



PDHonline Course R130 (5 PDH)

More Engineering Ethics Cases

Instructor: Thomas Mason, PE

2020

PDH Online | PDH Center

5272 Meadow Estates Drive
Fairfax, VA 22030-6658
Phone: 703-988-0088
www.PDHonline.com

An Approved Continuing Education Provider

More Engineering Ethics Cases

Thomas Mason, P.E.

ETHICS CASE 1 - High Voltage Lines

ETHICS CASE 2 - Trench Boxes

ETHICS CASE 3 - ASME vs. Hydrolevel Corp.

ETHICS CASE 4 - Mt. Dioxin

ETHICS CASE 5 - Free Engineering

ETHICS CASE 6 - Design / Build Bid Error

ETHICS CASE 7 - Radiation from Cellular Phones

ETHICS CASE 8 - Missile Explosion

ETHICS CASE 9 - E-Mail Encryption

ETHICS CASE 10 - The Aberdeen Three - No Request for Clean-up Funds

ETHICS CASE 11 - Toaster Short-Circuit

ETHICS CASE 11 - Use of Another's Project Study

ETHICS CASE 12 - Airline Mechanic

REF: <http://ethics.tamu.edu/nsfcases/elen/08/ee08.htm>

ETHICS CASE 1 - High Voltage Lines

Background

The Professor read a book that electromagnetic energy is dangerous to the human body [Gandhi, O.P, 1990, Biological Effects and Medical Applications of Electromagnetic Energy, Prentice-Hall]. The book says that effects are largely mitigated by a shabby Faraday screen of copper window screening as one layer of the roof and grounded.

Situation / Problem

Real estate developer asks engineering firm to design homes in a new development with utility easements for 230kV transmission lines.

Choices

1. Take the job and insist on Faraday screen roofs on homes within the calculated hazardous distance from the high-voltage lines.
2. Take the job and contribute the costs of adding Faraday screen roofs on homes within the calculated hazardous distance from the high-voltage lines.
3. Take the job and do not talk about Faraday screen roofs.
4. Refuse the job without Faraday screen roofs.
5. Lobby the local building standards agency to mandate Faraday screen roofs on homes within the calculated hazardous distance from the high-voltage lines.

Analysis

Choice 1 is good business and consistent with the highest standards of engineering professional ethics.

Choice 2 brings liability to the design firm. If they are correct in every respect, there is still the suspicion at the “grey line” separating protected from unprotected homes. There is a very, very high likelihood that, when someone gets sick in an unprotected home, they will sue the design firm.

Choice 3 is ethically justifiable. The book referenced is one of many on the subject and the conclusions are not widely supported. There are contradictory studies showing no long-term deleterious effects on persons living near or working on high-voltage lines. Note that the Professor is confused about electric and magnetic fields. He says, in the source text, that “highest exposure times correspond to times of day that the electrical power consumption is highest.” This is current flow, and magnetic field. The volts stay constant. However, he recommends a Faraday shield against the electric field.

Choice 4 doesn't appear to benefit anyone. Normally, design engineers are proud of their work product. They like to see their offices, or factories or homes constructed. Choosing not to participate is a harsh penalty for a personal belief that living near a high-voltage power line is dangerous. Such a belief and action are very hard for

your author to envision. It is certainly part of each engineer's definition of who he is, both personally and professionally.

Choice 5 is completely beyond my comprehension. I work on a generalized basis of, IF A, AND B, THEN C. In this case, IF A has not been satisfied. My reading of popular, technical and medical press is that there is no consensus regarding deleterious effects of nearby high-voltage lines. Yes, I chose not to pursue a condo next to a transmission line, but I didn't survey the neighbours on their health status or speak on the subject to the realtor.

Actual(sic)

This is an academic case. They are not interested in reality. I see high-end residences being built on the edge of transmission line right-of-ways. I have never heard of installing a Faraday screen roofing layer. I suspect you would have to ground it with a 115kCMIL lightning downcomer at each end of the roof.

Discussion

Please stop for a moment and ask yourself, "Do I believe in the deleterious effects of living near a high-voltage transmission line?" Is this hazard greater or less than sitting next to a smoker in a restaurant? Is it greater or less than eating McDonald's French fries? What level of hazard are we willing to accept personally? For our family? At what point does the NSPE Code of Professional Ethics require that we make phone calls and participate in public meetings?

REF: <http://ethics.tamu.edu/ethics/trench/trench.htm>

ETHICS CASE 2 - Trench Boxes

Background

1926.652(a)(1)

Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

1926.652(a)(1)(i)

Excavations are made entirely in stable rock; or

1926.652(a)(1)(ii)

Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

[http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10776]

Trench box, shoring, sloping wall (1/2-to-one) or engineer-designed support systems are considered protective systems.

Use of a trench box adds to the schedule and cost of a project.

Situation / Problem

Engineer makes “observation of construction” (formerly “inspection”) visit and notes deep excavation in clay soil taking place without trench box or other required protection.

Choices

1. Talk to the Construction Manager on site and ask what exception to 1926.652 they are using to avoid trench boxes.
2. Talk to Lead Discipline Engineer when they return to the office.
3. Talk to the Chief Engineer when they return to the office.
4. Talk to the Project Engineer when they return to the office.
5. Talk to spouse at home that night.
6. Call Fox News.
7. Don't even notice it if you aren't a civil engineer.

Analysis

Choice 1 is mandated by the Guest Registration Form which must be signed before entering a construction site for one major design/build firm. The wording suggested is your current author's. It may bring swift retaliation from the management of some design firms or from the Architect leading the project.

Choice 2 is a low-stress, low-hazard response. Most Lead Discipline Engineers have the time and willingness to discuss engineers' concerns. It is extremely unlikely that there will be unfavourable consequences. As recommended in other cases, make a note of the conversation. Sign and date it and make sure it will be available to you at some unspecified future time.

