[Translation]

Investigation Report
(Summary)

August 1, 2022

Special Investigation Committee
Hino Motors, Ltd.

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Hino Motors, Ltd.

Kazuo Sakakibara, Chair
Makoto Shimamoto, Committee Member
Mieko Okita, Committee Member

This report sets out the findings of the investigation (the "**Investigation**") conducted by the Special Investigation Committee (the "**Committee"**) established by Hino Motors, Ltd. ("**Hino**").

This report is a summary of the results of the investigation and analysis that the Committee believes are as appropriate as possible under time constraints and limited conditions. The conclusion or other matters contained herein may be subject to change, should any new findings be revealed in any subsequent investigation.

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Chapter 1 Outline of the Committee

1. Background of the establishment of the Committee

Hino announced on March 4, 2022 to the effect that it had identified past misconduct in applications for certification concerning the emissions and the fuel economy performance of vehicle engines for the Japanese market. In the view of the seriousness of the issues, Hino established the Committee composed of outside experts, who have no vested interest in relation to Hino.

2. Commissioned matters to and scope of investigation by the Committee

The Committee's activities commissioned by Hino include (i) complete clarification of the case, (ii) true cause analysis, and (iii) provision of its opinion on the recurrence prevention measures addressing the way that Hino's organization should be and the development process.

Furthermore, regarding Hino's response "as a result of our investigation with the internal relevant departments on the presence or absence of misconduct in the emissions and fuel consumption tests, no inappropriate case has been found" provided when Hino received a report submission order (the "**Report Submission Order**") titled "Survey on Domestic Actual Conditions Following Mitsubishi Motors Corporation's Misconduct Case in Emissions and Fuel Consumption Tests" dated April 20, 2016 from the Ministry of Land, Infrastructure, Transport and Tourism (the "**MLIT**"), the Committee also decided to investigate whether the response accurately reflected Hino's actual conditions when making the application for certification concerning the emissions and fuel consumption (this issue is hereinafter referred to as the "**2016 Issue**" and the issues investigated by the Committee are hereinafter collectively referred to as the "**Issue**").

3. Composition of the Committee

The Committee is composed of the following three members:

Chair	**Kazuo Sakakibara**	**Attorney-at-law and former Superintending Prosecutor, Osaka High Public Prosecutors Office**
Member	**Makoto Shimamoto**	**Adviser, Yamaha Motor Co., Ltd.**
Member	**Mieko Okita**	**Attorney-at-law**

The chair and one of the members are legal experts, and the other member is an expert with technical knowledge. None of the members of the Committee have ever had an interest relationship, such as a contractual relationship for business, with Hino.

In addition, the Committee appointed the following attorneys-at-law belonging to Nishimura & Asahi as secretariats for, among other purposes, assistance for the investigation:

Kei Umebayashi	Yoshimi Arai	Ichita Matsunaga	Satoshi Miyamoto	Jun Koichibara	Yusuke Suzuki	Eisuke Kunimoto
Fumiya Kinoshita	Keita Asano	Yusuke Iwaya	Shuhei Umezawa	Masato Sawai	Mai Wakabayashi	

4. Method and contents of the Investigation by the Committee

The Committee collected materials related to the Issue that existed at Hino and scrutinized and examined the contents.

The Committee preserved the e-mail data stored in the PCs for business use of the officers and employees related to the Issue and on the mail server. The volume of the preserved data was approximately 6,660 MB in total.

In order to reveal, among other matters, the facts and the causes and background of the Issue, the Committee held interview sessions with Hino's current and retired officers and employees. The number of the officers and employees were 101, and the number of interview sessions were 243 in total (including interview sessions held by the secretariats).

In order to widely analyze the causes and backgrounds of the Issue, the Committee conducted a questionnaire targeted at a total of 9,232 officers and employees belonging to Hino (the "**Employee Questionnaire**").

5. Base date of the Investigation

The Committee was established and commenced the Investigation on March 11, 2022. The base date for the report on the Investigation is July 31, 2022.

Chapter 2 Assumptions

1. Distinction of engines manufactured by Hino

Hino calls vehicle-mounted engines that it sells "on-road engines," and those sold alone "off-road engines."

2. Emissions and fuel efficiency

(1) Relationship between emissions and fuel efficiency

The emission components of diesel engines that run on diesel fuel are categorized into particles (solids and fluids) and gases, and the particles in emissions are collectively referred to as particulate matter ("**PM**"). The Regulation for Enforcement of the Air Pollution Control Act provides that emissions components that are questioned in terms of environmental pollution refer to carbon monoxide ("**CO**"), hydrocarbons ("**HC**"), lead compound, nitrogen oxides ("**NOx**"), and PM.

Of the components of emissions, NOx in particular is a component generated through chemical combination of nitrogen and oxygen in the air inside the engine combustion chamber, whereas PM is a component primarily comprised of soot that is mainly caused by oxygen shortage. Using a large amount of oxygen to reduce PM will raise thermal efficiency and thus fuel efficiency, while in turn increasing NOx at the same time, meaning that NOx and PM, and NOx and fuel efficiency are respectively in a trade-off relationship.

(2) Emissions reduction technology

Emissions is generated by burning fuel in the engine. The engine-side emissions reduction technology involves reducing gas emitted from the engine by utilizing technology pertaining to the injection system, combustion system, turbocharger system and EGR (exhaust gas recirculation) system.

An after-treatment system is an apparatus that purifies emissions before they are released into the atmosphere. Generally speaking, the after-treatment system is mainly divided into a diesel oxidation catalyst ("**DOC**"), which is effective for purifying CO, non-methane hydrocarbons ("**NMHC**"), and PM; diesel particulate filter ("**DPF**"), which is effective for purifying PM; and NOx catalyst, which is effective for purifying NOx.

(3) History of emissions regulations and regulation on the measurement method

A. History of emissions regulations concerning on-road engines

The emissions regulations concerning vehicles with a gross vehicle weight exceeding 3.5 tons (excluding those that are provided for the exclusive use of riding and that have a riding capacity of ten people or less) are as shown in the following table.

	Short-term regulations	**Long-term regulations**	**New short-term regulations**	**New long-term regulations**	**Post new long-term regulations**	**Post-post new long-term regulations**
Hino's appellation	E4 regulations	E5 regulations	E6 regulations	E7 regulations	E8 regulations	E9 regulations
Start of regulations	1994	1997	2003	2005	2009	2016
NOx (g/kWh)	Direct injection: 7.80 Sub-chamber: 6.80	4.50 (5.80)	3.38 (4.22)	2.0 (2.7)	0.7 (0.9)	0.4 (0.7)
PM (g/kWh)	0.96	0.25 (0.49)	0.18 (0.35)	0.027 (0.036)	0.010 (0.013)	0.010 (0.013)
CO (g/kWh)	9.20	7.40 (9.20)	2.22 (3.46)	2.22 (2.95)	2.22 (2.95)	2.22 (2.95)
NMHC (g/kWh)	3.80	2.90 (3.80)	0.87 (1.47)	0.17 (0.23)	0.17 (0.23)	0.17 (0.23)

The Regulation Values in the above table without any parenthesis mean the average value per type, and values with parenthesis mean the maximum value per unit.

B. History of emissions regulations concerning off-road engines

In 1991, the MLIT set forth standard values concerning emission components and the quantity of black smoke (**Tier 1 Regulations**); the MLIT also introduced a PM regulation in 2001 (**Tier 2 Regulations**); subsequently, on April 1, 2006, regarding non-road vehicles (*tokutei tokushu jidosha*)[1] that do not run on public roads, such as construction machines, the Act on Regulations for Emissions from Non-Road Vehicles (the "**Off-road Act**"), which regulates emissions, were enforced, in order to prevent atmospheric pollution due to the use of non-road vehicles and protect the health of the people and preserve their living conditions (**Tier 3 Regulations**). In 2011, the Off-road Act strengthened the regulation (**Tier 3.5 Regulations**) and the regulation of the standard values of emissions was further strengthened in 2014 (**Tier 4 Regulations**).

[1] This refers to special vehicles (*tokushu jidosha*) that do not travel on public roads and are subject to the Off-road Act.

(4) History of fuel consumption regulations

On November 10, 2005, policies were decided regarding fuel consumption standard values for heavy-duty vehicles to be achieved by FY 2015 (**FY2015 Target**). On March 17, 2006, fuel consumption standard values were decided and became applicable starting April 1, 2006. Accordingly, manufacturers of trucks and busses were required to improve fuel economy performance so that the average fuel consumption values of these vehicles (weighted harmonic averages of vehicles' fuel consumption values calculated using the number of shipments) would be at or above the fuel consumption standard values by FY2015; accordingly, it became necessary for them to achieve the fuel consumption standard values early, whereas it became possible for them to be granted an incentive, i.e., vehicle acquisition tax reduction for vehicles that reduced emissions. Further, starting April 1, 2006, manufacturers of trucks and busses were required to indicate fuel consumption values in product catalogs of heavy duty vehicles that they sold. Afterward, standards as a FY2025 target (**FY2025 Target**) were newly formulated in March 2019.

Chapter 3 Issues related to on-road engines

1. Background to the occurrence of the Issue at Hino, and the overview

(1) Possible backgrounds that resulted in the occurrence of the Issue at Hino

A. The Powertrain Evaluation & Engineering Department had a growing recognition that the deterioration factor[2] was zero

Since the E5 regulations, a variable turbocharger started to be mounted in some engines, and when it is used, the nozzle in the turbo is worn, and therefore, when the engine is run for a long time, NOx values tend to be favorable. It seems that due to such a characteristic of the variable turbocharger, a recognition that the deterioration factor was zero with a variable turbocharger being mounted had grown in the Powertrain Evaluation & Engineering Department of Hino.

Since the E6 regulations, when it started to be allowed to calculate deterioration factors through actual measurement by conducting the durability tests,[3] the Powertrain Evaluation & Engineering Department, in which there was a growing recognition that the deterioration factor was zero, started to use the "deterioration factor of zero" regardless of the results of the durability tests, which resulted in a mood where the durability tests were disrespected.

B. Contradicting recognitions concerning a shortage of the Benches

When the durability tests were introduced, it became necessary to conduct the durability tests for the number of hours set forth by laws and regulations, and thus, the schedule of making do with the durability test benches became tight. In addition, since the E6 regulations, when the durability tests

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2 Meaning the value used for taking functional deterioration of a carbon monoxide emission prevention device after running for certain number of kilometers run into account. Further, the "**carbon monoxide emission prevention device**" means the device to prevent emissions such as vehicle soot, foul-smelling gas and harmful gas.

3 Meaning the tests to verify whether emissions satisfy the Regulation Values when a vehicle or engine deteriorates, by running the vehicle for the number of kilometers run set forth by laws and regulations, or by operating the engine for the number of hours set forth by laws and regulations.

launched, it became necessary to measure emissions values at the measurement points[4] set forth by laws and regulations during the durability tests, and the frequency of use of the certification test benches increased.

However, it seems that the recognition of whether there were enough durability test and certification test benches was not the same even in the Powertrain Evaluation & Engineering Department, and a recognition that the benches were insufficient had never grown within Hino as a whole. The schedule for which engine will use which bench from when to when was formulated tightly on the premise of making do with the existing benches. Such a lack of room repeatedly caused an event where it was impossible for the persons in charge of the Powertrain Evaluation & Engineering Department to measure emissions values at the measurement points set forth by laws and regulation.

C. Only the Powertrain Evaluation & Engineering Department understood the durability tests

Hino started to conduct the durability tests in order to calculate deterioration factors since the E6 regulations; however, the officers and employees of the departments involved in development at Hino have little understanding of the durability tests, except for the Powertrain Evaluation & Engineering Department, which is the department in charge of the durability tests.

(2) Issues which occurred at the time under the E6 regulations and at the time under the E7 regulations

A. Issues related to emissions

(a) Misconduct related to conducting durability tests

As the schedule for securing certification test benches to measure emissions values was tight, instances of failing to move engines to the certification test benches to measure emissions values according to the initial schedule occurred, such as when unexpected trouble occurred during durability tests. As a result, the following misconduct occurred in the durability tests:

(i) The emissions values were measured at measurement points which significantly deviated from the measurement points prescribed by laws and regulations;

(ii) The emissions values at some of the measurement points prescribed by laws and regulations were not measured;

(iii) The durability tests were stopped halfway through, and engines were not rotated until the end of the time prescribed by laws and regulations (therefore, the measurement of emissions values at the measurement points prescribed by laws and regulations was also not conducted); and

(iv) The required durability tests themselves were not conducted.

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[4] Meaning the points to measure emissions, every 40,000km ± 4,000km, after measurements have been completed at points where the converted kilometers run after the start are (i) 5,000km ± 500km and (ii) 40,000km ± 4,000km for each vehicle category, up to the time when the post-running measurement is done at the point where the converted kilometers run is equal to or more than "the running distance when applying the extrapolation method (method to obtain the results after the running for the kilometers run set forth in Article 1 of the Public Notice on Long-Distance Durability Tests and Chapter I, 4.2. of the Designation Standards by extrapolation)." Further, the "**Designation Standards**" mean the designation standards of the Attachment 21 of the Operation Procedures for Device-Type Designation.

(b) Rewriting test data of durability tests

With the occurrence of the misconduct related to durability tests, emissions values were not measured at the measurement points prescribed by the laws and regulations, and sometimes the test data itself did not exist in the first place. As a result, the following misconduct occurred:

(v) The test data was rewritten as if emissions values were measured at the measurement points prescribed by laws and regulations; and

(vi) As no test data obtained by measuring emissions values at the measurement points prescribed by laws and regulations existed, other data including measurement data at the time of development was diverted.

Further, even if durability tests were conducted and emissions values were measured at the measurement points prescribed by laws and regulations, some emissions values did not satisfy the Regulation Values, or when using the test data, some deterioration factors did not become zero. As the concept that "deterioration factors are zero" had already grown in the Powertrain Evaluation & Engineering Department, the cause of deterioration factors not becoming zero was not traced, and the necessary measurement was not re-conducted; therefore, the following misconduct occurred:

(vii) The deterioration factors were calculated after rewriting test data, such as by diverting other data or unfounded values including measurement data at the time of development, and not using the results of durability tests as they were.

