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**Assignment Topic: Ethics in Engineering Case 01: The Intel Pentium® Chip**

***Course Title: Ethics and Cyber Law***

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**1. Was this case simply a customer-relations and PR problem, or are there ethical issues to be considered as well? If so, what are they?**

**Ans:** This case was not simply a customer-relations and public-relations problem. Rather, there are certain ethical issues to consider. This is because ITP discovered a problem in its microprocessor shortly after selling a few pieces of their chips, yet it continued to market its defective products. Secondly, the corporation only exchanged or replaced the chip of customers who came forward and asked for it, ignoring the customers who couldn't discover the problem with the product. This demonstrates the company's immoral attitude toward its clients and the services it delivers to them. Finally, when another version of ITP's chip was discovered to have the same problems, the company quickly announced it and replaced all the customers' chips. As a result, ITP established an ethical approach this time and maintained good public and customer relations.

**2. Use the IEEE Code of Ethics to analyze this case and identify all violations (identifying number is ok). Note: pay attention to issues of accurate representation of engineered products and to safety issues.**

**Ans:** The above scenario violates the first three principles of the IEEE Code of Ethics. They are as follows:

**i) To accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to promptly disclose factors that might endanger the public or the environment.**

This principle was violated in this case since there were safety risks relating to the flaws discovered in the Pentium CPUs. One of the safety hazards is that the calculation results were misinterpreted, causing problems in the construction of bridges or machinery. As a result, there is a significant possibility of casualties, which raises the risk of injuries.

**ii) To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist.**

But despite knowing about the problem, the engineers kept it a secret. This demonstrated Intel's indifference towards customers to maximize profits, thereby violating the principle.

**iii) To be honest and realistic in stating claims or estimates based on available data.**

However, Intel initially denied that there was a problem with the chip and then declared that the defect was minimal.

**3. Should you reveal defects in a product to a consumer?**

**Ans:** Yes, from my perspective, I should try to reveal the defects in the chips to the customers.

1. **Is the answer to this question different if the defect is a safety issue rather than simply a flaw?**

**Ans:** No, the answer would not be a different one whether the fault in the Pentium chips was a safety problem or merely a flaw. Because most consumers utilize computers to perform complex computations that cannot be solved in real-time. As a result, the scientists or researchers who use Intel Pentium chips-based computers might miscalculate the results. Consequently, the accurate design and study of bridges or other structures were impossible. Therefore, the bridges could collapse at any time, endangering people and causing accidents without warning. This is a vital safety concern for those who build bridge using computers. The flaw in the floating-point unit could produce incorrect findings, resulting in massive miscalculation steps, making it unsafe for the company to conduct its research solely using this method.

1. **Is the answer to this question different if the customer is a bank that uses the computer to calculate interest paid, loan payments, etc., or a hospital that uses the computer to control critical patient care equipment?**

**Ans:** No. Because the main issue with Pentium chips is due to a defect in the floating-point unit, which caused miscalculations in the whole process. This has an impact not only on the research area, but also on the financial sector, where computations are a key priority. One of the most serious flaws was discovered in the software used to perform the computations on the Pentium chips to calculate the interest paid or loan installments. Any minor blunder might devastate the entire banking sector as banks try to determine how much money should be delivered to clients at what interest rate. A minor miscalculation could cause significant pressure since the quantity of money that banks should keep may differ from the expected amount. As a result, the correct loan payments might not be supplied to the clients, ultimately causing loss to the customers.

**4. Should you replace defective projects even if customers won’t recognize the defect?**

**Ans:** It is the seller’s professional duty and ethical obligation to make the customer aware of the product defects no matter when the customer buys the product.

In this situation, even if customers are unaware of the defect, I would nonetheless replace the damaged products. This is because it is not only my professional duty, but also my ethical responsibility, to replace any defective products and to inform customers of any flaws or defects in the things they are purchasing. In any case, if the buyer purchases the item, the defect should be disclosed to him. However, I would make every effort to avoid selling any defective things, and if by accident I did, I would replace them by calling the customer and informing him of the defect and replacement of the product to win the consumers' trust. It will also help my company grow by boosting consumer confidence.

