



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

ODI RESUME

Investigation: EA 04-004
Prompted By: RQ03-006
Date Opened: 02/03/2004 Date Closed: 07/29/2004
Principal Investigator: Bruce York-B
Subject: Refueling Spit Back

Manufacturer: KIA Motors America, Inc.
Products: 1998 - 2001 KIA Sephia And 2000 - 2001 KIA Spectra
Population: 245,409

Problem Description: During refueling, gasoline allegedly may spit back out of the fuel filler pipe onto the consumer.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	17	18	35
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	46	46

*Description of Other: Warranty claims involving fuel spit back.

Action: This engineering analysis has been closed.

Engineer: Bruce York *LB*
Div. Chief: Jeffrey L. Quandt
Office Dir.: Kathleen C. DeMeter

Date: 07/29/2004
Date: 07/29/2004
Date: 07/29/2004

Summary: Based on the low rate of fuel spit-back incidents (14.3 incidents per 100,000 vehicles sold), a low warranty claims rate of 0.02 percent, and the lack of engineering information that would support the presence of an engineering defect, a safety-related defect trend has not been identified and further use of agency resources does not appear to be warranted. 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.

For additional information, see the attached closing report.

ENGINEERING ANALYSIS CLOSING REPORT**SUBJECT:** Refueling Spit Back.**EA No:** EA04-004**Date Opened:** 03-Feb-04**Date Closed:** 29-Jul-04

BASIS: On June 27, 2000, KIA Motors Corporation notified ODI of a safety defect that could result in fuel spillback or fuel spitback from the fuel filler neck on approximately 100,137 model year (MY) 1998 through 1999 KIA Sephia vehicles (NHTSA Recall No. 00V-175, KIA Recall No. SC015). According to KIA, the Onboard Refueling Vapor Recovery (ORVR) valve installed from October 17, 1997 through May 16, 1999 may contain defects that could result in fuel spitback. KIA indicated that the defective valves could close during refueling prior to the tank reaching full as indicated by the fuel gauge. This induced the consumer to "re-click" the fuel nozzle to try and reach a full tank. When adding fuel after the first automatic shut off of the nozzle and before the fuel tank was full, fuel can spit back out of the filler pipe. Vehicles repaired under the recall received new ORVR valves.

On August 15, 2003, ODI opened a Recall Query (RQ03-006) to investigate allegations of 12 incidents of fuel spit back on MY 1998 through 2001 Sephia vehicles either manufactured after or having received the repairs of the 00V-175 recall. On February 3, 2004, RQ03-006 was upgraded to an Engineering Analysis, EA04-004, covering approximately 278,266 MY 1998 through 2001 KIA Sephia and Spectra vehicles. The upgrade was based on 29 reports of fuel spit back on vehicles that were not included in KIA's recall.

ALLEGED DEFECT: Any of the following symptoms or conditions: (1) fuel expulsion from the filler pipe port during or following attempted refueling of the vehicle; (2) difficulty refueling the vehicle due to frequent nozzle shut-offs; or (3) any pressure build-up in the tank.

SUBJECT VALVE DESCRIPTION: The subject ORVR control valve is a float type valve that is opened and closed by the level of fuel in the vehicle gas tank. The ORVR valve (Figure 1) is designed to limit the level of fuel that can be dispensed in to the gas tank as well as direct refueling vapors in the gas tank to the Carbon Canister when fuel is added. The ORVR valve is located inside the fuel tank.

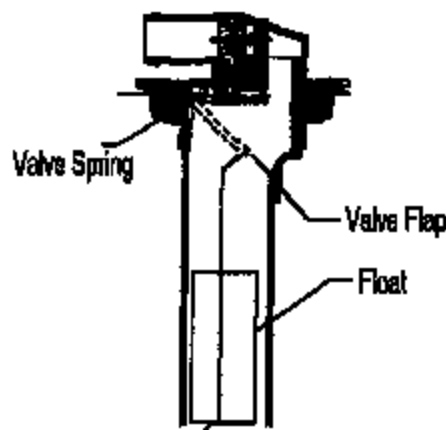


Figure 1. ORVR Control Valve Design

FAILURE MECHANISM: Three aspects of the design of the ORVR valve that control when the valve closes are related to the premature closing of the valve. These three aspects are the stiffness of the valve spring, the length of the rod attaching the float to the valve, and the angle of the valve flap at the closed position. If any one of these three aspects is not designed correctly, the valve can close prior to the tank being full and induce the consumer to continue to try and add fuel. Once the valve has reached the closed position, and more fuel is added, the additional fuel will be forced out the filler pipe.

