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October 4, 2016

Mark R. Rosekind
Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE, West Building
Washington, DC 20590

RE: Docket 2016-0098 – General Motors LLC, Receipt of Petition to Amend Takata DIR Schedule

Dear Administrator Rosekind:

The following is a response to NHTSA's request for comments on General Motors' (GM) request to amend the Part 573 Defect Information Report filing schedule set forth in the agency's November 3, 2015 Consent Order with Takata Holdings Inc. ("Takata"). GM requests that it be given a one-year extension to comply with NHTSA's order that recalls of certain model years must be completed by December 31, 2016. We respectfully urge the agency to deny this request.

At the outset, it is important to note that GM has flouted the Consent Order for months. Its repair rate for Takata-related recalls is a dismal .17 percent. Only 552 vehicles have been remedied,[1] despite GM's admonitions in earlier recalls. In October 2014, GM notified customers it "strongly recommends that you have this safety recall repair performed immediately" and urged occupants not to sit in the passenger seat.[2] However, in the most recent round of passenger-side airbag recalls, GM merely issued a preliminary recall and refused to repair the vehicles:

> "GM continues to believe that there is no immediate danger of inflator rupture in the recalled GM vehicles and that these vehicles are presently safe to drive. You will be notified when there is a need to take action."[3] [4]

GM has also allowed dealers to sell vehicles subject to these recalls, as long as they advise customers that although the vehicle is recalled, it is safe to drive and they will be notified if future action is needed.[5]

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[1] NHTSA, Takata Air Bags Recalls Completion Rates, accessed Oct. 2, 2016 at www.safercar.gov/rs/takata/takata-completion-rates.html
[2] GM, Recall No. 14V655, Safety Recall Notice, Oct. 2014
[3] GM notice to dealers, June 16, 2016
[4] GM, The Takata Airbag Safety Recall, www.gmtakataairbag.com

Thus, for months, GM has explicitly and publicly refused to comply with NHTSA's order to recall and repair vehicles Takata and NHTSA have deemed unsafe. Rather than reward GM for its reckless disregard of NHTSA mandates and customer safety, NHTSA should deny the petition and initiate an enforcement action to compel GM to make the recall repairs.

Standard of Proof

As the agency is aware, on May 4, 2016, NHTSA and Takata modified the original Consent Order to require that Takata declare a defect in all inflators that contain ammonium nitrate propellant without a moisture-absorbing desiccant added.[6] Reviewing expert opinions from Dr. Harold Blomquist, Exponent, and Orbital ATK, NHTSA concluded:

> "The findings of all three research organizations are consistent with previous theories that most of the inflator ruptures are associated with a long-term phenomenon of PSAN [Phase-Stabilized Ammonium Nitrate] propellant degradation caused by years of exposure to temperature fluctuations and intrusion of moisture present in the ambient atmosphere….
>
> In light of the Agency's findings, set forth in Paragraphs 2 through 10 above, NHTSA has concluded that at some point in the future all non-desiccated frontal Takata PSAN inflators will reach a threshold level of degradation that could result in the inflator becoming unreasonably dangerous." [7]

Despite this urgency, the agency included a provision allowing manufacturers to seek deferment of mandated recalls. The agency later clarified that such an extension could be granted only on a showing, by preponderance of the evidence, that

> "either: (i) There has not yet been, nor will be for some period of years in the future, sufficient propellant degradation to render the inflators contained in the particular class of vehicles unreasonably dangerous in terms of susceptibility to rupture; or (ii) the service life expectancy of the inflators installed in the particular class of vehicles is sufficiently long that they will not pose an unreasonable risk to motor vehicle safety if recalled at a later date."[8]

GM asserts that its analysis shows that GM passenger inflators are "not currently at risk of rupture" because there have been no ruptures in 44,000 field deployments in GMT900 vehicles or in ballistic tests of 1,055 "covered" inflators (this population must include inflators that were not recovered in the recalls, given that only half of that total has been repaired).[9] GM also argues that there is no evidence of propellant degradation in its inflators, which, it states, "have a

