Examples of Real World Engineering Ethics Problems*

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Keywords: ethics, ethics support, cases, safety, hotline, respirator, air bags, IEEE, intensive care unit, exit lights, wrongful discharge, tanks

ABSTRACT: Nine examples are presented illustrating the kinds of problems encountered in actual practice by conscientious engineers. These cases are drawn from the records of the IEEE Ethics Committee, and from the experience of the ethics hotline initiated recently by the Online Ethics Center for Engineering and Science. They range from situations in which companies try to cheat one another to those in which human health and safety are jeopardized. In one case, an engineer learned that even a quiet resignation can prove very costly in a personal sense. Some ways in which professional societies might make ethical practice of engineering somewhat easier are mentioned.

1. Introduction

Starting in the early nineties, there was a resurgence of ethics-related activity in the Institute of Electrical and Electronics Engineers (IEEE), the world’s largest technical society with over 330,000 members internationally. Important developments included:

1. The annual distribution to members of the IEEE Ethics Code;
2. The inauguration of a bimonthly ethics column in the IEEE Newspaper received by all members;

* An earlier, shorter version of this paper was presented at the International Conference on Ethics in Engineering and Computer Science, Case Western Reserve University, Cleveland, March 21-24, 1999, and can be accessed on line at http://onlineethics.org/cases/unger.html.

In all cases described in this paper, the names of individuals and organizations have been suppressed or fictionalized.

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Paper received, July 1999: revised, March 2000; accepted, April 2000.

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3. The establishment of an ethics web site;
4. Promulgation of Guidelines For Engineers Dissenting On Ethical Grounds. ("Engineer" is used here as a shorthand term for technical professionals in the fields encompassed by the IEEE);
5. The establishment of an ethics hotline to support engineers with ethics related problems.

Also, a proposal was developed for an IEEE Ethics Support Fund, to be financed by voluntary contributions. Unfortunately, in 1997, a backlash at the highest level of the IEEE squelched progress in the ethics area and, among other things, terminated the hotline, which had been operated successfully for a year, beginning August, 1996. But that is another story.1-2 Subsequently, the people who operated the IEEE Ethics Hotline, along with some other people, initiated an Ethics Help-Line with similar objectives, under the aegis of the On Line Ethics Center for Engineering and Science.4 A cosponsor is the National Institute for Engineering Ethics (NIEE).

Most of the cases to be reported on here came to the attention of the IEEE Ethics Committee during the past few years. Most came in via the ethics hotline, while the initial contacts for others was via communications addressed to authors of ethics columns that appeared in the IEEE Institute. Some other cases arrived on the new ethics help-line. Most of these cases have not been carefully investigated, although we are fairly confident that the essential information is correct. The outcomes of most of the cases are not yet known—in some cases matters are still in a state of flux. Names and other information that might identify individuals or organizations have been suppressed or fictionalized.

2. Infants Under Pressure

Sam Wilson, an experienced engineer was employed by MedTech, a company that made medical equipment. An important line of products were respirators, used in hospitals. A colleague of Sam asked him to check out one of these respirators, one designed for infant use. He soon determined that a relief valve intended to protect against overpressure being applied to the infant's lungs was incorrectly placed, so that, under certain circumstances, the infant could experience dangerously high pressure.

Correcting the error would not be difficult, since all that was needed was to reposition the relief valve. In similar circumstances in the past, Sam had seen such problems handled with dispatch. He called the matter to the attention of the appropriate manager and assumed that it would be taken care of.

A month or so later (Sam was not directly involved with this particular device) he learned that nothing had been done. Hundreds of these devices were already in use, and Sam was concerned about the increasing likelihood of a tragic event. He went back to the manager and urged him to take appropriate action. When the manager fended him off, Sam said that if prompt measures were not taken to correct the problem he would have to report it to the cognizant regulatory agency. The response of
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MedTech was to fire Sam. Apparently the then current president of MedTech did not have the same attitude toward product quality that had been prevalent in the past.