(c) False statements in the document of durability tests[5]

With the occurrence of the above misconduct, the following misconduct was also thought to have occurred at Hino:

(viii) The false statements were made in test conditions including "running time" and "emissions measurement method" or deterioration factors, from among the matters to be stated in the document of durability tests.

B. Issues related to fuel consumption

Hino adopted a policy to obtain the tax incentives for E13C's representative models that addressed the E7 regulations; and during such process, misconduct of changing fuel flow meter adjustment values occurred. Further, also for representative models of A09C launched in May 2007, a policy to obtain the tax incentives was adopted; therefore, misconduct similar to that of E13C may have occurred.

(3) Issues which occurred at the time under the E8 regulations

Under the E8 regulations, the maximum value regulation of NOx was drastically tightened; and at Hino, in order to comply with the tightened NOx regulation, an after-treatment system, NOx catalyst (SCR), was introduced, and the DOC and the DPF were also improved to comply with the tightened PM regulations. During the above process, any of the above misconduct (i) through (viii) occurred with respect to the engines that addressed E8 regulations (however, (i) and (iii) have not been found).

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5 Collectively meaning documents specified by Schedule 7-6 "Certificate of Running Completion and Standards Conformity of Applied Vehicles (No. 3)" to the Attached "Operational Procedures for Automobile Type Certification" of the Notification No. 1252 of November 12, 1998 of the Type Approval and Recall Division, Road Transport Bureau, MLIT titled "Regarding Operational Procedures for Automobile Type Certification" and documents specified in 4.(2)3 of the Exhibit 2 to Chapter I of the Designation Standards.

When the after-treatment system, NOx catalyst (SCR), was introduced to comply with the E8 regulations and catalyst deterioration began to have an effect on the emissions values, there were more instances of the emissions values not satisfying the Regulation Values if the durability test result were used as they were. Accordingly, there may have been more instances of the above misconduct (vii) occurring after application of the E8 regulations when the Regulation Values were not satisfied.

Furthermore, with respect to regeneration tests,[6] the following misconduct also occurred because persons in charge had a misunderstanding, to begin with, that use of test results measured during development would suffice; and the Kf values (values used for weighting fuel consumption in relation to a regeneration adjustment coefficient) and Ki values (values used for weighting emissions values in relation to a regeneration adjustment coefficient), which are required to achieve the fuel consumption and emissions Development Target Values, were determined at the development stage.

(ix) The regeneration test provided under laws and regulations was not implemented, and as a result, the regeneration correction coefficient was not calculated based on actual measurement.

Furthermore, after the E8 regulations, there were instances when a durability test was continued after replacing components because the components broke during the durability test. Under the laws and regulations, test cars and test engines running during the durability test must be inspected and maintained after every certain number of kilometers run; furthermore, when it becomes inevitably necessary to conduct maintenance on a temporary basis at a time and by a method other than the designated time and method, the substance of the maintenance must be recorded in the "Long-Distance Run (Part 3) Inspection and Maintenance Record" after the maintenance. Furthermore, while running, components related to emissions performance such as motor and carbon monoxide emission prevention device may not be replaced, except for components that are replaced on a regular basis, and if a there was a replacement for an inevitable reason, the replaced components must be kept during the period of the type-approval application so that they may be presented as necessary. However, specifically the following misconduct occurred, because Hino failed to take necessary measures.

(x) The durability test was continued without following the necessary procedures despite replacing components during the durability test.

(4) Issues which occurred at the time under the E9 regulations

Hino improved its emissions reduction technology on the engine side, as well as improving NOx catalysts (SCR), in response to the imposition of stricter NOx Regulation Values and fuel efficiency improvement under the E9 regulations. In the development period from the E8 and the E9 regulations spanning seven years, at Hino, the Development Function is believed to have been extremely busy, as multiple tasks coincided in the period under the E9 regulations, such as a simultaneous full-model change of heavy- and medium-duty engines, making adjustments to comply with stricter NOx regulations, and plant relocation.

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6 Meaning the tests to (i) measure average emissions of each component of emissions (g/kWh), in at least three WHTC hot start tests, including one test with DPF regeneration and two tests without DPF regeneration using a stabilized after-treatment system, and (ii) calculate the weighted emissions rate (g/kWh) that takes the period without and with regeneration into account, using the average emissions in a test with regeneration and the average emissions in tests without regeneration, based on the designated formula. Further, the "**DPF regeneration**" means the process to remove soot collected in the DPF.

Among the models that addressed the E9 regulations, Hino has already announced the occurrence of misconduct for E13C, A09C and N04C (Urea-SCR[7]) concerning fuel efficiency measurement in certification tests, as well as misconduct concerning durability tests for A05C (HC-SCR). The Committee, however, has also examined, in the Investigation, whether there were issues concerning other models that addressed the E9 regulations, and whether there were other issues concerning any of these Four Models.

(5) Change to the ECU program

The Committee became aware of the fact that people in charge in the Powertrain Evaluation & Engineering Department changed the ECU[8] program, and thus there were cases where the ECU program at the time of durability tests and witnessed certification tests,[9] and that at the time of mass production, were different.

Originally, ECU programs for durability tests, witnessed certification tests, and mass production must be the same; if any change to the ECU program is necessary, details thereof must be accurately recorded, and whether to perform durability tests and witnessed certification tests again must be determined after discussing with National Agency for Automobile and Land Transport Technology ("**NALTEC**"). However, at Hino, those in charge in the Powertrain Evaluation & Engineering Department appear to have been revising the ECU program as necessary without recognizing the nature of the issue thereof, and no particular discussions with NALTEC took place.

2. Issues concerning the E8 regulations (response to MLIT's Report Submission Order)

(1) Overview

In April 2016, Hino received the Report Submission Order from the MLIT. In response, Hino collected test data and materials they used when applying for the certification of the then currently sold models, E13C, A09C, A05C, N04C and J-series engines (J05E, J07E, and J08E) that addressed the E8 regulations. However, at the time of the Order, Hino created the test data and materials by diverting or adjusting other measurement data.

(2) Background

At Hino, in response to the Report Submission Order, it was decided that the Technical Management Department would be in charge of the compilation of the report. The reason for this decision was because the Report Submission Order was triggered by injustice during Mitsubishi Motors' certification test, the officer in charge of the Development Function considered this to be a matter of the Development Function, and instructed that the Technical Management Department, within which exists the Vehicle Regulation & Compliance Department that is in charge of regulation certification work within the Development Function, handle the matter, including reporting to interested parties. Meanwhile, the Quality Assurance Department did not participate in the meetings for the response to the Report Submission Order and was not involved in handling the matter, such as preparing the response, either.

Because the Powertrain Evaluation & Engineering Department newly became in charge of collecting materials for preparing the response to the Report Submission Order, instructions were provided within the Powertrain Evaluation & Engineering Department to collect multiple test data concerning fuel consumption values, n=10 data of emissions values (test data of 10 engine units), regeneration

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7 Meaning the urea selection reduction catalyst.

8 Meaning the computer controlling the engine (the electronic control unit).

9 Meaning the certification tests witnessed by examiners of MLIT.

correction coefficient (Kf values), regeneration correction coefficient (Ki values), and deterioration factors.

On May 13, 2016, the draft materials accompanying the response were sent to officers in charge at the Powertrain Evaluation & Engineering Department and the officers in charge of the Development Function for their approval. Subsequently, by May 17, 2016, the approval of the President was obtained, and the response and the materials accompanying the response were sent to the MLIT. Furthermore, a meeting of the executive officers was held on the same day, at which there was a report on the content of the response sent to the MLIT.

(3) Materials and test data prepared for the Report Submission Order

When materials were collected in response to the Report Submission Order, because some materials and test data used when applying for the certification did not exist, they contained some materials and test data that were newly created when responding to the Report Submission Order, and figures that were already adjusted when applying for certification. The problems such as creation of test data at the time of the Report Submission Order are compiled in the following table.[10]

Items	E13C	A09C	A05C	J05E	J07E	J08E	N04C
Fuel consumption value	Inappropriate	Inappropriate	Appropriate	Inappropriate	Inappropriate	Unknown	Inappropriate
Test data of the regeneration correction coefficient (Kf values)	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate
n=10 data of emissions values	Inappropriate	Inappropriate	Appropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Test data of the regeneration correction coefficient (Ki values)	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Test data of deterioration factors	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate	Inappropriate

(4) The Committee's evaluation

Hino responded that "there was nothing inappropriate in the emissions and fuel consumption test when obtaining type-approval." Hino cannot escape the determination that it made a false report. Hino made this report under the name of the President. However, it cannot be said that Hino sufficiently understood the significance of the Report Submission Order and handled the report with sincerity as a company. Hino should have been triggered by the Report Submission Order to uncover and correct the Issue.

[10] "Appropriate" in the tables indicates that materials and backup data from the certification application were submitted as they were at the time of the Report Submission Order, and "Inappropriate" indicates that materials and backup data were newly created when responding to the Report Submission Order, or figures were already adjusted when applying for certification.

3. Issues concerning E13C

(1) Verification and verification results of fuel consumption o E13C

When Hino compared the heavy-duty vehicles fuel consumption values[11] recalculated based on the fuel consumption map data of the master engine at the time of its development with the Specification Values, it confirmed that there were divergences between the heavy-duty vehicles fuel consumption values of each vehicle type equipped with engines developed during each project and the Specification Values as shown in the following table.

Emissions regulations	E7	E8			E9
Project	Project A	Project E	Project G	Project H	Project I
Divergence	-4.9% (-4.9%)	-2.1 to -4.9% (-4.9%)	-3.3 to -7.1%	-3.7 to -8.2% (-8.2%)	-3.7 to-9.2% (-8.2%)

The figures in parenthesis in the line "Divergence" in the above table show divergence in the types of trucks whose gross vehicle weight exceed 20 tons and are equipped with a 12-speed transmission. These vehicle types are known to be the most fuel efficient among the highly-demanded core E13C engines, and for which the degree of accomplishing the Development Target Values were reviewed during their development. During Project G, because no application for certification was made with respect to the types of trucks whose gross vehicle weight exceed 20 tons and are equipped with a 12-speed transmission, the above table contains no figures in parenthesis.

(2) Background and the substance of misconduct

A. Response to the E7 regulations

(a) Background leading to review of heavy-duty vehicles fuel consumption values of E13C addressing the E7 regulations

a. Heavy-duty vehicles fuel consumption values of E13C addressing the E7 regulations circa November 2005

On November 22, 2005, a meeting was held to review the achievement status of the FY2015 Target in relation to heavy-duty vehicles that Hino sold. The Executive Technical Adviser who has been leading the development of diesel engines over the years at Hino instructed to take a tax incentive with respect one of the vehicle types by means such as limiting the vehicle type in relation to E13C that addressed the E7 regulations. Also during this meeting, the Executive Technical Adviser instructed to study TRIAS well (test rules stated in Attachment 1 of the Rules on Examination Affairs Pertaining to Motor Vehicles) in considering measures to improve fuel consumption. Because the instructions by the Executive Technical Adviser were basically received to mean that they "must be accomplished," it was decided that the Engine Development Department and the Powertrain Evaluation & Engineering Department would consider how to achieve the FY2015 Target with respect to E13C that addressed the E7 regulations, as well as how to be accepted for vehicle acquisition tax reduction incentives.

As of November 22, 2005, the heavy-duty vehicles fuel consumption values of each vehicle type equipped with E13C that addressed the E7 regulations failed to achieve the FY2015 Target by approximately 6.5 to 7.8%.

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[11] This refers to the fuel consumption values based on the fuel consumption standards of heavy-duty vehicles.

b. Change to the correct calculation method of heavy-duty vehicles fuel consumption values

Subsequently, as a result of changing the calculation method and recalculating the heavy-duty vehicles fuel consumption values by December 7, 2005 at the latest, among vehicles equipped with E13C that addressed the E7 regulations, the heavy-duty vehicles fuel consumption values of the vehicle type equipped with a 12-speed transmission in the T11 category (the "**12-speed Transmission-type E13C**") improved by approximately 1.9 to 2.0%, and failed achieve the FY2015 Target by approximately 5.0%. The officer in charge of the Product Planning Department at the time commented during the interview with the Committee that he believed it would be difficult for E13C to achieve the FY2015 Target with respect to any vehicle type, but that he put strong pressure on the Engine Development Department and the Powertrain Evaluation & Engineering Department to concentrate resources and make considerations toward achieving the FY2015 Target with respect to the 12-speed Transmission-type E13C.

c. Status of reviewing the heavy-duty vehicles fuel consumption values from December 16 to 28, 2005

As of December 16, 2005, heavy-duty vehicles fuel consumption values of the 12-speed Transmission-type E13C that addressed the E7 regulations failed to achieve the FY2015 Target by approximately 4.6 to 5.0%; subsequently, despite no prospects of improving fuel consumption, on December 21, a report was made to the Senior Managing Director, who was the officer in charge of the Product Planning Function and the Product Development Function, to the effect that they expected to achieve the FY2015 Target. Subsequently, on December 28, 2005, in light of the contents of the report made on December 21, the Product Planning Department reported to the then Vice President to the effect that there were prospects of the 12-speed Transmission-type E13C that addressed the E7 regulations achieving the FY2015 Target, and it was decided that application will be made to receive tax incentives, and that the FY2015 Target would be the Specification Value of the 12-speed Transmission-type E13C.

However, there are no subsequent signs of the person in charge of developing E13C that addressed the E7 regulations making moves to improve the heavy-duty vehicles fuel consumption values of the 12-speed Transmission-type E13C.

