KIA Sorento Fire Investigations

Prepared for:

Jason K. Levine, Executive Director
Center for Auto Safety
1825 Connecticut Avenue
Suite 330
Washington, DC 20009

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Prepared by:_____
Daniel M. McDonough, P.E., ACTAR, CFEI, CVFI

2288 Second Street Pike P.O. Box 78 Penns Park, PA 18943-0078 215-598-9750 215-598-9751 (Fax)

Overview:

This report pertains to the investigation of two separate 2012 Kia Sorento fires. One was owned by Lorinda Hixon, who was driving her 2012 Kia Sorento north on the 405 freeway in California. She stated that while driving she heard a popping noise and saw the check engine light illuminate. Then, she heard a second popping noise and the oil warning light came on, followed immediately by smoke. She pulled over to the side of the freeway and by that time her vehicle was on fire. Nobody was injured in the fire.

I also inspected a second vehicle, owned by Laurie Preste. I was provided very little background information on the circumstances, but it is my understanding that Ms. Preste was driving her vehicle when it caught fire. She was able to pull off the road and exit the vehicle.

ARCCA, Inc. was retained to investigate the subject incidents and discuss the potential origins and causes of the fires. The investigation and analysis was conducted in accordance with accepted industry standards and protocols, including NFPA 921 Guide for Fire & Explosion Investigations.

Qualifications:

The opinions given in this report are based on my analysis of the materials available using scientific and engineering methodologies generally accepted in the accident reconstruction and automotive industries.[1,2,3,4,5] The opinions are also based on my education, background, knowledge, and experience. I have B.S. and M.S. degrees in Mechanical Engineering. I am a licensed Professional Engineer. I am a member of the Society of Automotive Engineers, the American Society of Safety Engineers, and the American Motorcycle Association. I am presently employed as a Senior Engineer for ARCCA, Incorporated, and I specialize in the investigation, evaluation, failure analysis, and testing of automotive, marine, aviation, recreational, and industrial equipment and mechanical systems. I am an ACTAR accredited accident reconstructionist (ACTAR #2229) and a certified Crash Data Retrieval System analyst. I am a Certified Fire and Explosion Investigator (CFEI) and Certified Vehicle Fire Investigator (CVFI) through the National Association of Fire Investigators (NAFI).

Inspection of 2012 Kia Sorento, owned by Linda Hixon:

On October 4, 2018, I traveled to AAA Southern California, located at 16920 S. Figueroa Street, in Gardenia, California. I met with Eric Bolling and Marie Montgomery Nordhues, both from AAA. After getting prior approval to conduct the inspection from Mr. Bolling, I was informed when I arrived that the inspection would be limited in scope to visual only, as AAA had retained an expert and Kia had also expressed an interest in having a representative present. Therefore, I was unable to remove or disturb anything on the vehicle.

The subject vehicle was a 2012 Kia Sorento, manufactured in August of 2011. The vehicle identification number (VIN) was 5XYKU3A63CG242877 (See Figures 1 through 5). An exterior examination revealed extensive fire damage in the front of the vehicle, most significantly in the engine compartment and spreading into the front of the occupant compartment. The windshield

1 Fricke, Lynn B. (1990). Traffic Accident Reconstruction. Volume 2 of the Traffic Accident Investigation Manual. Evanston, Northwestern University Traffic Institute..
2 Tumbas, N., Gilberg, A., and Fricke, L., (1988) Minimum guidelines for efficiently acquiring or preserving basic information in a motor vehicle accident, Society of Automotive Engineers, Warrendale, PA, Publication number 880067.
3 Halliday, D., Resnick, R., Walker, J. (1997). Fundamentals of Physics. Fifth Edition. New York, John Wiley & Sons.
4 Shames, I.H. (1980). Engineering Mechanics: Statics and Dynamics. 3rd Ed. Englewood Cliffs, N.J., Prentice-Hall, Inc.
5 Daily, John, Nathan S. Shigemura, and Jeremy Daily (2006). Fundamentals of Traffic Crash Reconstruction. Jacksonville, FL: Institute of Police Technology and Management, University of North Florida.

was partially fractured and melted along the lower aspect. Both front tires were deflated and showed heat damage. The hood and front quarter panels were distorted from the heat.