At about the same time, the respirator problem was identified by a physician who had encountered one in hospital practice. Sam brought suit against MedTech for wrongful discharge, claiming that his actions in calling attention to the problem were mandated by the code of ethics that binds professional engineers. Sam is a licensed PE. Various management changes have since occurred and the legal process is slowly moving along.

The IEEE Member Conduct Committee recommended that the IEEE file an amicus curiae brief supporting Sam on the principles involved. The IEEE Board of Directors approved such action, which is to be taken at an appropriate point in the legal proceedings.

3. Using Other People’s Software

Jim Warren was a senior software systems expert, hired by NewSoft, a start-up company, to help in the development of a new product. He soon learned that the product was based on proprietary software for which NewSoft did not have a license. Jim assumed that this was some sort of mistake and spoke to the company president about the matter. He was assured that the situation would be rectified. But time passed and nothing happened except that Jim found other instances of the same practice. Repeated efforts to get NewSoft to legalize its operations failed and Jim, after threatening to notify the victimized companies, was discharged.

Law enforcement officials were brought into the picture and lawyers on all sides began negotiating. At this date it is not clear whether criminal charges will be filed. There appears to be a strong possibility of some sort of out-of-court settlement among the companies involved. We don’t know how this will ultimately affect Jim Warren.

4. Not Lighting Up

Will Morgan, a licensed electrical engineer, worked for a state university on construction and renovation projects. His immediate manager was an architect, and next in the chain of command was an administrator, John Tight, a man with no technical background. Tight, without talking to the engineers, often produced estimates on project costs that he passed on to higher university officials. In those cases, not infrequent, where it became evident that actual costs were going to exceed his estimates, he would pressure the engineers to cut corners.

One such occasion involved the renovation of a warehouse to convert some storage space into office space. Among the specifications detailed by Morgan was the installation of emergency exit lights and a fire detection system. These were mandated by the building code. As part of his effort to bring the actual costs closer to his unrealistic estimate, Tight insisted that the specifications for these safety features be deleted.
Will strongly objected on obvious grounds. When he refused to yield, Tight brought charges against him, claiming that he was a disruptive influence. Although his immediate superior, the architect, did not support these charges, he did not fight for Morgan, who was ultimately dismissed by the university. Morgan is now suing for wrongful discharge.

A related issue in this case is that Tight was designating unlicensed people to modify electrical designs submitted by Morgan. This constitutes another improper and, indeed, illegal act.

5. Intensive Care

George Ames, a young software engineer worked for a hospital computer department. He was assigned to work with the people in the intensive care unit (ICU). The computer group was working on the interface between a piece of commercial data processing software and various units in the ICU, including real-time patient monitoring devices.

From the manager down, the computer group was not technically up to the mark in experience or in education. They were falling significantly behind schedule. George learned that they were seriously considering cutting back on testing in order to close the schedule gap. Appalled at this idea, George argued strongly against it. In this case, his arguments had some effect, but he was nevertheless given the clear impression that his prospects with this organization were now significantly impaired. Apparently, part of the problem had to do with a reluctance on the part of higher management to clash with the physician who headed the computer group. George felt that the basic problem was incompetence and he did not see how he could be effective on his own in combating it. About six months later, he resigned.

6. Making Good Wafers Look Bad

Don Fisher, an electrical engineer, worked for Dicers, a company that purchased wafers for microprocessor chips from another company and then diced, packaged, and sold them. Don was assigned the task of testing these wafers. After a while, he was instructed by his manager to alter the testing process in such a manner that the quality of the purchased wafers was made to seem lower than it really was, which had the effect of lowering the price paid. Don objected to this practice and refused to go along. Eventually, he was discharged.

7. Air Bags

SafeComp is a company that, among other things, designs and makes sensing devices for automobile air bags. Bob Baines was hired to work in the quality control department. About six weeks after starting work, he was asked to sign off on a design
that he felt very uncertain about. He checked with people involved in the design and found the situation, at best, ambiguous.

