Joint Comments of Safety Professionals from Autoliv, FCA US, Ford, General Motors, Hyundai, Kia, Maserati NA, Tesla, Toyota, and Volkswagen Group of America Relating to NHTSA's Initial Decision That Certain Frontal Driver and Passenger Air Bag Inflators Manufactured by ARC Automotive Inc. and Delphi Automotive Systems LLC Contain a Safety Defect

Docket No. NHTSA-2023-0038

On September 8, 2023, the National Highway Traffic Safety Administration (NHTSA) published a *Federal Register* Notice of its Initial Decision that certain frontal driver and passenger air bag inflators manufactured by ARC Automotive (ARC) and Delphi Automotive (Delphi) contain a safety-related defect and invited public comments on this decision. The range of vehicles affected by NHTSA's Initial Decision covers those equipped with inflators manufactured by ARC and Delphi from 2000-2018.

Prior to the publication of this Notice, NHTSA contacted affected vehicle manufacturers and suppliers, advising that this Initial Decision had been made and a Notice about it would be forthcoming. The Agency also indicated that it was preparing to share a Confidential File with affected companies to better enable them to have an opportunity, pursuant to the regulations, to review the data and present information, views, and arguments about the decision. This File contained mainly the submissions from the various manufacturers and suppliers that received information requests during NHTSA's multi-year investigation of the subject inflators beginning in 2015 with PE15-027. A Protective Agreement to preserve Confidential Business Information and Personally Identifiable Information was finalized on August 24, 2023, and a voluminous file was then made available to the affected companies.

Safety professionals from Autoliv, FCA US, Ford, General Motors, Hyundai, Kia, Maserati NA, Tesla, Toyota, and Volkswagen Group of America (the "participating companies")[1] undertook a review of the Confidential File, but its size, organization, and engineering detail did not permit an exhaustive review prior to the December 18, 2023, submission deadline. These comments are based on this review. For purposes of this comment, the information included in the Confidential File was presumed to be accurate by the commenters.

The Information in the Confidential File Does Not Support a Conclusion that there is a Safety Defect Among the 52 Million Subject Inflators Beyond the Population Already Included in Existing Safety Recalls

While NHTSA's investigation has been ongoing for a number of years, the safety professionals from the participating companies reviewing this File did not have a broader view of the existing data (as it is spread across multiple companies) until NHTSA shared the Confidential File after the Protective Agreement was finalized on August 24, 2023.[2] Thereafter, these safety professionals endeavored to review as much as possible of the hundreds of thousands of files and in hundreds of gigabytes of data[3] within the Confidential File. In reviewing that File, the safety professionals noted that the inflators are not homogenous. In fact, there are many differences in design configurations and

[1] Autoliv ASP, Inc., FCA US LLC, Ford Motor Company, General Motors LLC, Hyundai Motor America, Inc., Kia America, Inc., Maserati North America, Inc., Tesla, Inc., Toyota Motor North America, Inc., and Volkswagen Group of America, Inc.

[2] While the Confidential File contained responses from the various manufacturers that received Information Requests from NHTSA during the course of NHTSA's investigation, the Confidential File appears to contain few files showing NHTSA's analyses of the complete data set. Thus, while the sharing of the Confidential File provides the underlying raw data, it does not appear to provide a complete picture of NHTSA's analyses of the data supporting its Initial Decision.

[3] Each participating company had somewhat different file and file size totals ranging from approximately 100,000 to 270,000 files and from approximately 600 to 700 GB of data, in spite of downloading the files from the same source.

manufacturing attributes of the 52 million inflators that are the subject of NHTSA's Initial Decision. As further discussed in these comments, it is the collective opinion of the safety professionals from the participating companies that there simply is insufficient information to conclude that there exists a safety defect in the 52 million subject inflators and that a safety recall is appropriate.[4]

As an initial matter, it is important to understand that airbag inflators are a part of an occupant protection system. While a collection of inflators manufactured by a particular company might have similar model designations and other features, each implementation of an airbag inflator is unique, as each implementation of an inflator is for the inflation of a particular airbag that forms a part of an overall occupant protection system. For example, there are variations based on the occupant the system is intended to protect (driver vs. passenger), the number of inflation stages (single vs. dual), the overall dimensions, the exit orifice diameters (e.g., 4.3, 4.8, 5.3, and 5.8 mm), the average peak pressures during deployment, mass flow, pressure curve slopes, and amounts of propellants. These variations are of consequence to the performance of the inflator.

