January 29, 2024

To Toyota Industries Corporation

Investigation Report
(Summary Version)

Special Investigation Committee

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I. Overview of the Investigation

Part 1. Background Leading Up to the Investigation

In the second half of 2020, Toyota Industries Corporation ("**Toyota Industries**") complied with an inquiry from the United States Environmental Protection Agency ("**EPA**") for the deterioration durability testing data submitted in the past, and found some questions about the appropriateness of the deterioration durability testing. Then, Toyota Industries engaged outside attorneys to investigate the facts, as a result of which 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. In response to this, Toyota Industries established the Special Investigation Committee ("**Committee**"), which is made up of independent outside experts with no interests in Toyota Industries.

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 (Gaikoku Kyodo Jigyo) ("Nishimura & Asahi") assisted the investigation by the Committee.

Part 3. Scope of the Investigation

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 given that for U.S. and EU emissions certification, foreign authorities are conducting investigations and voluntary reporting etc. to foreign authorities were made, the scope of the investigation by the Committee was limited to improper

conduct relating to emissions certification in Japan.[1]

Further, 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 emissions certification in Japan after the Tier 2 Regulations, which make mandatory the implementation of deterioration durability testing, came into effect.[2]

Furthermore, Toyota Industries developed and produced not just engines for industrial vehicles, but also engines for automobiles for Toyota Motor Corporation ("**Toyota Motors**"),[3] and consequently, the Committee also 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, but with regard to engines for automobiles, it was confirmed that instead of Toyota Industries, Toyota Motors performed all the work relating to certification including deterioration durability testing[4] [5].

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 of specifications 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.[6]

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1 As discussed below, however, there are some cases where domestic emissions certification was obtained on the premise of U.S. and EU emissions certification, in which case conduct relating to U.S. and EU emissions certification was also investigated to the extent relating to domestic emissions certification.

2 The Committee investigated whether there was any improper conduct relating to industrial vehicle engines, and the emissions performance of the industrial vehicle engines subject to the investigation (i.e., whether the performance of such engines for industrial vehicles satisfies the emissions regulations in Japan) is excluded from the scope of the investigation.

3 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.

4 Regarding engines for automobiles, Toyota Motors has obtained automobile type designation and device type designation of carbon monoxide, etc. emissions control devices.

5 Regarding engines for automobiles, in order to obtain automobile type designation, etc., emission measurements are required by laws and regulations to be conducted on the engines alone for heavy-duty automobiles and on the engines installed in automobiles for light- and medium-weight automobiles. Therefore, among the engines for automobiles developed by Toyota Industries on consignment from Toyota Motors, as described in II Part5-2 below, emission measurements were conducted on the engine alone for the 1GD Engine installed in the Dyna and the Coaster, which are heavy-duty automobiles, and the other engines for automobiles were measured while they were installed in the automobiles.

6 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

The Committee examined 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, and took possession of, and included in the examination, relevant materials that had previously been collected and records of interviews conducted by the attorneys from Nishimura & Asahi which conducted a partial investigation before the establishment of the Committee.

The Committee also conducted interviews of 72 concerned persons and performed a data review for PCs and servers used by 38 officers and employees.

Further, 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.

The Committee was established on March 17, 2023. The reference date for the Committee's investigation report is January 29, 2024.

II. Investigation Results

Part 1. Overview of Toyota Industries

1 Overview of business

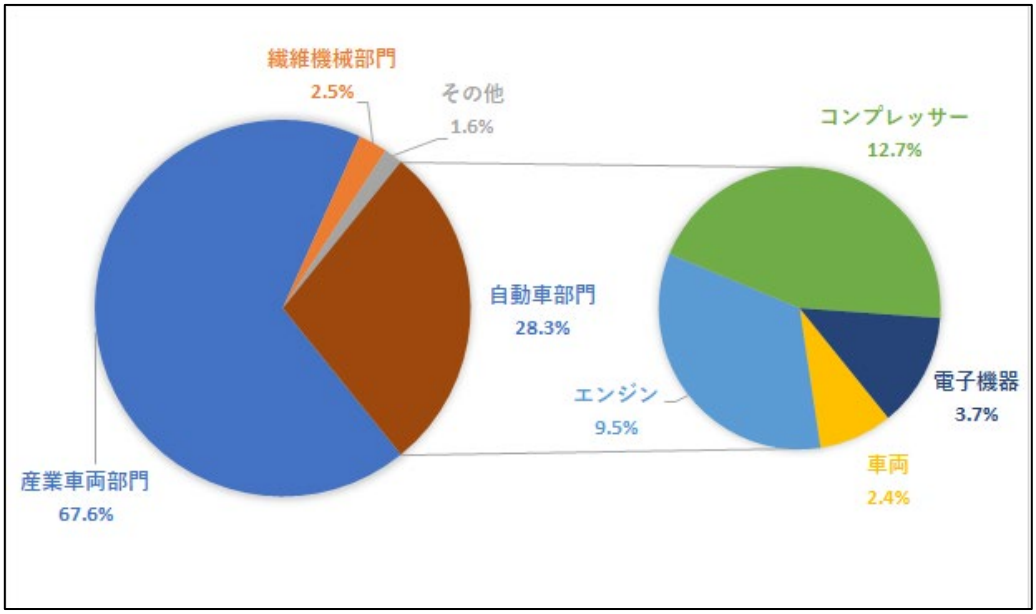
Toyota Industries' business is broadly divided into the textile machinery business, industrial vehicle business, automobile business, engine business, compressor business, electronics business, and battery business.

The industrial vehicle business 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).

Further, the engine business manufactures engines used in industrial vehicles as well as engines used in Toyota Motors vehicles. 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, the engine business 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.

Toyota Industries' segment sales (including subsidiaries) for the fiscal year ended March 2023 are

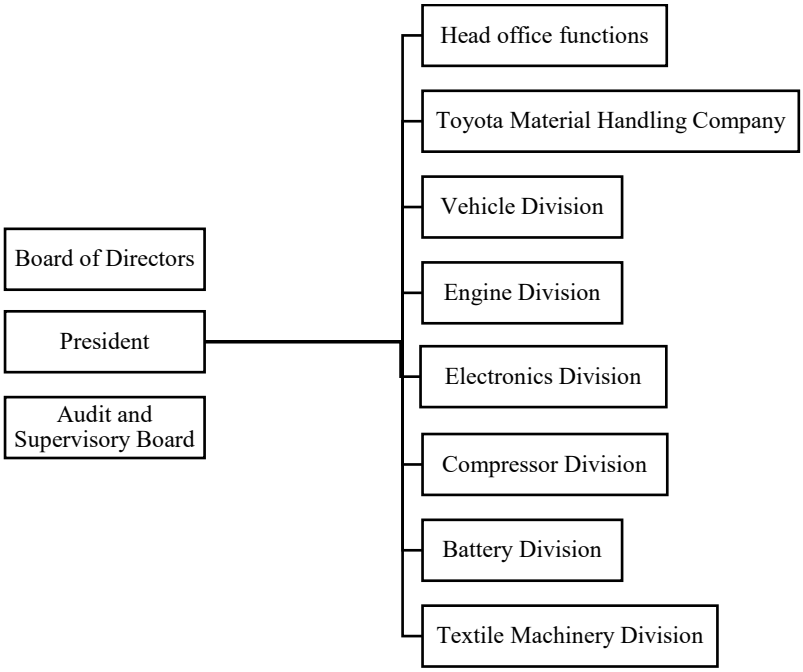
as indicated below.



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%

2 Organizational overview of Toyota Industries

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



At Toyota Industries, business divisions and business offices responsible for each business have been established, and like many companies that adopt a business divisions system, each business division is independently responsible for its own profit and loss. Toyota Material Handling Company ("**TMHC**") is an internal company of Toyota Industries which oversees the industrial vehicle business, but in the overall organization, is positioned as one division similar to other divisions.

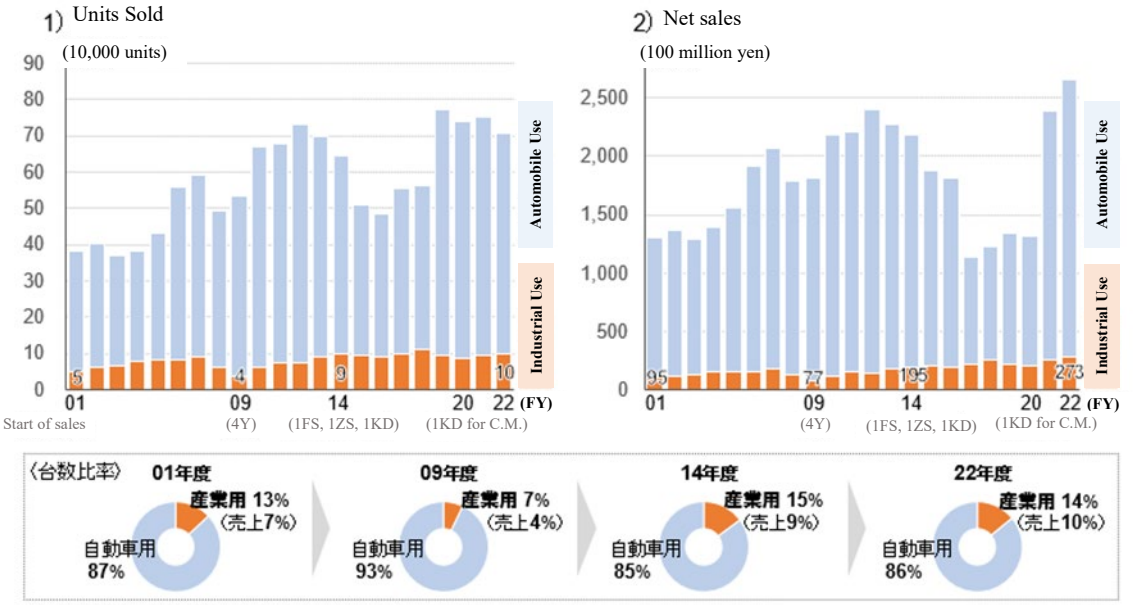
3 Overview of the Engine Division

(1) Business overview

Automotive engines constitute the core of the engine business. The Engine Division develops Forklift Engines and engines for ships on the basis of the technologies and know-how accumulated in the automotive engines business. Furthermore, it 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.

As shown in the trends in units sold and net sales of engines of the Engine Division in the figures below, automobile engines account for the majority of both.

The sales of the industrial vehicle business or TMHC accounts for more than 60% of the entire sales of Toyota Industries, but in the Engine Division, the sales of industrial engines is limited to around 10%, and it cannot be said the presence thereof is significant.



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%

(2) Organizational overview

Engineering Dept. No. 1 and Engineering Dept. No. 2 are responsible for engine development. Previously, the Engineering Dept. was a single department; however, triggered by the switch of the main organization responsible for the development of diesel engines for automobiles from Toyota Motors to Toyota Industries, it was split into Engineering Dept. No. 1 and Engineering Dept. No. 2 in September 2021 for the purpose of reinforcing the development system. At the time improper conducts recently discovered were committed, the Engineering Dept. was a single organization. Under the Engineering Office of the Engineering Dept., a department responsible for design work ("**Design Group**"), a department responsible for engine calibration work ("**Engine Calibration Group**"), and a department responsible for control work ("**Control System Development Office**") existed and also, there were departments that performed preliminary development and other 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.

