Identify and discuss the ethically important elements in this case. How relevant is it that subsequent review showed that none of the falsified documents needed to be changed? (Although Judge Wolverton did not impose the maximum penalty, he did not treat Landers as a least offender.)

CASE 44

Where Are the Women?[118]

Although women have become more prevalent in engineering schools during the past few decades, they still make up only approximately 20 percent of engineering school undergraduates in the United States. Even this percentage is somewhat misleading. Women are more prevalent in some engineering fields than others. For example, more than 30 percent of the undergraduates in chemical engineering departments are women, but only 13 percent of the undergraduates in mechanical engineering and electrical engineering are women.[119] Eighteen percent of all engineering PhDs are awarded to women. There are even fewer women faculty in engineering schools. The higher the faculty rank, the fewer women there are. At the top rank of full professor, less than 5 percent are women.[120] This means that engineering students in the United States are taught and mentored almost exclusively by males, that there are few women faculty serving as role models for female students, and that engineering more generally remains dominated by men.

As interesting comparisons, women receive 57 percent of all baccalaureate degrees in the United States and 55 percent of all social science PhDs, women make up at least 50 percent of the students in medical and law schools, and 28 percent of full professors in the social sciences are women.[121] Therefore, what is happening in engineering schools? No doubt, there are a number of contributing factors to the fact that there are so few women in engineering. But many common beliefs about women and academic advancement in engineering prove to be without merit when the evidence is examined.

Belief	**Evidence**
1. Women are not as good in mathematics as men.	Female performance in high school mathematics now matches that of males.
2. It is only a matter of time before the issue of ''underrepresentation'' on faculties is resolved; it is a function of how many women are qualified to enter these positions.	Women's representation decreases with each step up the tenure track and academic leadership hierarchy, even in fields that have had a large proportion of women doctorates for 30 years.
3. Women are not as competitive as men. Women do not want jobs in academe.	Similar proportions of men and women with science and engineering doctorates plan to enter postdoctoral study or academic employment.
4. Women and minorities are recipients of favoritism through affirmative action programs.	Affirmative action is meant to broaden searches to include more women and minority group members but not to select candidates on the basis of race or sex, which is illegal.
5. Academe is a meritocracy.	Although scientists like to believe that they ''choose the best'' based on objective criteria, decisions are influenced by factors—including biases about race, sex, geographic location of a university, and age—that have nothing to do with the quality of the person or work being evaluated.
6. Changing the rules means that standards of excellence will be deleteriously affected.	Throughout a scientific career, advancement depends on judgments of one's performance by more senior scientists and engineers. This process does not optimally select and

(*Continued*)

Belief Evidence (Continued)

	advance the best scientists and engineers because of implicit bias and disproportionate weighting of qualities that are stereotypically male. Reducing these sources of bias will foster excellence in science and engineering fields.
7. Women faculty are less productive than men.	The publication productivity of women science and engineering faculty has increased during the past 30 years and is now comparable to that of men. The critical factor affecting publication productivity is access to institutional resources; marriage, children, and elder care responsibilities have minimal effects.
8. Women are more interested in family than in careers.	Many women scientists and engineers persist in their pursuit of academic careers despite severe conflicts between their roles as parents and as scientists and engineers. These efforts, however, are often not recognized as representing the high level of dedication to their careers they represent.
9. Women take more time off due to childbearing, so they are a bad investment.	On average, women take more time off during their early careers to meet caregiving responsibilities, which fall disproportionately to women. However, by middle age, a man is likely to take more sick leave than a woman.
10. The system as currently configured has worked well in producing great science; why change it?	The global competitive balance has changed in ways that undermine America's traditional science and engineering advantages. Career impediments based on gender, racial, or ethnic bias deprive the nation of talented and accomplished researchers.[122]

Recently, a number of academic researchers have attempted to separate the myths from the facts about why so few women hold senior-level and leadership engineering positions. One plausible explanation is that slight disparities accumulate over time to disadvantage women and advantage men. Subconscious expectations tied to gender (gender schemas) are an important source of these disparities. We expect, for example, men to be the primary earners and women to be the primary providers of child care. A full range of studies on the influence of gender schemas in assessments of professional competence shows quite convincingly that over time, gender schemas contribute significantly to female engineering faculty being consistently underrated and male engineering faculty being consistently overrated.[123] Gender schemas are held unconsciously by both men and women and subtly influence perceptions and judgments made about one another.[124] Experimental data show, for example, that letters of reference for professional women tend to be shorter and to contain twice as many doubt-raisers (e.g., ''she has a somewhat challenging personality''), more grindstone adjectives (e.g., ''hardworking'' or ''conscientious''), and fewer standout adjectives (e.g., ''brilliant'') as letters for men.[125] Other studies show that women tend to feel less entitled to high salaries and less confident in their mathematical abilities even when their actual performance levels equal those of male peers. Men are expected to be strong and assertive (leaders) and women to be nurturing listeners. As a result, women holding positions of leadership often must work harder to demonstrate actual leadership.

