National Society of Professional Engineers (NSPE) Code of Ethics for Engineers

Outline

- Introduction to the NSPE Code of Ethics
- Case studies (4)
- Use in MAE126B

Why Are Ethics Important to Engineers?

- Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity.
- Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness and equity, and must be dedicated to the protection of the public health, safety and welfare.
- Engineers must perform under a standard of professional behavior which requires adherence to the highest principles of ethical conduct.

Fundamentals

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically and lawfully so as to enhance the honor, reputation and usefulness of the profession.

Safety

- Engineers shall hold paramount the safety, health and welfare of the public.
- If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
- Engineers shall perform services only in the areas of their competence.

Objectivity and Honesty

- Engineers shall be objective and truthful in professional reports, statements or testimony.
- They shall include all relevant and pertinent information in such reports, statements or testimony, which should bear the date indicating when it was current.
- Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.

Trustees

- Engineers shall disclose all known or potential conflicts of interest which could influence or appear to influence their judgment or the quality of their services.
- Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.
- Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.

Deceptive Acts

- Engineers shall not falsify their qualifications or permit misrepresentation of their, or their associates' qualifications.
- They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments.
- They shall not offer any gift, or other valuable consideration in order to secure work.
- They shall not pay a commission, percentage or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

Integrity

- Engineers shall acknowledge their errors and shall not distort or alter the facts.
- Engineers shall advise their clients or employers when they believe a project will not be successful.
- Engineers shall not promote their own interest at the expense of the dignity and integrity of the profession.

Public Interest

- Engineers shall seek opportunities to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health and well-being of their community.
- Engineers shall not complete, sign or seal plans and/or specifications that are not in conformity with applicable engineering standards. If the client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further service on the project.
- Engineers shall endeavor to extend public knowledge and appreciation of engineering and its achievements.

Case Study

B.F. Goodrich Air Force A7-D Brake Problem Case And The Whistleblowing Debate

Introduction

- On June 18, 1967, the B.F. Goodrich Wheel and Brake Plant in Troy, Ohio, received a contract to supply wheels and brakes for the new Air Force light attack aircraft.
- Goodrich won the contract based on their competitive bid and, more importantly, their innovative technical design, featuring a light-weight four-rotor brake1.
- Before the Air Force could accept the brake, B.F. Goodrich had to present a report showing that the brake passed specified qualifying tests.
- The last two weeks of June, 1968, were set aside for flight testing the brake, giving Goodrich almost a full year for design and testing.

Introduction

- Following brake failure at the June, 1968 flight tests, and the ensuing accusations by a former B.F. Goodrich employee, Kermit Vandivier, regarding qualification test report falsification and ethical misconduct on the part of specific B.F. Goodrich personnel, Senator William Proxmire (D-Wisconsin) requested a governmental inquiry into the brake qualification testing performed by the B.F. Goodrich Troy Plant.
- On August 13, 1969, a four-hour Congressional hearing2, chaired by Senator Proxmire, was held to investigate the Air Force A7D Aircraft Brake Problem.

Vandivier's Goodrich Chronology 1967

- June 18: Goodrich receives Purchase Order P-237138 (for $69,417) from LTV Aerospace Corporation. LTV orders 202 four-rotor brake assemblies from B.F. Goodrich for the new Air Force A7D light attack aircraft LTV is contracted to build for the Air Force.
- LTV sets last two weeks of June 1968 aside for flight testing of the B.F. Goodrich brake assemblies. Goodrich must qualify the brake for testing prior to flight test commencement.
- June 1967- B.F. Goodrich engineer, Searle Lawson, builds and tests
- March 1968: braking prototypes. All tests fail crucial temperature tests.

Vandivier's Goodrich Chronology 1968

- April 4: Thirteenth attempt to qualify the four-rotor brake begins. No longer any pretense of qualifying the brake to military specifications. The brake is "nursed" through the required 50 simulated stops, with fans set up to provide special cooling for the brake.
- April 11: Vandivier gets involved. Vandivier, in looking over raw data from the A7D brake tests observes that many irregularities in testing methods were noted in the test logs. Vandivier queries Lawson and discovers that Lawson was instructed to deliberately miscalibrate tests, thereby ensuring the four-rotor brake qualifies to the letter of the government specification.
- May 2: Fourteenth and final attempt to qualify the brake begins. Lawson is told by his superiors, Robert L. Sink and Russell Van Horn, to qualify the brake, "no matter what."