CONTRIBUTING FACTORS: The factors contributing to the alleged defect are divided into two general categories: (1) design factors and (2) use factors. Both of these categories play a role in the fuel spitback issue.

Design factors. As discussed in the Failure Mechanism section of this document, three aspects of the ORVR valve design that can lead to a premature closing of the valve are the stiffness of the spring, the length of the float connecting rod, and the angle of the valve flap. In October 1997 during the first month of production of the 1998 MY Sephia, the ORVR valve manufacturer made design changes to the ORVR valve. The spring diameter was increased from .325 mm to .38 mm; the float rod length was increased from 126 mm to 137 mm, and the angle at which the valve closed was changed from 30° to 45°. These changes were intended to help prevent fuel leaks during an anticipated vehicle roll-over, but had the unintentional effect of prematurely closing the valve. These design changes were later remedied for the MY 2000, 2001 new production and 1998, 1999 recalled vehicles.

Use/service factors. Use factors include the number of attempts the consumer makes to add fuel to reach a full tank after the fuel nozzle has reached the automatic shut off point. When the ORVR valve closes, the fuel tank will no longer accept fuel. If the fuel gauge does not read full, as would be the case if the valve closes early, the consumer might continue to try and add more fuel by continuing to "click" the fuel nozzle. Because the fuel can not enter the tank, it will spill or splash back out of the filler tube.

STATUS:

<u>Problem Experience</u>	<u>EA Opened</u>		<u>EA Closed</u>		<u>Total</u>
	<u>ODI</u>	<u>MFR</u>	<u>ODI</u>	<u>MFR</u>	
<u>Owner / Field Reports</u>	21	12	17	18	35
<u>Lawsuits</u>	0	0	0	0	0
<u>Injuries</u>	0	0	0	0	0
<u>Fatalities</u>	0	0	0	0	0

POPULATION: The subject vehicles are MY 1998 and 1999 Sephia vehicles that have had recall 00V-175 performed and all MY 2000 through 2001 KIA Sephia and Spectra vehicles. KIA

has sold 245,409 subject vehicles in the United States. Table 1. shows the vehicle sales volumes and complaint data by model and model year.

MY	Model		Total	Complaints	
	Sephia	Spectra		ODI	KIA
1998	28851	-	28851	4	3
1999	41012	-	41012	9	6
2000	89988	11042	101030	3	6
2001	53266	21250	74516	1	4

Table 1. Subject vehicle population.

DESIGN/PROCESS CHANGES: Table 2 summarizes the design and manufacturing process changes from the introduction of the subject valves through the end of MY 2001, when KIA stopped using the valves in the subject models.

Date Opened	Change	Reason
9/3/1997	Original ORVR Valve Design	Initial Release
10/17/1997	1st Modification to ORVR Valve spring rate, float rod length, flap angle	To prevent an anticipated fuel leak during vehicle roll over
4/29/1999	2nd Modification to ORVR Valve spring rate, float rod length, flap angle	To eliminate the early close of the valve resulting in fuel spitback

Table 2. Design/manufacturing process changes.

There was not a design or manufacturing change in the ORVR valve after the design change that was implemented on the recalled and MY 2000 – 2001 vehicles.

WARRANTY: During EA04-004, KIA provided information on 1,335 warranty claims relating to ORVR valve repairs in the subject vehicles. In March 1999, KIA provided their dealers with a new list of condition codes that would be used by repair technicians to classify warranty claims. The code that was intended to be used for a fuel spitback concern was N12 and its description was "Overflowing". Of the 1,335 claims KIA provided to ODI, only 46 were coded in the KIA warranty system as an "Overflow" condition. KIA's standard warranty coverage for subject Sephia and Spectra vehicles is three years or 36,000 miles. Table 3. shows the warranty claims for the ORVR valves by model and model year.

MY	Warranty Claims	
	Sephia	Spectra
1998	0	-
1999	0	-
2000	23	6
2001	8	9

Table 3. ORVR Warranty claim data by model and MY.

The claim rates are low, with only the MY 2000 Spectra vehicles reaching an "Overflowing" claim rate of five tenths of a percent. When reviewing the warranty data related to the ORVR valve it showed a decreasing trend in the number of claims being submitted.

PART SALES: KIA provided information about sales of approximately 81 thousand ORVR valves for service use in the subject vehicles, through May 2004.

