CHRYSLER

April 3, 2012

Mr. D. Scott Yon, Chief
Vehicle Integrity Division, NVS-214
U.S. Department of Transportation

National Highway Traffic Safety Administration (NHTSA)
Office of Defects Investigation (ODI)
Room W48-304
1200 New Jersey Avenue SE
Washington, D.C. 20590

Reference: NVS-212am; EA11-010

Dear Mr. Yon:

Attached is Chrysler Group LLC's ("Chrysler") response for Questions 16, 17, 19, 21, 23, and 24 of the referenced inquiry. Also attached are supplemental responses to Questions 18 and 20. By providing the information contained herein, Chrysler is not waiving its claim to attorney work product and attorney-client privileged communications.

Sincerely,

David D. Dillon

Attachment and Enclosures

Preliminary Statement

On April 30, 2009 Chrysler LLC, the entity that manufactured and sold the vehicles that are the subject of this Information Request, filed a voluntary petition for relief under Chapter 11 of Title 11 of the United States Bankruptcy Code.

On June 10, 2009, Chrysler LLC sold substantially all of its assets to a newly formed company now known as Chrysler Group LLC. Pursuant to the sales transaction, Chrysler Group LLC assumed responsibility for safety recalls pursuant to the 49 U.S.C. Chapter 301 for vehicles that were manufactured and sold by Chrysler LLC prior to the June 10, 2009 asset sale.

On June 11, 2009, Chrysler LLC changed its name to Old Carco LLC. The assets of Old Carco LLC that were not purchased by Chrysler Group LLC, as well as the liabilities of Old Carco that were not assumed, remain under the jurisdiction of the United States Bankruptcy Court – Southern District of New York (*In re Old Carco LLC, et al*., Case No. 09-50002).

Note: Unless indicated otherwise in the response to a question, this document contains information through December 27, 2011, the date the information request was received.

Please repeat the applicable request verbatim above each response. After Chrysler's response to each request, identify the source of the information and indicate the last date the information was gathered.

16. Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that relate to, or may relate to, the Alleged Defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, Chrysler. Ensure that this response includes testing or analysis conducted either by Chrysler or its suppliers, on any and all headlamp switches returned to Chrysler or the supplier, from field service or other consumer use. For each such action, provide the following information:

a. Action title or identifier;
b. The actual or planned start date;
c. The actual or expected end date;
d. Brief summary of the subject and objective of the action;
e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action; and
f. A brief summary of the findings and/or conclusions resulting from the action.

For each action identified, provide copies of all documents related to the action, regardless of whether the documents are in interim, draft, or final form. Organize the documents chronologically by action.

A16. The requested assessments are listed below and for each assessment the appropriate enclosures are referenced as applicable.

Assessment 1: Complaint Analysis by Total, Open Date, Build Date, Mileage, and Months in Service

Start Date	End Date	Engineering Group Responsible
09/06/2011	02/27/12	Chrysler Product Investigations & Recall Administration

Complaint Analysis Assessment Objective: Determine if there are any identifiable trends in the number of complaint vehicles (any vehicle, subject or peer, with a CAIR, field report or legal claim associated with the alleged condition), sorted by open date (date of complaint), vehicle build date, mileage of the vehicle when the complaint occurred, and months in service when the complaint occurred.

Complaint Analysis Assessment Summary:

- Most of the 2005 MY vehicles and a portion of the 2006 MY vehicles are responsible for the vast majority (93%) of the total complaints.
- Complaint analysis identifies a suspect vehicle build date range between March 2004 and November 2005, which corresponds directly to supplier

design and process changes (herein referred to as the 21 month "Suspect Population").

- The vast majority of complaints (72%) occurred within the 36,000 mile warranty period. Very few complaints occur after 100,000 miles.
- A significant downtrend is evident for the Suspect Population vehicles.
- Very few complaints occur after 48 months in service (90% of complaints occur prior to 48 months in service). As vehicles age, they are less likely to experience this condition.
- Ninety five percent (95%) of the Suspect Population has been in service for a minimum of 66 months. Almost all (96%) of the complaints have been reported within the first 66 months of service.
- An analysis of the Suspect Condition during the 21 month Suspect Population demonstrates that the complaint rate has reduced significantly as the vehicles age (during the last calendar year prior to the EA: 6.2 c/100,000 vehicles).

Complaint Analysis Assessment Results:

Part I – Distribution of Complaints by Model Year: The analysis by total complaints indicates that the 2006 and 2007 model year vehicles have a similar proportion of the complaints as compared to the peer 2004 and 2008 model year vehicles. As noted in Enclosure 11- Assessment 1, Figures A and B, the 2005 model year vehicles are responsible for a much larger proportion (65%) of the total complaints.

Part II – Distribution of Complaints by Build Date: Enclosure 11 – Assessment 1, Figure C provides an analysis of the complaints received for the Alleged Defect, as defined by NHTSA, by vehicle build date. The vast majority (93%) of complaints occur in vehicles built between March of 2004 (early 2005 MY) and November of 2005 (early 2006 MY). For reasons discussed more thoroughly in Assessment 7 – Headlamp Root Cause Analysis, this 21 months of production has been identified as vital in this investigation. In short, the beginning and end of the 21 months of elevated complaint data shown in Enclosure 11 – Assessment 1, Figure C, also aligns precisely with a change in suppliers for the headlamp switch assembly in March of 2004 and a supplier design change made in November of 2005.

Part III – Distribution of Complaints for Target Condition by Build Date: Chrysler has isolated complaints that may be related to: 1) fail to illuminate; or 2) illuminate and extinguish (herein referred to as the "Suspect Condition"). As noted in Enclosure 11 – Assessment 1, Figures D and E, an analysis of complaints by vehicle build date demonstrates that the greatest number of Suspect Condition complaints also occurs within the 21 month Suspect Population. As noted in Part II, above, this period also aligns precisely with a change in headlamp switch suppliers (March of 2004) and a supplier design change (November of 2005).

As indicated in Enclosure 11 – Assessment 1, Figure F, the Suspect Condition represents 71% of the total number of complaints received by Chrysler that are or may be related to the Alleged Defect received during the 21 month Suspect Population.

Part IV – Distribution of Complaints by Miles in Service: Enclosure 11 – Assessment 1, Figure G, illustrates the complaint analysis for the Alleged Defect by mileage and shows a significant downward trend in complaints as mileage increases. The majority (72%) of complaints occurred within the 36,000 mile warranty period and very few complaints are occurring after 100,000 miles.

Furthermore, Enclosure 11 – Assessment 1, Figures H and I, show this significantly downward trend holds true for vehicles built within the 21 month Suspect Population. The majority of complaints (69%) also occurred within the 36,000 mile warranty period. Finally, the trend is consistent for complaints that are or may be related to the Suspect Condition of headlamps that fail to illuminate or illuminate and extinguish during the 21 month Suspect Population, where 70% of the complaints occurred during the 36,000 mile warranty period and only 3% occurred after 100,000 miles.

Part V – Distribution of Complaints by Months in Service: The complaint analysis for the Alleged Defect by months in service displays a significant downward trend in the complaints as time increases. Enclosure 11 – Assessment 1, Figure J shows that the majority (80%) of the complaints occurred within the 36 month warranty period. The vast majority (90%) of the complaints occur within the first 48 months. Very few complaints occur after 48 months in service. As the vehicles age, they are less likely to experience the Alleged Condition(s).

Furthermore, Enclosure 11 – Assessment 1, Figures K and L illustrate that this trend holds true for vehicles included in the 21 month Suspect Population, as 79% of the complaints that are or may be related to the Alleged Defect occurred during the 36 month warranty period. Finally, this trend is consistent for complaints that relate to the Suspect Condition during the 21 month Suspect Population. Eighty-one percent of the complaints that are or may be related to the Suspect Condition occurred during the 36 month warranty period. Further, 95% of all of the vehicles built within the 21 month Suspect Population have been on the road for a minimum of 66 months. Significantly, only 4% of the Suspect Condition complaints involving vehicles assembled during the 21 month Suspect Population have occurred in vehicles that have been on the road for more than 65 months.

Part VI: Distribution of Complaints over Complaint Date: Finally, when evaluating the number of complaints over time, Enclosure 11 – Assessment 1, Figure M, once again demonstrates that the rate of inputs is significantly declining over time. In fact, the number of complaints over the last calendar year is 3.7 per month or 6.2 c/100,000 vehicles.

Assessment 2: Warranty MOP MIS Analysis of Subject Components

Start Date	End Date	Engineering Group Responsible
09/06/2011	02/13/12	Chrysler Product Investigations & Recall Administration

Warranty MOP MIS Analysis Objective: Determine the warranty rates by month of production and months in service (MOP MIS) by subject. This will indicate which months of production have relatively higher warranty rates.

Warranty MOP MIS Analysis Summary:

- MOP MIS charts are included in Enclosure 11 – Assessment 2 - MOP MIS Analysis.
- The headlamp switch is the primary component contributing to the Suspect Condition.

Warranty MOP MIS Analysis Results: Both the BCM and headlight switch have significantly higher warranty rates than the balance of the Subject Components (headlamps, FCM, and associated wiring). The warranty rates for the BCM drop significantly in November of 2004 (mid 2005 MY) and experience yet another decline in May of 2005 (2005 MY). This is inconsistent with the rate of complaints for the Suspect Condition during the 21 month Suspect Population. This suggests that the BCM is not a component that has a meaningful impact on the rate that the Suspect Condition is occurring.

The warranty rates for the headlamp switch increased significantly early in the 2005 MY (March of 2004) when a new headlamp switch design was implemented by a new supplier. The warranty rate drops significantly in the early part of the 2006 model year (November of 2005) when a supplier design change within the headlamp switch was implemented. This is consistent with the rate of complaints for the Suspect Condition during the 21 month Suspect Population. This demonstrates that the headlamp switch was the primary component contributing to the Suspect Condition.

Assessment 3: Analysis of Subject Component Warranty Claims

Start Date	End Date	Engineering Group Responsible
09/06/2011	02/27/12	Chrysler Product Investigations & Recall Administration

Analysis of Subject Component Warranty Claims Objective: Determine the breakdown, by Subject Component and labor operation, of warranty complaints submitted in this response.

