



U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: EA07-009

Date Opened: 7/10/2007

Date Closed: 8/28/2008

Principal Investigator: Ali Motamedamin

Subject: Fuel Pump Module Leaks Gasoline

Manufacturer: General Motors Corporation

Products: 2002-2004 GM 360/370 SUV's

Population: 1,244,889

Problem Description: Fuel and/or fuel vapors are leaking from the top of the fuel pump module.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	81	7	88
Crashes/Fires:	0	0	0
Injury Incidents:	0	0	0
# Injuries:	0	0	0
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other*:	0	206	206

*Description of Other: Warranty claims related to the alleged defect.

Action: This Engineering Analysis (EA) is Closed.

Engineer: Ali Motamedamin *AM*

Date: 8/28/2008

Div. Chief: Thomas Z. Cooper

Date: 8/28/2008

Office Dir.: Kathleen C. DeMeter

Date: 8/28/2008

Summary: During the course of this EA investigation, ODI observed that the majority of the complaints (88%) and warranty claims (94%) were reported for vehicles that are registered for use in the "salt belt" region of the US. This area includes 20 states in the Northeast, Mid-Atlantic and the Midwest regions and the District of Columbia.

Consumers in the salt belt region reported to ODI that they could smell fuel vapors in their vehicles while driving. Upon further examination of their vehicles, they discovered that fuel vapors were coming out of the top of the fuel tank.

This condition is caused by corrosion of the return and sender lines of the fuel pump module. Water and road salt collect on top of the fuel pump leading to small pinholes appearing on the fuel lines. Fuel may leak and collect on top of the module and/or spill onto the ground.

The data evaluated under this investigation reflect a relatively low frequency of occurrence which largely arises in salt belt states. GM has extended the warranty on the subject component to ten years or 120,000 miles.

Further use of agency resources does not appear to be warranted at this time; accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that no safety-related defect exists. The agency reserves the right to take further action if warranted by the circumstances.

BACKGROUND:

The National Highway Traffic Safety Administration's (NHTSA) investigation of fuel pump modules in several model and model year General Motors (GM) vehicles leaking gasoline began when Preliminary Evaluation (PE 07-013) was opened on March 12, 2007. This PE covered all model year (MY) 2002-2003 Chevrolet Trailblazer, Trailblazer EXT, GMC Envoy and Envoy XL vehicles (PE subject vehicles). Consumers alleged they detected an odor of gasoline while in the vehicle, and some alleged they saw a puddle or a stream of fuel underneath the vehicle. During the course of the EA investigation, ODI observed that the majority of the complaint and warranty data submitted to the agency seemed to be reported from an area of the United States in the north central and northeastern states where there are extensive applications of road salt in the winter (these are referred to as salt belt states). ODI also observed that the MY 2004 version of the subject vehicles, as well as other MY 2002-2004 GM vehicles (Oldsmobile Bravada, Isuzu Ascender, and the Buick Rainer), seemed to exhibit complaint and warranty data similar to the PE subject vehicles. The investigation was upgraded to an Engineering Analysis (EA07-009) on July 10, 2007. Later, the scope of the investigation was expanded to include all MY 2002-2004 Chevrolet Trailblazer, Trailblazer EXT, GMC Envoy, Envoy XL, Oldsmobile Bravada, Isuzu Ascender, and Buick Rainer vehicles.

VEHICLE POPULATION:

General Motors Corporation sold 1,244,889 subject vehicles in the United States. Of those, GM sold 645,240 vehicles in the "salt belt" region and 599,649 in the remaining regions of the United States.

DESCRIPTION OF COMPONENT OR VEHICLE SYSTEM:

The subject component is the fuel pump module, also called the modular reservoir assembly (MRA) (Figure 1). The MRA is installed into the top of the fuel tank. The top

of the MRA is exposed at the top of the tank and a ring gasket provides a seal between the top of the MRA and the top of the fuel tank. Two metal fuel lines (supply and return) emerge from the top of the MRA and are bent 90 degrees to the horizontal to connect to plastic fuel lines that supply fuel to the engine and return unused fuel (see Figure 2).



