding, the TMHC Engine Group is responsible for the deterioration durability testing and calculation of deterioration correction values, and I was not aware of the need to understand the laws and regulations relating to the deterioration durability testing and calculation of deterioration correction values, and to manage the work done by the person in charge”, and the like. Thus, it appears that they did not intend to proactively understand or manage the situations etc. of the deterioration durability testing.

B. TMHC Engine Group

The TMHC Engine Group was responsible for procuring the catalyst for the 2009 4Y Engine, and the TMHC Engine Group was in charge of the deterioration durability testing. Therefore, the TMHC Engine Group regularly checked the measurement values from the deterioration durability testing, and received reports on the status of the deterioration durability testing from the Engine Calibration Group. The Group Manager, the Working Group Leader and two persons in charge at the TMHC Engine Group were aware, through the management of the Durability Test Bench and the reports from the Engine Calibration Group, that emission values were measured in the deterioration durability testing after replacing only the catalyst and the O2 sensor.

The Group Manager, the Working Group Leader and the persons in charge at the TMHC Engine Group state that they were not aware that acts in violation of laws and regulations were being carried out because the deterioration durability testing method was the same as that for the 2007 4Y Engine, the predecessor of the 2009 4Y Engine. In addition, the people involved in the TMHC Engine Group state that the persons in charge at the Engine Calibration Group were responsible for management of the Measurement Bench and calculation of deterioration correction values, and thus, they were not aware of the need to understand the laws and regulations relating to the deterioration durability testing and calculation of deterioration correction values.

Among improper acts that were recently found, there are improper acts that might have been detected if the raw data had been checked, but the people involved in the TMHC Engine Group state that because they thought they could leave the deterioration durability testing and the calculation of deterioration correction values entirely to the Engine Calibration Group, and the TMHC Engine Group did not need to confirm or verify, they did not check the raw data from the deterioration durability testing.

4 1FS Engine

(1) Overview and development background of the 1FS Engine

A. Overview of the 1FS Engine

The 1FS Engine is an inline four-cylinder forklift engine with a total displacement of 3.7 liters, and is fueled by gasoline or LPG. On June 17, 2014, the 1FS Engine obtained domestic certification.

As background information behind the 1FS Engine development, in response to the introduction of the Tier 2 Regulations, Toyota Industries developed the 1FZ Engine (detailed below) as a forklift engine fueled by gasoline or LPG, and on August 10, 2007, obtained domestic certification. The 1FZ Engine was developed based on the 1FZ Engine for automobiles, but when production of the 1FZ Engine for automobiles ended in July 2009, the methods for procuring components for the 1FZ Engine components for forklifts changed[212], and manufacturing costs increased. In response to this, the Engineering Dept., the Engine Division proposed ending the manufacture of the 1FZ Engine to TMHC, and those discussions led to the development of a low-cost engine (1FS Engine) to take the place of the 1FZ Engine.

B. Development system

The Engineering Office of the Engineering Dept., the Engine Division was responsible for

[212] When the 1FZ Engine was also being produced as an engine for automobiles, Toyota Motors supplied some of the components, but with the discontinuation of the 1FZ Engine for automobiles, it became necessary for Toyota Industries to procure all the components on its own.

development of the 1FS Engine. The Engine Calibration Group was responsible for the deterioration durability testing[213] of the 1FS Engine and the calculation of deterioration correction values based on the results thereof.

C. Background of the 1FS Engine development

Because the 1FS Engine was first certified in the U.S., after the deterioration durability testing for receiving U.S. certification was performed and the deterioration factors to be submitted to the U.S. authorities (CARB[214] and the EPA) were calculated, the deterioration correction values were calculated based on those deterioration factors, and based on those deterioration correction values, device type designation for carbon monoxide, etc. emission control device pursuant to the Vehicle Act was received. As a result of discussions with CARB, the deterioration durability testing for the 1FS Engine employed a testing method of acceleration durability[215] and the emission component values were measured when the engine was operated at the C2 mode and the NRTC mode.

The development of the 1FS Engine largely followed the following chronology.

Date	Event
Around June-October, 2009	It was decided to consider the development of a successor engine to the 1FZ Engine due to the fact that the manufacturing cost of the 1FZ Engine had increased, among other things.
April 5, 2011	DR was held.
July 11, 2011	DR was held again.
September 7, 2011	DR was held.

213 When emissions were measured during the deterioration durability testing, the persons in charge at the Laboratory Section primarily operated the engine and measured emission component values upon request from the person in charge at the Engine Calibration Group.

214 California Air Resources Board. In order to sell engines across the United States including California, an application must be made to CARB as well as the EPA.

215 "Acceleration durability" means a deterioration durability testing method in which compared with normal deterioration durability testing, the heat load applied to the catalyst is intensified, and the deterioration of the catalyst is accelerated. Because the deterioration of the catalyst is accelerated, the testing time is shorter. How much heat load will be applied to the catalyst, or in other words, how much the deterioration durability testing time will be shortened, is decided through consultation with the U.S. authorities.

Date	Event
December 19, 2011	DR was held again. The 1FS Engine was initially planned to be developed as not only a forklift engine, but also a general-purpose engine for external customers. However, the target profit margin for a general-purpose engine was not expected to be achieved; therefore, by this time, production of prototypes was approved to begin for forklift engines only.
January 18, 2012	By January 18, 2012 at the latest, it was decided not to develop the 1FS Engine as a general-purpose engine.
June 28, 2012	The deterioration durability testing ("**DF1 of 1FS**") of the engine for deterioration durability testing ("**Official Engine**") began.
June 29, 2012	DR was held, and it was confirmed that the emission values achieved the development targets.
July 5, 2012	To prepare for any problems that might occur during the deterioration durability testing of the Official Engine, the deterioration durability testing of a backup engine ("**DF2 of 1FS**") began.
October 1, 2012	DR were held, and approval was given to begin preparations for mass production.
December 6, 2012	During DF2 of 1FS, the catalyst was damaged[216] while checking the emission component values on the engine calibration bench to study Control Parameters, so DF2 of 1FS was stopped[217].
December 18-19, 2012	During DF1 of 1FS, NOx values sharply increased, and the catalyst was suspected to be damaged. The catalyst of the Official Engine was replaced.
February 1, 2013	DR was held.
February 8, 2013	DF1 of 1FS was completed.
March 26, 2013	DR was held, and approval was given to manufacture the mass production prototype.
June 21, 2013	Application was filed for EPA certification.
June 27, 2013	Application was filed for CARB certification.

216 As a valve of the tank supplying fuel to an engine was not open, it caused the engine to run out of gas and damaged the catalyst.

217 Due to the catalyst breakage failure, the company lost reserve for any problems that may occur with the Official Engine during deterioration durability testing, and therefore, Toyota Industries began deterioration durability testing on around December 7, 2012, with a different engine than the backup engine that had been used up to that point. However, since DF1 of 1FS concluded in February 2013, the deterioration durability testing on the other engine was also stopped.

Date	Event
July 25, 2013	DR was held, and approval was given to start mass production.
August 6, 2013	CARB certification was obtained.
August 22, 2013	EPA certification was obtained.
April 25, 2014	Application was filed for domestic certification.
May 21-22, 2014	Witness Test was conducted for domestic certification.
June 17, 2014	Domestic certification was obtained.

(2) Details of improper conduct found in investigation, etc.

A. The catalyst was replaced during the deterioration durability testing.

The investigation found that, during DF1 of 1FS, the catalyst was replaced after 3000 hours of operating (2250 hours of actual operating) and deterioration durability testing was continued in that state. On December 18, 2012, the person in charge of deterioration durability testing measured the emission component values twice following completion of the 3000 hours of operating (2250 hours of actual operating) of DF1 of 1FS. In the first of the two measurements, there was no significant change in the HC value, and the total of the HC value and the NOx value was below the regulation value, but the NOx value rapidly increased. And in the second measurement, the total of the HC value and the NOx value exceeded the regulation value. Then, from December 18 to 19, 2012, the person in charge of the deterioration durability testing measured the emission component values four times, including after swapping the catalyst onto another engine and after changing the O2 sensor, and examined the cause of the rapid increase in NOx values. As a result of the examination, damage to the catalyst was suspected; however, the cause was not identified.

In response to the total of the HC value and the NOx value exceeding the regulation value, the person in charge reported that the total of the HC value and the NOx value exceeded the regulation value and that damage to the catalyst was suspected as the cause thereof, etc. at a meeting attended by the Assistant General Manager of the Engineering Office, the Group Manager of the Engine Calibration Group and others, and discussed how to handle subsequently. Then, after the person in charge and the Assistant General Manager, etc. discussed the same, it was decided to replace the catalyst installed on the Official Engine with another catalyst and continue the deterioration durability testing.

The person in charge replaced the catalyst on the Official Engine with another catalyst, returned the Official Engine that had been installed on the Measurement Bench to the Durability Test Bench, and continued deterioration durability testing[218].

The Assistant General Manager of the Engineering Office states, “As I did not want to know about

[218] It is unclear as to whether the Official Engine catalyst was replaced with a new catalyst or a used one at this time.

this matter anymore, and I also did not want there to be a record made of what I heard from the person in charge, I chose not to follow-up the situations thereafter", and "As I did not want to be involved in this matter to the extent possible, I did not report it to the General Manager of the Engineering Dept." In fact, no facts were found suggesting that the Assistant General Manager or other members of the Engineering Office made any reports to the General Manager of the Engineering Dept.

B. Emission component values measured for a purpose other than the deterioration durability testing were used

As discussed in A above, the total of the HC value and the NOx value after operating the engine for 3000 hours (2250 hours of actual operating) exceeded the regulation value. Because of this, even if deterioration durability testing was to be continued after replacing the catalyst, emission component values that did not exceed the regulation value after 3000 hours of operating (2250 hours of actual operating) were needed.

As described below, since the person in charge of deterioration durability testing had measured the emission component values for a purpose other than deterioration durability testing, he decided to use them as the emission component values after operating the engine for 3000 hours (2250 hours of actual operating).

Specifically, on December 12, 2012, when DF1 of 1FS passed 2955 hours (2222 hours of actual operating), a radiator problem occurred, and the water temperature of the industrial water used to cool the engine rose, causing the Official Engine to perform an emergency shutdown. In response to the emergency engine shutdown, the person in charge of deterioration durability testing suspected that the shutdown could have damaged the catalyst, leading to the deterioration of emission component values, and decided to measure the emission component values to check. The person in charge removed the catalyst from the Official Engine that had performed the emergency shutdown, mounted the catalyst onto an engine that was installed on a Measurement Bench at the Hekinan Plant and was being used for engine calibration work, and measured the emission component values. The measurements showed that the emission component values had not deteriorated, and damage to the catalyst could not be confirmed.

As described above, the persons in charge of deterioration durability testing recorded the emission component values measured on December 12, 2012 as the emission component values after operating the engine for 3000 hours (2250 hours of actual operating) during DF1 of 1FS in the deterioration durability testing results report, and submitted the report to the U.S. authorities.

As mentioned in A above, the person in charge reported to the Assistant General Manager and Group Manager, etc. that the total of the HC value and the NOx value exceeded the regulation values when measured after operating the engine for 3000 hours (2250 hours of actual operating), and that damage to the catalyst was suspected as the cause thereof, etc., but despite this, the results of DF1 of 1FS were used in the application for certification to the authorities. In light of this, it is conceivable that the Assistant General Manager and Group Manager were both aware that values that differed from the actual values were used as the measurement values after operating the engine for 3000 hours (2250 hours of actual operating).

C. ECU Software Control Parameter values were modified.

(a) Governor characteristic Control Parameter values were modified.

The person in charge modified the governor characteristic Control Parameter values in the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test to values different from those of the ECU Software for Mass Production.

The persons in charge of development of the ECU Software were aware that the control system expected on the Measurement Bench for performance of the Witness Test by the Automobile Type Approval Test Department was different from the control system for the ECU Software for Mass Production, so if the ECU Software for Mass Production were used to perform the emissions testing on the aforementioned Measurement Bench, it would not be possible to recreate the driving patterns in the NRTC mode. Then, the Engine Calibration Group prepared the ECU Software for Deterioration Durability Test and ECU Software for Witness Test by changing the values of the governor characteristic Control Parameters to be consistent with the control system expected on the Measurement Bench. Among the Working Group Leader and the persons in charge, no one thought it was problematic to change the governor characteristic Control Parameter values of the ECU Software for Deterioration Durability Test and ECU Software for Witness Test from those of the ECU Software for Mass Production.

(b) Status of reporting to Manager

Regarding the improper conduct described in (a) above, the person in charge of the Witness Test states that he reported it to the Group Manager, who states that he had no recollection of receiving such report. Although both persons' statements contradict each other, the Group Manager presented the circumstances as a reason for his failed recollection, including that at that time, he had entrusted the preparations for the Witness Test to the persons in charge thereof; this suggests that he had no intention to proactively understand and manage the development status of the ECU Software from the beginning.

The Assistant General Manager at the time when the deterioration durability testing was performed states, "As I was aware that the ECU Software for the 1FS Engine used many parts of the ECU Software for the 2009 4Y Engine that had been certified, I thought that there would be no problem with the software development of the 1FS Engine," and states that he was not aware of the improper conduct described in (a) above.

D. Other improper conduct

(a) Control Parameter values of the ECU Software for Witness Test were changed in terms of output

As a result of a comparison by Toyota Industries between the ECU Software for Mass Production, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test, it was learned that the Control Parameter values had been changed so that the output of the ECU Software for Witness Test would be more than the ECU Software for Mass Production and the ECU Software for Deterioration Durability Test.

The 1FS Engine Witness Test was performed from May 21 to 22, 2014, and when checking engine performance, etc. ahead of the Witness Test, the persons in charge of the Witness Test from the Engine Calibration Group noticed that the output did not satisfy the values notified in advance to the Automobile Type Approval Test Department. The persons in charge took various measures to increase output, but in the end, output was not improved. Then, the persons in charge of the Witness Test increased the output by operating the ECU Software for Witness Test and changing the Control Parameter values affecting output.

The persons in charge of the Witness Test were aware that operating the ECU Software for Witness Test and changing the Control Parameter values affecting output was improper conduct.

The person in charge of the Witness Test states that he reported the change to the Control Parameter values affecting the output in the ECU Software for Witness Test to the Group Manager, who states that he had no recollection of receiving such report. Although both persons' statements contradict each other, the Group Manager presented the circumstances as a reason for his failed recollection, including that at that time, he had entrusted the preparations for the Witness Test to the persons in charge thereof; this suggests that he had no intention to proactively understand and manage the development status of the ECU Software from the beginning.

(b) Estimated values were used for the maximum torque in the table of specifications

When applying for domestic certification, it is necessary to submit a table of specifications[219] as an attachment to the application, and it is also necessary to enter the maximum torque value in such table

219 One of the written documents stating the structure and performance of engines.

of specifications.[220]

Regarding the method of entering in a table of specifications, the Designation Standards provides that Approval Implementation Guidelines Supplementary Rule 5 shall be followed[221], and Approval Implementation Guidelines Supplementary Rule 5, 1-34 provides that, regarding the maximum torque, "Enter the maximum torque value during full load operation measured according to the Testing Rules attached to the Facility Examination Affairs Rules". As such, it is believed that it is necessary to enter measured values in the table of specifications, and it would be unacceptable to enter estimated values therein.

However, for the 1FS Engine, not measured values but estimated values were entered as the maximum torque value. In this regard, the employee who was involved in the determination of the maximum torque value at that time states as follows: when they measured the torque, they used a used air cleaner while a new air cleaner is used for mass production engines; thus, when determining the maximum torque value, they estimated the amount of torque to be increased when using a new air cleaner and added such amount to the measured torque value.

(c) Deterioration factors were calculated using only part of the testing data measured several times.

U.S. laws and regulations require that all testing data measured be reported to the U.S. authorities (even data that is treated as invalid is required to be reported).

However, because the emission component value measurement results varied greatly because preconditioning[222] had not been appropriately performed and there was variation in the measurement results due to the air temperature and other environmental factors and the condition of the bench, among other things, the persons in charge of the compilation of emission component value measurement results and preparation of deterioration durability testing results reports measured the emission component value multiple times after each certain time of operating during the 1FS Engine deterioration durability testing in order to submit data to the U.S. authorities with less variation[223].

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220 Designation Standards Vol. II, 3.2 and Attachment 2-1, 2.(1), 1(3).

221 Designation Standards Vol. II, 3.2 and Attachment 2-1, 2.(1), 2.

222 A bench from TMHC was used for operating the 1FS Engine until each measurement time, and when the emission component values were to be measured, the engine had been moved to a bench at the Hekinan Plant. In order to move the engine to another bench, the engine had to be disconnected from the battery, which cleared the control learning values that had been input into the ECU Software by that point in time. For this reason, it is necessary to configure the ECU settings to take into account the learning values up to the relevant point in time. This configuration work is called preconditioning.

223 As discussed above, although the Laboratory Section was directly responsible for conducting the measurement work, the persons in charge of the said section performed the measurement work under the direction of the persons in charge of deterioration durability testing in the Engine Calibration Group.

And, the deterioration durability testing results report that Toyota Industries submitted to the U.S. authorities included the measurement results for only some of the measured data, and the deterioration factors set forth in the report were calculated based on only that portion of the measurement results.

(d) Cracked front pipe and other components were repaired or replaced without notifying the U.S. authorities.

During the deterioration durability testing of the Official Engine, from around July to August 2012, due to vibration during the engine operation, the front pipe, muffler, flange section, collar section, etc. cracked multiple times, or the front pipe broke.

In this regard, U.S. laws and regulations require that any repairs or replacements of components made during the deterioration durability testing be recorded and reported to the U.S. authorities. However, the person in charge instructed the Laboratory Section to weld the cracks and replace the broken front pipe and other components. Nevertheless, Toyota Industries did not report the repairs and replacements of front pipe and other components to the U.S. authorities.

5 2020 1KD Engine for Construction Machinery

(1) Overview and development background of the 2020 1KD Engine for Construction Machinery

A. Overview of the 2020 1KD Engine for Construction Machinery

The 2020 1KD Engine for Construction Machinery is an in-line four-cylinder diesel engine[224] with a total displacement of 3.0 liters developed for excavators with standard specifications[225] manufactured by an external construction machinery manufacturer based on the 1KD Engine, and was developed in response to the emission regulations (EU Stage V) in Europe, which came into force in 2020.

The 2020 1KD Engine for Construction Machinery was first certified in Europe, in February 2020. An application for domestic certification was made using the deterioration correction values that were

224 As discussed below, the 2016 1KD Engine for Construction Machinery was developed for excavators with hybrid specifications, which adopt an energy regeneration system on the Lift Truck side where the engine is installed. In comparison to this, the 2020 1KD Engine for Construction Machinery was developed for excavators with standard specifications, which use a diesel engine as the sole source of power and do not adopt an energy regeneration system on the Lift Truck side.

225 As discussed below, the 2016 1KD Engine for Construction Machinery included a hybrid engine model with an assist motor, but the 2020 1KD Engine for Construction Machinery was a standard diesel engine without an assist motor.

calculated from the deterioration factors used for application for the EU certification, and obtained domestic certification on November 10, 2020.

As explained in I Part 1 above, Toyota Industries entrusted the investigations to outside attorneys, and as a result of those investigations, improper conduct described below was discovered. In response, Toyota Industries made an announcement to that effect on March 17, 2023 and decided to suspend shipments of the 2020 1KD Engine for Construction Machinery. Subsequently, Toyota Industries again conducted deterioration durability testing of engines. As a result of such deterioration durability testing, it was discovered that the NOx value measured using the NRTC mode method after operating the engine for 2670 hours exceeded the regulation value set forth by laws and regulations.

B. Development system

The Engineering Office of the Engineering Dept., the Engine Division was responsible for the development of the 2020 1KD Engine for Construction Machinery. The Engine Calibration Group was responsible for deterioration durability testing[226] and for calculating deterioration correction values based on the test results.

C. Background of the 2020 1KD Engine for Construction Machinery development

The development of the 2020 1KD Engine for Construction Machinery is summarized in the following chronology.

Date	Event
February 28, 2017	The external manufacturer approached Toyota Industries for development of an engine to be installed in the next generation model of 12-ton class excavators with standard specifications.
November 3, 2017	DR was held, at which the development plan was approved.
March 1, 2019	The deterioration durability testing began.
May 7, 2019	DR was held, at which it was reported that the emission values achieved the development target values.
September 20, 2019	DR was held, at which the production preparation schedule and plan for mass production were approved.
September 24, 2019	The deterioration durability testing concluded.

226 When emissions were measured during the deterioration durability testing, the engineers in charge at the Laboratory Section primarily operated the engine and measured emission component values upon request from the engineer in charge at the Engine Calibration Group.

Date	Event
January 14-15, 2020	Witness Test for EU certification was conducted.
February 10, 2020	EU certification was obtained.
June 2, 2020	DR was held, at which test mass production on the production line was approved.
July 2, 2020	Follow-up meeting for DR was held.
September 24, 2020	DR was held[227].
October 1, 2020	Witness Test for domestic certification was conducted.
November 10, 2020	Domestic certification was obtained.
March 5, 2021	Follow-up meeting for DR was held, at which the launch of mass production was approved[228].

(2) Details of improper conduct found in investigation, etc.

A. ECU Software Control Parameter values were modified.

(a) Governor characteristic Control Parameter values were modified.

The engineers in charge modified the governor characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test to values different from those of the ECU Software for Mass Production.

The engineers in charge were aware that the governor characteristic Control Parameter values for the ECU Software for Mass Production were set so that the fuel injection amount changed rapidly in relation to the changes in the engine rotation speed and that if emissions testing were conducted using the ECU Software for Mass Production, the engine rotation speed and fuel injection amount would become unstable, which would make it impossible to reproduce driving patterns in the emissions testing. As a result, the engineers in charge modified the governor characteristic Control Parameter values so that the pace of changes in fuel injection amount that occur in response to changes in the engine rotation speed become more gradual, and as a result the engine rotation speed and the fuel injection amount during the Measurement Bench run became stabilized.

The Working Group Leaders and the engineers in charge who were involved in the deterioration durability testing and the Witness Test believed that the above modification of the governor characteristic Control Parameter values were necessary for correct measurement, and thought that

227 At this DR, an unresolved issue was to take countermeasures against the crack of DPF prior to the launch of mass production.

228 At this DR, the unresolved issue of the countermeasures against the crack of DPF was reported.

these actions would not cause any problems in relation to laws and regulations.

The investigation conducted by Toyota Industries confirmed that when emissions are measured using the NRTC mode for an engine equipped with the ECU Software for Deterioration Durability Test or the ECU Software for Witness Test, relative to a case for an engine equipped with the ECU Software for Mass Production, NOx in the emissions will be lower.

(b) Air flow meter flow characteristic Control Parameter values were modified.

The air flow meter flow characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test were modified from those of the ECU Software for Mass Production.

As in the case of the improper conduct concerning the 1KD Engine and the 1ZS Engine,[229] the engineers in charge modified the air flow meter flow characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test so that the Fresh Air intake amount measured by the externally-attached measurement device matched the Fresh Air intake amount measured by the air flow meter.

The Working Group Leaders and the engineers in charge who were involved in the deterioration durability testing, all believed that such modification of the air flow meter flow characteristic Control Parameter values was necessary for correct measurement and thought that it would not cause any problems in relation to laws and regulations.

(c) Values of Control Parameter for DPF regeneration conditions were modified.

The engineer in charge modified the Control Parameter values for DPF regeneration conditions[230] for the ECU Software for Deterioration Durability Test used during the Durability Test Bench operation ("**ECU Software for Durability Operation**") to values different from those of the ECU Software for Mass Production.

In the development testing for the 2020 1KD Engine for Construction Machinery, when a preliminary and preparatory test for the deterioration durability testing called "pre-DF testing" was conducted, a crack from unknown causes appeared on the DPF. With respect to the cause of the crack, the engineer in charge presumed that when the DPF regeneration was conducted at the time when the

229 Refer to 1(2)B(b)b above concerning the 1KD Engine and 2(2)C above concerning the 1ZS Engine.

230 As explained in Part 2-2 above, when the amount of PM collected exceeds a certain amount, the DPF is "regenerated," that is, the filters regain performance by burning PM collected by, for example, increasing the exhaust temperature by increasing the amount of fuel injected. The Control Parameter which decides under what kind of conditions the DPF regeneration is conducted is hereafter referred to as the "Control Parameter for DPF Regeneration Conditions."

durability operation pattern used in the deterioration durability testing for the 2020 1KD Engine for Construction Machinery shifted to a state of low rotation/low load called an “idle” state, the amount of emissions taken into the DPF decreased[231] and, as a result of the temperature in the DPF becoming too high, the crack appeared due to heat expansion. Accordingly, the above engineer in charge modified the Control Parameter values for the ECU Software for Durability Operation to make the engine rotation speed and torque increase when the DPF regeneration is conducted in an idle state.

However, despite such modification of the Control Parameter values, a crack continued to appear on the DPF in the subsequent pre-DF testing. Therefore, the above engineer in charge further modified the Control Parameter values for the ECU Software for Durability Operation to prevent the DPF regeneration in an idle state.

After that, the deterioration durability testing for the 2020 1KD Engine for Construction Machinery was commenced using the ECU Software for Durability Operation modified as above; however, when about 800 hours elapsed, there was a defect which caused the DPF regeneration not to be conducted despite the PM accumulation on the DPF. That is, although the DPF regeneration was supposed to be conducted by the control system in the ECU Software when (i) the amount of PM accumulated on the DPF is considered to reach a certain amount or more by sensors,[232] or (ii) the estimated value of the amount of PM accumulated, which is calculated based on the operating status of the engine after the previous DPF regeneration, reaches a certain amount or more,[233] the DPF regeneration due to (i) above was not conducted due to the defect with unknown causes. Therefore, the above engineer in charge decided to increase the number of times the DPF regeneration would be conducted due to (ii) above, and modified the values of the Control Parameter for DPF Regeneration Conditions for (ii) above in the ECU Software for Durability Operation during the durability operation.[234]

The Working Group Leader and the engineer in charge who were involved in the deterioration durability testing both believed that such modification of the values of the Control Parameter for DPF Regeneration Conditions was necessary for preventing a crack on the DPF and correct measurement, and thought that it would not cause any problems in relation to laws and regulations.

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231 The amount of emissions taken into the DPF is in proportion to the engine rotation speed and torque. The emissions taken into the DPF have an effect of cooling the DPF, and the effect of cooling the DPF is proportional to the emissions amount taken into the DPF.

232 When the DPF becomes clogged due to PM accumulation, there is a difference in pressure between the front (intake side) and back (exhaust side) of the filter. Using this difference, the pressure of each side is measured by sensors installed in the front and back of the filter, and the DPF regeneration is conducted when the difference reaches a certain amount or more.

233 The estimated value of the amount of PM accumulated in the DPF can be calculated based on the rotation speed, load, operating hours and other conditions of the engine.

234 Specifically, the engineer in charge doubled the PM accumulation speed in the formula for calculating the estimated amount of PM accumulated.

B. Other improper conduct

EU laws and regulations[235] provide that all test data resulting from deterioration durability testing conducted shall be provided to the certification authority; and if an applicant regards some of the test data to be void, such test data and reasons why it has been regarded as void shall be provided. However, although the engineers in charge measured emissions multiple times at each measurement timing, they used only some of these test data, based on which they calculated deterioration factors and used them for the certification application. Further, although the engineers in charge invalidated some of the test data because of gauge malfunctions, they submitted to the certification authority neither the invalidated test data nor the reasons for invalidation.

The Working Group Leaders and the engineers in charge who were involved in the deterioration durability testing, all believed that under EU laws and regulations it was acceptable to measure emissions multiple times and use only some of the results to calculate deterioration factors, and so selected the test results similar to the estimated values; further, none of them were aware that invalidated test results had to be submitted with the application for certification, and all believed that it would suffice to record the reason for the invalidation internally and redo the test.

C. Status of reporting to Manager

Regarding the improper conduct referenced above in A and B, the engineers in charge of development of the 2020 1KD Engine for Construction Machinery routinely provided reports to the Working Group Leaders and the Group Manager verbally and also in writing, by preparing weekly reports. However, the Group Manager did not report the improper conducts to the Assistant General Manager of the Engineering Office because he was not aware of the fact that the relevant conducts were improper.

(3) Main reason the emissions performance did not meet the regulation values

As stated in (1)A above, as a result of Toyota Industries having re-conducted the deterioration durability testing for the mass production version of the 2020 1KD Engine for Construction Machinery, it was confirmed that the NOx value measured at the specified hours using the NRTC mode method exceeded the regulation value.

According to Toyota Industries' investigations, the conceivable reasons for the NOx value exceeding the regulation value in the reconducted deterioration durability testing, although in the deterioration durability testing conducted at the time of development of the 2020 1KD Engine for Construction

235 Annex III, No. 3.2.4.1. of Commission Delegated Regulation (EU) 2017/654

Machinery the NOx value did not exceed the regulation values, are as follows.

First, as stated in (2)A(a) above, for the 2020 1KD Engine for Construction Machinery, the governor characteristic Control Parameter values for the ECU Software for Deterioration Durability Test were modified from those of the ECU Software for Mass Production. It was confirmed that, due to this modification, the NOx initial value for the mass produced engine rises higher than the NOx initial value for the engine used in the deterioration durability testing.[236]

Second, the 2020 1KD Engine for Construction Machinery had an air-fuel ratio learning control function. The air-fuel ratio learning control function is a function for adjusting the EGR rate so that the actual air-fuel ratio matched the targeted air-fuel ratio[237] by comparing the targeted air-fuel ratio and the actual air-fuel ratio measured by the air-fuel ratio sensor. In the case of the air-fuel ratio learning control function in the 2020 1KD Engine for Construction Machinery, it was set so that, if the actual air-fuel ratio is lower than the targeted air-fuel ratio (namely, if the amount of fuel is rich), it would make adjustments to increase the air-fuel ratio by reducing the EGR rate.[238] The degree of

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236 Specifically, the specification of the governor characteristic for the ECU Software for Mass Production was such that the range of increase in the fuel injection amount when the engine rotation speed decreased because of high load was larger, compared to that of the ECU Software for Deterioration Durability Test. It is considered that, as a result of the foregoing, the fuel injection amount became unstable in the mass produced engine, which caused the EGR rate to decrease and thereby increased NOx.

237 As explained in II Part 2-2 above, the air-fuel ratio refers to the proportion of the mass of air and the mass of fuel, and is calculated by dividing the mass of air by the mass of fuel. When the air-fuel ratio is low (namely, when there is more mass of fuel compared to the mass of air; referred to as being “rich”), high output can be obtained; however, PM will increase due to insufficient air. Conversely, when the air-fuel ratio is high (namely, when there is less mass of fuel compared to the mass of air; referred to as being “lean”), fuel efficiency improves; however, NOx increases because of higher combustion temperature due to too much air. Because the air-fuel ratio has an effect on the engine output and fuel efficiency as well as emission values, during the development of engines, the optimal air-fuel ratio appropriate for the driving condition is set by calibration of the ECU Software. The “targeted air-fuel ratio” in the main text refers to the optimal air-fuel ratio set by the ECU Software.

238 Among the engines for industrial vehicles that Toyota Industries developed, only the 1KD Engine for Construction Machinery had the air-fuel ratio learning control function. In the case of the 1KD Engine for Construction Machinery, because urea SCR, a device to decrease NOx, was not installed in it, it was decided that during calibration ECU Software would be set so that NOx would be low as much as possible, and the PM that would increase due to keeping NOx low was to be decreased by DPF. DPF is an after-treatment device to collect PM emissions by a filter. When a certain amount of PM accumulates on the filter, in order to prevent the filter from clogging, the engine is powered up to increase the exhaust temperature, thereby burning and removing the PM accumulated on the filter (DPF regeneration). Generally speaking, because DPF regeneration has effects such as consuming fuel and increasing exhaust temperature, it is desirable that the DPF regeneration occurs less frequently (DPF regeneration cycle becomes longer); as such, it was also the case for the 2020 1KD Engine for Construction Machinery that the above-mentioned external manufacturer requested to make the DPF regeneration cycle 6 hours or longer. Accordingly, in order to prevent PM from increasing and resulting in the DPF regeneration cycle being shortened due to the actual air-fuel ratio being lower than the targeted air-fuel ratio, Toyota Industries decided to install the air-fuel ratio learning control function in the 2020 1KD Engine for Construction Machinery. Because the reason for installing the air-fuel ratio learning control function was to prevent PM from increasing, the air-fuel ratio learning control function installed in the 2020 1KD Engine for Construction Machinery was set so that it only operated when the actual air-fuel ratio became lower than the targeted air-fuel ratio, and did not operate when the actual air-fuel ratio was higher than the targeted air-fuel ratio.

difference between the targeted air-fuel ratio and the actual air-fuel ratio, as well as whether the actual air-fuel ratio would be higher or lower than the targeted air-fuel ratio, varies depending on the individual differences caused by manufacturing variance in and deterioration state of the air flow meter, injector, air-fuel ratio sensor, and EGR cooler etc. Toyota Industries confirmed that during the deterioration durability testing at the time of development of the 2020 1KD Engine for Construction Machinery, the fuel became rich due to deterioration of the injector with the increased operating hours, and the actual air-fuel ratio was gradually lowered; nonetheless, the actual air-fuel ratio was never lower than the targeted air-fuel ratio, and therefore there was never an instance when the air-fuel ratio learning control function operated to modify the air-fuel ratio, and as a result, NOx tended to decrease with the passage of time. On the other hand, it was confirmed that during the reconducted deterioration durability testing, because the actual air-fuel ratio was lower than the targeted air-fuel ratio, the air-fuel ratio learning control function operated and modified the air-fuel ratio to decrease PM. As a result, NOx, which is in a trade-off relationship with PM, increased. This difference was caused as a result of the air-fuel ratio learning control function operating due to individual differences in and deterioration state of the components. However, originally, in the engine development, the emissions performance must be made to meet the regulation values, taking variations caused due to individual differences in and deterioration state of the components into consideration. Thus, the engine development was insufficient in terms of having configured the settings for the air-fuel ratio learning control function which might cause NOx values not to meet the regulation values due to individual differences in and deterioration state of the components.

Consequently, modification of governor characteristic Control Parameter values and the fact that settings for the air-fuel ratio learning control function taking individual differences in the components into consideration were not properly configured presumably caused the NOx value to exceed the regulation value in the reconducted deterioration durability testing, despite the NOx value in the deterioration durability testing at the time of development of the 1KD Engine for Construction Machinery not exceeding the regulation value.

Furthermore, the Witness Test is conducted by measuring the initial values to which the deterioration correction values are added in order to confirm whether emission component values satisfy the regulation values.

However, as stated in (2)A(a) above, presumably because in the case of the 2020 1KD Engine for Construction Machinery the governor characteristic Control Parameter values for the ECU Software for Witness Test were modified to values different from those of the ECU Software for Mass Production, the NOx initial value of the engine for the Witness Test remained low. Furthermore, as stated above, because during the deterioration durability testing at the time of development NOx tended to decrease with the passage of time, the deterioration correction value calculated based on the deterioration durability testing at the time of development was zero. Presumably, because of these reasons, the NOx value did not exceed the regulation value during the Witness Test either.[239]

6 Prior models of engines

(1) 2007 1DZ Engine

A. Overview and development background of the 2007 1DZ Engine

(a) Overview of the 2007 1DZ Engine

The 2007 1DZ Engine is an in-line four-cylinder and swirl-chamber[240] diesel engine with a total displacement of 2.5 liters for forklifts, skid steer loaders,[241] and other industrial vehicles. The first model of the 1DZ Engine, the 1DZ, was developed in 1989, and an upgrade with anti-noise features, the 1DZ-II, was developed in 1999. In order to comply with the new emissions rules rolled out starting in 2006 in Japan, the U.S. and Europe, the 1DZ-III, or the 2007 IDZ Engine, an upgrade with improved emissions performance based on the 1DZ-II was developed in 2007. The 2007 1DZ Engine has a mechanical control system (i.e., fuel injection timing, and fuel injection amount are controlled mechanically)[242], and thus does not have an ECU.

The new emission regulations to be enforced from 2006 onward in Japan, the U.S., and Europe (the Tier 2 Regulations in Japan) included new deterioration durability requirements, requiring satisfaction of not only the initial emission values (i.e., for a just after manufactured engine that has not deteriorated) but the emission values after a deterioration durability period. In its initial development stage (prototype assessment), the 2007 1DZ Engine was expected to meet the regulation values for its

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239 As explained above in I Part 3, the analysis in this paragraph is premised on the results obtained from the technical verifications of the deterioration durability testing re-conducted by Toyota Industries and the results of that test, and the Committee has not independently verified the accuracy or reliability of such verifications etc.

240 A "swirl-chamber" is defined as a type of combustion chamber for a diesel engine. In a swirl-chamber type combustion chamber, a swirl-chamber (sub-chamber) is installed in addition to the main combustion chamber at the cylinder head portion of the engine. In the sub-chamber, a swirl of air is forced to be generated during the compression stroke; by injecting fuel from the injection valve, the fuel is ignited in the sub-chamber and then mixed with air and combusted in the main combustion chamber. It is generally understood that the advantage of a swirl-chamber type combustion chamber is that it is easier than a direct-injection type combustion chamber to control combustion therein, whereas it is inferior to a direct-injection type in terms of fuel efficiency.

