Reply to: United States Department of Transportation, Office of Inspector General Audit Report, ST-2015-063 Inadequate Data and Analysis Undermine NHTSA's Efforts to Identify and Investigate Vehicle Safety Concerns

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In response to the *Audit Report* which was published on 18 June 2015 by the United States Department of Transportation, Office of the Secretary of Transportation, Office of Inspector General, report number: ST-2015-063, this reply will address the Inspector General's criticisms which are presented in it. To answer those criticisms about the EWR analytical system, there will be a discussion of its design and its subsequent field testing. Even though misgivings regarding the practical utility of the EWR aggregate data were expressed in response to the 2001 Advance Notice of Proposed Rulemaking, the final rulemaking resulted in the same EWR aggregate data about which numerous deficiencies were described in the *Audit Report*. Those misgivings and deficiencies were immediately recognized at the beginning of the design phase of the EWR analytical system. It is only now, fourteen years later, that they are receiving formal high level attention. In the meantime, the final rulemaking resulted in giving O.D.I. sets of defect ladened EWR aggregate data. When reading the *Audit Report*, it is apparent, that the Inspector General overlooked some basic precepts of quality management. The numerous criticisms of the engineering staff which are made in the *Audit Report* violate Edwards Deming's fourteen points of total quality management which are generally accepted by successful manufacturers. Such an appreciation of the principles of total quality management, had they been observed, would have

guided the Inspector General to reveal weaknesses in the system which governs the business of O.D.I., rather than to blame the workers. Some faults of the EWR aggregate data which are cited in the *Audit Report* do have merit, and they are discussed in this reply. The *Audit Report*, on the other hand, would have been more comprehensive, if the authors of it had addressed additional deficiencies which exist in the management of O.D.I. and of N.H.T.S.A.. Missing from the *Audit Report*, for instance, is a thorough discussion of the influence which the Office of Chief Counsel has had on determining the likelihood of the engineering staff to pursue a safety defect investigation; a discussion of why granting authority was not prescribed by the rulemaking which would allow N.H.T.S.A. to monitor the quality control of the E.W.R. operations of the manufacturers; the degree to which Congressional under-funding undermines the regulatory mission of N.H.T.S.A.; and the adverse effect which Executive Order 13563 [1] has on a regulatory agency by hindering a timely safety investigation and a rulemaking by prescribing obligatory cost-benefit analyses. Several examples of past high profile investigations are used to illustrate the influence of the Office of Chief Counsel in determining the outcome of an investigation; the sometimes pointless effort to carry out a statistically based cost-benefit analysis for judging the merits of an investigation; and, the inherent difficulty of conducting a statistical analysis of rare events when sound engineering judgement would be sufficient to answer a safety issue. In as much as there are valid criticisms cited in the *Audit Report*, the Office of the Inspector General could have recommended in fulfillment of its mission more substantial measures for saving lives by calling for N.H.T.S.A. to propose regulations which will require alcohol locking devices to be installed on automobiles and to require the installation of equipment to block the use of mobile telephones by a driver when a car is turned-on. These two regulations by themselves for which technology already exists could immediately save several hundred lives every year in the United States, no matter what is done to improve the usefulness of EWR data.

1 Introduction

The United States Department of Transportation Inspector General's principal claim which forms the central thesis of the *Audit Report* is contained in the title:

> "INADEQUATE DATA AND ANALYSIS UNDERMINE NHTSA'S EFFORTS TO IDENTIFY AND INVESTIGATE VEHICLE SAFETY CONCERNS".

The authors of the report go on to criticize the statistical methods which underlie the EWR analytical system and the competency of the professional staff of O.D.I. They conclude that the quality of the aggregate data and the technical competency of the automotive engineers

[1] https://www.whitehouse.gov/the-press-office/2011/01/18/executive-order-13563-improving-regulation-and-regulatory-review

who work in the Office of Defects Investigations are inadequate. Specifically, the *Audit Report* described at least three major deficiencies under the following headings.

1. Inadequate statistical analysis of the EWR data which was described on page 12 in the section,

   WEAK DATA ANALYSES AND REVIEWS UNDERMINE ODI'S EFFORTS TO IDENTIFY VEHICLE DEFECTS

2. Uninformative EWR aggregate data cited on page 5 in the section,

   ODI LACKS EFFECTIVE PROCESSES FOR COLLECTING COMPLETE AND ACCURATE VEHICLE SAFETY DATA

3. Shortcomings in the competency of the engineers who work in O.D.I. are described on page 17 in the section,

   ODI's Pre-investigation Staff Lack the Training and Supervision To Effectively Analyze Vehicle Safety Data

There are merits in the arguments presented in each of these three categories of criticisms. However, the authors could have made a more thorough investigation and developed a substantially better report by having done the following.

1. Obtained a better understanding of the basic design of the EWR analytical system.

2. Described arguments which were received for the 2001 *Advance Notice of Proposed Rulemaking* and which disagreed with the proposed rules for requiring submissions of EWR aggregate data.

3. Assessed the effects of Congressional under-funding on the efficiency of accomplishing the regulatory and investigative missions of N.H.T.S.A.

4. Evaluated the influence of the N.H.T.S.A. Office of Chief Counsel in determining which engineering initial evaluations should be pursued.

5. Determined to what extent does Executive Order 13563 [2] which requires a cost-benefit analysis impede a timely decision to bring about a recall from a defect investigation.

6. Estimated the amount of uncompensated overtime performed by the professional and managerial staff with respect to 5 U.S.C. 61 *Hours of Work* [3].

[2] https://www.whitehouse.gov/the-press-office/2011/01/18/executive-order-13563-improving-regulation-and-regulatory-review

[3] http://www.gpo.gov/fdsys/granule/USCODE-1995-title5/USCODE-1995-title5-partIII-subpartE-chap61

The adverse publicity which N.H.T.S.A. has recently received in the press and produced from Congressional hearings deserves attention. In this adversarial climate, the reputation of N.H.T.S.A. can be quickly tarnished, if the management of N.H.T.S.A. does not effectively react to automotive safety issues before they receive much publicity. Neither is the Office of the Inspector General an exception. The tenor of the O.I.G. *Audit Report* is overwhelmingly negative. Not mentioned in the *Audit Report* are N.H.T.S.A.'s accomplishments such as its contribution of reducing deaths due to highway accidents from 54,589 to 32,719 per year through air bags and seatbelts, in particular. Those safety devices are the signature achievements of the agency in its 50-year history. The driving public has bought into them; industry is committed to them world-wide.

Notwithstanding prior achievements, what matters most is when N.H.T.S.A. fails to catch an automotive manufacturer trying to conceal the existence of a safety defect over an extended period. When such behavior is discovered and publicized before N.H.T.S.A. takes action, we have a Federal agency charged with catching such defects being made to look negligent in protecting the public from automotive safety defects thereby undermining public confidence in the government.

A systematic analysis of the reasons for a Federal agency to fail in its mission should be made in accordance with principles of total quality management as advocated by the renown expert, Edwards Deming. Contrary to these basic principles of total quality management, the Inspector General in his *Audit Report* assigned responsibility of alleged operational deficiencies of O.D.I. to the competency of the engineering staff. The *Audit Report* does not describe how the competency of the engineers and statisticians was determined. There is no mention of them taking a civil service written examination, nor were they examined by a panel of recognized safety experts, nor did the *Audit Report* find that they were derelict in performing their assigned duties. The Inspector General, nonetheless, blamed the failures of the investigative system on the people who must work under that system rather than on the design and efficiency of the system itself.

The following highly publicized investigations illustrate the difficulty which is encountered when using statistics in a reliability analysis of defects when the statistical analysis depends on the tails of a probability distribution. One would think that the engineering expertise of the staff should be sufficient to decide the outcome of an automotive safety defect investigation. In other words, the justification for resolving a safety defect investigation depends not on a statistical analysis of the data but on engineering and legal opinions.

Contrary to the I.G.'s implied argument that, if only O.D.I.'s statistical methods were modernized and the quality of the data were to be made better, a statistical analysis would be sufficient to resolve an investigation, the following examples cite the small number of observations which were actually used to resolve an investigation. They show that, in practice, the tails of a probability distribution constitute the set of data for a reliability analysis of a safety defect.

Compounding the difficulty of depending on the tails of a probability distribution, there is the obligation to conduct usually an *ad hoc* cost-benefit analysis. In other words, would the GM Ignition Switch investigation which was cited in the *Audit Report* have been prematurely stopped by O.D.I., if there was no obligatory cost-benefit analysis performed by the responsible engineer? The Inspector General should have found fault instead with the root cause of the decision for prematurely terminating the investigation rather than blaming the engineer.

The following summarized investigations illustrate the essentially unsuccessful attempts to employ some kind of cost-analysis benefit for deciding the outcome of an investigation and the influence of the Office of Chief Counsel in overriding engineering expertise, perhaps due to an imperative to resolve an investigation as expediently as possible rather than to rely on complex and difficult engineering analyses.

1.1 GM C/K Pick-up Truck

In the case of the GM C/K pick-up truck investigation conducted by O.D.I., General Motors argued that the trucks met Federal Motor Vehicle Safety Standard (FVMSS) 301 (fuel system integrity) and, therefore, a defect determination would be retroactive rulemaking. N.H.T.S.A. tested 27 pick-up trucks in FVMSS 301 test conditions; the trucks met all the standards. Furthermore, upon examining autopsy reports, O.D.I. engineers found that about 50% of the autopsies showed that the victims died from blunt force trauma as there was no smoke in the victims' lungs - thus these people had already stopped breathing from the side impact. The actual number of fire fatalities was lower than claimed in the *Center for Auto Safety* recall petition. Congress had hearings; *60 Minutes* did a story, as well as *20/20*. Replacing the fuel tank with a fuel cell or something comparable would have cost at least $1,000 per vehicle. Considering that the population of such vehicles was 20 million, the cost of the recall would have been enormous.

O.D.I. actually found that the GM trucks were better overall in fire fatalities, but worse in fire fatalities at side hits (clock = points 3,4,5 and 6,7,8). After much debate, the N.H.T.S.A. lawyers settled the investigation with an agreement: GM would make available 200,000 child seats for free dispersion among poor families. Furthermore, GM would donate 55 million dollars to research and development in vehicle fire research. In the end, none of the trucks were repaired.

O.D.I. estimated that 5 to 7 fatalities would occur annually for the life of the trucks. According to FARS data, five years later, the O.D.I. estimate was accurate. N.H.T.S.A. and GM engineers thought that the numbers when normalized were too small and the trucks did meet the standard. The Secretary of DOT at the time felt that a recall should occur, and the O.D.I. staff was working in that direction, when the negotiated settlement was made by the Office of Chief Counsel.

Conclusion 1 *A statistical analysis was irrelevant; Office of Chief Counsel settled the inves-*

tigation independently of O.D.I.

1.2 Ford-Firestone

The crux of an investigation is whether it can be shown that injury is the result of a defect. That is not an easy task. In the case of Ford-Firestone, if a person is killed because the tire on his truck blew out or disintegrated while driving on the freeway, was it because of a tire defect or was it because the tires were significantly under inflated and overheated causing delamination? Certain Firestone tires were failing with a double tread belt separation. The tire did not lose air pressure, rather it lost *grip* when the tread belts separated. Only when mounted on the rear of a Ford Explorer would we see loss of control and deaths.

Investigation revealed many of the tires reported in the Ford-Firestone issue were significantly and sometimes grossly under inflated. Investigation of tire inflation in the general public revealed a high percentage of under inflated tires. This one aspect greatly complicated the investigation. This knowledge also resulted in laws requiring tire pressure monitoring systems on new vehicles.

Firestone argued that the Explorer was at fault. Ford argued that if the tire did not fail, the vehicle would not crash. The set of recorded incidents was small and the incidents were hard to identify. Ultimately, a recall was negotiated but even in that case the key legal words, *Ford has made a safety related defect determination*, were not in the notification. While it was a recall, it did not meet the legal standards required by the Safety Act.

Conclusion 2 *The Office of Chief Counsel settled the investigation without reference to a statistical analysis.*

1.3 Toyota Sudden Acceleration

In the case of the Toyota sudden acceleration, there were multiple considerations to address. Toyota did have problems with floor mats getting tangled in the accelerator, and they were recalled with N.H.T.S.A.'s intervention. Furthermore, there was a second issue where a piece of interior trim on the side of the "tunnel" would prevent the accelerator from dropping back to idle when released. Shawn Kane of Strategic Safety argued that the electronic accelerator linkage was being interfered with by radio waves. After much testing, he found that the real problem according to *black box* was the driver. Pedal misapplication - the drivers would step on the wrong pedal and, when the car accelerated, they stepped harder on the accelerator, thinking it was the brake. O.D.I. downloaded 73 *black boxes* and 72 showed conclusively that the gas pedal was applied and the brake pedal was not applied. Therefore, no recall was made. So, in every

case, the engineers generally are dealing with very small numbers and were unable to make the argument that the complaint/failure rate rises to a high enough level to warrant a recall.

Conclusion 3 *Whatever statistical analysis was done, it did not, in the sense of a cost-benefit analysis, contribute to bringing about a recall, rather, a cost-benefit analysis might have stopped further engineering investigation, if a rigorous cost-benefit analysis had been done.*

1.4 GM Ignition Switch

In the case of the GM Ignition Switch recall a proposal was discussed in O.D.I. to open an investigation on non-deployment of air bags (the real problem was the key being in the off position had not been identified). The air bag non-deployment rate was very low and much lower than other investigations, and, therefore, the investigation was not continued.

A detailed account of the GM Ignition Switch investigation is discussed in *NHTSA's Path Forward*(Rosekind, June 5, 2015b). This report does not find fault with the statistical techniques which are used for analyzing EWR data, but it does state:

> "Various committees within GM considered proposed fixes to the ignition switch issue, but each was deemed too costly, especially in light of GM's judgment that the issue was not a safety hazard."

Appendix E [4] of (Valukas, May 29, 2014) provides an insight into the operation of the Tread Reporting team of General Motors, and it provides a description of the Tread database. It is this Tread Reporting which supplies EWR data to N.H.T.S.A. It is reported in this document that General Motors analysts use a key word search for finding incidents in General Motors' Tread database. It is noted on page 159 of (Valukas, May 29, 2014) that:

> "As many witnesses have noted, the Tread database is extremely difficult to use and search, potentially resulting in valuable data being passed by those investigating potential safety or other problems."

The Inspector General may criticize the analytical statistical methods used by O.D.I., however, even employees of a large and well staffed department of a relatively well respected manufacturer like General Motors who are dedicated to managing Tread data experience difficulty in analyzing the Tread database. Moreover, the manufacturer has all of the raw non-aggregated data available for a detailed analysis, whereas O.D.I. has only summarized tallies in the form of EWR aggregate data with the responsibility to analyze the data for the entire industry of light vehicles, heavy trucks, and trailers.

[4] See page 306

The report of the GM Ignition Switch recalls written by Anton Valukas (Valukas, May 29, 2014) provides an interesting account of the complex internal investigation which was conducted by General Motors especially beginning on page 165 with the description of General Motors electrical engineer John Dolan's research into the cause of the air-bags failing to deploy.

Both *NHTSA's Path Forward*(Rosekind, June 5, 2015b) and the *Audit Report* contain references to Wisconsin State Highway Patrolman Keith Young's analysis. He concluded that the movement of the ignition switch from the run to the accessory position was the cause of the air bag non-deployment.

The authors of the *Audit Report* state that

> "A Wisconsin State Trooper's report that identified the ignition switch defect as a possible cause of air bag non-deployment during the accident. However, the two ODI staff who reviewed the report did not note this finding when documenting their reviews of the report."

In *NHTSA's Path Forward*(Rosekind, June 5, 2015b), there appears the claim that

> "The IU[5] report did not adopt the Wisconsin State Patrol report's opinion that the key position was the cause of the air bag non-deployment, instead stating it was not known if the switch position accounted for the air bags not deploying. IU observed that making such a determination would require an analysis of the air bag system and vehicle wiring beyond the scope of their investigation."

Although Mr. Keith Young's deduction is noteworthy, and it is commendable, it does not appear to be relevant to the thesis of the *Audit Report* that "inadequate data and analysis undermine NHTSA's efforts". One must wonder as to the reason why the contract with Indiana University was not modified to expand its scope. If the Inspector General had carefully examined this question, he might have discovered not a problem with the sets of EWR data and their analyses as he evidently expected, but with something else with respect to the management of N.H.T.S.A.

The extensive testimony and documentation which was collected by the U.S. House of Representatives Energy and Commerce Committee (Upton, April 1, 2014b) regarding the GM Ignition Switch recall again attests to the complexity of this investigation. Document 15 (Upton, April 1, 2014a) contains a copy of a certified letter which was sent by the Chief of the E.W.R. Division to General Motors in June 2007 citing evidence in the fourth quarter 2006 submitted EWR data about a possible safety defect with General Motors vehicles. Considering that out of many thousands of EWR records coming industry wide to N.H.T.S.A. in that quarter, the EWR system nonetheless provided evidence for O.D.I. to initiate a formal inquiry into what turned

[5]Indiana University

out to be the GM Ignition Switch recall. The engineers and analysts of the E.W.R. Division should have been given credit in the *Audit Report* for making successful use of the EWR analytical system. Instead, the Inspector General tried to use the GM Ignition Switch recall to substantiate the claim that the EWR data and analysis are inadequate. A counter argument can be made that without the EWR data and analysis, the letter cited in Document 15 (Upton, April 1, 2014a) would not have been sent with the probable consequence that initiation of the GM Ignition Switch investigation would have been delayed.

Conclusion 4 *Whether it is an actual or a perceived attempt by a manufacturer to conceal the existence of a safety defect over an extended period of time, the credibility of N.H.T.S.A. is held accountable for catching it. The public expects due diligence by the civil service. As the GM Ignition Switch investigation shows even in a large organization such as General Motors which has all the raw non-aggregated data available for analysis, the analysis of the Tread data is extremely difficult. To the credit of O.D.I., based on the EWR data and its analysis, the investigation was, nonetheless, launched.*

These highly publicized cases illustrate the influence which the Office of Chief Counsel has had in determining the outcome of an O.D.I. initiated investigation and they show the influence which cost-benefit analysis has had in misleading an investigation. Cost-benefit analysis has no basis in law. None of the Acts under which N.H.T.S.A. operate address cost-benefit analysis. Rather, they require reasonability and practicability. Executive Order 13563 formally turns money into a major consideration in regulatory action for which N.H.T.S.A. is held responsible. That sense of conducting a cost benefit analysis, though usually *ad hoc* in practice, extends down to the investigative unit. We read an example of it mentioned in the *Audit Report* on page 24.

> "Specifically, the Defects Assessment Panel believed the air bags did not deploy because the drivers were not wearing their seat belts and because the vehicles left the road during the accidents. At the same panel meeting, an ODI air bag investigator advocated against opening an investigation because he had concluded, based on his analysis of complaints, that the rate of air bag non-deployment complaints for the Cobalt and Ion was similar to that of peer vehicles."

Reference to the fallacy in a cost-benefit analysis was discussed in Edwards Deming's book *Out of the Crisis* (Deming, 1986) where he wrote that "Costs are sometimes elusive; difficult to estimate" and "Benefits are even more difficult to evaluate in dollars". He goes on to say:

> "If you can not estimate satisfactorily the numerator or the denominator of a fraction, it is impossible to calculate the value of a fraction. This is where cost/benefit analysis often leaves us.

I would not participate in any attempt to use cost/benefit analysis for design of product where possible injury or loss of life is at risk" [6]

Conclusion 5 *An obligation to conduct a cost-benefit analysis misled O.D.I. The culture which has been created in a regulatory agency like N.H.T.S.A. must be changed to eliminate a cost-benefit analysis from entering into an investigation.*

1.5 Edwards Deming's Concept of Total Quality Management

"What is the system?" [7] is a rhetorical question which Edwards Deming posed in his book, *Out of the Crisis* (Deming, 1986). It is a fundamental question in the theory of total quality management, because a mistake can be blamed on the system or on a specific cause like a worker. The concepts which underlie Deming's notion of total quality management were formalized by Walter Shewhart who is given credit for developing industrial quality control. Edwards Deming whom General Douglas MacArthur hired to help in rebuilding Japanese industry played a prominent role in revitalizing the use of quality control in American manufacturing. Automotive manufacturers have generally embraced Deming's teaching of total quality management. There is a slight reference to an aspect of Japanese total quality management in the Inspector General's report, *Process Improvements Are Needed for Identifying and Addressing Vehicle Safety Defects* (Come, October 6, 2011) by referring to the Japanese practice of hiring retired workers in vehicle development or vehicle quality control to investigate safety defects[8].

There are employees of O.D.I. whom the Inspector General failed to acknowledge for having been trained during their careers in manufacturing prior to their government employment at N.H.T.S.A. in quality control and who are well acquainted with the basic concepts of total quality management. Their opinions, however, do not seem to have been taken into account in the *Audit Report*, nor does it appear that the Inspector General, himself, is well versed in the concepts of total quality management, otherwise the focus of the *Audit Report* would have been on improving the system rather than accusing Federal workers of conducting inadequate analyses. Rather than to follow the Japanese approach to management championed by Edwards Deming, the Inspector General clearly violates Deming's eighth principle.

The eighth of Edwards Deming's fourteen points [9] is:

"**Drive out fear**. No one can put in his best performance unless he feels secure. *Se* come from the Latin, meaning without, *cure* means fear or care. Secure means

[6] Page 396 (Deming, 1986)

[7] Page 317 (Deming, 1986)

[8] Page 20 of (Come, October 6, 2011)

[9] http://asq.org/learn-about-quality/total-quality-management/overview/deming-points.html and Chapter 2 of (Deming, 1986)

> without fear, not afraid to express ideas, not afraid to ask questions. A common denominator of fear in any form, anywhere, is loss from impaired performance and padded figures." (Deming, 1986)

The Office of Inspector General's *Audit Report* cannot be viewed as an instrument to drive out fear. Rather, the criticisms which are articulated in the *Audit Report* place blame squarely on the civil servants while losing focus on the imperfections of the EWR system itself. The Inspector General, instead, should be asking how did the rulemaking permit the kind of EWR aggregate data which the Inspector General finds to be inadequate but, nonetheless, must be submitted by industry to N.H.T.S.A. while, at the same time, not to give N.H.T.S.A. authority to monitor the quality control of the production of the aggregate data. The nature of the EWR aggregate data makes it impossible to do any forensic statistical analysis as to the origins of the data. Without that authority, Deming's fifth point in quality management of constant improvement of the system becomes impossible to do:

> "**Improve constantly and forever the system of production and service**. A theme that appears over and over in this book is that quality must be built in at the design stage. It may be too late, once plans are on their way." (Deming, 1986)

Regardless of the statistical system which is in place, its purpose is only to support the engineering staff for the purpose of discovering a safety defect. Sometimes recalls are initiated on only one complaint. But the complaint has to meet many tests and satisfy many questions under the scrutiny of engineering expertise before sufficient support can be developed to bring about a recall. Finding true safety defect trends takes a great deal of effort, rigor, and experience.

2 EWR Aggregate Data

In reaction to the Ford-Firestone investigation, the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act was enacted in 2000. It created a system called Early Warning Reporting (EWR) which is supposed to supply sets of data to N.H.T.S.A. from manufacturers which contain sufficient information for the personnel of O.D.I. to discover an emerging safety defect.

In the rulemaking process which followed the enactment of the TREAD Act, minimum specifications were established for manufacturers to follow when submitting the required data. A controversial rulemaking arose over the concept of aggregated data. When public comments were solicited for the proposed rulemaking, Mr. G. T. Bowman submitted an extensive critique of the proposed sets of aggregated data which the manufacturers were to supply. The *Audit Report*, in essence, concurs with Mr. Bowman's critical opinion about the utilitarian value of the

EWR aggregate data. The Inspector General missed an excellent opportunity, however, to investigate the rulemaking process which was conducted fourteen years ago but which has resulted ever since in wasted efforts by both O.D.I. and by the industry to extract consistently useful information out of the EWR aggregated data. Why did the rulemaking require the production of expensive minimally useful sets of aggregate data should have been a subject with an extensive explanation in the *Audit Report*.

In Table 4 found on page 13 of the *Audit Report*, there appears a list of "ODI's Statistical Tests Analyzing Early Warning Reporting Data". The first four entries are:

- CROW-AMSAA
- Mahalanobis Distance
- Probability Measure
- Logistic Regression

These four methods are applied to sets of aggregate data. The fifth entry:

- CRM-114

constitutes a component of the Bayesian filter which is used to rank engineering field reports.

That four tests have been developed for ranking entries of the aggregate data whereas there is only one method of ranking engineering field reports is indicative of the inherent difficulties in extracting useful information from the aggregate data. The *Audit Report* is not the only source of criticisms regarding the utility of the EWR aggregate data. Criticisms surfaced even during the rulemaking which established the minimum requirements of the manufacturers for creating the aggregate data.

Had an account of the rulemaking which occurred in 2001 for setting the minimum requirements of the data which manufacturers must follow in compliance with the *TREAD Act* been provided, a reader of the *Audit Report* would have learned about the origins of the specifications of the EWR aggregate data. An account of the rulemaking along with the expressed concerns of the utility of the EWR aggregate data, if it had been included in the *Audit Report*, would have improved the criticisms found in the *Audit Report* about the minimal practical utility of the EWR aggregate data, and it would raise questions about deficiencies in the rulemaking process.

For example, in the middle and late 1970's, a team was organized at N.H.T.S.A. to tear down complete automobiles, to determine the cost and the weight of every part, to code them, and to reconcile the cost and weight of each to the total car by part, component, subsystem, system, and parts group. Everything had to add to dealer cost and manufacturer's suggested retail price

(MSRP) and to the total vehicle empty weight. The total parts count was about 15,000 and consisted of eight parts groups. Given the changes since then, eleven to twelve groups would be necessary and the parts count could go as high as 30,000 given the electronics. In spite of that effort, the rulemaking of 2001 which eventually defined the current EWR coding of a vehicle's components did not reflect that earlier work.