In addition, these inflators were produced for decades under conditions that varied by both place and time. The inflators were produced in four ARC facilities on numerous separate assembly lines across the world[5] using different manufacturing equipment with different attributes, including control systems (hydraulic v. servo control), number of parameter settings, weld monitoring, weld time, and overall cycle time, etc. Field

[4] The participating companies note that several manufacturers have conducted safety recalls of vehicles which contain ARC inflators.

[5] Delphi inflators were produced separately from these ARC facilities.

performance and Lot Acceptance Test (LAT) data do not show any significant performance trend pattern across the entire subject inflator population.

NHTSA asserts that the evidence shows a likely cause of inflator ruptures as relating to "a friction welding process that in some inflators produces weld slag" or other material that "can become lodged in that exit orifice and block the air flow required to fill the air bag cushion," and concludes that the scope of the concern ends in January 2018, when ARC fully installed borescopes on their hybrid toroidal manufacturing lines. However, data in the Confidential File show that the 52 million inflators are not all the same in design, they were not produced under the same conditions or at the same manufacturing facilities using the same processes or equipment.[6] We could find no analyses of how these many differences are irrelevant to the conclusions NHTSA has made about the entire inflator population and its scope. We also could not find an explanation of how a conclusion can be drawn based on the 7 identified field ruptures (that the record shows have either inconclusive root causes or root causes that are distinct from NHTSA's orifice blockage theory) without a detailed assessment of all these differences.[7]

There are many open technical questions for which answers or analyses cannot be found in the Confidential File. Therefore, it is not clear how NHTSA arrived at its Initial Decision in light of these uncertainties. Based on the review of the Confidential File and

[6] This is also true of the Delphi-manufactured inflators, of which there are no reported field ruptures.

[7] The information in the Confidential File also appears to be missing any analyses that the agency did regarding any relevant comparisons between the performance of the involved inflators and any inflators manufactured by ARC's peers. Despite the efforts of the safety professionals of the participating companies to find this type of analysis in the Confidential File, documentation that indicates NHTSA conducted such a comparative analysis as part of this investigation could not be located. NHTSA would likely have the underlying data to support such an analysis as it has been collecting rupture reports from the automotive industry under applicable Standing General Orders that it issued.

their collective experience, it is the opinion of the safety professionals of the participating companies that there is insufficient information to conclude that a safety defect exists among the 52 million subject inflators.

ARC's Toroidal Hybrid Inflators Have Different Design Configurations that Vary in Each Vehicle Implementation

ARC designs and manufactures airbag inflators for a variety of applications used as original equipment and service parts for vehicles sold in the U.S. The subject of NHTSA's investigation is the driver and front passenger hybrid toroidal inflators (the subject inflators) manufactured from 2000 to January 2018. While the subject inflators are generally of two main types, they were not designed the same nor were they designed at the same time. Further, they were not intended for systems that protect the same occupants (some are intended for occupants in the driver seating position, others for the front passenger).

These inflators utilize a compressed inert gas with a limited amount of pyrotechnics to inflate the airbag. According to ARC,[8] these types of inflators provide benefits such as reduced inflator exhaust gas temperatures, lower effluents as a result of lower generant material (i.e., propellant), lower performance variation across a temperature range, and greater tuning capability by balancing stored gas and generated combustion gas.

The subject inflators are generally constructed as a pressure vessel (PV), with the lower PV assembly consisting of the lower PV, initiators, and propellant. The center support can be initially part of the upper or lower PV depending on design. The upper PV is joined to the lower PV assembly through a friction welding process, and a burst disk

[8] *See generally*, ARC product webpage, *available at* http://www.arcautomotive.com/products.html

contains the compressed gas in the assembly.[9] Airbag deployment is accomplished by the initiators igniting the propellant, which increases the pressure within the inflator, bursting through a disk, and allowing the mixture of stored and propellant generated gas to inflate the airbag. Different propellant loads, etc., are used depending on the specific design.