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[5] GM notice to dealers, June 16, 2016
[6] In re: EA15-001 Air Bag Inflator Rupture, Amendment to November 3, 2015 Consent Order, May 4, 2016
[7] In re: EA15-001 Air Bag Inflator Rupture, Amendment to November 3, 2015 Consent Order, May 4, 2016 at ¶¶ 2, 12
[8] NHTSA Enforcement Guidance Bulletin 2016-03; Procedure for Invoking Paragraph 17 of the May 4, 2016 Amendment to the November 3, 2015 Takata Consent Order, 81 Fed. Reg. 47854 (July 22, 2016) at 47856
[9] 81 Fed. Reg. 64575 (Sept. 20, 2016), General Motors LLC, Receipt of Petition to Amend Takata DIR Schedule, at 64576

number of unique design features that influence burn rates and internal ballistic dynamics," and that its vehicles' designs better protect the inflators from temperature cycling.[10]

This might be compelling evidence, if not for the fact that manufacturers and Takata have had eight years to prove the safety of their inflators and have been consistently unsuccessful. In fact, since the first minimal recall in 2008, the defect history has been marked by a pattern of failed root cause assessments, followed by expanded recalls. Takata has known since the beginning that propellant degradation led to over-pressurization, but it could not determine what caused the degradation. Each time a recall was issued, the manufacturer excluded certain vehicles because they had not experienced "sufficient propellant degradation to render the inflators contained in the particular class of vehicles unreasonably dangerous in terms of susceptibility to rupture." Each time, they were proven wrong.

Likewise, inflator ruptures in more recent model year vehicles, such as the 2013 Chevrolet Cruze, challenge NHTSA's focus on long-term exposure to high humidity and temperature cycling. Even newer inflators are at risk because Takata has not remedied its systemic manufacturing and quality control problems. Therefore, assertions by GM or any other manufacturer that "the service life expectancy of the inflators installed in the particular class of vehicles is sufficiently long that they will not pose an unreasonable risk to motor vehicle safety if recalled at a later date," must be called into question.

Thirteen years after the rupture in a BMW in Switzerland – but only two weeks after the latest death in Malaysia – it is clear that more ruptures will occur and more recalls are forthcoming.

<u>PSAN Danger</u>

As NHTSA has asserted, the underlying root cause of the ruptures is Takata's use of PSAN as a propellant. It has been well known for decades that PSAN is a volatile chemical that must be used with extraordinary precision and care, or it is likely to over-pressurize, especially when exposed to moisture and temperature cycling.

Takata has affirmed this for two decades in a series of patents. In a 1995 patent for a process for preparing azide-free gas generate composition, Takata [which often filed patents under its Research and Development arm, Automotive Systems Laboratory, Inc.] noted that if ammonium nitrate is cycled at temperatures below or above 32 degrees Celsius, its crystals will expand, cracking the gas generant:

> "This is totally unacceptable in a gas generant used in air bag inflators because the burning characteristics would be altered in such that the inflator would not operate properly or might even blow up because of the excess pressure generated."[11]

In a 2003 patent filing for phase-stabilized ammonium nitrate, Takata noted that:

> "Unfortunately, the incorporation and use of ammonium nitrate in pyrotechnic gas generant formulations has generally been subject to certain difficulties or limitations. For

[10] Id.
[11] U.S. Patent No. 5,531,941, Process for Preparing Azide-Free Gas Generant Composition, July 2, 1996

> example, ammonium nitrate-containing pyrotechnic gas generant formulations have commonly been subject to one or more of the following shortcomings: low burn rates, burn rates exhibiting a high sensitivity to pressure, as well as to phase or other changes in crystalline structure such as may be associated with volumetric expansion . . . As will be appreciated, such changes of form or structure may result in physical degradation of such gas generant formulation forms such as when such gas generant formulation has been shaped or formed into tablets, wafers or other selected shape or form. . . . Unless checked, such changes in ammonium nitrate structure may result in such performance variations in the gas generant materials incorporating such ammonium nitrate as to render such gas generant materials unacceptable for typical inflatable restraint system applications."[12]

They reiterated this concern in 2006:

