Addendum to PE 18-004 Response

DTNA responded to NHTSA's information request in PE18-004 on June 19, 2018, for all requests except Request No. 12. DTNA indicated that a response to Request No. 12 would be provided at a later date, once the company's assessment was complete. This letter provides DTNA's response to Request No. 12 and completes DTNA's response to the PE18-004 information request.

Request No. 12 is repeated below, followed by DTNA's response.

Request No. 12:

Furnish DTNA's assessment of the alleged defect in the subject vehicle, including:

a) *The causal or contributory factor(s)*

b) *The failure mechanism(s);*

c) *The failure mode(s);*

d) *The risk to motor vehicle safety that it poses; and*

e) *The reports included with this inquiry.*

Response to Request No. 12:

As part of its investigation of the PNDB issue and response to PE18-004, DTNA reviewed warranty claims related to the PNDB for the subject vehicles. Claims reviewed include those with any mention of the PNDB; many are likely entirely unrelated to the alleged defect in the subject vehicles, but DTNA took an overly inclusive approach and reviewed all claims mentioning the PNDB in any way.

DTNA considered the various components of the "alleged defect" definition, including a loose electrical connection at the PNDB power input terminal; loose fuses inside the PNDB; improper power supply cable routing; interruption or loss of power to the PNDB; and thermal events or vehicle fires originating at the PNDB.

Review of PNDB warranty claims for the subject vehicles indicated very few (0.09% claim rate) related to a loose power supply connection. Road generated vibration is believed to be the cause of these claims, which involve either a loose nut holding the cable to the stud, or the terminal to which the cable is attached becoming loose inside the PNDB.

Claims related to loose blade fuses within the PNDB were very low (0.25% claim rate); these were caused by supplier difficulties maintaining consistent manufacturing tolerances of the fuse terminals.

The claim rate for improper power supply cable routing was 0.00%.

The claim rate for interruption or loss of power from the PNDB was 0.07%; these claims included loose output terminals on the PNDB, loose fasteners on those terminals, or loose connections on the components to which power is supplied. Again, vehicle vibration is considered a main cause of these claims.

There were no warranty claims reporting a vehicle fire.

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The PNDB warranty claims included a small number that noted a burn, melt or char condition (0.09% claim rate); these claims encompass other vehicle components in addition to the PNDB and therefore this condition is not necessarily related to the PNDB. In general, DTNA believes that there are several possible reasons for burn, melt or char reports, including a loose connection causing sparking, an electrical short resulting in overheating, or poor grounding in a component.

DTNA determined that the most serious consequence reported in the PNDB-specific warranty claims appeared to be engine shutoff with a vehicle in motion. In order to evaluate the worst-case scenario, DTNA concentrated on these claims in its assessment of the alleged defect. DTNA further determined that the bulk of the warranty claims involving engine shutoff while moving were for vehicles equipped with a PNDB built with a solenoid. These solenoid-equipped PNDBs therefore were the main focus of DTNA's assessment.

In vehicles with the solenoid-equipped PNDB, the unit monitors the voltage before and after the solenoid. If the voltages differ by an unacceptable amount, potentially due to dust or corrosion on the solenoid's contacts, the PNDB senses the difference and enters an auto-reset mode. In this mode, the internal contacts open for one second, stopping the flow of electricity, and then close, restoring the flow for two seconds. This cycle is repeated for up to five times; after a maximum of thirteen seconds, the PNDB defaults to the on position and all functionality is restored. Therefore the worst-case scenario for the alleged defect involves intermittent one-second vehicle shutdowns lasting, at maximum, a total of five seconds over a period of thirteen seconds, after which the vehicle restarts and full functionality is restored. This worst-case impact involves a transient loss of power but does not cause any permanent engine disablement. During the one-second loss of power intervals, windshield wipers, identification lights, turn signals, tail lights and rear stop lights are momentarily disabled, but low-beam headlights continue to function and clearance and side marker lights flash. Moreover, there are ample warnings provided in the event the vehicle enters auto-reset mode, including a warning message on the instrument panel, an error code, and the flashing clearance and marker lights, which would warn any following drivers.

As a precaution, the solenoid-equipped PNDB part was modified in August 2017 to eliminate the auto-reset feature.

DTNA's review of warranty claims found that none of the claims reported any form of accident, fatality, bodily injury, property damage, or vehicle fire. While a number of claims involved engine shut downs or other symptoms while the vehicles are in operation, as explained above these conditions are brief and intermittent, with full functionality soon restored. For all of the foregoing reasons, DTNA does not believe this issue presents an unreasonable risk to automotive safety.

NHTSA has provided report ID number 10838295 for evaluation. DTNA can only provide limited information because the anonymized serial number on the report prevents the actual vehicle components from being identified. The report is of a Model Year 2014 Cascadia traveling on I-5 at Oregon mile marker 138 at which time the driver reports the dash lights and gauges quiver, loss of engine and transmission functions, Jake and power braking, and power steering.

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Because the dash lights did not extinguish, the loss of power was limited to the Powertrain PDM (PTPDM) circuit which connects to terminal 1 of the PNDB. But a determination whether the problem is with the PTPDM or PNDB cannot be made without more information.

"DTNA conducted experiments in which the battery isolator solenoid that controls the power supplied to terminals 1, 2, & 3 was opened while the vehicle was in gear. In the case where the transmission was left in gear, the engine even though not fueled was kept turning, which made power steering available. Low beam headlights remained lit, and side marker lights and clearance lights flashed. Power train, PDM, SAM cab and SAM chassis were not operational during this time. It was also found that with the vehicle in gear the engine would restart when the power was restored (by closing the solenoid). At this point, full vehicle functionality was restored.

In the case where the engine is allowed to stop turning, either from the vehicle coming to a halt or being shifted out of gear while the solenoid is still open, again the low beam headlights remained lit, and side marker lights and clearance lights flashed. Once power was restored (by closing the solenoid) the engine did not restart but remaining functionality (beyond the power steering and air brake compressor) was restored."

Without power to the PTPDM, an automated manual transmission cannot shift out of gear, but a manual transmission may be shifted into neutral by the driver. And while no additional air will be added to the air reservoirs, the air brake system will still be available. Given the event is reported to have started at the top of the grade, the air brake system should have been adequate to bring the vehicle to a full and complete stop.

Based on these factors, DTNA does not believe the report provided by NHTSA indicates an unreasonable risk to motor vehicle safety.