UNITED STATES DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

In re:

Docket No. NHTSA-2016-0124

GENERAL MOTORS LLC'S PETITION FOR INCONSEQUENTIALITY REGARDING CERTAIN GMT900 VEHICLES EQUIPPED WITH TAKATA "SPI YP" AND "PSPI-L YD" PASSENGER INFLATORS SUBJECT TO JANUARY 2018 TAKATA EQUIPMENT DIR FILINGS

General Motors LLC ("**GM**") hereby petitions the National Highway Traffic Safety Administration ("**NHTSA**") under 49 U.S.C. §§ 30118(d), 30120(h) and 49 C.F.R. part 556 with respect to the Takata "SPI YP" and "PSPI-L YD" model front-passenger airbag inflators installed as original equipment in the GM vehicles covered by Takata's equipment defect information reports ("**DIRs**") filed on January 2, 2018. In support of this petition (the "**Third Petition**"), GM relies on: (i) the arguments and engineering analysis summarized in this Petition; (ii) the information that GM has submitted to the Agency during periodic briefings on the status of its Takata inflator investigation; and (iii) the arguments, data, and analysis that GM has supplied to the Agency in connection with its (a) November 15, 2016 Petition for Inconsequentiality and Request for Deferral of Determination Regarding Certain GMT900 Vehicles Equipped with Takata "SPI YP" and "PSPI-L YD" Passenger Inflators (the "**First Petition**"), (b) the January 11, 2017 Petition for Inconsequentiality and Request for Deferral of Determination Regarding Certain GMT900 Vehicles Equipped with Takata "SPI YP" and "PSPI-L YD" Passenger Inflators Subject to January 2017 Takata Equipment DIR Filings (the "**Second Petition**"), and (c) GM's August 25, 2017 supplemental brief filed in support of the First Petition and Second Petition.

I. Introduction

This is GM's third inconsequentiality petition relating to the Takata "SPI YP" and "PSPI-L YD" model front-passenger airbag inflators installed as original equipment in GM's GMT900[1] trucks and sport utility vehicles (the "**GMT900 Inflators**"). GM's First and Second Petitions related to the GMT900 vehicle populations covered by Takata's May 2016 and January 2017 equipment DIR filings, respectively. This Petition relates to the vehicles covered by the latest round of Takata equipment DIRs, which Takata filed on January 2, 2018. Together, GM's three petitions cover the following populations of GMT900 vehicles (the "**GMT900 Vehicles**"):

	Zone A States	**Zone B States**	**Zone C States**
First Petition	2007 - 2011 model year	2007 - 2008 model year	N/A
Second Petition	2012 model year	2009 model year	2007 - 2008 model year
Third Petition	2013 model year	2010 model year	2009 model year

In the First and Second Petitions, GM requested that NHTSA defer a decision on the merits until after the competition of the first phase of Orbital ATK's ("**OATK**") long-term aging study, which was intended to definitively assess the long-term safety of the GM-specific variants in the GMT900 Vehicles. This request was based on a threshold showing that the inflators in these vehicles were safe and were not likely to pose an unreasonable risk to safety for at least the term of GM's proposed deferral. As more fully summarized in GM's August 25, 2017 supplemental brief, the GM study subjected test inflators to an estimated 30 years of aging, including moisture levels and temperatures significantly worse than real-world conditions in the GMT900 Vehicles

[1] The GMT900 is a specific vehicle platform that forms the structural foundation for a variety of GM trucks and sport utility vehicles, including the Chevrolet Silverado 1500, GMC Sierra 1500, Chevrolet Silverado 2500/3500, GMC Sierra 2500/3500, Chevrolet Tahoe, Chevrolet Suburban, Chevrolet Avalanche, GMC Yukon, GMC Yukon XL, Cadillac Escalade, Cadillac Escalade ESV, and Cadillac Escalade EXT.

in the highest risk "Zone A" region. NHTSA granted this request for deferral and consolidated both Petitions under NHTSA Docket NHTSA-2016-0124. *See* General Motors LLC, Receipt of Petition for Inconsequentiality and Decision Granting Request To File Out of Time and Request for Deferral of Determination, 81 Fed. Reg. 85681 (Nov. 28, 2016); General Motors LLC, Receipt of Petition for Inconsequentiality and Notice of Consolidation, 82 Fed. Reg. 42718 (Sept. 11, 2017).

