SECTION TWO

Overview of Waste Reduction Concepts and Opportunities

2.1 Are We All Speaking the Same Language?

Before we see who benefits from waste reduction and how it happens, we need to define what it means. This guide emphasizes the term **"waste reduction"** defined in EPA's, **Business Guide for Reducing Solid Waste**, as "all actions taken to reduce the amount and/or toxicity of waste requiring disposal." That includes waste prevention or source reduction, recycling, composting, purchasing, and manufacturing goods having recycled content or that are made with less waste.

This definition has **two distinct concepts**. **First**, we need to think about the materials or energy waste involved in using those resources to produce goods and services. Such wastes include solid and hazardous materials, air emissions, sewer discharges, and energy consumption. **Second**, waste can be reduced by buying products and services made or provided from recycled content materials or that are produced with less waste. This second point does not always directly benefit the purchasers bottom line, but it can help. For example, purchasing products with less packaging or returnable packaging reduces or eliminates waste for the buyer.

Let's consider priorities in managing wastes before we try to understand waste reduction terms. The U.S. EPA established a **hierarchy** for waste management that has been adopted in essentially the same form by most states. The Pollution Prevention Act of 1990 set a national policy from Congress that parallels similar priorities for solid waste management. This system emphasizes source reduction at the top of the pyramid and disposal at the bottom as illustrated in Figure A.

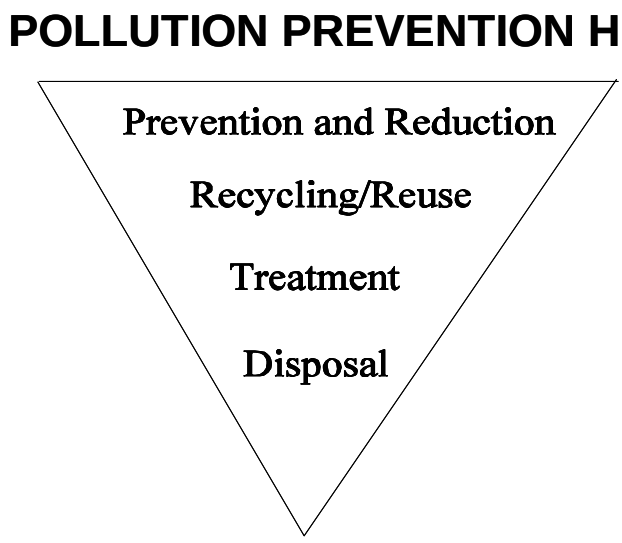

Figure A

The **first priority** is to **reduce waste at the source,** with less material entering the waste stream. This concept has the greatest potential to benefit a business, since it directly saves raw materials

costs. It also could reduce disposal, treatment, waste handling costs, and extra cost of liability and disposal of hazardous materials.

The familiar concept of **recycling, along with composting,** is **a second priority**. A waste is still being generated that must be recycled. It is a better resource management choice to recycle the material than to dispose of it at a landfill. However, the business must still pay at least twice for the recycled material. First, the recycled material is lost raw material that was to be purchased. Then, once it becomes a recyclable waste stream item, there is additional waste handling cost.

Treatment is **a third priority** related particularly to hazardous wastes. This approach is taken in conjunction with **pollution control technologies.** Incineration, treatment of sewer discharges, and chemical treatments are included. With solid waste, incineration for energy recovery would be at the same priority level.

The **lowest priority** is **land disposal** of the final waste stream. This is the most expensive way to use natural resources.

Speaking the Right Language

When educators, technical assistance providers, counselors, and regulators communicate with the business community, they must use mutually understood terms and concepts. We take this for granted, but communication failure is common. Technical assistance providers know that waste management terms are often confusing and misunderstood by businesses.

For example, regulated businesses have been subject to an increasingly complex array of environmental laws, regulations, rules, and policies since the 1960s. The first major concept widely championed was "pollution control". This is an end-of-pipe, post-generation waste treatment strategy. Pollution control meant removing excess pollutants or reducing the toxicity of wastes released to sewers or through smoke stacks. This was followed by a major emphasis on solid waste management and properly designed landfills. Various recycling, source reduction, and composting initiatives followed solid waste management. For more hazardous materials, we heard about "waste minimization" in the 1980s. This gave way to "pollution prevention". Is it any wonder that businesses are confused?

This is not an attempt define all terms used by the regulatory community and others promoting better material use practices. It is more important to assist the smaller business or manufacturer to understand the most meaningful terms. The business counselor or technical assistance person can provide this help. Large companies often have staff devoted to waste stream reporting, thus they have a better understanding of the laws and terminology.

A recent informal survey of current waste-related terms (Table 2.1) affirms confusion over these words. From a regulatory view, "pollution prevention" and "pollution control" had almost identical responses. This interpretation is contrary to the distinction that pollution prevention is a

more voluntary source reduction strategy than pollution control. This survey showed that "waste management" and "recycling" had a significant regulatory image. The least regulatory term was "waste reduction". This term was more closely aligned with "cost reduction" than any other term surveyed.

Several state pollution prevention technical assistance providers recognize this problem. They have placed more emphasis on using "waste reduction" as a synonymous concept that helps businesses better understand pollution prevention and the potential benefits. Therefore, **this guidebook will continue to emphasize waste reduction**, recognizing that pollution prevention is included in the concept.

Table 2.1 Speaking the Right Language: Small Business Development Center counselors, county extension agents, state agency representatives, and small business representatives in Wisconsin were surveyed. Responses indicate reactions to current terms to determine if people see them as having either regulatory or economic implications.

Terminology	***Regulatory***	***Neutral***	***Economic***
Cost Reduction	0	2	25
Pollution Control	24	2	11
Recycling	16	6	14
Waste Reduction	11	3	21
Pollution Prevention	21	1	12
Elimination of Waste	14	2	19

2.2 Why Should Small Businesses Care about Waste Reduction: The Plus and Minus Perspective

The argument has been made that reducing waste results in reducing operational costs. Waste reduction helps businesses be more competitive. This is illustrated by the examples for 3M and the Japanese auto industry outlined in Section 1 illustrate that point. However, let's consider detailed advantages or incentives that businesses have to commit the time and effort for efficiency through waste reduction.

At the same time, there are distinct barriers or obstacles that could discourage a company, or be used as a convenient excuse not to change. The challenge presented here is to understand both sides of the equation, and to help client businesses understand the ensuring net benefit.

Resistance to change is a constant challenge. Companies willing to change can reap the benefits at the expense of those who think change is unnecessary or not worth the effort. Many have seen the commercial trademark "Body by Fisher" in reference to automobile bodies. Fisher was a buggy manufacturer, willing to change to meet new market demands. Who remembers Cooper Wagon Works? Cooper, a major manufacturer of wagons and buggies, rejected an offer from Henry Ford to convert his plant to automobile manufacturing.

On the Plus Side

+ Reduced Regulatory Burden - Implementing waste reduction projects can reduce a company's regulatory exposure, and may eliminate the need for permits, manifesting, monitoring, and reporting. The paperwork burden related to regulated waste streams is costly for businesses, often requiring a full staff position.

+ Reduced Operating Costs - Over time, waste reduction activities can save money for a company, offsetting the cost of project development and implementation. The cost savings may be immediate or anticipated, based on avoiding future costs. Lower operating costs can result from lower disposal costs, reduced materials costs, and improved operating efficiency. Sometimes the cost is not connected to the product, but is considered an "overhead" cost. This is explored in the Full Cost Accounting section.

