NHTSA issued this Supplemental Initial Decision on July 31, 2024, pursuant to 49 U.S.C. § 30118(a) and 49 C.F.R. § 554.10. This is a pre-publication copy of the Federal Register notice.

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DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

Docket No. NHTSA-2023-0038

Supplemental Initial Decision that Certain Frontal Driver and Passenger Air Bag Inflators Manufactured by ARC Automotive Inc. and Delphi Automotive Systems LLC, and Vehicles in Which Those Inflators Were Installed, Contain a Safety Defect

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

ACTION: Notice of supplemental initial decision; request for public comments.

SUMMARY: NHTSA is confirming its initial decision that certain frontal driver and passenger air bag inflators manufactured by ARC Automotive Inc. and Delphi Automotive Systems LLC, and vehicles in which those inflators were installed, contain a defect related to motor vehicle safety. NHTSA is issuing this supplemental initial decision to address in greater detail the basis for the agency's initial decision and to ensure that all vehicles and manufacturers that would be impacted by any recall order are included within the scope of the initial decision.

DATES: Comments must be received on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: You may submit written submissions to the docket number identified in the heading of this document by any of the following methods:

- *Federal eRulemaking Portal:* Go to https://www.regulations.gov. Follow the online instructions for submitting comments.
- *Mail:* Docket Management Facility: U.S. Department of Transportation, 1200 New Jersey Avenue SE, West Building Ground Floor, Room W12-140, Washington, DC 20590-0001.

- *Hand Delivery or Courier:* 1200 New Jersey Avenue SE, West Building Ground Floor, Room W12-140, between 9 a.m. and 5 p.m. ET, Monday through Friday, except Federal holidays.
- *Fax:* (202) 493-2251.

Instructions: All submissions must include the agency name and docket number. Note that all written submissions received will be posted without change to https://www.regulations.gov, including any personal information provided. Please see the Privacy Act discussion below. We will consider all written submissions received before the close of business on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

Docket: For access to the docket to read background documents or written submissions received, go to https://www.regulations.gov at any time or to 1200 New Jersey Avenue SE, West Building Ground Floor, Room W12-140, Washington, DC 20590, between 9 a.m. and 5 p.m., Monday through Friday, except Federal Holidays. Telephone 202-366-9826.

Privacy Act: In accordance with 49 U.S.C. § 30118(b)(1), NHTSA will make a final decision only after providing an opportunity for manufacturers and any interested person to present information, views, and arguments. DOT posts written submissions submitted by manufacturers and interested persons, without edit, including any personal information the submitter provides, to www.regulations.gov, as described in the system of records notice (DOT/ALL-14 Federal Docket Management System (FDMS)), which can be reviewed at www.transportation.gov/privacy.

Confidential Business Information: If you wish to submit any information under a claim of confidentiality, you must submit your request directly to NHTSA's Office of the Chief Counsel. Requests for confidentiality are governed by 49 CFR part 512. NHTSA is currently treating electronic submission as an acceptable method for submitting confidential business information

(CBI) to the agency under part 512. If you would like to submit a request for confidential treatment, you may email your submission to Allison Hendrickson in the Office of the Chief Counsel at allison.hendrickson@dot.gov or you may contact her for a secure file transfer link. At this time, you should not send a duplicate hardcopy of your electronic CBI submissions to DOT headquarters. If you claim that any of the information or documents provided to the agency constitute confidential business information within the meaning of 5 U.S.C. § 552(b)(4) or are protected from disclosure pursuant to 18 U.S.C. § 1905, you must submit supporting information together with the materials that are the subject of the confidentiality request, in accordance with part 512, to the Office of the Chief Counsel. Your request must include a cover letter setting forth the information specified in NHTSA's confidential business information regulation (49 CFR § 512.8) and a certificate, pursuant to § 512.4(b) and part 512, appendix A. In addition, you should submit a copy, from which you have redacted the claimed confidential business information, to the Docket at the address given above.

FOR FURTHER INFORMATION CONTACT: Allison Hendrickson, Office of the Chief Counsel, National Highway Traffic Safety Administration, 1200 New Jersey Avenue SE, Washington, DC 20590; (202) 366-2992.

The publicly available information on which this supplemental initial decision is based is available on the agency's website at https://www.nhtsa.gov/recalls?nhtsaId=EA16003, https://www.nhtsa.gov/recalls?nhtsaId=PE15027, and on the public docket under Docket No. NHTSA-2023-0038.

The information in the investigative file for which confidential treatment has been requested was shared with the manufacturers that would be affected in the event of a recall order, as required under 49 U.S.C. § 30118(a) and 49 CFR § 554.10(b). That information was shared with the manufacturers under a protective agreement. The information subject to confidentiality requests remains unredacted in this document pursuant to 49 U.S.C. § 30167(b). File-path citations to the investigative file have been shared with the manufacturers in a confidential appendix to this decision.

SUPPLEMENTARY INFORMATION:

Pursuant to 49 U.S.C. § 30118(a) and 49 CFR § 554.10, NHTSA confirms its initial decision that certain frontal driver and passenger air bag inflators manufactured by ARC Automotive Inc. (ARC) and Delphi Automotive Systems LLC (Delphi), and vehicles in which those inflators were installed, contain a defect related to motor vehicle safety.

NHTSA previously issued an initial decision on September 5, 2023.[1] After additional consideration of the totality of the evidence, including comments previously submitted in this proceeding, NHTSA is issuing this supplemental initial decision to address in greater detail the basis for the agency's initial decision and to ensure that all vehicles and vehicle manufacturers that would be impacted by any recall order are included within the scope of the initial decision. This action allows for additional transparency and additional comment from any interested persons.[2]

The additional information provided in this notice confirms the agency's initial decision that certain frontal driver- and passenger-side hybrid toroidal air bag inflators manufactured by ARC and Delphi from 2000 through the full implementation of the automated borescope (the subject inflators) contain a defect related to motor vehicle safety. The implementation of the

[1] 88 FR 62140 (Sept. 8, 2023).

[2] NHTSA is addressing certain comments in this supplemental initial decision to describe the basis of its initial decision more fully and, in certain instances, to update certain information, including its calculation of predicted future ruptures. NHTSA reviewed and considered all written and oral comments previously submitted in this proceeding. NHTSA intends to further and more fully address all comments it ultimately receives if and when it issues a final decision in this proceeding.

borescope, beginning in August of 2017, was fully completed in June of 2018. The latter date is a correction from the January 2018 completion date identified in the September 5, 2023 initial decision.[3]

Based on available information, approximately 51 million subject inflators were manufactured and installed in approximately 49 million vehicles in the United States.[4] The subject inflators were incorporated into air bag modules manufactured by five air bag module suppliers and ultimately used in vehicles manufactured by 13 vehicle manufacturers: BMW of North America, LLC (BMW), FCA US LLC (FCA), Ford Motor Company (Ford), General Motors LLC (GM), Hyundai Motor America, Inc. (Hyundai), Jaguar Land Rover North America (JLR), LLC, Kia America, Inc. (Kia), Maserati North America, Inc., Mercedes-Benz USA LLC, Porsche Cars North America, Inc. (Porsche), Tesla Inc., Toyota Motor North America, Inc. (Toyota), and Volkswagen Group of America, Inc. (Volkswagen).[5] Although JLR was not included in the September 2023 initial decision, the agency has confirmed that it has vehicles in the U.S. with the subject inflators.

These air bag inflators are at risk of rupturing when the vehicle's air bag is commanded to deploy, causing metal debris to be forcefully ejected into the occupant compartment of the vehicle. A rupturing air bag inflator poses an unreasonable risk of serious injury or death to vehicle occupants. At least seven people have been injured and one person has been killed by these rupturing air bag inflators within the United States. NHTSA has identified evidence during

[3] ARC completed implementation of the automated borescope process on lines producing PH7 inflators (which are passenger-side inflators) in January 2018, and then completed implementation on the remaining lines producing toroidal inflators in June 2018.

[4] While the correction to June 2018 increases the number of subject inflators, based on best available information, the agency is adjusting its estimate to approximately 51 million inflators. The exact number of recalled inflators and vehicles would be confirmed by the manufacturers as part of any recall filings that may result.

[5] In the event of a recall order, BMW would be responsible for recalling vehicles manufactured by Rolls Royce Motor Cars, General Motors would be responsible for recalling vehicles manufactured by Isuzu Motors Limited, and Volkswagen would be responsible for recalling vehicles manufactured by Audi AG.

its investigation that connects these ruptures to the friction welding process, which has created, in some instances, blockage material, including excessive weld flash, and, in others, insufficient friction weld bonds. Upon air bag deployment, any loose debris in the center support, including weld flash, can block the exit orifice, causing over-pressurization and rupture. Additionally, friction welds with insufficient bonds have also led to inflator ruptures. The same friction welding process was used across ARC and Delphi's various manufacturing plants and lines to produce the subject inflators. When an inflator ruptures, shrapnel or metal fragments from the inflator are forcefully propelled through the air bag cushion and into the occupant compartment. Additional inflator ruptures are expected to occur in the future, risking more serious injuries and deaths, if they are not recalled and replaced.

I. Investigation and Proceeding Background

On July 13, 2015, NHTSA's Office of Defects Investigation (ODI) opened a Preliminary Evaluation (PE) defect investigation, designated PE15-027, to investigate an alleged safety defect in hybrid toroidal inflators designed by ARC and manufactured by ARC and Delphi for use in vehicles sold or leased in the United States. NHTSA opened the investigation after receiving reports of ruptures in vehicles (field ruptures). Specifically, driver-side air bag inflators in a model year (MY) 2002 Chrysler Town & Country and a MY 2004 Kia Optima ruptured upon air bag deployment during crashes.

In the early stages of the investigation, NHTSA collected information from ARC regarding the design and manufacturing process for frontal driver- and passenger-side hybrid toroidal inflators. Frontal driver-side and passenger-side inflators are used to inflate air bags immediately in front of vehicle occupants in those seats. A hybrid inflator uses stored gas that is excited by propellant to fill the air bag cushion, and toroidal inflators are round, non-cylindrical inflators. NHTSA's investigation involved both single-stage and dual-stage inflators. Single-stage inflators deploy at a preset speed and at full force. Dual-stage inflators deploy at two different stages depending on the size of the occupant as measured by the load sensor in the front seat and the severity of the impact.[6] ARC licensed its design and manufacturing specifications to Delphi, which manufactured approximately 11 million of the approximate 51 million subject inflators using the same friction welding process at issue.[7] ARC manufactured the other subject inflators at several different manufacturing facilities.

NHTSA learned that, based on ARC's inflator design, part of the manufacturing process for these inflators involves a welding method known as friction welding. Through this method, once certain pieces of the inflator are ready to be joined together, they are aligned. One piece is held stationary while the other is rotated at a high velocity and simultaneously pressed together with the stationary piece. The friction generated by the high-velocity rotation creates heat, which melts the metal. Once the proper temperature has been reached, the rotation is stopped, and the pressure is increased to weld the parts together. Each inflator undergoes three friction welds at two points in the manufacturing process.[8] Friction welding produces a byproduct called "weld flash" or "weld slag" that accumulates along the weld seam. In an attempt to prevent weld flash from blocking the gas flow during deployment, a pin, known as a flash-dam pin, is inserted through the exit orifice during the friction welding process between the center support and upper

[6] The two inflation stages can deploy sequentially or simultaneously. Typically, the first stage is approximately 80% of the full force of the air bag, and the second stage is approximately 20% of the full force of the air bag. The second stage can deploy simultaneously with the first stage should the severity of the impact warrant dual deployment. The second stage can deploy subsequent to the deployment of the first stage for lower severity impacts.
[7] Delphi stopped manufacturing the inflators in 2004. The Delphi entity that manufactured these inflators no longer exists. NHTSA indicated in its April 27, 2023 recall request letter that the entity was acquired by Autoliv ASP, Inc. ("Autoliv"). Autoliv has since provided NHTSA with some information indicating that it may not have legal liability for the Delphi-manufactured inflators. At this time, NHTSA has not verified the entity that has legal responsibility under 49 U.S.C. Chapter 301 for those inflators. However, regardless of that responsibility, the vehicle manufacturers that used the inflators as original equipment would be responsible for carrying out any recalls.
[8] *See* ARC Presentation on CADH Inflator Design; ARC Presentation on PH7 Inflator Process Details.

half of the inflator housing. The flash-dam pin is removed after the weld is complete. This friction welding process was used in all five ARC plants where the subject inflators were made—located in Knoxville, Tennessee; Reynosa, Mexico; Xi'an, China; Ningbo, China; and Skopje, Macedonia—and on all manufacturing lines that produced the subject inflators. It was also used by Delphi when it produced subject inflators under a license agreement.

During a crash that triggers an air bag deployment, a signal is sent to the inflator. When it receives this signal, the inflator's initiator ignites the propellant that is stored inside the inflator.[9] The propellant burns and excites pressurized gas stored in the inflator.[10] To fill the air bag cushion, the gas flows through the inflator's hollow center support and exits through the exit orifice at the top of the center support.[11] The inflator's exit orifice is the single path for the gas to exit the inflator and fill the air bag cushion. If the exit orifice is blocked during deployment such that the gas cannot escape, the inflator will likely over-pressurize and rupture. In this event, the center support typically elongates, splits into two pieces, and ejects from the inflator housing. These characteristics indicate that a rupture was caused by over-pressurization of the inflator.[12] In some instances, the blockage can still be seen in the upper half of the center support after the rupture. In others, the blockage may become knocked loose by the force of the rupture but can leave small indentations on the edge of the exit orifice, which are known as "witness marks."[13]

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[9] *See* ARC Response to Request 1 of NHTSA Aug. 25, 2015 IR Letter at p. 16.
[10] *See id.*
[11] *See id.*
[12] *See* ARC Presentation dated Mar. 1, 2016 on MY 2004 Kia Optima Rupture at pp. 5, 22; ARC Presentation dated Aug. 25, 2017 on SGO 2016-01/2017-01 Report 39 at pp. 6, 11, 37; ARC Response to Request 1 of NHTSA Aug. 25, 2015 IR Letter at p. 72.
[13] *See* ARC Presentation dated Apr. 1, 2017 on SGO 2016-01/2017-01 Report 80 at pp. 8-11; ARC Presentation dated Nov. 10, 2017 on SGO 2016-01/2017-01 Report 120 at p. 7; ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 130 at pp. 8-11; ARC Presentation dated Nov. 8, 2017 on SGO 2016-01/2017-01 Report 178 at pp. 13-14.