Figure 1: MRA Module



Figure 2: Metal Supply and Return Lines from top of MRA Flange

THE ALLEGED DEFECT:

The alleged defect is gasoline leaking from either or both of the MRA's metal supply and return lines.

Failure/Malfunction Modes

The primary cause of the MRA leaking gasoline is corrosion of the metal gasoline supply and return lines. The top of the MRA and metal fuel lines are exposed to outside elements, including water and, where applied, road salt. Also, the top of the MRA is slightly recessed into the vehicle's fuel tank shell and thus can hold standing water and salt. When the vehicle's engine is running, the fuel in the metal supply and return lines is

under pressure (the metal supply line fuel pressure can be as high as 68 pounds per square inch (psi) while the return line fuel pressure is generally under 5 psi). As corrosion progresses, the pressurized fuel can leak from the metal supply and return fuel lines, and puddles of fuel can form on the recessed top of the MRA and drip down the side of the fuel tank.

DESIGN, MATERIAL AND/OR PRODUCTION MODIFICATIONS:

There were several production modifications made to the MRA installed on MY 2005 and later subject vehicles:

- Redesigned MRA
- Changed MRA original equipment supplier
- Modified corrosion protection coating requirements
- Redesigned the fuel tank shell to allow water drainage away from the MRA
- Improved corrosion protection validation and testing

SERVICE BULLETINS:

GM did not issue any Technical Service Bulletins regarding the alleged defect in the subject component.

COMPLAINTS:

Problem Experience	Total US	Salt Belt	NY, OH, PA
Owner/Field Reports	88	77	63

WARRANTY:

The standard warranty coverage for the subject vehicles is three years or 36,000 miles, whichever occurs first. The vast majority, if not all, of the subject vehicles are currently

beyond standard warranty coverage. However, dealers may offer “goodwill” coverage beyond the normal warranty.

GM received 206 claims relating to the alleged defect in the subject component between March 2002 and March 2008 out of a population of 1,244,889 vehicles. Of these 206 claims, 193 came from owners of vehicles in salt belt states, while only 13 claims came from owners of vehicles outside of this area. Figure 4 shows the number of warranty claims from owners in salt belt states by report date. The chart also appears to show an overall continuity of repairs over time. The chart appears to show an increasing repair trend during the winter months, when most of the road salt is applied to roads. By contrast, Figure 5, which shows the number of claims from owners outside of the salt belt region from June 2003 to February 2008, appears to show no upward trend, seasonally or over time.