+ Reduced Exposure to Liability - Companies using hazardous or toxic materials have greater liability risks. Disposing hazardous waste from these materials can carry long-term liability for environmental damages when a failed disposal system allows materials to enter the environment. This has been an expensive liability for many manufacturers. Environmental regulations could result in stiff fines or criminal penalties for companies, and individuals in those companies, where there has been documented mismanagement of hazardous materials. Civil litigation related to environmental damages could extend well into the future. This is even true for some materials that may not be currently regulated as hazardous.

+ **Improved Worker Safety** - Reducing toxics and hazardous materials in the workplace has a direct, positive impact on a safe work environment. There is a direct relationship between workers' compensation costs and risks, and the amount and toxicity of hazardous materials used and produced in the workplace. Reducing the potential for leaks, spills, or other releases can reduce the exposure of workers, visitors, contractors, or others in the facility. Improved worker safety translates into better labor relations, lower insurance rates, reduced paper work, reduced worker training on using hazardous materials, and reduced use of sometimes cumbersome personal protective equipment or apparel.

+ **Improved Productivity** - Waste reduction is achieved through more efficient use of raw materials and through process and operations improvements. This includes good maintenance practices and better employee training and involvement. Old technologies were not driven as much by regulations, raw material costs, waste costs, and global competition as are today's markets. Even small improvements in processes may increase product yield and improve quality.

+ **Improved Quality Management Systems** - Waste reduction or pollution prevention strategies parallel total quality management and other related systems. These systems use employees and team techniques to improve access to information and ideas and to gain wider support for implementation. The reduction of waste and improvement in quality are common goals of pollution prevention and continuous improvement strategies. Ultimately, it could lead to product design strategies which would reduce waste during the manufacture and life of the product.

+ **Improved Public Image and Better Environmental Protection** - Varying companies from dry cleaners to manufacturers can gain significant goodwill from the community when there is a clear commitment to waste reduction. Important tangible benefits in terms of supporting future growth plans for a company in that community may be a direct outcome of employee morale, and good employee morale can extend to the community.

On the Minus Side

Companies often have several concerns when they have an opportunity to identify and implement waste reduction projects. These concerns are usually real and legitimate, but often can be overcome.

- **Project Capital** - Projects with significant capital requirements face serious funding challenges when competing with production funding requests. These challenges are overcome when reasonable paybacks are shown. This should include a complete analysis of all costs associated with the waste generated by the present processes of the target project.

- **Immediate Production Needs** - The best idea for waste reduction may not get implemented if customer demands are high and production cannot be interrupted. The time, money, and personnel needed for such changes may require a longer term strategy. A scheduled plant shut-down or other reasons to make plant changes may be necessary.

- **Customer Specifications** - In federal contracts, product design and manufacturing specifications are dictated by the terms of contracts or agreements. These may require materials with a higher cost or environmental impact, without necessarily providing the best quality or the least possible waste. For example, specifying virgin materials for automobile lubricants, when recycled materials would be suitable, can increase the cost and environmental impact without improving quality.

- **Customer Acceptance** - Customer acceptance is driven by the customers' perception of quality and cost. For example, customers may want a wide range of colors available for a product, but is that always necessary? Has the company studied customer preferences? Having several colors causes a great deal more waste for the manufacturer in terms of clean-up and potential disposal. Customer education can be a vital part of reducing waste. In some cases, suppliers find their customers increasingly insisting on reducing waste associated with the product.

- **Inertia, Time, and Resistance** - Good ideas, even when favorable economics are in plain view, are not always used. Projects must overcome the "if it isn't broke, don't fix it" philosophy and the lack of staff time available. In smaller companies the people responsible for environmental projects wear many hats. It is often necessary to focus on high priority issues to improve the probability that projects will be used, and to win longer term support to implement other ideas.

- **Lack of Expertise** - Companies may have good intentions, but may not have the expertise to identify options or to implement the necessary technology to be changed. The key in this situation is to help the company access competent, affordable help.

- **Quality** - At the same time, quality improvement is an incentive for implementing waste reduction projects. There is the view that tampering with a process that results in proven quality risks quality and customer satisfaction. Waste reduction projects don't guarantee that quality improvement is an outcome, but should opportunities to test the potential for improved quality, or at least to maintain existing quality while seeing other benefits.

- **Regulatory Issues** - When using processes that are regulated or require a permit or government approval, it may be necessary to modify the permit for a new process. This can be time consuming and costly. It may require trial periods, inspections, tests, or other activities that may mean long delays for full implementation.

Sources:

Pollution Prevention: A Guide to Program Implementation, SHWEC and University of Wisconsin Extension, 1993.
Facility Pollution Prevention Guide, EPA/600/R-92/088, 1992.
Waste Prevention: Source Reduction Now, Minnesota Office of Waste Management, 1993.
A Business Guide to Pollution Prevention, Idaho Division of Environmental Quality, 1995.

2.3 Dimensions of Waste: It's Not Just in the Dumpster

If business owners identified the costs of basic types of waste they encountered, they would likely cite such waste categories as materials, energy, space, labor, and time. Each can be an unwanted or unnecessary cost. Upon examination, it is likely that business owners will understand the details of many waste sources in each category.

The two waste categories most impacted by regulations and related technical assistance programs are **material waste and energy**. Material waste is often classified by the nature of material and by the environmental medium into which it is released. Table 2.3 lists some material wastes and their potential fate in terms of the environmental medium that could receive the waste:

Table 2.3 Waste Disposal

WASTE TYPE	AIR	LAND	WATER
Solid waste	Incineration	Landfill	Landfill leaks
Hazardous waste	Incineration	Hazardous waste landfill	Leaks/Spills
Sewered waste discharge			Direct
Smoke stacks	Direct discharge	Landfill	Precipitation
Fugitive emissions	Direct discharge		Precipitation

Table 2.3 illustrates that although a particular waste stream is intended for one environmental medium, it often ends up in another. This is why the U.S. EPA and state regulatory agencies are emphasizing **multimedia pollution prevention**. The emphasis is to reduce or eliminate waste without transferring the problem between mediums.

To begin with, any one waste material can cause degradation by ending up in several places in the environment. Any of these routes can be a direct cost to the company in terms of disposal charges, permits for releases, reporting requirements, et cetera. Now let's consider material waste from a different perspective. Instead of looking at one waste at a time, consider all of the wastes associated with making one product, and try to determine what potential impact that has on the cost of producing that product or service.

Here is a partial list of waste streams related to one product.

Manufacture of a metal toy or a bicycle

- **packaging waste** in the receiving department in which the raw materials and parts are shipped.
- **waste coolants and lubricants** from the machining operations.
- metal punching process results in **scrap** generation.
- metals have to be cleaned before painting, resulting in **used cleaning agents and sludges**.
- pre-treat metals for painting, resulting in **sludges and sewer discharges**.
- welding operations release the product to be painted, and waste will be generated from **overspray, air filters, and paint gun cleaning**. The latter may result in a hazardous waste. The paint releases **air emissions or VOCs** (volatile organic chemicals).

Each of these waste streams will have one or more cost element to the company.

Energy consumption, like material use, can potentially generate many waste areas. Companies use energy in different forms, and like material use, it can be easy to miss energy-saving opportunities. For example, the toy manufacturer may use electricity and gas, the two most common energy sources. Some companies use coal, fuel oil, waste oil, wood, or diesel generators.

Lighting, building heating, process machinery, paint drying, and parts cleaning are all energy consumers and are possible waste energy sources. Companies can commonly save on energy by using more efficient lighting, heating, machinery motors, and heat recovery and reuse in processes or for building heat.

Sometimes a waste reduction or prevention project results in using a technology that requires more energy. In that case, the company needs to decide what makes the most sense in terms of net cost and company priorities. The important point is that when possible, **use an integrated approach to reducing waste**. To emphasize this, waste materials take up space, time, and labor to process. For example, generating hazardous waste from a painting operation requires storage space, recordkeeping, reporting, handling, employee training, and other potential responsibilities.

