

February 17, 2012

Ms. Jennifer T. Timian  
Chief, Recall Management Division  
National Highway Traffic Safety Administration  
Office of Defects Investigation, Recall Management Division  
1200 New Jersey Avenue SE  
Washington, D.C. 20590

Re: Response to NHTSA Request for Information  
Identification Number EQ12-002

Via email: [rmd.odi@dot.gov](mailto:rmd.odi@dot.gov) and U.S. Mail

Dear Ms. Timian:

Please let this letter serve as the response of Autoliv ASP, Inc. ("Autoliv") to your letter of February 14, 2012. We provide, below, the two items of information you requested in your letter, and we will comment on the existence of a potential safety defect in the items of motor vehicle equipment that we supplied. As you will see from our explanation, the four reports that NHTSA has received from vehicle manufacturers actually relate to different products. For the reasons set out below, while we do not disagree with the conclusions and actions proposed by Honda and Toyota, we strongly believe that other products (including those related to the Subaru and Nissan reports) will function properly and do not contain safety defects.

1. Customers receiving airbag inflators or modules containing potentially affected propellant

The quantities of products shipped to each customer indicated below are accurate based on our ongoing review of production and shipping records. We are continuing to verify all products shipped and will update this correspondence should any of the information require correction or explanation.

Also, please note that not all individual products in the quantities shipped to customers contain potentially affected propellant, although the percentage that do is unknown.

Vehicle Manufacturers (completed airbag modules)

Chrysler Group LLC  
800 Chrysler Drive  
Auburn Hills MI, 48326-2757  
248-576-5741  
Quantity: 2177



Ship Dates: Nov, 15, 16, 18, 21, 23, and 25, 2011

Ford Motor Company

1 American Road

Dearborn, MI 48126

313-322-3000

Quantity: 1565

Ship Dates: Nov. 22, 23, 28, 29, 30, 2011

American Honda

919 Torrance Ave.

Torrance, CA. 90501

310-703-2000

Quantity: 571

Ship Dates: Nov. 7, 9, 10, 22, 26, 28, and 29, 2011

Dec. 1, 2, and 5, 2011

Kia Motors Manufacturing Georgia Inc.

7777 KIA Parkway

West Point, GA 31833

706-902-7848

Quantity: 693

Ship Dates: Nov. 16, 18, 23, 28, 2011

Nissan North America Inc.

1 Nissan Way

Franklin TN. 37067

615-725-1000

Quantity: 984

Ship Dates: Nov. 17, 18, 21, 22, 23, 28, and 29, 2011

Dec. 1, 2, 9, 10, and 14, 2011

General Motors Company

300 Renaissance Center #L1,

Detroit MI 48243-1403

313-556-6000

Quantity: 214

Ship Dates: Nov. 4, 8, 9, 10, 17, and 21, 2011

Dec. 9, 2011

Suzuki

300, Takatsuka-cho, Minami-ku

Hamamatsu City, Japan 432-8611

(053)440-2061

Quantity: 132

Sale Dates:

Toyota Motor Manufacturing Canada, Inc.

1055 Fountain St. North

Cambridge, Ontario, Canada N3H 5K2

Quantity: 589

Ship Dates: Nov. 21, 23, 24, and 25, 2011

Dec. 2, 5, 8, and 13, 2011

Daimler AG

Prof. Dr.-Ing. Rodolfo Schöneburg

Director

Mercedes-Benz Cars / Development Passive Safety, Durability, Veh. Functions

HPC X270

71059 Sindelfingen, Germany

Telephone +49-(0)7031-90-2790

Quantity: 12 **Note: All products shipped to this customer were prototype parts.**

Ship Date: Nov. 28, 2011

Equipment Manufacturers (airbag inflators)

Takata Holdings Inc.

2500 Takata Dr.,

Auburn Hills, MI 48326

248-373-8040

Quantity: 3483

Sale Dates: Takata China –Nov.4, 2011

TK Holdings – Nov. 14 – 28, 2011

Neaton Auto Products Manufacturing, Inc.

