Hogan Lovells US LLP
Columbia Square
555 Thirteenth Street, NW
Washington, DC 20004
T +1 202 637 5600
F +1 202 637 5910
www.hoganlovells.com

November 7, 2013

<u>Via Federal Express</u>

D. Scott Yon, Chief
Vehicle Integrity Division
Office of Defects Investigation
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Re: EA13-003 – Engineering Analysis to Investigate Allegations of Fuel Leaks at or Near the Top of the Fuel Tank Assembly in MY 2003-2008 Mercedes-Benz E-Class Vehicles

Dear Mr. Yon:

This letter is submitted on behalf of Mercedes-Benz USA, LLC ("Mercedes") to the National Highway Traffic Safety Administration ("NHTSA" or "Agency") in response to the Office of Defects Investigation's request for information relating to Engineering Analysis (EA) 13-003 to investigate allegations of fuel leaks at or near the top of the fuel tank assembly in model year (MY) 2003-2008 Mercedes-Benz E-class vehicles.

This letter provides Mercedes' responses to Requests 15-25. Responses to Requests 1-14 were provided on October 31, 2013.

<u>REQUEST NO. 15:</u> *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, MB* ***since MB's response to PE12-001****. 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 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.

RESPONSE TO REQUEST NO. 15:

Following Mercedes' response to PE 12-001, Mercedes conducted the following investigations or actions to better understand the various potential root causes and consequences of fuel leaks on the subject vehicles:

1. [[redacted]

[redacted]

[redacted]

- [redacted]

- [redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

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REQUEST NO. 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* ***peer*** *vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, MB. 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 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.

RESPONSE TO REQUEST NO. 16:

The design and construction of the subject components on peer vehicles are identical to the components on the subject vehicles so no additional assessments or investigations were necessary.

REQUEST NO. 17: *Describe all modifications or changes made by, or on behalf of, MB in the design, material composition, manufacture, quality control, supply, or installation of the subject components from the start of production to date, which relate to, or may relate to, the alleged defect. Please note that the subject component definition has been expanded from the prior PE12-001 request (and MB's April 13, 2012 response to PE12-001 did not provide responses to all of the sub-parts for that request), therefore a full new response is requested. 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 number(s) (service and engineering) of the original component;
e. The part number(s) (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;
h. Whether the modified component can be interchanged with earlier production components; and,
i. Whether the change affected the ***subject*** *and or the* ***peer*** *vehicles.*

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

RESPONSE TO REQUEST NO. 17:

Attachment 17 contains the response to this request. Mercedes is aware of no modifications or changes which are planned for incorporation into vehicle production within the next 120 days.

REQUEST NO. 18: *Provide the following information regarding the subject components:*

a. Provide copies of all failure mode and effects analyses (FMEA) that were produced by MB or any of the subject component suppliers;

RESPONSE:

Attachment 18a includes the FMEA for the fuel tank and related components dated September 4, 2001.

b. Provide copies of all engineering specifications or other performance requirements that were produced by MB or any of the subject component suppliers;

<u>RESPONSE</u>:

Attachment 18b includes a side-by-side translation of the general engineering specification for the fuel tank and attached components, including requirements for design, production technique, quality control measures, material selection, function and transport of the fuel tank in assembly-ready state, equipped with all add-on parts.

c. Provide a detailed description of all durability testing and copies of related test results that were conducted by MB or any of the subject component suppliers;

<u>RESPONSE</u>:

Mercedes and its suppliers conduct extensive testing and validation on the fuel storage systems with respect to durability, both on and off the vehicle, during the development process. [redacted] Attachment 18c contains the durability components of the Design Verification Plan and Report, and summarizes the durability tests and test results for the fuel tank and related components.

d. Provide a list of all parts/subcomponents used in the subject component assemblies, including a picture or drawing of each part, the name of the part, the material composition of the part, the ASTM (American Society for Testing and Materials) and MB material specification/call-outs for all plastic, rubber, and foam parts;

<u>RESPONSE</u>:

Attachment 18d contains images of each of the subject components annotated with the material used, and any applicable specifications.

e. Describe all processes by which the refueling limiter valve is installed/attached to the plastic material the fuel tank itself is constructed of. Identify and describe all changes or modifications to the process made from the start of production to date, and provide the dates on which they occurred;

<u>RESPONSE</u>:

[redacted]

[redacted]

f. Provide a picture or drawing of the assembled fuel tank system with all parts/subcomponents labeled; and,

<u>RESPONSE</u>:

Attachment 18f contains images of the assembled tank system with all parts/subcomponents labeled.

g. List all component leakage/fluid integrity tests, and the pressures at which they are conducted, for any subject component subassemblies, including the fuel tank and the fully assembled vehicle, that are conducted either at the supplier level and/or the final assembly stage.