The next sections show the many dimensions of cost as related to waste, and show that companies need strategies to improve their understanding of waste and its impact on the bottom line for each product.

2.4 Dimensions of Cost: It's Almost Always More Than You Think

Our objective in this section is to look at the full range of costs associated with waste generation in businesses. Some dimensions of cost are often hidden, difficult to assess, frequently overlooked, or ignored. Increasingly, competition comes in part from companies that do pay attention to waste costs and innovate to eliminate those costs.

The Traditional Cost Model

While accounting systems vary in the costs classifications, typical cost categories include:

- direct costs such as materials and labor,
- manufacturing overhead, or operating costs,
- office or administrative overhead,
- sales and service costs, and
- research and development.

These categories may vary or be combined in different ways depending on the type of business.

Managing waste and the associated costs involved is often referred to as the **"cost of doing business"** or as part of the **overhead costs** related to manufacturing, service, or office areas. It is a convenient way to deal with miscellaneous business costs, when the more pressing matters relate to getting the product out the door or making sure that the service provided is what the customer wants. Providing a good product or service will always be the driving force for businesses. However, as our economy is increasingly affected by the global market place, new types of competition will affect virtually any business.

Linking all the identifiable costs to a product or service category rather than to an overhead category is a more effective way to understand the impact of waste-related costs. The business can more accurately assess whether that product or service is profitable in its present form, and reasonably justify process modifications that reduce wastes and associated costs. Where process modifications do not have reasonable paybacks, for example, a company may drop that product or service. The company may choose to outsource parts or supplies that can be produced more efficiently elsewhere.

The Environmental Cost Model

The Global Environmental Management Institute (GEMI) developed a primer on cost effective pollution prevention initiatives that outlines an alternative model for waste-related costs. This model has also been promoted by the U.S. EPA in its Pollution Prevention Benefits Manual. This method acknowledges that traditional cost accounting methods resulted in waste-related costs, or **environmental costs**, being distributed in various categories from direct cost to overhead costs.

Environmental costs are classified in four categories:

- direct costs;
- hidden costs;
- contingent liability costs; and,
- less tangible costs.

Each category is reviewed for waste-related cost examples that could be examined to determine the cost-benefit of implementing a waste reduction project. The categories have been adapted or limited to focus attention on the many dimensions of costs associated with waste, including other cost factors when conducting a cost accounting analysis of process changes for waste reduction purposes.

Direct costs are linked with the process, product, or service. They may include wasted raw materials, labor and waste management costs, and wasted or excess energy consumption. **Disposing** of solid and hazardous waste is the most tangible cost typically associated with waste streams. Fees are charged to both **transport** and dispose of materials. These records are easy to obtain. When solid and hazardous wastes are generated, usually part of the waste results from lost **raw materials** that already have been paid for once. As an environmental engineer at a farm equipment manufacturer states, "It seems silly to imagine that it's okay to buy raw materials, cut it up, and then throw (a bunch of) it away."

Labor cost is associated with managing waste materials on the floor, using building space for waste material storage, and for operating costs for **pollution control** and **recycling equipment**. **Excess energy consumption** can be a separate waste issue. However, it is also an extension of equipment operating costs related to waste management. These represent easily quantified, ongoing expenses.

Hidden costs represent a large category of waste-related miscellaneous costs. Many of these costs can be quantified. However, they are not often directly linked to wastes or hazardous materials. Major hidden cost sources include **regulatory compliance** activities, **health and safety** issues, **legal services**, and **insurance**.

Regulatory compliance can be very time consuming. The many responsibilities include: recordkeeping, monitoring, reporting, manifesting, training, labeling, spill responses, required plans, environmental audits, permitting, remediation, office support, and equipment costs.

Health and safety requirements include training or preparedness, protective equipment, maintenance of Material Safety Data Sheet files, medical surveillance, and insurance. Costs are also incurred with increased sick time resulting from exposure to hazardous or toxic materials in the workplace. Insurance costs are often higher due to the medical implications, the greater risk associated with on-site storage and use of hazardous and toxic materials, and the potential for liability.

Legal services are more likely to be a significant factor for manufacturers who use or have used hazardous materials, or are subject to more comprehensive regulation. This does not mean that small businesses and the service industry need not worry about legal expenses. Examples of non-manufacturers that could face significant legal costs are dry cleaners and auto service shops. These businesses may have had a history of land disposal, an accidental spill, or a leak that may have resulted in environmental contamination requiring cleanup or remediation.

Contingent liability costs result from the future costs of unexpected events. These could include: **accidental spills** or releases of pollutants and **regulatory penalties**, future **noncompliance penalties**, **and cleanup or damage costs** from past activities. These costs can include **personal injury claims** from employees, former employees, or neighbors. **Property damage suits** result from contaminated soils, groundwater, and diminished property values.

A few years ago, a small farm family discovered their leaking fuel storage tank would cost over $300,000 to remediate after it had contaminated the groundwater. Remediation costs exceeded the farm's value. Similarly, a very small wood products manufacturer saw a chance to sell the business property for $325,000 slip away when an environmental audit of the property uncovered a past spill or disposal that affected the property. Although the exact origin of the contamination was disputed, remediation costs exceeded the value of the potential sale.

Less tangible costs may be hard to identify and even more difficult to quantify. However, they can have a very negative impact on the business. These costs are often called **image** and **relationship costs**. For example, the EPA's TRI, or Toxics Release Inventory, requires companies to report releases of listed chemicals. This brings unwanted publicity to many companies. However, many companies then focus on those materials, and commit to reducing or eliminating use of those materials. Public relations are often improved following these initiatives.

A contrary public relations approach by a Midwestern company was less successful. The company was the largest air emission source in the state. Using TRI data, the company said it was not polluting the environment because it was within its permit release levels. Such claims are certain to prompt some public skepticism, and this could set the stage for unwanted limitations on company growth. Good relationships with the host community can be crucial for granting future zoning adjustments or accessing expanded utility capacity. Difficulties in this process arise if a community feels threatened by the activities of the business.

Good environmental image is increasingly important in many other business relationships. Customers are insisting on more environmentally friendly products and services. This includes businesses and vendor relationships. Business customers and private consumers want less waste associated with products, and customers may demand changes in specifications that reduce their environmental problems.

Investors and lenders are increasingly wary of doing business with companies with adverse environmental reputations, or those having site contamination problems. Businesses must demonstrate a proactive approach to environmental responsibility to attract capital. Similarly, regulatory agencies want businesses to make a sincere effort. In recent years, there has been a trend by the U.S. EPA and state agencies to be more lenient on compliance problems when companies demonstrate commitment and effort to correct problems and to reduce or eliminate waste. Businesses deliberately avoiding compliance are much more likely to face fines or penalties.

Sources:

An Introduction to Environmental Accounting as a Business Management Tool, EPA 742-R-95-001, June 1995.
Finding Cost-Effective Pollution Prevention Initiatives: Incorporating Environmental Costs into Business Decision Making, a primer, Global Environmental Management Institute (GEMI), Washington, D.C., 1994.

2.5 Full Cost Accounting: What's the Whole Story?

A common problem in waste reduction or pollution prevention projects is getting monetary support from management. People managing waste streams are more likely to face this battle than people in research and development, process engineering, marketing, or others in the organization, who traditionally appear to have a very direct impact on the output and the sale of a product or service. Environmental managers, or others who identify a waste reduction project that might require capital investment, have often been viewed as part of an "overhead" expense category that does not add value to the product or service.

The problem of not recognizing or ignoring the potential for added value from waste reduction projects is rooted in the failure to actualize all cost dimensions. If those costs are identified and quantified, then full cost accounting methods can help managers recognize the project's value.

