

Cleaner Production Training in Asia: Experience from the ASEAN Environmental Improvement Program

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Abstract

A regional program conducted Cleaner Production training for business managers around Asia from 1993 to 1996. The training programs developed are described. Participants were surveyed after the training to identify what aspects of the training they found to be the most useful. A majority said that basic business improvement and management communication methods that were described as aids to CP implementation were among the most useful topics. The conclusion is that CP training programs should not just focus on technical approaches, but should also include a significant amount of basic business improvement methods.

Introduction

Pollution can impose high costs and risks on companies. Training employees, suppliers, and customers in cleaner production and cleaner production strategies can significantly reduce these costs and risks. These strategies include activity-based costing of wastes, process analysis using Total Quality Management tools, risk prioritization, and application of the Cleaner Production Hierarchy. Training is most effective when it is highly participatory and includes case studies of companies that have successfully prevented the generation of wastes and pollution. From 1993 to 1996 the ASEAN Environmental Improvement Project (EIP) provided training in cleaner production and cleaner production for factory managers throughout Southeast Asia and developed a series of training modules for executives, managers and technical staff that addressed the particular concerns of each group. This targeted training approach resulted in very high satisfaction ratings from training participants and stimulated the development of numerous company cleaner production programs to reduce waste costs and risks.

Business Environmental Objectives

Treatment of pollution is an expensive requirement. It also increases corporate risks by adding a complex, regulated final step to the production process. Industries have the common objective of reducing these costs and risks, while achieving compliance. But in

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the last ten years a new objective has been adopted by many organizations. They seek not only to minimize compliance costs, but also to eliminate the generation of wastes at the source. Their Cleaner Production (CP) objectives have led to increased efficiency in materials use, elimination of hazardous and toxic substances, less waste generated and reduced treatment requirements.

Methods for cleaner production are now well known in the developed countries. In the United States, hundreds of organizations deliver technical and management information on CP to industry. There are many successful environmental partnerships between business and government because they share the common objective of preventing pollution through production improvements.

CP specialists who have worked with thousands of businesses agree that the most important element in a successful program to reduce environmental costs and risks is training. This is because pollution can only be prevented by the people working directly on business processes, making conscious decisions about ways to avoid environmental problems. This includes production staff, and also marketing, research, design and engineering, accounting and human resources. In contrast, pollution control is usually implemented using outside expertise, and only the pollution control engineer or the environmental manager is responsible for making sure that it works.

The importance of training as a business environmental objective is recognized in the many environmental management standards being established around the world. The most important standard, the ISO 14001 Environmental Management Systems (EMS) specification, explicitly identifies training as one of the major components of a verifiable EMS. The business managers who developed the standards are conducting cleaner production training in their own companies as a critical complement to their pollution control technologies. Without such training, the production employees are usually unaware of the high costs and risks of pollution control, and they do not know the best strategies for reducing the environmental problems caused by the particular business processes on which they work.

Cleaner Production Strategies

The best strategy to prevent pollution is to follow the flow of production and apply appropriate management and technical tools at each step. This ensures that potential costs and risks are reduced as early as possible, and that each department uses the methods with which they are most familiar. Effective training courses offer examples of each of these elements to reinforce the fact that cleaner production is a general management strategy that requires internal team efforts.

The Cleaner Production Hierarchy is a set of strategies that follows the production process, from R&D to waste treatment. The individual elements are all standard business practices. It is the application of the ideas from the beginning of the production process that makes the difference, because this ensures that potential requirements for waste treatment are avoided as soon as possible. During training sessions, these points can be

illustrated with case studies and discussion by participants. Table 1 lists the elements of the Hierarchy and training ideas for each one.

Note that there is a wide range of management skills and responsibilities needed to understand and implement all the elements of the hierarchy. This illustrates the need for cross-functional teams in organizations in order to take advantage of all the possibilities for cleaner production.