A thorough discussion of the merits of supplying aggregate data to N.H.T.S.A. was made in (Bowman, 2001). These comments dated 22 March 2001 were submitted to the N.H.T.S.A. Docket by Mr. G. T. Bowman, Manager, Products Integrity of Arvin Meritor. This seventeen page document describes the weakness of the aggregate data fourteen years before the O.I.G. audit report formally raised the same criticisms. In retrospect, Mr. Bowman's comments still have merit today, however, the final rule which was a compromise between N.H.T.S.A. and the automotive industry produced the minimum requirements of the aggregate data which the O.I.G. has determined to be inadequate for the intended purposes of early warning reporting.

Conclusion 6 *Had the Audit Report contained an account of the 2001 rulemaking, a reader would know that the engineers of O.D.I. have been given less than satisfactory sets of data from which to discover emerging safety defects. The Inspector General should have recommended that the rulemaking concerning EWR aggregate be re-opened for the purpose of either eliminating the requirement of industry to supply aggregate data or to grant N.H.T.S.A. more authority to enforce good quality control over the production and access to the raw non-aggregate data possessed by manufacturers.*

Notwithstanding the recognized limitations of the EWR aggregate data, the first four statistical methods listed in Table 4 of the *Audit Report* were developed in attempts to extract whatever useful information from the EWR aggregate data which is possible. The structure of the EWR aggregate data has six dimensions:

- number of warranty claims
- number of field reports
- number of consumer complaints
- number of deaths
- number of injuries
- number of property claims

A record of the EWR aggregate data includes each of the six dimensions for every make, model, model year, and quarter. The nature of the defects underlying the number of warranty

claims, for example, corresponding to a particular make, model, model year, and quarter is unknown. The warranty claims could be related to peeling paint, squeaky windows, static on the radio, or manufacturer's decorative medallions falling off the vehicle. Likewise, the nature of the causes underlying the other five dimensions are unknown. Nonetheless, the rationale adopted by the rulemaking supposes that the higher the aggregate numbers relative to the volume of production, the more likely a safety defect might exist. That implied assumption could not be substantiated during the field testing of the statistical methods cited in Table 4 of the *Audit Report* nor by the Inspector General.

A popular statistical technique which is used to identify outliers in sets of multi-dimensional data is the Mahalanobis distance. It is a technique which was developed in 1936 (Rao, 1973). The authors of the *Audit Report* allege that

> "ODI does not follow standard statistical practices when analyzing early warning reporting data, conduct thorough reviews of consumer complaints, or provide adequate supervision or training for staff responsible for reviewing these data and complaints." [10]

The Mahalanobis distance is a staple in the analysis of data found in many different disciplines. It was the first of the tests which are listed in Table 4 of the *Audit Report* to be derived for use by O.D.I. The method of using the Mahalanobis distance was derived by statisticians of the National Center for Statistics and Analysis (N.C.S.A.). The other methods listed in Table 4 came later.

None of the methods listed in Table 4 are tests in the sense of testing statistical hypotheses. Rather, they are methods for ranking EWR data for the purpose of identifying makes, models, and model year vehicles which have the potential for having a safety defect. Other than the method of logistic regression, the methods are non-parametric.

When the statistical analytical system was being designed, it was immediately recognized by examining the very nature of both the EWR aggregate data and of the engineering field reports that a statistical model whether a linear or non-linear model would not explain the set of influenced recalls given the EWR aggregate data or the EWR engineering field reports. Therefore, no attempt was made to derive a statistical model presumably of the kind which the authors of the *Audit Report* have in mind. The guiding principle which governed the development of the analytical system for analyzing EWR data was one of ranking EWR aggregate records and EWR field reports in such a way as to sort the records according to the likelihood that they contain a safety defect. Therefore, no statistical tests were derived, because no statistical test exists which can discover a safety defect independently of engineering expertise. There cannot be a reliable statistical test such as the one wished for in the *Audit Report* for discovering safety defects

[10] Page 12 of the *Audit Report*

which is independent of the technical expertise of the engineers. Rather the current analytical system orders the thousands of records which N.H.T.S.A. receives every quarter in likelihood of containing a safety defect to which a safety engineer can turn his attention.

The EWR analytical system processes tens of thousands of records every quarter across the entire automotive industry not only for light vehicles, but also for heavy trucks and trailers. The system ranks EWR aggregate records according to Mahalanobis distances or according to the probabilities of a product having a safety related defect. By ranking all EWR records by these methods, the engineers may more efficiently utilize their time by examining those products which are most likely to have a safety related defect. An explanation of the Mahalanobis distance method is given in Appendix A. A description of the probability method is given in Appendix B.

The methods which are listed in Table 4 were derived and subsequently field tested before being implemented for operational use. The first four methods apply only to aggregate data and the fifth one applies only to field reports. Not included in that list of methods but which should be mentioned is a sixth method which was developed by R.A. Whitfield and A.K. Whitfield (Whitfield and Whitfield, 2004).

The Whitfield method, as it became known in O.D.I., had received a great deal of attention and careful review. It was proposed for use to N.H.T.S.A. in 2004. The Whitfield method is actually a special case of the probability method. The probability method is based on the theory of discrete state space - discrete time Poisson stochastic processes where all six dimensions of the EWR aggregate data are used as well as the ancillary FARS and GES data. The Whitfield method is essentially the same as the probably method, except that it is applied only to the three dimensions: aggregate numbers of deaths, injuries, and property claims. It was not implemented for operational use, because the probability method already is a function of all six variables.

Related to the probability method is the CROW-AMSAA technique. It is equivalent to the probability method in that it is derived from the same theory of Poisson stochastic processes. The CROW-AMSAA method is different from the probability method in that it shows trends over time of a specific product, while the probability method produces a probability of the event that a safety defect exists for all products for which a record is submitted to N.H.T.S.A. and falling within the scope of EWR requirements. The CROW-AMSAA technique, on the other hand, must be applied on a product-by-product basis.

2.1 Impracticality of Using Base Cases

Let us return to the notion of a base case as advocated by the Inspector General in his *Audit Report*. The authors of the *Audit Report* advance the seemingly easy implementation of establishing base cases as an improvement to the current statistical analytical system. The Inspector

General argues that

> "Specifically, ODI does not consistently identify a model (a set of assumptions) for the aggregate data to establish a base case, that is, what the test results would be in the absence of safety defects. According to the statistical experts, identifying assumptions and models and checking to see whether they fit the data are essential for establishing a base case. Without a base case, ODI cannot differentiate trends and outliers that represent random variation from those that are statistically significant that is, scores that indicate a safety issue should be pursued."

In light of the field testing of the probability method and the Mahalanobis distance method for analyzing the EWR aggregate data, Mr. Bowman's, insightful comments, and of the *Audit Report*'s assessment of the inability to trace data to a specific vehicle or incident makes the method of establishing base cases in the sense advocated in the *Audit Report* simply infeasible.

Considering that there are approximately 1,500 make, model, model years of light vehicles alone each categorized by 24 components over 32 reporting quarters, what would a base case look like and how can someone find a base case in that mass of data? The audit report suggests that the process of early warning of safety defects can be made into some sort of clinical trial wherein a placebo is used to create a base case against which the relative effects of a drug can be measured. The mission of E.W.R. is not to conduct something like a clinical trial where base cases can be constructed at liberty using placebos presumably in any given manufacturing assembly line, rather it is to discover the presence of safety defects which might perhaps be present even at the beginning of production.

On page 6 of the *Audit Report*, the statement is made that:

> "ODI cannot trace aggregate data to a specific vehicle or incident without requesting additional information from a manufacturer."

This statement was re-iterated on page 7 of the report:

> "However, ODI investigative chiefs and vehicle safety advocates told us that ODI's early warning aggregate data are ultimately of little use due to the inconsistencies in manufacturers' categorizations of safety incidents."

Both statements support Mr. Bowman's prediction of EWR aggregate data not being a useful source of information as cited in items 2 through 6 of page 18 of this report, and both statements acknowledge inherent deficiencies of the EWR aggregate data to the point that the nature of the EWR aggregate data precludes any practical use from establishing base cases, even if establishing base cases were possible.

Conclusion 7 *The sheer number of make, model, model years, and manufacturing plants and the inability to trace specific aggregate data make determining base cases every quarter as advocated by the authors of the Audit Report neither applicable nor feasible.*

2.2 Field Testing of the EWR Aggregate Statistical Methods

Before the probability method was approved for operational use, it was field tested. A total of twelve products and component combinations of light vehicles were selected from the population of aggregate data according to the highest probability and corresponding highest Mahalanobis distance that a safety defect exists. Two manufacturers volunteered to participate in an endeavor to test the predictability of O.D.I.'s statistical ranking methods. Their EWR departments were asked to conduct thorough investigations of the specified twelve products and components.

The results of the investigations concluded that the probability and Mahalanobis distance methods succeeded in discovering defects and they appear in Table 1.

Table 1

Component		Finding
6	Engine and Cooling	Check engine light.
10	Power Train	Weepage with transmission fluid.
11	Electrical	Airbag light.
16	Structure	Power sliding door.
20	Wheels	Plastic medallion falls off.
20	Wheels	Plastic medallion falls off.
20	Wheels	Plastic medallion falls off.
7	Fuel System	Dented hood. Fuel check light. Loose gas cap.
11	Electrical	Owner complaint about sound in audio system.
13	Visibility	Washer hose melted and separated.
13	Visibility	Power mirror motor stalled.
13	Visibility	Heater hose came loose.

Only one out of the twelve defects related to safety. It was the airbag light which was only related to safety. The analytical system did identify apparent defects twelve times out of twelve, but only one could be construed to be a bona fide safety defect. The conclusion was made that the analytical system performed as designed to find defects by sifting through the EWR aggregate data and that the method was approved for operational use.

The inherent problem with any method for analyzing EWR aggregate data is that no statistical technique can distinguish a safety related defect from a non-safety related defect based on EWR aggregate data alone. According to the field testing of the analytical system, we may estimate that there is a probability of $\frac{1}{12}^{th}$ that a record supposedly having a defect is actually safety

related given that it was a record found in the EWR aggregate data. Determining whether or not a discovered defect in the EWR aggregate data is safety related requires the manufacturer to conduct an investigation which would not be an appropriate procedure to implement in practice. One could say, then, that the efficiency offered by the EWR aggregate data in finding a safety defect, in practice, is low. The field testing of the analytical system for the EWR aggregate data substantiates the opinion of Mr. Bowman (Bowman, 2001) and demonstrated the weak utility of the EWR aggregate data for discovering a safety defect. It supports the opinion of the engineers of O.D.I. about EWR aggregate data which was expressed in the *Audit Report*.

Conclusion 8 *The Type-I error associated with finding an EWR aggregate record which is related to safety is about 90%. This reflects the weak capability to discriminate a useful EWR record from a non-safety related defect. It is a direct consequence of aggregating the frequency of records without having access to the original non-aggregated records.*

2.3 Comments to ANPRM 49CRF Parts 554, 573, and 576

A summary is given here of the important points which Mr. Bowman (Bowman, 2001) made in his comments to a proposed rulemaking for determining the minimum requirements which a manufacturer must follow in submitting EWR aggregate data.

1. p.3 NHTSA is likely to be awash in an ongoing flow of data that cannot be analyzed, interpreted, or put to any effective use.
2. p.5 NHTSA should recognize that warranty claim data is unlikely to be a useful source of information.
3. p.10 Arvin Meritor does not believe that warranty claim data is a reliable source of information.
4. p.10 Aggregated data is even less informative.
5. p.13 Arvin Meritor does not believe that "aggregate statistical data" is useful for detecting emerging issues and discourages NHTSA from considering aggregate data as a source of information.
6. p.16 Arvin Meritor believes that data provided in "aggregate statistical" form will be too general to be a value in detecting emerging-product-specific issues.

The concern raised by Mr. Bowman's point 1 has been satisfactorily addressed by the EWR analytical system which processes all submitted records for the entire industry within one week of receiving them. The merits of his other points agree with the findings given in the *Audit*

Report. For example, Mr. Bowman's comment given in item 3 takes on the observation found in the *Audit Report*.

> "Despite this complexity, ODI does not provide detailed guidance to help ensure manufacturers interpret and apply the appropriate codes. According to ODI staff, additional rulemaking would be required in order to provide more guidance to manufacturers. ODI analysts told us that when a manufacturer asks for specific guidance on assigning codes, their practice is not to provide guidance and instead allow each manufacturer to make its own decisions. "

The rulemaking of 2001 should have taken into account the deficiencies which are now only being officially recognized by the *Audit Report* to exist in the EWR aggregate data.

3 Bayesian Filter

In Table 4 of the *Audit Report*, there appears an entry, CRM-114. CRM-114 is an algorithm which was devised for Bayesian filters in detecting unwanted electronic mail (e-mail). A Bayesian filter is based on the concept of Bayesian statistics in which a prior distribution is selected to produce a posterior distribution based on the data. Information obtained from experts is used to train the Bayesian filter for developing a posterior distribution. In the Bayesian filter, expert engineering opinion is used to teach the Bayesian system to discriminate between a field report which contains useful information about a safety defect and a field report which is essentially useless. Several thousand engineering field reports were evaluated by automotive engineers of O.D.I. who determined which field reports certainly required a higher level of engineering review and which ones could be dismissed as unimportant or irrelevant. By means of that engineering expertise, the Bayesian filter was taught to discriminate between useful and useless field reports.

Several relevant algorithms listed in Table 2 were evaluated for choosing an effective Bayesian filter.

Table 2

Annoyance-filter	Dbacl	Spamassassin
Bogofilter	Ifile	Spambayes
CRM-114	Popfile	Spamoracle

The CRM-114 produced the best ranking of engineering field reports with respect to engineers' training files and to a X^2 test.

Because the contents of the field reports are written in English rather than being numerically coded, the Bayesian filter is able to read tens of pages of text per field report and assign a score in accordance with engineering expertise, so that reports can be ranked from most likely to contain information which might be relevant to a safety defect to the least likely. Of the many thousands of field reports which are submitted from across the automotive industry to N.H.T.S.A. every quarter, all of them which are in an acceptable electronic format are read and ranked in a matter of a few days by the EWR analytical system.

3.1 Field Testing of the Bayesian Filter

Before the Bayesian filter was put into production, it was tested as far are its accuracy in identifying engineering field reports which should be reviewed by the engineering staff in O.D.I.

The Bayesian filter is continuously trained as new engineering safety determinations arise by using two sets of accurately evaluated field reports. One set is called NONO, and it contains field reports which are deemed to be unimportant for discovering a safety related defect. The other set is called YESYES, and it contains field reports which are deemed to be important. Every field report to which the trained Bayesian filter is applied receives a score which could appear anywhere in the range of -300 to +300. The higher the score, the more likely that the field report is important. The ability of the Bayesian filter to discriminate between important and unimportant field reports is limited because the Bayesian filter utilizes probabilities. The resolution of the Bayesian filter works best on the extreme ends of the spectrum of scores. In the range from -2 to 2, the capability of the Bayesian filter cannot achieve a practical resolution. The field testing assessment of the Bayesian filter, therefore, focused on records for which the Bayesian scores were outside that range of ambiguity, that is, for which scores exceeded 2 or were less than -2.

The Bayesian filter is not perfect. The quality and size of the training sets of data affect the accuracy of the Bayesian filter. In the course of developing the Bayesian filter, O.D.I. estimated the accuracy of the Bayesian scores by comparing them with field reports of known importance (YESYES). Of those records for which the Bayesian score exceeded 2, 3.0% were actually unimportant. Of those field reports for which the Bayesian score was less than -2, 14.7% of them were actually important field reports. The 3.0% is an estimate of committing a Type-II error, and the 14.7% is an estimate of committing a Type-I error.

The results of the field testing of the accuracy of the Bayesian filter appear in Table 3.

The probability of committing a Type-I error by the Bayesian filter is the probability that an important field report will escape detection. We see in Table 3 that an estimate of the Type-I error which the Bayesian filter commits is 14.7%. That is, the Bayesian filter will miss classifying a bona fide safety related engineering field report with a probability of about 15%. The probability

Table 3

True	Predicted as YESYES	Predicted as NONO
YESYES	- 85.3%	Type-I Error 14.7%
NONO	Type-II Error 3.0%	- 97.0%

of misidentifying a field report to be a safety related one when in fact it is irrelevant is the probability of committing a Type-II error which was estimated to be 3% from the Bayesian filter field testing. The Type-II error engineering reports will only result in lost time for the O.D.I. engineers until they discover that the field report is unimportant. But when the Bayesian filter commits a Type-I error, then an important misidentification will have occurred, because a potential safety defect might go unnoticed. That error is 15%, in other words, the Bayesian filter ranks engineering field reports in such a way that of those field reports which are flagged for review, there is a probability that 85% of them are likely to be safety related. We can see that the Bayesian filter is much more efficient in discovering a possible safety issue than the probability method and the Mahalanobis distance method in ranking EWR aggregate data where the probability of committing a Type-I error is at least $1-\frac{1}{12} = \frac{11}{12}$. The very high probability that the EWR aggregate data will produce a false identification of a safety related issue is due to the lack of information in the contents of the EWR aggregate data in agreement with the opinion of Mr. Bowman which he made fourteen years earlier and which the rulemaking evidently rejected.

3.2 A Recommended Application of the Bayesian Filter

A celebrated controversy arose over the Exempt Organizations Unit of the U.S. Internal Revenue Service (I.R.S.) in 2013 when employees of that office of the I.R.S. were accused by members of Congress of showing biased processing of applications for exempt organizations. It is clear that the employees of the Exempt Organizations Unit were using a dictionary of terms to search for deceptive applications. O.D.I. chose not to develop a dictionary of key words and phrases for processing EWR engineering field reports precisely because the method of using a dictionary of key words and phrases cannot be unbiased. Moreover, a word dictionary is inefficient. Instead, O.D.I. developed the Bayesian filter which is applied to every engineering field report independently of any choice of words which could be construed to represent any biased targeting of a company. In other words, if the Exempt Organizations Unit had known and used N.H.T.S.A.'s Bayesian filter, the controversy over a perceived bias of applications which were submitted by certain politically conservative organizations probably would not have occurred.

If only the U.S.D.O.T. Inspector General had promulgated the principles which underlie Deming's fourteen points of total quality management to his staff, the authors of the *Audit Report* would have recognized the good utility of the Bayesian filter and would have recommended to the Inspector General that perhaps O.D.I.'s Bayesian filter be brought to the attention of the Exempt Organizations Unit of the I.R.S. along with a suggestion for the Exempt Organizations Unit to enter into an inter-agency agreement with N.H.T.S.A. for O.D.I. to develop a Bayesian filter for the I.R.S..

To the credit of the O.D.I. engineering staff, the authors of the *Audit Report* did not find any evidence of biased investigating against any company nor was any evidence cited for malfeasance nor was there mentioned in the report that an O.D.I. investigator was either derelict in fulfilling his duties when examining the EWR data or remiss in seeking statistical assistance from a statistician in N.C.S.A.

4 Petitions for Defect Investigation

N.H.T.S.A. receives petitions to open defect investigations. One such petition was submitted by the *Center for Auto Safety* in 2009 (Ditlow, 2009). The petition stated that the design and location of the fuel tank of the Jeep Grand Cherokee constituted a safety defect.

A careful statistical analysis of EWR aggregate data, EWR engineering field reports, FARS, NASS/CDS, and consumer complaints could not distinguish the Jeep Grand Cherokee from its peers with respect to the claim given in the petition. In other words, no matter what statistical technique could have been applied to the EWR data, the set of EWR data was insufficient to have allowed one to discover the existence of a problem with the fuel tank of the Jeep Grand Cherokee. This particular petition, also, illustrates the inherent limitations of a statistical analysis given all available data in N.H.T.S.A. to prosecute a safety defect under the conceptual constraints of a cost-benefit analysis. It was only due to the petition, however, that a concern was raised with the safety of the vehicle, otherwise the safety issue would have gone unnoticed.

The fuel tank design defect of the Jeep Grand Cherokee came to light only when an employee of the manufacturer brought the placement of the fuel tank in the Jeep Grand Cherokee to the attention of the *Center for Auto Safety*. The Jeep Grand Cherokee investigation demonstrated that not only does O.D.I. depend on in-house data like EWR data, FARS, NASS/CDS, and consumer complaints, but O.D.I. relies on other organizations like the *Center for Auto Safety* for discovering safety defects.

In light of the Jeep Grand Cherokee investigation, until the nature of the EWR aggregate data is substantially improved, the EWR aggregate data will not admit a better statistical method than the collection of methods currently being used, no matter how contemporary the statistical methods might be for discovering safety related defects.

Those opinions of the Inspector General which suggest that there exists a better analytical method than the current system can actually be tested, because the O.I.G. has unrestricted access to all data and collection of records maintained in N.H.T.S.A. with which to conduct relevant statistical analyses. Were the O.I.G. to employ any statistical method, independently of N.H.T.S.A.'s current operational analytical system, to discover a safety defect on its own and to develop, beginning at the discovery phase, a successful initial evaluation (IE), then the O.I.G. will have demonstrated that the criticisms which are presented in the *Audit Report* of the EWR analytical system are well founded. Such an exercise, however, will surely fail.

5 Summary

The Inspector General could have made a more forceful critique of O.D.I.'s business practices, if he had acceded to Deming's fourteen points of total quality management. The Inspector General should have directed the attention of the reader to existing systemic problems which can be found throughout the investigative and rulemaking processes and avoided criticizing personnel who have no control over crucial elements of those processes. Problems such as faulty rulemaking, lack of remedial training in the principles of total quality management at all levels of N.H.T.S.A., and the pervasive but usually detrimental imperative to do a cost-benefit analysis should have been prominent topics of discussion in the *Audit Report*.

The criticisms of the statistical analytical system which is used to process EWR data should have been substantiated by an attempt of the authors of the *Audit Report* themselves to discover a safety related defect in the EWR data by using any statistical method of their choosing. And once such a discovered case is found, the authors should have replicated the building of an initial evaluation of that defect which they had discovered . If such an exercise had been attempted, most of the criticisms leveled against the personnel of O.D.I. about conducting inadequate analyses would have probably disappeared from the *Audit Report*.

The criticisms about the utility of the EWR aggregate data do have merit. Those same criticisms were already anticipated by Mr. G. T. Bowman in 2001 when he presented his comments to the ANPRM. The Inspector General should have determined why, in the final rulemaking which established the minimum specifications of the EWR aggregate data, Mr. Bowman's concerns along with others who said that the EWR aggregate data would essentially provide little useful information were dismissed. And the Inspector General should have carefully examined that same rulemaking to determine why N.H.T.S.A. was not granted authority to exercise good quality control oversight of the industry's production of EWR data. The Inspector General missed a good opportunity to evaluate the consequences of the auto industry's successful lobbying in the rulemaking to shield manufacturers from stringent government oversight with respect to the TREAD Act.

The authors of the *Audit Report* had an excellent opportunity when they interviewed members of O.D.I. to ascertain the extent to which they work overtime without compensation. The Inspector General, as a matter of course, should have initiated a time-clock audit of O.D.I. and probably of N.H.T.S.A. to determine whether Federal law governing hours of work performed by Federal workers is being violated. The time-clock audit might have revealed more than isolated cases of violations in Federal overtime law to which the O.I.G., in fulfillment of its charged mission, ought to have investigated. In this respect, the *Audit Report*, though it is lengthy, is nonetheless incomplete.

Why should the professional and managerial staff of O.D.I. feel obliged to work overtime without compensation is a question that the Inspector General should have as a matter of routine evaluated for the *Audit Report*. Undoubtedly, the answer would have centered on Congressional under-funding of N.H.T.S.A. or not prudent administration of those funds by top management. Inadequate Congressional funding would answer the complaint of the Inspector General that the professional staff of N.H.T.S.A. does not receive adequate training and professional development. The Inspector General should have observed that not just the professional staff needs training, but also the members of the Senior Executive Service many of whom require better understanding of elementary engineering and statistical concepts besides being better versed in the principles of total quality management. The Inspector General should have recommended that employees of all levels undergo regular continuing education on those topics. A first step in addressing inadequate staffing is discussed by the Administrator of N.H.T.S.A. to increase the number of personnel from 64 to 380 (Rosekind, June 5, 2015a). Notwithstanding the Administrator's request to hire more workers, more attention to continuing education in N.H.T.S.A. must be made.

Another important omission in the *Audit Report* is the influence which the Office of Chief Counsel exerts on determining which possible defect investigations should be pursued. Even though the Office of Chief Counsel is not cited in *Exhibit C. Flowchart of ODI'S Pre-investigative Process* (Scovell III, June 18, 2015) nor in *Exhibit D. Overview of ODI's Investigative Process* (Come, October 6, 2011), examples which are given in the Introduction show that the Office of Chief Counsel may, by overruling engineering expertise, determine the outcome of an investigation.

The authors of the *Audit Report* state that

> "Attorneys in NHTSA's Office of Chief Counsel state that while NHTSA must establish severity for all cases, it can establish either frequency or root cause to force a manufacturer to initiate a recall."

Who determines if the argument of *root cause* is convincing and who sets the threshold of *severity*? The Office of Chief Counsel is certainly an element in the O.D.I. investigative process and as such an assessment of its influence should have been included in the *Audit Report*. The authors,

if they had done so, probably would have satisfied their curiosity as to why some investigations which they reviewed were suddenly terminated without explanation.

The policy should be adopted whereby manufacturers should be required upon request from N.H.T.S.A. to supply information even before an initial engineering (IE) application is approved by the internal O.D.I. assessment panel review stage of the pre-investigative process.