Analysis of Subject Component within Suspect Population Warranty Claims Summary:

- The Body Control Module (BCM) represents the largest percentage of warranty, which is two times the rate of the next highest component, the headlamp switch.
- Although the BCM has the largest percentage of warranty (59%), the data indicates the vast majority (98%) of these claims are not associated with the Suspect Condition.
- The Headlamp Assembly represents the third largest percentage of warranty (8%). The data demonstrates that the vast majority (98%) of these claims are not associated with the Suspect Condition.
- The Front Control Module (FCM) represents the fourth largest percentage of warranty (5%). The data demonstrates that the vast majority (95%) of these claims are not associated with the Suspect Condition.
- The Headlamp Switch represents the second largest percentage of warranty (25%). The data demonstrates that 51% of the Headlamp Switch warranty may be attributed to Suspect Condition.
- The Headlamp Switch will be the focus of Chrysler's final assessment.

Analysis of Subject Component Warranty Claims Results:

Part I – Warranty Analysis of the Subject Vehicle Population: There were approximately 84,331 subject vehicle warranty claims, associated with the 2005-2007 model years that are or may be related to the Alleged Defect and noted in Enclosure 11 – Assessment 3, Figure A. The distribution of the warranty by component is as follows:

Body Control Module	58%
Headlight Switch	22%
Headlamp Assembly	11%
Front Control Module	5%
Others	4%

Part II – Warranty Analysis of the 21 Month Suspect Population: There were approximately 74,299 Suspect Population warranty claims associated with the 2005-2007 model years that are or may be related to the Alleged Defect

(Enclosure 1 – Assessment 3, Figure B). The distribution of the warranty by component is as follows:

Body Control Module	59%
Headlight Switch	25%
Headlamp Assembly	8%
Front Control Module	5%
Others	3%

Part II(a) - Evaluation of Body Control Module Warranty: Of the 21 month Suspect Population, Body Control Module (BCM) warranty represents 59% of all warranty that are or may be related to the Alleged Defect (Enclosure 11 – Assessment 3, Figure C). Half (50%) of all the BCM warranty claims are associated with software updates (indicated as "Flash Module"). The remaining half (50%) are related to multiple conditions associated with the BCM (indicated as "Non Flash Module"). Both halves of the BCM warranty are assessed in greater detail below.

Body Control Module Warranty – "Flash Module": As noted above on Part II (a), 50% of the BCM warranty claims during the 21 month Suspect Population are associated with the "Flash Module" warranty Labor Operation. Of these claims, Enclosure 11 – Assessment 3, Figure D demonstrates that 56% of the "Flash Module" claims are associated with Technical Service Bulletins, provided in Enclosure 10 – Dealer Communications. These TSBs were for conditions associated with inoperative remote keyless operation, inoperative driver and passenger door locks, and operation of the lift gate resulting in the theft alarm being triggered. None of the TSB related conditions, totaling 56% of the BCM "Flash Module" warranty, are related to the Alleged Defect.

As for the remaining 44% of the "Flash Module" warranty claims, the data demonstrates that nearly all of these warranty claims are unrelated to the Alleged Defect. Only one claim was confirmed as being related to the Suspect Condition (Fail to Illuminate / Illuminate and Extinguish). Forty seven claims (3%) did not have sufficient information to allow Chrysler to confirm that they were unrelated to any of the Alleged Defects.

In Summary, the "Flash Module" portion of the BCM warranty data (50% of all BCM Warranty claims) indicates that the vast majority of the conditions resulting in a flashed module are not related to the Alleged Defect.

Body Control Module Warranty – "Non-Flash Module":
As for the second half of the BCM warranty, those claims that did not fall directly into the category of a "Flashed module", there were a total of 1,849 narratives available for evaluation. Of the available narratives, 787 had sufficient information to enable Chrysler to bin them into eleven different categories in the following table:

Category	Percent of Narratives
Door Locks	42.4%
TSB Reflash	32.1%
Loss of Communication	6.5%
Mileage Related	4.1%
Fuel System or Gage Related	3.2%
Dash Panel/Interior Lights	2.8%
Remote Key Operation	2.7%
Wiper Operation	2.0%
Headlamp Illumination	1.8%
Airbag Light Illumination	1.3%
Turn Signal Related	1.1%

As can be seen, the majority of the narratives are related to door locks or the previously discussed TSB re-flashes (Enclosure 10 – Dealer Communications) and are unrelated to the Alleged Defect. As for "Loss of Communication," the third largest contributor, it is important to note that if the BCM were to lose communication with the other systems, that the headlamp system is designed such that it will default to "ON" if communication is lost. Therefore, these claims would not have resulted in a loss of headlamp function and are not related to the Alleged Defect.

In total, 98.2% of the nearly 800 categorized narratives were associated with conditions unrelated to the Alleged Defect. In other words, only 1.8% of the "Non-Flash Module" narratives may be related to the Alleged Defect.

BCM Warranty Summary:
Although the BCM has the largest percentage of warranty (59%), the data indicates the vast majority (98%) of these claims are not associated with the Suspect Condition.

Part II(b) - Evaluation of Headlamp Assembly Warranty:
Headlamp Assembly warranty makes up the third largest portion of the warranty claims during the 21 month Suspect Population (8%). Chrysler was able to assess 478 warranty narratives associated with these claims. As can be seen below, the data indicates that only 0.8% of all of the Headlamp Assembly warranty data may be related to the Suspect Condition. There were 4 claim narratives or 0.6% of all Headlamp Assembly narratives that Chrysler was unable to determine whether or not they were related to any of the Alleged Defects.

Not Related	Unknown	Related	TOTAL
471	4	3	478
98.5%	0.8%	0.6%	100.0%

In summary, the Headlamp Assembly warranty data demonstrates that the vast majority (98%) of these claims are not associated with the Suspect Condition.

Part II(c) - Evaluation of Front Control Module Warranty:
Front Control Module warranty makes up the fourth largest portion of the warranty during the 21 month Suspect Population (5%). Chrysler was able to assess 326 warranty narratives associated with these claims. As can be seen below, the data indicates that only 4.9% of all of the Headlamp Assembly warranty data is related to the Suspect Condition. There were 5 claim narratives, or 1.5% of all Front Control Module narratives, that Chrysler was unable to determine whether or not they were related to the Alleged Defects.

Not Related	Unknown	Related	TOTAL
305	5	16	326
93.6%	1.5%	4.9%	100.0%

In summary, the Front Control Module warranty data demonstrates that the vast majority (95%) of these claims are not associated with the Suspect Condition.

Part II(d) - Evaluation of Headlamp Switch Warranty
Headlight switch assembly makes up the second largest portion of the warranty during the 21 month Suspect Population (25%). Chrysler was able to assess 1,316 warranty narratives associated with these claims. As can be seen in Enclosure 11 – Assessment 3, Figure E, the data indicates that 51% of the headlight switch warranty are or may be related to the Suspect Condition.

The headlamp switch will be the focus of Chrysler's final assessment.

Assessment 4: Field Report Study of Repair Actions

Start Date	End Date	Engineering Group Responsible
09/06/2011	02/27/12	Chrysler Product Investigations & Recall Administration

Field Report Study Objective: Determine how the complaint vehicles identified in the field reports were being repaired.

Field Report Study Summary: A summary of the results is shown below.

Field Report Study Results: Chrysler was able to identify 173 field reports during the 21 month Suspect Population related to the Suspect Condition with sufficient information to enable determination of a repair action. Enclosure 11 – Assessment 4, Figure A shows that a vast majority (91%) of these repairs involved the replacement of a headlamp switch.

Assessment 5: Customer Survey

Start Date	End Date	Engineering Group Responsible
02/29/2012	Target 05/01/2012	Chrysler Product Investigations & Recall Administration

Survey Objective: Survey of customers that own or owned Minivans within the Suspect Population that have complained about flicker and/or dim condition, in order to assess customer definition of "flicker" and "dim" and if the condition represents a safety defect.

Survey Results: The survey results are pending.

Survey Summary: The survey is in progress. Supplemental information will be provided upon completion of this assessment.

Chrysler has initiated a survey of 2005 model year Suspect Population Minivan owners who reported incidents of flicker and/or dim. A total of 70 owners were identified that reported complaints via a CAIR and/or Field Reports associated with the Alleged Defects of flicker and/or dim.

Minivan owners were selected based the following criteria:

- Vehicle is in service a minimum of 48 months;
- Vehicle was manufactured within the 21 month Suspect Population;
- The customer registered a complaint of flicker and/or dim.

A defined set of questions, outlined in Enclosure 11 – Assessment 5 Survey Questions, was used as discussion prompters.

The survey is currently in process and final results are pending. To date, Chrysler was able to successfully survey 14 owners. A summary of the results will be submitted upon completion of the assessment.

Assessment 6: Flicker and Dim Complaint Analysis

Start Date	End Date	Engineering Group Responsible
02/28/2012	3/12/12	Chrysler Product Investigations & Recall Administration

Analysis of duplicate complaints objective: Analysis of complaint data relative to flicker and/or dim in the Suspect Population. Determine if flicker and dim symptom is a precursor to a failure to illuminate condition.

Duplicate complaint analysis summary:

- An initial complaint of flicker and/or dim is unlikely to have a failure to illuminate and/or an illuminate and extinguish condition as a subsequent condition.
- The flicker and/or dim condition are independent from failure to illuminate and/or illuminate and extinguish condition.
- An initial complaint of flicker and/or dim is not a precursor to a failure to illuminate and/or an illuminate and extinguish condition.
- Conditions of flicker and dim are often used interchangeably by the customer in complaints.

Duplicate complaint analysis results:

A review of inputs with respect to duplicate complaints within the 21 month Suspect Population was completed with results shown in Enclosure 11 – Assessment 6, Figure A.

The data set for Figure A includes all unique VINs with subsequent complaints within the Suspect Population that were initially reported as a flicker and dim condition. A total of 49 complaints were identified from a total complaint set of 1,784. This represents 2.7% of all complaints returned for a subsequent complaint. Of the 49, forty two reported a subsequent complaint of flicker and/or dim. Only one reported “illuminate and extinguish” as a subsequent complaint. Analysis of the narrative for this VIN identified that the actuation of seat heaters triggered a flickering of headlights and dimming of interior lights. The subsequent complaint also described other conditions unrelated to headlamp function. These subsequent complaints indicate the issue is associated with voltage variations and/or electrical loads within the vehicle as opposed to an issue with the headlamp system or any of its components.

Additionally, an analysis of the last four years of inputs relative to flicker and dim was completed (see Enclosure 11, Figure B). A total of 64 complaints were identified and an analysis of corrective actions with respect to these complaints was also completed. This revealed that either a ground wire (14%) or a heated seat (14%) was attributed to the cause of the condition. Other electrical (11%), battery (11%), normal condition (11%), wire harness (9%), and front control module (8%) made up half of the causes of this condition. The remaining 22%

are distributed among 6 other random causes. This indicates that the cause of the flicker and dim condition over the last four years are random and isolated and not related to the condition of failure to illuminate and/or illuminate and extinguish.