Table 1.
The Cleaner Production Hierarchy: Training Issues and Solutions

1. Cost Accounting

1.1. Cost Awareness and Responsibility

Business people *ALWAYS* underestimate the true cost of waste and pollution. Training needs to focus on identifying *all* the costs of waste and pollution, especially including the value of lost raw materials. Participants can build cost inventories in group discussions and identify reasons why costs are not accounted for.

1.2. Baseline Environmental Costs

Establishing a factory environmental cost baseline provides the basis for determining where prevention will be most cost effective. Participants can discuss approaches to doing a current costs study.

1.3. Cost Analysis and Activity-Based Allocation

When baseline costs are known, they must be allocated to responsible parties. Activity-based costing provides accountability by process. Participants can discuss the management issues in allocating waste costs to the waste generators.

1.4. Forecasting and Budgeting

Long-term forecasting is critical for environmental cost management and cleaner production. Participants can identify trends in regulation and technology and develop timelines for expected future expenses.

2. Source Reduction: Strategies to reduce materials use

2.1. End Product Design

Changing the design of the product can significantly reduce pollution. Using a classroom product such as an overhead projector, participants can identify design changes that would reduce the pollution from its manufacturing.

2.2. Toxic Chemical Substitution

Replacing a toxic chemical ingredient with a non-toxic substitute can eliminate the need for treatment at the end of the pipe. Water-based paints are a good example for use in training.

2.3. Reduced Chemical Concentrations

By reducing concentrations of particular chemicals, treatment to manage them can be reduced.

2.4. Purchasing Control

Purchasing should include environmental criteria and evaluation of the environmental performance of suppliers. Participants can identify types of waste generated through purchasing practices, such as packaging of purchased goods.

2.5. Distribution Control

Tight control over chemical distribution within the company reduces wastage and accidents. Participants can discuss inventory management systems they use effectively.

2.6. Water Conservation

Most companies use more water than really necessary, and therefore have to treat too much wastewater. Participants can identify common examples of water wastage. The full cost of water can also be discussed.

2.7. Housekeeping

Preventing spills and leaks, and keeping a cleaner plant, reduces accidents and spills. Participants can share their shop floor management strategies.

3. Waste Reduction: Strategies to reduce generation of waste

3.1. Benchmarking

Benchmarking identifies the best performance standards among competitors. Participants should share their knowledge of cleaner production strategies in their industry and how they might obtain more information.

3.2. Process Training

Small investments in training of process operators can produce big improvements in process efficiency and reduced waste. Yet training is often under-utilized. Participants should examine the obstacles to training and how to overcome them.

3.3. Maintenance

Improving equipment maintenance can significantly reduce pollution generation by stopping leaks and spills and reducing wash-down needs. More frequent maintenance improves production efficiency. Participants can develop a comparison of the costs of more maintenance vs. the costs of downtime and waste due to lack of maintenance.

3.4. Improve Process Control

Simple process control equipment such as float valves, flow meters and sensors can significantly reduce production errors that lead to waste. Participants can identify production steps that are manually controlled and what kinds of automated controls would be effective replacements.

3.5. Change Process Design

Changing the layout or steps in a process can often reduce water needs and waste generation. For example, the use of three-step counter-current rinsing has greatly reduced water use in thousands of electroplating companies. Lots of examples are the best training tool for this topic.

3.6. Equipment Improvement

New equipment that is more efficient reduces the generation of waste from the process. The savings from reduced treatment may quickly offset the cost of new equipment. Participants need to relate the cost of new equipment to the total cost of waste and pollution control created by the existing equipment.

4. Recycling: Strategies to re-use or regenerate materials

4.1. Waste Stream Segregation

When waste streams are segregated or kept apart at the process level, they do not contaminate each other and create a single large problem. Participants can draw process waste diagrams and identify where large mixed waste streams are created, and consider the options for managing the waste streams separately.

4.2. Closed-Loop Recycling

Segregated waste streams can sometimes be recycled directly back into the process through a closed-loop system, thereby eliminating all waste from the process step.

4.3. Re-Use

Often, wastes can be re-used elsewhere in a factory, or even by nearby businesses, without treatment. Cooling waters and non-toxic cleaning waters can almost always find other uses. Participants can identify ways to capture and store reusable wastes.