The examples which were given in the Introduction, also, illustrate the effect of requiring a cost-benefit analysis on a regulatory agency as a part of conducting an investigation or rule-making. The Inspector General should have evaluated how the perceived obligation to conduct a cost-benefit analysis can interfere with an otherwise good and timely action for preventing injuries and deaths.

The Bayesian filter can be applied not only to engineering field reports but it can be modified to rank consumer complaints. The Inspector General should recommend that N.H.T.S.A. expand its use of the Bayesian filter to process other written documents as well as integrating the Bayesian filter with the probability method for ranking the EWR aggregate data in accordance with the original concept of the EWR analytical system.

The employees of N.H.T.S.A. should have been commended by the Inspector General for having developed a very efficient Bayesian filter for processing many tens of thousands of engineering field reports for the entire automotive industry every quarter within one week. The Inspector General failed to give credit to the E.W.R. Division for launching the GM Ignition Switch investigation which originated from the very EWR data and its analytical system which the Inspector General determined to be inadequate.

In the same vein, if the Inspector General had recognized the successful performance of O.D.I.'s Bayesian filter, he could have recommended it as a model for use in other Federal agencies like the Exempt Organizations Unit of the U.S. Internal Revenue Service where its use could have spared that agency unfair Congressional attacks. Finally, the members of the O.D.I. engineering staff deserve credit for executing their assigned duties impartially when investigating a company, and it is commendable that no evidence was cited in the *Audit Report* of any member of the staff being derelict in performing his job.

In as much as there are valid criticisms cited in the *Audit Report*, the Inspector General could have recommended more substantial measures for saving lives by proposing regulations to require alcohol locking devices to be installed on automobiles and to require the installation of equipment to block the use of mobile telephones by a driver when a car is turned-on. These two regulations by themselves for which technology already exists could immediately save several hundred lives every year in the United States, no matter what is done to improve the usefulness of EWR data.

6 Comments on the Recommendations Presented in the *Audit Report*

The omissions and deficiencies associated with the *Audit Report*, of course, do not have corresponding recommendations of the Inspector General.

The same recommendations presented in the *Audit Report*, also, appear in Appendix C. The Administrator of N.H.T.S.A. concurs with all of the recommendations which are presented in the *Audit Report*, and he has specified dates by which they are scheduled to be completed[11]. As noted by the Administrator of N.H.T.S.A., recommendations 1 and 3 require a rulemaking. Absent from these two recommendations is the proposition to determine through the rulemaking process whether or not the submission of EWR aggregate data should be discontinued. Should the rulemaking be re-opened, then the opinions of Mr. Bowman regarding the utility of the EWR aggregate ought to be taken into account in light of fourteen years of operational experience and the critical review made by the Inspector General.

If submission of the EWR aggregate data is deemed necessary to be continued, neither recommendations 1 and 3 suggest granting N.H.T.S.A. authority to monitor the quality control programs of manufacturers' production of EWR data. Recommendations 1, 2, 3, and 4 are related and would support the objective of a quality control program.

Recommendations 7, 8, and 9 seem to be reasonable although the term *out-of-sample testing* was not defined and its meaning is not clear. Perhaps, the Inspector General had meant to say *field test the analytical system*. The problem with these three recommendations is that they follow from a lack of understanding of the design and testing of the current analytical system. Had the authors of the *Audit Report* tried by themselves to replicate the discovery process of finding a record in the EWR data which is safety related using any method of their choosing independently of the statistical methods already in use, they probably would have realized that they cannot analyze the data any better than what is now being done. Upon arriving at that realization, recommendation 7 would not have been made.

Had the authors been aware of the field testing which had been conducted before the analytical system was made operational, they would have connected recommendation 8, in the context of a quality control, with a rulemaking associated with recommendations 1 and 3.

Recommendation 9 is a curious one. The *Audit Report* incorporated the opinions of experts in statistical methods who presumably carefully examined the design and performance of the current system. Therefore, the current analytical system has now been reviewed at least once by external experts who happened to have contributed to the composition of the *Audit Report*. On the other hand, the language of the *Audit Report* suggests that the authors of it have a weak understanding of the application of the Mahalanobis D2 to EWR aggregate data, of the probability

[11] Page 41 of the *Audit Report*

method, and of the Bayesian filter.

In place of the existing methods, the authors advance the idea of creating a base case by which a safety defect may be discovered in sets of EWR data. However, there does not appear in the *Audit Report* a description of what a base case with respect to EWR aggregate data would look like, if it were possible to create one in the first place. In that light, one must wonder whether any other group of external experts can possibly provide a more informative evaluation of the EWR analytical system than the experts who had already examined it for the *Audit Report*. The next logical question is how then can O.D.I. in compliance with recommendation 9 find a group of comparable or better experts than the Inspector General's chosen group of experts whose knowledge of the current EWR analytical system appears to be deficient.

What the Inspector General should have done was to have instructed his office to interview the actual architects of the EWR analytical system, rather than to have let them expend time and resources trying to infer, incidentally without success, what the system might be doing. If the Inspector General had done so, the opinions about the EWR analytical system which the authors of the *Audit Report* deem to be inadequate would have been, in all likelihood, much more informative.

7 Appendix A: Mahalanobis Distance Method

Let $\bar{\mathbf{x}}_{cq}$ be a six dimensional vector in which each component of the vector is the average over all records for a given EWR component which are found in the aggregate data per quarter. Specifically,

$$\bar{\mathbf{x}}_{cq} = \left[\frac{\sum_{m=1}^{n_{cq}} deaths_m}{n_{cq}}, \frac{\sum_{m=1}^{n_{cq}} injuries_m}{n_{cq}}, \frac{\sum_{m=1}^{n_{cq}} property\ damage_m}{n_{cq}}, \frac{\sum_{m=1}^{n_{cq}} wc_m}{n_{cq}}, \frac{\sum_{m=1}^{n_{cq}} cc_m}{n_{cq}}, \frac{\sum_{m=1}^{n_{cq}} fr_m}{n_{cq}} \right]$$

where `cc` is the number of consumer complaints, `wc` is the number of warranty claims, `fr` is the number of field reports, n_{cq} is the number of records which are associated with component, c, for a given quarter, q. Quarter, component, make, model, and model year uniquely identify a record in the set of EWR aggregate data. According to this method, all records regardless of manufacturer, model, and model year are used to calculate the centroid, $\bar{\mathbf{x}}_{cq}$, for a given quarter and component. The calculation of the centroid uses the cumulative values over the preceding quarters for each of the six variables found in the aggregate data.

By definition, $\bar{\mathbf{x}}_{cq}$ is a six dimensional vector representing the centroid over all records for a given quarter and component. Each element of $\bar{\mathbf{x}}_{cq}$ represents one of the variables of the

aggregate data: deaths, injuries, property damage, warranty claims, consumer complaints, and field reports.

Perhaps the Inspector General's notion of a base case corresponds to something like the centroid which is used in calculating the Mahalanobis distance.

All information for a quarter, make, model, model year by component is used to compute D2. Let c represent a component, q represent a quarter, m represent a make, model, and model year, then

$$D2_{mcq} = (\mathbf{x}_{mcq} - \bar{\mathbf{x}}_{cq})' S_{cq}^{-1} (\mathbf{x}_{mcq} - \bar{\mathbf{x}}_{cq})$$

where S is the sample variance-covariance matrix of $\mathbf{x}_{mcq}$ for a given quarter and component across all makes, models, and model years.

There is only one Mahalanobis D2 per record. It is reasoned that a product specified by make, model, model year with a large D2 is unusual relative to the bulk of the other products with respect to hazard and frequency data and should be brought to the attention of the engineers. However, as was explained above regarding the rulemaking which set the minimum level of specificity of the aggregate, the quality of useful information contained in the set of aggregate data is deemed to be poor which causes high unreliability of D2.

The collection of EWR aggregate data corresponding to deaths, injuries, and property damage comprises the hazard data, and those which correspond to warranty claims, consumer complaints, and field reports constitute the frequency data.

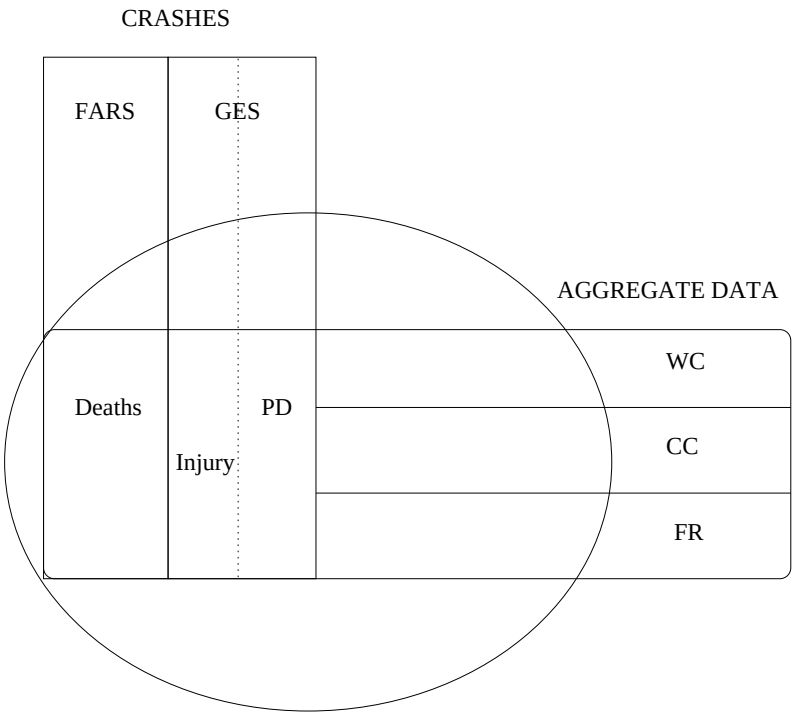

Figure 1: Schematic of the relationship between the aggregate data, FARS data, and GES data.

8 Appendix B: Probability Method

The probability method considers one quarter at a time per make, model, model year, and component. An important inconsistency with the aggregate data prevents any attempt to correlate hazard data with the frequency data. It is impossible, for instance, to determine the number of warranty claims by make, model, and model year which can be associated with property damage, injuries, or deaths as reported in the aggregate data.

The schematic diagram shown in Figure 1 illustrates the relationships between the hazard and frequency aggregate data with the FARS and GES data for some category of vehicle.

The set of FARS data is a complete set of data regarding deaths which are associated with an accident of a motor vehicle. The set of FARS data includes information about the death of any driver, passenger, or pedestrian. Not all deaths relating to a safety defect issue are reported in the aggregate data nor are all injuries which relate to a safety related defect appear in the aggregate data. While it is assumed that all reported deaths which are found in the aggregate data are reported in FARS, it is likewise assumed that all injuries and all instances of property

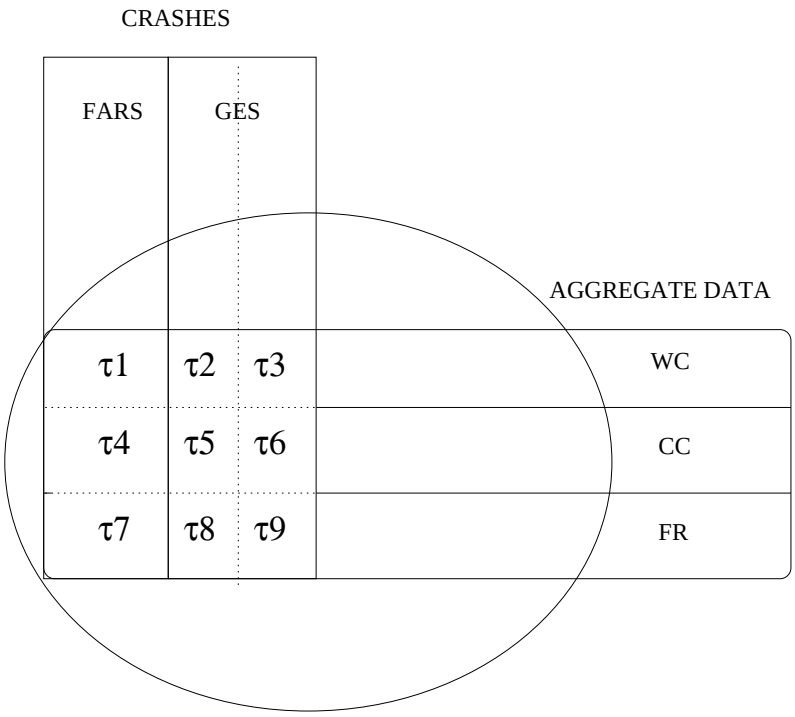

Figure 2: The relationship of the set of aggregate data with FARS and GES sets of data is depicted by the nine cells, $\tau_1 \ldots \tau_9$.

damage are covered by GES estimates. In regard to frequency data, it is assumed that, by the requirements of the TREAD Act, the numbers of all warranty claims, consumer complaints, and field reports which relate to safety issues are reported in the aggregate data. However, the set of aggregate data might possibly contain entries which are not necessarily safety related, even though they satisfy the rules stated in the TREAD Act governing which reports are to be tallied for the aggregate data. These extraneous records interfere with the process of discovering important safety related records by obscuring the important records which are mingled with the collection of aggregate data. Consequently, any successful ranking of the aggregate data must overcome these numerous imperfections in the aggregate data.

The likelihood that too few deaths, injuries, and reports of property damage relating to safety related defects seem to appear in the tallies of the aggregate data compounds the problem of not knowing the correlation between the hazard and frequency data. It would be informative to associate the number of deaths of a particular vehicle with the corresponding number of warranty claims, consumer complaints, and field reports by make, model, model year, component, and quarter. If a correlation can be made between the hazard and frequency data, then it would be

possible to estimate the probabilities for each of the nine cells in the intersection of the hazard and frequency data as portrayed on the left hand side of Figure 2. To that end, the following definitions are made.

For the hazard data:

Definition 1

$$p_i = \frac{\tau_i}{\sum_{i=1}^{9} \tau_i}$$

and $q_i = 1 - p_i$

For the frequency data:

Definition 2

$$\pi_i = \frac{\phi_i}{\sum_{i=1}^{3} \phi_i}$$

and $X_i = 1 - \pi_i$ *where* $\phi_1 = wc$, $\phi_2 = cc$, *and* $\phi_3 = fr$.

In terms of p_i and π_i, the two generating functions are defined as follows:

Definition 3

$$G(s) = \prod_{i=1}^{9} (q_i + p_i s)$$

and

$$\Gamma(s) = \prod_{i=1}^{3} (X_i + \pi_i s)$$

Both $G(s)$ and $\Gamma(s)$ are calculated for a specific make, model, model year, component, and quarter. In addition to the generating functions, $G(s)$ and $\Gamma(s)$, we will define the arrival rates, λ and μ, likewise for a specific make, model, model year, component, and quarter to be

Definition 4

$$\lambda = \frac{deaths + injuries + pd}{total\ production}$$

and

$$\mu = \frac{wc + cc + fr}{total\ production}$$

Numerous complications exist. For instance, there may be multiple duplications of warranty claims, consumer complaints, and field reports for the same vehicle such that μ might exceed 1; therefore, a constraint is imposed on μ, so that it cannot exceed 1.

To overcome the inability to correlate frequency data with hazard data which could have permitted the determination of τ_i, it is assumed that the proportion of EWR deaths to injuries and property damage is the same as the proportion of FARS deaths to GES injuries and property damage only crashes. In other words, to make the notation easier, the following will be defined:

Definition 5

$$\begin{aligned}
F_1 &= \frac{FARS}{FARS + GES} \\
F_2 &= \frac{GES \quad Injuries\ but\ no\ deaths}{FARS + GES} \\
F_3 &= \frac{GES \quad property\ damage\ crashes}{FARS + GES} \\
G_1 &= \frac{wc}{wc + cc + fr} \\
G_2 &= \frac{cc}{wc + cc + fr} \\
G_3 &= \frac{fr}{wc + cc + fr}
\end{aligned}$$

The simplest method for imputing the values of the nine cells of τ is given in Table 4.

Table 4

$p_{11} = \frac{\tau_1}{\sum \tau_i} = G_1F_1$	$p_{12} = \frac{\tau_2}{\sum \tau_i} = G_1F_2$	$p_{13} = \frac{\tau_3}{\sum \tau_i} = G_1F_3$
$p_{21} = \frac{\tau_4}{\sum \tau_i} = G_2F_1$	$p_{22} = \frac{\tau_5}{\sum \tau_i} = G_2F_2$	$p_{23} = \frac{\tau_6}{\sum \tau_i} = G_2F_3$
$p_{31} = \frac{\tau_7}{\sum \tau_i} = G_3F_1$	$p_{32} = \frac{\tau_8}{\sum \tau_i} = G_3F_2$	$p_{33} = \frac{\tau_9}{\sum \tau_i} = G_3F_3$

That is, $p_{ij} = G_iF_j$ and $q_{ij} = 1 - p_{ij}$, so that, $G(s)$ can then be written as:

$$G(s) = \prod_{i=1}^{3} \prod_{j=1}^{3} (q_{ij} + p_{ij}s)$$

Not all vehicles are involved in an accident. The arrival rate for the hazard data, λ, for a given make, model, model year, and component must be adjusted accordingly to reflect the size of the population of vehicles which are involved in a crash. The estimated number of crashes based on GES data will be denoted by GESTOT. The estimated total number of light vehicles, for example, which are on the road will be denoted by GRANDTOT. Their ratio provides a way

to modify λ by adjusting the production of a make, model, and model year. Let $\kappa = \frac{GESTOT}{GRANDTOT}$, then $\lambda = \frac{deaths+injuries+property\ damage}{(production)\kappa}$ per make, model, model year, component, and quarter.

The derivation of the formula which is used in the probability method begins with the definition of the following random variable.

Definition 6

$$X_{icmqk} = \begin{cases} 1 & \textit{if a record is in the population of safety related defects with probability } p_{icmqk} \\ 0 & \textit{otherwise} \end{cases} \quad (1)$$

where i represents one of the nine cells in the intersection of the hazard and frequency data, c represents one of the twenty-four EWR components, m represents the make, model, and model year, q represents the quarter, and k represents the VIN.

Define N_{m_q} to be the number of cars which are produced for a particular model, m, up to and including quarter, q. The sum of X_{icmqk} will, therefore, represent the number of vehicles which belong to the population of safety related defects.

Definition 7

$$S_{mcq} = \sum_{i=1}^{9} \sum_{k=1}^{N_{m_q}} X_{icmqk} \quad (2)$$

We note that N_{m_q} which is the number of vehicles of a make, model, and model year that are produced is itself a random variable and that S_{mcq} counts the number of vehicles which have a safety related defect for a particular make, model, model year, component, and quarter. Denote the probability generating function for the hazard data to be: $H(s)$. According to Feller[12], the probability generating function for the random sum, S_{mcq} is: $H_{mcq}(s) = e^{-\lambda_{mcq}(1-G_{mcq}(s))}$ where

$$G_{mcq}(s) = \prod_{i=1}^{3} \prod_{j=1}^{3} (q_{ijmcq} + p_{ijmcq}s)$$

Likewise, for the frequency side, the probability generating function is: $F_{mcq}(s) = e^{-\mu_{mcq}(1-\Gamma_{mcq}(s))}$

Let D be a random variable which is the number of safety related defects for a make, model, model year, component, and quarter, and let A be the event of an accident, then

$$P(D = d) = P(D = d|A)P(A) + P(D = d|A^c)P(A^c)$$

[12]See page 288, volume 1, *An Introduction to Probability Theory and Its Applications* by William Feller, John Wiley & Sons, 1970

The conditional probability, $P(D = d|A)$ is the probability that d safety related defects occur given the population of cars which are involved in an accident (hazard data) whereas $P(D = d|A^c)$ is the conditional probability that d safety related defects which occur given that no crash occurs (frequency data). If $D(s) = \sum_{d=0}^{\infty} P(D = d)s^d$ defines the probability generating function of D, then

$$D(s) = \left(\sum_{d=0}^{\infty} P(D = d|A)s^d \right) P(A) + \left(\sum_{d=0}^{\infty} P(D = d|A^c)s^d \right) P(A^c)$$

which can be written in terms of $H(s)$ and $F(s)$ as $D(s) = H(s)P(A) + F(s)P(A^c)$ or in full

$$D(s) = e^{-\lambda(1-G(s))}P(A) + e^{-\mu(1-\Gamma(s))}P(A^c)$$

Whether or not there is one safety related defect or many such defects, it is sufficient to find at least one safety related defect; therefore, the probabilities of interest are the high probabilities of finding at least one safety related defect. Based on the probability generating function, D(0) represents the probability that no safety related defects exist, hence, 1-D(0) is the probability that at least one safety related defect exists. It is upon 1-D(0) that the elements in the set of aggregate data are ordered as a function of finding at least one safety related defect. In the probability method, the rank of an element contained in the set of aggregate data does not depend on any other manufacturer, model, model year, and component.

Expert engineering opinion is lacking in the ordering of the aggregate data. To incorporate expert engineering opinion into the ranking, 1-D(0) is compared to the records of O.D.I. recall investigations. When recalls are influenced by the O.D.I., the process of investigating a safety related issue begins with a screening. Not all screenings lead to an investigation. Those which lead nowhere are deemed to be failed screenings. The screenings which proceed to the next step in the process of investigating a product are deemed to be successful screenings. Using the O.D.I. recall investigations, a logistic regression is performed by which 1-D(0) is compared to the success or failure of a screening. An example of a fitted logistic curve to the collection of successes denoted by 1 and failures denoted by 0 appears in Figure 3.

Only by means of numerical techniques can estimates for the parameters, α_0 and α_1, be produced. The estimated probability of finding a safety related issue which will bring about a successful screening is:

$$p = \frac{e^{\widehat{\alpha_0}+\widehat{\alpha_1}x}}{1 + e^{\widehat{\alpha_0}+\widehat{\alpha_1}x}}$$

where $x = 1 - D(0)$

It is this probability which is used to order the aggregate data.

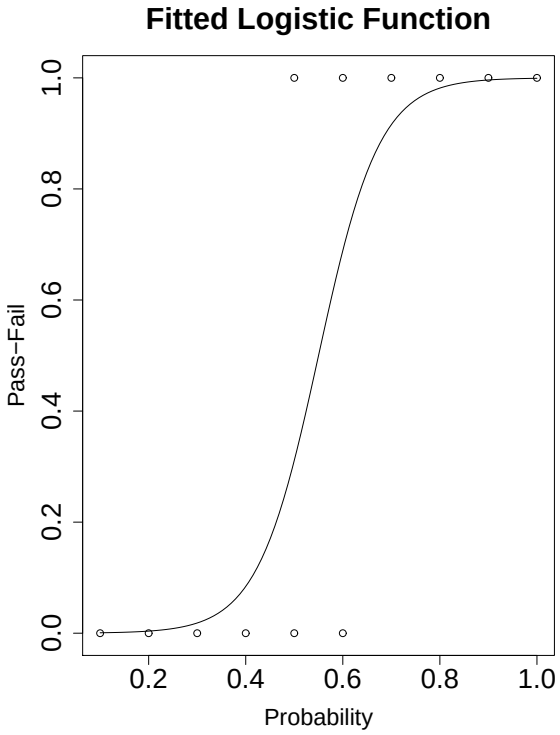

Figure 3: Logistic regression.

9 Appendix C: Recommendations Made in the *Audit Report*

1. Develop and implement a method for assessing and improving the quality of early warning reporting data.

2. Issue guidance or best practices on the format and information that should be included in non-dealer field reports to improve consistency and usefulness.

3. Require manufacturers to develop and adhere to procedures for complying with early warning reporting requirements; and require ODI to review these procedures periodically.

4. Expand current data verification processes to assess manufacturers' compliance with regulations to submit complete and accurate early warning reporting data. At minimum, this process should assess how manufacturers assign vehicle codes to specific incidents and how they determine which incidents are reportable.

5. Develop and implement internal guidance that identifies when and how to use oversight tools to enforce manufacturers' compliance with early warning reporting data requirements.

6. Provide detailed and specific guidance to consumers on the information they should include in their complaints, as well as the records they should retain (such as police reports and photographs) in the event that ODI contacts them for more information.

7. Develop an approach that will determine which early warning reporting test scores provide statistically significant indications of potential safety defects.

8. Periodically assess the performance of the early warning reporting data tests using out-of-sample testing.

9. Institute periodic external expert reviews of the statistical tests used to analyze early warning reporting data to ensure that these methods are up-to-date and in keeping with best practices.

10. Implement a supervisory review process to ensure that all early warning reporting data are analyzed according to ODI policies and procedures.

11. Develop and implement a quality control process to help ensure complaints are reviewed thoroughly and within a specified timeframe.

12. Update standardized procedures for identifying, researching, and documenting safety defect trends that consider additional sources of information beyond consumer complaints, such as special crash investigation reports and early warning data.

13. Document supervisory review throughout the pre-investigative process including data screening.

14. Evaluate the training needed by pre-investigative staff to identify safety defect trends; and develop and implement a plan for meeting identified needs. To promote a streamlined process for opening investigations of potential safety concerns, we recommend the National Highway Traffic Safety Administrator take the following actions:

15. Develop and implement guidance on the amount and type of information needed to determine whether a potential safety defect warrants an investigation proposal and investigation.

16. Develop a process for prioritizing, assigning responsibility, and establishing periodic reviews of potential safety defects that ODI determines should be monitored.

17. Document and establish procedures for enforcing timeframes for deciding whether to open investigations; and establish a process for documenting justifications for these decisions.

10 References

G.T. Bowman. Comments regarding NHTSA interest in suggested approaches for Standards Enforcement and Defect Investigation. *Advance Notice of Proposed Rulemaking (ANPRM) 49CFR Parts 554, 573, and 576*, 22 March(Docket No. NHTSA 2001-8677; Notice 1-13), 2001.