Finally, the table below, Estimate of Number of Flicker Complaints that are Dim, summarizes an analysis of the last four years of complaints along with the results of Assessment 5, Customer Survey. Of the 64 complaints identified, 6 clearly identified dimming as the condition. Further analysis of the remaining 58 complaints revealed that 19 of the 58, or 33%, complaints that were logged as flicker and/or dim were actually describing a dimming condition. Assessment 5, Customer Survey, served as a second source to substantiate almost one third of complaints that were initially received as a flicker and/or dim were actually describing a dimming condition.

EA11-010 Estimate of Number of Flicker Complaints that are Dim

Category	Data Source		TOTAL
	Field Reports (Last 4 Years)	Customer Survey (Assessment 5)	
Flicker	58	20	78
Flicker that are Dim	19	6	25
Percent Flicker that are Dim	32.8%	30.0%	**32.1%**

In summary, the aggregate of the above analysis demonstrates that complaints of a flicker or a dim condition are often interchanged by the customer, causes of flicker and/or dim conditions are not related to any one particular Subject Component and, most importantly, an initial complaint of flicker/dim is not a precursor to a failure to illuminate and/or illuminate and extinguish complaint.

Assessment 7: Headlamp Switch Root Cause Analysis

Start Date	End Date	Engineering Group Responsible
02/28/2012	3/12/12	Chrysler Product Investigations & Recall Administration TRW Engineering

Headlamp switch root cause analysis objective: Root cause analysis of headlamp switch failure.

Headlamp root cause analysis switch summary:

- As previously discussed in Assessments 1 and 3, the cause of the headlamp malfunction in the vast majority of the vehicles with the Suspect Condition is a result of a faulty headlamp switch.
- A Black Belt project determined that the root cause of the headlamp switch malfunction was unidentified contamination causing an unintended open circuit in switch contact #2.
- During the course of this EA, TRW provided information indicating that the contamination was acetyl debris originating from the headlamp switch mechanical cam.
- TRW determined that the acetyl debris from warranty returned parts was larger in size than the residue found in prior PV tested parts.
- TRW also determined that while the acetyl residue found in PV tested parts was not large enough to interrupt the headlamp switch circuit and change the output voltage, the larger debris found in warranty returned parts could, in fact, interrupt the headlamp switch circuit.
- TRW provided information demonstrating that no less than 13 process and/or design changes were made from December of 2004 through April of 2006 in an effort to eliminate acetyl debris from the headlamp switch.
- Although TRW identified a number of changes that were implemented during the Suspect Population build period, the warranty data and complaint data do not reduce substantially until after November of 2005 when TRW introduced grease to the cam surface.
- Chrysler believes there may be three potential mechanisms that generate acetyl debris, all of which could result in a reduction in the potential for acetyl debris formation over time with the usage of the switch.
- There are a number of conditions that must all occur in order for acetyl debris in the switch cell to result in a loss of headlamp function, which, in part, accounts for the randomness of the condition.
- Warranty and complaint data indicates that when the Suspect Condition is experienced, toggling of the switch allows the acetyl debris to be removed from the contact point, immediately restoring headlamp function.

Headlamp root cause analysis results:

SYSTEM BACKGROUND

The headlamp electrical control system in the subject and peer vehicles is comprised of a headlamp switch, a body control module (BCM), a front control module (FCM), front left and right headlamps, park-lamps, optional fog lamps, and optional automatic headlamp switch and mirror mounted ambient light sensor, as well as associated wire harnesses and relevant connectors.

The system is Resistance Multiplex (RMX) based. Headlamp states are controlled by the BCM via interpretation of voltage inputs received from the headlamp switch, based upon resistance changes within the headlamp switch, dependent upon the state of the headlamp switch. The headlamp switch state is changed via user input through rotation of the switch knob. The selection of state by the user consists of a rotational selection of a headlamp state and/or a push-pull selection to change the fog lamp state. The user selection of a headlamp state is initiated by the rotation of an acetyl control cam within the headlamp switch that, by virtue of its rotational position, mechanically engages three individual switches, each constructed with a spring steel fulcrum. Rotation of the knob/cam selects a combination of three electrical contacts within the switch cell. The combination of contact positions within the switch cell causes a change in switch resistance value and the resultant voltage output signal from the headlamp switch. Any change of state within the headlamp switch (e.g., turning the headlamps on) will vary the resistance value of the switch and thus decrease or increase the voltage output read by the BCM. Based upon pre-defined logic within the BCM, the BCM will then relay a command to the FCM to change the headlamp state. The detailed electrical schematic of the switch and headlamp electrical system was previously provided on September 3, 2010 as Enclosure 11 of PE10-022.

HEADLAMP SWITCH MANUFACTURER CHRONOLOGY

The 2004 model year (Peer Vehicle) headlamp switch was manufactured by Delphi and utilized a redundant bifurcated switch. The 2004 model year headlamp switch was also used in vehicles through the first two months of the 2005 model year. Beginning in March of 2004 (two month into the 2005 model year), TRW began to supply a new headlamp switch with a completely different design, which will be discussed later in this assessment. Finally, the 2008 model year (peer vehicles) headlamp switch was manufactured by Pollock and employed a different design than the TRW headlamp switch, including a redundant bifurcated switch.

TRW HEADLAMP SWITCH FUNCTION

The TRW headlamp switch was utilized as a direct replacement for the Delphi headlamp switch. However, the TRW switch has both a unique design and manufacturing process. Switch logic redundancy was present in both Peer Vehicle headlamp switches, effectively requiring more than one input within the switch to initiate a change of headlamp switch state. The TRW headlamp switch used from the early 2005 model year through 2007 model year (March 2004 through July 2007) minivan vehicles did not provide for switch logic redundancy.

The TRW design implemented a switch cell comprised of 3 individual normally closed switches, each constructed, in part, with a spring steel fulcrum. The fulcrums are engaged and activated individually by an acetyl mechanical cam that rotates in unison with the switch knob that the customer rotates to select a headlamp state. The cam to fulcrum interface is designed to provide 3 combinations of switch inputs that combine to provide resistance values resulting in voltage outputs that correspond with the selected headlamp state. The 3 switch combinations generated as a result of the knob/cam position and their corresponding headlamp states are identified in the table below.

TRW Headlamp Switch Main Logic

Headlamp State	***Switch 1***	***Switch 2***	***Switch 3***
Headlamp OFF	*1*	*0*	*0*
Park Lamps	*1*	*0*	*1*
Headlamp ON	*1*	*1*	*1*

1 = closed; 0 = open

Analysis of the headlamp state and corresponding switch combinations demonstrates that switch 2 controls the function of the headlamps. Independent of switch 1 and switch 3, if switch 2 changes from open to closed or vice versa, then the state of the headlamps will change. This is an important point to remember when root cause is discussed later in this section.

Observations of the cam design demonstrate that cam travel path 2, which actuates switch 2, has the longest travel distance. In other words, the surface of switch fulcrum 2 engages the cam surface for a longer distance than any of the other switch fulcrums engage their corresponding cam travel path surface. This is also important to remember when root cause is discussed later in this section.

ROOT CAUSE

Black Belt Project

As referenced in PE10-022 Enclosure 8J, a Black Belt Project 4865 was completed in September of 2006. The study concluded that the root cause (Red X) of the headlamp switch malfunction warranty was unidentified contamination that made its way between the switch contacts, causing an unintended open circuit in one of the contacts in the switch cell. Of the headlamp switches evaluated, switch contact 2 was most likely to have contained the contamination.

At the time of the Black Belt study, it was learned that TRW had implemented a process change involving a washing operation to minimize the potential for contamination to occur during the assembly process. Based on information recently supplied to Chrysler, we believe that the process change that occurred on June 10, 2005, involving an ultrasonic washing operation of the 3 finger switch contact (previously referred to as the switch cell) is the process change referred to in the Black Belt study. The study indicated a belief that this process change would have a positive impact on warranty returns and that the field would continue to be monitored.

Post Black Belt Project Findings

During the course of this investigation, EA11-010, TRW presented Chrysler with their findings regarding the root cause of the Suspect Condition and the corrective actions that they had previously taken (see Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info). Based on this information, the previously unknown debris was identified as acetyl originating from the headlamp switch mechanical cam. It was noted that during PV testing, acetyl residue had been identified, but the size of which was not significant enough to interrupt the headlamp switch circuit. However, upon inspection of warranty part returns, TRW discovered that there was acetyl “debris” in the switch that was much larger in size than had previously been identified during PV testing. The significance is that the debris found in the warranty returns was large enough to interrupt the headlamp switch circuit. This condition could result in a loss of headlamp function, if the debris comes to rest at the point where the circuit involving switch position 2 is otherwise intended to be closed.

During the course of 11 months ranging from December of 2004 through April of 2006, TRW implemented no less than 13 process and/or design changes. At the time of the September, 2006 Black Belt project, as well as at the time of Chrysler’s September 3, 2010 PE response, Chrysler was unaware of the extent of these additional TRW process and/or design changes and their effect on eliminating the acetyl debris contamination on switch #2.

In summary, activity completed by TRW and provided to Chrysler during the course of this EA investigation indicates that TRW determined that the source of the contamination identified in the Black Belt study was the headlamp switch actuator cam and that the size of the acetyl debris was larger than what had been experienced during PV testing.

Acetyl Debris Formation:

Although new headlamp switches from the Suspect Population are no longer available for confirmation, Chrysler believes that the acetyl debris could have been formed in one of or a combination of 3 ways:

- The surface finish of the fulcrum contact point may have varied and on some fulcrums was such that it scraped the acetyl surface, which generated the debris large enough to interrupt the switch contact. Over time, the fulcrum surface is likely to wear down and become smooth. This would reduce the potential for abrasion of the acetyl cam to occur and, therefore, reduce the potential for debris. As a result, the potential for acetyl debris would be reduced over time with the usage of the switch.
- The surface finish of the acetyl cam may have varied and any surface irregularities were worn off by the fulcrum contact point generating acetyl debris. Over time by the swiping motion of the fulcrum contact point on the acetyl cam removed the surface irregularities, leaving a smooth surface. As a result, the potential for acetyl debris would be reduced over time with the usage of the switch.
- Over time, a groove may be worn into the cam surface by the fulcrum contact point. As a result, the force applied by the fulcrum on cam at the contact point would be reduced over time. As a result, the potential for acetyl debris would be reduced over time with the usage of the switch.

