Chapter 12. Environmental Cost Accounting

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Costs associated with poor environmental performance can be devastating. Waste disposal fees, permitting costs, and liability costs can all be substantial. Wasted raw material, wasted energy and reduced manufacturing throughput are also consequences of wastes and emissions. Corporate image and relationships with worker and communities can suffer if environmental performance is substandard. But, how can these costs be quantified?

This chapter will review the tools available for estimating environmental costs. Many of these tools are still in their developmental stages, and practices therefore vary widely from company to company. In general, however, accounting practices have acted as a barrier to implementation of green engineering projects because they hide the costs of poor environmental performance. Many companies are now giving more consideration to all significant sources of environmental costs. The principle is that if costs are properly accounted for, business management practices that foster good economic performance will also foster superior environmental performance.

The relationships between economic and environmental performance are examined in a number of steps. First, in Section 12.2, a few key terms are defined to simplify and clarify the presentation of material. In Section 12.3, the magnitude and types of environmental costs typically encountered by companies are reviewed. Then, in Section 12.4, a framework for assessing environmental costs is described. Finally, sections 12.5 through 12.8 describe specific methods for evaluating environmental costs.

Prerequisites to fully understanding the benefits of environmental accounting practices are an unde rstanding of the time value of money and some familiarity with present value, payback period, internal rate of return, and other financial evaluation calcuations. These concepts are covered in textbooks on engineering economics (see, for example, Valle - Riestra, 1983). Also, it is assumed that the reader understands how to evaluate potential environmental impacts associated with products and processes (see Chapter 11).

Chapter 12 Example Problem
Example 12-2

A chemical manufacturing facility buys raw material for $0.50 per pound and produces 90 million pounds per year of product, which is sold for $0.75 per pound. The process is typically run at 90% selectivity and the raw material that is not converted into product is disposed of at a cost of $0.80 per pound (by incineration). A process improvement allows the process to be run at 95% selectivity, allowing the facility to produce 95 million pounds per year of product. What is the net revenue of the facility (product sales - raw material costs - waste disposal costs) before and after the change? How much of the increased net revenue is due to increased sales of product and how much is due to decreased waste disposal costs?

Solution

The net revenue before the change is:

(90 million pounds * $0.75/pound - 100 million pounds raw material *$0.50/pound - 10 million pounds waste * $0.80) = $9.5 million/year

The net revenue after the change is:

(95 million pounds * $0.75/pound - 100 million pounds raw material *$0.50/pound - 5million pounds waste * $0.80) = $17.25 million/year

Of the difference ($7.75 million), about half ($3.75 million) is due to increased product sales and the remainder is due to decreased disposal cost. Note that the disposal cost assumed in this example is very high and thus represents a likely upper bound on these costs. It should also be noted that the cost of capital depreciation, per pound of product is reduced after the change.

Chapter 12 Sample Homework Problems

1. Lurmann, et al. (1999) have estimated the costs associated with ozone and fine particulate matter concentrations above the National Ambient Air Quality Standards (NAAQSs) in Houston. They estimated that the economic impacts of early mortality and morbidity associated with elevated fine particulate matter concentrations (above the NAAQS) are approximately $3 billion/year. Hall, et al. (1992), performed a similar assessment for Los Angeles. In the Houston study, Lurmann et al examined the exposures and health costs associated with a variety of emission scenarios. One set of calculations demonstrated that a decrease of approximately 300 tons/day of fine particulate matter emissions resulted in a 7 million person-day decrease in exposure to particulate matter concentrations above the proposed NAAQS for fine particulate matter, 17 less early deaths per year, and 24 fewer cases of chronic bronchitis per year. Using estimated costs of $300,000 per case of chronic bronchitis and $6,000,000 per early death, estimate the social cost per ton of fine particulate matter emitted. How does this compare to the range of values quoted by the AIChE CWRT? Review the procedures for estimating costs (see Hall, et al., 1992) and comment on the uncertainties associated with the methodology.