Vandivier's Goodrich Chronology 1968

- late May: Vandivier refuses to write a falsified qualification report, and is backed up by his immediate supervisor, Ralph Gretzinger.
- Despite protests, graphic portion of Qualification Report Q6031 is completed by Vandivier and Lawson (taking approximately one month).
- Chief Engineer Bud Sunderman informs Gretzinger that the engineering section has no time to write the qualification report, so the Technical Services section must. Vandivier is ordered to write the report. He does so, despite the fact that he knows it is a falsified report.

Vandivier's Goodrich Chronology 1968

- late May: A few days later Lawson returns from a conference in Dallas with LTV and the Air Force, where the Air Force officials rescind their approval of Qualification Report Q-6031, and demand to see the raw data from the B.F. Goodrich testing laboratory. Vandivier tells Lawson that his attorney has advised him that both he and Lawson are guilty of conspiracy. Lawson asks Vandivier to see his attorney, and one week later Lawson is introduced to FBI agent Hathaway.
- June 5: Qualification Report Q-6031 officially published by B.F. Goodrich and delivered to LTV and the Air Force.
- June 12: Flight tests begin at Edwards Air Force Base in California. Lawson is present at the tests, and returns two weeks later with reports on testing incidents caused by failure of the Goodrich brake.

Vandivier's Goodrich Chronology 1968

- late June: On hearing Lawson's story about danger to the pilot resulting from the faulty brake, Vandivier sees his attorney, who advises Vandivier that both he and Lawson might be considered part of a conspiracy to defraud the government.
- early July: Vandivier's attorney takes him to Dayton, Ohio to meet with FBI agent Joseph Hathaway, who advises Vandivier not to discuss his story, and assures Vandivier he will forward the information to his superiors in Washington.

Vandivier's Goodrich Chronology 1968

- July 27: Saturday morning conference held between Vandivier, Lawson, Sink and Warren to discuss strategies for telling LTV about the differences in "engineering" interpretation of the test results found in Qualification Report Q-6031. Sink cautions Vandivier that this is not lying; rather, it is a case of engineering "rationalization," or judgment. During the meeting, 43 discrepancies were noted. Sink deems only 3 of these worth mentioning to LTV.
- August- Visits between LTV and B.F. Goodrich engineering personnel.
- September: (Unbeknownst to Vandivier, a five-rotor brake was being designed and tested, at no additional cost to either LTV or the Air Force, as a replacement to the faulty four-rotor brake.)

Vandivier's Goodrich Chronology 1968

- October 11: Lawson resigns his position at Goodrich, securing employment at LTV.
- October 18: Vandivier resigns from Goodrich, making his effective date November 1. His letter contains numerous accusations of ethical misconduct at the Troy Plant over the past six months.
- October 25: Sunderman calls Vandivier in and dismisses him immediately for disloyalty to Goodrich. Sunderman asks Vandivier if he will take further action. Vandivier says, "Yes." Sunderman responds, "Suit yourself."
- October 27: B.F. Goodrich recalls Qualification Report Q-6031 and the four-rotor brake, and announces it will replace the brake with a new, improved, five-rotor brake at no cost to LTV.

Vandivier's Goodrich Chronology 1969

- May 13: Senator Proxmire requests GAO to investigate B.F. Goodrich's Qualification Report Q-6031 testing procedures.
- August 13: Four-hour Congressional hearing, chaired by Senator Proxmire, held before the Subcommittee on Economy in Government to determine: (1) the accuracy of B.F. Goodrich's reported qualification test results; (2) the effect the defective brakes had on the test pilot's safety; (3) the identification of additional costs, if any, incurred by the Government to obtain an acceptable brake; and (4) the responsibilities of the Government, including Air Force actions, in the qualification testing.
- August 14: Department of Defense announces changes in inspection, testing and reporting procedures.