241 A skid-steer loader is a vehicle for transporting heavy loads, i.e., an industrial vehicle steered by "skid steering," in which rolling and turn orientation differences in the wheels are leveraged, rather than by turning a steering wheel.

242 Specifically, it included a system for fuel injection timing, fuel injection amount, etc. using centrifugal force and lever movement amount.

initial emission values but it was expected to exceed the regulation values for its emission values after deterioration; thus, an important issue was how to improve emission values after deterioration.

Development of the 2007 1DZ Engine began around January 2005; an EU certification was obtained in April 2007, and on September 20, 2007, a domestic certification for the 2007 1DZ Engine was obtained with the data used when obtaining the EU certification.

There were two specifications with different rated power for the 2007 1DZ Engine (i.e., a high power output model with rated power of 41 kW and a low power output model with rated power of 31 kW). Accordingly, for the EU certification, the high power output model and the low power output model were classified into different engine families,[243] and the high power output model was chosen as the parent engine[244, 245] representing the exhaust characteristics of these two engine families, and based on the results of the deterioration durability testing for the high power output model, deterioration

243 Under EU laws and regulations, "engine family" means an engine classification made by manufacturers for engines that are expected to have similar exhaust characteristics in terms of design (Article 2 of 97/68/EC (as at the time of development of the 2007 1DZ Engine; hereinafter the same)). For engines to be considered in the same engine family, they must have similar exhaust characteristics as well as a common basic design (combustion cycle, coolant, individual cylinder displacement, intake method, fuel type, etc.) (Annex I, section 6 of 97/68/EC).

244 Under EU laws and regulations, "parent engine" means an engine in an engine family having the highest fuel injection amount per stroke at the maximum torque speed (or, if more than one engine meets these criteria, the one with the highest fuel injection amount per stroke at the rated speed). However, in some circumstances, it is permissible, in place of the above criteria, to select as the parent engine the engine in the relevant engine family that is thought to have the highest exhaust level (greatest degradation of emission performance) (Article 2, and Annex I, section 7 of 97/68/EC).

245 For an application for certification of an engine family, an examination for the certification application is made only for the parent engine of said engine family (see paragraph (7) of preamble to, and paragraph 2 of Article 3 of, 97/68/EC).

correction values[246] for the 2007 1DZ Engine were calculated[247]. For domestic certification of the 2007 1DZ Engine, the deterioration correction values used for the EU certification were used to obtain device type designation pursuant to domestic laws and regulations.

The deterioration correction values used for the EU certification of the 2007 1DZ Engine were also used for the domestic certification of the 3Z Engine and 15Z Engine[248] developed in 2007, and based on this, both engines obtained domestic certification.

Further, the 1KD Engine and the 1ZS Engine described above were developed as successor models of the 2007 1DZ Engine, 3Z Engine, and 15Z Engine in order to comply with the new tightened emission regulations to be enforced from 2013 onward in Japan, the U.S. and Europe (the Tier 3 Regulations in Japan)[249].

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246 Under EU laws and regulations, "deterioration correction value" (a.k.a., "additive deterioration factor") is defined as the value obtained by subtraction of the emission value determined at the beginning of the deterioration durability testing from the emission values after the prescribed deterioration durability period, whereas "deterioration factor" (a.k.a., "multiplicative deterioration factor") is defined as the emission value after the prescribed deterioration durability period divided by the emission value recorded at the beginning of the deterioration durability testing (Annex III, Appendix 5, section 1.1.1.3 of 97/68/EC). Under EU laws and regulations as of the time the 2007 1DZ Engine was developed, in certification applications, if an engine did not use an after-treatment device, deterioration correction values (a.k.a., additive deterioration factors) were to be used, whereas if the engine did use an after-treatment devices, deterioration factors (a.k.a., multiplicative deterioration factors) were to be used (Annex III, Appendix 5, sections 1.2.1 and 1.2.2 of 97/68/EC). Since the 2007 1DZ Engine did not use an after-treatment devices, deterioration correction values (a.k.a., additive deterioration factors) were used for the certification application.

247 As stated above, deterioration durability testing was performed on the high power output model, and therefore it might appear that the results of deterioration durability testing for this engine cannot be used for a low power output model, which is in a different engine family. However, under EU laws and regulations, even if an engine is in a different engine family, if it uses an emission control system technology equivalent to the one used in the engine that underwent deterioration durability testing, and if the engine that underwent deterioration durability testing represents the emission deterioration characteristics of said different engine family, the deterioration correction values calculated as a result of such deterioration durability testing may be used for said different engine family (Annex III, Appendix 5, section 1.1.1.1 of 97/68/EC). The application for EU certification of the 2007 1DZ Engine stated that the reasons for choosing the high power output model as the parent engine to undergo deterioration durability testing were that (i) both engine families have the same injection pump style and almost identically shaped combustion chambers; (ii) the number of cylinders is the same; and (iii) in each engine family, the high power output model has the worst emission value.

248 The 3Z Engine and the 15Z Engine are, like the 2007 1DZ Engine, swirl-chamber diesel engines for forklifts etc. that were developed in 2007. While the 2007 1DZ Engine has 4 in-line cylinders with a 2486 cc displacement, the 3Z Engine ~~E~~has 4 in-line cylinders with a 3469 cc displacement and the 15Z Engine has 6 in-line cylinders with a 5204 cc displacement, both of which indicate greater engine power than the 2007 1DZ Engine.

249 Production and sales of the 2007 1DZ Engine terminated in 2013 because its subsequent models, the 1KD Engine and the 1ZS Engine, were developed in 2013. However, thereafter in July 2018, the 2018 1DZ Engine, a new model with lower output than that of the 2007 1DZ Engine, was developed and its production and sale continues until now. The 2018 1DZ Engine has rated output of 17.5kW and is not subject to domestic emission regulations (as stated in Part 2-1 above, engines with rated output of 19kW or more are subject to domestic emission regulations); thus, it has not obtained domestic certification. Therefore, the 2018 1DZ Engine is not covered by the Committee's investigation because the engine is not subject to domestic emission regulations, and it didn't obtain domestic certification.

(b) Development system

The Engineering Office of the Engineering Dept., the Engine Division was responsible for the development of the 2007 1DZ Engine. The Engine Calibration Group was responsible for the deterioration durability testing of the 2007 1DZ Engine[250] and for calculating deterioration correction values on the basis of the test results.

(c) Development background

The development of the 2007 1DZ Engine is summarized in the following chronology.

Date	Event
January 2004	To comply with the new emission regulations, the idea of developing TMHC next-generation engine series, including the 2007 1DZ Engine, was considered.
Around January 2005	Prototype assessment[251] for the 2007 1DZ Engine began.
May 31, 2005	DR was held, at which it was approved to launch the production of prototypes.
August 4, 2005	DR follow-up meeting was held.
December 7, 2005	The deterioration durability testing began.
July 3, 2006	The deterioration durability testing concluded.
September 26, 2006	DR was held, at which it was reported that deterioration durability testing results found the emission values to achieve the development target values. As a result, a transition to preparations for mass production was approved.
November 30, 2006	DR follow-up meeting was held.
March 7, 2007	DR was held, and approval was given to manufacture the mass production prototype.
March 19, 2007	Witness Test for EU certification on the high power output model was

250 When emissions were measured during the deterioration durability testing, the engineers in charge at the Laboratory Section primarily operated the engine and measured emission component values upon request from the engineer in charge at the Engine Calibration Group.

251 Prototype assessment means, at the stage before test production, assessing the performance and characteristics of prototypes by incorporating new technology and mechanisms into existing mass-produced vehicles for the purpose of obtaining information for product planning and setting design targets.

Date	Event
	conducted.[252]
March 20, 2007	Witness Test for EU certification on the low power output model was conducted.
April 2, 2007	EU certification for the low power output model was obtained.
April 3, 2007	EU certification for the high power output model was obtained.
May 22, 2007	DR was held, and approval was given to start mass production.
August 29, 2007	Witness Test for domestic certification on the high power output model was conducted.
August 30, 2007	Witness Test for domestic certification on the low power output model was conducted.
September 20, 2007	Domestic certification was obtained on the high power output model and a low power output model.

As is clear from the above chronology, with respect to the 2007 1DZ Engine, deterioration durability testing began when the engine calibration work was still being conducted after approval of the start of manufacture of a prototype at DR, and deterioration durability testing was conducted in parallel with engine development. Asked about the reason for commencing deterioration durability testing before the specifications for the mass-production product had been generally finalized, the Assistant General Manager at that time explained that "rush development was needed for the 2007 1DZ Engine, and under the development schedule, deterioration durability testing had to commence at this timing."

B. Improper conduct found in investigation, etc.

As stated in A(a) above, domestic certification for the 2007 1DZ Engine was obtained using the deterioration correction values that were calculated for application for the EU certification which was obtained prior to the domestic certification.

The investigation confirmed that improper conducts of rewriting the test data occurred as described below during deterioration durability testing for the EU certification application.

At each measurement time, emissions were measured by the engineer in charge in the Laboratory Section, pursuant to the request by the engineer in charge at the Engine Calibration Group. The engineer in charge at the Engine Calibration Group received the raw data obtained by measurement

[252] The EU certification for the 2007 1DZ Engine was obtained from the Vehicle Certification Agency (VCA), which is a vehicle-type approving agency governed by the U.K. Department for Transport. The Witness Test was conducted in the presence of the person in charge at a third-party certification organization certified by the VCA, who visited the Hekinan Plant and witnessed a test of measurement of emissions which was conducted with the facilities at the Hekinan Plant

that was handed over by the engineer in charge in the Laboratory Section and entered the data into an Excel file, which is the format for entering measurement results.

In the present case, the engineer in charge at the Engine Calibration Group, for each measurement time, correctly entered raw data obtained by measurement into Excel files to create emissions measurement logs (the Excel files in which raw data were correctly entered for each measurement time are hereinafter also referred to as "**Group A**"). However, thereafter, the engineer in charge at the Engine Calibration Group rewrote the values in the emissions measurement logs for the measurement times on two separate occasions.

Specifically, the engineer in charge at the Engine Calibration Group, by no later than the end of September 2006, had rewritten the values of, among those entered in Group A, dry bulb temperature, wet bulb temperature, and particulate matter volume etc., and created separate Excel files (the Excel files created by partially rewriting Group A are hereinafter also referred to as "**Group B**")[253]. Moreover, the engineer in charge at the Engine Calibration Group, by no later than the end of January 2007, had rewritten the values entered in Group B for shaft torque, atmospheric pressure, particulate emissions collection time, and particulate matter volume etc., and created separate Excel files (the Excel files created by partially rewriting Group B are hereinafter also referred to as "**Group C**").

These rewritten values are used to calculate NOx and other emission values. Accordingly, the rewriting of these values altered the NOx and other values for each measurement time.

Further, when calculating the emission values for elapsed time 8000 hours and the deterioration correction values, the engineer in charge at the Engine Calibration Group, among other manipulations, altered the measurement times (measurement dates) of the rewritten test data.

More precisely, the engineer in charge at the Engine Calibration Group decided not to use the test data[254] measured at elapsed time 1075 hours (measurement date April 26, 2006), and in order to fill the gap, used the (rewritten) test data measured at elapsed time 1250 hours as the data for 1075 hours and the (rewritten) test data measured in the first measurement at elapsed time 1425 hours[255] as the

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[253] The engineer in charge at the Engine Calibration Group prepared graphs indicating changes in emission values based on the Group B data and submitted them at DR held on September 26, 2006, as materials showing the results of deterioration durability testing. Accordingly, the Group B data are believed to have been created for the purpose of creating the material to be submitted at DR.

[254] It appears that when the measurement for 1075 hours concluded the engineer in charge at the Engine Calibration Group calculated tentative emission values for elapsed time 8000 hours based on the data whose measurement had concluded, saw that the tentative value for NOx exceeded the regulation value and development target value, and decided not to use the test data for 1075 hours which showed the high NOx value.

[255] From elapsed time 0 hours (measurement date December 7, 2005) to elapsed time 1250 hours (measurement date May 31, 2006), one measurement was carried out for each measurement time; but at elapsed time 1425 hours (measurement date June 14, 2006) and elapsed time 1680 hours (measurement date July 3, 2006), the measurements were carried out twice. It is believed that this is because, as stated in the preceding footnote, the engineer in charge at the Engine Calibration Group, at the time the measurement at 1075 hours concluded, decided not to use the test data for 1075 hours showing the high NOx value, and instead carried out measurements twice at elapsed time 1425 hours and 1680 hours to obtain test data to fill the gap.

data for 1250 hours, and then calculated the emission values for elapsed time 8000 hours and the deterioration correction values. The table below shows how measurements were made for the deterioration durability testing of the 2007 1DZ Engine, and how the rewritten test data were used.

	Measurement date	Elapsed time	Whether rewritten test data were used to calculate deterioration correction value, etc.
1	December 7, 2005	0	Yes
2	December 21, 2005	100	Yes
3	January 13, 2006	300	Yes
4	February 15, 2006	600	Yes
5	March 21, 2006	900	Yes
6	April 26, 2006	1075	No
7	May 31, 2006	1250	Yes (used as data for 1075 hours)
8	June 14, 2006	1425 (1st time)	Yes (used as data for 1250 hours)
9	June 14, 2006	1425 (2nd time)	Yes
10	July 3, 2006	1680 (1st time)	Yes
11	July 3, 2006	1680 (2nd time)	No

As a result of the above rewriting of test data, the deterioration correction values were altered, and the altered deterioration correction values were used for the application for EU certification[256].

The main reason the engineer in charge in the Engine Calibration Group rewrote the above test data was that among the emission values at elapsed time 8000 hours which were calculated by the engineer in charge based on Group A data by the extrapolation method, NOx did not meet the regulation value and the development target value, and the sum of NOx and HC did meet the regulation value but did not meet the development target value; therefore, the rewriting was intended to make it seem that these figures did meet the regulation values and development target values.

The engineer in charge who rewrote the test data states that “At that time, I was not aware that the test data were important data that would be the basis for the application for certification. Although in the development of the 2007 1DZ Engine it was an issue how to improve emission values after

256 The deterioration correction values used for the EU certification application were calculated based on the Group C data, but the Group C data itself was not submitted to the certification authority. This is likely because under EU laws and regulations, although deterioration correction values need to be specified at the time of certification application, information used as the basis for calculating deterioration correction values only needs to be submitted if requested by the certification authority (Annex III, Appendix 5, section 1.2.3 of 97/68/EC), and no such request for information submission was received from the certification authority.

deterioration, I thought that because measures therefor had been duly taken, it could not happen that the emission values would exceed the regulation values in the deterioration durability testing; and accordingly, I thought that what was wrong was, rather than the engine's emission performance itself, the measurement results; therefore, I rewrote the data without careful consideration."

The above engineer in charge states that he reported the rewriting of the test data at the Engine Calibration Group meetings, etc., that were also attended by the Group Leader.

On the other hand, the Group Leader states that he was unaware of the rewriting of the test data.

Having said that, both the Group B and Group C data in which test data were rewritten, and the Excel files in which the engineer in charge calculated the deterioration correction values based on the Group B and Group C data, etc., were stored in a shared folder of the Engineering Office or Engine Calibration Group that were accessible by all employees in the Engineering Dept. without passwords or other security measures, so any employee in the Engineering Dept. could access such data. Group A and Group B data for each measurement time were stored side by side in the same folder, and the Group B files were named after Group A files by adding "_乾湿球調整" (which means "dry-wet bulb adjustment") or the like at the ends of the Group A file names; these file names apparently could raise suspicion of rewriting of test data. Such objective state in which the test data was saved supports that the engineer in charge did not find it necessary to conceal the rewriting of the test data from his colleagues or superiors.

Given the above, it is natural to consider that the improper conducts above were reported from the engineer in charge to the Group Leader.

(2) 2007 4Y Engine

A. Overview and development background of the 2007 4Y Engine

(a) Overview of the 2007 4Y Engine

The 2007 4Y Engine is an inline four-cylinder engine with a total displacement of 2.2 liters using gasoline, LPG or CNG (compressed natural gas) as fuel.

The 2007 4Y Engine is installed in forklifts as well as shovel loaders.

The 2007 4Y Engine was certified in the United States and Japan. Because it was certified in the United States first, deterioration correction values were calculated based on the deterioration factors which were calculated through the deterioration durability testing and submitted to CARB and the EPA, and with such deterioration correction values, on January 9, 2007, the engine obtained domestic certification.

(b) Development system and work sharing between Engineering Office of Engine Division and

TMHC

As stated in 3(1)B, the development system for the 2007 4Y Engine, although some of the persons in charge were shuffled, was the same as that for the 2009 4Y Engine, and the Engine Calibration Group of the Engine Division was responsible for engine calibration, but the deterioration durability testing was the responsibility of the TMHC Engine Group[257]. Engine calibration-related work and the deterioration durability testing were performed on the bench set in the Takahama Plant where TMHC is based.

As a result of consultation with CARB, it was decided to use the C2 mode and the NRTC mode for the 2007 4Y Engine deterioration durability testing, and also to adopt the test method of acceleration durability.

Deterioration factors were decided in the end by the TMHC Global Product Planning Dept., the TMHC Engine Group and the TMHC Technical Administration Office through consultation.

(c) Background of the 2007 4Y Engine development

The development of 2007 4Y Engine largely followed the following chronology.

Date	Event
February 3, 2005	DR was held, at which it was approved to launch the production of prototypes[258].
November 23, 2005	DR was held, at which it was confirmed that the emission values of the prototypes were expected to achieve the development target value.
December 1, 2005	The deterioration durability testing began.
Late December 2005	The back-up deterioration durability testing began[259].
December 27, 2005	The follow-up meeting for DR was held.
May 11, 2006	DR was held, at which the production of the mass production prototypes was approved.

257 When emissions were measured during the deterioration durability testing, the persons in charge at the Laboratory Section primarily operated the engine and measured emission component values upon request from the department responsible.

258 At that time, the mass production launch date of the 2007 4Y Engine was scheduled in late July 2006, and an application for CARB and EPA certification was scheduled in late August 2007. According to the interviews, apparently, this schedule was drawn up so that the engine could be sold as soon as the U.S. certification is obtained because although the mass production of the engine was scheduled before the application for U.S. certification was made, the transportation of engines for the U.S. market takes a few months.

259 Catalysts which were deteriorated separately from the regular deterioration durability testing were eroded, and thus, this test began as a back-up for the regular deterioration durability testing.

Date	Event
May 15-22, 2006	The deterioration durability testing completed.
July 25, 2006	The deterioration durability testing results were reported to CARB.
August 22, 2006	DR was held, at which the launch of mass production was approved.
November 2, 2006	An application for domestic certification was made.
November 20-27, 2006	The Witness Test was conducted. In the test of the LPG engine for 3t vehicles, CO exceeded the regulation value, whereby another test was planned.
December 14, 2006	The Witness Test (another test of the LPG engine for 3t vehicles) was conducted. The engine achieved the regulation value, and passed the test[260].
December 6, 2006	U.S. certification (CARB) was obtained.
December 13, 2006	U.S. certification (EPA) was obtained.
January 9, 2007	Domestic certification was obtained.

As stated in 3(1)A above, one of the purposes of the development of 2007 4Y Engine was to comply with the Tier 2 Regulations applied to the gasoline or LPG engines from October 1, 2007. Engine calibration work for emissions performance is typically carried out with deteriorated catalysts[261], but because it was planned that the 2007 4Y Engine would use a new catalyst to comply with the regulations, when engine calibration work for emissions performance commenced, deteriorated catalysts which could be used for engine calibration work were not available. Therefore, the person in charge at the Engine Calibration Group decided to proceed with engine calibration work while causing catalysts to deteriorate.

Under normal circumstances, it is necessary to begin the deterioration durability testing after engine calibration work for emissions performance is completed, but the deterioration durability testing began before engine calibration work completed. Consequently, even after the deterioration durability testing began, engine calibration work continued in response to declines in emission values, and the parameters for the ECU Software for Mass Production were modified.

B. Details of improper conduct found in investigation, etc.

Regarding the deterioration durability testing, the 2007 4Y Engine received domestic certification

260 The measurement results during the Witness Test shows that some of the HC measurement values exceeded the specification, and on December 18, 2006, the Automobile Type Approval Test Department was informed that such exceeding values were within the range of measurement variability.

261 According to the interviews, deteriorated catalysts collected from the market were used.

using the deterioration correction values calculated based on the deterioration factors calculated for the application for U.S. certification. The investigation confirmed that the following improper conduct was taken in the application for U.S. certification which was the basis for the application for domestic certification.

In the application for U.S. certification, the values of the gasoline engine and the LPG engine measured in the C2 mode and the NRTC mode, respectively, were used. But because in the application for domestic certification, the deterioration factors of the emission values of the gasoline engine measured with the C2 mode were used, the improper conduct occurring when measurements of the gasoline engine were taken in the C2 mode is explained below.

(a) Data from the deterioration durability testing were rewritten.

The deterioration factors were calculated by rewriting the test data from the deterioration durability testing after operating the engine for 0 hours (being hours of actual operating; hereinafter the same in this B), 1500 hours, and 1750 hours.

Regarding the source of the replaced values, the measurement values after 0 hours indicated in the certification application document are consistent with those measured with another new catalyst after the deterioration durability testing.

Also, the measurement values after 1500 hours indicated in the certification application document are consistent with those of the back-up catalyst after 1500 hours.

Further, the certification application document shows that after 1500 hours, the same result was measured twice, and after 1750 hours, in the certification application document, the same result was measured twice. But according to internal documents, after 1500 hours, the result indicated in the certification application document was measured only once. Similarly, after 1750 hours, the result indicated in the certification application document was measured only once. Thus, the statement that the same results were obtained twice after 1500 hours and 1750 hours, respectively, is contrary to fact.

Because the persons responsible for preparation of the application document have retired, and other related parties state that they have no clear recollection of the details back then, detailed background thereof could not be found. But in view of the objective materials above, it is understood that values different from the values actually measured during the deterioration durability testing were used as emission values after 0 hours and 1500 hours, and in terms of the emission values after 1500 hours and 1750 hours, descriptions contrary to fact were made in the certification application document.

(b) ECU Software Control Parameter values were modified during the deterioration durability testing.

The persons in charge at the Engine Calibration Group modified the ECU Software Control

Parameter values and measured the emission values after 1500 hours and 1750 hours.

That was a change of the Control Parameter values which would decrease NOx; however, when the deterioration durability testing began, engine calibration work for emissions performance had not been completed, and thus, the person in charge continued engine calibration work for the engine in response to declines in the emission values during the deterioration durability testing. For that reason, during the deterioration durability testing, the ECU Software Control Parameter values were modified.

The persons in charge at the Engine Calibration Group state that they were not aware of the details of the laws and regulations relating to the deterioration durability testing, and did not know that such conduct would violate laws and regulations. In addition, the persons in charge at the Engine Calibration Group state that they had received information on U.S. laws and regulations collected and shared by TMHC Technical Administration Office, but could not fully understand the details of the restrictions under the U.S. laws and regulations relating to the deterioration durability testing even with such information. For example, the persons in charge at the Engine Calibration Group state that (i) the documents they received when they were actually carrying out the deterioration durability testing were documents relating to the amendments in the revised U.S. laws and regulations and their Japanese translation, no information relating to the entire picture of laws and regulations was provided and, other than provision of materials relating to laws and regulations, no particular follow-up support was provided, and therefore, they needed to interpret the laws and regulations on their own; (ii) subsequently, information explaining the entire picture of laws and regulations was disseminated, but it was a massive volume of English documents, and they couldn't spare time to peruse such a massive volume of English documents due to the workload at that time; and (iii) any questions about the laws and regulations had to be confirmed with the U.S. authorities through TMHC Technical Administration Office and the U.S. subsidiary of Toyota Industries, and it took time to receive answers.

(c) Engine was replaced during the deterioration durability testing.

For measurement of the emission values after 750 hours and up, the persons in charge at the Engine Calibration Group used an engine different from the engine used to take measurements up to 500 hours.

This fact can be obviously found because the numbers assigned to individual engines stated in the test plan request form for measurements after 500 hours and those stated in the test plan request for measurements after 750 hours differ.

The persons in charge at the Engine Calibration Group state that they did not know the details of the laws and regulations relating to the deterioration durability testing, and therefore, were not aware that such conduct would violate laws and regulations.

(d) Only the catalyst was replaced to measure emission values with a different engine.

When an engine operating on the Durability Test Bench reached a certain number of running hours when emission values were to be measured, the persons in charge at the Engine Calibration Group removed only the catalyst, attached it to a different engine body which was set on the Measurement Bench and was used for engine calibration work, and measured the emission values.

The person in charge of management of Measurement Benches and calculation of deterioration correction values at the Engine Calibration Group states that he thought that the catalyst accounted for most of the factors of deterioration of the engine which affect emission values and parts other than the catalyst had only a limited impact on emission values even if they deteriorated, and also thought that the measurement of the emission values after allowing the catalyst to deteriorate would suffice as the deterioration evaluation of the emission values.

(e) Initial values were rewritten.

In (a) through (d) above, we explained, among improper conduct carried out at the time of application for U.S. certification, acts that affected domestic certification, but further improper conduct was carried out in the process of application for domestic certification.

Namely, in the application for domestic certification for the 2007 4Y Engine, where actual measured values should have been indicated as emission initial values in the Durability Documents of the EBT-4Y-GCA-E1 Engine (4Y Engine with an output capacity of 3t, which can use either gasoline or CNG) submitted to the Automobile Type Approval Test Department, the values were rewritten to estimated values[262].

An internal document prepared for domestic certification states that the values indicated as the default emission values of the EBT-4Y-GCA-E1 Engine in the Durability Documents are values estimated from the ratio of measurement values of two types of catalyst.

The Approval Implementation Guidelines Supplementary Rule 7-8 1.(7)E requires indication of "emission values actually measured (measurements must be taken after running 100 hours or longer)" as initial values in the Durability Documents if the deterioration correction values are calculated based on the deterioration factors calculated when U.S. certification was obtained[263]. Because the persons who were in charge of preparation of the application document have retired, and other related parties

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[262] It was also found that the source of the initial values indicated in the Durability Documents for the EBT-4Y-GSB-C7 engine, which is another model, is unknown; however, no evidence was discovered showing that the values not being actually measured values were used for the default values indicated in the Durability Documents for the EBT-4Y-GSB-C7 engine.

[263] This falls under the case where deterioration correction values are calculated pursuant to the Approval Implementation Guidelines Supplementary Rule 7-8 1.(7)D(b).

state that they have no clear recollection of the details back then, the background behind the fact that the estimated values were used as initial values could not be identified. However, under normal circumstances, actual measured values should be indicated as initial values of an engine; accordingly, using estimated values was an act in violation of laws and regulations.

(f) Other improper conduct

The number of emission measurements was not the same in each measurement time in the deterioration durability testing.

The table below summarizes the number of measurements for gasoline engines in the C2 mode, which were the subject of a domestic certification application, among the deterioration durability testing data for the 2007 4Y Engine. Some emission values were measured using O2 sensors with different characteristics, and the number of such measurements is not included and is shown in parentheses, but none of them were used in the U.S. certification application[264].

Time elapsed	Number of measurements
0 hours	3(0)
250 hours	2(1[265])
500 hours	3(0)
750 hours	3(0)
1000 hours	2(0)
1250 hours	2(0)
1500 hours	0(4)
1750 hours	2(4)
2000 hours	2(0)
2500 hours	2(2)

As shown in the above table, the number of measurements at each measurement point was not uniform. The test plan request form for deterioration durability testing states that "If the data is low and stable at N=2, the third measurement will be omitted (to be determined based on the data)," and presumably in cases where three or more measurements were taken, the results of the two measurements were not stable, which led to the third and subsequent measurements.

In addition, while the emission values were measured multiple times as discussed above, only two measurements thereof were used in the certification application at each measurement point.

U.S. laws and regulations require that all test results be reported to the U.S. authorities (even data

264 In an interview, the person in charge states that he conducted the measurements using an O2 sensor with different characteristics to confirm the cause of deterioration in emission values and to confirm whether the emission values achieved their targets even considering the variability in the O2 sensor characteristics.

265 A different new O2 sensor, although its characteristics were the same, was used for measurement.

that is treated as invalid is required to be reported). However, the persons involved in the deterioration durability testing state that they were not aware at the time that such conduct would violate U.S. laws and regulations.

Further, with respect to the 2007 4Y Engine, the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test had governor characteristic Control Parameter values for the control system that were modified from those of the ECU Software for Mass Production. The materials showing the content of the ECU Software for Deterioration Durability Test and ECU Software for Witness Test for the 2007 4Y Engine no longer exist. However, the person involved in development at the time states that since the control system expected on the Measurement Bench and the control system for ECU Software for Mass Production were different, they thought that when the ECU Software for Mass Production was used to perform emissions testing on the Measurement Bench, the rotation of the engine became unstable; and that they prepared ECU Software for Deterioration Durability Test and ECU Software for Witness Test by changing the governor characteristic Control Parameter values to be consistent with the control system expected on the Measurement Bench.

C. Status of reporting to Manager

(a) Engine Calibration Group

The status of reporting etc. to a Manager of the Engine Calibration Group was fundamentally the same as the practices taken for the 2009 4Y Engine explained in 3(3)A above, and the persons in charge at the Engine Calibration Group routinely provided reports to the Working Group Leader and the Group Manager verbally and also in writing by preparing weekly reports. Weekly reports were circulated not only to the Working Group Leader and the Group Manager, but also to the Assistant General Manager of the Engine Calibration Group, and the fact, described in B(b) above, that the Control Parameter values of the ECU Software were modified during the deterioration durability testing was reported in weekly reports. Further, the Group Manager had approved the test plan request form.

Nevertheless, the Assistant General Manager and the Group Manager state that they were not aware of the fact that any violation of laws or regulations was taking place.

The Assistant General Manager and the Group Manager of the Engine Calibration Group state that they had never engaged in deterioration durability testing operations, and understood that the TMHC Engine Group was responsible for the deterioration durability testing and the calculation of deterioration factors; and they were not aware of the necessity to recognize or understand the laws and regulations relating to the deterioration durability testing and calculation of deterioration factors in U.S. and domestic certifications and to manage the duties of persons in charge.

(b) TMHC Engine Group

The TMHC Engine Group's involvement in the deterioration durability testing was fundamentally the same as the involvement in case of the 2009 4Y Engine explained in 3(3)B above. The 2007 4Y Engine catalyst is a component, of which the TMHC Engine Group was in charge of procurement, and the department in charge of deterioration durability testing was the TMHC Engine Group, so the TMHC Engine Group periodically checked the deterioration durability testing measurement values and received reports on the status of deterioration durability testing from the Engine Calibration Group.

In addition, the Group Manager, the Working Group Leader, and the person in charge of the TMHC Engine Group were aware, through Durability Test Bench management operations and reports from the Engine Calibration Group, that during deterioration durability testing the catalyst was replaced when measuring the emission values.

However, people involved at the TMHC Engine Group state that they were not aware of any violation of laws or regulations taking place.

The people involved at the TMHC Engine Group state that they understood that the department in charge of collecting and disseminating information on regulations was the TMHC Technical Administration Office, and the persons in charge at the Engine Calibration Group managed Measurement Benches and calculated the deterioration factors, so they were not aware of the necessity to recognize or understand, except for what was needed for management of Durability Test Benches, the laws and regulations relating to the deterioration durability testing and the calculation of deterioration factors in U.S. and domestic certifications.

(3) 1FZ Engine

A. Overview and development background of the 1FZ Engine

(a) Overview of the 1FZ Engine

The 1FZ Engine is an in-line six-cylinder gasoline or LPG engine with a total displacement of 4.5 liters for forklifts. The 1FZ Engine obtained domestic certification on August 10, 2007.

In conjunction with the Tier 2 Regulations coming into effect, the earlier 1FZ Engine, which was used on forklifts with maximum load capacity in the 3.5-ton to 5.0-ton class, was made compliant with the Tier 2 Regulations, and engine development was conducted for use on forklifts with maximum load capacity in the 5.0-ton to 7.0-ton class, on which the 3F Engine had been used in the past.

As stated in 4(1)A above, the 1FZ Engine was developed on the basis of the 1FZ Engine for automobiles, and in conjunction with the termination of production of the 1FZ Engine for automobiles in July 2009, manufacturing costs increased. In response to this, as a result of discussions with TMHC, the Engineering Dept. of the Engine Division decided to develop the 1FS Engine discussed above as a low-cost engine replacing the 1FZ Engine.

(b) Development system and division of work between the Engine Division and Toyota Material Handling Company

As was the case with the 4Y Engine in 2007, for the 1FZ Engine, the Engineering Office of the Engineering Dept., the Engine Division was the primary organization responsible for development of the engine body, and the Machinery Group No. 1 of Engineering Office No. 1 of the Engineering Dept. of TMHC ("**TMHC Machinery G1**") was primarily responsible for development of the ECU Software (the Engineering Office of the Engineering Dept., the Engine Division was responsible for development of those portions of the ECU Software relating to calibration). Also, the TMHC Technical Administration Office was responsible for operations relating to certification applications.

For the deterioration durability testing, the engine was operated for the specified time on a bench set in the Takahama Plant and emissions were measured at the specified times, and the engineers in charge in the TMHC Machinery G1 were responsible for both operating the engine and measuring emissions.

Engineers in charge in the TMHC Machinery G1 calculated the deterioration correction values. When calculating the deterioration correction values, the engineers in charge in the TMHC Machinery G1 consulted with the engineers in charge in the Engineering Office of the Engine Division, and the TMHC Machinery G1 Group Manager approved the calculated deterioration correction values.

(c) Background of the 1FZ Engine development

The development of the 1FZ Engine is summarized in the following chronology.

Date	Event
May 31, 2006	The Business Planning Dept. of the Engine Division issued written instructions to begin considering development of the 1FZ Engine, and the Engineering Dept. of the Engine Division began considering development of engine.
Around June 2006 to around July 2006	DR was originally planned to be held around June 2006, but consideration of development costs and so on was delayed, so DR was postponed.
October 2, 2006	The deterioration durability testing began.

Date	Event
November 7, 2006	DR was held, but approval to move on to the next step was not given, and a decision to hold DR again was made.
November 27, 2006	DR was again held, at which it was approved to launch the production of prototypes.
Around February 21, 2007	The deterioration durability testing concluded.
March 22, 2007	DR was held, at which it was reported that the deterioration durability testing results achieved the development target values.
June 20, 2007	Application was filed for domestic certification.
July 5, 2007	DR was held, at which it was reported that development of the engine body had been completed as planned.
July 17, 2007	Witness Test was conducted.
August 10, 2007	Domestic certification was obtained.
October 19, 2007	DR was held, at which the launch of mass production was approved.

In the development of the 1FZ Engine, deterioration durability testing commenced around October 2006 before DR was held, but at that time, a prototype 1FZ Engine had not even been produced. The 1FZ Engine development schedule had originally called for deterioration durability testing to be conducted before the production of a prototype 1FZ Engine.

B. Details of improper conduct found in investigation, etc.

(a) Deterioration durability testing was conducted using the 1FZ Engine for automobiles.

a. Overview of the improper conduct

As a result of the investigation, it was discovered that the 1FZ Engine deterioration durability testing was conducted not on the 1FZ Engine for forklifts, development of which was underway, but using the hardware and ECU Software for the 1FZ Engine for automobiles.

The hardware of the 1FZ Engine for automobiles used for the deterioration durability testing differed from the 1FZ Engine for forklifts in terms of the piston compression ratio, ignition plug specifications, and cam shaft specifications.

In addition, to mount the 1FZ Engine for automobiles on the Durability Test Bench, a preliminary prototype intake and exhaust system for the 1FZ Engine for forklifts that was still in development was used.

The Approval Implementation Guidelines Supplementary Rule 7-7, 2. provides, "The test vehicle or test engine shall have the same structure, equipment, and performance as the vehicle engine and emission reduction equipment to which the vehicle type designation application, device type designation application, or type certification application pertains."

For the 1FZ Engine, although the intake and exhaust system used was a system for the 1FZ Engine for forklifts, this was a preliminary prototype, and the deterioration durability testing was conducted using the hardware and ECU Software for the 1FZ Engine for automobiles. Therefore, the deterioration durability testing was conducted using an engine that differed from the engine for automobiles for which the device type designation application was submitted, which was conduct that was clearly in violation of the Approval Implementation Guidelines Supplementary Rule 7-7, 2.

The Group Manager of the TMHC Machinery G1 and lower-level employees and the Assistant General Manager of the Engineering Office of the Engine Division and lower-level employees were aware that the deterioration durability testing was conducted using the 1FZ Engine for automobiles.

b. Background to the improper conduct

(a) Reason for using the 1FZ Engine for automobiles to conduct the deterioration durability testing

It is believed that the reason why deterioration durability testing of the 1FZ Engine was conducted using the hardware and ECU Software of the 1FZ Engine for automobiles was because if the deterioration durability testing had been conducted after the 1FZ Engine specifications were finalized, it would not have been possible to meet the development schedule.