(b) Change of fuel flowmeter and engine tachometer

Circa April 2006, the persons in charge at the Powertrain Evaluation & Engineering Department learned that the fuel efficiency of E13C that addressed the E7 regulations did not satisfy the Specification Value, and were considering how to handle the problem. As they were instructed to "do something to solve the problem," during the meeting with the persons in charge at the Technical Center for advance confirmation of the witnessed certification test, they provided instructions to "alter the measuring equipment so that the values are favorable in terms of fuel consumption within the tolerance of the measuring equipment approved by TRIAS." In response to this instruction, the persons in charge at the Technical Center operated the fuel flowmeter and the engine tachometer within 2.0% so that the values would be the most favorable in terms of fuel consumption. However, heavy-duty vehicles fuel consumption values of the 12-speed Transmission-type E13C that addressed the E7 regulations still failed to achieve the FY2015 Target by approximately 1.0%.

Accordingly, the persons who provided the instructions to the Technical Center further changed the fuel flow rate calibration values on their own so that they are approximately 1.0% more favorable, and confirmed that the Specification Values had been achieved.

In light of the above background, on May 24 and 25, 2006, witnessed certification tests concerning fuel consumption were conducted, the result of which showed that the measured values of fuel consumption during the witnessed certification test satisfied the Specification Values.

Subsequently, pursuant to NALTEC' instructions, it was decided that witnessed certification tests concerning fuel consumption would be conducted on May 31, 2006. Because, on this occasion, a witnessed certification test was to be conducted with respect to emissions in addition to fuel consumption, the witnessed certification tests were to be conducted on testing benches that differed from those used during the witnessed certification tests on May 24 and 25. Because the persons in charge at the Technical Center indicated that operation by the test mode provided in TRIAS might not be possible if the engine tachometer is changed, the person in charge at the Powertrain Evaluation & Engineering Department decided to alter only the fuel flow rate calibration values on the new testing benches so that they would be more favorable in terms of fuel consumption in order to satisfy the Specification Values. This person was aware that if the fuel flow rate calibration values were altered so that they would be more favorable in terms of fuel consumption, the result would significantly exceed 2.0%.

In light of the above background, the witnessed certification tests were conducted on May 31, 2006, the results of which showed that the measured values of fuel consumption and emissions satisfy the Specification Values.

(c) The Committee's evaluation and summary regarding E13C that addressed the E7 regulations

Circa April 2006, when the Powertrain Evaluation & Engineering Department conducted an advance confirmation in preparation for the witnessed certification tests, the heavy-duty vehicles fuel consumption values did not meet the Specification Values, and deciding to engage in misconduct became inevitable. Accordingly, during the witnessed certification tests on May 23 and 24, 2006, the Specification Values were achieved by, in addition to changing the fuel flowmeter and the engine tachometer within 2.0% so that the values would be the most favorable in terms of fuel consumption, changing the fuel flow rate calibration values so that they would be more favorable in terms of fuel consumption. Furthermore, during the witnessed certification tests on May 31, the Specification Values were achieved by only changing the fuel flow rate calibration values so that they would be more favorable in terms of fuel consumption.

The person in charge at the Powertrain Evaluation & Engineering Department claims that changing the fuel flow rate calibration values and engine tachometer within 2.0% was "within the tolerance accepted under TRIAS." However, TRIAS accepts tolerance of ±2.0% only because it assumes measurement error in the fuel flowmeter and engine tachometer, and it does not accept a person conducting the measurement to engage in changing within ±2.0%, let alone altering the fuel flow rate calibration values above ±2.0% favorably in terms of fuel consumption.

Triggered by intrinsically unaccepted change of the fuel flow rate calibration values and engine tachometer, subsequently, the Powertrain Evaluation & Engineering Department became out of control, and during the witnessed certification tests on May 31, 2006, it altered the fuel flow rate calibration values favorably in terms of fuel consumption to an extent that significantly exceeded the 2.0% tolerance.

The Powertrain Evaluation & Engineering Department engaged in the misconduct pursuant to decisions made within the Powertrain Evaluation & Engineering Department, and there is no evidence indicating that other persons involved in the development of E13C that addressed the E7 regulations were aware that such misconduct took place. However this does not mean that a person who was not aware of the particular misconduct would not be held responsible. Rather, considering the background due to which the Powertrain Evaluation & Engineering Department was forced to engage in the misconduct, the Committee believes that the responsibilities of the following persons to be grave: all persons who were aware as of December 20, 2005 that the 12-speed Transmission-type E13C that addressed the E7 regulations had no prospects of achieving the FY2015 Target, but nevertheless were involved in making the report on the following day, December 21, that there were prospects of achieving the FY2015 Target without any technical substantiation; and all persons in

charge of developing E13C who subsequently left the matter unattended despite not making any technological efforts toward achieving the FY2015 Target.

Furthermore, it seems that the Powertrain Evaluation & Engineering Department was not able to share the fact that it engaged in the misconduct with other departments such as the Engine Development Department and the Product Development Department presumably because it engaged in the misconduct at its decision only. However, presumably only some of the persons involved in the development of E13C that addressing the E7 regulations at the Powertrain Evaluation & Engineering Department knew the fact that this had a lasting effect and caused the FY2015 Target to be achieved by inflating the values when E13C that addressed the E7 regulations did not have the ability to achieve the FY2015 Target, and the misconduct was continued even during the development of E13C that addressed the E8 regulations, and thereafter.

B. Response to the E8 regulations

(a) Project E

In Project E, on the assumption that the 12-speed Transmission-type E13C that addressed the E7 regulations had achieved the Specification Values, development was conducted, confirming whether the "Hino running fuel consumption value"[12] was improved by 3.0% compared thereto. Consequently, by June 30, 2009, Hino confirmed that the Hino running fuel consumption value of the development phase (2) prototype achieved an improvement of 3.0% over that of E13C that addressed the E7 regulations. However, the 12-speed Transmission-type E13C that addressed the E7 regulations was short by approximately 5.0% against the Specification Values, and in order to achieve them, the fuel flow rate calibration value and the engine tachometer were changed favorably in terms of fuel consumption in witnessed certification tests. Therefore, even if the fuel economy performance of E13C that addressed the E7 regulations was improved in Project E, the Specification Values were not able to be reached.

The person in charge at the Powertrain Evaluation & Engineering Department recognized that the Specification Values were never achieved, but as he was not able to share the fact of misconduct for E13C that addressed the E7 regulations with other departments, such as the Engine Development Department and the Product Development Department, he was not able to allege the necessity to further improve fuel consumption. Meanwhile, he believed that if the fuel flow rate calibration value of E13C that addressed the E8 regulations and was developed in Project E was altered until fuel consumption satisfies the Specification Values, it could achieve the Specification Values in a certification test.

Around February 2010, in the prior confirmation for a witnessed certification test, the person in charge at the Powertrain Evaluation & Engineering Department confirmed the percentage below the Specification Values to calculate how much the fuel flow rate calibration value should be altered to satisfy the Specification Values, and then he altered the fuel flow rate calibration value favorably in terms of fuel consumption and confirmed that the Specification Values were achieved. Through the process above, on February 24, 2010, a witnessed certification test was conducted and brought test results that the measurement values of fuel consumption and emissions in the witnessed certification test satisfied the Specification Values.

(b) Project G

In Project G, for MT vehicles, from the heavy-duty trucks mounting E13C that addressed the E8 regulations, which had not achieved the FY2015 Target in Project E, consideration for improvement of

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12 Meaning the fuel consumption values calculated using the fuel consumption map data measurement method and the fuel consumption data processing method conducted independently in Hino.

the engine began to achieve the FY2015 Target and expand the FY2015 Target-achieved vehicle-type. The heavy-duty vehicle fuel consumption value of MT vehicles, from the heavy-duty trucks mounting E13C that addressed the E8 regulations and was developed in Project E, did not achieve the FY2015 Target by 2.5%.

Subsequently, the person in charge at the Powertrain Evaluation & Engineering Department confirmed that the heavy-duty vehicle fuel consumption value of MT vehicles, from the heavy-duty trucks mounting E13C, achieved improvement of 2.5%. The persons in charge at the Powertrain Evaluation & Engineering Department understood that even if the heavy-duty fuel consumption value was confirmed to have been improved by 2.5%, this did not mean that it actually achieved the Specification Values; however, this fact was recognized by limited persons in the Powertrain Evaluation & Engineering Department.

The raw data that referred to the rate of deviation between the heavy-duty vehicle fuel consumption value and the Specification Value of the master engine at the time of the development of E13C that addressed the E8 regulations and was developed in Project E, and that contains the results of in-house certification tests[13] of E13C that addressed the E8 regulations, was rewritten so as to achieve the Specification Value. For E13C that addressed the E8 regulations and was developed in Project G, as no witnessed certification test was conducted, it was not necessary to alter the fuel flow rate calibration value favorably in terms of fuel consumption; and thus, misconduct was committed in a manner different than before.

(c) Project H

In Project H, development was carried out with the aim of improving fuel consumption by adopting the technology introduced in MT vehicles in Project G to the vehicle-type for which application for certification was not filed in Project G and introducing new technologies, such as a fuel adding valve.

In a meeting held on May 14, 2013, the Powertrain Evaluation & Engineering Department reported that the performance evaluation of the development phase (2) prototype resulted in an achievement of the Development Target Value of 5.0% over the FY2015 Target and thus it set the value as the Specification Value and completed the development. However, as E13C that addressed the E8 regulations and was developed in Project E had not achieved the Specification Values, even if fuel consumption of E13C that addressed the E8 regulations and was developed in Project E was improved in Project H, it could not reach the Specification Value. This fact was recognized only by limited persons in the Powertrain Evaluation & Engineering Department.

Around October 2013, during the prior confirmation of the heavy-duty vehicle fuel consumption value for a witnessed certification test, the person in charge at the Powertrain Evaluation & Engineering Department confirmed that it did not reach the Specification Value as expected. Another person in charge who received a report to that effect confirmed the percentage insufficient for the Specification Value to calculate how much the fuel flow rate calibration value should be altered to satisfy the Specification Value, and then altered the fuel flow rate calibration value favorably in terms of fuel consumption and confirmed that it achieved the Specification Value, as before.

After the process above, on November 14, 2013, a witnessed certification test for E13C that addressed the E8 regulations and was developed in Project H was conducted and brought the results that the measurement values of fuel consumption and emissions in the witnessed certification test satisfied the Specification Values.

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13 Meaning a test conducted by the applicant in accordance with TRIAS.

(d) The Committee's evaluation and summary regarding E13C that addressed the E8 regulations

All of that misconduct was committed by the Powertrain Evaluation & Engineering Department at its own decision without notifying the other departments, which was triggered by misconduct where the fuel flow rate calibration value of E13C that addressed the E7 regulations was changed to meet the Specification Values. The recognition that the values of E13C that addressed the E7 regulations were inflated was shared only within the persons in charge at the Powertrain Evaluation & Engineering Department, and they were not able to report such inflation to the persons in charge of development at other departments, and eventually, the Powertrain Evaluation & Engineering Department was trapped in a vicious cycle where it had no choice but to engage in misconduct at its own decision for E13C that addressed the E8 regulations.

On the other hand, alternation of the fuel flow rate calibration values could improve fuel consumption as much as it wanted by adjusting alternation width, which was a "magic mallet" for the Powertrain Evaluation & Engineering Department. That is, the Powertrain Evaluation & Engineering Department seriously considered improving fuel consumption through calibration but at the same time it came to rely on the "magic mallet" as the final mean for portions that could not be improved.

C. Response to the E9 regulations

(a) Project I

In response to emissions regulations having been tightened in the E8 regulations through the E9 regulations, Hino decided to develop E13C that addressed the E9 regulations. The Development Target Value of fuel economy performance was determined to be equivalent to that of E13C that addressed the E8 regulations and was developed in Project H, i.e., 5.0% over the FY2015 Target.

In the development phase (2), the Powertrain Evaluation & Engineering Department confirmed that a portion of fuel consumption that deteriorated due to addressing the E9 regulations compared to that of E13C that addressed the E8 regulations and was developed in Project H, would be improved by introducing fuel consumption improvement measures. However, a portion that had been insufficient for the FY2015 Target since E13C that addressed the E7 regulations and E13C that addressed the E8 regulations was not improved at all, and the planned Specification Values could not be achieved.

Subsequently, the Powertrain Evaluation & Engineering Department made no consideration for improving fuel economy performance, and on November 15, 2016, as it was reported at the development meeting (4) that the Development Target Value of 5.0% over the FY2015 Target was achieved, the engine development of E13C that addressed the E9 regulations was completed, setting the value as the Specification Value.

In mid November 2016, the person in charge at the Powertrain Evaluation & Engineering Department who measured fuel consumption map data for prior confirmation calculated the heavy-duty vehicle fuel consumption value and found for the first time that the heavy-duty vehicle fuel consumption value of E13C that addressed the E9 regulations did not satisfy the Specification Value, and when he reported this, he was instructed to alter the fuel flow rate calibration value favorably in terms of fuel consumption. The person in charge at the Powertrain Evaluation & Engineering Department recognized that it was misconduct but changed the fuel flow rate calibration value favorably in terms of fuel consumption and confirmed that it achieved the Specification Value.

After the process above, on December 14, 2016, a witnessed certification test was conducted and brought the test results that the measurement values of fuel consumption and emissions in the witnessed certification test satisfied the Specification Values.

(b) The Committee's evaluation and summary regarding E13C that addressed the E9 regulations

For E13C that addressed the E9 regulations, the Development Target Values were set in a manner that the values that were inflated for E13C at the time of the E7 regulations were kept, based on which an improvement target percentage compared to the Specification Values of the predecessor model E13C that addressed the E8 regulations was determined; therefore, it is evaluated that the Powertrain Evaluation & Engineering Department continued misconduct as it could not break from the vicious circle where it continued misconduct at its own decision.

The Committee evaluates that even though the misconduct for E13C that addressed E9 regulations was committed only by some people at the Powertrain Evaluation & Engineering Department, the root is attributable to all of the members involved in the development of E13C that addressed the E7 regulations at that time who decided to file an application for tax incentives, stating that the FY2015 Target was expected to be achieved despite no technical grounds.