During the PE phase of the investigation, NHTSA collected a list of air bag module (or Tier 1) manufacturers to which ARC sold the inflators from 2000 through 2004, which covered the timeframe between when ARC had begun manufacturing hybrid toroidal inflators and the manufacture dates of the two inflators that ruptured in vehicles. NHTSA then obtained information from the air bag module manufacturers to identify the vehicle manufacturers that had purchased those air bag modules and incorporated them into their vehicles. In addition, NHTSA ordered vehicle and inflator manufacturers, including ARC, to report any alleged or suspected inflator field rupture under Standing General Orders (SGO) 2015-01 and 2015-02.[14] Manufacturers subject to these orders must submit an initial report upon notification of an alleged field rupture incident, as well as ongoing supplemental reports as the investigation into the incident progresses and until it is complete.

On July 11, 2016, an ARC-manufactured inflator in a MY 2009 Hyundai Elantra ruptured in Canada. The driver was killed. ARC confirmed that this inflator was manufactured using the same manufacturing processes described above in this section. ODI upgraded the investigation to an Engineering Analysis, designated EA16-003, on August 4, 2016. During this phase of the investigation, ODI issued information request letters to ARC, Delphi, air bag module manufacturers, and vehicle manufacturers in 2016, 2020, 2021, and 2022. These letters requested information for an expanded timeframe on the production volume of the subject inflators, air bag modules with the subject inflators and vehicles with the subject inflators, testing procedures and results, complaints, and air bag deployments.

[14] Those orders were not limited to ARC or the vehicle manufacturers that used ARC inflators. They were intended to help NHTSA learn of any alleged inflator ruptures, including inflators not designed or manufactured by ARC. Since their original issuance, these orders have been updated and superseded by SGO 2015-01A and SGO 2015-02A. https://static.nhtsa.gov/odi/inv/2015/INLM-EA15001-62640.pdf; https://static.nhtsa.gov/odi/inv/2015/INLM-EA15001-62642.pdf.

Also during this phase of the investigation, NHTSA issued Standing General Order 2016-01. Standing General Order 2016-01 required ARC to notify the agency of non-field ruptures of inflators. It was superseded by SGO 2017-01, which revised the reportable rupture incidents to include only those occurring during lot acceptance tests. Lot acceptance tests (also referred to as "LATs") are random tests of completed air bag inflators produced for use in consumer vehicles.[15] If an inflator ruptures or fails in some way during a lot acceptance test, the entire lot of inflators is quarantined. Under these SGOs, ARC reported thirty-four ruptures of frontal driver- and passenger-side hybrid toroidal inflators during lot acceptance testing.[16]

ARC's lot acceptance testing process evidenced a problem, but the problem was not addressed by actions limited to specific lots. Since NHTSA issued SGOs 2015-01 and 2015-02, manufacturers have reported to the agency and confirmed five ruptures in vehicles in the United States of ARC-manufactured frontal driver- and passenger-side hybrid toroidal inflators, for a total of seven confirmed field ruptures in the United States, plus the fatal rupture in Canada. In response to some of the field ruptures, the relevant vehicle manufacturer issued a small recall targeted at the production lot of the ruptured inflator.[17] Such recalls, like the quarantine process for lot acceptance test ruptures, are premised on the idea that there is some sort of manufacturing

[15] A lot acceptance test is conducted at the beginning, middle, and end of a manufacturing shift, or at any time the assembly line is shifted to production of a different part. The term "lot" refers to the inflators that were manufactured in an identified manufacturing plant on a specific assembly line for a specific shift.

[16] Two vehicle manufacturers have conducted small inflator recalls associated with lot acceptance testing. First, BMW recalled thirty-six vehicles after learning that the production lot in which there had been a rupture was not fully contained, and some inflators from the lot were shipped by ARC to a module supplier and ultimately were incorporated into vehicles. NHTSA Recall Nos. 17V-189 (describing the safety risk as "impaired gas flow could create excessive internal pressure, which could result in the body of the inflator rupturing upon deployment"). Second, Ford recalled 650 vehicles after its air bag module supplier notified Ford of "an abnormal deployment" of an inflator during a lot acceptance test at the supplier's engineering facility. NHTSA Recall Nos. 17V-529 ("Preliminary analysis indicates that weld flash from the inflator canister welding process at the Tier 2 inflator supplier may obstruct the gas exhaust port.").

[17] *See* NHTSA Recall Nos. 19V-019 (recalling 1,145 vehicles), 21V-782 (recalling 555 vehicles), 22E-040 (recalling 74 replacement air bag modules), 22V-246 (recalling 2,687 vehicles), and 22V-543 (recalling 1,216 vehicles). Following the most recent rupture, GM also expanded on its earlier lot recalls by recalling four model years of three vehicle makes. NHTSA Recall No 23V-334.

problem limited to that short period of production at that particular facility. As detailed below, however, the evidence collected in NHTSA's investigation shows that ruptures have occurred in inflators manufactured across different time periods, plants, and manufacturing lines, thus warranting a broader recall.

In a recall request letter sent to ARC on April 27, 2023, the agency tentatively concluded that the subject inflators present a defect related to motor vehicle safety.[18] NHTSA explained that a defect resulting in metal fragments being projected toward vehicle occupants creates an unreasonable risk of death and injury.[19] The agency, therefore, demanded that ARC file a recall identifying the subject inflators as defective.[20] In its response on May 11, 2023, ARC described the seven U.S. field ruptures as "random 'one-off' manufacturing anomalies" that had been properly addressed by the lot recalls.[21] ARC refused to acknowledge the safety defect or file a recall.[22]

When a safety defect exists in original equipment used by more than one vehicle manufacturer, as in this case, the equipment supplier and each vehicle manufacturer must notify the agency by filing a recall report. 49 CFR § 573.3(f). A defect in original equipment (meaning equipment originally installed in or on a vehicle) is considered a defect in the vehicle. 49 U.S.C. §§ 30102(b)(1)(C), (F). Therefore, vehicle manufacturers are generally responsible for carrying out recalls of their vehicles containing defective parts, such as air bag inflators, by notifying vehicle owners and providing a free remedy. *See id.* §§ 30118-20. An equipment manufacturer is also responsible under the Safety Act for recalling its replacement equipment. *See id*. 30118.

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[18] *See* NHTSA Recall Request Letter to ARC, https://static.nhtsa.gov/odi/inv/2016/INRM-EA16003-90615.pdf.
[19] *See id.*
[20] *See id.*
[21] *See* ARC Response to NHTSA Recall Request Letter, https://static.nhtsa.gov/odi/inv/2016/INRR-EA16003-90616.pdf at p. 2.
[22] *See id.* at p. 1.

Replacement equipment is "motor vehicle equipment . . . that is not original equipment." *Id*. § 30102(b)(1)(D).

The National Traffic and Motor Vehicle Safety Act (Safety Act) imposes an affirmative obligation on a manufacturer to initiate a recall if it "learns the vehicle or equipment contains a defect and decides in good faith that the defect is related to motor vehicle safety." *Id.* § 30118(c)(1). To date, the manufacturers of the subject inflators, and the manufacturers of the vehicles containing the subject inflators, have not commenced broader recalls addressing the full scope of the problem. Thus, NHTSA is using its authority under the Safety Act to consider ordering a recall.

The Safety Act authorizes NHTSA to order a recall when the Administrator[23] determines that a vehicle or replacement equipment "contains a defect related to motor vehicle safety." *Id.* § 30118(b). The Safety Act defines a "defect" as "any defect in performance, construction, a component, or material of a motor vehicle or motor vehicle equipment." *Id.* § 30102(a)(3). A defect is related to motor vehicle safety if it presents an unreasonable risk of an accident or of death or serious injury in an accident. *Id.* § 30102(a)(9).

Before it can order a recall, the agency first issues an initial decision finding a defect in a vehicle or replacement equipment, notifies the manufacturer of the decision and provides it with the information on which the decision was based, and publishes notice of the decision in the Federal Register. *Id.* § 30118(a); 49 CFR § 554.10. The manufacturer and the public are afforded an opportunity to present information, views, and arguments at a public meeting, in written comments, or both. 49 CFR § 554.10. After considering the available information, the

[23] As authorized by statute, the Secretary has delegated the authority in the Safety Act to the NHTSA Administrator. 49 U.S.C. § 105(d); 49 CFR § 1.95(a). In the absence of an Administrator, the Deputy Administrator performs the functions and duties of the Administrator. 49 CFR §§ 501.4(a), 501.5(a).

Administrator may make a final decision finding a safety defect and ordering a recall. 49 U.S.C. § 30118(b); 49 CFR § 554.11.

In the instant proceeding, NHTSA issued an initial decision of a safety defect on September 5, 2023 regarding frontal driver- and passenger-side hybrid toroidal inflators manufactured by ARC and Delphi from 2000 through January 2018. 88 FR 62140 (Sept. 8, 2023). NHTSA held a public meeting on October 5, 2023, during which the agency presented information about its investigation and initial decision, and manufacturers and members of the public were invited to make their own statements.[24] ARC and certain other members of the public, including the son of the person killed by a subject inflator rupture, made statements at the public meeting.[25] NHTSA also provided manufacturers and the public the opportunity to submit written comments in response to the initial decision,[26] which were due December 18, 2023.[27]

II. Initial Determination of Defect Related to Motor Vehicle Safety

After further consideration of all available information, including from its investigation and this proceeding, NHTSA is confirming its initial determination that the subject inflators contain a defect and that the defect is related to motor vehicle safety. The subject inflators may rupture upon deployment and project shrapnel into the occupant compartment, which is likely to cause and has caused serious injury and death to vehicle occupants.

A. The subject inflators are defective.

Air bag inflators that have an established risk of rupturing when commanded to deploy are defective within the meaning of the Safety Act. The Safety Act defines "defect" as including

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[24] *See* Public Meeting Transcript and Addenda, Docket No. NHTSA-2023-0038, https://www.regulations.gov/document/NHTSA-2023-0038-0003.
[25] *Id.*
[26] Public versions of all written comments are posted on the public docket at https://www.regulations.gov/docket/NHTSA-2023-0038/comments.
[27] *See* Second Extension of Deadline for Written Submissions, https://www.regulations.gov/document/NHTSA-2023-0038-0005.

"any defect in performance, construction, a component, or material of a motor vehicle or motor vehicle equipment." 49 U.S.C. § 30102(a)(3). "Defect" must be understood by its plain meaning: a flaw, shortcoming, or abnormality.[28] An inflator that is at risk of rupturing when commanded to deploy is flawed. It turns a lifesaving device into one that can do great harm, including causing death or serious injury.

Air bags and related components can be defective in multiple ways. Among other things, the air bag may fail to deploy when appropriate, deploy when it should not, or only partially deploy. All of these defects are issues that the agency takes seriously and that have resulted in recalls.[29] An air bag inflator that has a risk of rupturing when commanded to deploy—sending shrapnel into the occupant compartment—presents a particularly dangerous type of defect. This is why the industry standard calls for tests to confirm that "an inflator shall not eject any components or fragments."[30] In other words, an inflator rupture is not an industry-accepted failure mode.

The subject inflators exhibit this especially dangerous defect, which warrants NHTSA's taking the significant step of proposing to order a recall. To date, there have been seven confirmed field ruptures of the subject inflators in vehicles in the United States, each of which presented evidence of over-pressurization or weld insufficiency as a likely cause of the failure. In addition, there have been twenty-three reported ruptures during lot acceptance testing that share over-pressurization or weld insufficiency commonalities with the seven field ruptures. Moreover,

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[28] https://www.merriam-webster.com/dictionary/defect.

[29] *See, e.g.*, NHTSA Recall 24V-064 (recall issued by Honda addressing air bags that may deploy in a crash when they should have been suppressed); NHTSA Recall 23V-865 (recall issued by Toyota addressing air bags that may not deploy in a crash when intended); NHTSA Recall No. 12V-055 (recall issued by Nissan for vehicles equipped with curtain air bags with incorrect propellant mixture, possibly resulting in partial deployment); NHTSA Recall No. 01V-318 (recall issued by Ford for vehicles with replacement inflators having insufficient welds, possibly preventing proper inflation of the air bag).

[30] *See* USCAR Inflator Technical Requirements and Validation, p. 7 ¶ 3.2.2 (SAE Int'l, 2023). *See also* USCAR Inflator Technical Requirements and Validation, p. 10 ¶ 3.2.2 (SAE Int'l, 2013).

at least an additional four inflators have ruptured in vehicles outside the United States, killing at least one person.

To be sure, the overwhelming majority of the subject inflators will not rupture upon deployment. However, based on the evidence linking past ruptures to the same friction welding process, all of the subject inflators are at risk of rupturing. The unpredictable nature of this defect has played out with some inflators passing lot acceptance testing but later rupturing in a vehicle and causing injury or death. The only way to know which of the subject inflators remaining in vehicles will rupture is for them to deploy. The Safety Act does not allow such a defect to go unaddressed.

In recognition of the commonsense understanding that an inflator that may rupture is defective, some vehicle manufacturers have already issued limited recalls following field ruptures.[31] This approach is insufficient to address the defect. The evidence shows that the risk of rupture pervades the entire subject inflator population and, as such, a recall for all subject inflators is needed. Ruptures have continued to occur outside the scope of these lot-based recalls and in lots that passed lot acceptance testing. There is no reasonable basis to conclude that the recalls issued to this point have captured the full scope of the defect. Instead, NHTSA has preliminarily concluded, based on the available evidence, that all the subject inflators are defective.

Whether there is a "defect" depends on the specific facts and circumstances of each case, including the nature of the component involved and its importance to the safe operation of the vehicle, the circumstances in which failures occurred, and the number of failures experienced.

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[31] After the most recent rupture, GM apparently recognized that a lot-based recall was no longer sufficient. However, the ensuing recall was limited to specific model years and models of vehicles and fails to address the full population of GM vehicles containing the subject inflators. *See* Recall No. 23V-334 (recalling 2014-2017 Buick Enclave, Chevrolet Traverse, and GMC Acadia vehicles).

U.S. v. General Motors Corp., 518 F.2d 420, 427, 438 n.84 (D.C. Cir. 1975) ("*Wheels*"). Considering all of the available information, NHTSA finds that there is sufficient evidence that the total population of subject inflators is defective within the meaning of the Safety Act.

1. An air bag is critical to the safe operation of a vehicle.

Factors to be considered in determining whether a defect exists include the relationship between the component and safe vehicle operation and the circumstances of the failures involved. An air bag is vital to the safe operation of a vehicle. It is a required safety device.[32] In the event of a crash where the air bag is commanded to deploy, which can include a minor crash, the air bag helps protect the occupant's upper body and head from impact with hard objects such as the windows, dashboard, and steering wheel. NHTSA estimates that air bags saved more than fifty thousand lives between 1987 and 2017. The defect in this case turns this life-saving purpose on its head, instead introducing a risk of serious injury or death from flying metal fragments ejected into the occupant compartment. As described below in section II.A.3, rupturing inflators have caused severe injuries, the most common of which are injuries to the face, head, jaw, and neck. In three instances, a piece of the inflator became lodged in the driver's neck or arm and had to be surgically removed.[33] In another, the shrapnel caused permanent muscle and nerve damage to the driver.[34] In two instances, the driver died after being struck by a piece of the inflator. By forcefully propelling metal shrapnel into the occupant compartment, often aimed directly at an occupants' face, the rupturing inflator creates a high risk of severe injury or death, potentially converting a minor crash into a life-threatening event.