With regard to this point, the Group Manager of the TMHC Machinery G1 and lower-level employees and the Assistant General Manager of the Engineering Office of the Engine Division and lower-level employees believed, with regard to implementation of the deterioration durability testing using the hardware and ECU Software of the 1FZ Engine for automobiles, that the temperature of catalyst of the 1FZ Engine for automobiles would be higher than that of the 1FZ Engine for forklifts, and as a result, the test would be conducted under conditions where technical deterioration of the catalyst would progress, that is, under disadvantageous test conditions, and therefore, that it would not be a problem.

(b) Method of determining the 1FZ Engine development schedule

Toyota Industries launched a new project called the X460 Project and started development of new forklifts around July 2006 with the aim of achieving compliance by the forklifts it had manufactured until then in the 3.5-ton to 8.0-ton class with the emission standards that were to come into effect in Europe and the U.S. in January 2008 and the Tier 2 Regulations in Japan that were to come into effect in October 2008. The 1FZ Engine was developed as a part of this X460 Project.

The new forklift development project was a project for development not just of engines, but of entire forklifts including the engines. The engine development schedule was set based on the development schedule for forklifts as a whole.

At that time, the engineers in charge of the TMHC Global Product Planning Dept. was responsible for the development of forklifts as a whole under the supervision of the chief engineer affiliated with the Global Product Planning Dept. The Global Product Planning Dept. formulated product plans, development schedules, and so on for entire forklifts and confirmed the details of those plans and schedules with other departments involved in development. Within this process, TMHC Machinery G1 also confirmed the development schedule and confirmed that there were no problems with the development schedule for entire forklifts based on the results of an examination of the development schedule for the 1FZ Engine discussed below. In addition, the development schedule for entire forklifts was ultimately approved during a TMHC DR (DR for development of entire forklifts).

The 1FZ Engine development schedule was set following discussions and investigations by the engineers in charge in the TMHC Machinery G1 and engineers in charge from the Engineering Office of the Engine Division based on the development schedule for entire forklifts. The 1FZ Engine development schedule received final approval at an Engine Division DR (DR for development of engines).

(c) Details of the 1FZ Engine Development Schedule

Under the X460 Project, development of forklift body was also necessary, and consequently, the development schedule for each engine to be newly developed under the X460 Project needed to be coordinated with the development schedules for forklift body. Because of this, consideration of the 1FZ Engine development schedule proceeded based on the development schedule for forklift body, and the start of mass production was set for October 2007 so that forklifts equipped with engines for use in Europe and the United States could start by January 2008.

In addition, under the 1FZ Engine development schedule, deterioration durability testing was planned to be conducted from around September 2006 to around February 2007, premised on the start of mass production in October 2007. In fact, as stated above in A(c), the 1FZ Engine deterioration durability testing was conducted from October 2, 2006 to around February 21, 2007, and thus, the deterioration durability testing was generally conducted in accordance with the above schedule.

That said, the 1FZ Engine development schedule provided that 1FZ Engine prototype design was to be performed in October 2006, after the start of deterioration durability testing. Thus, the schedule provided that deterioration durability testing would start at a stage when an engine prototype had not yet been prepared.

In this way, it is thought that the 1FZ Engine development schedule was prepared “in reverse” with the assumption that mass production would start in October 2007, and from the start, it was not possible to conduct deterioration durability testing using the engine for forklifts.

The 1FZ Engine is an engine intended for domestic use, and considering that the Tier 2 Regulations were scheduled to come into effect in October 2008, from the perspective of regulatory compliance, it was not necessarily essential that mass production start in October 2007, and the timing of mass production could have been postponed.

However, both the TMHC Machinery G1 and the Engineering Office of the Engine Division participated in the formulation of the 1FZ Engine development schedule, and none of the engineers in charge or the managers had any awareness of a problem regarding the fact that the development schedule did not allow for deterioration durability testing using the engine for forklifts.

(b) Other improper conduct

In addition to the instances of improper conduct described above in (a), when 1250 hours had elapsed during the deterioration durability testing, the O2 sensor was replaced by another one and the engine was operated. The engineers in charge in the TMHC Machinery G1 did not initially perceive this conduct as problematic and did not report to the Group Manager. The Approval Implementation Guidelines Supplementary Rule 7-7, 4.2 provides that, in principle, deterioration durability testing is expected to be conducted using the same engine and the same parts. Consequently, it is believed that replacing the O2 sensor by another one was conduct in violation of Approval Implementation Guidelines Supplementary Rule 7-7, 4.2.

In addition, there are currently no materials indicating the details of the ECU Software for Witness Test of the 1FZ Engine, but engineers involved in development at the time stated that the control system expected on the Measurement Bench differed from the control system for ECU Software for Mass Production, and consequently, it was thought that, when emissions testing was conducted at a Measurement Bench using the ECU Software for Mass Production, operating the engine would become unstable, so the governor characteristic Control Parameter values were modified to match the control system expected on the Measurement Bench, and ECU Software for Witness Test was prepared.

(4) 2016 1KD Engine for Construction Machinery

A. Overview and development background of the 2016 1KD Engine for Construction Machinery

(a) Overview of the 2016 1KD Engine for Construction Machinery

Like the 2020 1KD Engine for Construction Machinery, the 2016 1KD Engine for Construction Machinery is an in-line four-cylinder diesel engine with a total displacement of 3.0 liters developed for excavators manufactured by an external construction machinery manufacturer.[266]

The 2016 1KD Engine for Construction Machinery includes a hybrid engine model comprising a diesel engine with an assist motor and a standard diesel engine model without an assist motor (for both models, the diesel engine itself is the same; in cases where the former engine is specified, it is referred to as the "**2016 1KD-1 Engine for Construction Machinery**," and in cases where the latter engine is specified, it is referred to as the "**2016 1KD-2 Engine for Construction Machinery**."[267]).

The 2016 1KD Engine for Construction Machinery is an engine intended to be installed on an excavator with hybrid specifications manufactured by the external construction machinery manufacturer referenced above, and is a model compliant with the Tier 4 Regulations. An excavator with hybrid specifications is an excavator equipped with an engine as well as an energy regeneration system[268] as a power source on the Lift Truck side.

The background to the development of the 2016 1KD Engine for Construction Machinery is as follows. Around 2011, Toyota Industries was developing technology for a new combustion method that optimizes the fuel injection timing in order to comply with the Tier 4 Regulations, and by

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266 The same external construction machinery manufacturer referenced in the discussion of the 2020 1KD Engine for Construction Machinery.

267 As discussed below, the 2016 1KD-1 Engine for Construction Machinery is for 20-ton class excavators with hybrid specifications, and the 2016 1KD-2 Engine for Construction Machinery is for 12-ton class excavators with hybrid specifications. The 2016 1KD-1 Engine for Construction Machinery has rated output of 74 kW by the diesel engine alone, which is not sufficient output to operate a 20-ton class excavator, thus to make up for the shortfall, an integrated engine-motor unit comprising the diesel engine and an assist motor (with rated output of 44 kW) was adopted. In contrast, the 74 kW rated output is sufficient to operate a 12-ton class excavator, and accordingly the 2016 1KD-2 Engine for Construction Machinery is not equipped with an assist motor.

268 Excavators with hybrid specifications that are equipped with the 2016 1KD-1 Engine for Construction Machinery adopt an electric power regeneration energy recovery system that uses energy during slewing deceleration to store electricity and uses the electricity during slewing acceleration to support acceleration. In contrast to this, excavators equipped with the 2016 1KD-2 Engine for Construction Machinery adopt a hydraulic energy regeneration system that stores energy in the form of hydraulic pressure during slewing deceleration and releases the stored hydraulic pressure during slewing acceleration to support acceleration. Each of these systems, by recovering energy generated during slewing deceleration, was designed to save energy and achieve improved fuel efficiency.

establishing that technology Toyota Industries sought to develop high-output diesel engines[269] that were not equipped[270] with urea SCR.[271] The construction machinery manufacturer referenced above was aware that Toyota Industries was proceeding with development of high-output diesel engines not equipped with urea SCR and in May 2012 made a request to Toyota Industries to develop a diesel engine not equipped with urea SCR for use on 20-ton class excavators with hybrid specifications that would be compliant with the Tier 4 Regulations, and Toyota Industries decided to commence preliminary development of the 1KD Engine for Construction Machinery.[272] In addition, in October 2014, Toyota Industries received a request from the construction machinery manufacturer referenced above to develop an engine for use on a 12-ton class excavator,[273] and a decision was made to develop the 2016 1KD-1 Engine for Construction Machinery and the 2016 1KD-2 Engine for Construction Machinery in parallel (as stated above, the 2016 1KD-1 Engine for Construction Machinery and 2016

269 Under the Tier 4 Regulations, the NOx regulation value for diesel engines with rated output of 56 kW or more was modified from 3.3 to 0.4, substantially tightening the regulation. As a result, it is difficult for diesel engines to satisfy the NOx regulation value without being equipped with urea SCR, and in actuality, diesel engines with rated output of 56 kW or more previously developed by manufacturers other than Toyota Industry as models compliant with the Tier 4 Regulations were all equipped with urea SCR. Accordingly, as a diesel engine with rated output of 56 kW or more, the 1KD-1 Engine for Construction Machinery was the world's first model that achieved compliance with the Tier 4 Regulations without the use of urea SCR.

270 Urea SCR can reduce NOx without a deterioration of fuel efficiency, but there are various disadvantages such as the need to install the urea SCR and a urea tank on the engine, which increases the size of the engine itself and involves more design work for installation of the urea SCR; the fact that the engine will stop operating if the urea solution, which is the catalyst, is depleted, necessitating installation of a storage facility for urea solution at the construction site, and it takes time and effort to refill the tank with urea solution; and expenses for the urea solution are incurred as running costs. Consequently, an engine not equipped with urea SCR can reduce engine costs and is advantageous to users in terms of running costs and convenience, making them attractive products for construction machinery manufacturers.

271 As discussed above, SCR stands for Selective Catalytic Reduction and refers to a system for rendering regulated substances harmless by adding a reducing agent to the emissions. SCR that uses urea aqueous solution as a catalyst to reduce NOx is referred to as urea SCR.

272 More specifically, the construction machinery manufacturer referenced above approached Toyota Industries about development of (i) a diesel engine not equipped with urea SCR, (ii) an assist motor integrated with that engine, and (iii) a hybrid system comprising an inverter for that assist motor. Development of such a hybrid system was conducted during the preliminary development of the 2016 1KD-1 Engine for Construction Machinery.

273 Following the request for development of the 2016 1KD-1 Engine for Construction Machinery, the request for development of the 2016 1KD-2 Engine for Construction Machinery from the construction machinery manufacturer referenced above was the result of a request by Toyota Industries to the construction machinery manufacturer to adopt the 2016 1KD-1 Engine for Construction Machinery for use on its 11-ton to 13-ton class excavators as well, since it was expected during the process of preliminary development of the 2016 1KD Engine for Construction Machinery that the planned production volume of 20-ton class excavators with hybrid specifications equipped with the 2016 1KD-1 Engine for Construction Machinery would be substantially less than initially anticipated. The 2016 1KD-2 Engine for Construction Machinery was initially expected to be used on 12-ton class excavators with standard specifications, but subsequently, in January 2015, the construction machinery manufacturer referenced above modified its request to development of an engine for use on 12-ton class excavators with hybrid specifications, not standard specifications.

1KD-2 Engine for Construction Machinery used the same diesel engine, and consequently, when the development started, DRs for both were held at the same time, but subsequently, development of the 2016 1KD-1 Engine for Construction Machinery moved ahead, and after development of the 2016 1KD-1 Engine for Construction Machinery was completed, DR for the 2016 1KD-2 Engine for Construction Machinery was to be held).

The 2016 1KD Engine for Construction Machinery received domestic certification on November 1, 2016[274] and certification in Europe in December 2016.

(b) Development system

The department in charge of development of the 2016 1KD Engine for Construction Machinery was the Engineering Office of the Engineering Dept., the Engine Division. The Engine Calibration Group was responsible for the deterioration durability testing and calculating the deterioration correction values based on its results.

(c) Background of the 2016 1KD Engine for Construction Machinery development

The development of the 1KD Engine is summarized in the following chronology.

Date	Event
May 2012	A request was received from an external construction machinery manufacturer to develop the 2016 1KD-1 Engine for Construction Machinery as an engine to be used on the next-generation model of 20-ton class excavators with hybrid specifications.

274 The 2016 1KD-1 Engine for Construction Machinery comprises a diesel engine equipped with an assist motor, but as a result of consultations with the Ministry of Land, Infrastructure, Transport and Tourism and the Automobile Type Approval Test Department, it was determined that for domestic certification, only the diesel engine portion not including the assist motor is subject to device type designation. As a result, the 2016 1KD-1 Engine for Construction Machinery and the 2016 1KD-2 Engine for Construction Machinery were treated as the same device type (device type name: YDP-1KD-4-02) and a single domestic certification was obtained pursuant to a single certification application. The member engine table submitted at the time of application for domestic certification stated that the 2016 1KD-1 Engine for Construction Machinery has “hybrid specifications” and that the 2016 1KD-2 Engine for Construction Machinery has “engine specifications.”

Date	Event
November 15, 2012	DR minus[275] was held for the 2016 1KD-1 Engine for Construction Machinery, at which a decision to proceed to preliminary development was made.
July 18, 2013	DR minus was held for the 2016 1KD-1 Engine for Construction Machinery at which a report on the progress of preliminary development was made.
July 25, 2014	DR minus was held for the 2016 1KD-1 Engine for Construction Machinery at which the completion of preliminary development was approved.
October 7, 2014	The external construction machinery manufacturer referenced above made a request for development of the 2016 1KD-2 Engine for Construction Machinery as an engine for use on 12-ton class excavators.
October 14, 2014	DRs were held for the 2016 1KD-1 Engine for Construction Machinery and 2016 1KD-2 Engine for Construction Machinery, at which it was approved to launch the production of a prototype.
August 20, 2015	DR was held for the 2016 1KD-1 Engine for Construction Machinery, at which it was reported that the emission values achieved the development targets. In response to such report, it was approved to proceed with production preparations for mass production.
November 18, 2015	The deterioration durability testing began.[276]
January 20, 2016	The air-fuel ratio sensor was replaced during deterioration durability testing.
February 19, 2016	The turbo failed during deterioration durability testing and was replaced.
March 23, 2016	DR was held for the 2016 1KD-1 Engine for Construction Machinery, at which finalization of the details of the mass production engine drawings was approved.
April 15, 2016	DR was held for the 2016 1KD-1 Engine for Construction Machinery, at which the schedule of production preparations for mass production was approved.
June 9, 2016	The DR follow-up meeting for the 2016 1KD-1 Engine for Construction Machinery was held.

275 As explained in Part 3-1(1) above, the engine development process is managed through DR in accordance with the Design Review Rules, and in the case where preliminary development of the relevant engine was performed, the preliminary development process was managed through "DR minus" in accordance with the "Preliminary Development Design Review Rules."

276 As stated above, the 2016 1KD Engine for Construction Machinery does not include an assist motor, and only the diesel engine portion is subject to device type designation in domestic certification. Thus, the deterioration durability testing was conducted using only the diesel engine portion (therefore, deterioration durability testing was not conducted respectively for the 2016 1KD-1 Engine for Construction Machinery or the 2016 1KD-2 Engine for Construction Machinery).

Date	Event
July 1, 2016	The deterioration durability testing concluded.
October 19, 2016	Witness Test for domestic certification was conducted.
November 1, 2016	Domestic certification was obtained.
November 15, 2016	DR was held for the 2016 1KD-1 Engine for Construction Machinery, at which a mass production trial on the production line was approved.
December 7-8, 2016	Witness Test for EU certification was conducted.
December 30, 2016	EU certification was obtained.
March 7, 2017	DR was held for the 2016 1KD-1 Engine for Construction Machinery, at which the launch of mass production was approved.
July 14, 2017	DR was held for the 2016 1KD-2 Engine for Construction Machinery, at which the transition to production preparations for mass production was approved.
January 17, 2018	DR was held for the 2016 1KD-2 Engine for Construction Machinery at which a mass production trial on the production line was approved.
August 2, 2018	DR was held for the 2016 1KD-2 Engine for Construction Machinery, at which the launch of mass production was approved.

B. Details of improper conduct found in the investigation, etc.

(a) A portion of the test data was rewritten.

A portion of the test data in the deterioration durability testing was rewritten, and those data were used for the certification application. Specifically, the engineer in charge of the Engine Calibration Group rewrote the PM values included in the emissions at the time when 1500 hours of deterioration durability testing had elapsed.

A weekly report prepared at that time contains the following statement: "for the PM at 1500 hours, without changing the average value, the values before and after maintenance approach the average value." This weekly report was circulated to the Group Manager of the Engine Calibration Group and it was stored in a shared folder that was accessible by all personnel of the Engineering Office, but in actuality, it was seen only by the engineer in charge and the Group Manager, and it was not directly confirmed by the Assistant General Manager or General Manager. The engineer in charge of the Engine Calibration Group who rewrote the data believed that if the original test results were used, the variation in the PM values would be great, which could make it appear that there was a problem with performance, so he modified the values such that each data point was closer to the average without changing the average PM values measured twice when 1500 hours had elapsed.

Although the test data were rewritten in this manner, the average value of the two test data points did not change, and as a result, there was no impact on the deterioration correction values, but the act of rewriting the test data itself is believed to be a violation of domestic laws and regulations.

The Group Manager who received reports in the form of a weekly report from the engineer in charge was aware that a portion of the test data had been rewritten in this way. When reporting the results of the deterioration durability testing at the Engineering Dept. Meeting[277], the Group Manager instructed the engineer in charge to restore the rewritten data to the original values and caused the engineer in charge to prepare Engineering Dept. Meeting materials based on the original data. However, the engineer in charge did not correct the Excel file summarizing the results of the deterioration durability testing,[278] and later, the Excel file was handed over to a successor when he was transferred. As a result, the successor engineer in charge applied for certification using the rewritten data.

(b) Partially invalid test data was used in the certification application.

Of the test data used in the certification application, the test data at zero hours indicate that the torque error and gas flow speed on the surface of the PM collection filter exceeded the error ranges specified by laws and regulations,[279] resulting in fundamentally invalid test results. In addition, the test data at the time when 500 hours had elapsed also exceeded the error range specified by laws and regulations for gas flow speed on the surface of the collection filter.

The engineer in charge responsible for the deterioration durability testing at these test times did not notice that the test data were invalid and used this test data for the certification application. The use of test data that should be designated as invalid for a certification application is believed to be a violation of domestic laws and regulations.

As stated above, the engineer in charge did not notice that the test data were invalid and was unaware that the use of these data in a certification application was improper conduct, and consequently, the engineer in charge did not consult with or report to an Assistant General Manager, Group Manager, or

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277 The Engineering Dept. Meeting is attended by General Manager of the Engineering Dept. and Assistant General Managers of each Office.

278 The engineer in charge does not have a clear memory of why he did not correct the Excel sheet, but he explained that it is possible that he simply forgot to make the correction or that correction was not necessary since the average values did not change.

279 Clause 7.8.1.3 of Attachment 43 to the Public Notice on Details titled "Measurement Method for Diesel Special Motor Vehicle Emissions" provides, "The measured torque may not deviate from the standard torque by more than ± 2% of the maximum torque at the test rotation speed." Clause 9.3.3.4.4 of the attachment provides regarding PM sampling, "The gas flow speed on the surface of the collection filter shall be from 0.90 to 1.00 m/s and 5% of the recorded flow volume values shall not exceed this range," but the results deviated from this requirement.

Working Group Leader concerning the use of these data in the certification application.

(c) ECU Software Control Parameter values were modified.

a. Governor characteristic Control Parameter values were modified.

As was the case with the 2020 1KD Engine for Construction Machinery, the engineer in charge modified the governor characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test of the 2016 1KD Engine for Construction Machinery to values that were different from those of the ECU Software for Mass Production. The engineer in charge modified the governor characteristic Control Parameter values so that the degree of change in the fuel injection amount relative to the amount of change in engine speed was gradual in order to stabilize the engine rotation speed and fuel injection amount while operating on the Measurement Bench.

In addition, as stated above, even though the governor characteristic Control Parameter values were modified to stabilize the fuel injection amount, for some test modes (6-mode and 7-mode) set forth in the 8-Mode Method, the fuel injection amount was not stabilized.[280] In response, the engineer in charge embedded a special-program in the ECU Software for Deterioration Durability Test and ECU Software for Witness Test, causing the fuel injection amount to become fixed.

The Group Manager, Working Group Leaders, and engineers in charge involved in the deterioration durability testing and Witness Test believed that the above modification of the governor characteristic Control Parameter values was necessary for correct measurement and did not believe that there was any problem concerning laws and regulations.

b. Air flow meter flow characteristic Control Parameter values were modified.

As was the case with the 2020 1KD Engine for Construction Machinery, the engineer in charge modified the air flow meter flow characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test from the values of the ECU Software

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280 Generally, on engines installed on construction machinery, the governor characteristic Control Parameter values are adjusted to compensate for the decrease in engine speed when a load is applied by increasing the range of fuel injection increase to improve operability of the Lift Truck when rotating an upper rotating body, digging with a bucket, or engaging in other such actions. On the 2016 1KD Engine for Construction Machinery, the governor characteristic Control Parameter values specified by the construction machinery manufacturer referenced above were set in this manner. As a result, it is believed that the engine fuel injection amount did not stabilize simply by correcting the governor characteristic Control Parameter values.

for Mass Production.[281]

Everyone involved in the deterioration durability testing including the Group Manager, Working Group Leaders, and the engineers in charge believed that the above modification of the air flow meter flow volume characteristic Control Parameter values was necessary to eliminate manufacturing variations and for correct measurement and did not believe that there was any problem concerning laws and regulations.

(d) Other improper conduct

a. Deterioration correction values were calculated using only part of the testing data measured several times.

As was the case with the 2020 1KD Engine for Construction Machinery, the engineers in charge repeatedly measured the emission component values at each measurement time of the deterioration durability testing until test results that were close to the values anticipated in advance were obtained and used only some of those values for the certification application. As discussed above in 3(2)E, however, if this is permitted, it would be possible to arbitrarily manipulate the deterioration correction values, and it is believed that this conduct is in violation of domestic laws and regulations.

All of the engineers in charge of this deterioration durability testing considered that taking multiple measurements and using only a portion of the data for certification application is permitted and used test results from among the multiple measured values that were close to the expected values.

b. Deterioration correction values were calculated using test data before inspection and maintenance.

When deterioration correction values were calculated, both data before engine inspection and maintenance and data after inspection and maintenance at each measurement time were used. Under domestic laws and regulations, however, in cases where testing is performed before and after inspection and maintenance, deterioration correction values are to be calculated using the data from after inspection and maintenance,[282] and the calculation of deterioration correction values using both

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281 An investigation conducted by Toyota Industries confirmed that in cases where the emission component values of an engine equipped with ECU Software for Deterioration Durability Test or ECU Software for Witness Test is measured using the NRTC mode, there is a possibility that the PM amount in the emissions will be less compared to the case where each emission component value of an engine equipped with ECU Software for Mass Production is measured using the NRTC mode. However, the impact on the emissions from the difference in b is extremely small, and when combined with the difference referenced in a above, there is a high likelihood that the overall amount of NOx in the emissions will be reduced.

282 The Approval Implementation Guidelines Supplementary Rule 7-10 1.(7)D(a)(c).

data before engine inspection and maintenance and data after inspection and maintenance is in violation of domestic laws and regulations.

Everyone involved in the deterioration durability testing including the Group Manager, Working Group Leaders, and the engineers in charge was not aware of these laws and regulations at the time, and some believed that data should be measured both before and after maintenance in order to obtain accurate measurements. These test data were stored in a shared folder that could be accessed by all personnel of the Engineering Office.

c. Replacement of parts during deterioration durability testing

(a) Replacement of turbo

The engine turbo failed during the deterioration durability testing, and the engineer in charge replaced the turbo and continued the test. The engineer in charge of the deterioration durability testing when the turbo failed reported that the turbo failed to the Group Manager. Upon receiving the report, the Group Manager investigated what response is required under domestic laws and regulations[283] and EU laws and regulations[284] in cases where a component etc. fails during deterioration durability testing and confirmed that in unavoidable circumstances, replacement of parts is permitted if the details of the replacement work are recorded. Later, the Group Manager and the engineer in charge consulted with the Assistant General Manager and decided to use for the deterioration durability testing a turbo that had completed other durability testing,[285] and when measuring the emissions, to

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283 The Approval Implementation Guidelines Supplementary Rule 7-9 provides as follows in Clause 4.1: "With respect to inspection and maintenance of a test vehicle or test engine during the running or operating period, the first time and thereafter, inspection and maintenance may be performed in accordance with the inspection and maintenance methods specified in Article 3, Paragraph 2, Item 7 of the Type Designation Regulations in the case of a type designated vehicle, and inspection and maintenance may be performed in accordance with the inspection and maintenance methods specified by the automobile or engine manufacturer in the case of other vehicles. In this case, the inspection and maintenance items shall be as specified by the automobile or engine manufacturer; provided, however, that in unavoidable circumstances where it becomes necessary to perform other temporary maintenance, the maintenance shall be performed, and a record of the details shall be made." In addition, the Approval Implementation Guidelines Supplementary Rule 7-9 provides as follows in Clause 4.2: "Parts relating to emissions performance such as an engine or emission control device for the control of carbon monoxide and so on other than periodically replaced parts may not be replaced during the running or operating period; provided, however, that in cases where a part is unavoidably replaced, the replaced part shall be retained during the type designation application period, etc. so that it can be presented."

284 It was planned that this deterioration durability testing result would also be used for the EU certification application, and accordingly, EU laws and regulations were also investigated. Under EU laws and regulations as well, in the case where a part and so on fails, it is permitted to replace the part with one that has equivalent operating time and to continue the deterioration durability testing (Annex III, No. 3.5.2. of Commission Delegated Regulation (EU) 2017/654).

285 The "durability testing" referenced here is durability testing relating to performance reliability different from the deterioration durability testing.

use a turbo that had completed the first deterioration durability testing.[286] This irregular response was made because a turbo that had completed the first deterioration durability testing was valuable as a sample, and care was taken to ensure that it was not damaged (substantial load is imposed on a turbo during the durability operation). This response taken after the turbo failure was reported at the Engineering Dept. Meeting, a regular meeting where each Assistant General Manager in the Engineering Dept. reports to the General Manager of the Engineering Dept.

The engineers in charge believed that since the turbo that had completed deterioration durability testing had already undergone 2000 hours of durability operation, it had sufficiently deteriorated, that there would be no improvement of the emissions performance compared to the failed turbo, and that there would be no problem with using the turbo that had completed the first deterioration durability testing solely during measurement. The Assistant General Manager and Group Manager were also of the same opinion.

It is certainly true that under laws and regulations, replacement of parts during deterioration durability testing is permissible in unavoidable circumstances, and it is conceivable that in the case where a turbo fails, replacement of the turbo constitutes an unavoidable circumstance. However, even if the turbo is replaced, the same replacement turbo should be used during the durability operation and when measuring emissions, and the use of different turbos during the durability operation and when measuring emissions cannot be recognized overall as the replacement of a part due to unavoidable circumstances and may be in violation of laws and regulations. In addition, under domestic laws and regulations, in cases where maintenance is performed during deterioration durability testing, maintaining a record of the details is required, and in the case where a part is replaced, the replaced part must be retained during the type designation application period, etc. so that it can be presented. At that time, however, no record of the turbo replacement was made and the replaced turbo was not retained, and it is believed that these points too are in violation of domestic laws and regulations.

(b) Replacement of air-fuel ratio sensor

During the deterioration durability testing, it was discovered that a decision had been made to discontinue the air-fuel ratio sensor (A/F sensor)[287] used on the engine and that it would not be possible to use that sensor during the mass production stage, and consequently, the engineer in charge replaced the air-fuel ratio sensor with a new sensor during the deterioration durability testing and continued the testing. The decision to replace the air-fuel ratio sensor was made following

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[286] Deterioration durability testing is performed twice. The first time, testing was performed to expose issues, and the second time was the real deterioration durability testing for certification application. Therefore, a turbo that had completed the first deterioration durability testing had completed 2000 hours of durability operations.

[287] A device for measuring the air-fuel ratio in emissions.

investigation by the Group Manager and others, and the engineer in charge instructed the Laboratory Section to perform the replacement work. When replacing the air-fuel ratio sensor, a comparison of the performance of the new and old air-fuel ratio sensors was performed and it was confirmed that the performance was equivalent and that there would be no impact on the test results even if the sensor were replaced.

As stated above in (a), under domestic laws and regulations, replacement of parts during deterioration durability testing is permissible after recording the details of the maintenance in unavoidable circumstances, and in the case where a part is replaced, the replaced part must be retained during the device type designation application period so that it can be presented. Replacement due to the discontinuation of the air-fuel ratio sensor constitutes unavoidable circumstances, and since the sensor was replaced with a comparable part with the same performance, is believed that there was no impact on the deterioration durability testing result due to the replacement. However, no record concerning replacement of the air-fuel ratio sensor was made and the replaced air-fuel ratio sensor was not retained, and consequently, it is believed that this constitutes a violation of domestic laws and regulations.

(e) Status of reporting to Manager

The engineers in charge of development of the 2016 1KD Engine for Construction Machinery orally reported the incidence of improper conduct described above to Working Group Leaders and Group Managers, generally on a daily basis, and also prepared weekly reports and reported in writing.

The Group Managers, however, fundamentally did not report the improper conduct to the Assistant General Managers because they were not aware that it was improper conduct or for other reasons.[288] Regarding the rewriting of test data stated in (a) above, the weekly report hinting at the existence of improper conduct with the statement "for the PM at 1500 hours, without changing the average value, the values before and after maintenance approach the average value" was stored in a shared folder accessible by all Engineering Office personnel, but the Assistant General Manager had no experience in development of engines for construction machinery or engines for industrial machinery and was also in charge of development of other engines in addition to the 2016 1KD Engine for Construction Machinery, and as a result, the Assistant General Manager stated that he delegated to the Group Managers the task of checking the detailed data relating to the deterioration durability testing of the 2016 1KD Engine for Construction Machinery and checking whether the deterioration durability testing implementation method complied with laws and regulations, and that he did not check the details personally and did not check the relevant weekly reports.

288 However, as stated in (d)c(a) above, the improper conduct relating to replacement of the turbo was reported as high as the Assistant General Manager, and approval was obtained from the Assistant General Manager.

7 Mass Production Sampling Inspections

(1) Quality control systems, etc. for engines for industrial vehicles

In the Engine Division, after the start of mass production of engines, the Quality Assurance Dept. performs inspections (the inspections are performed using a sampling inspection method, rather than inspecting all mass production engines; referred to as "**Mass Production Sampling Inspections**") to determine whether each emission component value of mass production engines satisfies the standard values established in internal rules designated as the "Inspection Method" ("**Inspection Method**") on Measurement Benches in the Quality Assurance Dept. for the purpose of confirming whether there are any problems with the quality of the mass production engines. During the initial stage of mass production, the possibility that variations in the quality of mass production engines will occur cannot be denied, so normally, Mass Production Sampling Inspections are performed with a higher sampling frequency for approximately three months after the start of mass production (thus, implementation of sampling inspections with a higher sampling frequency during the early stage of mass production is referred to as "early-stage control").

The Quality Assurance Dept. was responsible for determining the Mass Production Sampling Inspection method and for implementing Mass Production Sampling Inspections.

The inspection management department[289] of the Quality Assurance Dept. prepared the Inspection Method specifying the inspection items, criteria for assessing whether inspection is passed, and so on by the time of evaluation of the Mass Production-Equivalent Engines produced on the production line

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289 The inspection management department for the 1KD Engine was the Machinery Group of the Higashichita Assurance Office of the Quality Assurance Dept. when mass production was started, but in August 2017, it was changed to the Mass Production Group of the Hekinan Assurance Office of the Quality Assurance Dept. (referred to as the "**Mass Production Group**," regardless of whether before or after the organization name change) in conjunction with the change of the 1KD Engine production site from the Higashichita Plant to the Hekinan Plant. Also, the inspection management department for the 2007 4Y Engine, 2009 4Y Engine, 2020 4Y Engine, 1FS Engine, 1ZS Engine, and 1KD Engine for Construction Machinery was the Mass Production Group in the initial stage of mass production. Later, the Quality Control Group of the Hekinan Assurance Office of the Quality Assurance Dept. became the inspection management department for the 2020 4Y Engine, 1FS Engine, 1KD Engine, 1ZS Engine, and 1KD Engine for Construction Machinery in 2021.

on an experimental basis.[290] In addition, the inspection work department[291] of the Quality Assurance Dept. performed evaluations of the Mass Production-Equivalent Engines based on the Inspection Method. Later, the inspection management department revised the Inspection Method in light of the results of the evaluation of the Mass Production-Equivalent Engines, and the inspection work department of the Quality Assurance Dept. performed Mass Production Sampling Inspections of the engines in accordance with the revised Inspection Method.

In this way, the Quality Assurance Dept. conducted evaluations of Mass Production-Equivalent Engines and Mass Production Sampling Inspections, but the Engine Calibration Group and Control System Development Office were responsible for development of the ECU Software used when performing evaluations of Mass Production-Equivalent Engines and Mass Production Sampling Inspections ("**ECU Software for Inspection**").

(2) Details of laws and regulations and internal rules concerning Mass Production Sampling Inspections

The manufacturer, etc. of a carbon monoxide, etc. emissions control device that has received device type designation pursuant to Article 75-3, Paragraph 1 of the Vehicle Act must make the said emissions control device have the structure and performance of the type that received designation, and so that the same has uniformity, perform an inspection in accordance with the inspection implementation

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290 The evaluation of the Mass Production-Equivalent Engines produced on the manufacturing line on an experimental basis is an evaluation performed, after the establishment of a provisional manufacturing line for mass production engines, by the Quality Assurance Dept. on a Measurement Bench managed by the department to check whether the emission component values of the Mass Production-Equivalent Engines produced on the provisionally established manufacturing line meet the standard values established by internal rules for the purpose of confirming whether engines with performance equivalent to that of engines performance during development can be manufactured on that manufacturing line.

291 The inspection work department for the 2007 4Y Engine, 2009 4Y Engine, 1FS Engine, 1 KD Engine, and 1ZS Engine was the Quality Section of the Hekinan Assurance Office of the Quality Assurance Dept. at the start of mass production, but later, an organizational restructuring was implemented, and the Hekinan Quality Section of the Quality Administration Office of the Quality Assurance Dept. took over this role in 2016. In actuality, this was simply a change of the organization name, and the employees that had worked in the Quality Section of the Hekinan Assurance Office of the Quality Assurance Dept. worked for the Hekinan Quality Section of the Quality Administration Office of the Quality Assurance Dept. without change. The inspection work department for the 1KD Engine for Construction Machinery and 2020 4Y Engine was the Hekinan Quality Section of the Quality Administration Office of the Quality Assurance Dept. from the start of mass production (regardless of whether before or after the organization name change, the inspection work department for the 2007 4Y Engine, 2009 4Y Engine, 2020 4Y Engine, 1FS Engine, 1KD Engine, 1ZS engine, and 1KD Engine for Construction Machinery is referred to as the "**Quality Section**").

summary[292] submitted to the Minister of Land, Infrastructure, Transport and Tourism at the time of application for domestic certification.[293] In addition, the Designation Standards provides in Vol. II, 10.2 that the above inspection may be performed through a sampling inspection procedure using quality control procedures.

The inspection implementation summary submitted by Toyota Industries to the Minister of Land, Infrastructure, Transport and Tourism when applying for domestic certification for the 2009 4Y Engine, 2020 4Y Engine, 1FS Engine, 1KD Engine, 1ZS Engine, and 1KD Engine for Construction Machinery stated that the Quality Section would inspect the emission component values using a sampling inspection procedure in accordance with the Inspection Method.[294]

The Inspection Method specified the sampling frequency, provided that the determination whether Mass Production Sampling Inspections relating to the emission component values are passed or failed would be based on whether each emission component value of a single measured engine satisfied the limit values ("**Control Limit Values**") and whether the mean values of each measured emission component value of the five most recently measured engines satisfied the standard values ("**Control Standard Values**"), and indicated the Control Limit Values and Control Standard Values for each emission component value.

In addition, the Mass Production Sampling Inspection implementation method, the method of determining the Control Limit Values and Control Standard Values, and so on are specified in internal rules ("**Emission Control Guideline**") separate from the Inspection Method, and the Emission Control Guideline provided that for gasoline and LPG engines, each emission component value is to be determined using the 7-Mode Method and for diesel engines, each emission component value is to be determined using the 8-Mode Method and the NRTC mode method.

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[292] The inspection implementation summary is a written statement of the inspection work organization and the inspection implementation guidelines submitted by the applicant to the Minister of Land, Infrastructure, Transport and Tourism when applying for device type designation for a carbon monoxide, etc. emissions control device. The inspection implementation summary must state the inspection work organization and the inspection implementation guidelines (inspection items, inspection method, inspection format, and a list of inspection equipment and tools (Vol. II, 3.2 of the Designation Standards and Attachment 2-1-6).

[293] Article 76 of the Vehicle Act; Article 7, Paragraphs 1 and 2 of the Device Type Designation Regulations; Vol. II, 10.1 of the Designation Standards. The results of the inspection must be preserved for one year (Article 7, Paragraph 3 of the Device Type Designation Regulations).