An interior examination revealed less extensive fire and smoke damage throughout the occupant compartment, mostly concentrated to the interior side of the bulkhead and internal dashboard area (See Figures 6 and 7). There was debris collected from the scene that was placed in the occupant compartment, and I was not permitted to disturb this debris. The headliner showed heat patterns, more significantly on the passenger side. Both front windows were intact, and the driver's side front window was partially opened.

The engine compartment was inspected in more detail by raising the hood (See Figure 8). I was again limited to a visual inspection of the engine compartment only, so I took care not to disturb any of the electrical wiring or harness components. Most of the plastic components on the top and rear of the engine were consumed or melted. The battery was partially melted, with the terminals detached and buried in the debris. A visual examination of the battery wiring, starter, and alternator wiring, revealed no obvious signs of arc damage. The power distribution module and fuse panel was partially melted on the top. I traced the wiring bundle from this module to the interior of the vehicle, and many of the wires inside the loom still had insulation. The brake master cylinder and reservoir were missing. Many aluminum components on the rear of the engine were consumed. The area of most significant heat appeared to be the center rear area of the engine (See Figure 9). The front of the engine, especially the lower portion, had less damage and some plastic components that were not melted or consumed (See Figure 10).

I further investigated the area in the center rear of the engine. The exhaust manifold and catalytic converter were located in this area. I discovered a hole in the sidewall of the engine block, between the engine and the bulkhead (See Figures 11 and 12). Heat patterns on the bottom of the exhaust manifold and down tube in this area are consistent with the presence of significant heat (See Figure 13).

Inspection of 2012 Kia Sorento, owned by Laurie Preste:

On December 18, 2018, I traveled to Bosco's Towing, located at 155 South Road, in Enfield, Connecticut. Prior to conducting the inspection, I received permission from Ms. Preste's attorney, Robert Elliott. The subject vehicle was a 2012 Kia Sorento, manufactured in September of 2011. The vehicle identification number (VIN) was 5XYKTDA61CG257628 (See Figures 14 through 18). The vehicle was sitting outside in a yard, uncovered and exposed to the elements. An exterior examination revealed extensive fire damage in the front of the vehicle, most significantly in the engine compartment and spreading into the front of the occupant compartment. The windshield was almost completely melted, with small remnants in the upper corners. Both front tires were deflated and showed heat damage. The hood, front quarter panels, and roof panel were distorted and discolored from the heat.

An interior examination revealed extensive fire and smoke damage throughout the occupant compartment, as the headliner was consumed and the upper portions of the front and rear seatbacks were damaged from the heat. (See Figures 19 and 20). The left front window was fractured, but other windows remained intact.

The engine compartment was inspected in more detail by raising the hood (See Figure 21). Most of the plastic components on the top and rear of the engine were consumed or melted. The battery was partially melted, with the terminals detached. A visual examination of the battery wiring, starter, and alternator wiring, revealed no obvious signs of arc damage to any of the high-current

conductors. The power distribution module and fuse panel was melted and partially consumed. I traced the wiring bundle from this module to the interior of the vehicle, and found no indication of any arc damage. The brake master cylinder and reservoir were missing. Many aluminum components on the rear of the engine were consumed. The aluminum radiator was partially consumed. The area of most significant heat appeared to be the top of the engine, where the air intake and filter box would be located. (See Figure 22). The fuel lines would also enter the fuel rail in this location. The throttle body was found separate, and was distorted and partially consumed in the fire. The fuel rail and injectors would be on the front of the block, and they were likely encased in the melted plastic of the intake manifold. The front of the engine, especially the lower portion, had less damage and some hoses and wiring insulation was not consumed (See Figure 23). There was visible oil seeping from the engine in this area. A photograph of an undamaged exemplar was used for comparison purposes, to identify the location of the some of the engine components (See Figure 24).

Recalls:

The 2012 Kia Sorento was subject to a manufacturer recall, SC147. The NHTSA reference number for this recall was 17V224. In a letter to vehicle owners, Kia stated that metal debris may have been generated from factory machining operations of the crankshaft, which could restrict the flow of oil to the bearings and increase the potential for bearing wear. According to Kia, a worn connecting rod bearing could produce a cyclic knocking noise, and may result in the illumination of the vehicle's engine warning and/or oil pressure lamp. The remedy for the recall was to take the vehicle to a dealer, where they would perform an inspection to determine if there was significant bearing wear. If bearing wear was detected, the engine would be replaced. If no wear was detected, no action was taken. The test involved placing a microphone device into the oil dipstick and running the engine, along with a software program provided by Kia. The software program would determine whether the engine passed or failed.