Because most of the faculty and administrators at engineering schools, both male and female, genuinely wish to advance and promote more women, focusing on gender schemas is especially relevant to advancing women in engineering fields. Virginia Valian, a researcher on gender schemas, makes this point. She writes, ''The moral of the data on gender schemas is that good intentions are not enough; they will not guarantee the impartial and fair evaluation that we

all hold as an ideal.''[126] As engineering schools attempt to recruit and advance more women, it is important to assess the ways in which and the degree to which harmful gender schemas serve as barriers to women's advancement. At some institutions, such as the University of Michigan, such efforts have involved conducting gender schema workshops, forming focus groups, conducting interviews, and collecting survey data to assess the prevalence of gender schemas contributing to underrating women faculty in science, technology, engineering, and mathematics fields.[127] One hypothesis is that once the harmful implicit schemas are made explicit, we can begin to address them at individual, departmental, and institutional levels and, at the very least, decrease their harmful impact.

Identify and discuss some of the subtle expectations both men and women have about gender. How do these gender schemas influence the advancement and promotion of women in engineering? Can you think of any examples from your own experience of men being advantaged and women being disadvantaged as a result of gender schemas?

CASE 45

XYZ Hose Co.[128]

Farmers use anhydrous ammonia to fertilize their fields. The anhydrous ammonia reacts violently with water, so care must be exercised in disbursing it. Farmers' cooperatives rent anhydrous ammonia in pressurized tanks equipped with wheels so the tanks can be pulled by tractors. The farmers also rent or purchase hoses that connect the tanks to perforated hollow blades that can be knifed through the soil to spread the ammonia. Leaks from the hose are potentially catastrophic.

For years, the industry standard hose was made of steel-meshed reinforced rubber, which was similar in construction to steel-reinforced automobile tires. Two separate trade associations had established these industry-wide standards.

Approximately 15 years ago, a new, heavy-duty plastic became available that could replace the steel in the hoses. The plastic-reinforced hoses were less expensive, lighter, and easier to process than the steel-braided rubber. The new hose met the industry standards. One company, the XYZ Hose Company, began marketing the plastic-reinforced hose to farmers. Officials of XYZ knew, as a result of tests by a consultant at a nearby state agricultural college, that the plastic did not react immediately to the anhydrous ammonia; however, over the years the plastic did degrade and lose some of its mechanical properties. Accordingly, they put warnings on all the hoses they manufactured, indicating that they should be replaced periodically.

After the product had been on the market a few years, several accidents occurred in which the XYZ hoses ruptured during use and blinded and severely injured the farmers using them. Litigation followed, and XYZ argued in its defense that the farmers had misused the hoses and not heeded the replacement warnings. This defense was unsuccessful, and XYZ made substantial out-of-court settlements.

XYZ has since dropped this product line and placed advertisements in farmers' trade journals and producers' cooperatives newsletters asking farmers to turn in their XYZ hoses for full refunds. The advertisements state that the hoses are ''obsolete,'' not that they are unsafe.

Identify and discuss the ethical issues this case raises, paying special attention to relevant, key ideas presented in this chapter. What are the relevant facts? What factual, conceptual, and application issues are there? What methods for resolving these issues might be used?

NOTES

1. Steven Weisskoph, ''The Aberdeen Mess,'' *Washington Post Magazine*, January 15, 1989.
2. *The Aberdeen Three*, a case prepared under National Science Foundation grant number DIR-9012252. The principal investigators were Michael J. Rabins, Charles E. Harris, Jr., Charles Samson, and Raymond W. Flumerfelt. The complete case is available at the Texas A & M Engineering Ethics website (http://ethics.tamu.edu).
3. Case study prepared by Ryan Pflum, MA philosophy student at Western Michigan University.