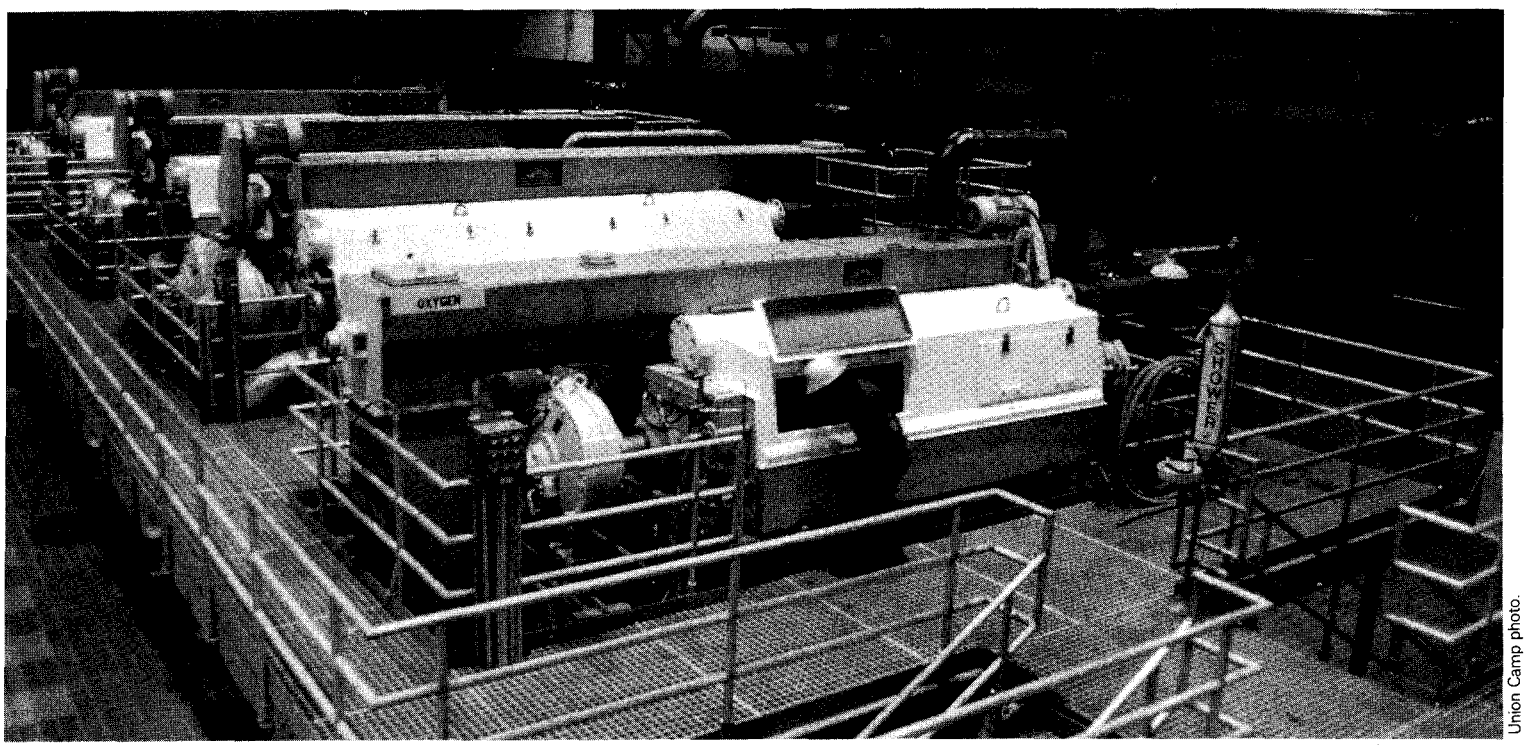

Union Camp photo.

At Union Camp's Franklin, Virginia, paper mill, the primary bleaching agents are ozone and oxygen, instead of the chlorine conventionally used, and the mill recycles most of its wastewater. Initial capital costs are somewhat higher than for a conventional plant, but operating costs are lower.

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Accounting for Pollution Prevention

Total cost assessment enables companies to see the true costs and benefits

by Allen L. White

(White is Director of the Risk Analysis Group at the Tellus Institute for Resources and Environmental Strategies in Boston. *The author thanks Deborah Savage and Monica Becker for contributions to this article.)*

Accounting is the cornerstone for managing any business enterprise. It also is fundamental to supporting wise pollution prevention decisions.