<u>RESPONSE</u>:

[redacted]

<u>REQUEST NO. 19:</u> *For each subject vehicle model and model year:*

a. Provide MB's recommended procedure for refueling the fuel tank, and state how the procedure is communicated to the consumer/vehicle owner;

<u>RESPONSE</u>:

Mercedes' recommended procedure for refueling clearly states that the tank should only be filled until the automatic filler nozzle cuts off for the first time. This procedure is clearly communicated in several places including: 1) the Mercedes Owners' Manual; 2) the inside of the filler cap access door on the subject vehicles; 3) warning labels provided by most gas stations; 4) various places on the internet, including on the U.S. Environmental Protection Agency website.

The subject vehicles' Operator's Manual states:

"Only fill your tank until the filler nozzle unit cuts out – do not top up or over-fill."

The Operator's Manual also states:

"Warning! Overfilling of the fuel tank may create pressure in the system which could cause a gas discharge. This could cause the gas to spray back out when removing the fuel pump nozzle, which could cause personal injury."

The label inside the filler cap access door states:

Insert Nozzle Properly

DO NOT TOP OFF

Sample warnings from all four sources of information are included in Attachment 19a.

b. State the nominal fuel capacity in the storage tank when the procedure identified in item a is followed, and state any normal and expected variation (min and max) around that capacity;

RESPONSE:

The nominal fuel capacity on the subject vehicles after the first automatic shut-off click is between 78.4-80.0 liters, based on ORVR requirements. There is a range of nominal design values because the interior dimensions of the molded plastic tanks can vary. In addition, the exposure of the plastic tank to fuel can cause a slight expansion of the tank. Tested tank volumes show a range up to 80.2 liters.

c. Discuss any factors outside the consumers' direct control that may lead to, or result in overfilling of the fuel tank even when the procedure in item a is followed (e.g., fuel pump nozzle types, variations in pumping rates from one station to another, altitude, ambient and/or fuel temperature, relative humidity, barometric pressure, and/or fuel types/grades);

RESPONSE:

If the ground at the filling station next to the pump has more than a 4˚ angle, the shut-off signal at the nozzle can be affected so that the maximum or minimum fuel tank capacity can vary slightly. Most filling stations have level ground next to the fuel pump for this reason, and this is not a common cause of overfilling. The maximum stored volume in the tank is independent of ambient temperatures, fuel temperatures, altitude and barometric pressure, special and fuel grades.

d. Discuss any factors within the consumers' control that can lead to overfilling of the fuel tank (e.g., the fuel level at the point they decide to refill the tank, how many times they reapply the fuel pump nozzle after is *has automatically shut off, how fully they depress the fuel nozzle handle when refilling, etc.);*

<u>RESPONSE</u>:

There are three ways to overfill the tank that are within the customer's control:

1. **Topping Off:** First, the customer can "top off" by repeatedly squeezing the fuel filler nozzle handle after the automatic shutoff is first activated. Clicking the nozzle more than three times can lead to an overfilled tank condition.

2. **Trickle Filling:** Second, by filling the tank at a very slow rate, with the nozzle lever partially depressed, "trickle fill" at a rate of 0.3 gal/min. can result in an overfill situation.

3. **Removal and Reinsertion of the Nozzle:** Finally, the expansion volume in the tank can be filled up by pulling the nozzle out of the filler neck, and then reinserting the nozzle to resume filling. Removing the nozzle releases the valve that maintains pressure in the fuel tank expansion reservoir, releases the pressure in the fuel tank reservoir, and resets the refueling limiting process. Reinserting the nozzle and then recommencing the refueling process can fill the vapor expansion tank, the ORVR vent line, and the filler pipe with liquid fuel. This misuse scenario results in the highest volumes of excess fuel in the fuel storage system.

e. Based on the factors identified in items c and d, and any others, state what in MB's view would constitute a refueling procedure that would result in an unreasonable (or abusive) overfilling of the fuel storage system, and describe the specific procedure;