The Regulation Certification & Administration Dept. is an organization whose predecessor, the Regulation Certification Office, was established in March 2021 after the U.S. authorities began an investigation on the U.S. certification application and upgraded to a department in September 2021. The Regulation Certification & Administration Dept. is in charge of Regulation Certification Work including legal interpretation, negotiations with the authorities, and organizing certification testing.

Before the Regulation Certification Office was established, the Engine Calibration Group had been in charge of Regulation Certification Work.

4 Overview of organizations relating to quality control

(1) Head Office Quality Management Dept.

At Toyota Industries, each division has a quality assurance department., and the Quality Management Dept.[7] was established as a head office function and has provided organizational development support relating to quality throughout the Toyota Industries Group. The Quality Management Dept. was in charge of preparation of the Quality Guideline drawn up by Toyota Industries for each business year, and after gathering issues and opinions about quality assurance activities from individual divisions and carrying out other preparation work, the Quality Policy was drafted and the details thereof were finalized with approval from the responsible officer and the president and representative director. The Quality Management Dept. was also supposed to hold meetings of the Quality Assurance Dept. General Managers Conference, in which the heads of the quality assurance departments of each division participated, and participate as an observer in the Division Quality Assurance Conferences held by each division, support the development of rules and guidelines relating to quality assurance by each division, and plan and support quality training and QC circle activities for employees.

(2) Overview of the Quality Assurance Dept.[8] of the Engine Division

The organizational system of the Quality Assurance Dept. of the Engine Division ("**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 responsible for quality control operations including inspection and management of testing and experiment equipment and inspecting and confirming the quality of various parts.

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[7] 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.

[8] 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.

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.

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

Toyota Industries established the Audit Dept. as an internal audit organization of the head office, and 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. In a periodic audit each year, each organization conducted a self-inspection in accordance with the instructions of the Audit Dept., and when the Audit Dept. later conducted internal audits of each organization, it confirmed management systems based on the self-inspection sheets prepared by the said organization.

In addition, in topic-based audits, the Audit Dept. performed risk analysis based on problems that arose at other companies or within Toyota Industries and so on, and based on the results, determined audit topics, and then 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 risk that the series of improper conduct recently discovered would have occurred was not accurately determined. 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.

5 Overview of risk management systems

Toyota Industries established a risk management system in 2008, and the Corporate Code of Conduct Committee (renamed the CSR Committee in June 2009), which is a management-level committee was the primary body in charge of risk management. In response, the Internal Control Office of the Corporate Planning Dept. created a risk catalog summarizing assessments of the details of anticipated specific risks and their scores, the department in charge of the risk, and so on. However, analysis, assessment, preventive measures, and so on concerning individual specific risks were left up to the divisions in charge of the respective risk and head office functional divisions made responsible for them, and as a result, there were problems including an inability to organize or evaluate company-wide risks. In fact, the Internal Control Office of the Corporate Planning Dept. identified company-wide risks in 2008, but subsequently, identification of company-wide risks and reevaluation and so on

were not performed.

Later, in 2021, it's the risk management system was reviewed and updated, and the CSR Committee was given risk management functions, with which the CSR Committee designated "priority 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, it was clarified that risks are to be evaluated, priority risks are to be designated, and so on annually.

6 Overview of compliance training for employees

(1) Status of compliance training

At Toyota Industries, the Compliance Subcommittee established in June 2009 as a subcommittee of the CSR Committee is in charge of conducting compliance measures in general, and as initiatives relating to compliance training, communicates the Employee Code of Conduct, operates the e-learning system for compliance training, carries out employee compliance awareness surveys, and so on.

(2) Status of quality training

At Toyota Industries, the Head Office Quality Management Dept. conducts quality training for employees in collaboration with individual divisions and other organizations, and rank-specific programs are organized according to an employee's rank, years of employment, and other factors. Also, the training conducted when employees are promoted to a high-level rank (a personnel classification within Toyota Industries) always includes programs relating to quality training. These various training programs also present examples of problems relating to quality that occurred at other companies.

In addition to this training and so on, Toyota Industries also distributes a Quality Control Textbook which Toyota Industries prepared in-house on the basis of the details of quality control examination.[9]

The fundamental quality control educational system at Toyota Industries was largely established around the 1980s.

[9] 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.

(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, but at the time, Toyota Industries did not conduct education or training for officers and employees to respond to the tightening of emission regulations.

7 Overview of internal reporting systems

Toyota Industries established the Corporate Ethics Consultation Hotline in 2003 as an internal reporting and consultation hotline available to its employees and others. The Corporate Ethics Consultation Hotline comprises two types of hotline: an internal consultation hotline for which the Audit Dept. as secretariat responds to consultations, and an external consultation hotline for which an attorney affiliated with an outside law firm appointed by the secretariat responds to consultations. From 2003 to the end of February 2023, a total of 1193 reports were made to the Corporate Ethics Consultation Hotline. The bulk of these reports were consultations relating to labor-management or ethics (such as harassment), and none of the improper conduct recently discovered was reported.

Part 2. Emission Regulations for Industrial Vehicle Engines

1 Overview of emission regulations

Compared with automobile engines, the history of emission regulations for industrial vehicle engines is relatively shallow. The Ministry of Land, Infrastructure, Transport and Tourism on August 3, 2001 partially amended Safety Standards for Road Transport Vehicles ("**Safety Standards**"), and emission regulations for diesel engines installed on special motor vehicles[10] that drive on public roads, came into effect on October 1, 2003 (known as "**Tier 1 Regulations**").

Later, the Ministry expanded the application of emission regulations to special motor vehicles equipped with gasoline engines that drive on public roads effective December 2, 2005.

Also, on May 25, 2005, the Act on Regulation, Etc. of Emissions From Non-road Special Motor Vehicles ("**Off-Road Act**") and emission regulations were expanded in stages according to the rated output of special motor vehicles equipped with diesel engines and gasoline engines that do not operate

[10] 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."

on public roads starting on October 1, 2006 ("**Tier 2 Regulations**"). Furthermore, starting with the Tier 2 Regulations, implementation of engine deterioration durability testing became mandatory when applying for device type designation (also referred to as "**domestic certification**") for carbon monoxide etc. emissions control device pursuant to the Road Transport Vehicle Act ("**Vehicle Act**").

As a result of the March 18, 2010 amendment of various laws and regulations, phased application of new regulations ("**Tier 3 Regulations**") started on October 1, 2011 according to rated output, and emission regulations were tightened (for example, the particulate matter (PM) regulation values were tightened 88% to 93%).

As a result of the January 20, 2014 amendment of various laws and regulations, phased application of new regulations (known as "**Tier 4 Regulations**") started on October 1, 2014 according to rated output, and the regulatory value of nitrogen oxide (NOx) applicable to diesel engines[11] installed on some special motor vehicles was tightened.

2 Overview of the certification system for engines for industrial vehicles

Toyota Industries obtains device type designation for carbon monoxide etc. emissions control devices for industrial vehicle engines pursuant to the Vehicle Act. Carbon monoxide, etc. emissions control devices are devices that reduce regulated substances in emissions to limit emissions to within the regulation values.

When applying for a device type designation of a carbon monoxide etc. emission control device, deterioration durability testing must be performed in advance, and the deterioration correction values must be calculated on the basis of the result thereof.

After an application for device type designation for a carbon monoxide etc. emission control device is accepted, in the presence of Automobile Type Approval Test Department ("**Automobile Type Approval Test Department**") of the National Agency for Automobile and Land Transport Technology, an engine installed with the carbon monoxide etc. emissions control device subject to the device type designation is operated to measure the initial value of each emission component,[12] and it is determined whether a value obtained by adding the deterioration correction value relating to the application to the initial value satisfies the regulation value set forth in the Safety Standards (the emissions test conducted in the presence of the Automobile Type Approval Test Department is referred to as the "**Witness Test**").

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[11] Engines with the rated output of greater than 56kW but less than 75kW, greater than 75kW but less than 130kW, and greater than 130kW but less than 560kW.

[12] Specifically, for gasoline engines, carbon monoxide (CO), hydrocarbon (HC) and NOx, and for diesel engines, CO, non-methane hydrocarbon (NMHC), NOx and PM.

3 Deterioration durability testing

Deterioration durability testing 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 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, and are calculated on the basis of the results of deterioration durability testing.

Toyota Industries performs deterioration durability testing by operating the engine while it is mounted on a piece of equipment called a bench. 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, (3) the engine is returned to the Durability Test Bench and operated until the number of operating hours for the next emission measurement, and this process from (1) though (3) is repeated until the specified number of operating hours is reached.

Both in the Witness Test and in deterioration durability testing, emissions are measured by operating the engines with the operating cycle called the 7-Mode Method for gasoline engines and the 8-Mode Method and NRTC mode method for diesel engines.

The engine used for deterioration durability testing must have “the same structure, equipment, and performance” 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.

It should be noted that 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.

Part 3. Toyotas Industries’ Engine Development and Emissions Certification Acquisition Processes

1 Development process for engines for industrial vehicles

At Toyota Industries, the development process for engines for industrial vehicles was generally as described below.

First, specific development targets including engine performance[13] and price are set based on specifications required by the customer. After a prototype is manufactured, an engine performance test (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 to identify and address problems and approach the development targets.

Once the prototype achieved the development targets, a prototype in conformity with the mass production specifications ("**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 development testing is performed to confirm the status of achievement of development targets.

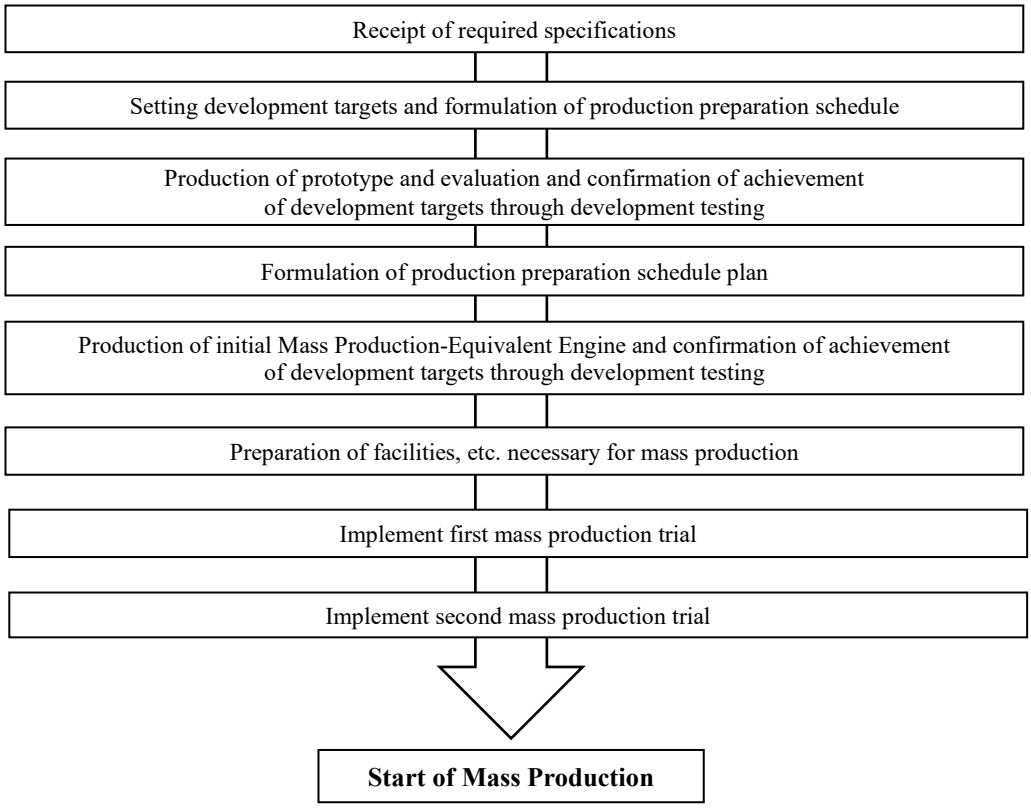
The development process is divided into a number of phases and provide that when proceeding to the next phase, a deliberative meeting known as design review (referred to as "**DR**") is to be held.

