Environmental Aspects & Impacts

A system for identifying priorities and setting goals

By David Ayers

AS COMPANIES BECOME MORE SOCIALLY conscious, SH&E professionals are often assigned environmental responsibilities as well as safety responsibilities. The modern environmental movement in the U.S. is closely associated with the 1962 publication of Rachel Carson's *Silent Spring.* "Rachel Carson meticulously described how the pesticide DDT entered the food chain in the fatty tissues of animals, including human beings, and caused cancer and genetic damage" (NRDC, 2008).

In 1969, Congress declared in Sec. 101 of the National Environmental Protection Act (42 USC § 4331):

> [I]t is the continuing policy of the federal government, in cooperation with state and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic and other requirements of present and future generations of Americans.

The more recent green movement and the trend toward corporate social responsibility indicate that many companies are listening to stakeholders who want clean, efficient operations that are protective of the environment. Many companies are finding that such operations not only protect the environment but also help the companies save money. This creates a win-win situation in which operations are analyzed for environmental performance and a cost savings is realized by reducing waste. Waste costs time and money, not only in its disposal, but also in its production in the first place.

Several environmental management systems (EMS) have been published, most notably ISO 14001. This standard is designed to help firms manage their environmental responsi-

bilities to all applicable regulations through an effective EMS. Whether a company pursues ISO 14001 or creates a custom version, a system to manage the company's environmental responsibilities is important.

Electing to use an EMS is the first step toward addressing environmental affairs in a proactive way. First, the company should have an environmental policy. This is an overall document that explains what the company intends to do from an environmental standpoint. The environmental policy statement should show management commitment, be easy for employees and the public to understand, and reflect the company's vision and values.

This article examines how SH&E professionals with environmental responsibilities can identify environmental aspects and impacts, and introduces a scoring system that can be used to determine environmental priorities, then set measurable environmental goals.

Environmental Aspects

According to clause 3.3 of ISO 14001:2004, an environmental aspect is any "element of an organization's activity, products or services that can interact with the environment." Goetsch & Davis (2001) state:

> In simple terms an environmental aspect is anything resulting from the organization's activities, products or services that has the poten-

David Ayers, M.S., CSP, CHMM, has been an SH&E professional for 14 years. He is the managing director of compliance for the National Ready Mixed Concrete Association in Silver Spring, MD, and holds an M.S. in Safety Management from West Virginia University and an M.S. in Environmental Management from the University of Maryland. Ayers is a member of ASSE's National Capital Chapter, and of the Society's Construction, Engineering and Environmental practice specialties.

tial to cause an environmental impact, even if it is presently controlled, or prevent such impact. The fact that the potential exists (if something goes wrong, for instance) makes it an environmental aspect (p. 18).

An environmental aspect can be either negative or positive. Negative aspects include emissions to the air or water, discharge of oil to the land or water, generation of hazardous waste, generation of solid waste, community impact, and the generation of dust and noise. Positive aspects include recycling of used materials such as steel, aluminum, copper, glass bottles and paper, removal of pollutants from the air or water, and restoring land by removing decontaminated soil.

Environmental Impact

In cause and effect, if one considers an environmental aspect to be the cause, then the environmental impact is the effect. An environmental impact is any change to the environment, whether adverse or beneficial, wholly or partially resulting from the organization's activities, products or services. Essentially, the environmental impact is the result of the environmental aspect.

For example, suppose a company is discharging wastewater to a nearby stream. A potential environmental impact of that activity is pollution to the water. Table 1 (p. 27) presents some practical examples of aspects and impacts from a ready mixed concrete facility.

Abstract: *SH&E professionals with environmental responsibilities can use a scoring system to identify environmental aspects and impacts, determine priorities and set measurable goals for reducing a company's impact on the environment.*

The trend toward corporate social responsibility indicates that many companies are listening to stakeholders who want clean, efficient operations that are protective of the environment.

Examine Company Operations:
Form a Multidisciplinary Team

Examining a company's operations helps one determine what environmental aspects/impacts it produces. One way to start this process is to form a team. Team members should bring different attributes to the group to allow for a holistic solution. Table 2 lists some potential team members and their contributions (EPA, 1999).