Bob told his manager that he would not feel right about signing off and, since he was relatively inexperienced with SafeComp’s procedures, asked that he not be required to do this. His manager kept applying pressure. Eventually, Bob decided that he wished neither to violate his principles by doing something that he thought was wrong, nor to become involved in a battle in which his career would certainly be a major casualty. He quietly resigned. (For a little more information on this case, see reference3).

8. Flight is also Risky

Ralph Sims had worked for the US Government for many years as an engineer, rising to a fairly high managerial position. On retirement, he accepted an executive position with SuperCom, a company producing electronic equipment for the military.

Shortly after coming on board, Ralph was informed by a subordinate that, for a long time, a key test on an important product was not being made in the manner specified by the contract. This had been going on for several years and the subordinate felt very uncomfortable about it. Ralph, who had considerable expertise in the technology involved, looked into the matter carefully. It turned out that, in his previous career, he had acquired some knowledge about the specified test.

He found that a shorter, and hence less costly, test had indeed been substituted for the required one. But, after some study, he concluded that SuperCom’s test was actually as effective as the specified test.

Nevertheless, by this unauthorized substitution, SuperCom was violating the contract and exposing itself both to criminal and to civil prosecution. He took his findings to upper management and urged them to apply to the contracting agency for a contract change authorizing the simpler test. Ralph felt confident that such a change would be accepted.

But his arguments were not accepted and SuperCom continued on their previous course. The apparent reason was the company president’s reluctance to confess that the company had been deceiving the government for years. Ralph did not see why he should get into an unpleasant battle with the SuperCom’s leaders over this, since there were no safety issues and even the quality of the product was not actually at stake. Nevertheless, he did not wish to be involved in a dishonest and probably illegal operation. Therefore, he chose the course of quietly resigning, without “turning in” the company.

About three years later, a SuperCom employee reported the deception to the government, and a criminal investigation was launched. When he resigned, Ralph had signed a non-disclosure agreement as a condition for receiving some severance pay. Nevertheless, when called upon by the prosecutor’s office to give information about the situation, he cooperated fully.
To his dismay, when the indictments came down, he was one of the people charged with complicity in the fraud. This necessitated his hiring an attorney and undergoing both the expenses and anguish of being a defendant in a criminal case. Fortunately for him, after many months, a new prosecutor was assigned to the case. Shortly afterward, the charges against Ralph were dropped. But, meanwhile, the affair had cost him months of anguish, embarrassment, and a damaged reputation due to publicity whose effects can never be fully repaired.

The trial took three months. All five of the company’s employees were acquitted. There was a hung jury in the case against the president. The company was fined $800,000 and its estimated legal expenses were estimated at close to a million dollars. Furthermore it is no longer permitted to work on government contracts involving testing.

9. Tank Job

John Strong is a licensed PE in private practice. He was asked to review the installation of a water tank for a client, the Friendly Water Company, operating a small public water supply system. The tank, purchased from the Crystal Water Company, was stated to be eight years old and appeared to be in good condition. Checking with another engineer with some knowledge of Crystal’s operations, Strong was informed that the tank was listed on that company’s records as being 20 years old.

Strong was concerned about the condition of the tank, since, when such tanks rupture, people are sometimes seriously injured, or even killed, and there can be significant property damage. He therefore recommended to Friendly Water that the tank be inspected by a qualified engineer (Strong himself was not qualified to do this) to ensure that it would be safe to use under the expected conditions.

He also explained the situation to the state agency responsible for issuing a construction permit for the addition to the water system. They issued a permit in which they strongly recommended, but did not mandate that the tank be inspected. The client expressed an inclination not to undergo the expense for an inspection if this were not a required condition for the permit.