> "One concern with PSAN-containing propellants as well is that they exhibit significant aggressive behavior with regard to ballistic properties, particularly with respect to USCAR Thermal Shock conditioning when ballistically tested at elevated temperatures (the industry standard is about 85 C).
>
> It is also required that airbag inflators be subjected to environmental conditioning, such as high temperature heat aging, thermal aging, thermal cycling, thermal shock, humidity cycling, and so forth. These extreme tests can cause many problems, ranging from failure to inflate the airbag to over-pressurization of the inflator leading to rupture. It is therefore desirable to have a gas generant and inflator system that performs the same regardless of conditioning. The present invention provides a solution to many of these possibilities.
>
> Moisture or volatile contaminants can be introduced to gas generating systems in many ways. A few examples include: improperly processed gas generants that contain excess moisture; moisture introduced to the system via humidity during assembly; moisture introduced to the system during environmental conditioning such as high humidity cycling or salt spray; moisture introduced to the system via decomposition of materials within the system such as auto-ignition materials, seals, gaskets, greases, and other gas generator constituents."[13]

In 2013, after another round of passenger inflator recalls, Takata engineers proposed a new gas generant compound, noting that:

> "During temperature cycling inside of an inflator, tablets or wafers of gas generating compositions containing phase-stabilized ammonium nitrate or PSAN (e.g. PSAN containing about 85 to 90 weight percent ammonium nitrate coprecipitated with about 10-15 weight percent of a potassium salt such as potassium nitrate), may lose density especially in the presence of moisture or humidity. It is believed that in some circumstances, the density loss may lead to less predictable performance criteria."[14]

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[12] U.S. Patent No. 6,872,265 B2, Phase-Stabilized Ammonium Nitrate, Mar. 29, 2005
[13] U.S. Patent No. 20070084532 A1, Gas Generant, Oct. 2, 2006
[14] U.S. Patent No. 20140150935 A1, Self-healing Additive Technology, Dec. 2, 2013

More recently, researchers at Pennsylvania State University's High Pressure Combustion Laboratory analyzed Takata's PSAN propellant between 2011 and 2014, at the request of Takata and Honda. Over protests from Takata, the researchers concluded that PSAN is susceptible to dynamic burning, meaning when the propellant is exposed to sudden pressure increases, such as that created by low-density wafers, it may burn at a much faster rate and at higher temperatures than expected, leading to over-pressurization.[15] The researchers believed this dynamic burning effect contributed to the ruptures and published their conclusions in 2012, warning that "the effect of dynamic burning behavior of the propellant needs to be accounted for when designing or analyzing systems that subject the PSAN propellant to high pressurization rates."[16]

Experts commissioned by NHTSA also agree that PSAN wafers undergo significant change when exposed to prolonged moisture. Orbital ATK has confirmed that although PSAN's chemical composition does not change with moisture intrusion, moisture does impact the shape, size, and growth of the wafers. This creates larger pores and cracks that allow increased gas flow when the propellant is ignited, causing over-pressurization that leads to ruptures.[17] Fraunhofer ITC found that humidity could have "deeply detrimental effects in the behaviour of the material," including crush strength and increased burn rates.[18] Fraunhofer noted that with increased humidity, propellant grains dissolved and glued together and that Takata's PSAN formula can become destabilized and form larger crystals, both of which cause porosity and subsequent over-pressurization.[19]

<u>Manufacturing Quality Problems</u>

Despite the demands that PSAN places on manufacturers, there is ample evidence that Takata has never sufficiently met them. The supplier has been plagued by systemic manufacturing and quality control problems.

Since 2001, when a Unibody passenger inflator ruptured in a Honda vehicle because the welds did not hold the filter together (prompting recall 02V080), Takata has detailed in the public record numerous problems not specifically related to its use of PSAN: too much propellant ("overpack"),[20] tape seal leaks,[21] low compaction force,[22] use of reprocessed propellant,[23]no automatic-reject function or auto-reject function shut off,[24] poor traceability,[25] cracked igniter assemblies,[26] damaged booster tubes and cups,[27]missing propellant wafers or springs,[28] low

[15] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 52-53
[16] Jonathan T. Essel et al., Transient Burning Behavior of Phase-Stabilized Ammonium Nitrate Based Airbag Propellant, 11 Int'l J. of Energetic Materials & Chemical Propulsion 473 (2012)
[17] Orbital ATK, Takata Inflator Rupture Root Cause Summary Report, Sept. 2016, at 19
[18] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 71
[19] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 72
[20] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 25
[21] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 29
[22] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 39
[23] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 39
[24] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 41
[25] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 46
[26] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 58
[27] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 58

compaction load (not enough propellant fed into the press),[29] and propellant being left out at the plant.[30]