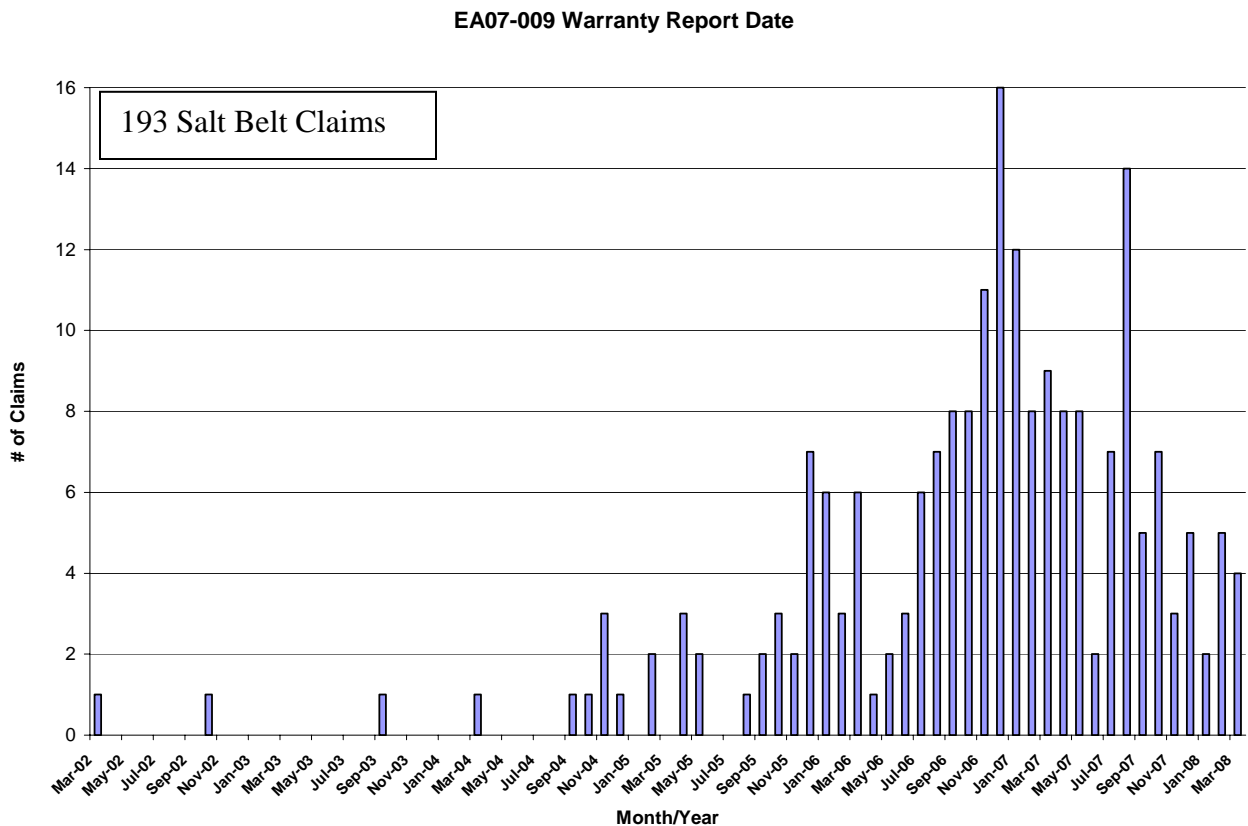


Figure 4: Warranty Claims Salt Belt by Report Date

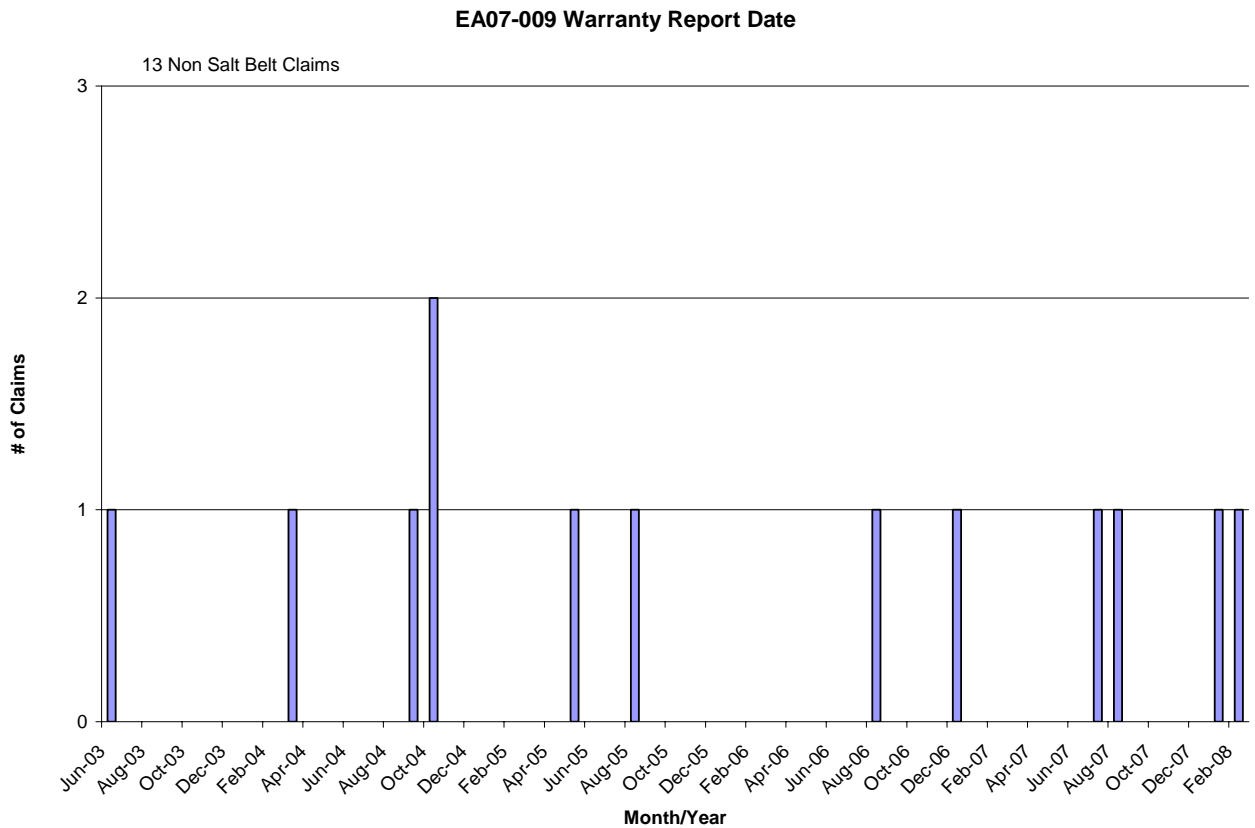


Figure 5: Warranty Claims Non Salt Belt by Report Date

VEHICLE TESTING

NHTSA's Vehicle Research and Test Center (VRTC), located in East Liberty, Ohio, assisted ODI by conducting a survey of owners of subject vehicles in the northeastern Ohio area, an area where vehicles are exposed to snow and road salt during winter months. VRTC mailed questionnaires to 2,001 registered owners of the subject vehicles (43 letters failed to reach the intended recipient and were returned by the United States Postal Service). The results of the survey are shown in Table 1.

Table 1

	Number	Percent (of the Surveys Not Returned to Sender)
Mailed	2,001	
Not Returned to Sender	1,958	100%
Replies	402	20.5%
Visible Leak	32	1.6%
Odor	72	3.7%
Replaced MRA	31	1.58%

VRTC acquired and examined five MRA's from owners who responded to the survey. Of the five acquired MRA's, two were tested while still installed in the original vehicle. The other three MRA's were removed from their original vehicles and installed in a test vehicle. For all five tests, the fuel tank was detached from the vehicle frame and lowered so the MRA could be observed during operation. The test results of the two MRAs tested while installed in their original vehicle are listed below.

Vehicle D1299:

MY 2002

108,722 miles

After the vehicle was turned on, test personnel observed fuel leaking from the MRA and fuel began to drip liquid fuel down and around the fuel tank.

Vehicle A314:

2002 MY

108,890 miles

