Open-Ended Problems: A Future Chemical Engineering Education Approach. J. Patrick Abulencia and Louis Theodore.

22

Ethics

This chapter is concerned with ethics. As with all the chapters in Part II, there are several sections: overview, several technical topics, illustrative open-ended problems, and open-ended problems. The purpose of the first section is to introduce the reader to the subject of ethics. As one might suppose, a comprehensive treatment is not provided although several technical topics are also included. The next section contains three open-ended problems; the authors' solution (there may be other solutions) are also provided. The final section contains 34 problems; *no* solutions are provided here.

22.1 Overview

This overview section is concerned with—as can be noted from the chapter title—ethics. As one might suppose, it was not possible to address all topics directly or indirectly related to ethics. However, additional details may be obtained from either the references provided at the end of this Overview and/or at the end of the chapter.

Note: Those readers already familiar with the details associated with this subject may choose to bypass this Overview.

The following was adapted from Theodore [1] and obviously represents this author's opinion on what has become a controversial issue.

"Unfortunately, ethics has come to mean different things to different people. Ethics is a philosophical discipline that draws on human reason and analysis to assess moral choices; Webster talks of *conforming to moral standards* where moral relates to decisions that have an impact on the lives of other people.

There is currently a renaissance or grass roots movement in academia to make students aware of the FOLD (Fabricating data, Omitting information, Lying and acting in a Deceitful manner) principle. It is happening because many colleges and/or universities are now including ethics training in their curriculum. The Accreditation Board of Engineering and Technology (ABET), which accredits engineering schools, now requires ethics training to be incorporated in the curricula. In fact, all engineering programs need to address ethical issues in order to receive accreditation.

One needs to examine what is happening out in the real world. The federal government is nearly totally corrupt. Elected officials are primarily concerned with getting reelected and not representing the electorate; they regularly apply the aforementioned FOLD principle [11].

The chapter contains sections concerned with

1. The Present State
2. Moral Issues
3. Engineering Ethics
4. Environmental Justice

A significant portion of the above sections have been drawn from the work of Wilcox and Theodore [2].

22.2 The Present State

Sine this chapter is on ethics, there is a need for information on definitions. Here are four that might help the reader.

1. *Ethics* is defined as that branch of philosophy dealing with the rules of right conduct.

2. *Environmental ethics* deal with the moral issues of conduct with respect to the environment.
3. *Ethical theory* is an attempt to answer certain questions about standards of conduct or ethics. It also attempts to provide a framework for decisions regarding what moral principles are correct and how one should treat one another, the environment, other species, etc.
4. *Morality* is concerned with reasons for the desirability of certain kinds of actions and the undesirability of others. To say that an act is right is not to express a mere feeling or bias, but instead to asset the best moral reasons supporting. Moral reason is a reason that requires individuals to respect other people. In addition, moral reasons are such that they set limits to the legitimate pursuit of self-interest. They can be used to evaluate, praise, and criticize laws.

With respect to the above, MBAs and CPAs of industry have spawned financial abuses and excesses. These individuals have turned what used to be moral and ethics questions into legal technicalities. Industry executives are more likely to ask what one can get away with legally rather than to be concerned with what is right, honest and/or fair.

The above abuses and excesses have spread like a cancer to society, particularly with lawyers and individuals in government. Lawyers have become adept at creating controversy, smokescreens, and/or obstruction of the truth, and using the complexity of the laws for their own aggrandizement. Elected officials *at all levels of government* on the other hand, have used their entrusted position of power to further and maintain their career… rather than to represent their constituency. And, as most know, nearly all elected officials are lawyers [1].

Consider if a chemical engineer, acting as an expert witness in a court of law, knowingly conjures up an idea that creates reasonable doubt even though it is highly unlikely. This type of conduct is clearly defined as fraud in any engineering Code of Ethics. Given the above, the reader should consider a lawyer's present-day conduct in and out of court [1].