In considering measures to improve fuel consumption, the Executive Technical Adviser initially instructed to study TRIAS well. It was not assumed that the Executive Technical Adviser indicated misconduct in the instruction. However, this could lead to an idea that within the scope of the tolerance of ±2.0% that is permitted under TRIAS, it is fine to change the fuel flow rate calibration value and the engine tachometer favorably in terms of fuel consumption. In addition, this 2.0% was quickly deviated further, and in the end, the change of the fuel flow rate calibration value could not be stopped as it became a "magic mallet." This change of the fuel flow rate calibration value had been used from E13C that addressed the E7 regulations to E13C that addressed the E9 regulations, and a deviation between the heavy-duty vehicle fuel consumption value and the Specification Value increased from 4.9% to 9.2%. As such, Hino crossed the "line" to change the fuel flow rate calibration value and the engine tachometer and must fully understand that this would lead to a major misconduct later.

4. Issues concerning A09C

(1) Verification and verification results of A09C's fuel consumption

When Hino compared the heavy-duty vehicles fuel consumption values with the Specification Values, it confirmed that there were divergences between the heavy-duty vehicles fuel consumption values of each vehicle type equipped with engines developed during each project and the Specification Values as shown in the following table.

Emissions regulations	E7	E8			E9
Project	Project D	Project E	Project G	Project H	Project I
Divergence	0% to –6.2% (–4.9%)	0% to –7.1% (–6.0%)	0% to –7.3% (–4.7%)	–1.9% to –9.4% (–6.8%)	–7.1% to –8.0% (–5.7%)

Note: Bracketed values are divergences of the models that were considered in the development stage as superior-fuel-efficiency models.

(2) Background and the substance of misconduct

A. A09C that addressed the E7 regulations

(a) Achievement of fuel efficiency

A09C's fuel efficiency was developed aiming to improve the fuel efficiency performance of the former model P11C by 10%. As of November 22, 2005, however, A09C's fuel efficiency fell short, by 5.1%, of the Development Target Value of 10% over that of P11C. The Executive Technical

Adviser issued an instruction to achieve the FY2015 Target for all A09C models by 2007. The FY2015 Target, however, was still underachieved, as of December 19, 2005, by 3.1% at maximum for category T10, and by 4.9% at maximum for category T11. There was also a reliability issue with respect to A09C due to a crack in the cylinder head, and Hino was struggling to resolve the issue.

Thereafter, persons in charge at the Product Development Department decided to narrow down the representative engine models subject to certification applications to cargo-type engines. In April 2006, departments such as the Product Development Department and the Engine Development Department started considering methods to achieve the FY2015 Target. Hino adopted the high-speed differential gear that was in discussion in around April 2006, but did not put into practice a camshaft change or the setting of low-viscosity oil standards (reduction of engine friction); nevertheless, Hino reported achieving the FY2015 Target at development meeting (16) on November 28, 2006.

Hino then conducted witnessed certification tests for the 320-horsepower A09C on February 28, 2007 and March 1, 2007, received certification for having achieved the FY2015 Target and started production in May 2007.

(b) The Committee's evaluation

As for the fuel efficiency of 320-horsepower A09C, a representative model, Hino reported that the fuel efficiency achieved the FY2015 Target and submitted the Specification Values. However, the real capability was below the Specification Values. There are no persons in charge of development in the Powertrain Evaluation & Engineering Department who responded to the Committee that they had engaged in some misconduct in order to achieve the FY2015 Target for A09C that addressed the E7 regulations.

The Committee, however, has doubts about the above response of the persons in charge at the Powertrain Evaluation & Engineering Department. Although the FY2015 Target was underachieved as of December 19, 2005, Hino did not newly introduce any fuel-efficiency improvement measures for A09C thereafter, except for adopting high-speed differential gear, and obtained certification for having achieved the FY2015 Target by narrowing down the subject of the 320-horsepower engines to cargo-type engines. In reality, however, there are divergences between heavy-duty vehicle fuel efficiency values and the Specification Values.

The Committee, therefore, believes that there may also have been misconduct for A09C that addressed the E7 regulations, similarly to the misconduct for E13C that addressed the E7 regulations, which occurred approximately at the same time.

B. A09C that addressed the E8 regulations

(a) Project E

Persons in charge of A09C that addressed the E8 regulations in Project E in the Powertrain Evaluation & Engineering Department believed that if a heavy-duty vehicle fuel consumption value had been overstated for A09C that addressed the E7 regulations, there should be no issue in overstating the heavy-duty vehicle fuel consumption value for A09C that addressed the E8 regulations and was developed in Project E. Those persons then engaged in some misconduct and overstated the heavy-duty vehicle fuel consumption value, although they do not recall the specific method they used.

(b) Project G

The fuel consumption specification value of A09C developed in Project G was 4.30km/liter, while the heavy-duty vehicle fuel consumption value of the master engine at the development stage was 4.10km/liter, with a divergence of 4.7% below the Specification Value. This suggests that the heavy-duty vehicle fuel consumption value of A09C that addressed the E8 regulations in Project G may have

been overstated not only when Hino filed a certification application but also in the development phase (2).

(c) Project H

Persons in charge of measuring fuel consumption data[14] for A09C that addressed the E8 regulations in Project H checked the benchmark fuel consumption performance of A09C that addressed the E8 regulations and was developed in Project G, and a value significantly below the Specification Value was obtained. This result suggested that the real capability of A09C that addressed the E8 regulations in Project H, many of whose components are also used for A09C, was below the assumption. Accordingly, those persons predicted that it would be difficult to achieve the goal of exceeding the heavy-duty vehicle fuel consumption standard by 5% for key types of vehicles. As a result, persons in charge at the Powertrain Evaluation & Engineering Department were instructed to satisfy the Development Target Value, even if doing so required misconduct. They, therefore, raised the fuel efficiency by either changing the fuel flow calibration value so that the fuel efficiency would increase in in-house certification tests or altering the fuel efficiency raw data measured in in-house certification tests. In this way, those persons created a test result that ostensibly satisfied the Specification Value.

(d) The Committee's evaluation

As stated above, misconduct concerning A09C that addressed the E8 regulations is evidently found in Projects E and H, a wrongdoing in which persons in the Powertrain Evaluation & Engineering Department admit they engaged. As it has also been confirmed that the heavy-duty vehicle fuel consumption value in Project G was considerably lower than the Specification Value, some misconduct likely occurred and a heavy-duty vehicle fuel consumption value may also have been overstated in Project G.

C. A09C that addressed the E9 regulations

(a) A09C (two-stage turbocharger)

Hino decided that the Development Target Value for fuel consumption of A09C (two-stage turbocharger) that addressed the E9 regulations to be 10% over the FY2015 Target and approved the commencement of its development.

With respect to A09C (two-stage turbocharger) that addressed the E9 regulations , the type of vehicle adopting 12-speed transmission in the T11 category (the "**12-speed Transmission-type A09C**") achieved 8.5% over the heavy-duty vehicle fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G as a result of advanced development on June 10, 2013. Hino expected an achievement of 10% over the heavy-duty vehicle fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G by additionally incorporating fuel efficiency improvement measures. As the fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G was considered equivalent to the FY2015 Target, Hino anticipated that it would be able to achieve a development target of 10% over the FY2015 Target if the heavy-duty vehicle fuel consumption value of A09C (two-stage turbocharger) that addressed the E9 regulations was 10% above the heavy-duty vehicle fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G. However, the heavy-duty vehicle fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G failed to satisfy the Specification Value and was a result of altering the in-house certification test data to make the value appear to satisfy the Specification Value. Accordingly, the heavy-duty vehicle fuel consumption

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[14] This collectively refers to (i) vehicle specification data, (ii) engine data, (iii) transmission data, (iv) entire load torque data and friction torque data, and (v) fuel consumption map data.

value of A09C (two-stage turbocharger) would not reach 10% over the FY2015 Target, which was the Development Target Value, even if the heavy-duty vehicle fuel consumption value of A09C (two-stage turbocharger) did achieve 10% over the heavy-duty vehicle fuel consumption value of E13C that addressed the E8 regulations and was developed in Project G.

The Powertrain Evaluation & Engineering Department reported in its internal meeting on May 20, 2015 that the heavy-duty vehicle fuel consumption value of the development phase (1) prototype was 3.3% over the FY2015 Target. The department also reported in development meeting (4) on June 2, 2015 attended by relevant officers that the heavy-duty vehicle fuel consumption value of the development phase (1) prototype was 8.3% over the FY2015 Target by groundlessly adding 5% on top of the heavy-duty vehicle fuel consumption value of A09C (two-stage turbocharger), while knowing that there had been no major improvement in the fuel efficiency performance. The Powertrain Evaluation & Engineering Department thereafter added fuel efficiency improvement measures and reported in the development meeting (4) on July 7, 2015 that the 12-speed Transmission-type A09C achieved the Development Target Value of the heavy-duty vehicle fuel consumption value. The department also reported that the Hino running fuel consumption value was still 1.0% short of achieving the Development Target Value but there was a prospect of achieving the target. In this way, in the development phase (1) of A09C (two-stage turbocharger) that addressed the E9 regulations, Hino decided that there was a prospect of achieving the Development Target Value of fuel consumption on a false reporting not supported by measurement data and approved transitioning to the design stage in the development phase (2).

Persons in charge of A09C (two-stage turbocharger) that addressed the E9 regulations in the Powertrain Evaluation & Engineering Department evaluated the development phase (2) prototype and found that the Hino running fuel consumption value had deteriorated from the development phase (1) prototype. Those persons, however, informed other members of the department that there was a prospect of achieving the Development Target Value of the Hino running fuel consumption value by introducing new fuel efficiency improvement measures. Still, the heavy-duty vehicle fuel consumption value and the Hino running fuel consumption value of A09C (two-stage turbocharger) that addressed the E9 regulations were both far below the Development Target Value, even if the deterioration of the Hino running fuel consumption value of the development phase (2) prototype from the development phase (1) prototype was improved by introducing new fuel efficiency improvement measures.

The Powertrain Evaluation & Engineering Department reported at the development meeting (4) on May 18, 2016 that evaluation of the development phase (2) had determined the achievement of the Development Target Values of both the heavy-duty vehicle fuel consumption value and the Hino running fuel consumption value, and the meeting approved the transition to the production and design stage. The department then gave the same report on fuel consumption at the development meeting (4) on July 18, 2016 as it did at the development meeting (4) on May 18, 2016 and completed developing the A09C engine (two-stage turbocharger).

(b) A09C (single-stage turbocharger)

At the beginning, Hino expected that A09C (single-stage turbocharger) would comply with the E9 emissions regulations by increasing the capacity of Urea SCR, an after-treatment system. However, Hino evaluated the development phase (1) prototype and found that the Development Target Value of emissions would not be achieved by simply increasing the Urea SCR capacity. Accordingly, the Powertrain Evaluation & Engineering Department was required to improve the engine body emissions as well. This had a negative impact on the fuel efficiency, and when the evaluation of the development phase (1) prototype was completed, the Hino running fuel consumption value of A09C (single-stage turbocharger) was 0.5% below that of A09C that addressed the E8 regulations and was developed in Project H, which was the Development Target Value.

Nevertheless, as a prospect came into sight that the Development Target Value would be achieved by taking additional fuel efficiency improvement measures, the Powertrain Evaluation & Engineering Department reported at the development meeting (4) on June 2, 2015 that the Development Target Value was still underachieved by 0.5% but there was a prospect of achieving the goal by taking additional fuel efficiency improvement measures.

That said, however, the achievement of the Development Target Value here was only the achievement of the Hino running fuel consumption value of A09C that addressed the E8 regulations and was developed in Project H. Accordingly, the achievement of the Development Target Value was, in fact, still far below the Specification Value.

The Powertrain Evaluation & Engineering Department reported at the development meeting (4) on May 18, 2016 that it evaluated the development phase (2) and found that the Development Target Values of both the heavy-duty vehicle fuel consumption value and the Hino running fuel consumption value was satisfied.

The Hino running fuel consumption value reported at the development meeting (4) was calculated based on actual fuel consumption data and achieved the Development Target Value, whereas the heavy-duty vehicle fuel consumption value was found not achieving the Development Target Value according to a calculation based on actual fuel consumption data. Nevertheless, the Powertrain Evaluation & Engineering Department reported that the heavy-duty vehicle fuel consumption value also achieved the Development Target Value.

The Powertrain Evaluation & Engineering Department then gave at the development meeting (4) on November 15, 2016 the same report on fuel consumption as it did at the development meeting (4) on May 18, 2016 and completed developing the A09C (single-stage turbocharger).

(c) Change of fuel flow rate calibration values

In around October 2016, a person in charge in the Powertrain Evaluation & Engineering Department conducted prior confirmation ahead of a witnessed certification test for A09C (two-stage turbocharger) and found a major divergence from the Specification Value. That person then issued an instruction to calculate the fuel flow rate calibration value required for A09C (two-stage turbocharger) to satisfy the fuel consumption Specification Value and to change the fuel flow rate calibration value to be favorable for fuel consumption. In this way, the fuel flow rate calibration value was altered to the value that met the instruction.

After the witnessed certification test for A09C (two-stage turbocharger), an internal certification test for A09C (single-stage turbocharger) was conducted on the same bench that had been used for A09C (two-stage turbocharger). A person in charge in the Powertrain Evaluation & Engineering Department conducted the internal certification test for A09C (single-stage turbocharger) without resetting the fuel flow rate calibration value in the witnessed certification test for A09C (two-stage turbocharger). As a result, a test result was obtained that the emissions and fuel consumption measurement values satisfied the Specification Values.

(d) The Committee's evaluation

As stated above, the fuel flow rate calibration values of A09C (two-stage turbocharger) and A09C (single-stage turbocharger) that addressed the E9 regulations were both changed to favor fuel consumption during certification tests by the same method as was used for E13C. That being said, the Committee believes the Powertrain Evaluation & Engineering Department was compelled to change those values because it had failed to report at the development meeting (4) the significant underachievement of the fuel consumption below the Development Target Value and it had made a false report by overstating the fuel consumption without any supporting grounds.

