

Mettle Fatigue: VW's Single Point of Failure Ethics

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Purpose

- Our intent here is to comprehend how engineers could abandon their mettle and to help other engineers see the perils of doing so, even when company pressure makes dishonest practices seem like part of the job.

Diesel Engine Functionality

- A diesel engine does not have spark plugs.
- Air in the cylinder is compressed to a high pressure and temperature
 - The resulting increase in temperature ignites the fuel that is injected into the cylinder.
 - The higher combustion temperature results in higher efficiency.
 - The higher temperature also causes nitrogen to combine with oxygen, causing nitrous oxide emissions.

Dysfunctional Practices

- Senior officers insistence on the pursuit of infeasible objectives with no tolerance for failure;
- Suppression of open communication, enforced by an intolerance for bad news and dissenting views;
- Creation of software to cheat, rather than solve engineering problems and protection of that software from disclosure as if it were a trade secret;
- Departure from honesty in the chain of command and reckless disregard for the consequences.

Decisions Leading to the Defeat Device

Insistence on Infeasible Objectives

- VW “Strategy 2018” establishes objective to surpass Toyota in car sales.
 - Requires large expansion of diesel sales in US market.
- VW cancels its license of AdBlue technology
 - Controls NoX emissions
 - VW's alternative not sufficient
- Failure is not an option

Suppression of Open Communication

- Management style was one of intolerance for bad news.
- Chairman boasted publicly that he would fire any engineering team that failed to achieve an objective.
- “Always have good news” became the watch word when reporting to upper management.

Use of Corrupt Software

- Software gives the engine two operating modes
 - Mode changes when no steering wheel movement is detected. This is assumed to be a marker for being under test.
 - Test mode fully engaged emission controls
- Such software needed to be tested fully to make sure that it worked when intended but did not reduce motor performance by activating when not under test.

Departure from Honesty

- No reports of anyone in VW's senior management recognizing or protesting these practices.
 - The risk to VW's reputation and customer trust was not recognized.
- As the engine was installed in more and more models, it became necessary to involve larger numbers of engineers and managers in the deception.
- The result is a mindset that sees no problem in deceiving those outside the organization.

Aftermath and Cover up

Disingenuous Denials

- VW tries to discredit West Virginia University (WVU) results
 - Basis for discrediting WVU results changes regularly
- VW issues recall
 - CARB tests show emissions reduced but still above legal limits
 - VW disputes test environment
- VW eventually acknowledges use of a hack to defeat pollution tests

VW's Interim Report

- Problems due to
 - Misconduct and shortcomings of individual employees
 - Weaknesses in some processes
 - Mindset that tolerated rule breaches
- No assumption of responsibility by top level officers for creating the work environment in which the failures occurred.

VW's Code of Conduct

- “Our common goal is to be number one among the world's automobile manufacturers ... based on superior quality.” (Forward)
- “Each of our employees shall make sure that his or her demeanor in public does not damage the reputation of the Volkswagen Group. The fulfillment of his or her duties must always be directed hereto in all respects.”
- “Every superior has responsibility for his or her employees. Every superior sets an example and must act in strict accordance with the Code of Conduct.”
 - “By providing regular information and instruction about the relevant responsibilities and powers for each work area, supervisors promote behavior by their employees that conforms to the Code of Conduct.”

The Aftermath of Disclosure

- VW's post disclosure behavior has reinforced concerns about corporate culture.
 - Denials of EPA and CARB findings
 - Reversals only when forced
 - Perfunctory apologies
 - Dearth of meaningful explanations
- US DOJ has filed a civil complaint that may result in billions of dollars in fines.

Ethics and Mettle Fatigue

- Ethics were VW's single point of failure
 - Results at any cost
 - Lack of checks on dishonest behavior
 - Secrecy
 - No refusals to work on the defeat device
- Mettle fatigue:
 - Long exposure to ethically dubious activities that prevents the recognition of reality, acceptance of facts, and responding with integrity

Trust: Another Casualty

- The environmental impact of 11 million cars was misrepresented
- With a million plus lines of code, consumers need to be able to trust the developer.

Codes of the Profession

IEEE Code of Ethics

- The code commits engineers “to be honest ... in making claims.”
 - Does not specify to whom
 - VW management or government regulators?
- No requirement to act responsibly in the presence of other's malfeasance.

ACM Code of Ethics

- Contribute to society and human well-being.
 - When designing or implementing systems, computing professionals must attempt to ensure that the products of their efforts will be used in socially responsible ways, will meet social needs, and will avoid harmful effects to health and welfare.
- Avoid harm to others.
 - Well-intended actions, including those that accomplish assigned duties, may lead to harm unexpectedly. In such an event the responsible person or persons are obligated to undo or mitigate the negative consequences as much as possible.

Tau Beta Pi Ethics Code

- Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties.
 - First fundamental canon
- Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
 - Assumes the engineer is independent of the employer

US Military Academy

A cadet will not lie, cheat, steal, or tolerate those that do.

Questions

Culture and Ethics

- Are the following necessary or sufficient conditions for ethical lapses?
 - Management Culture
 - “My way or the highway”
 - “Don't bring me problems; bring me solutions.”
 - Unachievable requirements
 - Externally focused ethical standards
- Single Point or Chain of Failures?

Agile and Ethics

- How does agile programming facilitate or prevent ethical lapses?
 - Scrums
 - Sprints
 - Technical Debt
 - Evolving Requirements
 - Misconceptions