975 South Franklin Street

Eaton, Ohio 45320

937-456-7103

Quantity: 136

Ship Dates: Nov. 16, 2011

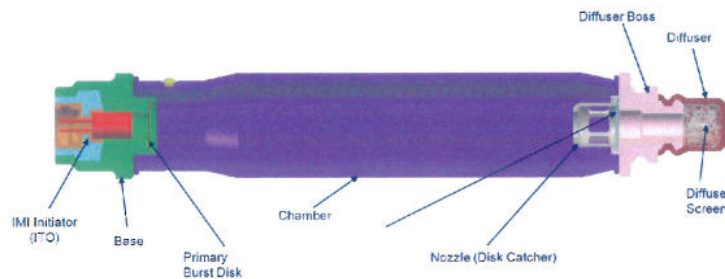
2. Replacement Market

Autoliv did not distribute or sell any potentially affected equipment in the replacement market.

3. Discussion of Possible Safety Defect

A. The Products and Technology

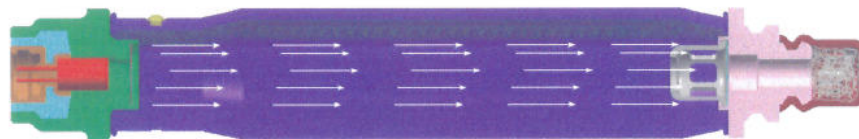
The inflators assembled into the side curtain airbag modules that are the subject of the four defect reports attached to your letter of February 14 are in the general category of Autoliv products referred to as Autoliv Curtain Hybrid (ACH) inflators. Inflators in this category share a basic technology. Unlike pyrotechnic inflators that use the combustion of a flammable material to generate the gas to fill an airbag cushion, hybrid inflators store compressed gas in a central chamber with a small pyrotechnic charge (an initiator) at one end.



In the event of a crash, an electrical signal is sent to the initiator, causing it to “fire.” The firing of the initiator causes a sudden increase in the pressure in the initiator base. The increased pressure ruptures the burst disk at the base of the inflator, and a resultant shockwave travels the length of the chamber to rupture a second burst disk at the other end of the chamber, allowing the stored gas to exit the inflator and fill the airbag cushion.



**1. Initiator fires and pressure increases inside base**



**2. Base burst disk ruptures and shock wave travels through chamber**



**3. Diffuser burst disk ruptures and gas exits inflator**



Within this common technology, inflator performance may vary depending on the design of the primary and secondary burst disks, and the length and diameter of the chamber, among other things.

Four different designs of Autoliv hybrid inflators were assembled with potentially affected initiators. As will be explained below, these four inflator products vary significantly in the design characteristics listed above, and those engineering differences can greatly affect performance characteristics, including susceptibility to variations in initiator output. The designations used by Autoliv for these products are ACH 2.1, ACH 2.1B, ACH2.4 and ACH 2.0B.

**B. Background**

The only pyrotechnic material found in a hybrid airbag inflator is a small amount contained in the initiator. The pyrotechnic material is created by mixing the constituents in a liquid form called slurry. The slurry is then loaded into the initiator cups in an automated production process.

One ingredient used in several initiator propellant compounds is titanium hydride. Autoliv uses titanium hydride in two different particle sizes, 1.8 micron or 5 micron depending on the product. Particle size can affect initiator output and thus is one variable used in formulating a mixture with the intended performance. The initiators at issue were intended to be built using slurry with 1.8 micron titanium hydride (the 5 micron particle size is used in other Autoliv initiators). In late October, 2011, Autoliv determined that a batch of slurry mixture was formulated using 5 micron, not 1.8 micron, titanium hydride. The mistake was discovered, but not until after a quantity of inflators (ACH2.1, ACH2.1B, ACH2.4 and ACH2.0B) had been built using initiators with the 5 micron titanium hydride mixture. None of the potentially affected inflators had been shipped to customers, however, and all were ordered quarantined at Autoliv's plant.

