TOYOTA

**Toyota Motor Engineering & Manufacturing North America, Inc.**

Vehicle Safety & Compliance
Liaison Office
Mail Stop: W4-2D
6565 Headquarters Drive
Plano, TX 75024

January 31, 2018

# DEFECT INFORMATION REPORT

1. Vehicle Manufacturer Name:

Toyota Motor Corporation ["TMC"]
1, Toyota-cho, Toyota-city, Aichi-pref., 471-8571, Japan

Toyota Motor Manufacturing Canada Inc. ["TMMC"]
1055 Fountain Street North, Cambridge, Ontario, Canada N3H 5K2

Affiliated U.S. Sales Company:

Toyota Motor North America, Inc. ["TMNA"]
6565 Headquarters Drive, Plano, TX 75024

Manufacturer of Airbag Sensors:

DENSO CORPORATION
1-1, Showa-cho, Kariya-city, Aichi-pref., 448-8661, Japan
Phone: +81-566-25-5511

Country of Origin: Japan

2. Identification of Involved Vehicles:

| Make/ Car Line | Model Year | Manufacturer | Production Period |
|---|---|---|---|
| Toyota/ Prius | 2016 | TMC | June 9, 2015 through Dec 25, 2015 |
| Lexus/ NX | 2015 - 2016 | | May 25, 2015 through Oct 16, 2015 |
| Lexus/ RX | 2016 | TMC, TMMC | May 7, 2015 through Jan 13, 2016 |

NOTE: (1) Although the involved vehicles are within the above production period, not all vehicles in this range were sold in the U.S.

(2) The involved vehicles are equipped with the airbag sensors, which could contain an IC chip manufactured under improper production conditions during the specific period. No other Toyota or Lexus vehicles sold in the U.S. are equipped with these sensors.

| Applicability | Part Number | Part Name | Component Description |
|---|---|---|---|
| Prius, RX | 8983A-47010 | Sensor Assembly, Air Bag Pressure | Side Air Bag Sensor |
| RX | 8983A-0E010 | | |
| NX, RX | 89173-78010 | Electric Sensor, Crash | Front Air Bag Sensor |
| RX | 89173-0E050 | | |
| NX | 89831-78010, 89831-78020 | | Side Air Bag Sensor |
| RX | 89831-28040, 89831-0E130 | | |

3. Total Number of Vehicles Potentially Involved:

| | | |
|---|---|---|
| Toyota Prius | : | 7,956 |
| Lexus NX | : | 19,365 |
| Lexus RX | : | 21,351 |
| Total | : | 48,672 |

4. Percentage of Vehicles Estimated to Actually Contain the Defect:

Unknown. Toyota is unable to provide an estimate of the percentage of vehicles to actually contain the defect. Whether the issue in each case will lead to an airbags deactivation or non-deployment, creating an unreasonable risk to safety, depends on each vehicle's operating conditions.

5. Description of Problem:

The subject vehicles are equipped with an airbag system containing pressure sensors and/or acceleration sensors (also known as "G sensors") which detect impact to the vehicle. There is a possibility that, due to two different manufacturing issues, the integrated circuits "IC" chips in affected pressure sensors and G sensors have insulation layers that could peel over time, creating an open circuit in the IC chip. If this were to occur, the airbag warning light will illuminate and the side/curtain shield airbags and/or front airbags, may not deploy (Prius models do not have the G sensor issue and their front airbags are not affected). Nondeployment of the side/curtain shield airbags and/or front airbags could increase the risk of injury to the occupants in the event

of a crash.

6. Chronology of Principal Events:

October, 2015 - June, 2016

Toyota received field technical reports indicating an illumination of an airbag warning light from Asian markets, including Japan, and one field technical report from the U.S. market. Airbag "G sensors" (which detect acceleration by impact of collision) from these vehicles were recovered and investigated. The investigation results of the recovered G sensors found that there was no output signal, an open circuit, and peeling of the insulation layer in the IC chip of the G sensor had occurred.

Because many of the field technical reports were from vehicles manufactured in June, 2015 or July 2015, Toyota focused on that vehicle manufacturing period and investigated the production history of the IC chip in the G sensor. Further, because the number of reports from Asian markets were much higher than the U.S. market, Toyota initially focused on failures that occurred in other markets.

As a result of reviewing the production history for these G sensors, it was found that the gas flow control method of the insulation layer forming process was changed at the supplier on November 15, 2014, in order to stabilize the flow rate of gas, and on December 13, 2014 the gas flow control method was changed back to the original method. By measuring the phosphorus concentration in the insulation layer of the IC chips of G sensors manufactured around that period of time, it was found that the phosphorus concentration in the insulation layer formed between November 15, 2014 and December 13, 2014 were higher than parts produced outside of that period. At this time, Toyota continued to investigate what the impact of higher phosphorus concentration was on the insulation layer in the IC chips over time.

June, 2016 - March, 2017

As of June 2016, there was only one confirmed case of the G sensor insulation layer peeling in the U.S. Thus, as a part of this investigation, Toyota considered the possibility that there were regional factors in the U.S. that could contribute to a low rate of insulation layer peeling.