<u>RESPONSE</u>:

The following three refueling practices can result in an unreasonable and abusive amount of fuel in the storage system: 1) topping off with four or more clicks of the automatic shut-off device; 2) reinserting the nozzle after the initial automatic shut-off and filling up the expansion reservoir; 3) filling at a trickle rate < 1 l/min (approximately 0.3 gal/min) until the designed capacity of the fuel tank is exceeded.

f. For the procedure described in item e, state the storage tank fuel capacity the procedure would result in, and state any expected variation (min and max) around that value;

RESPONSE:

[redacted]

g. For the procedure described in item e, state the volume of fuel, if any, that may accumulate in the ORVR vent tube (or other ORVR system components) above the refueling limiter valve, and state any expected variation (min and max) around that value, and state the maximum amount of fuel that can accumulate in this same area under any conditions;

RESPONSE:

[redacted]

h. Describe the expected air pressure in the tank under conditions of minimum and maximum design intent ambient temperatures when the fuel level is full and overfilled (as in items b and e) when the vehicle is static, and describe any normal operating conditions (e.g., aggressive driving, engine operation at idle or wide-open throttle, during hot soak conditions, etc.) that would cause increases or decreases in the fuel tank's internal air pressure;

<u>RESPONSE</u>:

[redacted]

i. Describe in detail the venting system that controls the minimum and maximum air pressures in the tank, list all components involved (including the fuel cap), describe their function, and state the expected range of pressures at which the system will vent air into or out of the tank, and describe any variables (temperature, altitude, pressure, etc.) that may impact the system's operation;

<u>RESPONSE</u>:

Attachment 19i includes a schematic drawing of the fuel storage system with all components labeled and identified. This attachment also includes separate slides showing the following: 1) standard venting process; 2) the level of fuel at the point of automatic shut-off; 3) level and location of fuel after topping off (10 clicks); 4) the level and location of fuel after topping off (10 clicks) and after removal of the fuel filler nozzle; 5) the level and location of fuel after overfilling by removing and reinserting the filler nozzle; 6) the vent path for fuel vapor during refueling; and 7) the vent path for fuel vapor during normal operation.

j. Describe the expected air pressure on both sides of the fuel filter module access port cover plate when the vehicle is being driven in a steady-state at 70 MPH (assume no head/tail wind and worst case conditions for window opening);

RESPONSE:

[redacted]

[redacted]

k. State the maximum pressure differential that the sealing components for the fuel filter module access port cover plate, including the material that seals the electrical harness that connects to the fuel filter module, can sustain for i) as manufactured (new) components, and ii) for components that have been saturated and/or otherwise effected by gasoline.

RESPONSE:

Mercedes performed five different tests to characterize the sealing performance of the fuel filter module access port cover plate to liquids and fuel vapor. These tests, which are described in detail under the response to Request No.15, [redacted]

l. Identify the material used to seal the fuel filter module access port cover plate to the vehicle body and describe the suitability of the material for use in environments with liquid and vaporous gasoline; and,

<u>RESPONSE</u>:

[redacted]

m. Identify the material used to seal the electrical harness that connects to the fuel filter module and describe the suitability of the material for use in environments with liquid and vaporous gasoline.

<u>RESPONSE</u>:

[redacted]

<u>REQUEST NO. 20:</u> *This request is intended to assist ODI in its understanding of the physical fuel level within the fuel tank under specific circumstances. For each unique design subject vehicle fuel tank installation, and for a fuel tank section taken about a lateral (transverse) plane that passes through the center of the refueling limiter valve, produce a drawing that shows the fuel level (i.e., the fluid level across the tank's sectioned width) under the following conditions:*

a. The tank is at nominal full such as described in Request 19, item b, and;
  - *i) Accelerating at 0.2 g;*
  - *ii) Decelerating at 0.2 g;*
  - *iii) Turning right at 0.2 g;*

b. The tank is overfilled as described in Request 19, item e, and;
  - *i) Accelerating at 0.2 g;*
  - *ii) Decelerating at 0.2 g;*
  - *iii) Turning right at 0.2 g; and,*

c. The tank is at 3/4 of nominal full, and
  - *i) Accelerating at 0.2g;*
  - *ii) Decelerating at 0.2g;*
  - *iii) Turning right at 0.2g.*

<u>RESPONSE TO REQUEST NO. 20:</u>

a) Attachment 20a contains the three requested lateral/transverse plane drawings at nominal full capacity.

b) Attachment 20b contains the three requested lateral/transverse plane drawings at the three overfilled capacities described in response to question 19(e).

c) Attachment 20c contains the three requested lateral/transverse plane drawings at ¾ nominal full capacity.