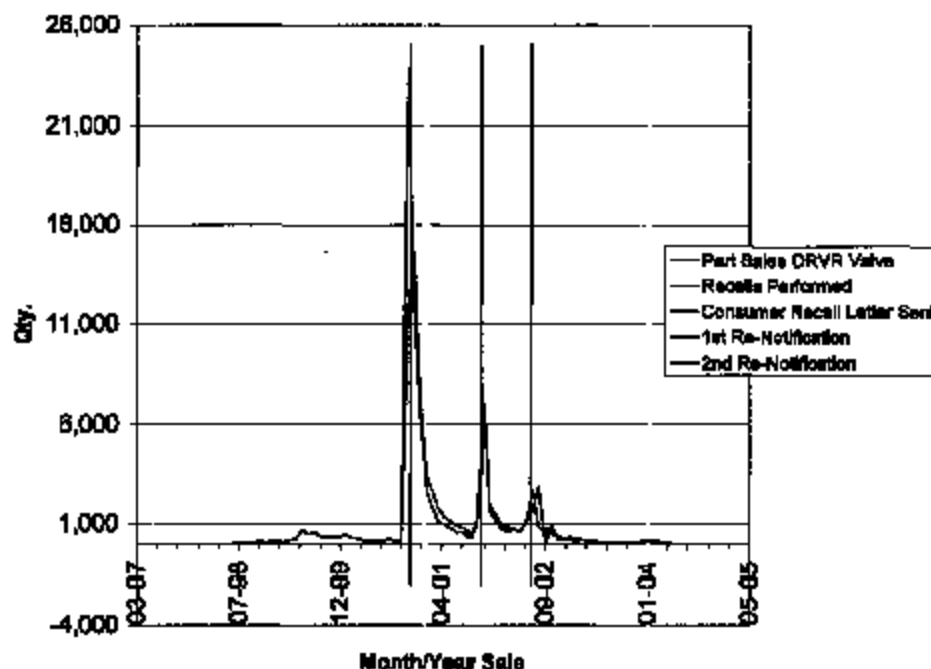


Figure 2. Service part sales of subject valves

Figure 2. shows the monthly sales of ORVR valves. Sales of the ORVR valves follow very closely the number of recalls performed during any month. The total number of valves sold after the recall was announced and installed on vehicles that were not having the recall performed is approximately 5,470. The number of these valves that were sold as a result of a consumer complaining about fuel spit back can not be determined, but as shown in the warranty data, there were only 46 claims of "Overflowing" indicating that many of these valves were replaced for other reasons.

ADDITIONAL INFORMATION: Five peer investigations related to fuel spit back, conducted prior to this one, were reviewed to examine their complaint rates. The complaint rates of these prior investigations were then compared to the complaint rate of this investigation. A summary of the investigation numbers, vehicle populations, complaint information, warranty information, and action resulting from the investigation are shown in Table 4.

PE98-001	27984	108	379.1	129	481.3	99V-058
EA98-034	100137	87	86.9	1608	1605.8	OOV-176
EA00-026	277656	68	24.5	251	90.4	Closed
PE02-052	192631	167	86.7	320	168.1	02V-300
PE04-001	428670	185	45.5	873	203.7	Closed
EA04-004	245409	35	14.3	48	18.7	Closed

Table 4.

The complaint and warranty rates for this investigation are lower than any of the peer investigations.

KIA'S POSITION: KIA believes that there is no evidence of a defect trend in the ORVR valve in the subject vehicles and that the remedy of recall OOV-175 adequately addressed the potential for fuel spit back resulting from premature closing of the valve on the recalled vehicles. KIA believes that a low complaint rate, a low warranty rate, and a lack of any engineering information support their conclusion.

ODI ANALYSIS: Complaints of fuel spit back on the subject vehicles have dropped off and ODI has only received 1 complaint in the last 6 months. The number of warranty claims per year has dropped off. KIA received 16 warranty claims with the condition code N12 for overflowing in the year 2002 on the subject vehicles. Only 1 claim was received in 2003 for the N12 condition code. The number of consumer complaints of fuel spit back on the subject vehicles is low. During this investigation, only 35 complaints, or 14.3 per hundred thousand vehicles sold, were identified. This complaint rate is far lower than the fuel spitback complaint rate on peer investigations that were also closed with no action taken. The number of warranty claims with the condition code N12, "Overflowing", is also low when compared to peer investigations that have been closed by ODI with no action taken. ODI has not found any engineering or design defect in the ORVR valve after the last design change in April 1999.

REASON FOR CLOSING: Based on the low rate of fuel spit back incidents (14.3 incidents per 100,000 vehicles sold), a low warranty claims rate of 18.7 claims per 100,000 vehicles sold, and the lack of engineering information that would support the presence of an engineering defect – a safety-related defect trend has not been identified and further use of agency resources does not appear to be warranted. 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.

EA04-004



Safety Defects Engineer

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Date

I Concur.

Chief, Vehicle Control Division

Date

Director, Office of Defects Investigation

Date