Well, what's the answer? Is there an answer? The reality may be that the above-referenced corruption is just too widespread and amorphous—like humidity in South Florida in the summer. It seems that the only thing that can ultimately turn things around on this issue is for each individual to take a stand for basic values and virtues, and return to the likes of integrity, responsibility and selflessness. If a grass-roots movement is to succeed, it will ultimately rest on each individual's ability and willingness to discard

the practices of so many lawyers and elected officials. As Albert Schweitzer put it, "Man must cease attributing his problems to his environment, and learn again to exercise his will and his personal responsibility in the realm of faith and morals" [2].

22.3 Moral Issues

It is generally accepted that any historical ethic can be found to focus on one of four different underlying moral concepts [2–4]

1. *Utilitarianism* focuses on good consequences for all
2. *Duties Ethics* focus on one's duties
3. *Rights Ethics* focus on human rights
4. *Virtue Ethics* focus on virtuous behavior

(Note that Duties and Rights Ethics are often combined and referred to as *Deontological Ethics*)

Utilitarians hold that the most basic reason why actions are morally right is that they lead to the greater good for the greatest number. "Good and bad consequences are the only relevant consideration, and, hence all moral principles reduce to one: 'we ought to maximize utility'" [5].

Duties Ethicists concentrate on an action itself rather than the consequences of that action. To these ethicists there are certain principles of duty such as "Do not deceive" and "Protect innocent life" that should be fulfilled even if the most good does not result. The list and hierarchy of duties differs from culture to culture and religion to religion. For Judeo-Christians, the Ten Commandments provide an ordered list of duties imposed by their religion [5].

Often considered to be linked with Duties Ethics, Right Ethics also assesses the act itself rather than its consequences. Rights Ethicists emphasize the rights of the people affected by an act rather than the duty of the person(s) performing the act. For example, because a person has a right to life, murder is morally wrong. Rights Ethicists propose that duties actually stem from a corresponding right. Since each person has a "right" to life, it is everyone's "duty" not to kill. It is because of this link and their common emphasis on the actions themselves that Rights Ethics and Duty Ethics are often grouped under the common heading: Deontological Ethics [6].

The display of virtuous behavior is the central principle governing *Virtue Ethics*. An action would be wrong if it expressed or developed vices, e.g., bad character traits. Virtue Ethicists, therefore, focus upon becoming a morally good person.

To display the different ways that these moral theories view the same situation one can explore their approach to the following scenario that Martin and Schinzinger [5] present:

"On a midnight shift, a botched solution of sodium cyanide, a reactant in organic synthesis, is temporarily stored in drums for reprocessing. Two weeks later, the day shift foreperson cannot find the drums. The plant manager finds out that the batch has been illegally dumped into the sanitary sewer. He severely disciplines the night shift foreperson. Upon making discreet inquiries he finds out that no apparent harm has resulted from the dumping. Should the plant manager inform government authorities, as is required by law in this kind of situation?"

If a representative of each of the four different theories on ethics just mentioned were presented with this dilemma, their decision-making process would focus on different principles based on the definition above.

Numerous case studies of this nature are provided by Wilcox and Theodore [2].

22.4 Engineering Ethics [3,7]

The ethical behavior of chemical engineers as well as other professionals is more important today than at any time in the history of the profession. The chemical engineers' ability to direct and control the technologies they master has never been stronger. In the wrong hands, the scientific advances and technologies of today's engineer could become the worst form of corruption, manipulation, and exploitation. Chemical engineers, however, are bound by a code of ethics that carry certain obligations associated with the profession. A baker's dozen of these obligations follow.

1. Support one's professional society
2. Guard privileged information and data
3. Accept responsibility for one's actions
4. Employ proper use of authority
5. Maintain one's expertise in a state-of-the-art world
6. Build and maintain public confidence
7. Avoid improper gifts and/or gift exchange(s)
8. Avoid conflict of interest
9. Apply equal opportunity employment
10. Maintain honesty in dealing with employers, clients and government
11. Practice conservation of resources, pollution prevention, and sustainability

12. Practice energy conservation
13. Practice health, safety, and accident prevention and management

There are many codes of ethics that have appeared in the literature. The preamble for one of these codes is provided below:

"Engineers in general, in the pursuit of their profession, affect the quality of life, for all people in our society. Therefore, an Engineer, in humility and with the need for divine guidance, shall participate in none but honest enterprises. When needed, skill and knowledge shall be given for the public good without reservation. In the performance of duty and in fidelity to the profession, Engineers shall give utmost" [5].