There are two main types of the subject inflators used in vehicles produced for the U.S. market. Inflators produced for frontal driver applications are designated as DCADH for dual-stage applications or CADH for single-stage applications. Inflators produced for frontal passenger applications are designated as DPH7 for dual-stage applications or PH7 for single-stage applications. Passenger inflators did not begin production until 2010. All driver and front passenger inflators have different standard configurations and must be further tailored depending on customer (i.e., Tier 1 and / or vehicle manufacturer) requirements.

Airbag inflators are a part of an overall occupant crashworthiness safety system where they are used to inflate airbags that, in turn and in concert with other components in the vehicle (e.g., seat belts), are designed to reduce the potential for occupant injury in the event of a crash. This is an important concept, as even if the inflators at issue are of certain particular types (e.g., DCADH or DPH7), these are not identical inflators.[10] Each application of these inflators involves the need to provide the gas to inflate different sizes/shapes of airbags within different amounts of time to provide that piece of the overall

[9] The assembly is positively pressurized and hermetically sealed; exchange of gas with the atmosphere (especially air entering the assembly) is not expected.

[10] *See generally*, ARC product webpage, *available at* http://www.arcautomotive.com/products.html (showing high-level product details that already contain variations in pressures, etc., that would be tuned to specific system needs).

occupant protection system. The needs of these systems vary by vehicle and by the occupant that the system is intended to protect (i.e., front passenger vs. driver). Thus, each application of an, e.g., DCADH or DPH7 inflator involves different configurations. For example, different configurations may have different:

- Number of inflation stages, single vs. dual,
- Timing delay between stages (for dual stage inflators),
- Average peak pressures during deployment,
- Mass flow,
- Pressure curve slopes,
- Overall dimensions,
- Exit orifice diameters (e.g., 4.3, 4.8, 5.3, and 5.8 mm), and,
- Propellant amounts.

Many Different Design Configurations Exist Among the Subject Inflators

In addition to their review of the Confidential File, the safety professionals from the participating companies reviewed information about the various configurations that exist for the subject inflators manufactured by ARC. Their preliminary review has identified almost 40 different configurations of inflators for the U.S. with different overall dimensions, mass flow, exit orifice diameters, amount of propellant, among others.[11]

As is apparent from the information in the Confidential File, there are many configurations for which no field incidents or incidents during design/component testing

[11] NHTSA may have collected similar information during the course of its investigation. However, a summary and analyses of this information could not be identified within the Confidential File. This suggests that NHTSA did not analyze these differences, as any such analysis should have been included in its Initial Decision or in the Confidential File per 49 CFR Part 554.10.

have occurred, and it is not apparent from the Confidential File whether NHTSA undertook any analyses to investigate whether any of these design configuration differences are relevant for the safety defect that NHTSA alleges. For example, following the Agency's postulation at the October 5, 2023, public meeting that debris of a certain size may block the exit orifice, presumably debris of a sufficient size to block an inflator type with an exit orifice diameter of 4.3 mm may not be sufficient in size to block the exit orifice in a type with a 5.8 mm diameter.

Orifice size is just one of the many relevant questions that arise based on variations in inflator design. In addition, there are questions as to the relationship between the amount of propellant, mass flow, and profile of the pressure curve and the known incidents (notwithstanding other potential contributing factors). In short, the whole population of 52 million inflators cannot be described as copies of one or two identical types, and there is not enough information to conclude that a safety defect exists in the subject inflators based on the information in the Confidential File.

ARC's Toroidal Hybrid Inflators were Manufactured for Decades under Varying Production Conditions

In addition to the different design variations that are necessary for each application, these airbag inflators were also manufactured under a variety of conditions over their decades in production.

It is first worth noting that different companies and facilities were involved in producing these inflators at different times, depending on the type and configuration. ARC produced the subject inflators for vehicles sold in the U.S. at different points in time across four manufacturing facilities around the world: (1) Knoxville, TN, (2) Reynosa, Mexico, (3)

Xian, China, and (4) Macedonia. Passenger inflators were produced in a narrower time period. Around 2010, ARC began producing passenger inflators at their facilities in the U.S., Mexico, and China. Thus, the proportion of passenger inflators produced is a fraction of the estimated total 52 million inflators under investigation by NHTSA. Separate from ARC, it appears there were approximately 11 million inflators produced by Delphi, based on information from the Initial Decision.