After the vehicle was turned on, test personnel observed fuel seeping out from the metal return line.

MANUFACTURER’S EVALUATION OF ALLEGED DEFECT:

According to GM, “Corrosion of fuel pump module flange is due to outside exposure above the tank. As the condition progresses, a small amount of fuel may seep out of the MRA and accumulate on the top of the fuel tank in the recessed cavity. Depending on driving maneuvers, the accumulated fuel may drip down the sides of the fuel tank to the ground. Fuel vapors can leak through openings as small as .005 inches. Fuel tank design and location relative to ignition sources were considered. No fires, injuries, crashes or property damage have been reported.” Additionally, GM states that “the exhaust system is located on the passenger side of the vehicle approximately 185mm from the fuel tank heat shield that is mounted to the fuel tank.”

GM SPECIAL COVERAGE PROGRAM

GM has informed the agency that it initiated an extended warranty for vehicles located in salt belt states and in the District of Columbia. The warranty covers corrosion of the MRA for 10 years or 120,000 miles, whichever occurs first.

ODI ANALYSIS:

Complaint and Warranty Data

Tables 2 and 3 show the total complaint count and rate (per 100,000 vehicles), respectively, by model year.

Table 2	Model Year Complaint Count			
Region	2002	2003	2004	Total
All US	48	35	5	88
Salt Belt	40	33	4	77

Table 3	Model Year Rate per 100,000 vehicles			
Region	2002	2003	2004	Total
All US	11	8	1	7
Salt Belt	17	15	2	12

Tables 4 and 5 show the warranty count and rate in percent, respectively, by model year.