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[32] Federal Motor Vehicle Safety Standard 208 sets requirements for occupant crash protection, including air bags. 49 CFR § 571.208.

[33] *See* Email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center; Photos attached to email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center; Medical Discharge Summaries, Report ID ****8352 at p. 3; Information package provided by the Saudi Ministry of Commerce and Industry; Hyundai Report submitted for MY 2011 Hyundai Elantra Rupture.

[34] *See* VOQ dated Dec. 20, 2014.

The circumstances in which these failures occur are also severe. The ruptures occur with no warning to the driver or other vehicle occupants.[35] A vehicle owner can neither prevent this failure from occurring nor take action to mitigate the severity of its outcome, given the rapid pace of an air bag deployment and the already vulnerable position of the occupants in the midst of a collision. A vehicle's air bags can deploy even in minor crashes, meaning this defect can turn an incident from which the occupants could have walked away unscathed into one that will likely cause serious injury or death. There is no way for a vehicle owner, or anyone else, to know that a particular subject inflator will rupture until it is too late. The safety of vehicle occupants is significantly compromised by the rupture of the subject inflators—a considerable factor in the agency's determination that the subject inflators are defective under the Safety Act.

2. Problems that lead to over-pressurization and weld failure may be present throughout the entire population of inflators.

While the actual occurrence of ruptures is rare, the subject inflators' risk of rupture nevertheless constitutes a defect, especially when considering the nature and purpose of an inflator and the severity of the risk to vehicle occupants. For a component that is designed to function without replacement, courts have found that a defect may be established by showing that a significant—or non-*de minimis*—number of failures occurred in normal operation. *E.g.*, *Wheels*, 518 F.2d at 427, 438 n.84. As mentioned in the section above, the number of failures is one of the factors among the various facts and circumstances that assists in the agency's determination of whether there is a defect related to motor vehicle safety, requiring a recall.

[35] Severity, frequency, and detectability are factors that NHTSA and manufacturers consider when deciding whether there is a safety defect requiring a recall. *See Risk-Based Process for Safety Defect Analysis and Management of Recalls*, DOT HS 812 984 (Nov. 2020), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/14895_odi_defectsrecallspubdoc_110520-v6a-tag.pdf. These factors are interrelated so high severity and non-detectible failures warrant a recall with a lower frequency of occurrence. *See id.*

Indeed, "[t]he purpose of the Safety Act . . . is not to protect individuals from the risks associated with defective vehicles only after serious injuries have already occurred; it is to prevent serious injuries stemming from established defects before they occur." *United States v. General Motors Corp.*, 565 F.2d 754, 759 (D.C. Cir. 1977) ("*Carburetors*").

Air bags are not subjected to wear and do not require maintenance. As such, they are not replaced unless and until they deploy. The subject inflators are hermetically sealed, protecting the interior from elements that may cause propellant degradation.[36] Nevertheless, ruptures have continued to occur despite manufacturers' assertions that narrower recalls have addressed the safety defect. NHTSA's investigation and analysis of the ruptures supports its preliminary determination that all subject inflators are at risk of rupturing and, therefore, contain a defect.

During its investigation, NHTSA obtained evidence of issues in the friction welding process of the subject inflators that resulted in either over-pressurization or weld failure when the inflators were commanded to deploy. This propensity for over-pressurization or weld failure, based on one or more variables, can cause and has caused repeated ruptures of the subject inflators. All seven known field ruptures in vehicles in the United States, along with at least twenty-three lot acceptance testing ruptures, were caused by over-pressurization or weld failure. Thus, the evidence demonstrates that the same friction welding process used to manufacture all of the subject inflators creates a risk of rupture. Stated more plainly, any of the subject inflators is subject to over-pressurization or weld failure leading to rupture when commanded to deploy. There is no evidence-based means to predict which specific subject inflators will rupture when commanded to deploy. Limited-scope recalls initiated in response to some of the ruptures were

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[36] *See* USCAR Inflator Technical Requirements and Validation at ¶ 3.2.11 (SAE Int'l, 2023).

reactionary and narrowly focused and did not proactively address the propensity of the larger population of subject inflators to rupture. As a result, ruptures continued to occur.

The ruptures that have already occurred in vehicles have demonstrated the unpredictable nature of the defect. As detailed below, these ruptures have involved inflators manufactured at different times and in different manufacturing facilities, both single-stage and dual-stage air bag inflators, driver-side and passenger-side inflators, inflators incorporated into air bag modules by different module suppliers, and inflators used in different vehicle manufacturers' vehicles. The inflators that ruptured due to over-pressurization or weld failure in lot acceptance testing likewise had been manufactured at different times in different manufacturing facilities, included both single-stage and dual-stage air bag inflators, driver-side and passenger-side inflators, and were intended to be sold to different air bag module suppliers. The critical element that the subject inflators have in common is the friction welding process – significant evidence indicates that this process has led to ruptures caused by over-pressurization and weld failure.

3. The inflators have ruptured in the field seven times.

The defect in the subject inflators has manifested in seven confirmed ruptures in vehicles in the United States, injuring at least seven people and killing another.

First Field Rupture – January 2009, Ohio

The first known field rupture of a subject inflator in the United States occurred on January 29, 2009 in Ohio. The driver of a MY 2002 Chrysler Town & Country was turning into a driveway and collided with another vehicle. The crash triggered air bag deployment, and the driver-side, dual-stage air bag inflator—manufactured in ARC's Knoxville, Tennessee plant—ruptured, sending pieces of metal through the air bag cushion and into the occupant compartment. The driver sustained severe injuries to the face, neck, shoulder, and jaw, causing permanent muscle and nerve damage.[37]

During an inspection of the vehicle, ARC took photographs of the pieces of the ruptured inflator, including the center support. When the inflator in the MY 2002 Chrysler Town & Country ruptured, the center support elongated, split into two pieces, and ejected from the inflator housing.[38] These characteristics indicate that a rupture was caused by over-pressurization of the inflator.[39] The photos of the upper portion of the center support show a blockage in the exit orifice.[40] NHTSA and ARC agree that because this blockage prevented the gas from escaping through the exit orifice, the pressure inside the inflator built and exceeded the inflator's strength limit and, ultimately, the inflator over-pressurized and broke apart (*i.e.*, ruptured). ARC posited that the blockage was caused by a piece of the flash-dam pin, a tool that is inserted through the exit orifice during the friction welding process in an attempt to prevent weld flash from blocking the gas flow. The flash-dam pin is normally removed after completion of the weld, but based on visual inspection of the photographs, ARC suggested that a piece of this pin broke off during the manufacturing process and, during deployment, blocked the inflator's exit orifice.[41] No metallurgical testing was done to determine the composition of the blockage material.

The vehicle manufacturer, FCA,[42] has not advanced any contrasting potential explanation for this field rupture.

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[37] *See* VOQ dated Dec. 20, 2014.
[38] *See* Photos of air bag parts from MY 2002 Chrysler Town & Country Rupture at pp. 6-9.
[39] *See* ARC Presentation dated Mar. 1, 2016 on MY 2004 Kia Optima Rupture at pp. 5, 22; ARC Presentation dated Aug. 25, 2017 on SGO 2016-01/2017-01 Report 39 at pp. 6, 11, 37; ARC Response to Request 1 of NHTSA Aug. 25, 2015 IR Letter at p. 72.
[40] *See* Photos of air bag parts from MY 2002 Chrysler Town & Country Rupture at pp. 6-9.
[41] *See* Written Response of ARC Automotive, Inc. to the September 5, 2023, Initial Decision Docket No. NHTSA-2023-0038 at p. 32, https://www.regulations.gov/comment/NHTSA-2023-0038-0027.
[42] Then known as Chrysler.

Second Field Rupture – April 2014, New Mexico

The second known field rupture of a subject inflator occurred on April 8, 2014 in New Mexico. The driver of a MY 2004 Kia Optima collided with a roadside barrier, triggering air bag deployment. The driver-side, single stage air bag inflator—manufactured in ARC's Knoxville, Tennessee plant—ruptured, and fragments were propelled through the air bag cushion and into the occupant compartment. At the hospital, a piece of the shrapnel was removed from the driver's neck.[43] The driver was also treated for head trauma, a jaw fracture, and lacerations to the lip, neck, and cheek.[44]

ARC conducted a visual, on-site inspection of the vehicle and inflator parts and took photographs of the vehicle and inflator pieces. As with the MY 2002 Chrysler Town & Country rupture, the center support of the inflator elongated, broke into two pieces, and ejected from the inflator housing.[45] ARC concluded that the inflator ruptured due to over-pressurization,[46] a conclusion with which NHTSA agrees. ARC's analysis identified exit orifice blockage as the most likely cause of the over-pressurization and rupture.[47] The photographs of the center support taken after the rupture occurred do not show that a blockage remained in the exit orifice.[48] ARC surmised that an internal blockage of the exit orifice was unlikely based on this observation and three additional indicators: (1) during manufacturing, the inflator had been filled with the stored, internal gas through the exit orifice, (2) the lot acceptance test data for the associated lot of inflators was compliant, and (3) the exit orifice diameter was an acceptable size.[49] ARC

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[43] *See* Medical Discharge Summaries, Report ID ****8352 at p. 3.
[44] *See id.*
[45] *See* ARC Presentation dated Mar. 1, 2016 on MY 2004 Kia Optima Rupture at pp. 5, 22.
[46] *See id*.
[47] *See id*. at pp. 5, 7, 32.
[48] *See id.* at pp. 8-9.
[49] *See id.* at p. 68.

hypothesized, instead, that the over-pressurization was caused by an *external* blockage of the exit orifice and conducted tests to mimic this condition.[50]

The photos of the center support in this instance do not show exit orifice blockage; however, the blockage could have been knocked out of the exit orifice when the inflator ruptured, as likely happened in several of the lot acceptance test ruptures believed to have been caused by internal exit orifice blockage.[51] Debris found inside the air bag cushion after this rupture was of a sufficient size to block the exit orifice.[52] Therefore, the evidence does not undermine internal blockage as the underlying reason for the over-pressurization in this incident. The three additional indicators listed above and cited by ARC are present for each of the U.S. field ruptures and do not, separately or combined, refute internal blockage of the exit orifice as the cause of over-pressurization.

In comments, Kia disputed that the rupture may have been caused by weld slag blocking the inflator orifice and noted a number of observations. However, in attempting to explain the rupture, Kia could only conclude that it was "an isolated case of unknown cause."

Third Field Rupture – September 2017, Pennsylvania

The third known field rupture occurred on September 22, 2017 in Pennsylvania. The driver of a MY 2011 Chevrolet Malibu rear-ended another vehicle, triggering air bag deployment. The driver-side, dual stage air bag inflator—manufactured in ARC's Reynosa,

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[50] *See id.* at pp. 70-71, 74.

[51] *See* ARC Presentation dated Apr. 1, 2017 on SGO 2016-01/2017-01 Report 80 at pp. 8-11; ARC Presentation dated Nov. 10, 2017 on SGO 2016-01/2017-01 Report 120 at p. 7; ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 130 at pp. 8-11; ARC Presentation dated Nov. 8, 2017 on SGO 2016-01/2017-01 Report 178 at pp. 13-14.

[52] *See* Photo 25 from inspection of MY 2004 Kia Optima rupture; Photo 27 from inspection of MY 2004 Kia Optima rupture; Photo 29 from inspection of MY 2004 Kia Optima rupture; Photo 31 from inspection of MY 2004 Kia Optima rupture; Photo 33 from inspection of MY 2004 Kia Optima rupture; Photo 34 from inspection of MY 2004 Kia Optima rupture.

Mexico plant[53]—ruptured. Pieces of the inflator shot through the air bag cushion and into the occupant compartment. The shrapnel caused multiple fractures to the driver's face, nose, and jaw as well as other trauma, lacerations, and nerve damage to the face.[54]

General Motors (GM) took photographs of the vehicle and inflator during an on-site inspection. A visual inspection of photos of the inflator shows that the center support did not elongate, split in two, or eject from the inflator.[55] These characteristics are unique to this field rupture. Based on observations made during physical inspections on December 13, 2018 and January 22, 2019, GM noted the lack of center support elongation as an indication that the exit orifice was not blocked in this rupture.[56] Neither GM nor ARC nor NHTSA were able to conduct destructive testing on the inflator, so all conclusions and hypotheses were based on visual inspection of the photographs.

Based on information available to it, ARC proffered a potential explanation that partially attributed the rupture to issues with Operation 50 of the inflator manufacturing process.[57] Similarly, GM noted that the inflator ruptured specifically at the Operation 50 weld, along with another weld.[58] For driver-side subject inflators, Operation 50 is the point in the manufacturing process at which two friction welds occur: The center support is friction welded to the inside of the lower half of the inflator housing, and, at the same time, the lower and upper halves of the inflator housing are friction welded together.[59] In their analyses of this field rupture, ARC and GM identified issues with this particular friction weld and posited those issues as potential

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[53] In the September 5, 2023 Initial Decision, the description of this field rupture incorrectly stated that the vehicle was a MY 2010 Chevrolet Malibu and that the inflator had been manufactured in Xi'an China.
[54] *See* Complaint filed in lawsuit arising from the crash on Sept. 22, 2017 at pp. 11-12.
[55] *See* Photos from inspection of MY 2011 Chevrolet Malibu rupture at p. 65; GM Presentation dated Jan. 29, 2019 on MY 2011 Chevrolet Malibu rupture at pp. 4-6.
[56] *See* GM Presentation dated Jan. 29, 2019 on MY 2011 Chevrolet Malibu rupture at pp. 1, 3.
[57] *See* ARC Presentation dated Mar. 21, 2019 on MY 2011 Chevrolet Malibu rupture at p. 4.
[58] *See* GM Presentation dated Jan. 29, 2019 on MY 2011 Chevrolet Malibu rupture at p. 3.
[59] *See* ARC Presentation on CADH Inflator Design at slide 12.

causes of the rupture. These descriptions are repeated in ARC's analyses of certain ruptures that occurred during lot acceptance testing where deficiencies in this same friction weld were identified as having contributed to each failure.[60]

While NHTSA acknowledges that characteristics of this field rupture differ from those seen in the other U.S. field ruptures, they do not undermine the agency's defect determination. These characteristics are not anomalous or isolated; they also appear in several lot acceptance test ruptures. After studying each such rupture, ARC attributed all of these ruptures partially to friction weld failures.[61] Moreover, manufacturers attributed other field and lot acceptance test ruptures to additional issues related to the friction welding process, including excessive weld flash—created by friction welding—that blocked the exit orifice, and a broken piece of the flash-dam pin—a tool used to try to prevent weld flash blockage—that blocked the exit orifice. In fact, the extent to which the MY 2011 Chevrolet Malibu rupture differs from other field ruptures serves as evidence that there are variations in the friction welding process, intentional or unintentional, that can lead and have led to ruptures.