Choice 3 is very dependent upon the Chief Engineer, as a person, and his stress level preceding the meeting. With discretion, this action may work well. There is a distinct possibility, however, that the engineer will receive the tag, "troublemaker" which will resurface at performance review and salary review times.

Choice 4 is also dependent upon the Project Engineer person. There is usually less personal link between a design engineer and the Project Engineer and more of a loyalty by the Project Engineer to the Client. Project Engineers are severely focused on schedule, and mention of "trench boxes" is interpreted as "schedule slip."

Choice 5 is better for maintaining personal mental health than for solving site problems. It may be a good place, however, to figure out the significance of career continuity and family responsibilities.

Choice 6 is offered facetiously. Fox News has a hard time understanding the event after a worker gets killed in a cave-in (annually, where I live). This action will not have favourable consequences.

Choice 7 has been popular for many years. The Texas A and M source material suggests that the litigation environment is changing and this may not be acceptable in the second decade of the third millennium.

Actual(sic)

This is an academic case and they don't care about reality.

Discussion

The last two big construction jobs I worked on had very proactive Construction Managers. The first had the Guest Registration Form mentioned in Choice 1 and a mandatory safety training session for regular visitors. It was said again and again that we don't look away from violations - we fix them. The second construction manager actually shut down the job site (already behind schedule) for a day after a near-miss and his conclusion that people weren't taking safety rules seriously.

REF: <http://ethics.tamu.edu/ethics/asme/asme1.htm>
ETHICS CASE 3 - ASME vs. Hydrolevel Corp.

Background

McDonnell and Miller, engineering firm and manufacturer of boiler low-level cut-offs asked the American Society of Mechanical Engineers (ASME) for an interpretation of the Boiler and Pressure Vessel Code. Chairman of the ASME sub-committee and Vice President of Hartford Steam Boiler Inspection and Insurance Company wrote the interpretation. The other subcommittee member from Hartford who went to dinner with them reviewed it before release.

McDonnell and Miller used the interpretation to show that a boiler control device competitor, the Hydrolevel Corp, was selling a non-compliant boiler low-level cut-off.

Hydrolevel went bankrupt and sued McDonnell and Miller, Hartford and the ASME. McDonnell and Miller and Hartford paid. ASME took it through appeals to the Supreme Court. The Supreme Court ruled for Hydrolevel and the net judgement against ASME was \$4.75 million.

Situation / Problem

What should ASME do to avoid this in the future?

Choices

1. Ask members for donations to cover the judgement.
2. Change internal procedures so that a sub-committee chairman cannot personally issue interpretations on ASME letterhead.
3. Publish inquiries and interpretations.
4. Add disclaimers to interpretations including right-of-appeal by interested parties. (cf, consensus standards, ANSI)
5. Have all officers and staff sign a no-conflict-of-interest promise.

Analysis

Actual(sic)

All of the above.

Discussion

There appear to be three major defects in the way ASME handled the Code interpretation request. First, it started as part of a 1971 dinner hosted by an officer of the first low-level cut-off manufacturer, and his Vice President, who was on the sub-committee,

and the sub-committee chairman, from the insurance company. This is apparent conflict of interest, in today's environment.

Second, the ASME officer who handled the question on low-level cut-offs didn't know much about the (then) current market. If he had known about the growing Hydrolevel sales and the product features, he would not have been sucked into writing an interpretation which pretty clearly said the Hydrolevel product was non-compliant.

Third, ASME showed considerable arrogance regarding their special status being above the law and not subject to internal reviews or external appeals. They thought that volunteers, with no pecuniary interest, were above liability. They really didn't know that writing an interpretation that a product was non-compliant was an act of restraint of trade within Federal statutes.

REF: <http://www.onlineethics.org/Resources/Cases/mtdioxin.aspx>

ETHICS CASE 4 - Mt. Dioxin

Background

Abandoned wood treating facility on 26 acres adjacent to African American residential neighbourhood in Alabama. The original use was creosote coating and more recently penta-chlorophenol (PCP). The owner went into bankruptcy. The EPA accidentally found high concentrations of creosote, dioxin, benzene, lead and arsenic in runoff groundwater while investigating an adjacent industrial producer. (Full analytical results are included in the source data.)

\$5 million was spent to stockpile contaminated soil on the site under vinyl tarp. The excavation released contaminant-carrying dust particles and volatile chemicals into the air and residents complained of a wide range of health problems. Five years after the excavation and bagging were completed, the EPA allocated funds to relocate residents of one allotment.

Situation / Problem

This is Monday. Wednesday, noon, is the deadline for filing a request for an Emergency Removal grant. If authorized, work can begin immediately.

Choices

1. File for Emergency Removal funds and begin work when authorized.
2. Lobby for expedited relocation of the persons in the allotment approved.
3. Lobby for relocation funds for additional neighbourhoods downwind of the planned excavation.
4. Intentionally miss the filing deadline to have time to prepare a long-range plan which includes dust mitigation and runoff control.
5. File the request and schedule a series of public meetings for comment as is normally done for non-emergency actions.

Analysis

Choice 1 has widespread support. It is doing your job. There is no suggestion that your assigned duties are contrary to public policy or law as promulgated by the Environmental Protection Agency.

Choice 2 has weak external support. It is not your job function to expedite past projects. Politically, it is unattractive to interfere in another project. Per the NSPE Code you are not supposed to attempt to supplant another engineer's services.

Choice 3 is even further from your job assignment. There is nothing wrong with offering assistance to the persons with this responsibility, but it is fairly certain that this is not a priority anywhere within EPA or local activist groups.