Getting the Numbers: Control Valve Manufacturer Case Study

This company used conventional solvent-based coatings for valves subjected to exterior exposure. Because of coatings flaws, the valves had a 7 percent refinish rate in the manufacturing process. The paint line generated a significant amount of hazardous waste.

Four employees, consisting of line personnel, the coatings supervisor, and the environmental manager, identified alternative coatings and an application technology that might save money. They presented their idea to management, but it was rejected because it did not show a positive impact on the bottom line. However, they did not give up. Instead, the group did a detailed analysis of the existing and proposed systems, which included a complete accounting of waste costs. With the additional information, they returned to management. By compiling more complete analysis, the group showed a positive impact for the company and management was able to support the changes.

After implementing the coating system, the company virtually eliminated all hazardous waste and related costs from the paint line. They reduced the refinish rate on the line from 7 percent to about one-tenth of 1 percent. The project was so successful that management realized the potential for an entirely new approach to dealing with waste, and the value of searching for waste reduction opportunities. The company developed written policy demonstrating top management support. Also implemented was a standard practice of identifying teams that included production personnel for each identified project or opportunity. Ultimately, the effectiveness of this plant sparked a corporate-wide waste-reduction initiative in the parent organization.

Who Can Use These Cost Accounting Techniques?

Using full cost accounting and other parts of **environmental accounting** is appropriate for large and small businesses, manufacturers, and service sectors. Any type of business in this guidebook, and many others as well, can use this tool to make better decisions about implementing a waste reduction project. The analytical complexity will vary with the size and needs of the project. In simpler cases, it may be enough to use the basic concepts of full cost accounting as a guide to better identify costs. In some cases, as will be shown in this section, the basic analysis can be relatively simple.

Top management support and employee commitment and participation is needed to begin the process. In order to gather the necessary information, a team representing different functions in the organization will be required. The team can include management representatives, the accountant, the environmental or compliance manager, the purchasing agent, production personnel, and others who know about the cost components related to all the activities of producing the product or service.

What is Full Cost Accounting?

The **full cost accounting** (FCA) process identifies all costs associated with a process or product. From an environmental perspective, it may incorporate both the private or internal business costs, and the external or societal costs. For the sake of simplicity, this discussion focuses on internal business costs that could impact a decision about potential cost benefits of different options. A more comprehensive FCA could include external or societal costs that could be significant concerns, and are described in the context of the less tangible costs.

FCA can be used initially as a screening tool for processes that produce a product or service. It identifies all the cost sources of those processes, so some prioritization can be made regarding potential areas of opportunity. For example, if an auto service business examined all the costs associated with its various service components, including the wastes being generated, the business might discover that cleaning solvents were the largest single expense. It may then become the first priority for a complete review of potential alternatives.

At this stage, **cost allocation** is essential. Any process-related cost should be assigned to the cost of a product or service. That may seem obvious, but we have already seen that many businesses have usually written off recognized waste-related costs as overhead, while others are not recognized. The challenge is to find all potential cost trails. Once the team looks in that direction, it doesn't take long to see the hidden cost dimensions that should be "allocated" to the product or process.

This is the time to invoke four cost categories in the search process: 1) direct costs, 2) hidden costs, 3) contingent liability costs, and 4) less tangible costs. If this cost allocation process is not properly completed, other products or services that are more profitable carry the burden of those that generate excess cost.

Once the initial cost allocation effort is complete, FCA can move to the more comprehensive stage of obtaining cost allocation data. In some cases, this could take time if certain costs had not been previously separated. For example, if all solid waste disposed from a company was mixed together with only one expense listed for land disposal costs, it would be impossible to immediately assign cost to the processes most responsible for waste generation. Consider a small computer manufacturer with both solid and hazardous waste sources. A significant cost opportunity was eliminating paper hand towels. While this seemed an unlikely candidate, eliminating paper towel purchase and disposal costs, and converting to laundered towels saved over $9,000. That discovery required waste separation and a cost breakdown.

Total Cost Assessment

Capital budgeting is the process used to plan capital investments. It is in this arena that many environmental projects fail. They do not use proper FCA and cost allocation procedures to effectively compete with other projects for available dollars. In the past, the hidden or less tangible costs have been generally ignored in the processes. Thus other projects prevail that were seen as having a more positive effect on the bottom line.

Capital budgeting compares present operations with a proposed project, or several alternatives based on the costs and revenues of each option. These comparisons are made using selected financial measurement tools to help determine the relative value of each option, keeping in mind the cost of business capital.

For example, a small boat trailer manufacturer was in the middle of upgrading or replacing its paint line. It had three options in mind, but had not taken into account the hidden costs related to wastes that would be generated by each option. After realizing that the environmental costs were a real part of the total process cost, the benefit cost of each option gave a different result. This was a crucial addition to the decision to commit capital to new processes and equipment.

Total cost assessment (TCA) is a capital budgeting tool that allows waste reduction projects to be evaluated using environmental cost data identified with FCA, acceptable implementation timetables, and generally accepted financial measures. TCA, in part, levels the playing field with other capital projects or changes in operations. When evaluating investment choices, companies vary in the choice of measurements or financial tools. Four common tools are payback period, internal rate of return, cost-benefit ratio, and net present value.

1. **Payback period** measures the time it takes to return the investment capital. Businesses look for the shortest payback period and tend to assume it is the best choice. This is not always

true. Long-term investments may have the best return on investment. However, extending financial risk beyond two years has been a difficult hurdle for American businesses to overcome.

2. **Internal rate of return**, also known as return on investment (ROI), is the interest rate that produces a return on invested capital equal to the project's return. For example, the internal investment in a waste reduction project that had a net annual return of 40 percent would be equal to investing in a bank certificate at a 40 percent interest rate.

3. **Benefits cost ratio** is also known as the profitability index. It is calculated by dividing the sum of all present value financial benefits of the project by the present value of all project costs. A ratio of greater than 1.0 means the benefits outweigh the costs, and the project could be justified for implementation.

4. **Net present value** demonstrates the value of a waste reduction project as a present value sum. In this case the present values of all benefits are added. The same is done for all costs. The difference between the two values represents the net value, positive or negative, of undertaking the project.

For sample problems using these techniques, see EPA's, "A Primer for Financial Analysis of Pollution Prevention Projects" or "A Workbook for Total Cost Assessment Cooperative."

The first level of opportunity with environmental accounting techniques is to decide which process options make the most economic sense. This strategy can be extended to the next levels of environmental management to include total quality assessment, life cycle assessment, and design for the environment. These will be explored briefly in Section 2.8.

Sources:

An Introduction to Environmental Accounting as a Business Management Tool: Key Concepts and Terms, U.S. EPA, EPA 742-R-95-001, June 1995.
A Primer for Financial Analysis of Pollution Prevention Projects, U.S. EPA, EPA/600/R-93/059, April 1993.
Finding Cost Effective Pollution Prevention Initiatives: Incorporating Environmental Costs into Business Decision Making, a primer, Global Environmental Management Initiative (GEMI), 1994.

Additional Reading:

Pollution Prevention and Profitability: A Primer for Lenders, Northeast Waste Management Officials Association, Boston MA.
Will Polluting Less Save You Money? A Workbook for Total Cost Assessment, Pollution Prevention Cooperative, 67 Maplewood Ave., West Hartford, CT, 1994.

2.6 Waste Reduction Options: Going to the Source

The focus here is primarily **source reduction.** Where options can be identified, this strategy invariably is the most cost efficient. Although recycling has sometimes been included in waste reduction discussions, recycling **does not** reduce the amount of waste generated at the business site. Recycling does reduce the amount of waste going to landfills. However, because material is still generated as a waste, it means the business source of the recyclable materials incurs potential cost inefficiencies.

