Kia America, Inc.
Corporate Headquarters
111 Peters Canyon Road, Irvine, CA 92606-1790 USA

VIA ELECTRONIC SUBMISSION

October 23, 2023

Peter Kivett, Chief VDD-C
Office of Defects Investigation
U.S. Department of Transportation
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington D.C. 20590

Re: **Preliminary Evaluation (PE23-012);**
Reduced/Complete Loss of Motive Power Due to ICCU Failure
(MY) 2022 Kia EV6

Dear Mr. Kivett:

This letter is submitted in response to your letter received by Kia America, Inc. ("Kia") on July 24, 2023 (Reference NEF-103LCN/PE23-012). That letter requested information regarding "allegations of reduced or complete loss of motive power and failure of the Integrated Charging Control Unit in certain model year (MY) 2022 Kia EV6 electric vehicles" while driving.

REQUEST NO. 1:

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, Kia. 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.

RESPONSE TO REQUEST NO. 1:

A list of the "Actions" responsive to this request is being submitted. **TAB A** and associated documents **TABS A.1-A.6.**

The source of the information submitted in response to this request is Kia Corporation. The information was collected as of October 5, 2023.

REQUEST NO. 2:

Describe all modifications or changes made by, or on behalf of, Kia in the design, material composition, manufacture, quality control, supply, or installation of the subject component, 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 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; and
h. Whether the modified component can be interchanged with earlier production components.

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

RESPONSE TO REQUEST NO. 2:

A list of the modifications responsive to this request is being submitted. **TAB B**.

The source of the information submitted in response to this request is Kia Corporation. The information was collected as of October 5, 2023.

REQUEST NO. 3:

State the number of each of the following that Kia has sold that may be used in the subject vehicles by component name, part number (both service and engineering/production), model and model year of the vehicle in which it is used and month/year of sale (including the cut- off date for sales, if applicable):

a. Subject component;
b. Add any further requests or delete all, including requests for similar or substantially

similar components;
c. Any kits that have been released, or developed, by Kia for use in service repairs to the subject component/assembly.

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 Kia is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

RESPONSE TO REQUEST NO. 3:

A chart summarizing the requested part sales data and supplier information is being submitted. **TAB C.**

The source of the information submitted in response to this request is Kia America, Inc. and Kia Corporation. The information was collected as of July 15, 2023.

REQUEST NO. 4:

Furnish Kia's assessment of the alleged defect in the subject vehicles, 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 in our first information request letter dated June 23, 2023.

RESPONSE TO REQUEST NO. 4:

This investigation relates to reports of failure of the Integrated Charging Control Unit (ICCU) in certain 2022MY Kia EV6 vehicles and focuses on instances of reduced or eventual complete loss of motive power caused by such failure.

A review of Kia's field data indicates that 0.37% (73 unique VINs/19,824 vehicles)[1] of 2022MY EV6 vehicle population reported reduced motive power or a loss of motive power as a result of an ICCU failure. This is consistent with Kia's understanding of the progression of events that result

[1] The total number identified represent unique VINs from Customer Care Complaints (CC's), Techline Assistance Reports, and warranty claims. Kia further notes that in its 8/18/2023 response it submitted 180 warranty claims involving the repair/replacements of the ICCU unit. However, the majority of those claims do not involve reduced motive power or loss of motive power. Only 42 of the 180 claims involve reports of loss of motive power for a claims rate of 0.21%.

when an ICCU failure occurs; i.e., drivers are provided with both visual and audible warnings well before motive power is reduced. As explained in more detail below, the vehicle's motive power only becomes impacted if the driver continues to operate their vehicle while the ICCU is damaged despite multiple successive warnings (including a message instructing the driver to "stop vehicle"). Under those conditions, the vehicle is designed to engage its failsafe logic that will progressively reduce the vehicle's motive power. Even with this progression of reduced motive power key vehicle features, such as steering assist, brake assist, exterior lighting, rearview camera, and door locks continue to operate normally allowing the driver to safely maneuver their vehicle off of the roadway and call for assistance.

In addition, no injuries or deaths have been reported as a result of ICCU failure in the subject vehicles.[2] Moreover, Kia has addressed this issue in production, and has initiated a voluntary service campaign with customer notification (SC271) to remedy the affected vehicles in the field. As such, Kia does not believe that the ICCU condition creates an unreasonable risk to motor vehicle safety.