REQUEST NO. 21: *This request is intended to assist ODI in its understanding of the physical fuel level within the fuel tank under specific circumstances. For each unique design subject vehicle fuel tank installation, and for a fuel tank section taken about a longitudinal plane that passes through the center of the fuel filter module, produce a drawing that shows the fuel level (i.e., the fluid level across the tank's sectioned length) under the following conditions:*

a. The tank is at nominal full such as described in Request 19, item b, and;
   i) Accelerating at 0.2 g;
   ii) Decelerating at 0.2 g;
   iii) Turning right at 0.2 g;

b. The tank is overfilled as described in Request 19, item e, and;
   i) Accelerating at 0.2 g;
   ii) Decelerating at 0.2 g;
   iii) Turning right at 0.2 g; and,

c. The tank is at 3/4 of nominal full, and
   i) Accelerating at 0.2g;
   ii) Decelerating at 0.2g;
   iii) Turning right at 0.2g.

RESPONSE TO REQUEST NO. 21:

a) Attachment 21a contains the three requested longitudinal plane drawings at nominal full capacity.

b) Attachment 21b contains the three requested longitudinal plane drawings at the three overfilled capacities described in response to Request No. 19(e).

c) Attachment 21c contains the three requested longitudinal plane drawings at ¾ nominal full capacity.

REQUEST NO. 22: *This request is intended to assist ODI in its understanding of fluid accumulation in the fuel tank depression above the fuel filter module (referred to as a "containment well"), the subject component leakage sources that can contribute to liquid fuel accumulation in the containment well, and the path the fluid takes if it overruns the containment well. For each unique design subject vehicle fuel tank installation:*

a. State the nominal volume and expected variations (min and max) of fluid that can accumulate in the containment well (i.e., without escaping or overrunning) when the vehicle is at rest and on level ground;

RESPONSE:

When the vehicle is at rest on level ground, the theoretical maximum amount of fuel that can be retained in the containment well for the fuel filter module, based on CAD drawings, is 400 ml. The actual amount contained on level ground measured by Mercedes is approximately 500 ml. This differential reflects the limitation of the CAD measurement process. The top of the fuel filter module itself will retain 45 ml of fuel before any fuel flows over into the containment well. Attachment 22a includes the referenced CAD drawings.

b. Identify all known subject component leakage sources that can contribute to accumulation of fuel in the containment well, and discuss the path fuel travels to get from the leak source to the containment well;

RESPONSE:

[redacted]

c. Discuss specifically whether or not leakage from the ORVR vent tube, the refueling limiter valve, or the device(s) that connects the two components together will contribute to fuel in the containment well;

RESPONSE:

[redacted]

d. For each leakage source identified in item b, state the nominal volumes and expected variations (min and max) of fuel the source can potentially contribute to the containment well, and discuss any factors (such as ambient temperature, pressure, fuel tank fill level, vehicle attitude, or affects from driving circumstances) that can affect this volume;

RESPONSE:

[redacted]

[redacted]

e. In the event fluid does accumulate to a level that results in an overrun from the containment well, describe the path the fluid would take as it runs off the top of the fuel tank when the vehicle is static and on level ground, and describe any other path(s) that may result if the vehicle is being driven, and the driving circumstances that cause them;

RESPONSE:

Attachment 22e depicts the path that fluid would take when it exceeds the capacity of the fuel filter containment well, and refueling limiter valve depression.

[redacted]

[redacted]

Attachment 22e shows the path of liquid over the side of the tank and onto the underbody cover. In addition, Attachment 15-2-b shows the placement of the underbody covers under the vehicle.

f. If fuel were to contact exhaust system components during an overrun condition from the containment well, discuss in detail the possibility that the fuel could self-ignite due to contact with high-temperature surfaces, and provide information to substantiate this assessment;

RESPONSE:

As explained in detail during the PE phase of this investigation, it is not possible for fuel from the containment well to contact any high-temperature exhaust components. [redacted] Attachment 22f provides additional information regarding fuel paths and underbody temperatures.