GM should be well aware that Takata's issues are greater and more complex than propellant degradation and exposure to high temperatures and humidity. Indeed, vehicle manufacturers, including GM, have recalled Takata airbags for more recent manufacturing problems:

- June 2014: GM recalled model year 2013 and 2014 Chevrolet Cruze vehicles after an investigation of a rupture in a 2013 Cruze showed that some SDI-X inflators were made using outer baffle components intended for the PSDI-X inflator.[31] Nissan also issued a U.S. recall, and Nissan and Honda issued foreign recalls.

- July 2014: Mercedes-Benz recalled 311 model year 2014 SLK and SL class vehicles because inadequate fasteners could come apart, allowing the diffusor to detach and enter the passenger compartment.[32]

- September 2015: GM recalled 395 model year 2015 vehicles after the body bore seal separated from a side airbag inflator (SSI-20 inflator) during lot acceptance testing.[33] The root cause remains unknown.

- October 2015: Honda recalled 515 model year 2016 CR-V vehicles after a PSDI-X inflator failed during lot acceptance testing. Takata concluded there was either a stamping issue or a weak metal canister.[34]

- January 2016: Volkswagen recalled 734 model year 2015 vehicles after an SSI-20 side airbag ruptures in a 2015 Tiguan.[35] Takata subsequently combined the GM and Volkswagen vehicles into one equipment recall for SSI-20 airbags in 1,129 vehicles, noting that it had not yet determined a root cause.[36]

In fact, less than two weeks ago, BMW announced another recall of Takata inflators for manufacturing problems. The manufacturer recalled 3,606 model year 2014-2015 vehicles after a PSDI-X driver inflator in a 2014 X5 broke apart during a crash, which BMW said "could result in metal passing through the air bag cushion material."[37] Takata and BMW confirmed the root cause was an incorrectly welded inflator housing.

These manufacturing problems are exacerbated by defects in the inflator designs – developed by Takata and approved by the manufacturers – which contribute to moisture intrusion. Orbital

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[28] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 60
[29] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 62
[30] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 66
[31] GM, Recall No. 14V372, Part 573 Defect Notice, June 25, 2014
[32] Mercedes-Benz, Recall No. 14V386, Part 573 Defect Notice, July 1, 2014
[33] GM, Recall No. 15V666, Part 573 Defect Notice, Oct. 16, 2015
[34] Honda, Recall No. 15V714, Part 573 Defect Notice, Oct. 28, 2015
[35] Volkswagen, Recall No. 16V045, Part 573 Defect Notice, Jan. 27, 2016
[36] Takata, Recall No. 16E009, Defect Information Report, Feb. 3, 2016
[37] BMW, Recall No. 16V683, Part 573 Defect Notice, Sept. 20, 2016

ATK's recent report specifies that the inflators were designed with multiple leak paths that allowed for moisture intrusion over time. The passenger inflators, such as the inflators at issue in GM's petition, had design and manufacturing defects in the o-ring seals and excessively large crimp outer diameters.[38] Fraunhofer ITC concluded moisture could enter the inflators through the o-ring, igniters, and foil burst shims. The wafers themselves were also faulty: Fraunhofer found that the shape and size of the batwing wafers enabled them to absorb moisture gradually but retain it for a long time, allowing moisture build-up through multiple temperature cycles.[39]

Fraunhofer concluded that "in the absence of manufacturing problems, HAH and high temperature cycles are necessary, but not necessarily sufficient, to cause inflator ruptures."[40] Admittedly, Fraunhofer did find that passenger inflator "outcomes vary significantly between [vehicle makes] and vehicle models, even with common inflators" because the vehicle designs allow varying degrees of moisture intrusion.[41] However, neither Takata nor GM can ensure that its inflators made between 2008 and 2012 are not compromised by any one of the many manufacturing defects that cause ruptures. Sixteen deaths worldwide and approximately 150 injuries – many of which occurred in inflators that had not yet been recalled when they ruptured – have demonstrated that.