On January 11, 2012, Autoliv was notified by a customer that an ACH2.1 product had failed a cold temperature (-35 C) deployment test (a lot acceptance or LAT test). Cold temperature deployment tests are conducted as a routine part of the production process, both by Autoliv and its Tier 1 customers. The deployment energy of pyrotechnic components typically decreases at lower temperatures, and -35 C is generally thought to exceed the low temperature extremes to which these components would be subject. An inspection of the part by Autoliv revealed that, although the initiator had fired, the secondary burst disk had not opened, suggesting that the inflator output was insufficient to rupture the burst disk. The inflator serial number was in the population that Autoliv had earlier quarantined. Our investigation concluded that a subset of the quarantined inflators had inadvertently been shipped to customers.

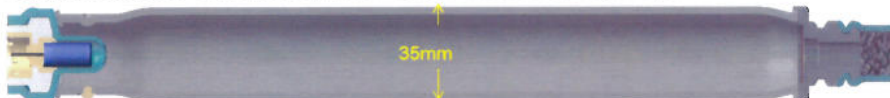
On January 12 and 13, 2012, Autoliv notified the two customers of the ACH 2.1 product of the potential issue and its ongoing investigation. Simultaneously, Autoliv

began reviewing production and shipping records as well as production test records. In addition to the ACH 2.1 products, Autoliv began identifying other products that could contain the potentially affected initiators and conducting an engineering analysis of those products. Autoliv notified the customers of those products of a potential issue on January 31/February 1, 2012. As will be shown below, Autoliv's testing of the other products (ACH2.1B, ACH2.4 and ACH2.0B) that has continued up to the date of this letter indicates that those designs will function normally even with an initiator built with 5 micron titanium hydride material. The test results are explained by significant design differences between the four products that substantially reduce the susceptibility of the ACH2.1B, ACH2.4 and ACH2.0B to low initiator output as compared to the ACH2.1.

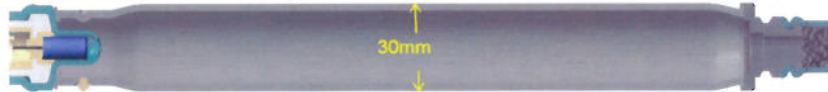
ACH-2.1 Inflator: Standard ignition: Shock wave value 17,336 psi



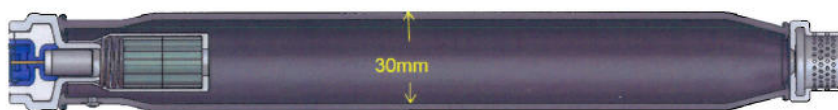
ACH-2.1B Inflator: Enhanced ignition: Shock wave value 20,272 psi



ACH-2.0B Inflator: Enhanced ignition & reduced dia: Shock wave value 21,564 psi



ACH-2.4 Inflator: Enhanced ignition & reduced dia: Not shock wave dependent



### C. Chronology

- Oct. 27, 2011: Slurry mixed using an ingredient with incorrect particle size.
- Oct. 31, 2011: Non-conforming test result in production testing. Root cause investigation begun.
- Nov. 4, 2011: The investigation identified the improperly mixed slurry as the root cause. Products manufactured using the slurry were contained in ASP facilities.
- Nov. 12, 2011: Products inadvertently released from containment and either shipped to tier 1 customers as inflators or assembled into modules and shipped to OEM customers. The error was not discovered until January 12, 2012 (see below).
- Jan. 11, 2011: ASP receives a customer report of a failure of an ACH 2.1 inflator in a module level Lot Acceptance Test (LAT).



- Jan. 12, 2012: ASP determines that the inflator burst disk failed to open, and that the inflator serial number was one believed to have been included in the Nov. 2011 containment actions.
- Jan. 12 to Jan. 26, 2012: Analysis of originally contained parts; review of traceability records to determine parts shipped and customers receiving the parts.
- Jan. 20 to Feb. 5, 2012: Construction and testing of prototype initiators and inflators intended to simulate components built with the incorrect propellant mix.
- Feb. 6 to Feb. 15: Construction of inflators of the ACH 2.1B, ACH2.4 and ACH2.0B designs using production equipment and processes, and testing of the inflators.

#### D. Test Results

Between January 20 and January 27, 2012, Autoliv began subscale shock tube testing of the ACH2.1B product. The results of those preliminary tests appeared to be within a normal range.