Now Strong faced a dilemma. He was reluctant to sign off on the modified system unless the newly added tank was inspected. But the state agency, which should have been protecting the public safety in this respect, was waffling on the issue, and Friendly Water was taking a short-sighted view by trying to save some money at the risk of exposing itself to serious liability claims, should the tank rupture.

While pondering the matter, Strong checked further and learned that the tank might indeed be only eight years old. Apparently Crystal had replaced an old tank with a newer one (the one at issue) without notifying the state agency and obtaining the required permit. While this eased Strong’s concerns to some extent, he still felt that an inspection was important. But now he had a new option: to urge his client, Friendly Water, to press the seller, Crystal, to pay for the inspection, with the incentive of
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avoiding exposure of their earlier failure to notify the state agency about the tank replacement. At this writing, Friendly Water seemed to be inclining toward having the tank inspected.

Should they not do so, an option that Strong might consider is to notify local government officials, who might then try to get the state agency to do its job.

10. Tanks Again

The Tight Screen Company manufactured various kinds of air filtering equipment, including a dust filtering unit for air compressors and blowers. This was housed in a tank purchased from an outside vendor, Noe Tanks. There are no safety valves or other protective features. Engineer Ralph Kair learned that the tanks were not pressure rated by Noe, so that the pressure rating specified by Tight Screen was not justified. Kair pointed this out to his management, but nothing was done.

Subsequently, Kair was asked to design another version of the system. At this time, management, at Kair’s urging, agreed to have the tank designs reviewed by another company, who confirmed Kair’s view that they were not adequate. Tight Screen then agreed to use a more suitable tank manufactured by a different company. But they continued to use the Noe tanks in the older system. Later, in an effort to trim costs, Tight Screen began using the Noe tanks in the newer system as well.

Around this time, Kair left Tight Screen to work for another company in the field. He is wondering what he ought to do about Tight Screen continuing to market a product with a potential for a pressure failure with serious consequences. He is considering notifying some state agency with regulatory responsibility in this area, or informing customers of Tight Screen. It is not clear how his current employer would view such actions.

11. Some Remarks

An interesting aspect of some of these cases, fully consistent with other such cases previously on record, is the blatant irrationality displayed by some managers. What combination of ignorance, arrogance, stupidity, and greed produced the self-destructive behavior of management in the respirator case?

Although the IEEE Ethics Hotline was listed in the IEEE Institute and occasionally mentioned in that publication, my impression is that only a small percentage of IEEE members were aware of its existence. The newer help-line, although dealing with a larger population of engineers, is even less well publicized. Therefore, I suspect that the cases that came to us represent only a small fraction of what is out there.

Providing engineers facing ethics-related problems with advice from experienced people as well as a sympathetic ear is clearly very useful. But, it should also be evident from the samples provided above, that there is a real need to do more. The options
available to an individual in conflict with even a small organization, are very limited. Only those with exceptional courage and dedication are willing to put their careers on the line.

Engineers acting in concert through their societies could alter the situation significantly. Aside from the obvious value of providing some financial aid, there is also the possibility of low key, informal intervention at the early stages. For example, such intervention in the ICU case and in the air bag case might have had very beneficial effects for all concerned, including not only the engineers and the general public, but also the employers. The mere presence in such cases of a large organization expressing an interest in the engineer's situation and contentions changes the entire picture. It makes it far more difficult for an employer to casually brush off an engineer expressing serious professional concerns. We have seen evidence of this in the past and, in a few recent cases, not mentioned here.

Acknowledgments: Listing names of people who are part of an important enterprise is analogous to making up a list of people to invite to a wedding. A very short list omits significant contributors, and a longer list makes omissions more painful. Nevertheless, here is a short list of key figures in the drive to develop and energize ethics support in the IEEE, with apologies to others not mentioned: Walt Elden, Ray Larsen, the late Joe Wijek, Mal Benjamin, Finley Shapiro, Joe Herkert.

REFERENCES

4. The URL of the Online Ethics Center is: http://www.onlineethics.org