Moulder Company was founded in 1922 by William A. Moulder III, son of a Framingham shipping magnate. William left Framingham and moved to northern New England to seek his fortune in wood products manufacturing. For decades, Moulder Company specialized in value-added products, such as fine-milled lumber, doors, and specialty moldings. In the 1950’s, he expanded Moulder’s product line to include wooden stadium seating (bleachers and stadium chairs). William Moulder ran the company until he retired in the late 1970’s and his son-in-law, Wilson Jacobs, took over as president. Wilson expanded the firm, organized into 4 divisions with several new employees. The Stadium Seating Division eventually became the largest and most profitable part of the company.

Both William Moulder and his successor, Wilson Jacobs viewed environmental management expenditures as a burden on the business that reduced profits and inhibited productive investment in new plant and equipment. However, the industrial environment had undergone changes, with greater environmental activism that was particularly intense in the New England region. A recent news article became a wake-up call for the Moulder enterprise. A community activist group with strong connections to the local newspaper and other regional environmental groups had begun scrutinizing the company. Shortly thereafter, the local paper ran a front-page article featuring Moulder’s Toxics Release Inventory (TRI) reporting data and its environmental impacts.1

Jacobs finally hired a full-time environmental manager, Terry Wilbur, who took over the duties that had been performed by several engineers in their spare time. Wilbur’s mandate was to ensure compliance, while “keeping environmental spending to a minimum.” However, Wilbur was aware of the recent instances of firms experiencing steep fines and sought to advice Jacobs to take special steps to consider risk management through a pollution prevention approach.2

Pollution prevention (P2) was the fundamental concept behind nearly all emerging trends in environmental rulemaking and regulatory compliance, including international efforts to reduce

1 [http://www2.epa.gov/toxics-release-inventory-tri-program](http://www2.epa.gov/toxics-release-inventory-tri-program)
2 Risk Management Plan: [http://www.epa.gov/emergencies/content/rmp/](http://www.epa.gov/emergencies/content/rmp/)
VOC and HAP emissions. P2 stands in contrast to common environmental management methods like end-of-the-pipe pollution control and environmental remediation. The latter approaches work at the facility boundary to clean up toxics that the operation has generated before they enter the general environment. Stack scrubbers and hazardous waste collection for special treatment are typical end-of-pipeline pollution control measures. P2, on the other hand, seeks to reduce or eliminate pollution problems at their source. P2 includes such initiatives as product design changes and technology or process modifications, such as substituting toxics chemicals with safer alternatives, or collecting volatile emissions and hard-piping them back into the manufacturing process. P2 also encompasses good operating practices such as waste segregation, preventive maintenance, training and awareness programs, and production scheduling (Moretti 2002). Wilbur was well aware that more facilities were affirming the benefits of P2 and source reduction that led to cost savings in such areas as reduced capital investment for end-of-pipe control, lower waste-disposal costs, lower costs for complying with environmental regulations, less need for worker protective equipment, and lower annual operating and maintenance costs. However, the challenge was to communicate the opportunities while also understanding the difficulties involved in change management.

Stadium Seating Division

Moulder’s Stadium Seating Division produces two product lines: Bleachers and Stadium Chairs. Bleachers are manufactured from flat boards while the Stadium Chairs require specialized manufacturing processes due to the complex shapes of the arms, backs and seats.

Wilbur decided to focus on the finishing operations, where most of the environmental problems originated. Moulder uses two types of finishing operations: (1) manual application of coatings for the flat boards used in the Bleacher seating, and (2) spray application for the

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3 Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Hazardous air pollutants (HAPs) are air pollutants listed by the EPA and promulgated by the Clean Air Act Amendments of 1990 to achieve maximum achievable control.
complex wooden shapes of the Stadium Chairs. Wilbur focused his P2 assessment on the spray finishing of the arms, backs and seats of the Stadium Chairs as this accounted for the highest use of coating materials.

The finishing process would begin after the wooden components of the Stadium Chairs were assembled onto metal frames, and then carried into a large ventilated spray booth. Typically, three or four coats were applied with high volume, low pressure (HVLP) spray guns: stain, sealer, and two lacquer topcoats. After each coat, the part was carried to a flash-off area to dry, then to a prep area for sanding before being returned to the spray booth for the next coat. The spray gun assembly (lines, nozzles etc.) were cleaned with the hydrocarbon solvent, such as toluene, at the end of each shift and when lacquer pigments were changed. Because these solvents emit VOC’s, the paint booths were equipped with filtered ventilators. Spray operators were outfitted with protective suits and full-head respirators to meet CDC guidelines. The spray booth had a strippable coated paper liner that was replaced as needed. All stadium seating was custom-made to order with different finishing specifications requiring varied finishing times and quantities of materials. Depending on the work flow and order backlog, workers moved back and forth between the Bleacher finishing and the Stadium Chair finishing operations.

The foreman, Elkind, kept track of the total number of hours worked at each area. He had assigned finishers on a rotating basis to track the amounts of each type of finishing material used for each job. The coating materials, purchased in 55-gallon drums, were moved to the production area as needed and the contents transferred into the spray dispensers. Employees were responsible for cleaning the spray equipment with solvent after each shift or for coating changeovers. They obtained solvent from a 55-gallon drum stored near the work area. When drums were used up, the person who emptied it contacted the store room for a replacement.

Used solvent was dumped into an open drum, which was sealed when full and sent to a centralized waste disposal holding area. Contaminated rags and spray booth liners were also drummed and sent to the waste disposal holding area. Maintenance staff was responsible for calling a certified hazardous waste hauler to pick up the drums when the holding area approached capacity. The different steps are depicted in the Stadium Chair Finishing process diagram (Figure 1).

4 The CDC guidelines on organic solvents are available at: http://www.cdc.gov/niosh/topics/organsolv/
Wilbur handled most of the environmental compliance work - manifesting, labeling, recordkeeping etc., but had not yet kept very good track of the amount of time he spent within each division, much less on any specific activity.

Collection of Cost Information

Prior to evaluating pollution prevention options, Wilbur wanted to develop an accurate picture of the costs of the finishing operations for the Stadium Chair product line. Because the management accounting system provided only an aggregated picture of direct labor and materials costs by job, he needed to understand those cost factors at a greater level of detail, and identify and track down as many of the indirect costs as possible. Wilbur decided to set up the Environment, Health and Safety (EH&S) team drawn from the employees in the Seating Division and Corporate Services to specifically meet the reporting and planning requirements of TURA. Figure 2 provides the organizational chart for the employees in the Seating Division and Corporate Services.

The core members of the EH&S team included Wilbur himself, Bingham, the Controller and Grimes, the Cost Accountant. The team decided to consult operational supervisors as needed. The first meeting of the team focused on the essentials, the listing of Annual Operating Costs associated with finishing the Stadium Chair products. After some discussion, the team came to a consensus on the finishing costs: coating materials, production labor, cleaning solvent, solvent disposal, rag and spray booth disposal, electricity for ventilation, heating oil, environment compliance, employee and EH&S Training. Wilbur was skeptical that this information required for the analysis would be easily available. The next meeting with Bingham and Grimes confirmed that assessment. After a discussion, Bingham saw the limitations of the cost classification system that applied a traditional approach to costs, without any consideration of environment-related factors. Gathering the required information became the next most important step.

Wilbur needed an estimate of his own time spent on compliance and reflected: “I spend about an eighth of my time on compliance activities for Stadium Chair finishing operations”.