GM's Failed Oversight

In the last two years, automakers and, often, NHTSA, have suggested that Takata bears almost all of the blame for more than 70 million potentially defective inflators in the U.S. fleet. They charge that Takata falsified testing data and hid ruptures from automakers. But, this narrative does not square with individual automakers experiences, or with the supplier quality control systems that all major OEM purport to employ.

For example, a Takata-Honda audit committee recently found that the falsified data, while egregious, did *not* have a role in the ruptures. An executive summary from its initial findings notes that "although there were multiple instances of data manipulation…This audit did not find any test results with peak pressure results in either DV or PV test programs that could have caused explosive ruptures."[42]

In addition, GM reportedly knew from the beginning of its business with Takata that the PSAN inflators were dangerous. According to *The New York Times,* Takata competitor Autoliv told GM in the late 1990s that PSAN was too volatile to use in inflators.[43] The August 2016 article states that after GM threatened to remove its business if Autoliv could not match Takata's low costs, Autoliv's chemists tested the propellant compound. According to the article, Robert Taylor, Autoliv's head chemist at the time, said that when they deployed airbags with the PSAN propellant, they found "the gas is generated so fast, it blows the inflator to bits."[44] The scientists

[38] Orbital ATK, Takata Inflator Rupture Root Cause Summary Report, Sept. 2016, at 17
[39] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 70-71
[40] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 76
[41] Rpt. of TK Holdings Inc. Pursuant to Paragraph 33.a of Nov. 3, 2015 Consent Order, at 76-77
[42] Brian O'Neill et al., Takata Engineering Integrity Audit – Phase One Executive Summary, Aug. 15, 2016
[43] Hiroko Tabuchi, "A Cheaper Airbag, and Takata's Road to a Deadly Crisis," N.Y. Times, Aug. 26, 2016
[44] Hiroko Tabuchi, "A Cheaper Airbag, and Takata's Road to a Deadly Crisis," N.Y. Times, Aug. 26, 2016

said that not only did they alert GM to the dangers of using PSAN, but they also alerted other manufacturers as well.[45] Nonetheless, GM and the other manufacturers hired Takata.

More importantly, automakers should have flagged these problems via their stringent supplier quality control systems that are designed to detect and prevent defective products before they reach customers.

GM, like all other manufacturers, has quality control guidelines for its suppliers, enforced by its Supplier Quality Engineer (SQE). Central to its supplier relationship is that "the goal is a zero tolerance for defects."[46] The Global Supplier Quality Manual in place when the defective inflators were manufactured states that GM will be significantly involved in the supplier manufacturing process, including approving designs, ensuring the supplier is tracking lessons learned, monitoring errors, stopping production until countermeasures are affirmed, auditing the plants, and suspending or canceling business if the supplier cannot control its quality issues.[47]

An important tool all manufacturers use to monitor suppliers is the Failure Mode and Effects Analysis (FMEA), including the Design FMEA (DFMEA) and Process FMEA (PFMEA). After the part is designed, the supplier creates a team that identifies potential failure modes – all the ways in which a component or system does not meet the design intent. The DFMEA is submitted to the OEM for approval before process and validation testing begins. According to a DFMEA Reference Manual used by GM, Ford, and Chrysler:

> "In its most rigorous form, an FMEA is a summary of an engineer's and the team's thoughts (including an analysis of items that could go wrong based on experience and past concerns) as a component, subsystem or system is designed. This systematic approach parallels, formalizes and documents the mental disciplines that an engineer normally goes through in any design process."[48]

Among other goals, the DFMEA aids "in the objective evaluation of design requirements and design alternatives" and provides "future reference to aid in analyzing field concerns, evaluating design changes and developing advanced designs."[49] Further:

> "The Design FMEA is a living document and should be initiated before or at design concept finalization, be continually updated as changes occur or additional information is obtained throughout the phases of product development, and be fundamentally completed along with the final drawings."[50]

All possible failure modes are identified and the likelihood of occurrence, severity and detection are assessed on a scale of 1-10.[51] In determining failure modes,

> "a recommended starting point is a review of past things gone-wrong, concerns reports, and group 'brainstorming.' Potential modes that could only occur under certain operating

