Dieselgate: A Case Study in Engineering Ethics

When West Virginia University’s Center for Alternative Fuels, Engines and Emissions was called to perform real-world testing in California on the latest “clean diesel” engines from Volkswagen, their eye-opening results shook the automotive industry, revealing an emissions cheating scandal that ultimately cost the automaker $2.8 billion in federal fines and another $18.32 billion in expenses in an attempt to rectify the deception.

In this case study, Roger Forsgren, NASA’s Chief Knowledge Officer, examines how the unrealistic—and perhaps impossible—goals set by the automaker to simultaneously push engine power levels up and emission levels down left engineers working on the project with an ethical test that they ultimately failed.

The case study includes the story of one of these engineers, Oliver Schmidt, a brilliant man who rose through the ranks at Volkswagen, was sent to the United States to better understand the demands of this crucial market, and who ultimately paid a high personal price for his role in the scandal.

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By Roger Forsgren

Volkswagen AG, headquartered in Wolfsburg, Germany, makes several different brands of autos but the most well known are the VW, Audi and Porsche nameplates. In 2008 Volkswagen was the largest automobile manufacturer in Europe and the third biggest in the world behind only Toyota and General Motors. That same year Volkswagen introduced “Strategy 2018” setting an ambitious goal utilizing their diesel expertise to become the world’s largest automobile company within a decade.

With a particular focus on Toyota and its fuel-efficient line of hybrid vehicles that were becoming increasingly popular in the lucrative U.S. market, company executives were determined to develop an all new diesel engine that could not only compete with such Toyota offerings as the Prius on fuel efficiency and environmental cleanliness but would surpass hybrids, well known for their poor performance, on power and acceleration.

But in 2015 the company’s plan for domination of the automobile market became derailed when three mechanical engineering graduate students at West Virginia University (WVU) noticed an anomaly between the emissions measurements of several VW models during real world driving conditions compared to lab results. Before long, these significantly differing readings were traced to a covert code lurking in the VW emissions control computer. Suddenly, just as Volkswagen was hoping to cross the Strategy 2018 finish line, the company became embroiled in the largest corporate fraud in history.

The Turbocharged Direct Injection (TDI) Engine

Diesel engines have a long history in the European market. Because of their exceptional fuel economy a diesel engine emits less carbon dioxide (CO2) per mile than a gasoline internal combustion engine. European politicians saw this as an answer to concerns over climate change and greenhouse gasses which have been directly related to CO2 emissions. The European Union has further supported diesel cars by taxing gasoline at a higher rate than diesel fuel and as well as discounting diesel car registrations. The European auto manufacturers supported these policies knowing they already had in place a substantial manufacturing infrastructure to develop diesel cars.

Diesels are more fuel efficient and do have a smaller carbon footprint compared to internal combustion engines but they do pollute significant amounts more of nitrogen oxide (NOx) and particulate matter. NOx has been shown to be one of the primary causes for smog that plagues cities and also can cause severe respiratory ailments in humans.
In the United States, the Environmental Protective Agency (EPA) and the California Air Resource Board (CARB) have a different focus towards auto emissions than their European counterparts. Whereas European politicians seek to stem the effects of global warming, American regulators focus on clean air standards, particularly smog, which is caused primarily by NOx emissions from automobiles and is a continual hazard for large congested cities, particularly in California where the mountains can act as a barrier trapping smog to the point where it obstructs visibility.

The engineers at Volkswagen were given a daunting task of designing a four-cylinder diesel that could meet American emission standards. If they could do it, Volkswagen could challenge hybrids by having a small carbon footprint with exceptional fuel mileage while beating it with more power and acceleration. If successful, the VW engineering team had the opportunity to see their company ascend to the biggest car maker in the world.