Choice 4 smacks of dereliction of duty and non-performance. It suggests unfavourable professional consequences if there is anyone in the EPA chain of command who cares about long-range mitigation of recognized hazards.

Choice 5 has substantial attractiveness if you seek pain on a daily basis. You are suggesting discussing something for which there are no alternatives and drawing attention to expected health hazards for which you have no remedy.

Actual(sic)

The source document introduces this case as an actual situation in Alabama, except that there are no Emergency Removal funds available.

Discussion

The lack of funds does not change the validity of the underlying question, “Do you do your job when it is legal, supports long-range public good and has severe immediate negative consequences to a small subset of the public?”

REF: <http://www.niece.org/cases/index.htm>

ETHICS CASE 5 - Free Engineering

Background

State-supported community and technical college contacted several engineering firms seeking proposals for a new facility, approximately 60-ft x 110-ft, including a water-testing laboratory, lecture hall, study area and small scale demonstration municipal water treatment processes.

After the screening interviews the college asked the three top-ranked firms for a plan sketch and a budgetary construction estimate.

Situation / Problem

Do you submit a plan sketch and budgetary construction estimate?

Choices

1. Submit the plan sketch and estimate – not on letterhead or drafting border, but stamped, “Not for Construction”.
2. Submit the plan sketch and estimate, with disclaimer that it is very preliminary, not even meeting +/- 20% accuracy because of the need for site investigation.
3. Decline to submit the plan sketch and estimate.
4. Decline to submit the plan sketch and estimate, noting that it would be a violation of NSPE Code Section 11(g) “An Engineer will not use ‘free engineering’ as a device to solicit or otherwise secure subsequent paid engineering assignments.”
5. File a malpractice charge with the State licensing board against the engineering firm selected for violating Section 11(g).

Analysis

Choice 1 is “business as usual” for every firm I have ever worked for. It has been common for an Architect seeking a big job to do a little job for free and ask for free sub-contract work, with the promise of riding his coat tails on the later big job. By the way, we have frequently been burned when the big job goes to an out-of-town Architect with in-house engineering.

Choice 2 is arguable, both for and against. In favour, it appears to have qualifications to protect the engineering firm. Alternatively, the technical terminology makes it look more like preliminary engineering than a sketch attachment to a proposal. I have always preferred the succinct response when there is ambiguity. Elaborating on unknowns gives an opponent something to talk about and possible use your own words against you.

Choice 3 is easily justified and certainly safe. Unfortunately, firms have “continuity” concerns, just as individuals. After getting on the short list, it is stressful to decide not to spend another 30-minutes on a sketch and ballpark estimate.

Choice 4 is “preachy”. It is factual but carries an adversarial tone towards a potential Client. It is not viewed as likely to bring favourable consequences and has a high likelihood of being remembered at the time of the next Request for Proposal.

Choice 5 is an expression of bad-feeling and would leave a reputation in the engineering community that would last a long time. In the future it might be hard to get on any joint-ventures bidding for large projects. It would not produce any benefit to the firm beyond the healthy release of liver bile.

Actual(sic)

Choice 5 is the right answer.

Discussion

Wait a minute! Where did this case come from? Did they actually protest to the State Licensing Board?

Well, yes and no. This case is posted to the Internet by the National Society of Professional Engineers. It is paraphrased to avoid copyright problems and there is interpretation on what “actual” means. The source text concludes that choice 5 is the right answer. They don’t actually say that any real firm did or would do it.

This brings up an ethical question which has been hinted at in many of the cases in this course, “Does the agenda of ‘Authority’ match the goal of ‘ethics’?” The Supreme Court Ruled that ASME was a violator. It appeared that the EPA had been and wanted to continue to poison residents. Does the NSPE seek public good or engineering fees?

REF: <http://ethics.tamu.edu/nsfcases/elen/09/ee09.htm>

ETHICS CASE 6 - Design / Build Bid Error

Background

Your firm has been selected to design and construct a new water treatment and distribution system for a small city a short distance from the home office. The contract has not been signed. Your firm was low-bid, from the following range:

- \$14.11M
- \$13.38M
- \$12.88M

The internal estimate breakdown is as follows:

- \$ 0.910M - Design Engineering and Construction Management
- 2.900M - Construction Materials
- 5.600M - Construction Labour
- 0.360M - Support and Overhead
- 0.700M - Subcontractor Services
- 0.500M - Performance Bonds, Insurance
- 0.200M - Environmental Impact Study
-
- \$ 11.170M
- 0.536M - Contingency
- 1.170M - Profit
-
- \$ 12.880M - Submitted Bid

Situation / Problem

You are the proposed Project Engineer. While working with the Chief Engineer (and Partner in the firm) you (plural) discover an error in the design basis for purification. As-proposed, the treatment system will not meet EPA standards. Together, you re-estimate the job.

The revised internal estimate breakdown is as follows:

- | | |
|------------|---|
| \$ 0.910M | 0.910M - Design Engineering and Construction Management |
| 2.900M | 3.300M - Construction Materials |
| 5.600M | 6.600M - Construction Labour |
| 0.360M | 0.360M - Support and Overhead |
| 0.700M | 0.700M - Subcontractor Services |
| 0.500M | 0.500M - Performance Bonds, Insurance |
| 0.200M | 0.200M - Environmental Impact Study |
| ----- | ----- |
| \$ 11.170M | 13.070M |
| 0.536M | 0.599M - Contingency |
| 1.170M | 1.310M - Profit |

\$ 12.880M 14.380 - Submitted Bid / Corrected Bid

B) Personal problem. You are on a panel at a public hearing and a competitor asks how you could possibly bid lower than their internal cost estimate, before profit.