[45] Hiroko Tabuchi, "A Cheaper Airbag, and Takata's Road to a Deadly Crisis," N.Y. Times, Aug. 26, 2016
[46] GM, Global Supplier Quality Manual, Sept. 2008
[47] GM, Global Supplier Quality Manual, Sept. 2008 at 10
[48] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at Introduction
[49] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 2
[50] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 2
[51] SAE Intl., Surface Vehicle Standard J1739, Potential Failure Mode and Effects Analysis in Design, Jan. 2009

conditions (i.e. hot, cold, dry, dusty, etc.) and under certain usage conditions (i.e. above average mileage, rough terrain, only city driving, etc.) should be considered."[52]

Severity is an assessment of the seriousness of the failure mode should it occur. "Severity applies to the effect only. A reduction in Severity Ranking index can be effected only through a design change."[53] Severity is ranked 1 through 10. A ranking of "10" means the effects could be catastrophic effects for vehicle occupants.[54]

Occurrence is the likelihood of the failure mode.[55] In determining the occurrence ranking, the supplier should consider the service history and field experience of the product and what changes have been made to the components.[56]

The detection rate is the ease with which the supplier could detect the failure mode with the given process controls – the lower the number, the easier the supplier thinks it will be able to detect it. These indices are multiplied together to give a Risk Priority Number (RPN). This number alerts the engineer to the potential causes of failure for consideration of possible corrective action. "In general practice, regardless of the resultant RPN, special attention should be given when severity is high."[57]

The DFMEA also provides corrective measures. In production, a Failure Mode Analysis would be used as an analysis tool (in conjunction with the DFMEA and PFMEA).

Engineering experts have opined that there should never be a design with severity levels of 10. A design with the highest severity level must be redesigned or, if a redesign is impossible, the supplier must provide data to show that it has fail safes built in to keep the failure mode from causing serious harm.

After the DFMEA is approved, it is used by the supplier as the basis for the PFMEA to eliminate potential failure modes in the manufacturing and assembling processes. For instance, the PFMEA for an airbag inflator would include analyzing the potential failure modes associated with loading the correct amount of propellant into the inflator. GM's Global Supplier Quality Manual requires that its SQEs ensure that supplier PFMEAs have detailed action plans for high RPN and severity rankings.[58]

Takata's FMEAs have not been made public. However, NHTSA should have access to these documents. Given the long-recognized danger that PSAN destabilized by moisture can lead to rupture, any competent DFMEA should have included rupture caused by moisture exposure, humidity, and low density propellant. And given that rupture of a metal canister can obviously lead to injury and death, the severity ranking should have been a 10 for each of those. The automakers have claimed Takata lied about the propensity for rupture, but the DFMEA should

[52] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 6
[53] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 7
[54] Raytheon, Design Failure Modes and Effects Analysis, 2007, at 11
[55] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 8
[56] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 8
[57] Potential Failure Mode and Effects Analysis in Design (Design FMEA) Reference Manual, undated, at 10 (emphasis in original)
[58] GM, Global Supplier Quality Manual, Sept. 2008 at 18

have predicted the dangers – and if it didn't, it is automakers' obligation to ask Takata to explain its absence.

Suppliers bundle these DFMEAs and many other analyses into packets called Production Parts Approval Process (PPAPs), which automakers use to ensure the design functions perfectly during a significant production test run.[59] The PPAP is the "test" that every supplied part in a car goes through to prove it can do its job and last the life of the vehicle. According to a PPAP manual by the Automotive Industry Action Group (AIAG), a coalition made up of GM, Ford, and Chrysler, new PPAPs are always required when there is a new part or product, a correction to a discrepancy on a previously-submitted part, or the part is modified by an engineering change.[60] Additionally, suppliers must submit a new PPAP before the first production after there has been, among other things, a customer request to suspend shipment due to a supplier quality concern.[61] Once a supplier gives the PPAP to the automaker, the part is considered "production," and any quality problems that occur will be the responsibility of the automaker's supplier quality department.