5. Issues related to A05C (HC-SCR) that addressed the E9 regulations

Among A05C (HC-SCR) that addressed the E9 regulations, the four prototypes of engines for which durability test-related misconduct was found are: A05C development code (1), A05C development code (2), A05C development code (3), and A05C development code (4). Durability tests for A05C (HC-SCR) that addressed the E9 regulations were implemented only for A05C development code (1); therefore, the Report mainly discusses A05C development code (1) below.

(1) Second muffler was replaced and durability tests were continued

Once durability tests were started for engines under A05C development code (1) for A05C (HC-SCR), the NOx value measured gradually deteriorated. It was inferred that the purification rate rapidly deteriorated as a result of deterioration of the catalyst in HC-SCR. The personnel in charge in the Powertrain Evaluation & Engineering Department instructed to change the ECU program, and the program was changed; however, the NOx purification rate continued to decline.

In order to improve the NOx value, the personnel in charge in the Powertrain Evaluation & Engineering Department instructed to replace the second muffler in which HC-SCR was installed. Durability tests were continued using the same engine even after the replacement of the second muffler.

However, the measured NOx purification rate remained unstable even after the replacement of the second muffler; thus, the ECU program was continuously changed to adjust the amount of light oil to be added. As a result, the NOx purification rate became stable after the running time during the durability tests exceeded 1,000 hours.

(2) Hino did not measure emissions at the stipulated frequency and points in time; further, it applied for certification by diverting values that were not measured in the actual durability tests

For A05C, which is for middle-duty engine vehicles, it is necessary under laws and regulations to run it for 5,000km ± 500km, 40,000km ± 4,000km, 80,000km ± 4,000km, 120,000km ± 4,000km, and 150,000km or more, during its durability tests and measure emissions values at each of the five points in time. However, in durability tests for A05C (HC-SCR) that addressed the E9 regulations, emissions values were measured only at four points in time: at approximately 38 hours (4,077km), approximately 483 hours (51,826km), approximately 865 hours (92,815km), and approximately 1,416 hours (151,937km). In addition, the first measurement was conducted at the point in time when the running distance was 4,077km, which was below 5,000km ± 500km, the value accepted under laws and regulations; the second measurement was conducted at the point in time when the running distance was 51,826km, which exceeded 40,000km ± 4,000km, the value accepted under laws and regulations; the third measurement was conducted at the point in time when the running distance was 92,815km, which exceeded 80,000km ± 4,000km, the value accepted under laws and regulations, respectively.

Thus, other data, which was measured using benches other than those used for measurement in durability tests, was inserted in Excel files which included formulas for calculating deterioration factor, etc. used at the time in the Powertrain Evaluation & Engineering Department, then the deterioration factor, etc. were calculated, and the calculated results were stated in durability test documents.

6. Issues related to N04C (Urea-SCR) that addressed the E9 regulations

Issues related to fuel consumption of N04C (Urea-SCR) are regarding engines developed in Project N. This Project N was a project that addressed the J-OBD2 regulations for engines developed in Project

M, and it succeeded to fuel consumption and emissions performance of the engine developed in Project M. Thus, circumstances concerning Project M are explained below.

N04C (Urea-SCR), which is the engine developed in Project M, involves 2 models, N04C-WA and N04C-WB, and these models have different horsepower.

(1) Measurement of fuel consumption when engines transition from motoring to idle

This misconduct was conducted for both N04C-WA and N04C-WB.

Under laws and regulations, when calculating fuel consumption, it is necessary to measure the raw data for the Equal Fuel Consumption Map; Hino measured fuel consumption at 51 points in total. During the test for measuring fuel consumption during the idle running of N04C (Urea-SCR) (both N04C-WA and N04C-WB), Hino warmed-up the engines by running them at the rated output (maximum output); after that, it motored them, and then idled the engines; it then measured the fuel consumption amount at a time at which the measurement value of fuel flowmeter was yet to be stable.

When engines are motored, they do not use their own power; therefore, the fuel consumption amount will temporarily be zero. When engines are brought into an idle condition after that, the fuel consumption amount consumed during the idle running will be certain, but due to a characteristic of the fuel pressure adjusting machine, the amount of fuel measured by the fuel flowmeter will gradually increase at the point in time when engines transition to idle from the motoring condition; in case of light-duty engines, it will take about 20 to 30 minutes for the measurement value of fuel consumption amount when idle to be stable. When measuring fuel consumption of engines not limited to N04C (Urea-SCR), in many cases Hino implemented the measurement taking “3 minutes to be stable, and 1 minutes to measure” or “4 minutes to be stable, and 1 minutes to measure.” That is to say, Hino did not take approximately 20 to 30 minutes, which was the time required for the measurement value of the fuel consumption amount to actually become stable.

(2) Picking up convenient measurement results

In in-house certification tests for N04C-WB, Hino measured fuel consumption after engines were motored and made to idle, and when the measurement value of fuel consumption amount was yet to be stable; however, it was discovered, after starting in-house certification tests, that fuel consumption had still not reached the Specification Values. Person in charge in the Powertrain Evaluation & Engineering Department selected, from among a number of data measured on different dates, fuel consumption data at the time of idle running wherein the fuel consumption was particularly good; they then intentionally selected convenient data so that fuel consumption would also be good for the fuel consumption data at the remaining 50 measurement points. As such, they created data that satisfied the Specification Values and prepared a certificate of analysis based on the created data.

(3) Committee’s evaluation on these misconducts

For N04C (Urea-SCR), the fuel consumption values were calculated through a method that was against the purport of laws and regulations. This fact should never be overlooked. However, this is different, in terms of nature, from misconduct performed for E13C and A09C. The situation surrounding N04C (Urea-SCR) that addressed the E9 regulations occurred in order to achieve the Specification Values in witnessed certification tests, on the spur of the moment. It is obvious, however, that Hino put less emphasis on the certification system itself; if these misconduct is neglected, misconduct will escalate in the future.

Chapter 4 Off-road Engine Issues

1. Background to the occurrence of the issue with the off-road engines and full details

(1) Background factors considered to have led to the occurrence of misconduct relating to the off-road engines at Hino

A. Judgment that the performance of the after-treatment system would not deteriorate and the deterioration correction coefficient was 1

Since after-treatment systems such as the DPF and NOx catalyst (SCR) deteriorate according to the operating time, it was necessary, when developing an off-road engine, to formulate Target Development Values based on the premise that the performance of the after-treatment system would deteriorate. However, all of the staff in charge of off-road engine development thought the after-treatment system would not deteriorate.

B. Inability to cope with the difficulty of developing an off-road engine

It was extremely difficult to develop an off-road engine that was able to withstand use at high loads and high rotation speeds looking ahead to whether it would suitably match the industrial machinery for construction ("Construction Vehicle") in which it was to be installed. In particular, after the after-treatment systems were brought in, it became even more difficult to develop the off-road engines, and it was not possible to sufficiently cope with this extreme difficulty.

C. Tight development schedule

Originally, the process for the development of an off-road engine should have been as follows: (1) delivery of a prototype engine to the customer, (2) confirmation, etc. of the performance by the customer after installing the prototype engine on a Construction Vehicle (confirmation of on-board performance), (3) improvement of the engine in light of the results of checking the on-board performance, and (4) start of a durability test with the engine that had been improved based on feedback from the customer. However, in reality, the prototype engine was delivered to the customer in the process step of (1) without going through the process steps of (1) to (4), and in tandem with this, the durability test of (4) was started using an equivalent prototype engine.

D. Inability to inform the customer of the required development schedule

Since the off-road engine business is a business that develops engines for specific customers, the development schedule could have become tight depending on the customer's circumstances.

E. No work manual or operations standards

Regarding the planning and development of off-road engines, Hino has still not applied rules such as the development standard process operational rules for on-road engines, and in fact, there was no standardized development process. In addition, there was no rule requiring the holding of a partition meeting or a transition meeting to check whether the development had been completed, and in actuality, no such meetings were held.

(2) Issues that occurred at the time of the Tier 3.5 Regulations

There are five models of engines that addressed the Tier 3.5 Regulations, and in all of the models, the NOx value exceeded the Regulation Value (2.0g/kWh) at all of the measurement points in the durability test. The following misconduct arose to deal with the situation:

(i) Rewriting of the test data as if the emissions values had been measured at the measurement points specified by laws and regulations;

(ii) Rewriting to numerical values which differed from the measurement results; and

(iii) Despite replacement of the engine parts during the durability test, continuation of the durability test without going through the necessary procedures.

In addition, the following misconducts also occurred in the regeneration test:

(iv) Originally, it was necessary to calculate the regeneration correction coefficient using the hot engine state of the NRTC mode, but the regeneration coefficient was calculated using the measurement results of both the hot engine state and the cold engine state of the NRTC mode; and

(v) insufficient continuous number of runs in the regeneration test.

(3) Issues that occurred at the time of the Tier 4 Regulations

Hino introduced Urea-SCR as an after-treatment system in the off-road engines in order to respond to the significantly stricter NOx regulations. At the time of the Tier 4 Regulations, the following misconduct also occurred:

(vi) Failure to explain to the certification body the reason why a specific measurement result out of the measurement results in the durability test was not selected;

(vii) When no measurements results had been taken at the measurement point specified by laws and regulations, use of fictitious numerical values when calculating the deterioration correction coefficient;

(viii) Arbitrary selection of values after performing multiple measurements at each measurement point;

(ix) Diversion to the measurement results at the measurement points specified by laws and regulations despite the measurement results having been taken at measurement points other than the measurement points specified by laws and regulations; and

(x) Change in the ECU settings in order to improve emissions performance during the durability test and witnessed certification test.

The misconduct that occurred for each model at the time of the Tier 4 Regulations is as summarized below.

J08E-YD:	(i), (vi)
J08E-VV:	(i), (ii), (iii), (v)
P11C-VN:	(i), (ii), (v), (vii), (x)
E13C-YS:	(i), (ii), (iii), (v), (viii), (ix), (x)
E13C-YM:	(iii), (viii), (ix), (x)
J05E-UN:	(i), (ii), (iii) (the test results for J08E-VV substituted for the durability test), (v)
J05E-VB:	(i), (vi) (the test results for J08E-YD substituted for the durability test)
J08E-WV:	(i), (ii), (iii), (v) (the test results for J08E-VV substituted for all of the durability tests, witnessed certification tests, and regeneration tests)
J05E-UM:	(i), (ii), (iii), (v) (the test results for J08E-VV substituted for the durability tests, the test results for J05E-UN substituted for the witnessed certification tests and regeneration tests)

J05E-VA: (i), (vi) (the test results for J08E-YD substituted for the durability test)

2. P11C-VN

(1) Misconduct such as rewriting the measurement results in the durability tests

A. Rewriting of the test data as if the emissions values were measured at the measurement points specified by laws and regulations

With regard to P11C-VN, the results of the durability test in accordance with European laws and regulations were used when applying for certification in Japan. The measurement results of the emissions values at the time of (1) 125 hours of break-in operation, (2) 1,000 hours of operation, and (3) 2,000 hours of operation were supposed to be given in the documents submitted by Hino to the European certification body.

The person in charge at the Powertrain Evaluation & Engineering Department specified the time of 0 hours as the first measurement point for the Technical Center. Also, he instructed the Technical Center to measure the emissions at the midway point, and at the time of the instruction, the engine had already been running for 1,402 hours, exceeding the specified time of 1,000 hours. Later he instructed the Technical Center to take a measurement at 2,000 hours of operation as the final measurement point and received a report on the measurement results.

When the test data measured at 0 hours was reported, since it was thought that there was not enough time and equipment to measure it again at 125 hours, the measurement data at 0 hours as the measurement data at the end of the 125-hour break-in operation was used.

In addition, the measurement data at 1,402 hours as the measurement results at the midway point were reported but it was thought that there was no time to redo the durability test due to the development schedule, so even though the engine was actually operated for 1,402 hours, the measurement data at that time was used as the measurement data at the time of 1,000 hours of operation.

B. Rewriting to numerical values which differed from the measurement results

When the measurement result exceeded the Regulation Value, the numerical value was rewritten to keep it within the Regulation Value. In addition, the numerical values were corrected so that the deterioration correction coefficient of the measurement results at the three measurement points became 1. These numerical corrections were made at any of the initial, midway and final measurement points.

C. When measurement results had not been taken at the measurement point specified by laws and regulations, use of fictitious numerical values to calculate the deterioration correction coefficient

Although the European laws and regulations do not set a limit on the number of times each measurement point can be used to calculate the deterioration correction coefficient, Hino customarily carried out three measurements at each measurement point; however, the number of measurements was insufficient. Therefore, the person in charge at the Powertrain Evaluation & Engineering Department wrote baseless fictitious numerical values in the document purporting the measurement results had been taken three times at each measurement point, and then calculated the average value of the three measurement results including the fictitious values and then calculated the deterioration correction coefficient.

(2) Changes in the ECU settings

The ECU settings were changed during the durability test, and the ECU settings for the witnessed certification test engine and the durability test and mass-produced engine differed.

(3) Insufficient continuous number of runs in the regeneration tests

Hino was supposed to conduct DPF regeneration after carrying out 19 continuous runs in the specified running mode under laws and regulations to collect soot; however, with respect to P11C-VN, in reality, DPF regeneration was conducted without 19 continuous runs, and the regeneration correction coefficient was calculated by measuring emissions values before, during, and after regeneration.

3. E13C-YS

(1) Misconduct such as rewriting the measurement results in the durability tests

A. Arbitrary selection of the numerical values after performing multiple measurements at each measurement point

Although Hino was supposed to take measurements three times at each measurement point, since there were inconsistencies in the measurement results, measurements were taken four or more times at each measurement point.

According to European laws and regulations, when multiple measurements are taken at each measurement point, it is necessary to use all the measurement results to calculate the deterioration correction coefficient, and if the results of the emission values measured in the durability test are considered invalid and are excluded from the data for calculating the deterioration correction coefficient, an explanation must be given to the certification body on the reason for the invalid results and the emission values must be measured again within 100 hours of the invalid measurement.