The originally planned OATK study is now complete, and—despite three decades of extreme exposure to humidity- and temperature-related propellant degradation—all of the GMT900 Inflators in the study safely deployed without any ruptures. The recalled non-GMT900 Takata inflators in the comparison group, by contrast, experienced ruptures and abnormal deployments, at rates and times consistent with ballistic test data generated by the same type of inflators recovered from the field. These results demonstrate that the GMT900 Inflators, which have not ruptured in the field or in ballistic testing, will continue to operate safely for decades, even in the highest temperature and humidity regions. Based on the record presented, GM respectfully requests that NHTSA grant the Petitions. In the alternative, if NHTSA believes that more study is required, GM requests that NHTSA defer its decision on all three petitions until March 31, 2018, which will permit GM and OATK to complete additional study and analysis, as more fully discussed below.

II. Background

A. GM's January 2018 DIRs

On January 9, 2018, following Takata's filing of its January 2018 DIRs under the Amendment to November 3, 2015 Consent Order between NHTSA and TK Holdings Inc. (the "**Amendment**"), GM filed three DIRs which explained that GM does not believe that a defect that poses an unreasonable risk to safety exists in the GMT900 Vehicles, that GM had not determined that such a defect exists, and that GM would be contemporaneously filing this Petition. Nothing in this Petition or in the act of filing this Petition or the DIRs is an admission, implied or otherwise, that such a safety defect exists.

B. The significance of manufacturing, inflator-design, and vehicle-integration differences

Takata PSAN inflators from different inflator models, families, variants, and build periods vary greatly—in design, quality, and long-term performance and safety.[2] Over the last two decades, Takata produced more than 60 different non-desiccated PSAN inflator variants for use as either driver- or front-passenger airbag inflators. Throughout this production period, Takata made major manufacturing improvements in its inflator- and propellant-manufacturing processes, and produced inflators with a number of different venting designs, inflator-housing materials, and propellant shapes, among other variations.[3] Vehicle manufacturers incorporated Takata non-desiccated PSAN inflators into different module applications (driver or passenger-airbag) and vehicle environments—two additional variables that can materially alter the risk of injury to the occupant in the event of a rupture. Vehicle model and platform can significantly affect the temperature and humidity that the inflator will be exposed to over the life of the vehicle, while the design of the inflator variant and of the propellant wafer itself can significantly influence the

[2] *See* ORBITAL ATK, TAKATA INFLATOR RUPTURE ROOT CAUSE SUMMARY REPORT 7 (Sept. 2016), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/orbital_atk_research_summary.pdf (hereinafter the "**OATK ITC REPORT**") ("The Takata family of inflators is complex in design, manufacture and operation."); THE INDEPENDENT MONITOR OF TAKATA AND THE COORDINATED REMEDY PROGRAM, THE STATE OF THE TAKATA AIRBAG RECALLS 17 (Nov. 15, 2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/the_state_of_the_takata_airbag_recalls-report_of_the_independent_monitor_112217_v3_tag.pdf (hereinafter the "**TAKATA MONITOR REPORT**") ("Within [driver- and passenger-side PSAN inflator categories], there was significant variation and customization among inflators to match different vehicle makes and models.").

[3] *See* OATK ITC REPORT, supra note 2, at 7-9 (summarizing design, ballistic, and performance differences between different Takata PSAN passenger inflators); *see also* DECHERT LLP, REPORT OF TK HOLDINGS INC.. PURSUANT TO PARAGRAPH 33.A OF THE NOVEMBER 3, 2015 CONSENT ORDER (June 30, 2016), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/takata_report_internal_investigation.pdf (hereinafter the "**DECHERT REPORT**") (generally discussing Takata's development and design of PSAN inflators).

impact of that temperature and humidity exposure on propellant degradation and the risk of rupture.[4]

The impact of these design and vehicle-integration differences is profound. Takata PSAN driver-side inflators recovered from certain 2001-2003 Honda and Acura vehicles—part of the so-called "Alpha" vehicle population—"contain a manufacturing defect which greatly increases the potential for dangerous rupture when a crash causes the air bag to deploy"; in ballistic testing, these inflators have "explosion rates of 50% or higher."[5] Other non-Alpha Takata inflators with different characteristics from different vehicles have far lower energetic deployment rates. Even in isolation, vehicle integration is a significant variable: as OATK noted in its September 2016 root-cause assessment, one Takata passenger inflator variant "shows a higher rate in one vehicle model, lower rates in three others, and a zero rate in two more models."[6] The GM-specific Takata inflators in the GMT900 vehicles, as more fully discussed below, have no reported incidents of rupture in the field and no ruptures in test deployments of field parts or parts subjected to accelerated aging.