--- Insert Figure 1 here ---

--- Insert Figure 2 here ---
was particularly difficult to estimate solvent use. Roberts, the plant manager recalled that “we used a total of about 5-6 drums a month for all operations, but we do not track solvent use for Stadium Chair finishing.” After a pause, he added: “Probably half of what is used for Stadium Chair finishing ends up as fugitive emissions or is absorbed by cleaning rags.” Grimes estimated that “about a drum a month for Stadium Chair finishing.” Disposal cost for rag and spray booth liner cost another $10,000 per year for Stadium Chair finishing. EH&S training costs related to finishing line cost about $2000 per person. Moulder trained two employees per year.

The energy costs for finishing stadium chairs posed another challenge. A quick call to Roberts, the Plant Engineer, confirmed that a significant portion of the heating oil bill was attributable directly to Stadium Seating (about 75%). Roberts estimated that finishing required increased ventilation to contain “fugitive emissions,” leading to overall increases in the heating costs of about 25%. In addition, he also estimated that the portion of electricity bill attributable to Stadium Chair finishing ventilation was “about 10%”.

Grimes volunteered to collect the remaining cost information necessary for completing the cost computation, available from the records maintained by Elkind, Burrows and Dixon. This information is consolidated in Appendix A.

To complete the analysis, Wilbur indicated the need for financial information that Bingham found relatively easy to provide. Capital budgeting at Moulder had always been a fairly informal process and Jacobs continued to use the simple payback method to make capital budgeting decisions. Major equipment investments required a 5 year payback while smaller capital outlays required a 3 year payback. Cost of capital for all divisions was set at 20%. All long-term analysis assumed an economic lifetime of 10 years, with the depreciation method being the straight-line method. Overall, Moulder operated for 50 weeks during the year.

Pollution Prevention Options

The EH&S research team conducted an extensive research into alternative options to the current coating technology, emphasizing the need to meet the TURA guidelines while also abiding by the strategic goals of the firm, particularly those related to capital financing. The team

5 The EPA defines “fugitive emissions” in the regulations promulgated under title V as “those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening” (see title 40 of the Code of Federal Regulations, sections 70.2 and 71.2). See Memorandum on Fugitive emissions accessible from: http://www.epa.gov/region07/air/title5/t5memos/fug-def.pdf
came up with three options for the stadium chair, with careful consideration of cost implications and the use of toxic items listed under TRI inventory, and presented them to Wilbur.

The first, Project A, involved switching from sealer and lacquer coatings that averaged 26 percent solids to coatings with 35 percent solids. To enable proper application of the material with HVLP guns, Moulder would have to heat the coatings in-line and would need to work with its equipment supplier to modify the spray gun caps, nozzles and tips. These High-Solids Coatings with HVLP spray guns contained approximately 40 percent fewer VOCs and 80 percent fewer HAPs.

The second option, Project B, involved switching from nitrocellulose coatings to aqueous (water)-based coatings. While the potential environmental gains were significant, the financial benefits were less certain, and Wilbur was also concerned about quality issues. Some customers had made it clear that they preferred the high gloss of the conventional nitrocellulose lacquer. Nevertheless use of the aqueous coatings would reduce Volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) by over 75% and would eliminate the need to use chlorinated solvents for cleanup.6 The water used for cleaning the spray equipment would require some type of treatment to allow its discharge under an existing NPDES permit, but Wilbur didn’t anticipate any problems with that, other than a potential additional permit fee of “about $500 per year”.

The third option, Project C, emerged from a suggestion from an employee, Johnson, who had previously worked for a competitor in the Northwest. This involved the possibility of installing a state-of-the art ultra-violet coating system. Although such systems had been installed in the industry primarily to coat flat boards, such as those used on the bleacher seating, new equipment had been introduced by one vendor to enable the use of ultra-violet coating on the more complex dimensions of other multiple wood seating and furniture.7 The technology looked promising but did not yet have an extensive track record for the type of application Moulder was considering. Moreover, an automated system would require a significant upfront investment. It did, however, have the potential to generate major savings in materials and labor and provide significant environmental advantages.

6 http://www.worker-health.org/chlorinatedsolvents.html
7 http://www.ppg.com/coatings/industrial/technologiesproducts/ultravioletelectrobeam/Pages/default.aspx
The research team examined the alternative projects in detail, considering the differences in technology and its impact on the costs elements identified earlier. Their summary estimates are provided in Appendix B.

**What are the Economic Incentives for Pollution Prevention?**

As Moulder had grown in size, it was also apparent that they had to take the opinions of stakeholders more seriously, given the increased scrutiny into their activities. Most important was worker health. Although a union did not represent Moulder workers, a Workers’ Safety and Health Committee that had been formed years earlier had successfully lobbied for more robust worker personal protection equipment (PPE) in the finishing operation. This was found to have increased employee morale and productivity. They were particularly concerned about their relationships with regulators, therefore increasing the importance of not being in violation of local, state, or federal compliance statutes. However, Wilson was surprised to learn that some innovative companies had begun to explore innovative strategies to prevent or abate pollution, which not only eliminated pollution, but also led to significant cost savings. He determined to learn about this area from Wilbur, as the new environment did not allow for the status quo. He perceived that the old approach (“if it is not broken, don’t fix it” approach) of ignoring these impending changes had put Moulder at a disadvantage, but, as the adage goes, “better late than never”. The question was, could they begin now and develop a strategy that was not only compliant but also fully integrated with their long term goals? In other words, as he pointed out to Wilbur, “can we make up for lost time and adopt an approach to sustainability that was strategic and transformative?”

**SUGGESTED QUESTIONS**

Wilbur is responsible to bring together the information and develop adequate reports that would justify a course of action. To perform the financial analysis:

1. Compare the three options using Payback Period, NPV and IRR. Highlight your preferred option and indicate your reasons.
2. Are there qualitative aspects of the project that might argue either for or against its implementation? Comment.
3. Wilbur provides a detailed note to the CEO, Wilson Jacobs on the changes needed to integrate sustainability more fully with the operations of the firm. Provide a detailed report that includes:

a) Explain the stages through which the firms increase their levels of adherence to sustainability. How would these approaches to sustainability impact cost management requirements?

b) Extend sustainability to Internal and external reporting systems. What are advantages and disadvantages from adopting such extended reporting systems?

**SUGGESTED SUPPLEMENTAL READINGS (By Topic)**

**General Information on Environment (including TURI) and Sustainability**


**Environment and Recent Empirical Research**


**Accounting and Strategic Tools and Techniques**


**FIGURE 1: FLOWCHART OF FINISHING IN STADIUM PRODUCTION**

```
Unfinished Stadium Chair
  Prep Area
    Chair Sanded
    Sanded Stadium Chair
    2x
  Ventilated Spray Booth
    Finish Coat Applied
    Spray Gun Parts Cleaned with Solvent
  Coated and Dried Stadium Chair
  Flash-off Area
    Finish Coat Dried
    Coated Stadium Chair
  Waste Collection Area
    Liners, solvent, rags stored in drums
    Used booth liners, used solvent, solvent-contaminated rags
  To Hazardous Waste Hauler
Finished Stadium Chair
```
APPENDIX A