In all of the mechanisms that generate acetyl debris mentioned above, the potential for acetyl debris would be reduced over time with the usage of the switch.

TRW's Permanent Corrective Action

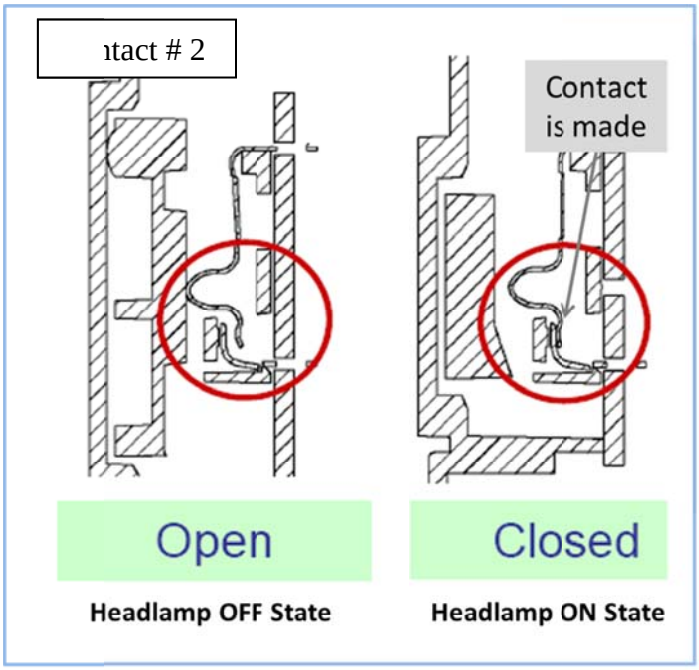
As stated earlier, through the course of this EA investigation, TRW provided Chrysler with additional information relevant to corrective actions implemented with the headlamp switch design and manufacturing process as identified in Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info. Although TRW has identified a number of changes that were implemented during the Suspect Population build period, the warranty data and complaint data do not reduce substantially until after November of 2005 when TRW introduced grease to the cam surface. The

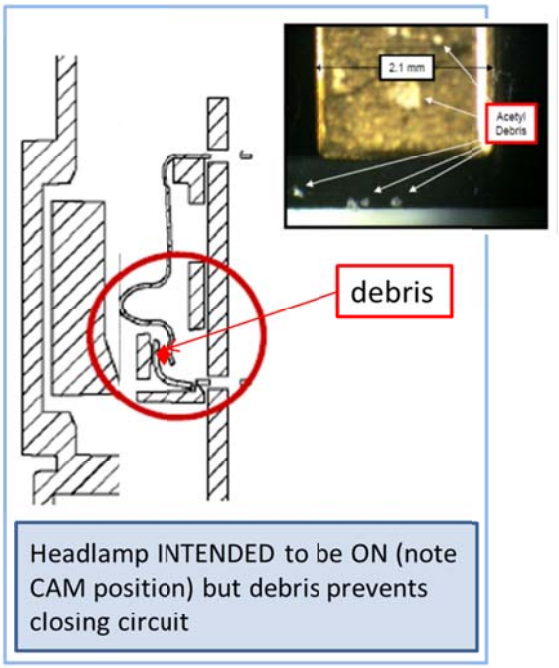
greased cam surface was intended to prevent acetyl debris from falling into the switch cell area, which could, with a specific combination of circumstances, potentially become positioned between switch contact point 2 resulting in a loss of headlamp function. The effect of TRW's corrective action is best illustrated in Enclosure 11 – Assessment 7, Figure A.

Circumstances Resulting in an Unintended Open Switch 2

Chrysler notes that there are a number of conditions that must all occur in order for acetyl debris in the switch cell to result in a loss of headlamps:

- The conditions required to form acetyl cam debris must be present;
- The acetyl debris must be sufficient in size to prevent the switch contact from closing;
- The acetyl debris would have to land at precisely the same location as the place where the point contact of the fulcrum lands to generate the closed circuit; and
- The debris would have to remain in that position during actuation of the headlamp switch.





Contact switch # 2 is normally in OPEN state (Headlamps OFF). Actuation of CAM to turn headlamps ON will CLOSE switch # 2

Knob Position	Contact Position 1	2	3
HL OFF (Ship)	Closed	Open	Open
PARKLAMP ON	Closed	Open	Closed
HL ON	Closed	Closed	Closed

Contained in Chrysler's warranty and complaint data are many instances where the customer reported the Suspect Condition that is corrected by toggling the headlamp switch. Chrysler believes that this toggling action allows for the acetyl debris to fall away from the location where the point contact of the fulcrum lands enabling the circuit to close and immediately restore headlamp function.

The combination of the above would have to occur, which provides explanation to the random nature of the Suspect Condition in vehicles that are 4 years or older.

17. Describe all modifications or changes made by, or on behalf of, Chrysler in the design, material composition, manufacture, quality control, supply, or installation of any of the subject components, including original equipment (production) and service parts, from the start of production to date, which relate to, or may relate to, the Alleged Defect in the subject vehicles. For each such modification or change, provide the following information:

a. The date or approximate date on which the modification or change was incorporated into vehicle production;
b. A detailed description of the modification or change;
c. The reason(s) for the modification or change;
d. The part numbers (service and engineering) of the original component;
e. The part number (service and engineering) of the modified component;
f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
g. When the modified component was made available as a service component; and
h. Whether the modified component can be interchanged with earlier production components.

Also, provide the above information for any modification or change that Chrysler is aware of which may be incorporated into vehicle production within the next 120 days.

A17. All of the subject components are purchased assemblies, with the exception of the BCM (which was supplied by an internal Chrysler supplier). A detailed summary of the available change information for the subject components can be found in Enclosure 12 – Subject Component Change History Conf Bus Info.

In preparing its response to this IR, TRW presented Chrysler with additional information about many other design and process changes, which are recited by TRW in Enclosure 16 – TRW RS Headlamp Root Cause Analysis. These changes, which were previously unknown to Chrysler, are described in two additional documents in Enclosure 12:

1) A chronological summary of the design and process changes is included in EA11-010 TRW Headlight Switch Change Summary Conf Bus Info.pdf; and

2) A chart of the distribution of complaints for Suspect Condition by Build Date that includes key design and process changes implemented by TRW is included in EA11-010 Field data – Change History Overlay Conf Bus Info.pdf.

18. Separately, by component name, part number (both service and engineering/production), state the (i) model and model year of the vehicles in which each of the following subject components may properly be installed as a service part, and (ii) sales numbers by month/year from 2004 to the present:

a. Switches, relays, wiring, body control modules, front control modules, integrated power modules, and other devices with parts that control the headlights on subject vehicles and peer vehicles; and

b. Any kits that have been released, or developed, by Chrysler for use in service repairs to such switches, relays, wiring, body control modules, front control modules, integrated power modules, and other devices with parts that control the headlights.

For each component part number, provide the supplier's name, address, and appropriate point of contact (name, title, and telephone number). Also identify by make, model and model year, any other vehicles of which Chrysler is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

A18. Part sales information is included in Enclosure 13 – Part Sales Conf Bus Info.
It is important to note that all subject component service part sales have been included, whether they are related to the alleged condition or not. It is difficult to determine whether the alleged condition prompted these part sales, as there are circumstances not related to the alleged condition that generate sales. For instance, the BCM provides dozens of functions not related to front exterior lighting. Therefore, any BCM replacement related to repairs for such functions increase part sales. Additionally, headlamps are often purchased for crash related repairs that are unrelated to the alleged condition. Thus, Chrysler has concluded that the use of part sales data will not be conclusive to assess any trend related to the alleged condition.
Part number information is included in Enclosure 13 – Part Number and Supplier Conf Bus Info. Subject components referenced are unique to the RS Minivan program, and are not utilized in other make or models Chrysler manufactures.

Supplemental A18 Response:
Updated part number information is included in Enclosure 13 – EA11-010 REVISED Part Number and Supplier Info Conf Bus Info.pdf. Service and production part numbers have now separated into columns.

19. Regarding the headlight control switch (switch) installed in the subject vehicles:

a. State the design intent cycle life for the headlight control switch (i.e. how many cycles the headlight control switch is intended to last, where one cycle is defined as switching the headlight switch on and off once) in (i) cycles per year and (ii) entire design intent life cycle;

b. Describe any adverse effects vibration has on the switch, describe any testing conducted to assess theses effects, and provide the results of any testing conducted;
c. Describe any adverse effects humidity has on the switch, describe any testing conducted to assess theses effects, and provide the results of any testing conducted;
d. Describe the process Chrysler used to select and qualify the supplier of the switch;
e. Describe the manufacturing and/or production processes used by the switch supplier;
f. Describe how debris or foreign material may collect in the switch cell area of the switch, and how debris may affect contact #2 of the switch cell;
g. Further to item 'f,' state whether debris may have, or did collect during the manufacture of the switch, describe in detail the debris that may collect (material, size, origin, etc), and state what if any actions Chrysler took to mitigate this issue including any action to purge the production or service parts supply of potentially substandard headlight switches;
h. Further to item 'f,' state whether debris may have, or does collect during consumers' use of the vehicle, describe in detail the debris that may collect (material, size, origin, etc), and state whether there is any scenario where the debris may escape the switch cell area;
i. Describe the plating material used, and the thickness specified, for the switch contacts;
j. State whether the switch contacts were designed for low current, and if so, explain what measures were taken to accomplish this;
k. Describe any lubrication specified for use on the switch contacts, and state the purpose of the lubrication (i.e., to prevent corrosion, increase life); and
l. List all other makes, models, and model years of Chrysler products that utilize a similar headlight control system design approach (i.e., where the headlight switch acts as a resistive network and produces an analog output voltage that is interpreted by a BCM).

A19. The subject vehicle's headlight control switch (switch) was designed and developed using the Outside Design and Development ("ODD") process. Under the ODD process, outside suppliers design and develop various components to meet the Chrysler's performance requirements.

There were two completely different ODD switch assemblies used in the subject vehicles that were supplied by two different suppliers:

- For the first two months of the 2005 model year, Delphi supplied an ODD switch assembly that utilized a redundant, bifurcated switch. This was a carryover design from the peer vehicles.

- Beginning in March of 2004 (two months into the 2005 MY) and through the 2007 MY, TRW supplied an ODD switch assembly that utilized a switch cell comprised of three individual switches, each constructed with a spring steel fulcrum. (A more complete description of the TRW switch design is described in the response to Q16, Assessment 7: Headlamp Switch Root Cause Analysis.)