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W. Edwards Deming. *Out of the Crisis*. The MIT Press, Cambridge, Massachusetts, 1986.

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Calvin Scovell III. *Audit Report: Inadequate Data and Analysis Undermine NHTSA's Efforts to Identify and Investigate Vehicle Safety Concerns, ST-2015-063* . U.S. Department of Transportation, Office of Inspector General https://www.oig.dot.gov/library-item/32523, Washington, D.C., June 18, 2015.

Chairman Fred Upton. *Certified Mail. Return Receipt Request, Document 15, http://docs.house.gov/meetings/IF/IF02/20140401/102033/HHRG-113-IF02-20140401-SD024.pdf*. Energy & Commerce Committee, United States House of Representatives, http://energycommerce.house.gov/hearing/%E2%80%9C-gm-ignition-switch-recall-why-did-it-take-so-long%E2%80%9D, Washington, D.C., April 1, 2014a.

Chairman Fred Upton. *The GM Ignition Switch Recall: Why Did It Take So Long?* Energy & Commerce Committee, United States House of Representatives, http://energycommerce.house.gov/hearing/%E2%80%9C-gm-ignition-switch-recall-why-did-it-take-so-long%E2%80%9D, Washington, D.C., April 1, 2014b.

Anton R. Valukas. *Report to Board of Directors of General Motors Company Regarding Ignition Switch Recalls*. Jenner & Block, www.beasleyallen.com/webfiles/valukas-report-on-gm-redacted.pdf, May 29, 2014.

R. A. Whitfield and A. K. Whitfield. Improving surveillance for injuries associated with potential motor vehicle safety defects. *Injury Prevention*, 10:88–92, 2004.

HHRG-113-IF02-20140401-SD024.pdf
Certified letter which was sent to the General Motors Company

U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

[redacted]

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ms. Gay Kent
General Motors Corp.
[redacted]

NVS-217ph
DI07-044

Dear Ms. Kent:

The Office of Defects Investigation (ODI) of the National Highway Traffic Safety Administration (NHTSA) has received information about certain death and injury incidents reported by General Motors (GM) in its light early warning report from 4th quarter of 2006. We are writing to request additional information about the following incidents:

Selected Death and Injury Incidents For Reporting Category: 1.
For the following Sequence IDs: 30, 40, 88, 91, 103, 116, 135, 137, 140, 155, 221, 244, 246, 256, 257, 273, 274, 285, 295, 345, 360, 368, 401, 424, 436, 439

Unless otherwise stated in the text, the following definitions apply to these information requests:

Incident: each incident identified in the table above.

Claim and Notice: shall have the meanings stated in 49 CFR §579.4(c). Claim and notice also specifically refer to the claim(s) and notice(s) that are the predicate for the early warning report on the incident.

Manufacturer: refers to GM.

Vehicle: the vehicle produced by GM that is identified in the claim or notice.

Tire: the tire produced by GM that is identified in the claim or notice.

Equipment: the item of motor vehicle equipment produced by GM that is identified in the claim or notice.

Defect: means any failure, malfunction, lack of durability, or other problem in performance, construction, a component, or material of a motor vehicle or piece of motor vehicle equipment.

Document: "Document(s)" is used in the broadest sense of the word and shall mean all written, typed, graphic and photographic matter whatsoever (except autopsy photographs), be it in original, copy or electronic form. Any photograph originally produced in color must be provided in color and in electronic form, if possible. Furnish all documents whether verified by GM or not. If a document is not in the English language, provide both the original document and an English translation of the document. Document(s) includes all documents in GM custody and/or control.

Please provide numbered responses to the following inquiries, repeating the applicable request verbatim before each response. After GM's response to each request, identify the source of the information and indicate the last date the information was gathered. When documents are produced, the documents shall be produced in an identified, organized manner that corresponds to each pertinent information request. A separate response must be provided for each incident. Each response, document or attachment must be clearly identified with the incident Sequence ID (SeqID) number.

1. Provide a complete copy of the initial claim or notice document(s) that notified GM of the incident, excluding: (a) medical documents and bills, except those showing the cause of death or injury; (b) property damage invoices or estimates; and (c) documents related to damages.

2. Provide a copy of the Police Accident Report.

3. At your option, provide GM's assessment of the circumstances that led to the incident including GM's analysis of the claim and/or notice regarding allegations of a defect.

This letter is being sent to GM pursuant to 49 U.S.C. § 30166, which authorizes NHTSA to conduct any investigation that may be necessary to enforce Chapter 301 of Title 49 and to request reports and the production of things. It constitutes a new request for information. GM's failure to respond promptly and fully to this letter could subject GM to civil penalties pursuant to 49 U.S.C. § 30165 or lead to an action for injunctive relief pursuant to 49 U.S.C. § 30163. (Other remedies and sanctions are available as well.) Section 5(a) of the TREAD Act, codified at 49 U.S.C. § 30165(b), provides for civil penalties of up to $5,000 per day, with a maximum of $16,050,000 for a related series of violations, for failing or refusing to perform an act required under 49 U.S.C. § 30166. *See* 49 CFR 578.6 (as amended by 69 Fed. Reg. 57864 (Sept. 28, 2004). This includes failing to respond to ODI information requests.

If GM claims that any of the information or documents provided in response to this information request constitute confidential commercial material within the meaning of 5 U.S.C. § 552(b) (4), or are protected from disclosure pursuant to 18 U.S.C. § 1905, GM must submit supporting information together with the materials that are the subject of the confidentiality request, in accordance with 49 CFR Part 512, as amended (69 Fed. Reg. 21409 et seq; April 21, 2004), to the Office of Chief Counsel (NCC-110), National Highway Traffic Safety Administration, [redacted].

Your response to this letter, together with a copy of any confidentiality request, must be submitted to this office by **June 8, 2007**. Please include in your response the identification codes referenced on page one of this letter. If you are unable to provide all of the information requested within the time allotted, you must request an extension from me at [redacted], no later than five business days before the response due date. If all of the information requested by the original deadline is unavailable, you must submit a partial response by the original deadline with whatever information then is available, even if an extension is granted.

If you have any technical questions concerning this matter, please contact Mr. Leo Yon at [redacted] or by fax at [redacted]

Sincerely,

[redacted]

Christina Morgan, Chief
Early Warning Division
Office of Defects Investigation
Enforcement

GENERAL MOTORS NORTH AMERICA
Structure & Safety Integration

June 7, 2007

Ms. Christina Morgan, Chief
Early Warning Division
Office of Defects Investigation
National Highway Traffic Safety Administration
[redacted]

NVS-217ph
DI07-044

Dear Ms. Morgan:

This is General Motors' (GM) response to your inquiry dated May 7, 2007 regarding certain death and injury incidents reported by GM in its light vehicle early warning report from 4th quarter of 2006.

GM's response is comprised of 29 CDs for the incidents that are the subject of DI07-044.

Attachment "A" includes instructions for navigating the CD. Each CD, on its face, is identified by the NHTSA Sequence ID number, the Manufacturer's Unique ID number and the year, make and model of the vehicle involved in the incident, e.g., 256 210873110 - 625130 and 2004 Chevrolet Suburban 1500. When the CD is launched, this identification number appears again along with all of the documents (including photographs and videos) on the CD listed under "Filename." The first document listed under Filename is an index with the Request and Responses, e.g., identified as 256 210873110 - 625130 **_00_Request and Responses.** The index is numbered 1 through 3 to correspond to Inquiries 1 through 3, which are repeated verbatim below. The index also details whether any documents responsive to each inquiry were located.

For example, the first two Inquiries and Responses in the index for the CD are as follows:

DI07-044
256 210873110 - 625130
2004 CHEVROLET SUBURBAN 1500

Request for Information:

1. Provide a complete copy of the initial claim or notice document(s) that notified GM of the incident, excluding: (a) medical documents and bills, except those showing the cause of death or injury; (b) property damage invoices or estimates; and (c) documents related to damages.

Response: See Attached Document.

2. Provide a copy of the Police Accident Report.

Response: See Attached Document.

The remaining documents listed under Filename, reference the Manufacturer's Unique ID number along with the responsive Inquiry number. For example:

256 210873110 - 625130 **_01_1** - is the first document responsive to Inquiry no. 1.
256 210873110 - 625130 **_02_1** - is the first document responsive to Inquiry no. 2.

Your inquiries and our corresponding replies are as follows:

1. **Provide a complete copy of the initial claim or notice document(s) that notified GM of the incident, excluding: (a) medical documents and bills, except those showing the cause of death or injury; (b) property damage invoices or estimates; and (c) documents related to damages.**

   Response: See Attached Document.

   The table below lists the incidents that are the subject of DI07-044, by Reporting Category, Sequence ID, VIN and type of notice received by GM (as "notice" is commonly used, not as it is defined by 49 C.F.R. §579.4(c)). Incidents reported on GM's Early Warning Report Death and Injury worksheet fall into four categories: Lawsuit (LIT), NISM (Not In Suit Matters), Product Allegation Resolution (PAR), or Rumor (RMR). Lawsuit and NISM case types generally meet the §579.4(c) definition of "claim." PAR cases, in this context, refer to customer contacts in which an injury or fatality is alleged to have occurred as a result of a product defect, and are accompanied by a writing that may or may not meet the §579.4(c) definition of "claim" or "notice." Rumor incidents do *not* involve a written or verbal, implied or express allegation of a defect by a customer. Rather, rumor cases generally refer to incidents that GM learned of through the media, which were subsequently investigated further. As such, the document included in response to Inquiry 1 that can be found on the enclosed CD for the PAR and Rumor case listed in the table, may not be a claim or notice of the type generally defined as such by §579.4(c).

(26 Vehicles from the Light Vehicle Template)

SEQUENCE ID	VEHICLE IDENTIFICATION NUMBER (VIN)	TYPE
30	1G6DP577770107881	NISM
40	1G6KD54Y05U185793	NISM
88	1G1AK52F657565454	RUMOR
91	1G1AK52F957604280	RUMOR
103	1G1AL15F877158420	NISM
116	1GNFG15T851205704	LIT
135	2G1WH52K349385234	NISM
137	2G1WH52K249216628	NISM
140	2G1WF52E159355280	LIT
155	1G1ND52J83M524239	NISM
221	2GCEC19T041107821	LIT
244	1GCHK29U23E306493	LIT
246	1GCHK23225F900750	LIT
256	1GNFK16T74J239113	LIT
257	3GNFK16T64G313428	RUMOR
273	1GNEC13V74J269971	LIT
274	1GNEC13TX5R108595	LIT
285	1GNDS13S822427780	LIT
295	1GNDT13S542353931	RUMOR
345	1GTEC14T74Z155041	LIT
360	1GKEC16Z14R309863	LIT
368	5GTDN136468106799	RUMOR
401	1G2ZG58B574135701	NISM
424	2G2WP552661242984	RUMOR
436	1G8AJ52F14Z167768	LIT
439	1G8AJ55F96Z101063	NISM

Comments which were submitted by Mr. G. T. Bowman in 2001 Docket No. NHTSA 2001-8677

124886

ArvinMeritor

2135 West Maple Road
Troy, MI 48084-7186

arvinmeritorinc.com

March 22, 2001

Docket Management
Room PL-401
National Highway Traffic Administration
400 Seventh Street S.W.
Washington, D C 20590

Subject: Request for Comments regarding NHTSA interest in suggested approaches for Standards Enforcement and Defect Investigation; Defect and Noncompliance Reports; Record Retention

Ref : ANPRM 49CFR Parts 554, 573, and 576
Docket No. NHTSA 2001-8677; Notice 1 — 13

This response is written on behalf of ArvinMeritor. ArvinMeritor is pleased to comment on the Advance Notice of Proposed Rulemaking (ANPRM) seeking information and comments from industry in an effort to implement an "early warning reporting system" intended to improve NHTSA's timeliness and effectiveness in detecting prospective safety defects in motor vehicles and motor vehicle components.

ArvinMeritor is a major global manufacturer of drive and non-driving front axle assemblies, rear drive axle assemblies, trailer axles, suspension systems, and air and hydraulically actuated drum and disc foundation brakes and drivelines for heavy-duty commercial vehicles. ArvinMeritor is also a major global manufacturer of wheels, door latches, window regulators, shock absorbers, and exhaust systems for passenger car vehicles. ArvinMeritor is also a partner in Meritor WABCO, a major manufacturer of AntiLock Braking Systems (ABS) for heavy-duty vehicles and Meritor-ZF, a major manufacturer of heavy vehicle transmissions.

ArvinMeritor believes that the automotive industry clearly understands the intent of the regulatory initiative. ArvinMeritor also believes that most major manufacturers have already developed or have attempted to develop internal reporting methods intended to obtain high quality information in a timely manner so that problem performance issues--- especially those performance issues pertaining to safety--- may be detected and corrected expeditiously.

ArvinMeritor believes that the concept of an effective "early warning system" has long been desirable to the automotive industry and that industry experience and successes in detecting emerging issues have had varying degrees of success among manufacturers. ArvinMeritor points out that in spite of these efforts, there is no single demonstrated system that can be used as the "ideal model" to follow in order to develop an early reporting system.

ArvinMeritor hopes that the Agency will carefully consider the suggestions put forth by manufacturers in these responses. ArvinMeritor is extremely concerned that NHTSA is evaluating the early warning system reporting concepts on a highly aggressive implementation schedule that could create the risk of imposing unreasonable, ineffective, and expensive reporting burdens on industry and simultaneously risk creating an unmanageable administrative burden for the Agency.

ArvinMeritor's response is presented in two sections:

I – Major Concerns & Considerations associated the preliminary concepts that NHTSA has suggested for early problem detection

II- Responses to Specific Questions that NHTSA has asked

Section I – Major Concerns

ArvinMeritor believes that NHTSA needs to recognize and resolve the following issues and challenges associated with adopting an "early warning system".

(1) Clarify whether the goal is to create an "Early Warning System" or an "Advance Notification Requirement for NHTSA"

ArvinMeritor believes that most manufacturers have a means to detect early indications of emerging issues, particularly issues that could indicate a concern regarding motor vehicle safety. The methods that manufacturers use for detection may vary from formal data tracking systems (for large sophisticated manufacturers) to less formal internal communications networks (more likely for smaller manufacturers).

Each manufacturer is in the unique position of knowing the strengths and weaknesses of their own "early warning system" and what additional investigation is appropriate to validate whether any indicated "emerging issue" is valid and, if so, what actions are appropriate for that manufacturer to take in response.

ArvinMeritor believes that it is unwise for NHTSA to interject themselves into manufacturers' investigation activity during the "emerging issue" phase. Inquiries from NHTSA at this earliest (and most nebulous) phase of an emerging issue risks distracting a manufacturer's attention to responding to NHTSA inquiries rather than focusing fully on maintaining progress on investigation activities.

ArvinMeritor suggests that the NHTSA should not focus on attempting to "second guess" manufacturers' collection, analysis, and interpretation of "raw" incident data during the "emerging issue" stage of an investigation.

ArvinMeritor believes that it is highly unlikely that NHTSA can collect and manage the flow of raw data received from multiple data sources and from diverse manufacturers in any meaningful way. NHTSA should recognize that the goal of "early notification" is likely to be better achieved by implementing a requirement for a simplified manufacturer's summary report (which has been analyzed and interpreted from the manufacturer's experience-based perspective) to identify and describe emerging issues.

Discussion about the suggested contents of such an "emerging issue" report is outlined below.

(2) NHTSA should accept responsibility and assure industry that NHTSA, as a recipient of data generated at considerable expense to the industry, has a valid and effective analytical process in place to assure that data submitted is effectively screened for accuracy and analyzed in a manner that provides meaningful indications that an imminent safety issue may exist.

ArvinMeritor is concerned that the "laundry list" of data sources listed by NHTSA in the ANPRM suggests NHTSA is considering collecting vast amounts of performance data. ArvinMeritor urges NHTSA to limit the data requested from industry solely to that information which is likely to have demonstrated and direct relationship to assessing product safety.

ArvinMeritor also suggests that NHTSA assume the responsibility upon themselves to define and defend the process by which NHTSA will process and analyze any data requested. Just as manufacturers are trained to challenge the need and value of internal reports so that management is assured that costly data is put to a constructive use, ArvinMeritor challenges NHTSA to adopt a similar discipline so that it is clear that the expense and effort of collecting and providing the requested data will provide a useful value to NHTSA and to highway safety. ArvinMeritor further suggests that NHTSA set a self-imposed deadline of two years within which the Agency will be able to demonstrate by statistical modeling or by case example the efficacy of the "emerging issue data collection" activities.

(3) The volume of requested data should be limited to that which is manageable and meaningful.

ArvinMeritor is concerned that the breadth of the data sources that NHTSA has tentatively identified is unrealistic and unusable. Unless the requested data is narrowed and focused substantially, NHTSA is likely to be awash in an ongoing flow of data that cannot be analyzed, interpreted, or put to any effective use.

ArvinMeritor suggests that it might be reasonable to initiate the data collection and management process by requiring reports only on significant incidents such as

(1) deaths
(2) serious injuries
(3) significant property damage

ArvinMeritor is concerned that NHTSA will need to provide definitions and guidelines to assist industry in providing appropriate and consistent data.

As an example, for the reporting category of "incidents resulting in deaths", would NHTSA intend to include a case where a driver was involved in a single vehicle property damage accident (e.g. grazed a guard rail) but suffered a fatal heart attack as consequence of the ensuing stress ?

As a second example, or the reporting category of "incidents of property damage" would NHTSA intend to include any type of damage incurred by a vehicle or would some minimum threshold level of damage have to be incurred before reporting is required ?

ArvinMeritor suggests that NHTSA consider defining with precision the phrase "incidents of significant property damage" and that NHTSA establish within the definition the level of property damage required to qualify the incident as "significant"and therefore reportable.

ArvinMeritor believes that establishing guideline definitions will require a substantial amount of effort to clarify of the definitions of relevant terms and reach a common understanding between the Agency and industry of which incidents must be reported in each of the designated categories.

ArvinMeritor acknowledges that other potential sources of information that NHTSA has identified (field reports, consumer complaints, customer satisfaction campaigns, internal investigations, and changes to component and service parts) may yield information of some potential, but marginal value. ArvinMeritor is concerned the quantity and quality of that data to be reviewed is overwhelmingly disproportionate to the number of times that NHTSA analysts are likely to detect any emergent trends or issues through analysis of these sources of data.

ArvinMeritor suggests that each manufacturer is best able to analyze his own data, interpret its significance, and provide a meaningful summary report to NHTSA and that NHTSA should not attempt to analyze this data independently of the manufacturers guidance.

(4) The "emerging issue" data collection should establish a process for accumulating and reconciling requested data to prevent redundant and and/or contradictory information.

ArvinMeritor is concerned that NHTSA is likely to receive redundant information, incomplete or partial information, and possibly contradictory information when collecting data from parallel sources (final vehicle assembler, Tier 1 Component suppliers, individual part manufacturers, aftermarket suppliers, and other manufacturers of items of motor vehicle equipment).

ArvinMeritor suggests that the consistency and quality of the data would be improved and potential redundancies eliminated by reducing the sources of this data solely to final vehicle assemblers (OEMs). In most cases, OEMs are the primary source of any relevant information that a component supplier receives. In those few cases where a supplier learns of an incident first, one of the supplier's earliest-expected actions is to notify the affected OEM.

Since final vehicle assembler OEMs do not account for all components that NHTSA has suggested be monitored for "emerging issues", the list of reporting vehicle OEMs might need to be supplemented by requests for data from manufacturers of "items of motor vehicle equipment" (such as infant seats) and "manufacturers of replacement parts" which are not sold as part of a finished vehicle.

(5) NHTSA should acknowledge that industry will need to expend additional incremental resources to support each additional reporting requirement that NHTSA proposes.

Each of the suggested data reporting activities represents an incremental burden to manufacturers. The imposed burden grows significantly with each innovative data source that NHTSA identifies and proposes as a data source of potential interest.

ArvinMeritor believes that NHTSA should acknowledge that the various data collection proposals impose a burden to manufacturers and the any data beyond that which is directly indicative of a safety issue soon approaches the point of being unreasonable.

(6) ArvinMeritor is not aware of any automotive industry standardized "field incident" data reporting nomenclature or formats and logistics. There are a number of obstacles that prevent this standardization from happening easily.

ArvinMeritor anticipates that NHTSA will encounter significant challenges and complexity in attempting to standardize and integrate "field incident data" from various manufacturers.

(7) NHTSA should recognize that "warranty claim" data is unlikely to be a useful source of information.

There is wide latitude in the nomenclature used to describe field performance, and use of the term "warranty claim" should be discouraged as being an ambiguous and not a particularly informative term for data collection and investigation purposes.

Warranty claim documents are fundamentally intended to convey financial information: a request for repair reimbursement. Warranty claims seldom convey technically sophisticated information.

Warranty documents typically require data to be provided in abbreviated format such as "Failure Codes". For simplicity and ease of use, descriptors are rudimentary and relatively non-informative. Typical descriptor codes such as "broke", "noisy", "wrong part", etc. are, by themselves, of extremely limited value in assessing product performance issues and typically reveal virtually nothing about the environmental, use, and application factors which should be investigated in order to understand the true factors associated with a "warranty claim".

Warranty claims are written for the purpose of obtaining reimbursement for vehicle servicing and are frequently written by individuals who are skilled at obtaining reimbursement and not by individuals who have extensive failure analysis or product training. Therefore, the contribution of this data must be carefully scrutinized and compared to data from many other sources in order to develop a complete product performance issue profile.

ArvinMeritor extracts product performance information from many sources depending on the circumstances and has never relied on "warranty claims" as the initial indicator of a potential safety issue.

Data from extended warranty (warranty coverage provided for a period of time after the OE warranty period has expired), internal product investigation committee reviews, field call reports, OEM-directed studies, engineering and quality investigations, returned parts analysis, field surveys and the like contribute to form the overall picture.

Timeliness. From a supplier's perspective, warranty data must be submitted to the OE and forwarded to the supplier's warranty system. The data is reviewed and edited, analyzed, published and distributed within the supplier organization. Any sort of meaningful indication of an "emerging issue" would require several months of data for a trend or spike to be evident. Any indicated trend or spike would need to be researched to determine whether data is truly indicating variant performance. Data spikes can be created by simple administrative issues such as an OEM or dealer who postpones processing warranty claims and then "releases" them in a wave rather than process them in an even flow.

Mis-coding or mis-classification of incident descriptions are frequent issues that can compromise the integrity of warranty data.

Data Analysis. A meaningful analysis of product performance data frequently requires a well-grounded and sophisticated statistical analysis. Various analysis techniques and measurement tools are used by manufacturers depending on their product interests: full year performance, lifetime performance, 30 or 90 day performance bands offer different perspectives and advantages in understanding and measuring product performance. Deciding which method is most appropriate for which product lines and manipulating the data accordingly is territory best left to the product experts in that area, not to NHTSA.

Consolidation of data. ArvinMeritor has worked on a number of industry committees with the objective of bringing standardization to field performance reporting. From this historical perspective, ArvinMeritor suggests that the effort required to coordinate and consolidate field data from diverse product lines, components, various product maturities and time-in-service, from aftermarket user markets for both OE and aftermarket will be substantial and that the value of the final summary product is likely to be of questionable value.

(8) Suggestion that NHTSA adopt a simple reporting criteria.

ArvinMeritor suggests that NHTSA requires only a simple report in lieu of "warranty reports", lawsuits, and other voluminous sources of data. ArvinMeritor believes that the most direct indicator of a potential safety issue exists is whether an individual has been hurt or injured. ArvinMeritor is not suggesting that manufacturers wait for an injury to occur before taking action but suggests that NHTSA focus on the criteria of human injury when considering new levels of reporting requirements. Death and injury criteria appear to the most direct indicator of a potential safety issue yet likely to consist of a database that is small enough to be manageable.

Using injury/death as the reportable data mirrors NHTSA's charter focused of reducing deaths and injuries on the highways and measures that effect without obscuring that goal by attempting to measure other indirect, inaccurate and fuzzy indicators of product performance, such as warranty claim performance.

The proposed regulatory requirement might say:

"Each Vehicle Manufacturer shall Provide the Agency with a list of all fatal, personal injury, or significant property damage reports received during the month which are alleged to have been caused in whole or in part by a performance malfunction of a product manufactured by that company whether these reports are received by field call report, lawsuit, hearsay, phone call or any means of notification, and whether or not verified by the manufacturer."

"The following information shall be included in the report for each incident: the name of the injured or deceased party, date of incident, location of incident, VIN(s), a description of the product, a description of the incident, a description of the purported role of the manufacturers product in the incident."

(9) NHTSA should amend their premise that manufacturers will not be required to upgrade existing data collection systems.

ArvinMeritor believes that NHTSA should adopt a more aggressive stance than suggested in the ANPRM when encountering cases in which a manufacturer's performance indicates that that manufacturer does not have an adequate data collection and analysis to address prospective safety issues. NHTSA should invest some effort under the auspices of the TREAD Act to define the minimum acceptable requirements for a safety monitoring systems so that manufacturers who having under-performing safety investigation processes are identified and challenged to improve their surveillance and management of these issues. These improvements will be slow in coming if uncommitted manufacturers are permitted to be "grand-fathered" into an endless cycle of "maintaining the status quo".

Section II- Responses to Specific Questions asked by NHTSA

Following are responses to specific questions posed the Agency. These responses reflect the practices of ArvinMeritor but are probably representative of most major automotive supplier companies. For economy of space, the ArvinMeritor has opted not to re-write the individual questions.
Responses to Questions Regarding "Types of Information"

(1) Responses in this section describe processes at ArvinMeritor but are probably fairly representative of practices at other large Tier 1 suppliers.