R. Burrows, from payroll, has information on compensation, which includes the following:

<table>
<thead>
<tr>
<th>Rate (including all benefits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice-Presidents</td>
</tr>
<tr>
<td>Assistant Vice-Presidents (EH&amp;S Manager)</td>
</tr>
<tr>
<td>Engineering staff</td>
</tr>
<tr>
<td>Foremen</td>
</tr>
<tr>
<td>Office staff</td>
</tr>
<tr>
<td>Finishers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To</th>
<th>Rate (including all benefits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice-Presidents</td>
<td>$60,000 annual salary</td>
</tr>
<tr>
<td>Assistant Vice-Presidents (EH&amp;S Manager)</td>
<td>$50,000 annual salary</td>
</tr>
<tr>
<td>Engineering staff</td>
<td>$45,000 annual salary</td>
</tr>
<tr>
<td>Foremen</td>
<td>$20 per hour</td>
</tr>
<tr>
<td>Office staff</td>
<td>$15 per hour</td>
</tr>
<tr>
<td>Finishers</td>
<td>$15 per hour</td>
</tr>
</tbody>
</table>

T. Elkind, Finishing Foreman, has the following information:

“There are a total of 12 people employed in the Bleacher finishing and Stadium Chair finishing operations”. The Weekly Summary Labor Report for Stadium Chair Finishing:

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours</td>
<td>340</td>
<td>345</td>
<td>305</td>
<td>290</td>
<td>295</td>
<td>330</td>
<td>325</td>
<td>315</td>
<td>335</td>
<td>320</td>
</tr>
</tbody>
</table>

J. Dixon, from Accounts Receivable, and Accounts Payable/Purchasing, had the following information on the costs of chemical items to be used:

<table>
<thead>
<tr>
<th>Item</th>
<th>COST (including taxes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stain</td>
<td>$6.00 per gallon</td>
</tr>
<tr>
<td>Lacquer</td>
<td>$7.10 per gallon</td>
</tr>
<tr>
<td>Sealers</td>
<td>$5.00 per gallon</td>
</tr>
<tr>
<td>Solvent</td>
<td>$.85 per pound (11 pounds per gallon)</td>
</tr>
<tr>
<td>Solvent Disposal</td>
<td>$1.10 per pound (11 pounds per gallon)</td>
</tr>
<tr>
<td>Rag Disposal</td>
<td>$750 per drum (55 gallons per drum)</td>
</tr>
<tr>
<td>Electricity</td>
<td>“average monthly company bill - $4000”</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>“average monthly company bill - $6000”</td>
</tr>
</tbody>
</table>

Coating materials used per year for Stadium Chair finishing:

<table>
<thead>
<tr>
<th>Coating</th>
<th>Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stain</td>
<td>6500</td>
</tr>
<tr>
<td>Sealer</td>
<td>8000</td>
</tr>
<tr>
<td>Lacquer</td>
<td>10000</td>
</tr>
</tbody>
</table>
APPENDIX B

POLLUTION PREVENTION OPTIONS

The research team came up with three options (Projects A, B, C) for the stadium chair, with careful consideration of cost implications and the use of toxic items listed under TRI (toxic reduction inventory), and presented them to Wilbur.

Project A - High-Solids Coatings with HVLP spray guns would have costs and savings as listed below.

Coating materials: The higher-solids coatings are about double the cost of the low solids coatings on a per gallon basis but less material is used to achieve the same finished thickness. Combined with the elimination of the second topcoat, total quantity of coating purchased was expected to decline but the total cost was projected to be about 10 percent more, given the higher cost of the high-solids coatings. The supplier expected the price differential to decrease as more companies switched to higher solids coatings.

Production Labor: The higher solids coating would eliminate the need for a second topcoat in most cases and thus would reduce labor by about 4500 hours per year on constant volume. The sealer coat, however, would be more difficult to sand, requiring orbital rather than block sanders, and an additional 1000 hours of labor per year.

Maintenance: Cleaning solvent required increases of about 30 per cent more due to higher viscosity of the material.

Solvent disposal: increases by one-half of solvent use – i.e., 15%

Rag & spray booth liner disposal: No significant change.

Utilities - Electricity: Heating the coatings - additional $1000; increased air flow in the sealer flash-off area - additional $500

Heating oil: Increased air flow in the sealer flash-off area - $3000

Environmental Compliance: No major change

Training: Extra production training in first 3-6 months of operations: $5000; annual costs for training are unchanged.

Rework: Increased rework because there is less margin for error with a single, heavier topcoat: $15000 per year

Plant and Equipment: $30,000 to upgrade flash-off area and modify spray-gun equipment
Project B – Aqueous-Based Coatings option had the following estimated cost items:

*Coating materials:* The aqueous-based coatings cost approximately 10 percent more than what Moulder was currently using, but Wilbur expected the relative difference to decrease.

*Production Labor:* No change - the same number of employees would be required to apply the aqueous-based formulations.

*Maintenance:* Chlorinated solvent as cleaning solvent use would be eliminated.

Aqueous-based cleaner @ 20% of cost.

*Rag & spray booth liner disposal:* 20% of former cost.

*Utilities - Electricity:* The ventilation requirements would be reduced by 25%

*Heating Oil:* Reduced by 25%

*Training:* Extra production training in first 3-6 months of operations: $5000; annual training costs cut in half.


*Environmental Compliance:* Wilbur estimated that he would save about two hours per week due to the elimination of solvent at this operation but would add about an hour to check on the water treatment and discharge.

Project C - Ultra-Violet Coatings option costs and savings were estimated to be the following:

*Coating Materials:* The U-V coatings cost more on a per gallon basis but considerably less would be used because the coatings have a higher percentage of solids and over-spray is captured and re-circulated into the spray equipment, eliminating waste. Wilbur projected a reduction of about 30% in the cost of coating materials.

*Production Labor:* The automated system would enable the reassignment of at least two employees to other operations.

Maintenance: UV coatings would reduce the amount of cleaning solvent required for clean-up by 90%.

*Solvent disposal:* Same reduction as solvent use - 90%

*Rag & spray booth liner disposal:* Same reduction as solvent use - 90%

*Utilities - Electricity:* The ventilation requirements would be reduced by 25%. UV lamps would cost about $5000 annually to operate.

*Heating Oil:* The ventilation requirements would reduce heating oil use by 25%.
**Environmental Compliance:** Reduced by 50%.

**Training:** Extra training in first 3-6 months of operations: $10000. More production training on an annual basis - $3000.

**Plant and Equipment:** $350,000 for equipment and $130,000 for installation, phased start-up and lost production during changeover.
CASE LEARNING OBJECTIVES AND IMPLEMENTATION GUIDANCE

Contextualizing Notes

This case highlights legislation related to Toxics Use Reduction Act (TURA) that supports the overall goals of sustainability. The term ‘sustainability’ has come into frequent use in recent years, but has been subject to varying definitions and interpretations. Frequently, the definition is understood to be that first proposed by the UN World Commission on Environment and Development (WCED) (commonly known as the Brundtland Commission, after its chairman, former Norwegian Prime Minister Gro Brundtland), which defined the related term ‘sustainable development’ as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” This definition has been further refined to incorporate the ‘triple bottom line’, or ‘3 E’s’, of sustainability: environment, economy, and (social) equity as indicated in Figure TN-1. This model conceptualizes the three pillars as being intrinsically interrelated to create a sustainable environment for society. Thus, ignoring environmental concerns makes social perspective along unbearable for the peoples of that society, while economic perspective without addressing environmental concerns are not viable in the long term. This inter-relatedness also indicates the need for cross-disciplinary focus in environmental sustainability, as is evident in the Moulder case, where the concepts underlying toxicity control mechanisms (i.e., environmental protection) are brought into the classroom and aligned with the goals of cost controls and profits (economic vitality), elements of worker protection and ‘good neighbor’ practices (social equity). Thus, the integration of the different concepts presents a realistic view of the issues that managers grapple with. As Epstein points out, for sustainability, “the goal is to simultaneously achieve excellence in social and environmental and financial performance. Managing and measuring this paradox creates challenges” (p. 23). The TURA legislation provides one perspective on how sustainability goals are systematically regulated, and integrated with the financial and operational goals of the firm.