Because the focus of this investigation is on the TRW switch, the following subpart responses apply only to the TRW switch. Furthermore, as the ODD supplier and at Chrysler's request, TRW has provided responses to some of the below subparts that seek information not otherwise in Chrysler's possession. The sources for TRW's responses are contained in Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf.

19a. State the design intent cycle life for the headlight control switch (i.e. how many cycles the headlight control switch is intended to last, where one cycle is defined as switching the headlight switch on and off once) in (i) cycles per year and (ii) entire design intent life cycle.

A19a. Chrysler PF-10083 sets forth the life cycle performance requirements, which are described by TRW in Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 32.

19b. Describe any adverse effects vibration has on the switch, describe any testing conducted to assess theses effects, and provide the results of any testing conducted.

A19b. TRW reported that the switch met Chrysler specification PF-9688, Section 2.6 Mechanical Vibration, with no adverse effects noted during testing. See Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 32.

19c. Describe any adverse effects humidity has on the switch, describe any testing conducted to assess theses effects, and provide the results of any testing conducted.

A19c. TRW reported the switch was subjected to several types of humidity tests, as required by Chrysler specification PF-10083, Section 6.3.6, Film Growth, and Section 6.3.1.2, Cycles/Temperature, PF-9688, Section 2.6 Mechanical Vibration, with no adverse effects noted during testing. See Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 32.

19d. Describe the process Chrysler used to select and qualify the supplier of the switch.

A19d. The supplier selection process used at the time was as follows:

- The direction is given to source a component;
- Engineering authors a technical requirements document (Source Package);
- Potential suppliers on the bid list are requested to respond to the Source Package with technical, commercial and manufacturing specifics;
- A series of reviews with each supplier, Chrysler Purchasing, Engineering and Supplier Quality are conducted. Each Chrysler group assesses the capabilities of each supplier relative to their area of responsibility;
- Purchasing will evaluate and coordinate a final assessment, and award Purchase Order to successful supplier; and
- All affected groups are notified to begin working with awarded Supplier.

19e. Describe the manufacturing and/or production processes used by the switch supplier.

A19e. The production process for the switch assembly has been supplied by TRW and is included as Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 34.

19f. Describe how debris or foreign material may collect in the switch cell area of the switch, and how debris may affect contact #2 of the switch cell.

A19f. Chrysler refers ODI to its response to Q16, Assessment 7: Headlamp Switch Root Cause Analysis, which provides an overview of how acetyl contamination may affect switch cell contact #2. As noted in Assessment 7, the details supporting this analysis are recited in two engineering studies were conducted to analyze the debris condition:

1. Black Belt Project 4865, which was previously provided in Chrysler's September 2010 PE response as ENLCOSURE 8J – Project 4865 – CONF BUS INFO; and
2. TRW's presentation of root cause findings, which is provided in Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slides 8 through 24.

19g. Further to item 'f,' state whether debris may have, or did collect during the manufacture of the switch, describe in detail the debris that may collect (material, size, origin, etc), and state what if any actions Chrysler took to mitigate this issue including any action to purge the production or service parts supply of potentially substandard headlight switches.

A19g. TRW reported that it found no evidence of debris collecting during the manufacturing of the switch. Any type of debris that may have been introduced during the manufacturing process (which could include fibers, dust, and/or particulate to the point of causing the contact system to remain open) would have resulted in the unit failing the end of line tester. Any suspect unit that failed final test would have been automatically rejected, and not shipped. The rejected unit would have been subjected to root cause analysis at the TRW manufacturing plant. See Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 38.

19h. Further to item 'f,' state whether debris may have, or does collect during consumers' use of the vehicle, describe in detail the debris that may collect (material, size, origin, etc), and state whether there is any scenario where the debris may escape the switch cell area.

A19h. Chrysler refers ODI to its response to Q16, Assessment 7: Headlamp Switch Root Cause Analysis, which provides an overview of how acetyl contamination may affect switch cell contact #2. As noted in Assessment 7, the details supporting this analysis are recited in two engineering studies were conducted to analyze the debris condition:

1. Black Belt Project 4865, which was previously provided in Chrysler's September 2010 PE response as ENLCOSURE 8J – Project 4865 – CONF BUS INFO; and
2. TRW's presentation of its root cause findings, which is provided in Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slides 8 through 24.

In Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf at slide 38, TRW reported that, based on units that were returned from the field, where the condition was found to be repeatable through the TRW tear down procedure, it was reasonable to assume the debris was generated during the use of the switch in the vehicle. In some returns, debris was identified by TRW as actuator cam material (acetyl), generated through excessive wear between the actuator cam and the dome of switch cell contacts. However, TRW notes that the type of debris noted in the field returns was not discovered during any EV, DV or PV level testing or in any DOE's performed by TRW.

TRW states that "in order for the debris to collect [on switch #2], the presence of oil on the contact surface is required" (slide 35). TRW also states in its root cause analysis (slide 35), that "[debris] can also collect if the switch sees an abnormal high amount of debris, caused by excessive wear between the Actuator Cam and the Dome of Contact #2."

19i. Describe the plating material used, and the thickness specified, for the switch contacts.

A19i. In Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 39, TRW reported that the stationary and flexible contacts use the same plating configuration, as follows.

Under-plating: Ni, 2um minimum, per ASTM B488.
Over-plating: Au, 0.635 um minimum, per ASTM B488 – Type 2, Grade C.

This combination results in a gold-on-gold contact interface.

19j. State whether the switch contacts were designed for low current, and if so, explain what measures were taken to accomplish this.

A19j. In Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 39, TRW reported that the contact system was specifically designed to be used in low current applications. Furthermore, TRW reported that, in addition to the gold-on-gold plating configuration identified above in A19i, a contact pressure in excess of 50 grams was used to assure a stable interface with minimal/no contact bounce.

19k. Describe any lubrication specified for use on the switch contacts, and state the purpose of the lubrication (i.e., to prevent corrosion, increase life).

A19k. In Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf, slide 39, TRW reported that no lubricant was specified to be used directly on the switch contact interface. However, Chrysler notes that TRW discovered the presence of manufacturing oil on switch contacts, which could potentially cause switch discontinuity (slide 5). TRW reported that both the switch cell supplier (Sun Microstamping Technologies) and TRW implemented a number of corrective measures to remove the oil throughout 2004 calendar year (slides 12 and 26-30).

19l. List all other makes, models, and model years of Chrysler products that utilize a similar headlight control system design approach (i.e., where the headlight switch acts as a resistive network and produces an analog output voltage that is interpreted by a BCM).

A19l. Chrysler has utilized a similar headlight control system design approach in all makes and model years (i.e., where the headlight switch acts as a resistive network and produces an analog output voltage that is interpreted by a BCM), from 2001 model year to present.

It should be noted the TRW headlamp switch used in the 2005 through 2007 MY Minivans (Subject Population) was the only application of a single point contact headlamp switch in Chrysler vehicles.

20. In the last paragraph of Chrysler's PE10-022 IR response to ODI, dated September 3, 2010, Chrysler states "Furthermore, corrective action was taken by the headlamp supplier, TRW, during early 2006 MY production." Describe in detail

a. the corrective action taken by TRW;
b. the condition it was intended to address;
c. the conclusions reached by TRW and Chrysler regarding the condition the corrective action was intended to address and the corrective action itself; and
d. the effectiveness of the action that was taken.

A20. TRW documentation is included in Enclosure 15 – TRW Corrective Actions Conf Bus Info.

Supplemental A20 Response:

The statement quoted in this question was intended to refer to the Black Belt Project 4865, which was previously provided in Chrysler's September 2010 PE response as ENLCOSURE 8J – Project 4865 – CONF BUS INFO. Chrysler is providing this supplemental response to further clarify what it now knows about the "corrective action [that] was taken by the headlamp supplier, TRW" recited in the September 2006 Black Belt Project 4865 study.

This Black Belt project referenced a corrective action taken by TRW – an undefined wash procedure -- that was implemented to prevent contamination of the switch. Chrysler now believes that this was intended to refer to one of several wash procedures now identified by TRW from December 2004 through April 2006. At the time of its September 3, 2010, response, Chrysler believed this TRW corrective action that had attributed to the significant decline in headlamp warranty and customer complaints over the past several years. However, in preparing its response to this IR, TRW presented Chrysler with additional information about many other corrective actions taken by TRW in In Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf. In short, TRW implemented no less than 13 process and/or design changes. Some of these changes were noted in Enclosure 15 – TRW Corrective Actions Conf Bus Info, which was provided with Chrysler's original response to this question.

At the time of the September, 2006 Black Belt project, as well as at the time of Chrysler's September 3, 2010 PE response, Chrysler was unaware of the extent of these additional TRW process and/or design changes and their effect on eliminating the acetyl debris contamination on switch #2.

As noted in its response to Q16, Assessment 7: Headlamp Switch Root Cause Analysis, Chrysler has overlaid the previously unknown series of TRW design and manufacturing process changes against the build month and complaint data. It is now apparent that the November 2005 addition of grease to the cam actuator by TRW was likely the corrective action that resolved the acetyl debris contamination condition affecting switch #2 in the Suspect Population.

In short, Chrysler's September 3, 2010 statement that "Furthermore, corrective action was taken by the headlamp supplier, TRW, during early 2006 MY production" remains correct, but for reasons now known to Chrysler that were not known at the time the statement was made.

21. Produce all documents sent to TRW and received from TRW related to the Alleged Defect and/or the corrective action, including any studies, tests, or evaluations conducted in connection with the corrective action and conclusions reached, and all communications between Chrysler and TRW related to the corrective action.

A21. TRW documents not otherwise referred to in the response are included in Enclosure 16 – TRW Documents Conf Bus Info. Enclosure 16 – EA11-010 5B318971 TRW Preliminary Analysis 12Oct11 Conf Bus Info.pdf reports a tear down analysis of a returned component in which TRW reports part was received as damaged. Chrysler believes this damage was caused either by improper removal of headlamp switch at the dealership and/or caused during transit.

23. State whether or not the Body Control Module (BCM) installed in the subject vehicles can be software reprogrammed (reflashed) with respect to headlight performance and if so describe the process required to conduct the BCM reflash, and state whether or not service technicians at Chrysler dealerships have the equipment and training to conduct a BCM reflash.

A23.