Function of ICCU and Background

The ICCU is an assembly that is located under the rear seat and combines the functions of a bidirectional onboard charger and a low-voltage DC-to-DC converter. The bidirectional onboard charger converts 110/220 V alternating current (AC) to direct current (DC) to supply power to the high-voltage battery while the vehicle is connected to an external charging infrastructure (i.e., electric vehicle supply equipment) for vehicle charging. It can also operate in the reverse direction (DC to AC) to supply household voltage (110/220 V) to devices plugged into vehicle outlets via the vehicle-to-load function. The low-voltage DC-to-DC converter function in the 2022MY EV6 is analogous to the function of an alternator in a vehicle powered by an internal combustion engine by converting high-voltage battery power to low voltage to charge the 12-volt auxiliary battery. In turn, the 12-volt auxiliary battery supplies power to many vehicle systems and devices, such as steering assist, brake assist, exterior lighting, rearview camera, and door locks.

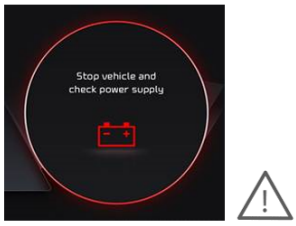
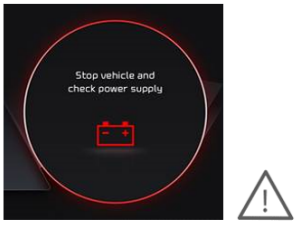
Progressive Failsafe Logic. The ICCU contains progressive failsafe logic in case of a failure of the low-voltage DC-to-DC converter.[3] If a DTC is detected, warning lights, warning messages, and warning sounds activate on the vehicle's instrument panel alerting the driver to the issue. If the driver turns the vehicle off during this time, the vehicle may prevent restarting, requiring it to be towed for service.

If the vehicle continues to be driven despite the initial warning, additional visual and audio warnings are provided, and the drive power is subsequently reduced in a progressive fashion. It is

[2] In one customer complaint, the customer alleges his ICCU failed and caused him to hit a pole and sustain bumper damage. The circumstances leading up to the alleged contact with the pole as described by the customer are unclear to Kia. The customer did not report any injuries. See Kia IR Response submitted on 8/18/2023.

[3] A DC-to-DC failure can be identified by DTC P1A9096 (DC/DC Converter Input Voltage Sensor Fault).

important to note that the vehicle's drive power is limited by design to maximize the vehicle's driving range and provide time for the driver to stop the vehicle before the auxiliary battery discharges to a point that renders the vehicle undrivable. Ultimately, if the driver fails to heed the multiple warning messages and continues to drive the vehicle despite the five steps of increased warnings and reductions in power, the vehicle will eventually come to a stop. To date, Kia is not aware of any indications of a defect associated with the intended failsafe drive logic used in the subject vehicles. The table below summarizes the warnings provided to the driver and details the gradual reductions in power if the vehicle continues to be operated while the ICCU is damaged.

	Condition	Warning Type	Details (indicated durations are based on vehicle test)
Step 1	Upon LDC failure	Visual and audible warnings	Warning message, lights, and sound are activated (duration: 3 minutes): - "Check electric vehicle system" warning message - Master warning light - Charging system warning light - Audible warning chimes (every 3 minutes) - Normal driving possible - Vehicle restart is possible 
Step 2	3 minutes after LDC failure, if vehicle continues to be operated	Visual and audible warnings	Warning message, light, and sound are activated (duration: 23 minutes): - "Stop vehicle and check power supply" warning message - Master warning light - Audible warning chimes (every 3 minutes) - Normal driving possible - Vehicle restart is possible 
Step 3	When auxiliary battery drops below 11.5 V, if vehicle continues to be operated	Visual and audible warnings + speed reduction	Warning message, light, and sound are activated, along with a reduction in power (duration: 10 seconds): - "Stop vehicle and check power supply" message - Master warning light - Audible warning chimes (every 3 minutes) - Vehicle power is reduced and speed is limited to 50 kph (31 mph) - Vehicle restart is possible 