Choices

1. Withdraw the bid citing defect in computations.
 2. Go ahead, awaiting EPA review of construction documents.
 3. Go ahead, using the revised the design basis
 4. Frantically review the base purification design, the revised purification design and the EPA regulations.
-
- B1. "We have a long-standing relationship with the contractors and were able to cooperate on schedule get reduced net costs at the standard hourly labour rates."
 - B2. "Our proposed design utilizes a new EPA-approved process that permits higher flow rate, therefore smaller tanks and less concrete."
 - B3. "We have an excellent estimating crew who are very experienced in this kind of work. We spent a lot of time matching the current requirements with process licensing application engineers to get the best design."
 - B4. "We used a very sharp pencil, recognizing the financial constraints of the City and limiting ourselves to a profit just barely enough to keep the firm going."
 - B5. "We used our best engineering judgement and years of experience. We have a long list of satisfied municipalities where we have worked.."
 - B6. "We erred and expect Change Orders to provide enough profit to cover the lapse."

Analysis

Choice 1 is very hard for a firm to do. The consequences are a severe marketing black eye. It would take a majority of the Partners to make such a decision. Per other information presented in the source text, such a decision would require significant personnel reductions and subleasing out some of the existing office and production space.

Choice 2 has a lot of attractive consequences. If EPA catches the problem, then it becomes an external Design Change Order which protects original profit and adds profit. It will cause a stink to come up with the additional funding, but only a minor blemish on the firm. If EPA doesn't catch the problem, construction can go ahead on the original estimate, and the firm can expect the original profit. Later corrections will probably come through as more work for the firm. There is variability in the effectiveness of treatment processes, and, even though present calculations indicate unfavourable results, the actual results may be marginal and acceptable to EPA on a temporary or permanent basis.

Choice 3 is the feel-good answer. It looks like contingency and profit will almost cover the re-design shortfall. If Field Change Orders develop, the shortfall can be recaptured and a modest profit made. There is no downside, as long as sub-contractors can be closely control on cost and the project doesn't run into serious delays or problems.

Choice 4 is essential, regardless of the conceptual leanings. You don't undertake any of the choices offered until you have confidence in the process need and incremental construction cost.

Choice B1 is appropriate if you do have a good relationship with contractors and genuinely believe you get preferred net costs at standard hourly rates. And cooperative scheduling can generate 20% net labour cost reduction.

Choice B2 is a really bad idea. It opens the question of the adequacy of the design. It is especially hazardous if it is a "new fact", not supported by a new EPA-approved process.

Choice B3 is a moderately bad idea. As with B2, it opens to question the adequacy of the design. You don't want to start getting Council Members' opinions on the design.

Choice B4 works only with a broad smile and a laugh from the audience. A panel member with very good crowd skills can make it work. We are only redirecting the discussion to other topics, not answering the question.

Choice B5 is delivered with confident eye-contact with the questioner and a sombre voice. It is redirection, again, but follows a standard script that everyone in the audience expects.

Choice B6 is unthinkable. Everyone who has participated in public construction contracts knows this is true. We agree not to mention it. Don't mention it.

Actual(sic)

The Chief Engineer directed the Project Engineer to pursue Choice 3. This is subtly communicated in the source text. The Chief Engineer says, "We will get our true cost." True cost is the revised cost. The Chief Engineer says not to tell the Partners or anyone else in the firm about the perceived defect and strategy.

Discussion

Do errors occur in setting a Design Basis? Yes. One firm I worked for refused to prepare a Design Basis until after the project was completed and operating. (They were a public utility and did some other strange things, too. But, they were right that the Design Basis kept changing, even through the commissioning stage.)

How does a design firm handle a major change in Design Basis. There are three standard methods. First is to eat the cost. If it is a small project, especially for a continuing Client, it is acceptable to lose a little money occasionally. Often a Principal works on completing the job and doesn't charge his time.

Second, the design firm asks for more money. Surprisingly, many large Clients understand that when they change the job, they pay more. This is far from universal, but an available choice, especially for a diplomatic person performing liaison with the Client.

Third, many long-standing designer/Client relationships are time-and-materials, with a cap requiring re-authorization when reached. This indicates substantial trust between the two firms, but works well with the right liaison and the right Client contracting officer.

How does a construction contractor (construction management means acting as general contractor) handle a change in Design Basis. Many independent contractors will immediately stop work until it is resolved. In the case, the Construction Manager doesn't have this choice. He must issue contracts shortly after getting an authorization-to-proceed document from the city. (The dates will be part of the contract.) It is extremely unlikely that a "friendly" construction manager will be able to reduce field costs significantly below the estimate. Brutal construction managers force the subcontractors to eat any field changes (based upon predatory contracts) and the subcontractor goes bankrupt. This still doesn't get the cost below the contracted base line.

On a somewhat unrelated track, is it clear that the internal estimating was valid, independent of the recognized error in the design basis? Both competitors offered prices considerably below the "corrected" price of our firm. Were they in error or has out estimating been excessively conservative. Perhaps the materials and labour estimates were inflated. If our base cost was high, the erroneous bid may be valid anyway.

REF: <http://ethics.tamu.edu/nsfcases/elen/07/ee07.htm>

ETHICS CASE 7 - Radiation from Cellular Phones

Background

The IEEE publication cited states that the average maximum safe radiation a human body can be exposed to is 400mW/kg.

Situation / Problem

Young engineer Andrew, who reads SPECTRUM and several TRANSACTIONS, got lab results that the firm's hottest selling new cellular phone gives out 350mW/kg.

Choices

1. He could suggest to his boss that they modify the antennas and do a product recall
2. He could do a broader search to verify that their test method matched that used in the IEEE study.
3. He could do an internet search to see what a range of studies reports.
4. He could use a library terminal and false e-mail account or pay phone and contact the IEEE author to discuss how serious the problem might be.
5. He could contact the investigative reporter of the local Fox television station.