Automakers identify the submission or documentation level that will be required to approve a PPAP from each supplier. Their choice of levels is often determined by such factors as:

- Supplier Quality Status – their quality record and performance
- Part criticality
- Experience with prior part submissions
- Supplier expertise with the specific commodity[62]

The submission levels are a significant indicator of how much the automaker trusts the supplier. Those with a proven record of quality and expertise are not required to submit nearly as much supporting documentation as suppliers the automaker does not trust. Supplier submission levels include: the following:

- Level 1 - Part Submission Warrant (PSW) only submitted to the customer.
- Level 2 - PSW with product samples and limited supporting data.
- Level 3 - PSW with product samples and complete supporting data.
- Level 4 - PSW and other requirements as defined by the customer.
- Level 5 - PSW with product samples and complete supporting data reviewed at the supplier's manufacturing location.[63]

GM's default is considered a Level 3.[64] But based on the historical problems industry practice dictates GM should have increased Takata to a Level 5 – this is an area the agency should evaluate carefully in order to understand their role in the defect.

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[59] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 1
[60] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 2
[61] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 2
[62] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 4
[63] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 4
[64] GM, Global Purchasing and Supply Chain Global Supplier Quality, Jan. 2015, at 32

Before the supplier submits a PPAP, the supplier and automaker must determine an acceptable level of “preliminary process performance” for key safety characteristics.[65] The AIAG states:

> “Preliminary process studies are short-term and will not predict the effects of time and variation in people, materials, equipment, measurement systems, and environment. Even for these short-term studies, it is important to collect and analyze the data in the order they are produced using control charts.
>
> …
>
> The control chart should be examined for signs of instability. If there are signs of instability, corrective action should be taken. If stability cannot be achieved, contact the customer and determine appropriate action...
>
> Depending on the nature of the instability, the process may not meet customer requirements. Special causes should be identified, evaluated and, wherever possible, eliminated…Process improvement must be given a high priority and documented in a corrective action plan. A revised Control Plan for these interim actions must be reviewed with and approved by the customer.”[66]

The system was designed to ensure that the automakers are ultimately responsible for the end product. According to AIAG, “suppliers must never ship production quantities of their products before receiving customer approval.”[67] GM represents to suppliers that it will enforce this through regular process control plan audits.[68]

As part of the PPAP, GM requires that suppliers submit control plans, documenting the controls necessary for each process and updated with solutions as new issues arise.[69] GM also requires an Early Production Containment plan for all new and changed parts to ensure that quality issues are identified before the product gets to a GM factory.[70] GM stresses to suppliers that they must constantly update their quality control documents with Lessons Learned from “previous programs and not revisit the same quality or design issues.”[71]

When GM has identified a high-risk part or process, such as an airbag containing explosives, during its launching phase, it is supposed to initiate a Proactive CS2 process that requires a third-party company to inspect and evaluate parts before they are shipped.[72] Once a product is launched, the supplier is required to maintain a continuous-improvement process “to ensure process stability and capability over time.” [73] GM’s SQE is responsible for monitoring the

[65] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 7
[66] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 7-8
[67] Auto. Indust. Action Group, Production Part Approval Process, 1993, at 15
[68] GM, Global Supplier Quality Manual, Sept. 2008, at 51
[69] GM, Global Supplier Quality Manual, Sept. 2008, at 19
[70] GM, Global Supplier Quality Manual, Sept. 2008, at 21
[71] GM, Global Supplier Quality Manual, Sept. 2008, at 26
[72] GM, Global Supplier Quality Manual, Sept. 2008, at 38
[73] GM, Global Supplier Quality Manual, Sept. 2008, at 42

supplier's compliance, communicating specific concerns, requiring definitive root cause analyses and countermeasures for issues, and following up to ensure the problem is solved.[74]

When there has been a serious nonconformance that has not been contained, GM puts the supplier in Controlled Shipping Level 1, which requires "that a supplier put in place a redundant inspection process at the supplying location to sort for a specific and specified nonconformance, implement a root cause problem solving process, and isolate Customer from the receipt of nonconforming parts/material."[75] If that does not work, the supplier is put into Controlled Shipping Level 2, which requires redundant inspection by a third-party.[76]

Companies with "demonstrated poor performance over time" are forced into the Executive Champion Process to drive "systemic changes in manufacturing and quality through executive leadership engagement and accountability focused on clear expectations and metrics."[77] This involves onsite visits, extensive document review, meetings with supplier executives, consequences for failure to meet targets, and significant GM oversight.[78] Companies that have a poor performance history that has negatively impacted GM manufacturing centers are placed into a Top Focus Process, which is a more aggressive version of the Executive Champion Process.[79] Finally, if all of that fails, GM is supposed to place the supplier in a new business hold/exit program, which prohibits the supplier from proposing new business and resources the business to other suppliers.[80]

Had GM, and the other automakers, followed these strict controls over supplier quality, Takata would have been terminated as an inflator supplier as early as 2010, when it was clear that Takata could not definitively identify the root cause, vehicles affected, or countermeasures for defects that had already resulted in two deaths. Yet, it appears GM continues to use Takata as an airbag supplier.