Regarding environmental ethics, Taback [8] defined ethics as, "the difference between what you have the right to do and the right thing to do." More recently, he has added that the engineer/scientist should recognize situations encountered in professional practice with conflicting interest that test one's ability to take the "right" action. Then, take each situation to a trusted colleague to determine the best course of action consistent with the above precepts and which would have the least adverse impact on all stakeholders.

Because of the Federal Sentencing Guidelines, the Defense Industry Initiative, as well as a move from compliance to a value-based approach in the marketplace, corporations have inaugurated companywide ethics programs, hotlines, and senior line positions responsible for ethics training and development. The sentencing Guidelines allow for mitigation of penalties if a company has taken the initiative in developing ethics training programs and codes of conduct.

Regarding education, the ABET 2000 accreditation guidelines require academic programs to clearly demonstrate that students are exposed to an ethics education; and they also have to do outcome assessments. In spite of indicators that reveal the value of an ethics education, few large universities require an ethics course. Ideally, a student would take an ethics course and would also be exposed to ethics in several other courses each year.

22.5 Environmental Justice

The environmental policy of the EPA has historically had two main points of focus: defining an acceptable level of pollution and creating the legal rules to reduce pollution to a specified level. Understandingly, it seems that the program has also been concerned with economic costs and efficiency [9]. Thus, it appears to some to lack consideration of equity, both distributional

and economic. While EPA's two main points of focus are important considerations, relying on such criteria in the formation of environmental protection policy can potentially neglect to account for potential inequalities of capitalism and its effects throughout the policy process.

The history of environmental policymaking illustrates to some the incompatibility of equity and efficiency. Economic pressures of environmental regulations have motivated corporations to seek new ways to reduce costs. Industries have attempted to maximize profits by "externalizing" the environmental costs [10]. It has been suggested that this redistribution of costs is more regressive in its effects than the general sales tax [11]. To date, big corporate polluters sometimes have more to gain financially by continuing pollution practices than in obeying regulations. In some instances, the result of increased environmental costs has paradoxically caused negative impacts on environmental degradation. In effect,they have little incentive other than altruism to end these debilitating practices.

22.5.1 The Case For and Against Environmental Justice

Environmental protection policy has attempted to reduce environmental risks overall; however, in the process of protecting the environment, risks have been redistributed and concentrated in particular segments of society. Although federal regulations to protect the environment are not explicitly discriminatory, some argue that environmental protection policies have not been sensitive to distributional inequalities. Other insists that they have not adequately addressed specific minority environmental concerns. Like many programs of reform and activism, environmental justice was principally started with good intentions. However, ground rules need to be set before any meaningful discussions regarding environmental justice can be presented. One of the problems is that environmental justice has come to mean different things to different people, at different times, at different locations, and for different situations. There appears to be no clear-cut decision regarding this term but the EPA defines it as "the fair treatment of people of all races, cultures, and incomes with respect to development, implementation, and enforcement of environmental laws and policies, and their meaningful involvement in the decision-making process of government [11]. Based on the EPA's definition, there appears to be three major components of environmental justice:

1. Environmental racism
2. Environmental equity
3. Environmental health

Details of each are available in the literature [12–14].

A detailed and expanded treatment of ethics is available in the following two references

1. J. Wilcox and L. Theodore, *Environmental and Engineering Ethics: A Case Study Approach*, John Wiley & Sons, Hoboken, NJ, 1998 [2].
2. L. Theodore, *Chemical Engineering: The Essential Reference*, McGraw-Hill, New York City, NY, 2014 [14].