Cont'd	Condition	Warning Type	Details (indicated durations are based on vehicle test)
Step 4	When auxiliary battery drops below 11.0 V, if vehicle continues to be operated	Visual and audible warnings + further speed reduction	Warning message, lights, and sound are activated, along with a further reduction in power (duration: 5 minutes): - "Stop vehicle and check power supply" message - Master warning light - Power down (turtle) warning light - Audible warning chimes (every 3 minutes) - Vehicle power is further reduced and speed is limited to 20 kph (12 mph) - Vehicle restart is possible 
Step 5	When auxiliary battery drops below 10.5 V, if vehicle continues to be operated	Visual and audible warnings + maneuvering speed (restart inhibited)	Warning message, lights, and sound are activated, along with a further reduction in power (duration: 5 minutes): - "Stop vehicle and check power supply" message - Master warning light - Power down (turtle) warning light - Audible warning chimes (every 3 minutes) - Vehicle power is further reduced and speed is limited to approximately 9 kph (6 mph) - Vehicle restart is inhibited  Note: If the vehicle continues to be driven and the auxiliary battery continues to discharge, various warning lights are turned on, vehicle speed decreases gradually and the vehicle stops, as systems lose power.

On May 8, 2023, NHTSA informed Kia's North America Safety Office ("NASO") that it was investigating 21 VOQ complaints related to the ICCU failure allegations in the 2022MY Hyundai Ioniq and inquired as to whether Kia had a peer model exhibiting a similar issue. During the Kia-ODI meeting on May 10, 2023, NASO updated ODI regarding the EV6 ICCU issue and advised that the ICCU failure is related to an LDC failure, the cause of which was under investigation. Additional testing conducted by Kia confirmed that the EV6 can be driven for 22 minutes[4] with the ICCU compromised before power reduction will begin to occur. During that time period, the driver receives an abundance of warning messages as described in the above table.

On May 29, 2023, NASO advised NHTSA that it was planning to conduct a service campaign with customer notification to address this issue.

Analysis

[4] Total drive time prior to loss of motive power can be affected by the cumulative loads from accessory systems/components and ambient conditions.

Kia's field data contains 35[5] customer complaints alleging reduced motive power or eventual loss of motive power (0.18% complaint rate). Notably, none of those reports allege a sudden loss of motive power while driving. Instead, customers that experience reduced power due to an ICCU failure first receive several clear warnings and instructions to pull their vehicles off of the road. In fact, the majority of these customers (24 of 35) reported receiving warning messages informing them that their vehicle was compromised before the power reduction occurred. This is consistent with the vehicle's failsafe logic which allows the vehicle to be driven for approximately 22 minutes after the ICCU is compromised before the drive power becomes affected. During that time, the driver receives audible warnings (beeps) as well as visual warnings instructing them to "Check the electric vehicle system" and to "Stop vehicle and check power supply" before motive power is reduced. These warnings and instructions are specifically identified in the EV6 Owner's Manual so that the customer understands the importance of them.

In particular, on page 2-47 of the EV6 Owner's Manual, customers are introduced to the "Check the electric vehicle system" warning. Drivers are instructed to immediately stop driving, pull over, and have their vehicle towed if they receive this message.

Check electric vehicle system



A: **Check electric vehicle system**
This warning message is displayed when there is a problem with the electric vehicle control system.

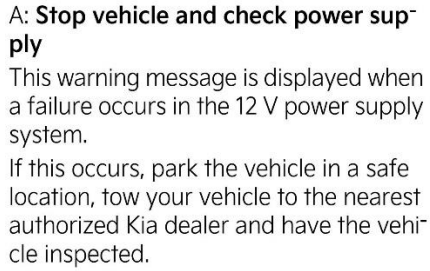
⚠ WARNING
Refrain from driving when the warning message is displayed.
If this occurs, park the vehicle in a safe location and have your vehicle towed to the nearest authorized Kia dealer and have the vehicle inspected.

The second warning message affirmatively tells drivers to, "Stop Vehicle and Check Power Supply[.]"

Stop vehicle and check power supply



[5] Kia identified 36 Customer Care responsive complaints in its response dated 8/18/23. However, CC No. 15477348 and CC No. 15669600 relate to the same incident. Thus, Kia's analysis is based on the 35 identified non-duplicative customer complaints.


A: **Stop vehicle and check power supply**
This warning message is displayed when a failure occurs in the 12 V power supply system.
If this occurs, park the vehicle in a safe location, tow your vehicle to the nearest authorized Kia dealer and have the vehicle inspected.

If these messages are ignored and the vehicle is continually operated, it will enter the third stage of the failsafe logic, which reduces the vehicle's drive power. The reduction in power is designed to gradually reduce the vehicle's acceleration capabilities in an effort to maximize the potential driving distance for the customer before the auxiliary battery discharges to a point that ultimately renders the vehicle undrivable. The vehicle can still be driven at a maximum speed of 31 mph for approximately 22 minutes and key vehicle safety functions (steering assist, exterior lighting, door locks, rearview camera, etc.) remain fully operational.