Ethical Issues Of The Case

1) Was this a clear-cut case of ethical wrong-doing? If so, what were the wrong(s), and did they justify whistleblowing? What are the responsibilities of the whistleblower?
2) How did events escalate such that the only recourse was whistleblowing? What causal forces spurred Vandivier to action? What personal, social, economic and political considerations were involved at the time? What roles did failed technological innovation, poor communications and erroneous qualification testing procedures play? And, could whistleblowing have been avoided?
3) What procedures can individuals/engineering societies/businesses/government put in place to ensure whistleblowing is not the end result?

Case Study

Credit for Engineering Work
Design Competition

Credit for Engineering Work Design Competition - Case No. 92-1:

- Engineer A is retained by a city to design a bridge as part of an elevated highway system.
- Engineer A then retains the services of Engineer B, a structural engineer with expertise in horizontal geometry, superstructure design and elevations to perform certain aspects of the design services

Credit for Engineering Work Design Competition - Case No. 92-1:

- Engineer B designs the bridge's three curved welded plate girder spans which were critical elements of the bridge design.
- Several months following completion of the bridge, Engineer A enters the bridge design into a national organization's bridge design competition.
- The bridge design wins a prize. However, the entry fails to credit Engineer B for his part of the design.

Question?

- Was it ethical for Engineer A to fail to give credit to Engineer B for his part in the design?

Discussion

- Basic to engineering ethics is the responsibility to issue statements in an objective and truthful manner
- The concept of providing credit for engineering work to those to whom credit is due is fundamental to that responsibility.
- This is particularly the case where an engineer retains the services of other individuals because the engineer may not possess the education, experience and expertise to perform the required services for a client.

Discussion

- The engineer has an obligation to the client to make this information known
- The principle is not only fair and in the best interests of the profession, but it also recognizes that the professional engineer must assume personal responsibility for his decisions and actions.

Case Study

Duty to Report Unsafe Conditions/Client Request for Secrecy

NSPE Case No. 98-9: Duty to Report Unsafe Conditions/Client Request for Secrecy

- Engineer A, a structural designer of a large commercial building, incorporates new and innovative design concepts.
- After construction is complete and the building is occupied, he finds an omission in his calculations that could result in its collapse under severe, but not unusual wind conditions.
- The collapse would not only jeopardize the occupants and their immediate surroundings but could possibly cause a "domino" effect threatening a much larger area.

NSPE Case No. 98-9: Duty to Report Unsafe Conditions/Client Request for Secrecy

- Engineer A advises the architect and client of the problem.
- After consultation with the architect, the client, and the city engineer, all agree upon remedial construction, which can be accomplished over the next few months.
- A storm monitoring system and contingency evacuation plan for the building and surrounding neighborhood are developed for the time before construction is complete.

NSPE Case No. 98-9: Duty to Report Unsafe Conditions/Client Request for Secrecy

- Both the client and architect strongly agree that the situation should be kept secret, with construction accomplished during the evening hours when the building is unoccupied. Engineer A is confident that the construction will completely rectify any structural concerns and that the evacuation plan has a reasonable chance of success.
- Engineer B, the city engineer, has concern for the public, especially the office workers in the building and their right to know, but the architect and the client maintain that right is superseded by the consequences of a possible public panic resulting from any notification.

Questions

- Is it ethical for Engineer A, the structural engineer, to comply with the client's and the architect's desire for secrecy?
- Is it ethical for Engineer B, the city engineer, to maintain the secrecy?

Discussion

- Engineer A's actions in promptly reporting his findings to the client and providing a corrective design were both ethical and commendable. Nevertheless, the necessary repairs require months before the building's stability could be ensured. During that time, the building's occupants along with a large area of the city, remained in jeopardy, with only an untested evacuation plan protecting them from possible disaster.
- The desire to avoid public panic is certainly a legitimate factor in deciding upon a course of action. However, withholding critical information from thousands of individuals whose safety is compromised over a significant period of time is not a valid alternative for the conditions presented.