--- Insert Figure TN-1 here ----

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Educational Rationale/ Teaching Objectives

Bruns (1993) describes a good case as the vehicle by which a “chunk of reality is brought into the class room to be worked over…” (p. 3). From a general perspective, the case provides opportunities for the development of crucial skills for success in management and accounting careers (e.g., Bruns 1993). Such skills include critical analysis, creative thinking and independent learning, as well as interpersonal skills such as, teamwork and communication (e.g., Ballantine and Larres 2004; Bruns 1993; Milne and McConnell 2001). In addition, case studies provide the opportunity for deeper learning through research into real-life situations and scenarios that enable students to understand the complexity of such situations.

More specifically, the case also contributes to the growth and extension of the management accounting profession through integration with sustainability and environmental management (Grinell and Hunt 2000). It equips students for a changing environment, where corporate image and future prospects of firms are contingent on how they anticipate institutional changes and their implications from trends in global sustainability (Porter and Kramer 2006; Nidumolu et al. 2009). Overall, the growth in the area of sustainability provides increased potential for management accountants to play an integral and synthesizing role in strategic planning and implementation, and extends their knowledge, keeping them from the dangers of insularity. The goals and objectives of the case include:

- Application of Cost accounting and Critical thinking skills in the application of capital budgeting
- Understanding of the application of accounting techniques in the context of Pollution Prevention (P2) Assessment.
- Review of Cost Systems and extensions such as Environmental Management Accounting and technological developments in support the development of integrated strategies for sustainability
- Integrate financial and nonfinancial considerations in strategic planning in a multiple stakeholder environment

\[^{9}\]Global sustainability trends are increasingly part of the institutional changes, as highlighted through the principles of UN’s Global Compact. Global Compact principles at: [http://www.unglobalcompact.org/aboutthegc/thetenprinciples/index.html](http://www.unglobalcompact.org/aboutthegc/thetenprinciples/index.html)

\[^{10}\]This emerging area has also become the focus of multiple professional groups, as evidenced by the development of the professions such as Chief Sustainability Officer and Environmental Planner.
• Research projects into the results of environmental legislation on firm performance, regulatory environment, internal and external reporting systems that result from different strategies
• Strategic cost management and other change management and operational techniques, as well as a general understanding of risk management and business ethics.

Implementation Guidance

Developed in coordination with TURI, the case has benefited from feedback from practitioners who used the case to illustrate application of P2 principles. More recently, the case was used in an MBA course integrating sustainability and accounting, with an emphasis on management accounting techniques. The course included broader regulatory aspects such as greenhouse emissions and carbon trading, and the local regulation such as TURI. The case was useful in contrasting the different regulations (emphasizing local regulations) and highlighting the approaches to integrate strategy in applying the regulation.

The case would find a place in an MBA level or Masters level courses on managing environmental regulation, or upper level undergraduate management accounting course that integrates sustainability and managerial accounting concepts, in line with Grinnell and Hunt III (2000). Grinnell and Hunt III (2000) provide an outline for course content in Accounting with a focus on environmental issues. Their outline includes three tiers, the first involving environmental degradation and role of governments in addressing such issues, including regulations, taxes and standards. The second involves the role and responsibilities of business in addressing environmental issues, including responsiveness of business to environment and strategic aspects in pollution control. The third addresses various accounting dimensions as they pertain to environmental issues and consists of accounting topics and concepts, such as costing systems and budgets. The case provides opportunities to integrate the three areas at different levels of intensity and therefore, can form a capstone case in illustrating the integrative nature of the different tiers.

The regulatory provisions for toxics use in Massachusetts under the provisions of Massachusetts Toxics Use Reduction Act (TURA) provide a basis for companies to approach environmental issues proactively (i.e., Pollution Prevention) by investigating alternative approaches to address toxics use. The alternatives provide a means for firms to integrate
pollution prevention into strategic planning. Thus, the cases may be adapted to suit the topic areas and approaches of different courses by modifying questions to apply selectively to topics based on the specific goals of the course. Specifically, in addition to the use of information in decision-making, the case also provides insights into the importance of integrating external technical and socio-economic considerations, increasing the scope for further research, for example integrating the results form empirical accounting research (Clarkson et al. 2004; Hughes 2000; Joshi et al. 2001). The application of the techniques highlights the need for environmental cost systems. In addition, the increased measurement also provides potential for connection to voluntary reporting where management accountants have the potential to play an important role. Overall, these areas support the different tiers of knowledge and skills that form an approach to sustainability based accounting courses (Grinnell and Hunt 2000). Given the challenges to applying the case method has challenges, particularly the time and resource investments, it may be is important to cover as many objectives in the cases to warrant the resources invested. The case provides this opportunity, as illustrated in the teaching notes below.

**Figure TN-1: “3 E's” of Sustainability (UN General Assembly, 2005)**
TEACHING NOTES

References to Appropriate Literature

This section connects the concepts in the case to appropriate literature and sources, to enable instructors to provide students the adequate background to fully appreciate the pedagogical value of the case. The case is based on firms in Massachusetts that are required to report under the Toxics Use Reduction Act (TURA) under the regulatory authority of the Massachusetts Department of Environment Protection (MassDEP). TURA is intended to encourage economic development while protecting the quality of life and social responsibility to communities in the region. Enacted in 1989 and amended in 2006, TURA requires Massachusetts companies that use large quantities of specific toxic chemicals to annually measure and report their toxics use, and then evaluate and plan for pollution prevention opportunities. TURA does not require filing companies to meet specific targets for toxics reduction, or even to implement plans. Instead, TURA presumes that the required planning step will induce companies to undertake toxics reduction projects that will be beneficial to the environment while reducing costs and improving profits. It is this unique aspect of TURA – requiring detailed technical and financial analysis and planning rather than mandating specific numerical targets of polluting emissions – that has proven to be the key to the law’s success. In the TURA program’s nearly 25 year history, Massachusetts’ overall toxics use has been reduced by over 40%, and toxics emissions by over 90%.

12 Relevant sites: http://www.turi.org/; http://www.mass.gov/dep/toxics/toxicus.htm
13 The Massachusetts Department of Environmental Protection (MassDEP) administers state laws and regulations aimed at preventing pollution, protecting natural resources, promoting safe disposal and recycling of wastes, and ensuring timely cleanup of contamination. The U.S. Environmental Protection Agency (EPA) administers similar federal laws and regulations, but delegates much of its enforcement authority to state environmental agencies like MassDEP.
14 See http://www.turi.org/Our_Work/Toxic_Chemicals/Chemicals_Used_in_Massachusetts/Latest_Data_Release and “A Detailed Analysis of the TURA Data by Chemical Category 1990-1997, 2000” linked from the same page. Reported amounts of toxics use are based on a core group of companies, and vary from period-to-period because of changes in reporting requirements, companies moving in and out of the state, changes in product formulations, and other factors. See http://www.turi.org/Our_Work/Toxic_Chemicals/Chemicals_Used_in_Massachusetts/Understanding_the_TURAData
The goals of the case are to extend implementation of this legislation to the use of accounting (capital budgeting) highlighting the need for adequate costing systems, and also facilitating the exploration of extension of environment compliance to strategic integration. In this regard, Clarkson et al (2004) provide insights into investment of capital expenses. Low-pollution firms appear to have greater impact and benefits from such investment. In addition, the importance of adequate cost accounting systems is also related to environmental compliance and strategy. Joshi et al (2001) suggest that environmental costs can be hidden, particularly when new costs are introduced. The changes in other areas, for example, administrative may not be revealed unless there is an adequate costing system. Thus, the case highlights the need for transition from the traditional internal reporting systems to environmental oriented management accounting.