Following is the requested break-down of a manufacturers internal activity and associated functions who participate in analyzing incident claim data:

Activity	Responsible Function
Receive & Process Data	Warranty Dept
Classify / Analyze Data	Reliability Engineering
Information Relating to Deaths, Serious Injuries	Product Integrity (Product Compliance)

(2) Product performance information is received in many forms. For example, warranty data from major vehicle manufacturers is typically provided in electronic format whereas data from smaller vehicle manufacturers may be provided in "hard copy" format.

Fortunately, ArvinMeritor seldom has occasion to conduct incident and investigation reports relating to deaths and serious injury incidents. When this type of data is collected, it is generally the most comprehensive and thorough due to the concern and priority for product issues that affect product safety.

(3) Warranty claims forms are classified by VIN, vintage, product line, associated component, and failure mode. A numerical coding system is used to identify the observed failure mode. In certain cases, additional detail may be provided in the report. Lawsuits and claims are classified by name of claimant, and not grouped by an internal coding system. Product investigations consolidate and summarize information from relevant incident claims for use in the investigation.

(4) ArvinMeritor does not regularly receive incident claim information from overseas. This data is maintained and managed within the relevant region.

(5) Any incident data would be sent directly to ArvinMeritor and not be forwarded to an intermediate party. ArvinMeritor headquarters would be unlikely to receive routine field incident data from a foreign location unless associated with a specific investigation activity being conducted on a significant field performance issue. A report of a personal injury or significant property damage incident from a foreign source would almost surely be reported and generate participation from ArvinMeritor headquarters.

(6) ArvinMeritor does not receive data from foreign sources in any regular electronic form and does not normally combine this data with USA sources. Any requirement to include incident data from foreign sources represents an incremental expense to ArvinMeritor.

(7) ArvinMeritor keeps USA warranty records for a period of approximately 20 years. Records pertaining to Product Investigations are kept seven years. Records of engineering changes are kept indefinitely.

(8) ArvinMeritor's field organization attempts to identify "first event" or emerging product issues. As a component supplier, ArvinMeritor does not have a dealer system or direct-access to dealer service records. ArvinMeritor would have to obtain this information from vehicle manufacturer's records.

(9) NHTSA should define an age-of-vehicle cut-off for reporting for two reasons: (1) the quality of data describing field repairs decreases after the vehicle has outlived the OEM vehicle warranty period and (2) as a vehicle ages, there is increased likelihood that vehicle repairs may have been conducted and compromised by marginally qualified service centers. Any conclusions based on incidents occurring after repairs have been performed by marginally qualified service centers is suspect since there is a risk that a mis-repair may have been a factor in subsequent performance.

In the case of passenger cars, owners will generally seek required repairs at an authorized vehicle dealer within the warranty period because the dealer has the experience and skill and since owners do not want to jeopardize warranty coverage by having servicing done at less-qualified repair centers. Further, vehicle owners are motivated to use dealers early in a vehicle life (within the warranted period) since warranty repairs performed at an authorized dealer are frequently performed at the vehicle manufacturer's expense.

Heavy truck fleet and bus operators have a commercial interest in assuring that accurate maintenance records are maintained as long as the vehicle is owned by the fleet. Transit busses remain with the original owners for extended periods of time and records for vehicles in this vocation are probably the most reliable source for long-life service records . Original purchasers of heavy vehicles may keep those vehicles and the associated service records for approximately 5 years before "trading in". Once traded in, ArvinMeritor feels that the quality of the data associated with incident reports begins to diminish.

(10) ArvinMeritor believes that the performance data that NHTSA is considering will prove to be voluminous, hard to manage, and largely unsuitable for reaching any conclusions about emerging problem issues. ArvinMeritor suggests that NHTSA evaluate the benefit in reviewing other sources of data only after achieving familiarity and partial success with the reporting elements that ArvinMeritor is advocating through this response: deaths, personal injuries, and significant property damage".

Responses to Questions Relating to Claims

(1) As stated earlier in this response, ArvinMeritor is critical of the value of a "claim" of any type unless that "claim" is investigated by a knowledgeable function associated with the respective manufacturer.

For the purposes of the ANPRM, ArvinMeritor suggests that the term "incident" is more appropriate than the term "claim".

ArvinMeritor's warranty and field report systems would contain both accepted and denied claims.

(2) ArvinMeritor suggests that NHTSA collect only incident data from (1) deaths, (2) personal injuries, or (3) significant property damage (affecting more that a single vehicle).

ArvinMeritor suggests that it is inefficient for both industry and the Agency to extend the requested data beyond these indicators and reminds NHTSA that they already have access to these other sources on data on individual investigation issues since the Agency has the authority to request and explore any and all other sources of data as warranted for any particular specific product investigation that the Agency feels may be fruitful in detecting a prospective safety issue.

(3) ArvinMeritor does not see the merit in limiting reporting responsibilities to certain components.

(4) See Paragraph 2 (directly above) above for ArvnMeritor's suggested reporting parameters.

Responses to Questions Relating to Warranties

(1) As outlined above, ArvinMeritor does not believe that warranty data is a reliable source of information for evaluating potential safety issues. ArvinMeritor suggests that NHTSA focus on requesting summary reports of incidents involving death, injuries, (both strong indicators that a risk to safety may exist) and significant property damage incidents (a potential indicator that a risk to safety may exist).

(2) ArvinMeritor retains warranty data in electronic format for a period of approximately 20 years. Data is maintained primarily for financial purposes. ArvinMeritor's Product Integrity (Product Compliance) may research this data for two purposes: (1) to determine the completion status of Campaigns and (2) for its potential contribution (to complement field incident reports, product failure analysis, customer complaints, reports from the field, etc.) in internal Product Safety Investigations. Other functions may access this data to assess validity of claims, plan financial reserves, plan new product features and for other similar commercial purposes.

(3,4) ArvinMeritor suggests that it is inappropriate to apply incident rate threshold limits for reporting warranty claim data in an effort to identify safety issues. Depending on circumstances, it may be appropriate for a manufacturer to initiate an investigation based on a single field incident. ArvinMeritor believes that the affected manufacturer is in the best position to judge whether or not a threshold is appropriate for action in response to a prospective safety concern.

(5) See # 2, Section "Questions Relating to Claims"

(6) ArvinMeritor is aware of attempts to standardize warranty coding but believes that progress has been difficult since each manufacturer is primarily interested in analyzing and reporting data in a manner best focused to meet his own specific interests.

(7) NHTSA should not attempt to standardize coding for warranty claims or field reports. ArvinMeritor believes that conducting discussions with industry regarding standardized warranty codes is likely to be highly controversial and unproductive. Further, the use of codes tends to group incidents according to loosely-defined categories and is therefore likely to obscure the potential value that could be found in the details of a report.

(8) Any data required by NHTSA should be collected in electronic format (such as word-processing or spreadsheet analysis) and NHTSA should agree to accept any of several standard software packages commonly used in the industry as preferred by each individual manufacturer.

Responses to Questions Relating to Lawsuits

(1,2) ArvinMeritor believes that it is inappropriate for NHTSA put any value or weight on lawsuits as an indicator of field performance. NHTSA should not collect any data relating to lawsuits unless this type of information assists the Agency as part of a specific investigation being conducted by the Agency.

Lawsuits are an attempt for a plaintiff to obtain financial recovery through legal channels. Lay-persons, rather than NHTSA, decide the merits of the assertions against a manufacturer when facts are presented in a court environment. Using lawsuits are a means of collecting "early warning" data suggests that NHTSA presupposes that a lawsuit has some fundamental credibility relative to indicating a potential product defect when, in fact, there may be little or no data to support that premise.

ArvinMeritor believes that NHTSA should be critical of the use of lawsuits as an indicator of safety issues. ArvinMeritor is concerned that NHTSA unduly elevates the significance of lawsuits by giving them a measure of undeserved credibility without any review of the quality or relevance of the evidence supporting that case. ArvinMeritor hopes that NHTSA can implement an objective detection and screening process more reflective of incidents activity than likely to be found by monitoring lawsuit activity.

NHTSA should be able to acquire approximately the same level of information about a product's safety performance if the agency confines its interest in data collection to deaths, injuries, and serious personal injuries since these issues are typically the basis for product liability lawsuits. Information about these kind of events are typically available prior to a lawsuit and, if not, manufacturers can extract and summarize this type of incident data from the specifics of the lawsuit without revealing the details of the lawsuit or even have to acknowledge that a lawsuit had been used as the source for the information reported.

Responses to Questions Relating to Design Changes

(1,2) ArvinMeritor believes that design changes occur for a number of reasons including manufacturability, standardization, product improvement, product upgrades, new applications, customer requests, and the like. ArvinMeritor is highly skeptical that any function outside of the affected manufacturer can extract any information from design changes that would be useful for detecting prospective safety issues.

Responses to Questions Relating to Death & Serious Injuries

(1, 2, 3) ArvinMeritor does not use any injury rating systems and therefore cannot comment meaningfully on the value of such a system.

(4) As suggested earlier in this response, ArvinMeritor suggests that any death/injury be reported and that attempting to make distinctions as to injury severity, especially during the early stages of investigation when facts are uncertain, could add complexity to the task of data analysis with no obvious associated benefit.

(5) ArvinMeritor forwards any reports of death or serious injuries to our Corporate Product Integrity (Product Compliance) Department whether these claims originated in the USA or from a foreign country. Reports from foreign sources generally take longer to receive and frequently lack the quality of information found in reports originating in the USA. Occasionally, information from foreign sources is not provided in English.

Responses to Questions Relating to Property Damage

(1) ArvinMeritor does not believe that "aggregate statistical data" is useful for detecting emerging issues and discourages NHTSA from considering aggregate data as a source for information.

(2), (3) ArvinMeritor maintains property damage claims as a running list by claimant and occasionally uses this list to review historical performance to assess whether or not a product performance issue exists and, if so, whether known field incidents correlate with the suspect design or manufacturing periods.

(4) As stated earlier, ArvinMeritor suggests that there could be some benefit in investigating "significant" property damage incidents that meet certain criteria. ArvinMeritor encourages NHTSA to define the reporting criteria so that data reported is likely to be of greatest value in detecting a potential safety issue.

Responses to Questions regarding Internal Investigations

(1) ArvinMeritor suggests that manufacturers should not be required to report internal investigation issues to NHTSA. Manufacturers who currently conduct internal investigations may be inhibited from conducting investigations if they become concerned that NHTSA will be monitoring progress and/or intervening as the investigation unfolds.

Manufacturers could initiate fewer investigations if they also become concerned that investigations could become more difficult to close if conducted under NHTSA scrutiny.

Manufacturers who are reluctant to expose internal investigation information to NHTSA can easily redefine the "investigation" activity as a "monitoring", "engineering product study" or the like and potentially elude reporting responsibility.

An internal investigation occurs when a manufacturer initiates a pro-active effort to obtain facts to better understand a product performance issue. Manufacturers undoubtedly vary in the methods by which they initiate an investigation and the method by which progress is tracked. ArvinMeritor believes that some manufactures assign investigation tracking numbers and Product Safety Committee review schedules to determine when an issue has progressed from a passive monitoring phase into a phase of pro-active investigation activity.

Manufacturers should not be required to report when an investigation has commenced since early reporting requirements may delay the initiation of a timely investigation and foment inquiries from NHTSA at a time when few facts are known. Investigation results should be communicated to NHTSA after the manufacturer has determined that an defect exists as currently required by 573.5, Defect Information Reports

Responses to Questions regarding Customer Satisfaction Campaigns, etc

(1) NHTSA already requires notification of manufacturers customer satisfaction campaigns and the like under 573.8 "Notices, Bulletins, and Other Communications".

If NHTSA is not confident that manufacturers are complying with this existing requirement, ArvinMeritor suggests that enforcing the currently required documentation would be more productive that creating new reporting requirements.

(2) ArvinMeritor is not aware of any advisories, recalls, or other activity which have occurred in the USA that have not been reported to NHTSA as required by 573.8. It is possible that an overseas operation of ArvinMeritor has issued such notices to address products used in foreign countries. ArvinMeritor USA would have to conduct a global search of foreign markets to determine whether any such advisories have been issued.

Responses to Questions on Identical and "Substantially Similar" Motor Vehicles and Equipment

(1) The word "identical" as applied to foreign product is ambiguous. Similar components may appear to be identical but differ in significant ways. For example, (1) constituent components are frequently sourced from local suppliers and therefore may appear to be virtually identical but vary somewhat in certain characteristics (2) manufacturers may make subtle design variations to meet regional specifications, applications, or exposure requirements.

ArvinMeritor suggests that it would be rare for a component produced in a foreign country to be precisely "identical" to components produced in the USA.

ArvinMeritor prefers to describe near-like components as "substantially similar" and leave the distinction of defining which components are "substantially similar" to the judgment of the manufacturer depending on the attributes of the product and their relevance to the issue and product characteristic being investigated.

ArvinMeritor suggests that vehicles that share the same platform may have some relevance to passenger car applications but will prove to be less useful when comparing individual vehicle components. A certain type and model of brake may be used through a variety of vehicle models. This is particularly true in heavy truck vehicles where, for standardization reasons, a "substantially similar" component may be used through a range of vehicle ratings and chassis models.

Further, a component may share some attributes that make it "substantially similar" to a one family of parts but have other attributes that would make it "substantially dissimilar" from that same family. For example, a heavy duty foundation brake may be used with a standard brake drum up to a prescribed axle weight rating or application severity at which point a heavier brake drum may be recommended. The foundation brake would remain "substantially similar" throughout the range of use whereas the associated brake drums would be "substantially dissimilar" though they could be installed on similarly-appearing vehicles.

Responses to Questions regarding Field Reports

(1) A field report is a summary of a reported field incident issued by a representative of the manufacturer. This representative may be a field rep, returned parts analyst, investigating engineer, or outside technical assistance.

Field reports are typically written by an experienced representative who is authorized to collect detailed information about a specific product issue. For this reason, field reports tend to contain more credible information than warranty reports but field reports are less credible than reports issued by engineers or reports written by experts who are specialists in their functional areas (such as metallurgy or failure mode forensics).

(2) ArvinMeritor discourages having NHTSA attempt to list systems, parts, or components that are safety related for screening field reports. Each manufacturer is best able to determine what components and environmental and loading factors constitute a possible risk of product failure and whether those failures are likely to pose a risk to safety.

(3) ArvinMeritor does not screen field reports for safety-related relevance and instead relies on our Field Service Organization whose representatives are trained to notify the Product Integrity Department immediately when they encounter issues associated with accidents or encounter issues that potentially involve or are alleged to involve product-related safety risks.

(4) ArvinMeritor enters and maintains all information from field reports, sales call reports, warranty claims, and extended warranty claims in an electronic data base.

(5) ArvinMeritor suggests that the only objective and quantifiable data that is a direct indicator of product safety performance is whether or not a product malfunction may have posed a risk to safety as demonstrated by the circumstances of the incident associated with the malfunction. The most direct indicators are (1) death (2) personal injury and (3) significant property damage (of a serious nature such that someone could have been injured under different circumstances).

ArvinMeritor suggests that NHTSA request that end-vehicle manufacturers (not component manufacturers) be required to furnish this data, and only this data, each month.

All other sources of data (such as warranty claims) are only indirect indicators of product safety issues.

Questions about when information should be reported

(1, 2, 3, 4) ArvinMeritor suggests that affected manufacturers provide NHTSA with an "incident summary" each month. Varying the required reporting frequency from anything but a regular monthly reporting requirement risks creating an uneven data flow and requiring increased administrative complexity, and increases the risk of data errors and confusion.

ArvinMeritor suggests that providing certain "higher priority" information to NHTSA a few days earlier than month-end solely because the incident may have resulted in a more serious outcome is arbitrary and will not increase the progress of the investigation activity to any substantial exten .

Responses to Questions regarding how data should be reported

ArvinMeritor reminds the Agency that the premise of the ANPRM indicates that NHTSA expects that "manufacturers must do more than merely provide raw information and data" (p 6542). The implied responsibility is that the TREAD Act implicitly imposes an incremental reporting responsibility on manufacturers.

ArvinMeritor is concerned that these reporting requirements remain reasonable and do not become overly burdensome. In light of the broad categories of suggested data sources, Arvin asks NHTSA to carefully review the final reporting requirements in light of Section 30166 (m)(4)(D) to be certain that the final rule "shall not impose unduly burdensome requirements to a manufacturer..." (p 6544).

(1) ArvinMeritor suggests that manufactures be permitted to furnish the required summary information by being given the option of selecting and using one of several standardized commercial software (word processing or spreadsheet) commonly used in the industry.

(2) ArvinMeritor believes that data provided in "aggregate statistical" form will be too general to be of value in detecting any emerging product-specific issues.

(3, 4) ArvinMeritor is concerned that NHTSA will initiate a number of unproductive investigations by pursuing issues that the aggregate data suggests exists but which are actually "phantom issues". Manufacturers are not able to anticipate "in advance" what supplemental information NHTSA might feel is useful to clarify a specific issue. Therefore, ArvinMeritor anticipates that NHTSA is likely to initiate a number of fruitless investigations using aggregate data.

If NHTSA chooses to collect aggregate or other data, the Agency should consider adopting a "pre-investigation" methodology. A "pre-investigation" inquiry might consist of a requirement (on request) for manufacturers to provide an abbreviated response to clarify questions arising from NHTSA's review of the raw data submissions".

Responses to Questions regarding how data might be used

(1) ArvinMeritor estimates that 3 additional people will be required internally to support the startup and to sustain the proposed reporting requirements. This estimate assumes the followir.g support will be required:

Job Function	Tasks
Management Information Analyst	Design Develop Global Data Collection Systems & Reporting formats
Product Field Engineer	Gather and interpret sustaining data
Product Safety or Product Compliance Engineer	Interface and respond to NHTSA generated inquires

This is a very rough estimate based on the concepts of possible reporting requirements outlinec in the ANPRM. Staffing levels will vary depending on the requirements stated in the Final Rule.

(2) ArvinMeritor believes that reporting is "unduly" burdensome if industry is required to furnish data using incremental (previously unnecessary) resources and NHTSA is unable to demonstrate a useful application of the data and/or associated improvement in highway safety.

ArvinMeritor suggests that the "Emerging Issue" Reporting Requirement be eliminated after a two year period if NHTSA is unable to provide a "proof of effectiveness" and/or an improvement in highway safety associated with the the "incident data" initiatives.

(3) The most effective detection system is one in which the manufacturer (who is most familiar with his product and his performance data) voluntarily evaluates relevant data and informs NHTSA when an emerging issue affecting safety has been detected. If NHTSA feels that they cannot depend on all manufacturers to meet this burden of self-evaluation burden, then authorizing NHTSA to collect "incident data" (only) appears to be the next-most effective suggestion.

(4) Most manufacturers already have an early detection system but these will vary in specific procedural requirements across the industry since they have evolved to suit each particular manufacturer's needs for product performance information.

External reporting requirements such as being proposed by NHTSA under this ANPRM represent an incremental burden to these existing systems and appear unlikely to offer added value over existing detection systems to either the manufacturers or NHTSA.

Sincerely,

ArvinMeritor

G. T. Bowman
Manager, Product Integrity

USDOT Inspector General's
18 June 2015 Audit Report: ST-2015-063

Office of Inspector General

Audit Report

INADEQUATE DATA AND ANALYSIS UNDERMINE NHTSA'S EFFORTS TO IDENTIFY AND INVESTIGATE VEHICLE SAFETY CONCERNS

National Highway Traffic Safety Administration

Report Number: ST-2015-063

Date Issued: June 18, 2015

Memorandum

U.S. Department of Transportation
Office of the Secretary of Transportation
Office of Inspector General

Subject: **ACTION:** Inadequate Data and Analysis Undermine NHTSA's Efforts To Identify and Investigate Vehicle Safety Concerns
National Highway Traffic Safety Administration
Report No. ST-2015-063

Date: June 18, 2015

From: Calvin L. Scovel III
Inspector General

Reply to Attn. of: JA-30

To: Secretary of Transportation
National Highway Traffic Safety Administrator

Since February 2014, the General Motors Corporation (GM) has recalled 8.7 million vehicles in the United States[1] due to an ignition switch that can unexpectedly move from the "run" or "on" position to the "accessory" or "off" position, shutting down the engine and disabling power steering, power brakes, and air bags. More than 110 fatalities and 220 injuries have been linked to the vehicles' defective ignition switches.[2]

The National Highway Traffic Safety Administration's (NHTSA) Office of Defects Investigation (ODI)—which is responsible for identifying and investigating potential vehicle safety issues and requiring recalls when warranted—looked at GM air bag non-deployments as a potential safety issue starting in 2007. However, it ultimately decided not to investigate the problem and never identified the ignition switch defect as the root cause.

In an April 2014 hearing before the Senate Commerce, Science, and Transportation Committee's Consumer Protection, Product Safety, and Insurance Subcommittee, NHTSA's Acting Administrator[3] testified that the Agency and the Department's Office of General Counsel were assessing ODI's process in light of the GM recalls.[4] The Secretary of Transportation also requested that we assess

[1] Recalled vehicles include Chevrolet Cobalts and HHRs, Saturn Ions and Skys, and Pontiac G5s and Solstices that were manufactured between 2003 and 2011.
[2] GM's ignition switch compensation fund had approved 114 death and 229 injury claims as of June 12, 2015.
[3] At the time, NHTSA's Deputy Administrator served as the Agency's Acting Administrator.
[4] The Department issued a report summarizing its review results and planned actions on June 5, 2015. We did not assess the Department's review as part of this audit.

NHTSA's vehicle safety procedures and determine whether NHTSA had information on GM's ignition switch issues. Accordingly, we assessed ODI's procedures for (1) collecting vehicle safety data, (2) analyzing the data and identifying potential safety issues, and (3) determining which of these issues warrant further investigation. In doing this, we considered how those procedures affected ODI's handling of concerns related to the GM ignition switch. We examined information available to NHTSA prior to GM's 2014 recall announcement; however, our audit did not assess whether GM fully disclosed information on the ignition switch issue to NHTSA. In addition to the Secretary's request, we are also conducting a separate audit to assess NHTSA's actions to implement OIG's 2011[5] recommendations aimed at strengthening ODI's process for identifying and addressing safety defects. We plan to report our findings on this topic later this year.

We conducted our work in accordance with generally accepted Government auditing standards. See exhibit A for our full scope and methodology.

RESULTS IN BRIEF

ODI's processes for collecting vehicle safety data are insufficient to ensure complete and accurate data. Deficiencies in ODI's vehicle safety data are due in part to the Agency's lack of detailed guidance on what information manufacturers and consumers should report. For example, ODI regulations specify 24 broad codes for categorizing early warning reporting data for vehicles. However, according to ODI, an average vehicle may have over 15,000 components. Without detailed guidance, decisions regarding key aspects of early warning reporting data are left to the manufacturers' discretion—resulting in inconsistent reporting and data that ODI investigative chiefs and vehicle safety advocates consider to be of little use. Further, ODI's processes for verifying that manufacturers submit complete and accurate early warning reporting data are insufficient. For example, in May 2014, ODI officials told us that one vehicle manufacturer reported less early warning reporting data than comparable manufacturers. However, ODI took no enforcement action until the manufacturer self-reported the omission of 1,700 death and injury claims in October 2014, even though ODI contacted the manufacturer about inconsistencies in its reporting in late 2011 or early 2012. Consumer complaints—ODI's primary source for identifying safety concerns—often lack detail, including information to correctly identify the vehicle systems involved. In the GM case, ODI received data on the ignition switch defect as early as 2003. Some of these data specifically described the ignition switch problems; however, other information lacked sufficient detail or was inconsistently categorized.

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[5] *Process Improvements Are Needed for Identifying and Addressing Vehicle Safety Defects*, (OIG Report Number MH-2012-001), Oct. 6, 2011. OIG reports are available on our Web site at: www.oig.dot.gov.

Weaknesses in ODI's processes for analyzing vehicle safety data further undermine ODI's efforts to identify safety defects. Specifically, ODI does not follow standard statistical practices when analyzing early warning reporting data, such as establishing a base case for what statistical test results would look like in the absence of safety defects. Consequently, ODI cannot differentiate trends and outliers that represent random variation from those that are statistically significant. In addition, ODI does not thoroughly screen consumer complaints. For example, ODI's initial screening of the roughly 330 complaints received daily is not thorough, and about 90 percent of complaints are set aside. While screeners are encouraged to query all complaints for similar issues in their area of concentration, half of them told us that they do not consistently do this. Finally, ODI does not adequately train or supervise its staff. For example, NHTSA has a training plan for ODI staff, but it has not implemented this plan. As a result, ODI's pre-investigative staff told us they have received little or no training in their areas of concentration, some of which are technologically complex. Collectively, these weaknesses have resulted in significant safety concerns being overlooked. For example, in June 2007, GM provided ODI with a State trooper's report that identified the 2005 Chevrolet Cobalt's ignition switch as a possible cause of air bag non-deployment during a fatal accident. However, two ODI staff who reviewed the report in 2007 did not note this potential link when documenting their reviews. Additionally, ODI officials told us that at the time, they were uncertain under what conditions the air bags were supposed to deploy.

ODI's process for determining when to investigate potential safety defects is also insufficient to prompt needed recalls and other corrective actions. While ODI has identified factors for deciding whether an investigation is warranted, it has not developed sufficient guidance or reached consensus on how these factors should be applied. ODI emphasizes investigating issues that are most likely to result in recalls, which has led to considerable investigative duties being performed during the pre-investigative phase, often by screeners who are not trained to carry out these responsibilities. In addition to these shortcomings, ODI's investigation decisions lack transparency and accountability. Specifically, ODI does not always document the justifications for its decisions not to investigate potential safety issues and does not always make timely decisions on opening investigations. In the GM case, ODI considered a proposal to investigate air bag non-deployments in the Chevrolet Cobalt and Saturn Ion in November 2007 but did not document why it decided not to investigate. Further, NHTSA's Associate Administrator for Enforcement directed ODI to gather more information on the issue after reports of fatal accidents associated with the air bag non-deployments. However, the ODI screener responsible for monitoring the issue left NHTSA in 2008, and the Defects Assessment Division Chief did not reassign that responsibility. ODI also missed other opportunities to investigate the ignition switch when new evidence came to light in subsequent years.