In many instances, recycling is still necessary, or may be an important first step toward source reduction. For example, a printing company discovered that it could turn pallet waste from a cost to a profit center. The company had been disposing of pallets in the landfill. By repairing or rebuilding pallets, and then selling them, the company saw a $100,000 waste cost became a $300,000 net profit. This example works because the particular business generates a large number of pallets. However, this is not true for many businesses. A more cost effective alternative in many instances is to switch to returnable, reusable pallets or other forms of non-disposable shipping units.

To further emphasize the source reduction approach, some companies have established **"zero waste"** goals. In some cases this was in response to voluntary partnerships like EPA's **33/50 program.** This program established 33 percent and 50 percent reduction goals for 17 targeted chemicals by 1992 and 1995, respectively. Approximately 1,300 companies joined this program. Many of them greatly exceeded the partnership goals. Some achieved the 50 percent overall reduction goal a year ahead of schedule.

In **Climate Wise,** another EPA-sponsored program, the goal is to turn energy efficiency and pollution prevention into corporate assets. In this program companies establish a plan to identify and implement cost-effective energy efficiency and pollution prevention options. The program began in 1994. By the year 2000 it is expected to produce an $80 million cost savings annually among participants. Some facilities have already achieved $400,000 to $500,000 in cost savings.

Regardless of the initial reason for companies voluntarily establishing waste reduction goals, an important point is that management recognize the importance of making the commitment. This is accomplished through establishing goals and policies that involve all employees. Every employee is an essential asset for identifying and implementing waste reduction ideas. Outside consultants and technical assistance representatives can help get things started, but in the long run, it takes knowledge of both the internal process and the organization to be most effective.

Old Habits Die Hard

There are many cost savings examples related to waste reduction. However, it can be difficult to start projects and try to implement change in a company that is not enthusiastic about waste

reduction as an important part of its business strategy. Changing old habits can be a significant hurdle, even when management and staff have shown an initial interest.

For example, a small custom truck body manufacturer became interested in the idea of saving money by working to eliminate wastes from processes. They were partially driven by hoping that eliminating waste would also reduce the regulatory burden that affected the business. A number of options were identified for solid and hazardous waste reduction. These ideas included both source reduction and recycling measures.

The company's painting operation's source reduction proposals were greeted with great interest. The proposed changes involved a better understanding of customer needs, a reduction in hazardous waste costs, and a reduction in the regulated waste streams. The changes could be made without significant changes in the work patterns or habits of employees.

In contrast, another opportunity identified for pallet wastes failed after a short attempt at implementation. Pallets were being disposed of at the local landfill by a local hauler who picked them up at one of two company loading docks. The company was paying both hauler and landfill disposal fees. The pallets came from many suppliers, and it would take some time to work towards a returnable pallet system.

The short-term solution identified for pallets seemed to make good economic sense. A regional pallet company that rebuilt pallets and ground up unusable materials for animal bedding parked an empty trailer at the company's other loading dock. Employees were asked to bring pallets to the new location and place them in the trailer. Even though there was a clear and substantial savings opportunity, the change in habits related to pallet management were an implementation barrier. Furthermore, management's understanding of the cost implications of waste had not matured enough to try to facilitate the change with employees. This lost opportunity equaled the cost of one hourly position.

This illustrates the importance of helping companies realize the potential value of cost reduction through waste reduction. It also shows the need to ensure that the business has the tools to evaluate the projects that may be identified and of helping to establish priorities that will be supported by management and employees. Where employees encounter barriers and cannot facilitate change, management must understand those barriers and have enough information about the project to determine the merit of helping employees overcome those hurdles.

In the pallet example, management could have supported the change process to assist employees in breaking old habits. This could have been a successful project if management had assigned a small portion of a fork lift operator's time to move the pallets to the new location, and to then insert them into the trailer.

Setting Priorities

Helping a business begin identifying options often means finding some initial opportunities that will have an obvious positive impact. This will likely gain the support of employees and management. Priority projects should meet one or more of the following criteria:

- Easy to identify and implement.
- Requires low capital investment;
- Delivers an attractive payback period or return on investment;.
- Results in attractive savings for the business;
- Offers a positive public image;
- Improves safety for employees;
- Reduces the regulatory burden;
- Lowers company liabilities;
- Reduces a large volume of waste;
- Lowers energy consumption; and/or
- Reduces the use of toxic or hazardous materials.

One simple way to evaluate ideas that have been identified is to set up a simple **comparison matrix** in which each projects can be scored on a number of points. For example, one might identify three possible projects such as switching from wood to returnable plastic pallets, eliminating the use of a hazardous solvent in a painting operation, and switching to more efficient lighting systems. Eventually it would be good to implement all three, but it may be necessary to pick one to start. The following comparison matrix is scored to show a hypothetical ranking system where a score of "5" is the maximum value and a "1" has the minimum value for each category of evaluation. The categories are added for each project to determine the priority ranking.

Table 2.6 Project Comparison Matrix

Project	Cost Savings Potential	Regulatory Relief	Degree of Hazard	Liability Relief	SUM
Wood to plastic pallets	3	1	1	1	6
Eliminate solvent	1	5	4	5	15
Change lighting system	5	1	2	2	10

In this example, the change in the lighting system has the greatest cost savings using return on investment as the criterion. The pallet system conversion has noteworthy potential for cost savings, but otherwise offers minimal benefits. The elimination of the solvent system has minimal cost savings because the replacement system will have nearly the same costs. However, this

system brings about major benefits in other evaluation categories, such as costs or potential costs not considered in the return on investment in the first column.

This example emphasizes the regulatory and liability portion of potential evaluation criteria. The criteria used depends on the businesses' priorities and concerns. This example would fit well for some manufacturers; however, a retail store might choose criteria such as volume of waste or waste storage space, product packaging costs, employee handling time, et cetera.

Basic Strategies

Source reduction begins when assessing materials or equipment to be purchased. A few basic tips include buying only the amount of product needed, buying durable goods that can be repaired and maintained, and reducing or eliminating the use of toxic materials. In these examples the **purchasing agent** or buyer is very important in helping the business identify material and equipment sources to achieve these goals.

Buying only the amount and type of product needed for the job is a very simple, low-cost strategy. This strategy applies to both individuals and to businesses. This strategy is often sidetracked by marketing or pricing schemes that encourage the buyer to get a larger volume of material at a lower price per unit volume. The high volume purchase promotion is a good buy if all of the product can be used. It becomes a bad deal when there is significant unused product that becomes a waste after the job is completed.

Good examples of the volume purchase traps include paints, occasional use cleaning products, and industrial solvents. If a small business wants to redecorate the office, for example, and paint is being purchased, it is important to get a good estimate of the surface area to be covered. The company can then work with the paint supplier to determine the amount of paint needed. A quart of paint often costs about half the price of a gallon of paint, but if a quart is all that is needed, then don't buy the gallon. Or, if three gallons will do the job, don't buy the five gallon pail. The most common high volume waste from households and small businesses at hazardous waste collection events has been paint and related solvents and cleaners. Small businesses find it very expensive to properly dispose of small quantities of hazardous waste.

If a salesman comes to a small business and says "I have a wonderful new cleaning product" or "We have a great discount on solvent X this month", how should the business respond? New products run the risk of not being acceptable. The buyer should know what is in the product before agreeing to try the product. The buyer should also have an agreement with the supplier that if the product is unacceptable, then the supplier will take the material back. Purchasing a large volume of product on sale is fine if that product will clearly be used within the period of its shelf life. Volume purchases should be avoided if the product is only occasionally used. Waste could become a problem in these cases. A special promotion of a solvent for $200 per drum may seem like a good deal until it becomes a $1,000 hazardous waste disposal cost.