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. Subsequently, the status of mass production preparations is reviewed, and the mass production trial is approved.
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.

[13] Output, torque performance, fuel efficiency, exhaust, durability, noise performance, etc.

The details of the development process varied depending on the engine. The 1KD Engine development process was as shown in the following chart.



2 The emissions certification acquisition process for engines for industrial vehicles

The Engine Calibration Group is in charge of the deterioration durability testing and certification application (However, because in the past, TMHC developed gasoline engines, TMHC carried out the deterioration durability testing and certification applications for gasoline engines. Subsequently, from the 2007 4Y Engine development, the Engine Calibration Group and TMHC split the deterioration durability testing,[14] and from around April 2011 when the 1FS Engine development began, the Engine Calibration Group was put in charge of both the deterioration durability testing and certification applications).

The deterioration durability testing was generally conducted from around when the DR where the

[14] Because the 2007 4Y Engine used electronically-controlled fuel injection devices, and the Engine Division, which had knowledge of electronically-controlled fuel injection devices as a result of its development of engines for automobiles, was put in charge of development of the engine while the deterioration durability testing ended up being split. TMHC continued to be in charge of certification application work.

sales product plan review was held until around when the DR where the mass production transition review was held. In response to the discovery of the improper conduct relating to emissions certification, in July 2022 Toyota Industries established a standardized schedule relating to certification acquisition, but until then, there was no clear indication of in which development stage the procedures for acquisition of certification should be implemented.

3 Development process for engines for automobiles

(1) Development process prior to June 30, 2021

Prior to June 1, 2021, Toyota Industries developed engines for automobiles pursuant to the Development Master Outsourcing Agreement with Toyota Motors under the instruction and supervision of Toyota Motors. The Engineering Office of the Engineering Dept. 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. was audited by the Toyota Motors department responsible for audits.

Toyota Motors manages engine development in accordance with its own development process, and held a conference called a development gate conference for each development phase.

Toyota Industries also held DR meetings, but 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.

(2) Development process after June 30, 2021

On June 1, 2021, Toyota Industries executed a drawing etc. transfer agreement with Toyota Motors, and ownership rights and intellectual property rights to design drawings for engines for automobiles developed by Toyota Industries belonged to Toyota Industries. As a result, Toyota Industries managed development processes on its own.

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 internal rules, “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.

Regarding the main points of change made pursuant to the revision of the Design Review Rules, 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 for review. In contrast, after the revision, the rules designated as the responsible department a “supervisory department” that is responsible for reporting etc. relating to each DR review item and added a “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 became necessary for 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.

4 Overview of certification acquisition process for engines for automobiles

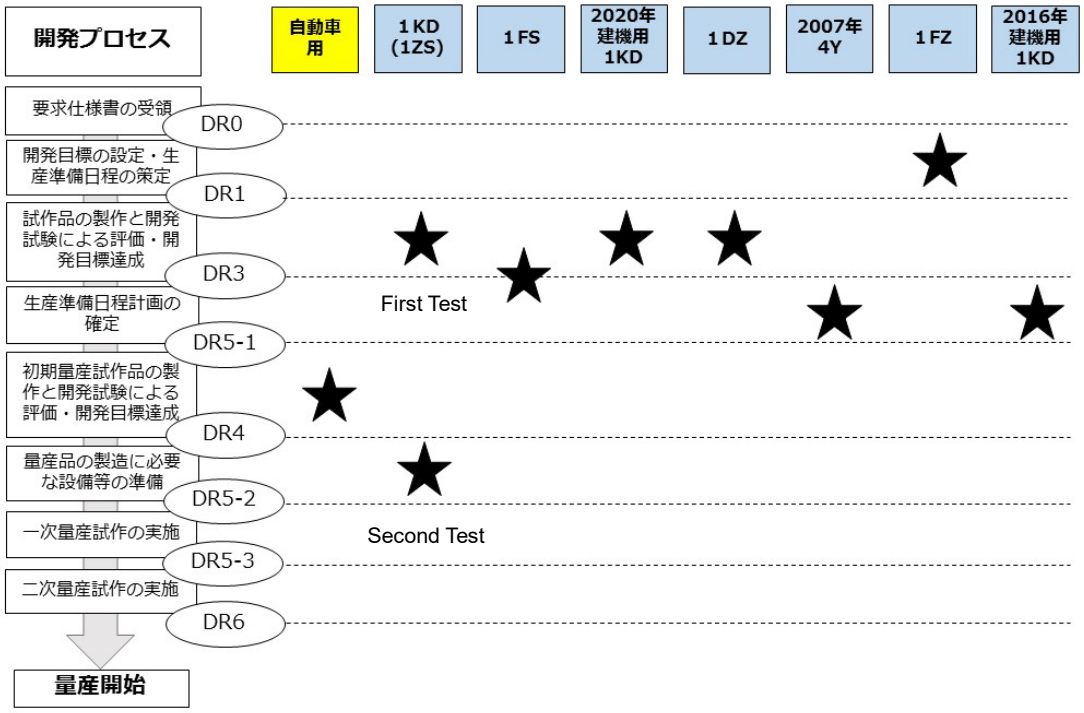
As discussed in 3(1) above, the development of engines for automobiles is performed through close cooperation by Toyota Industries and Toyota Motors, and at the stage when it is expected that the emissions performance of a particular engine will achieve the development targets, Toyota Industries obtains instructions from Toyota Motors, manufactures engines for use in deterioration durability testing, and provides them to Toyota Motors, but the subsequent deterioration durability testing, filing of an application for certification with the authorities, and the Witness Test are all performed independently by Toyota Motors.

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

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 are shown in the

figure below. The stars indicate the timing of the start of deterioration durability testing.[15]



Left side figure translation, from top to bottom:	Top of graph, from left to right:
Development Process	**Engines for Automobiles**
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	**1DZ**
Production of initial mass production prototype and confirmation of achievement of development targets through development testing	**2007 4Y**
Preparation of facilities, etc. necessary for mass production	**1FZ**
Implement First Mass Production Trial	**2016 1KD for Construction Machinery**
Implement Second Mass Production Trial	
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

[15] 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.

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. Because the timing of deterioration durability testing was earlier, as discussed below, during deterioration durability testing, the specifications of the injector and the ECU Software Control Parameters, which have an impact on the emissions performance, were modified, and as a result, it is possible that the deterioration correction values were not properly calculated.

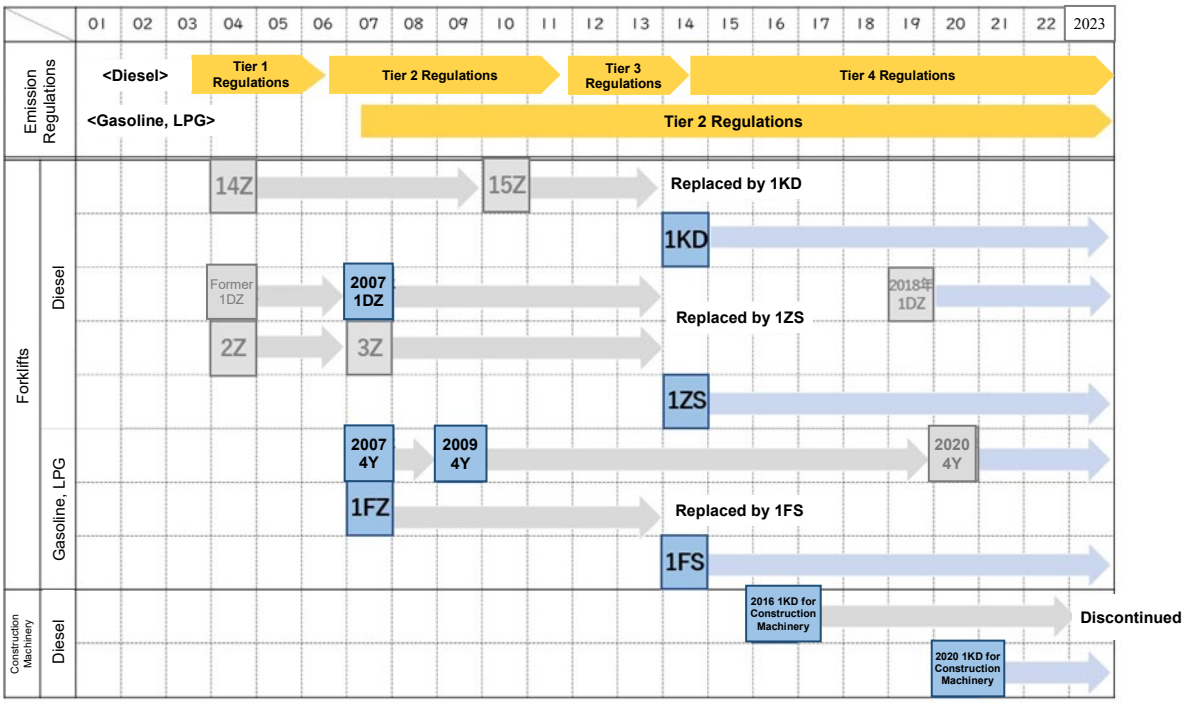
Part 4. Improper Conduct Relating to Engines for Industrial Vehicles Found in the Investigation

For improper conduct relating to engines for industrial vehicles found in the investigation, we will explain below 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 improper conduct during sampling inspections after transition to mass production.

The following table summarizes the engines with which improper conduct has occurred, and the key details of improper conduct.

	Use (Engine type)	Type	Domestic certification acquisition timing	Key details of improper conduct			
				Used values different from measured values	Modified ECU Software	Replaced parts etc. during testing	Used different engines for the test
Current models	Forklift (diesel)	1KD	2014	●	●		
		1ZS	2014		●		
	Forklift (gasoline, LPG)	2009 4Y	2009	●	●	●	●
		1FS	2014	●	●	●	
	Construction machinery (diesel)	2020 1KD for Construction Machinery	2020		●		
Past models	Forklift (diesel)	2007 1DZ	2007	●			
	Forklift (gasoline, LPG)	2007 4Y	2007	●	●	●	●
		1FZ	2007				●
	Construction machinery (diesel)	2016 1KD for Construction Machinery	2016	●	●	●	

The following figure illustrates the statuses of 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.