Appearing to recognize these variations, several commenters suggested that more testing and analysis of the variables in the subject inflators' design and manufacturing process is needed to support NHTSA's initial decision. However, in the many years since the first ruptures occurred and the investigation opened, the agency and the manufacturers have conducted extensive analyses. To the extent some commenters point to a lack of confirmed root cause for

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[60] *See* ARC Presentation dated Oct. 17, 2016 on SGO 2016-01/2017-01 Report 3 at pp. 14-16; ARC Report dated Nov. 4, 2016 under SGO 2016-01/2017-01 Report 5 at p. 2; ARC Report dated Nov. 4, 2016 under SGO 2016-01/2017-01 Report 5 at p. 2; ARC Presentation dated Nov. 7, 2016 on SGO 2016-01/2017-01 Report 12 at slides 39-40; ARC Report dated Dec. 12, 2016 under SGO 2016-01/2017-01 Report 13; ARC Report dated Dec. 12, 2016 under SGO 2016-01/2017-01 Report 18; ARC Presentation dated Feb. 8, 2017 on A9/ZB Model Inflators at pp. 2-3; ARC Presentation dated May 14, 2017 on SGO 2016-01/2017-01 Report 20 at slides 27-30; ARC Report dated Dec. 14, 2016 under SGO 2016-01/2017-01 Report 22 at p. 2.

[61] *See id.*

every incident, the agency notes that a root cause determination is not required to determine that a defect exists, as discussed further below in section II.A.6. The agency also does not believe that additional analysis is likely to shed meaningful light on issues that remain unsettled at this point. In light of the severe safety risk, the Safety Act warrants a recall based on the already clear evidence of a defect.

Fourth Field Rupture – August 2021, Michigan

The fourth known field rupture occurred on August 15, 2021. In Michigan, the driver of a MY 2015 Chevrolet Traverse vehicle, returning from a family outing with her children,[62] was turning onto a highway and was struck by another vehicle. The air bags deployed, and the driver-side, dual stage air bag inflator—manufactured in ARC's Reynosa, Mexico plant—ruptured, sending fragments of metal through the air bag cushion and into the occupant compartment. The pieces of the center support struck the driver in the neck, and the driver died from the injury.

One of the driver's children traveled from Michigan to Washington, D.C. to speak at the public meeting on October 5, 2023 in support of NHTSA's initial determination that the subject inflators are defective and should be recalled. During the meeting, he described in detail his presence at the crash scene and how the air bag, rather than protecting his mother from injury, exploded, sent metal shrapnel into her face and neck, and ultimately killed her.[63]

Photos taken by Michigan State Police personnel after the crash show that the center support elongated, split in two, and ejected from the inflator,[64] demonstrating that over-pressurization caused the rupture. The Michigan State Police also performed X-rays of the

[62] Public Meeting Transcript and Addenda at pp. 73-74, Docket No. NHTSA-2023-0038, https://www.regulations.gov/document/NHTSA-2023-0038-0003.
[63] *Id.*
[64] *See* Photos from inspection of MY 2015 Chevrolet Traverse rupture in Michigan at pp. 188-229.

inflator pieces and provided the images to GM.[65] The X-rays do not show any obstruction in the exit orifice.[66] NHTSA does not believe the X-ray images negate the possibility of exit orifice blockage. The force of the rupture could have knocked any blockage material loose, as the evidence suggests happened in lot acceptance test ruptures. [67] Moreover, an X-ray image is not always detailed enough to identify witness marks caused by debris in the exit orifice.

GM noted that the X-ray images for this field rupture did not show material in the exit orifice and that CT scans of inflators retrieved from the same lot did not show exit orifice blockage.[68] As explained above, X-ray images cannot rule out exit orifice blockage as the cause of over-pressurization, and, furthermore, lot-based comparisons are not broad enough to guarantee that the risk is contained. GM studied this rupture in tandem with the subsequent fifth field rupture (discussed in more detail below) and a lot acceptance test rupture.[69] The remainder of GM's analysis related to propellant was not specifically applicable to this field rupture.[70] ARC likewise has not offered any potential explanations for this fatal field rupture incident, though it is undisputed that over-pressurization ultimately caused the rupture.

Fifth Field Rupture – October 2021, Kentucky

[65] *See* GM Presentation dated Oct. 6, 2021 on MY 2015 Chevrolet Traverse rupture in Michigan at p. 10.
[66] *See id.*
[67] *See* ARC Presentation dated Apr. 1, 2017 on SGO 2016-01/2017-01 Report 80 at pp. 8-11; ARC Presentation dated Nov. 10, 2017 on SGO 2016-01/2017-01 Report 120 at p. 7; ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 130 at pp. 8-11; ARC Presentation dated Nov. 8, 2017 on SGO 2016-01/2017-01 Report 178 at pp. 13-14.
[68] *See* GM Presentation dated Jun. 15, 2022 on DAB ARC Inflator Ruptures at p. 2.
[69] *See id.* at p. 1.
[70] GM enlisted the help of an independent research firm to study propellant-related issues more broadly. The group studied 329 driver-side subject inflators manufactured between 2013 and 2021. While the study identified "[m]any areas of manufacturing variability," it concluded that "moisture migration into the propellant," which is the cause of propellant degradation, "is not a concern in this inflators design." *See* Northrop Grumman Presentation dated May 5, 2023 on GM ARC Inflator Investigation at p. 48. GM did not identify a specific explanation for the inflator ruptures but proposed that too much propellant, low propellant density, and "possible other unknown factors" may be considered as contributors. *See* GM Presentation dated Jun. 15, 2022 on DAB ARC Inflator Ruptures at p. 1.

The fifth known field rupture occurred on October 20, 2021. In Kentucky, the driver of a MY 2015 Chevrolet Traverse vehicle collided with another vehicle at an intersection, which triggered the air bags to deploy. The driver-side, dual stage air bag inflator—manufactured in ARC's Reynosa, Mexico plant—ruptured, and fragments of the metal inflator were projected through the air bag cushion and into the occupant compartment. The driver sustained injuries to the face.

Photographs were taken of the vehicle as well as the ruptured inflator pieces. The photos show that the center support elongated, split in two, and ejected from the inflator,[71] demonstrating that over-pressurization caused the rupture. The upper portion of the broken center support shot through the air bag cushion and into the driver-seat head rest.[72] The photos of this piece of the center support show material blocking the exit orifice.[73] GM suggests the material may be fabric from the head rest,[74] however, a determination of the blockage material has not been confirmed as the manufacturers were not able to perform an analysis of the material to identify its makeup.

GM assessed this field rupture in tandem with the previous field rupture and a lot acceptance test rupture, as explained above in discussing the fourth rupture (2021 Michigan). As GM stated in that analysis, no parts from the same lot as the inflator in this field rupture were available for analysis,[75] so the conclusions in its report are not particularly relevant. GM did not perform a separate analysis for this field rupture. Similarly, ARC has not provided a potential explanation for this rupture.

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[71] *See* GM Presentation dated Apr. 6, 2022 on MY 2015 Chevrolet Traverse rupture in Kentucky at p. 3.
[72] *See id*. at p. 4.
[73] *See id*. at p. 3.
[74] *See id*.
[75] *See* GM Presentation dated Jun. 15, 2022 on DAB ARC Inflator Ruptures at p. 2.

Sixth Field Rupture – December 2021, California

The sixth known field rupture occurred on December 18, 2021 in California. The driver of a MY 2016 Audi A3 e-Tron collided with another vehicle. The air bags deployed, and the passenger-side, dual stage inflator—manufactured in ARC's Reynosa, Mexico plant—ruptured, with some of the fragments projecting through the air bag cushion and into the occupant compartment. The passenger suffered serious injuries to the face and ear.[76] The pieces of the inflator also struck the driver, causing lacerations to the right hand and right shin.[77]

Photos from the vehicle inspection indicate that the center support split in two and ejected from the inflator,[78] demonstrating that over-pressurization caused the rupture. The upper portion of the center support ultimately ejected through the windshield and the lower portion became lodged in the instrument panel.[79] The upper portion of the center support was never recovered and, therefore, never analyzed for blockage. Neither ARC nor Volkswagen has offered potential explanations for this rupture.

Seventh Field Rupture – March 2023, Michigan

The seventh, and most recent, known field rupture occurred on March 22, 2023 in Michigan. The driver of a MY 2017 Chevrolet Traverse vehicle collided with a tree, causing the air bags to deploy. The driver-side, dual stage inflator—manufactured in ARC's Reynosa, Mexico plant—ruptured, sending fragments through the air bag cushion and into the occupant compartment. The driver suffered injuries to the face, teeth, and neck. A child in the back seat also suffered lacerations to the face, potentially caused by shrapnel from the inflator rupture or

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[76] *See* Complaint filed in lawsuit arising from the crash on Dec. 18, 2021 at p. 2.
[77] *See* State of California Crash Report dated Dec. 18, 2021 at p. 3.
[78] *See* Photos from inspection of MY 2016 Audi A3 e-Tron rupture.
[79] *See id.*

other debris from the crash. The upper portion of the center support struck the driver in the neck and had to be surgically removed from the driver's airway.[80]

Photos taken of the vehicle and pieces of the inflator show that the center support elongated, split in two, and ejected from the inflator,[81] once again demonstrating that over-pressurization caused the rupture. Photos of the removed upper center support show that the exit orifice was completely blocked.[82] No further explanation for this rupture has been advanced by ARC or GM.

Foreign Field Ruptures

In addition to the seven confirmed field ruptures in the U.S., there are four confirmed ruptures of frontal driver- and passenger-side hybrid toroidal ARC inflators that occurred in other countries. In July of 2016, a driver-side hybrid toroidal ARC inflator manufactured in ARC's Xi'an, China plant ruptured in a MY 2009 Hyundai Elantra in Canada.[83] The center support split into two pieces and ejected, a piece of which struck and killed the driver.[84] In October of 2017, a passenger-side hybrid toroidal ARC inflator manufactured in ARC's Knoxville, Tennessee plant ruptured in a MY 2015 Volkswagen Golf in Turkey.[85] The center support split in two and ejected from the inflator housing, and Volkswagen hypothesized that

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[80] *See* Email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center; Photos attached to email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center.

[81] *See* Photo 10 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 35 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 38 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 17 from inspection of MY 2017 Chevrolet Traverse rupture.

[82] *See* Photos attached to email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center; Photo 38 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 36 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 48 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 45 from inspection of MY 2017 Chevrolet Traverse rupture.

[83] *See* Hyundai Report dated Jul. 20, 2016 under SGO 2015-01/2015-02; Hyundai Letter to NHTSA dated Apr. 15, 2020 at p. 2.

[84] *See* Hyundai Report dated Jul. 20, 2016 under SGO 2015-01/2015-02; Hyundai Letter to NHTSA dated Apr. 15, 2020 at p. 2; Photo 1 from inspection of MY 2009 Hyundai Elantra rupture; Photo 2 from inspection of MY 2009 Hyundai Elantra rupture; Photo 375 from inspection of MY 2009 Hyundai Elantra rupture.

[85] *See* Key Safety Systems Report dated Dec. 1, 2017 under SGO 2015-01/2015-02.

weld flash blockage of the exit orifice caused the rupture.[86] Fortunately, there was no passenger in the vehicle, and no one was injured.[87] In March of 2020, a passenger-side hybrid toroidal ARC inflator manufactured in ARC's Xi'an, China plant ruptured in a 2009 Hyundai Elantra in Saudi Arabia, sending fragments of metal into the occupant compartment.[88] The driver sustained injuries in the incident.[89] In October of 2021, a driver-side hybrid toroidal ARC inflator manufactured in ARC's Xi'an, China plant ruptured in a MY 2011 Hyundai Elantra Touring in Saudi Arabia.[90] The center support broke into two pieces and ejected from the inflator housing.[91] The driver was seriously injured when a piece of the center support struck the driver's arm and had to be surgically removed.[92]

4. A comparison to peer inflators supports a defect determination.

While the overall incidence of rupture is rare, these failures can result and have resulted in severe injury or death. As such, and considering the evidence of problems in the friction welding process, the subject inflators present a defect. Moreover, the number of field ruptures in the United States described here stands in stark contrast to the near absence of such occurrences from other manufacturers of frontal air bag inflators. In assessing a defect, courts have considered how the number of failures compares to the number seen from other manufacturers particularly in situations where—unlike here—the circumstances of failure do not reveal an obvious defect. *See, e.g.*, *Wheels*, 518 F.2d at 438 n.84. Such a comparison further bolsters the conclusion that the subject inflators are defective.

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[86] *See* Photos from inspection of MY 2015 Volkswagen Golf rupture; Volkswagen Presentation on MY 2015 Volkswagen Golf rupture.
[87] *See* Key Safety Systems Report dated Dec. 1, 2017 under SGO 2015-01/2015-02.
[88] *See* Hyundai Letter to NHTSA dated Apr. 15, 2020 at p. 2.
[89] *See* Hyundai Report dated Mar. 30, 2020 under SGO 2015-01/2015-02.
[90] *See* Hyundai Report dated Apr. 7, 2023 under SGO 2015-01/2015-02; Hyundai Report dated May 26, 2023 on Canada Safety Recall R0239 ARC Inflator.
[91] *See* Information package provided by the Saudi Ministry of Commerce and Industry.
[92] *See id.*

As previously discussed in section I, SGOs 2015-01A and 2015-02A require all manufacturers to report alleged inflator field ruptures to NHTSA. Out of all of the field ruptures reflected in reports received as of July 2024,[93] NHTSA identified only one comparable U.S. field rupture of a non-ARC air bag inflator, which has resulted in three recalls.[94] The agency recognizes that the predecessor SGOs, 2015-01 and 2015-02 (with similar reporting requirements), were first issued on July 27, 2015. NHTSA believes it likely, however, that if other alleged ruptures had occurred before the SGOs' issuance, the agency would have been made aware of them through various channels. For example, the first Takata inflator ruptures occurred in 2007-2008,[95] and the first Takata recall was initiated in 2008, so it is likely that, due to the publicity, any inflator ruptures after that time would have been reported to NHTSA through a complaint, which is how NHTSA learned of the subject inflator rupture in the MY 2002 Chrysler Town & Country.[96]

A collection of all SGO reports involving confirmed ruptures of frontal driver and passenger air bag inflators thus yielded a total of eighteen potentially relevant reports involving non-ARC inflators. Of these eighteen, ten of the reported ruptures occurred outside of the United States. Relative to the U.S. market, the agency does not have the requisite depth of information (e.g., the total inflator population manufactured for each additional relevant foreign market) to

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[93] This does not include field ruptures—based on the agency's review of these reports and field incidents—that involved inflators manufactured by Takata, many of which have long been under recall. As one commenter asserted (albeit in the context of discussing how to define the defective population) it is difficult to make "direct rate comparisons" between the inflators here and those in the Takata recalls, and the Takata recalls "have limited comparative value" given, among other things, the apparent failure mechanisms and the number of reported deaths and injuries associated with Takata air bag inflators. Comments of Jay Logel at p. 7 (Dec. 18, 2023).