Reducing toxicity of materials used by a company is another waste reduction strategy that saves money in terms of insurance, employee exposures and sick time, liability, hazardous waste disposal, and regulatory reporting. This opportunity can be found in almost any business. Medical, dental, and veterinary clinics, for example, can find alternatives to mercury thermometers, or developer system cleaners that don't contain chromium. Both of these materials are hazardous, and a mercury spill from broken equipment can be costly to clean up. Printers and artists are often exposed to solvents and heavy metals in inks and paints. Substituting pigments and using vegetable-based inks reduces the exposure hazard and the amount of hazardous waste.

Material substitution is an option for reducing material toxicity or hazardous waste generation by a business. This is one of the most significant opportunities for businesses, whether it is finding non-toxic cleaning solutions for building maintenance, or non-solvent based cleaners for an industrial process.

One company switched to a cleaning solution with less volatile materials and saved $20,000. An industrial valve manufacturer switched to a water-based coating to finish a product, saved nearly $30,000 in hazardous waste disposal costs, and had a higher quality finish on the product. A small manufacturer of metal fasteners switched from cleaning parts with mineral spirits to using an aqueous cleaner. The spent mineral spirits were a hazardous waste, while the aqueous cleaner could be neutralized and periodically sent to the local sewer system.

Process change often accompanies the material substitution strategy. As a growing, competitive business looks to upgrade its operations, it is an ideal time to think about the materials used and the waste streams generated by process options. For other businesses a less progressive philosophy is "if it isn't broken, don't fix it". Satisfaction with an existing process or product quality can be a barrier to using better alternatives. Other barriers to process change include downtime, capital requirements, payback period, and sometimes regulatory issues.

If a business asks the right questions up front, it has a much better chance of finding the most cost effective solution. For example, a company decided to go into a new venture that remanufactured used office furniture. It would have been easy for the company to adopt standard technology for stripping and refinishing the furniture, but that involved using solvent-based coatings. Instead, the company sought help in finding alternative technologies to reduce the potential for generating hazardous wastes. By establishing alternative coating technology processes at the beginning, the company reduced its regulatory exposure, and saved approximately $250,000.

A motor vehicle filter manufacturer changed from spray painting to powder coating a product. This eliminated all hazardous waste costs. A powder overspray recovery system was developed that completely eliminated waste. The payback period was more than two years, but the improved product quality and the elimination of expensive waste streams were strong incentives. A toy manufacturer switched to powder coating and had a payback period of less than one year. In addition, the company found new customers who wanted the products because they had lower environmental impacts during manufacture.

A small metal fabricator had a problem with phosphate discharges to the local sewer system. They had a very efficient powder coating system. However, there was a problem with the phosphating system that prepares the metal surface for coating. It was found that the multi-stage phosphating system could be modified and process water changed. Thus, the phosphate discharge would be virtually eliminated, and the treatment solution life could be significantly extended. In this case, the company could realize both regulatory relief and raw material cost savings.

Packaging reduction is a common manufacturing and retail business opportunity. While many forms of packing create a solid waste, reducing packaging costs can save in several ways. Since packaging does not add to product value, reduced packaging saves the manufacturer in terms of product cost and also saves the consumer money.

Examples of retail packaging reduction include eliminating plastic bags on undergarments on display, reducing material used in a container of canned goods, eliminating multiple layers of packaging materials, and providing product in bulk or concentrated forms. Both the store and the customer benefit from using less packaging.

The benefits and opportunities for manufacturers are basically the same as for retailers. For example, a maker of small auto parts was shipping parts in Gaylord boxes. The boxes were closed and mounted on wooden pallets with steel banding. This created three solid wastes for the customers, and the company had to continually buy the packaging materials. It switched to a plastic, returnable pallet with folding sides. After the initial investment, the company eliminated the constant cost of buying disposable packaging. In addition, customers were more satisfied when the waste was eliminated.

Reuse of products or materials is often possible, even when products are designed for single use. Office paper is a very large volume waste stream that can be reduced by reusing the back side of papers for draft materials or creating note papers. Boxes can be sent to corrugated manufacturers for recycling, but often can be reused before being recycled. A carton company was created by collecting cardboard boxes, cleaning them, and selling them for reuse.

A small newspaper virtually eliminated ink waste by collecting waste color inks and black ink and blending them. The resulting black ink was perfectly suitable for press use. Not only was the waste cost eliminated, but reusing "waste" ink reduced the purchase of new ink. The drums used to ship ink and other materials were designed for single use. However, many drum recyclers will take drums from companies, clean them, and prepare them for resale.

A **materials exchange** is a special service that promotes reusing materials. These exchanges may function at the local, state, or regional level. They help businesses identify other businesses that may be able to use their waste material as a raw material. They also help businesses searching for a specific material locate that material in another company's waste stream.

Durable goods should be repaired and reused whenever possible. Products designed for single use that cannot be easily repaired should be avoided. For example, toner cartridges are increasingly being reclaimed and reused in offices. Equipment and tools requiring rechargeable batteries should be easily serviceable, ensuring that batteries can be replaced when no longer usable. Products designed to discourage service or repair should be avoided.

Good housekeeping practices are effective in reducing waste and preventing costly repairs. Machines properly maintained will be least wasteful and will provide a better quality product. Whether it is an office copy machine or a widget machine, good maintenance is essential. Machines poorly maintained develop leaks that become waste problems in terms of clean up costs and replacing lost product or material.

An electrical equipment manufacturer found that good maintenance and repair practices on machines virtually eliminated cleanup and disposal problems of waste oils and coolants. The machines did not leak lubricants, and the coolants were periodically removed, cleaned, and reused to extend their life. The company had very little downtime because of good maintenance. In contrast, another machinery manufacturer had a poor maintenance and general housekeeping program. As a result, metal turnings from drill presses and oil leaks from various presses and stamping machines spilled onto the floor and were tracked around the facility. When the company realized it had a significant cleanup problem, it found that it had a $1.5 million bill just to clean the facility, not including any repairs that were needed.

Employee training and involvement is key to a good program. Employees are a good source of ideas, and are critical to implementing waste reduction practices. Office staff have numerous opportunities to reduce paper use, recycle materials, use returnable toner cartridges, use more computer communications and records, and make sure that equipment undergoes routine maintenance. Lunch room environments can also be a good place for employees to reduce waste. Employees can reduce waste by bringing a personal mug or using company mugs, by reducing use of disposable food containers, and by using a linen service instead of paper hand towels.

A small electronics company with 90 employees switched to cloth linens in the lunch room and rest room. The company saved a net value of $9,000 annually vs. the paper towel system. The company also eliminated disposable cups for employees and replaced them with company mugs. Visitors or employees who forgot mugs could purchase a “disposable” cup from the company. The trash volume from this area was reduced by nearly 90 percent.

Perhaps one of the more notorious opportunities for waste reduction begins with the fork lift operator. A fork lift operator is found in many businesses besides manufacturing. They move materials and equipment, and play a key role in warehouse and product inventory operations. Careless forklift operators have often led to substantial damages to materials in warehouses, which creates additional waste streams. Good fork lift operating practices can save a company significant waste costs.

Proper equipment use training is a given when trying to reduce waste. Technicians using paint spray equipment, for example, have reduced paint waste from overspray by 10 percent or more, simply through training. Additional waste reduction has been achieved with equipment or process changes.

Giving employees a chance to share their waste reduction ideas is virtually a zero-cost opportunity that can reap great benefits. A dairy plant had too much water waste. The volume of water from cleaning operations was creating capacity problems with sewer disposal. While management was not sure what to do, it was discovered that one of the employees knew where and how much water was being wasted, and what could be done to reduce water consumption. The problem was that no one had asked the employee for his ideas.