1 1KD Engine

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

The 1KD Engine is an in-line four-cylinder diesel engine with a total displacement of 3.0 liters, the development of which began in April 2011 as a new diesel engine for industrial vehicles in compliance with the Tier 3 Regulations.[16] The 1KD Engine first obtained U.S. certification, and then obtained

16 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.

domestic certification as of June 17, 2014 using the data used for U.S. certification[17]. The Engineering Office of the Engineering Dept. of the Engine Division was in charge of the development. The Engine Calibration Group performed the deterioration durability testing and calculated deterioration correction values on the basis of the testing results.

The 1KD Engine was initially developed as a model equipped with a DPF[18] which is an after-treatment device to collect PM, and later, the policy was changed to proceed with developing the same as a model with a common rail system but without a DPF. Following the policy change, simplified verifications and simulations using actual engines in hand and theoretical studies were carried out, and it was reported that the emission development target values were expected to be achieved. In this regard, an engineer who was involved in the development 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. However, at the Engine Committee[19] held in December 2010, it was reported by the Engineering Dept. of the Engine Division that the emission development target value was expected to be achieved 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, and the Assistant General Manager of the Engineering Office and others were aware that the schedule was unreasonable. 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

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17 After improper conduct was found, Toyota Industries performed deterioration durability testing for the 1KD Engine again. The deterioration durability testing found that with respect to the 1KD Engine, PM values measured using the NRTC mode method after operating the engine for 500 hours, and PM values measured using the 8-Mode Method after operating the engine for 1000 hours exceeded the regulation values set forth in laws and regulations. In response to this result, on March 17, 2023, Toyota Industries made a public announcement that the PM values of the 1KD Engine exceeded the regulation values set forth in laws and regulations due to deterioration over time, and concurrently decided to suspend the shipping of forklifts equipped with the engine. Toyota Industries subsequently on April 11, 2023, submitted to the Ministry of Land, Infrastructure, Transport and Tourism a recall notification regarding forklifts equipped with the 1KD Engine.

18 Diesel Particulate Filter.

19 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.

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 specifications for forklifts ("**Forklift Specifications**"), and the specifications 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. Meanwhile, the ECU Software for the Wider Sale Specifications and the ECU Software for the Forklift Specifications were developed separately. 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.

As of the DR on August 30, 2011 at the latest, the deterioration durability testing was supposed to be conducted twice (respectively, "**DF1**" and "**DF2**").[20]

At DF1 of 1KD started on January 25, 2012, 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 this, the Engine Calibration Group asked the external parts manufacturers to investigate the cause of this, and it was found that it was estimated that the dry sludge accumulated on a device called the armature attached to the upper part of the injector caused the increase in the PM values. From December 13, 2012, DF2 was carried out using an engine installed with an improved injector etc. However, during DF2 as well, decline in EGR cooler efficiency, measurement device breakdown, and other problems occurred.

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[20] The reason why the deterioration durability testing was planned to be conducted twice is that it was considered that first, DF1 would be conducted, and if no particular issue were found, deterioration factors would be calculated with the DF1 results and submitted to the U.S. authorities; however, if any problem occurred at DF1, then DF2 would be held after making improvements, and deterioration factors would be calculated with the DF2 results and submitted to the U.S. authorities.

Around April 2013, the Group Manager of the Engine Calibration Group concluded that the DF2 results could not be used as source data for calculation of deterioration factors to be submitted to the U.S. authorities, but thought that there was no time to redo the deterioration durability testing as the mass production launch date was approaching. The Group Manager consulted via email the Assistant General Manager about measures to be taken. The Assistant General Manager did not reply to that email. The Assistant General Manager explains the reason by saying, "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". Without reply from the Assistant General Manager, the Group Manager thought that the mass production launch date must be kept, and further thought that it would be the most reasonable way to calculate deterioration factors on the basis of the data estimated in a case where it is assumed on the basis of the DF1 results that there is no impact of dry sludge accumulation. With this method, the Group Manager calculated deterioration factors to be submitted to the EPA, and then, with the confirmation of the Assistant General Manager, submitted the same to the EPA.

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 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.

Under normal circumstances, the ECU Software at the time of the deterioration durability testing ("**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**"). However, the engineers in charge at the Engine Calibration Group modified governor characteristic Control Parameter values[21] 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.

[21] 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.

Working Group Leaders and an engineer in charge at the Engine Calibration Group were aware that the control system expected on the measurement bench 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 with the ECU Software for Mass Production, the driving patterns in accordance with the NRTC mode method could not be recreated.[22] The Working Group Leader 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. None of Working Group Leaders and engineers in charge saw the different governor characteristic Control Parameter values between the ECU Software for Mass Production, and the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test problematic. The Assistant General Manger did not oppose such conduct, either.

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.

In addition, the ECU Software for Witness Test had actual injection correction Control Parameter values, the air flow meter Control Parameter values, the target EGR rate Control Parameter values and the target supercharging pressure Control Parameter values that were modified from those of the ECU Software for Mass Production.

In preparation for the Witness Test, the engineer in charge checked for abnormalities in the fuel injection amount, 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. The engineer 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. This occurred because of manufacturing variations of the injectors and air flow meters installed in such engines, but the engineer 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

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[22] It should be noted that 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 method using the ECU Software for Mass Production.

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.

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, and thus, such modifications are considered improper.

2 1ZS Engine

(1) Overview of the 1ZS Engine

The 1ZS Engine is an in-line three-cylinder diesel engine with a total displacement of 1.80 liters, and 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.[23] The 1ZS Engine obtained domestic certification as of June 17, 2014, but in applying for that certification, 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, 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 (for that reason, deterioration durability testing was not performed for the 1ZS Engine).[24] The Engineering Office of the Engineering Dept., the Engine Division, was responsible for the development.

The 1ZS Engine was considered at the advanced development stage to be a four-cylinder engine with a total displacement of 2.0 liters, but, the Executive Vice President, Member of the Board noted

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[23] 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.

[24] After improper conduct was found, Toyota Industries performed deterioration durability testing for the 1ZS Engine again. The deterioration durability testing found that with respect to the 1ZS Engine, PM values measured using the NRTC mode method and the 8-Mode Method after operating the engine for 2000 hours exceeded the regulation values set forth in laws and regulations. In response to this result, on March 17, 2023, Toyota Industries made a public announcement that the PM values of the 1ZS Engine exceeded the regulation values set forth in laws and regulations due to deterioration over time, and concurrently decided to suspend the shipping of forklifts equipped with the engine. Toyota Industries subsequently on April 11, 2023, submitted to the Ministry of Land, Infrastructure, Transport and Tourism a recall notification regarding forklifts and shovel loaders equipped with the 1ZS Engine.

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.

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

The engineers 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.

First, when in preparation for the Witness Test, the engineer in charge measured the emission component values of the 1ZS Engine, and the PM values were found to be worse than expected, after consulting the Group Manager, the engineer in charge modified the target EGR rate Control Parameter values of the ECU Software for Witness Test so that the regulation values could be achieved at the Witness Test.[25]

Manipulation similar to what was done with the 1KD Engine was also carried out. Namely, 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 for Witness Test delivered by the external supplier so that they would be consistent with the control system expected on the measurement bench, and the predetermined driving patterns could also be recreated on the measurement bench Further, 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, the Working Group Leader 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.

3 2009 4Y Engine

(1) 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, it underwent a full model change to the 2007 4Y Engine. Thereafter, the 2009 4Y Engine, a cost-reduced

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[25] As discussed in 7(2)A(B) below, the modification of such Control Parameter values was also done with the ECU Software for Inspection used for the Mass Production Sampling Inspections.

model of the 2007 4Y Engine, was developed, and the 2020 4Y Engine, a successor model of the 2009 4Y Engine, was developed after.[26]

The 2009 4Y Engine was certified in Japan on May 28, 2009. Regarding the 2009 4Y Engine development system, the Engine Calibration Group 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. A deterioration correction value was first calculated in the Engine Calibration Group, and the TMHC Engine Group approved and finalized said value.

The development of the 2009 4Y Engine was under the premise that only the metal support capacity of the catalyst was reduced and that the engine controls would not be modified, and DR was not held.

(2) Details of improper conduct found in investigation, etc.[27]

A. Data from the deterioration durability testing was rewritten.

The engineer 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 and 250 hours with the emission values measured during a different test. It is considered that the values were replaced in such a way because if deterioration correction values had been calculated using actual 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.

Because the NOx values worsened more than expected after operating the engine for 750 hours, and thus, the engineer in charge at the Engine Calibration Group replaced the O2 sensor with a different sensor[28] with the characteristic of easily detecting oxygen concentration to measure emission values.

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[26] 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 applying for domestic certification for the 2020 4Y Engine.

[27] In addition to improper conduct discussed herein, other improper conduct such as that deterioration correction values were calculated using only a part of the data of testing in which multiple measurements were taken was found.

[28] Specifically, the O2 sensor specifications remained the same, but within the scope of manufacturing variations among individual sensors, the change was made to a different sensor ("lower limit sensor") with the characteristic of easily detecting oxygen concentration.

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

The engineer in charge removed only the catalyst and the O2 sensor after operating the engine on the Durability Test Bench, mounted the same to a different engine set on the measurement bench, and measured emission values.

As a matter common to what is explained in B above, it should be noted that the engineers in charge at the Engine Calibration Group did not correctly understand Japanese laws and regulations according to which, as a rule, deterioration durability testing must be conducted on the same engine and same parts. One of the engineers 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 engineer in charge states that he did not confirm the details of the Japanese laws and regulations for that reason. Another engineer in charge states that he adhered to the method adopted by the engineer 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.

As with the 1KD Engine and the 1ZS Engine, the engineer in charge modified the governor characteristic Control Parameter values so as to conform with the control mode anticipated by the measurement bench so that the predetermined driving patterns could also be recreated on the measurement bench.

4 1FS Engine

(1) Overview of the 1FS Engine

The 1FS Engine is an in-line four-cylinder engine with a total displacement of 3.7 liters and is fueled by gasoline or LPG. After obtaining U.S. certification, the 1FS Engine applied for domestic certification using the deterioration correction values calculated on the basis of the deterioration factors used for U.S. certification and obtained domestic certification as of June 17, 2014. The Engineering Office of the Engineering Dept., the Engine Division was responsible for development. The Engine Calibration Group was responsible for the deterioration durability testing and the calculation of deterioration correction values based on the results thereof.

(2) Details of improper conduct found in investigation, etc.[29]

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

When the engineer in charge at the Engine Calibration Group measured the emission component values after the deterioration durability testing for 3000 hours of operating (2250 hours of actual operating[30]) of 1FS Engine had ended, the NOx value rapidly increased, and the total of the HC value and the NOx value exceeded the regulation value. The engineer in charge examined the cause of the increase in NOx values, as a result of which damage to the catalyst was suspected; however, the cause was not identified.

The engineer in charge consulted the Assistant General Manager, the Group Manager of the Engine Calibration Group and others about this problem, and after replacing the catalyst of the engine with another catalyst, continued the deterioration durability testing.

The problem was not reported to the General Manager of the Engineering Dept., but the Assistant General Manager of the Engineering Office explains the reason by saying, "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."

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

As discussed in A above, because the total of the HC value and the NOx value after running the engine for 3000 hours exceeded the regulation value, emission component values that did not exceed the regulation value after 3000 hours of running (2250 hours of actual running) were needed. Then, the engineer in charge entered component values measured for a purpose other than deterioration durability testing[31] in the deterioration durability testing results report, and submitted the report to the U.S. authorities.