With regard to the ARC facilities, ARC produced inflators for many years on multiple manufacturing lines with equipment and process changes that happened over time. For example, with respect to the friction welding process for joining the upper and lower PV, ARC utilized different equipment depending on the specific manufacturing location and line. The weld equipment machines included types produced by at least two different companies. According to ARC,[12] there are technical differences between the types of equipment used for welding, for example, the:

- Control systems (hydraulic v. servo control),
- Number of parameter settings,
- Weld monitoring,
- Weld time,
- Overall cycle time, and
- Weld orientation (horizontal v. vertical).[13]

In addition, the variations in equipment and manufacturing processes (i.e., steps) were changed over time. The subject inflators are manufactured through a number of

[12] *See generally* file "_Working Group\ARC Presentations & Reports\LINE C, O, P COMPARATIVE ANALYSIS.pdf."
[13] Our understanding is that weld orientation was changed, over time, beginning in the latter timeframes of the production of the involved inflators.

operations, the details of which could vary depending on the type of inflator being manufactured, the type of equipment being used, the plant / line in which it is manufactured, among other factors, and under different conditions. Differences in the manufacturing process can impact both pressure vessel integrity, and propellant performance in future deployments. For example, excess heat during welding, failure to cool the inflator post-weld, or increased humidity captured within the pressure vessel, can impact the ballistic performance of the inflator in future deployments.

Without answers to questions such as those listed below, it is unclear how NHTSA could arrive at a conclusion that the 52 million inflators covered by their Initial Decision contain a safety-related defect based on the information in the Confidential File. The above types of differences in manufacturing raise questions such as:

- What were the specific machines used in the manufacturing process at each of ARC's and Delphi's facilities and how did this change over time?
- When were pieces of weld equipment installed, retired, and replaced?
- What were the specific processes used at each of the manufacturing facilities and how did they change over time?
- Were there changes in raw materials?
- Were there part set-up or alignment issues identified during manufacturing over time?
- What were the differences in production history of the operating parameters across pieces of weld equipment (e.g., RPM, pressure, time)?
- What was the maintenance history across the different pieces of equipment used?
- Are there specific calibration items and schedules and what is the history of those calibrations?
- How do production variations over time affect the size of any weld slag?

    - If “weld slag” can occur during manufacturing, it is generally fused in the weld zone; which production process changes could affect the propensity of weld slag to become dislodged?

- Were there differences in scrap rate based on equipment, manufacturing facilities, maintenance schedules, periods in time, etc. and did NHTSA compare ARC’s scrap rate with other inflator suppliers?

Additional data that were available in the Confidential File, that may relate to assessing differences in manufacturing and the potential influence on inflator performance, included post-production sampling through lot acceptance testing (LAT). LAT can involve a number of different types of tests and varies from manufacturer to manufacturer. The relevant LAT for NHTSA’s investigation involves ballistic testing typically at various temperatures (i.e., hot, ambient, cold). These tests can be performed in various amounts, at various frequencies, or at different frequencies across periods of time depending on customer requirements (set as appropriate for the particular implementation in the end vehicle) and other factors present during a particular period of production (e.g., a new model launch may involve more testing at start-up than stable production). According to information in the Confidential File,[14] hundreds of thousands of these tests were performed since production began and were deemed successful. It is worth noting that, where issues were identified in LAT, the process at ARC involved quarantining and further investigating the specific lot. According to ARC, beyond their in-line process controls and quality checks, in the case of a LAT abnormality, the production

[14] As indicated in ARC’s response to a December 13, 2022 Information Request from the agency. *See generally* file “\ARC - IR Letter Responses\2022 IR Letters Responses\CONFIDENTIAL – 20230204\CONF BUS INFO - EA16003 – Dec. 13, 2022 IR Response Req. No. 1 Cstmr and Deploy Data.xlsx” (showing a testing conducted for a subset of the subject inflator population). It is also worth noting that this information is based on the testing that ARC conducted (for the subset of their subject inflator population). This does not include any testing that Delphi conducted during its production run.