Service Records:

According to the records provided by Ms. Hixon, the subject vehicle was purchased at Rally Kia on September 26, 2011. The vehicle had routine maintenance, with regular oil changes every 5,000 miles. The last service before the incident was on June 11, 2018, at which time the vehicle had 104,799 miles. According to the documents, Rally Auto Group performed the engine inspection per the SC147 campaign on July 7, 2017 when the vehicle had 90,371 miles. The engine was not replaced at that time, so it is assumed that the subject vehicle passed the test.

According to the records provided by Laurie Preste, her vehicle was purchased used, and serviced at Gary Rome Kia of Enfield. In February of 2016, when the vehicle had 41,527 miles, Ms. Preste complained of a ticking noise from the engine. Gary Rome Kia replaced the engine under warranty due to a low end rod knock. Shortly after the engine replacement, the technicians found that the transmission would not engage, and so they also replaced the transmission under warranty. In June of 2016, there was an oil leak and the oil pan gasket was replaced. In July of 2016, it was discovered that the vehicle had a blown transfer case and seized intermediate shaft bearing and worn CV axle. These components were replaced at that time, also under warranty. In July of 2017, with 53,560 miles on it, the engine was inspected per the SC147 recall campaign. The vehicle passed the test, and no further repairs were done at that time. There were other complaints of oil leaks, and the last record provided indicates that in June of 2018, with 65,445 miles, the timing cover and oil pan had to be resealed to address oil leaks.

Discussion:

The fire damage on the subject Hixon Kia Sorento was localized to the engine compartment, with some extension into the dash area of the occupant compartment. All fire patterns are consistent with an area of origin in the engine compartment. More specifically, the heat patterns in the engine compartment indicate a point of origin and most significant damage as the center rear of the engine, between the block and the bulkhead.

The fire damage on the subject Preste Kia Sorento was also localized to the engine compartment, with more significant extension into the occupant compartment. It is likely that the Preste vehicle burned for a longer period of time than the Hixon vehicle. Due to the longer period of burn, the heat patterns in the Preste engine compartment are harder to establish, but the area of most significant damage appeared to be to the top of the engine, to the right of the block between the head and the electronic distribution. This area, based on the exemplar, is originally occupied by the airbox and air intake components, including the throttle body and incoming fuel lines.

Once the origin has been established, the cause can be investigated. For a fire to occur, there must be a fuel source, as well as a mechanism of ignition whereby the fuel is ignited. Using the data gathered from the inspection, for the Hixon vehicle, there was a fuel source introduced into the area of origin when a catastrophic engine failure caused a hole in the rear sidewall of the engine block. The hot engine oil that would normally exist in the lower portion of the engine could escape through the hole. The oil would spray onto the adjacent surfaces. The exhaust manifold is located in this immediate area, which would provide a competent heat source. Surface temperatures of the exhaust components can easily be high enough to ignite sprayed oil. Although a thorough investigation of the electrical system could not be performed due to the limitations imposed by AAA, I saw no immediate visual indications of any potential electrical causes to the Hixon fire.

According to the information provided by Ms. Hixon, she was operating her vehicle along the highway when she heard a popping noise, noticed the check engine light illuminate, heard another popping noise, and noticed the oil warning light illuminate, then she almost immediately observed smoke. The scenario described by Ms. Hixon is consistent with a catastrophic engine failure. The engine failed, causing the noises that she heard, and when the engine sidewall ruptured, the engine oil escaped causing the oil warning light to illuminate. This scenario is also consistent with the physical evidence observed at the time of my inspection. This is consistent with the circumstances described in the Kia SC147 recall campaign. The vehicle was inspected per the recall campaign, but still suffered a similar catastrophic failure approximately 15,000 miles after the inspection. This catastrophic engine failure caused a rupture in the side of the engine, which then caused engine oil to spray onto the hot exhaust manifold and components, which initiated a fire in the engine compartment. Ms. Hixon was able to control her vehicle, get it to the side of the road, and exit the vehicle without injury.