[94] NHTSA Recall Nos. 20V-681, 21V-766, and 21V-800.

[95] Approximately 67 million non-desiccated Takata PSAN air bag inflators, across nineteen vehicle manufacturers, are under recall because they may rupture when deployed, causing serious injury or even death. Certain other types of Takata inflators are also under recall. For more information about the Takata air bag inflator recalls, see *Takata Recall Spotlight* (NHTSA), https://www.nhtsa.gov/vehicle-safety/takata-recall-spotlight.

[96] In addition, since 2002, manufacturers have been required under NHTSA's early warning reporting regulations to report on incidents involving injury or death. *See* 49 CFR Part 579, Subpart C.

enable an effective peer comparison that would encompass inflators manufactured for the various foreign markets. In addition, the considerations relevant to determining whether a defect exists under U.S. law may not be the same in other countries. The foreign ruptures are, therefore, not included in a comparison with seven U.S. subject inflator field ruptures.[97]

Of the remaining eight ruptures in the collection of reports, six inflators appear to be substandard or imitation products not designed or manufactured to meet U.S. safety standards or based on the same industry standards as legitimate inflators. For this reason, they should not be used as peer comparators. Of the remaining two ruptures, one involved reported damage—scratching—on the inflator housing that appeared to have been caused by a tool and not by deployment or rupture. Further, while the reporting inflator manufacturer confirmed a rupture, the reporting vehicle manufacturer did not.[98] Given that none of the seven ruptures involving the subject inflators contained similar evidence, it is inappropriate to use this event in a comparison.

Appropriately filtering the list of confirmed ruptures of frontal driver- and passenger-side air bag inflators to include true peer incidents, there is only a single field rupture from all other inflator manufacturers to compare to the seven subject inflator field ruptures. As noted above, that rupture already resulted in three recalls, and the scope of vehicles under these recalls is broader than just a particular lot. NHTSA is not aware of further ruptures of that type of inflator, which is distinguishable from the repeated ruptures of the subject inflators. After each lot recall of subject inflators, another inflator outside the scope of the recall eventually ruptured in a

[97] To the extent any of the foreign field ruptures evidence a pattern, the agency is taking a closer look to ensure such trends do not implicate vehicles or equipment in the U.S.

[98] *Compare* Air Bag Inflator Rupture Incident Report (Initial & Final), Autoliv (Dec. 2, 2016) (confirming rupture but noting that "scratching" on areas of the inflator are "not consistent with Autoliv's quality requirements and the inflator exhibits damage/scratches inconsistent with normal deployment or a rupture") *with* Air Bag Inflator Rupture Incident Report (Final), Nissan (Dec. 20, 2016) ("There is damage on the outside of the housing which appears to be caused by an external tool, as evidenced by the multiple witness marks surrounding the hole in the inflator. Nissan does not believe that a rupture occurred in this incident.").

vehicle, supporting the need for a more comprehensive recall to address the full defective population.

5. ARC's addition of an automated borescope examination process recognizes and mitigates the risk of a field rupture due to exit orifice blockage.

In August of 2017, ARC began adding an automated borescope to the manufacturing process.[99] After the last friction weld is complete, the borescope inspects the inside of the center support to detect any debris, including weld flash.[100] By June of 2018, ARC had fully implemented this process by installing these automated borescopes on all assembly lines used to manufacture the subject inflators. ARC rejects any inflator for which the borescope detects material or debris in excess of the specified parameters,[101] and, from the first borescope installation to March 2023, ARC rejected 195,166 inflators based on the borescope's inspection.[102]

The automated borescope examination process, which detects excessive weld flash or other debris in the inflator center support, recognizes and mitigates the risk of a field rupture due to exit orifice blockage. The agency is unaware of a field rupture of a frontal, driver- or passenger-side hybrid toroidal inflator manufactured using the borescope examination process. Thus, the subject inflators subject to this initial determination are the inflators manufactured before the full implementation of this process change.

The borescope process provides additional evidence of the likelihood that problematic levels of debris are present in the subject inflator population. Inflators built after the borescope process was introduced continued to otherwise undergo the same friction welding process as

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[99] *See* ARC Presentation dated Oct. 2017 on Automated Borescope.
[100] *See id*.
[101] *See id*.
[102] *See* ARC Response to Request 8 of NHTSA May 31, 2023 Special Order.

before the borescope inspection began. This means that the rejection rates from the borescope inspections provide insight into the extent of debris present in the subject inflators, which were produced under similar manufacturing procedures. Before implementation of the borescope process, there was no analogous mechanism in place for detecting—and removing from the manufacturing line—inflators with excessive and dangerous levels of debris.

Moreover, ARC's representations during this investigation suggest that the number of inflators with excessive debris before 2017 was potentially even higher than the extent of debris present in inflators manufactured after borescope implementation. By 2017, ARC claims that it had already taken numerous other steps to update the manufacturing process for the inflators, such as upgrading the welding equipment on several production lines and refining welding tolerances in response to field and testing ruptures.[103] In this investigation, ARC has claimed that the manufacturing procedures and equipment in place by 2017 were improvements on the procedures and equipment in place in the preceding years of inflator production. If so, the rate of unacceptable inflators due to debris as revealed by the borescope inspections likely would have been even higher for inflators built during the years in which the manufacturing processes were less stringent. At the very least, the nearly 200,000 inflators rejected between the start of the borescope implementation process and March 2023 corroborate the other evidence from analyses of the field ruptures and lot acceptance testing ruptures that suggests a large number of inflators in the subject population contain unacceptable levels of debris, posing a risk of rupture.

6. The field and LAT ruptures show a defect common to all of the subject inflators.

The evidence demonstrates that the friction welding process is responsible for debris and weld insufficiencies, which have led to over-pressurization and weld failures, causing ruptures.

[103] *See, e.g.*, ARC Working Group Meeting Minutes dated Dec. 5, 2017.

The seven confirmed ruptures of the subject inflators in vehicles in the United States each presented evidence of over-pressurization or weld insufficiency as a likely cause of the rupture. In addition, at least twenty-three of the reported lot acceptance test ruptures share over-pressurization or weld insufficiency commonalities with the seven field ruptures. These instances of over-pressurization and weld insufficiency are linked to the friction welding process.

As described in section II.A.3, ARC and GM identified problems with one of the friction welds in their analyses of the rupture of the MY 2011 Chevrolet Malibu inflator, attributing the rupture as most likely caused by a failure of the friction weld.[104] ARC reiterated the cause of the rupture as a "welding issue" in its response to the agency's September 2023 initial decision.[105] In six of the subject inflator ruptures that occurred during lot acceptance tests, ARC identified similar issues related to the same friction weld, again noting that friction weld failure as a potential causes of the ruptures.[106] In addition, the investigative file contains significant evidence that the friction welding process has led to exit orifice blockage, causing over-pressurization and rupture. Information gathered in three of the U.S. field incidents includes evidence of material in the exit orifice: photos of the upper portion of the center support in the MY 2002 Chrysler Town & Country show an unmistakable blockage in the exit orifice;[107] photos of the upper piece of the center support in the MY 2015 Chevrolet Traverse in Kentucky show material blocking the exit

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[104] *See* ARC Presentation dated Mar. 21, 2019 on MY 2011 Chevrolet Malibu rupture at p. 4; GM Presentation dated Jan. 29, 2019 on MY 2011 Chevrolet Malibu rupture at p. 3.
[105] *See* Written Response of ARC Automotive, Inc. to the September 5, 2023, Initial Decision Docket No. NHTSA-2023-0038 at p. 32, https://www.regulations.gov/comment/NHTSA-2023-0038-0027 at n. 31.
[106] *See* ARC Presentation dated Oct. 17, 2016 on SGO 2016-01/2017-01 Report 3 at pp. 14-16; ARC Report dated Nov. 4, 2016 under SGO 2016-01/2017-01 Report 5 pdf at p. 2; ARC Report dated Nov. 9, 2016 under SGO 2016-01/2017-01 Report 8 at p. 2; ARC Presentation dated Nov. 7, 2016 on SGO 2016-01/2017-01 Report 12 at slides 39-40; ARC Report dated Dec. 12, 2016 under SGO 2016-01/2017-01 Report 13; ARC Report dated Dec. 12, 2016 under SGO 2016-01/2017-01 Report 18; ARC Presentation dated Feb. 8, 2017 on A9/ZB Model Inflators at pp. 2-3; ARC Presentation dated May 14, 2017 on SGO 2016-01/2017-01 Report 20 at slides 27-30; ARC Report dated Dec. 14, 2016 under SGO 2016-01/2017-01 Report 22 at p. 2.
[107] *See id*.

orifice;[108] and photos of the upper portion of the center support in the MY 2017 Chevrolet Traverse show that the exit orifice was completely blocked.[109] Exit orifice blockage remains a possible cause based on the evidence for three other incidents—the MY 2004 Kia Optima, the MY 2015 Chevrolet Traverse in Michigan, and the MY 2016 Audi A3 e-Tron. In addition, Volkswagen attributed weld flash blockage leading to over pressurization as a potential cause for the inflator rupture in the MY 2015 Volkswagen Golf in Turkey.

Other data support exit orifice blockage as a common factor in these ruptures. In May of 2017, a group of manufacturers involved in the investigation that has been described as the "Collaboration Group" joined together to study the subject inflators. The Collaboration Group analyzed fourteen reports submitted pursuant to SGOs 2016-01 and 2017-01 of passenger-side hybrid toroidal inflator ruptures during lot acceptance test deployments and conducted related testing. The Collaboration Group concluded that all fourteen ruptures were caused by over-pressurization; in all fourteen incidents, the center support elongated, split in two, and ejected from the inflator housing; and, in all fourteen incidents, the upper portion of the center support had material in the exit orifice, witness marks around the exit orifice (indicating debris was forced into the exit orifice upon deployment but was subsequently knocked loose), or other evidence of exit orifice blockage or obstruction.[110] ARC has acknowledged the exit orifice

[108] *See id*. at p. 3.

[109] *See* Photos attached to email dated Apr. 5, 2023 to NHTSA from Hurley Medical Center; Photo 38 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 36 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 48 from inspection of MY 2017 Chevrolet Traverse rupture; Photo 45 from inspection of MY 2017 Chevrolet Traverse rupture.

[110] *See* ARC Presentation dated Feb. 8, 2017 on SGO 2016-01/2017-01 Report 4; ARC Presentation dated Dec. 8, 2016 on Inflator Incidents Update at p. 17; ARC Presentation dated Jan. 10, 2017 on SGO 2016-01/2017-01 Report 39; ARC Presentation dated Mar. 9, 2017 on ZC Anomaly; ARC Presentation dated Apr. 1, 2017 on SGO 2016-01/2017-01 Report 80; ARC Presentation dated Apr. 1, 2017 on SGO 2016-01/2017-01 Report 94; ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 95; ARC Presentation dated Nov. 10, 2017 on SGO 2016-01/2017-01 Report 120; ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 130; ARC Presentation dated Nov. 10, 2017 on SGO 2016-01/2017-01 Report 158; ARC Presentation dated Nov. 10 2017 on SGO 2016-01/2017-01 Report 176; ARC Presentation dated Nov. 8, 2017 on SGO 2016-01/2017-01 Report

blockage issue by implementing changes in its Failure Mode and Effects Analysis (FMEA)[111] and manufacturing process to mitigate it.[112] In fact, ARC implemented the automated borescope to identify excessive weld flash and other debris inside the inflator on all of its toroidal air bag inflator manufacturing lines as a direct response to the Collaboration Group's findings.[113] The borescope inspection process has identified unacceptable levels of debris in inflators produced on all ARC production lines using friction welding to manufacture hybrid toroidal inflators, which include 20 different production lines across five different ARC manufacturing plants. This extensive range illustrates that problems with excessive debris apply broadly across the subject inflators.

Some commenters suggested that the results of a field recovery program conducted by certain manufacturers during NHTSA's investigation show there is no defect in the subject inflator population. This program was initiated in the early stages of the investigation during the Preliminary Evaluation. During the field recovery program, 918 inflators from a subpopulation of the total subject inflator population were collected from salvage yards and deployed, with none of the inflators rupturing. Given the fact that this testing program was developed after just the first two U.S. field ruptures (the MY 2002 Chrysler Town & Country and the MY 2004 Kia Optima), the inflators tested represent a limited portion of the total subject population. They were selected based on (1) production date, with the vast majority being manufactured between 2001 and 2004, and (2) the vehicles into which the inflators were incorporated, which were Chrysler,

178; ARC Presentation dated Nov. 10 2017 on SGO 2016-01/2017-01 Report 184; ARC Presentation dated Nov. 10 2017 on SGO 2016-01/2017-01 Report 186; ARC Presentation dated Nov. 10 2017 on SGO 2016-01/2017-01 Report 192.

[111] In general, a Failure Mode and Effects Analysis is a qualitative tool associated with the design and manufacturing process that businesses use to identify and analyze potential failures in processes, such as those involving equipment, systems, and personnel. The goal of this analysis is to prevent failures, improve processes, and reduce the likelihood of failure causes and effects.

[112] *See* ARC Presentation dated Apr. 5, 2017 on SGO 2016-01/2017-01 Report 95 at p. 86.

[113] *See* ARC Working Group 8D Technical Closure Statement at p. 1.

Kia, and GM vehicles.[114] As such, the overall number of inflators recovered and deployed under the field recovery program was low compared to what ultimately became the total number of inflators in the subject population. While there were no ruptures under the field recovery program, ruptures in the field continued: after the program's initiation, there were five additional U.S. ruptures of the subject inflators.

The field recovery program confirmed, however, that some inflators in the field contain large amounts of debris. Prior to their deployment, the recovered inflators underwent X-ray imaging and, in some cases, CT scanning to determine whether debris intruded upon the exit orifice opening.[115] Seven of the recovered inflators were identified as containing such debris, including from weld flash.[116] All of those inflators deployed normally, which is consistent with the large number of complex variables that may factor into whether debris in the inflator leads to over-pressurization. The existence of this debris around the exit orifice of inflators in the field demonstrates the prevalence of this issue in the subject inflator population.