Accounting activities are commonly classified into two types. *Financial accounting* gathers information for users *outside* the organization, such as stockholders, creditors, and the tax collector. The profit-and-loss statement and filings with the Security and Exchange Commission are products of financial accounting. *Managerial accounting* gathers information aimed at managers *inside* the organization—those responsible for planning, controlling, and directing operations.

Financial accounting focuses primarily on the near-term, is governed by uniform practices and principles, and uses dollars as its standard unit of measurement. Managerial accounting, on the other hand, focuses on the longer term, follows firm-specific practices and principles, and uses a variety of measurement units to communicate information to managers. As such, managerial accounting is key in making pollution-prevention investment decisions.

From a pollution prevention perspective, effective managerial accounting requires two types of information. The first is physical—quantities of water, energy, chemicals, wastes generated and disposed of; the second is cost—how much the use, processing, and disposal of these materials cost the firm in terms of labor, equipment, buildings, depreciation, bank interest, liability, permitting, and so forth. Consistent, timely physical and cost information is necessary for characterizing how much, what types, where, and at what cost pollutants are generated in the operations of the firm. This alone, however, is not enough. To identify and exploit pollution prevention opportunities, managers need to translate this information into the

If accounting practices misrepresent the true profitability of prevention options, both business and the environment lose out.

language of business using yardsticks designed to measure performance and profitability.

Total Cost Assessment

Few dispute the critical role of managerial accounting in effective pollution prevention. But studies during the last three years point to a number of biases in current accounting practices which can systematically undermine its adoption. The consequences can be formidable. Each year, U.S. industry spends an estimated $115 billion on pollution control activities, $41 billion of which is capital investments. If accounting practices misrepresent the true profitability of prevention options, both business and the environment lose out. Correcting such bias requires an approach we call "Total Cost Assessment" (TCA). As discussed below, TCA encompasses four elements: cost inventory, cost allocation, time horizon, and financial indicators.

Cost inventory. In evaluating the profitability of prevention investments, firms often exclude costs which rightfully belong in the analysis. This is a cost inventory problem. It may occur due to shortcomings in either physical or cost data collection, or a combination of the two. For example, new utility costs or future savings could have been forgotten, or hard-to-measure, but nonetheless real savings could have been ignored. The latter might include avoided future liability, reduced occupational injury or illness, or increased revenues due to the introduction of "green products."

Accurate costing for prevention has obvious benefits for sound business management, but in practice it is often more complicated than may first appear. To illustrate, consider the case of a firm committed to reducing its use of a solvent, Chemical X. Chemical X is used as both an input in manufacturing a product and as an agent to clean pipes leading to a mixing tank. If one queries the operations personnel who use batch sheets (chemical recipes) for manufacturing the product, the answer to "how much" solvent is used will be based on units of product multiplied by the quantity of Chemical X in each unit.

If, on the other hand, one asks the environmental engineer the same question, the answer also may be based on batch sheets, but *with the addition* of quantities of Chemical X that are recycled in-process. One reason: Under some state regulations, use is use no matter what the source of chemical input, virgin or recycled.

Finally, if one asks the purchasing department the very same question, the answer may be based on still a different measurement approach—the difference in quantity of Chemical X remaining in storage tanks at the end of each month compared to the quantity at the beginning of the month.

What is the correct answer? All three may be correct, though their answers may vary by as much as 20 percent, depending on the exact question being asked, the accuracy of measurement methods, and the degree of quality control in last storing and analyzing the data. Of course, these figures ultimately must be reconciled if the task of targeting and costing pollution prevention opportunities is to proceed rationally. Overseeing their reconciliation is the job of the management accountant.

Cost allocation. Closely coupled with "how much" is the question, "by what." In other words, which processes or products are responsible for hazardous materials used and wastes generated. To answer this, the firm must assign figures to specific processes or products. Doing so requires a precise picture of how materials flow into, through, and out of the manufacturing process. This tracking is often referred to as a "mass balance."

In concept, all operating and capital costs should be allocable to some process or product: e.g., synthesizing a chemical, packaging a product, labeling a package, or disposing of a solid waste from a cutting or trimming operation. To develop accurate data, the management accountant must work in concert with production, purchasing, materials management, environmental, and R&D staff.