The person in charge at the Powertrain Evaluation & Engineering Department instructed the person in charge at the Technical Center to measure the emissions at least four times at each measurement point. Then, when a numerical value exceeding the Regulation Value was calculated, he did not include the numerical value in the data used for calculation of the deterioration correction coefficient, and moreover, arbitrarily selected three measurement results from multiple measurement results at the same measurement point and calculated the average value and the deterioration correction coefficient so that the deterioration correction coefficient became 1.

B. Diversion of the measurement results at the measurement points specified by laws and regulations despite the measurement results having been taken at measurement points other than the measurement points specified by laws and regulations

The person in charge at the Powertrain Evaluation & Engineering Department tried to adjust the deterioration correction coefficient to 1 by arbitrarily selecting the measurement results from multiple results measured at the same measurement point. However, the deterioration correction coefficient could not be set to 1 by that alone, and the measurement results at measurement points other than the measurement points specified by laws and regulations were diverted as the measurement results at the measurement points specified by laws and regulations.

C. Rewriting to numerical values which differed from the measurement results

At the third measurement point in the specified running mode under laws and regulations, in addition to multiple measurements being conducted and numerical values being arbitrarily selected, NOx values were rewritten to different numerical values.

D. Rewriting of the test data as if the emissions values were measured at the measurement points specified by laws and regulations

Regarding the durability test, in the documents to be submitted at the time of the type-approval application, Hino was to give the measurement results of the emissions at the time of (1) the completion of 125 hours of break-in operation, (2) 1,000 hours of operation, and (3) 2,000 hours of operation.

The person in charge at the Powertrain Evaluation & Engineering Department received the report from the Technical Center stating that the measurement results at the first measurement point were the measurement results at 0 hours, the measurement results at the midway measurement point were the measurement results at 991 hours of operation, and the measurement results at the final measurement point were for 1,700 hours of operation. In response, in the data for calculating the deterioration correction coefficient, he used the measurement results at 0 hours as the measurement results at 125 hours, the measurement results at 991 hours as the measurement results at 1,000 hours, and the measurement results at 1,700 hours as the measurement results at 2,000 hours of operation.

(2) Replacement of the engine parts and continuation of the durability test without going through the necessary procedures

In addition, according to European laws and regulations, when repairing the engine body and emissions control system, the durability test up to that point is invalid unless a part that has passed the same operating time is used as the replacement, and when a new part is used, the test must be started again.

In E13C-YS, the NOx value deteriorated at a measurement point in the middle of the durability test. Therefore, the person in charge at the Powertrain Evaluation & Engineering Department thought that the airflow sensor had become dirty, and the behavior of the engine had changed with the accumulation of the operating time, leading to the deterioration of the NOx value, and so he replaced the airflow sensor with a new one at a measurement point in the middle of the durability test and continued with the durability test as it was.

(3) Change in the ECU settings

Even with the E13-YS, the ECU settings were changed during the durability test, and the ECU settings of the witnessed certification test engine and the durability test and mass-produced engine differed

(4) Insufficient continuous number of runs in the regeneration tests

Hino was supposed to conduct DPF regeneration after carrying out 19 continuous runs in the specified running mode under laws and regulations to collect soot; however, with respect to E13C-YS, in reality, DPF regeneration was conducted without 19 continuous runs, and the regeneration correction coefficient was calculated by measuring emissions values before, during, and after regeneration. This is the same issue as P11C-VN.

4. E13C-YM

(1) Misconduct such as rewriting the measurement results of the durability tests

A. Arbitrary selection of the numerical values after performing multiple measurements at each measurement point

Upon being instructed by the group manager, the person in charge at the Powertrain Evaluation & Engineering Department instructed the persons in charge at the Technical Center to measure the emissions values multiple times at each measurement point.

Although all the measurement results were reported, he arbitrarily selected three measurement results from the four or more measurement results and calculated the average value and the deterioration correction coefficient so that the deterioration correction coefficient approached 1.

B. Diversion of the measurement results at the measurement points specified by laws and regulations despite the measurement results having been taken at measurement points other than the measurement points specified by laws and regulations

With regard to E13C-YM, aside from when the number of measurements was lacking, when the deterioration correction coefficient was not able to be set to 1 simply by arbitrarily selecting the measurement results from multiple results measured at the same measurement point to calculate the average value, the measurement results at measurement points other than the measurement points specified by laws and regulations were diverted to the measurement results at the measurement points specified by laws and regulations, and adjustments were added to make the deterioration correction coefficient 1.

(2) Replacement of the engine parts and continuation of the durability test without going through the necessary procedures

The turbocharger and VN (variable nozzle) controller were replaced in the middle of the durability test, and the durability test was continued as it was.

(3) Change in the ECU settings

Even with the E13C-YM, the ECU settings were changed during the durability test, and the ECU settings of the witnessed certification test engine and the durability test and mass-produced engine differed.

Chapter 5 Issues with the Quality Assurance and Quality Control Departments

1. Development completion evaluation (cross-check) not conducted for some models without any rational reason

In developing on-road engines, after the evaluation of the development phase (2) prototype by the Powertrain Evaluation & Engineering Department is completed, the Quality Control Departments and Engine Assembly Departments of the respective plants are to perform the engine development completion evaluation (cross-check) using engines for which development has been completed (generally using the development phase (2) prototype). At Hino, models subject to the development completion evaluation were selected and items to be evaluated were decided based on procedures for engine performance management and upon prior consultation. However, among the models, for which the development completion evaluation was decided not to be conducted as a result of such consultation, there were some models for which development was not conducted without any rational reason.

2. Fuel consumption measurement at the Quality Assurance and Quality Control Departments not conducted

At Hino, generally fuel consumption measurement is only conducted by the Powertrain Evaluation & Engineering Department at the development stage, and there was no situation where the Quality Assurance and Quality Control Departments measured fuel consumption.

As the Development Function started to put emphasis on achievement of fuel consumption standards, it can be said that it was in a situation where motivation to commit misconduct concerning fuel consumption was apt to occur. Therefore, the Quality Assurance and Quality Control Departments

should have exercised their check functions against the Development Function, and should have actively verified fuel consumption from a third-party standpoint.

3. Verification of deterioration factors at the Quality Assurance and Quality Control Departments not conducted

Regarding A05C (HC-SCR) that addressed the E9 regulations, misconduct in durability tests for calculating deterioration factors has been identified. However, up until the time when the transition to the mass production stage was completed, the Quality Assurance and Quality Control Departments had not verified the deterioration factors at all.

4. Off-road Engine Issue

The involvement of the Quality Assurance and Quality Control Departments in off-road engines is weaker than that in on-road engines. Under the current situation where no rule is set forth for the involvement of the Quality Assurance and Quality Control Departments during the period from the completion of development of off-road engines to their mass production, persons in charge in the field can carry out mass production at their own discretion by simply obtaining relevant customer's approval, without confirmation by the Quality Assurance and Quality Control Departments, and even without production prototype evaluation.

5. Issues related to control values

The control values are the values used as the standard for the pass or fail judgment in production sample inspections. If the average values of emissions used as the base for determining control values are close to the Regulation Values and the standard deviations (σ) are large, it would result in many engines having emission values which significantly exceed the Regulation Values being put on the market despite production sample inspections being conducted. Therefore, the Quality Assurance and Quality Control Departments should consistently consider the necessity to review the control values and the fact that standard deviations (σ) are large, and this leads to the check function.

However, over many years, the Quality Assurance department has not been involved in setting of the control values or the like, at all, and the quality control departments have not confirmed measurement results of engines that are used as the base of control values, and their actual data. That is, neither the Quality Assurance Department nor the Quality Control Departments have performed any check functions. As a result, in setting the control values, values without rational basis have been provided by the Powertrain Evaluation & Engineering Department for some models, and that has not been regarded as a problem.

6. Issues in production sample inspections

According to the operational procedures for inspections of the diesel engines emissions amount, if, as a result of a production sample inspection, an engine fails to pass the inspection due to an excess of limiting control values, in order to judge whether such defects are solely due to that engine, additional sample inspections are required to be conducted using two or more engines.

However, when values that exceeded or were likely to exceed the limiting control values were obtained in the results of a production sample inspection, the Quality Control Departments re-measured the engine's emissions after adjusting inspection conditions, such as air supply pressure, exhaust temperature and exhaust pressure, without conducting additional sample inspections, and did not leave the data before the re-measurement on record. This would have to be evaluated as not only a formal violation of internal rules, but also as an act of deleting information, which is important and useful for production management, and ignoring the purpose of production sample inspections.

Chapter 6 True Cause Analysis of the Issue

1. Summary of the Issue

The Issue is that in Hino's engine development, certification was obtained by misrepresenting the "emissions performance" and "fuel economy performance." The question arises whether Hino's officers and employees ever considered prior to the Issue being discovered what it meant for automobile manufacturers to misrepresent "emissions performance" and "fuel economy performance" and why obtaining certification through their misrepresentation was strictly prohibited in the rules relating to car manufacturing.

There is an important perspective to be taken into account when considering the gravity and true causes of the Issue. It is the perspective that the existence of automobiles has both "positive and negative" aspects. In other words, while there is a positive aspect that automobiles are indispensable in modern society, and we enjoy the great convenience that they provide, there are also negative aspects such as risks to human life and physical safety, noise, air pollution, global warming and recycling issues. In car manufacturing, the "positive and negative," "light and shade," and "brightness and darkness" of the cars can never be ignored and dealing with these aspects is both the challenge and the real pleasure of making a car. It is also an opportunity to showcase the skills of the engineers.

These "positive and negative" aspects of automobiles have shown different elements depending on the times. Until now, automobile manufacturers have boldly taken on the challenge of dealing with the dual aspects of automobiles changing with the times, have overcome various difficulties, and ensured the evolution of its product, the automobile. The automobile manufacturers' philosophy and thinking of car manufacturing is strongly reflected in how automobile manufacturers deal with this duality. Trucks and buses are one of the important social infrastructures that contribute to the mass transportation of goods and people, but trucks and buses are not free from the negative aspects of automobiles. Rather, it can be said that the negative aspects of trucks and buses have a greater impact than passenger cars.

In the past, car manufacturing tended to focus on dealing with the "negative side" of risks to human life and physical safety, and related regulations were put in place. However, these regulations have gradually changed due to the demands of the times and changes in the circumstances affecting automobiles. The best example is the regulations on "emissions performance" and "fuel economy performance." Both are regulations that focus on the negative aspect of the "environmental impact" that automobiles bring. Such regulations did not exist in the early days when automobiles were first invented. However, as human society underwent major changes and development due to the positive aspects of automobiles, the negative aspects of automobiles became apparent in the form of air pollution and global warming due to the large consumption of fossil fuels. In order to deal with these problems, regulations on "emissions performance" and "fuel economy performance" were established, and these regulations have become stricter based on an increased awareness of the environment in line with the times and measures in relation to the environmental issues under a global framework.

Looking at Hino's car manufacturing, on one hand, fully recognizing the gravity of the traditional "negative aspects" such as risks to human life and physical safety, necessary countermeasures have been taken, but on the other hand, it appears that the responses to counter this new "negative aspect" of the "environmental impact" has not been sufficient. Certainly, Hino's car manufacturing has been rated highly in the past as having gained the support of its customers by advancing product development with due consideration for the environmental performance ahead of its competitors. However, with the changing times, it seems that there was not enough understanding within Hino that awareness of environmental performance was no longer simply one of the favorable commercial characteristics of Hino, but as much as safety, or even more so, is an indispensable factor in the very existence of automobiles for acceptance by society.

The certification system in Japan is a system of "innate goodness" that is built on trust of automobile manufacturers. The presentation of individual automobiles for new registration and new inspection in the case of certified automobiles can be omitted since it is assumed that the automobile manufacturer will manufacture the cars according to the type-approved model. Even when an automobile manufacturer receives a type-approval, the examining body NALTEC makes a judgment, in principle, on the premise that the results of the in-house certification test conducted by the automobile manufacturer itself are correct.

The Issue is the pretense that the certification test required for the application for certification met the emissions regulations and fuel consumption standard values even though it did not, and the pretense that the required tests and procedures that should have been carried out in the in-house certification test had been carried out even though they were not, and such acts fundamentally rock the foundation of the certification system that was built on the "innate goodness" of automobile manufacturers. First and foremost, Hino needs to be aware of the severity of what it has done.

2. The true causes of the Issue and the theoretical causes derived from them

The Issue occurred in the department called the Powertrain Evaluation & Engineering Department, but the Committee believes that simply reducing this to a localized issue in the Powertrain Evaluation & Engineering Department would lead to a misunderstanding of the substance of the issue.

There are trade-offs everywhere in car manufacturing, such as price versus quality, weight reduction versus durability, power versus fuel consumption, transportation capacity versus mobility, and improvement of fuel economy performance versus NOx reduction. In order for car manufacturing to deal with these trade-offs, it is necessary to either find a way to simultaneously solve these conflicting issues or to decide on prioritizing one of these conflicting events thereby sacrificing one for the other through bold technological innovations or deploying a completely different way of thinking. However, neither the former method nor the latter method is an issue that can be solved simply based on the capabilities or discretion of one sole department involved in car manufacturing. The Powertrain Evaluation & Engineering Department was a department that tackled the issue of conflicting emissions performance and fuel economy performance through calibration work, but emissions performance and fuel economy performance could also be improved through engine design and vehicle design. Nevertheless, Hino had become used to the Powertrain Evaluation & Engineering Department, which is in charge of the calibration work, the final stage of development, struggling alone.

Looking at the responses to the Employee Questionnaire, it was not always the case that there were many responses that blamed the Powertrain Evaluation & Engineering Department in which the Issue occurred and the individuals involved in the Issue, but rather many of the responses pointed out that the true cause of the Issue lay in the corporate culture and predisposition of Hino as a whole. In this regard, although a number of employees were aware of the issue faced by Hino, as a company, Hino was not able to prevent the occurrence of the Issue or detect it at an early stage. By digging deeper into this point, the Committee has come to consider the three below as the true causes of the Issue.