C. Unique GMT900 Inflator and vehicle characteristics

The first GM-manufactured vehicles to utilize Takata PSAN inflators were model year 2007 GMT900 vehicles and the 2006 model year Saab 9-3 and Saab 9-5. This first-usage occurred many years after Takata began producing PSAN inflators, after Takata had made the majority of

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[4] *See* OATK ITC REPORT, supra note 2, at 21 ("The particular vehicle model or platform was found to be a contributing modifier.).

[5] TAKATA MONITOR REPORT, supra note 2, at 5; Press Release, National Highway Traffic Safety Administration, New test data on particular subset of Takata air bag inflators shows substantially higher risk (June 20, 2017), https://www.nhtsa.gov/press-releases/nhtsa-new-test-data-particular-subset-takata-air-bag-inflators-shows-substantially.

[6] *See* OATK ITC REPORT, supra note 2, at 3 ("Examples of the same prefix inflator show significantly different ED rates from field returns. PSPI AB shows a higher rate in one vehicle model, lower rates in three others, and a zero rate in two more models. Different vehicles reach different maximum temperatures under same test conditions.").

its design, quality, and process improvements in its PSAN inflator production operation, and only after Takata could meet GM's stringent validation requirements.

The GMT900 Inflators, moreover, are unique to GM vehicles, and have multiple unique design differences when compared to other Takata PSAN inflator variants—even inflators of the same Takata inflator family. These GM-unique design differences were purposeful: To meet GM's airbag inflator sourcing requirements, which were some of the most exacting in the industry when the GMT900 vehicles were being developed, GM required Takata to heavily modify the characteristics of their standard SPI and PSPI-L inflators. These modifications included, among other things, lighter, thinner propellant wafers that have more predictable ballistic properties; stainless steel instead of aluminum inflator end-caps, which improved the inflators' hermetic seals and resistance to high-internal pressures; and a greater vent-area-to-propellant-mass ratio for more efficient burning and deployment. *See also* GM's September 29, 2017 Responses to NHTSA's September 15, 2017 Information Request 4 - 5, attached as **Exhibit A** (discussing other design differences in the GMT900 Inflators).[7]

Many of these changes were necessitated by GM's occupant-performance and component requirements, which included having all prospective airbag inflator suppliers satisfy the United States Council for Automotive Research, or USCAR, airbag-inflator performance specifications. Strict adherence to these specifications, which GM helped develop, resulted in inflators with increased inflator-structural integrity, better ballistic performance, and greater resistance to moisture. Further, the large interior volume of the GMT900 platform required a passenger-airbag cushion large enough to meet requirements in a variety of occupant-performance tests. Filling

[7] GM submitted its exhibits to the Agency by secure file transfer contemporaneously with the submission of this Petition.

such a large cushion in a timely manner led to the use of thinner propellant wafers, which burn faster and more completely. This, along with the larger inflator-vent area, allowed the gas generated by the inflator to fill the airbag cushion in the fractions of a second required to meet safety requirements during deployment.

As part of its initial analysis, which GM presented to the Agency in September 2016, OATK analyzed these design differences, and concluded that two in particular likely materially affect the inflator's propensity to rupture:

- GM's design change from thick wafers (10.8 g/11.0 mm) to medium/thin wafers (8.1 g/8.4 mm and 5.0 g/5.36 mm) in the PSPI-L YD inflator resulted in ballistic advantages. Heavy-weight test data with intentionally restricted nozzle vents indicated that the thinner wafers are less susceptible to energetic deployment as compared to the thicker 10.8 g/11.0 mm PSPI-L wafers.
- The increased primary-chamber vent area on the GMT900 PSPI-L YD inflator (36.19 mm^2 on the PSPL-L YD v. 31.25 mm^2 on the PSPL-L FD) results in faster flow of gas, which reduces the potential for higher peak pressures with degraded propellant.

See GM's August 23, 2017 presentation to NHTSA (the "**August Presentation**"), slds 81 - 83, attached as **Exhibit B**.