But, once again, gathering data is more complicated than might first appear. Even seemingly straightforward data such as solid-waste management costs may be confounded, for example, by disposing of wastes from various product lines into single receptacles. The benefits of greater precision are at some point outweighed by the costs of implementing the requisite tracking systems. For most firms, however, there appears to be much room for cost-effective improvement in cost allocation.

Time horizon. When a business looks at a potential prevention investment, it must ask the question: How long will it take to show profitability? For small, cash-strapped companies, the answer might have to be less than a year. For larger, better capitalized firms, an acceptable answer might be five or ten years, or even longer.

Prevention investments often take time to show profits, particularly when profitability is based on such items as future liability avoidance, recurrent savings due to waste avoidance, and revenue growth owing to market development of environmentally sound products. A TCA approach takes these future benefits into account by considering at least a five-year time horizon, whenever feasible.

Financial indicators. Financial indicators for pollution prevention projects should capture all the elements discussed above. Some, but not all, indicators used by business meet these standards. Among those that do are Net Present Value (NPV)

and Internal Rate of Return (IRR). One that does not, though it still may be used as a project screening tool, is simple payback.

Sharpening the Accounting Lens

As described in the accompanying box, we applied TCA to actual pollution prevention projects recently considered by two pulp and paper mills. As a major source of industrial pollution, pulp and paper provide a useful context for examining TCA. Historically, environmental regulation of the industry has focused on end-of-pipe control of discharges to the air and water. More recent restrictions, however, such as limits on toxic constituents in mill sludge and standards for foam, odor, and color, are moving the industry to examine materials and process changes.

For each project, we developed a "company analysis" comprising costs and allocation practices typically used by the firms. We compared these to "TCA analyses" of the same project, in which a fuller accounting and careful allocation of costs and savings were made over an extended time horizon.

Analysis of this limited sample suggests many opportunities for improving both physical and cost accounts. We also found that more comprehensive treatment of project costs and savings does not necessarily yield greater profitability for prevention investments. TCA is equally likely to turn up additional *costs* as it is additional *savings*, potentially diminishing the appeal of prevention investments. Moreover, the effort expended in preparing the TCA analysis, though typical of startup costs of any new management practice, may be substantial enough to make even large firms wary of adopting such an approach. In our view, however, the substantial benefits from improved accounting outweigh these initial costs and provide the foundation for better informed management practices. □

Two Cases in the Pulp and Paper Sector

To assess how TCA might work in the real world of business management, we worked in close collaboration with the staff of two paper mills to analyze the economics of two pollution prevention projects. Project 1, at a fine paper mill, would permit fiber, filler, and water reuse on two paper machines at all times, thereby conserving raw materials and reducing water use, wastewater volumes, and energy use for fresh and wastewater pumping and freshwater heating. Project 2, at a paper coating mill, would convert solvent/heavy metal coating to aqueous coating. This investment would substantially reduce use of solvents and heavy metals, emissions of volatile organic compounds, and hazardous waste generation. However, it would substantially increase water, steam, and electricity usage as well as wastewater streams to the local public treatment works.

The results of an analysis are revealing. In Project 1, the white water/fiber reuse project, the company analysis omitted very substantial energy savings from reduced fresh and wastewater pumping and treatment and freshwater heating. This omission, alone, dramatically underestimated the true profitability of the investment.

In the case of Project 2, the paper coating firm omitted all non-disposal waste management costs, utilities (energy, water, and sewerage), solvent recovery, and regulatory compliance costs from its analysis of the aqueous conversion project. Also omitted, and to some extent corrected in the TCA analysis: estimates of liability avoidance resulting from reduced solvent wastes disposed of off-site, savings due to reduced worker exposure to fugitive solvent emissions, and reduction of fire and explosivity hazards. Finally, potential (though difficult to quantify) improvements in "green" market competitiveness were excluded.

But the real surprise in Project 2 was the omitted costs of installing a heating system to prevent aqueous coatings from freezing, the energy for operating the heating system, and the additional energy needed to dry aqueous versus solvent-based coatings. These costs more than outweighed the savings, and the TCA evaluation revealed Project 2 to be profitable, but actually less profitable than the company analysis indicated.

Financial indicators for each project tell the story. For Project 1, the white water and fiber reuse investment, the net present value (NPV)—over 15 years—for this $1.5 million capital expenditure shifted from $0.36 million in the company analysis to $2.85 million under the TCA approach; the internal rate of return (IRR) increased from 21 percent to 48 percent; and the simple payback of 4.2 years decreased to 1.6 years, well within the mill's two-year payback guideline. By excluding the savings associated with freshwater pumping, treatment, and heating, and wastewater pumping, the company analysis made the project appear substantially less profitable than it actually would be.