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29 In addition to the improper conduct discussed herein, other improper conduct was found, such as that the output Control Parameter values of the ECU Software for Witness Test were modified, estimated values were used as maximum torque values in the table of specifications, deterioration factors were calculated using only a part of values of emission components and without notice to the U.S. authorities, cracks on exhaust pipes were repaired or exhaust pipes were replaced.

30 For the 1FS Engine, as a result of discussions with the U.S. authorities, a method called acceleration durability was employed during the deterioration durability testing, and the testing time was shortened.

31 On December 12, 2012, when the engine encountered an emergency stop during deterioration durability testing, to determine whether the catalyst was damaged, the engineer in charge removed the catalyst from the engine, mounted the same to an engine used for engine calibration work, and measured emission component values.

C. ECU Software Control Parameter values were modified.

As with the 1KD Engine, the 1ZS Engine and the 2009 4Y Engine, the engineer 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 be consistent with the control methods expected on the measurement Bench so that the predetermined driving mode could be recreated on the measurement Bench.

5 2020 1KD Engine for Construction Machinery

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

The 2020 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 based on the 1KD Engine. The 2020 1KD Engine for Construction Machinery was first certified in Europe in February 2020, and obtained domestic certification[32] in November 2020 using the deterioration correction values that were calculated from the deterioration factors used when applying for EU certification. 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 and for calculating deterioration correction values based on the test results.

(2) Details of improper conduct found in investigation, etc.[33]

The engineer in charge modified the governor characteristic Control Parameter values and the air flow meter flow characteristic Control Parameter values for the ECU Software for Deterioration Durability Test and ECU Software for Witness Test of the 2020 1KD Engine for Construction

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[32] After improper conduct was found, Toyota Industries performed deterioration durability testing again for the 2020 1KD Engine for Construction Machinery which was the current model at that time. The deterioration durability testing found that with respect to the 2020 1KD Engine for Construction Machinery, NOx values measured with the NRTC mode method after operating the engine for 2670 hours exceeded the regulation values set forth in laws and regulations.

[33] In addition to improper conduct discussed herein, it was also found that although EU laws and regulations stipulate that all testing data (deterioration durability testing results) shall be provided to the certification authority, and if an applicant invalidates a part of the testing data, the applicant must submit the testing data thereof, and provide the reason for invalidation; however, the invalidated data were not submitted to the certification agency.

Machinery to the values different from those of the ECU Software for Mass Production.

When the engineer in charge performed a preliminary and preparatory test for the deterioration durability testing for the 2020 1KD Engine for Construction Machinery, a crack appeared on the DPF, for which incorrect timing of DPF regeneration[34] was suspected as the cause. Also, during the deterioration durability testing conducted later, there was a defect which caused the DPF regeneration not to be conducted despite the PM accumulation on the DPF. For that reason, the engineer in charge modified the values of the Control Parameter for DPF Regeneration Conditions of the ECU Software used on the Durability Test Bench to the values different from those of the ECU Software for Mass Production.

6 Prior models of engines

(1) 2007 1DZ Engine

A. Overview of the 2007 1DZ Engine

The 2007 1DZ Engine is an in-line four-cylinder diesel engine with a total displacement of 2.5 liters for industrial vehicles. The first model of the 1DZ Engine was developed in 1989, and subsequently, although the model changed repeatedly, the 2007 1DZ Engine was developed to comply with the new emission regulations to be enforced progressively from 2006 onward in Japan, the U.S., and Europe (the Tier 2 Regulations in Japan). It should be noted that the 2007 1DZ Engine is controlled mechanically, and thus, does not have ECU installed.

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 1DZ Engine was obtained with the data used for the EU certification. The Engineering Office of the Engineering Dept., the Engine Division was responsible for the development of the 1DZ Engine. The Engine Calibration Group was responsible for the deterioration durability testing and for calculating deterioration correction values on the basis of the test results.

According to the development chronology of the 2007 1DZ Engine, deterioration durability testing began at the beginning of December 2005 when the engine calibration work was still being conducted after approval of the start of manufacture of a prototype at DR held at the end of May 2005, and deterioration durability testing was conducted in parallel with engine development. A person involved stated that under the development schedule, deterioration durability testing had to commence at this

[34] DPF regeneration means that when the amount of PM collected exceeds a certain amount, the filters regain performance by burning PM collected by, for example, increasing the exhaust temperature by increasing the amount of fuel injected.

timing.

B. Improper conduct found in investigation, etc.

The improper conduct of rewriting the test data occurred during deterioration durability testing.

Around September 2006 and January 2007, on two separate occasions, the engineer in charge at the Engine Calibration Group created files reflecting rewritten testing conditions and the value of particulate matter volume etc. for each measurement time. The rewriting of these values altered the values of NOx and PM etc. 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. The engineer in charge calculated the deterioration correction values for of EU certification application on the basis of the rewritten test data.

The main reason the engineer in charge in the Engine Calibration Group rewrote the test data was that among the emission values at elapsed time 8000 hours which were calculated on the basis of the actual data, 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.

(2) 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. After the 2007 4Y Engine was certified in the United States, it applied for domestic certification using deterioration correction values calculated based on the deterioration factors used for application for U.S. certification, and on January 9, 2007, obtained domestic certification. The development system for the 2007 4Y Engine, although some of the engineers in charge were shuffled, was the same as that for the 2009 4Y Engine.

B. Details of improper conduct found in investigation, etc.[35]

(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, 1500 hours, and 1750 hours.[36]

(b) ECU Software Control Parameter values were modified during the deterioration durability testing.

The engineers 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 which would decrease NOx; however, when the deterioration durability testing began, engine calibration work for emissions performance had not been completed, and thus, the engineers 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 engineers 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.

The engineers 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 because the received information in Japanese was fragmentary, and the information providing the overall picture was provided only in English, 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.

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35 In addition to improper conduct discussed herein, there was improper conduct that the number of emission measurements was not the same in each measurement time in the deterioration durability testing. Also, although no material evidencing the particulars of the ECU Software for Witness Test for the 2007 4Y Engine exists, a person involved in the development at that time explained that the governor characteristic Control Parameter values were modified so as to be consistent with the control system expected on the measurement bench, and then the ECU Software for Deterioration Durability Test and the ECU Software for Witness Test were created.

36 The detailed background information was not found because the person who prepared the application form had already left the company, and others involved stated that they did not clearly remember the chronology back then.

(c) Engine was replaced during the deterioration durability testing.

For measurement of the emission values after 750 hours and up, the engineers in charge at the Engine Calibration Group used an engine different from the engine used to take measurements up to 500 hours.

The engineers 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 operating hours when emission values were to be measured, the engineers in charge at the Engine Calibration Group removed only the catalyst, attached it to a different engine which was set on the measurement bench, and measured the emission values.

(e) Initial values were rewritten.

During application for domestic certification, where actual measured values should have been indicated as emission initial values in the documents submitted to the Automobile Type Approval Test Department, the values were rewritten to estimated values.[37]

(3) Improper conduct etc. at the development stage of the 1FZ Engine

A. Overview the 1FZ Engine

The 1FZ Engine is an in-line six-cylinder gasoline or LPG engine with a total displacement of 4.5 liters, and obtained domestic certification on August 10, 2007. As was the case with the 2007 4Y Engine, 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

[37] Because the persons who were in charge of preparation of the application document have retired, and other related parties 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.

Software relating to calibration). Also, the TMHC Technical Administration Office was responsible for operations relating to certification applications. Further, the engineer in charge at the TMHC Machinery G1 performed deterioration durability testing, and calculated deterioration correction values on the basis of the testing results, and the TMHC Machinery G1 Group Manager approved the calculated deterioration correction values.

B. Details of improper conduct found in investigation, etc.[38]

The 1FZ Engine deterioration durability testing was conducted using the 1FZ Engine for automobiles, not the 1FZ Engine for forklifts, development of which was underway. 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.

The reason why the deterioration durability testing was conducted with the engine for automobile was because if the deterioration durability testing had been conducted after the 1FZ Engine specifications for forklifts were finalized, it would not have been possible to meet the development schedule. 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. Meanwhile, 1FZ Engine prototype design was to be performed in October 2006. Thus, the schedule provided that deterioration durability testing would start at a stage when an engine prototype had not yet been prepared.

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 development schedule.

(4) 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 based on the 1KD

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38 In addition to improper conduct discussed herein, there was improper conduct that when 1250 hours passed during the deterioration durability testing, the O2 sensor was replaced with a different sensor. Additionally, although no material evidencing the particulars of the ECU Software for Witness Test for the 1FZ Engine exists, an engineer involved in the development at that time explained that the governor characteristic Control Parameter values were modified so as to be consistent with the control method expected on the measurement bench, and then the ECU Software for Witness Test was created.

Engine, and is a model compliant with the Tier 4 Regulations. The department in charge of the development 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.

B. Details of improper conduct found in the investigation, etc.[39]

(a) A portion of the test data was rewritten.

In the deterioration durability testing, the engineer in charge rewrote the PM values included in the emissions at the time when 1500 hours had elapsed. 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. 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.

Aware that the test data had been rewritten in this way, in preparation for reporting the results of the deterioration durability testing at the Engineering Dept. Meeting,[40] 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 actual data. However, the engineer in charge did not correct the Excel file summarizing the results of the deterioration durability testing,[41] 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) A portion of 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

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39 In addition to improper conduct discussed herein, there was improper conduct that deterioration correction values were calculated using only a portion of the data of multiple measurements; deterioration correction values were calculated using the test data prior to inspection and maintenance; a turbo and air-fuel ratio sensor were replaced during deterioration durability testing, but the replacement was not recorded, and the like.

40 The Engineering Dept. Meeting is attended by General Manager of the Engineering Dept. and Assistant General Managers of each Office.

41 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.

by laws and regulations, 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.

(c) ECU Software 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 in order to stabilize the engine rotation speed and fuel injection amount while operating on the test bench and created the ECU Software for Deterioration Durability Test and ECU Software for Witness Test. In addition, for some test modes in the 8-Mode Method, the fuel injection amount was not stabilized, thus 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.

Further, 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 for Mass Production.

7 Mass Production Sampling Inspections

(1) Quality control systems, etc. for engines for industrial vehicles

The manufacturer etc. of a carbon monoxide, etc. emissions control device must ensure that the carbon monoxide, etc. emissions control device has the structure and performance of the type that received designation, and perform an inspection in accordance with the inspection implementation summary submitted to the authority at the time of acquisition of domestic certification to maintain uniformity.

The inspection implementation summaries submitted by Toyota Industries 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 provided that the emission component values must be inspected using a sampling inspection procedure in accordance with the internal rules called the “Inspection Method” (“**Mass Production Sampling Inspection**”). The Inspection Method specified the sampling frequency, provided that the determination whether Mass Production Sampling Inspections 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 specific Control Limit Values and Control Standard Values. 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.

The Quality Assurance Dept. of the Engine Division was responsible for the Mass Production Sampling Inspection based on the Inspection Method etc.