lot is held for further investigation and the lot(s) is potentially scrapped depending on the results of the investigation.[15]

The Information in the Confidential File Lacks Context and is Difficult to Interpret

The information that NHTSA provided in the Confidential File, while voluminous, was not organized in any particular fashion that matched NHTSA's analysis in its investigation. Overall, the Confidential File contained little information about the Agency's analyses at all. As a result, documents in the Confidential File lacked context or other information that would show the significance of the information and how it relates to the Agency's alleged defect theory. For example, in some cases, manufacturing audits, plant reports, random photos, and working instructions are grouped together.[16] However, documents in such grouping often do not identify plant location, manufacturing line, product produced on that line, or dates when a report was made. In addition, some photos in a grouping were of inflators that are not part of this investigation.

The Information in the Confidential File is Bounded by what was in NHTSA's Information Requests to Manufacturers and Suppliers

Almost all the information within the Confidential File is information submitted by the involved manufacturers and suppliers based on Information Requests issued by the Agency. As is the nature with information requests, the data produced is defined by the questions posed. In reviewing the Confidential File, along with the information requests from the Agency, it is clear that the information is a patchwork of different questions that

[15] *See generally*, file "\ARC - IR Letter Responses\2020 IR Letter Response\CONFIDENTIAL\Microsoft Word - ARC Automotive Response to 8-18-2020 IR from NHTSA (29 Sep 2020) 4852-8595-5277 v.1.docx."
[16] *See, e.g., generally* directory \ARC - SPECIAL ORDER - 2017 - 20170623-SUPPLEMENTAL - 1 OF 2\Prod002 Confidentail Images001\IMAGES\IMG001."

changed over the course of the Agency's investigation. While, to some degree, it is to be expected that the Agency's thinking would evolve over the course of an 8-year investigation, the effect is that not all data that is available is a comprehensive view of the 52 million inflators that are covered by NHTSA's Initial Decision.

For example, when searching for information related to changes that may have been made over time to the design and manufacturing of the subject inflators, the Agency did request such information from ARC in an August 25, 2015 letter, but the scope of the request covered a period from June of 2000 through late 2004 and the subject inflators were from a more limited set of vehicle manufacturers than are currently the subject of EA16-003. From the 2015 Information Request letter, NHTSA requested: "Describe all modifications or changes made by, or on behalf of, ARC in the design, manufacture (including operations and/or production equipment), monitoring and/or maintenance processes of production equipment, quality control, or material composition of the subject component during the subject production time frame which relate to or may relate to the alleged defect in the subject component." Subsequent information requests did not appear to include the same question addressing different time periods, and Delphi was apparently not asked to provide this information for any period in which it manufactured ARC-designed inflators. Thus, it seems that information regarding design and manufacturing changes for the entire 52 million inflator population does not exist in the Confidential File.

Other questions from observations of the Confidential File relate to whether any trends or patterns exist in the available data set. For example, with regard to potential incidents during development or quality control testing, in the November 2016 information

request letters sent to manufactures, the question was asked, “describe the applicable test procedures and list each incident where a rupture of the airbag inflator was determined to be the cause of, or a contributing factor to the air bag module failing to meet test requirements. Limit the response to those incidents occurring from calendar year 2010 up to the date of this letter.” In other words, the data requested for this question were limited to a certain period (i.e., 2010-2016) and do not include the full range of inflators (2000-2018) covered by the Initial Decision.

While these are only a few examples, they are sufficient to illustrate the limitations of the Confidential File as a comprehensive data source for analyses related to the subject inflators.

Conclusion

The available information in the Confidential File does not enable a conclusion that a safety defect exists for the 52 million subject inflators. There are many differences in design configurations and manufacturing conditions for the 52 million inflators that are the subject of NHTSA’s Initial Decision. Data in the Confidential File show that the subject inflators are not all the same in design, and they were not produced under the same conditions or at the same manufacturing facilities using the same processes or equipment. Based on the review of available information, there simply is insufficient information to conclude that there exists a safety defect among the 52 million subject inflators.