Environmental testing was conducted to determine if the high phosphorus concentration could cause the insulation layer to peel over time in the IC chip on the G sensor. IC chips in the G sensor containing insulation layers with various phosphorus concentrations were produced and tested under conditions of high temperature and high humidity for extended periods in an attempt to duplicate the condition observed in the recovered sensors.

While Toyota received one field technical report and one dealer report of unconfirmed cases of an airbag warning light illumination that were not attributable to the G sensor issue, starting in July 2016, Toyota began to observe an increase in of these types of field technical reports in overseas markets. Airbag "pressure" sensors (which detect pressure change between the door panel and door trim caused by a collision) from various vehicles were recovered and investigated. The investigation results found that there was no output signal, an open circuit, and peeling of the insulation layer in the IC chip in the pressure sensor had occurred.

Because these field technical reports indicated potential pressure sensor failures on the vehicles

manufactured in October, 2015 or November 2015, Toyota focused on that vehicle manufacturing period, and the production history of the IC chip in the pressure sensor was investigated. A review of the production history at the supplier found that the X-ray emitting tube of a device, which measures the boron concentration in the insulation layer, stopped working on April 5, 2015. During calibration of the repaired device, it was found that the measured value of boron concentration had been inaccurate and was lower than the actual value. Existing sampling data stored at the supplier as a part of their production process was reviewed, and the boron concentration values were near the upper limit of the production specification. The target value of boron concentration was adjusted at the supplier to the center of the production specification on April 12, 2015.

To determine whether high boron concentration in the insulation layer could affect peeling of the insulation layer in the pressure sensors, environmental testing was conducted. Samples were produced with insulation layers of various boron concentration levels, and peeling of the insulation layer was checked under severe conditions of high temperature and high humidity for extended periods. Peeling of the insulation layer was duplicated on the samples containing higher boron concentrations. To further investigate whether the peeling of the insulation layer is causing an open circuit in the IC chip of the pressure sensor, additional pressure sensors containing IC chips with various high boron concentrations in the insulation layer were produced for duplication testing.

April, 2017 - January, 2018

As of April 2017, there were only three confirmed cases of the insulation layer peeling in the G sensor and three cases in the pressure sensor in the U.S. (including field technical reports and dealer reports). The number of confirmed cases in the U.S. continued to be significantly lower than the cases in other markets such as Japan.

As a result of duplication testing for the G sensor issue, it was found that the insulation layer in IC chip of the G sensor could peel and the circuit in the IC chip of the G sensor could open if the phosphorus concentration in the insulation layer is equivalent to the parts produced between November 15, 2014 and December 13, 2014. The supplier of the sensor reported to Toyota that it was theorized that moisture in IC chip of the G sensor would dry early on because of heat generation during power ON and failure would not occur after drying of the moisture under normal vehicle use. Toyota requested the supplier to continue investigating to verify that theory. The supplier continued its investigation and testing to demonstrate their theory. However, they found that no correlation between the investigation results and failure occurrences in the field. As a result of the aforementioned investigations of the G sensor, Toyota determined that an open circuit in the IC chip of the G sensor containing the insulation layer formed between November 15, 2014 and December 13, 2014 could continuously occur in the field due to moisture absorption during vehicle usage due to the high concentration of phosphorus in the insulation layer.

In parallel, duplication testing of an open circuit of the IC chip of the pressure sensor (due to high boron concentrations) was conducted under the conditions of high temperature and high humidity. As a result of duplication testing for the pressure sensor issue, it was confirmed that the insulation layer in IC chip could peel and the circuit in the IC chip could open due to moisture absorption if the boron concentration is near the upper limit of the production specification, even if the boron concentration is within the production specification. In addition, recorded data of the boron concentration value for each production lot was reviewed, and it was confirmed that IC chips of pressure sensors containing the insulation layer formed after April 12, 2015 do not have this issue.

If an open circuit in the IC chip of the G sensor or pressure sensor occurs, the airbag warning light will illuminate and certain airbags can become deactivated or may not deploy, depending on the location and type of the affected sensor.

While the confirmed cases in the U.S. continued to be low in comparison to the cases other markets, Toyota was not able to identify any factors that contributed to the much lower failure rate in the U.S. market.

January 25, 2018

Based on the results of the above investigation, Toyota decided to conduct a voluntary safety recall campaign.

As of January 25, 2018 based on a diligent review of records, Toyota's best engineering judgment is that there are 7 Toyota Field Technical Reports (including 4 unconfirmed Field Technical Reports) and 110 warranty claims (including 104 unconfirmed warranty claims) that have been received from U.S. sources that relate to this condition and which were considered in the decision to submit this report.

7. Description of Corrective Repair Action:

All known owners of the subject vehicles will be notified by first class mail to return their vehicles to a Toyota or Lexus dealer. The dealers will inspect the serial number of the sensors and replace affected sensors with new ones.

Reimbursement Plan for pre-notification remedies

The owner letter will instruct vehicle owners who have paid to have this condition remedied prior to this campaign to seek reimbursement pursuant to Toyota's General Reimbursement Plan.

8. Recall Schedule:

Notifications to owners of the affected vehicles will occur by April 1, 2018. A copy of the draft owner notification letter will be submitted as soon as available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers were sent on January 30, 2018. Copies of dealer communications will be submitted as they are issued.

10. Manufacturer's Campaign Number:

Lexus: JLA
Toyota: J0F