True cause (1): "We make cars together" not being true
True cause (2): Being left behind by the changes in the world
True cause (3): Neglect of the mechanism for management of the work

(1) "We make cars together" not being true

In the process of the Investigation, there were many occasions where the Committee felt that Hino's officers and employees were not united as a team to build the entire car. In short, they "did not make cars together."

Car manufacturing is a collection of highly specialized technologies, and it is difficult for everyone to have a deep knowledge of everything, and the scope within which the staff's expertise can be transferred is limited. In addition, development was being promoted at Hino on a module-by-module basis with the goal of efficient development, so the focus tended to be on "partial optimization" of the module the staff member was in charge of. In this way, the more specialization and efficiency required in the car manufacturing, the greater the risk that the organization develops a silo mentality. Therefore, in order for Hino's officers and employees to make cars together, it is necessary to always have an awareness of the risks and to deal with them.

Hino does, in fact, have a mechanism and a framework enabling everyone to work together to make the car together, but ultimately, the individual officers and employees lacked the conscious awareness of the need to work together to make the cars, and it would appear that the actual situation was such that the officers and employees were not united in building cars together.

A. Sectionalism and fixed personnel

(a) Isolation of the Powertrain Evaluation & Engineering Department

It would appear that by keeping the burden of the calibration work to themselves and ensuring that it was work that only they could understand, the Powertrain Evaluation & Engineering Department were able to avoid interference from other departments and were able to assert the importance of their position.

The calibration work performed by the Powertrain Evaluation & Engineering Department is at the end of the development process. Also, at the end of the development process, it is often no longer possible to review the engine design or change the layout of the vehicle as a whole. At the end of the development process, the Powertrain Evaluation & Engineering Department was expected to play a role as the last bastion to achieve the Development Target Values while engaged in calibration work that was difficult for other departments to understand, and it seems that it was left holding the bag.

Even if the person from the Powertrain Evaluation & Engineering Department, who was a member of the project, brought an issue to the attention of the department, the office manager or department manager of the Powertrain Evaluation & Engineering Department, or the officer in charge, could not be relied on as a person to go to with a problem. It would appear that, in the end, the person from the Powertrain Evaluation & Engineering Department, who was a member of the project, had no one to rely on in the project or in the Powertrain Evaluation & Engineering Department, and was forced to struggle alone, had the whole task thrown at them, and was gradually backed into a corner.

(b) Whether the person in charge of the project had an overall view of the entire project

The persons in positions of responsibility for the project were supposed to supervise the members participating in the project from each department and implement the policy of everyone making car together.

However, the question arises whether the persons in positions of responsibility for the project at Hino managed the development process with an overall picture of car manufacturing. Did they fully understand the structure of the trade-offs involved in car manufacturing? Did they take responsibility for subsequent follow-ups when one aspect was prioritized, and another was sacrificed? Can it be said that the personnel, who were working on development under these persons in positions of responsibility, also maintained sufficient professionalism when working to build cars together?

For example, in the Issue, the act of misrepresenting the emissions performance mainly occurred in the durability tests conducted by the Powertrain Evaluation & Engineering Department. However, the vehicle CE, engine CE and Engine Chief Engineer barely had any understanding of the durability tests. Since they did not know the contents and procedures of the durability test, they did not know

the time required for the durability test or the appropriate schedule based on it, and they also did not know when and how many Benches would be needed for the durability test. The vehicle CE, engine CE, and Engine Chief Engineer all relied entirely on the Powertrain Evaluation & Engineering Department for the durability tests and calibration work, but this was not because they trusted the Powertrain Evaluation & Engineering Department and had left them to do the work having gained a thorough understanding of what the work entailed, but rather they threw it all at the Powertrain Evaluation & Engineering Department precisely because they didn't understand what it entailed.

Meanwhile, the act of misrepresenting the fuel economy performance is an issue where some managers such as those in the Engine Development Department, who had received instructions from some officers at the last minute to improve the fuel consumption, completely ignored the schedule and technical support required for the engine's fuel consumption and improvements, easily promised to make improvements to the fuel consumption, then abandoned it, and finally threw everything at the person in charge in the Powertrain Evaluation & Engineering Department who would be performing the calibration work at the end. This seems to symbolize that everyone was "not making a car together."

(c) Non-pursuit of overall optimization

At Hino, each department was trapped in the idea of partial optimization and did not pursue overall optimization of what was necessary to make a better car, and their awareness and desire towards making a car together was lacking. In other words, adhering to a policy of "own process completion," each department seemed to fulfil its responsibilities by pursuing partial optimization of only the work that they were in charge of, which in truth meant that they simply played their own role within a given range, and it appears that they had become used to the habit of sectionalism of not bringing extra work back to their department. As this thinking progressed, due to a territorial sense, they lost respect for the other departments and become obsessed with the inward-looking values of rank within the organization.

This kind of organization is also reluctant to accept new personnel from other departments and is more likely to hold onto the personnel of their own department. In such case, staff become fixed throughout the company. As a result, each department developed a silo tendency. At Hino, the Powertrain Evaluation & Engineering Department was a typical silo organization.

Hino's "engine superiority," "elitism in the Engine Development Department," "culture of not violating another's territory," "hierarchy within the design department," etc. were criticized in the Employee Questionnaire. Both those who stick to the hierarchy with engine design at the top, and those who lament this seem to be too caught up in the position of the "engine" department and the order within the company.

B. Lack of constructive discussions based on professional skepticism and a critical mind

The Committee believes that in order to be a good engineer, it is important to maintain a sound professional skepticism and a critical mind as well as the mindset and attitude of respect for the work of others. In Hino's development process, the reports and products of other departments were accepted as they were, and there was no environment of trying to have constructive discussions based on sound professional skepticism and a critical mind. The reason why reports and products from other departments were accepted as they were was not because of a conviction in the infallibility of these reports and products, but simply because, due to familiarity, it was easier to go along with them and not to think too deeply, and also because of a sense of indifference towards other departments, and by extension, a lack of the knowledge and qualities necessary for criticism and verification.

The importance of checking based on professional skepticism and a critical spirit from a third-party standpoint is the fundamental thinking required of engineers in the field of science and technology, but

this kind of thinking was missing in Hino's car manufacturing. This appears to overturn Hino's philosophy of making cars together.

C. Disconnect between the management and the on-site employees regarding capabilities and resources

There is a disconnect between the management and the on-site employees in terms of awareness of Hino's own capabilities and resources. In other words, the mechanism for appropriately reaching the management team to share an awareness of the issues and to report on the status of issues faced by the on-site employees was not functioning well, and it seems that the management team did not have the desire to collect information from the on-site employees when formulating a business strategy.

The reason for this situation appears to have been due to the disconnect between the management team, which was the side that issued instructions on the car manufacturing and the on-site employees, which was the side that received the instructions. Both the management team and the on-site employees are supposed to be colleagues whose objective is to engage in "good car manufacturing" by facing the same direction. However, the management may have seen themselves as the "orderer" of the car manufacturing issuing orders to the on-site employees. The on-site employees may have felt this is how management saw themselves and thus stopped speaking out. This is an issue for both the management team and the on-site employees to reconsider, while understanding the meaning of "making a car together."

D. Weakness in the mechanism to understand the trends in laws, regulations and rules, and sharing their content and impact throughout the company

In order to make a car under various regulations, the work involves monitoring the changes in the rules due to the laws and regulations of each country in a timely and accurate manner and sharing them internally, understanding what needs to be done in order to deal with the "negative" aspects of cars and, in the background, it is also essential to take how society's needs for cars are changing as a company-wide issue, and to take measures to meet these needs.

In this regard, the Vehicle Regulation & Compliance Department was established in Hino, but this office simply shared the revision information internally after an official decision on the revision of domestic and overseas laws and regulations had been made and left the monitoring of the trends in the revision of the laws and regulations before the official decision had been made to each department of the applicable development department. In addition, there was no systematization or process in place for sharing of the information obtained by the department within the company. Therefore, in the event that information was obtained in advance that there was likely to be a revision of the laws and regulations that would have a significant impact on the development process, etc., even if the department that obtained the information were to analyze the impact on its own department, the situation was such that the company as a whole did not examine the impact on the entire development process, the impact on necessary resources or the impact on the entire vehicle.

Looking at the Japanese and European laws and regulations that stipulate the method of conducing the durability test, despite the content being complicated, this is an issue that was treated as though it only related to the Powertrain Evaluation & Engineering Department, which was responsible for actually conducting the test, but it was impossible for the Powertrain Evaluation & Engineering Department to interpret the laws and regulations by themselves and to think about and carry out all the technical operations such as the testing method by themselves. This led to the various circumstances in the Issue such as the lack of understanding about the durability test, the necessary Benches not being secured, a manual on how to carry out the durability test not being prepared, no mechanism being created to ensure the accuracy of the test data, and preliminary reports on the tests not being properly prepared and managed.

E. The roles of the Quality Assurance Department and the Quality Control Department not being fully understood

The importance of the roles of the Quality Assurance Department and the Quality Control Department was not fully understood at Hino, and as a result, these departments were not given the authority and resources to fulfill their allocated roles. Perhaps because of this, these departments themselves did not fully understand their roles and were unable to exert their function of applying effective checks without even realizing that they lacked the resources they should have been given.

The Quality Assurance Department is not simply responsible in the latter process of the development stage or the production stage for checking whether there was an issue in the preceding processes. The role of the Quality Assurance Department should surely be to check and consider what kind of mechanism should be constructed in order to ensure quality by taking an overall view of the entire process including the development stage and production stage. However, it seems that the officers and employees of the Quality Assurance Department perhaps felt intimidated by the development department and did not fully understand the role expected of the quality assurance department.

This issue does not mean that there was a problem with the qualities of the employees who belong to the Quality Assurance Department or the Quality Control Department. The issue is that Hino did not fully understand that these departments play an indispensable role in car manufacturing, and so the appropriate authority and resources were not given to these departments and their importance was not emphasized throughout the company.

(2) Being left behind by the changes in the world

In the employee questionnaire, some respondents pointed out that Hino had "the work style of the Showa era, which dates back decades" and some commented that the company "failed to see the outside world." Hino is undoubtedly one of the world's foremost automobile manufacturers in terms of its scale, market share and the global expansion of its truck and bus business, and with its head office in Tokyo, it should have been easy to grasp the changes and trends in the world. Despite being in this environment, the impression of the Committee is that Hino had been left behind by the changes in the world and had certainly "failed to see the outside world."

In addition, customers have been demanding higher standards not only with regard to car manufacturing but also in terms of manufacturing in general. About a decade ago, if there were no issues with the final performance or quality, even if there were some issues in the process, it was rarely regarded as a big issue in itself, but now these issues attract public attention as being "quality misconduct."

In response to the changes in the "yardstick" used by the world, many companies have tried to change accordingly. Manufacturing companies have updated their product merchantability, the processes from the development and procurement to the production of their products, and the standard of quality assurance and quality control to match the new "yardstick." The question arises what Hino was doing when many companies were working on such updates. Based on the results of the employee questionnaire and the results of the Investigation at least, Hino has not changed. Why did Hino not change? Did it make any efforts to change? Did it not notice the changes in its surroundings because of its inward-looking tendency? Or did it sense the changes but still not attempt to change?

Due to its past huge successes and because of the long duration of its successes, Hino may have thought that rather than instilling changes, it was better to follow Hino's tried and true path. However, seen from the outside, Hino appears to be in an inward-looking, conservative climate, or simply trapped in a shell. It becomes difficult for this kind of organization to see itself objectively, and it does not notice changes in the external environment and values, "failing to see the outside world." Since Hino "failed to see the outside world," Hino probably could not see the current

situation where acts that deviated from the new values and yardstick were becoming widespread within the organization.

A. Organization with a strong command hierarchy and workplace harassment tendency

At Hino, there was strong respect for past pioneers and achievements in engine development, and it seems that there was a tendency to believe that it was a virtue to obediently follow what older generations said. At Hino, the human resources tend to be fixed in their role and there is a tendency towards sectionalism, so it is very easy to create an atmosphere where employees cannot go against their boss. As a result, workplace harassment by superiors is likely to occur, creating an organization where employees find it difficult to feel secure.

B. Resting on its laurels; an environment of not being good at "making an about-turn"

The reason why Hino has been left behind by the changes in the world is because it has been resting on its laurels. As a result, it is not good at "making an about-turn" to minimize damage. Behind this is the culture in which superiors praise the efforts and dedication of the employees in the field to make the "impossible" possible, and when an issue is pointed out, the person who pointed it out is instructed to solve it. Therefore, it seems that the climate of "there being nothing to gain from speaking out," where pointing out the issues is frowned upon, is also related.

In terms of fuel efficiency, the company entered the fuel efficiency competition with the expectation of becoming the front runner in terms of fuel efficiency, based on its past success of being the front runner out of the truck and bus manufacturers for many years. Then, having achieved the Development Target Values of fuel efficiency through improper means, it fell into a state of "embellishing the truth," so to speak, and the succeeding models were developed based on this past embellishment of the truth, and as a result, misconduct was continued with later models.

C. Insufficient check function for Hino's development process

Hino did not have a mechanism to effectively verify whether the check function for the development process was sufficient from an outside perspective.

Hino explains that it has its own quality control system that includes the management of development process. However, the "Quality Assurance System Manual," which is thought to constitute the applicable rules, only abstractly stipulates Hino's way of thinking about quality assurance, and in it, there are only a few lines about managing the development process. It cannot be used as a guideline for business in actually managing the development process. These rules are merely a document explaining Hino's quality assurance system to external organizations such as overseas certification bodies, and in fact, Hino does not really manage the development process based on these rules. If Hino really thought it unnecessary to obtain ISO9001 because it did manage the development process independently based on these rules, this in itself seems to indicate that they had not adapted to the change where the world's "yardstick" measuring quality was becoming stricter, and the company did not correctly understand the importance of properly managing the development process from the viewpoint of quality assurance.