Environment management accounting systems also provides the opportunity to extend strategy implementation to reporting, where such reporting highlights sustainability strategy alone or such reporting is integrated with the financial reporting associated with the strategic integration of sustainability initiatives (e.g., Ballou et al. 2012). The systems and processes lead to reporting systems, both internal and external (Epstein 2008; Eccles and Krzus 2010; Hopwood et al. 2010). The internal reporting systems support the ongoing sustainability strategy. Firms use internal communication to implement “sustainability embedding” as an integral part of organizational philosophy and culture, particularly when sustainability is integrated with overall strategy (Hopwood et al. 2010). The external reporting systems are used to apprise stakeholders to management’s approach of addressing sustainability Ballou et al. (2012). Specific standards and formats (Global Reporting Institute (GRI)), also allow companies to be externally evaluated and their activities highlighted to serve as benchmarks. Hughes II (2000) examines the value relevance of nonfinancial measures of air pollution in the electric utility industry, drawing insights into how such information is informative in supplementing financial information. Further, firms are highlighting environmental strategy may be communicated through connected and integrated Reporting (Eccles and Krzus 2010; Hopwood et al. 2010; Ballou et al. 2012). Increasingly, stakeholder pressures have also increased firm motivation to increase their focus on
integrated reporting, also called Connected Reporting (Hopwood et al. 2010; Schalltegger and Wagner 2006).\textsuperscript{15}

**Implementation Guidance/Teaching Plan**

The questions and suggested answers provide guidance for use of the case. As indicated earlier, Grinnell and Hunt III (2000) provides a three tier approach to course content for a course integrating environmental issues with accounting. The case provides opportunities to integrate the three areas at different levels of intensity, with the option to highlight several aspects of environmental sustainability legislation, from compliance to strategic integration, as illustrated in the questions that follow (particularly question 3, given its open-ended nature). Thus, it may be adapted to suit the topic areas and approaches of different courses by modifying questions to apply selectively to topics based on the specific goals of the course. Such extension is possible particularly using the additional research highlighted in the previous section and integrated into the case solutions, as indicated below.

**MOULDER CASE SUGGESTED QUESTIONS AND ANSWERS**

Assume your role as Wilbur, responsible to bring together the information and develop adequate reports that would justify a course of action. The questions below first relate to the implementation of the plan, and further, an extension of the plan to integrate environmental issues into strategy. To perform the financial analysis:

1. First, compare the three options using Payback Period, NPV and IRR, highlighting the financial factors involved in the decision.
2. Next, review qualitative aspects of the project that might argue either for or against its implementation.
3. Finally, Wilbur provides a detailed note to the CEO, Wilson Jacobs on the changes needed to integrate sustainability more fully with the operations of the firm. Using the supplemental readings and other relevant research, provide a detailed report that includes:
   a) An explanation of the stages through which the firms increase their levels of adherence to environmental sustainability, specifically highlighting how would these approaches to sustainability impact cost management requirements.

\textsuperscript{15} Such integration also constraints “greenwashing” (Lubin and Esty 2010).
b) **Extend sustainability to Internal and external reporting systems. What are advantages and disadvantages from adopting such extended reporting systems?**

**Question 1:** Compare the three options using Payback Period, NPV and IRR. Highlight your preferred option and indicate your reasons

To determine the Costs and the Comparative Analysis, the following stages are useful:

Stage 1: Compile the costs from the sources provided in the case, using the cost classification indicated by the EF&S team, namely, Coating Materials, Production Labor, Cleaning Solvent, Solvent Disposal, Rag and Spray booth disposal, Electricity for ventilation, Heating oil, Environment Compliance, Employee and EH & S Training. The calculations are provided in Appendix TN-1.

Stage 2: Prepare a comparison of the actual costs and the alternative projects comparing the information from the actual list with that of the projected costs for each project, as indicated below.

<table>
<thead>
<tr>
<th>Projects</th>
<th>Payback</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.56</td>
<td>20,341</td>
<td>36</td>
</tr>
<tr>
<td>B</td>
<td>4.95</td>
<td>(12,291)</td>
<td>16</td>
</tr>
<tr>
<td>C</td>
<td>4.29</td>
<td>(10,754)</td>
<td>18</td>
</tr>
</tbody>
</table>

From the quantitative perspective, Project A appears the most viable, as it comes close to the Payback period target (of 2 years) for smaller capital outlays. Additionally, it has the highest IRR and NPV figures (there may be some differences in calculations, resulting from differences in interpretations). However, some items that were to be included as one time training costs, if included in annual costs, can change the overall outcomes. Project C is a higher risk investment, given the outlay, but it does meet the Payback target for larger capital outlays (5 years). Overall, Project A appears the best option from the quantitative perspective.
PROJECT A - HIGH SOLIDS COATINGS

Section 1 - CAPITAL COSTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment purchase</td>
<td>$30,000</td>
</tr>
<tr>
<td>Start-up Costs</td>
<td>$5,000</td>
</tr>
</tbody>
</table>

Section 2 - OPERATING CASH FLOWS

<table>
<thead>
<tr>
<th>Description</th>
<th>Current Costs</th>
<th>Project A Costs</th>
<th>Incremental (Costs) &amp; Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating materials</td>
<td>$150,000</td>
<td>$165,000</td>
<td>($15,000)</td>
</tr>
<tr>
<td>Production labor</td>
<td>$240,000</td>
<td>$187,500</td>
<td>$52,500</td>
</tr>
<tr>
<td>Maintenance (Cleaning solvent)</td>
<td>$12,000</td>
<td>$15,600</td>
<td>($3,600)</td>
</tr>
<tr>
<td>Solvent disposal</td>
<td>$8,000</td>
<td>$9,200</td>
<td>($1,200)</td>
</tr>
<tr>
<td>Rag &amp; spray booth liner disposal</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$0</td>
</tr>
<tr>
<td>Electricity</td>
<td>$4,800</td>
<td>$6,300</td>
<td>($1,500)</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>$14,400</td>
<td>$17,400</td>
<td>($3,000)</td>
</tr>
<tr>
<td>Environmental Compliance</td>
<td>$6,250</td>
<td>$6,250</td>
<td>$0</td>
</tr>
<tr>
<td>Training</td>
<td>$4,000</td>
<td>$4,000</td>
<td>$0</td>
</tr>
<tr>
<td>Rework</td>
<td>$15,000</td>
<td></td>
<td>($15,000)</td>
</tr>
</tbody>
</table>

Annual Operating Cash Flow  
$449,450  $436,250  $13,200

Section 3 - NPV CALCULATIONS

Annual Operating Cash Flow  
$13,200

x PV Annuity Factor (10 yrs @ 20%)  
4.1925

= Present Value Operating Cash Flows  
$55,341

- Capital Costs  
$35,000

= Net Present Value  
$20,341

Internal rate of return  
36%

Payback Period  
2.65
**PROJECT B - AQUEOUS COATINGS**

### Section 1 - Capital Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment purchase</td>
<td>$75,000</td>
</tr>
<tr>
<td>Evaluation &amp; Training</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>Total Capital Costs</strong></td>
<td><strong>$80,000</strong></td>
</tr>
</tbody>
</table>