[294] The Inspection Method for the 2007 4Y Engine does not currently exist, and it was not possible to confirm the details.

(3) Details of improper conduct found in investigation, etc.

A. ECU Software for Inspection Control Parameter values were modified.

(a) Governor characteristic Control Parameter values were modified.

The control system anticipated by the Measurement Bench[295] used to implement Mass Production Sampling Inspections and the control system of the ECU Software for Mass Production differed with respect to all of the following: the 2020 4Y Engine,[296] 1FS Engine, 1KD Engine, 1ZS Engine, and 1KD Engine for Construction Machinery.[297] Furthermore, as previously discussed, ECU Software that differed from the ECU Software for Mass Production was used for the deterioration durability testing and the Witness Test with respect to the 2020 4Y Engine, 1FS Engine, 1KD Engine, 1ZS Engine, and 1KD Engine for Construction Machinery, and similarly, the ECU Software for Inspection that differed from the ECU Software for Mass Production was used for Mass Production Sampling Inspections.

The Engine Calibration Group prepared the ECU Software for Inspection, but people involved in the Engine Calibration Group did not have any doubts regarding the existence of ECU Software for Inspection separate from the ECU Software for Mass Production, just as they did not see a problem with the existence of ECU Software for Deterioration Durability Test and ECU Software for Witness Test separate from the ECU Software for Mass Production.[298]

The Engine Calibration Group provided ECU Software for Inspection to the Quality Assurance Dept., and the Quality Assurance Dept. conducted the Mass Production Sampling Inspections using the ECU Software for Inspection, but none of the people involved in the Quality Assurance Dept. understood the details of the governor characteristic Control Parameter values for the ECU Software. Because of this, the Quality Assurance Dept. used the ECU Software for Inspection in the condition that it was provided by the Engine Calibration Group without confirming the details and used it to perform the Mass Production Sampling Inspections. Furthermore, the Engine Calibration Group did not inform the Quality Assurance Dept. that the control system of the ECU Software for Inspection

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295 The said Measurement Bench was managed by the Quality Assurance Dept. at the Hekinan Plant.

296 The ECU Software and materials summarizing the details of the ECU Software relating to the 2007 4Y Engine and the 2009 4Y Engine also do not currently exist, and it was not possible to confirm the details.

297 The control system anticipated by the Measurement Bench used to conduct the deterioration durability testing and the Witness Test was the same as the control system anticipated by the Measurement Bench used to conduct the Mass Production Sampling Inspections.

298 No evidence was discovered indicating that the engineer in charge at the Engine Calibration Group reported to the Assistant General Manager that the governor characteristic Control Parameter values of the ECU Software for Inspection had been changed from those of the ECU Software for Mass Production.

differed from the control system of the ECU Software for Mass Production. As a result, none of the people involved in the Quality Assurance Dept. were aware that the control systems of the ECU Software for Inspection and the ECU Software for Mass Production were different.

(b) Target EGR rate Control Parameter values were modified (1ZS Engine).

As stated in 2(2)A above, when the 1ZS Engine underwent the Witness Test and the engine's emission component values were measured, it was discovered that the PM values were worse than anticipated, and as a result, the engineer in charge at the Engine Calibration Group consulted with the Group Manager and lower-level employees and modified the target EGR rate Control Parameter values of the ECU Software for Witness Test by April 24, 2014 at the latest.

Later, the engineer in charge similarly modified the target EGR rate Control Parameter values of the ECU Software for Inspection in the same manner as the ECU Software for Witness Test by June 24, 2014 at the latest. The engineer in charge stated that he was aware that it was necessary to make modifications to the ECU Software for Inspection similar to the modifications made to the ECU Software for Witness Testing, and consequently, he modified the target EGR rate Control Parameter values of the ECU Software for Inspection in the same manner as the ECU Software for Witness Test.[299] Later, the ECU Software for Inspection with the modified target EGR rate Control Parameter values was provided to the Quality Assurance Dept. and was used for Mass Production Sampling Inspections.

B. There were instances where Mass Production Sampling Inspections were not conducted at the sampling frequency specified in the Inspection Method.

As stated in (2) above, the Inspection Methods specified the sampling frequencies, but as indicated below, it was discovered that there were instances where Mass Production Sampling Inspections were not performed at the sampling frequencies specified in the Inspection Methods.

1KD Engine

The Inspection Method for the 1KD Engine specified that for Mass Production Sampling Inspections, two engines were to be sampled and the emission component values were to be measured each quarter, but as discussed below, inspections were not performed at this sampling frequency.

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299 No evidence was discovered indicating that the engineer in charge reported to the Assistant General Manager that the target EGR rate Control Parameter values of the ECU Software for Inspection had been changed from those of the ECU Software for Mass Production.

- In the first quarter[300] of fiscal 2019, not even a single engine was inspected.
- In the third quarter of fiscal 2019, only one engine was inspected.
- In the first quarter of fiscal 2021, not even a single engine was inspected.

1ZS Engine

Of the Inspection Methods for the 1ZS Engine, the Inspection Method during the initial stage of mass production provided that for Mass Production Sampling Inspections, four engines were to be sampled and the emission component values were to be measured each quarter. Later, the Inspection Method for the 1ZS Engine was revised in September 2020, and the revised Inspection Method provided that for Mass Production Sampling Inspections, two engines were to be sampled each quarter and the emission component values were to be measured. As discussed below, however, inspections were not performed at these sampling frequencies.

- From the first quarter of fiscal 2016 to the third quarter of fiscal 2018, only two engines were inspected each quarter.
- In the fourth quarter of fiscal 2018, only one engine was inspected.
- In the first quarter of fiscal 2019, not even a single engine was inspected.
- In the third quarter of fiscal 2019, only one engine was inspected.
- In the fourth quarter of fiscal 2019 and the first quarter of fiscal 2020, only two engines were inspected.
- In the second quarter of fiscal 2020, only one engine was inspected.
- In the first and second quarters of fiscal 2021, not even a single engine was inspected.

1KD Engine for Construction Machinery

The Inspection Method for the 1KD Engine for Construction Machinery (both the 2020 1KD Engine for Construction Machinery and the 2016 1KD Engine for Construction Machinery) provided that for Mass Production Sampling Inspections, one engine was to be sampled and the emission component values were to be measured each quarter, but as discussed below, inspections were not performed at these sampling frequencies for either the 2016 1KD-1 Engine for Construction Machinery or the 2016 1KD-2 Engine for Construction Machinery.

2016 1KD-1 Engine for Construction Machinery and 2016 1KD-2 Engine for Construction Machinery

- From the second to fourth quarters of fiscal 2018, in the first and second quarters of fiscal 2019, from the first to third quarters of fiscal 2021, and in the first quarter of

[300] Hereinafter, the first quarter refers to the period from April to June, the second quarter refers to the period from July to September, the third quarter refers to the period from October to December, and the fourth quarter refers to the period from January to March.

fiscal 2022, not even a single engine was inspected.

4Y Engine

The Inspection Method for the 4Y Engine provided that for Mass Production Sampling Inspections, two engines were to be sampled and the emission component values were to be measured each quarter, but as discussed below, inspections were not performed at this sampling frequency.

- In the first and third quarters of fiscal 2021, not even a single engine was inspected.

1FS Engine

The Inspection Method for the 1FS Engine provided that for Mass Production Sampling Inspections, two engines were to be sampled and the emission component values were to be measured each quarter, but as discussed below, inspections were not performed at this sampling frequency.

- In the first, third and fourth quarters of fiscal 2021, not even a single engine was inspected.

Toyota Industries did not have any internal rules specifying who, when, and by what procedures Mass Production Sampling Inspections of engines for industrial vehicles for domestic use are to be performed or who should confirm whether inspections are being performed at the sampling frequencies specified in the Inspection Methods and by what means such confirmation should be made. Consequently, the inspection management department prepared an annual Mass Production Sampling Inspection implementation plan,[301] in regard to its application, and the inspection work department determined the allocation of Measurement Benches based on the implementation plan and performed the Mass Production Sampling Inspections. That said, Measurement Benches could not be used for certain periods due to Measurement Bench inspection and maintenance, and there were instances where Mass Production Sampling Inspections were not conducted in accordance with the implementation plan. Because of this, in cases where it was expected that it would not be possible to perform Mass Production Sampling Inspections as initially planned, the engineers in charge at the inspection management department would consult with the engineers in charge at the inspection work department and suspend implementation of Mass Production Sampling Inspections or push back the implementation dates.

With regard to this point, the manager of the Quality Assurance Dept. stated, “Under Japanese law, Mass Production Sampling Inspections are to be performed in accordance with the rules voluntarily established by the applicant for domestic certification, and it seems that personnel in the Quality Assurance Dept. had a deeply-rooted awareness that they did not need to comply strictly with the sampling frequency specified in the Inspection Methods.” In addition, among the engineers in charge

[301] From January 2021, the inspection management organization prepared quarterly implementation plans.

at the Quality Assurance Dept., stated, "Laws and regulations provide that in the case of gasoline engines for industrial vehicles destined for the United States, Mass Production Sampling Inspection data must be submitted to the U.S. authorities periodically, and as a result, there was a strong sense that Mass Production Sampling Inspections must be performed in accordance with the rules established by laws and regulations, and there were strict internal rules established. In contrast, in the case of engines for industrial vehicles for the domestic market, laws and regulations provided only that Mass Production Sampling Inspections must be carried out in accordance with internal rules established voluntarily by the applicant for certification, and many personnel in the Quality Assurance Dept. had little awareness of the need to comply with the rules, considering them to be no more than internal rules."

C. The regulation maximum limit values and regulation average values specified by laws and regulations after deducting deterioration correction values were used as criteria for Mass Production Sampling Inspections, rather than the Control Limit Values and Control Standard Values pursuant to the Emission Control Guideline.

With regard to which specific values should be used for the Control Limit Values and Control Standard Values specified in the Inspection Method, the Emission Control Guideline provided for different calculation methods depending on whether each of these specification values[302] was the same as the regulation average values specified by laws and regulations or less than the regulation

302 Emission component values stated in the table of specifications submitted by Toyota Industries to the Minister of Land, Infrastructure, Transport and Tourism at the time of application for device type designation for a carbon monoxide, etc. emissions control device.

average values specified by laws and regulations.[303]

With regard to engines for industrial vehicles for domestic market, the Inspection Method at the start of mass production generally provided the Control Limit Values and Control Standard Values which were appropriately calculated in accordance with the Emission Control Guideline.[304]

Later, in September 2019, Toyota Industries was subjected to an SEA audit[305] by the EPA. Based on the results of that audit, Toyota Industries examined whether operations in the Quality Assurance Dept. were in compliance with the laws and regulations of each country, and it was found that there were scattered documents, known as "serial memos," issued by the Audit Group of the Quality Audit Office of the Quality Assurance Dept. ("**Audit Group**") that recorded numerical values that were the basis for the Control Limit Values and Control Standard Values specified in the Inspection Method, and it was not possible to determine which of these serial memos recorded proper Control Limit Values and Control Standard Values or whether the Control Limit Values and Control Standard Values

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303 Specifically, the guideline provided as follows.

In cases where the specification values equal the regulation average values specified by laws and regulations:

Control Standard Value = Regulation average value specified by laws and regulations - Deterioration correction value

Control Limit Value = Control Standard Value + 3σ̂・・・A

≦ (Regulation maximum value specified by laws and regulations - Deterioration correction value) ・・・B * In cases where A ＞ B, the Control Limit Value = B

In cases where the specification values are less than the regulation average values specified by laws and regulations:

Control Standard Value = (Specification value - Deterioration correction value) + 3σ̂/√5・・・C

≦ (Regulation average value specified by laws and regulations - Deterioration correction value)・・・・D * In cases where C ＞ D, the Control Standard Value = D

Control Limit Value = (Specification value - Deterioration correction value) + 3σ̂・・・・E

≦ (Regulation maximum value specified by laws and regulations - Deterioration correction value)・・・F * In cases where E ＞ F, the Control Limit Value = F

Value of σ̂ = Calculation based on evaluation results of mass production prototypes and initial management results.

304 As a result of an investigation conducted at Toyota Industries concerning whether Control Limit Values and Control Standard Values specified in the Inspection Method at the start of mass production of engines for industrial vehicles for domestic market were calculated in accordance with the Emission Control Guideline, there were cases where materials that served as the basis for calculating the Control Limit Values and Control Standard Values specified in the Inspection Method at the start of mass production were not found. To the extent that Toyota Industries was able to confirm materials that served as the basis for these calculations, in the Inspection Method at the start of mass production, it was discovered that the Control Limit Values and Control Standard Values were calculated appropriately in accordance with the Emission Control Guideline.

305 A Selective Enforcement Audit (SEA) is an audit conducted at irregular periods by the EPA pursuant to the Code of Federal Regulations, Title 40, Chapter I, Subpart E 1068.401-1068.455. For the audit, the plant of a company that manufactures engines that received U.S. certification is visited and emissions testing of the said engine is conducted to confirm that the emissions are in compliance with U.S. laws and regulations and so on.

specified in the Inspection Method were calculated properly. As a result, in September 2020, the Audit Group issued a serial memo summarizing the regulation average values and regulation maximum limit values specified in laws and regulations and deterioration correction values, and so on for all industrial and general-purpose engines being manufactured at that time.

In response, the Mass Production Group circulated to the Quality Section the serial memo issued by the Audit Group referenced above, and as a result, starting in September 2020 at the latest, for Mass Production Sampling Inspections of all engines for industrial vehicles for the domestic market, the Control Standard Value was defined as the regulation average value specified in laws and regulations minus the deterioration correction value, and the Control Limit Value was defined as the regulation maximum limit value minus the deterioration correction value, rather than the values calculated in accordance with the Emission Control Guideline. Also, whether Mass Production Sampling Inspections were passed or failed was determined based on whether the average values of the emission component values for the five most recent engines measured satisfied the regulation average value minus the deterioration correction value and whether the emission component values of the sampled engines satisfied the regulation maximum limit value minus the deterioration correction value.

The manager of the Quality Assurance Dept. stated, “In September 2009, the Audit Group reviewed the Control Standard Values and Control Limit Values, but awareness regarding the need to comply with internal rules was low, and it was believed that it was good enough if the regulation average values and regulation maximum limit values specified in laws and regulations were satisfied. It seems that the Control Standard Values and Control Limit Values specified in the Inspection Method, that is, the Control Standard Values and Control Limit Values calculated in accordance with the Emission Control Guideline, came to no longer be used,” etc.

D. There were instances where MTS at the time of Mass Production Sampling Inspections was not in agreement with the test mode specified by the Emission Control Guideline.

The Emission Control Guideline provides for diesel engines, that emission component values are to be calculated using the NRTC mode method and the 8-Mode Method. The NRTC mode method and the 8-Mode Method refer to test modes specified in Attachment 43 to the Public Notice on Details.[306]

Clause 7.7.1 of Attachment 43 to the Public Notice on Details provides that emissions testing using the 8-Mode Method is to use MTS calculated in accordance with Clauses 7.6 and 7.7.2.1 and Figure 7.3 of Attachment 43 to the Public Notice on Details (“**Calculated MTS**”), but in cases where the Calculated MTS is within ±2.5% of the MTS declared by the engine manufacturer (“**Declared MTS**”), the Declared MTS may be used. In addition, Clause 7.7.2.1 of Attachment 43 to the Public Notice on

[306] Attachment 43 to the Public Notice on Details specifies emission measurement methods for diesel engines for special motor vehicles.

Details provides that emissions testing using the NRTC mode method is to use the Calculated MTS, but in cases where the Calculated MTS is within ±3% of the Declared MTS, the Declared MTS may be used.[307]

Therefore, according to the Emission Control Guideline, the MTS used at the time of Mass Production Sampling Inspections must comply with Attachment 43 to the Public Notice on Details specified above.

However, the MTS used for Mass Production Sampling Inspections of the 1KD Engine performed in June 2021 at the latest and earlier, did not comply with either the Calculated MTS or Declared MTS specified in Attachment 43 to the Public Notice on Details for emissions tests conducted using the NRTC mode method and the 8-Mode Method, and it is possible that there were instances where the Emission Control Guideline was violated.

In other words, until June 2019, the Quality Assurance Dept. usually set the MTS at 2200 rotations when performing Mass Production Sampling Inspections of the 1KD Engine.[308] At those times, the Quality Assurance Dept. continued to use the MTS of 2200 rotations without confirming whether it satisfied the Declared MTS specified in Attachment 43 to the Public Notice on Details.

However, in cases where the MTS of 2200 rotations satisfied the Declared MTS requirement specified in Attachment 43 to the Public Notice on Details, Mass Production Sampling Inspections performed in and before June 2021 were not in violation of Attachment 43 to the Public Notice on Details. In other words, if the emissions testing Calculated MTS using the 8-Mode Method was within ±2.5% of 2200 rotations (specifically, between 2145 and 2255 rotations) and the emissions testing Calculated MTS using the NRTC mode method was within ±3% of 2200 rotations (specifically,

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307 Attachment 43 to the Public Notice on Details was revised by the Ministry of Land, Infrastructure, Transport and Tourism Notification No. 197 of March 18, 2010 (Attachment 43 revised by the Ministry of Land, Infrastructure, Transport and Tourism Notification No. 197 of March 18, 2010 is referred to as the "**2010 Revised Attachment 43**"), and with the revision, Calculated MTS or Declared MTS is to be used for emissions testing (Clause 7.7.2.1 of Attachment 43 to the Public Notice on Details). In addition, the Public Notice that Provides Matters Necessary for Application of Provisions in Chapter 2 and 3 of Safety Regulations for Road Transport Vehicles was revised by Ministry of Land, Infrastructure, Transport and Tourism Notification No. 198 of March 18, 2010 ("**Application of Provisions Public Notice**"), and from October 1, 2013, in cases where device type designation is received for a carbon monoxide, etc. emissions control device, it is necessary to conduct emissions testing in accordance with the methods specified in Attachment 43 to the Public Notice on Details after the revision in 2010 (Article 28, Paragraph 143 of the Application of Provisions Public Notice).

308 The background to discovering that the MTS was always set at 2200 rotations is as follows. In preparation for the SEA audit by the EPA scheduled for September 2019, the Quality Assurance Dept. checked test equipment that it managed, and by about May 2019 at the latest, it was discovered that the measurement program of the Measurement Bench was not in compliance with the latest U.S. laws and regulations at that time, and in addition, in relation to domestic laws and regulations, was not in compliance with Attachment 43 to the Public Notice on Details. In response, the Quality Assurance Dept. contracted an outside service provider to update the measurement program, and as a result, the specifications were such that the MTS used for Mass Production Sampling Inspections was automatically calculated by the Measurement Bench from late July 2019. With this change, the MTS used for Mass Production Sampling Inspections was the Calculated MTS calculated in accordance with Attachment 43 to the Public Notice on Details from late July 2019.

between 2134 and 2266 rotations), then the Mass Production Sampling Inspections were performed using a Declared MTS in compliance with Attachment 43 to the Public Notice on Details, and as a result it can be assessed that the inspections were not in violation of the Emission Control Guideline.

In and after late July 2019,[309] the MTS used for Mass Production Sampling Inspections of the 1KD Engine was the Calculated MTS, and in most cases, this MTS was approximately 2500 rotations for both the NRTC mode method and 8-Mode Method, in excess of the maximum of the rotation range specified above. There are no materials with accurate Calculated MTS for Mass Production Sampling Inspections conducted in June 2019 and before, and as a result, the Calculated MTS was unclear, but the Calculated MTS used in June 2019 and before and the Calculated MTS used in late July 2019 and later were generally the same values, and it can be inferred that the Calculated MTS used in June 2019 and earlier was in the range of 2500 rotations, and therefore, it is possible that there were not a few instances where the MTS of 2200 rotations did not satisfy the requirements for the Declared MTS specified in Attachment 43 to the Public Notice on Details.

Based on the above, the MTS for Mass Production Sampling Inspections of the 1KD Engine performed in June 2021 or earlier did not comply with the Calculated MTS or Declared MTS specified in Attachment 43 to the Public Notice on Details, and it is possible that there were instances where the Emission Control Guideline was violated.

With respect to this point, the manager of the Quality Assurance Dept. stated, "In the Quality Assurance Dept., there was no one who checked the revision status of laws and regulations or who verified the compliance of equipment status or test conditions and so on with laws and regulations, and as a result, it is likely that there was no one who noticed that the MTS for Mass Production Sampling Inspections was not in compliance with the test mode specified in the Emission Control Guideline," etc.

E. During Mass Production Sampling Inspections, exhaust gas flow rate was calculated using a method not permitted by laws and regulations.

It was discovered that during Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine, exhaust gas flow rates were calculated using a method not permitted by laws and regulations.

Attachment 103 to the Public Notice on Details, which specifies the emission measurement methods from gasoline and liquefied petroleum gas special motor vehicles, stipulates that emissions of CO, THC, NOx, and CO2 (hereinafter referred to as "**CO etc.**") are to be measured on the basis of either

[309] As discussed above, the updating performed on the Measurement Bench measurement program was completed by around this time, and thereafter, Calculated MTS calculated automatically by the program was used.

the CVS measurement method,[310] exhaust gas flow rate measurement method,[311] or fuel flow rate measurement method,[312, 313] and during the Mass Production Sampling Inspections, Toyota Industries measured CO etc. emissions on the basis of one of the above methods, the exhaust gas flow rate measurement method.

When the exhaust gas flow rate measurement method is employed, emissions of CO etc. are determined on the basis of the exhaust gas flow rate and the concentration of emission components measured directly from the exhaust pipe of the test engine, and the exhaust gas flow rate is calculated using the fuel mass flow rate and the intake air volume. For this reason, Attachment 103 to the Public Notice on Details requires that the fuel mass flow rate and intake air volume be measured at predetermined points in time for each operating mode of the 7-Mode Method.[314] However, as it is specified that "the carbon balance method specified in Annex A.1 of JIS B 8008-1 or the carbon/enzyme balance method specified in Annex A.2 may be used for analytical determination" of intake air volume,[315] it is also allowed to calculate the intake air volume by the prescribed method without actual measurement. Meanwhile, as there is no such specification for fuel mass flow rate, it is always necessary to perform actual measurements.

Since about March 2019, Toyota Industries has been unable to accurately measure the mass of fuel with its LPG fuel flow meters because some of the LPG vaporizes in the process of feeding the LPG into the engine. Because of this situation, engineers in charge of Mass Production Sampling Inspections at the time considered methods that did not use the fuel flow meters described above. The engineers in charge, seeing that Attachment 103 to the Public Notice on Details[316] stated that "the carbon balance method specified in Annex A.1 of JIS B 8008-1 … may be used for analytical determination of intake air volume", misunderstood this to mean that it was also permitted to calculate exhaust gas flow rate using the carbon balance method. Therefore, the above engineers in charge decided to use the carbon balance method to determine the exhaust gas flow rate without measuring the fuel mass flow rate. As a result of this insufficient confirmation of laws and regulations, from July

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310 "CVS measurement method" refers to a method of measuring emissions of CO etc. using a CVS device (constant volume sampling device) (see 10.2.1 of Attachment 103 to the Public Notice on Details).

311 "Exhaust gas flow rate measurement method" refers to a method of measuring emissions of CO etc. on the basis of the exhaust gas flow rate and the concentration of emission components measured directly from the exhaust pipe of the test engine. (see 10.2.2 of Attachment 103 to the Public Notice on Details).

312 "Fuel flow rate measurement method" refers to a method of measuring emissions of CO etc. by fuel flow rate and the concentration of emission components measured directly from the exhaust pipe of the test engine (see 10.2.3 of Attachment 103 to the Public Notice on Details).

313 10.2 of Attachment 103 to the Public Notice on Details.

314 10.2.2 of Attachment 103 to the Public Notice on Details.

315 10.2.2 of Attachment 103 to the Public Notice on Details.

316 10.2.2 of Attachment 103 to the Public Notice on Details.

2019 onwards, in the Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine, when measuring emission values using LPG, Toyota Industries calculated the exhaust gas flow rate using the carbon balance method specified in Annex A.1 of JIS B 8008-1, and used those values to determine whether Mass Production Sampling Inspections were passed or failed.

F. During Mass Production Sampling Inspections, HC values at idle were measured using an analyzer that was different from the one specified by laws and regulations.

It was discovered that during Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine, HC values at idle were measured using a detector that was different from the one specified by laws and regulations.

Attachment 103 to the Public Notice on Details specifies that a heated hydrogen flame ionization detector (HFID) or a hydrogen flame ionization detector (FID) is to be used to measure HC in each operating mode of the 7-Mode Method. Meanwhile,[317] with respect to the measurement of emissions at idle, it is also stipulated that "the concentration of CO, HC, and CO2 in the emissions from the exhaust pipe of the test engine into the atmosphere shall be measured using a non-dispersive infrared (NDIR) sensor".[318]

However, engineers in charge of Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine overlooked that HC values at idle are to be measured using an NDIR sensor, and therefore, in Mass Production Sampling Inspections since 2011 at the latest, had been measuring HC values at idle with an HFID, as is done when measuring HC in each operating mode of the 7-Mode Method.[319, 320]

317 Table 9 in 10.2.3 of Attachment 103 to the Public Notice on Details.

318 12(1) of Attachment 103 to the Public Notice on Details.

319 The Measurement Bench currently used by Toyota Industries in Mass Production Sampling Inspections was newly installed in 2011. Therefore, records have been kept for equipment used in Mass Production Sampling Inspections conducted since 2011, and it was confirmed that HC values at idle were measured using an HFID in Mass Production Sampling Inspections conducted since 2011 at the latest. Meanwhile, the Measurement Bench used in Mass Production Sampling Inspections in 2011 and earlier had already been disposed of, and there were no records of the equipment etc. used in those inspections. For this reason, it was not clear whether or not HC values at idle were also measured using an HFID in Mass Production Sampling Inspections in 2011 and earlier.

320 We investigated the Measurement Bench used for Mass Production Sampling Inspections and found that, in addition to E. and F. above, the exhaust gas flow meters used for Mass Production Sampling Inspections of the 1KD Engine, 1ZS Engine, and 2020 1KD Engine for Construction Machinery were not calibrated as required by laws and regulations, and that some of the calculating formula used to calculate emission values, etc. were different from those specified by laws and regulations. Each of the above incidents was due to a lack of understanding or confirmation of laws and regulations. According to the Toyota Industries investigation results, there was no or negligible impact on emission values due to the above incidents, and they did not affect the pass/fail determination of the Mass Production Sampling Inspections.

(4) Reasons why it was not discovered that the PM values for the 1KD Engine and 1ZS Engine and the NOx values for the 2020 1KD Engine for Construction Machinery exceeded the regulation values in Mass Production Sampling Inspection

As discussed above, Toyota Industries conducted the deterioration durability testing for the mass production engines of the 1KD Engine and the 1ZS Engine again and as a result, discovered that after operating for a certain period, the PM values measured using the NRTC mode method and the 8-Mode Method exceeded the regulation values. In addition, as a result of reconducting the deterioration durability testing of the 2020 1KD Engine for Construction Machinery, it was discovered that after operating for a certain period, the NOx values measured using the NRTC mode method exceeded the regulation values. Until then, however, it had not been confirmed in Mass Production Sampling Inspections that the PM values for the mass production engines of the 1KD Engine and the 1ZS Engine exceeded the regulation values or that the NOx values for the 2020 1KD Engine for Construction Machinery exceeded the regulation values.[321]

A. 1KD Engine and 1ZS Engine

As stated in (3)C above, the Control Standard Values and Control Limit Values that served as the criteria for determining whether Mass Production Sampling Inspections were passed or failed were determined by taking into account the deterioration correction values used for domestic certification. For example, in cases where the specification values are the same as the regulation values, the Control Standard Value is the regulation value minus the deterioration correction value, and the determination of whether the Mass Production Sampling Inspection is passed is made according to whether the mass production engine emissions satisfy this value. However, the deterioration correction values used for domestic certification of the 1KD Engine and the 1ZS Engine were lower than the original deterioration correction values for these engines.

Furthermore, as stated in 1(3) above, the 1KD Engine has a characteristic whereby the higher the MTS, the more the PM amount increases, and as stated in (3)D above, the MTS was always set at 2200 rotations for Mass Production Sampling Inspections of the 1KD Engine from the start of mass production until June 2019, but of the 1KD Engines, the original MTS (Calculated MTS) of the mass production engines (with Forklift Specifications) was in the range of 2500 rotations. As a result, the

[321] With regard to the 1KD Engine, it was confirmed during a Mass Production Sampling Inspection performed around August 2022 that the measured PM values using the NRTC mode method exceeded the Control Standard Value, but an investigation had already been performed by outside attorneys and Toyota Industries had reconducted the deterioration durability testing, and consequently, a decision was made to investigate responses based on the results of that investigation and the results of that test. As a result, an announcement was made on March 17, 2023 that it had been discovered that the PM values of the 1KD Engine exceeded the regulation values set forth by laws and regulations due to deterioration over time.

PM values of the 1KD Engine measured during Mass Production Sampling Inspections were lower than those of the mass production engines.

Moreover, as stated in (3)A(b) above, the target EGR rate Control Parameter values of the ECU Software for Inspection of the 1ZS Engine were modified. As a result, the PM values of the 1ZS Engine measured during Mass Production Sampling Inspections were also lower than those of the mass production engines.

It is believed that for the above reasons, the PM values in the Mass Production Sampling Inspections did not exceed the regulation values.

B. 2020 1KD Engine for Construction Machinery

The governor characteristic Control Parameter values of the ECU Software for Inspection for the 2020 1KD Engine for Construction Machinery were modified from those of the ECU Software for Mass Production. It is believed that as a result, the NOx values in the Mass Production Sampling Inspections were lower than those for the mass production engines. In addition, as stated in 5(3) above, in the deterioration durability testing for certification application, NOx tended to decrease with the passage of time, and consequently, the deterioration correction value calculated based on the deterioration durability testing for certification application became zero. It is believed that because of this, the NOx values in the Mass Production Sampling Inspection did not exceed the regulation values.

Part 5. Improper Conduct Relating to Output Measurements of Engines for Automobiles Found in the Investigation

As explained in I Part 3 above, the Committee investigated improper conduct relating to domestic emissions certification for engines developed and produced by Toyota Industries, and during the process of that investigation, the Committee discovered that Toyota Industries engaged in improper conduct by modifying fuel injection amounts when measuring the output of engines used by Toyota Motors when applying for vehicle type designation, etc.,[322] with respect to engines for automobiles developed by Toyota Industries under contract from Toyota Motors.

In response, the Committee investigated whether there was any improper conduct relating to output measurements of engines for the domestic market actually in production at the time of the Committee's investigation among those engines for automobiles that were developed by Toyota Industries.

[322] Apart from the automobile type designation, Toyota Motors had obtained device type designation of carbon monoxide, etc. emissions control devices for some of its engines for automobiles.

1 Overview of laws and regulations relating to output in vehicle type designation

As detailed in Part 2-3(2), A and B, considering the reality that the vehicle type designation system is allowed for new inspections for vehicles, and therefore vehicles, having the same and uniform structure, equipment and performance, are normally mass-produced, if confirmation is made that the structure, equipment, and performance of vehicles pertaining to an application for Vehicle Type Designation comply with the Safety Standards and the vehicles are uniform, new inspections are not necessary for each mass produced vehicle; thereby new inspections are streamlined. In light of the objectives of this system, it can be understood that the vehicles used for the data measurements submitted when applying for Vehicle Type Designation are assumed to have the same properties, etc. as mass production vehicles.

When applying for Vehicle Type Designation, the applicant must submit to the Minister of Land, Infrastructure, Transport and Tourism a document stating the structure, equipment, and performance of the vehicle (a table of specifications) as an attachment to the application form.[323] One of the items that must be included in the table of specifications is "an entry of the maximum output value during a full load operation[324] measured according to the Testing Rules attached to the Facility Examination Affairs Rules"[325, 326] Therefore, when obtaining Vehicle Type Designation, it is necessary to submit a table of specifications stating the maximum output value under full load operation measured by the method specified in the Testing Rules attached to the Facility Examination Affairs Rules.[327]

EU laws and regulations[328] provide that it is acceptable if the measured values in the output measurement are within ± 2% of the maximum output value for which the applicant provided notice (i.e., a tolerance of ± 2% is permitted), but domestic laws and regulations do not contain any provisions relating to the tolerance of the output measurement.[329]

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323 Vehicle Type Designation Regulations, Article 3, Paragraph 2, Item 1; and Approval Implementation Guidelines, Attachment 1 Vehicle Type Designation Implementation Guidelines, No. 3 and Appended Table 1.

324 Operating the engine in a condition with the fuel injection device fully open, i.e., operating the engine under conditions of maximum load.

325 Approval Implementation Guidelines Supplementary Rule 5, No. 2, 1-33.

326 A test conducted in accordance with the Testing Rules attached to the Facility Examination Affairs Rules is referred to as a "Motor Vehicle Engine Output Testing (Diesel Engine)."

327 This is also the case when applying for device type designation of carbon monoxide, etc. emissions control devices (Designation Standards Vol. II, 3.2; Attachment 2-1, 2.(1)).

328 Annex I, No. 6.1. of Council Directive 80/1269/EEC

329 However, Approval Implementation Guidelines Supplementary Rule 5, No. 2, 1-33 proviso provides with respect to the maximum output stated in the table of specifications that for the time being, the EEC Directive, i.e., the test methods specified in EU laws and regulations, may be used. Therefore, it is understood that in the case where an applicant elected to measure the maximum output stated in the table of specifications using the test method specified in EU laws and regulations, the provisions of the EU regulations that allow for the ± 2% tolerance specified above would apply.

2 Status of Toyota Industries' participation in development of engines for automobiles

Of the current models of vehicles [330] for the domestic market that received Vehicle Type Designation, etc., with Toyota Motors as the applicant, Toyota Industries developed the engines listed below under contract from Toyota Motors. In addition, Toyota Industries measured output during the development stage, and submitted to Toyota Motors the results as the underlying data for the table of specifications to be submitted at the time of application for Vehicle Type Designation, etc.

Engine	Vehicles using the Engine
1GD Engine[331]	HiAce[332]
	GranAce
	Land Cruiser Prado
	Dyna[333]
	Coaster[334]
2GD Engine	Hilux
F33A Engine	Land Cruiser

The general flow of Toyota Industries submitting the output measurement results to Toyota Motors is as described below.

The Toyota Industries group responsible for automotive engine calibration work measures output at the stage when a Mass Production-Equivalent Engine is completed and measures data relating to the engine output including maximum output during full load operation in accordance with the method

330 All of these vehicles received Vehicle Type Designation, etc., with Toyota Motors as the applicant, and as the applicant, Toyota Motors submitted the table of specifications to the Minister of Land, Infrastructure, Transport and Tourism.

331 Among automobiles equipped with the 1GD Engine, the Dyna and the Coaster are classified as heavy-duty automobiles (i.e., standard or light-duty automobiles with a gross vehicle weight exceeding 3.5 tons). Therefore, for the 1GD Engine installed in the Dyna and the Coaster, emission measurements are conducted on the engine alone (see Attachment 41 to the Public Notice on Details "Emission Measurement Methods for Heavy-Duty Automobiles"). In contrast, since automobiles other than the Dyna and the Coaster are not classified as heavy-duty automobiles, emission measurements are conducted while the engines are installed in those automobiles (see Attachment 42 to the Public Notice on Details "Emission Measurement Methods for Light/Medium-Duty Automobiles").

332 Toyota Motors sells (OEM supply) HiAce using the 1GD Engine to Mazda Motor Corporation after obtaining its vehicle type designation, and Mazda sells it as Bongo Brawny Van.

333 Toyota Motors sells the 1GD Engine used in Dyna to Hino Motors, Ltd.; the engine is also used in Hino Dutro, for which Hino obtained vehicle type designation.

334 Toyota Motors sells (OEM supply) Coaster using the 1GD Engine to Hino Motors, Ltd. after obtaining its vehicle type designation, and Hino sells it as Liesse II.

specified in the Testing Rules attached to the Facility Examination Affairs Rules.

There are instances where the output measurement of engines pertaining to type designation applications is conducted in the presence of an examiner or other such person ("**Witnessed Output Test**") and instances where measurement is conducted not in the presence of an examiner or other such person with the approval of the Automobile Type Approval Test Department ("**In-House Output Test**").[335]

In cases where an In-House Output Test was conducted, after conducting the In-House Output Test, the group responsible for engine calibration work submitted to Toyota Motors a test performance sheet and engine performance curve diagram[336] indicating the results of the In-House Output Test and reported the results at a meeting held to determine the specification values including the maximum output.[337]

In contrast, in cases where a Witnessed Output Test was conducted, after confirming the engine performance to be used for the Witnessed Output Test, the results were reported at the meeting above, and after determining the specification values including the maximum output, the Witnessed Output Test was implemented.

In-House Output Tests were conducted for all of the engines subject to investigation by the Committee.

3 Details of improper conduct found in investigation, etc.

As a result of the investigation by the Committee, it was discovered that the fuel injection amounts were modified in some rotation speed ranges including the maximum output point when In-House Output Tests were conducted for the engines developed by Toyota Industries under contract from Toyota Motors specified in 2 above.

