University of Technology
Department of Materials Engineering
Fourth Grade
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Second semester - First Lecture

Ethical Issues in Engineering Practice

1. Introduction

1.1 Case - 1

In August 10, 1978, a Ford Pinto was hit from behind on a highway in Indiana. The impact of the collision caused the Pinto's fuel tank to rupture and burst into flames, leading to the deaths of three teenage girls riding in the car. This was not the first time that a Pinto had caught on fire as a result of a rear-end collision. In the seven years following the introduction of the Pinto, there had been some 50 lawsuits related to rear-end collisions. However, this time Ford was charged in a criminal court for the deaths of the passengers. This case was a signific can't departure from the norm and had important implications for the Ford engineers and managers. A civil lawsuit could only result in Ford being required to pay damages to the victim's estates. A criminal proceeding, on the other hand, would indicate that Ford was grossly negligent in the deaths of the passengers and could result in jail terms for the Ford engineers or managers who worked on the Pinto. The case against Ford hinged on charges that it was known that the gas-tank design was flawed and was not in line with accepted engineering standards, even though it did meet applicable federal safety standards at the time. During the trial, it was determined that Ford engineers were aware of the dangers of this design, but management, concerned with getting the Pinto to market rapidly at a price competitive with subcompact cars already introduced or planned by other manufacturers, trained the engineers to use this design.

The dilemma faced by the design engineers who worked on the Pinto was to balance the safety of the people who would be riding in the car against the need to produce the Pinto at a price that would be competitive in the market. They had to attempt to balance their duty to the public against their duty to their employer. Ultimately, the attempt by Ford to save a few dollars in manufacturing costs led to the expenditure of millions of dollars in defending lawsuits and payments to victims. Of course, there were also uncountable costs in lost sales due to bad publicity and a public perception that FORD did not engineer its products to be safe.

Background Idea

The Pinto case is just one example of the ethical problems faced by engineers in the course of their professional practice. Ethical cases can go far beyond issues of public safety and may involve bribery, fraud, environmental protection, fairness, honesty in research and testing, and conflicts of interest. During their undergraduate education, engineers receive training in basic and engineering sciences, problem solving methodology, and engineering design, but generally receive little training in business practices, safety, and ethics. This problem has been partially corrected, as many engineering education programs now have courses in what is called engineering ethics. Engineering ethics is the rules and standards governing the conduct of engineers in their role as professionals. Engineering ethics encompasses the more general definition of ethics, but applies it more specifically to situations involving engineers in their professional lives. Thus, engineering ethics is a body of philosophy indicating the ways that engineers should conduct themselves in their professional capacity.

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1.2 Case – 2

Between June of 1985 and January of 1987, at least six patients receiving treatment using the Therac-25 were exposed to high doses of radiation, leading to serious injury or death. The Therac-25 was a radiation therapy machine capable of irradiating tumors with either electrons or X-rays. Based on earlier versions of the machine, the Therac-25 was the first to incorporate significant computer controls. The use of radiation for treating cancer is a well-established medical tool. Machines have been developed that deliver precisely controlled doses to tumors and the surrounding tissue without causing harm to healthy tissue in the patient. The Therac-25 was one of these machines and was based on earlier models produced by the same company. These machines had successfully treated thousands of patients. The problem with the Therac-25 was that the computer software used to control the machine and monitor the dose delivered to the patient was inadequate. Under certain circumstances, the software allowed the machine to be energized when it wasn't in the correct configuration. When this happened, patients could receive doses orders of magnitude larger than planned. Investigations in these cases determined that accepted standards for writing, testing, and documenting the software that controlled the Therac-25 had not been followed, directly leading to the accidents. During the course of their careers, engineers use computers and software in performing design and analysis, or incorporate computers and software into the systems they design. Computers don't really create new ethical issues in engineering practice. However, computers do create new ways in which ethical issues confront engineers.

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1.3 Why study engineering Ethics?

1- Several notorious cases that have received a great deal of media attention in the past few years have led engineers to gain an increased sense of their professional responsibilities.

2- These cases have led to an awareness of the importance of ethics within the engineering profession as engineers realize how their technical work has far-reaching impacts on society.

3- The work of engineers can affect public health and safety and can influence business practices and even politics.

4- One result of this increase in awareness is that nearly every major corporation now has an ethics office that has the responsibility to ensure that employees have the ability to express their concerns about issues such as safety and corporate business practices in a way that will yield results and won't result in retaliation against the employees. Ethics offices also try to foster an ethical culture that will help to head off ethical problems in a corporation before they start.