Further, as noted in the First and Second Petitions, the physical environment in GMT900 vehicles better protects the front-passenger inflator from the extreme temperature cycling that causes propellant degradation and has led to inflator rupture in other OEM vehicles. GMT900 vehicles, which are light trucks and SUVs, have larger interior volumes than smaller passenger cars, and are equipped with standard solar-absorbing windshields and side glass,[8] all of which significantly reduce interior-vehicle temperatures. Peak-inflator temperatures during daily cycling

[8] Solar-absorbing glass does not appear to have been standard in a number of non-GM vehicles that utilized Takata non-desiccated PSAN inflators.

has been identified as a significant root cause of propellant degradation by various experts investigating Takata inflators, including OATK, Exponent, and NHTSA's expert, Dr. Harold R. Blomquist.[9]

D. The OATK long-term aging study

In his 2016 expert report (the "**Blomquist Report**") filed in support of the Amendment, Dr. Blomquist expressly discussed the limitations of the Exponent model that formed the scientific basis of NHTSA's factual findings in the Amendment, stating that future testing could "demonstrate that inflators in certain vehicle platforms, models, or configurations take a longer time to present an increased [rupture] risk . . . ."[10]

In May 2016, GM retained OATK, a third-party engineering firm with recognized ballistics expertise, to begin conducting this testing: a long-term aging study that would evaluate the future performance of the GMT900 Inflators through simulated laboratory aging. To artificially age the inflators, OATK exposed groups of inflators, both GMT900 Inflators and a comparison group of recalled non-GMT900 Takata inflators, to 1680 4-hour temperature cycles at moisture levels and temperatures significantly worse than real-world conditions in the GMT900 Vehicles in the highest risk "Zone A" region. The study was designed to induce propellant degradation in the test inflators

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[9] *See, e.g.*, Expert Report of Harold R. Blomquist, Ph.D. at ¶ 18.b.iv, In re: Airbag Inflator Rupture (No. EA15-001) (hereinafter the "**Blomquist Report**") ("[S]olar loading aggravates the high temperature value during the diurnal cycle which drives the extent to which booster propellant desorbs moisture, increasing the moisture level in the space around the main propellant."); EXPONENT, INC., INVESTIGATION OF TAKATA INFLATOR RUPTURES 26 (Jul. 2016) (hereinafter the "**EXPONENT REPORT**") ("The degradation of the propellant arises from diurnal and seasonal temperature cycling, and it is exacerbated by higher peak cycle temperatures and increased moisture content in the inflator."); OATK ITC REPORT, supra note 2, at 3 (stating that propellant degradation "requires moisture and temperature cycling such as in High Absolute Humidity (HAH) areas," and that "[d]ifferent vehicles reach different maximum temperatures under same test conditions.").

[10] Blomquist Report, supra note 9, at ¶ 30 n.12; *see also id.* at ¶ 18(a) (stating that "vehicle platform . . . can affect in-vehicle temperature and humidity near the inflator"); Amendment at ¶ 6 (stating that Takata's "own testing and analysis" supports the conclusion that manufacturing variations, vehicle make/model, and the specific type of inflator at issue "considerably" impact the "potential for propellant degradation and the expected rate of degradation").

sufficient to cause inflator ruptures and energetic deployments—a true "test-to-failure" experiment.

The OATK aging study was intended to simulate 30 years of aging—twice the service-life design practices for safety systems in these vehicles and five years longer than the end point in NHTSA's 2006 vehicle survival probability schedules (which provide survivability estimates only out to 25 years in service). The safety systems in the GMT900 Vehicles were intended, based on GM's internal engineering and design practices, to generally have a service life of 15-years[11] or 150,000 miles driven in the field. This expectation is consistent with the most recent update of the *Vehicle Survivability and Travel Mileage Schedules* published by NHTSA's National Center for Statistics and Analysis.[12] This study sought to understand vehicle survivability in the context of annual miles driven and vehicle age. Notably, the survival probability analysis on Table 2 of this study, which analyzes light truck vehicle usage and age, stops at 25 years, with diminishing values associated with the accumulated miles driven on a hypothetical vehicle that might still be in use at that vintage.