We are making recommendations aimed at improving ODI's processes for collecting and analyzing vehicle safety data and for determining which potential safety issues warrant investigation.

BACKGROUND

NHTSA, established by the Highway Safety Act of 1970,[6] administers highway safety and consumer programs intended to reduce deaths, injuries, and economic losses resulting from motor vehicle crashes. NHTSA's ODI is responsible for reviewing vehicle safety data, identifying and investigating potential vehicle safety issues, and requiring and overseeing manufacturers' vehicle and equipment recalls (see table 1). NHTSA reports that it has influenced, on average, the recall of nearly 9 million vehicles every year since 2000.

Table 1. ODI's Vehicle Safety Oversight Process

Phase	Number of Staff	Description
Pre-Investigation	13	ODI collects and analyzes vehicle safety data to identify and select potential safety issues for further investigation.
Investigation	20	ODI investigates the potential safety issue to determine whether a recall is warranted.
Recall management	8	ODI ensures that manufacturer recalls comply with statutory requirements.

Source: OIG analysis

ODI's pre-investigative phase includes four key elements:

- **Collection and analysis of early warning reporting data.** The Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act[7] of 2000 authorized NHTSA to require manufacturers to report on a variety of early warning data. These data include property damage claims, consumer complaints, warranty claims, and field reports from incidents involving certain vehicle components and conditions defined in NHTSA regulations.[8] In addition, manufacturers are required to report all death and injury claims and notices. ODI's Early Warning Division staff[9] are responsible for verifying that manufacturers submit these data, prioritizing the data using statistical tests, and identifying and referring potential safety trends to the Defects Assessment Division for further analysis.

[6] Pub. L. 91-605.
[7] Pub. L. 106-414.
[8] Title 49, Code of Federal Regulations (CFR), Part 579.
[9] The Early Warning Division currently has four staff including two safety defects analysts, one statistician, and one safety defects engineer.

- **Collection and analysis of consumer complaints.** ODI receives consumer complaints through a variety of sources including letters, vehicle safety hotline calls, and submissions through NHTSA's safercar.gov Web site. ODI's Defects Assessment Division screens all complaints and forwards ones with potential safety significance for additional review.[10]

- **Identification of potential safety issues.** If a potential safety issue is identified, the Defects Assessment Division researches and analyzes available safety data and prepares an investigation proposal for ODI's investigative division chiefs to review.[11]

- **Selection of potential safety issues to investigate.** ODI's investigative division chiefs review investigation proposals and recommend to the Director of ODI whether to open an investigation, decline an investigation, or refer the proposal to the Defects Assessment Panel for further review.

Most recently in October 2011, we reported on NHTSA's oversight of vehicle safety.[12] We noted that NHTSA followed its established procedures in investigating unintended acceleration issues for Toyota and other manufacturers; however, process improvements were needed for identifying and addressing vehicle safety defects. We also reported that ODI's limited information sharing and coordination with foreign countries reduced opportunities to identify safety defects or recalls. NHTSA fully or partially concurred with all 10 of our recommendations. As of May 29, 2013, ODI had taken action to address 9 of our 10 recommendations but had not yet completed a recommended workforce assessment. At the end of April 2015, we received NHTSA's workforce assessment and closed the remaining recommendation. We are conducting a separate audit to assess NHTSA's actions to implement our 2011 recommendations and plan to report our findings on this topic later this year.

ODI LACKS EFFECTIVE PROCESSES FOR COLLECTING COMPLETE AND ACCURATE VEHICLE SAFETY DATA

ODI's processes for collecting vehicle safety data are insufficient to ensure complete and accurate data. Deficiencies in ODI's vehicle safety data are due in part to the Agency's lack of detailed guidance on what information manufacturers and consumers should report. Further, ODI does not verify the completeness and accuracy of manufacturers' early warning reporting data, or take timely action to

[10] The Defect Assessment Division currently has nine staff including eight screeners and a Division Chief.
[11] ODI has three investigative divisions: the Vehicle Control Division, Vehicle Integrity Division, and the Medium and Heavy Duty Vehicle Division.
[12] *Process Improvements Are Needed for Identifying and Addressing Vehicle Safety Defects*, (OIG Report Number MH-2012-001), Oct. 6, 2011.

correct identified inaccuracies and omissions. In the GM case, ODI received data on the ignition switch defect as early as 2003. Some of these data specifically described the ignition switch problems; however, other information lacked sufficient detail or was inconsistently categorized.

ODI Lacks Detailed Guidance and Verification Processes To Obtain Complete and Accurate Early Warning Reporting Data

The TREAD Act and related regulations require vehicle and equipment manufacturers to report quarterly to NHTSA on a variety of early warning reporting data that could indicate a potential safety defect (see table 2).

Table 2. Early Warning Reporting Data Requirements

Aggregate data	• Aggregate data are quarterly counts of manufacturers' documentation of potential safety issues. Examples of aggregate data include quarterly counts of dealer field reports, consumer complaints, warranty claims, and property damage claims. • ODI cannot trace aggregate data to a specific vehicle or incident without requesting additional information from a manufacturer. • Manufactures are not required to report incidents that do not involve a component or condition specified in the regulations.
Disaggregate data	• Disaggregate data are documents describing specific incidents that may be safety-related. Disaggregate data that manufacturers must submit include: o non-dealer field reports that involve components or conditions specified in the regulations and o all death or injury claims and notices, including those that do not involve components or conditions specified in the regulations. • ODI can trace disaggregate data to a specific vehicle or incident.
Other	• Manufacturers are required to notify NHTSA of technical service bulletins,[13] consumer advisories, and warranty communications • Manufacturers are also required to report foreign recalls of vehicles substantially similar to ones sold in the United States.

Source: OIG analysis

ODI's assessment of early warning reporting data is greatly influenced by the codes manufacturers assign to incidents. While regulations specify 24 broad vehicle codes (see exhibit D for a complete list of codes), ODI notes that an average vehicle may have over 15,000 components, and categorizing them can be open to interpretation. For example, ODI staff told us that a manufacturer could categorize a malfunction of an air bag component located in a seat using three

[13] Technical service bulletins are documents provided by the manufacturer containing information on safety recalls, defective product components, service campaigns, and customer satisfaction campaigns.

different vehicle codes: air bags, seats, or electrical system. Additionally, the regulations allow manufacturers to decide if an incident not included in the 24 defined codes should be reported. However, this does not apply to death and injury claims, all of which must be reported.

Despite this complexity, ODI does not provide detailed guidance to help ensure manufacturers interpret and apply the appropriate codes. According to ODI staff, additional rulemaking would be required in order to provide more guidance to manufacturers. ODI analysts told us that when a manufacturer asks for specific guidance on assigning codes, their practice is not to provide guidance and instead allow each manufacturer to make its own decisions. However, ODI investigative chiefs and vehicle safety advocates told us that ODI's early warning aggregate data are ultimately of little use due to the inconsistencies in manufacturers' categorizations of safety incidents.

According to ODI staff and a January 2008 report issued by the Volpe National Transportation Systems Center (Volpe),[14] non-dealer field reports[15] are the most important source of early warning reporting data because they can provide a specific, technical basis for launching investigations. However, lacking guidance on the reporting format or what information to report, manufacturers submit reports of varying usefulness. For example, one manufacturer's non-dealer field reports contain a few lines of text briefly describing the consumer's complaint. Another manufacturer's reports provide considerably more information, including the technician's analysis of the condition, root cause analysis, corrective actions taken, and whether the action resolved the condition.

ODI staff check that manufacturers submit early warning reporting data on time and may request that manufacturers provide underlying documentation for aggregate data and death and injury data. Additionally, ODI staff told us that they request additional documentation for aggregate data if they identify an anomaly in the data. However, ODI staff noted that their requests for such documentation have declined, from an average of 23 annually between 2006 and 2009 to an average of 4 annually between 2010 and 2014, as a result of their increased workload.

Moreover, ODI does not verify that manufacturers' early warning reporting data are complete and accurate. Although ODI has the authority to inspect manufacturers' records for compliance with early warning reporting

[14] In 2006, ODI initiated an evaluation of its early warning reporting system, with support from Volpe.

[15] Non-dealer field reports are communications between consumers, authorized service facilities, and manufacturers regarding the failure, malfunction, lack of durability, or other performance problem related to a vehicle or vehicle part.

requirements,[16] NHTSA officials told us the Agency has never used this authority. In addition, the Agency has no processes in place for systematically assessing the quality of early warning reporting data or internal guidance on using oversight tools to enforce data reporting requirements. The Agency also has not established best practices for providing early warning reporting data and does not periodically review manufacturers' early warning reporting procedures. Instead, the Director of ODI told us ODI relies on the "honor system." However, according to ODI staff, manufacturers routinely miscategorize safety incidents. For example, staff told us that some manufacturers avoid using the word "fire" in non-dealer field reports and instead use phrases such as "strange odor" to avoid categorizing an incident as fire-related. Miscategorizations such as these compromise ODI's efforts to quickly identify potential safety defect trends.

Yet even in cases where ODI suspects noncompliance, it has not taken prompt enforcement action. For example, ODI officials told us they were aware that a vehicle manufacturer was "conservative" in reporting early warning reporting data. According to a November 2014 audit prepared for the manufacturer, two ODI employees called the manufacturer's officials in late 2011 or early 2012 to ask about inconsistencies between previously reported early warning reporting data and reported death and injury incidents pertaining to an air bag recall.[17] However, ODI took no enforcement action to address this issue until the manufacturer self-reported the omission of about 1,700 death and injury claims in October 2014. NHTSA subsequently required the manufacturer to describe its procedures for complying with early warning reporting requirements and provide the Agency with supporting documentation for all third-party audits of its reporting.

In another case, ODI knew a major recreational vehicle manufacturer was noncompliant but did not take action for nearly a decade. In November 2004, ODI discovered that the manufacturer did not report required death and injury data and other early warning reporting data. The lack of reporting continued without ODI action until September 2014, when the office opened an investigation into the manufacturer's reporting following a suspected recall noncompliance issue. During the investigation, the manufacturer stated that it failed to report the early warning reporting data for over 10 years because of internal miscommunications and a failure in the manufacturer's software.

[16] Title 49 United States Code (U.S.C.) Section 30166 establishes NHTSA's subpoena power and its authority to inspect manufacturers' records and require recordkeeping to assess compliance with early warning reporting requirements.

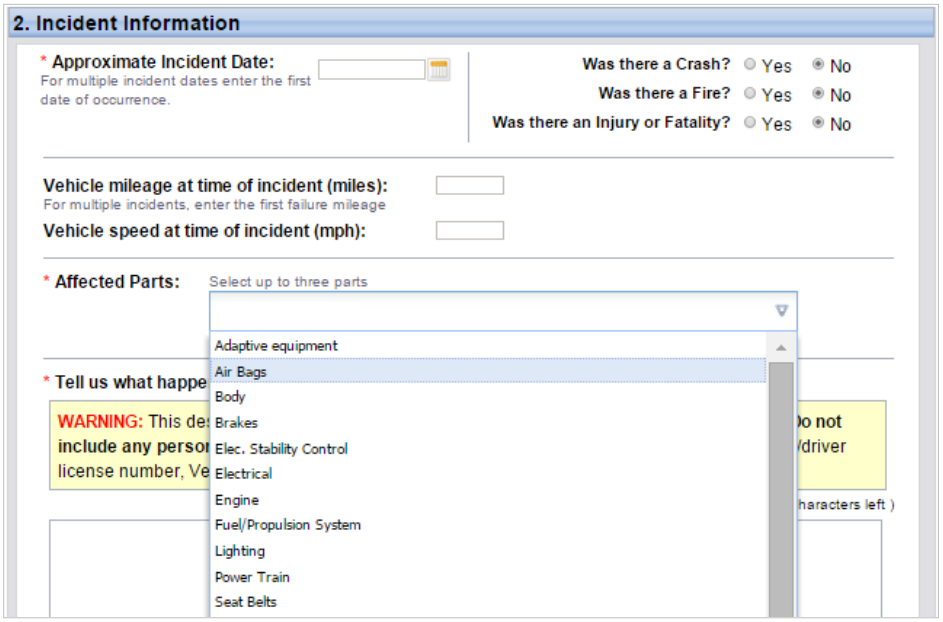
[17] The manufacturer officials did not follow up with ODI to provide a full explanation of the inconsistencies.

ODI Does Not Provide Sufficient Guidance to Consumers on the Type of Information To Include When Submitting Complaints

ODI relies primarily on consumer complaints to identify potential safety concerns. However, consumer complaints often do not provide enough detail to determine the existence of safety concerns or do not correctly identify the vehicle systems involved.

The majority of consumer complaints are submitted through NHTSA's safercar.gov Web site, which prompts consumers to provide details about the vehicles and incidents in question. The online complaint submission form requires consumers to select up to 3 affected parts from a drop-down list of 18 options, such as air bags and electronic stability control (see figure 1). Additionally, the Web site provides a text field for consumers to describe the incidents underlying their complaints.

Figure 1. ODI's Online Submission Form for Consumer Complaints



Source: http://www.safercar.gov

According to ODI's initial screener, roughly 50 to 75 percent of complaints incorrectly identify the affected parts, and roughly 25 percent do not provide adequate information to determine the existence of safety concerns. These data quality issues occur in part because ODI does not provide consumers with detailed guidance on submitting complaints. For example, safercar.gov does not define the 18 affected parts categories—some of which may be unfamiliar to consumers, such as "adaptive equipment." Furthermore, safercar.gov does not allow consumers to submit, or encourage them to retain, supporting documentation (such

as photographs or police reports), which ODI's screeners and management have indicated are valuable in identifying potential safety concerns. In contrast, the U.S. Consumer Product Safety Commission's complaint Web site (saferproducts.gov) allows consumers to upload as many as 25 documents or photos related to their complaints.[18]

ODI Received Early Warning and Consumer Complaint Data Related to the GM Ignition Switch Defect

ODI received early warning reporting data and consumer complaints related to the GM ignition switch defect[19] for more than a decade before GM notified ODI of the recall on February 7, 2014. (Exhibit E provides a timeline of select data NHTSA received on the GM ignition switch defect.) However, some of this information lacked sufficient detail or was inconsistently categorized. From 2003 through 2013, GM submitted about 15,600 non-dealer field reports and about 2,000 death and injury reports on vehicles subject to the ignition switch recall—especially related to the 2005 to 2010 Chevrolet Cobalt (see table 3). In a 2011 ODI early warning reporting analysis of 22 vehicles with potential air bag issues, the 2005 to 2010 Chevrolet Cobalt ranked fourth for fatal incidents and second for injury incidents involving air bags.[20]

Table 3. Early Warning Reporting Data Related to Vehicles Subject to GM Ignition Switch Defect

Non-dealer field reports	GM submitted about 15,600 non-dealer field reports.	The Cobalt represented 36 percent of these non-dealer field reports.
Death and injury claims and notices	GM submitted about 2,000 death and injury reports. About 90 indicated at least 1 fatality.	The Cobalt represented 63 percent of the death and injury reports—and 74 percent of these reports indicated at least one fatality.

Source: OIG analysis

GM inconsistently categorized some of the early warning reporting data it submitted to ODI. For example, GM assigned different codes for similar non-dealer field reports related to the ignition switch defect.

- In March 2005, GM submitted a non-dealer field report in which a GM employee described the ignition switch defect in a 2005 Chevrolet Cobalt. The

[18] The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of injury or death associated with the thousands of types of consumer products under the Agency's jurisdiction.

[19] According to GM recall documents and the evaluation of how GM handled the ignition switch defect conducted by Anton Valukas, the defect is unintended movement of the ignition switch from the "run" or "on" position to the "accessory" or "off" positions. Additionally, the defect can cause unintended engine stalling while driving and air bag non-deployment during crashes in which the air bags should have deployed.

[20] In addition to the Cobalt, ODI analyzed consumer complaints and death and injury data categorized as air bag-related for 21 other passenger vehicles from GM and other manufacturers.

employee wrote that the vehicle stalled on a highway when the employee's knee "hit the GM brown leather key holder." The employee concluded that minor impact to the ignition key could easily cause the engine to shut off. GM categorized this report using the "Engine and Engine Cooling" code.

- In May 2007, GM submitted another non-dealer field report in which a GM employee describes the ignition switch defect in a 2006 Pontiac Solstice. The employee wrote that the vehicle ignition system turned off several times while driving when his knee hit the accessories attached to the key ring. GM categorized this report using the "Electrical" code.

In addition, GM's categorization of a death and injury report pertaining to a fatal accident involving a 2005 Chevrolet Cobalt was inconsistent with supporting documentation. NHTSA regulations state that manufacturers must identify each vehicle system or component that allegedly contributed to the incident when reporting death and injury claims and notices.[21] GM categorized the accident as not involving any of the systems, components, or conditions defined in regulations. However, underlying documentation for the report included a Wisconsin State trooper's report indicating that the ignition switch and air bags were both involved in the accident:

> The ignition switch on the…vehicle appears to have been in the accessory position when it impacted the trees preventing the air bags from deploying. A search of the [NHTSA] web site indicates five complaints of 2005 Chevrolet Cobalt ignition switches turning off while the vehicle was being driven. Three of the complaints talk about the knee or leg touching the ignition or key chain causing the engine to turn off...It appears likely that the vehicles' key turned to accessory as a result of the low key cylinder torque/effort.[22]

In February 2007, a GM technical service bulletin uploaded to Artemis[23]—ODI's primary database for storing data used to identify and address potential safety defects—described inadvertent turning of the key cylinder and loss of electrical systems. The bulletin applied to vehicle models and model years that would eventually be subject to the February 2014 recall. Although the bulletin does not describe the potential for the vehicle to stall as a result of inadvertent turning of the ignition switch, it does state that the problem was more likely to occur when the vehicle was turning. GM categorized this bulletin using the "Steering" code.

From January 1, 2003, through February 7, 2014, ODI received 9,266 complaints involving the vehicles subject to the GM ignition switch recall—including

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[21] 49 C.F.R. §§ 579.21(b)(1)-(2).

[22] *Collision Analysis and Reconstruction Report*, prepared by the Technical Reconstruction Unit of the Wisconsin State Patrol Academy, Feb. 14, 2007.

[23] The Advanced Retrieval of Tire, Equipment, and Motor Vehicle Information System.

72 complaints indicating at least 1 injury and 3 complaints indicating at least 1 fatality. The majority of these complaints involved the 2005 to 2010 Chevrolet Cobalt and the 2003 to 2007 Saturn Ion.

Some consumer complaints were miscategorized or lacked sufficient detail to link them to the ignition switch defect. For example, a June 2005 complaint stated only that an accident had destroyed a 2005 Chevrolet Cobalt and injured one person and that the air bags did not deploy. The complaint did not specify whether this accident occurred on or off the road, or whether the impact was to the front, side, or back of the vehicle—details that were essential to ODI's analysis of air bag non-deployment in these vehicles.

However, some consumer complaints described the ignition switch defect in detail. For example, in June 2005, a consumer sent NHTSA a copy of a letter that she sent to the GM customer service department describing how her 2005 Chevrolet Cobalt had turned off on three occasions while driving. The letter stated that the service manager tested the vehicle and was able to turn the ignition switch when his knee hit the bottom of the "opener gadget" on the keychain. The letter goes on:

> This is a safety/recall issue if there ever was one. Forget the bulletin. I have found the cause of the problem. Not suggested causes as listed in bulletin. The problem is the ignition turn switch is poorly installed. Even with the slightest touch, the car will shut off while in motion. I don't have to list to you the safety problems that may happen, besides an accident or death…[24]

Furthermore, ODI contractors miscategorized some consumer complaints related to ignition switch defects. For example, in September 2003, a driver of a 2003 Saturn Ion reported experiencing engine shutoff on three occasions when the driver's knee accidently hit the car keys. According to the complaint, two of these events occurred when the car was traveling at 65 miles per hour on a freeway. When entering this complaint into Artemis, ODI contractors miscategorized this complaint using the codes "Unknown or Other" and "Exterior Lighting: Headlights: Switch" rather than the correct code "Electrical Systems: Ignition: Switch."

WEAK DATA ANALYSES AND REVIEWS UNDERMINE ODI'S EFFORTS TO IDENTIFY VEHICLE DEFECTS

ODI does not follow standard statistical practices when analyzing early warning reporting data, conduct thorough reviews of consumer complaints, or provide

[24] Consumer letter to General Motors Corp. regarding a 2005 Chevrolet Cobalt, dated June 29, 2005 (attachment to ODI Vehicle Owner Questionnaire Number 10129121).

adequate supervision or training for staff responsible for reviewing these data and complaints. As a result, it cannot reliably identify the most statistically significant safety issues to pursue. ODI's complaints process is not thorough and in the case of GM, ODI missed multiple opportunities to link the GM ignition switch defect to air bag non-deployments because ODI staff lacked technical expertise and did not consider all available information.

ODI Does Not Follow Standard Statistical Practice When Analyzing Early Warning Reporting Data

ODI uses four statistical tests to analyze aggregate early warning reporting data (such as consumer complaints, warranty claims, and property damage claims)—as well as a fifth test to analyze non-dealer field reports (see table 4).

Table 4. ODI's Statistical Tests for Analyzing Early Warning Reporting Data

Statistical test	Description
Crow-AMSAA	Trend analysis used to analyze aggregate data
Mahalanobis distance	Test used to analyze aggregate data
Probability measure	Test used to analyze aggregate data
Logistic regression	Regression test used to analyze death and injury aggregate data
CRM-114	Filter used to analyze non-dealer field reports

Source: OIG analysis

While the statistical experts we consulted[25] note that conducting multiple tests provides a sound basis for analysis, ODI does not follow standard statistical practices when implementing the tests of the aggregate data. Specifically, ODI does not consistently identify a model (a set of assumptions) for the aggregate data to establish a base case—that is, what the test results would be in the absence of safety defects. According to the statistical experts, identifying assumptions and models—and checking to see whether they fit the data—are essential for establishing a base case. Without a base case, ODI cannot differentiate trends and outliers that represent random variation from those that are statistically significant—that is, scores that indicate a safety issue should be pursued.

ODI has missed opportunities to update and improve its statistical methods for analyzing early warning reporting data. For example:

- ODI does not regularly assess the performance of its aggregate data tests. According to the statistical experts, out-of-sample testing—a standard

[25] The statistical experts we consulted with are from academia and research institutes. See exhibit B for a complete list of the experts and their affiliations.

statistical assessment practice—would allow ODI to determine whether potential safety issues identified in one portion of its aggregate data turn up in the remaining portion. However, ODI performed out-of-sample testing on only one aggregate data test and only when the test was first implemented. ODI also conducted out-of-sample tests on non-dealer field reports, but it has not done so since 2009.

- Despite recent developments in data analytics, ODI has not updated its statistical tests from initial implementation in 2006 through 2009, so it has not taken advantage of recent methodological advances. Although ODI has periodically recalibrated some of its tests (such as logistic regression) using current data, it has not updated the analytical methodologies it uses.

- Volpe conducted the only external review of ODI's aggregate data tests since their implementation. According to its January 2008 report, Volpe reported that the review's scope was limited because of concerns about the informational burden on ODI and manufacturers. As a result, Volpe was unable to reach any conclusions about the tests' effectiveness. ODI has not requested any other external reviews of its statistical tests.

ODI similarly lacks procedures to promote timely screening of early warning reporting data. For example, ODI's Early Warning Division staff review non-dealer field reports based on the results they receive from a statistical test; however, there is no process for ensuring that all non-dealer field reports are included in the universe from which the sample is drawn. ODI has overlooked non-dealer field reports for months or even years if, for example, manufacturers submit the reports in formats that ODI's statistical test cannot process.

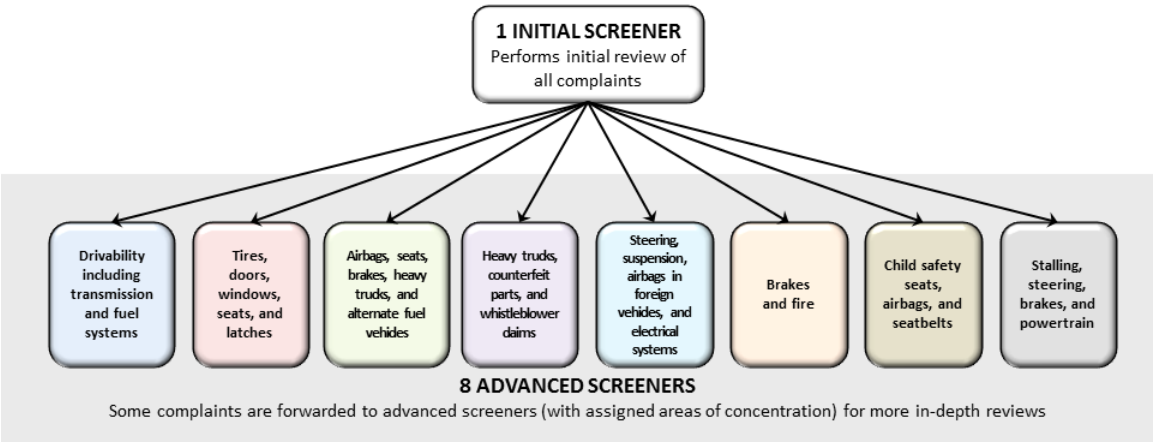
In addition, advanced screeners, who are responsible for proposing safety defect investigations, told us that they are less likely to rely on early warning reporting data because of the data's lack of timeliness. The information in early warning reporting data can be delayed by months because manufacturers submit the reports quarterly.