Tools for Starting Programs

This guidebook makes no attempt to identify all the tools and processes that businesses can use to implement waste reduction programs in their office or shop. There are a variety of references available for that purpose listed in the following Additional Reading section.

Additional Reading

Facility Pollution Prevention Guide, U.S. Environmental Protection Agency, EPA/600/R-92/088, May 1992.
Business Guide for Reducing Solid Waste, U.S. Environmental Protection Agency, EPA/530-K-92-004, November 1993.
Waste Prevention: Source Reduction NOW, How to Implement a Source Reduction Program, by Ken Brown, Minnesota Office of Waste Management, February 1993.
Pollution Prevention: A Guide to Program Implementation, University of Wisconsin-Extension, Solid and Hazardous Waste Education Center, July 1993.

2.7 What About Regulations?

The environmental regulatory climate provides incentives and barriers for small businesses. This section considers the implications and concerns about environmental regulations that affect small businesses. Section 5 of the guidebook provides a **primer** of environmental regulations, offering information about specific areas of environmental regulations.

A recent study of small- to medium-sized manufacturers in Wisconsin revealed that environmental regulation was one of two top issues for Wisconsin companies. Similar observations have been made in business retention questionnaires. Issues related to wastes and environmental regulations rank very high as concerns. Most often the concerns stem from a company or business not in compliance, or not knowing all the regulations that apply to the business.

Where Do Regulations Start?

For a new business, environmental regulations can be a large factor before the business has opened its doors. There are several things to consider, such as types of wastes the business will generate and what regulations will apply. Regulations could impact the equipment purchased and processes used. In addition, the business location may be restricted by the type of wastes generated.

Consider finding a property or building that seems suitable for a new business. A new business owner may find what appears to be a good site and building. However, the site could be a bad environmental location. For example, does the property have any known contamination or was there previous business activity that generated contaminants? If the property has an underground fuel storage tank or was contaminated by a spill, the buyer assumes responsibility for cleanup costs.

A small ice cream shop might find an old gas station an ideal location and that the building is easily adapted to serving ice cream. The owner of the new business should have an environmental audit of the property completed to make certain that no environmental liabilities exist or remain unknown before purchase. This actually happened, but the new shop owner did not have an environmental audit done before buying the property. It was found later that leaking fuel tanks, though they had been removed, left contaminated soils to be remediated. The shop owner was subject to testing and cleanup costs.

In another case a small furniture manufacturer was going out of business and wanted to sell his property. An environmental audit revealed that the land was contaminated by a previous occupant. The furniture manufacturer found that remediation costs equaled the property's market value. He could not recover his initial investment in the property because he had assumed responsibility for the land.

In a third example, a small metal fabricating facility wanted to locate a plant in an industrial area near Lake Michigan. An ideal property was found with no contamination problems. However, another regulatory obstacle was found. The company cleans parts with halogenated solvents, but discovers that the region is in an ozone "non-attainment" area. Under the Clean Air Act requirements, limits are placed on air emissions. Maximum available control technology is required to limit those emissions. This could add an unanticipated cost, unless the business can find an alternative coating system that eliminates the emissions problem.

If There are Wastes, There are Regulations

A good rule of thumb is that if a business generates any waste, it is likely to be subject to an environmental regulation. The most obvious wastes subject to regulation are hazardous wastes, air emissions, sewer discharges, and solid wastes. For each of these wastes, there are a number of regulations at the local, state, and federal level (see Section 5).

The more dangerous the material is to the environment or human health, the more complex the regulations. Hazardous materials resulting in hazardous waste, are regulated in terms of shipping or transport, storage and labeling, employee exposure, treatment and disposal, and long-term liability. These regulations involve agencies such as the U.S. EPA, Wisconsin Department of Natural Resources, Department of Transportation, OSHA, Department of Commerce, and so forth.

Solid wastes that have little apparent environmental hazard may still be regulated. Certain recyclable materials, for example, cannot go to a landfill. Businesses must have an appropriate recycling program in place, or one accessible to the business. Trash that must go to a landfill cannot be disposed of or burned on-site. In special cases, materials such as waste wood or waste oil may be used as an on-site energy source.

A company with a large amount of air pollutants once claimed that it was not a polluter because it complied with its air permit. Compliance with regulatory permits, however, does not necessarily relieve a company from legal responsibility if a lawsuit is filed for damages caused by the emissions.

A sewer discharge that is acceptable in one location, may not be acceptable in another. Sewer treatment facility discharges are regulated as to the content and volume of materials. Capacity varies both in terms of the facility design and the receiving surface water. A small rural dairy may have to pretreat before it can discharge its load to a small municipal facility. However, in another community a competitor finds that the sewer plant can handle its discharge.

These examples illustrate that the potential issues are diverse and often depend on a variety of factors, including location.

What Is a Small Business to Do?

With these few examples, it is apparent why small businesses are overwhelmed by environmental regulations. It is extremely difficult for a small business to keep up with all the regulations. However, the question is, "what regulations apply to a small business and who can provide that information."

The key is to identify the processes, materials, and wastes that a business is likely to use or generate. Once that information is known, a business can identify sources of help, or a business counselor can assist the business to identify sources of help.

For example, if a person wants to start a dry cleaning business, it would be important to know the air emission and hazardous waste regulations that apply to the business. This information is critical in ensuring that the new owner does not invest in a “good deal" on used equipment that releases too much cleaning solvent. There is always used equipment available, but it might not be a good investment if using it results in regulatory problems.

Section 5 of this guidebook is a regulatory primer that can be used as a first look at the regulatory environment. While consultants and technical assistance providers often guide businesses through the regulatory maze, they cannot provide a final interpretation. This is best done through the appropriate regulatory agency.

2.8 Environmental Management, Quality, Design for the Environment, and Other Important Buzzwords

Developing sound environmental management systems together with product design considerations may be an important key to competitive success for companies that think to the future. Concepts related to full cost accounting (FCA) and total cost assessment (TCA) are potentially applicable to any business. The concepts in this section are an extension of FCA and TCA that apply particularly to the manufacturing sector.

Emerging Environmental Management Systems

When the **ISO 9000** quality standards were put into place, many manufacturers in the United States felt pressure to seek ISO 9000 certification to improve their access to global markets. Certification implied that a company had a management system in place that promoted quality standards through continuous improvement. While it did not set a specific quality standard, the certification program identified companies that had management systems in place that fostered quality improvements.

Some expect that **environmental management systems** (EMS) will take on similar importance in the years ahead. Regulatory agencies like the U.S. EPA will offer some relief or preferential treatment to companies who voluntarily implement an EMS program, assuming that the program standards would assure regulatory compliance. Under the guidance of the International Organization for Standardization (ISO), the best known system being released for implementation is the **ISO 14000** series, which includes an EMS standard.

In case studies of seven companies that have implemented a form of EMS, it was found that companies think that international trade will require ISO 14000 certification to be competitive and to have market access. Those who already have ISO 9000 certification tend to be better positioned to implement an EMS system. Some smaller companies have a more difficult time quantifying the benefits of EMS. One hurdle is that programs such as ISO 14000 will result in management systems that "prevent" environment-related waste costs or liabilities.

Some companies are taking a wait and see approach, since the case for investing in ISO 14000 certification seems less justifiable than for ISO 9000. A distinction is made between **quality** and **environmental** standards by these two management systems. Quality is driven mainly by customer satisfaction with the quality of the product or service. Management systems are used which focus on understanding customer satisfaction and practices which support continuous improvement in quality.