An example of this is reflected in VOQ No. 11520591 where an ICCU failure occurred while the customer was driving 55 mph. Here, the customer acknowledges driving an additional "2 miles" after receiving the first warning and receiving a second warning to "Stop Vehicle and Check Power Supply" before experiencing a reduction in motive power. Indeed, even in this instance, the customer acknowledges that the power reduction was gradual (i.e., "my vehicle started throttling my speed down"), all safety features remained operative, and they were able to safely maneuver to a parking lot to turn off the vehicle and seek assistance.

Notably, many of the 35 complaints relate to part supply issues affecting the repair time for their vehicles. Of the 35 customer complaints, 25 reference some form of part delays causing the customer to lose use of their vehicle. In many of those instances, the parts delay and lack of availability of their vehicle was the first issue raised when Kia Customer Care was contacted, suggesting that the lack of parts and increased vehicle downtime was the primary concern for those customers. This is also reflected in a variety of references to part supply concerns in the 11 VOQs identified as part of this investigation. (See VOQ No. 11522379, complaining because "parts are on backorder in the US with no ETA from Korea."; VOQ No. 11528221 complaining because "[t]he dealership could not tell me when the part would arrive so they could replace it."; and VOQ No. 11527585, stating "[t]he worst part is just the wait time for backordered parts. . .[,] dealership can't even give us an estimate of when to expect the parts.") Although Kia takes these complaints seriously and is working with the suppliers to address these concerns, the concerns raised are customer satisfaction issues that are unrelated to motor vehicle safety.

On July 11, 2023, Kia initiated Voluntary Service Campaign (SC271) to inspect the ICCU and install an improved software logic in the 2022-2023MY EV6 to address damage to the ICCU caused by an over-current condition in the high-voltage system. Owners were notified of the campaign on July 13, 2023, and advised that the condition could cause the illumination of the "Service Warning Light," "Check electric vehicle system", and/or "Stop vehicle and check power supply" warning messages, along with audible beeps, instructing the driver to stop the vehicle at a safe location. Customers were further advised that if the vehicle continues to be driven despite the

warnings, the vehicle would gradually come to a halt. Customers were instructed to stop the vehicle at a safe location if any of the above warnings were experienced and request towing assistance via Kia's Roadside Assistance program. As of October 20, 2023, the campaign completion rate is 49%.

CONCLUSION

Based on the presence of significant warnings and messages and the gradual nature in the reduction of motive power, Kia does not believe that the ICCU issue identified in the 2022MY EV6 creates an unreasonable risk to motor vehicle safety. The designed power reduction occurs gradually over time permitting the driver to safely navigate their vehicle off of the roadway and seek assistance.

Kia's assessment of the VOQs included as part of the IR letter is submitted**. TAB D.**

REQUEST NO. 5:

Provide responses to each item below and all related design and/or test documents:

a. Detailed description of the design, function, logic, and principles of operation of the subject components.
b. Detailed description of the parameters and logic that trigger Diagnostic Trouble Code P1A9096 – DC/DC Converter Input Voltage Sensor Fault.
c. Detailed description of the design and function of the DC/DC Converter Input Voltage Sensor.
d. Design specification for the DC/DC Converter Input Voltage Sensor, ICCU Fuse, all Field Effect Transistors (FET), and 12V auxiliary battery
e. Manufacturing first article test records and production lot test records for the DC/DC Converter Input Voltage Sensor, ICCU Fuse, all Field Effect Transistors (FET), and 12V auxiliary battery.
f. A complete list with a detailed description including the range of voltage draw from the 12V battery, for all items, components, and accessories, that draw a load from the 12V battery.

RESPONSE TO REQUEST NO. 5:

The information and documents are being submitted as follows:

a) See TAB 5A
b) See TAB 5B
c) See TAB 5C
d) See TAB 5D
e) See TABS 5E.1—5E.52
f) See TAB 5F

The source of the information submitted in response to this request is Kia Corporation. The information was collected as of October 5, 2023.

If you have any questions or if you need anything further, please do not hesitate to contact me.

Sincerely,

Jurassic park (Oct 23, 2023 15:28 PDT)

J.S. (Jurassic) Park
Vice President, Chief Safety Officer