ODI Does Not Thoroughly Screen Consumer Complaints

In October 2010, ODI established a two-tiered process for screening consumer complaints, its primary source for identifying potential vehicle safety concerns. Currently, one employee reviews all submitted consumer complaints, determines which complaints have potential safety implications, and forwards those complaints to eight advanced screeners who perform more in-depth reviews (see figure 2). In 2011, we recommended that ODI conduct a workforce assessment to determine the number of staff required for ODI to meet its objectives and determine the most effective mix of skill sets. ODI has recently completed its

workforce assessment. We are conducting a separate audit to assess NHTSA's actions to implement our 2011 recommendations—including the workforce assessment—and plan to report our findings on this topic later this year.

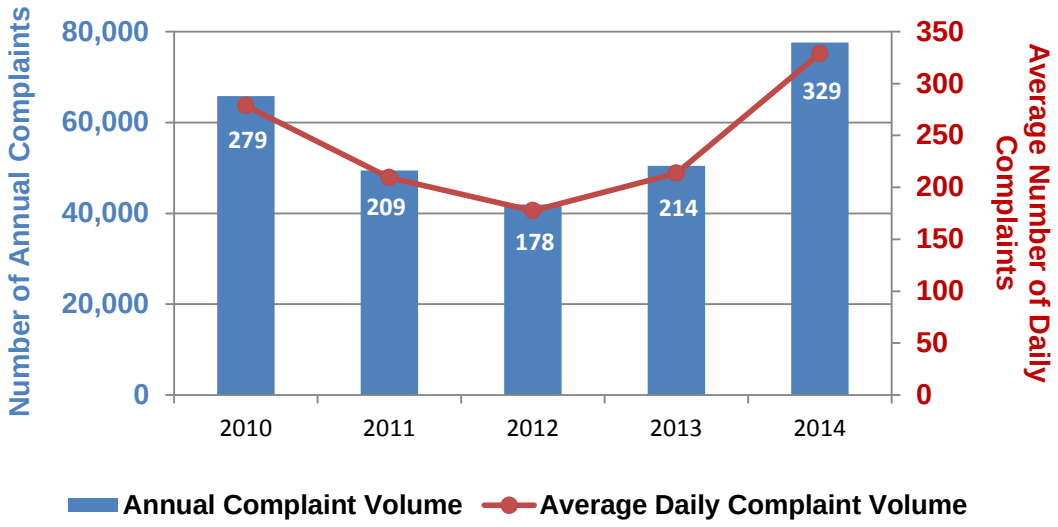
Figure 2. ODI's Consumer Complaint Review Process



Source: OIG analysis

Since 2010, ODI has received at least 40,000 complaints a year. In 2014, it received nearly 78,000 complaints (see figure 3). In other words, the initial screener's workload is roughly 330 complaints each day. Determinations of whether complaints warrant further review are made within a matter of seconds—in part because the initial screener spends roughly half of the day carrying out other work responsibilities.

Figure 3. ODI's Annual and Average Daily Complaint Volume



Note: Calculation of average daily complaint volume assumes 236 working days per year.

Source: OIG analysis of complaint data in Artemis

According to the initial screener and our independent verification, about 10 percent of complaints are forwarded to advanced screeners for in-depth reviews,[26] leaving no assurance that the remaining 90 percent of complaints receive additional review.

In making determinations, the initial screener relies on his professional experience and judgment, as well as informal guidance and precedent. While he noted that ODI informally established certain complaint categories that automatically warrant further analysis—including most air bag non-deployments and seatbelt issues—ODI lacks formal guidance for initial screening. The initial screener further noted that he prioritizes incidents that occur suddenly, with little warning for the consumer, but assigns lower priority to engine, transmission, and vehicle body issues and generally does not forward certain incidents that most likely do not lead to investigations, such as sharp door edges. The initial screener also does not forward complaints he believes are covered by existing recalls.

ODI's process for initially screening consumer complaints leaves the office vulnerable to a single point of failure and the risk that complaints with potential safety significance may not be selected for further review.

Like the initial screener, ODI's eight advanced screeners have access to a variety of data sources—such as technical service bulletins and special crash investigation reports—and have the authority to reach out to consumers and perform field inspections to augment their research. However, three advanced screeners told us that they rely mainly on consumer complaints to identify safety concerns, and four advanced screeners said they only occasionally use other sources of data. While screeners are encouraged to query all complaints for issues in their areas of concentration, four screeners told us they do not consistently do this—in some cases because it takes too much time. Advanced screeners also have access to early warning reporting data; however, four advanced screeners told us that they are less likely to rely on these data because they are untimely. Two screeners were also concerned about the early warning reporting data's lack of usefulness because they felt the data provided no significant additional detail.

In 2013, ODI began requiring advanced screeners to annotate the complaints they review by documenting the condition that led to the incident and their reasons for deciding not to pursue potential issues. According to the Defects Assessment Division Chief, the annotations are intended to identify and correct inconsistencies and inaccuracies in complaints—and thereby enable ODI to properly link them to relevant safety concerns—and provide a record of review. However, an ODI internal audit found that roughly half the complaints were incorrectly annotated or

[26] We independently verified that, in 1 week of review, the initial screener forwarded about 10 percent of complaints to advanced screeners.

lacked critical information. Additionally, we analyzed annotations for complaints received in the fourth quarter of 2013 and found that about 57 percent of the complaints that screeners determined did not warrant further review lacked justifications. Advanced screeners told us that annotating complaints is time consuming.

ODI's Pre-Investigation Staff Lack the Training and Supervision To Effectively Analyze Vehicle Safety Data

While NHTSA has a training plan, it has not been implemented effectively. As a result, ODI staff who review early warning reporting data and consumer complaints lack adequate training to carry out their responsibilities. For example:

- ODI staff charged with interpreting statistical test results for early warning reporting data told us they have no training or background in statistics. Three screeners assigned to analyze air bag incidents lacked training in air bags. One screener who was originally hired to review child seat restraint issues was assigned in 2008 to review air bag issues—without any air bag training and without an engineering or automotive background.

- Screeners told us that training to maintain professional certifications—such as the Automotive Service Excellence certification for automotive mechanics—must be completed on their own time and generally at their own expense.

- Screeners also noted that ODI lacked the funding to allow them to attend training to stay abreast of the latest developments in vehicle technology.

Further, ODI has not established an adequate supervisory review process to evaluate the quality of screeners' work in identifying potential safety issues. Except for reviews of final investigation proposals, we found no documentation of supervisory review. In addition, ODI staff told us that their data analysis and screening efforts were generally not reviewed and that they received little feedback on the quality of their work.

For example, the Defects Assessment Division Chief characterized his oversight of the initial complaint screener's work as "minimal" and acknowledged that he does not provide much guidance to the initial screener. Instead, ODI relies on the screener's years of experience and professional judgment to identify complaints warranting further analysis. Advanced screeners also told us that supervisory review is often informal and that the Defects Assessment Division Chief does not regularly review their complaint annotations.

Inadequate training and supervisory review have led to deficient analyses of early warning reporting and complaint data. For example, the developer of one

statistical test that ODI uses to analyze early warning reporting data stated that the test should produce the same results every time for the same data input in the same order. However, ODI staff told us that different test runs produce different results, and management has not considered this to be a problem.

ODI Staff Overlooked Documentation Pointing to the GM Ignition Switch Defect

NHTSA staff and contractors reviewed non-dealer field reports that described the GM ignition switch defect, and reviewed death and injury and special crash investigation reports that explicitly linked the ignition switch defect and air bag non-deployments. However, ODI staff missed opportunities to connect the ignition switch defect to air bag non-deployments because they did not consider all available information.

For example, in 2007, two ODI employees reviewed the underlying documentation for a death and injury report on a fatal accident involving a 2005 Chevrolet Cobalt, which contained evidence that linked the ignition switch defect to the vehicle's air bag non-deployment. However, neither employee—an early warning reporting analyst and an ODI air bag investigator—made this connection during their analyses of the documentation. The death and injury report documentation specifically included:

- A Wisconsin State Trooper's report that identified the ignition switch defect as a possible cause of air bag non-deployment during the accident. However, the two ODI staff who reviewed the report did not note this finding when documenting their reviews of the report.

- Event data recorder data[27] showed the vehicle's power mode status had been in the "accessory" position during the accident—a key indicator of the ignition switch defect. However, the ODI analyst reviewing this report did not include this information in his annotation. The air bag investigator noted this information in his review but ultimately concluded that the air bag non-deployment was caused by the long delay between the first and final impacts.

A NHTSA special crash investigation report on the same fatal accident also suggested a link between the ignition switch defect and air bag non-deployments. Specifically, the report concluded that the vehicle's air bags failed to deploy possibly due to "power loss due to movement of the ignition switch just prior to the impact," among other potential reasons. NHTSA's special crash investigation

[27] An event data recorder is a device installed in a vehicle to record technical vehicle and occupant information for a brief period of time (seconds, not minutes) before, during, and after a crash.

staff told us that they submitted their report to ODI for review in April 2007. However, ODI told us its staff did not review the report.[28]

Between the second quarter of 2012 and the fourth quarter of 2013, ODI received 13 non-dealer field reports on the 2005 to 2010 Chevrolet Cobalts that GM categorized as air bag-related and that we determined may be related to the ignition switch defect.[29] However, ODI staff reviewed only one of these non-dealer field reports before the February 2014 recall. According to ODI staff, they did not review the majority of these reports because in the second quarter of 2012, GM began using a new file format for most of their document submissions (.docx), which could not be read by the statistical test ODI uses to analyze these reports.[30] ODI staff acknowledged that they did not notice the reports were not analyzed until after the recall.

In addition to the non-dealer reports, ODI received 9,266 consumer complaints between January 1, 2003, and February 7, 2014, that involved GM vehicles subject to the ignition switch recall. Because ODI's screeners were not required to annotate their reviews of complaints until 2013, ODI cannot establish a full picture of why it did not investigate complaints related to the GM ignition switch and air bag non-deployment issues prior to 2013. From the time that the annotations were required to the date of the recall, ODI received 926 consumer complaints involving the recalled vehicles. ODI's initial screener advanced 27—or 3 percent—of these complaints for further review, compared to the average of 10 percent that are typically forwarded. ODI's advanced screeners noted in their annotations that 11 of the 27 complaints included allegations of front air bag non-deployment, but they did not advance these complaints for further consideration because they concluded there was either "no actionable trend indicated" or "minimal hazard." ODI staff did not thoroughly understand when air bags were supposed to deploy in these vehicles, which prevented them from linking the ignition switch defect to the air bag non-deployment. This may be explained by ODI staff's acknowledged lack of training on air bags.

ODI prepared three investigation proposals for the Chevrolet Cobalt and Saturn Ion about loss of electric power steering and air bag non-deployment. Each proposal was supported by early warning reporting referrals identifying these

[28] Artemis records for the GM air bag non-deployment issue contain a preliminary version of the special crash investigation report (IN-06-033) completed in December 2006. According to the preliminary report, evidence showed that the ignition switch was in the "accessory" position at the time of the crash and that the contractor was "continuing its investigation into this aspect of the crash."

[29] To determine which non-dealer field reports were related to the ignition switch recall, we limited this analysis to vehicle models, model years, facts, and circumstances that would make an incident eligible for compensation through the GM ignition switch compensation fund.

[30] ODI's written instructions to vehicle manufacturers for submitting early warning reporting documents specify seven acceptable electronic file formats (including .doc and .html), but .docx is not one of those specified. Docx is the Microsoft Office extensible markup language file format.

potential safety concerns. However, ODI staff did not establish the ignition switch defect as a potential root cause for these issues. For example, in September 2007, an ODI screener submitted an investigation proposal on front air bag non-deployment in the 2005 and 2006 Chevrolet Cobalt and the 2003 through 2005 Saturn Ion. The proposal attributed 4 fatalities, 11 injuries, and 29 crashes to the potential safety defect, and it explained that "driver and passenger side frontal air bags fail to deploy during crash events where [data] suggest the air bags should have deployed." However, the proposal did not link the air bag non-deployment to the ignition switch defect, even though proposal documentation included an interview with a vehicle owner who mentioned the special crash investigation report that identified the position of the ignition switch as a possible cause of the air bag non-deployments. ODI officials told us that they did not understand the safety consequences of the ignition switch defect before the GM recall.

ODI INITIATES INVESTIGATIONS WITHOUT ASSURANCE THE MOST SIGNIFICANT SAFETY DEFECTS ARE TARGETED

ODI lacks the procedures needed to effectively identify safety defects that warrant an investigation. Specifically, ODI has not developed guidance for applying the factors it established for opening an investigation. In addition, the factors that influence ODI's decisions on whether to open an investigation are not transparent, and it is unclear who is accountable for these decisions. This was the case with ODI's decision not to investigate the GM air bag non-deployment defect.

ODI Lacks Consensus and Detailed Guidance on the Amount and Type of Information Needed To Open Investigations

According to ODI's Defects Assessment Division Chief, ODI considers three factors when proposing a vehicle safety defect investigation: (1) rate of consumer complaints,[31] (2) severity of the potential safety issue, and (3) identification of a potentially defective vehicle component or root cause. However, ODI has not developed specific guidance on how screeners should apply these factors, and there is a lack of consensus among ODI leadership on the factors necessary to open an investigation—leaving screeners uncertain about how much support is needed to propose an investigation.

Attorneys in NHTSA's Office of Chief Counsel state that while NHTSA must establish severity for all cases, it can establish either frequency or root cause to force a manufacturer to initiate a recall. However, according to ODI's Defects Assessment Division Chief, all three factors should be met before proposing an investigation. Specifically, the Defects Assessment Division Chief expects

[31] The rate of complaints is the number of relevant complaints received by NHTSA divided by the number of vehicles in production.

advanced screeners to find the root cause in order to build a compelling proposal for an investigation, but the Director of ODI does not think the root cause is necessary and prefers screeners to focus on establishing the safety consequences of a potential defect. ODI's two investigative chiefs agree that establishing a pattern of safety concerns is more important than identifying root cause.

The Director of ODI can also unilaterally decide not to open an investigation after discussion with Defects Assessment Panel participants. For example, the Director of ODI decided not to pursue the following investigative proposals after concluding that they presented minimal hazards:

- In June 2014, an advanced screener proposed an investigation of 2007 to 2011 vehicles that suddenly lost steering power assist. The proposal established the rate of complaints (over 1,000 as of November 2014), severity of the issue (increased crash risk), and the defective component (steering pump and/or steering gear). The vehicle manufacturer had issued an extended warranty to cover the defect, but ODI did not verify whether the warranty adequately addressed the issue.

- In July 2014, an advanced screener proposed an investigation of 2012 model vehicles that experienced intermittent loss of electrical power. In the proposal phase, ODI established the rate of complaints (over 46 complaints), severity of the issue, and the defective component.

Without specific guidance on the amount and type of information needed to launch an investigation, screeners largely rely on precedent and professional judgment to determine which issues merit investigation. One screener told us he uses his "gut feeling" when reviewing complaints to gauge the "appetite" of the office for specific issues. Another screener told us he only proposes investigations that have the greatest chance of being selected to avoid the extra work of proposing investigations that are ultimately denied. Three screeners said they are hesitant to propose investigations if similar proposals have been rejected in the past. For example:

- In October 2012, a screener proposed an investigation of a 2002 and 2003 model vehicle for subframe rust. The severe corrosion allegedly caused the wheels to collapse, potentially resulting in loss of driver control. According to the initial screener, ODI officials were opposed to investigating these vehicles because of their age. As a result, the initial screener told us that he now hesitates to advance similar issues in older vehicles because of the skepticism this proposal met.

- A screener told us he did not propose an investigation of a safety defect that caused a vehicle's hood to fly open while driving because previous proposals on hood latch issues did not lead to investigations.

In general, ODI officials prefer to open investigations that are most likely to result in a manufacturer recall—an assertion echoed by four of the eight screeners we spoke with. In 2011 and 2012—the most recent years for which ODI has actionable data—about 70 percent of the investigations eventually resulted in recalls. According to an ODI investigative division chief, repeatedly opening investigations that do not result in a recall could cause ODI to lose credibility with manufacturers. However, ODI's focus on issues most likely to result in recalls creates the potential for missed opportunities to investigate issues that have serious safety implications. For example:

- In June 2013, an advanced screener proposed an investigation of headlamp outages on 2003 to 2005 vehicles. Although the proposal cited about 400 complaints, ODI declined to open an investigation due in part to concerns that it would not lead to a recall.

- In October 2014, ODI decided not to open an investigation of a vehicle's faulty brake lights due to an investigative division chief's concerns that the issue may be covered by an existing recall—even though an advanced screener had noted prior to the meeting that they did not believe this issue was covered by a recall.

Targeting potential safety defects that most likely lead to recalls blurs the line between pre-investigative and investigative duties. According to the Defects Assessment Division Chief, ODI relies heavily on the pre-investigative phase because of the resources needed to conduct investigations. However, it is unclear whether screeners have access to the data needed to prompt an investigation, such as manufacturer data. While NHTSA's Office of Chief Counsel stated that ODI may compel information from manufacturers during the pre-investigative stage, the Defects Assessment Division Chief told us they generally do not compel this information without first launching an investigation. Regardless, three screeners were unaware that their division has the authority to compel information from manufacturers without launching an investigation.

Additionally, considerable investigative duties—such as research and engineering analysis work—are being performed in the pre-investigative phase, often by screeners who are not adequately trained and may not have access to complete information. For example:

- One screener told us he attempted to identify the cause of a potential safety defect by freezing a brake component to assess the impact of ice buildup on the component.

- Another screener told us he could not detect any exhaust odor in a vehicle when subsequent work by investigative staff found that the carbon monoxide level reached Consumer Product Safety Commission thresholds for noticeable headache, fatigue, and nausea, and exceeded Occupational Safety and Health Administration standards if exposure exceeded 8 hours.[32]

- Three advanced screeners assigned to analyze air bag incidents lacked training in air bags.

ODI relies on screeners, who are not provided adequate training, to conduct technical research and testing before opening investigations. This may result in potential safety defects being overlooked. In addition, these added duties take time away from the advanced screeners' primary duty of screening safety data, resulting in backlogs of those data.

ODI's Investigation Decision Process Lacks Transparency and Accountability

In ODI's investigation decision process, the Defects Assessment Chief provides a list of proposals to ODI's investigative division chiefs—along with supporting documentation, such as consumer complaints and warranty claims. The division chiefs review the proposals and decide whether to open an investigation, decline to investigate, or send the proposal to ODI's Defects Assessment Panel for further review.[33] According to ODI's written policy, division chiefs have 2 weeks to complete their review. However, the investigative division chiefs consider the 2-week requirement to be a suggested timeframe that should be balanced against other competing priorities.

Untimely proceedings by the Defects Assessment Panel have delayed investigation decisions. During a 9-month period we reviewed, the panel conducted five meetings. The panel often reschedules meetings and according to some screeners, the meetings tend to be pro forma. For example, one screener stated the meetings focus on the reasons for not opening an investigation rather than reasons for opening one; another called the meetings "dog and pony shows." The panel also repeatedly delays decisions on proposals to obtain additional information. For example:

- In August 2014, the panel reviewed a proposal to investigate a side air bag non-deployment that resulted in a fatality. At that meeting, the Director of ODI, who sits on the panel, requested additional information. By October, the manufacturer had responded to ODI's questions, but an investigative division

[32] The investigation proposal for this potential safety defect is currently pending further review.
[33] The Defects Assessment Panel is a body chaired by the Director of ODI that is intended to meet monthly to review investigation proposals and decide whether to open an investigation.

chief requested that an investigation not be opened until his team had completed an on-site inspection of the vehicle involved in the accident. As of the most recent panel meeting in February 2015—5 months after the panel first reviewed the potential defect—a decision to investigate this issue remains pending.

- In January 2014, the panel discussed a proposal on a vehicle's steering failure. However, the panel has delayed the decision whether to investigate this issue for over a year—despite a recommendation from the investigative division to open an investigation.

In addition to delays, ODI's decisions are not transparent. Of the 56 investigation proposals for light vehicle safety defects in 2013, 32 were not investigated—18 of which lacked documented justifications for not investigating. While the panel may provide a reason for declining an investigation, such as "minimal hazard," it does not document the evidence that supports its decision. In addition, a proposal may be rejected by investigation divisions, which do not always document reasons for declining to investigate. Lack of transparency exacerbates the problems created by reliance on precedent because screeners do not learn what management deems worthy of investigation.

Transparency and accountability are especially critical since ODI generally does not revisit proposals once they are declined for investigation. Screeners told us that there is a need for ever increasing numbers of incidents to consider reopening previously rejected investigative proposals. While ODI lists declined proposals in Artemis as being "monitored," it does not track who monitors these issues. Four of the eight advanced screeners noted that they consider monitored proposals to be essentially denied and rarely resubmit proposals unless there is a new angle or "smoking gun." One screener said resubmitting a proposal is like "beating a dead horse."

ODI Did Not Investigate or Adequately Monitor the GM Air Bag Non-Deployment or Ignition Switch Issues

At a November 2007 Defects Assessment Panel meeting, ODI management and staff discussed a proposal to investigate frontal air bag non-deployments related to the Chevrolet Cobalt and Saturn Ion. ODI ultimately declined the proposal but did not document the justification for doing so. According to ODI staff, the decision not to investigate was based on a flawed understanding of air bag technology. Specifically, the Defects Assessment Panel believed the air bags did not deploy because the drivers were not wearing their seatbelts and because the vehicles left

the road during the accidents.[34] At the same panel meeting, an ODI air bag investigator advocated against opening an investigation because he had concluded, based on his analysis of complaints, that the rate of air bag non-deployment complaints for the Cobalt and Ion was similar to that of peer vehicles.

According to ODI staff who attended the 2007 panel meeting, the Defects Assessment Panel had requested that the potential safety defect be monitored to identify future air bag non-deployments occurring on the road, where air bag deployment would be expected. In addition, NHTSA's Associate Administrator for Enforcement, who did not attend the panel discussion, told the Director of ODI and the Defects Assessment Division Chief that "given the reports of fatal crashes, this [investigation proposal] looks like one we want to jump on and learn as much as we can quickly." The ODI screener who prepared the investigation proposal was initially assigned to monitor the issue. However, the Defects Assessment Division Chief did not reassign that responsibility after the screener responsible for monitoring the issue left NHTSA in 2008.

ODI missed other opportunities to investigate the air bag non-deployment issue. For example, in April 2009, the Defects Assessment Division Chief requested a special crash investigation of a collision involving air bag non-deployment in a 2005 Chevrolet Cobalt. However, ODI did not follow up on the investigation's results, and the Defects Assessment Division Chief had no explanation for why ODI did not pursue the issue. Two ODI staff members reviewed the findings of the special crash investigation in February 2010, but neither reported the results of their reviews. The first, an investigator, told us he did not report the results because he was not responsible for screening safety issues. The second, an advanced screener, told us that while he does not recall reviewing the report, he would only have noted issues in his area of concentration: engine, power train, and speed control.

According to ODI officials, in 2010, an ODI screener suggested revisiting the 2007 investigation proposal on air bag non-deployments in the Chevrolet Cobalt because of new consumer complaints. However, after the air bag investigator updated his analysis of consumer complaints and identified a downward rate of complaints for the vehicles, the screener decided that the issue did not present enough of a safety trend to warrant renewing the investigation proposal.

While ODI identified air bag non-deployments as a potential safety issue, it did not identify or propose an investigation of the GM ignition switch issue.

[34] According to GM, frontal air bag deployment takes into consideration factors such as speed of the vehicle, severity and location of the impact, and rate of deceleration. Air bags are programmed not to deploy in non-accident circumstances, such as driving over potholes or rough terrain.

According to ODI staff, there were no discussions of the ignition switch defect prior to the February 2014 recall.

CONCLUSION

NHTSA administers highway safety and consumer programs intended to save lives, prevent injuries, and reduce economic losses resulting from motor vehicle crashes. NHTSA's ODI is charged with requiring manufacturers to recall vehicles with safety-related defects. However, weaknesses in ODI's training and supervision of pre-investigation staff and its processes for identifying potential safety concerns and initiating investigations, as evidenced by NHTSA's handling of the GM ignition switch defect, deter NHTSA from successfully meeting its mandate to help prevent crashes and their attendant costs, both human and financial.

RECOMMENDATIONS

To improve ODI's collection of vehicle safety data, we recommend the National Highway Traffic Safety Administrator take the following actions:

1. Develop and implement a method for assessing and improving the quality of early warning reporting data.
2. Issue guidance or best practices on the format and information that should be included in non-dealer field reports to improve consistency and usefulness.
3. Require manufacturers to develop and adhere to procedures for complying with early warning reporting requirements; and require ODI to review these procedures periodically.
4. Expand current data verification processes to assess manufacturers' compliance with regulations to submit complete and accurate early warning reporting data. At minimum, this process should assess how manufacturers assign vehicle codes to specific incidents and how they determine which incidents are reportable.
5. Develop and implement internal guidance that identifies when and how to use oversight tools to enforce manufacturers' compliance with early warning reporting data requirements.
6. Provide detailed and specific guidance to consumers on the information they should include in their complaints, as well as the records they should retain (such as police reports and photographs) in the event that ODI contacts them for more information.

To improve ODI's processes for screening and analyzing vehicle safety data, we recommend the National Highway Traffic Safety Administrator take the following actions:

7. Develop an approach that will determine which early warning reporting test scores provide statistically significant indications of potential safety defects.

8. Periodically assess the performance of the early warning reporting data tests using out-of-sample testing.

9. Institute periodic external expert reviews of the statistical tests used to analyze early warning reporting data to ensure that these methods are up-to-date and in keeping with best practices.

10. Implement a supervisory review process to ensure that all early warning reporting data are analyzed according to ODI policies and procedures.

11. Develop and implement a quality control process to help ensure complaints are reviewed thoroughly and within a specified timeframe.