22.6 Illustrative Open-Ended Problems

This and the last section provide open-ended problems. However, solutions *are* provided for the three problems in this Section in order for the reader to hopefully obtain a better understanding of these problems, which differ from the traditional problems/illustrative examples. The first problem is relatively straightforward while the third (and last problem) is somewhat more difficult and/or complex. Note that solutions are not provided for the 34 open-ended problems in the next section.

Problem 1: Vincenzo has a Ph.D. in chemical engineering, a Professional Engineer (P.E.) License, and a job as an assistant professor at a local university. To learn more about ISO 14000 and to earn some extra money, Vincenzo became a certified ISO 14000 auditor. During an audit of a facility, Vincenzo observed a significant violation of an EPA regulation. (Note that ISO 14000 is a voluntary standard of environmental management systems, i.e., it is not a regulation and ISO 14000 audits are confidential.)

What does Vincenzo do? Does he forget about the significant violation since he is not an EPA inspector and it does not violate the ISO 14000 standard he is there to audit? Does he insist it be part of the audit report? Does he call it to the attention of the facility management? Does he report it to the EPA?

Solution: The question of professional ethics presented here can be generalized as follows: does a professional have an ethical duty to report any violation of which he/she becomes aware? Most licensing organization have codes of ethics to which their professionals must subscribe. These codes generally call upon the professional to serve their client/employer with loyalty and to protect the welfare of the public. The codes, however, are sufficiently vague so as to not provide a clear-cut answer to Vincenzo's

situation. In the absence of such a clear-cut code, there is no one right answer and one's answer may vary from the one presented below.

Vincenzo must first investigate further to make certain of his facts. If the violation is confirmed and has never been reported, he must insist that it be part of the findings presented to management at the exit meeting and in the report to the ISO Registrar who makes the final decisions on awarding certification. Although ISO 14000 does not require compliance, knowingly failing to comply could affect the evaluation of the facility's commitment to good environmental management system practices that the standard does require.

Having done all that, does Vincenzo go the last step and report it to the U.S. EPA? Such a report would violate the confidentiality of the audit and might even precipitate a lawsuit. Vincenzo is also concerned that he may never be hired again as an auditor. He senses a conflict between two sets of ethics: the ethics of a professional bound to protect the public, and the ethics of a professional bound to confidentiality. Keeping silent would be easier but ethics is not easy.

It would be easy to answer "report it!" but the real question is what would YOU (the reader) do?

Problem 2: The passage of a number of environmental laws in recent times, coupled with educational campaigns on the part of environmental groups and a supportive citizenry, have resulted in a substantial reduction in the quantity of waste produced. It is not likely, however, that the production of waste can be completely eliminated. As long as waste is generated, it will be necessary to dispose of that waste as safely as possible.

Incineration is an effective method of waste disposal and it has become safer than ever. Yet, local communities (often with the help of vocal environmental groups) have successfully opposed construction of waste incinerators in their areas. Discuss the ethics of opposing the construction of a waste incinerator in your local community.

Solution: This is obviously an open-ended question with no single correct answer. Your answer may have addressed points that are not made here, and vice versa.

On the issue of opposition to the construction of the hazardous waste incinerator, it is not unethical to protect one's self, family, and community from a risk. This is especially true concerning the risk from, for example, a hazardous waste incinerator, over which one may have little control. Even with the best design and pollution controls, no one can absolutely guarantee that the incinerator will have zero emissions. Nor can anyone absolutely guarantee that the low level of emissions will not pose a hazard to anyone.

Although the risk may be estimated to be as low as one excess cancer or other disease in each one million exposed people annually, this is no consolation if that one additional affected party is you or a member of your family.

It would, however, be unethical to avoid your risk by shifting it to someone else. The manufacture and use of products, such as furniture, rugs, clothing, cars, and electronics, have become an integral part of one's way of life. Wastes are produced by the manufacture of all these products. As long as the products continue to be used, there is a moral obligation to share the risk that results from the disposal of the waste generated in making these products.