The potential causes of the Preste fire were considered. There were no apparent ruptures in the sidewall of the block, so no evidence of a catastrophic engine failure. However, there were prior complaints of oil leaks after the engine was replaced. There was also evidence of active oil seepage at the time of my inspection. A hot surface ignition of leaking oil on the exhaust system is less likely, but cannot be ruled out. The vehicle did have the engine replaced prior to the initiation of the SC147 recall. Once the recall was issued, the replaced engine was tested and passed. A cursory inspection of the electrical system did not reveal any arcing or melting of the high-current wiring, such as the battery connections, starter, or alternator. Some of the wiring and electrical components were encased in the melted plastic and destructive testing and/or X-ray would be required to further

inspect those components. The area of most damage would contain components of the fuel system, including fuel lines. The fuel lines were mostly consumed in the fire. I did not receive any statements from Ms. Preste, but there was no indication that she smelled fuel or anything else prior to the fire. At this time the cause of the fire in the 2012 Kia Sorento owned by Ms. Preste is undetermined.

Conclusions:

It is my opinion to a reasonable degree of engineering certainty that the origin of the fire in the subject 2012 Kia Sorento owned by Lorinda Hixon was the center rear of the engine compartment, between the engine and the bulkhead. The cause of the fire was likely ignition of the engine oil by the hot exhaust components after a catastrophic engine failure caused a breach in the side of the engine. The fire was related to a Kia Safety Recall Campaign SC147. The subject 2012 Kia Sorento was inspected according to the Kia Safety Recall Campaign SC147 remedy by Rally Auto Group, however, the vehicle still suffered catastrophic engine failure approximately 15,000 miles later.

The origin of the fire in the 2012 Kia Sorento owned by Laurie Preste was in the engine compartment. Based on the extent of burn and the limited scope of the inspection, the cause at this time is undetermined.

Please do not hesitate to call if you have any questions or if any new information requiring additional review becomes available.

