

Ethical Issues Related with Mechanical Engineering and their Impact to Safety, Health and Welfare of the Public

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Abstract:- The purpose of this paper is giving a review of ethics and ethical principles in the field of mechanical engineering. The paper gives a review on the ethical principles in mechanical engineering which are based on the fundamental principles defined in the ASME Code of Ethics. At the same time, i will give an overview on real examples that illustrate ethical challenges and how they affect to the safety, health and welfare of people.

Keywords:- ethics, ethics aspects, research review, mechanical engineering.

I. INTRODUCTION

We can say that history of mechanical engineering dates back many years before our era. Here we talk about the development and the progress of the social community how closely is related to the ability of members of society to produce and manipulate materials to meet their own needs and the needs of society. Proof of this is the three-period system that got its name from the material that had a dominant use in the respective epoch (Stone, Bronze and Iron Age) [1]. The development is many years further where mechanical engineering plays one of the important roles in technological changes and the existence of various innovations. Mechanical engineering has significant role in development of construction, transport, aviation, robotics, electric vehicles, artificial intelligence, and so on.

With the rapid technological development over the years there have been a number of disasters that have affected the safety, health and welfare of people and the environment. Often, the desire for project success was before the safety of the workers. As mechanical engineering developed, so did the need to regulate moral principles relating to the practice of engineering, the need to examine the responsibilities of engineers and society, professional care, the development of formal codes of ethics and morality, and the need for authorized mechanical engineers, contractors and associations are designed to keep an eye on the risks to safety, health, security, welfare and the environment [2].

The safety and welfare of workers as well as other working staff should be taken into consideration during the initial planning and in the work process. The standards and regulations defined by health and workplace safety laws for each country should be observed. The Regulations on the conditions for employees, organizations, technical and other conditions to be met by the company and individuals.

II. ETHICAL ASPECTS IN MECHANICAL ENGINEERING

Ethical principles should be included in every step of the design, documentation and implementation process to help predict and mitigate the negative consequences. In the 19th century, several American associations were formed for developing formal codes of ethics for the protection of humans and the environment: ASCE (American Society of Civil Engineers), AIEE (American Institute of Electrical Engineers), ASME (American Society of Mechanical Engineers), AIME (American Institute of Mining and Metallurgical Engineers).

“Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.” (ASME, Code of Ethics 2012) [3].

Ethical principles in mechanical engineering are based on the three basic principles defined in the ASME Code of Ethics (ASME, Code of Ethics 2012) [3]:

- using their knowledge and skill for the enhancement of human welfare;
- being honest and impartial, and serving with fidelity their clients (including their employers) and the public;
- striving to increase the competence and prestige of the engineering profession.

The basic ethical principles that organizations and all certified mechanical engineers strive for should serve to increase the safety, health and welfare of people. The focus of ethical principles is to assist engineers in shaping their professional responsibility by formulating general ethical principles and providing methods and techniques for dealing with the ethical issues and dilemmas that engineers encounter in their work (Brey, 2015) [4].

III. CASE NO.1: SPACE SHUTTLE COLUMBIA DISASTER

On February 1, 2003, the space shuttle Columbia, returning from its 16-day science mission, disintegrated into the atmosphere over Texas. It all happens sixteen minutes before the planned landing and all seven crew members died in the accident. The final report states that the cause of the accident was damage to the left wing, which occurred during the launch of the shuttle when part of the insulation foam detached from the outer fuel tank and hit the wing, making a hole in it [5]. Upon entering the Earth's atmosphere, the hole in the wing allowed the hot gases to enter the interior of the wing, leading to the complete destruction of the spacecraft. In

the whole process, it is contradictory that there were already problems in the past with detachment of the insulation foam, but they were not considered because all the landings ended successfully. The warnings of some of the engineers were not considered from the management board receiving a response that they have had successful landings so far. Also, the high temperature protection system was composed of reusable and lightweight materials that instead of being mechanically fastened, they are glued to save time and money [6]. This problem is also noticed by some engineers but ignored by the board of directors. In the case of the space shuttle Columbia, engineers are bound by the National Society of Professional Engineers Code of Ethics (NSPE Code of Ethics, 2019) [7]. What NASA needs to change in the future, is to allow engineers to be more free to express themselves about missions, technical conditions, and the ability to be "heard" if they believe there is a problem that could lead to a mission threat or loss of life. In this case, the board of directors did not pay too much attention to some of the engineers who alluded to the problem of tearing off pieces of foam which in the case of the Columbia shuttle resulted with seven human lives. It is also the moral obligation of every engineer to report a problem he suspects that could result in injury or even death to employees regardless of the time and means and delaying the work. In this case, a key moment is the role of an employee, project manager, who is responsible for several phases of the project such as project safety, timely launch and acceptable costs within the project budget, where often these roles are opposing parties and should be considered, discussed between different employees, individuals.

IV. CASE NO.2: FUEL LEAK FROM THE DEEPWATER HORIZON PLATFORM

On April 20, 2010, there was an explosion and a fire at the Deepwater Horizon platform on the Gulf of Mexico, killing 11 people and injuring 17 others, spilling thousands of tons of oil into the environment. The reasons for this accident are human factors: wrong decisions due to speeding up the work process and non-compliance with safety measures [8]. From the initial pressure of those responsible for the project delay of several weeks which resulted in inadequate cementation, inability to close valves, inadequate pressure reading, overloaded separator, failure of the gas alarm system to contradictory and immoral rewarding with bonuses certain employees. Engineers need to think about the worst case scenario and try to find a way to prevent it, what safety measures should be taken to avoid the worst case scenario. Safety in every industry should come first, in all standard operating procedures. Lack of ethics occurs because of the desire for success, material goods, the demand of industry and thus results in underdeveloped security measures that lead to threatening the safety, health and well-being of people.

V. CONCLUSION

Based on the above, it can be concluded that even the largest companies face a number of problems related to the safety, health and well-being of people. All companies

regardless of size, finances and reputation should comply to ethical principles and build a safe working environment for their employees.

Mechanical engineering as a science that has changed over the years should provide high-fidelity mechanical engineers who, in addition to working principles, should comply to the ethical codes of their company, where the safety and health of employees would always take precedence over income or term of employment. They should try to create a safe working environment, where as a result they would get satisfied workers who would be more productive and thus will positively affect the increased work and income of the company.

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