Once the team is formed, it must select a method to document and track progress. Many different strategies exist for selecting which area to address first. One area to be addressed should be all permitted and regulatory areas to ensure that a company is operating legally.

Example Scoring System

A numerical scoring system can be used to identify a company's top 5% environmental aspects/impacts that will be addressed. By addressing the top 5%, the company will show continuous improvement. As aspects and impacts are addressed, scores will be lower.

Following is an example rating formula (modified and adapted from original National Semiconductor Texas formula) to help prioritize environmental aspects and impacts.

(Probability x Consequence) + Regulatory Requirements + Concerns to Customers or Community x Resource Requirements = Total Score

Probability: How Often Does the Aspect Occur?

5: routine; impact can occur through everyday operations;

4: periodic; impact can occur at regular intervals more than once/year;

3: occasional; impact can occur at a frequency not more than three times in 5 years;

2: possible; impact not expected at this plant, but could still occur;

1: limited; impact not expected at this plant; control system designed to control or minimize impact.

Consequences: What Is the Environmental Consequence of the Aspect/Impact?

5: extreme; results in severe, disruptive or persistent ecological damage or impacts to human health;

Table 1

Environmental Aspects & Impacts Examples

Table 1 presents practical examples of environmental aspects and impacts from a ready mixed concrete facility.

Table 2 lists potential members of a multidisciplinary team that might be formed to examine environmental concerns.

Environmental aspects	Environmental impacts
Storage of fuel	Spills and leaks
Delivery of cement to ready-mixed concrete production facility	Air emissions, noise
Delivery of concrete	Air emissions, noise
Truck washout	Process water, track out and housekeeping
Electricity use	Air pollution, global warming
Use of recycled paper	Conservation of natural resources
Truck parking	Stormwater, spills and leaks, housekeeping
Use of returned concrete (forms, yard paving, etc.)	Conservation of natural resources

Table 2

Potential Team Personnel & Their Contributions

Function	Knowledge/skills needed	Potential contribution
Production	Knowledge of production processes	Management of environmental aspects of production processes
Maintenance	Knowledge of maintenance operations and procedures	Management of environmental aspects of equipment and building maintenance
Quality	Knowledge of quality management and document control procedures	Integration with quality control systems and documentation procedures already in place
Plant manager	Knowledge of production process and facility	Knowledge of production process, schedules, tracks costs and other metrics as well as environmental permits
Human resources	Knowledge of training and performance measurement procedures and policies	Integration of environmental criteria into training and performance measures
Purchasing	Knowledge of procurement process, including screening of suppliers, material composition of components and development of specifications	Integration of environmental considerations into procurement process
Public relations	Knowledge of resources and policies for public relations	Communication with stakeholders on environmental issues
Accounting/finance	Knowledge of company's financial tracking system	Tracking of environmental costs of operations and savings achieved by environmental projects.
SH&E	Knowledge of current SH&E procedures	Integration of current practices; provision of technical assistance to EMS
Company management	Knowledge of company goals and objectives	Integration of environmental policy from concept to reality, environmental performance tracking, providing management commitment, provides funding as needed.
Facility engineering	Knowledge of procedures for new construction and equipment installation or modification	Management of environmental aspects of new construction and equipment installation or modification

results in large-scale nonrenewable uses of energy, water or other natural resources;

4: high; results in uncontrolled emissions to air, water or land or measurable impacts to human health; results in significant use of energy, water or other natural resources;

3: moderate; results in controlled emissions to air, water or land or potential to affect human health; use of natural resources reduced by energy conservation and waste reduction and recycling programs;

2: minor; minimal emissions to air, water or land; use of natural resources reduced by energy conservation or use of renewable resources, waste reduction and recycling programs and use of recycled materials in products produced by and materials used by the facility;

1: no consequence.

**Regulatory Requirements:
Is the Aspect/Impact Covered by a Regulation?**

5: regulated;
4: potential to be regulated;
3: company policy;
2: voluntary;
1: nonregulated.

**Concerns to Customer or Community:
How Concerned Is the Customer or Community?**

3: extremely concerned;
2: very concerned;
1: mildly concerned;
0: not concerned.