(2) 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[42] 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,[43] 1FS Engine, 1KD Engine, 1ZS Engine, and 1KD Engine for Construction Machinery.[44] 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 ("**ECU Software for Inspection**") that differed from the ECU Software for Mass Production was used for Mass Production Sampling Inspections.

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 same, but none of the people involved in the Quality Assurance Dept. understood the details of the ECU Software governor characteristic Control Parameter values. Because of this, the Quality Assurance Dept. used the ECU Software for Inspection as provided by the Engine Calibration Group without confirming the details to perform the Mass Production Sampling Inspections.

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42 The said test bench was managed by the Quality Assurance Dept. of the Engine Division at the Hekinan Plant.

43 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.

44 The control system anticipated by the test bench used to conduct the deterioration durability testing and the Witness Test was the same as the control system anticipated by the test bench used to conduct the Mass Production Sampling Inspections.

(b) Target EGR rate Control Parameter values were modified (1ZS Engine).

As stated in 2(2) above, the engineer in charge at the Engine Calibration Group modified the target EGR rate Control Parameter values of the ECU Software for Witness Test for the 1ZS Engine, and the same engineer in charge 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. The said ECU Software for Inspection 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.

The Inspection Methods specified the sampling frequencies, but there were instances where Mass Production Sampling Inspections were not performed at the sampling frequencies specified in the Inspection Methods.

Toyota Industries did not have any internal rules specifying specific procedures to perform Mass Production Sampling Inspections of engines for industrial vehicles for the domestic market, procedures to make sure that the sampling frequencies specified in the Inspection Methods are complied with, or the like. In practice, at the Quality Assurance Dept., the inspection management department prepared an annual Mass Production Sampling Inspection implementation plan, and the inspection work department determined the allocation of measurement benches and performed the Mass Production Sampling Inspections, but due to measurement bench inspection and maintenance, there were instances where Mass Production Sampling Inspections were not conducted in accordance with the implementation plan, and the inspections were suspended, or the implementation dates were pushed back.

C. Values obtained by subtracting deterioration correction values from the regulation maximum limit values and regulation average values under laws and regulations 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 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.[45]

However, later, in light of the results of an audit conducted by the EPA in September 2019, whether operations of the Quality Assurance Dept. were in compliance with the laws and regulations of each country were examined, and it was found that there were scattered documents, known as "serial memos," 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 whether the Control Limit Values and Control Standard Values specified in the Inspection Method were calculated properly. As a result, in September 2020, the Audit Group of the Quality Audit Office of the Quality Assurance Dept. 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, and such memo was circulated to the Quality Section. As a result, starting in September 2020 at the latest, 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.

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 of Safety Standards ("**Attachment 43**"). According to Attachment 43, emissions testing using the 8-Mode Method is to use MTS[46] calculated in accordance with Attachment 43 ("**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, emissions testing using the NRTC mode method is to use the Calculated MTS, but in cases where the Calculated MTS is

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45 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.

46 MTS stands for Maximum Test Speed and 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.

within ±3% of the Declared MTS, the Declared MTS may be used.

However, until June 2019, the Quality Assurance Dept. usually set the MTS at 2200 rotations when performing Mass Production Sampling Inspections of the 1KD Engine without confirming whether it satisfied the Declared MTS specified in Attachment 43 (subsequently, in late July 2019, as a result of update of the measurement program for measurement bench, the Calculated MTS automatically calculated on the measurement bench began to be used).

The investigation confirmed that there may be cases where the MTS of 2200 rotations that was used until June 2019 did not satisfy either the Calculated MTS or Declared MTS standards specified in Attachment 43, and violated the Emission Control Guideline.

E. During Mass Production Sampling Inspections, exhaust gas flow rate was calculated using a method not permitted by laws and regulations.

In the Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine, Toyota Industries' policy was to measure emissions of CO, THC, NOx, and CO2 (hereinafter referred to as "**CO etc.**") on the basis of the exhaust gas flow rate measurement method[47] pursuant to Attachment 103 to the Public Notice on Details, which specifies the emission measurement methods for gasoline and liquefied petroleum gas special motor vehicles.

When the exhaust gas flow rate measurement method is employed, in order to calculate emissions of CO etc., it is necessary to measure the fuel mass flow rate and the intake air volume.[48] 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,[49] 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. The engineers in charge of Mass Production Sampling Inspections who considered how to respond misunderstood that it was also permitted to calculate exhaust gas flow rate using the carbon balance method, and decided to use the carbon balance method to determine the exhaust gas flow rate without measuring the fuel mass flow rate. As a result, from July 2019 onwards, in the Mass

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47 "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).

48 10.2.2 of Attachment 103 to the Public Notice on Details.

49 10.2.2 of Attachment 103 to the Public Notice on Details.

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 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)[50] is to be used to measure HC in each operating mode of the 7-Mode Method, and it is stipulated that a non-dispersive infrared (NDIR) sensor[51] is to be used to measure HC at idle.

However, engineers in charge of Mass Production Sampling Inspections of the 1FS Engine, 2009 4Y Engine, and 2020 4Y Engine overlooked provisions of laws and regulations relating to the detector to be used at idle, and therefore, in Mass Production Sampling Inspections since 2011 at the latest, had been measuring HC values at idle with an HFID.[52, 53]

(3) 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 a result of conducting the deterioration durability testing again for the mass production engines of the 1KD Engine and the 1ZS Engine, it was discovered that the PM values exceeded the regulation

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50 Table 9 in 10.2.3 of Attachment 103 to the Public Notice on Details.

51 12(1) of Attachment 103 to the Public Notice on Details.

52 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.

53 We investigated the Measurement Bench used for Mass Production Sampling Inspections and found that, in addition to E. and F. above, some of 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.

values. In addition, as a result of reconducting the deterioration durability testing of the 2020 1KD Engine for Construction Machinery, it was discovered that the NOx values 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.

A. 1KD Engine and 1ZS Engine

According to the Inspection Method, 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.

Furthermore, the 1KD Engine has a characteristic whereby the higher the MTS, the more PM increases, and as stated in (2)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 PM values measured during Mass Production Sampling Inspections are considered to have been lower than those of the mass production engines.

Moreover, 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 are also considered to have been 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 for the 1KD Engine and the 1ZS Engine 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, and 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, the air-fuel ratio learning control function (a function that adjusts the EGR rate to make the actual air-fuel ratio consistent with the target air-fuel ratio) installed in the 2020 1KD Engine for Construction Machinery was configured to have cases where NOx does not satisfy the regulation value due to differences among parts, and NOx tended to decrease with the passage of time in the deterioration durability testing for certification application, and consequently, the deterioration correction value calculated based on the deterioration durability testing for certification application became zero (meanwhile, when the deterioration durability testing was performed again, NOx tended to increase with the passage of time due to differences among parts). It can be said 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

During the process of the investigation carried out by the Committee, it was 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.,[54] with respect to engines for automobiles developed by Toyota Industries under contract from Toyota Motors.

1 Overview of laws and regulations relating to output in vehicle type designation

When applying for Vehicle Type Designation, etc., the applicant must submit to the Minister of Land, Infrastructure, Transport and Tourism a document stating the structure, equipment, and performance of the vehicle ("**Table of Specifications**"), and in the Table of Specifications, "the maximum output value during a full load operation[55] measured according to the Testing Rules attached to the Facility Examination Affairs Rules must be included" (the values stated in the Table of Specifications are referred to as the "**Specification Values**"). The engine used when measuring the data that is recorded in the Table of Specifications must have the same structure, equipment, and performance as those for mass production engines.

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54 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.

55 Operating the engine in a condition with the fuel injection device fully open, i.e., operating the engine under conditions of maximum load.

2 Status of Toyota Industries' participation in development of engines for automobiles

Of the current models of vehicles 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, and by measuring output during the development stage, submitted to Toyota Motors the measurements 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[56]	HiAce[57]
	GranAce
	Land Cruiser Prado
	Dyna[58]
	Coaster[59]
2GD Engine	Hilux
F33A Engine	Land Cruiser

As the flow of Toyota Industries submitting the output measurement results to Toyota Motors, the group responsible for automotive engine calibration work measures engine output at the stage when a Mass Production-Equivalent Engine is completed. The output measurement is either conducted in the presence of an examiner or other such person or without the presence of an examiner or other such person with the approval of the Automobile Type Approval Test Department ("**In-House Output Test**"), and the engines above underwent the In-House Output Test. In cases where an In-House Output Test was conducted, the group responsible for engine calibration work submitted to Toyota Motors a test performance sheet and engine performance curve diagram (also known as "torque curve") indicating the results of the In-House Output Test and reported the results at a meeting held at Toyota Motors.

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[56] 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. 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.

[57] 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.

[58] 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.

[59] 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.

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 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.[60]

EU laws and regulations 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. 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, 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 among parts or the like. 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, and the torque curve would become distorted, and the engineers in charge were concerned that in such case, doubts would arise concerning the engine performance and other matters during meetings with Toyota Motors. For those reasons, 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 by modifying the ECU Software Control Parameter values or the like.

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 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.

Modification of the fuel injection amounts only for the engines used for In-House Output Tests is

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60 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.

deemed improper conduct.

It should be noted that the maximum output values in the Mass Production Sampling Inspections of these engines all satisfied the shipment standard values.[61, 62]

Part 6. Inadequacies in Organizational Systems Intended to Ensure Development and Production Compliant with Laws and Regulations

1 Inadequacies in QMS in Engine Division

(1) Overview of QMS

The Engine Division has constructed a document-based QMS system, at the apex of which stands the "Quality Manual". The broad policy described in the Quality Manual delves into specific rules and technical standards. Further, in order to realize the matters set forth in those rules and technical standards, also stipulates task procedures and task guidelines etc., each individual task performed in accordance with the same is to be recorded in a quality record. In addition, internal audits are used to check that tasks have been performed in accordance with task procedures, 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").

(2) QMS issues in Engine Division

As a result of the investigation, it is believed that the Quality Manuals stipulated by the Engine Division are in themselves compliant with international standards 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 the engineering departments.

Below, we provide specific examples illustrating that rules etc. were not fully in place in the Engine Division.

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61 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 (regulations enacted with multilateral agreement of the United Nations Economic Commission for Europe) 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).

62 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.

A. Inadequacies in development reference timetables

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. With regard to deterioration durability testing in particular, deterioration durability testing is 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 there were no rules specifying the temporal relationship between DR and deterioration durability testing.

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.

C. Inadequacies in rules etc. in Quality Assurance Dept.

As was detailed in Part 4-7 above, also at the Quality Assurance Dept., "serial memos" were scattered around, and because of that, instead of the Control Standard Values and Control Limit Values stipulated in the Inspection Method, a value obtained by subtracting the deterioration correction value from the regulation average value stipulated in laws and regulations was used as a Control Standard Value, and a value obtained by subtracting the deterioration correction value from the regulation maximum limit value was used as a Control Limit Value. Regarding this point, the Emission Control Guideline, an internal regulation of the Quality Assurance Dept., 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 the like, and the establishment and management of rules etc. was inadequate not only in the engineering departments, but even at the very linchpin of QMS, i.e., in the Quality Assurance Dept.