Analysis

Choice 1 is the normal response of most concerned employees. Success is very dependent upon the mood of the boss at the time of presentation. Many supervisors can be supportive and sensitive to new employees' difficulties in learning the internal procedures and priorities.

Choice 2 is suggested by your present author. He has experience doing small-signal RF testing and is sensitive to the vagaries of methodology and the phenomena.

Choice 3 addresses the "Chevron phenomenon." When Chevron didn't want to spend money mitigating greenhouse emissions, they undertook a project to collect all dissenting research and researchers and discredit global warming. RJ Reynolds headed the project. [ref, On The Media, PBS, July 6, 2007, onthemedial.org] It is sensible today to question the validity of research and the vested interests of the researchers. Who funded the IEEE study? Were the researchers experienced in the field and use of the equipment (curriculum vitae). What is the range of results produced by similar and replicated experiments? It may be that the question is still in a state of flux, "not ripe," as the Supreme Court says when they are not ready to address a question ("Civil Liberties and the Bill of Rights", John E. Finn, Teaching Company course 8530, teach12.com).

Choice 4 sounds facetious, but is a valid alternative. The IEEE authors are fairly ordinary people, accessible and interested in pursuing the topics they write about. The suggestion to avoid traceability is not facetious either. Most firms cultivate an active sense of paranoia, sometimes including a high level investigative office. Again, the goal is to determine the validity and seriousness of the radiation problem. Even IEEE is subject to social pressures to avoid alarming the public.

Choice 5 is truly facetious, but suggested by the Texas A&M source. I have limited respect for the sustentative content of local news, but this may be an alternative to a truly concerned person with limited career continuity interests.

Actual(sic)

Andrew took the problem to his boss who had a strongly emotional and unfavourable reaction.

Discussion

This problem is especially difficult in a number of dimensions. First, is a low-level desk engineer who sees unfavourable test reports ethically responsible for protecting the public? Second, if the best available information suggests a 400mW/kg maximum permissible dosage and the product produces 350mW/kg, aren't we stretching a bit to call it a danger to public welfare? Third, is "proactive" a part of the Code of Engineering Ethics? Must we seek out problems to protect the public against? Fourth is the question of statistical distributions. If one user in 100,000 suffers unfavourable side effects, does that mean the product should be pulled from the market? One in 1,000? One in 10? We know that tobacco kills and the solution is to put a sticker on the package.

REF: <http://ethics.tamu.edu/nsfcases/elen/06/ee06.htm>

ETHICS CASE 8 - Missile Explosion

Background

Missile designer got the idea that his new ground-to-air missile might be ignited by static electricity in handling. He took the concern to his supervisor, who responded that (a) breakdown of air insulation around the missile was unlikely and (b) that it did occur, there was only a very remote possibility that it would cause any problem. The supervisor, however, took the concern to the military procurement officer on the project. The military officer agreed that the mechanism was possible, but unlikely. He said that any design change would seriously delay deployment of the missile. He said that warning information was unnecessary since military personnel handling weapons are always at highest level of care.

Situation / Problem

One blew up while being uncrated in Germany and killed three enlisted men.

Choices

1. "Collateral damages" are ok for civilian deaths; why not for military deaths? Maybe, consider it "friendly fire" from a factory in Indiana?
2. Clearly (in retrospect), all three should have insisted a yellow warning tag be affixed to the missile, "May explode while being unpacked."
3. Grounding of materials should be a standard practice when involving ordinance, just as it is with flammable chemicals (see aircraft garage requirements, NEC Section 513).
4. Someone should read *ESD Protection Requirements from DoD Manual 4145.26-M-1975*.

Analysis

Choice 1 doesn't address ethical considerations and seems to ignore the tragedy of loss of lives of innocent participants.

Choice 2 is a little bit silly, but appears to be the only constructive response available to the participants who were building a missile for the US Army.

Choice 3, after the fact, points out the similarity between known explosive events and mitigation and the explosion which occurred.

Choice 4, unfortunately, reveals that the problem had been recognized generically, and addressed, generically, by the Department of Defence in 1975. The deaths may not be attributable to the static hazard known by the engineer - rather to the lack of communications and procedures within the US Army.

Actual(sic)

The men are dead.

Discussion

Hopefully the US Army learned from the incident.

There is no reason to think that the manufacturer learned anything from the incident or, really, had anything to learn. The failure was internal US Army communication and procedures.

Can we learn that considering extreme situations and lack of training are essential to buildings and products intended for extended use?

REF: <http://ethics.tamu.edu/nsfcases/elen/01/ee01.htm>

ETHICS CASE 9 - E-Mail Encryption

Background

Greg was hired with a new computer science degree. His first assignment was to write a piece of software to preclude reading of intercepted e-mail (encryption). This was to be used within the company on their Wide Area Network.

After submission, testing and widespread installation of the software, Greg saw a news blurb about a fellow in California who sold a similar e-mail add-in overseas. He was reported to be under prosecution in a federal court for distribution of algorithms and information which (by law) must remain within the United States for purposes of national security.

Greg figured out that his employer had offices overseas. He told his boss about the news article. The boss replied that they were no threat to security and the rule didn't apply to internal use by a US firm.

Chatty Greg found out that the middle eastern office of the firm was sharing his e-mail add-in with contractors and clients so that they could avoid interception of business information, especially prices. The sharing was taking place in Saudi Arabia, Singapore and Thailand.

Situation / Problem

Greg read that the programmer was being prosecuted, not his employer. Greg is worried.

Choices

1. Document the situation and the conversation. Sign and date it. It is not necessary to give it to anyone, just make sure it is available to you when you need it.
2. Do a little more research on the news article and more generally, over the internet. Make sure the Feds are going after the programmer, not the firm.
3. Confirm that you do or do not have an agreement with your employer that all work becomes property of the employer.
4. Ask his boss if it is OK to talk to the corporate legal department.
5. Talk to the corporate legal department. Use the anonymous call-in line from a phone booth.
6. Try to get the toothpaste back in the tube or the cat back in the bag.