ARC's own failure analysis throughout the investigation has also indicated that, even if the company has been unable to identify the full universe of variables that can lead to a rupture, the commonalities in the failures are sufficient to reveal the nature of the problem—including the failure mode and the aspects of the inflator design and welding process most likely to contribute to it. In 2016, ARC was even able to conduct testing that replicated four ruptures out of 50 deployments.[117] In doing so, ARC identified five manufacturing variables in the assembly

[114] *See* Field Recovery Program Data Sheet dated May 10, 2018.
[115] *See* ARC Inspection Procedure and Evaluation dated Feb. 28, 2017.
[116] *See* Field Recovery Program Deployment Data Sheet; ARC Presentation dated Aug. 1, 2017 on Field Recovery Program.
[117] *See* ARC Presentation on Design of Experiment #5.

process that, when out of limits, appeared to contribute to the likelihood of a rupture.[118] ARC's fault trees and failure mode effects analyses similarly isolate the specific steps in the manufacturing process most likely relevant to the ruptures. The existence of factual differences or different variables that led to the ruptures does not establish that the ruptures lacked a common defect.

Outside of this investigation, ARC has openly acknowledged the problems with its friction welding process that have led to the defect NHTSA seeks to remedy. For instance, in representations to the United States government outside of this investigation, ARC has acknowledged that the "problematic" characteristics of the subject inflators are not limited to isolated production lots. Specifically, in a patent application filed with the United States Patent and Trademark Office in 2020, ARC requested a patent on an improved air bag inflator design. When explaining the background of existing designs that prompted the need for an improved design, ARC's application represented that "[s]ome existing inflator assemblies utilize a center support structure that requires two simultaneous welds, which is problematic in respect of manufacturing and also increases the potential for weld particles to exit the inflator upon deployment. Existing designs have also been configured to fragment during deployment as a consequence, in the event of excessive pressure increase within the inflator due to some failure or external condition or the like, these existing inflator designs can be potentially hazardous for vehicle occupants."[119]

The claimed improvements to mitigate these problems with prior inflators focused on the precise aspects of the inflator that are at issue in NHTSA's proceeding. Specifically, ARC

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[118] *Id.* Additional efforts in 2017 to replicate the failure mode in a more precise manner were unsuccessful, further indicating that different variables may combine to contribute to the risk of rupture. *See* ARC Working Group Meeting Minutes dated Feb. 13, 2018.

[119] U.S. Pat. App. Pub. No. 2022/0185224 A1 to Rose *et al.*, at ¶¶ 0005-06.

intentionally redesigned its inflator in a way that would avoid the friction welding process that caused problems for the subject inflator, such as the step of simultaneously friction welding the top and bottom of the inflator housing to the center support.[120] As ARC explained in the patent application, "[t]he described inflator also eliminates the requirement for simultaneous welds, which facilitates manufacturing and reduces potential weld particles."[121] In addition, the redesigned inflator included a pressure relief valve to create a failure mode that would avoid rupture if over pressurization occurred.[122] These representations and redesign efforts demonstrate that, at the same time ARC was insisting in the NHTSA investigation that the subject inflators were neither defective nor inappropriate in their performance, the company was actively trying to correct the problems with its inflators and conceding the existence of those problems to another agency in the United States government.

Ignoring the evidence of a common defect attributable to the friction welding process, certain commenters have nevertheless argued that there is, as of yet, no definitive, established "root cause."[123] While comments from two individuals supported NHTSA's identification of weld-flash evidence[124] common to several of the ruptures, other commenters incorrectly suggested that, to establish a defect here, NHTSA must identify a more specific cause that is

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[120] For the subject inflators, ARC refers to this step of the manufacturing process as Operation 50 for the driver-side inflator and Operation 42 for the passenger-side inflator. *See, e.g.*, ARC Presentation on CADH Inflator Design.

[121] U.S. Pat. App. Pub. No. 2022/0185224 A1 to Rose *et al.*, at ¶ 0047.

[122] "The inflator also advantageously includes a pressure relief in the event of an elevated system internal pressure without any rupture of the inflator." *Id.*

[123] *See, e.g.*, Comments of Kia America Inc. at pp. 1-2; Written Comments of General Motors LLC at p. 13; Comments from Hyundai Motor America at pp. 2, 20; Public Comment Submitted by Jacqueline Glassman at p. 10 (stating that while the root cause "may not necessarily be a prerequisite to understanding that there is a safety related defect," there must "be some meaningful relationship in order to infer that the underlying problem is a 'class-wide' problem.").

This is despite the years of analysis the industry has undertaken during the agency's investigation. The agency does not believe that it is either necessary or appropriate to allow for additional time for such analysis.

[124] *See* John Keller P.E., Comments on NHTSA's Initial decision to Declare ARC Automotive Toroidal Airbag Inflators Defective (Dec. 6, 2023) at p. 1; Jerry W. Cox, Esq., Comments in Support of the National Highway Traffic Safety Administration's Initial Decision to Declare 52 Million ARC Automotive Airbag Inflators Defective at p. 2.

identical in each of the failures. Some of these comments hinge, at least in part, on the notion that a specific root cause of the defect in the Takata air bag inflators had been identified.[125] For example, Hyundai asserted that the agency's September 2023 initial decision was "entirely inconsistent with its decision-making in the Takata case," citing in part a consensus root cause at the time of the Takata recall request letter.[126] Whether a particular recall had an identified cause before or at the time it was filed does not establish that such a particularized root cause is a requirement for a recall. It is not.[127]A "'defect' includes any defect in *performance*, construction, component, or material of a motor vehicle or motor vehicle equipment." 49 U.S.C. § 30102(a)(3) (emphasis added). Accordingly, "a determination of 'defect' does not require any predicate of a finding identifying engineering, metallurgical, or manufacturing failures. A determination of 'defect' may be based exclusively on the *performance record* of the vehicle or component." *Wheels*, 518 F.2d at 432 (emphasis added); *see also United States v. General Motors Corp.*, 841 F.2d 400, 413 (D.C. Cir. 1988) (explaining that a defect can be established by the performance record alone and does not require an engineering explanation).[128] A non-defective inflator does not rupture when it is commanded to deploy, absent some extraordinary circumstance such as

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[125] Commenters appear to overstate NHTSA's reliance on the Takata recalls as a basis for the initial decision here. Takata was discussed essentially twice in the initial decision: in a section providing general background on air bags and in another providing background on the agency's past practices regarding recall request letters. NHTSA's references to Takata in the initial decision were made to provide context on recalls involving inflator ruptures and not as a particularized substantive argument.

[126] In fact, NHTSA's recall request letter to Takata makes clear that the agency believed that multiple variables could result in propellant degradation, which caused ruptures. Letter from F. Borris, NHTSA, to K. Higuchi, TK Holdings Inc. (Nov. 26, 2014), https://static.nhtsa.gov/odi/inv/2014/INRM-PE14016-60978.pdf (describing high absolute humidity as one variable, but explaining that other ruptures occurred outside areas of high absolute humidity). That is also the case here, where the evidence points to multiple variables that may result in over pressurization, causing rupture.

[127] Pointing to the specific facts in the Takata recalls as precedent for *necessary* elements to order a recall, among other things, ignores that each recall is fact specific—and suggests, incorrectly, that the agency must match the bases for the Takata recalls to order a recall here.

[128] It is well established that a safety defect determination does not require an engineering explanation or root cause. *See* NHTSA Enforcement Guidance Bulletin 2016–02: Safety-Related Defects and Automated Safety Technologies, 81 FR 65705, 65708 (Sept. 23, 2016).

tampering.[129] The repeated ruptures of the subject inflators would not have occurred absent a defect.[130]

Manufacturers' arguments related to a "root cause" finding are inconsistent with their legal obligations and actions they have taken pursuant to those obligations. Under the Safety Act, a manufacturer is required to initiate a recall once it "learns the vehicle or equipment contains a defect and decides in good faith that the defect is related to motor vehicle safety." 49 U.S.C. § 30118(c)(1). It is common for the industry to recognize obvious defects without identifying a specific cause when, based on the performance record, they present a severe risk to safety.[131] Related to air bags in particular, manufacturers have recalled inflators susceptible to rupture without identifying the type of particularized cause demanded by the commenters.[132] In fact, ARC and other manufacturers have done so here. For example, BMW, GM, and Volkswagen initiated recalls without identifying a cause based on the severity of the risk as shown by one

[129] *See* NHTSA, *Special Crash Investigations: On-Site Air Bag Inflator Rupture Crash Investigation; Vehicle: 2009 Honda Civic; Location: Maryland; Crash Date: September 2017* (June 2020), https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812972 (explaining, in investigation into ruptured inflator, that "[t]he wiring harness for the driver's frontal air bag inflator had been tampered with since the vehicle's date of manufacture").

[130] In much of the prior litigation under Safety Act the issue of whether there was a defect was not in question, in part due to the obvious nature of the defect. *See*, *e.g., United States v. General Motors Corp.*, 561 F.2d 923, 924 (D.C. Cir. 1977) ("*Pitman Arms*"); *United States v. Ford Motor Co.*, 453 F. Supp. 1240, 1249 (D.D.C. 1978).

[131] *See* Defect Notices, NHTSA Recall Nos. 23V-867 (In describing the cause of the defect that "may lead to thermal overload, possibly resulting in smoke or a fire," Volkswagen stated that "[t]he root cause is still under investigation, but the risk is associated with the battery modules exhibiting the potentially critical self-discharge behavior."); 23V-840 (In its description of the cause of a defect that "can lead to thermal events and in some cases fires," Porsche states that "[t]he root cause is still under investigation."); 23V-369 (JLR provides "NR," commonly understood to mean 'no response,' to describe the cause of a "thermal overload" condition that "may show as smoke or fire" and "can result in increased risk of occupant injury."); 23V-626 (In determining a defect exists that can "result in a loss of motive power," Ford identified one contributing factor but stated that "a second factor must be present or induced," and that "[t]his factor is still unknown and under investigation."); 24V-099 (For a defect affecting seatbelt function that "may result in injury in the event of a crash," Ford attributed the issue to corrosion "caused by an undefined supplier manufacturing issue."); and 24V-418 (For a defect resulting in seatbelts becoming "unavailable as an occupant restraint" and resulting in "an increased risk of injury if the vehicle is involved in a crash," GM describes the cause as "[t]wo internal components" that "may be slightly our of dimensional specifications" but does not explain how the components came to be out of specifications.)

[132] *See* Defect Notice, NHTSA Recall No. 16V-045 ("The cause is yet not determined. Takata and Volkswagen are still under investigation of the root cause.").

rupture.[133] ARC acknowledged that it has "supported targeted recalls by vehicle manufacturers related to field ruptures and production lots with an identified potential risk of defect."[134] These actions are consistent with a manufacturer's obligations under the Safety Act to recall vehicles when it decides a defect related to motor vehicle safety exists. The Safety Act does not allow a manufacturer to evade or delay a recall because it has not identified a specific "root cause." NHTSA routinely takes enforcement actions against manufacturers for failure to timely make recall determinations, including where the lack of an identified root cause contributed to the delay.[135]

Commenters' arguments regarding root cause also ignore the evidence of a common defect collected during NHTSA's investigation and described above in this section and II.A.2-3 & 5. The evidence indicates that problems related to friction welding can lead to both over-pressurization due to exit orifice blockage and insufficient friction welds. All of the field ruptures and a majority of the lot acceptance test ruptures share these commonalities.

The evidence collected in NHTSA's investigation establishes that the subject inflators have an unacceptable risk of rupturing. Therefore, the entire subject inflator population is

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[133] *See* Defect Notices, NHTSA Recall Nos. 17V-189 ("The root cause has not yet been determined and is still under investigation."); 19V-019 (providing no response ("NR") as to the description of the cause); 21V-782 (providing no response ("NR") as to the description of the cause); 22E-040 ("GM's investigation has not identified the specific root cause of the LAT rupture"); 22V-246 (providing no response ("NR") as to the description of the cause); 22V-543 ("The root cause is currently unknown . . . ."). Even in GM's most recent ARC-related recall, which it no longer sought to limit to a specific production lot, it indicated as to cause that "GM is continuing its investigation into this incident." *See* Defect Notice, NHTSA Recall No. 23V-334.

[134] *See* Written Response of ARC Automotive, Inc. to the September 5, 2023, Initial Decision Docket No. NHTSA-2023-0038 at p. 20, https://www.regulations.gov/comment/NHTSA-2023-0038-0027.

[135] *See, e.g.*, Consent Order between NHTSA and Daimler Trucks North America, LLC, In re: AQ18-002 ¶ 29 (Dec. 29, 2020), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/aq18-002_consent_order_executed.pdf ("DTNA acknowledges that the failure to identify a specific root cause, develop an adequate repair or remedy, or confirm the affected population of vehicles are not bases for delaying the identification of a defect or noncompliance, the determination of whether a defect related to motor vehicle safety, or the timely reporting a defect or noncompliance to NHTSA."); Consent Order between NHTSA and General Motors Company, In re: TQ14-001 ¶ 24 (May 16, 2014), https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-11/TQ14-001-General-Motors-Consent-Order-5-6-2014-tag.pdf ("GM shall not delay holding any meeting . . . to decide whether or not to recommend or. conduct a safety recall because GM has not yet identified the precise cause of a defect, a remedy for the defect, or prepared a plan for remedying the defect.").

defective and must be recalled. As demonstrated by past ruptures, the occurrence of a rupture is unpredictable. Ruptures have occurred outside of narrower inflator populations previously identified by the manufacturers to be the defective population. There is substantial evidence tying the defect to the friction welding process, and this process was used across all manufacturing lines and plants that produced the subject inflators. After multiple years of thorough investigation and analysis, the evidence does not identify another element linking the ruptures. As such, the subject inflator population identified in this decision is the narrowest defective population supported by the evidence.

ARC claims the subject inflator population is too broad due to variations in design and manufacturing of the subject inflators. Similarly, other commenters have pointed out these variations and assert that certain subpopulations of the subject inflators should be excluded from the scope of a recall, *e.g.*, passenger-side subject inflators and subject inflators installed in certain makes and models. Despite years of comprehensive analysis, NHTSA has found no design or manufacturing evidence that shows these subpopulations are less susceptible to rupture. In addition to the field rupture of a passenger-side inflator, passenger-side inflators also ruptured in fourteen lot acceptance tests. While NHTSA recognizes there may be practical and logistical challenges to implementing a recall for the full defective population, these concerns do not warrant a narrower scope. Under the Safety Act, unreasonable risks cannot be countenanced simply because of logistical challenges that may be involved in remedying them.