Sometimes, widespread opposition to hazardous waste disposal results in industry finding creative ways to eliminate the production of a waste that they cannot dispose of. Those who are successful in advocating the Not-In-My-Backyard (NIMBY) policy can then claim the highest of ethical behavior since all society had benefitted from the improved production processes. All too often, unfortunately, industry simply moves its operations to a state or country where environmental restrictions are less severe. In addition to possibly shifting the risk to someone else, the NIMBY policy also causes the harm of loss of jobs. Since one cannot ascertain whether opposition to the hazardous waster incinerator will lead to the elimination of the production of the waste or the shifting of the risk to someone else, this behavior cannot be classified as ethical.

On the issue of the problem raised by such opposition, a possible (but not perfect) solution may be a national hazardous waste incinerator siting program. Each region would be required to accept its share of incinerators. A government agency, or some other neutral body, could evaluate all potential sites in each region based on factors such as availability of facilities, accessibility, number of people affected, etc. A lottery system could be used to make the final choice among the top, and roughly equal sites. To mitigate the risk imposed on the selected site, benefits, such as free health care or reduced taxes, could be provided to the people in the selected area. In this way, the risks and alternatives would have to be squarely faced by virtually everyone. It would be possible to simply evade the problem by shifting it to someone else.

Problem 3 [2]: Bill is a senior chemical engineer in the biomedical division of a major corporation and the head of a research department that specializes in the construction of artificial organs. About a year ago, an artificial heart was created and tested in a human patient. (One of the authors, who suffers from cardiomyopathy may someday be the recipient of one of these hearts.) Unfortunately, the patient survived only nine months. Although

it was a huge step in the fight against heart disease, it brought world-wide recognition to his company and himself.

One day, Mary, his top research assistant, reports to him that a problem has been detected in the tricuspid valve of the artificial heart model. With further testing, it is discovered that the rate at which this valve allows blood to pass tends to slow down after eight months of continuous usage. The coroner's report states that the patient's death was due to the body's rejection of the artificial heart. However, it is very likely that the patient's death was brought on by this flaw in the artificial heart.

Bill becomes extremely worried and is confronted with a dilemma. If he tells his superiors about this piece of information there is a great possibility that the project will be terminated. And, if this knowledge becomes public, not only will it bring humiliation to the company and probably cause his dismissal, but also the company will be highly susceptible to a million-dollar lawsuit by the patient's family. If Bill decides to withhold this information, a new model could be created with the flaw corrected, without anyone knowing about the dilemma.

Bill decides to ask for advice from two older colleagues. He first asks Bob, a fellow chemical engineer and someone who understands the technical aspects of the project.

"You have no choice Bill," replies Bob. "You made a mistake and now have to suffer the consequences. Also, if you withhold this information and it is discovered later, the situation will worsen."

Bill then phones his sister, Sheila (a cardiologist), and explains the situation to her. "It's a tough call Bill," replies Sheila. "Ordinarily, I would say let the truth be known, but it is your decision."

Bill also contacted the authors of this book for critical advice. They suggested he attempt to address the following four questions:

1. What are the facts in this case?
2. What ethical dilemma has been encountered?
3. Are you being selfish if you do not report the flaw in the artificial heart?
4. Should your loyalty to the company play a major role?

22.7 Open-Ended Problems

This last section of the chapter contains open-ended problems as they relate to ethics. No detailed and/or specific solution is provided; that task

is left to the reader, noting that each problem has either a unique solution or a number of solutions or (in some cases) no solution at all. These are characteristics of open-ended problems described earlier.

There are comments associated with some, but not all, of the problems. The comments are included to assist the reader while attempting to solve the problems. However, it is recommended that the solution to each problem should initially be attempted *without* the assistance of the comments.

There are 34 open-ended problems in this section. As stated above, if difficulty is encountered in solving any particular problem, the reader should next refer to the comment, if any is provided with the problem. The reader should also note that the more difficult problems are generally located at or near the end of the section.