The ignition temperature of liquid gasoline is approximately 1300˚ F depending on the composition of the fuel, substantially higher than the temperature of the heat shield or any other components that fuel could come in contact with. Similarly, the minimum auto ignition temperature ("AIT") for a gasoline air mixture in a partially enclosed vessel at normal atmospheric pressure using ASTM E-659 is around 280˚ C or 536˚ F. The ASTM E-659 test procedure creates an optimal combustion scenario that has been generally recognized to not reflect the actual ignition point of gasoline dripping on a hot surface in open air on a motor vehicle. In the ASTM E-659 test method, approximately 100 µl of fuel is injected into a uniformly heated 500 ml glass flask containing air heated to a predetermined temperature in a furnace. As the liquid enters the flask it evaporates and mixes with the surrounding air. This creates nearly optimal conditions for thermal ignition. The temperature of air and the volume of the liquid sample are adjusted until the minimum AIT is determined. Numerous studies of the auto ignition of hydrocarbons dripped onto a hot surface in open air have established that the surface temperature must be significantly above the accepted minimum AIT of the hydrocarbon involved. For example, an API study of the risk of ignition of hydrocarbons on hot surfaces concluded that a surface temperature of approximately 360˚ F above the accepted minimum AIT of the hydrocarbon is necessary to ignite the fuel in open air.[2] Similarly, research done specifically on gasoline in the automotive context similarly concluded that actual ignition temperatures for gasoline dripped on a hot surface in open air is significantly higher (between 200˚- 655˚ F higher) than the theoretical minimum AIT depending on the test parameters.[3] Finally, according to training materials for NHTSA and other fire investigators, the actual ignition temperature for gasoline on hot surfaces in open air on a vehicle is significantly higher than any temperatures that could be encountered by fuel leaking on the subject vehicles. Specifically, the training materials state that "unless the surface temperatures are greater than 1100˚ F, it is unlikely that gasoline will ignite on an open hot surface."[4] Therefore, even in a case where fuel would overflow the containment well and get onto a hot surface under the subject vehicle, it is not even theoretically possible for self-ignition of the liquid fuel or fuel vapor.

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[2] Ignition Risk of Hydrocarbon Liquids and Vapors by Hot Surfaces in the Open Air, API Recommended Practice 2216, third edition, December 2003.

[3] Colwell, J.D., and Reza, A., "Hot Surface Ignition of Automotive and Aviation Fluids," *Fire Technology*, Vol. 41, No. 2, 2005, pp 99-118; R.E. Ebersole, L. C. Matusz, M. S. Modi, and R. E. Orlando, "Hot Surface Ignition of Gasoline-Ethanol Fuel Mixtures", SAE SP, 2009-01-0016.

[4] Univ. of Washington, Motor Vehicle Fire Investigation, Computer Based Training, Process of Investigation, http://depts.washington.edu/vehfire/ignition/autoignition/process.html; Shields, L.E., and Scheibe, R.R., "Computer-Based Training in Vehicle Fire Investigation Part 2: Fuel Sources and Burn Patterns," SAE 2006-01-0548.

g. Discuss and describe any other vehicle-borne ignition sources that may ignite liquid fuel either while it sits in, or if it overruns the containment well;

RESPONSE:

The Mercedes design ensures that on the subject vehicles there are no sources of vehicle-borne ignition, including ESD, mechanical sparks and electrical sparks, that could ignite liquid fuel leaking from the fuel tank.

h. State the nominal and expected variations (min and max) of the vertical distance that exists between the lower edge of the vehicle body (i.e., the body panel in the area just above the containment well where the fuel filter module access cover is secured) and the upper surface of the fluid when the containment well is filled to its maximum level (i.e., just before overrun), and the vehicle is static and on level ground; and,

RESPONSE:

[redacted]

i. Provide diagrams and/or other illustrations depicting the dimensions described in item h and specifically showing the relationship between the fuel level and a) the lowest point of the fuel filter module access cover, and b) the depression in the body panel where the electrical harness that connects to the fuel filter module is routed.

RESPONSE:

Attachment 22i contains the requested CAD drawings.