Discussion

- It would seem that Engineer A should have informed the client and the architect that, while he has an obligation of confidentiality to them as clients, he has this ultimate, paramount obligation to see that the public is protected. He should have let them know that he must inform the appropriate authorities unless they immediately develop and carry out a plan to do so. Such a plan, developed in consultation with a public relations firm and legal advice, could have avoided panic and sensational media hype, while protecting the public."

Discussion

- The argument can be made that the Engineer B, the city engineer, could be considered an "appropriate authority." However, given the magnitude of the situation, it was incumbent for Engineer A, as well as Engineer B, to vigorously advocate actions necessary for public protection and notification to higher authorities. By not doing so, both engineers failed to hold paramount the obligation for public safety.
- Engineer A could have taken other steps to address the situation, not the least of which was his paramount professional obligation to notify the appropriate authority if his professional judgment is overruled under circumstances where the safety of the public is endangered.

Engineer's Duty To Report Data Relating to Research - Case No. 85-5

- Engineer A is performing graduate research at a major university. As part of the requirement for Engineer A to complete his graduate research and obtain his advanced degree, Engineer A is required to develop a research report.
- In line with developing the report, Engineer A compiles a vast amount of data pertaining to the subject of his report.

Engineer's Duty To Report Data Relating to Research - Case No. 85-5

- The vast majority of the data strongly supports Engineer A's conclusion as well as prior conclusions developed by others. However, a few aspects of the data are at variance and not fully consistent with the conclusions contained in Engineer A's report.
- Convinced of the soundness of his report and concerned that inclusion of the ambiguous data will detract from and distort the essential thrust of the report, Engineer A decides to omit references to the ambiguous data in the report.

Question

- Was it unethical for Engineer A to fail to include reference to the unsubstantiated data in his report?

Discussion

- The engineer must be objective and truthful in his professional reports and must include all relevant and pertinent information in such reports.
- In this case, that would suggest that Engineer A had an ethical duty to include the unsubstantiated data in his report because such data were relevant and pertinent to the subject of his report.
- His failure to include them indicates that Engineer A may have exercised subjective judgment in order to reinforce the thrust of his report.

Discussion

- In a sense, Engineer A's failure to include the unsubstantiated data in his report caused his report to be somewhat misleading.
- An individual performing research at some future date, who relies upon the contents of Engineer A's report, may assume that his results are unqualified, uncontradicted, and fully supportable.
- That may cause such future research to be equally tainted and may cause future researchers to reach erroneous conclusions.

Discussion

- By misrepresenting his findings, Engineer A distorts a field of knowledge upon which others are bound to rely and also undermines the exercise of engineering research.
- Although Engineer A may have been convinced of the soundness of his report based upon his overall finding and concerned that inclusion of the data would detract from the thrust of his report, such was not enough of a justification to omit reference to the unsubstantiated data.

Discussion

- The challenge of academic research is not to develop accurate, consistent, or precise findings which one can identify and categorize neatly, nor is it to identify results that are in accord with one's basic premise.
- The real challenge of such research is to wrestle head-on with the difficult and sometimes irresolvable issues that surface, and try to gain some understanding of why they are at variance with other results.

Ethics and MAE156B

Identify your Sources

- All resources utilized in your project should be clearly referenced in the final report and on the website
  - texts, articles, papers
  - test data
  - standards and specifications
  - patents

Safety

- Immediate safety of people involved in aspects of your project
- Evaluate larger impact on society of innovative design
- If these are concerns for your project address this with an appendix or section in the report

Honesty and Integrity

- Acknowledge errors and do not distort or alter the facts
- Advise their sponsors and instructors when you believe a project will not be successful

Proprietary Information

- Evaluate with the sponsor the level of detail you may disclose without disclosing sensitive information
- Reference similar patents to your design
  - specify why yours is different

References

- Text quoted and paraphrased from the following sources:

NSPE Code of Ethics
http://ethics.tamu.edu/ethics/goodrich/goodric1.htm
http://www.onlineethics.org/