1. Describe the early history associated with the ethics movement.
2. Discuss the recent advances in implementing ethical programs at the industrial level.
3. Select a refereed, published article on ethics from the literature and provide a review.
4. Provide some normal everyday domestic applications involving the general topic of ethics.
5. Develop an original problem on ethics that would be suitable as an illustrative example in a book.
6. Prepare a list of the various technical books which have been written on ethics. Select the three best (hopefully, it will include a book written by one of the authors [2]) and justify your answer. Also select the three weakest books and, once again, justify your answer.
7. The following writeup on plagiarism applied to the preparation of a laboratory report at the academic level.

   "Plagiarism occurs when you represent someone else's work as being your own, whether the source is another student's laboratory report or a copyrighted publication. College policy requires that plagiarism be reported by the instructor to a judiciary committee. If the committee finds the student guilty of plagiarism, the penalty is an automatic "F" in the course and a notation in the student's academic files. Plagiarism includes borrowing a computer disk from a friend "to look at the experimental trends," then submitting the same report, graphs, spreadsheet, and/

or MathCAD calculations (perhaps after some minor revisions such as substituting your own data). If this disk swapping is caught, both the borrower and owner of the disk will be severely penalized."

Prepare a similar statement that a company could prepare for its chemical engineering employees.

8. Discuss the difference between moral obligation and personal responsibility.
   Comment: Refer to the literature [2] for more information.
9. Discuss the problems associated with recognizing ethical issues.
10. Discuss the relationship (if any) between honesty and integrity.
    Comment: Refer to the literature [2] for additional details.
11. Much has been written about "the guardians of the system". Provide your interpretation of this phrase
    Comment: Refer to the literature [2] for additional details.
12. How can ethics best be taught at the academic level?
    Comment: Refer to the literature [2] for additional details.
13. How can ethics best be taught at the domestic level?
    Comment: Refer to the literature [2] for additional details.
14. How can ethics best be taught at the industrial level?
    Comment: Refer to the literature [2] for additional details.
15. How can ethics best be taught at the business level?
    Comment: Refer to the literature [2] for additional details.
16. Most regulations depend on voluntary compliance. Hence, ethics becomes a concern. In dealing with ethics there are several terms that one may encounter: ethical theory, consequentialist theory, deontological theory, utilitarianism, ethical egoism, nationalism, and retributivism. Briefly explain these terms.
    Comment: Refer to the literature [2] for additional details.
17. As noted in the Overview, there was an anti-technology movement in the 1960s in which engineers were blamed for the ills of society. Engineers were blamed for nuclear bombs, pesticides, crashes, etc. This is sometimes described as the "Existential Pleasure of Engineering." Explain this description, and discuss how it relates to ethical conduct.
18. How are ethical values determined by you?
19. It has been generally accepted despite cultural variations that any historical ethic can be found to focus on one of

four different underlying moral concepts. Identify and define each of these in your own words.

Comment: Refer to the Overview.

20. Aldo Leopold made the following observation on personal ethics in his 1949 *A Sand County Almanac*,…"The scope of one's ethics is determined by the inclusiveness of the community with which identifies oneself." In terms of the concept of environmental ethics, how does the concept of "community" expand beyond that captured in the cited concept of personal ethics?
21. If a consortium of investors from California and Germany was proposing to build a ski resort on U.S. Forest Service land near your property and, as a rule, you like to ski, would you be likely to use the facilities? If so, do you think this is "evidence" that you prefer development of public lands over forest resource preservation? Do citizens always "vote with their pocketbooks?" Why?
22. The U.S. Forest Service has a "multiple-use" directive, i.e., the lands and resources it administers provide a variety of goods and services to the public. For example, this means that the land and resources provide not only recreational opportunities but revenues from timber harvests and sales as well. Should government agencies such as the U.S. Forest Service strive to make a profit? Why or why not? How do you think your ethics affect your opinion on this issue?
23. As a chemical engineering student, how do you incorporate environmental awareness into your everyday ethics?
24. ISO 14000 is a voluntary standard for environmental management systems. A company can declare itself in conformity with the standard, but third-party certification of conformity is available and is generally regarded more highly by purchasers. The company seeking third-party certification contacts a "registrar" who sends an audit team of three trained professionals to review the company's management system. The audit usually takes three days.