GM, in particular, has a long history of exercising poor oversight over its suppliers and not enforcing quality measures. In 2014, the defective ignition switch scandal, which forced GM to revamp its quality controls, revealed this structural weakness. And the news media has extensively documented the company's poor quality control practices going back to the 1980s, in interviews with former and current GM employees. [81] In 2014, CEO Mary Barra testified before Congress that GM previously focused more on costs than on safety. And a damning report, prepared for GM by attorney Anton Valukas, chronicled the automaker's catastrophic decision to use an ignition switch it knew was defective for more than a decade, causing more than 100

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[74] GM, Global Supplier Quality Manual, Sept. 2008, at 42
[75] GM, Global Supplier Quality Manual, Sept. 2008, at 63
[76] GM, Global Supplier Quality Manual, Sept. 2008, at 67
[77] GM, Global Supplier Quality Manual, Sept. 2008, at 75
[78] GM, Global Supplier Quality Manual, Sept. 2008, at 76
[79] GM, Global Supplier Quality Manual, Sept. 2008, at 79
[80] GM, Global Supplier Quality Manual, Sept. 2008, at 83
[81] See Patrick M. Sheridan, "GM's 'Culture' Blamed for Current Crisis," CNN Money, June 28, 2014; Jeremy Smerd, "Back to the Drawing Board: Can a New Company Culture Save General Motors," Workforce, Oct. 27, 2009; Tim Kuppler, "GM Culture Crisis Case Study – A Tragedy and Missed Opportunity," CultureUniversity.com, June 24, 2014.

fatalities and hundreds of injuries.[82] Valukas noted that in the 2000s, GM heavily pushed suppliers to reduce costs.[83] Valukas stated:

> "The cost-cutting naturally flowed through to suppliers. One cost-cutting measure in the time leading up to GM's bankruptcy was to source parts routinely to the lowest bidder, even if they were not the highest quality parts."[84]

Moreover, GM employees reported a cultural reluctance to raise safety concerns, and when concerns were raised, nothing was done to correct them.[85]

The inflators GM is asking for a delay to replace were manufactured during this period of poor internal supplier controls.

Summary

NHTSA, reputable scientists, and Takata itself in multiple patents, have determined: PSAN-based propellant is volatile and dangerous, especially when used in inflators that are poorly designed and built, allowing moisture to degrade the propellant. The agency has concluded that ALL non-desiccated inflators containing PSAN are at risk of eventually rupturing.

Takata's epic and systemic inability to control its manufacturing and quality controls is well documented. Many of those failures have resulted in ruptures and recalls, even in newer models. Despite purportedly rigorous supplier quality controls, GM and other automakers failed to detect these issues, and once they surfaced, failed to force Takata to improve its procedures. When it was clear Takata was unable to do that, the OEMs failed to find a new airbag supplier.

GM now asks NHTSA to accept its assurances that its inflators are safe and that no ruptures could possibly occur during a one-year extension. Unfortunately, the extensive record renders these guarantees worthless. We respectfully urge NHTSA to consider the totality of the evidence and deny GM's request. As the agency has stated numerous times, it is essential that Takata airbag inflators be recalled and repaired expeditiously. Even a one-year extension could have calamitous results.

Sincerely,

Sean E. Kane

[82] Anton R. Valukas, Report to Bd. of Dirs. of General Motors Co. Regarding Ignition Switch Recall, May 29, 2014

[83] Anton R. Valukas, Report to Bd. of Dirs. of General Motors Co. Regarding Ignition Switch Recall, May 29, 2014, at 23

[84] Anton R. Valukas, Report to Bd. of Dirs. of General Motors Co. Regarding Ignition Switch Recall, May 29, 2014, at 251

[85] Anton R. Valukas, Report to Bd. of Dirs. of General Motors Co. Regarding Ignition Switch Recall, May 29, 2014, at 252-256