### Section 2 - Operating Cash Flows

<table>
<thead>
<tr>
<th>Item</th>
<th>Current Costs</th>
<th>Project B Costs</th>
<th>Incremental (Costs) &amp; Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating materials</td>
<td>$150,000</td>
<td>$165,000</td>
<td>($15,000)</td>
</tr>
<tr>
<td>Production labor</td>
<td>$240,000</td>
<td>$240,000</td>
<td>0</td>
</tr>
<tr>
<td>Maintenance (Cleaning solvent)</td>
<td>$12,000</td>
<td>$2,400</td>
<td>$9,600</td>
</tr>
<tr>
<td>Solvent disposal</td>
<td>$8,000</td>
<td>0</td>
<td>$8,000</td>
</tr>
<tr>
<td>Rag &amp; spray booth liner disposal</td>
<td>$10,000</td>
<td>$2,000</td>
<td>$8,000</td>
</tr>
<tr>
<td>Electricity</td>
<td>$4,800</td>
<td>$3,600</td>
<td>$1,200</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>$14,400</td>
<td>$10,800</td>
<td>$3,600</td>
</tr>
<tr>
<td>Environmental Compliance</td>
<td>$6,250</td>
<td>$5,000</td>
<td>$1,250</td>
</tr>
<tr>
<td>Training</td>
<td>$4,000</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Treatment Chemicals</td>
<td>0</td>
<td>$2,000</td>
<td>($2,000)</td>
</tr>
<tr>
<td>Permit Fee</td>
<td>0</td>
<td>$500</td>
<td>($500)</td>
</tr>
<tr>
<td><strong>Annual Operating Cash Flow</strong></td>
<td><strong>$449,450</strong></td>
<td><strong>$432,800</strong></td>
<td><strong>$16,150</strong></td>
</tr>
</tbody>
</table>

### Section 3 - NPV Calculations

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Operating Cash Flow</td>
<td>$16,650</td>
</tr>
<tr>
<td>x PV Annuity Factor (10 yrs @ 20%)</td>
<td>4.1925</td>
</tr>
<tr>
<td>= Present Value Operating Cash Flows</td>
<td>$67,709</td>
</tr>
<tr>
<td>- Capital Costs</td>
<td>$80,000</td>
</tr>
<tr>
<td>= Net Present Value</td>
<td>($12,291)</td>
</tr>
</tbody>
</table>

**Internal rate of return** 16%  
**Payback period** = 4.95
Question 2: Are there qualitative aspects of the project that might argue either for or against its implementation? Comment.

Wilbur could seek to differentiate the projects through their qualitative aspects that could include measures that have long-term financial implications, those that have direction relationship to the reputation of the firm, and those that could lead to costs and long-term reputational and tangible financial implications.

First, qualitative measures such as Productivity, Product Quality and customer satisfaction could result in long-term revenue increases. Qualitative measures that impact the reputation of the firm include Employee Health and Safety, Stakeholder Relations and public image (for example, through significant improvements in environmental and social
performance). Other qualitative aspects could directly impact long term finances negatively particularly stemming from potential violation of regulations. These include Criminal Liability (product leads to injury or death) or other types of Financial Liability (increased cause of Storage and Disposal, Real Property Damage, Civil Actions/ Toxics Tort Suits and Fines and Penalties. These could impact the projects (and possibly disqualify them from consideration). While the more serious aspects were not evident in the projects, the following analysis considers those aspects highlighted in the case:

**Project A**: While the case does not lead to a specific mention about quality in relation to Project A, the only real change that this project offers is increasing the amount of solids in the formula, and thus reducing VOC’s by 40% and HAP’s by 80%. However if we look closely at the costs of the project, there is a small possibility of reduced quality. This option introduces the element of rework, which is the result of the single application being done incorrectly. Though the problem appears to get corrected in the rework stage, it nonetheless introduces the possibility of decreased quality. However, it does not appear that the concern about the rework quality should be enough of a concern to rule out this project.

**Project B**: This project appears to fail in the financial test, given the projected negative financial impact on the firm. In addition, it appears to have other obstacles, the greatest of which is uncertain customer acceptance of Aqueous-based coatings. Some of Moulder’s customers have expressed a specific preference for conventional coatings, and the company risks alienating these customers by switching to a product that they may deem inferior. In addition, there is some uncertainty regarding obtaining the permit for treatment of the water used for cleaning the equipment. It is true that project B offers a large reduction in VOCs and HAPs, and would also eliminate the use of chlorinated solvents; however, given that other TURA-compliant solutions exist that provide bottom-line gains for Moulder (viz., A & C), project B ought not be selected.

**Project C**: The upside of Project C is clear; there is the opportunity to reduce operating costs by a lot more than the other two projects. Nevertheless, the savings this project offers will pay back the $480,000 up front costs over period exceeding 4 years (not meeting the capital project payback period criteria of 3 years) and overall, appears less quantitatively desirably than Project A (particularly given the significantly negative NPV). Qualitatively, the problem that this project faces is that this technology does not have enough of a track record in this type of application to
know if the quality would hold out. Moulder would essentially be banking on the promise of the technology, rather than any track record showing proof that the technology will improve the quality. Since project C has by far the highest initial cost, it also presents the greatest risk of catastrophic loss if the technology does not work as promised, and the projected annual savings do not materialize.

Nevertheless, based on the information on each of the Projects, it would also appear that Project C alone offers any promise of a significant improvement in quality over the long term. Project C also offers the highest upside in the environmental impact. However, based on the costs of the projects, quantitative outcomes and the element of unproven technology related to Project C, there is the uncertainty involved (in addition to the quantitative aspects). Overall, Project A appears the most viable project from the financial perspective, while leading to an overall reduction in emissions of the VOCs and HAPs that would serve to appease regulators.

The alternatives above also highlight the potential ethical dilemmas and the tension in using only financial considerations in the development of environmental strategy, and omitting such intangible factors as employee safety, customer preference, and most importantly, the long term implications for providing for environmental safeguards that could meet contingent changes in emerging regulation. Specifically, such strategic factors provide long term perspectives that consider the possibility of environmental regulations that could otherwise increase costs and/or reduce share value (Hughes 2000), or impact the reputation of the firm. These are discussed further in the next question (Question 3).

**Question 3:** Wilbur provides a detailed note to the CEO, Wilson Jacobs on the changes needed to integrate sustainability more fully with the operations of the firm. Provide a detailed report that includes:

a) Explain the stages through which the firms increase their levels of adherence to sustainability. How would these approaches to sustainability impact cost management requirements?

b) Extend sustainability to Internal and external reporting systems. What are advantages and disadvantages from adopting such extended reporting systems?
The points below may be presented in a report format in line with the question that requires Wilbur to present a report to President Wilson.

a) *Explain the stages through which the firms increase their levels of adherence to sustainability.*

*How would these approaches to sustainability impact cost management requirements?*

While there are different views on the stages through which firms develop their sustainability strategy (e.g., Nidumolu et al. 2009; Willard 2005), a continuum of four stages in the development of a sustainability strategy captures the possibilities (see Figure TN-2). Firms in Stage 1 are “non-compliant.” Such firms are focused on profits, generally overlook sustainability and may actively oppose regulations. Stage 2 firms seek to meet regulatory requirements to manage their liabilities by obeying the law and all labor, environmental, health, and safety regulations. Such firms do what they need to do legally, and treat environmental and philanthropic social actions as costs, without any proactive support for Corporate Social Responsibility (CSR). Firms enter Stage 3 when they recognize the potential to save expenses with proactive and incremental operational eco-efficiencies, leaner processes, and better waste management. However, sustainability initiatives are still marginalized in specialized departments - they are tacked on as "green housekeeping," not built in and institutionalized. Stage 4 firms recognize that compliance with norms becomes an opportunity for innovation (Nidumolu et al. 2009), and increase commitment to sustainability through integration of sustainability with key business strategies, and transformation of their brand image. Such firms may capture added value from breakthrough sustainability initiatives that benefit all stakeholders and include cleaner products, eco-effectiveness and life-cycle stewardship initiatives.\(^{16}\)

---*Insert Figure TN-2 here*---

The framework from the figure provides a basis to depict the firm approach to sustainability strategy beginning with (A) firms seeking *Compliance* to meet regulatory requirements and for pragmatic reasons; (B) to firms *Transitioning* to “Beyond Compliance” to take advantages of efficiencies; (C) Transformational firms who are invested in sustainability for the long-term and make structural changes to accommodate this change.