**Resource Requirement Level: How Easy
or Difficult Is It to Control the Aspect/Impact?**

5: very difficult to control; requires many resources;
4: difficult to control; requires many resources;
3: requires moderate resources to control;
2: requires some resources to address;
1: easily controlled; requires few measures.

Some of the formula inputs are easy to measure while others are more subjective. On occasion, the team will need to use its best judgment until enough data are available to change the category rating. Some companies also gather direct input from customers and from the communities in which they operate. This is a great strategy for showing residents how the company is handling environmental matters responsibly. However, remember that the public may be emotionally driven to remove some element (such as a toxic chemical, process or a step in the manufacturing process) that cannot be elimi-

The team can use a spreadsheet to document results and track progress. The spreadsheet can also automatically calculate scores as they are entered into the five different categories.

Figure 1

Example Aspect/Impact Tracking Sheet

Activity	Task	Aspect	Adverse	Beneficial	Operational controls	Impact	N=normal; U=upset	Probability	Consequence of rating	Probability x consequence score	Regulatory requirements	Concerns to customer or community	Resource requirement level	Total score
Activity, product or service. High-level processes organized according to business practices.	Description, a specific task with an activity. An activity will have numerous tasks.	Environmental interaction. The way in which an activity, product or service can have an effect on the environment.			Procedures, work instructions, training and engineering controls	Under normal operating conditions and upset operating conditions								
Water quality management	Process water discharge	Water	X		Water quality SOP, training, lined sedimentation pit, truck and chute wash down	Consumption of natural resources	N	5	3	15	5	1	3	63
Hazardous materials management	Petroleum and chemical usage	Used lubricants	X		Used oil SOP, training, spill kits	Used oil disposal	N	5	4	20	5	3	2	56
Air quality management	Airborne process emissions	Hot water boiler	X		Air quality SOP, air permit to operate, maintenance	Combustion by-products	N	5	3	15	5	3	2	46
Sustainability	Recycling efforts	Aluminum cans		X	Recycling SOP	Recycled material disposal	N	5	2	10	3	3	2	32
Sustainability	Recycling efforts	Wooden skids		X	Recycling SOP	Recycled material disposal	N	5	2	10	3	3	2	32
Water quality management	Stormwater discharge	Water	X		SWPPP, training, sampling, process water and stormwater separation, stormwater permit	Stormwater runoff	N	5	1	5	5	3	2	26
Hazardous materials management	Spill prevention control and countermeasures (SPCC)	Diesel fuel	X		SPCC plan, training inspections, maintenance, adequate containment dike	Sample stormwater before discharging	N	5	2	10	5	0	1	15
Water quality management	Stormwater discharge	Water	X		SWPPP, no permit	Stormwater and process water runoff	U	5	5	25	5	3	5	165
Air quality management	Airborne process emissions	Bag house	X		Air quality SOP, air permit to operate, maintenance	Uncontrolled air emission	U	5	4	20	5	3	4	112
Water quality management	Process water discharge	Water	X		Water quality SOP, training	Process water spill on land or water	U	4	4	16	5	3	3	72
Hazardous materials management	Spill prevention control and countermeasures	Diesel fuel delivery	X		SPCC plan, diesel fuel delivery SOP	Diesel fuel spill to land or water	U	3	2	6	5	3	3	42

Note: Adapted from National Semiconductor—Texas environmental aspects/impacts matrix. Actual tracking sheet would include a comments field.