Environmental standards are driven by more than the customer, and can include a variety of other stakeholders who may have an interest in the environmental impact of the processes used by the company. This becomes more of a community or regional interest, and includes the interests of regulatory agencies. Buyer acceptance of the product or service is increasingly

impacted by “green” characteristics which become part of the quality perception. For example, organically grown foods are finding greater acceptance, both because of the low environmental impact of farming practices, and because the food is seen as being of better quality than non-organically grown foods.

While some may view quality and environmental impacts as mutually exclusive, very often quality is linked to environmental impacts. When waste is generated from a process, it indicates that the process may be inefficient, and a waste may have several associated cost dimensions.

For example, a food packaging company has a packaged goods reject rate of about 2 percent. The company prides itself in providing a quality product. Most of the reject rate is not from off spec food product, but from packaging problems. The packaging line generated about 200,000 units or more per day, based on spot checks for leaks and continuous monitoring of weight and other factors. The company considered the reject rate acceptable and did not consider the quality of the packaging process to be an issue. However, the company employed two full-time inspectors and an operator to remove reject packets, rip them open, and recover the product. It also spent money buying and disposing of the waste packaging. In addition, it had machinery to shred the packets. No cost analysis had been done about improving the packaging line quality versus the operating costs to inspect and reject packets.

In another example, a company applying paint to its product prided itself in having a high quality, durable finish. However, it had to refinish 7 percent of its products before shipment. After finding an alternative paint product that eliminated its hazardous waste stream, it found that it also had virtually eliminated the need for rework. The management approach to improving environmental performance also produced a better quality product. The key point is that similar practices and procedures are used for both **quality and environmental improvement**. Rather than being mutually exclusive, the two are complementary.

Based on these examples, the step from “total quality management” to “total quality environmental management” may be a small, but beneficial step. Just as quality improvements may lead to less environmental impact, so might environmental improvement projects lead to quality improvement.

Life Cycle Assessment

In 1969 the Coca Cola Company began a study of the comparative environmental releases and the use of raw materials and energy in producing different types of beverage packaging. The methods introduced and then laid the foundation for Life Cycle Assessment of products being produced.

The process involves examining the impact of the product at various stages in its life, from procuring materials to final disposition at the end of its useful life. The stages of a product life cycle can be broken down as follows:

- **Raw Materials Acquisition**
- **Manufacturing**
  - **materials manufacture**
  - **product fabrication**
  - **packaging**
  - **distribution**
- **Use, Maintenance, and Reuse**
- **Recycling and Waste Management**

In addition to materials issues that are present throughout the life cycle, energy is consumed in almost every stage of making, using, and disposing of the product.

The information gathered from life cycle assessment may have a variety of applications. These applications could be: addressing environmental priorities, identifying data gaps, ranking the relative impact of each stage, supporting product certification (i.e. green labeling), or educational use.

Life Cycle Design/Design for the Environment

Modern manufacturing and design practices require a better understanding of product specifications for performance and customer satisfaction. The number of criteria that customers may use in judging a product's quality or acceptability can be very diverse. These criteria need to be accounted for in the design process. The product must be defined in terms of those criteria. In this way, all the attributes can be included.

This approach to design is known as **design for X** which allows the designer to quantify the range of pertinent criteria such as the following:

assembly	**manufacturability**	**reliability**
compliance	**materials**	**safety and liability**
environment	**orderability**	**serviceability**
		testability

From this perspective, it can be seen that environment is one of many design concerns. With the advent of computer-aided design and computer-aided manufacturing (CAD/CAM), it is feasible to design and test many of the attributes on the computer before a prototype is built.

The data gathered from life cycle assessments can be part of the foundation for **life cycle design** or **design for the environment** (DfE) initiatives. DfE is gathering interest from companies because it is a cost effective way to produce competitive products. It is defined as a design process for producing more ecologically and economically sustainable products.

In this system, environmental needs are balanced with performance, cost, cultural, and legal criteria. It provides the designer with an opportunity to factor these issues into each stage. The designer can take advantage of what has been learned from life cycle assessments, and the product designers become more aware of the environmental and quality consequences of the designs. Companies like AT&T are investing more time and effort into DfE practices as they realize the potential for lowering costs. The companies are also realizing the environmental consequences of product chassis that are reusable and materials that are more easily claimed for recycling and reuse in the manufacturing process.

Sources:

Industrial Ecology, by T. E. Graedel and B. R. Allenby (AT&T), Prentice Hall, 1995.
Life-Cycle Assessment: Inventory Guidelines and Principles, U.S. EPA, EPA/600/R-92/245, February 1993.
Life Cycle Design Guidance Manual, U.S. EPA, EPA/600/R-92/226, January 1993.
Preparing for ISO 14000: An Assessment Guide, by T. Ambrose, *in* Total Quality Management (Winter 1995/96).
Voluntary Environmental Management System Standards: Case Studies in Implementation, by C. P. Diamond, *in* Total Quality Management (Winter 1995/96).

2.9 Roles of SBDC's, Business Agents, and Other Business Counselors

"One-stop shopping centers" have become popular concepts for customers in recent years. Various businesses such as retail sales at drug stores, convenience gas stations, discount shopping centers, and malls have adopted this concept. For many of the same reasons, the small business owner may find the concept of one-stop shopping for business assistance to be attractive.

In our efforts to provide educational assistance to businesses, our ability to serve clients with a broader range of information and education may be a key to our overall effectiveness and the future of our programs. The problem with continuing to diversify our programs is that staff are faced with an ever-increasing burden of information and programs to support. A logical solution to the problem is to form partnerships in the delivery of a greater diversity of education and technical services that will satisfy our clients.

One of the prevailing concerns for small businesses today is that of regulations, and environmental regulations in particular. This applies to all businesses, and is a specific concern of manufacturers. Environmental regulations exist because our businesses generate wastes. The message that businesses should comply with environmental regulations is not always well understood or appreciated by businesses. Cost is a more universal consideration from the client perspective. Waste is business cost equated with inefficiency. The opportunity for the counselor is to help business understand that waste costs can be a critical consideration to the success of the business. The question is how can business counselors provide that information without adding a new layer of responsibility. The **answer is partnerships**.

This guidebook and the companion video tapes were developed to foster a partnership concept between Small Business Development Centers, other business agents and counselors, and waste-reduction specialists such as the Solid and Hazardous Waste Education Center. SBDC's and other counselors have better access and credibility with small businesses, while SHWEC has the waste reduction expertise. Each program has in the past served clients independently. The partnership of SBDC and SHWEC offers expanded service access to clients without adding new program responsibilities.

This partnership serves the general small business community and parallels the Wisconsin Manufacturing Extension Partnership (WMEP) which also includes SBDC's and SHWEC. WMEP is a broad partnership of the Wisconsin manufacturing community with the University of Wisconsin Extension and the Wisconsin Technical College System. It employs field agents who provide a menu of general services, but it relies on an extensive network of partner institutions along with their faculty and staff to bring the appropriate expertise to meet the needs of the client.

In this and the WMEP partnership, the customer should be able to access a wider array of educational and technical services without having to identify all the independent sources. The

partnerships bring together informed counselors, agents, and specialists who can provide their expertise and expert referrals for the client.

In this case, the counselor can be an informed first source regarding the economic impacts and opportunities related to waste generation by businesses. The counselor can help clients understand the implications of waste on the bottom line. They can then refer the client to SHWEC or other appropriate contacts for technical or regulatory assistance.

While a counselor is not expected to be an expert on waste reduction, the extent to which a counselor can get involved on waste issues with the client will vary. This guidebook offers flexibility to the counselor in that role. For those who have the time, interest, and appropriate client contacts, there is significant opportunity for involvement. This has been shown in county agent programs. For others with limited time but who want to do as much as possible, more of the effort can be referred to partners. In both cases, having a basic understanding or awareness is key to providing the client with a more complete and satisfying service.