Background

The BCM interprets a voltage input received by the headlamp switch. The instruction given to the BCM as to the intended lighting state is received as (1) an open circuit, (2) a short circuit, or (3) some fraction of a 5 Volt signal. In both states (1) and (2), the BCM instructs the FCM to illuminate both Park and Low Beams if the key is in the ON position. When the key is on the OFF position, the FCM is instructed to turn all exterior lighting off. The voltage returned by the headlamp switch assembly is established based on customer input relative switch position. Switch positions for fog lamps, park lights, headlamps, and auto headlamps each output unique resistance values. The resistance, as applied to the 5 Volt signal, is interpreted by the BCM. The BCM, in turn, instructs the FCM to perform the specified lighting function(s).

The BCM software initiates a check routine to validate voltage values sent to and received by the headlamp switch assembly.

If the BCM detects an unexpected voltage value or an out of range condition from the headlamp switch, the BCM defaults to headlamps on Low Beam when the ignition switch is in the run position.

The BCM software strategy for the headlamp switch has remained consistent, from original release for the 2001 RS, through both the peer and subject vehicles indicated in this investigation.

Feasibility

It should be noted that the BCM software must be modified as an integral change, and not a modular change and/or a data table value change to address any headlamp functionality. The BCM module is near the limit of memory capacity, and intricate logic to modify headlamp functionality may not be possible.

The range of changes to the software regarding headlamp functionality may be limited. The resistance ladder used within the headlamp switch is a governing factor. In order to completely eliminate the headlamp switch voltage output as a cause for the Suspect Condition identified in Assessment 7, from a BCM perspective, the vehicle would have to ensure that a headlamp on to headlamp off only occurred when the vehicle was off, and from a headlamp off to a headlamp on, the vehicle must be running. This would mean that the entire time

the vehicle is running, headlamps would always be on (full power running lights). This would introduce some additional complexity to deal with, such as the dimming of interior lights during daylight hours (as a vehicle not equipped with auto-lamp feature is unable to distinguish between daylight and nighttime). This may also affect other components, such as battery, that may not have been designed or manufactured for this type of duty cycle.

Chrysler has not yet determined whether a software flash to the BCM is feasible, and is in currently in the process of completing an evaluation of feasibility and functional compromises that may be involved, and whether or not these compromises may affect any existing lighting compliance requirements.

The BCM software for the Subject Vehicle population supported an electrical architecture, flash procedure, and development tools that are no longer used for production vehicles. Chrysler has confirmed that development computers and compilers necessary for any software changes for the BCM are available to develop and validate any software changes for the BCM. However, the equipment has been not been in active use for a Chrysler vehicle since 2005. Any software change would require an entire modification of the software within the BCM, and thus would require a software development and validation program. To date, Chrysler was unable to locate test instrumentation equipment to be used in the development of a BCM software flash. Chrysler is continuing to attempt to locate test equipment and/or alternate options that may assist. In addition, the available code space within the BCM is limited to 72 bytes. Existing code may need to be refactored or deleted to make room for new changes.

Field Flash Capability

The service procedure to flash the BCM for the Subject Vehicle population would involve the use of the Chrysler DRBIII® tool. The Chrysler DRBIII® tool has been replaced by the Chrysler WiTech tool for all new vehicles. It is backward compatible for select vehicles, but not for the 2005, 2006 or 2007 RS. The DRBIII® tool was a standard tool at the time. Chrysler would have to verify if the DRBIII® tool is still be available at <u>all</u> Chrysler dealerships.

BCM Reflash Procedure

The process required to flash the BCM module would follow the process below:
Diagnosis:

1. With the ignition switch in the “RUN” position, determine the original software part number of the BCM currently in the vehicle. Using DRBIII® select:
    a. “DRBIII® standalone.”
    b. “1998-2005 Diagnostics.”
    c. “All (Except Below).”
    d. “Body Interior.”
    e. “Body Computer.”

f. "Module Display."
g. Record the "Software part #" on the repair order for later reference.
h. Check DTC's.

Repair Procedure:

1. Before beginning a flash procedure, remove any old flash files from the DRBIII ® memory. To clear memory from the MAIN MENU:
    i. Simultaneously press the "MORE" and "YES" keys.
    j. A screen will appear requesting a "COLD BOOT."
    k. Follow the on screen instructions by selecting the "F4" key.
    l. When the DRBIII ® reboots to the MAIN MENU, proceed to Step #2.
2. Connect the DRBIII® to TechCONNECT. Open TechTOOLS and verify that the DRBIII® Status: Connected" message is in the upper right corner of the TechTOOLS screen.
3. Enter the "BCM part #," recorded in "Diagnosis Step #1," in the "Parts Criteria" area and select "Show Updates." TechTOOLS will populate the appropriate flash file.
4. Select the flash file.
5. Select "DRBIII®" radio button which is next to the "Download/Update" button.
6. Select the "Download/Update" button.

Note: If this flash process is interrupted or aborted, the flash process should be restarted and then follow the directions on the DRBIII®.

24. Furnish Chrysler'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;
e. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the Alleged Defect was occurring or subject component was malfunctioning; and
f. The reports included with this inquiry.

A24.

Introduction

For reasons discussed more thoroughly below, Chrysler has concluded the headlamps in the Subject Vehicles do not pose an unreasonable risk to motor vehicle safety. Chrysler has analyzed the available field data and engineering history involving the Subject Vehicle headlamp function and has reached the following conclusions:

1. **Subject Vehicle Population:** The field data and headlamp supplier's manufacturing process and design change history point both to a 21 month assembly period when the 2005 and 2006 MY minivans received a certain TRW headlamp switch that may be susceptible to causing low beam headlamps to either fail to illuminate or extinguish while driving. The Subject Vehicle population of can be reduced to this 21 month period, which Chrysler has defined throughout this IR response as the "Suspect Population."

2. **Alleged Defect:** Based upon Chrysler's understanding of the field data, it is reasonable to eliminate the Alleged Defect involving flicker or dim from further consideration because they do not cause or lead to an unreasonable risk of a driver losing forward headlamp lighting.

3. **Subject Components:** Aside from headlamp switches, there is no reliable evidence that the remaining Subject Components caused the reports of headlamps either failing to illuminate or headlamps extinguish while driving.

4. **Root Cause:** The Suspect Population of minivans may be equipped with a headlamp switch that is susceptible to debris contamination and can, under extraordinary circumstances, cause a voltage change inside the switch and affect headlamp function. Parking and fog lamps light are not affected by a switch malfunction.

5. **Safety Consequence:** Loss of headlamp function occurred early in the life of the Suspect Population and the now low occurrence rate may, in fact, continue to decline as the vehicle ages. There are no reports over the past 8 years in any of the Subject Vehicles where loss of forward lighting caused a collision. With eight years in service and over 60 billion miles driven, the field experience simply does not suggest that an unreasonable safety risk exists in the Suspect Vehicle population.

Chrysler offers the following analysis and support for these conclusions.

1. The Subject Vehicle Population

The field data and headlamp supplier's manufacturing process and design change history both point to a 21 month assembly period when the 2005 and 2006 MY minivans received a certain TRW headlamp switch that may be susceptible to causing low beam headlamps to either fail to illuminate or extinguish while driving. The Subject Vehicle population can be reduced to this 21 month period, which Chrysler has referred throughout this IR response as the "Suspect Population." This Suspect Population represents 726,174 vehicles.

a) The Field Data Supports Redefining the Subject Vehicle Population

A noted in *Assessment 2, Warranty MOP/MIS Analysis of Subject Components*, Chrysler believes it is apparent that the greatest concentration of warranty claims related to the Alleged Defect occurred for the 2005 and 2006 model year minivans that were assembled between March 2004 and November 2005. Vehicles assembled after November 2005 clearly show a distinct reduction in warranty claims related to the Alleged Defect. *Figure A* in *Enclosure 17 – Final Assessment*, represents the MOP/MIS history of warranty claims and illustrates this point. In short, of the 84,331 total warranty claims between 2005 MY through 2007 MY, 74,299 (88%) warranty claims relate to this 21 month build period for the Suspect Population.

Moreover, Chrysler's analysis of the complaint data reflects the same warranty claim pattern. In *Assessment 1, Complaint Analysis by Total, Open Date, Build Date, Mileage, and Months in Service*, Chrysler noted that the greatest concentration of customer complaints for the 2005 and 2006 model year minivans that were assembled between March 2004 and November 2005. There was a clear drop in complaints for vehicles assembled after November 2005. Vehicles built during the Suspect Population period accounted for 95% of the total complaints received by Chrysler that may be related to the Alleged Defect.

The warranty data and the complaint data correlate and overlap in this 21 month build period.

b) The Headlamp Switch Change History Also Supports Redefining the Subject Vehicle Population.

In March of 2004 (two months into the 2005 MY production), TRW began to supply an entirely new switch assembly for Chrysler's minivans. Following the launch of the new switch, over a 21 month period TRW implemented no less than 13 manufacturing process and/or design changes. At the time of the September, 2006 Black Belt project, as well as at the time of Chrysler's September 3, 2010 PE response, Chrysler was unaware of the extent of these additional TRW process and/or design changes and their effect on drastically reducing both warranty and customer complaints of headlamp malfunctions.

Chrysler has now overlaid these previously unknown series of design and manufacturing process changes against the complaint data by build month. (*See Enclosure 12 – EA11-010 Field Data - Change History Overlay Conf Bus Info.pdf*). The change history indicates a number of changes that occurred during the 2005 and early 2006 model years. It is evident that the increased field inputs are attributed to the March, 2004 launch of the TRW switch. It is also now evident is TRW's November 2005 addition of grease to the cam actuator resulted in a steep drop in headlamp field inputs.

Chrysler's focus in this investigation has turned to the 21 month period between launch of the TRW headlamp switch and a series of changes that eventually resulted in a clean point for the TRW switch in November 2005. Chrysler believes it is reasonable to reduce the Subject Vehicle population for the remainder of this investigation to this 21 month "Suspect Population" period.

2. The Alleged Defect

NHTSA defined the Alleged Defect in this investigation as "headlights flicker, dim, fail to illuminate, and/or illuminate and extinguish, on either a continuous or intermittent basis." However, based upon Chrysler's review of field data, the Alleged Defect involving flicker or dim should be eliminated from further consideration because they do not cause or lead to an unreasonable risk that a driver will lose forward low beam headlamp lighting in the Subject Vehicles. Moreover, based upon its engineering analysis, Chrysler believes the flicker and dim complaints in the Subject Vehicles are not a precursor to the known instances of lost headlamp lighting.

a. Flicker and Dim Events Do Not Pose an Unreasonable Safety Risk.