    On the third day of an audit of a facility, one member of the team reveals to the lead auditor that he has worked for the facility recently as a consultant. Is this an ethical problem? What should the lead auditor do?

    Comment: See also the earlier chapter on Environmental Management.

25. You are a young chemical engineer and have just completed an interview for a new environmental management position with a relatively small company that manufactures metal specialty products. Until now, this position has been non-existent within the company. During your interview, the company's president openly praised the company's "responsible attitude toward the environment," citing an example of employees organizing the recycling of aluminum and other metals from certain lathing operations, as well as the company's "clean record" with the state regulatory agency.

    While touring the facility's metal degreasing process area, you notice two employees through an open doorway in the rear of the building pouring liquids from two 5-gallon waste solvent containers directly onto the ground. The ground is extremely discolored in the area where the liquids are being poured and void of vegetation. The vegetation nearby is visibly stressed.

    You have been offered the position at an attractive salary rate and are asked to make a decision within 2 weeks. What would be your decision regarding employment with this company?
26. Refer to the previous problem. If you were to take the job, what would be your approach to the environmental management attitude you witnessed during the interview? Would you report the improper discharge of solvent to the local regulatory authorities? Support your decision from either a professional or personal ethical standpoint, or both, and be explicit.
27. Refer to Problem 2 in the previous Section. Propose a solution to the problems raised by such opposition.
28. Consider the following hypothetical scenario where three adjoining states have conflicting needs for disposal of wastes.

    The citizens of New Jersey (population of 12 million, an urban state with little available land) are reluctant to dispose of their waste in their own state and are forbidden under federal law to dump it at sea. They have the political will and the financial ability to dispose their waste out of state. To do this, they must transport their waste through the state of Pennsylvania, and store it there temporarily

until completion of a treatment, storage and disposal facility (TSDF) planned for construction in the state of West Virginia. About half the waste is currently accumulating under conditions that are not considered safe for storage beyond a period of 10 years. Land in New Jersey is either too scarce, too expensive, or too close to densely populated areas for a TSDF, and waste incineration was voted down as an option two years ago.

The state of Pennsylvania (population of 16 million) has decided to dispose of its wastes in several engineered landfills that are permitted to contain properly containerized hazardous wastes. The landfills were sized to allow for a 50-year operating life before closure based on projected waste generation rates within the state. New Jersey's wastes would be transported along a corridor that would expose about one million additional people to risks of transportation accidents, and then temporarily stored north of a large city in the western part of the state. Pennsylvania does not want New Jersey's waste temporarily stored on its soil and has threatened to pass legislation banning the temporary facility. It has also threatened to sue New Jersey in federal court if the latter tries to contract for out-of-state disposal of its wastes that involves interim storage in Pennsylvania.

The state of West Virginia (population of 3 million) is relatively poor and rural. Its economy has been devastated by layoffs from steel mills and coal mines, and its citizens and elected officials are very interested in attracting new industries to the state. A TSDF capable of accepting wastes from several states in the region, including New Jersey's, would produce several hundred jobs during the construction and operation phases and would be a potential source of tax revenue to the impoverished state. The largely blue-collar labor pool is used to industrial hazards and is receptive to the opportunity to be retained to treat, store, and dispose of containerized wastes. There is widespread support for the construction of a regional facility that would dispose of both West Virginia's and New Jersey's wastes. There is a small vocal opposition that is concerned about the environmental risks and does not want West Virginia to be perceived as a dumping ground for other states. The governor of West Virginia has contacted his influential U.S.

senator, who is holding hostage a federal water quality bill that funds projects for water quality improvements that are administered jointly with Pennsylvania until Pennsylvania becomes more compliant on the waste transportation and interim storage issue.

The federal government, in the persons of the Congress, various regulatory agencies, and the courts may be called upon to participate in the resolution of the dispute among these states.

