

Engineering Ethics Cases with Numerical Problems

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Civil Engineering Case 2

Weston Wastewater Treatment Case

Authors:

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Suggested Courses:

Wastewater Engineering

Level:

Senior

I. Narrative

In 1991, Richard Madison was the operations supervisor at the Weston Wastewater Treatment Plant. A mechanical engineer, he had worked at the plant for almost 15 years.

On August 21, 1991, he attended a meeting at City Hall with the Mayor of Weston, Steve Pallin. The intent of the meeting was to address tensions which had arisen among managers at the treatment plant. Also present at the meeting were John Carson, the Director of Public Works and the city official with overall responsibility for the plant; Barry Best, the plant superintendent; Sam Stanton, the plant maintenance supervisor; and George Freed, the plant testing and quality control supervisor. Carson was a political appointee and a long-time close ally of the Mayor. Madison, Stanton, and Freed were city employees, and were also political supporters of the Mayor.

Best was employed by Enviroservices, Inc., a consulting firm that managed the plant under a contract from the city. The company had been hired to manage the plant in 1988, after a series of management problems resulted in a fine by the U.S. Environmental Protection Agency (EPA). Carson had recommended the hiring of Enviroservices from among more than a dozen firms which had submitted proposals.

At the meeting, Madison accused Best, Stanton and Freed of several violations of environmental laws. Specifically, he stated that on several occasions since early 1990, he had observed them tampering with samples which were to be tested for compliance with biochemical oxygen demand (BOD) standards for discharging treated wastewater (effluent) into the Weston River. The river serves as a source of drinking water for several

downstream communities. The results of the tests were sent monthly to state and federal environmental officials, and tampering with the tests is a criminal offense under federal law.

Madison also stated that, on several occasions, Best, Stanton and Freed had used high pressure hoses to discharge sewage sludge from tanks directly into the river. He charged that they had falsified records to cover-up the sludge discharges.

Madison stated that he had informed Carson of his suspicions in May, 1991, but that no actions were taken. Carson, Best, Stanton, and Freed denied the allegations.

In the days following the meeting, Mayor Pallin appointed a committee to investigate the charges. The committee hired LabSciences to provide testing and consulting services. The U.S. Attorney's Office, representing the EPA, announced that it was beginning a criminal investigation.

On August 29, Mayor Pallin fired Carson, stating that Carson had misled him about operations at the plant. In November, Pallin was defeated in his re-election bid by City Councilman Thomas Golden. Golden had served as an administrative consultant at the treatment plant from 1978 to 1988, when he was fired for using plant personnel in connection with his political activities. He had also been a City Councilman during that period.

During the Fall of 1991, several grievances were filed against Madison by plant workers, alleging a variety of abuses and unfair treatment. Three technicians who had worked closely with him were reassigned to other jobs. Madison also stated that he had been threatened and harassed by Best, Stanton, and Freed.

On January 6, 1992, Golden took office. On January 28, he announced that Madison was being suspended indefinitely and that Best would leave the plant in mid-February. He cited as the reason for the dismissals the need to restore public confidence in the plant.

In February, the Mayor's committee announced that it had found evidence of several irregularities at the plant, including tampering with test samples and discharges of sludge into the river. One of the plant workers testified that he had witnessed Best diluting a sample with tap water. While it had no evidence that Best, Stanton and Freed had personally carried out any illegal dumping of sludge, several plant workers reported that the men had ordered them to hose out the tank; other workers reported seeing the men in the vicinity of the tank around the time of the discharges.

Madison was fired in mid-March, 1992. The reason cited for his dismissal was poor job performance. He subsequently sued the city, contending that he was fired because of his whistle-blowing. The city denied the charge.

In July, 1992, Best, Stanton and Freed were charged by the U.S. Attorney's Office with four counts of violating the Clean Water Act. The indictment charged that they had ordered the discharge of at least 14 tons of sludge into the river and had filed incomplete and inaccurate test reports. The city agreed to pay legal fees for Stanton and Freed; EnviroServices paid Best's legal fees. When criticized for agreeing to pay the legal fees for Stanton and Freed, Golden blamed the City Council. He defended Madison's dismissal and denied that the indictments were related to Madison's allegations.

In November, Best was acquitted of the charges against him. Freed and Stanton were convicted and each received a 15 month sentence. They were suspended from their jobs, pending appeal. The appeal was denied,

and they entered prison in February, 1994.

Between January, 1992, and March, 1994, Madison sent out over 600 resumes and was interviewed 25 times, but was unable to find a job. In March, a jury ruled that he had been fired because of his whistle-blowing. He was awarded \$163,800.

II. Numerical Problems

The test with which Best, Stanton and Freed were charged with tampering involved measuring the biochemical oxygen demand (BOD) of effluent from the plant. The test involves collection of 50 ml of effluent . The specimen is placed in a 300 ml bottle, diluted with 50 ml of tap water, and placed in an incubator at 20° for five days. At the end of that time, the depletion of dissolved oxygen (DO) is measured, indicating the extent to which organic matter is present in the sample and the efficiency of the treatment process in removing organic matter from wastewater. Madison charged that Best, Stanton and Freed had collected less than 50 ml of effluent and diluted it excessively.

The BOD in the sample is calculated as

$$\text{BOD} = (D_1 - D_2)/P, \text{ where}$$

D_1 = DO of sample 15 minutes after preparation, mg/l;

D_2 = DO of sample after incubation, mg/l; and

P = decimal fraction of effluent in the sample

$$= (\text{volume of effluent in sample})/(\text{total volume of sample, including tapwater})$$

The test was conducted monthly by plant personnel and the results were forwarded to the EPA and state environmental officials. State and federal regulations specified that the BOD must be at least 38 mg/l.