2 Vulnerabilities of Quality Assurance Dept.

(1) Vulnerabilities of internal audits

Internal audits by the Quality Assurance Dept. of the Engine Division, which are an important function to be exercised by the quality assurance departments to establish QMS, 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, was never once internally audited by the Quality Assurance Dept. in the ensuing period from 2008 to 2011 after QMS international standard certification was relinquished in 2007. Further, an internal audit must check whether tasks are being carried out in accordance with rules etc., but it appears that the inadequacies in the rules etc. were also a hindrance to the Quality Assurance Dept.'s performance of internal audits. 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, but no past internal audit noted as a problem the lack of rules etc. regarding development reference timetables or deterioration durability testing. 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 there was improper conduct. One of the essential functions of an internal audit is to instill in employees the consciousness that "an internal audit may discover improprieties", and thus to prevent improprieties before they happen, but the previous internal audits by the Quality Assurance Dept. entailed no such sense of urgency for employees, and 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, and even during product development, is required 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. In this sense, a quality assurance department plays an important role by performing checks against engineering departments.

However, at the time the recently discovered improprieties occurred, the Quality Assurance Dept. was not playing an entirely adequate role in engine development processes. The Quality Assurance Dept.'s substantive involvement in DR was at the stage of mass production prototype evaluation onward, and 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, there is no discernible trace in the DR for the engines for which improper conduct recently has been discovered 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.

(3) Vulnerabilities of staff

In order to substantively get involved in the development process and act as a check, the Quality Assurance Dept. is required to have staff with enough technical knowledge and experience to allow them to point out development problems to the engineering departments, but the Quality Assurance Dept. at such time did not have staff with that technical knowledge and experience.

Further, as discussed above, the fact that in Mass Production Sampling Inspections conducted by the Quality Assurance Dept., there was improper conduct in which Control Standard Values and Control Limit Values were calculated without using the method stipulated in the Inspection Method can only be taken to mean that there was insufficient understanding or consciousness also in the field of quality control that the Quality Assurance Dept. is responsible for by nature 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, 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.

In this respect, with regard to the cause of the improper conduct in the Mass Production Sampling Inspections, a person connected with the Quality Assurance Dept. conjectures that there was tenuous awareness that the sampling frequency specified in the Inspection Method was merely a self-imposed rule and had to be strictly complied with. However, 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 Quality Management Dept. was expected to support the establishment of regulations and guidelines related to quality assurance for each business division, but even the Quality Assurance Dept. had flawed rules etc., which was one of the causes of the improper conduct, and thus, 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. 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.

3 Inadequacies in systems for Regulation Certification Work

(1) Previous system for Regulation Certification Work at Toyota Industries

Toyota Industries had no dedicated department responsible for Regulation Certification Work until the establishment of the Regulation Certification Office and the Regulation Certification & Administration Dept. in 2021, and Regulation Certification Work was overseen by employees of the Engine Calibration Group.

(2) Harmful effects of absence of dedicated department responsible for regulation certification

A. A lack of information gathering about and accurate understanding of regulations

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.

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, the development schedule, deterioration durability testing implementation methods, certification application document preparation methods, and other such matters formulated by engineering departments, 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.

C. Harmful effects of putting engineers in charge of development in charge of Regulation Certification Work

As was detailed 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 were identical and the operational system increased the risk of improper conduct. For example, with regard to the recently discovered rewriting of test data, it seems that adopting a mechanism in which someone other than an engineer in charge of development applied for certification, after verifying test data, would have created ample possibility of preventing such improper conduct.

III. Analysis of Causes of Improper Conduct and Suggested Recurrence Prevention Measures

Part 1. Analysis of Causes of Improper Conduct

1 Intentional improper conduct to obtain certification

(1) Overview of improper conduct

Cases where improper conduct that was intentionally carried out such as 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. It is believed that the Group Manager and engineers in charge engaged in improper conduct was to obtain certification by satisfying regulation values in deterioration durability testing and Witness Tests, under pressure that without improper conduct, the development schedule could not 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.

(3) Unreasonable development schedules

If we think about the size of the impact etc. in cases where the development schedule is changed immediately before the launch of mass production, it is easy to imagine that the engineering

departments would have intense psychological resistance to a change to the mass production launch date because the deterioration durability testing must be redone or for other reasons. When a development schedule is formulated, setting a tight schedule should not in itself be regarded as a problem, but the question should be whether the formulated schedule is tight but also reasonable.

In the Engine Division, however, many cases were found in which development schedules were formulated which appear to have been completely unreasonable. For example, regarding the 1KD Engine, the policy was changed so that that the engine moved through development as a model not equipped with DPF, and a report forecasting that the emission development target values would be met was issued on the basis of only simplified verifications etc. using actual engines on hand were carried out for two or three months. The mass production launch date of the 1KD Engine for the U.S. market was moved up one year upon request from the Executive Vice President, Member of the Board. A great many people connected with the Engineering Office of the Engine Division felt that this acceleration of the development schedule was unreasonable, but that fact was never pointed out. Moreover, the development schedule for the 1FZ Engine was formulated counting backwards from the mass production launch date, as a result of which before the production of engine prototypes, deterioration durability testing was conducted using the 1FZ Engine for automobiles.

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.

(4) Dysfunction among managerial personnel

A. Managers' lack of action to solve problems and obstruction of escalation

Regarding the fact that the unreasonable schedules above were drawn up, there were some among the engineers in charge and the Group Manager in the Engineering Office who advised the Assistant General Manager that the development schedules were unreasonable, but the Assistant General Manager never took any action to correct the same.

A manager's role includes 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 manger cannot solve a problem on their own, 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 problems, despite awareness of said problems, must be considered tantamount to a dereliction of managerial duty.

Many employees of the Engine Division 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,” or “It was impossible to change the mass production launch date, so it did not even occur to us to request a schedule change”. This evidences 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, “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.”

This fact indicates that the Assistant General Manager failed to fulfill the duty of a manager, but the same fact simultaneously means that the General Manager of the Engineering Dept. also failed to take up problems 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.

Regarding the problem of unreasonable development schedules above, the General Manager of the Engineering Dept. was in a position to understand and decide (or not approve) the details of the development schedules as the person responsible for engineering departments, but all of the 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. However, the failure 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.

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.

(5) Inadequacies regarding organizations and systems necessary to advance development and production in compliance with laws and regulations

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.

2 Other intentional improper conduct

(1) Overview of improper conduct

The recently uncovered intentional improper conduct includes cases in which the regulation values for the emission values could be achieved to some extent, but the test results were rewritten with a desire to conceal large engine performance variations by arranging good-looking numbers and make the results look better, or in cases in which the most favorable test data were selected from among multiple test datasets.

Also, regarding engines for automobiles, improper conducts took place in In-House Output Tests 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.

(2) Lack of compliance awareness and trivialization of data integrity

Even if the purpose is limited to making the data look better and not for the purpose of obtaining certification, it is obvious that it is not permissible to rewrite test data without any scientific or technical basis. 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. 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.

In other words, regarding the act of selecting favorable data from multiple measurement results, because it is natural that there will be variations in measurement results, 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.

With regard to the improper conduct relating to engines for automobiles, manipulating the output by adjusting the fuel injection amounts only in the In-House Output Tests 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.

Such improper conduct trivializing data accuracy 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

It is deemed that there were also significant problems in managerial personnel's behavior of tolerating or overlooking such improper conduct above.

First, in the improper conduct relating to engines for industrial vehicles, many Assistant General Managers and Group Managers stated that in absence of the knowledge of or experience with engine calibration work or forklift engines, they were not able to fulfill their managerial checks. However, it is rather rare for managers to have experience in all the work under their control as engineers in charge, and with that acknowledgment, managers need to acquire basic knowledge of the work under their purview and the essentials of management, strive to uncover any problems, and manage work to ensure that it is executed appropriately.

Furthermore, in the first place, even if they lacked knowledge of and experience with deterioration durability testing, the managers should have seen, as a matter of common sense for engineers, the conduct of rewriting the test data and selecting values from the multiple test results as a problem. Nevertheless, the fact that the managers had no suspicions of impropriety proves that the managers lacked the awareness to supervise 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, and the Group Manager approved the adjustment of fuel injection amounts, despite being told by subordinates of such 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 engineers in charge under them.

3 Improper conduct due to lack of understanding of laws and regulations

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. Group Managers and Assistant General Managers also were unaware that the subject matter of such reports constituted improper conduct when they received reports from engineers in charge due to their 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, resulting in gaps in the understanding of information on laws and regulations and inadequate deployment of information to related personnel. Further, it is believed that inadequate maintenance of rules etc. is also 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

In the Mass Production Sampling Inspections conducted by the Quality Assurance Dept., improper conduct was found in such cases where the inspections were not conducted at the frequency specified by the Inspection Method, where Control Limit Values and Control Standard Values were not defined in accordance with the Inspection Method, and where MTS 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 is a fact that needs to be taken seriously, but it seems that the managers and employees of the Quality Assurance Dept. as a whole did not fully understand the essence of quality assurance.

That is, to assure quality means to demonstrate quality to customers, but quality can be assured (demonstrated) to customers only when the processes specified under the QMS system are reliably implemented. Furthermore, the Inspection Method specifies the frequency and number of Mass Production Sampling Inspections using statistical quality control methods. It is clear that it is impossible to assure quality to customers at the time of deviation from the Inspection Method, but Mass Production Sampling Inspections were not conducted at the frequency specified in the Inspection Method.

The reason for that may be that the bench could not be used for measurement for a certain period of time because of inspection and maintenance, or the like, but if so, then the revision of the Inspection Method should have been considered in accordance with the actual situation at the test site. 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

Regarding the fact that Mass Production Sampling Inspections were not conducted at the frequency required by the Inspection Method, 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, the Inspection Method is a rule incorporated into the device type certification system pursuant to the requirements of the Vehicle Act, and compliance with such a rule is as important as compliance with laws and regulations themselves.

There were some employees of the Quality Assurance Dept. who stated that 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, while for engines for industrial vehicles for the domestic market, Mass Production Sampling Inspections were only conducted according to internal rules, and thus, they were less conscious that they had to comply with the rules, but the idea is that it is acceptable to break rules if the authorities are not monitoring.

Regardless of whether the rules are based on laws and regulations, internal rules, or 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

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, and it is believed that inadequate rules etc. regulating Mass Production Sampling Inspections, inadequate storage and management of "serial memos" and other related documents, or other factors may have resulted in the improper conduct during Mass Production Sampling Inspections.

5 Root causes

(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, and the Engine Division has been developing engines for automobiles under the management and supervision of Toyota Motors for many years. 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.

The Engine Division's contractor's mentality is likely to have been formed under the development process for engines for automobiles. 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."

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, but the problem 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 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, but it is believed that the Engine Division failed to understand accurately and respond to the risks because of the influence of 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 because the Engine Division was independently developing such engines, but the reason behind that 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, 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.

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.

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.

However, 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

In 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 that began around 2003, no materials were discovered that would indicate that at Business Execution Conferences etc., the Engine Division reported or discussed specific ways to comply with Tier 2 Regulations or systemic establishment issues or challenges.

Also in a review of the actual development process for engines for industrial vehicles at the Engine Division 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.

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.

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. As a result, TMHC and the Engine Division ended up in a relationship of an order-issuing party (customer) of industrial vehicle engines and supplier.