Analysis

Choice 1 is good advice for every engineer. Courts are very respectful of "contemporaneous documentation". [I am not an attorney, but my wife got

\$142,000 back in a lawsuit.] If you make good decisions day-by-day, your record of them will stand well for you.

Choice 2 costs nothing and puts you in a better position to make a good decision. This might be a good time to talk to an attorney experienced in Federal statutes relating to software. Most will discuss a possible case for free and provide good direction for immediate steps you can take.

Choice 3 is more collecting of background information. If you have the agreement that it is all his, then all the liability is his. If you still have an interest in the software it implies you have some control over its use and may imply liability. Fortunately, most employers are exceedingly greedy and take away title to anything which might be construed as intellectual property.

Choice 4 is diplomatic and realistic. It is important to document, sign and date your notes of this conversation.

Choice 5 is extremely dangerous. American business is founded on the maxim, "Kill the messenger." They will spend 10x the effort finding out who reported the problem as opposed to spending to correct the problem.

I was in this situation once, and my manager said, "Don't kill the messenger." The Director answered, "Then who should we kill?" After that, my manager learned to shoot first and ask questions later.

Actual(sic)

This is an academic case. They don't care about reality. It is not reported.

Discussion

First question, is there any reason to think that ethics apply to programmers? They are not licensed. The State doesn't recognize that they have any responsibility to the public. Programmers write lines-per-day and get demerits for bugs found after widespread implementation. They aren't asked if it is a good idea to shoot a nuclear missile, just how soon they can get the navigation software done. Think of the liability if the missile is used and NO ONE DIES!

Clearly, the programmer must gather more information on Federal prosecutions, document his situation and conversations with his employer and recognize that legal liability is of critical importance.

Let us consider the situation anyway. We design, seal and issue a job; it gets built and then we find that it contains fatal defects. This is not the case at hand, but it is worth addressing - before the juices are flowing in a moment of crisis. What we should do is notify the Architect, Owner and civil authorities. (The fatal defects here are

implied to be dangerous to the general public.) Can anyone envision actually doing this? YES! This was reported in the earlier course [PDHonline R125] and the consequences were NONE. It is possible to do right in the real world. (Please see this case in it entirety. There are a range of factors, including a newspaper strike the week that the defect was revealed.)

REF: <http://ethics.tamu.edu/ethics/aberdeen/aberdee1.htm>

ETHICS CASE 10 - The Aberdeen Three - No Request for Clean-up Funds

Background

The US Army has used Aberdeen Proving Ground to develop, test, store and dispose of chemical weapons since World War II. Inspections between 1983 and 1986 reported problems in the Pilot Plant, including flammable and cancer-causing substances left in the open; chemicals that become lethal if mixed were kept in the same room and drums of toxic substances were leaking. The Army authorized clean-up funds. The Three were upper level managers in the Pilot Plant. They made no request for clean-up funds.

Situation / Problem

On September 17, 1985, an outside sulphuric acid tank leaked 200 gallons of acid into Canal Creek and on to the Susquehanna River, just upstream of the Baltimore, MD, drinking water intake. Federal and State investigators found that the containment dikes were unfit.

Choices

1. Claim that corrosion is an “Act of God” and not subject to personal liability.
2. Claim that their job descriptions were very clear on their responsibilities and there was no mention of materials storage.
3. Claim that they were chemical engineers and they practiced good “engineering sense” and had never had an incident.
- 4.. Blame it on the EPA for a pattern of not enforcing the relevant statutes in the Baltimore area.
5. Claim that long-standing precedent was followed with the acid tank and containment. It had been in place for the entire 20-years for which records were available.
6. Claim that “chain of command” applies and their superiors walked thru the Pilot Plant on monthly inspections and made no comments regarding materials storage.
7. Claim that Aberdeen Proving Grounds did not distribute Federal materials storage requirements and changes to them and no one ever told them about the clean-up funds available.
8. Claim that Aberdeen Proving Grounds had a designated environmental officer who had the responsibility for overall storage procedures and equipment.

Analysis

Keep in mind that all we know is the defence strategy selected by the defendants. The choices are speculative, but suggestive as to the personal pressures brought upon the defendants to protect their employer, even when they went to prison.

Choice 1 requires considerable knowledge and experience in the tribunal adjudicating the case. If there have been many similar cases claiming “Act of God” and they were uniformly rejected, it is a weak choice. If a substantial number using this defence have prevailed, then it is worth considering. This is why you hire a local, sharp attorney who has practiced in the court having jurisdiction.

Choice 2 should work very well in an Army hearing, but has limited impact on a Federal Court. The EPA invest all of their time attributing problems to persons and firms unable to defend themselves. There is no defence except Congressional intervention, which beyond the budget of individuals.

Choice 3 would be much more powerful if presented as, “following conventional standards prevalent in the industry.” This is what medical doctors do and practicing design engineers do. Of course, you have to find some standards to support the claim. From what I know of the Baltimore chemical industry, it should be easy to take photos of similar installations.

Choice 4 was my idea. After looking at pictures of chemical plants on the river upstream of Baltimore, I suggest that this defence was not pursued as part of a plea bargain with EPA. The industrial area north of Baltimore, in 1985, was termed by De Toquville as, “the armpit of America”. (no citation offered) The defendants went from 10-years of incarceration to three because they didn’t mention EPA culpability.