Photographs

Figure 1: Hixon 2012 Kia Sorento, left front

Figure 2: Hixon 2012 Kia Sorento, left rear

Figure 3: Hixon 2012 Kia Sorento, right rear

Figure 4: Hixon 2012 Kia Sorento, right front

Figure 5: Hixon 2012 Kia Sorento, manufacturer build plate

Figure 6: Hixon 2012 Kia Sorento, interior driver's area

Figure 7: Hixon 2012 Kia Sorento, interior passenger's foot well area

Figure 8: Hixon 2012 Kia Sorento, engine compartment

Figure 9: Hixon 2012 Kia Sorento, engine compartment, center rear area

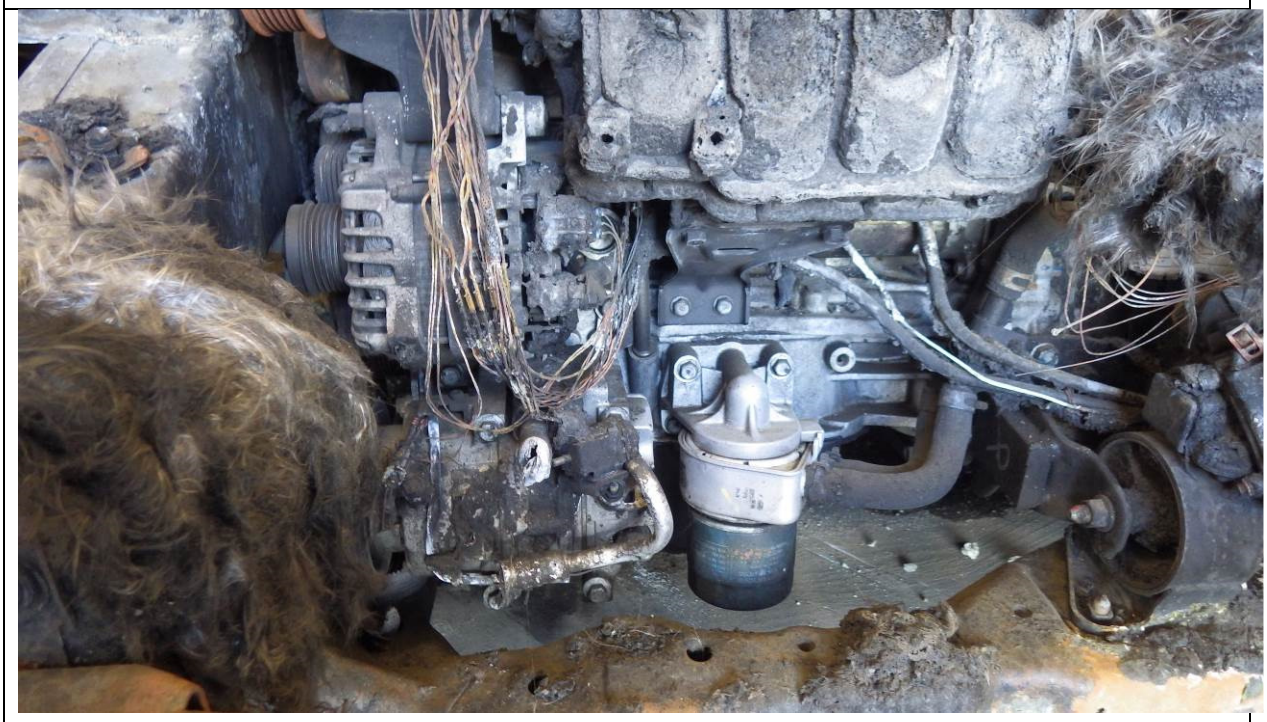

Figure 10: Hixon 2012 Kia Sorento, front of engine showing protected area

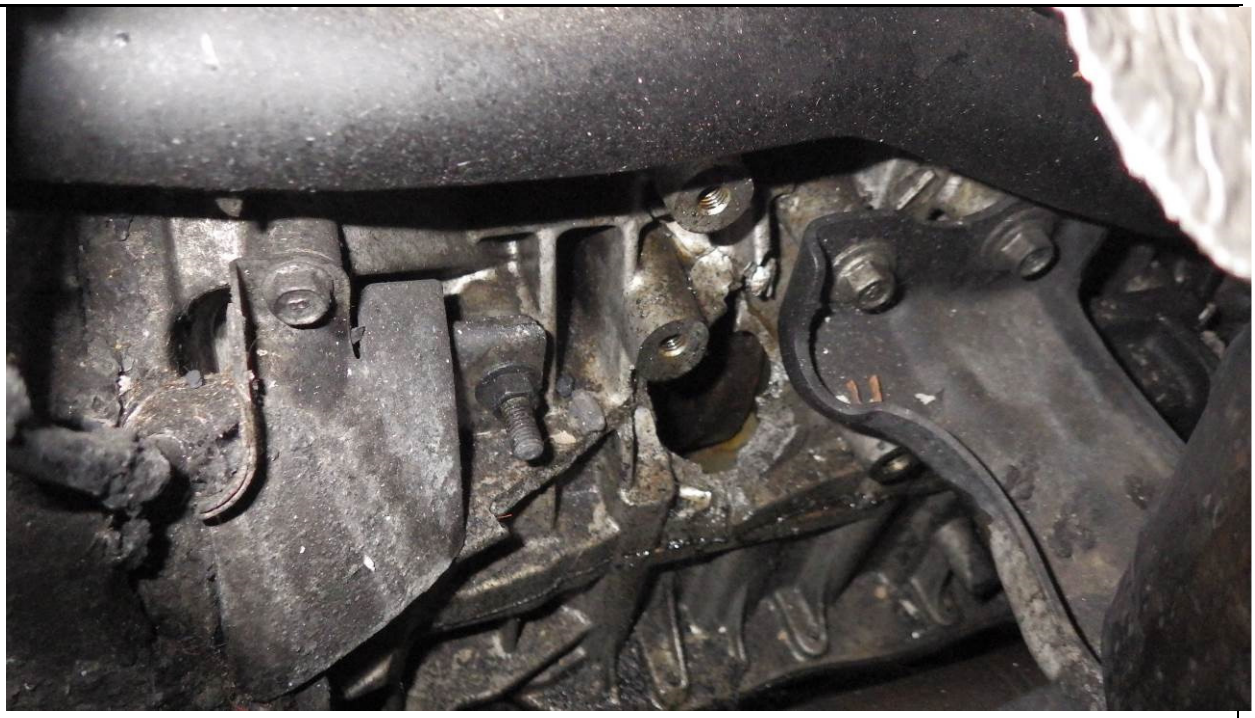

Figure 11: Hixon 2012 Kia Sorento, rear of engine

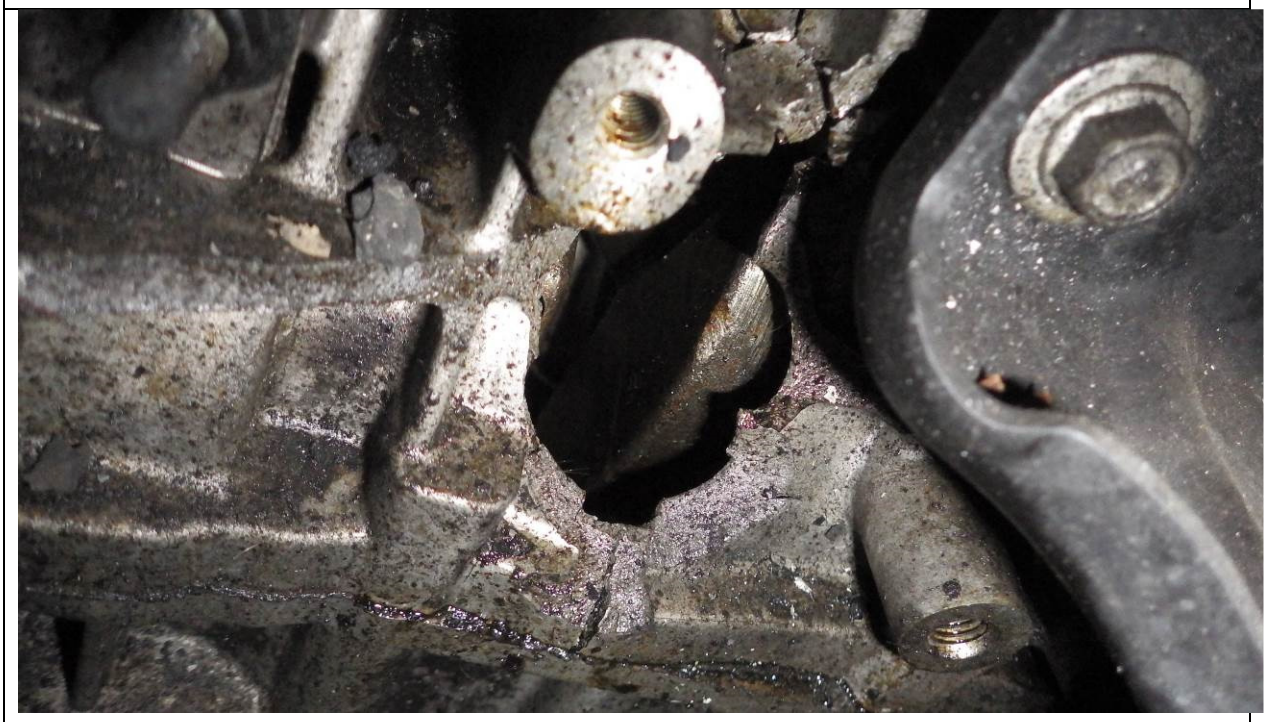

Figure 12: Hixon 2012 Kia Sorento, hole in rear of engine