VW designers developed the all new TDI, a turbocharged, direct fuel injection four cylinder that was installed in numerous VW models such as the popular Beetle, Jetta, and Golf. As United States and Japanese manufactures began banking on hybrids to gain market share, Volkswagen bet on the diesel. Volkswagen proudly touted their new offering with an expansive marketing campaign including reaching out to huge audiences during the Super Bowl.

**WVU Mountaineers Hit the Road**

In California, where emissions restrictions are even tighter than the EPA's, CARB was puzzled that environmental testing of Volkswagen products were showing significant anomalies. They reached out to a group of researchers at WVU to help solve the mystery. Three grad students, Arvind Thiruvengadam, Hemanth Kappanna and Marc Besch borrowed several VW cars, equipped them with emissions monitoring equipment and set off along the California highways. What they discovered was that the TDI equipped cars were releasing
up to forty times the permitted amount of NOx gasses. The readings were so far off the trio of young engineers thought their equipment faulty. Pulled off the side of the California highways to clean and recalibrate they had to explain themselves to curious highway patrolmen. But again, the readings were showing NOx emissions well above those permitted by the state of California and the EPA.

German Engineering: The Defeat Device

Volkswagen engineers couldn’t meet U.S. pollution guidelines and still provide good gas mileage and acceleration. The compromise they faced involved the nitrogen oxide trap on the TDI. In order for the trap to work effectively, that is pass U.S. pollution regulations, it required the engine to burn more fuel, thus decreasing fuel mileage as well as acceleration, thereby cancelling the very advantage Volkswagen was hoping for in a diesel. As one VW manager said, “The CARB is not realistic. We can do quite a bit… But (the) impossible, we cannot do.”

The sophisticated software algorithm was designed to recognize when the car was being placed on an emissions control dynamometer. That is, the car’s sensors could detect when the drive wheels were rotating while the other wheels were stationary and the steering wheel was held constant in a straight position. When the computer detected these inputs it would send commands to the NOx trap increasing its effectiveness but also causing more fuel to be burned thus allowing the TDI to pass the test. Once the computer recognized that the automobile was removed from the dynamometer it returned the engine to the default settings, burning less fuel, lowering the NOx trap’s effectiveness, and increasing allowable NOx emission well above regulated limits.

The engineers at Volkswagen found themselves in an all too familiar spot, they were expected to deliver on unrealistic and in this case, impossible, promises made by marketing and supported by upper management.

German Engineer: Oliver Schmidt

Oliver Schmidt was born in Lower Saxony where Volkswagen was headquartered and where it employed more than 100,000 people. VW is to Lower Saxony as GM is to Detroit, but on steroids. After graduating as a mechanical engineer and performing his military service, Oliver got his dream job and joined Volkswagen in 1997. He was a committed and loyal employee to the company and in his spare time would rebuild old VW Beetles in his garage.
When he married his wife, another Volkswagen engineer, they hosted the ceremony in a friend’s VW dealership.

In 2005 Schmidt was recognized as a brilliant engineer with a solid future and was selected with several other gifted employees to join team “Moonraker.” They were sent to the United States to integrate themselves within society to see what Americans like, to understand their culture and needs and to bring this knowledge back to Wolfsburg where it could be used to better market Volkswagen cars in the U.S. As he travelled across America, Schmidt later wrote, “Over the eighteen months I spent there, I learned a lot… I also fell more in love with America.” Schmidt was moving up the corporate ladder.

In 2012 Oliver Schmidt was promoted to General Manager in charge of the Environmental and Engineering Office stationed outside Detroit in Auburn Hills, Michigan. In this role, with a salary of $170,000, he was responsible for communicating and coordinating with regulatory agencies such as the EPA and CARB. Schmidt and his wife purchased property in Florida with the dream of someday retiring in the United States.

Events Move Slowly, Then Very Quickly

In May of 2014 the EPA started pressing VW for answers concerning the discrepancies discovered by the WVU team. Volkswagen’s response, led by Schmidt, was an attempt to stonewall the agencies with promises of recalls and simple software fixes. For more than a year VW's strategy worked.