Choice 5 is what most engineers and managers do, but don’t talk about it. “If it ain’t broke; don’t fix it.” This is frugal and often rewarded in annual reviews and raises. It is, however, weak when the subject gets broke. In a previous engineering ethics course, I concluded that “Lethargy is a major force in engineering decisions.” [PDHonline course R125]

Choice 6 appears to be a powerful defence. It was stated in the source text that the Army did not assist the defence of the Three since it was civilian charges. Lack of use of this defence suggests that persuasion was successfully applied, however indeterminate in nature at this time.

Choice 7 is reported in other sources [http://www.ee.unt.edu/dlr/EE_repository/EENG1920/spring07/The%20Aberdeen%20Three.ppt]. Again, this appears powerful and amenable to suppression as part of a plea agreement.

Choice 8 is a 2010 concept, not a 1985 concept. Nobody at Aberdeen was in charge of environmental compliance. This defence was not available to the Three.

Actual(sic)

The defendants followed Choices 2, 3, and 5. In 1989 the three were convicted of storing, treating and disposing of hazardous wastes in violation of Federal statutes and sentenced to three years in a nearby minimum security correctional facility.

Discussion

Obviously, in this decade of this century, operators, manager and engineers go around looking for unsafe conditions and lobby hard to correct them. Ha! You have never visited a chemical plant on the verge of bankruptcy. Rusting tanks - yes. Failing containment dikes - yes. Nearby estuaries serving populated centres - yes. And this is in the operating area, with operators, managers and engineers. Guess what is going on in the “back 40”?

What is an engineer to do? I suggest making a list of problems and recommended solutions and referencing it in the next report to the Owner or Manager. It will mysteriously disappear before the report is filed, but it will be in your set, and, hopefully, on a .pdf file. Where I have worked, it will disappear before it is mailed out.

What would be the action of an engineer who doesn't care about future pay checks and employer-paid medical insurance? Actually send the attachment with the report.

REF: <http://ethics.tamu.edu/nsfcases/elen/12/ee12.htm>

ETHICS CASE 11 - Toaster Short-Circuit

Background

Jane, a recent EE graduate was working for a consulting engineering firm. Her immediate supervisor reviewed the work and a Partner of the firm sealed it before release. Her current assignment was laying out receptacle circuits for a residence. She was using 15A circuit breakers and #14AWG copper wire, rated for 15A. An ME co-worker, Jerry, told her it is better to use 20A circuit breakers because they will handle the inrush current of a motor. Her delivered design included #14AWG wire and 20A circuit breakers.

Situation / Problem

Two months after the house was built and the family moved in, a fire occurred in the house, causing \$75,000 damage. The Fire Marshall's report stated that the fire was caused by an electric toaster having a short circuit in it. The report stated that the short circuit was estimated at 550A for 10-seconds.

Choices

1. Hire a forensic laboratory and fight the cause of the fire being the toaster.
2. Hire a defence attorney and fight the Plans Review officer, Electrical Inspector and construction contractor for dereliction of duty.
3. Make sure the PE who sealed the dwgs is a partner in the firm, then never mention his name again.
4. If the PE was not a partner, fire him and Jane and claim that it was a momentary oversight, not a structural problem and has been remedied and cannot recur.
5. Roll over and pay since legal expenses will exceed \$75,000, even if you win.

Analysis

Note that this is an academic case, from the electrical engineering department of tamu.edu (Texas A&M University). In the discussion in the source, they don't know the difference between NFPA-70 (National Electric Code) and IEEE-C2 (National Electric Safety Code). The NEC applies to commercial, industrial and residential inside wiring. The NESC applies to utility outside wiring. They are correct, however, that you use 15A wire with a 15A breaker and 20A wire with a 20A breaker.

Also, electrical engineering profs at Texas A&M don't know much about moulded case circuit breakers, as used in home electrical panel boards. 15A and 20A breakers are the same frame size and use the same instantaneous trip element. They are different on long-term trip, but identical on short-circuits. This is known by any electrical

engineer who has performed a co-ordination study. You cannot coordinate moulded case breakers within a frame size.

Choice 1 implies there is something arguable about the toaster being the source of the fire. Electrical engineers who read fire reports know that “electrical” is synonymous with “unknown” in these documents. It is very difficult to distinguish damage and charring of the toaster cord caused by the fire from damage and charring of the toaster cord causing the fire. Similarly, there is something very fishy about the estimated short-circuit current of 550A. How do they know it wasn’t 540A or 560A? Because 550A is the only place on the time-overcurrent curves for 15A and 20A breakers where a 15A unit would trip but a 20A would not. This is “post-hoc” evidence. Forensic laboratories are “hired guns”. You tell them what you want to prove and they do their darndest to prove it.

Choice 2 implies that there is a doctrine of “shared negligence” suggesting “shared liability”. I’m not an attorney so I don’t know what they are talking about. But, it might be a way to wiggle out of most of the liability.

Choice 3 follows the discussion in the Texas A&M text. The way the law reads, the person who seals the drawings is responsible, not the drafter or designer. Standard procedure in engineering firms is that only a partner signs drawings, and he certainly doesn’t have time to look at them. Note the presence of electronic seals on the drafting network server.

Choice 4 has much resonance from the daily newspaper. Perhaps not an appropriate part of a discussion of engineering ethics, this is certainly a part of our current culture.

Choice 5 doesn’t address ethics much either. The problem is that the situation may escalate. If you agree to actual damages, it is on record that you are liable. This is bad PR when seeking new jobs and an invitation to competitors to complain to the State Board of Registration about your negligence.

Actual(sic)

This is an academic case. They don’t care about the real world and don’t bother to report the consequences. I speculate that the design firm fought it weakly and settled out of court with a judicial order to gag all parties and seal the court documents. I guess this outcome because this is what I see when I follow interesting liability cases.