The background and so forth to the modification of the fuel injection amounts in the In-House Output Tests for the 1GD Engine and the 2GD Engine are as follows.[338]

As discussed in 1 above, domestic laws and regulations do not contain any provisions concerning

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335 Toyota Industries did not participate in the decision of whether to conduct Motor Vehicle Output Testing in the presence of an examiner or not.

336 The engine performance curve diagram is referred to as a torque curve and indicates how output and torque change as the engine rotation speed changes.

337 Based on the reports from Toyota Industries, Toyota Motors decided which values to adopt as the specification values, and Toyota Industries did not participate in the determination of specification values.

338 It was discovered that the fuel injection amount of the ECU Software used for the In-house Output Test of the F33A Engine differed from the ECU Software for Mass Production, and it was recognized that similar improper conduct occurred with regard to the 1GD Engine and 2GD Engine. It was possible to interview only some of the engineers involved, and as a result, it was not possible to elucidate the detailed background.

the tolerance in relation to the maximum output specification value.[339] The engineers in charge at the Engine Calibration Group were aware that a tolerance is not permitted in the output measurements under domestic laws and regulations and that the actual measured value of the maximum output in In-House Output Tests must exceed the maximum output value that was planned to be stated in the table of specifications (this is the output development target value). However, even if the output development target value was achieved in the development stage, with regard to each individual engine manufactured on a mass production line, it was possible that the actual measured output value at the maximum output point would be slightly less than the development target value due to variations in performance caused by individual differences in components such as the injectors or the weather conditions on the test day. It was also possible that the actual measured output values would be higher or lower than expected due to the types of factors specified above in rotation speed ranges other than the maximum output point. If these upward or downward deviations in the actual measured values accumulate in each rotation speed range, the torque curve would become distorted and the engineers in charge at the Engine Calibration Group were concerned that if such distortion of the torque curve were presented as a result of In-House Output Tests, doubts would arise concerning the engine performance and other matters during meetings with Toyota Motors.

Thus, even if it were assumed that variations in performance would occur, the engineers in charge at the Engine Calibration Group modified the fuel injection amount to ensure that the output value at the point of maximum output would reliably exceed the development target value and the output values would not be significantly higher or lower in each rotation speed range.

The specific method that the engineers in charge at the Engine Calibration Group used to modify the fuel injection amounts was as follows. First, when the engine to be used to measure output for the in-house test was determined, to check performance, the engineers in charge measured the output of the said engine using the ECU Software for Mass Production with no modification of the fuel injection amount. From this confirmation of performance, the degree to which measured output values would deviate above or below and in which rotation speed ranges became clear, and based on this, the engineers in charge determined the rotation speed ranges at which the fuel injection amount was to be changed and the amount of change of the fuel injection amount in each rotation speed range. Also, when actually changing the fuel injection amount, the engineers in charge used either or both of the methods of rewriting the Control Parameter values relating to the fuel injection amounts in the ECU Software and the method of directly modifying the fuel injection amount using a device known as a

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339 As stated above, in the case where the applicant elects to take measurements using the test method specified in EU laws and regulations concerning the maximum output stated in the table of specifications, it is understood that the provisions of the EU laws and regulations permitting the ± 2% tolerance referenced above are applied; however, Toyota Motors did not elect to measure maximum output using the test method specified in EU laws and regulations for these engines.

calibration tool[340] during the In-House Output Test.

The engineers in charge, at the instruction of and with the approval of the Working Group Leaders and Group Manager, modified the fuel injection amounts in the In-House Output Tests. The employees who participated in this improper conduct were aware that modification of the fuel injection amounts in the In-House Output Tests was improper conduct, but they stated that they confirmed during the development stage that the development target values were achieved within the 2% tolerance permitted under EU laws and regulations, and therefore believed that even if the development target values became the specification values, this would not be considered falsifying the underlying output engine performance, and that similar conduct had been widely practiced in the Engine Calibration Group for some time, leading to this improper conduct.

As discussed in 1 above, however, it is understood that the structure, equipment, and engine performance used when measuring data that serve as the basis for specification values must be the same as those for mass production engines, and therefore, modification of the fuel injection amounts only for the engines used for In-House Output Tests can be deemed improper conduct as a modification of the structure, equipment, and engine performances used for In-House Output Tests to differ from the structure, equipment, and performance of the mass production engines.

It should be noted that the maximum output values in the Mass Production Sampling Inspections of these engines all satisfied the shipment standard values.[341, 342]

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340 The calibration tool is a device generally used during engine calibration work. The calibration tool has a function for monitoring whether the ECU Software is issuing instructions to the engine in accordance with the Control Parameters and a function that directly instructs the injector to inject an amount of fuel regardless of the ECU Software Control Parameters. By using these functions, the fuel injection amount can easily be modified without rewriting the ECU Software every time, and it is also possible to confirm the resulting degree of change in the output.

341 Toyota Industries set the shipment standard values of engines for automobiles at ±5% of the maximum output value stated in the table of specifications. Toyota Industries set the shipment standard values to ±5% because the Agreement Regulations and EU laws and regulations provided that the output value measured in a shipping control test must be within ± 5% of the maximum output reported value (Annex 7, No. 4.1 of UN Regulation No. 85; Annex II, No. 6.1. of Council Directive 80/1269/EEC). The Agreement Regulations are "the regulations annexed to the Agreement concerning the adoption of harmonized technical United Nations Regulations for wheeled vehicles, equipment and components which can be fitted and/or be used on wheeled vehicles and the conditions for reciprocal recognition of approvals granted on the basis of these United Nations Regulations" (Public Notice on Details, Article 2, Paragraph 1, Item 8), and were established by a multilateral agreement of the United Nations Economic Commission for Europe with the aim of establishing uniform standards and reciprocal recognition regarding the safety and environmental performance of automobile structures and equipment.

342 No finding was made that the ECU Software for Inspection was modified from the ECU Software for Mass Production in Mass Production Sampling Inspections of engines for automobiles.

Part 6. Inadequacies in Organizational Systems Intended to Ensure Development and Production Compliant with Laws and Regulations

The results of the Committee's investigation revealed that there were inadequacies in the organizational systems intended to ensure development and production compliant with laws and regulations. The specifics are as follows.

1 Inadequacies in QMS in Engine Division

(1) Overview of QMS

QMS stands for "quality management system" and refers to the mechanisms by which a company ensures and continually improves the quality of the products it provides to customers. A key point in constructing QMS is the construction and enforcement of processes and mechanisms; it is vital to define standards and procedures and, on that basis, to clarify the authority and responsibilities of constituent members within organizations, and enforce them properly.

The representative international standard for QMS is ISO9001.[343] ISO9001 is a standard that covers all industrial sectors, and in response to it, with a focus on the Big Three automakers in the United States,[344] the QS9000 dedicated automotive industry standard was enacted in 1994, after which, in 1999, ISO/TS16949 was issued as an automotive industry standard integrated with the ISO standards. Thereafter, in 2016, in conjunction with the revision of ISO9001, IATF16949[345] was issued as a standard for the automotive industry.

The Engine Division formerly had obtained certification under international QMS standards through the machinery and assembly departments and foundry departments, but both of these certifications had been relinquished by 2009.[346]

It is pivotal to the establishment of QMS to define standards and criteria for managing processes and procedures, and the Engine Division has constructed a document-based system, at the apex of

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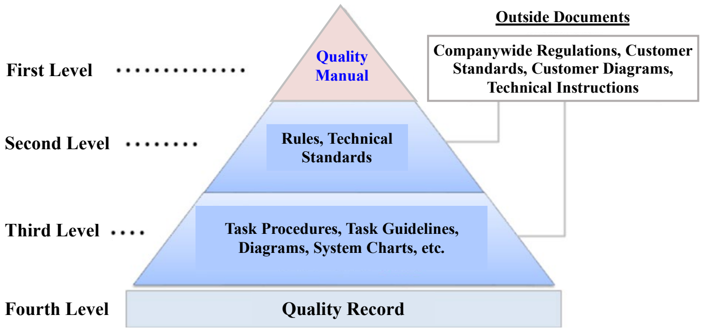
343 ISO stands for International Organization for Standardization, a non-governmental organization headquartered in Geneva, Switzerland. ISO9001 is a quality standard.

344 I.e., General Motors, Ford, and Chrysler.

345 IATF stands for International Automotive Task Force. IATF16949 is a standard that was created with the involvement of nine European and American automakers, and automotive-related organizations.

346 Specifically, the machine and assembly departments of the Engine Division acquired QS9000 standard certification in 1999, transitioned later to ISO/TS16949, and relinquished ISO/TS16949 in 2007. Likewise, the foundry departments of the Engine Division acquired ISO9001 certification in 2008 and relinquished it in 2009. As regards the reasons for relinquishing international standard certification, a person connected with the Quality Management Dept. cited concerns that QMS would be reduced to a mere formality because the focus would be entirely on dealing with audits by the certifying organization.

which stands the "Quality Manual". The broad policy described in the Quality Manual delves into specific rules and technical standards, and, in order to realize the matters set forth in those rules and technical standards, also stipulates task procedures and task guidelines etc. (hereinafter, the rules, technical standards, task procedures, task guidelines, and other subordinate models are sometimes collectively referred to as "**rules etc.**"). Each individual task performed in accordance with the task procedures and task guidelines is to be recorded accurately in a quality record. In addition, internal audits are used to check that tasks have been performed in accordance with task procedures and that quality records have been accurately recorded, and any issues thus discovered are improved by as revising the rules etc. or through other such methods. QMS is intended to realize the continuous improvement of quality management through the repetition of this process (known as a "PDCA cycle").



In this document-based QMS system, the Quality Manual at the apex is obviously essential, but it is equally important for the rules etc. to be fully developed. The laws and regulations related to quality are vast and complex, and it is not realistic to expect every employee to perform development work with laws and regulations in hand every day. If regulatory requirements are incorporated into rules etc. and employees conduct their work in accordance with those rules etc., it is naturally necessary to have mechanisms in place to ensure that development work is in accordance with regulations.

(2) QMS issues in Engine Division

Having obtained the Quality Manuals and their subordinate rules etc. and then received explanations of the Engine Division's QMS from persons connected with the Quality Assurance Dept., the Committee believes that the Quality Manuals stipulated by the Engine Division are in themselves compliant with international standards[347] and not problematic in terms of content. However, from the perspective of what is incorporated into rules etc., some issues were found, particularly with regard to development.

The recently discovered improper conduct included many cases where not only engineers in charge but managers engaged in such conduct without a clear understanding that it was contrary to regulations. We believe this could have been prevented had rules etc. regarding development work been fully in place.

347 Specifically, ISO/TS16949 and its revised version, IATF16949.

Below, we provide specific examples illustrating that rules etc. were not fully in place in the Engine Division.

A. Inadequacies in development reference timetables

The Engine Division had no rules etc. providing for development reference timetables.

Development work is in a sense a battle with timetables, in which the people directing development want to make the development schedule as short as possible, but shortening the development schedule deprives on-site engineers in charge of even the time needed to perform indispensable work; this can be one of the factors that leads to improprieties. A development reference timetable is a "touchstone" for determining whether a development schedule is appropriate, and acts as a brake on the stipulation of unreasonable development schedules. The Engine Division, however, had rules etc. for DR in place to some extent but had no rules etc. providing for development reference timetables, and thus was in a condition where it had no "touchstone" for determining the advisability of its development schedules.

Further, with regard to deterioration durability testing in particular, deterioration durability testing is testing intended to confirm whether the emissions of mass-produced vehicles can be said to satisfy regulations, and such testing is meaningless if not conducted at a stage where emissions performance for mass-produced vehicles is essentially finalized. Therefore, by nature, a development reference timetable would have had to stipulate the particular stage of development after which deterioration durability testing was to be conducted, but the Engine Division had provided no rules specifying the temporal relationship between DR and deterioration durability testing.

These inadequacies regarding development reference timetables seem to have been one of the causes of the occurrence of the recently discovered improprieties. The engine development process in which said improprieties occurred appears, in most models, to have begun deterioration durability testing at a stage when Control Parameters for emissions performance were not yet determined. This was because the development schedules were fundamentally unrealistic, which left no alternative to conducting deterioration durability testing at too early a time, and there were cases where this resulted in design changes for emissions performance being made while deterioration durability testing was in progress. Fundamentally, there should have been development reference timetables, and development schedules should have been evaluated on the basis of those timetables, from the initial stage of development, to ensure that they were reasonable. We believe these improprieties could have been prevented had the schedules been evaluated in this way.

B. Inadequacies regarding rules etc. on deterioration durability testing

In connection with A above, the Engine Division had no rules etc. stipulating how deterioration durability testing was to be conducted, nor any rules etc. stipulating how emissions measurement testing in the development stage was to be conducted.[348]

It can be said that rules etc. on deterioration durability testing must explicitly state, for example, that such testing is to be conducted on engines comprising the same structures, devices, and emissions performance as mass-produced engines, after the Control Parameters for emissions performance are broadly finalized; and that the ECU Software used for deterioration durability testing and Witness Tests must be basically the same as ECU Software for Mass Production.[349]

In addition, many of the recently discovered quality improprieties, including the fact that, in deterioration durability testing, only catalysts and O2 sensors were removed and mounted to engines installed on Measurement Benches to measure emissions, the fact that components were replaced with no report to authorities in the middle of deterioration durability testing and the replaced components were not retained, and the fact that only parts of data that had been measured multiple times were reported to authorities, can be regarded as improprieties which could have been easily prevented by incorporating regulatory requirements into the rules etc., and do not seem to have been of a nature that would have made them difficult to account for in the rules etc. The lack of rules etc. that made provisions on these points appears to have been a precipitating cause of the improper conduct.

C. Inadequacies in rules etc. in Quality Assurance Dept.

Improper conduct that occurred because of inadequacies in rules etc. was found in the Quality Assurance Dept., which is the linchpin of QMS.

As was detailed in Part 4-7 above, improper incidents were found in the Quality Assurance Dept. in which Control Standard Values and Control Limit Values were set without following the methods specified in the Inspection Method in Mass Production Sampling Inspections conducted after the mass production stage had begun, and a major factor behind these incidents was the fact that, at the time, Audit Group-issued documents called "serial memos", which listed values based on the Control Limit Values and Control Standard Values set forth in the Inspection Method, were scattered around, thus making it impossible to determine which serial memo's Control Limit Values and Control Standard Values were appropriate, or whether the Control Limit Values and Control Standard Values stipulated in the Inspection Method were calculated properly. Regarding this point, the Emission Control

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[348] The Engine Division rules etc. related to measurement testing of emissions include the "Guideline on Emissions Measurement Testing for Diesel Special Motor Vehicles" and the "Guideline on Emissions Measurement Testing for Petrol Special Motor Vehicles". However, both of these rules etc. are internal regulations of the Quality Assurance Dept. which apply only to emissions measurement testing in Mass Production Sampling Inspections etc. conducted by the Quality Assurance Dept.; they do not apply to emissions measurement testing such as deterioration durability testing conducted at the development stage by engineering departments.

[349] We believe there may be some leeway to allow ECU Software Control Parameter changes to an extent that will not affect emissions performance, but even so, the rules etc. must make clear the types of cases in which changes in the particulars of ECU Software are allowable.

Guideline, an internal regulation of the Quality Assurance Dept. that sets forth the method of conducting Mass Production Sampling Inspections,[350] stipulates, regarding the management targets for Control Standard Values of emissions, that it should be confirmed that the average of the emission values for the five most recently sampled engines does not exceed the Control Standard Value, and also stipulates the method of calculating such Control Standard Value, but does not indicate which ledger should be used to record calculated Control Standard Values or which ledger should be referenced when confirming that average values do not exceed the Control Standard Value. It can be said that the abovementioned improper conduct would have been amply preventable if such provisions had existed, and it does not appear that it would have been difficult to establish such provisions in the Emission Control Guideline at the time.

Regarding the content of the Emission Control Guideline at such time, a person connected with the Quality Assurance Dept., has stated, “Unfortunately, the rules etc. of the Engine Group at the time were in place to around that extent, and it actually would have been better to make detailed provisions in the rules etc. as of such time.” It must be said the establishment and management of rules etc. was inadequate even at the very linchpin of QMS, i.e., in the Quality Assurance Dept.

In addition, the inadequacies in rules etc. for Mass Production Sampling Inspections were one of the causes of the late discovery of the abovementioned improper conduct. More specifically, at the time, the rules etc. on Mass Production Sampling Inspections for engines for industrial vehicles for domestic market contained no internal regulations specifying who, when and through what procedures, would conduct the inspections, or who, in what way, would confirm whether inspections were conducted at the exact sampling frequency specified in the Inspection Method. The fact that Mass Production Sampling Inspections were not conducted at the frequency specified in the Inspection Method was not seen as a problem in the Quality Assurance Dept. for many years, but it appears that, if such internal regulations had existed, these problems could have been discovered early within the company and promptly resolved.

(3) Current initiatives to establish rules etc.

In response to the discovery of the present improprieties, Toyota Industries is examining the state of establishment of rules etc. for deterioration durability testing etc. and is moving forward with work to enact or revise the rules etc. that were flawed. Looking ahead, it is expected that adjustments will be made to the rules etc. that were flawed, including to accommodate rules etc. regarding such matters as development reference timetables and deterioration durability testing implementation methods.

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[350] Official name: “Emissions Control Guideline for Domestic Industrial Vehicles”.

2 Vulnerabilities of Quality Assurance Dept.

(1) Vulnerabilities of internal audits

Internal audits are an important function exercised by the Quality Assurance Dept. to establish QMS.

What is prioritized in QMS is processes and procedures, and in internal audits as well, the focus of the audit is whether work is being performed in accordance with defined processes. Examples of the development processes where improprieties have recently been discovered include instances where the audit was to cover whether there were mechanisms in place that made it possible to develop products in conformity with regulations and to apply for certification properly, whether development was carried out properly in accordance with such mechanisms, and whether the management levels of engineering departments were functioning.

However, the internal audits by the Quality Assurance Dept. did not entirely fulfill the functions naturally expected of them.

First of all, the Hekinan Plant, which was the Engine Division's machinery and assembly department, relinquished QMS international standard certification in 2007 but was never once internally audited by the Quality Assurance Dept. in the ensuing period from 2008 to 2011. It is not entirely clear why internal audits were not conducted even though the Internal Quality Audit Implementation Guidelines at such time specified that such audits were to be conducted every year, but a person connected with the Quality Assurance Dept., stated that "previously, the internal audit plan would be set up by the engineer in charge who served as a contact with the certifying authority, but there was no such engineer after we relinquished the standards, so this may have been why the internal audits stopped being conducted". Whatever the case, it is clear that the Quality Assurance Dept. did not fully recognize the importance of conducting internal audits.

Further, as detailed in 1(2) above, it appears that the inadequacies in the rules etc. were also a hindrance to the Quality Assurance Dept.'s performance of internal audits. An internal audit must check whether tasks are being carried out in accordance with rules etc., but if there are no rules etc. in the first place, it is difficult for the internal audit to pick up on problems.

Moreover, the fact that there were inadequacies in the rules etc. in the first place is something that should have been identified as a problem in a process audit, which is one type of internal audit. Yet in actuality, no past internal audit noted as a problem the lack of rules etc. regarding development reference timetables or deterioration durability testing. Regarding this point, a person connected with the Quality Assurance Dept., has stated, "Fundamentally, the inadequacies in the rules etc. should have been discovered in a process audit. I think the reason they were not identified as problems in a process audit may have been that, because the phrase 'deterioration durability testing' never appears in the Quality Manual, it was not understood that rules etc. on deterioration durability testing needed to be in place." It appears that the Quality Assurance Dept. fundamentally lacked the attitude of proactively and responsibly conducting process audits from the perspective that there may be inadequacies in the rules etc.

Additionally, internal audits by the Quality Assurance Dept. did not conduct checks in which, even as samples, individual engines were taken up, and raw data or materials etc. from the time of development were referenced, to check whether engines in conformity with regulations were being developed or whether there was improper conduct during certification applications.

Needless to say, a sample check would have confirmed only a small part of raw data chosen from among a wide range of testing data, and thus would not have been highly likely to discover the improprieties. But the purpose of an internal audit is not only the discovery and remedy of improper or inappropriate conduct. One of the essential and natural functions of such an audit is to instill in employees the consciousness that “an internal audit may discover improprieties”, and thus to prevent improprieties before they happen. Regarding this point, the previous internal audits by the Quality Assurance Dept., in which sample checks were not conducted, entailed no such sense of urgency for employees. In fact, in many of the recently discovered improprieties, conditions where test results had been manipulated were carefully recorded as data and saved brazenly on shared servers etc. without any attempt at concealment; this can be said to show that employees of the Engineering Office did not in any way comprehend the possibility that an internal audit might discover improprieties. Thus, the previous internal audits by the Quality Assurance Dept. did not adequately provide the preventive effect against improper conduct that an internal audit by nature ought to have.

(2) Lack of substantive involvement in development processes

A quality assurance department is the department primarily responsible for assuring the quality of products shipped to market, but its role is not limited to the product production stage. In other words, a quality assurance department is required, even during product development, to check the state of development from the perspective of whether products, when mass produced, will be products that conform to regulations even in light of the variations between them, and to remedy any problems there may be. Regarding this point, the role of DR in individual engine development is to confirm whether engines in conformity with regulations are being developed and whether certification applications are being carried out properly. Engineering departments have an undeniable tendency to focus their energy on pushing development forward. This is decidedly not an unhealthy thing, as it is indispensable for the advancement of business that engineering departments push product development forward with high motivation and strong driving force. However, this is precisely why there must be checks against engineering departments, and a quality assurance department has a major role to play in this regard.

However, at the time the recently discovered improprieties occurred, the Quality Assurance Dept. was not playing an entirely adequate role in engine development processes.

To be exact, conventionally, although the General Manager of the Quality Assurance Dept.

participated in all DR and was involved in development processes per se, the Quality Assurance Dept.'s substantive involvement in DR was at the stage of mass production prototype evaluation (the stage at which the Quality Assurance Dept. conducted development tests of Mass Production-Equivalent Engines to confirm whether they met development targets), and there is a strong impression that its participation in DR prior to that stage was purely to acquire reference information. In addition, when development target values were set for emissions, the Quality Assurance Dept. was not involved in those decisions, which were made by the Engineering Dept. alone. Furthermore, as detailed above, the engines for which improper conduct recently has been discovered included some engines that appear to have had unreasonable development schedules, and for most of the engines, deterioration durability testing began at a stage before emissions performance was finalized. Yet there is no discernible trace in the DR of anyone connected with the Quality Assurance Dept. pointing out that the schedule was unreasonable or that there were problems at the beginning of deterioration durability testing.

It was an inevitable consequence of the lack of substantive involvement in development processes that the Quality Assurance Dept. failed to verify whether deterioration durability testing in development processes was conducted appropriately and in accordance with regulations. To begin with, there appears to have been no clear understanding among the related parties involved in developing engines for industrial vehicles about who supervised the proper implementation of deterioration durability testing. A person connected with the Quality Assurance Dept. stated, in the Committee's interviews, "It was not clearly determined whether TMHC or the Engine Division was the process owner with regard to engines for industrial vehicles. Who supervised the conditions of deterioration durability testing was also not clearly determined, and it was not the case that the Quality Assurance Dept. was in charge of that role."

(3) Vulnerabilities of staff

As detailed in (2) above, the Quality Assurance Dept. was substantively involved in the development process and thus was expected to act as a check on the engineering departments, but this required that the Quality Assurance Dept. have staff with enough technical knowledge and experience to allow them to point out development problems to the engineering departments. However, the Quality Assurance Dept. at such time did not have staff with that technical knowledge and experience. A person connected with the Quality Assurance Dept. stated, in the Committee's interview, that "the Quality Assurance Dept. had nobody with specialized knowledge of emissions and wasn't in a condition that would have enabled it to voice opinions on development target values in the first place".

The problem of staff deficiencies among the people connected with the Quality Assurance Dept. appears to have led to functional incompetence in the Quality Assurance Dept. with regard to mass production prototype evaluations. A person connected with the Quality Assurance Dept. has stated, "Testing was performed using a Measurement Bench managed by the Quality Assurance Dept., and we naturally thought that we would be able to obtain results confirmed by the Engineering Dept. When we could not obtain results confirmed by engineering departments, the Engineering Dept. would say that 'the measurement methods were bad' and we would be unable to argue against this, so the test would be repeated until results confirmed by the Engineering Dept. were obtained".

Further, in addition to the problems of technical knowledge and experience with regard to development operations, the Quality Assurance Dept. also must be said to have had inadequate understanding and awareness in the field of quality control, which was its area of fundamental responsibility. As detailed in 1(2)C etc. above, in Mass Production Sampling Inspections conducted by the Quality Assurance Dept., the scattering of "serial memos" led to the impropriety in which not the Control Standard Values and Control Limit Values stipulated in the Inspection Method, but the regulation average values and regulation maximum limit values specified in regulations after deducting deterioration correction values, were used as the Control Standard Values and Control Limit Values. The "serial memos" were important materials detailing the values serving as the basis of the Control Limit Values and Control Standard Values set forth in the Inspection Method, and the fact that these were scattered about indicates in itself that the Quality Assurance Dept. did not fully recognize the importance of properly setting Control Limit Values and Control Standard Values. Further, Control Limit Values and Control Standard Values are values that are set in order to confirm statistically, through Mass Production Sampling Inspections, that emissions performance for all products satisfies regulation values, on the assumption that there will be some level of variation in the emissions performance of mass-produced engines; had the purpose and aims of setting these Control Limit Values and Control Standard Values been understood, we believe that there would have been adequate recognition that these values need not be equal to the regulation average values and regulation maximum limit values specified in regulations after deducting deterioration correction values. The fact that the regulation average values and regulation maximum limit values specified in regulations after deducting deterioration correction values were nonetheless blithely set as the Control Standard Values and Control Limit Values can only be taken to mean that there was not sufficient understanding or consciousness of quality control in the first place.

(4) Lack of basic awareness and attitude required of Quality Assurance Dept.

As detailed in (1) above, the Quality Assurance Dept. failed to conduct internal audits, in violation of the provisions of Internal Quality Audit Implementation Guidelines, failed to conduct responsible and proactive process audits to find inadequacies in the rules etc., and in this sense appears to have lacked the basic awareness and attitude required of a quality assurance department, which is the linchpin of QMS.

This is clear from the improper conduct in the Mass Production Sampling Inspections discussed in detail in Part 4-7 above. More specifically, even though the Inspection Method made provisions regarding the sampling frequency for Mass Production Sampling Inspections, inspections were not actually conducted at the sampling frequency specified in the Inspection Method. With regard to the cause of this, a person connected with the Quality Assurance Dept. conjectures that there was tenuous awareness among the engineers in charge that the sampling frequency specified in the Inspection Method was merely a self-imposed rule and had to be strictly complied with. Mass Production Sampling Inspections for carbon monoxide, etc. emissions control devices that have received device type designation are a self-imposed inspection system incorporated into the certification system under the Vehicle Act and should be regarded as the same as regulations, but whatever the details, insofar as a rule has been established in the form of an internal regulation, it naturally follows that sampling inspections should be conducted in compliance with the Inspection Method, and the fact that the rules etc. were neglected because they were an internal regulation, and tasks in accordance with said rules were thus not carried out, can only be regarded as indicating a lack of a basic compliance attitude.

(5) Problems in Head Office Quality Management Dept.

The existence of vulnerabilities in the Quality Assurance Dept. can only be taken to point to problems with the Head Office Quality Management Dept.

The Quality Management Dept. was expected to support the construction of robust quality assurance systems in the Toyota Industries Group by supporting the establishment of regulations and guidelines related to quality assurance for each business division, but, as was detailed in 1(2) above, even the Quality Assurance Dept. had flawed rules etc., and this was one of the causes of the improper conduct. In this regard, the Quality Management Dept. cannot be said to have played its role properly.

Likewise, from 2008 to 2011, no internal audits by the Quality Assurance Dept. were conducted at all, yet there is no discernible trace of the Quality Management Dept. regarding this as a problem or urging its remedy. Further, the Quality Assurance Dept.'s lack of substantive involvement in development processes and failure to allocate adequate staff can be regarded, by their nature, as things the Quality Management Dept. should have ascertained as problems and remedied in the course of supporting the Quality Assurance Dept., so the Quality Management Dept. cannot be said to have been adequately responsive in this regard either.

(6) Current initiatives to strengthen Quality Assurance Dept.

As was discussed in detail in Part 3-3 above, on June 1, 2021, Toyota Industries executed a drawing etc. transfer agreement with Toyota Motors, making Toyota Industries the principal of engine development in both reality and name. In response, the Engine Division decided to strengthen QMS for engine development processes, revised the Design Review Rules on June 30, 2021, and introduced

QMS along the model of Toyota Motors into its development processes. Under the revised Design Review Rules, a mechanism was introduced into DR in which the Quality Assurance Dept. was to screen and judge the content of engineering department reports,[351] thus systematically securing the Quality Assurance Dept.'s involvement in DR.

In addition, to strengthen the check function of the Quality Assurance Dept., approximately 30 employees, including some originating from the Engineering Dept., are to be additionally installed in the Quality Assurance Dept. to strengthen the staff front.[352]

Furthermore, Toyota Industries has moved forward with initiatives to improve internal audits by the Quality Assurance Dept., and is considering such measures as strengthening audit functions through the introduction of sample checks, the identification of quality risks, and the specification of audit subjects on the basis thereof, as well as having the Head Office Quality Management Dept. perform audits of whether the internal audits conducted by the Quality Assurance Dept. are functioning effectively.

In addition, as was detailed in Part 1-7(1) above, in order to strengthen the Quality Management Dept.'s managerial and supervisory function over divisions, initiatives for strengthening quality governance systems by having the Quality Management Dept. conduct quality audits of such divisions have begun.

3 Inadequacies in systems for Regulation Certification Work

(1) Previous system for Regulation Certification Work at Toyota Industries

Toyota Industries established the Regulation Certification Office in the Engine Division in March 2021, and then, in September of the same year, raised the Regulation Certification Office to departmental status, establishing the Regulation Certification & Administration Dept. as a dedicated department specializing in Regulation Certification Work. Before the establishment of these departments, however, Regulation Certification Work was overseen by employees of the Engine Calibration Group.

Toyota Industries thus had no dedicated department responsible for Regulation Certification Work until the establishment of the Regulation Certification Office and Regulation Certification &

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351 For details, see Part 3-3 above.

352 In addition, as detailed in Part 3-3 above, a mechanism has been introduced in engineering departments under which, in DR, employees of departments other than engineering departments who were not directly involved in the development of the engines in question would review the appropriateness of development processes as "function supervisors", thus strengthening the internal check systems of engineering departments.

Administration Dept. in 2021.[353]

(2) Harmful effects of absence of dedicated department responsible for regulation certification

A. A lack of information gathering about and accurate understanding of regulations

As has been stated repeatedly, the recently discovered improper conduct includes many cases where not only engineers in charge but managers engaged in such conduct without a clear understanding that it was contrary to regulations, and one of the causes of this appears to have been that there was no dedicated department responsible for regulation certification and information gathering and interpretation regarding regulations was left to individual engineers in charge in the Engine Calibration Group, thus creating an organization-wide deficit of understanding about regulations.

For example, an engineer in charge of engine calibration work for the 1KD Engine and 1ZS Engine, told the Committee, "Because there was no dedicated department for Regulation Certification Work, Engine Calibration Group employees who were not experts were forced to analyze the content of complex and abstruse legal regulations". Likewise, an engineer in charge of engine calibration work for the 2009 4Y Engine, told the committee, "The Assistant General Manager and Group Manager would have engineers in charge take care of interpreting regulations, just by telling them to obtain engine certification in time for the mass production launch date for forklifts. But the engineers in charge were responsible for handling defects in already-sold vehicles in addition to engine calibration work and could not block out enough time to interpret regulations, so deterioration durability testing was conducted without a full understanding of the content of regulations".

The absence of a dedicated department responsible for regulation certification appears to have been one of the causes of the improprieties committed in Mass Production Sampling Inspections. As was detailed in Part 4-7(3)D, in the Mass Production Sampling Inspections for the 1KD Engine, the MTS was not in conformity with regulations, and this was because there was nobody in the Quality Assurance Dept. who checked for revisions of regulations and evaluated whether equipment status, testing conditions and the like were in conformity with regulations. Originally, the view was that it was not realistic to have Quality Assurance Dept. employees that were engaged in Mass Production Sampling Inspections as day-to-day work check routinely for regulatory revisions during spare

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353 It bears noting that, in response to a January 2012 proposal to create a dedicated department responsible for regulation certification from Group Manager at the Engine Calibration Group, one engineer in charge of regulation certification was installed as a specialist in the Engine Division, but because of human resource issues and other such factors, no dedicated department responsible for regulation certification was created at such time. In addition, such engineer in charge became overwhelmed with work to gather information related to regulations in a foreign country (China) and was not fully able to provide information related to regulations in the United States and other countries or regions, so the situation persisted in which the Engine Calibration Group was forced to handle negotiations with the EPA and other authorities.

moments in their inspection work, but it seems that having a dedicated department for gathering information on regulations and spreading that information on site would have prevented the use of MTS not in conformity with regulations in the Mass Production Sampling Inspections for the 1KD Engine. Regarding this point, it seems that, had accurate information on regulations been provided to the Quality Assurance Dept., the Mass Production Sampling Inspections would have been conducted using MTS in conformity with regulations, and this would have made it possible to detect that the PM values for 1KD Engine emissions exceeded the regulation values. It must be said that the impact of this would have been significant.

B. Lack of a check function

A department in charge of regulation certification is, by its nature, expected to be independent of engineering departments, to verify, from the viewpoint of a third party, that the development schedule, deterioration durability testing implementation methods, certification application document preparation methods, and other such matters formulated by engineering departments are unproblematic from a regulation certification perspective, and to impartially note, and order the engineering departments to improve, any problems that may be discovered.

Nevertheless, the Engine Division, for years, had no dedicated department responsible for regulation certification independent of the engineering departments and entrusted Regulation Certification Work to the Engine Calibration Group, which was internal to the engineering departments, thus creating an environment in which such a check function could not readily operate. Regarding this point, a person connected with the Regulation Certification & Administration Dept. who was seconded from Toyota Motors told the Committee, “At Toyota Motors, a department independent of the engineering departments was in charge of Regulation Certification Work, and this allowed the check function to operate. At Toyota Industries, the engineering departments were in charge of Regulation Certification Work, so an adequate check function may not have been operative.”

For example, for the engines for which improprieties recently have been discovered, the Engine Calibration Group began deterioration durability testing before the Control Parameters for emissions performance had been broadly finalized, but it seems that the Engine Calibration Group would not have been allowed begin deterioration durability testing before the Control Parameters were broadly finalized if there had been a dedicated department responsible for regulation certification independent of the engineering departments. Yet there was no dedicated department responsible for regulation certification, and no one connected with the Engineering Office saw it as a problem to begin deterioration durability testing before Control Parameters were finalized, as result of which deterioration durability testing began before the Control Parameters were basically finalized, leading, by extension, to improper conduct such as changing Control Parameters midway through deterioration durability testing, and changing Control Parameters before Witness Tests.

C. Harmful effects of putting engineers in charge of development in charge of Regulation Certification Work

In connection with B above, one of the roles of Regulation Certification Work is to verify that the development work performed by engineering departments is in accordance with regulations, and engineers in charge of Regulation Certification Work and engineers in charge of development work accordingly have the relationship of an evaluator and evaluee. Making the evaluator and evaluee the same and causing the same engineers in charge to be engaged in both development work and Regulation Certification Work means that, when a problematic situation is confronted in which certification cannot be obtained at current engine performance, the engineers in charge very well could be seduced into trying to obtain certification according to the development schedule by such means as rewriting test results, and engineers in charge will find themselves in a position where such improper conduct is feasible. The risk of improper conduct in such situations can be considered high.

As was detailed in B above, in the Engine Division, engineers in charge that were engaged in engine calibration work on the frontlines of development were concurrently responsible for work related to certifications involving objective evaluation of the results of that development, and this can only be said to mean that the evaluator and evaluee truly were identical and the operational system increased the risk of improper conduct. For example, with regard to the rewriting of test data that occurred in the recently discovered improper conduct, it seems that adopting a mechanism in which someone other than an engineer in charge of development applied for certification, after verifying test data received from the engineers in charge of development, would have created ample possibility of preventing the engineers in charge of development from rewriting test data.

(3) Current system for Regulation Certification Work, etc.

As was detailed in Part 1-4(2) above, the launching of an investigation by U.S. authorities into U.S. certification applications prompted the 2021 establishment of the Regulation Certification Office and Regulation Certification & Administration Dept. and the creation of a system in which regulatory information was assembled and laterally disseminated by a dedicated department responsible for regulation certification. In addition, alongside the establishment of the Regulation Certification & Administration Dept., the DR mechanisms were changed to have said department be actively involved in DR for engines and screen for any problems from a regulation certification perspective,[354] thus constructing a mechanism that functions as a check against engineering departments. The certification applications and other Regulation Certification Work that up to then had been the purview of the Engine Calibration Group in the Engineering Office likewise became the responsibility of a Regulation Certification & Administration Dept. that was independent of engineering departments, thereby separating the evaluator and the evaluee of development work.