Schmidt was well aware of the defeat device. When he was originally informed that the U.S. regulators had discovered anomalies and were raising questions he emailed a colleague in Germany, “It should first be decided whether we are (to be) honest. If we are not (going to be) honest, everything stays as it is…”

In May 2015 Oliver Schmidt was promoted again and returned to Wolfsburg to become Principle Deputy to the Head of Engine Development. On several occasions Schmidt briefed management on the gathering storm back in the states. In corporate boardrooms Schmidt described the potential for enormous costs involved in actually fixing the TDI equipped cars as well as the possibility of the U.S. government issuing criminal indictments. Company officials tasked the loyal and dutiful Schmidt with returning to the U.S. to use whatever personal influence he may have to minimize the scandal and to continue to mislead the regulators but without revealing the existence of the defeat device. While Schmidt honed his strategy he had doubts about one of his team members when another VW manager warned him that an engineer (unnamed and known only as “Cooperating Witness 1” in the Criminal Complaint filed in the U.S. District Court) “… should not come along [to the CARB meeting] so he would not have to consciously lie.”

But upon arrival at the CARB offices in California in August, 2015 the VW engineer, (“Cooperating Witness 1”), who was feeling remorse for his role in the deception and didn’t feel comfortable lying to government officials, described the TDI's defeat device to stunned U.S. regulators.
On September 3, 2015, realizing they had no other choice available, Volkswagen management admitted that the defeat devices existed and had been installed on almost 600,000 diesel cars sold in the U.S. as well as 11 million more sold worldwide.

On September 18 the EPA issued a Notice of Violation to Volkswagen for failure to comply with the U.S. Clean Air Act, effectively stopping all sales of VW diesels in the United States.

Five days later the CEO of Volkswagen, Martin Winterkorn, who was the highest paid CEO in Germany with a salary of $18.6 million, and a notorious micromanager who carried a pair of micrometers with him when visiting assembly plants to personally verify part tolerances, resigned stating, “I am doing this in the interests of the company even though I am not aware of any wrong doing on my part.” Within days Volkswagen stock dropped 30 percent.

In October 2015, Volkswagen’s American CEO, Michael Horn, was summoned before a House oversight committee. He claimed that a group of “rogue software engineers” were responsible for the defeat device and that VW management was unaware of its existence until a month ago. Rep. Jan Schakowsky (D-Ill.) said, “The company’s word isn’t worth a dime.”

In October of 2016, Volkswagen agreed to a $14.7 billion settlement to compensate car owners and as punishment for environmental damage. By 2018 the cumulative cost to Volkswagen including fines, lawsuits, fixes and car buy-back programs had reached a staggering $30 billion. To put this in perspective, you could have built twenty-five of Dallas’ enormous, new AT&T stadium with the cost of Dieselgate. NASA’s 2018 budget was $19.1 billion.

Across the United States lie thirty-seven Volkswagen “graveyards” where thousands of diesel powered autos bought back from angry customers can still be seen in such areas as the Pontiac Silverdome and the Port of Baltimore.

Who Paid a Price…and Who Didn’t?

In January 2016, Schmidt and his wife vacationed at their Florida condo. When their Christmas holiday ended they prepared to return to Germany. At the Miami airport Schmidt was followed by eight federal agents as he entered the men’s room and when he came out he was wearing handcuffs and his wife was left sobbing at the airport gate.

After Schmidt saw the evidence against him he pled guilty, telling Judge Sean F. Cox in a letter, “I’ve learned that my superiors that claimed to me to have not been involved earlier
than me at VW knew about this for many, many years. I must say that I feel misused by my own company."

Judge Cox had previously sentenced another Volkswagen executive embroiled in Dieselgate and expressed the gravity he saw in the scandal stating, “This is a very serious and troubling crime against our economic system. Without that trust in corporate America, the economy can't function.”

