Laboratory 1: Cellular Phones and Cancer

"The Cigarettes of the 50s"

Purpose: This case illustrates the problems that engineers have in dealing with and managing the unknown. Many of the designs that engineers produce are experimental in nature or deal with effects that aren't fully understood. It is incumbent on the designer to be informed about the potential risks to users of their designs and to seek to minimize these risks to the extent possible for the General Public.

Case:

Concerns about potential adverse health effects of cell phones began in 1992 with a lawsuit filed in Florida. The possible problems with cell phones are clear.

In using a cell phone, you are placing a source of electromagnetic radiation near your brain. It doesn't take much imagination to see the potential for problems: Microwave ovens use electromagnetic radiation to cook food. Of course, cell phones operate at a different frequency and at much lower power levels than do microwave ovens, but the analogy is clear. The human body evolved in an environment that did not contain significant levels of radiofrequency (rf) radiation, so it is possible that the plausible t ubiquity of RF fields in our modern industrial world might cause some adverse health effects.

What types of studies related to exposure to rf radiation have been performed? Typically, these studies that were retrospective looks at people who have used cell phones. The goal of these

studies was to try to determine the levels of exposure to rf radiation from cell phones of every person in the study and to try to correlate the levels with subsequent health effects, especially cancers.

While the studies all generally indicated that there is no harm in cell phone use, problems remain. In fact, a most recent study from FDA 2020 [1] shows inconclusive evidence [2].

Many of the problems with these studies is they relied on **self-reporting** of cell phone use. They asked people to report how much time they spent talking on their phones. Many people reported their phone use accurately, but many others either didn't really know how much they used their phones or misestimated their use. These studies are also difficult to analyze, since it is hard to know the power levels everyone has been exposed to.

The power emitted by the phone depends on what model of phone you use and how far you are from the base station while talking. Also, brain cancers generally take a long time to develop. There may not have been enough time since the widespread use of cell phones for a significant number of cancers to have developed. Solid links between cell phone use and brain cancers might not show up for another 10 to 20 years.

Questions:

1. What is an engineer working for a cell phone company or some other company making products that emit rf radiation to do when confronted with the ongoing concerns about the health effects of rf fields?

2. Cell phones can certainly be redesigned to reduce or eliminate this problem, but, of course, any design that will lead to reduced emission will probably cost more. We won't know for many years what the final answer is regarding cell phone health effects. For

now, it seems that cell phones are probably safe to use---just like they thought that cigarette smoking was safe in the 50's and 60's. We do not know what time will reveal.

3. What is the prudent and ethical thing to do in designing such products in an atmosphere where some doubt about safety exists?

4. What do rights and duty ethics tell us? Consider these questions from the point of view of a design engineer who must work on a product that might emit hazardous radiation. What does the code of ethics of the IEEE tell us about this case?

5. Analyze this case by determining the factual issues, determining the conceptual issues, and deciding which moral issues apply.

6. If there are potential, but not well-understood, hazards in building a product, what are the future consequences of doing nothing, i.e., of making no changes in the design? Will warnings to the consumer suffice to get the designer off the hook? Must the product be engineered to be totally safe at all costs?

7. How can one best balance safety with economics in this case? Hint: Use your lecture notes to come up with a middle of the road answer.

8. Many of the studies researching cell phone safety have been funded by the cell phone industry. What are the ethical implications of this?

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