Table 3

Examples of Specific, Measurable Goals

Area	Goal	% Change	Personnel	Measurement
Water use	Increase use of recycled water	10% increase	Plant manager, Smith, accountant	Water bill, water meter on sedimentation pit, gallons/yd^3 concrete produced
Sustainability/carbon footprint reduction	Plant 30 pine tree saplings along north fence	50% increase	Smith, SH&E intern	Count trees
Returned concrete	Install concrete reclaimer and recycle 50% of returned concrete	50% increase	Plant manager, SH&E intern, Jones, accountant	Track % of returned concrete, track cost savings on virgin aggregate
Paper	Reduce paper usage in copiers	25% decrease	Plant manager, IT intern	Actual paper used in copier
Solid waste management	Reduce solid waste tonnage	10% decrease	Plant manager, facility manager, SH&E intern	Solid waste bill, lbs. of trash
Electricity usage	Reduce electricity usage	10% decrease	Plant manager, facility manager	Electrical bill, kW/widget produced
Used drums	Eliminate steel drums being cut up and thrown in dumpster	100% increase—donate to a drum reclaimer	Plant manager, facility manager, purchasing department	Drum reclaimer weekly ticket
Wooden skids	Eliminate wooden skids thrown in dumpster	90% increase—donate to a skid reclaimer	Plant manager, facility manager, purchasing department	Skid reclaimer weekly ticket

The team also must ensure that each goal is measureable. Ideally, the goals should be communicated to employees, and department managers should be able to explain to employees how the environmental goal affects them and what they can do to contribute to success.

nated without affecting final product output. In such cases, community members are demanding that their points of concern be addressed yet the company is unable to change the process.

Another example of community involvement might be with a facility's generation of dust. The company will be able to share its inspection and maintenance records, and discuss its policy of regularly sweeping plant property to control dust.

Input from customers is also an option as they may have certain goals and metrics they are hoping to achieve. Many socially conscious companies are requiring that suppliers be socially responsible about the environment as well. When this is done, some customers may ask that additional cost savings be passed on (e.g., by lowering unit cost per widget). This is not a bad strategy, and the company should be aware that it exists.

Developing a spreadsheet (Figure 1, p. 29) will help the team document results and track progress. There is no set format for this spreadsheet. Check with the quality department or whoever handles document control for the company to see how to best synchronize efforts.

The aspect/impact tracking sheet has an area to describe the activity (high-level process), the specific task, the aspect, whether that aspect is adverse or beneficial, operational controls in place (standard operating procedures, employee training and other engineering controls), impact and whether this activity is considered a normal or upset condition. The spreadsheet can be used to automatically calculate scores as they are entered into the five different categories.

After aspects and impacts are identified and scored, they can be sorted by a given parameter.

Several selection strategies exist. One effective approach is to focus on regulatory items first, then company policies and finally voluntary aspects.

In addition, the team should ask management representatives how they would like to see these issues addressed. However, what if the management team wants the team to determine the environmental priorities? One simple strategy is to follow the money. Where does the company spend the most money and on what items? An often overlooked and valuable resource is the accounting or finance department. This group pays the bills and often has metrics and data to provide a starting point.

Management by walking around (MBWA) is another strategy. Walk around the facility and observe the company in action. Perhaps the facility is water intensive or appears to use a lot of electricity. Look for areas of waste. Ask employees for their ideas. Environmental conservation contests are a great way to get valuable ideas and reward employees for examining their areas for waste.

After determining at least five environmental priorities, the team can present three to the management team for approval. The others can be held in reserve to be used if the management team does not approve the first choices. These other priorities also can be addressed at a later point if the first three priorities are completed before deadlines. However, it is best to focus on just three priorities so the team can measure progress toward goals.

Setting Goals

Once the team identifies environmental priorities, it must set goals. The key to setting environmental goals is prevention of pollution. Prevention of pollution is the "use of processes, practices, materials or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution." These goals are similar to those found in production and quality. They must be specific and measureable to be effective.

To ensure that goals are specific, ask the five key questions:
- Who: Who is on the team?
- What: What do we want to accomplish?
- Where: Where is the concern (can be an area of the plant or entire plant)?
- When: By when should this be accomplished (starting and ending)?

•Why: What is the reason(s), purpose or benefit(s) of accomplishing this goal? (Meyer, 2007).

Answering the why question is critical. Employees, supervisors and managers may ask why they should help with the environmental goals. Having others agree that goals are important leads to buy in. Without management and employee buy in, some progress is possible, but the goal may never be met or exceeded. In addition, specific goals show others that the team has developed a well thought-out plan and measurement system.