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. However, if there are power dynamics between the parties 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, 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, while the department responsible for engines for industrial vehicles is trivialized even within the Engine Division and thus was an extremely weak department that couldn't negotiate on an equal footing, and an imbalanced power dynamic developed between the two. It is inferred that even if TMHC made difficult demands about cost cuts and schedules, the department

responsible for engines for industrial vehicles could not meet or consult anyone about a solution. Regarding the recently occurred improper conduct, 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, while there were no employees who requested that TMHC reconsider a development schedule, let alone those who even considered making such a request. It is considered that the imbalanced power dynamic above seems to have influenced this improper conduct 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

The imbalanced power dynamics above were formed as an adverse effect of the adoption of a business divisions system by Toyota Industries.

Of course, it does not mean that adoption of a business divisions system in and of itself is problematic, but the management that has adopted a business divisions system needs to make efforts to reap such benefits while minimizing the drawbacks. However, at Toyota Industries, the management failed to sufficiently make such efforts.

As discussed earlier, at Toyota Industries, an imbalance had been formed in the power dynamics between TMHC and the department responsible for engines for industrial vehicles, and the awareness of "working together to build" better engines for industrial vehicles was virtually nonexistent.

The actual process for the development of industrial vehicles (forklifts) indicates that no personnel from the Engine Division ever attended DRs held by TMHC, nor did TMHC personnel attend any DRs held by the Engine Division. As an opportunity for the two departments to work together, meetings of the Engine Committee were held, but the two had a poor relationship and there were times when tensions between the two sides were running high, and the Engine Committee did not properly perform its functions as it was supposed to.

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, but there is no other way to describe the efforts by the management than to say they were insufficient.

Part 2. Advice on Recurrence Prevention Measures

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. 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.

Compliance and quality education carried out at Toyota Industries 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 choosing violation of law is always later discovered, in which case more serious consequences will be brought, such as 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 also keeping promises and matters agreed to with the various stakeholders of a corporation. It is important that all officers and employees fully understand 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 or the internal rules, the company's reputation will be damaged, and a reputation 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. 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. Education and training that allow for all officers and employees to properly understand the various risk items that Toyota Industries 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. It is necessary to make clear, and be understood throughout the company, that conduct prioritizing compliance will not be subject to any disadvantageous handling, and that this is the company's policy. In order to attain this, the management itself has to have a strong resolve that compliance takes priority over anything else and repeatedly make this clear to employees, as well as take the initiative in prioritizing compliance in their response to specific situations, for example, by giving orders to redo the deterioration durability testing, even if it means that the development schedule will be delayed. When there is specific conduct from the management executives, then employees will be able to feel safe psychologically as discussed above. 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 will never be subject to unfavorable treatment, and compliance is a subject of evaluation in personnel evaluations.

(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, a portion of the test data was rewritten. Even if this kind of problem would not have any bearing on the engine's innate capabilities, it must be reaffirmed just how serious a situation is that the handling that deviates from the fundamental behavior pattern of engineers was taken all too easily, and this conduct was prevalent in the division in charge.

Respecting the test data is the wellspring of trust for products. To regain the trust Toyota Industries has lost through these impropriety cases 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 engineer ethics, beginning with data integrity.

However, general education and training for the engineers in charge alone will likely have limited effects. It is believed that 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.

The management were not aware that the improper conduct that was recently discovered had happened, but for the management to grasp the problems or issues being faced on site, a system needs to be set up 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, 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

In the recently discovered impropriety, there were many cases where 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, and Assistant General Managers instructed or tolerated improper conduct. We should consider that such manager's attitude 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. It is not difficult to imagine that when there is no other choice but to delay the development schedule, managers 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 would be reluctant to do so.

In this regard, in order to foster a corporate culture where psychological security is ensured for all including managers and problems are escalated, 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, 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.

B. Direct escalations to the management and whistleblowing

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, it would probably be worth considering providing a dedicated forum allowing reports to be made directly to the management, or 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.

Further, 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 the managers were not inclined to squarely confront problems on site, as a result of which 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.

Meanwhile, in the course of its recent investigation, the whistleblowing hotline that the Committee set up received a flood of information in particular from relatively young personnel. As can be seen from this, 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.

With regard to whistleblowing, we recommend that the company make efforts to dispel any misgivings about whistleblowing by making clear once again that whistleblower secrecy will reliably be safeguarded, and any adverse treatment of whistleblowers in response to their reports is strictly prohibited, 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. By doing so, the company's whistleblowing system will be able to perform its function going forward.

(4) Summary

In addition to taking the measures above, overcoming the organizational culture which downplays the importance of data integrity will help individual officers and employees treat data carefully and practice greater compliance awareness, and an operational system and environment which handles data with care and safeguards compliance as an organization be established, and 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, 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.

(1) Establishing rules etc.

The procedures to be followed at the development stage should be fully embodied in company rules etc. Specifically, first, 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, 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 when deterioration durability testing should be commenced. Moreover, it was found that many improper conduct could easily have been prevented 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 organizing rules etc. regarding general certification acquisition work, 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, and the company must take on-site opinions into account while examining whether the content is necessary and sufficient, and whether the rules etc. will place an excessive burden on personnel, and at the same time, must routinely inspect and review their content, and must then continually make additional improvements.

(2) Separation of development engineers and certification engineers

In the recently discovered improper conduct, the engineers in charge of engine calibration work

were also in charge of certification work, and it has to be said that this kind of system creates conditions wherein the engineers in charge might be tempted to rewrite test results and gives them opportunities to commit impropriety. 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.

(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 departments, check the development schedule and the methods used to conduct deterioration durability testing, as well as the methods used to create certification application documents etc., point out problems if any and call upon the engineering departments 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 problems should arise, inquire or negotiate with the authorities; perhaps much of the recent improper conduct could have been avoided by doing the above.

With regard to this point, as stated in II Part 1-3(2) above, Toyota Industries established the Regulation Certification & Administration Dept. in September 2021, but going forward, the company needs to fully staff the Regulation Certification & Administration Dept. so that said department can exhibit the checking effects, provide information to the engineering departments, and demonstrate more than enough capability in 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, and to point out any problems. Further, 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 stage.

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 on the capability of and systemic support for personnel of the Quality Assurance Dept. by additionally posting employees from the Engineering Dept., but it would be desirable for the company to continue to verify and to make any overhauls. The long-term training of personnel is also crucial, and measures involving a company-wide viewpoint should be considered as well.

(4) Enhancing oversight functions

A. Enhancing the internal audit functions of the Quality Assurance Dept.

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. 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 to refine its auditing methods, secure adequate personnel, improve its capabilities, and train personnel from a long-term perspective.

B. Coordination with the head office department

Under the organizational system where there is a Quality Assurance Dept. in every division, effective audits based on a deep understanding of the business can be expected, 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. It would be important for the head office department to oversee whether the Quality Assurance Dept. is making critical judgements and conducting auditing activities reliably as expected, while providing support in terms of establishing any systems.

With regard to this point, at least with regard to the quality assurance activities of the Engine Division, the Quality Management Dept. did not provide effective support, and thus the reinforcement and enrichment of these head office functions is also an urgent issue. Further, in terms of head office functions, the supervision of quality assurance activities within divisions is also important, and it must cover both oversight and support in a cross-functional manner. 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 the Audit Dept. conducted an audit of the risk of certification-related impropriety, etc., the presence of impropriety was ultimately overlooked, but 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. A framework for strengthening collaborations should be put together and operated in a timely manner so that the Audit Dept. can establish an audit system equipped with specialized knowledge and capabilities.

(5) Promoting systemization

One effective measure from the standpoint of preventing impropriety would be to deploy a system intended to automatically record data or prevent data falsification. This would also be useful from the standpoint of preventing the employees from being forced into either/or situations. Further, such a system would enable an easy discovery of what happened if an employee were to commit any impropriety, which would serve to prevent impropriety ahead of time, and help discover it promptly.

Naturally, deploying such a system to automatically record data and prevent data falsification would require considerable expense, and thus it is necessary 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 determine the level of priority while considering alternative control means.

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, and 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, harmful effects of the business divisions system, and insufficient efforts by the management to compensate for such issues. 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 contractor's mentality is one of the background circumstances that led to the recent instances of improper conduct, and as recurrence prevention, the company needs to break away from 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, 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, 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 on a company-wide, cross-sectional scale.

Furthermore, it is necessary for the management to change not only its own awareness but also the awareness among the employees. 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, and changing employees' awareness is the responsibility of the management. 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, improper conduct was committed without the problems ever having been escalated to the General Manager of the Engineering Dept. and the executives of the Engine Division, 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, 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, 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. However, 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 not something that should ever be trivialized.

The Engine Division's executives should change their long-held awareness of trivializing industrial vehicles, and they must pay attention to the nature of the tightened regulations on engines for industrial vehicles and to whether there is any problem in their development system or development schedule to adequately accommodate such regulations.

Further, if such reforming of awareness and actions of the Engine Division's executives were to be realized by engineers in charge, problematic conditions will presumably be escalated in a timely manner.

It should be noted that such a reforming of awareness is also required of TMHC's executives, and, 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, by which significantly tightened regulations are introduced, but the Engine Division did not review the development process in light of these tightened regulations, nor was any education or training conducted with regard to 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 and failed to recognize the tightened emission regulations on engines for industrial vehicles as a risk. 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, 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 identify risks surrounding their business and check whether their organizational system and processes are sufficient to handle any such risks, etc., on a regular basis.

B. Improving risk sensitivity among the entire management

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.

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 it cannot be assessed that at Toyota Industries, until the recent improper conduct was discovered, the management communicated a strong message that compliance with laws and regulations was prioritized over development schedules, and the management did not acknowledge 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.

As described above in II Part 1-5, although Toyota Industries did establish a risk management system back in 2008 and 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.

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, 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, and the CSR Committee etc. must play a central part in the reliable running of the risk management 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, and practically no sense had been fostered between the two that they work together to produce better engines as a team, which could also be regarded as a detrimental effect of a business divisions system that is more focused on its responsibility for earning profits.

However, the problem is not the business divisions system as an organizational system, but that the management at Toyota Industries had failed to make adequate efforts to minimize the drawbacks of such a system.

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 to maximize its profits, with regard to Toyota Industries as a whole, the product lineup, development schedule, and the challenges and costs involved in dealing with regulations 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, overall optimization needs to be based on not only the perspective of sales or profits but also 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.

In order to rectify the said imbalanced power dynamic between TMHC and the department responsible for engines for industrial vehicles and create an environment in which TMHC and the department responsible for engines for industrial vehicles can develop better engines together, as well as to create a truly substantive framework for making management decisions that transcend division boundaries, the company must first remedy the tendency of the Engine Division to trivialize industrial vehicles and build a new dynamic which enables the two to have constructive discussions. 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, if it is difficult for the divisions to take the lead in solving a problem, the management should provide a venue for discussing how to achieve overall optimization in a way that transcends division boundaries, and then move on to implementation, and the management is required to make the necessary management decisions to that end.

4 Conclusion

We hope that Toyota Industries' management will discuss and consider these matters in a way that covers the problems with its organizational culture, including not only relevant departments at the Engine Division and TMHC that were subjects of the Committee's investigation but other divisions as well, with the management sending a clear message to all employees about the direction that the company aims to take.

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 sending a clear message to its employees and taking 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. Needless to say, each and every employee is supporting a variety of businesses of Toyota Industries, 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