Despite an enormous outpouring of personal references from friends and colleagues that impressed Judge Cox, he remained firm and sentenced Schmidt to seven years imprisonment. He reminded Schmidt, that as a judge he has a solemn duty to uphold justice even when he's confronted with, “good people just making very, very bad decisions.”

The judge told Schmidt he had committed his crime, “to impress senior management…’” Adding, “You saw this as an opportunity to shine …and climb the corporate ladder.” Judge Cox intended the stiff sentence to be seen as a deterrent to others who may become tempted to place their loyalty to a company above the law.

Standing before the judge after sentencing, with tears in his eyes and choking on his words, Schmidt read a statement:

“For the disruption to my own life, I only have to blame myself. The hardest part is knowing the pain I have caused to those who love me most, most especially my wife Kerstin, who dropped everything to move from Germany to the U.S. to be closer to me, so we can continue to support one another as we have done for the past 20 years.

“I accept responsibility for the wrongs I committed. …I made bad decisions and for that I am sorry. For a time, I was in denial that I personally did something wrong. I justified my bad decisions by telling myself that I was obligated to stick to my superiors’ instructions.

“Sitting here today it is of course easy to say what I could have or should have done differently. …I wish I did do things differently, but none of that is of any use. I am deeply sorry for the wrongs I committed, and I am as ready as I will ever be to accept the punishment you believe is just and fair.”

For Oliver Schmidt, Volkswagen had been his passion, his life, his religion. Now he was alone. The archetype loyal employee, the brilliant engineer who had devoted everything to Volkswagen and always did his duty now felt betrayed as a scapegoat and fall guy for many others higher than him on the corporate ladder. To accentuate his nightmare, he felt humiliated to see his mugshot as the emblem of the scandal.

Preamble to the National Society of Professional Engineers Code of Ethics

“...engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and
must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct."

Das Ende

After the scandal, Volkswagen desperately wanted a new image. The company dumped their familiar marketing slogan, “Das Auto” now synonymous with Dieselgate, and looked for a more “humble” marketing theme. For their shareholders they introduced, “Strategy 2025” a new effort to invest billions of Euros to become the leading manufacturer of electric vehicles worldwide. The company’s stock has mostly recovered and Volkswagen is now the second leading carmaker in the world behind, of course, Toyota. In Europe, Volkswagen has never paid out a Euro for the 8.5 million TDIs sold, claiming that even with the cheat device their cars still met EU standards therefore they never broke any laws. Diesel sales in Europe have plummeted as politicians reconsider their existing pollution standards and potential buyers shun them over fears of lower resale values. VW no longer sells diesels in the United States.

On October 13, 2017, the three West Virginia University grad students, Arvind Thiruvengadam, Hemanth Kappanna and Marc Besch, who unwittingly uncovered the greatest fraud in corporate history, were honored by roaring crowds as grand marshals during homecoming weekend when their alma mater played Texas Tech. WVU won, 46-35.

On May 3, 2018, Martin Winterkorn, VW’s former CEO, was formally charged in U.S. court for fraud and conspiracy. U.S. prosecutors allege he was briefed during the meeting with Oliver Schmidt in Wolfsburg in 2015 about the defeat device and approved continuing to conceal it from U.S. regulators. It’s doubtful Winterkorn, or any other Volkswagen employees, will ever be prosecuted because Germany seldom extradites accused citizens outside of the European Union. American prosecutors feel he, and others involved in the scandal, are being protected by the influence of a company that represents German pride as well as a company that is twenty percent owned by the state of Lower Saxony.

Oliver Schmidt was fired from Volkswagen and is currently serving his sentence in the Federal Corrections Institute in Milan, Michigan. When released in 2023, he will be immediately deported to Germany and required to pay $400,000 in restitution to the United States government. Oliver Schmidt will not be retiring to Florida.

Additional Resources:

Environmental Protection Agency: Notice of Violation
United States District Court Criminal Complaint against Oliver Schmidt