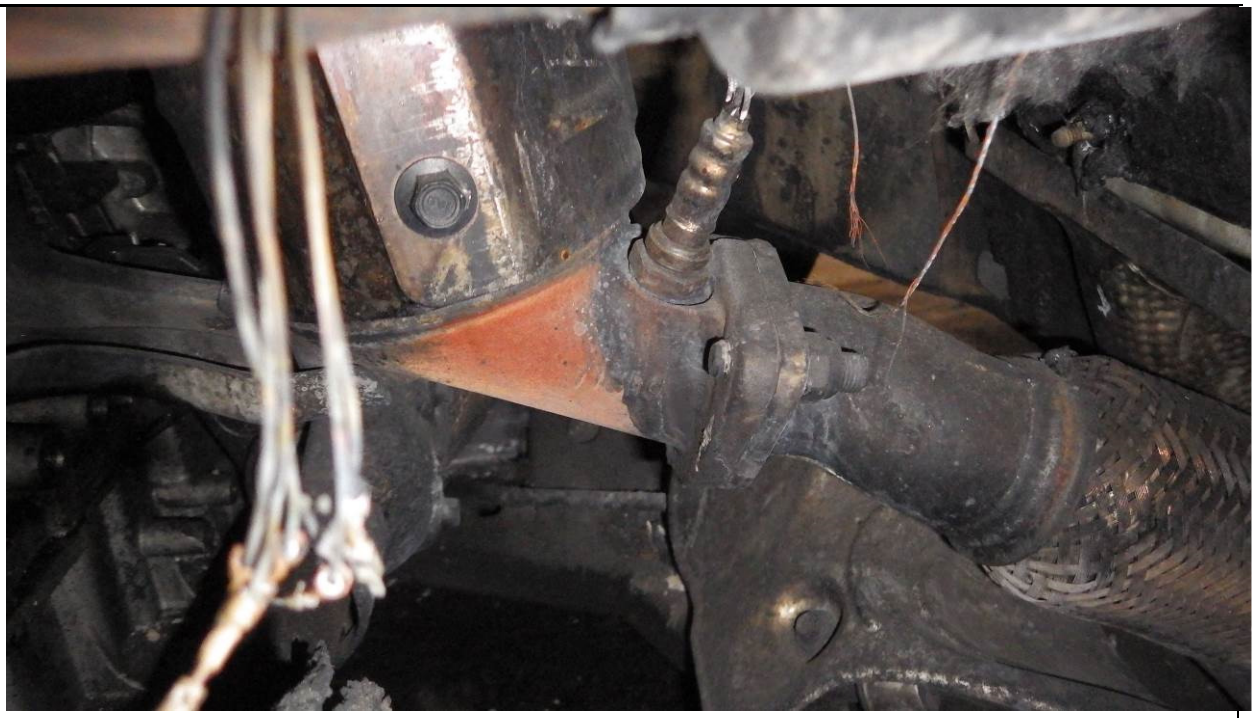

Figure 13: Hixon 2012 Kia Sorento, Exhaust near hole in rear of engine

Figure 14: Preste 2012 Kia Sorento, left front

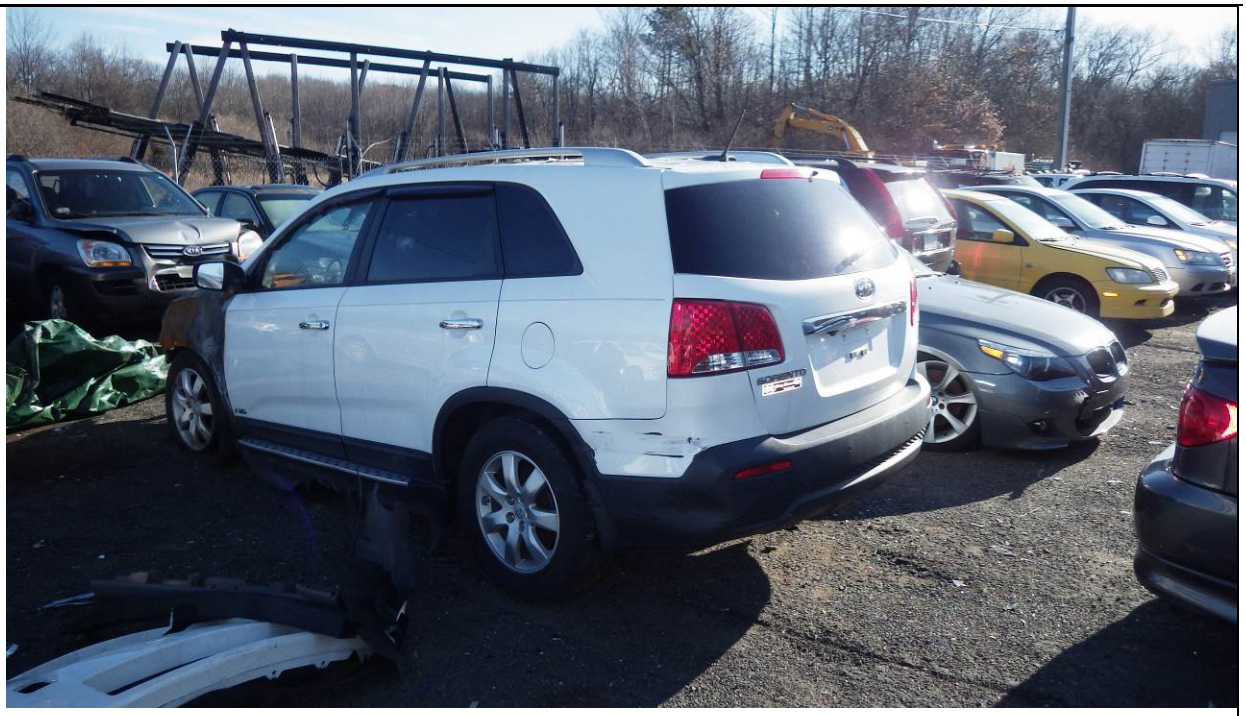

Figure 15: Preste 2012 Kia Sorento, left rear

Figure 16: Preste 2012 Kia Sorento, right rear

Figure 17: Preste 2012 Kia Sorento, right front

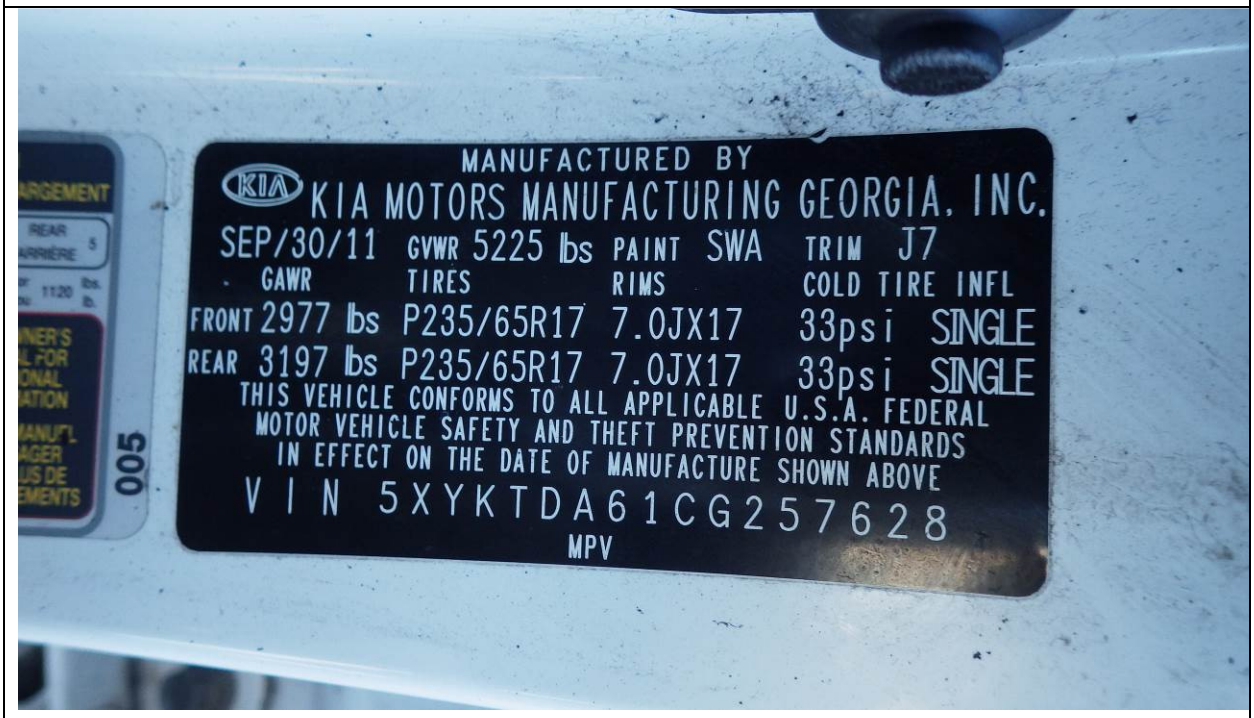

Figure 18: Preste 2012 Kia Sorento, manufacturer build plate

Figure 19: Preste 2012 Kia Sorento, interior driver's area

Figure 20: Preste 2012 Kia Sorento, interior headliner

Figure 21: Preste 2012 Kia Sorento, engine compartment

Figure 22: Preste 2012 Kia Sorento, engine compartment, center rear area

Figure 23: Preste 2012 Kia Sorento, front of engine showing protected area

Figure 24: Exemplar 2012 Kia Sorento, engine compartment