Takata specially constructed the inflators used in the study. See **Exhibit C**. The primary chambers in these inflators contained three different levels of moisture: (i) normal-build chambers with no additional moisture added; (ii) chambers with internal moisture approximately equal to 90th percentile moisture levels in GMT900 Inflators returned from Zone A; and (iii) chambers containing moisture levels approximately two-times higher than the highest level ever measured in a GMT900 Inflator recovered from Zone A. The secondary chambers in these inflators

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[11] Although these GM design practices were in place prior to the amendments to the Safety Act in 2015, they happen to be consistent with the amendments to the Safety Act in December of 2015 that extended to 15 calendar years the time period for safety recall remedies to be performed by an OEM free of charge. 49 U.S.C. § 30120(g)(1).

[12] S. Lu, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, NATIONAL CENTER FOR STATISTICS AND ANALYSIS, VEHICLE SURVIVABILITY AND TRAVEL MILEAGE SCHEDULES (2006), http://www-nrd.nhtsa.dot.gov/Pubs/809952.pdf.

contained moisture levels equivalent to the highest values measured in inflators returned from the field from any vehicle. During the study, OATK soaked these worst-case inflators in abusive, worst-case temperatures—temperatures exceeding the highest temperature that GM has ever recorded on a GMT900 Inflator in Zone A by 11 degrees Celsius.[13] This process had a specific engineering objective: to cause inflator failures during ballistic testing. Pushing the inflators in the study beyond the anticipated breaking point would generate data that could be used to help estimate the actual long-term service life of GMT900 Inflators in the field.

In order to validate this accelerated aging test procedure, OATK included Takata PSPI-L FD inflators, which were used in the Pontiac Vibe as well as in other OEM vehicles (the "**Vibe/Other OEM Inflators**"), as a comparison group in the study. Several factors made the PSPI-L FD ideal for this purpose. First, the PSPI-L FD inflators are from the same Takata inflator family as the GMT900 light-duty inflator; but while they have certain similarities in design and construction, they lack the critical design elements that, in GM's view, distinguish the GMT900 Inflators from other Takata non-desiccated PSAN inflators and make the GMT900 Inflators resistant to the risk of energetic deployment, even after the PSAN propellant has been damaged or degraded. Second, and unlike the GMT900 Inflators, PSPI-L FD inflators returned from the field have consistently experienced ruptures during ballistic testing and have also ruptured in the field during crashes.

The results from the Vibe/Other OEM Inflators in the comparison group provided a critical yardstick against which OATK evaluated both the design of the study and the safety of the GMT900 Inflators. As described more fully below, the OATK aging process succeeded in

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[13] In August and September 2015, GM left a GMT900 vehicle outside in Miami, Florida—facing south, exposed to direct sunlight, behind a windbreak, during the hottest part of the year, for 30 days—and collected temperature and humidity measurements from sensors placed directly on the inflator housing. The highest temperature that GM measured on the inflator was 59.5 Celsius.

producing ruptures and abnormal deployments in the Vibe/Other OEM Inflators after laboratory aging. Given that these deployments occurred at rates and pressures that matched the data from field inflators, the artificial aging process is demonstrably effective. In direct contrast, the normal deployment of GMT900 Inflators in comparison to the PSPI L FD inflators, under the same conditions, demonstrates that the GMT900 Inflators are truly safer and more resistant to rupture than other Takata PSAN inflators.

III. Discussion

A. Basis for Petition (49 U.S.C. § 30118(d) and § 30120(h); 49 C.F.R. Part 556.4(b)(5))

To petition for an exemption under sections 30118(d) and 30120(h) of the Safety Act, NHTSA's regulations require the manufacturer to file a DIR pursuant to 49 C.F.R. part 573. 49 C.F.R. § 556.4(c). If the manufacturer has not itself made a determination that a defect exists, this DIR does "not constitute a concession by the manufacturer of, nor will it be considered relevant to, the existence of a defect related to motor vehicle safety or a nonconformity." *Id.* GM has not determined that a defect that poses an unreasonable risk to safety exists in the GMT900 Vehicles covered by Takata's January 2018 DIRs or in any of the GMT900 Vehicles covered by one of the Petitions, and this Petition does not constitute a concession by GM of the existence of a defect in the any of the GMT900 Vehicles, as permitted by 49 C.F.R. § 556.4(c).