354 Specifically, the Regulation Certification & Administration Dept. was made responsible, as the department with decision-making authority regarding the handling of emission regulations, for screening, in sales product plan review, "that there are handling targets for the development requirements according to the full text of applicable regulations", and screening, in mass production transition review, whether "handling is complete for development requirements according to the full text of applicable regulations". At the time of these screenings, the Regulation Certification & Administration Dept. provides the engineering departments with a checklist known as a "Regulation Compliance Check Sheet". The engineering departments fill in the items requiring handling and the items for which handling is complete on the basis of such check sheet and submit to the Regulation Certification & Administration Dept., which then confirms the check sheet and screens whether there are handling targets and whether handling is complete.

III. Analysis of Causes of Improper Conduct and Suggested Recurrence Prevention Measures

Part 1. Analysis of Causes of Improper Conduct

As was detailed in II Part 6 above, inadequacies in the organizational systems of Toyota Industries (inadequacies in QMS, vulnerabilities of the Quality Assurance Dept., lack of a dedicated department responsible for regulation certification, etc.) can be pointed out as common causes that invited the present improper conduct, but other direct factors and factors of organizational culture etc. that precipitated the improper conduct can be found as well.

Incidentally, the improper conduct discovered in the Committee's investigation, although wide-ranging, is nonetheless amenable to some level of categorization.

First, the improper conduct included one group of cases where, as with the rewriting of test data, improper conduct was engaged in intentionally with awareness of its impropriety. Some of this conduct involved rewriting data in order to obtain certification by disguising the emissions performance and other capabilities of engines and was malicious and material improper conduct that carries the danger of perverting certification. On the other hand, there was also improper conduct in which, even though there were no pressing circumstances such as an inability to obtain certification, data were rewritten for such purposes as making variations in the values less conspicuous. Such improper conduct occurred not only in the development stage for engines for industrial vehicles, but also in Mass Production Sampling Inspections and development of engines for automobiles, and the trend of lacking compliance awareness and trivializing data integrity thus could have spread throughout the Engine Division, including to the Quality Assurance Dept.

Second, the improper conduct was found to include many cases where, because of insufficient awareness or understanding of laws and regulations, improper conduct was engaged in without clear awareness of the breach of laws and regulations. While these were not intentional improprieties, the fact that the state of insufficient understanding of laws and regulations persisted for so long without improvement suggests the existence of major problems in terms of organizational responsiveness.

To clarify the root cause of the improper conduct in this case, it is beneficial to begin by analyzing the direct causes and background that led individual employees at the engineer in charge level to engage in improper conduct, and then evaluate why managers failed to prevent the improper conduct and what judgments or efforts the management should have made to prevent such improper conduct. Thus, the following discussion proceeds through causal analysis by focusing on engineers in charge, managers, and the management, in that order, for each category of improper conduct, and then, in light of these factors, analyzes the root causes behind such conduct.

Moreover, although this goes without saying, it should be noted that responsibility for the repeated occurrence of various types of improprieties in Toyota Industries over a long period rests above all with the management, who have failed to develop and build an organizational structure and organizational culture that can properly absorb and address the various causes of improper conduct detailed below as organizational issues, and absolutely must not be attributed only to the individual employees that engaged in such improper conduct.

1 Intentional improper conduct to obtain certification

(1) Overview of improper conduct

As detailed above, among the improper conduct discovered with regard to engines for industrial vehicles, cases where improper conduct such as disguising facts was engaged in intentionally and with awareness of its impropriety, as by rewriting test results in order to obtain certification, were found in relation to almost all of the engines for industrial vehicles that were subjects of the investigation.

Typical examples are as follows.

- For the 2007 1DZ Engine, in the actual test results of deterioration durability testing for a European certification application, the NOx values did not meet the regulation values and development target values, while the sum of NOx and HC met the regulation values but did not meet the development target values; the test data were thus rewritten to make it seem that these figures did meet the regulation values and development target values.
- For the 1KD Engine, deterioration durability testing was conducted twice, but in the first deterioration durability test, the PM values exceeded the development target values, and the second deterioration durability test was marred by problems including a decline in EGR cooler efficiency and measurement device breakdown; thus, the Group Manager of the Engine Calibration Group, thinking that the deterioration factors to be submitted to U.S. authorities could not be calculated on the basis of the actual test results, reported the issue to the Assistant General Manager and then, with reference to data etc. of the deterioration durability testing that had been performed up to then, completely rewrote the test data by calculating estimated values on the assumption of emissions performance in accord with the designs.
- For the 2009 4Y Engine, if deterioration correction values had been calculated using actual test data, the CO values would have exceeded the regulation values, so the deterioration correction values were calculated by rewriting this to data from tests performed for other purposes.
- For the 1FS Engine, the NOx values exceeded the regulation values during deterioration durability testing and this appeared to be due to damage to the catalyst; thus, the engineer in charge, after consulting the Assistant General Manager and the Group Manager of the Engine Calibration Group, continued the deterioration durability testing after replacing with another catalyst and rewrote the actual test results to emission values measured for other purposes.

- For the 1ZS Engine, when the Witness Test was conducted by the Automobile Type Approval Test Department, emission component values were measured and the PM values were found to be worse than expected; thus, the target EGR rate Control Parameter values of the ECU Software for Witness Test were modified (the ECU Software for Inspection was modified in the same manner).

The primary reason the Group Manager and engineers in charge engaged in such obviously improper conduct was to obtain certification by satisfying regulation values in deterioration durability testing and Witness Tests, under pressure that forbade any delay in the development schedule.

In reality, in the case of the 1KD Engine, the Group Manager sent the Assistant General Manager an email indicating a view that could be seen as an agonizing determination that test results had to be rewritten to keep the development schedule, and the Assistant General Manager approved the rewriting of test results.

The same can be said of other engines, where in light of the development schedule, at the stage that emission component values exceeded the regulation values or other such problems arose, there was already no spare time to reassess calibrations and redo deterioration durability testing etc. The Group Manager and engineers in charge who were interviewed by the Committee made comments such as "compliance with the mass production launch date is absolute" and "there was no thought of delaying the start of mass production because testing didn't go well"; it therefore appears that the improper conduct was engaged in under pressure demanding that the development schedule be kept.

(2) Lack of compliance awareness among engineers in charge

When we consider the causes of this improper conduct, we must point to the insufficient or absent compliance awareness among the Assistant General Managers, Group Managers, and engineers in charge who were actually involved in the improper conduct.

However, in light of the temporal and contextual expansiveness of the improper conduct, which spread over a long period and affected many engines, it does not seem that the qualities of individual actors were a primary factor behind such improper conduct, which clearly was not an isolated problem dependent on momentary or department-specific circumstances. In other words, the most fundamental question in this case is why so many employees who should have been equipped with foundational knowledge as engineers and should have had sound ethical perspectives were forced to go to the length of engaging in improper conduct. In addition, another major question is why the fact that the proper option could not be taken without engaging in improper conduct was not reported to managers, their superiors or the management to appeal for a decision. This point is discussed below.

(3) Unreasonable development schedules

In light of the business conditions in which a functional division of labor is established within organizations, materials and components are ordered, an assembly line is set up, preparations for sale are advanced, and the manufacture and sale of products is otherwise moved forward with each unit pursuing the work for which it is responsible, keeping to the development schedule must be the top priority in the development and production of engines. Thus, if we think about the size of the impact on each related department and the likely damage to the company in cases where the development schedule is changed immediately before the launch of mass production, we see that, for example, the engineering departments would have to redo deterioration durability testing because of the failure and miscalculation, so it is easy to imagine that there would be intense psychological resistance to asking that the start of mass production be delayed by a certain period.

Obviously, when a development schedule is formulated, setting a tight schedule should not in itself be regarded as a problem. Utilizing resources to the utmost to complete development rapidly is a sound corporate activity. The question should be whether the formulated schedule is tight but also reasonable, and whether plans can be revised to something reasonable whenever unforeseen situations arise.

In the Engine Division, however, many cases were found in which development schedules were formulated which appear to have been completely unreasonable.

For example, the 1KD Engine initially moved through development as a model equipped with DPF, a post-processing device for collecting PM, but thereafter, the policy was changed so that that the engine moved through development as a model not equipped with DPF, which was employed in common rail systems, and a report forecasting that the emission development target values would be met was issued on the basis of only simplified verifications and simulations using actual engines on hand and theoretical studies were carried out. This study was conducted over a limited period of two or three months, and an employee engaged in it has stated that a high-accuracy evaluation was not possible.

In addition, the mass production launch date of the 1KD Engine for the U.S. market was initially scheduled for May 2014, but after the Executive Vice President, Member of the Board having responsibility for the industrial vehicles business demanded that the mass production launch date be changed to May 2013, it was officially decided, in February 2011, that the mass production launch date of the 1KD Engine for the U.S. Market would be moved to May 2013. A great many people connected with the Engineering Office of the Engine Division felt that this acceleration of the development schedule made for a schedule that was unreasonable. Yet the Engine Division never pointed out that the schedule was unreasonable.

Deterioration durability testing for the 1KD Engine was to be conducted twice, but in the first deterioration durability test, injector-related issues resulted in PM values that exceeded the development target values, so the test was stopped, countermeasures were implemented, and the second deterioration durability test was then conducted, but was marred by problems including the decline in EGR cooler efficiency and measurement device breakdown This was the occasion for the recently discovered improper conduct.

Further, the deterioration durability testing for the 1FZ Engine was started using the 1FZ Engine for automobiles at a stage before production of engine prototypes had begun, and the reason for this discombobulated schedule was that the development schedule had been formulated counting backwards from the mass production launch date.

Moreover, for the 2007 1DZ Engine, deterioration durability testing began at a stage after the start of prototype production had been approved in DR, while engine calibration work was underway, and before emissions performance was broadly finalized; as a result, measurement results exceeding the regulation values were produced, leading to improper conduct such as the rewriting of test data. Regarding the reason for this, the Assistant General Manager at the time of development has explained, "Rush development was needed for the 2007 1DZ Engine, and under the development schedule, deterioration durability testing had to commence at this timing."

Thus, in the engine development that was the scene of the recently discovered improper conduct, in many instances it was not the case that a tight schedule was daringly undertaken after ample consideration, and rather, the schedule was formulated by counting backward from the scheduled mass production launch date, resulting in a development schedule that could hardly be considered reasonable in light of the progress of development. This was clearly one of the causes of the improper conduct in relation to each engine.

(4) Dysfunction among managerial personnel

A. Managers' lack of action to solve problems and obstruction of escalation

The unreasonable schedules detailed above were determined by the Engine Division with the agreement of TMHC, and why such unreasonable schedules were officially formulated is the fundamental question. The same can be said with regard to the question of why the schedules were not revised when trouble arose during deterioration durability testing or test results failed to meet regulation values.

(a) Managers' lack of action to solve problems

In regard to this point, the failure of managers in the Engine Division to adequately fulfill their duties can be considered a major cause.

There were some among the engineers in charge and the Group Manager in the Engineering Office who were aware that the development schedules were unreasonable and advised the Assistant General

Manager to that effect, but the Assistant General Manager never took any action to correct the schedules.

For example, when the mass production launch date for the 1KD Engine was moved forward to May 2013, the Group Manager of the Engine Calibration Group told the Assistant General Manager that the schedule was unreasonable, but the schedule was not changed. Regarding the reason for this, the Assistant General Manager has stated, “I thought that even if I consulted my counterparty at TMHC, it was unlikely that they would accept the postponement of the mass production launch date and that the General Manager of the Engineering Dept. would not provide support even if I asked. Therefore, I did not consult TMHC about the possibility of postponing the mass production launch date.”

The situation was the same for the 2007 1DZ Engine: as detailed above, the Assistant General Manager, although aware that the development schedule was unreasonable, took no action to reassess the schedule, and deterioration durability testing began while engine calibration work was still ongoing.

The role of a manager is not only to disseminate on-site policies that are handed down from the management and conduct work under their jurisdiction according to plan. A manager’s role is to understand the problems confronted on site, discuss solutions with those on site, move those solutions to execution, and negotiate with other departments when necessary. In addition, if a problem cannot be solved under a manager’s direct authority and responsibility, an important role of a manager is to report the existence of the problem to superiors and urge those superiors to solve the problem.

The failure to take action to remedy the problems with development schedules, despite awareness of said problems, must be considered tantamount to a dereliction of managerial duty, and among the causes of the present improper conduct, this must be noted as one of the major problems.

(b) Obstruction of escalation

This attitude among managers appears to have been connected to an organizational climate that fundamentally precluded such on-site issues from being escalated up to managers.

Some employees of the Engine Division who were interviewed by the Committee stated, “Even if we told our bosses that the development schedule was too tight, they wouldn’t ask TMHC to reassess the schedule and instead would just instruct us to keep to the decided schedules, so it became the norm that we did not consult with our bosses even if the schedule was too tight.”

Further, much of the recently discovered improper conduct occurred in response to the discovery, during deterioration durability testing, of the occurrence of trouble in engines and measurement devices or the fact that emissions exceeded regulation values. The Committee asked the engineers in charge who engaged in the improprieties why they did not consult with managers to propose reassessing the development schedules and redoing deterioration durability testing, and the most common response to this question from the engineers in charge in the Engine Division was that “it was impossible to change the mass production launch date, so it did not even occur to us to request a schedule change". Fundamentally, if compliance with laws and regulations is in effect unattainable without changing the development schedule, then superiors should be consulted about the issue and the department in charge should act to change the development schedule. The fact that, despite this, it did not even occur to engineers to ask that the development schedule be changed, is evidence that managers never exhibited an attitude of treating on-site problems with consideration and discussing and executing solutions with those on site, resulting in failure to create an environment where engineers in charge appropriately escalated the problems they encountered on site.

B. Problems with General Managers

The recently discovered improper conduct was in many instances reported to and discussed with the Assistant General Manager, but was never reported to or discussed with the Assistant General Manager's superior, the General Manager of the Engineering Dept.

As regards the reason for this, the Assistant General Manager has stated, "In the department where we developed engines for industrial vehicles, the atmosphere was such that even if we consult our superior, we would, in any case, be told to 'Do something.' Accordingly, I did not make any report to the General Manager of the Engineering Dept. because I had halfway given up, thinking that it would be useless to consult the General Manager of the Engineering Dept." Further, as regards the reason no action was taken to improve the 1KD development schedule despite complaints from subordinates that the schedule was unreasonable, the Assistant General Manager has stated, "I thought that even if I consulted the General Manager of the Engine Division, that they would not provide support even if I asked. Therefore, I did not consult TMHC about the possibility of postponing the mass production launch date."

These facts indicate that the Assistant General Manager failed to fulfill the duty of a manager of appropriately escalating to superiors on-site problems that cannot be resolved under their authority and responsibility, but the same facts simultaneously mean that the General Manager of the Engineering Dept. (as well as Deputy General Managers) failed to take up problems confronted at the sites of development in a timely manner, and thus can be said to indicate that there were issues with the General Manager of the Engineering Dept.'s approach to subordinates and with the organizational climate. Obviously, any problems that were not moved up to the General Manager of the Engineering Dept. also would have failed to reach the officer responsible for the division, i.e., the General Manager of the Engine Division.

It is perhaps one aspect of the truth to say that the General Manager of the Engineering Dept. could not have had a detailed understanding of the state of the problems without detailed reports from subordinates. However, given that said General Manager received work progress reports from Assistant General Managers at weekly departmental meetings, and that circulated weekly reports displayed the progress of development in easy-to-understand form using “weather marks” denoting degrees of difficulty,[355] the General Manager of the Engineering Dept. had opportunities to learn about the on-site problems by slightly putting out antennae, yet not sufficiently took advantage of those opportunities.

Further, as detailed above, the engines for which improprieties recently have been discovered included engines for which development schedules were set that cannot be considered reasonable, and the General Manager of the Engineering Dept. participated in DR as the person responsible for engineering departments, knew the details of the development schedules, and was in a position to decide (or not approve) them. Nevertheless, people interviewed by the Committee who had experience with the General Manager of the Engineering Dept. say that said manager did not recognize the unreasonableness of the development schedule and did not adequately keep in mind the mentions of trouble in weekly reports.

The fact that the General Manager of the Engineering Dept. thus failed to understand the on-site problems must be taken to represent, first and foremost, that the General Manager of the Engineering Dept. did not make sufficient effort to understand the actual conditions at development sites. Furthermore, as regards the circumstances underlying this, the fact that compliance with tightened regulations for engines for industrial vehicles was not recognized as materially risky, and that the development (and compliance with regulations) of such engines was trivialized because it was because it applied knowledge from engines for automobiles and hence not difficult, can be cited as fundamental problems. These issues will be discussed below.

In any event, the General Manager of the Engineering Dept. failed to be attentive to the progress of work within the department and the words of subordinates etc., to ask subordinates if there were problems when there were perceptible signs, and otherwise to exhibit an attitude of working together to solve problems, and this must be regarded as one of the factors that created a climate which obstructed escalation from managerial personnel. We believe that, when general managers and the management above them exhibit an attitude of sweating out solutions to problems together, this engenders an environment where reports from subordinates are readily forthcoming and a climate where bad news, in particular, is promptly escalated.

(5) Inadequacies regarding organizations and systems necessary to advance development and production in compliance with laws and regulations

The lack of compliance awareness among officers and employees in charge, dysfunction among managerial personnel and general managers, and organizational climate that failed to escalate

355 For example, high-difficulty problems were given a lightning mark, and matters proceeding smoothly were given a sun mark.

problems can be pointed out as precipitating causes of such improper conduct as the rewriting test data to obtain certification, but, as discussed in II Part 6 above, there were inadequacies with regard to the construction of mechanisms to reduce the likelihood of improper conduct, i.e., of the organizations and systems necessary to advance development and production in compliance with laws and regulations. For example, the fact that QMS was not adequately in place, that there were no provisions for development reference timetables, and that the timing of deterioration durability testing was not defined in correspondence with the stages of DR, was a factor that left no alternative to formulating development schedules counting backwards from the mass production launch date and starting deterioration durability testing before basic calibration work was complete.

The fact that there was no dedicated department responsible for regulation certification, and that the business of applying for certification etc. was handled by the engineers responsible for engine calibration work, can be regarded as a system that seduced those involved toward rewriting test data when it did not satisfy regulation values etc., and the absence of a dedicated department responsible for regulation certification meant that there was no one to point out the problems with the development schedule or the implementation of deterioration durability testing from a perspective of compliance with laws and regulations, and thus no active check on development. In addition, the inadequacy of the functions and systems of the Quality Assurance Dept. meant that the checks on development timetables and development targets did not function from a perspective of ensuring the quality of mass production engines at the development stage, and that during evaluations of Mass Production-Equivalent Engines and Mass Production Sampling Inspections, measurements and evaluations from a perspective independent of engineering departments did not function, improprieties were tolerated, and their discovery was delayed. Furthermore, internal audits were not thoroughgoing, and there was no active check function to prevent improprieties via audits.

2 Other intentional improper conduct

(1) Overview of improper conduct

A. Engines for industrial vehicles

The recently uncovered cases of improper conduct did not take place in urgent situations in which certification could not be obtained without improper conduct, as described above, but rather in cases in which the regulation values for the emission values could be achieved to some extent, but there was large variation in values, so the test results were rewritten to make them less conspicuous, or in cases in which the most favorable test data were selected from among multiple test datasets. This is also found to be a type of intentional improper conduct in which emissions performance of the engine is falsified.

The specifics are as follows.

- For the 2016 1KD Engine for Construction Machinery, the engineer in charge of the deterioration durability testing believed that if the original test results were used, the variation in the PM values would increase, which could make it appear that there was a problem with performance, so he modified the values such that each data point was closer to the average so that there would be no change to the average PM values measured twice when 1500 hours had elapsed.
- Further, with respect to the 1KD Engine for Construction Machinery (both the 2020 1KD Engine for Construction Machinery and the 2016 1KD Engine for Construction Machinery), the engineers in charge of the deterioration durability testing measured the emission component values multiple times at each durability period of the deterioration durability testing and used only some values close to the anticipated values for the certification application. Because the test was repeated until the anticipated values were obtained, the number of measurements at each measurement time were not the same.
- For the 2009 4Y Engine as well, even though emission values were measured three times, the deterioration correction values were calculated on the basis of only the testing data of two measurements.
- For the 1FS Engine as well, in order to submit data with less variation to the U.S. authorities, the emission component values were measured multiple times during the deterioration durability testing, only some of the measured data were included in the deterioration durability testing report, and the deterioration factors were calculated based on only that portion of the measurement results.

In all of the above cases, even if the actual test results were used as they were, there would have been no problem in obtaining certification, but the engineers in charge wanted to have a good-looking set of values, that is, they wanted to hide the large variations in engine performance and make engine performance look good, so they repeated the tests until they obtained values close to the expected values or selected appropriate values from the results of multiple tests.

B. Engines for automobiles

The similar issue has been identified for In-House Output Tests for engines for automobiles. In the course of developing diesel engines for automobiles entrusted by Toyota Motors, Toyota Industries sometimes conducted In-House Output Tests of engine outputs to be used by Toyota Motors in its application for Vehicle Type Designation, etc., and provided test reports and engine performance curve diagrams containing the results of the In-House Output Tests; in such process, improper conducts took place in the form of changing fuel injection amounts in order to ensure that the output values were above the specification values (development target values) and that the torque curve was not distorted by an upward or downward swing of the output values.

The engineers in charge involved in the improper conduct were told by their superiors and seniors, “We have been doing it this way for a long time,” and although they felt uncomfortable at first, they began to adjust fuel injection amounts.

(2) Lack of compliance awareness and trivialization of data integrity

Although these actions may appear to be minor acts of improper conduct when compared to the improper conduct of rewriting test results that are essential to obtaining certification, such an assessment would be incorrect.

It is obvious that it is not permissible to rewrite test data without any scientific or technical basis, no matter how unchanged the average of multiple test datasets may be. It is also obvious that, despite the premise of conducting In-House Output Tests on the same engine as the mass production engine, it is not permissible to change the fuel injection amount for reasons such as ensuring that the development target values are achieved, even taking into account the variation of parts and other factors. This trivialization of data accuracy (data integrity) is not only a violation of the fundamental ethics of engineering, but also improper conduct that disguises the true capabilities of the engine.

Some of the engineers in charge who engaged in this type of improper conduct stated at a Committee interview, “We rewrote the measured values because the test data were different from the expected data, and we thought it was the test data that were odd.” However, if the data differed from the expected data, the scientific and technical causes of why the data differed from the expected data should be investigated, and if the investigation leads to the conclusion that there is a problem with the test, the test should be redone. Without doing so, rewriting the test data simply because it is “different from expectations” defeats the purpose of conducting the test in the first place.

The same is true of selecting favorable data from multiple measurement results. It is natural that there will be variations in measurement results, especially for emissions. Essentially, the performance of the engine should be evaluated in light of the status of variation, and if there is a problem, further development should be conducted to ensure sufficient tolerance. Selecting only favorable measurement results is also an act of falsifying the engine’s performance and should be evaluated as improper conduct equivalent to the rewriting of data.

With regard to the improper conduct relating to In-House Output Tests for engines for automobiles, some employees stated, “We think that the median value of the maximum output at the time of development tests is acceptable because it exceeds the development target”, and “We thought that the specification values for the maximum output, unlike emissions, do not have regulation values specified in laws or regulations, but are merely a matter of whether or not we have met the target values we have set for ourselves”. However, in the In-House Output Tests, the output must be measured using an engine that has the same engine structure, equipment, and performance as the mass production engine.

Therefore, it should be evaluated that manipulating the output by adjusting the fuel injection amounts only in the In-House Output Tests is still an act of disguising the engine's capabilities.

The improper conduct described above also raises significant questions about the compliance attitude toward the accuracy of data required of engineers, even though the conduct was not done in order to improperly obtain certification.

Moreover, this lack of awareness regarding data accuracy was not only observed among a few employees; given that the same type of conduct took place in the course of the development of several engines for industrial vehicles and some engines for automobiles, it is found to have been spread over a long period of time and to a considerable extent, and to have been one of the factors in lowering the psychological hurdle for engaging in serious and obvious improper conduct, such as rewriting test data to obtain certification.

(3) Lack of managerial and supervisory awareness by managers

With respect to cases such as those described above where, even though there would have been no problem in obtaining certification even if the actual test results were used as they were, a test was repeated until values close to the expected values were obtained, or values were selected from multiple test results, having a mind to have a good-looking set of values, or cases where the fuel injection amount in the In-House Output Tests was adjusted in order to ensure that the development target values were reliably achieved, in addition to the problem of compliance awareness among the engineers in charge who actually conducted the tests, it is deemed that there were also significant problems in managerial personnel's behavior of tolerating or overlooking such conduct.

First, in the improper conduct relating to engines for industrial vehicles, the Assistant General Managers and Group Managers were aware or in a position to be aware of such conduct through reports from engineers in charge, but in many cases, they were not aware that the conduct of engineers in charge was improper in the first place.

In this regard, some of the Assistant General Managers and Group Managers did not have experience in engine calibration work or deterioration durability testing, and some did not have experience in the development of engines for industrial vehicles in the first place.

In a Committee interview, some of these managers stated, "As I was from the Design Group and had no experience in engine calibration work, I trusted the engineers in charge of the Engine Calibration Group and the Takahama Plant, who were familiar with engine calibration work, and entrusted them with the work related to the deterioration durability testing", "Coming from a background of engines for ships, I don't know anything about forklift engines", and "Since I had no knowledge or experience in engine calibration work, I basically left the engine calibration work, including deterioration durability testing, to the engineers in charge, although I provided comments on the schedule and from the designer's point of view to the engineers in charge of engine calibration work", stating that they were not able to fulfill their managerial checks due to their lack of knowledge and experience in work and engines in which they themselves did not have experience.

However, these statements by the managers are tantamount to an admission that they were completely unaware of their responsibilities as managers.

It is rather rare for managers to have experience in all the work under their control as engineers in charge. In addition, managers need to acquire basic knowledge of the work under their purview and the essentials of management, listen to reports from subordinates, ask questions to uncover any problems, and manage work to ensure that it is executed appropriately.

In the first place, engineers should have been aware, as a matter of common sense for engineers, of the fact that the act of rewriting actual test data, repeating a test until a value close to the expected value is obtained, or selecting values from multiple test results is improper conduct that is at odds with the purpose of the testing system, even if they lacked knowledge or experience with respect to deterioration durability testing. Nevertheless, the fact that the managers had no suspicions of impropriety proves that the managers lacked the awareness to supervise the appropriateness of the actions of the engineers in charge under them, and it must be pointed out that this kind of response by the managers was a major cause of the decline in respect for data and compliance awareness, and the development of an organizational climate in which problem situations were not escalated.

The same applies to the improper conduct that was discovered with respect to engines for automobiles.

One Group Manager, who had little or no experience in In-House Output Tests, approved the adjustment of fuel injection amounts for In-House Output Tests, despite being told by subordinates of such adjustment. This Group Manager stated, "I had confirmed in previous reports that the engine's performance exceeded the development target values, so I did not think there was a problem with this kind of adjustment." However, it can be said that they should have been aware of the problem as a matter of common sense for engineers, and lacked the awareness to supervise the appropriateness of the actions of the engineers in charge under them.

3 Improper conduct due to lack of understanding of laws and regulations

(1) Overview of improper conduct

Much of the improper conduct that was discovered in relation to engines for industrial vehicles was found to be done without knowledge of the detailed rules under laws and regulations for deterioration durability testing, and therefore without awareness that the conduct violated laws and regulations.

For example, engineers in charge were often found to have engaged in improper conduct because they were unaware of the rules relating to deterioration durability testing, such as the requirement under Japanese laws and regulations to report to the authorities when parts are replaced for unavoidable reasons and to store the parts until the certification process is completed, the requirement under Japanese laws and regulations that the number of measurements must be the same at all measurement times, and the requirement under U.S. laws and regulations that all test results must be reported to the authorities. However, these are basically only procedural violations, and as long as the laws and regulations were properly understood and recognized, it would have been easy to comply with the procedures and obtain certification without problems. Additionally, in the Engine Calibration Group, the practice of removing only the catalyst and O2 sensor and mounting them to the engine on the test bench to measure emissions for the 2009 4Y Engine and 2007 4Y Engine was taken for granted, but this too was due to a lack of understanding of the laws and regulations relating to deterioration durability testing.

The lack of understanding of laws and regulations was not limited to engineers in charge, but Group Managers and Assistant General Managers also lacked understanding of laws and regulations. Even when they received reports from engineers in charge, they were unaware that the subject matter of such reports constituted improper conduct.

In addition, even with the awareness of inadequate understanding of laws and regulations, such as not knowing the details of the rules for deterioration durability testing stipulated by laws and regulations, the fact that no improvement was made to the situation for a long period of time must be pointed out as a problem with the attitude of the management.

(2) Causes of lack of understanding of laws and regulations

As discussed in II Part 6 above, one of the reasons for the lack of understanding of laws and regulations is that there was no dedicated department responsible for regulation certification, and engineers responsible for engine calibration work in the engineering department had no choice but to proceed with their work while investigating and reviewing laws and regulations in the course of their engine calibration work, resulting in gaps in the understanding of information on laws and regulations and inadequate deployment of information to related personnel.

Further, inadequate maintenance of rules etc., such as the lack of incorporation into rules etc. of detailed rules stipulated by laws and regulations relating to deterioration durability testing, is presumably one of the direct causes of the frequent occurrence of these instances of improper conduct.

4 Improper conduct relating to Mass Production Sampling Inspections

(1) Overview of improper conduct

The above is an analysis of the causes of impropriety in the development process. However, improper conduct also took place in the Mass Production Sampling Inspections conducted by the

Quality Assurance Dept. after the start of mass production.

The specifics are as follows.

- Mass Production Sampling Inspections were not conducted at the frequency specified by the internal rules, the Inspection Method. Further, there were no internal rules that specified who, and in what way, would check whether the Mass Production Sampling Inspections of engines for industrial vehicles for the domestic market were conducted at the sampling frequency as specified in the Inspection Method.
- Control Limit Values and Control Standard Values were not defined in accordance with the Inspection Method.
- MTS at the time of Mass Production Sampling Inspections did not always comply with laws and regulations.

(2) Lack of awareness of procedural compliance

The fact that the Quality Assurance Dept., which is the core of the QMS, engaged in improper conduct that did not comply with the internal rules regarding quality assurance work is a fact that needs to be taken seriously, but it seems that the employees of the Quality Assurance Dept. overall, including managers, did not fully understand the essence of quality assurance.

Namely, it goes without saying that to assure quality means to demonstrate quality to customers. To demonstrate quality, it is not enough to simply state, “There are virtually no quality problems,” or “Experience shows there are no problems.” Quality can be assured (demonstrated) to customers only when the specified processes are reliably implemented under the QMS system.

Furthermore, the Inspection Method specifies the frequency and number of Mass Production Sampling Inspections using statistical quality control methods, with the objective of ensuring the quality of all engines produced. It is clear that it is impossible to assure quality to customers when Mass Production Sampling Inspections that deviate from the Inspection Method are conducted. However, Mass Production Sampling Inspections were not conducted at the frequency specified in the Inspection Method.

The reason therefor may be that the Measurement Bench could not be used for a certain period of time because of Measurement Bench inspection and maintenance, and therefore Mass Production Sampling Inspections could not be conducted in accordance with the implementation plan, but if no method for appropriately handling such cases was specified, then the Inspection Method is not consistent with the actual situation at the test site, and therefore, the Inspection Method should have been revised, and the establishment of new rules for Mass Production Sampling Inspections based on statistical quality control methods should have been considered.

It is a basic principle of quality assurance to comply with the process, and if there is a problem with the process itself, to change the process through the proper procedures, but it appears that this basic principle had not penetrated among the employees of the Quality Assurance Dept.

(3) Lack of compliance awareness

The fact that Mass Production Sampling Inspections were not conducted at the frequency required by the Inspection Method is, at the same time, a fact that indicates a lack of compliance awareness on the part of Quality Assurance Dept. employees (including managers).

In this regard, the executives of the Quality Assurance Dept. stated, “Under Japanese laws and regulations, Mass Production Sampling Inspections are to be conducted in accordance with the rules voluntarily established by the applicant for domestic certification, and it seems that personnel in the Quality Assurance Dept. had a deeply-rooted awareness that they did not need to comply strictly with the sampling frequency specified in the Inspection Methods.”

However, it is a mistake to view the Inspection Method as merely a voluntary rule. The Vehicle Act requires the manufacturer of a carbon monoxide, etc. emissions control device that has received a device type designation to inspect the device in accordance with the inspection implementation summary to determine whether the carbon monoxide, etc. emissions control device has the structure and performance of the designated type and whether the mass production product is uniform, and the inspection implementation summary requires that the inspection be conducted in accordance with the Inspection Method, the results be analyzed, and records be maintained. Thus, the Inspection Method is a rule incorporated into the device type certification system pursuant to the requirements of laws and regulations, and compliance with such a rule is as important as compliance with laws and regulations themselves.

For gasoline engines for industrial vehicles for the U.S. market, the data from Mass Production Sampling Inspections must be submitted to the U.S. authorities on a regular basis under laws and regulations. Therefore, Mass Production Sampling Inspections were conducted in accordance with the rules stipulated in laws and regulations, but for engines for industrial vehicles for the domestic market, Mass Production Sampling Inspections were only conducted according to internal rules, and although the quality assurance department had employees who stated that they were less conscious that they had to comply with the rules, the idea is that it is acceptable to break rules if the authorities are not monitoring.

Regardless of whether the rules are established by laws and regulations, by internal rules, or by contract, and regardless of whether the authorities are monitoring for breaches of rules, it is fundamental to compliance that the rules governing a company’s work are followed. If a rule is unreasonable, then the procedures should be followed to change the rule.

In this regard, it must be said that there were serious problems in the way the Quality Assurance Dept. employees deemed the rules, i.e., in their awareness of compliance.

(4) Inadequacies in organization and systems necessary to promote development and production while complying with laws and regulations

In addition to the problems with the awareness of the employees (including managers) of the Quality Assurance Dept., there were inadequacies in the establishment of systems to prevent improper conduct from occurring in the first place, that is, the organization and systems necessary to promote development and production while complying with laws and regulations, as discussed in II Part 6 above.

For example, the fact that Mass Production Sampling Inspections were not conducted at the frequency specified in the Inspection Method also suggests that, because the procedures of implementation and confirmation of Mass Production Sampling Inspections were not adequately specified, enforcement could be easily aborted.

The fact that, instead of the Control Standard Values and Control Limit Values specified in the Inspection Method, the regulation average values and regulation maximum limit values specified in laws and regulations after deducting deterioration correction values were used as the Control Standard Values and Control Limit Values was also a direct result of inadequacies in storage and management of related documents.

The fact that the MTS settings for Mass Production Sampling Inspections were not in compliance with laws and regulations was also largely due to the fact that information regarding the changes in laws and regulations had not been fully disseminated.

With regard to the fact that regulation average values and regulation maximum limit values specified in laws and regulations after deducting deterioration correction values were used as the Control Standard Values and Control Limit Values, it must be pointed out that the purpose of setting Control Limit Values and Control Standard Values was not fully understood. That is, Control Standard Values and Control Limit Values are set so that, statistically, by Mass Production Sampling Inspections, it can be confirmed that the emissions performance of all products meets the regulation values, based on the assumption that there is a certain level of variation in the emissions performance of mass production engines; Control Standard Values and Control Limit Values are not necessarily equal to the regulation average values and regulation maximum limit values specified in laws and regulations. With regard to the fact that, nevertheless, the regulation average values and regulation maximum limit values after deducting deterioration correction values were simply used as stipulated in the laws and regulations as Control Standard Values and Control Limit Values, it must be said that there was insufficient understanding and awareness of quality control in the first place.

5 Root causes

We have examined the causes of the many instances of improper conduct recently uncovered by category, but when we look back at them as a whole, we find that the Engine Division has a corporate culture that should be said to have a "contractor's mentality" and an organizational climate of "trivializing industrial vehicles." As a result of this corporate culture and organizational climate, the executives of the Engine Division had low risk sensitivity to the emission regulations for engines for industrial vehicles and were not able to handle regulatory matters appropriately.

In addition, it can be pointed out that the business divisions system adopted by Toyota Industries was detrimental to the relationship between TMHC and the department responsible for engines for industrial vehicles, and that the management's efforts to cover such detrimental effects and achieve overall optimization were inadequate. We will further examine these points below.

(1) Corporate culture and organizational climate

A. Contractor's mentality

The Engine Division's business is largely engines for automobiles, not engines for industrial vehicles.

The Engine Division has been developing engines for automobiles under the management and supervision of Toyota Motors for many years. For example, the development process for engines for automobiles was not only managed in the DR of the Engine Division, but also in the development gate meeting of Toyota Motors. Audits of raw data relating to development tests were also conducted by a dedicated team at Toyota Motors. Toyota Motors determined when to perform deterioration durability testing, and Toyota Motors also calculated the deterioration correction values and performed all procedures for certification application.

Thus, there was a strong sense that Toyota Motors was responsible for the development of engines for automobiles, and the Engine Division was merely entrusted with the development of engines as requested by Toyota Motors. Within the scope of their contract work, they did not have to take responsibility for understanding the details of laws relating to regulations or negotiate with regulatory authorities, and they did not face the brunt of social criticism even if they breached regulations in some cases.

The Engine Division's contractor's mentality is likely to have been formed under the development process for engines for automobiles.