NHTSA has long recognized the condition of flicker and dim as a momentary loss of illumination (less than one second) or an intensity change only. Although the allegations of "flicker" (momentary headlamp loss) and "dim" (reduced headlamp intensity) are distinct and technically different conditions, they are often grouped

together as customers use these terms interchangeably. By way of example, as noted in *Assessment 6: Flicker and Dim Complaint Analysis*, 32% of those customers that originally complained of a "flicker" condition were actually describing a "dimming" condition where there was no loss of forward lighting.

Chrysler has determined the likely source of most flicker and dim complaints in the Subject Vehicles arises during routine operation of the vehicle. These complaints are usually related to momentary voltage drops in the electrical system. This often occurs during normal operation from momentary spikes in electrical loads, such as radiator fan initiation (e.g., during deceleration) or accessory electrical draws (power windows, power seats, heated seats, etc.).

As noted in *Enclosure 11 – Assessment 6 Figure B*, 64 field reports were analyzed for the possible causes of flicker and dim over the last four years of service for the Suspect Population. As noted in Figure B, the highest percentage of complaints (28%) is associated with ground wire and heated seats, followed by Other Electrical, Normal Condition and Battery, each of which were at 11%. This represents a total of 61% of all complaints related to flicker and dim and are directly related to sources that can be attributed to vehicle voltage variation. The remaining 39% of complaints are distributed among 8 other condition sources, with wire harness and FCM issues at 9% and 8% respectively. The headlamp switch does *not* surface as a cause in any of these flicker and dim field reports.

Flicker and dim complaints represents 29% of the total complaints that may relate to the Alleged Defect (*Figure B, Enclosure 17 – Final Assessment)*. *Figure C* in *Enclosure 17 – Final Assessment, Reports of Flicker and Dim by Complaint Date*, illustrates that these complaints reached a peak in January of 2006 and has been consistently declining, particularly over the past 12 months. An average of 2.3 complaints per month has been reported in this period, which is equivalent to a rate of 3.8 conditions per 100,000 vehicles.

Most importantly, there are no reported collisions, injuries or complaints about a loss of forward visibility associated with flicker and dim in the Subject Population of vehicles. While annoying to customers and often misunderstood, this condition in Chrysler's minivans simply does <u>not</u> affect the driver's forward low beam lighting. Chrysler understands why ODI included this condition in the Alleged Defect, because excessive and persistent flickering of headlamps or severe dimming can, in some circumstances, seriously affect forward lighting and pose a safety risk. There was no evidence of this type of flicker and dim severity in the complaints involving the Subject Vehicles. Including flicker and dim complaints in this investigation skews the data and detracts from the ability to conduct any meaningful trend analysis. It is for these reasons that Chrysler believes flicker and dim complaints should be eliminated from further consideration in this investigation.

b. Flicker and Dim is not a precursor to an eventual loss of headlamps.

As noted in *Assessment 6: Flicker and Dim Complaint Analysis*, Chrysler identified 49 flicker and dim complaints in the Suspect Population where there was a subsequent complaint even remotely related to the Alleged Defect. Only one of the 49 customers reported "illuminate and extinguish" as a subsequent complaint. An analysis of this complaint found that the actuation of seat heaters triggered a flickering of headlights and dimming of interior lights, and also simultaneously affected other vehicle accessories. Near all of the remaining 48 repeat customers only reported a subsequent flicker and dim complaint. These were all associated with minor voltage variations and/or momentary spikes in the vehicle's electrical loads. None of these remaining 48 customers reported a fail to illuminate or extinguish while driving condition.

If the data supported that a flicker and dim condition preceded an eventual failure of low beam headlamps, it would be prudent to continue to analyze flicker and dim complaints as part of the Alleged Defect in this investigation. The data, however, does not support this connection and Chrysler believes that a vehicle experiencing flicker and dim does not mean it is at risk of an eventual headlamp failure. In short, flicker and dim and the loss of forward low beam light are not related conditions in this investigation. This conclusion is further supported by Chrysler's understanding of the root cause behind the loss of forward lighting in the Suspect Population, discussed below.

There was no evidence in the field data to suggest that the flicker and dim conditions in the Subject Population pose a safety risk to drivers or others, and flicker and dim is not an indicator of an impending loss of low beam lighting. Chrysler believes that including flicker and dim in this investigation no longer serves to further the goal of determining whether the Subject Vehicles contain a safety-related defect. Chrysler, however, believes that fail to illuminate and/or illuminate and extinguish remains the proper focus of this investigation, which Chrysler has referred to throughout this IR response as the "Suspect Condition."

3) The Subject Components

Chrysler was asked to analyze a comprehensive list of components that may relate to the Alleged Defect, including the Front Control Module (FCM), Body Control Module (BCM) and the Headlamp Switch, among others. Chrysler has analyzed both the available 3/36 warranty data and the most recent complaint data (last 4 years) for the Suspect Population. See *Assessment 2: Warranty MOP MIS Analysis of Subject Components* and *Assessment 3: Analysis of Subject Component Warranty Claims.* Chrysler has concluded that, aside from headlamp switches, there is no reliable evidence that the Subject Components caused the headlamp to either fail to illuminate

or extinguish while driving. Below is a summary of these conclusions for each Subject Component.

a) **Body Control Module:** *Assessment 3* demonstrates that the BCM represents the highest percentage of the total warranty claims (nearly 60%) that relate or may relate to the Alleged Defect. Over 97% of the BCM claims were due to software reflashes (remote keyless operation, locks, liftgate) associated with TSBs or other conditions (locks, TSB reflashes, etc.) completely unrelated to the Alleged Defect.

b) **Headlamp Assembly:** *Assessment 3* demonstrates that the Headlamp Assembly is responsible for the third highest percentage of total warranty claims (8%) within the Suspect Population. Of the 478 available narratives Chrysler, less than 1 percent (0.6%) revealed the claims were related to the Alleged Defect. The narratives demonstrate that the remainder of the warranty is due to conditions unrelated to the Alleged Defect (e.g., poor sealing, headlamp loose, aim).

c) **Front Control Module:** *Assessment 3* demonstrates that the FCM is responsible for the fourth highest percentage of total warranty claims (5%) within the Suspect Population. Of the 326 narratives Chrysler was able to assess, less than 5 percent were related to the Alleged Defect. The narratives demonstrate that the bulk of the warranty is associated with other, non-related conditions.

d) **Other Components:** *Assessment 3* also contains Chrysler's warranty data analysis other components (wiring harnesses, grounds) that contribute to a small percentage (3%) of the total warranty in the Suspect Population. These are conditions that occurred randomly with no identifiable data trend.

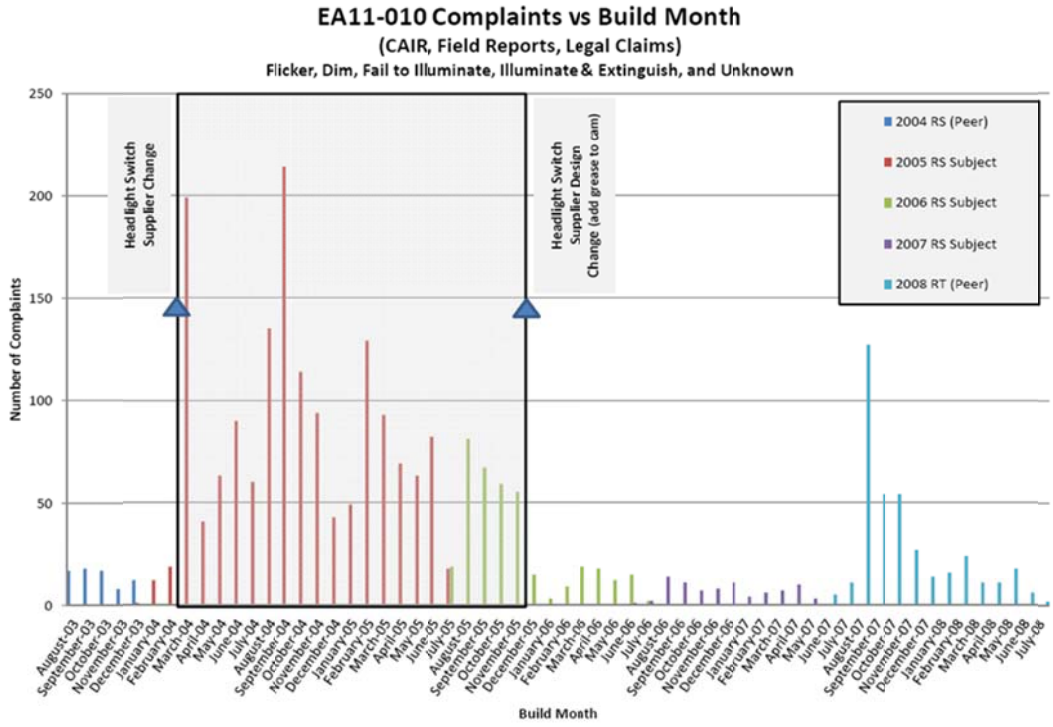
The customer complaint data does not contain useful information that would aid in evaluating whether one or more of the above components may be related to the Alleged Defect. Customer complaints typically complain about a symptom, such as headlights dim, rather than identify a specific component. Nevertheless, the warranty data Chrysler analyzed – comprising 72% of all warranty data relating to the Alleged Defect -- provided useful information to conclude that these components were serviced under warranty to correct an issue (e.g., door locks, theft alarm, headlamp alignment, etc.) that was totally unrelated to the Alleged Defect.

e) **Headlamp Switch:** In *Assessment 3,* Chrysler noted that the remainder of the warranty claims (25%) relate to a faulty headlamp switch in the Suspect Population. The headlamp switch is responsible for a substantial percentage of the total warranty claims and the complaint data received over the past 3 years. Warranty data, complaint data, and other assessments demonstrate that the headlamp switch is the component causing the failure to illuminate or illuminate and extinguish condition (the "Suspect Condition").

Chrysler has determined that the headlamp switch – and no other Alleged Component – is the proper focus of this investigation.

4) **Root Cause of Faulty Headlamp Switches**

In *Assessment 7: Headlamp Switch Root Cause Analysis*, Chrysler set forth its reasons for concluding that Suspect Population may be equipped with a headlamp switch that is susceptible to debris contamination. This debris can cause a voltage change inside the switch and affect headlamp lighting. Chrysler was drawn to this conclusion when it plotted the field data (by build month) with the previously unknown TRW switch change history into the following chart:



Enclosure 11 – Assessment 1, Figure C

Figure C reveals that most of the 2005 MY vehicles and a portion of the 2006 MY vehicles were responsible for the vast majority (93%) of the Alleged Defect complaints. Chrysler has now learned that this trend is defined by: 1) the launch of the new TRW switch (March of 2004); and 2) TRW's introduction of grease to the mechanical cam surface in the headlamp switch assembly (November of 2005) to prevent acetyl debris from interfering with the headlamp switch contacts.