REQUEST NO. 23: *From discussions with complainants ODI is aware of two additional leak sources associated with the fuel filter module and the fuel tank. Specifically, liquid fuel leaking from the pressure sensor located on the top of the fuel filter module, and from the fuel tank at the interface of the refueling limiter valve to the plastic material the fuel tank is constructed of. Discuss in detail MB's assessment as to the cause of these leak sources and identify the amount of fuel that could leak from each source both individually and collectively when the tank is filled to a nominal, overfilled, and 3/4 of nominal filled condition.*

RESPONSE TO REQUEST NO. 23:

Leak from the OBD Pressure Sensor Mounting Plate: [redacted]

[redacted]

Leak from the FLV: Mercedes is not aware of any fuel leaks associated with the connection between the FLV and the tank.

Small fuel leaks from the FLV may occur when the FLV is repeatedly soaked with certain types of aggressive fuels with high aliphatics and aromatics, and exposed to high temperatures over time. There are no reports of leaks from the FLV of the subject vehicles in countries in the EU that do not use such fuels. Where such fuels are used, and where customers chronically overfill their tank, chronic exposure of the FLV neck to liquid fuels and high average ambient temperatures can affect the stability of the plastic in the FLV neck. In addition, as the aggressive components of the fuel are absorbed into the plastic of the FLV, this soaking and swelling can cause damage to the plastic in the FLV neck itself, and result in microscopic fissures in the FLV neck. [redacted] Variations in these factors, along with variations in the type of fuel used, the frequency of over-filling the tank, and the operating temperature of vehicle over time, all play a role in determining whether micro-cracks will form in the FLV. [redacted]

REQUEST NO. 24: *This request relates to NHTSA Safety Recall No. 12V-557. On November 30, 2012, MB submitted a Defect and Noncompliance Information Report to notify the agency of its decision to conduct a safety recall on certain MY 2011 and 2012 MB S-, C-, E-, E-Coupé, GLK-, and CL-Class vehicles to remedy a defect in the fuel filter module. In the defect description, MB stated that the flange of the fuel filter could crack and result in fuel leaks and/or a loss of fuel system pressure and flow. NHTSA assigned Safety Recall No. 12V-557 to MB's recall action. Regarding Safety Recall No. 12V-557:*

a. Provide the total number (counts) of each of the following that MB received, or was otherwise aware of, as of the date that MB determined that a safety recall should be initiated in the U.S., by make, model, and model year of the recalled vehicles:

i) Consumer complaints;
ii) Warranty claims;
iii) Fire allegations;
iv) Injuries or injury allegations; and,
v) Fatalities or fatality allegations.

b. Provide a narrative description of any and all similarities and/or differences between the fuel filter module of the vehicles within the scope of Safety Recall No. 12V-557 and the fuel filter module used on the subject and peer vehicles.

c. Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that led to, or preceded the determination to conduct Safety Recall No. 12V-557 and its remedy. For each such action, provide the following information:

i) Action title or identifier;
ii) The actual or planned start date;
iii) The actual or expected end date;
iv) Brief summary of the subject and objective of the action;
v) Engineering group(s)/supplier(s) responsible for designing and for conducting the action;
vi) A brief summary of the findings and/or conclusions resulting from the action; and,
vii) Whether each action is identified and/or described in the Chronology (Part 573.5 (c)(6)) section of the Safety Recall No. 12V-557 Defect and Noncompliance Information Report.

RESPONSE TO REQUEST NO. 24:

Recall 12V-557 was conducted because of a leak in the pressurized portion of the fuel filter module in vehicles affected by the Recall. The fuel filter in the Recall was made by Magna Steyr, and the fuel filter used on subject E-Class vehicles was made by Continental. The issue covered by the Recall resulted from weaknesses in the microstructure of the flange caused by the injection molding process. The potential leaks on the subject E-Class fuel filters are different, resulting from a combination of issues discussed above, including the ultrasonic welding process, exposure to aggressive fuel components and high temperature over time. Leaks in the pressurized portion of the fuel filter module in vehicles affected by the Recall, which transmits fuel to the engine at a pressure of 82.6 psi on the affected units, can result in a constant stream of fuel being sprayed from the filter at high pressure. Due to the high pressure, cracks that form can grow rapidly due to the pressurized fuel. Fuel will continue to spray out of the filter module in the Recall condition, for as long as the engine is running, and there is fuel remaining in the tank. Fuel sprayed at high pressure from the filter may not remain in a single controlled location. In addition, a loss of integrity in this portion of the system can lead to engine performance issues or vehicle disablement. In addition, there is no OBD leak detection for a leak in the pressurized part of the system. All of these features distinguish the recalled vehicles from vehicles like the subject E-Class vehicles, which are subject to slow leaks of vapor or small quantities of fuel from the un-pressurized portion of the system, which can weep liquid fuel only when the tank is full or during refueling, and which are subject to OBD leak detection. Recall 12V-557 was initiated without any formal tests or actions. Mercedes had 28 warranty claims, and no complaints, fire allegations, injury allegations, or fatality allegations at the time it initiated Recall 12V-557.