During a Committee interview, Toyota Industries executives and several people associated with the Engine Division used the term contractor's mentality to refer to the temperament of the Engine Division. What this means is that "it can do what Toyota Motors tells it to do, but it is weak in its ability to discover problems and issues on its own and develop solutions to them."

Even so, it can be said that the contractor's mentality would not have been a major problem as long as the engine development was being performed under contract to Toyota Motors, because as long as the work was being performed under the direction and control of Toyota Motors, the client, the work could be performed properly.

The problem, however, is that the contractor's mentality was also affecting the development of engines for industrial vehicles, which Toyota Industries is responsible for manufacturing and selling on its own.

The Engine Division is solely responsible for the development of engines for industrial vehicles and conducts such development on its own. There is no third party (Toyota Motors in the development of engines for automobiles) that ascertains the details of laws relating to regulations and instructs the Engine Division on the appropriate way to conduct business, or that negotiates with regulatory authorities on behalf of the Engine Division; the Engine Division needs to ascertain the details of laws and regulations and the issues involved, and to develop measures to resolve them.

The full-fledged introduction of emission regulations for engines for industrial vehicles since 2003 brought about new risks for which the Engine Division had to take responsibility. However, it cannot be said that the Engine Division has been successful in accurately determining the nature of these new risks and the magnitude of the consequences if a breach in regulations is discovered, and responding to the new risks.

Certainly, the Engine Division was aware of apparent facts, such as the fact that emission regulations would be fully introduced with respect to engines for industrial vehicles and the content of those regulations, but merely being aware of such facts is not enough to take an appropriate response to the risks. Without considering what specific measures are necessary in response to emission regulations (and what disadvantages will result if the measures are taken incorrectly) and, from a new standpoint, confirming and evaluating whether the company's internal systems are capable of responding to new regulations, it would not be possible to take appropriate measures to deal with risks.

The fact that DR did not have a system of checks and balances in place at the time when the recently uncovered improper conduct took place, and that an organization responsible for the Regulation Certification Work was not in place, as well as the fact that, as a result, the Engine Division did not recognize nor understand the nature of the system of deterioration durability testing or the details of the rules, and allowed a development schedule that forced the commencement of deterioration durability testing before sufficient development could be conducted, or engaged in improper conduct such as rewriting test data to meet that development schedule, clearly show the Engine Division's failure to understand and respond accurately to the risks of full-fledged implementation of emission regulations.

The Engine Division's lack of such risk management was likely influenced by its contractor's mentality, in that it had not developed a pattern of action to take responsibility for dealing with risks on its own.

B. Trivializing engines for industrial vehicles

When the issue of the contractor's mentality is pointed out, a further question is why the effects of the contractor's mentality extended to the business of engines for industrial vehicles, which should have been unrelated to the contractor's mentality.

The Engine Division has been solely responsible for the development of engines for industrial vehicles, and with the exception of a few periods of time, the Engine Division has also long been responsible for conducting their deterioration durability testing and applying for certification. Thus, the development of engines for industrial vehicles was not done as services entrusted by a third party but was done by the Engine Division on its own initiative. This being the case, the Engine Division needed to take the lead in establishing mechanisms to ensure compliance with regulations and proper certification in conjunction with the full-fledged implementation of emission regulations for engines for industrial vehicles.

However, in the interviews conducted by the Committee with the management of Toyota Industries and the executives of the Engine Division, none of them stated that they were aware of the need to review the organizational system to ensure compliance with regulations and proper certification in conjunction with the full-fledged implementation of emission regulations for engines for industrial vehicles at that time.

This is in sharp contrast to the enhancement and strengthening that was ensured with respect to diesel engines for automobiles, the development of which was completely transferred from Toyota Motors to the Engine Division in June 2021, which triggered a review of the development system, resulting in a major revision of the rules for conducting design reviews and the introduction of a check-and-balance system for DR.

The reason behind this contrasting response seems to be the fact that the management of Toyota Industries and the executives of the Engine Division trivialized engines for industrial vehicles.

In fact, during the interviews conducted by the Committee, the management and executives of the Engine Division were frequently heard to say, "We thought that engines for industrial vehicles would be less difficult than the development of engines for automobiles."

Certainly, the difficulty of developing engines for automobiles is greater than that of developing engines for industrial vehicles, not only in terms of whether the targeted output is achieved and whether emission regulations are met, but also in terms of addressing tax incentives based on fuel economy, improving drivability (smoothness of acceleration, smoothness of engine rotation, etc.) unique to passenger cars, and many other challenges that need to be addressed. Further, with regard to the emission regulations, the regulations for engines for automobiles were introduced prior to those for engines for industrial vehicles, and engines for industrial vehicles were often developed on the basis of already developed engines for automobiles, so the Engine Division executives presumably thought that even if the emission regulations were applied to engines for industrial vehicles, they could apply their knowledge on how to address emission regulations for automobile engines.

However, there is no decisive difference in difficulty between engines for automobiles and engines for industrial vehicles with respect to engine calibration work for emissions. Just because development is based on engines for automobiles does not mean that calibrations can be applied directly to engines for industrial vehicles, as some engines for industrial vehicles require performance unique to industrial vehicles and may need to be developed from the ground up.

In this regard, the fact that the management and the Engine Division executives did not pay enough attention to the necessity of addressing engines for industrial vehicles when full-fledged emission regulations were introduced must be taken as evidence that they were lulled into thinking that the development of engines for industrial vehicles would be less difficult and that they did not accurately understand the risks.

The Engine Division’s tendency to trivialize engines for industrial vehicles is probably not unrelated to the fact that a large portion of the division’s business is in engines for automobiles.

Certainly, it can be said that the Engine Division executives should devote a great deal of resources to the business that supports the backbone of the division and be sensitive to business risks, as its routine approach from an organizational management perspective, but this does not mean that they do not need to pay attention to other businesses. More importantly, engines for industrial vehicles are a key component of forklifts manufactured and sold by Toyota Industries, and this is a business that should be given solid attention.

The Engine Division, which is in charge of the development of engines for automobiles and engines for industrial vehicles, has no choice but to take a balanced approach in terms of allocating resources such as personnel and equipment. Even so, when it comes to issues relating to compliance with laws and regulations, the impact on the company of a violation is enormous, regardless of the amount of sales or size of the business, and the division should have paid equal attention to whether systems were established to ensure compliance with laws and regulations even for the development of engines for industrial vehicles, which is of a smaller scale.

Nevertheless, the executives of the Engine Division did not review their organizational system to ensure compliance with regulations and appropriate certification, failing to recognize the magnitude of the risks involved in conjunction with the full-fledged implementation of emission regulations for engines for industrial vehicles, and this was likely due largely to the fact that the management of Toyota Industries and the executives of the Engine Division trivialized engines for industrial vehicles.

C. Low risk sensitivity among executives at the Engine Division

As stated in II Part 2-1 above, the full-scale rollout of emission regulations for engines for industrial vehicles began around 2003. The emission regulations (Tier 1 Regulations) covering diesel engines in special motor vehicles on public roads took effect on October 1, 2003, followed by the December 2, 2005 implementation of the emission regulations for gasoline and LPG engines in special motor vehicles on public roads. Starting October 1, 2006, the emission regulations covering diesel engines and gasoline and LPG engines in special motor vehicles not on public roads were phased in and a deterioration durability testing requirement was introduced for domestic certification applications (Tier 2 Regulations). Further tightening steps were also expected for the emission regulations for engines for industrial vehicles in Japan and elsewhere.

A review of how Toyota Industries analyzed and prepared for compliance with regulations as the full-scale rollout of the emission regulations for engines for industrial vehicles began as described as above confirmed that, at Business Execution Conferences and the Management Committee between 2005 and 2006, TMHC reported that preparations to comply with Tier 2 Regulations were being made, but in the Engine Division, which actually had the role of promoting engine development in compliance with the emission regulations, no materials were discovered that would indicate that reports concerning Tier 2 Regulations were made.[356] Subsequently, no records of reports or discussions were found, either, about specific ways to comply with Tier 2 Regulations or systemic establishment issues or challenges.[357]

A review of the actual development process for engines for industrial vehicles at the Engine Division also found no evidence of reconsidering the development process in light of the tightening of emission regulations for engines for industrial vehicles. For instance, with emission regulations mandating deterioration durability testing, since performing such testing would require quite some time, this would inevitably increase the number of development steps and require a longer development schedule; but there was no evidence that, after deterioration durability testing was mandated, the Engine Division engaged in any discussion about reconsidering the development system or schedule for engines for industrial vehicles.[358]

With regard to this point, personnel such as the person who served as the General Manager of the Engineering Dept. of the Engine Division around the time Tier 2 Regulations took effect made the following statements to the Committee: "With respect to the tightening of the emission regulations from 2003 to 2005 and the resulting introduction of deterioration durability testing, we had the notion that 'deterioration durability testing will take a long time and therefore it's troublesome' but I don't

356 It should be noted that at a Board of Directors meeting in July 2005, the Engine Division proposed building a second testing structure at the Hekinan Plant and installing additional Measurement Benches for the purpose of meeting the need for diesel engine development going forward. The objective of the proposal, however, was to accommodate the need for development of diesel engines for automobiles, which had been entrusted by Toyota Motors, and not to accommodate the tightening of emission regulations for engines for industrial vehicles.

357 The minutes of management meetings and other materials from 2003 to 2006 had already been destroyed after the recordkeeping period had passed, and the Committee was unable to verify the content of such materials.

358 As discussed above, the Engine Division did not have any rules setting forth development reference timetables in the first place, and this is thought to be one reason no discussion was held about the development schedule for engines for industrial vehicles.

recall having a discussion to the effect that we needed to review development schedules," and "I don't recall discussing investing in facilities like Measurement Benches or receiving concerns from subordinates about falling behind development schedule because of the tightening of the emission regulations." However, the improper conduct recently discovered includes cases of conduct engaged in pursuit of meeting development schedule. Had executives in the Engine Division reviewed the development system and schedules in conjunction with the full-scale rollout of the emission regulations, such impropriety might have been prevented.

Further, the Engine Division did not provide employees charged with deterioration durability testing or computation of deterioration correction values with any special education or training on details of laws and regulations concerning deterioration durability testing. For this reason, while performing their daily responsibilities, engineers in charge of deterioration durability testing voluntarily collected and reviewed information on laws and regulations concerning deterioration durability testing.

Asked about the reason why no special training was provided in the Engine Division, the Assistant General Manager of the Engineering Office said: "Because the regulations were being newly introduced, we didn't have anyone capable of explaining the laws and regulations concerning deterioration durability testing in detail, and the only option was for the engineers in charge to check the rules as necessary" and "the emission rules under the Off-Road Act at the time were not as strict as those for automobiles, so we thought that referring to the development experiences of engines for automobiles would suffice and that we would be able to address them without setting up particular training opportunities." However, the improper conduct recently discovered includes many cases of impropriety that resulted from a lack of understanding of the laws and regulations concerning deterioration durability testing. Had executives in the Engine Division provided employees engaged in deterioration durability testing with education and training on the details of the emission regulations and the laws and regulations concerning deterioration durability testing, they would likely have prevented such improper conduct.

As discussed above, in light of the full-scale rollout of emission regulations for engines for industrial vehicles, the Engine Division, which was responsible for the development of engines for industrial vehicles, should have reviewed the development system and schedules and conducted employee education and training, but took no measures in reality. If implementing measures on its own was difficult for the Engine Division, executives in the division should have discussed with TMHC about reviewing development schedules or taken such proactive steps as bringing up the need for compliance with regulations to the attention of the management of Toyota Industries and asking for personnel reinforcement. However, executives at the Engine Division failed to take such steps or review the internal process at the Engine Division.

As far as the review of the situation at the Engine Division shows, it must be said that executives at the Engine Division lacked risk sensitivity pertaining to the emission regulations for engines for industrial vehicles; the aforementioned corporate culture of contractor's mentality and the organizational culture of trivializing industrial vehicles must have had an impact to the extent that their risk sensitivity concerning tightening regulations, which any management executive should naturally have, was extremely diminished.

(2) Adverse effect of the business divisions system and lack of the management's efforts to address such effect

A. Imbalanced power dynamic between TMHC and department responsible for engines for industrial vehicles

The circumstances that contributed to the recently discovered improper conduct also include the fact that, under the business divisions system used by Toyota Industries, an imbalanced power dynamic had formed between the department responsible for engines for industrial vehicles of the Engine Division and TMHC.

Toyota Industries employs the business divisions system, and even though TMHC was responsible for the manufacture and sales of industrial vehicles (forklifts), what TMHC developed and manufactured was the body (Lift Truck) of forklifts, and the engines for forklifts were being developed by the Engine Division.

Such allocation of different areas of responsibility to different divisions is a perfectly rational step to take from the perspective of managerial efficiency. Toyota Industries is engaged not only in the industrial vehicle business but also in the automobile business, as well as engines for vessels, gas heat pumps (GHP), combined heat and power (CHP) systems and power generators. Development of these engines requires overlapping knowledge and experience, and consolidating efforts to develop, manufacture and sell different engines to a single location of the Engine Division is a natural management decision.

Adoption of this business divisions system placed TMHC, which oversaw industrial vehicle manufacture and sales, and the Engine Division, which developed engines for industrial vehicles and delivered the same to TMHC, in a relationship of an order-issuing party (customer) and supplier. In fact, just as it negotiated procurement prices with outside parts suppliers, TMHC negotiated with the Engine Division prices on engines for industrial vehicles (transaction prices between divisions, which are the basis for understanding profit or loss for each division). TMHC purchases engines for some models of large and compact forklifts from external engine manufacturers, and it apparently positioned the Engine Division similarly to these external engine manufacturers.

It is not a problem in and of itself for each division to pursue its business independently or for divisions to have a customer-supplier relationship. Rather, having each division be responsible for its business profitability and engage in tough negotiations with other divisions within the company to enhance management efficiency is one of the objectives of adopting a business divisions system.

However, if, under this business divisions system, a division that acts as a customer and a division that acts as a supplier have power dynamics that prevent negotiations on an equal footing (for instance, a relationship where one party makes an unreasonable demand and it is difficult for the other party to say no), this can sow the seeds of impropriety.

With regard to this point, looking at the relationship within Toyota Industries between TMHC and the department responsible for engines for industrial vehicles, TMHC is in charge of the manufacture and sales of industrial vehicles, which account for nearly 70% of total sales at Toyota Industries, and thus is a division with a strong say in matters within the company. On the other hand, the department responsible for engines for industrial vehicles is trivialized even within the Engine Division and was unable to receive any material or moral support from the Engine Division itself[359] and thus was an extremely weak department; accordingly, their power dynamics had a striking imbalance. Furthermore, 80% of the engines for industrial vehicles that the Engine Division developed and manufactured were delivered to TMHC, and given that forklift engines are currently not sold to outside customers per TMHC's request, it can be said that the two were not in a relationship of a customer and a supplier able to negotiate on an equal footing.

Because of these circumstances, at Toyota Industries, an imbalanced power dynamic developed between TMHC and the department responsible for engines for industrial vehicles. In this situation, TMHC made harsher demands to the department responsible for engines for industrial vehicles (because it was another division within the same company) than against outside suppliers about cost cuts and schedules, making it difficult for the department responsible for engines for industrial vehicles to say no even to demands that appeared difficult to meet or to consult anyone about a solution.

In fact, many instances of the recently occurred improper conduct involved such issues as emissions exceeding regulation values during deterioration durability testing and failure of measurement equipment, and occurred under pressure that delaying development schedule was not an option. The steps that should have been taken in these cases include redoing deterioration durability testing or redoing engine calibration work before performing deterioration durability testing, but employees in the department responsible for engines for industrial vehicles were under pressure that they had to meet the scheduled mass production launch date and ended up engaging in impropriety. There were no employees who requested that TMHC reconsider a development schedule, let alone those who even considered making such a request. In addition to that, the development schedules themselves were unreasonable in the first place, and in some cases the schedules did not allow for time to properly perform deterioration durability testing.

Factors contributing to the fact that employees in the department responsible for engines for industrial vehicles could not make a request to reconsider schedules, or could not object to such

359 In fact, during the investigation by the Committee, TMHC personnel often voiced complaints that the Engine Division was not willing to provide sufficient resources to engines for industrial vehicles.

unreasonable schedules in the first place, include the aforementioned issue of the failure by managerial personnel of the department responsible for engines for industrial vehicles to properly perform its role; in addition, the fact that there was an imbalanced power dynamic between TMHC and the department responsible for engines for industrial vehicles under the business divisions system seems to have influenced the situation to no small extent.

B. Insufficient management efforts to remedy the relationship between TMHC and the department responsible for engines for industrial vehicles and achieve overall optimization

As discussed above, the background to the recent improper conduct was influenced to no small extent by the imbalanced power dynamic between TMHC and the department responsible for engines for industrial vehicles, and such power dynamics were formed as an adverse effect of the adoption of a business divisions system by Toyota Industries.

This, however, does not mean that adoption of a business divisions system in and of itself is problematic. A business divisions system is an organizational system many corporations adopt to enhance management efficiency, and it was reasonable to consolidate engine development efforts to a single business division under Toyota Industries' business composition.

Any organizational system naturally has its benefits and drawbacks, and the management that has adopted a business divisions system needs to make efforts to reap such benefits while minimizing the drawbacks. Specifically, it is the responsibility of the management to, while leaving to the own discretion of each division the matters of which such division takes charge, examine risks and management issues that each division is unable to handle with a broader view to achieve overall optimization, and to analyze the future and portfolios of the divisions with the aim of enhancing the company's future enterprise value.

However, at Toyota Industries, the management failed to sufficiently make efforts to minimize the drawbacks of having a business divisions system, and this is one of the factors that caused the adverse effect of the business divisions system and led to the recent improper conduct.

As discussed earlier, at Toyota Industries, an imbalance had been formed in the power dynamics between TMHC, which handles the manufacture and sale of the bodies of industrial vehicles, and the department responsible for engines for industrial vehicles, which developed engines, a key component, and the awareness of "working together to build" better engines for industrial vehicles was virtually nonexistent. For instance, in an interview by the Committee, multiple employees of the department responsible for engines for industrial vehicles explained to the effect that TMHC made unreasonable and impossible demands about engine specifications and development schedules and that they had no choice but to meet them. However, it is apparent that officials and employees at TMHC believed that it was natural from the standpoint of ensuring the future of the industrial vehicle division to seek to develop engines with higher-level specifications, and that, even though a request to move up the development schedule was made due to the need based on the marketing strategy of the industrial vehicle division, the Engine Division was uncooperative in the development of engines for industrial vehicles.

The actual process for the development of industrial vehicles (forklifts) does not (unfortunately) show any evidence that the two divisions held constructive discussions with the aim of working together to develop better engines. TMHC during the process of developing forklifts held DRs, but no personnel from the Engine Division ever attended such DRs and there were separate DRs held where only TMHC personnel attended in light of engine development progress reports from the Engine Division. At the same time, no TMHC personnel attended any DRs held by the Engine Division, and TMHC in general did not directly get involved in engine development or oversee the situation. As an opportunity for the two departments to work together, meetings of the Engine Committee were held, and with the participation of the officers who were in charge of both divisions, discussions were supposed to be held on the selection and specifications of engines for industrial vehicles; however, according to the interviews by the Committee, TMHC and the Engine Division had a poor relationship and there were times when tensions between the two sides were running high, and although apparently the situation subsequently improved somewhat, the Engine Committee did not properly perform its functions as it was supposed to. If an outside supplier handled the development of engines for industrial vehicles, thorough discussions based on feedback from the supplier would have been held about costs and schedule in an effort to build better products; but such discussions were not sufficiently held between TMHC and the Engine Division, which are part of the same company, and the reason for this is that the two divisions, which were mired in an imbalanced dynamic, each prioritized maximization of its own profit, exposing the negative aspect of the business divisions system.

As shown above, at Toyota Industries, no constructive discussions for building better industrial vehicles were held between TMHC, the division handling the manufacture and sales of industrial vehicles, and the department developing engines for industrial vehicles, and it is evident that such uncooperative relations between the two divisions posed a major setback for Toyota Industries as a whole.

Improving the relationship between divisions is a management issue that cannot be solved easily by simply leaving it up to talks between the leaders of the relevant divisions; it was necessary for the management of Toyota Industries to more proactively discuss efforts to improve the uncooperative relationship between TMHC and the department responsible for engines for industrial vehicles and achieve overall optimization in the industrial vehicle business.

Needless to say, the management of Toyota Industries has the responsibility to examine and build an internal system that will further strengthen the industrial vehicle business, the company’s core business, and in this situation where TMHC and the department responsible for engines for industrial vehicles did not have a cooperative relationship, it was necessary to not only improve the relationship between the two divisions and take other steps to remedy negative factors but also to study, and review, what type of internal system and framework should be used to incentivize employees of these divisions to develop better engines for industrial vehicles. For instance, while cutting development costs for engines for industrial vehicles has a positive effect on TMHC's business revenue, it reduces the Engine Division's sales to TMHC and thus there is no incentive for the Engine Division to cut costs. In order to achieve an overall optimum for the industrial vehicle business, TMHC and the Engine Division need to have the same incentive to cut development costs, and to that end, one option would be to discuss whether engines for industrial vehicles should be reflected on the business revenues of TMHC and the Engine Division (whether to position the department responsible for engines for industrial vehicles in the Engine Division as a profit center). Specifically what type of internal system and framework should be adopted is naturally a question for the management, and instead of being led by the divisions, these discussions needed to be held by the management as a managerial challenge for Toyota Industries as a whole.

However, there is no other way to describe the efforts by the management of Toyota Industries than to say they were insufficient.

Part 2. Advice on Recurrence Prevention Measures

We will give here an overview and summary of the causes of the recently discovered cases of improper conduct, which were discussed in detail in Part 1 above. First, when addressing the Tier 2 Regulations, under which deterioration durability testing became a requirement and emission regulations for engines for industrial vehicles were otherwise significantly tightened, the organization was not sufficiently prepared when it embarked on development, and for this reason, even though the basic calibration work had not been completed, it had to commence deterioration durability testing; as a result, the organization was faced with the problematic circumstances where, among other things, the measured emission values did not meet the regulation values or development target values. At that point in time, because there was no longer enough time to carry out another round of deterioration durability testing, in order to obtain certification without delaying the mass production schedule, improper conduct such as rewriting test data was carried out. The organization did not learn from this lesson, as subsequently, when addressing the Tier 3 Regulations etc., it repeated similar improper conduct.

If we consider the causes that form the background against which this kind of conduct was taken, it appears that a number of problems the organization has in terms of its nature and culture were involved. More specifically, the overall organization had taken on a contractor's mentality, and was not able to sufficiently consider and implement, as something that was a concern of its own, how to address the fact of tightening regulations and other changes in social circumstances; in particular, the management and executives had a strong tendency to trivialize industrial vehicles (trivialize engines for industrial vehicles), and did not have awareness of emission regulations as an important and difficult problem, and the organization did not make sufficient preparations; management personnel did not carry out their functions properly, and, when problems arose in the development process, there was no escalation to superiors; and finally, across the organization overall, the resolve to respect data integrity and maintain compliance relating to data was weak; therefore, when pressed to make a choice between complying with laws and regulations and complying with the development schedule, it was easy to select rewriting data etc.

As regards recurrence prevention measures, the Committee will offer advice from a variety of angles in order to address these complicated causes, but as far as the Committee is concerned, the specific minimum target that must be attained is to ensure that when the officers and employees in charge are faced with the choice of compliance with laws and regulations or compliance with a development schedule, they can choose compliance with laws and regulations without hesitation and without wavering.

The measures for this purpose will cover a broad range, from measures directly addressing the issues to measures aimed at putting a foundation in place. First of all, because what will ultimately prevent these problems from arising is the resolve of the persons involved, the Committee will give advice relating to measures for fostering a culture of compliance, so that the officers and employees have a strong compliance awareness and the organization has a strong compliance structure. Second, because it is important that the organization have in place a mechanism that, before people find themselves in difficult situations where they are pressed to make the final decision, prevents improper conduct from arising by preventing problems from occurring (or when improper conduct does take place, a mechanism where it can be quickly discovered and corrected) and that the organization ensures that this mechanism functions properly; therefore, the Committee will give advice relating to measures for establishing a mechanism for preventing and discovering improper conduct; and third, because to resolve the organization's constitutional and cultural problems and ensure that going forward, no matter how difficult a situation may be, development and production are carried out without fail in full compliance with laws and regulations, it is essential that the awareness and the conduct of the management be reformed, the Committee will give advice regarding measures for the reform of the awareness and conduct of the management.

1 Fostering a compliance culture

(1) Ensuring that employees as individuals can make correct decisions

A Fostering employee compliance awareness

That laws and regulations must be complied with is an obvious thing, but in a situation where forced to choose between compliance with laws and regulations and a development schedule, it is not necessarily an easy thing to make that obvious selection. If the development schedule is not complied with, the impact will extend to the sales departments and many other places, and for this reason it is natural for employees to feel that they have to do whatever they can to avoid a delay in the development schedule. In addition, as regards emission regulations, which is the issue here, once certification is obtained, the possibility is not necessarily strong that any impropriety will be uncovered. On the other hand, if the development schedule is delayed, this will immediately become a major problem within the company, with the officers and employees of the engineering department who were in charge likely to be held responsible; and to an employee, forced to choose between compliance with laws and regulations and compliance with the development schedule, choosing the development schedule can even be called a natural reaction, if one assumes that humans by their nature have weaknesses.

Of course, employees do understand, as a general principle, that laws and regulations should be followed, but notwithstanding this, in order to avoid a pressing problem, they resorted to improper conduct; therefore, in order to ensure that when required to choose between compliance with laws and regulations and compliance with the development schedule, employees will make the proper choice without hesitation, it is necessary, first of all, to enhance and strengthen the education and training relating to compliance. The purpose of this would be to ensure that engineers in charge, managers, and the management, whatever the situation, will follow a fundamental code for decisions and behavior for fulfilling their own roles and responsibilities in their respective positions.

This is not to say that Toyota Industries up to now had disregarded taking any initiatives in compliance training etc. for its employees. As discussed above in II Part 1-9, Toyota Industries carried out training having specific content that took into account examples of quality-related problems that arose at other companies, and otherwise continuously carried out compliance and quality education, and the program itself appears well-developed. Notwithstanding this, these initiatives did not succeed in preventing the incidents under investigation here; therefore, it is necessary to verify the cause and devise an effective training program.

For example, it is necessary that employees can imagine, as a realistic problem, that while choosing violation of law may put off a pressing problem for the time being, that is always later discovered, in which case more serious consequences will be brought, specifically, the product brand and company reputation may suffer, there may be major obstacles to business operation, workplaces may be lost, and employees' livelihoods may be threatened.

Further, compliance in the first place is not simply a matter of simply following laws and regulations; it is also keeping promises and matters agreed to with the various stakeholders of a corporation, and, further, it is also meeting the expectations of these various stakeholders. It is important that all officers and employees gain a full understanding not only that laws and regulations are to be complied with, but also that, for example, in a case of a breach of contract with a customer, where the internal rules for inspection, which is a pillar of product quality assurance, are breached, the company's reputation will be damaged, and a reputation that is once damaged cannot easily be repaired.

Furthermore, regarding the changes in social awareness as concerns compliance, it is important not to fall behind the changes of the times and to correctly recognize their harsh reality. This point is particularly important when seen from the perspective of breaking away from the contractor's mentality. While particularly notable in quality-related impropriety incidents, even improper conduct that in the past was not considered problematic is now taken up by the media as a major problem and this can have a serious impact on corporate activities. Going forward, any violations of environmental legal regimes that, in addition to the standard pollution prevention, in recent years have come to include global warming prevention, are likely to be met with increasingly harsh reactions from society, and this is a risk item that Toyota Industries faces. Education and training that allow for all officers and employees, from the management to the engineers in charge on site, to properly understand the various risk items the company faces and the changes in the views of society, should be considered and implemented.

B Making clear the value standard that "compliance has priority over the development and production schedule"

In order for the engineers in charge on site and managerial personnel to engage in conduct that prioritizes compliance over development and production schedule, it is necessary to ensure that such persons are psychologically secure with regards to engaging in such conduct. In other words, when it is made clear, and is understood throughout the company, that all officers and employees should engage in compliance conduct in accordance with their respective positions, that they will not be subject to any disadvantageous disposition or handling because of their engaging in such conduct, and that this is the company's policy, then, if engineers in charge or managers happen to find themselves in a difficult position, they can, with peace of mind, make the choices and engage in conduct that are in line with compliance. In order to attain this, first of all, it is necessary that the management itself has a strong resolve that compliance takes priority over anything else and that it repeatedly makes this clear to employees.

Of course, even with a statement of resolve from the management, the awareness that compliance should be prioritized will not pervade the workplace overnight. In order to ensure that compliance awareness permeates the company, it is necessary for the management executives to constantly convey the message of prioritizing compliance and, in specific situations, take the initiative and set the example of prioritizing compliance. For example, if in order to comply with laws and regulations, the need has arisen to redo deterioration durability testing, the management executives should give orders to redo the deterioration durability testing, even if it means that the development schedule will be delayed. When there is this sort of conduct from the management executives giving priority to compliance, then employees will understand that compliance is not just an empty phrase, and they will be able to feel safe psychologically in giving compliance priority over the development schedule.

Further, to systematize this, the introduction of a mechanism should be considered, under which, among other things, a code of conduct that places priority on compliance is formulated and maintained, it is made clear that persons who make the correct selection and people who so advise will never be subject to unfavorable treatment, and compliance is a subject of evaluation in personnel evaluations.

It goes without saying that the compliance education for employees discussed at the start of this section will become effective only when the management itself continuously delivers the message that compliance should be prioritized and demonstrates that this is their true belief through their actions in actual situations.

(2) Adherence to engineering ethics

Among the recently discovered improper conduct, a significant number of cases were found in which, with the intention to prepare a good-looking set of values, that is to say, to conceal large variations in engine performance, a portion of the test data (parts having little correlation with regulation values or other key metrics) was rewritten, the tests were repeated until values that were close to the ones they had envisioned were produced, or suitable values from the results of the multiple rounds of tests conducted were chosen.

More than a few of the engineers in charge who committed such actions say that they thought it was the test data that seemed odd, but assuming this is not simply their way of excusing these falsehoods, these actions deviate from the fundamental behavior an engineer should exhibit, namely respecting the measured data and, if any doubts arise concerning the measured data, verifying it by retesting etc. Even if this kind of problem would not have any bearing on the engine's innate capabilities, the problematic way of handling was taken all too easily, and while not quite reaching the level of rewriting data in the regulation values to "obtain certification", these actions did already cross a line that must not be crossed. As such, it must be reaffirmed just how serious a situation is that this conduct was prevalent in the division in charge.

Respecting the test data is the wellspring of trust not only for engines, but also for all other products that are developed and produced. Ensuring that this fundamental attitude is firmly entrenched is a pre-condition for restoring the social trust that Toyota Industries has lost through these impropriety cases, and this fact must be reaffirmed at all levels from the management down, including managerial personnel and even the engineers in charge on site.

To regain this lost trust and continue to secure that trust into the future, Toyota Industries must immediately discuss and then implement ongoing education and training that affirms, maintains, and reinforces the fundamental ethics to be observed by all engineers, beginning with data integrity.

However, general education and training for the engineers in charge alone will likely have limited effects. This improper conduct occurred over a long period of time, and although many engineers have moved or changed posts, and although they included not only new graduates but also mid-career recruits, the fact is that conduct that was against engineering ethics had become commonplace. Perhaps a sense that it was permissible because others were also doing it was involved in this, as a sort of facile justification, but beyond that, there likely were also other factors that dissuaded these engineers from openly discussing the matter and considering the right way to handle it, such as concerns that presenting unattractive data or widely varying data would raise doubts from the authorities or Toyota Motors, or the pressure of being unable to meet the development schedule if additional retesting were required. Given that this situation has something in common with the compliance awareness problem among employees discussed above in (1), it is believed that, in addition to conducting education on engineering ethics, the management should repeatedly reinforce the importance for engineers to keep a sense of pride and self-respect, and themselves practice those things in the course of their daily work in order to cultivate a workplace where the engineers can freely engage in technically correct discussions while feeling psychologically safe and secure.

(3) Enabling the organization to make the right decisions

To cultivate a compliance culture, it is not enough to merely improve compliance awareness among individual employees—efforts need to be made to enable the organization itself to make the right decisions.

In particular, becoming an organization in which problems are appropriately escalated and solutions are reached, with even the management getting involved (if necessary), is extremely vital, not only in terms of preventing the wrong choices from being made in decisive and pressing situations, but also from the standpoint of quickly taking suitable measures to prevent impropriety.

The management were not aware that the improper conduct that was recently discovered had happened. The reason for this was that the problem had not been reported by managerial personnel to the management; but, from a different perspective, in some sense, the management had no interest in the difficult conditions on site and made no attempt to see the reality of the problems being faced there. To be sure, it is not easy for the management to directly ascertain the problems happening on site. For instance, even if the management were to frequently visit plant sites, it is difficult to expect that the employees on site will be inclined to share with the management any problems or issues they are having (even if given the opportunity to do so). For the management to grasp the problems or issues being faced on site, a system needs to be set up and operated that allows the organizational channels to function as a reporting line so that problems or issues can be escalated in a timely and appropriate fashion as part of the daily course of work, and a mechanism needs to be put in place to ensure that if this system fails to function, the management have a supplementary means of directly ascertaining any problems or issues on site.

A. Functioning as a reporting line

A commonality among many of the recently discovered impropriety is the fact that although the existence of the problem or impropriety was escalated up to the level of Assistant General Manager, it was not escalated any higher up to any managers above that level or to the management. More than a few of the problems being faced on site could not be solved simply by on-site efforts, requiring the judgment of those at the management level. In the interest of preventing impropriety, the engineers in charge, managers, and the management each need to be able to accurately decide, on their own authority and responsibility, whether they should handle a problematic situation themselves or should report it to their supervisor, and then take action accordingly, and in particular, they need to make sure that bad news is promptly escalated.

With regard to the recently discovered improper conduct, there were examples in which the Assistant General Manager understood the problem yet declined to consult his supervisor, the General Manager of the Engineering Dept., and giving instructions to engage in the improper conduct, or allowed the improper conduct to go on. The role of managers is to ascertain any problems happening on site, to discuss solutions with those on site and then move to implement them, and also to negotiate as needed with other departments. When managers alone cannot solve the problem, their role requires them to report the problem to their supervisors and encourage those higher up to resolve the matter. We should consider that the manager's attitude here—that is, his having grasped the problem and yet nevertheless declining to report it to his supervisor, the General Manager of the Engineering Dept., and instead giving instructions to engage in the improper conduct or allowing the improper conduct to continue—had led subordinates to feel psychologically unsafe to escalate such a problem to a supervisor. In this respect, it must be impressed again upon the managers that their role is to ascertain any on-site problems, discuss solutions with those on site and then move to implement them, and also escalate the problem as needed to those higher up the chain.

However, blaming the managers' attitudes as the only reason as to why problems are not escalated would arguably be to miss the mark.

From the viewpoint of managers in charge of on-site operations, adhering to the development schedule is the absolute highest priority. If a problem arises in the development process, and that forces the development schedule to be delayed, managers would naturally be concerned about being blamed for their own management inadequacies and might even fear that the very act of reporting to and consulting with their supervisor about the problem could expose deficiencies in their management abilities, and so it is not difficult to imagine that they would be reluctant to do so. In more than a few of the recently discovered instances of improper conduct, the Assistant General Manager grasped the problem but declined to report to and consult with the General Manager of the Engineering Dept., and the psychology here is not incomprehensible.

In this regard, the essential thing is for the division executives and the management to be firmly resolved to prioritize compliance with laws and regulations above all else, to make that clear to the employees, and to create an atmosphere in which managers and their subordinates will readily report any problems occurring on site, and then for them to take any reports made seriously, to adopt an attitude which entails showing initiative in making decisions and taking actions toward an appropriate resolution, and to ultimately build up a track record of such actions. In so doing, they can ensure psychological safety and security for managers when it comes to bringing up on-site problems and dealing with them head-on, which in turn will presumably help to foster a culture in which problems are escalated.

B. Direct escalations to the management and whistleblowing

(a) Direct escalations to the management

With problems being faced on site, escalation through organizational channels is the standard way for the organization to handle them, but these organizational channels are not necessarily always functioning, and in terms of supplementary mechanisms to use when those channels clog, it would be valuable to consider putting a system in place for problems to be escalated directly to the management. More specifically, there are cases where companies have provided a dedicated forum allowing reports to be made directly to the management. Further, as one operational measure that could easily be implemented, it would probably be worth considering having a system where at the time internal audits are conducted, employees are interviewed in order to directly ascertain the problems or issues being faced on site, and feedback is then given to the management.

(b) Using a whistleblowing system

A whistleblowing system is imperative as a separate mechanism for complementing the escalation of problems through organizational channels, but the whistleblowing system built by Toyota Industries was never used to address the recently discovered improprieties. One major reason for this would seem to have been that employees had no real sense that blowing the whistle would lead the situation to be rectified, and on the contrary, they feared that blowing the whistle would effectively lead them to suffer some detriment, which speaks to a broader lack of psychological security in this regard. What has led employees to have that sense is the fact that the managers have not been inclined to squarely confront problems on site, and this seems to have led to a pervasive awareness that speaking up does no good, and that it merely leaves one at risk of suffering some disadvantage, for instance.