Previously provided in Chrysler's September 2010 PE response was *ENCLOSURE 8J – Project 4865 – CONF BUS INFO*. This Black Belt project determined that the root cause of the headlamp switch malfunction was unidentified contamination causing an unintended open circuit in switch contact #2. This Black Belt project referenced a corrective action taken by TRW – an undefined wash procedure -- that was

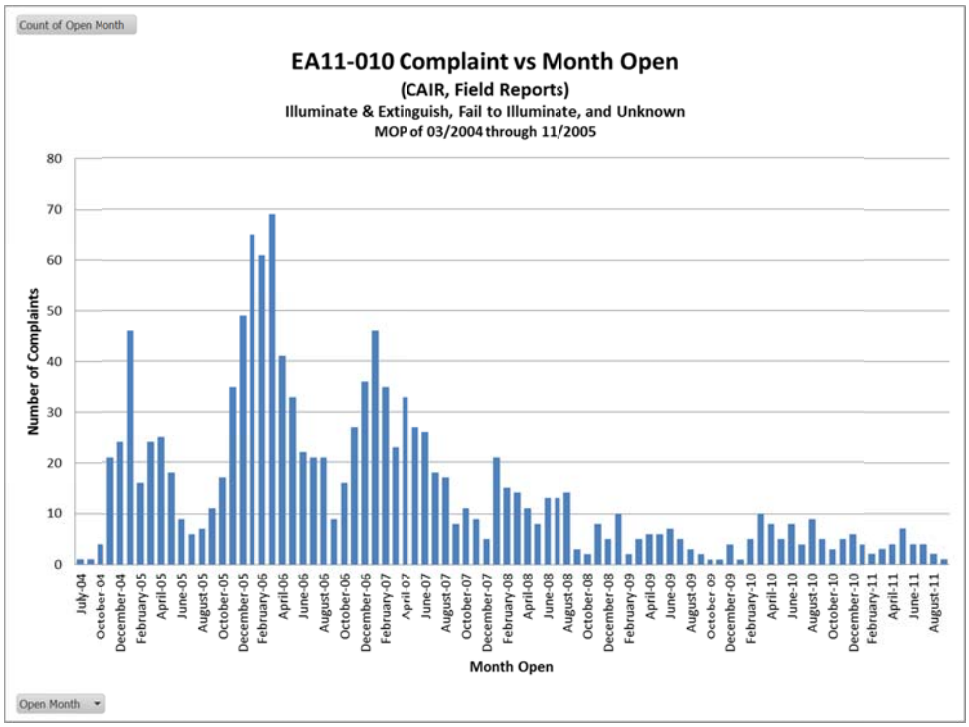
implemented to prevent contamination of the switch. Chrysler believes this was intended to refer to one of several wash procedures now identified by TRW from December 2004 through April 2006. At the time of its September 3, 2010, response, Chrysler believed this TRW corrective action had attributed to the significant decline in headlamp warranty and customer complaints over the past several years. However, in preparing its response to this IR, TRW presented Chrysler with additional information about many other corrective actions taken by TRW (Enclosure 16 – EA11-010 TRW RS Headlamp Root Cause Analysis Conf Bus Info.pdf.)

In *Enclosure 16*, TRW has now indicated that the contamination was acetyl debris originating from the headlamp switch mechanical cam. TRW determined that the acetyl debris from warranty returned parts was larger in size than the residue found in prior PV tested parts. TRW also determined that while the acetyl residue found in PV tested parts was not large enough to interrupt the headlamp switch circuit and change the output voltage, the larger debris found in warranty returned parts could, in fact, interrupt the headlamp switch circuit.

It is now apparent that the November of 2005 addition of grease to the cam actuator by TRW was likely the corrective action that resolved the acetyl debris contamination condition affecting switch #2 in the Suspect Population. It is also apparent that the Subject Vehicles assembled after November of 2005 are not at risk of being equipped with a faulty headlamp switch that causes a headlamp to either fail to illuminate or extinguish while driving.

5) Safety Consequence of Faulty Headlamp Switches

As shown in Figure D, below, the field data demonstrates that the loss of forward headlamp lighting relating to a faulty TRW switch occurred early in the life of the Suspect Population and there is a significant downward trend.



Enclosure 17 – Final Assessment, Figure D

Moreover, as described in *Assessment 1: Complaint Analysis by Total, Open Date, Build Date, Mileage, and Months in Service*, Chrysler noted the following:

- The vast majority of complaints (72%) occurred within the 36,000 mile warranty period. Very few complaints occur after 100,000 miles.
- Very few complaints occur after 48 months in service (90% of complaints occur prior to 48 months in service). As vehicles age, they are less likely to experience the random, extraordinary mix of circumstances that can cause acetyl debris to interrupt forward lighting. This is consistent with all of the 3 likely mechanisms of acetyl debris formation discussed in Assessment 7.
- Ninety five percent (95%) of the Suspect Population has been in service for a minimum of 66 months. Almost all (96%) of the complaints have been reported within the first 66 months of service.
- An analysis of the Suspect Condition during the 21 month Suspect Population demonstrates that the complaint rate has reduced significantly as the vehicles age (during the last calendar year 6.2 c/100,000 vehicles).

The field data trend rates in this investigation support Chrysler's belief that the remaining Suspect Population vehicles in service are at minimal risk of a headlamp switch malfunction. These rates are actually <u>less</u> than a similar investigation where ODI closed the EA based upon similar facts.

In EA05-009, ODI and Chrysler investigated complaints of headlamp failure, defined as "flicker and/or turn off unexpectedly," on 2001-02 RS Minivans. An extensive field data analysis was conducted and both entities reached the same conclusion – failure rates had declined and a field action was not required. Because Chrysler has segregated flicker and dim from failure to illuminate or illuminate and extinguish conditions in this investigation (the "Suspect Condition"), it went back to the EA05-009 data, segregated the data and conducted a similar analysis. Chrysler segregated flicker and dim from failure to illuminate or illuminate and extinguish complaints in EA05-009 and created a "Suspect Condition" data set, which is noted in the below table. The data has been calculated to reflect conditions per million vehicle years. The data pattern and results are the same, but the rates in this investigation are even lower than what was calculated in EA09-009 where ODI closed the investigation.

	PE to EA		Year Prior to the EA		4 Years Prior to the EA	
	Alleged Condition	**Suspect Condition**	**Alleged Condition**	**Suspect Condition**	**Alleged Condition**	**Suspect Condition**
EA11-010	108.24	70.96	127.79	76.67	210.89	129.52
EA05-009	190.87	80.98	313.78	154.03	260.28	133.06

EA05-009 and EA11-010 Field Data Comparison
(Conditions per Million Vehicle Years)

In *Assessment 7: Headlamp Switch Root Cause Analysis*, Chrysler noted the possibility that the rate of headlamp switch malfunctions may decline even further based upon its understanding of the mechanisms that generate acetyl debris in the TRW switch. If there were rough surface manufacturing variations on either the switch fulcrum or acetyl cam, years of switch activation could polish these surfaces or create a smooth groove and eliminate any future acetyl debris from being generated and falling into switch contact #2. In other words, the potential for acetyl debris was greater early in the switch life cycle and is less likely to occur in an aged vehicle, which is consistent with the actual steep decline in field data and what is now known about acetyl debris contamination.

Similar to EA09-059, the field data in this investigation also strongly suggests that headlamp malfunctions in the Suspect Population do not pose an unreasonable risk to persons or property. There are no reports over the past 8 years in any of the Subject Vehicles where loss of forward lighting caused a collision. There was only one unconfirmed report of a minor, non-collision related injury (bruises) when loss of low beam lighting reportedly led a driver to climb an embankment (Davis). In one other incident (NAME), the driver reported a momentary loss of forward lighting and slowed down when a deer then ran into the passenger side of her vehicle.

With eight years in service and over 60 billion miles driven, the field experience simply does not suggest that an unreasonable safety risk exists in the Suspect Population of vehicles. The random nature is the result of an extraordinary mix of

circumstances that must all occur before acetyl contaminate can interrupt forward lighting. In addition, there are five factors that also mitigate the safety risk:

1. There is ample evidence in customer complaints and field reports that the driver is able to toggle or move the headlamp switch, introducing forces through the cam and, in essence, "cleaning" the switch by dislodging the debris or residue. In doing so, the headlamp switch is returned to its normal, functional state; and/or
2. Over 50% of the Suspect Condition is attributed to a fail to illuminate condition rather than an illuminate and extinguish complaint. At startup, the operator can recognize the failure to illuminate and take appropriate action. If this same condition is experienced while driving, the operator has time to recognize the failure to illuminate and safely maneuver the vehicle to a secure location; and/or
3. As stated in complaint narratives, operators have held the high beam/low beam (i.e., flash to pass) selection on the multifunction switch ensuring continued forward illumination; and/or
4. Operators are unaware that they may have engaged the auto-headlamp function and/or are unaware of the operation of the auto-headlamp feature, which may cause the headlamps to turn on or off under fluctuating lighting conditions. Some complaints received may in fact be related to this auto-headlamp feature; and/or
5. Parking lamps are not affected by a malfunctioning headlamp switch, which allows other drivers and pedestrians to still locate the position of the vehicle during low ambient lighting conditions.

In addition to EA05-009, Chrysler notes the facts in this investigation closely parallel several other headlamp investigations that were closed with no action taken by either ODI or the manufacturer.[1] Factors leading to closure in these other investigations appear to include one or more of the following:

- Only random and intermittent loss of head lamp function;
- High beam/low beam (i.e., flash to pass) and parking lamp functions were still operable;
- Toggling or moving the switch restored headlamp function, even when both lamps extinguished while driving;
- Flicker or dimming of the headlamps due to voltage variations with no relationship to extinguishing headlamps; and
- Few or no crashes and/or injuries accompanied by low occurrence rates of actual loss of both headlamps while driving.

[1] PE02-005; PE03-017; PE04-020; PE05-007; PE06-017; PE08-066; PE09-019

Chrysler has concluded that all of these factors mitigating the potential for a safety risk are present in the current investigation. Chrysler believes that the Subject Vehicles do not pose an unreasonable risk to motor vehicle safety and this investigation should be closed.