As in the case of defect determinations under the Safety Act generally, the particular application and use of the defective component is relevant to—and, in this case, determinative of—whether the component poses a safety risk within a certain population of vehicles. As the D.C. Circuit held in the landmark case defining OEM obligations under the Safety Act, "[i]t is possible that the same component may contain a defect in performance relating to motor vehicle safety in one class of vehicle or use but not in another." *United States v. General Motors*

Corporation, 518 U.S. 420, 439 n.88 (D.C. Cir. 1975) ("*Wheels*"); *see also Ctr. For Auto Safety, Inc. v. NHTSA*, 342 F. Supp. 2d 1, 14 (D.D.C. 2004), *aff'd sub nom.*, 452 F.3d 798 (D.C. Cir. 2006) ("[U]sage is clearly relevant to a determination of whether a vehicle contains a safety-related defect."). Consistent with the *Wheels* case, as discussed more fully below, the SPI YP and PSPI-L YD variants that GM used in the GMT900 platform are not used by any other original equipment manufacturer and have unique design features, which, together with the unique in-vehicle environment in the GMT900 Vehicles, positively influences the performance of these inflators in the field over time compared to other inflator and vehicle variants.

B. Field data demonstrates that the GMT900 Inflators are currently performing as designed

1. An estimated 63,000 Takata passenger airbag inflators have deployed in GMT900 vehicles without a single reported rupture

As part of its Safety and Field Investigations process, GM actively monitors vehicle-performance data for evidence of potential safety issues, including incidents of inflator rupture. This dataset includes customer complaints, GM Technical Assistance Center logs, warranty claims, legal claims, field investigations, and NHTSA VOQs. Although these sources do not track airbag deployments in the field, it is possible to estimate field deployments using accident rate and severity information published by NHTSA (NASS). Using this method, GM estimates that over 63,000 PSPI-L and SPI inflators have deployed in GMT900 vehicles since model year 2007, the first model year that GMT900 vehicles utilized these inflators. GM is not aware of a single confirmed rupture report involving a Takata SPI YP or PSPI-L YD inflator in a GMT900 vehicle.

2. GM has analyzed and safely deployed approximately 3,855 Takata SPI YP and PSPI-L YD inflators from the oldest affected GMT900 vehicle population in the highest-risk region

The results from GM's ballistic testing is consistent with the field data. Since November 2014, GM has sent PSPI-L YD and SPI YP inflators from GMT900 vehicles in the field to Takata for ballistic testing and analysis. To date, Takata has ballistic tested 4,205 such inflators, and all deployed safely and as designed; none of the inflators ruptured or demonstrated elevated deployment pressure or other signs of abnormal deployment.[14] These deployed inflators included a significant number of GMT900 Inflators that, according to the Blomquist Report, would be at the highest risk of rupture. *See* Blomquist Report ¶ 17. The vast majority of these inflators—1620 PSPI-L YD and 2235 SPI YP inflators—came from Zone A GMT900 vehicles recovered from 2007-2008 model year vehicles, which are the oldest population of GMT900 vehicles in the field with Takata passenger airbag inflators.

C. The results from the OATK study confirmed that the GMT900 Inflators will operate safely well into the future

1. The OATK artificial aging process produced propellant degradation that replicated real-world PSAN propellant degradation

The data generated by the OATK long-term aging study confirmed one of the study's core design assumptions: that subjecting Takata PSAN inflators to 56 four-hour temperature cycles would approximate one year of real-world aging. As illustrated in **Exhibit D**, the OATK aging process caused propellant wafer outside diameter (OD) growth—an accepted measure of propellant degradation[15]—at levels and rates that parallel, and in some cases mirror, propellant degradation observed in returned field inflators. The parallel relationship between the dotted lines in the charts indicates that, for all three inflator variants in the study, the average growth rates

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[14] On information and belief, Takata has provided NHTSA with the data associated with these ballistic tests. For this reason, GM has not submitted this data with its Petition. GM can provide this data on request.

[15] Moisture and temperature induced degradation in PSAN propellant causes, among other things, an increase in the outside diameter of the propellant wafers. Measuring the outside diameter of the wafers using CT scanning is an accepted non-destructive measure of PSAN inflator propellant degradation. *See, e.g.*, BLOMQUIST REPORT, supra note 11, at 6 ("The density change manifests as increased diameter measurable by calipers once the inflator is disassembled."); EXPONENT REPORT, supra note 9, at 11 ("Exponent's analysis of field returned inflators indicates that the outer diameters (OD) of 2004 propellant wafers increase for degraded wafers and are associated with a reduction of the propellant density."); *see also* OATK ITC REPORT, supra note 2, at 4-5 (observing a general correlation between OD and probability of inflator failure).

produced by the artificial-aging process closely match the average measured growth rates in field returns of the same inflator variant.