Meanwhile, in the course of its recent investigation, the Committee set up a whistleblowing hotline, and this hotline received a flood of information from employees. In particular, there were more than a few internal reports made by relatively young personnel, who suspected that things they had personally experienced or had seen or overheard might be in violation of laws or regulations etc. The Committee is of course an independent organization from the company, and its reports may not be used in a way that would allow any individuals to be identified by the company; the fact that the employees felt comfortable that they were not at risk of being treated unfairly by the company is, presumably, a major factor behind these results.

As can be seen from the fact that so many reports were received, the employees of Toyota Industries were hardly unwilling to blow the whistle, and given that Toyota Industries has recently become more firmly committed to thoroughly uncovering the facts and has gone so far as to establish the Committee, it would seem that the company's employees understood Toyota Industries' seriousness about eliminating improper conduct, and that understanding has led them to provide such information more proactively. Quite a few of these reports were marked by the hope that Toyota Industries would take this opportunity to "lance the boil" and transform itself into an even better company.

With regard to whistleblowing, we recommend that the company make efforts to dispel any misgivings about whistleblowing by making clear once again that that any adverse treatment of whistleblowers in response to their reports is strictly prohibited, such as by pledging that whistleblower secrecy will reliably be safeguarded, that investigation methods etc. will take into account the whistleblower's intentions, and so forth, and we also propose that the management make it clear that they are committed to confronting on-site problems head-on, that they welcome whistleblowing for its usefulness in quickly discovering and remedying problems, and that the management themselves will make robust efforts when the whistle is blown to address the problem themselves, so that conditions can finally produce a sense of psychological security about whistleblowing. Given the large number of whistleblowing reports from young personnel who wish to be in compliance with laws and regulations, making such reforms would presumably enable the company's whistleblowing system to perform its function going forward.

(4) Summary

As described above, if the company were to enable various levels of officers and employees to make decisions and take actions that prioritize compliance at their respective positions, put in place a system and an environment in which problems are escalated in the course of conducting work, and create conditions in which whistleblowing is used as a supplementary information route, for example, then compliance awareness and standards for the organization overall would likely improve. In addition to this, Toyota Industries must overcome its organizational culture which downplays the importance of data integrity. By having individual officers and employees treat data carefully and practice greater compliance awareness, and by ensuring that the organization handles data with care and that it has an operational system and environment which safeguards compliance, the company will likely become widely recognized as an organization with a robust compliance culture.

To foster a compliance culture, it is essential to maintain a strong reform awareness and motivation, and by no means are these reforms easy. These initiatives will require the persistence to repeat the process of implementing improvement measures, observing conditions, and then devising and implementing further improvements accordingly, but the Committee hopes that the management will take the initiative and see these kinds of reforms through to their completion.

2 Putting mechanisms in place to help prevent and quickly discover improper conduct

Next, in order to prevent officers and employees from ever being forced to choose decisively between compliance with laws and regulations and adhering to their development schedule, we propose putting in place an organizational or systemic mechanism of some kind that has such preventative effects. The prevention of improper conduct may ultimately come down to a matter of personal choice, but the imperative thing is to put in place a mechanism that would make it less likely for individuals to make mistakes, a mechanism that enables problems to be solved before the situation reaches the point where extreme judgments must be made. Many such mechanisms would also help to promptly discover and remedy any improper conduct.

Setting up the sort of mechanisms described below is something that many companies have already undertaken to do, and we must point out that Toyota Industries has been behind the curve with regard to such measures. Nevertheless, we recognize that several of the proposals below are already being pursued at Toyota Industries, and the Committee hopes that the relevant measures will steadily be formulated and implemented with the following kept in mind.

(1) Establishing rules etc.

The procedures to be followed at the development stage should be fully embodied in company rules etc.

First, the Engine Division did not have development timetables for reference. Given that more than a few of the recently discovered improper conduct came about because of the lack of any reasonable development schedule, formulating development reference timetables is essential.

In addition, although DR-related rules etc. and deterioration durability testing-related rules etc. were, in fact, in place, no rules were provided that stipulated any temporal relationship between DR and deterioration durability testing. Given that the timing for commencing deterioration durability testing was evidently too soon, causing problems to arise during deterioration durability testing and improper conduct to be committed in some cases, certain rules need to be established as to the specific development stage at which deterioration durability testing should be commenced.

Moreover, it was found that many of the recently discovered improper conduct could easily have been prevented if, for instance, there were detailed rules regarding deterioration durability testing, or if matters required by laws and regulations were incorporated into company rules etc. Those rules etc. also need to be revised from this standpoint as well.

In addition, the rules etc. in the Quality Assurance Dept. regarding sampling inspections etc. of mass production engines were also discovered to be deficient, and thus proper rules etc. need to be put in place to cover this matter as well.

We recognize that Toyota Industries is currently preparing rules etc. regarding general certification acquisition work including deterioration durability testing, and rules etc. stipulating emission measurement methods etc., and that, with respect to development reference timetables, it is also considering measures such as amending its development-related rules etc. to stipulate such timetables in those rules etc., and we hope that this work will steadily be pursued.

Needless to say, merely putting formal rules etc. in place will not be enough to prevent improper conduct. In some cases of quality-related impropriety incidents discovered at other companies in the past, despite the fact that rules etc. were in place, those rules etc. were ignored because their content was thought to be unreasonable, or they did not line up with on-site conditions, or for other such reasons, and this led improper conduct to be committed. In the promotion of establishing its rules etc., the company must take on-site opinions into account while examining whether the content is necessary and sufficient while leaving nothing out, and whether the rules etc. will place an excessive burden on personnel. Further, even after the rules etc. have been enacted and revised, the company must routinely inspect and review their content, and must then continually make additional improvements in light of whether or not those rules diverge from the actual work being done on site, for example.

(2) Separation of development engineers and certification engineers

In the recently discovered improper conduct, the engineers in charge, who had been performing engine calibration work on the development frontlines, were also in charge of work relating to certification which entailed objectively evaluating development results. This kind of system creates conditions wherein the engineers in charge might be tempted to rewrite test results in order to obtain certification in keeping with their schedule, and gives them opportunities to commit impropriety, and it has to be said that this organizational system inherently contains the risk that impropriety will be committed. For that reason, it is imperative that development work and certification work be separated, and there is a great need for a dedicated department responsible for regulation certification to be created.

Naturally, creating an exclusive organization might be difficult from a management standpoint in light of the volume of administrative work involved, for instance, but even in that case, there is certainly room for various possible measures such as formulating special procedural guidelines which account for the high risk of impropriety.

(3) Ensuring checks in the development process

A. Dedicated department responsible for regulation certification

A dedicated department responsible for regulation certification is important in the sense of ensuring that checks and restraints on development are working, from the standpoint of compliance with laws and regulations. A dedicated department responsible for regulation certification is expected to be involved in DR, and, from a third-party perspective independent from the engineering department, check the development schedule established by the engineering department and the methods used to conduct deterioration durability testing, as well as the methods used to create certification application documents etc., point out any problems that have been discovered and call upon the engineering department to make improvements.

In addition, a dedicated department responsible for regulation certification is expected to collect information regarding laws and regulations, spread that information at worksites, and, if for instance disputes should arise over the interpretation of any laws or regulations or if deterioration durability testing is discovered to be deficient in some way, inquire or negotiate with the authorities; perhaps much of the recent improper conduct could have been avoided if a dedicated department responsible for regulation certification had performed its expected functions as appropriate.

With regard to this point, as stated in II Part 1-4(2) above, Toyota Industries established a Regulation Certification Office in March 2021 dedicated to Regulation Certification Work, and then in September 2021 it upgraded the Regulation Certification Office to be the Regulation Certification & Administration Dept. Going forward, the company needs to fully staff the Regulation Certification & Administration Dept., and must ensure that the Regulation Certification & Administration Dept. exhibits the appropriate checking effects and demonstrates more than enough capability in providing information to development sites and conducting public relations and external affairs.

B. Quality assurance department

The Quality Assurance Dept. also has a significant role to play in DR. The Quality Assurance Dept. has to actively contribute to DR from the standpoint of guaranteeing the quality of mass production engines shipped to the market, and to point out any problems. Further, to enable the Quality Assurance Dept. to properly conduct its checks and restraints, in terms of frameworks as well, there needs to be a mechanism in place which allows the Quality Assurance Dept. to substantively be involved in DR, for instance by ensuring that depending on the details of DR agenda items, approval must be given by the Quality Assurance Dept. in order to proceed to the next step.

It should be noted that, as a prerequisite for the Quality Assurance Dept. to substantively be involved in DR, it is essential that the Quality Assurance Dept. system be strengthened. We recognize that

Toyota Industries is already working to enhance the checking functions of the Quality Assurance Dept. by additionally posting Engineering Dept. personnel there, for instance, but it would be desirable for the company to continue to verify whether Quality Assurance Dept. personnel have enough capabilities and systemic support, and to make any overhauls to this arrangement as needed. It is also crucial for those personnel charged with quality assurance work to be trained from a long-term perspective, and for measures involving a company-wide viewpoint to be considered as well.

(4) Enhancing oversight functions

In addition to retrospectively verifying that QMS is reliably functioning, remedying any inadequacies, and preventing improper conduct from occurring, it is also important to have a mechanism in place that will help to quickly discover any improper conduct that has already been committed.

A. Enhancing the internal audit functions of the Quality Assurance Dept.

The Quality Assurance Dept. needs to conduct internal audits, check whether worksites are carrying out work in accordance with QMS, and point out and remedy any problems that may arise. Repeating this process will ensure that QMS is more effective.

To make the internal audits (quality audits) conducted by the Quality Assurance Dept. effective, rules etc. must be put in place. However, whether or not the development of these rules etc. is inadequate is a subject for oversight, and any such deficiencies need to be pointed out and rectified.

Further, the internal audits conducted by the Quality Assurance Dept. must be the sort to create a sense of tension on site. Instilling an awareness that an internal audit might turn up some impropriety will also serve to prevent such impropriety from happening in the first place. In that sense, from the standpoint of preventing impropriety in the context of deterioration durability testing, the company needs to consider adopting auditing methods such as checking raw data via sample checks, for example.

To make the internal audits conducted by the Quality Assurance Dept. effective, it is of course essential for its auditing methods to be refined, and to make sure that the Quality Assurance Dept. is adequately staffed and enhance its system such as by improving its capabilities. Training personnel from a long-term perspective is also vital in this regard.

B. Coordination with the head office department

Under the organizational system at Toyota Industries, there is a quality assurance department in every division. Naturally, it is very significant for the Quality Assurance Dept. to be in close contact with business operations, and the department would be expected to perform effective audits based on a deep understanding of the business, but because it is part of the division, there is also the risk that it will be reluctant to give critical judgments in its audits.

In order to ensure that the Quality Assurance Dept. is able to provide critical judgments that are assuredly independent, one possibility would be to create a head office department as a reporting line for the Quality Assurance Dept., but, as a basic requirement for this, it would be important for the head office department to monitor and oversee whether the auditing activities that are expected of the Quality Assurance Dept. in each division are reliably being conducted, and support the Quality Assurance Dept. in terms of expertise and establishing any systems. In particular, it would need to ascertain whether or not there are any problems involving how audits are being conducted, and if there were any issues or problems, to get the management involved and remedy the situation.

With regard to this point, as stated in II Part 1-7 above, Toyota Industries has established the Quality Management Dept. (formerly the Quality Control Dept.) as a head office function, and this department has principally been operated to provide a supportive role for the quality assurance departments in every division, but, at least with regard to the quality assurance activities of the Engine Division, effective and adequate support have not been provided when it comes to putting rules etc. in place, to ensuring the capacity to implement quality audits, and so forth, and thus the reinforcement and enrichment of these head office functions is also an urgent support-related issue. Further, in terms of head office functions, the supervisory function concerning quality assurance activities within business divisions is also important, and the aim here must be to ensure the effectiveness of quality assurance activities in the divisions in a cross-functional manner covering both oversight and support. That said, we recognize that Toyota Industries has already undertaken reforms to enhance the quality control department at the head office with the assistance of external agencies, and the Committee also hopes that these efforts will steadily be promoted.

In connection with the foregoing, collaboration with the audit department at the head office should be strengthened. Back in 2016 when quality improprieties were discovered at another company, the Audit Dept. affirmed the risk of certification-related impropriety at each division and conducted an audit accordingly, but due to an incomplete understanding and grasp of certification-related laws and regulations and of the state of work, the presence of impropriety was ultimately overlooked. However, if personnel with sufficient knowledge and experience about the engineering departments had been embedded among the audit members, then it is quite possible that a more accurate audit could have been performed. An audit system should be put together that is equipped with specialized knowledge and capabilities in the field and that can conduct in-depth audits, with cooperation from other departments, in accordance with the nature and the severity of the risks identified by the Audit Dept., and this should be achieved by establishing a framework for strengthening collaborations so that these operations can be conducted in a timely manner.

(5) Promoting systemization

From the standpoint of preventing impropriety, it is also important to take measures predicated on the concept that individuals can and do commit impropriety. One effective measure in that regard would be to deploy a system intended to automatically record data or prevent data falsification. For instance, by creating a system in which test data are automatically recorded and reflected in test reports, and in which values cannot be rewritten, you can make it possible to prevent any individuals from intervening arbitrarily, and thus leave no room for impropriety to enter into the process. Not only would this be an effective means of verification to assure product quality, but it would also be useful from the standpoint of preventing the employees from being forced into either/or situations. Further, making systematic arrangements so that a data revision history is kept, a warning is issued whenever an employee performs a different task than usual, and so forth would enable an easy discovery of what happened if an employee were to commit any impropriety, which would serve to prevent such impropriety ahead of time, and even if some impropriety were to be committed, this system would help discover it promptly.

Naturally, deploying such a system to automatically record data and prevent data falsification would require considerable expense, and thus first of all it is important to create a specialized team including the management, identify and understand what sorts of impropriety can enter into the development process or manufacturing process, and then assess to what extent your current framework can respond to those risks, after which you would have to consider how to address those risks that cannot be fully handled at present, based on their levels of priority. For example, while deploying a system for automatically recording data and preventing data falsification would be highly effective, it would likely be necessary to consider alternative means that would also enable the company to minimize risks. This is precisely what is meant by risk management, which will be discussed below. The specialized team including the management should make their considerations, and then it would be the management's responsibility to make the final decision and implement measures accordingly.

3 Reforming the perceptions and conduct of the management

The responsibility for implementing the recurrence prevention measures pointed out above in sections 1 and 2 lies primarily with the management. With regard to fostering a compliance culture, the management must themselves disseminate the value standard for compliance with laws and regulations as well as take the lead in putting that standard into practice as an example for all to see, thereby making it possible for the organization as a whole to securely carry out development and production in a way that prioritizes compliance with laws and regulations. Further, creating a framework for allocating responsibilities and performing checks in the course of development and production work under strict compliance with laws and regulations, as well as putting a system and structure in place for strengthening etc. the dedicated department responsible for regulation certification and the quality assurance departments, should be important pillars of the company's internal control system, and the management needs to determine the nature of that system and structure and have the officers in charge operate them appropriately.

Thus, to prevent such improper conduct from ever recurring at Toyota Industries, it is important for the management to take responsibility for implementing the various measures proposed in this report, but in addition to that, as discussed above in Part 1, the background leading up to the recent instances of improper conduct was found to include problems involving the company's corporate system and organizational culture, the resulting lack of risk sensitivity among the executives in the Engine Division, and moreover, insufficient efforts by the management to correct the relationship between TMHC and the department responsible for engines for industrial vehicles and thereby achieve optimal conditions overall. The management must make proactive efforts to solve these sorts of problems, with a renewed sense of awareness.

(1) Efforts to reform corporate system and organizational culture

A. Breaking away from a contractor's mentality

As we described earlier, the Engine Division has long been developing engines for automobiles under the direction and supervision of Toyota Motors, and thus in essence the division has what might be called a contractor's mentality, and although the division could implement instructions given by Toyota Motors, it had little ability to discover problems or issues on its own and derive measures to solve them. For that reason, in theory, the division needed to take the initiative to discuss and implement measures to comply with emissions regulations even for engines for industrial vehicles that were not contracted by Toyota Motors, yet nevertheless it failed to recognize the effects of the tightened regulations or the magnitude of the burden involved as something that was a concern of its own. This sort of contractor's mentality is one of the background circumstances that led to the recent instances of improper conduct, and to prevent a similar scandal from occurring going forward, the company needs to break away from this contractor's mentality.

Furthermore, since June 2021, the lead role in developing diesel engines for automobiles was transferred from Toyota Motors to Toyota Industries, and accordingly the Engine Division is required to identify the risks surrounding the business and then take precise measures to address those risks not only with regard to engines for industrial vehicles, but for diesel engines for automobiles as well. From this point on, the Engine Division can no longer be allowed to have a contractor's mentality, and thus breaking away from this mentality constitutes an urgent issue.

To that end, the management needs to put a system in place ensuring that the Engine Division can be self-reliant in carrying out engine development, and the mentality on a company-wide scale must be changed.

First, as regards establishing the system of the Engine Division, being that the Engine Division has thus far been carrying out development of both engines for automobiles and engines for industrial vehicles, it should have had a personnel system or facilities in place for handling development work. However, with regard to engines for automobiles, this work involved contract work by Toyota Motors, and thus any audits of raw data related to development tests, the implementation of deterioration durability testing, certification application procedures, and so forth were all carried out by Toyota Motors, and, when it came to designing the system and rules etc. for ensuring that development work was appropriately conducted in accordance with laws and regulations, they relied upon Toyota Motors. As a result, a contractor's mentality where simply performing as instructed by Toyota Motors was sufficient, was prevalent within the Engine Division, and although the Engine Division also needed to voluntarily comply with laws and regulations regarding engines for industrial vehicles, it failed to undertake such compliance measures as appropriate.

In order to correct this contractor's mentality, it is imperative for the Engine Division to develop a system of its own for carrying out development and production in full compliance with laws and regulations, so that it can also conduct that portion of work for which it had been relying, up to now, on Toyota Motors. More specifically, as described above, it must establish a dedicated department responsible for regulation certification, put a system in place which enables the Engine Division to independently collect information on laws and regulations and negotiate with the authorities, and also establish a framework under which the dedicated department responsible for regulation certification and the Quality Assurance Dept. are substantially involved in DR and provide appropriate checks and restraints during the development process. In addition, to ensure that this type of framework functions appropriately, suitable personnel obviously will need to be provided, and the management cannot simply put this framework in place, but instead must provide personnel to make sure that such a framework functions as it should. This kind of organizational system or framework reform needs to be undertaken not merely by the Engine Division but on a company-wide, cross-sectional scale, and the management itself must make efforts to reform their own awareness.

Furthermore, it is not enough for the management to merely put an organization or a framework in place, nor will it suffice to change the management's awareness—rather, the awareness among the employees themselves also needs to be changed.

Going forward, it will not be enough for the Engine Division just to steadily carry out whatever work it has been instructed to do by Toyota Motors, and the division will have to take responsibility for conducting engine development. To achieve this, each and every employee involved in engine development needs to be aware of his or her own role, and to have a strong sense of the need to fulfill that role. For example, in the case of employees engaged in emission-related engine calibration work, their role is to achieve an emission performance that satisfies regulations in all the different countries, and thus they must be conscious that they have taken that responsibility on themselves, and if they have difficulty achieving that, they must report to and consult with their supervisors, and strive to take the appropriate response which may include making design changes, amending the development schedule, and so forth. Further, in the case of Quality Assurance Dept. employees, they need to be aware of the primary responsibility to assure the market the quality of the company's products, to carefully check during the development process whether there are any problems or issues from the standpoint of guaranteeing the quality of mass production engines, and if any such problems or issues do exist, to discuss them in a free and unbiased way.

By having each individual employee understand the meaning and importance of his or her duties, it will be possible to orient them towards proactively looking to find any issues and solving them, and to thereby break away from the contractor's mentality.

Further, it goes without saying that changing employees' awareness is the responsibility of the management. Employees must understand the significance of their own work, be aware of their responsibility, and be able to take pride in the work they do. This is not something that can be accomplished through classroom-based education and training alone. It must begin with managers at each level changing their own perceptions, and through their daily work, instilling in their direct subordinates a sense of understanding of the significance of their work and the responsibilities they have. Therefore, the management must make all managerial personnel keenly aware that inculcating in their subordinates the significance of their work and their responsibilities, as well as leading them to take pride in that work, is one of their duties as managers. More than anything else, the management must themselves advocate for breaking away from the contractor's mentality, and they must not forget that this is predicated upon setting an example through their own actions.

B. Reforming the culture of "trivializing industrial vehicles"

With regard to these recent instances of impropriety, the General Manager of the Engineering Dept. and the executives of the Engine Division lacked the inclination to grasp the real conditions at the development worksites, and improper conduct was committed without the problems there ever having been escalated, and this situation would seem to have been influenced by the tendency among the Engine Division's executives and the management above them to trivialize industrial vehicles.

For engine development to be conducted independently, the Engine Division's executives and the management should seriously reflect upon how they trivialized the difficulty of developing engines for industrial vehicles, simply because the field makes only a small contribution to sales within the division, or because the knowhow gained from automobile engines can simply be applied to them, and then they should pursue reforms by first accurately grasping the real circumstances regarding the tightened regulations for the industrial vehicle business and the challenges involved in response to those circumstances.

When it comes to addressing the tightened regulations for engines for industrial vehicles, the actual conditions need to be reported accurately, covering topics including what the challenges are, what is lacking, how development is progressing, and what problems have arisen, and in order to grasp the situation, the executives need to demonstrate an intention and an inclination to be proactive, and if necessary the Assistant General Manager, managerial personnel, and even the engineers in charge must directly share their opinions with each other to accurately ascertain the circumstances and then reflect that understanding in their management decisions as appropriate.

To be sure, in terms of the Engine Division's balance sheet, the division's core products are engines for automobiles, with engines for industrial vehicles accounting for only a small proportion of its products. That the Engine Division's executives would be concerned with their own division's performance results, and would consequently place greater value on the development of the division's core products (for the Engine Division, this being engines for automobiles), is in some sense unavoidable, and yet if one looks beyond the confines of the division and considers Toyota Industries as a whole, the industrial vehicle business is a core business, and engines for industrial vehicles are a key component making up the products of that core business, and are not something that should ever be trivialized.

Rather than being interested only in the business profits of their division, the Engine Division's executives should be concerned as well about how the nature of the business under their supervision (i.e., the development of engines for industrial vehicles) relates to the business of other divisions (TMHC), and what sort of role they should play in Toyota Industries' overall management strategy and business strategy. They must change their long-held awareness of trivializing industrial vehicles, with regard to engines for industrial vehicles, they must pay attention to the nature of the tightened regulations on those engines, to whether their development system can adequately accommodate them, and to whether they are operating under an unreasonable development schedule.

Further, if such reforming of awareness and actions of the Engine Division's executives were to become visibly apparent at every level within the organization, then the engineers in charge would gain a tangible sense that industrial vehicles are not being trivialized, and problematic conditions will presumably also be escalated in a timely manner.

It should be noted that such a reforming of awareness is also required of TMHC's executives. Instead of merely making unilateral demands of the Engine Division to cut costs in order to improve their division's business profits, they must show an inclination to work as a partner dedicated to growing Toyota Industries' industrial vehicles business, sharing their awareness of the issues and problems that the Engine Division is facing, and seeking to arrive at an appropriate compromise.

(2) Improving risk sensitivity among the Engine Division's executives and the management

A. Improving risk sensitivity among the Engine Division's executives

The Tier 2 Regulations for emissions from engines for industrial vehicles made it mandatory to conduct deterioration durability testing and includes tightened NOx regulations, by which significantly tightened regulations are introduced on engines for industrial vehicles than the comparatively mild ones that had been in place.

As a way of handling these regulations, the Engine Division developed new diesel engines in the form of the 2007 1DZ Engine, the 3Z Engine and 15Z Engine, as well as new gasoline engines in the form of the 2007 4Y Engine and the 1FZ Engine, all of which received domestic certification in 2007 and were then put into production; yet, as described above in Part 1-5(1)C, no review was made of the development process in light of these tightened regulations, nor was any education or training conducted with regard to newly obligatory deterioration durability testing.

What led the Engine Division's response to be so insufficient was that the Engine Division's executives had failed to accurately recognize the magnitude of the damage that Toyota Industries would likely incur if it mishandled the response to the new emission regulations (this not being limited to economic loss, but also including intangible losses in the form of damage to the company's brand or reputation). As for why the Engine Division's executives at the time failed to recognize the tightened emission regulations on engines for industrial vehicles as a risk, it presumably had to do with the division's contractor's mentality and tendency to trivialize industrial vehicles, but executives in the position of overseeing the Engine Division should have properly understood and dealt with any risks resulting from the tightening of regulations for the business they oversee, and they cannot use the contractor's mentality and tendency to trivialize industrial vehicles as an excuse. In the first place, engines for industrial vehicles are not commissioned by Toyota Motors to be produced, but are instead developed primarily by the Engine Division, and when fully-fledged emission regulations were rolled out for engines for industrial vehicles, the Engine Division needed to play the lead role in undertaking compliance with regulations.

Furthermore, since June 2021 the lead role in developing diesel engines for automobiles has been played not by Toyota Motors but by Toyota Industries, and if regulations on diesel engines for automobiles are to be tightened even further in the future, it will be the Engine Division at Toyota Industries that has to take the lead in achieving compliance with regulations etc.

In light of the Engine Division's situation, with regard to every type of engine developed by the Engine Division (and not only engines for industrial vehicles), going forward, the Engine Division's executives must precisely identify the risks posed by the tightening of emission regulations or any other regulations and then take an appropriate response according to those risks. The Engine Division's executives have a responsibility to accurately grasp the nature of any newly rolled out or tightened regulations, to discuss whether a sufficient organizational system is established to deal with those regulations, whether they need to invest new resources, whether they have to revise their development schedule or other processes, and whether their employees have to undergo education and training, and then to implement any necessary measures, and it is important for them to make themselves more sensitive to the risks relating to emission regulations and other regulations. To that end, the Engine Division's executives must be prepared to regularly identify risks by learning what sorts of risks surround their business, and in cases where the laws and regulations concerning those risks has been revised or where a scandal has rocked a competitor in the same industry, for example, to check whether their organizational system and processes are sufficient to handle any such risks.

B. Improving risk sensitivity among the entire management

In terms of the background circumstances behind these recent incidents of improper conduct, we have pointed out how the executives of the Engine Division overseeing engine development lacked the proper sensitivity to the risks concerning emission regulations, but given the frequency with which quality-related impropriety incidents has been occurring at a number of Japanese manufacturers recently, it would seem incumbent not only on the Engine Division's executives but on the management of Toyota Industries as a whole to enhance their sensitivity to quality-related risks, and to make efforts to ensure that those on site at the work areas have a thorough appreciation of the need for compliance with laws and regulations.

In the 2000s, instances of quality improprieties were discovered at a number of Japanese companies (in manufacturing), with those companies subsequently being exposed to harsh criticism from society. As a result, the companies that were discovered to have committed impropriety—and even other companies that were not found to have had any instances of impropriety—made clear that they were firmly committed to checking and strengthening their quality management systems and to having their management prioritize compliance with laws and regulations above their development schedules, and they took the step of making sure that awareness was thoroughly ingrained in their worksite personnel.

However, although Toyota Industries publicly announced on March 17, 2023 the improprieties discovered at this time, an internal message from the President was also sent to convey the company's awareness that it had lacked a proper understanding of the certification rules and an appropriate appreciation for compliance regarding testing procedures, and the company stated its intent to make efforts to prevent such incidents from occurring again, and the company's Code of Conduct was even amended, rephrasing its basic stance on compliance to include the phrasing "In compliance with domestic and overseas laws and regulations, standards and criteria, and the specifications agreed upon with our customers, including those related to products and the environment, we provide products and services whose quality meets the expectations of our customers", it is nevertheless difficult to conclude that up until the discovery of these recent instances of improper conduct, the management had conveyed a strong message prioritizing the importance of compliance with laws and regulations over that of its development schedules.

At times, adhering to development schedules and being in compliance with laws and regulations can seem like an either/or choice. Many of the recently discovered improper conduct originated in the fact that employees faced with this either/or situation chose to adhere to their development schedule. When considered separately, adherence to development schedules and compliance with laws and regulations are each rightful and proper pursuits, but the problem here is that when their relationship is such that trying to adhere to the development schedule precludes achieving compliance with laws and regulations, whether employees will be able to choose compliance with laws and regulations without wavering.

Given the frequency of these instances of quality-related impropriety incidents in recent years, the management at many companies have expressed their strong determination to prioritize compliance with laws and regulations and have been taking countermeasures accordingly, and yet Toyota Industries has not acknowledged the risk of quality improprieties to be a matter of concern and taken adequate steps to overhaul its internal systems. Going forward, the management as a whole must enhance its sensitivity to the risks of quality improprieties and must announce its strong resolution so that employee awareness can be reformed.

C. Putting a risk management system in place

Furthermore, the management at Toyota Industries needs to conduct appropriate risk management, which would entail identifying any potential risks facing their businesses, and then checking whether they have internal systems in place for preventing such risks from manifesting.

At issue at this moment is emission regulations, but these are merely a tiny portion of the risks surrounding Toyota Industries. The management needs to enhance their level of sensitivity to the risks surrounding Toyota Industries and take measures before those risks actually materialize.

As described above in II Part 1-8, although Toyota Industries did establish a risk management system back in 2008 and had the Internal Control Office, Corporate Planning Dept. identify company-wide risks, it never made any subsequent searches for or reevaluations of company-wide risks. However, changes in the social and economic circumstances surrounding the company's business and so forth have undoubtedly led to changes in where the risks are located, and it is obvious that the company needs to regularly identify and reevaluate those risks. If such identification of risks had been carried out regularly, it is even possible that the tightening of emission regulations on engines for industrial vehicles would have been recognized as a business risk, and that steps would have been taken to caution the Engine Division about that risk.

While the Committee recognize that, in 2021, Toyota Industries began to reform its risk management system, for instance by giving its CSR Committee risk management functions and appointing a Risk supervisor, in order to ensure that these reforms function effectively, the management needs to be actively involved in these activities and to take the necessary measures such as providing human resources.

In addition, to make risk management effective, it is also important to continue running the PDCA cycle. Previously, Toyota Industries had been identifying risks in each division and creating risk maps, but it cannot truly be said that once these risk maps were created, the company had sufficiently perceived and managed the situation to check what kinds of measures the divisions have taken to minimize the risks that had been found, or to what extent the risks had been reduced as a result of those measures. Going forward, the CSR Committee and the Risk supervisor must play a central part in the reliable running of the PDCA cycle.

(3) Management decisions transcending business division boundaries

In the leadup to the improprieties discovered at this time, there had been an imbalanced power dynamic between TMHC and the department responsible for engines for industrial vehicles within the Engine Division. The department responsible for engines for industrial vehicles was in the position of being compelled to comply with TMHC's demands even when they seemed very difficult, and practically no sense had been fostered between the two that they work together to produce better engines as a team.

What brought this sort of dynamic about was that Toyota Industries had adopted a business divisions system, with the industrial vehicle business to be overseen by TMHC and with engines for industrial vehicles to be overseen by the Engine Division, which meant that TMHC and the Engine Division were in an customer-supplier relationship, and on top of that, there was a prevailing tendency within the Engine Division to value engines for automobiles as their leading product while trivializing engines for industrial vehicles (which account for a small percentage in their business), and in some sense, this situation could also be regarded as a detrimental effect of a business divisions system that is more focused on its responsibility for earning profits.

However, as can be seen from the fact that many companies have adopted a business divisions system as their organizational system, this system is not necessarily an unreasonable one. Any organizational system will naturally have benefits and drawbacks, and it is precisely because a business divisions system has a number of advantages that so many companies have adopted one. In addition, under Toyota Industries' business divisions system, it is also reasonable for engine development to be consolidated into a single division, and for oversight to be divided as described above.

The problem is that the management at Toyota Industries had failed to make adequate efforts to minimize the drawbacks of business divisions system. Whatever efforts the management was making to minimize those drawbacks were not enough, and this would appear to be one of the background circumstances which had detrimental effects on the business divisions system and thereby led to the recent instances of improper conduct.

Under a business divisions system, making each division be responsible for earning profit, and thereby having each division act to maximize its own profits, that is to say, having each division use its ingenuity and inventiveness in acting to maximize its own profits, will in turn also maximize their utility for the whole company.

However, it must be noted that in some cases, this inclination for each division to maximize profits will not necessarily be optimal in an overall sense. While in one sense it might be reasonable for TMHC to position the department responsible for engines for industrial vehicles in a similar fashion to an external engine manufacturer, with regard to Toyota Industries as a whole, engines are also included in the forklifts developed by Toyota Industries are what are sold to its customers, and as such, matters such as what the company's product or engine lineup should be, what sort of development schedule should be established, and how the challenges and costs involved in dealing with emission regulations should be regarded are ones that need to be discussed by the Engine Division and TMHC together, so that the optimal decision may be made for Toyota Industries' industrial vehicles business.

Further, it would be inappropriate to regard overall optimization merely from the perspective of sales or profits. Overall optimization needs to be achieved in light of the risk analysis described above, and this means for instance that the company must consider the likelihood that improper conduct will be committed and the impact it will have, and must then allocate resources appropriately.

That said, although Toyota Industries did organize the Engine Committee consisting partly of officers who oversee TMHC and the Engine Division respectively, and this committee deliberated about engine selection and specifications before development work was begun on engines for industrial vehicles such as forklifts, as we pointed out earlier, there was an "imbalanced power dynamic" between TMHC and the department responsible for engines for industrial vehicles, and thus it is difficult to say that the Engine Committee had adequately been fulfilling its function. Additionally, the Executive Committee was not in a position to discuss management issues in a way that transcended division boundaries.

In light of the recently uncovered improper conduct, Toyota Industries must rectify this imbalanced dynamic between TMHC and the department in charge of industrial engines within the Engine Division and must create an environment in which the two can cooperatively engage in the development of engines for industrial vehicles, as well as create a truly substantive framework for making management decisions that transcend division boundaries. To that end, the company must first remedy the tendency of the Engine Division to trivialize industrial vehicles and build a new dynamic between the Engine Division and TMHC which enables the two to have constructive discussions about developing engines for industrial vehicles in an optimal manner for the industrial vehicle business. However, if discussions between the Engine Division and TMHC alone are not enough to build the appropriate dynamic, then the management at Toyota Industries as a whole—including directors in charge of other divisions or outside directors—should examine what kind of framework would enable company-wide management decisions to be made, in a way that transcends division boundaries, to improve Toyota Industries' corporate value.

As for what such a framework would concretely look like, that is a matter for Toyota Industries to consider as appropriate. The important thing is for Toyota Industries' management to eliminate the detrimental effects of its business divisions system, come to a shared recognition of what needs to be discussed and decided from the standpoint of overall optimization, provide a venue for discussing how to achieve overall optimization in a way that transcends division boundaries, and then move on to implementation. For instance, under the current sort of business divisions system in which each division is responsible for its own business profits, when these issues are simply left to be discussed by TMHC and the Engine Division, the two divisions are highly unlikely to find an the optimal solution to resolve matters for which they have different incentives (such as cutting development costs for engines for industrial vehicles), and thus the company needs to discuss what is to be done to align the incentives of TMHC and the Engine Division in the same direction. Further, in scenarios where emission regulations or other regulations are significantly changed, and the company's organizational system must also be changed in response, it conceivably will be necessary to review the budget and personal allocation for each division. If it is difficult for the divisions to take the lead in discussing such issues, then it is Toyota Industries' management that will have to treat and discuss them as company-wide management issues, and then make the necessary management decisions.

4 Conclusion

The Committee's focus in this investigation has been on the Engine Division and TMHC's related departments, and it has analyzed issues facing Toyota Industries focusing on improper conduct with regard to emissions certification. However, we hope that Toyota Industries' management will discuss these matters in a way that covers the problems with its organizational culture, including not only the Engine Division and TMHC but other divisions as well, and that it will fully consider what kind of efforts should be made to solve the problems that have been identified, with the management sending a clear message to all employees about the direction that the company aims to take.

Despite any involvement in the improper conduct, the employees of Toyota Industries with whom the Committee has been in contact have all been diligent and honest. If the management is firmly committed to solving its problems including ones with its organizational culture, sends a message to its employees in a clear way, and takes the initiative in promoting reform-oriented actions, then we might be inclined to believe that Toyota Industries will earn society's trust as an organization with a robust compliance culture, and even transform itself into a resilient organization capable of handling any environmental changes or crises.

Finally, we would like Toyota Industries' employees to take pride in their work, and to have a strong desire to fulfill their roles. Toyota Industries operates a large variety of businesses, including not only an automobile-related business but also an industrial vehicle business and a textile machinery business, and it has a sizeable market presence in each of those businesses. Needless to say, each and every employee is supporting those business, and their high levels of ability are undoubtedly what has earned the market's confidence and enabled the company to enjoy its current market presence, which is something that every employee should be proud of. We hope that all of the company's employees take this sense of pride to heart and devote themselves to fulfilling their duties as individuals responsible for supporting Toyota Industries.

End