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\(^{16}\) TURI has also specified Toxic Use Reduction techniques ranging from Input Substitution to more integrated forms such as Integral Recycling that may be classified within the categories in Figure TN-2.
Moulder is a firm that initially resists environmental issues until the changes in the environment compel internal changes. Thus, the case primarily focuses on a firm seeking minimal compliance, but has the potential to extend beyond such an approach when they apply the TURA regulations, specifically the pollution prevention analysis. Such exploration reveals benefits to firms proactively considering pollution prevention. As summarized by Clarkson et al. (2004), such firms have the benefits as low polluting firms not only include the reduction of environment liabilities, but also have the added potential to attract customers who are environment conscious, could trigger innovations that could further improve corporate operational efficiency by substitutions of less costly materials, and optimal waste usage, besides increasing the standards for other firms to emulate (thereby becoming a cost leader). Clarkson et al. (2004) find that there are incremental economic benefits from capital investment by low-polluting firms, but not high polluting firms, indicating that such investments move firms into strategic areas, with the ability to internalize the costs of innovation through increased efficiency (transformational firms), rather than responding to external regulatory requirements and thereby being forced to pass on costs to customers.

Accountants Role

Accountants may have a direct role in how a company monitors the emissions of the company. Two aspects of accounting systems and methods are necessary to support strategic and operational cost management. The first, cost systems form the basis for information generated to meet strategic goals, and the second, accounting methods and tools, provides the model for sustainability planning, control and decisions. Development of cost systems also involves investments and alignment of information systems and technology. These are further elaborated below:

Cost Systems: The case indicates that the cost systems were generally inadequate providing the necessary information for the pollution and environmental decision-making. Firms may continue to use traditional methods of accounting where the firm has no specific information on environmental costs and usage. Such systems limit the ability of firms to address environmental issues strategically. To achieve an adequate analysis of environmental costs, it is

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17 For example, use of IT Solutions at SAP. SAP R/3. 2012 for sustainability extends use of technology to costing and the environment.
important to have proper classification of such costs to enable firms to apply cost techniques and decision models. Atkinson et al. (2012) has classified environmental costs into explicit and implicit costs. Explicit costs include direct costs of modifying technology and processes, costs of cleanup and disposal, costs of permits to operate a facility, fines levied by government agencies, and litigation fees. Implicit costs are often more closely tied to the infrastructure required to monitor environmental issues. These costs are usually administration and legal counsel, employee education and awareness, and the loss of goodwill if environmental disasters occur. Both these categories of costs were required in the Moulder case, and, significantly, are also required in determining the Cost of Toxics under TURA as part of the analysis of safer alternatives. The classifications provide the basis for further refinement in measuring the activities and the costs associated with them so that the firm may be able to apply such methods as Activity Based Costs.

Activity Based Costing (ABC) allows firms to have more transparency on “overhead” costs, isolating environmental costs and enabling cost driver analysis, rather than simply allocating indirect ‘overhead’ costs (such as utilities, process chemicals, or compliance activities) based on broadly averaged factors such as number of employees or floor space consumed. The cost driver analysis, in turn, can then incentivize specific cost reduction initiatives that would otherwise be obscured. In the Moulder case, for example, electricity and heating oil are billed for the entire facility, and allocated to various activities based on some unrelated factor such as floor space or labor hours; the stadium seating operation was allocated an invariable 10% of the monthly facility utility expenditure. Recent technology can be a significant contributor to measuring and analyzing some of the costs that previously could only be estimated or broadly averaged. In the Moulder case, electricity and heating oil costs were metered only at the facility level, and cost-allocated to specific activities based on an estimated and invariant cost allocation factor. This is common in many manufacturing facilities because metering or measuring utility usage at discrete manufacturing locations has been technically cumbersome and economically prohibitive. Increasingly, however, companies have begun ‘sub-metering’ energy use by deploying new inexpensive data loggers that are connected to central servers via wireless or wired Ethernet. Updated on a frequent basis (e.g., measuring electricity use once per minute), these data loggers can be used to allocate utility costs to each manufacturing cell, or even

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18 Institute of Management Accountants, Implementing Activity-Based Accounting, 2006
individual machines, thus enabling much finer resolution in allocating costs, analyzing cost
drivers, and incenting cost reduction strategies. Similar strategies can be employed to measure
raw material flows in continuous manufacturing operations, such as by using data loggers to
monitor flow meters or detect on and off states of pumps. These new technologies facilitate
collection of costs for implementing ABC. As Atkinson et al. (2012) assert: “A comprehensive
ABC model will help identify all of the activities and the total resource costs related to
preventing and remediating expected environmental damage” (p. 326). In addition, time is the
basic cost drive as both labor and machine hours are used to compute the activity costs. In the
case, the TDABC can help determine the consumption of costly environmental costs by the two
products, therefore providing specific environmental costs associated with each of the products.

Finally, firms that integrate strategy require depth of information, and therefore,
operationalize the systems to generate them, such as Environmental Management Accounting,
where the overall goals also consider the classification of items along the value chain (disposal
etc.) that support a comprehensive sustainable strategy.

Accounting Tools/Methods: Activity Based Management, which includes measuring
the processes, rates etc., helps determine ways to decrease use of toxics components and/or the
“fugitive emissions” that may result from processes that are not mapped in the ABC system.
Such ABM systems may also help the firm increase preventive measures that reduce the overall
costs through reduced time invested in non-value added activities. When the real costs of these
processes (tangible and intangible) are measured, there is also greater understanding of the costs
and the motivation to control them. The hidden costs of environmental regulation can be
substantive, as indicated by Joshi et al. (2001). They find that for every dollar of environmental
cost, about $9-$10 remained hidden in a variety of overhead accounts. Hence, the importance of
developing environmental cost systems that separately classify and trace environmental costs.

Environmental Management Accounting supports cost-efficient compliance, eco-
efficiency through monitoring and increasing performance measurement and standard costing for

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19 The new technology has reduced logging hardware costs, while the software interfaces have improved
immensely. Both of these factors have reduced the metering cost per point. - See more at:
http://www.onsetcomp.com/learning/application_stories/industry-viewpoint-energy-assessments-using-
data-loggers

20 International Guidance Document 2005: Environmental Management Accounting; International
Federation of Accountants (New York, New York 10017) IFAC_Guidance_doc_on_EMA_FINAL.pdf
continuous improvement programs (IFAC). The goal of such systems is to develop Material Flow Management to enable improving cost efficiency and environmental performance (Wagner and Enzler 2006) and would include financial and non-financial measures that are specific to the nature of the sustainability goal and integrated with strategy. Where the goals are to increase efficiency and effectiveness, firms apply tools for continuous improvement, process re-engineering, process integration and outcomes assessment. Within the context of strategic goals of the firm, methods and tools are useful in aligning and supporting strategy, such as value chain analysis, life cycle costing and the balanced scorecard. Balanced Scorecard may also be used in conjunction with ABC and Life Cycle Costing in attaining the goals of sustainability (Pineno 2012; Rohm and Montgomery 2011). Such tools also require the choice of measures that include process and product measures, Key Performance Indicators (KPIs) and Key Results Indicators (KRIks) to help monitor, support and improve operational and strategic outcomes.