**5. Is it ever possible to say that no defect exists in a product or structure? How thorough should testing be? (Note: use IEEE Code of Ethics as a guide to your answer)**

**Ans:** No defect exists in a product or structure if the manufacturer has completed all testing procedures and tested the product under all extreme situations and performance levels. If the product is shown to be a winner after being tested under all extreme situations, it may be confidently declared and claimed that no flaw exists in a product or structure.

A product's testing refers to the measuring of a product's qualities, performance levels, and criteria. Testing is carried out to confirm that the product can perform the functions and provide the results stated in its specifications and marketing. A product's testing should be so rigorous and thorough that it emerges as successful even if subjected to the maximum level of complexity of its performance level. Product testing is important because it indicates the performance level and capability of a product, which must be communicated to customers. This testing is also important for safety reasons, as a consumer must be informed of the dos and don'ts of a product, as well as how safe the product is to be used by them.

**6. Do flaws that Intel found in earlier generation chips have any bearing on these questions? In other words, if Intel got away with selling flawed chips before without informing consumers, does that fact have any bearing on this case? Why or why not?**

**Ans:** The flaws that ITP found in its models of microprocessor chips have a bearing on how goods are tested, replaced when they are defective, and checked for safety concerns, among other things. This is because the flaws in ITP's product were not apparent when it was first introduced to the market; however, after a small number of units were sold, the company received complaints and criticism, to which it quickly responded by replacing the defective chips with new ones that had been fixed. Even after becoming aware of the fault or weakness in the chip, ITP continued to sell the product until the supply was empty. This shows ITP's unethical behavior. Despite this, ITP was able to sell defective chips to consumers without disclosing the issue until the supply of the flawed chip was empty.

**7. G. Richard Thoman, an IBM senior vice president, was quoted as saying, “Nobody should have to worry about the integrity of data calculated on an IBM machine.” How does this statement by a major Intel customer change the answers to the previous question?**

**Ans:** Mr. G. Richard Thoman, an IBM senior vice president, said that customers should not worry about the integrity of data calculated on an IBM machine. This statement from such a prominent and renowned figure significantly alters ITP's negative reputation. This is because IBM is a significant client of ITP, and it would be a major growth for ITP if IBM declared that its ITP solution was error-free and fully operational. With such a comment from IBM, all the negative remarks that ITP had to deal with are diminished, which is a huge relief for ITP and its market reputation.

**8. Just prior to when this problem surfaced, Intel had begun a major advertising campaign to make Intel a household name. They had gotten computer manufacturers to place “Intel Inside” labels on their computers and had spent money on television advertising seeking to increase the public demand for computers with Intel processors, with the unstated message that Intel chips were of significantly higher quality than other manufacturers’ chips. How might this campaign affect what happened in this case?**

**Ans:** Prior to the issue of defective microprocessor chips, this company ITP had launched a major advertising and marketing campaign to make Intel a household name. The firm utilized every available avenue to promote its products, providing the impression that ITP's products are of higher quality than other comparable products on the market. This type of campaign, which ITP initiated, helped in giving the public the idea that the company and its products are superior to those of its competitors. However, shortly after beginning this campaign, the company was criticized for its faulty chips, which had a negative influence on the extensive advertising ITP had run before the revelation of this problem. This is because when a firm advertises its items widely, consumers tend to create favorable impressions of both the product and the company performing the advertising. The same thing happened to ITP; the negative news the company received spread like wildfire or turned all the company's advertising initiatives ineffective, leaving consumers once more distrustful of its goods.

**9. What responsibilities did the engineers who were aware of the flaw have before the chip was sold? (Again, check in with the IEEE Code of Ethics for your response)**

**a) After the chips began to be sold?**

**b) After the flaw became apparent?**

**Ans:** Before the chip was sold, the engineers should investigate the chip’s standard. Section II.1 of IEEE Code states "Engineers shall hold paramount the safety, health, and welfare of the public." Only those engineering documents should be approved by engineers which are consistent with applicable standards.

1. After the chip was sold to the public. Section III.1 of IEEE code states " Engineers shall be guided in all their relations by the highest standards of honesty and integrity." When engineers think a project won't succeed or have flaws, they must inform their clients or employers.
2. After the flaw became apparent, section II.3 of IEEE code states " Engineers shall issue public statements only in an objective and truthful manner. In professional reports, statements, or testimony, engineers must be unbiased and truthful.”