2. The results from the Vibe/Other OEM Inflator comparison group

The results from the Vibe/Other OEM Inflator comparison group further validated the study's design and the soundness of OATK's aging methodology. As shown in the attached **Exhibit E**, the OATK artificial aging process caused the outside diameters in the Vibe/Other OEM Inflator comparison group to expand beyond 29.2 millimeters—the point at which the Vibe/Other OEM Inflators recovered from the field have ruptured and abnormally deployed during ballistic testing. When the Vibe/Other OEM Inflators in the comparison group reached this threshold during the OATK aging process, they began to rupture and abnormally deploy. In total, seven Vibe/Other OEM Inflators in the comparison group ruptured or abnormally deployed during ballistic testing, and these events produced pressure traces that closely resemble pressure traces that Takata has collected on abnormal deployments and ruptures of Vibe/Other OEM Inflators returned from the field.

3. The results from the GMT900 inflator groups and overall conclusion of the August 2017 study

As shown in **Exhibits F** and **G**, three decades of simulated aging in Zone A or worse-than-Zone A conditions produced propellant wafers with larger outside diameters than GM has recovered from GMT900 Vehicles in the field. Despite this propellant degradation, none of the GMT900 Inflators in the study ruptured or deployed abnormally. <u>Even when GMT900 inflators that were specifically built containing twice the moisture level found in field-return inflators were exposed to hotter temperatures than the temperatures measured in the field and cycled to a 30-year equivalent service life, they all deployed safely during ballistic testing.</u>

To assist GM in interpreting the results of the OATK study from a statistical perspective, GM retained Professor Arnie Barnett, the George Eastman Professor of Management Science and Professor of Statistics at the Massachusetts Institute of Technology, and a nationally recognized expert in modeling and calculating risk. Working with the assistance of other experts at Cornerstone Research, Professor Barnett had full access to GM and OATK's test data and to the engineers that designed and ran the OATK study.

On August 16, 2017, Professor Barnett briefed NHTSA on his conclusions—that the absence of energetic deployments, both in the OATK study and more broadly, is "potent evidence of low risk" in the GMT900 Inflators:

- If the GMT900 Inflators had the same risk of energetic/abnormal deployment as the Vibe/Other OEM Inflators in the comparison group, the likelihood that GM and OATK would have observed zero energetic/abnormal deployments given the sample sizes in the OATK study is 1 in 1,146,363.
- After an estimated 65,000 field and ballistic testing deployments (as of August 2017), GM was not aware of a rupture or abnormal deployment involving a GMT900 Inflator. If the GMT900 Inflators had the same risk of energetic/abnormal deployment as other SPI and PSPI-L inflators used by other OEMs of the same vintage, the likelihood that no GMT900 Inflator returned from the field would have ruptured in ballistic testing was (using August 2017 data) 1 in 204, and the likelihood that no GMT900 Inflator would have ruptured in field deployments was 1 in 1,842,339.
- Under the hypothesis that the GMT900 Inflators have the same risk of energetic deployment as the other inflators considered above, the probability of observing no energetic deployments across all three data sources given the analysis and testing done as of August 2017 was, in Professor Barnett's view, "vanishingly small"—i.e., 1 in 430 trillion.

A copy of Professor Barnett's presentation to NHTSA is attached as **Exhibit H**.

Overall, the results from the study are consistent with the position that GM has taken all along: that the GM-specific design changes that Takata incorporated into the GMT900 Inflators made the GMT900 Inflators more robust than other Takata inflators that did not meet the standards GM imposed. *See* First Petition at 12. These differences, in GM's view, and as OATK's results demonstrate, form the basis of a more robust, rupture-resistant inflator. This helps explain why a humidity-related rupture has not occurred in these Takata inflators, even after significant real-world and laboratory exposure to temperature cycling and humidity, even after the propellant inside the GMT900 Inflators has been artificially degraded beyond the levels observed from returned field inflators.