Table 4	Model Year Warranty Count			
Region	2002	2003	2004	Total
All US	97	89	20	206
Salt Belt	92	83	18	193

Table 5	Model Year Warranty Percent			
Region	2002	2003	2004	Total
All US	0.02	0.02	0.004	0.02
Salt Belt	0.04	0.04	0.01	0.03

Complaint Trend

As shown in Figure 6, the majority of the complaints were reported between September 2006 and July 2008, the last month of data used in this report. The trend in complaints appears to be increasing. There are no indications from the data given to ODI that the increasing complaint trend is likely to reverse, especially since the underlying mechanism, corrosion, is a time dependent condition.

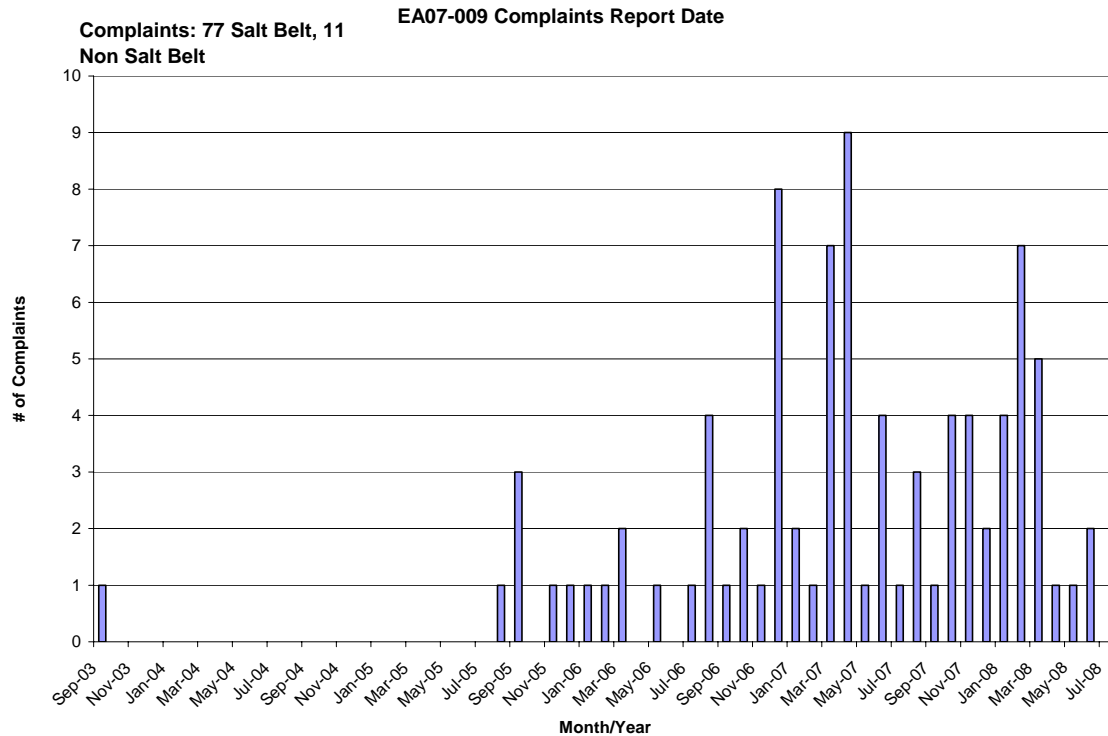


Figure 6: Reports by Month

Approximately eight of out every ten complaints reported to ODI originated from either New York, Ohio, or Pennsylvania. Further examination of the complaints in these three states revealed that the cities of origin for many of the complaints are adjacent to interstate highways. This suggests that the exposure during winter months to heavy amounts of road salt on interstate highways may accelerate the failure condition.

REASON FOR CLOSING:

Although leakage of fuel from a vehicle's fuel system often presents a risk of fire, the data evaluated under this investigation reflect a relatively low frequency of occurrence that largely arises in salt belt states. While not dispositive, we also note that GM has extended the warranty on the subject component to ten years/120,000 miles. Further use of agency resources does not appear to be warranted at this time; accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by

NHTSA that no safety-related defect exists. The agency reserves the right to take further action if warranted by the circumstances.