(3) The mechanism for managing business having been neglected

Hino is one of the leading truck and bus manufacturers in Japan, and it is a large company whose consolidated sales amount to approximately 1,460 billion yen and whose employees number approximately 34,000, as of the fiscal year ending March 2022.

However, the Committee identified issues at Hino such as: for its corporate size, the development of its internal regulations and manuals has not progressed, data storage and the formulation of rules related thereto have been insufficient, and for these reasons it is unclear who is authorized to make

decisions, while the decision-making process cannot be verified; authority has not been appropriately allocated, and the way that the organization currently works is that when deciding the division of duties among departments, the content and purpose of the work have not been sufficiently considered, resulting in check functions not working.

The Committee thinks that the reason for the above issues is that at Hino, the mechanism for managing business by exercising appropriate governance has been neglected.

A. Imprecision in the judgment of whether or not to move on to the next step in the development process

At Hino, at each stage of development, judgment on whether or not to move on to the next step in the development process was imprecise as exemplified by the following cases that sometimes occurred: a case where a partition meeting that decides whether to proceed to the next step was omitted, and a case where even if the development goal at that stage had not yet been achieved, a judgment was made to "conditionally move to the next step" by reason of there being "a likelihood of achieving the development goal." The Committee thinks that this system and operation will result in the partition meetings becoming nominal and will simply postpone dealing with problems. The Committee presumes that the above resulted in people casting their eyes away from the essential problems that were actually occurring, such as development not progressing well and the need to delay the time of sales release.

Regarding the off-road engines, not only were there no rules requiring a partition meeting in the first place, but there was also no mechanism in place to determine whether to proceed to the next stage at certain milestones such as delivery of the prototype engine and the start of the in-house certification tests.

The reason why the judgment on whether or not to proceed to the next step was so imprecise at Hino is thought to be that it was well established that "individuals" were to carry out their work at their own discretion, and a mechanism to apply control over them and manage the work seems to have been neglected.

In this way, if the mechanism for managing work is neglected, it will not be possible to make appropriate decisions in accordance with the rules, and the quality of work may be greatly affected by "individuals."

B. Powertrain Testing Department being in charge of both development work and certification work

Until around the time of addressing the E9 regulations, the employees of the Powertrain Evaluation & Engineering Department engaged in development work, and at the same time, they were also in charge of certification work such as the witnessed certification tests and in-house certification tests for the certification applications.

However, this cannot be said to be what the certification work mechanism was originally intended to be.

In other words, the goal of the department in charge of development is to develop products that meet the regulation values and internal target values, and the original task is to engage in trial and error with the aim of achieving this goal. On the other hand, in the certification work, the original work is to objectively judge whether or not the certification standard has been met, and it is not thought that the work, when it is done, entails discovering issues and improving them. As described above, the development work and the certification work originally have very different objectives and properties, and there is a problem with having the same personnel do both types of work even if both have many points in common.

Having the same department take charge of the certification work and the development work despite the above seems to show that Hino neglected the perspective of making the organization less prone to misconduct by managing the work using appropriate governance.

C. Regulations and manuals not being properly developed, and data and records not being properly managed

At Hino, regardless of whether it was for an on-road engine or off-road engine, and regardless of whether it was for the development department or quality assurance department, the Committee has found it notable that there were a number of cases where rules regarding the work and authority had not been prepared, and even in cases where they had been prepared, using them as a reference was not easy because their content was too abstract and simple to be a useful, practical reference.

In addition, due to the lack of rules, it was not clear who had the decision-making authority, resulting in situations occurring where the decision-making process could not be verified.

D. No proper allocation of authority between officers and on-site employees

Among the features of the development process at Hino are the many meetings held that are attended by the officers in charge, and that there is a mechanism adopted where a report is given to officers not only on general development policy but also on the status of items picked up to be improved, which are extremely technical matters, and on which the officers' opinions are sought.

Technological innovations relating to the development of engines and vehicles are advancing day by day, and it is often the person in charge of the practical work on site who has the knowledge and practical experience based on the most recent research. Given that the technology related to vehicle manufacturing is becoming more complex and the area of necessary knowledge is expanding, it is desirable to appropriately allocate authority, by such means as leaving technical decisions up to the on-site discussions rather than making these decisions based on a hierarchical command.

At Hino, it seems that officers spoke to the on-site employees more than was necessary giving rise to a corporate culture where the on-site employees in charge were intimidated and gave up examining matters and making judgments.

Chapter 7 Suggestions for recurrent prevention and Hino in the future

The Committee will not present a detailed list of recurrence prevention measures in this Report anew. Instead, in light of the analysis of the true cause in the previous chapter, the Committee will provide the points that it believes, due to their importance, require particular emphasis when Hino addresses recurrence prevention, as below.

1. Thoroughly discuss the goal for the state of vehicle manufacturing

The Committee pointed to "everyone not making a car together" as a true cause for the Issue. Hino's officers and employees should thoroughly discuss the goal for the state of vehicle manufacturing across department boundaries. With such a place for discussion, each officer and employee will come up with their own opinions about what the organization, development process, personnel distribution and personnel system, and further business strategies and business expansion should be in order to realize the goal for vehicle manufacturing at Hino. Holding a place for discussion only once is not enough to achieve an effect. It will be necessary to continuously hold a place for discussion, allowing for the participation of members from a variety of departments, genders, ages and positions.

Such discussions should be continuously held even in a development project. For example, members of each department who participate in a development project will fiercely discuss how to set the

Development Target Values, what type of technical challenges must be overcame in order to achieve them, what will be traded off to overcome them, whether the trade-off can be accepted, and how to make up for what was sacrificed as a result of the trade-off. In some cases, the Quality Assurance Department, the Product Planning Department and the Product Department may participate in the discussion. This is because costs, merchantability, and ease of quality control and production management cannot be sacrificed that easily. Furthermore, who will make the final decision is the person responsible for the project, or it may be the officer controlling the development department, as the case may be, and if there has been fierce discussion up to the decision, all of the members who participated in the discussion will fully understand and respect the importance of the decision and decide to fulfill their own roles to realize it. Everyone proudly performing their own roles is everyone making a car together.

2. Clarify the roles of the Quality Assurance Department and make efforts to strengthen its functions

The Committee has pointed out the vulnerability of check functions of the Quality Assurance Department as a cause of the Issue. The roles expected of the Quality Assurance Department are to improve Hino's entire development and production processes, such as considering what kind of development process is the best, whether the development target set is appropriate and how much variation in the production should be expected, in order to prevent problems with final products, rather than to simply confirm that there is no problem with final products.

The Issue calls for Hino to reconsider all aspects of its Quality Assurance Department from scratch, including its roles, functions, power and responsibility, and to inject required resources.
Individual consideration points potentially include the following:

- whether the present structure placing Quality Control Departments under the supervision of the respective plants is optimal for Hino;
- ideal involvement of the Quality Assurance Department in the initial stage of development processes, such as checking the feasibility of plans and the propriety of development goals;
- ideal involvement of the Quality Assurance Department in the development process management, such as checking the propriety of decision-making on stage transition and development goal changes;
- how to determine the models and points to be evaluated for development completion;
- involvement of the Quality Assurance and Quality Control Departments in verifying the propriety of deterioration factors;
- confirmation by the Quality Assurance and Quality Control Departments of the accuracy of measurement results that are used as the base of control values;
- propriety of the method of, and approach for, setting control values assuming an average value regulation; and
- conditions to approve the re-measurement in a sample inspection without any additional sample inspection, and the steps to take after the re-measurement.

3. Create a mechanism to preemptively monitor amendment trends of laws, regulations and rules, and to share them internally

The Committee has pointed out that the Issue partly stemmed from Hino's failure to properly share information on durability tests internally when required. Hino should develop a mechanism, such as by prescribing processes and flow, to address the absence of a sufficiently-systematized chain of processes to collect information on the amendment trends of laws, regulations and rules, analyze their implications and share the results internally.

In addition, laws, regulations and rules are bound to have a certain room for interpretation. Leaving the interpretation thereof to the development frontline workers may often allow them to adopt an interpretation to serve their convenience. To prevent such situation, Hino should have an

independent department, not the development frontline workforce, make final decisions on the interpretation thereof.

4. Check and improve the development processes on a rolling basis

The Committee has so far pointed out a number of issues concerning Hino's development processes. To address this situation, Hino must, as a first step, create and put into practice a proper QMS (Quality Management System) in development, check its effectiveness at all times and make improvements as necessary. In addition, Hino's organization is already comprised of diverse human resources, such as mid-career employees, loaned employees and dispatched workers. In order for Hino to manage its business operations from a broad point of view in the future, it would also be important for Hino to take advantage of its workforce with a different background and seek to create an open corporate atmosphere encouraging diverse, constructive dialogue among employees.

5. Draw on the lesson—misconduct can lead to escalation—to prevent a recurrence

The commonality of the Issue is that each conduct started when Hino decided to engage in a minor, gray act at the outset, but then Hino crossed a line and eventually became unable to halt the arbitrary act, which escalated to the point of being an obvious violation of law.

The Issue may have been avoided if Hino had exhaustively eradicated the minor questionable acts when they occurred at the initial stage.

It is important to establish and observe rules to ensure that no one crosses a line that must not be crossed. All Hino officers and employees must take this to heart.

6. Bold selection and concentration

The Issue has undoubtedly given a significant negative impact on Hino's business management. Accordingly, Hino is required to implement a bold selection and concentration more than ever for its sustainable growth going forward.

For Hino, an optimal selection and concentration is an extremely important business decision that will determine its future. However, as a significant number of employees (i) find it unrealistic for Hino, as it stands now, to continue to expand its global sales destinations or maintain numerous vehicle types and variations as before, and (ii) believe that doing so was conducive to the Issue, the Committee considers that Hino should respond to the employees' concerns above in some form as a company.

Chapter 8 Conclusion

It is very regrettable that the Issue occurred at Hino, one of Japan's major manufacturers of commercially-used vehicles, and that the Issue was not discovered for a long time.

The role that logistics plays in society is becoming increasingly important, and it is expected that the business of Hino, which plays a part in such role, will continue to be necessary and indispensable in society. On the other hand, with the increase of global interest toward environmental issues, Hino, as a vehicle manufacturer, is requested to proceed with its management by placing the issues concerning emission and fuel consumption as the value which has priority over profitability requested by shareholders, etc. and convenience requested by customers, despite the fact that such way of proceeding with management may be against the requested profitability or convenience. As a vehicle manufacturer, Hino should not consider the issues concerning emissions and fuel consumption merely as issues that should be addressed because laws and regulations require so; it should seek to spread the value, which lies behind those issues.

Recurrence prevention measures that will be established by Hino hereafter are expected to extend to wide-ranging areas, from practical or specific measures, such as revision of in-house rules, and operations, to ideal or abstract measures, such as spreading and sharing the values as described above. In addition, implementation of those measures are expected to be diverse, from those that should create effects in a short term, to those that require long-term and continuous efforts.

In this regard, the Committee would like to point out that building of a quality management system concerning development is one of the matters that should be implemented urgently. Those who are involved in the manufacturing business all have thoughts that they want to launch a better product as scheduled and deliver it to customers. However, to that end, it is inevitable that the development department will be under pressure to comply with the schedule, and for environmental performance and quality, the order of priority of which is likely to be low, allurement or "justification" for the falsification may easily occur even if the goal is yet to be achieved. In order to prevent occurrence of issues therefrom, it is necessary to build systems, such as those for enhancing the mutual check function within the development department, or enhancing the restraining function by the Quality Assurance Department and the Quality Control Department. This will be the indispensable and urgent matters that should hereafter be addressed at Hino.

The Committee would like to point out that, on the other hand, to improve Hino's corporate culture, it is necessary for the management to have the fortitude and seriousness to use their efforts with a field of view for a longer term, and that the road to it is never flat.

This year is the 80th anniversary of Hino since its incorporation. In the 75th anniversary journal, it is stated that the then-President, who came from Toyota approximately 20 years ago, faced the following culture at Hino: "Those who work at Hino follow given instructions no matter how difficult those instructions are; and they never interfere in other departments; this is a characteristic peculiar to Hino." The journal stated that the President used efforts to change employees' consciousness, suggesting: "To compete globally, it is necessary to overthrow the current status-quo, which can be called a 'play-it-safe policy' and have each employee awakened." The corporate culture of "Hino not making the car together," which the Committee referred to as one of the true causes of the Issue, had already been suggested to require improvement, approximately 20 years ago.

This shows that corporate culture of a company will not change in a short time; if the company neglects to make efforts thinking that the culture has already been improved, it will instantly return to the original state.

Words or slogans that are comfortable to hear or that are energetic are not currently necessary for Hino to reform; what is necessary is to show the management's fortitude and seriousness, that they should be reborn, through their behavior and in practice. Employees are expected to change, with enthusiasm, if they feel the management's fortitude and seriousness.

It is easy to imagine that, for a company which has a long history and had been a leading company in the industry both subjectively and objectively, such as Hino, thinking back on its own corporate value involves significant pain and resistance. It is inferred that some officers and employees may feel that the suggestions made in this Report are not cogent. However, if Hino stops to think and adhere to its past successful experience or feeling of self-approval, it cannot change or develop any further and achieve growth. What is necessary for Hino as of now is the attitude to humbly hear not only suggestions made by outside parties such as the Committee, but also opinions and objections raised by minorities within it. Hino must never forget and be aware of the fact that because it is a storied company, its culture is difficult to change, and if Hino becomes negligent, such culture will return to the original state.

As has been stated, the engine development department should not solely be liable for the Issue; however, it is true that the Issue left a great scar on the department. Hino's engine-related department had been leading the Company by developing excellent technology. The Committee

wishes that they recall their pride as engineers again, and that they overcome the wall of technology with the mettle to develop new technology, but not through falsification.

The Committee will conclude the Report wishing that Hino calls to its mind the ideology, “Deliver to the world secure and safe vehicles that pay attention to environment,” which is required for vehicle manufacturing today, and recover the brilliance of its brand.

End.