IV. Request for relief

The OATK study—a 18-month, multimillion dollar independent research study—is to GM's knowledge without precedent in the context of an inconsequentiality petition. The results of this study are consistent with the tens of thousands of normal deployments of the GMT900 Inflators in the field and in ballistic testing, and demonstrate that the GMT900 Inflators in Zone A will continue to operate safely even after 30 years of extreme exposure to humidity- and temperature-related propellant degradation—and potentially for even longer than that.

This data and analysis supports the long-term safety of the GMT900 Inflators in the lower-risk climate zones that are part of this third tranche of Takata DIRs—Zones B and C—with even more force. As discussed in more detail above, GM and OATK calculated the study's temperature-cycling and elevated-moisture levels using Zone A measurements, specifically, measurements for a vehicle parked outside in Miami, Florida. When potentially exposed to lower humidity levels and less extreme temperature cycling, the propellant in GMT900 Inflators in Zones B and C would take even longer to approach the degradation levels observed in the study—<u>levels that did not induce a single rupture or abnormal deployment during testing</u>. Put another way, Zone B and C vehicles would be even less susceptible to propellant degradation over an even longer period of time than the vehicles that were the subject of GM's previous two petitions for inconsequentiality.

Since the *Wheels* decision, the statutory predicate of a safety-defect recall has been empirical data: affirmative evidence of a defect—typically "a significant number of failures" in a vehicle or component—that creates an "unreasonable risk of accident, death, or injury." *Wheels*, 518 F.2d at 436. Neither element is satisfied in this case. Further, the cause of motor vehicle safety will not be advanced by disrupting critical, sensitive, fully operational safety systems in millions of customer vehicles. Even if conducted with the highest possible care, such a recall would create risk to consumers that, based on current evidence, would not provide a corresponding safety benefit.

GM believes that the evidence presented to date fully supports the relief requested in the Petitions. But if NHTSA believes that more study is required, GM requests that NHTSA defer its decision until March 31, 2018, which will permit GM and OATK to conduct further study and analysis—analysis that could not only inform NHTSA's decision on the Petitions, but also provide the public, manufacturers, lawmakers, and regulators globally with critical tools to analyze rupture risk and prioritize limited resources to the highest-risk populations in other OEM vehicles. GM has already begun working on this analysis with OATK:

- To develop an estimate of the GMT900 Inflators' likely service life beyond 30 years, GM has continued the aging study by aging the remaining test GMT900 Inflators beyond the original 30-year test plan.

- GM, working with OATK, is developing a predictive model that, unlike previous service-life estimation techniques, will account for variables such as inflator-design and vehicle-integration factors. This model, which GM estimates will be complete in early 2018, will predict inflator service life with a higher degree of accuracy than current models, and will help regulators, OEMs, and the Takata Monitor prioritize resources to the highest risk vehicle populations across OEM populations.

Delaying the decision on the Petitions through March 2018 will permit GM and OATK to complete this work and provide the results to NHTSA in advance of the decision. In light of the results of the OATK study described above, this delay will have no adverse impact on motor vehicle safety, and will materially advance the industry's understanding of the root causes and risks of inflator rupture in Takata PSAN inflators.

V. Conclusion

For the reasons described above, GM requests that NHTSA: (i) grant the Petitions; or (ii) in the alternative, defer its decision on the Petitions through March 31, 2018 to permit GM additional time to develop and present evidence relevant to the issues presented by the Petitions. If NHTSA decides to defer its decision, GM will continue to provide NHTSA with updates on its engineering analysis as well as any other data, analysis, or test results that GM develops in its effort to support its Petitions along with non-confidential summaries of each update for publication to the public docket.

Respectfully submitted,

GENERAL MOTORS LLC

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Exhibit List

Exhibit A: GM's Responses to NHTSA's September 15, 2017 Information Request
Exhibit B: GM's August 23, 2017 Presentation to NHTSA (with backup slides)
Exhibit C: Summary of OATK test samples
Exhibit D: Summary of OATK OD growth rates
Exhibit E: Summary of OATK ballistic tests – PSPI-L FD
Exhibit F: Summary of OATK ballistic tests – SPI YP
Exhibit G: Summary of OATK ballistic tests – PSPI-L YD
Exhibit H: Prof. Arnold Barnett's August 16, 2017 Presentation to NHTSA
Exhibit I: OATK Long-Term Aging Study Data Files
Exhibit J: Barnett/Cornerstone Data Backup Files