Discussion

What are the engineering ethics here? I suggest that first, listening to mechanical engineers should include considerable suspicion. I suggest that people who seal drawings should look at them. Anyone who has authority to seal electrical drawings should know that 15A breakers go with 15A wires. Third, I suggest that Fire Marshals and EE professors are not good sources of information on real-world

electrical problems. It may be hazardous and is certainly foolish to hire a prof to help with a problem.

REF: <http://www.niee.org/cases/index.htm>

ETHICS CASE 11 - Use of Another's Project Study

Background

Firm A prepared a study for a Federal agency for a demonstration solar power installation. The Federal agency shared the study with the State agency. The State Agency asked Firm A for help preparing a funds request for detailed design and construction.

The State got the funding but in an amount considerably less than needed for the scope of the original project. The State asked Firm A for help downsizing the scope to match the authorized funds.

Situation / Problem

The State agency gave the entire project file to Firm B and undertook fee negotiations.

Choices

1. Firm B can contact Firm A and talk through the situation.
2. Firm B can give every consideration to the State agency and ignore Firm A.
3. Firm A can write it off to marketing and good will and do everything possible to help the State Agency, short of actually performing engineering services.
4. Firm A can file a protest with the State Attorney General regarding unfair practices by the State agency.

Analysis

Choice 1 is good business and ethical and very, very difficult for individuals with a lot of personal investment and pride in the work.

Choice 2 is good business, but neglects a prominent ethical question. The NSPE says you are not to undertake efforts to supplant another engineer with an existing relationship. There is a reason for this canon. Cat-fighting hurts everyone and doesn't look good to Clients and to the public.

Choice 3 is good business and ethical, but, again, very, very hard for individuals with a lot of personal investment and price in the work. The source text references \$3,000 out-of-pocket expenses in preparing the revised scope. I dismiss this as being invested before Authorization-to-Proceed was received. This is a classic no-no in engineering, or, at least, a likely opportunity for un-recovered costs.

Choice 4 will generate a lot of ill-will with the State agency, the State funding board that handles all engineering contracts and ill-will with Firm B as well as engineering firms throughout the state.

Actual(sic)

Choice 4 is the correct answer.

Discussion

Wait a minute! Where did this case come from? Did they actually protest to the State Attorney General?

Well, yes and no. This case is posted to the Internet by the National Society of Professional Engineers. It is paraphrased to avoid copyright problems and there is interpretation on what “actual” means. The source text concludes that choice 4 is the right answer. They don’t actually say that any real firm did or would do it.

This again brings up an ethical question which has been hinted at in many of the cases in this course, “Does the agenda of ‘Authority’ match the goal of ‘ethics’?” The Supreme Court Ruled that ASME was a violator. It appeared that the EPA had been and wanted to continue to poison residents. Does the NSPE seek public good or engineering fees?

REF: <http://www.rbs2.com/ethics.htm>

ETHICS CASE 12 - Airline Mechanic

Background

An airline mechanic is a very highly paid professional, licensed by the Federal Aviation Agency and required to sign (seal) documents of air-worthiness of repairs he performs. (I know this because when I graduated as an EE, a friend graduated as an ME. He had been working nights as a licensed aircraft mechanic to pay his way, and kept working after graduation as a mechanic because it paid so much more.)

Situation / Problem

Mechanic noted that the axle sleeve on the main landing gear of a DC-9 was “scarred and grooved, with gouges and burn marks”. He ordered a replacement part and scheduled time to install it. His supervisor directed him to smooth the old sleeve with emery paper and certify the aircraft to return to service.

Choices

1. Smooth the old sleeve with emery paper and certify the aircraft to return to service.
2. Discreetly contact the shift superintendent and ask advice.
3. Contact your union steward and ask advice.
4. Show the repair manual section to your supervisor and insist upon replacement.

Analysis

Choice 1 implies trust and respect for the supervisor. The supervisor might have said, “We have encountered this scoring a few times in the past and used emery paper then watched for repeated scoring. The smoothing seemed to be a permanent repair.” The mechanic might have asked for anecdotal support for the recommended course of action.

Choice 2 is not fully political, but still within Company loyalty. Unfortunately, the next-higher supervisor is guaranteed not to be available within the timeframe needed for a decision and guaranteed not to be interested in a detail on one part on one aircraft. [This is certainly an opinion of your writer, but reflects the conclusion of an extended, unpublished, study of the characteristics of supervisory management. After attending courses on participatory management and successfully completing the quiz, they went back to their jobs with no change in methodology. It was concluded in that study that there are characteristics which are nearly-universal among managers, either before their promotion, or soon acquired afterwards.]

Choice 3 is not political from an employer viewpoint, but is consistent with a common employee perception - that their Union has strength in supporting ethical decisions and a willingness to stand up to Management.

Choice 4 is an extreme action, not uncommon in persons with a strong personal belief in “what is right”. Someone in my family has this characteristic, so I have observed it closely for several decades. This person had a good career working for an agency of the Federal government which valued “following the Book.”

Actual(sic)

Choice 3 was selected by the mechanic in the case reported. The airline fired him. The Union supported him and provided lawyers to take the case through the State Supreme Court.

Discussion

First, this is a very particular case. You can see that the attitudes of the persons involved at the time of the incident were very prominent in the way it developed. Not available from the source documents is the publicly expressed attitude of the airline or any of the arguments made by the airline in their defence.

Second, the result of the litigation is not reported. This is because that fact is not the focus of this case analysis. The focus of this case analysis is that the supervisor and airline were willing to publicly go to court to defend their right to violate FAA regulations and exercise their right to “fire at will.” Whether the mechanic received punitive damages after 10-years is not the point. The point is that ethical behaviour was aggressively fought.

Third, the course of this ethical confrontation and ensuing lawsuit did not involve any government or public agency supporting ethical behaviour. All costs and efforts were invested by the individual and the Union.

[eof]