None of the manufacturers have provided compelling technical evidence that connects any of these variations to the defect or to a particular subset of inflators that rebuts the need to recall the subject inflators, “[a]nd there is justice in this allocation to the manufacturer[s] of the burden of compiling significant data on the causes and consequences of mishaps in [their] cars.”

United States v. General Motors Corp., 561 F.2d 923, 931 (D.C. Cir. 1977) ("*Pitman Arms*"). And contrary to Hyundai's comment that there is "little downside" for the agency to "complete the necessary investigation and make a rational judgment as to whether" and to what extent a recall is needed, there is already sufficient evidence that the full population of subject inflators is defective. There is significant "downside" at this point to further investigation in lieu of a recall.[136] Absent a recall, vehicle owners are not notified of the defect or entitled to have it addressed when a remedy is available. NHTSA has, accordingly, initially determined that the full population of subject inflators is defective.

B. The defect is related to motor vehicle safety.

NHTSA has also preliminarily concluded based on the available evidence that the defect in the subject inflators (as described in section II.A) is related to motor vehicle safety because a risk of inflator rupture presents an unreasonable risk of death or injury in the event of an accident. It is undisputed that rupturing inflators have forcefully propelled pieces of metal at occupants, resulting in grave, permanent injuries and death. Future rupture events likely would have similar outcomes. An air bag's life-saving purpose also has bearing on the unreasonableness of this defect.

The Safety Act defines "motor vehicle safety" as "the performance of a motor vehicle or motor vehicle equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident and includes nonoperational safety of a motor

[136] Hyundai also noted that "no other country with a similar safety recall legal framework" has required a recall for the subject inflators. There are seven confirmed U.S. ruptures of the subject inflators, and over 20 million fewer ARC inflators were distributed globally (across *all* countries) than to the U.S. In any case, NHTSA's action is based on U.S. law. NHTSA is not bound by other jurisdictions and their respective authorities and is making this decision based on the facts before it (all of which may, or may not, be available to other jurisdictions).

vehicle." 49 U.S.C. § 30102(a)(9). The statute does not further define what constitutes an "unreasonable risk." Based on the ordinary meaning of that term, the high severity of an inflator rupture coupled with the inability of a vehicle owner or occupant to detect that the rupture will occur or otherwise mitigate the risk warrants a finding that the risk is unreasonable despite the low probability that a rupture will occur when the inflator is commanded to deploy.

In considering this issue, courts have found that an assessment of whether a risk is unreasonable requires a "'commonsense' approach." *Carburetors*, 565 F.2d at 757. The most obvious, or "commonsense," consideration in this assessment is, of course, the safety risk itself. A defect that "leads to failures in a vital component . . . is prima facie an 'unreasonable risk.'" *Pitman Arms*, 561 F.2d at 929. In other words, there is "no question" that a risk of an "extremely dangerous" situation "should be considered an unreasonable risk to safety." *Carburetors* at 757. If the risk is sufficiently severe, even an "exceedingly small" or "negligible" number of expected incidents is "unreasonably large." *Id.* at 759.[137] This is so regardless of whether any injuries have already occurred, or whether the projected number of failures or injuries in the future is trending down. *See id*.

Courts have also considered certain particularly severe defects to be "per se" safety-related defects regardless of how many injuries or accidents are likely to occur in the future. These decisions have involved defects that cause the failure of a critical component, a vehicle

[137] Commenters asserted that NHTSA did not use or follow risk matrices used by NHTSA's Office of Defects Investigation (ODI). NHTSA's risk matrices are not recall-determination tools. Rather, the matrices are used "[t]o assist in objectively evaluating whether a potential defect issue should be advanced to the next stage for an investigation. . . . ODI uses these matrices as deliberative tools to assist in evaluating the risk posed by a potential defect and identifying issues that should be elevated to an investigation." Risk-Based Process for Safety Defect Analysis and Management of Recalls, DOT HS 812 984 (Nov. 2020), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/14895_odi_defectsrecallspubdoc_110520-v6a-tag.pdf. NHTSA decided back in 2015 that this issue warranted investigation under its risk-based processes. Further, ODI's risk matrices and their application are not binding on NHTSA or any outside entity, and they are not "guidance"; they are a tool for ODI personnel.

fire, a loss of vehicle control, and a defect that suddenly moves the driver away from the steering wheel, accelerator, and brake controls. *See Carburetors*, 565 F.2d 754 (engine fires); *Pitman Arms*, 561 F.2d 923 (loss of control); *United States v. Ford Motor Co.*, 453 F. Supp. 1240 (D.D.C. 1978) ("*Wipers*") (loss of visibility); *United States v. Ford Motor Co.*, 421 F. Supp. 1239, 1243-44 (D.D.C. 1976) ("*Seatbacks*") (loss of control); *see also* NHTSA, *Motor Vehicle Safety Defects and Recalls: What Every Vehicle Owner Should Know*, *available at* https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/14218-mvsdefectsandrecalls_041619-v2-tag.pdf (providing examples of safety-related defects, including "[a]ir bags that deploy under conditions for which they are not intended to deploy" and "[c]ritical vehicle components that break, fall apart, or separate from the vehicle, causing potential loss of vehicle control or injury to people inside or outside the vehicle").

1. The risk posed by an inflator rupture is severe.

Here, there is no question that an inflator rupture presents an extreme danger. As already described, a rupture turns a component with the sole purpose of preventing serious injury and death into a device that can cause serious injury or death; the defect simultaneously undermines the component's life-saving purpose and introduces a life-threatening danger. To reiterate, the consequences of these ruptures thus far include lacerations to the legs, harm to the jaw and ear, severe injuries to the face, neck, head, shoulder, and arm, injury to the airway requiring a tracheostomy, and death. Commonsense dictates that the defect here poses an unreasonable risk. *See Carburetors*, 565 F.2d at 757-59.

Even if a vehicle occupant is fortunate enough not to be struck by the metal fragments ejected out of the inflator upon a rupture, the rupture also undermines the intended effectiveness of the air bag in protecting an occupant in a crash. An air bag is designed to deploy in a precise manner under very strict timeframes. Over the course of milliseconds, numerous vehicle systems working in tandem must perform a multitude of functions in a particular order to ensure that the airbag protects the occupant.[138]An air bag inflator is a critically important component in this sequence as it is responsible for ensuring that an air bag inflates a precise amount at a precise time in order to be in the right position when it meets the vehicle's occupant. When an inflator ruptures, the pressure accumulating in the inflator to is suddenly released, resulting in a complete disruption of the tightly controlled gas flow intended for the inflator.[139] This disrupts the air bag inflation timing, undermining the air bag's ability to perform its intended safety function. Thus, even apart from a rupture's dangerous explosion of metal fragments towards a vehicle occupant, the rupture deprives a vehicle occupant of the benefit of an air bag.[140] Manufacturers have issued recalls to address the increased safety risk to vehicle occupants when air bags do not properly inflate.[141]

Hundreds of recalls are issued each year for safety-related defects. In 2023 alone, there were nearly 800 such vehicle recalls. The vast majority of these recalls were uninfluenced by a NHTSA investigation.[142] The nature of the defects and potential consequences ranged widely. While some involved fire risks or loss of vehicle control (and certain such recalls were

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[138] Such functions include but are not limited to detecting an impact, classifying the impact as severe enough to warrant an air bag deployment, understanding the likely positioning of the vehicle occupant based on the occupant's seating position and seatbelt status, commanding deployment of the air bag at a specified inflation rate to match the occupant's expected position, and reaching a level of air bag inflation necessary for the cushion of the air bag to reduce the expected crash forces. This is a very complex dynamic in which numerous life-critical systems are interdependent and all components must perform exactly as intended to protect the vehicle occupants.

[139] This release causes the gas flow rate into the air bag to suddenly spike before dramatically dropping as the inflator's pressure equalizes with the ambient air.

[140] During the investigation, both ARC and at least one vehicle manufacturer acknowledged that the rupture of one of the subject inflators could cause an air bag to underinflate. *See* ARC Presentation dated Mar. 1, 2016 on MY 2004 Kia Optima Rupture; Hyundai Letter to NHTSA dated Apr. 15, 2020.

[141] *See* NHTSA Recall Nos. 12V-055 and 01V-318.

[142] NHTSA 2023 Annual Report: Safety Recalls (Mar. 2024), *available at* https://www.nhtsa.gov/sites/nhtsa.gov/files/2024-03/NHTSA-2023-Annual-Recalls-Report_0.pdf. "Uninfluenced" recalls are recalls issued by a manufacturer not influenced by NHTSA investigation into the issue.

accompanied by a "do not drive" advisory), others involved a variety of components and other potential consequences: sun visors that may detach (may distract or obstruct view); aluminum siding that may detach from a trailer; incorrectly assembled door latches that may allow the door to open unexpectedly during operation; incorrectly installed headlights (reducing visibility); and detached rearview mirror lenses (reducing visibility).[143] When viewed broadly against the backdrop of the hundreds of recalls issued each year for various types of components and attendant consequences, the severity of an inflator rupture—where the consequence of the defect is the projection of shrapnel into the occupant compartment—is extreme. The latent nature of the defect further exacerbates its severity. This defect cannot be discerned by a diligent vehicle owner or even as the result of an inspection. The defect only becomes apparent upon a deployment but, by then, the danger has already manifested. As a result, this defect provides no opportunity for a driver to take any mitigating actions absent a recall—either ahead of manifestation of the defect, or when the defect manifests.

The air bag inflator industry itself has long recognized the severity of the risk posed by an inflator rupture and the importance of preventing it. The United States Council for Automotive Research (USCAR) has published specifications establishing performance and validation requirements for air bag inflators. These requirements include assurance against certain behaviors in the event of an inflator rupture, which USCAR refers to as a burst. The specifications provide a testing procedure to confirm the structural integrity of an inflator, instructing the tester to block any exit orifices and increase the pressure until the inflator ruptures.[144] This test is to ensure that "[a]n Inflator shall not eject any components or fragments

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[143] *See* NHTSA Recall Dashboard, https://datahub.transportation.gov/Automobiles/NHTSA-Recalls-by-Manufacturer/mu99-t4jn; Recall Nos. 23V-781, 23V-612, 23V-373, 23V-650, 23V-856. The recall dashboard is a user-friendly platform that can be used to sort, filter, visualize, and export recall data.

[144] USCAR Inflator Technical Requirements and Validation at p. 30 ¶ 5.2.3.1 (SAE Int'l, 2023).

during any portion of [design validation] and [production validation] testing."[145] In the event of a rupture, any separation must be ductile and "the inflator shall not fragment or eject any part of the structural components."[146]

ARC's own design practices similarly recognize that inflator ruptures present an unacceptable level of risk. Similar to the USCAR specifications described above, ARC's own internal mistake proofing protocol acknowledged that it was critical during the Operation 50 step of the manufacturing process to ensure that "no vent orifice or weld flash blockage" occurred.[147] This is because ARC recognized that if those conditions exist, "[t]he inflator can "over pressurize and result in parts ejecting."[148] ARC assigned this type of over pressurization and rupture an FMEA severity number of 10 out of 10—the highest level of severity of all risks in ARC's FMEA. Any inflators in which such blockage occurred were to be "manually scrapped" and prompt a supervisor notification. As these materials illustrate, at the design and manufacturing planning stages, ARC expected a strict lack of tolerance for conditions that created a risk of ruptures, out of concern for the precise dangers at issue in this proceeding.

As previously discussed in section II.A.6, manufacturers in the instant case have also recognized the severity of the defective inflators in several ways. A single rupture was enough to prompt BMW, GM, and Volkswagen to issue recalls.[149] Some manufacturers engaged private

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145 *Id.* at p. 7 ¶ 3.2.2.
146 *Id* at p. 7 ¶ 3.2.2.1.
147 *See* ARC Response to Requests 2 & 3 of NHTSA Aug. 25, 2015 IR Letter at p. 40.
148 *Id.*
149 *See* Defect Notices, NHTSA Recall Nos. 17V-189, https://static.nhtsa.gov/odi/rcl/2017/RCLRPT-17V189-8204.PDF ("The root cause has not yet been determined and is still under investigation."); 19V-019, https://static.nhtsa.gov/odi/rcl/2019/RCLRPT-19V019-2023.PDF (providing no response ("NR") as to the description of the cause); 21V-782, https://static.nhtsa.gov/odi/rcl/2021/RCLRPT-21V782-3621.PDF (providing no response ("NR") as to the description of the cause); 22E-040, https://static.nhtsa.gov/odi/rcl/2022/RCLRPT-22E040-9723.PDF ("GM's investigation has not identified the specific root cause of the LAT rupture"); 22V-246, https://static.nhtsa.gov/odi/rcl/2022/RCLRPT-22V246-3538.PDF (providing no response ("NR") as to the description of the cause); 22V-543, https://static.nhtsa.gov/odi/rcl/2022/RCLRPT-22V543-3225.pdf ("The root cause is currently unknown . . . ."). Even in GM's most recent ARC-related recall, which it no longer sought to limit

research firms to try to better understand the defect.[150] In an effort to eliminate this severe risk from future inflators with the same design as the subject inflators, ARC implemented the automated borescope on all of its toroidal air bag inflator manufacturing lines.[151] Going a step further, ARC has taken steps to remove the potential for this defect and the associated risk by considering other inflator designs.[152] All of these actions underscore the commonsense recognition that a piece of equipment intended to protect people from injury and save lives that, instead, explodes and propels metal toward vehicle occupants presents an unreasonable risk to motor vehicle safety.

Some commenters contended that the "commonsense" approach to the assessment of unreasonable risk requires a cost consideration, and that NHTSA did not consider costs in issuing its decision. This contention is essentially based on language in *Wheels*, in which the U.S. Court of Appeals for the D.C. Circuit discussed an approach to safety in the context of defects—specifically, a "'commonsense' balancing of safety benefits and economic cost" that recognizes that "manufacturers are not required to design vehicles or components that never fail." The court stated that "[i]t would appear economically, if not technologically, infeasible for manufacturers to use tires that do not wear out, lights that never burn out, and brakes that do not need adjusting or relining. Such parts cannot reasonably be termed defective if they fail because of age and wear." *Wheels*, 518 F.2d at 435-36.

The subject air bag inflators are not the type of "wear and tear" component to which the cost consideration described in *Wheels* would be apposite. Similar to the defective component in

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to a specific production lot, it indicated as to cause that "GM is continuing its investigation into this incident." *See* https://static.nhtsa.gov/odi/rcl/2023/RCLRPT-23V334-3445.PDF.