<u>REQUEST NO. 25:</u> *In consideration of any additional information accumulated and evaluated in preparation of MB's response to this letter, furnish an update to MB'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. The fire risk that it poses;
f. 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,
g. The reports included with this inquiry.

<u>RESPONSE TO REQUEST NO. 25:</u>

Mercedes' additional investigation of the sources and consequences of fuel leakage in the subject vehicles has confirmed its original assessment, and validated the conclusion made in April of 2012 that this issue does not present a safety related defect on the subject or peer vehicles. Fuel leaks can occur on subject vehicles due to a variety of distinct root causes discussed above, including improper handling of the seals and retention rings on the modules during service, the fuel filter module flange, and the FLV. Leakage from any of these locations is inherently limited by the fact that they are on the top of tank, where there is little or no fuel stored when the tank is not over-filled. Further limiting the consequences of these leaks are the indentations on the top of the tank which collect leaked fuel from all known sources, and allow it to evaporate rather than spill onto the ground.

The recent evaluations done for the purpose of this EA have confirmed that when the leaks originate from the subject components (rather than incorrect service procedures), the potential leakage rate is extremely small, and is most commonly associated with emission of fuel vapors which result in odor complaints. [redacted] This is consistent with warranty data which show 2% referencing a leak large enough to activate the OBD MIL (0.5 mm). [redacted] Leaks from the FLV are further mitigated by the high location on the tank, where liquid fuel is generally only present during overfilling events and shortly after the refueling process. Where larger leaks are alleged, our investigation indicates [redacted]

Fuel leaking onto the ground or into the passenger compartment is not capable of creating a safety risk in the absence of a source of ignition. As described above, sources of ignition do not exist near the subject components. Nevertheless, Mercedes has investigated the potential for such leaks to better understand the potential for customer satisfaction complaints related to these issues. With respect to the risk of leakage onto the ground, this analysis indicates that evaporation and small leak sizes are significant factors in preventing fuel from accumulating in sufficient volume to overflow from the top of the tank. Specifically, the evaporation rate of fuel is greater than, or equal to, more than 90% of leaks that have been observed in fuel filter module examinations. Finally, even if fuel were to overflow from the top of the tank, the subject vehicles have underbody covers which function like a secondary containment vessel to prevent leakage onto the ground. With respect to fuel leaking into the passenger compartment, Mercedes' recent investigations have also confirmed that the access cover plate provides an effective seal against liquid fuel and vapor entering the passenger compartment, so long as it is properly reinstalled during service.

Finally, additional analysis of the potential for ignition of fuel from exposure to hot surfaces has once again confirmed that there are no sufficiently hot surfaces in the area where fuel may leak, and no other sources of potential ignition of fuel from any part of the vehicle are present.

With respect to customer warnings, humans are extremely sensitive to the smell of fuel vapor, which provides a strong early indication of the need for service on the fuel system. The efficacy of this warning is enhanced by the fact that the failure mechanisms analyzed for this EA require significant time to progress from an early stage where only vapor is emitted, to a stage where there is potential for liquid fuel to accumulate on the top of the tank. Where initial warnings are ignored, the amount of fuel odor generated by a leak will increase as micro-cracks grow and result in increasing amount of fuel on the outside of the tank, greater evaporation, and thus greater odor. Where the smell of fuel is not sufficient to cause a service visit, the vehicles' OBD system will detect leaks as small as 0.5 mm, and activate a MIL on the instrument cluster, which can only be cleared by a service technician.

For all of these reasons, Mercedes has concluded that a safety related defect does not exist on the subject or peer vehicles.

Please feel free to contact me with any questions regarding this matter.

Sincerely,

R. Latane Montague

Partner
latane.montague@hoganlovells.com
D 1-202-637-6567