There are several political rationales that could be used to resolve this dispute:

- A "greatest good for the greatest number" rationale could be applied, i.e., reducing the risk to the 12 million citizens of New Jersey outweighs the increased risk to the one million potentially exposed citizens of Pennsylvania.
- Alternatively, a "minority rights" rationale could be applied, where large populations are not allowed to worsen the quality of life of smaller populations. In this case, the minority is numerical, not ethnic.
- An "each takes care of their own" rationale could be applied, where each state must locate and develop, no matter what the cost, a waste TSDF within its own boundaries. This rationale deprives West Virginia of economic benefits, reduces risks for Pennsylvania, and increases disposal costs for the taxpayers of New Jersey.

List the major risks associated with allowing wastes to remain in New Jersey under partially unsafe conditions in a scenario where New Jersey "loses" its bid to transport its waste out of state.

29. Refer to the previous problem. List the risks of transporting New Jersey's waste via Pennsylvania (with interim storage in Pennsylvania) under a scenario where New Jersey "wins" its dispute. In formulating the answer, consider the increase in volume of waste transportation and storage that would occur in Pennsylvania.
30. Refer to the previous two problems. List the risks of disposing of New Jersey's wastes at a RCRA-permitted facility in West Virginia.

31. Refer to the previous three problems. List how New Jersey can reduce the risks associated with transporting its waste through Pennsylvania.
32. Consider the rationales described in the previous four problems. Each rationale above is cast in "win-lose" terms. Are there alternative rationales that are "win-win" or "lose-lose"? For example, under the first rationale, could New Jersey compensate Pennsylvania for the increased risk New Jersey exposes Pennsylvania to? The payments could be used for road, rail or river improvements and increased surveillance of hazardous waste shipments. What would be involved in determining a fair price for this compensation?
33. Consider the previous problem. Find and summarize some case studies in the library that involve actual disputes among state governments. In reading the literature on a particular dispute, try to identify the nature of the disposal problem (type of waste and disposal method), and the motivating interests of the parties in conflict, i.e., who stands to gain from having the proposed facility and why, and who stands to be hurt by the facility and why.
34. Refer to the previous problems. List the pluses and minuses, or "winners" and "losers" for each of the rationales described in the earlier problem statements.

References

1. L. Theodore, *On Ethics I*, Williston Times, Williston Park, NY, Nov. 28, 2003.
2. Adapted from: J. Wilcox and L. Theodore, *Environmental and Engineering Ethics: A Case Study Approach*, John Wiley & Sons, Hoboken, NJ, 1998.
3. L. Theodore, *On Ethics II*, Williston Park, NY, March 26, 2004.
4. M.K. Theodore and L. Theodore, *50 Major Issues Facing the 21st Century*, Theodore Tutorials (originally published by Prentice Hall), East Williston, NY, 1995.
5. H. Rolston, *Philosophy Gone Wild*, Prometheus Books, Buffalo, NY, 1986.
6. A. Leopold, *A Sand County Almanac*, Oxford University Press, New York City, NY, 1949.
7. I. Barbour, *Ethics in an Age of Technology*, Harper, San Francisco, CA, 1993.
8. H. Taback, *AWMA's Code of Ethics*, EM, Pittsburgh, pp. 42-43, September 2007.
9. www.awma.org/about/index/html.

10. R. Lazarus, *Pursuing Environmental Justice: The Distributional Effects of Environmental Protection*, Northwestern University Law Review, Chicago, IL, Spring 1987.
11. L. Cole, *Empowerment as the Key to Environmental Protection: The Need for Environmental Poverty Law*, Ecology Law Quarterly, 1992.
12. B. Marquez, Lecture, University of Wisconsin-Madison, Madison, WI, May 5, 1994.
13. M.K. Theodore and L. Theodore, *Introduction to Environmental Management*, CRC Press/ Taylor & Francis Group, Boca Raton, FL, 2010.
14. L. Theodore, *Chemical Engineering: The Essential Reference*, McGraw-Hill, New York City, NY, 2014.