[150] *See* Northrop Grumman Presentation dated May 5, 2023 on GM ARC Inflator Investigation; Memorandum – Meeting with HMA with Enclosure, Docket No. NHTSA-2023-0038, https://www.regulations.gov/document/NHTSA-2023-0038-0029.

[151] *See* ARC Working Group 8D Technical Closure Statement at p. 1.

[152] *See* U.S. Pat. App. Pub. No. 2022/0185224 A1 to Rose *et al.*, at ¶¶ 0005-06.

Carburetors, "[h]ere we do not deal with a part which is subject to failure because of age and wear, or a part which drivers reasonably expect to have to check and replace because of the particular problem involved." *Carburetors*, 565 F.2d at 759-60. The inflator industry already designs inflators never to rupture. In any case, by requiring a recall of the subject inflators, the agency is not requiring manufacturers to produce "perfect, accident-free vehicles at any expense." *See Carburetors*, 565 F.2d at 760. Rather, it is requiring the notification of owners about these inflators "which did not, from the beginning, meet the manufacturer's own standards." *See id.* at 760.

2. Future inflator ruptures are expected.

As the agency observed in its September 2023 initial decision, new ruptures have occurred outside of the sub-populations of vehicles previously recalled, and it is expected that additional ruptures will occur in the future. *See Carburetors*, 565 F.2d at 758 ("[W]here a defect—a term used in the sense of an 'error or mistake'—has been established in a motor vehicle, and where this defect results in hazards as potentially dangerous as a sudden engine fire, and where there is no dispute that at least some such hazards, in this case fires, can definitely be expected to occur in the future, then the defect must be viewed as one 'related to motor vehicle safety.'") (footnotes omitted). However, just as the agency (and manufacturers) could not have predicted the vehicles in which ruptures have already occurred, nor can it predict the vehicles in which ruptures will occur for vehicles that remain equipped with subject inflators. Each of those inflators remains at risk. What is predictable is that the consequences of a rupture will be severe and possibly deadly. Thus, even though the risk of any individual inflator rupturing is low, it is nevertheless unreasonable. "The purpose of the Safety Act . . . is not to protect individuals from risks associated with defective vehicles only after serious injuries have already occurred; it is to prevent serious injuries stemming from established defects before they occur." *Id.* at 759.

NHTSA is supplementing its statistical evaluation of the rupture risk of the subject inflators as a result of several adjustments made since the initial decision and partially as informed by the comments received.[153] Upon additional analysis, NHTSA finds that the subject inflators have a higher risk of rupture than initially believed, based on a lowered estimate of the number of subject inflators that have previously deployed in the field. NHTSA's estimate is based on 38,480,407 vehicles that have subject inflators in the driver-side air bag only, 8,992,543 vehicles that have subject inflators in the passenger-side air bag only, and 1,873,066 vehicles that have subject inflators in both driver- and passenger-side air bags, totaling approximately 49 million vehicles. NHTSA now estimates that 1,349,802 of the subject air bag inflators (combined driver-side and passenger-side) deployed in vehicles between 2000 and 2023.[154] Based on the known field ruptures, the rupture rate of the subject inflators is therefore 7 out of 1,349,802. In other words, the risk of any subject inflator rupturing when commanded to deploy was and is 1 in 192,829.[155] NHTSA is adding to the docket a report more fully explaining its statistical considerations and findings. *See* NHTSA, *Estimating the Rupture Rate and Projecting Future Ruptures for Subject Inflators in NHTSA's Proceeding Related to EA16-003*.

NHTSA does not conduct statistical analyses as a matter of course in every defect investigation. Nor was a statistical analysis strictly necessary here—particularly given that the unreasonable risk here is self-evident and one of "common sense." The analysis was initiated in

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[153] Changes include applying different deployment rates to driver- and passenger-side inflators based on historical crash data, refining the classification of vehicles for purposes of accounting for attrition, and accounting for vehicles being driven fewer miles as they age. These changes address a number of comments directed at this analysis.
[154] NHTSA previously estimated that approximately 2,600,000 of the subject air bag inflators had deployed in the field.
[155] This is an increase from the prior estimate of 7 in 2.6 million (or 1 in 371,429).

response to a statement by ARC. In its response to the agency's recall request letter, ARC asserted that seven ruptures as compared to the total subject inflator population was insufficient to determine that a defect exists in the subject inflator population.[156] However, a rupture only occurs if the air bag deploys. As such, it is more appropriate and accurate to compare the number of past field ruptures to the number of past field deployments to determine the rate at which the subject inflators have ruptured. Determining an estimated number of past field deployments required statistical calculations, which yielded the initial analysis. NHTSA disagrees with General Motors' characterization of NHTSA's reliance on that statistical analysis as "heavy." Indeed, the analysis was previously addressed in just a few sentences of NHTSA's September 2023 initial decision.[157] The statistical analysis, now updated, is not a prediction of the future. It is, rather, additional information that supplements the agency's ordinary consideration of what constitutes an unreasonable risk, including engineering and investigative evidence. Although it supports NHTSA's conclusion, the statistical analysis was not necessary to NHTSA's September 2023 initial decision. That remains the case here as well.[158]

While NHTSA's updated statistical analysis confirms the commonsense understanding that inflator ruptures will continue to be rare, the severity of rupture renders that risk unacceptable under the Safety Act. Unsurprisingly, the manufacturers who have continued to dispute the need for a broader recall disagree that the risk is unreasonable. A number of

[156] ARC's May 11, 2023 Response to NHTSA's Recall Request Letter, p. 2, https://static.nhtsa.gov/odi/inv/2016/INRR-EA16003-90616.pdf.

[157] A NHTSA statistician also further explained her work, in the interest of transparency, at the October 2023 public meeting.

[158] GM asserted that NHTSA's statistical analysis is inconsistent with the agency's previous rejection of an earlier, separate statistical analysis (which GM characterizes as a "much more sophisticated predictive model") in a previously submitted petition for inconsequentiality. *See* 85 FR 76159 (Nov. 27, 2020) (decision on petition). The statistical analysis that GM provided in its previous inconsequentiality petition was submitted to support the argument that the defect in an air bag inflator (*i.e.*, an air bag inflator *in which a defect had already been determined to exist*) was, nonetheless, inconsequential to motor vehicle safety as installed in GM vehicles.

commenters challenged the persuasiveness of the future rupture risk, asserting that the estimated number of future ruptures is too low to present an unreasonable risk to motor vehicle safety. Comments emphasizing the low number of expected future ruptures are unconvincing. Up to this point, the subject inflators have ruptured rarely, and yet they have still injured or killed at least eight people in the United States. The evidence is sufficient for the agency to find that the rare, though expected, occurrence of future rupture is unreasonable given the severity. Under the plain language of the Safety Act, such a severe, undetectable, and unpredictable risk of an inflator rupturing and sending shrapnel at high speed into the occupant compartment of a vehicle is "unreasonable." Even a "negligible" number of future ruptures is unreasonable given that a foreseeable outcome is severe injury or death. *See Carburetors*, 565 F.2d 754 at 759; *Pitman Arms*, 561 F.2d at 924.

While an inflator rupture occurs if the inflator has been commanded to deploy in a crash, several commenters nevertheless asserted that the relevant population of inflators from which to derive a rupture rate should be the entire subject inflator population (51 million, rather than the number of inflators estimated to have actually deployed). The reasons were varied, including that all inflators have the same potential to undergo deployment and rupture in a crash, that use of the entire population best accounts for both the risk of a deployment and the risk of a rupture and, as commented by ARC, "permits a more accurate comparison to peer inflator data and more appropriately compares the risk to comparable peer populations."[159]

[159] Written Response of ARC Automotive, Inc. to the September 5, 2023, Initial Decision (Dec. 18, 2023 (Corrected – February 12, 2024), at p. 23. ARC also asserted that such an approach would be based on two directly observable inputs (number of inflators and known field events) instead of one (number of field events) with a separate estimated input (deployments). *See id.* at p. 22. Whether an input is "directly observable" has little import in determining appropriate variables to use as a statistical matter in developing risk assessments. While the total inflator population may be more accurately estimated, that does not render it the more appropriate metric.

NHTSA agrees that, in the event of a deployment, each of the subject inflators is equally at risk of rupture. None can be eliminated as not at risk, and it is not possible to know whether a particular inflator will rupture unless a deployment occurs. But a deployment is a necessary condition for a failure, and the vast majority of inflators have not deployed. Including the entire population of manufactured inflators in deriving a rupture rate—knowing that the overwhelming majority have not deployed—vastly understates the prevalence of the defect by ignoring the necessary condition for a failure. This would lead to a vast understatement of the true rupture rate and predicted future ruptures. For this reason, it is wholly appropriate to ground the predicted future rupture rate with reference to ruptures experienced in past deployments, and not to the total number of manufactured inflators.[160]

The notion that the total population of inflators allows for better peer comparison is also unconvincing. As explained above in II.A.4, there has been only one U.S. rupture of a non-Takata air bag inflator (other than an ARC air bag inflator), and any reference to the comparative rupture rates is of limited import, because that inflator was recalled after the first rupture. Therefore, it is unknown whether ruptures would have continued to occur in the absence of a recall. As is the case here, NHTSA believed the risk was unreasonable and a recall was warranted. The severity of inflator ruptures was also evident there, as the rupture resulted in a fatality. In that case, however, the manufacturer agreed to broad recalls of entire models (all

[160] General Motors refers to a previous investigation regarding Mini Cooper S exhaust pipe tips in which the total population was used to refer to a failure rate. The product at issue there, however, did not involve a necessary condition like a deployment of the subject air bags for the defect to manifest. And notably, in previously evaluating certain statistical analyses in a General Motors inconsequentiality petition regarding Takata air bag inflators, NHTSA described the risk at issue in terms consistent with that here. *See* 85 FR 76159 (Nov. 27, 2020) (describing the fleet-level risk as "the probability that at least one air bag will rupture among the thousands of air bag deployments expected to occur in the nearly 5.9 million affected GMT900 vehicles over the coming years").

model years) of vehicles that used the same type of inflator without the need for the agency to exercise its statutory authority to order a recall.[161]

Some commenters asserted that NHTSA improperly assumed that manufacturing variables in different variants of the subject inflators have no impact on the rupture rate. However, there is no evidence-based justification for treating any subpopulation of the subject inflators as presenting more or less risk. FCA stated that certain field ruptures should not be included in the analysis—the ruptures in the MY 2002 Chrysler Town & Country and the MY 2011 Chevrolet Malibu—because of these incidents did not have an underlying cause or failure mode in common with the other ruptures.[162] NHTSA does not agree that these incidents lack sufficient commonality to be considered, as described in section II.A. Additionally, as previously explained, root cause is not necessary for a defect determination. It is not appropriate to eliminate any of the ruptures in vehicles—the very incidents where people have already been harmed—from its evaluation of whether there is an unreasonable risk.

Consumer safety "would be most ill served by extending [a] delay based on new predictions that the number of injuries caused by the defect will diminish." *Carburetors*, 565 F.2d at 759. The agency also does not believe that logistical and cost-related concerns raised by commenters about a recall of the subject inflators warrants leaving the unreasonable risk unaddressed by a recall. NHTSA acknowledges the potential ramifications of a recall of this magnitude and does not take its decision lightly. However, the crux of this issue is not a variety of potential (or even attenuated or largely hypothetical) reverberations stemming from a recall—it is that there is defect in the subject inflators that presents an unreasonable risk of death or injury in the event of a crash, and that defect must be addressed.

[161] *See* NHTSA Recall Nos. 20V-681, 21V-766, and 21V-800.
[162] *See* Comments of FCA US LLC Regarding Initial Decision at pp. 5-6.

Every subject inflator that deploys is at risk of rupture, and rupture events are unpredictable and dangerous. Three of the seven field ruptures in the United States occurred between 2009 and 2017, and three more field ruptures occurred in the span of just over four months in 2021. The last field rupture occurred very recently, in 2023. While it is impossible to predict when the next rupture will occur, each inflator that deploys is at risk. NHTSA's statistical evaluation of the future rupture risk, while not imperative to its decision here, reinforces that field ruptures are expected to occur in the future, and any hopes premised simply on the relatively low odds of an inflator rupturing are insufficient to warrant inaction. *Cf. Carburetors*, 565 F.2d at 759 ("[T]he fact that in past reported cases good luck and swift reactions have prevented many serious injuries does not mean that luck will continue to work in favor of passengers of burning cars. As a matter of statistics their chances may well . . . appear quite favorable. The purpose of the Safety Act, however, is not to protect individuals from the risks associated with defective vehicles only after serious injuries have already occurred; it is to prevent serious injuries stemming from established defects before they occur."). With each subject inflator that deploys, the vehicle occupants are at risk of severe injury or death from a rupture. That risk is plainly unreasonable under the Safety Act.

III. Conclusion

Every field rupture of the subject inflators in the United States has resulted in at least one vehicle occupant being injured, several have resulted in severe injury, and one has resulted in death. Seven of the subject inflators have already ruptured in vehicles the United States. The facts and circumstances surrounding these U.S. field ruptures, the four foreign field ruptures, and the twenty-three lot acceptance test ruptures underscore the severe impact of the defect on motor vehicle safety. Based on its comprehensive analysis, NHTSA has concluded that the evidence shows that the causes of these ruptures stem from use of a friction welding process without adequate inspection safeguards in place and that all of the subject inflators were produced using this same process. As such, all of the subject inflators have a risk of rupture and are defective. The pattern and evidence of these ruptures confirms that the reactionary, limited-scope recalls are insufficient to address the safety risk and that a recall for the full subject inflator population is necessary. Given the severity of a rupture and the known ruptures there is ample evidence of a defect in the subject inflators. Common sense demands acknowledging that metal shrapnel projecting at high speeds and causing injury or death presents an unreasonable risk to safety, and the Safety Act does not allow for such a risk to remain unaddressed.

Pursuant to the Safety Act, NHTSA may make a final decision "only after giving the manufacturer[s] an opportunity to present information, views, and arguments showing that there is no defect or noncompliance or that the defect does not affect motor vehicle safety. Any interested person also shall be given an opportunity to present information, views, and arguments." 49 U.S.C. § 30118(b)(1). Given the more extensive detail and discussion of the technical issues in this notice, and to ensure opportunity for additional public feedback, NHTSA is providing an additional 30-day comment period. No additional public meeting will be held.

If NHTSA makes a final decision that the subject inflators contain a safety defect, NHTSA will order ARC to comply with the obligation to file notice of the safety defect with the agency and will order the vehicle manufacturers to carry out recalls by providing notice and a free remedy. *See id.* § 30118(b)(2).

Authority: 49 U.S.C. § 30118(a), (b); 49 CFR § 554.10; delegations of authority at 49 CFR § 1.50(a) and 49 CFR § 501.8.

Issued on: July 31, 2024

EILEEN FALLON SULLIVAN

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