Environmental Management Systems

Stage 4 firms (Figure TN-2) often adopt Environmental Management Systems as a strategic approach to embedding sustainability into all aspects of operations. The EMS is an overall system of management processes and tools to help an organization address its environmental issues and goals, and to connect those issues and goals to other organizational objectives. One well-known EMS framework is based on the International Standards Organization (ISO) 14000 family of environmental standards. Based on the earlier 9000 family of standards for quality management, the ISO 14000 standards employ the Plan-Do-Check-Act (PDCA) continuous improvement cycle. Thus, these standards provide guidance on EMS system implementation (Plan), guidelines for conducting life-cycle assessments and managing environmental aspects (Do), standards for conducting environmental audits (Check), and guidelines on environmental declarations and claims (Act).²¹

EMS frameworks call for the identification of Environmental Aspects, which are elements of an organization’s activities, products, or services that can interact with the environment. Environmental Impacts, then, are changes to the environment, whether adverse or beneficial, wholly or partially resulting from those aspects. Aspects, in other words, can be

considered *causes*, and impacts the *effects*, of activities, products, or services that interact with the environment. Understanding these relationships also supports the development of ABC systems that support more detailed cost analysis, while also addressing environmental concerns. Because they are patterned after quality management systems that are also based on the PDCA cycle, EMS’s can also be used in tandem with, or as part of, quality systems. In essence, environmental aspects that lead to adverse environmental impacts can be regarded as though they were quality defects, and thus subject to preventive, appraisal and corrective action just as any other quality defect would (Figure TN-3).

---*Insert Figure TN-3 here*---

Once implemented, an EMS becomes an integral part of the firm’s management strategy, thus assuring that environmental factors are involved with general policy and strategy development, internal and external communications, operational controls, and so on as shown in Figure TN-4.

---*Insert Figure TN-4 here*---

Firms that approach environmental issues in this systematic manner can develop cost systems to understand the impact of quality costs and benefits. Under the Massachusetts TURA program, firms that must report their use of toxic substances may elect to implement an EMS in place of the usual TUR Planning – essentially replacing biannual planning with continuous improvement, in which each toxic being used is considered an environmental aspect (Stapleton and Glover 2001).23

22 See for example, a detailed review of Aspects and Impacts from the EPA website: [http://www.epa.gov/sectors/sectorinfo/sectorprofiles/shipbuilding/module_05.pdf](http://www.epa.gov/sectors/sectorinfo/sectorprofiles/shipbuilding/module_05.pdf) (accessed 02/06)

23 Toxics Use Reduction Institute, Environmental Management Systems for TUR, course manual 2012
philosophy and culture, particularly when sustainability is integrated with overall strategy (Hopwood et al. 2010).

The external reporting systems are used to apprise stakeholders to management’s approach of addressing sustainability (Ballou et al. 2012). Specific standards and formats (Global Reporting Institute (GRI)), also allow companies to be externally evaluated and their activities highlighted to serve as benchmarks. While firms generally provide external sustainability reports for social legitimacy, the extent of their integration with strategy may be communicated through connected and integrated Reporting (Eccles and Krzus 2010; Hopwood et al. 2010; Ballou et al. 2012). Increasingly, stakeholder pressures have required firms to increase their focus on integrated reporting (also called Connected Reporting (Hopwood et al. 2010; Schalltegger and Wagner 2006). It is also relevant to determine the nature of their internal systems and strategic intent, as consistency and alignment of strategy and reports are crucial to transparent reports. Inconsistency may well be symptoms of “greenwashing” (Lubin and Esty 2010). Rather, firms that pursue an integrated strategy (i.e., transformational firms) may have benefits from external reporting. Hughes II (2000), for example, examines the value relevance of nonfinancial measures in the electric utility industry, drawing insights into how such reports can supplement financial information. Their findings suggest that reporting nonfinancial measures on exposure to future environmental liabilities pollution prevention activities would “buffer investors from future environmental liabilities.” Specifically, exogenous shocks such as the Clean Air Act Amendments (1990) that required certain specified units to reduce sulfur dioxide (SO$_2$). The nonfinancial pollution proxies were value-relevant for high polluters; share prices of such firms declined. Thus, firms that proactively involved in pollution prevention also sustained and enhanced their reputations, when such efforts are included in external reporting.

In addition, the question also leads to other global aspects of environmental regulation focus, such as carbon emissions and emissions trading (Engels 2009). In this environment, it is beneficial for firms to be transparent and highlight their approach to business in order to inform stakeholders and others about their ethics and social responsibility.
REFERENCES


Figure TN-2 - Stages in Sustainability Strategy Continuum

1. Pre-Compliance  
2. Compliance  
3. Beyond Compliance  
4. Integrated Strategy

Figure TN-3: Examples of environmental aspects and associated impacts

- Toxic Chemical Use
- Energy Usage (Gas or Diesel)
- Used Oil Recycling
- Solid Waste Generation
- Degradation of Water Quality
- Reduction in Natural Resources
- Conservation of Natural Resources
- Reduction in Landfill Space
Figure TN-4 - Elements of an Environmental Management System
APPENDIX TN-1

COMPUTATIONS

1) Coating Materials:

Stain: 6,500 gallons x $6.00 per gallon = $39,000
Sealer: 8,000 gallons x $5.00 per gallon = $40,000
Lacquer: 10,000 gallons x $7.10 per gallon = $71,000

$150,000

2) Production Labor: 320 hours/week x $15/hour x 50 weeks/year = $240,000/year

3) Cleaning Solvent: Cost per gallon = $0.85/lb x 11 lb/gal = $9.35/gal

Total use per month = 1 drum spent solvent disposed + 1 drum evaporated/absorbed in rags = 2 drums x 55 gal/drum = 110 gal per month

Total Cost = 110 gal x 12 months/year x $9.35/gal = $12,342

(Cost per pound from Dixon, AR, AP, and Purchasing; pound per gallon from Wilbur, EH&S; drums used taken from Wilbur – solvent use is twice the amount sent to disposal (or twice what ends up as “fugitive emissions” and requires, i.e., one drum sent to disposal, half of what’s used ends up as fugitive emissions or in rags).

4) Solvent Disposal: 12 drums x 55 gal/drum x 11 lb/gal x $1.10/lb = $7,986

5) Rag and Spray Booth Disposal: $10,000

6) Electricity: $4,000/month x 12 months x 10% = $4,800

7) Heating Oil

Total Heat without Ventilation = X
Total Heat with Ventilation = 1.25X (ventilation increases total use by 25%)
Actual Heat with Ventilation = $6,000/month x 12 months/year = $72,000
Actual Heat without Ventilation = $72,000/1.25 = $57,600
Difference (attributable to Stadium Chair finishing) = $72,000 - $57,600 = $14,400

8) Compliance

$50,000/8 = $6,250

9) Training: $2,000 x 2 = $4,000