Contrasting results were produced for Project 2, the aqueous conversion investment. The NPV for this $0.9 million capital expenditure shifted from -$0.2 million to -$0.4 million in the company versus TCA analyses; IRR decreased from 11 percent to 6 percent, and simple payback rose from 7.6 to 11.7 years. The inclusion of previously omitted savings for waste management, regulatory compliance, and future liability in the TCA were outweighed by the previously omitted utility costs. As a result, the TCA analysis revealed that the proposed project was actually less profitable than originally thought.

EPA's Flagship Programs

Existing programs promote pollution prevention in innovative ways

by David J. Kling and Eric Schaeffer

s indicated earlier in this issue by Administrator Browner, pollution prevention has become the guiding principle—the central ethic—of EPA's efforts to protect human health and the environment. As this policy is put into practice, pollution prevention will be integrated into every EPA program and activity.

There is much work to be done. Yet prevention has already come a long way at EPA, and existing activities will provide a strong foundation for what's to come.

Several themes characterize our current pollution prevention activities. They and the programs that express them are described briefly below.

Integrating Pollution Prevention into EPA's Mainstream Activities

As industry leaders will testify, pollution prevention strategies reduce pollution and its management costs and conserve precious resources. They thereby provide the critical link between environmental protection and economic productivity. The challenge we face is integrating pollution prevention into the way we do business. Following are some examples of how we are beginning to incorporate prevention into our daily activities:

(Kling is director of EPA's Pollution Prevention Division; Schaeffer is director of EPA's Pollution Prevention Policy Staff.)

- *Source Reduction Review Project* (SRRP). As a short-term goal, the Source Reduction Review Project ensures that source reduction measures and multi-media issues are considered as air, water, and hazardous waste standards affecting 17 industrial categories are developed. For the long term, the project tests different approaches to provide a model for the regulatory development process throughout EPA. For example, EPA is developing a regulation affecting the pulp and paper industry that will promote process changes to reduce the quantity of pollutants released to air, water, and land.

- *Pollution Prevention in Enforcement Settlement Policy*. EPA negotiators are strongly encouraged to incorporate pollution prevention conditions into settlements—both criminal and civil—involving private entities, federal facilities, and municipalities. The conditions can either correct an existing violation ("injunctive relief") or constitute a "supplemental environmental project" that the party performs. For example, in fiscal year 1991, EPA agreed to reduce the penalty for a dry-cleaning company that had failed to report (through the Toxics Release Inventory) the use of an industrial chemical. In exchange, the company agreed to change its industrial process. The result was a drastic reduction in the use of tetrachloroethylene, with significant overall savings to the company.

State and Local Partnerships

Increasingly, state and local agencies are becoming the "face of government," which is why EPA is working to develop and assist state and local pollution prevention programs. A number of states already have progressive pollution prevention efforts underway. (For example, see article by New Jersey Governor Florio on page 31.) EPA initiatives to strengthen the national network of state and local programs include:

- *Pollution Prevention Incentives for States*. Under the state prevention grant program, EPA has awarded more than $25 million through fiscal year 1993. These grants help the states to enhance innovative and results-oriented programs, implementing multimedia prevention approaches and targeting high-risk, high-priority areas. For example, Tennessee was awarded $300,000 for its Waste Reduction Assistance Program (WRAP). The program has trained more than 12,000 employees from a variety of industries in the fundamentals of pollution prevention, thereby enabling them to conduct snapshot assessments of their company solid-waste streams. Companies find that reducing waste leads to savings in disposal, raw materials, labor, and utility costs. In addition, companies boost revenues by selling recyclable goods.

- *Multimedia Grants*. Each year, EPA awards about $500 million in state grants for permitting, inspections, enforcement actions, and carrying out other federal mandates under laws such as the Resource Conservation and Recovery Act, the Clean Air Act, and the Clean Water Act. The Agency's new grant guidance, effective in fiscal year 1994, gives states the flexibility to incorporate pollution prevention into these activities to the extent permitted by law. This grant flexibility will provide an important source of support for innovative state projects such as the Massachusetts Waste Prevention First program, which promotes source reduction as the principal means of