On January 27, 2012, in its prototype lab, Autoliv produced initiators using the same formulation of propellant as the suspect initiators. Prototype initiators were not made with a production process and were intended to be used as an initial testing indicator. These initiators were used for multiple length shock tube testing and testing of ACH2.1B, ACH2.0B and ACH2.4 inflators between January 28 and February 5. Customers were informed of the results as the testing progressed.

Because the results of testing using handmade initiators showed excessive variability suggesting that they were not representative of production parts, beginning February 6, Autoliv produced approximately 2500 initiators using the actual production process, but using the suspect propellant formulation. These initiators were assembled into ACH2.1 (to confirm the original LAT failure could be reproduced), and into ACH2.1B, ACH 2.4 and ACH2.0B inflators (to confirm the increased robustness of those designs). The inflators were built and tested according to customer specifications and requests. Of the more than 2200 inflators tested at temperatures ranging from ambient down to -40 C, all deployed as intended with the exception of 3 ACH2.1 inflators (the design involved in the LAT failure reported to Autoliv on January 11). Summaries of the test results by product are attached.

#### E. Conclusions

1. Based on the original LAT test failure at Autoliv's customer, reported to Autoliv on January 11, 2012, and Autoliv's subsequent investigation and testing, Autoliv does not disagree with the course of action proposed by Toyota and Honda in their reports to NHTSA of January 31, 2012 with respect to the ACH2.1 inflators (the only products covered by those reports).
2. Autoliv believes strongly that the ACH2.1B, ACH2.4 and ACH2.0B products will deploy properly whether or not assembled with a potentially affected initiator, and Autoliv believes that this conclusion is amply supported by the outcomes of more than 2200 tests, each of which deployed normally. Autoliv, therefore, disagrees with the conclusions reached in the Subaru and Nissan reports to NHTSA, dated

February 9 and February 13, 2012, respectively (each of which relates to ACH2.1B or ACH2.0B products), and does not believe that these products contain a safety defect.

Very truly yours,



Michael S. Anderson  
Vice President for Legal Affairs  
and General Counsel

cc: Alexander Ansley  
alexander.ansley@dot.gov



# ACH-2.1 Testing Summary

Inflator	Test Temp. °C	Dia. (mm)	Length (mm)	Prototype initiator test results	Production initiator test results
ACH-2.1	-40	35	269	4/4	3/15
	-35	35	269	39/39	

**Note:** Test results are formatted as: no. of abnormal deployments/no. of tests in the series.

# ACH-2.1B Testing Summary

Inflator	Test Temp. °C	Dia. (mm)	Length (mm)	Prototype initiator test results	Production initiator test results
ACH-2.1B	Ambient	35	392	1/38	0/100
		35	385		0/100
		35	332	2/100	0/100
		35	293	0/100	
	-40	35	392		0/ 100
	-35	35	392		0/50
	-30	35	392		0/100
	-40	35	385		0/100
	-40	35	373		0/100
	-40	35	332		0/100
	-30	35	332		0/100
	-25	35	332		0/100
	-40	35	325		0/50
	-40	35	312	3/75	0/100
	-35	35	312	5/75	0/100
	-40	35	293		0/100
	-35	35	293	2/100	
	-30	35	293		0/100
	-25	35	293	3/100	0/100
	-40	35	269	6/100	0/100
	-30	35	269		0/100
	-25	35	269	5/100	0/100

Note: Test results are formatted as: no. abnormal deployments/no. of tests in the series

# ACH-2.4 Testing Summary

Inflator	Test Temp. °C	Dia. (mm)	Length (mm)	Prototype initiator test results	Production initiator test results
ACH-2.4	Ambient	30	225	0/100	
		30	225		0/100
	-40	30	225	0/100	
	-40	30	225		0/100

Note: Test results are formatted as: no. of abnormal deployments/no. of tests in the series.



# ACH-2.0B Testing Summary

Inflator	Test Temp. ©	Dia. (mm)	Length (mm)	Prototype initiator test results	Production initiator test results
ACH-2.0B	Ambient	30	322	0/100	
		30	243	0/100	
	-40	30	300	2/100	
	-40	30	243	0/100	0/100

Note: Test results are formatted as: no. of abnormal deployments/no. of tests in the series.