12. Update standardized procedures for identifying, researching, and documenting safety defect trends that consider additional sources of information beyond consumer complaints, such as special crash investigation reports and early warning data.

13. Document supervisory review throughout the pre-investigative process including data screening.

14. Evaluate the training needed by pre-investigative staff to identify safety defect trends; and develop and implement a plan for meeting identified needs.

To promote a streamlined process for opening investigations of potential safety concerns, we recommend the National Highway Traffic Safety Administrator take the following actions:

15. Develop and implement guidance on the amount and type of information needed to determine whether a potential safety defect warrants an investigation proposal and investigation.

16. Develop a process for prioritizing, assigning responsibility, and establishing periodic reviews of potential safety defects that ODI determines should be monitored.

17. Document and establish procedures for enforcing timeframes for deciding whether to open investigations; and establish a process for documenting justifications for these decisions.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided NHTSA a copy of our report on April 30, 2015, and received its response—included in full in the appendix—on June 16, 2015. NHTSA concurred with our 17 recommendations, agreed to implement them as written, and provided appropriate target completion dates. Accordingly, we consider all recommendations resolved but open pending completion of the planned actions.

We appreciate the courtesies and cooperation of National Highway Traffic Safety Administration representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-1959 or Mitchell Behm, Assistant Inspector General for Surface Transportation Audits, at (202) 366-1995.

#

cc: DOT Audit Liaison, M-1
NHTSA Audit Liaison, NPO-330

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted our work from May 2014 through April 2015 in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform an audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence we obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The Secretary of Transportation requested that we assess NHTSA's procedures for collecting, analyzing, and managing vehicle safety data and determine whether information on ignition switch issues or non-deploying air bags was available to NHTSA but not used in the GM defect analysis. Our work examined information available to NHTSA prior to GM's 2014 recall announcement and did not assess whether GM fully disclosed information on the ignition switch issue to NHTSA. Specifically, we assessed ODI's procedures for (1) collecting vehicle safety data, (2) analyzing the data and identifying potential safety issues, and (3) determining which issues warrant further investigation. We also assessed how those procedures affected ODI's handling of issues related to the GM ignition switch recalls.

To assess ODI's procedures to collect and analyze safety-related vehicle defect data and determine which issues warrant further investigation, we reviewed relevant legislations and regulations, and ODI's early warning reporting and defect assessment procedures. To assess ODI's analyses of early warning reporting data, we reviewed the documents ODI provided and interviewed statistical experts, ODI staff responsible for conducting the statistical analyses, and ODI staff responsible for using the statistical test results to refer potential safety issues.

We reviewed data in Artemis (ODI's primary data repository), annotations for consumer complaints received during the last quarter of 2013, investigation proposals forwarded for review in 2013, special crash investigation reports, and documentation NHTSA provided for a congressional investigation of the GM recall. Our review was focused primarily on ODI's treatment of passenger cars and trucks and not on other vehicles, such as commercial trucks, busses, and motorcycles.

We interviewed the Director of ODI, Defects Assessment Division Chief, three investigative division chiefs, and a former Early Warning Division Chief. We interviewed all four Early Warning Division screeners and eight Defects Assessment Division screeners. We also observed the initial screener's screening of incoming consumer complaints. We interviewed special crash investigation personnel, Volpe staff, and external stakeholders—including Joan Claybrook, former NHTSA Administrator, and Clarence Ditlow, Executive Director of the

Center for Auto Safety, for their input on the pre-investigative process. Finally, we observed Defects Assessment Panels held from August 2014 through February 2015 to witness discussions of investigation proposals.

Exhibit A. Scope and Methodology

EXHIBIT B. ORGANIZATIONS AND EXPERTS CONTACTED

ODI's Contractors:

- BLF Technologies Inc.
- Volpe National Transportation Systems Center

Safety Advocates:

- Clarence Ditlow, Executive Director, the Center for Auto Safety
- Joan Claybrook, President Emeritus, Public Citizen

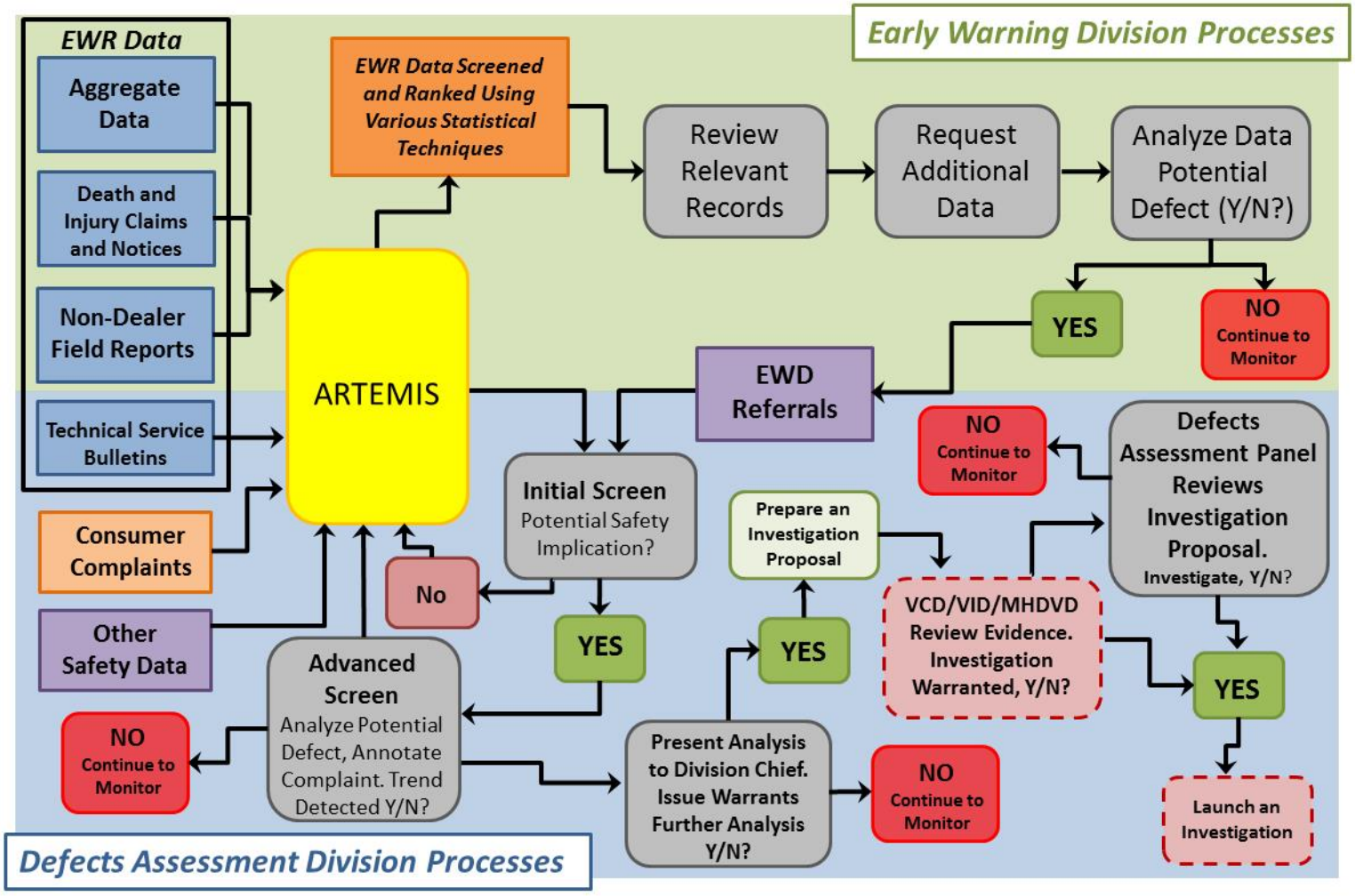
Experts in Statistical Analysis:

- Steve MacEachern, Ph.D., Professor, Ohio State University, Department of Statistics
- Peter Craigmile, Ph.D., Associate Professor, Ohio State University, Department of Statistics
- Lisa Goldberg, Ph.D., Adjunct Professor and Director of Research at the Center for Risk Management Research, University of California, Berkeley, Department of Statistics
- James Scott, Ph.D., Assistant Professor, University of Texas, Department of Statistics
- Bill Yerazunis, Ph.D., Mitsubishi Electric Research Laboratories (developer of CRM114, the algorithm underlying ODI's filter used to analyze non-dealer field reports)

Other Organizations:

- U.S. Consumer Product Safety Commission

EXHIBIT C. FLOWCHART OF ODI'S PRE-INVESTIGATIVE PROCESS



Source: OIG's analysis of ODI's pre-investigative processes

Exhibit C. Flowchart of ODI's Pre-Investigative Process

EXHIBIT D. EARLY WARNING REPORTING CODES

NHTSA regulations specify 33 codes that vehicle and equipment manufacturers must assign to early warning reporting data based on the vehicle systems, components, and conditions alleged to have contributed to the incident.

Codes for vehicles

1	Steering-01
2	Suspension-02
3	ServiceBrake-03
4	ServiceBrakeAir-04
5	ParkingBrake-05
6	EngAndEngCooling-06
7	FuelSys-07
8	FuelSysDiesel-08
9	FuelSysOther-09
10	PowerTrain-10
11	Electrical-11
12	ExtLighting-12
13	Visibility-13
14	Air bags-14
15	SeatBelts-15
16	Structure-16
17	Latch-17
18	SpeedControl-18
19	TiresRelated-19
20	Wheels-20
21	TrailerHitch-21
22	Seats-22
23	FireRelated-23
24	Rollover-24

Codes for child restraints

25	Buckle-51
26	SeatShell-52
27	Handle-53
28	Base-54

Codes for tires

29	Tread-71
30	SideWall-72
31	Bead-73

Codes for death and injury reports

32	Other-98
33	None-99

Source: ODI

EXHIBIT E. TIMELINE OF SELECT DATA NHTSA RECEIVED ON THE GM IGNITION SWITCH DEFECT AND RELATED ACTIONS

Data NHTSA Received

2003

MAY Consumer complaint that a 2003 Saturn Ion stalled on a highway, causing the steering column to lock, and that the vehicle had to be turned off and restarted to regain control.

SEPTEMBER Consumer complaint that a 2003 Ion engine shut off on three occasions—twice when the vehicle was traveling at 65 miles per hour—when the driver's knee hit the car keys.

2004

JANUARY Consumer complaint that a 2003 Ion's air bags failed to deploy in a frontal, on-road collision while traveling 60 miles per hour, injuring the driver.

MARCH Consumer complaint that a 2003 Ion's air bags did not deploy when it was travelling 45 miles per hour and rear-ended another vehicle.

NOVEMBER Consumer complaint that a 2003 Ion's air bags did not deploy during a frontal collision that resulted in injury and destroyed the vehicle.

DECEMBER Consumer complaint that a 2004 Ion's engine shut off when going over road bumps and that the dealer was not able to diagnose the problem.

2005

MARCH GM non-dealer field report that a 2005 Chevrolet Cobalt stalled on a highway when the driver's knee hit the key holder.

JUNE Copy of a consumer letter to GM's Customer Service Department describing a 2005 Cobalt that stalled on three occasions, stating that a Chevrolet dealer gave her a GM bulletin on the problem and that the dealer's service manager turned the ignition switch when he hit the keychain with his knee.

SEPTEMBER Consumer complaint that a 2005 Cobalt's "ignition shuts off while driving."

NOVEMBER Consumer complaint that a 2005 Cobalt "has a defective ignition switch" and that the dealer removed a key from the key chain and advised the owner to "watch his knee position while driving."

DECEMBER Consumer complaint on a 2005 Cobalt that "on three occasions, simply brushing the key chain...was enough to turn the car off" and that the vehicle dealer was not able to address this concern.

NHTSA Actions

AUGUST *NHTSA launches a special crash investigation of a July 2005 fatal crash involving a 2005 Cobalt. The air bags did not deploy, and the ignition switch was in the "accessory" position. According to ODI staff, they were invited to participate in the on-site inspection.*

Exhibit E. Timeline of Select Data NHTSA Received on the GM Ignition Switch Defect and Related Actions

Data NHTSA Received

NHTSA Actions

2006

APRIL GM documentation on a July 2005 fatal accident involving a 2005 Cobalt showing that the air bags did not deploy and the ignition switch was in the "accessory" position, and including a letter from an attorney representing the deceased's family, stating that experts who examined the vehicle and data concluded that the air bags should have deployed.

NOVEMBER Consumer complaint that a 2005 Ion's air bags did not deploy during a frontal accident, injuring the driver, who wore a seatbelt.

NOVEMBER Consumer complaint that a 2005 Cobalt's air bags did not deploy during a frontal accident, killing two and injuring one.

2007

FEBRUARY October 2006 GM technical service bulletin is uploaded to Artemis. The bulletin describes inadvertent turning of the key cylinder and loss of electrical systems; it applied to vehicles that would be subject to GM's ignition switch recall.

MAY GM non-dealer field report describing ignition switch defect in a 2006 Pontiac Solstice: The "vehicle ignition system turns off when my knee hits the accessories attached to the key ring...I have turned the car off several times while driving."

SEPTEMBER Consumer complaint that a 2005 Cobalt shut off while driving, along with Chevrolet dealership service records showing that the dealership diagnosed the ignition switch as the cause of the problem.

NOVEMBER Consumer complaint that a 2006 Chevrolet HHR "turns itself off" when going over road bumps.

DECEMBER Consumer complaint that a 2006 Cobalt's air bags did not deploy during an on-road frontal accident, injuring the driver.

DECEMBER Consumer complaint that a 2006 Cobalt's air bags did not deploy in an accident that destroyed the vehicle, asserting that a collision mechanic said the air bags should have deployed and that GM could not explain why the air bags failed. (Second complaint on this incident.)

MARCH *An analyst submits an early warning referral on an air bag non-deployment trend in Cobalts. According to ODI staff, they met with GM officials to discuss the issue but did not request GM to follow up.*

APRIL *A special crash investigation report concludes it is possible that a 2005 Cobalt's air bags did not deploy in a fatal accident due to the ignition switch position.*

NOVEMBER *A Defects Assessment Panel decides not to investigate front air bag non-deployments in Cobalts and Ions; the panel's reasoning is not documented.*

NOVEMBER *Reports of fatalities prompt NHTSA's Associate Administrator for Enforcement to request a follow up on Cobalt and Ion air bag non-deployments.*

NOVEMBER *An air bag investigator reviews GM documentation for a fatal incident involving a 2005 Cobalt. The documentation links the ignition switch defect and air bag non-deployment, but the investigator concludes that delay between the first and final impacts caused the non-deployment.*

2008

JANUARY Consumer complaint that a 2004 Ion's air bags and seatbelt pre-tensioner did not deploy during a frontal crash, injuring the driver.

OCTOBER Consumer complaint that a 2007 Chevrolet HHR stalls, and in one instance, while crossing train tracks.

DECEMBER Consumer complaint that a 2006 Ion's air bags did not deploy in a high-speed frontal crash, injuring the driver and passenger.

JANUARY *The air bag investigator submits his analysis of the fatal incident involving a 2005 Chevrolet Cobalt to the Defects Assessment Division and Early Warning Division Chiefs.*

Exhibit E. Timeline of Select Data NHTSA Received on the GM Ignition Switch Defect and Related Actions

Data NHTSA Received		*NHTSA Actions*
	2009	
OCTOBER Consumer complaint that a 2006 Chevrolet HHR stalled three times in 6 months when driving over potholes or bumps in the road and that the dealership was not able to determine why the vehicle stalled.		***APRIL*** *NHTSA launches a special crash investigation of an April 2009 fatal crash involving a 2005 Cobalt. The air bags did not deploy, and the ignition switch was in the "accessory" position. ODI learns of the incident but does not follow up.*
OCTOBER Consumer complaint that a 2006 Cobalt stalled four times in 3 months and that the dealership was not able to replicate or fix the problem.		
DECEMBER Consumer complaint that a 2008 Chevrolet HHR's air bags did not deploy in a frontal collision, injuring the driver.		
	2010	
MARCH Consumer complaint that a 2008 Pontiac G5's air bags did not deploy after the driver lost control and crashed into a guard rail, injuring and hospitalizing three passengers.		***FEBRUARY*** *Two ODI staff members review the findings of the special crash investigation report on the April 2009 incident, but neither report the results of their reviews.*
MARCH Consumer complaint that a 2006 Ion stalled and lost electrical systems, steering, and brakes after hitting a bump, requiring the driver to "force" the car to the side of the road to restart it.		***FEBRUARY*** *New complaints prompt a screener to revisit an August 2007 investigation proposal on air bag non-deployments in Cobalts and Ions. He ultimately decides not to resubmit the proposal because an air bag investigator identified a downward trend in the rate of air bag-related complaints for the vehicles.*
JULY Consumer complaint that a 2005 Cobalt stalls regularly while driving and that the dealership was not able to identify the cause of the problem.		
OCTOBER Consumer complaint that a 2006 Cobalt's air bags did not deploy in a frontal accident, injuring the driver.		
	2011	
APRIL Consumer complaint that a 2005 Cobalt's air bags did not deploy in a frontal accident, injuring the driver.		***MAY*** *ODI's early warning reporting analysis of 22 vehicles finds relatively high numbers of injury and death incidents attributed to air bags in the 2005 to 2010 Cobalts. The Cobalt ranked 15th in consumer complaints, but ranked 4th for early warning reporting of deaths and 2nd for injuries.*
JULY Consumer complaint that a 2007 Chevrolet HHR's air bags did not deploy in a frontal accident, injuring the driver, and noted that a GM investigator inspected the vehicle after the accident.		
NOVEMBER Consumer complaint that a 2006 Cobalt's air bags did not deploy in a frontal accident, injuring the driver.		
DECEMBER Consumer complaint that a 2007 Ion lost all power and "shut itself down" on multiple occasions while the car was being driven.		
	2012	
MARCH Consumer complaint that a 2007 Cobalt's air bags did not deploy after it crashed into another vehicle, injuring the driver.		***MARCH*** *A screener reviews a March 2012 complaint about air bag non-deployment in a 2007 Cobalt and concludes "no actionable trend indicated" and "no further action required at this time." The screener did not document the justification for this conclusion.*
MARCH Consumer complaint that a 2005 Cobalt had shut off multiple times when driving over a speed bump or pothole.		
APRIL Consumer complaint that a 2005 Cobalt lost power sporadically while being driven.		
MAY Consumer complaint that a 2006 Chevrolet HHR stalled and lost power on a ramp, causing the driver to lose control and hit the curb.		

Exhibit E. Timeline of Select Data NHTSA Received on the GM Ignition Switch Defect and Related Actions

Data NHTSA Received

NHTSA Actions

2013

FEBRUARY Consumer complaint that a 2006 Ion's air bags did not deploy during a frontal collision with a pole, severely injuring the driver and passenger.

FEBRUARY Consumer complaint that a 2006 Cobalt's air bags did not deploy in a crash with another car and that the driver hit his head on the steering wheel.

JUNE Consumer complaint that a 2005 Ion's air bags did not deploy in a crash with another car and that the driver hit his head on the steering wheel.

JULY Consumer complaint that a 2007 Ion's air bags did not deploy in a crash with another vehicle and that the driver fractured an eye socket.

JULY *A screener reviews a June 2013 complaint about air bag non-deployment in a 2005 Ion and concludes "no actionable trend indicated" and "no action at this time." The screener did not document the justification for this conclusion.*

AUGUST *A screener reviews a July 2013 complaint about air bag non-deployment in a 2007 Ion and concludes "no actionable trend indicated" and "no action at this time." The screener did not document the justification for this conclusion.*

2014

FEBRUARY GM notifies NHTSA that it is conducting a safety recall for the ignition switch of certain 2005 to 2007 Cobalts and 2007 Pontiac G5 vehicles; two and a half weeks later, GM revises the recall to include the 2003 to 2007 Ion, 2006 to 2007 Chevrolet HHR and Pontiac Solstice, and 2007 Saturn Sky.

MARCH GM notifies NHTSA that it is again expanding the scope of the recall to include the 2008 to 2010 Cobalt, 2008 to 2011 Chevrolet HHR, 2008 to 2010 Pontiac Solstice, 2008 to 2010 Pontiac G5, and 2008 to 2010 Saturn Sky.

Exhibit E. Timeline of Select Data NHTSA Received on the GM Ignition Switch Defect and Related Actions

EXHIBIT F. MAJOR CONTRIBUTORS TO THIS REPORT

Name	Title
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APPENDIX. AGENCY COMMENTS

Memorandum

U.S. Department of Transportation

National Highway Traffic Safety Administration

Subject: INFORMATION: Management Comments – Office of Inspector General (OIG) Draft Report on NHTSA's Efforts To Identify and Investigate Vehicle Safety Concerns

Date: June 16, 2015

From: Mark R. Rosekind, Ph.D.
Administrator, National Highway Traffic Safety Administration

To: Mitchell Behm
Assistant Inspector General for Surface Transportation Audits

The National Highway Traffic Safety Administration (NHTSA) Office of Defects Investigation (ODI) leads the world in protecting the driving public from vehicle safety defects. Over the last decade alone, ODI has conducted 1,060 defect investigations, resulting in 1,889 recalls, involving more than 129 million vehicles and items of equipment. During this time, the ODI staff of 8 defect screeners, 4 early warning data analysts, and 16 investigators received 1,617,245 different records reflecting the 265 million vehicles on U.S. roadways.

Efforts to enhance safety never end and examining lessons learned is critical to improving NHTSA's effectiveness in pursuing the agency's vital mission. After General Motors (GM) submitted its defect notice on the first ignition switch recall in 2014, NHTSA (with assistance from the Department of Transportation's Office of the General Counsel) initiated its own due diligence review. This review led to the development of two documents: 1) *NHTSA's Path Forward* is a critical look at the GM ignition switch defect issue, and outlines process improvements that go beyond this specific recall; and 2) NHTSA's *Workforce Assessment: The Future of NHTSA's Defect Investigations* identifies staffing and training needs for both near and long term enhancements.

Based on ongoing efforts to enhance NHTSA and ODI effectiveness, as well as the most recent examination of lessons learned in the GM ignition switch recall, improvements have already been instituted in pre-investigative, investigation, and recall completion processes. NHTSA also concurs with OIG's 17 recommendations, as written and will aggressively implement them (see chart on page 3). Additionally, extensive changes have already been implemented with many others underway or planned. Here are examples of such actions:

- Tracking pre-investigative work in a dedicated case management system that connects data from various sources that concern each issue being evaluated.

- Maintaining detailed records of issues presented to a defects panel for an investigation decision, showing the panel's date, attendance, and disposition of each issue.
- Special Crash Investigations (SCI) staff is present at all defect panel meetings to ensure the discussion includes the latest crash investigation information (relevant to GM issue).
- Continuing to follow up on all Early Warning Reporting (EWR) reports involving fatal incidents and making improvements to its handling and documentation of these incidents.
- When necessary, NHTSA will send manufacturers pre-investigative notices when the potential severity is very high but there is insufficient evidence to open an investigation (relevant to GM issue).
- Use of a systems safety approach to look for possible relationships between a symptom in one vehicle system and a possible critical failure of another system and to consider possible defect theories that do not fit with previously-held assumptions (relevant to GM issue).
- Use of a detailed documentation checklist for investigations to ensure that all relevant documents are identified and stored in a consistent manner.
- A new training plan for staff, focused on the pre-investigative and investigative divisions, to gain proficiency in new automotive and investigative technologies.
- Working with NHTSA's Office of Vehicle Safety Research, ODI is increasing its interactions with manufacturers regarding the latest automotive technologies.
- To increase identification of potential defects in new safety technologies, ODI is developing standardized inquiries for screening and investigating data about those new systems.
- Increased contacts with government counterparts in foreign countries to enhance cooperation on common defect issues.
- Several improvements to increase ODI recall completion rates have been made, including:
  - Development of a consumer option to sign up for immediate email notification of new recalls.
  - Enhancement to recall notice envelopes to focus attention to their safety-critical nature.
  - Design of a Vehicle Identification Number (VIN) lookup website allowing consumers the ability to quickly determine whether their vehicle has an open recall.
  - Launching of smart phone mobile apps for consumers to receive recall notifications, file complaints, and lookup VINs.

In addition to the improvements already implemented, more are being developed, to include:

- Providing more clarity to manufacturers about the EWR requirements and assisting manufacturers as they implement best practices to comply.
- Determining a mechanism to obtain detailed audits of manufacturers' internal processes for finding defects.
- Creating ways for consumers to provide more complete information to the agency, including making it easy to upload supporting documentation to the complaint.
- Establishing a Safety System Team, a small group of outside safety experts, to help implement changes and recommendations from internal and external reports.
- Creating an internal risk identification and control team to ensure that pertinent changes are implemented and established for the long term.

Appendix. Agency Comments

- Continuing the development and use of the computerized Corporate Information Factory (CIF), business intelligence software that will allow screeners and investigators to identify and data-mine information across NHTSA's data sets by integrating multiple databases.
- Developing a CIF process to track SCI reports throughout the review process and quickly bring crash investigation reports changes to the attention of appropriate ODI staff.
- Developing and implementing internal controls that require the defect assessment panel to revisit an issue or open a formal investigation if certain criteria are met.

Below is a chart showing NHTSA's anticipated completion dates for the OIG recommendations.

Estimated Completion Date	**OIG Recommendation Number(s)**
September 30, 2015	6
October 30, 2015	13, 15
November 30, 2015	17
January 31, 2016	3*, 10
April 30, 2016	2, 5
May, 30, 2016	1*, 11, 14
June 30, 2016	4, 7, 8, 9, 12, 16

**Unless rulemaking is required*

NHTSA will pursue any efforts that can enhance the agency's effectiveness in achieving its safety mission and appreciates the opportunity to provide this input to the OIG draft report. Please contact Frank S. Borris, Director, Office of Defects Investigations, at (202) 366-8089 with any questions or additional details about these comments.