1. Tests performed on plant effluent by LabServices between September, 1991, and February, 1992, yielded the following measures of BOD:

39.2	46.7	47.1	43.9	38.2
45.3	36.2	44.2	45.9	48.1
43.8	44.6	47.1	46.8	43.3
42.1	45.6	44.2	44.9	44.1
45.6	47.1	45.6	43.9	46.6
37.7	42.8	38.9	48.1	47.2

48.1	38.9	46.8	39.7	43.2
43.1	45.1	45.2	46.1	44.6
44.2	42.5	37.5	45.6	46.7
46.1	46.9	44.8	44.6	39.6

Based on these results, was the plant operating in accordance with EPA regulations? At what level of confidence can you state that?

2. Consultants from LabServices obtained the results of tests submitted by the plant to EPA between May, 1989, and August, 1991. These results were as follows:

May, 1989	43.2	January, 1990	61.1	January, 1991	43.2
June	38.6	February	55.4	February	66.1
July	41.6	March	63.2	March	54.2
August	36.1	April	59.3	April	58.6
September	37.8	May	55.7	May	64.2
October	32.4	June	62.1	June	32.3
November	59.8	July	68.6	July	34.3
December	66.2	August	61.2	August	37.5
		September	53.1		
		October	58.3		
		November	64.1		
		December	67.2		

Considering these results, what evidence could you derive that the test results had been tampered with? How confident would you be of this conclusion? Should EPA have caught the tampering?

3. Can you estimate to what extent the sample was diluted?

III. Ethical Questions

1. There was a delay of more than a year and a half between Madison's observing the illegal behavior and reporting it to Mayor Pallin or John Carson. Does that affect the ethics of his behavior? Why or why not?

2. There were numerous suggestions regarding Madison's motives for blowing the whistle. What might his motives have been? Do his motives affect the ethics of whistle-blowing? Why or why not?

3. How else might Madison have behaved in this situation? What are the pros and cons of each alternative course of action? What would you have done in his situation?

4. Suppose that Madison had not observed the illegal actions, but had based his charges on analysis of the test results submitted to EPA, as shown above. Would it have been ethical to report his charges to the mayor and EPA? Why or why not?

1. Best was acquitted of the charges, while Freed and Stanton were convicted. Can you suggest any explanations for that?

IV.

Solutions to Numerical Problems

1. The mean of these values is 44.1 and the standard deviation is 3.04. This indicates that the plant was operating in accordance with EPA regulations, with a confidence level of about 95% (since the mean less 2 std. devs. is approximately equal to 38).

2. From the data, it appears that the tampering might have begun in November, 1989, when there is a noticeable increase in the values, possibly indicating that the numerator in the P term in the BOD equation has been reduced by diluting the sample, thus reducing P and increasing the BOD in a given sample. Prior to November, there had been a gradual, if erratic, decline in the values of the BOD tests, which might have caused Freed and Stanton to fear that the plant was not operating in accordance with EPA guidelines, perhaps due to poor maintenance; Stanton was the maintenance supervisor. It appears that the tampering may have ended in June, 1991, after Madison had informed Carson of his suspicions.

The mean of the test results between May, 1989, and August, 1991, is approximately 52.7. Assuming that the 50 tests run by LabSciences represent accurate BOD results for the plant, this mean is approximately 3 std. devs. from the mean of 44.1, representing a 99% level of confidence that the test results were tampered with. If the results from May-Oct., 1989, and June-Aug., 1991, are excluded, the mean for the historic data is 60.0, suggesting even more strongly that the test results were tampered with between Nov., 1989, and May, 1991. Any analysis by EPA of the test results submitted during this period should have raised a red flag.

3. Comparing the mean during the tampering period with the mean of tests performed by LabSciences (60.0 vs. 44.1) suggests that the tampering involved reducing the concentration of specimen in the sample from .5 to about .375.

V. Solutions to Ethical Problems

1, 2, and 3. The delay suggests that Madison's motives might not have been completely altruistic. There may have been events or relationship changes in early 1991 that caused him to cease overlooking the tampering. Perhaps he had a falling out with the others or believed that he wasn't receiving the recognition, advancement or compensation that he deserved. His actions may also have had political motivations. It doesn't appear that his motives affect the fact that he acted properly in blowing the whistle, to Carson if not to Pallin. If he was acting unethically prior to blowing the whistle, it was better that he acted properly at that point.

However, it's not clear that he needed to inform Pallin of the actions. Based on the historic test data, conveying his allegations to Carson stopped the tampering. Of course, that may have been only temporary and would still have resulted in the wrong-doers going unpunished.

Alternative courses of action could have included confronting Freed and Stanton, sending an anonymous letter to EPA, letting Carson take care of it, or making sure that he was physically present during sample taking, telling plant workers that they should never hose out a sludge tank unless he was there, or other approaches. One con of the approach he did take is that it appears that the tampering had ended after he told Carson, yet he still destroyed his career.

4. It would probably take more convincing statistical data to justify whistle-blowing in the absence of actually observing the illegal behavior. Without definitive data, Madison could have risked ruining the careers of others without being able to prove his allegations.

5. There was a strong suspicion that Enviroservices got Best off by hiring high-priced attorneys who had strong political connections in the local community. However, there was less evidence against him than against the others. For example, the worker who testified that he had witnessed Best diluting a sample, may have only witnessed the dilution necessary to conduct the test.