As long as the team can answer the W questions, it will have specific goals (Meyer, 2007). A specific goal may sound something like "ABC Concrete will reduce paper usage in printer/copiers by 25% by Dec. 31, 2010, by setting the copier mode to always print double-sided. Also, reinforce with the workforce to only use printers/copiers when necessary. " A general or nonspecific goal may sound something like "ABC Concrete will reduce paper usage by 25%." A specific goal sets into motion a plan to achieve substeps along the way with a specific ending date and goal measurement.

The team also must ensure that each goal is measureable. To do this, the team establishes criteria against which to measure progress. Ask questions such as: How many? How much? How will we measure progress and know that we are done (or falling behind schedule)? (Meyer, 2007).

The first step is to make sure the goal can be measured. For example, it will be difficult to quantify the gallons of water saved per cubic yard of concrete produced if there is no way to measure baseline water use first. Make sure the company can measure progress per a fixed unit and not along a floating baseline such as dollars saved per widget produced. A fixed unit goal can state "amount of (electricity in kW, gallons of water, hazardous waste produced or solid waste produced) per widget produced." This way the company can measure progress even if the cost of waste disposal, water and electricity increases.

Table 3 presents several examples of specific and measureable goals. Ideally, the goals should be communicated to employees, and department managers should be able to explain to employees how the environmental goal affects them and what they can do to contribute to success.

The company also must have a system to communicate progress and goal status. Environmental goals such as those listed in Table 3 will pay for themselves over a given period. This payback period will vary depending on the goals, and may not always be in the form of money. For example, the facility used as an example in Table 3 is planting 30 pine saplings along the north fence. This activity can be measured and included as part of the company's annual report or it may just be a nice footnote to include in maintaining good community relations.

The company can involve outside parties in goal setting. For example, the team could research whether an outside group would like to be part of this effort while also helping the company achieve its environmental goals. Both groups profit in some way. For example, some companies collect paper and aluminum cans for youth group fundraising activities. Most companies devise a system where the outside parties collect the recyclables each week.

Such arrangements also can help with housekeeping. One company was being overrun by empty drums and wooden skids. General practice had been to throw skids in the dumpsters, while the drums were triple-washed then disposed of in the dumpsters. Realizing there might be a better way, the company contacted a drum reclaimer and wooden skid reclaimer. The reclamation firms came to the facility each week and removed the items for free. The company also saved a small amount of money by reducing the amount of solid waste weight in the dumpsters.

After going through these steps, suppose the company does not achieve its environmental goals. Reexamine the team's steps. Perhaps the goals were too ambitious (which is okay as long as there was an effort to achieve them). Track progress at least weekly and meet as a team on a monthly or quarterly basis. Adjust strategy as necessary. Discuss options and chart a new path as the situation dictates.

The company also may find that after several years of setting environmental goals that it is difficult to achieve a goal such as a 2% reduction in something. As the company examines the processes and improves its processes, environmental goals will be more difficult to achieve. Capitalize on incremental goal achievement. If the company goal is to reduce paper usage by 25% and at the 6-month mark the data indicate a 20% reduction, communicate that status to employees.

Conclusion

SH&E professionals are being asked to take on more and more environmental responsibilities. Identifying environmental aspects and impacts as well as environmental goal setting and measurement may be among those responsibilities. There is no set system for doing this, but an EMS that easily blends into the existing company culture is an effective approach. Achieving environmental goals will pay off in dividends, not just monetarily but also with an enhanced reputation as the company operates in as environmentally friendly a manner as possible and is a good neighbor to the community. ■

References

Carson, R. (1962). *Silent spring.* New York: Fawcett World Library.

EPA. (1999). EPA's design for the environment: Incorporating DfE into your gap analysis. Washington, DC: Author. Retrieved Dec. 16, 2009, from http://www.epa.gov/dfe/pubs/iems/tools/gap.pdf.

Goetsch, D. & Davis, S. (2001). *ISO 14001 environmental management.* New York: Prentice-Hall Inc.

Meyer, P. (2007). Creating smart goals. Simpsonville, SC: Top Achievement. Retrieved Sept. 9, 2008, from http://www.topachievement.com/smart.html.

Natural Resources Defense Council (NRDC). (2008). The story of silent spring. New York: Author. Retrieved Aug. 23, 2008, from http://www.nrdc.org/health/pesticides/hcarson.asp.