4.4. Recycle

Sometimes wastes must be re-processed to recycle them. For example, evaporators can recover almost all the water from some waste streams and the water can be reused. Simple technologies such as distillation and filtration should be explained.

4.5. Exchange

It may be possible for a business to give wastes to others who can use them. Participants can list their waste types and discuss other industrial uses for them.

5. Treatment: Strategies to convert or process wastes into profitable materials

5.1. By-Product Recovery

If waste streams contain potentially valuable materials, recovering the materials before final treatment may be cost-effective by offsetting the cost of treatment chemicals. Recovered materials can be re-used or sold. Participants should consider the value of raw materials in the waste streams.

5.2. Waste Conversion

Additional processing can turn an existing waste stream into a brand new product. Many examples should be used here.

Training Experience

Extensive Asian experience in cleaner production training was developed by the ASEAN Environmental Improvement Project (EIP) from 1993-1996. EIP was a program funded by the United States Agency for International Development (USAID) to help member countries of the Association of Southeast Asian Nations (ASEAN), namely Thailand, Indonesia, Brunei, Philippines, Malaysia, and Singapore, with environmentally sustainable industrial development. EIP was part of a larger program, the U.S.-Asia Environmental Partnership. The project management office was in Manila. Louis Berger International, Inc. (LBI), an international planning and environmental consulting firm, was the implementing contractor for EIP.

The goal of the ASEAN EIP was to facilitate environmentally acceptable economic development in ASEAN countries by strengthening local, national, and regional capabilities in environmental management. It specifically aimed to help private sector initiatives to reduce the generation of industrial wastes. By introducing U.S. technical and management strategies for cleaner production, the EIP assisted the ASEAN nations to advance towards environmentally sustainable growth.

EIP conducted training courses in cleaner production for industry managers, government officials, consultants and academics. Courses were presented in the Philippines, Malaysia, Singapore, Indonesia, and Thailand. The courses were designed to meet the needs of specific audiences, and resulted in significant awareness and new effort in participating industries. Over 1000 professionals participated in training sessions.

Training Solutions

Tailored Presentations

Training must be designed to meet the needs of the audience. By targeting the training towards different levels of authority, more useful information can be provided and participants are better able to interact with each other. Experience has shown that training production managers alone seldom leads to implementation success because the production managers cannot get the support of their top management to make significant changes. Top executives must also be trained to see the benefits of pollution and to know their own roles in implementation.

EIP designed four types of training program in cleaner technology and cleaner production:

- Two-hour seminars for senior executives and company owners, covering executive strategies for leading the company and implementing management systems for cleaner production
- Half-day workshops for financial managers and accountants, covering total environmental cost analysis, cost allocation strategies, and cash flow forecasting
- One-day workshops for consultants and academics, covering how to market cleaner production services and how to develop training curriculum
- Two-day workshops for production managers, covering “bottom line” environmental issues, cleaner production strategies, company integration, implementation tools, Total Quality Management tools for process analysis, and information resources.

Case Studies

Because the participants in cleaner production training are usually experienced managers, it is critical to provide real-world examples of cleaner production actions taken by other companies. Theory alone is not effective. Fortunately, there is a wide range of sources available, covering most industry categories. The case studies are used to illustrate the basic training concepts, and to provide technical information about specific industry problems. EIP instructors were personally familiar with a large number of companies that have made cleaner production a success, and can relate their experiences to the audience. New case studies are continually becoming available, primarily through government envi-

ronmental programs, and EIP maintained close contact with primary sources of case information. As a result, training classes can be provided for specific industries with heavy emphasis on process-specific problem solving.

Using the case studies, EIP instructors were able to teach cleaner production in a very relevant manner, regardless of their own familiarity with particular industries. This is a very important point, because it is more important to have a good trainer in charge than an industry expert. Experts know the material, but seldom are able to manage the challenges of delivering one or two full days of training to a large group of professionals. Good trainers know how to use case studies and audience expertise to ensure that sufficient industry-specific information is provided to the participants.

Participatory Techniques

Because the participants in cleaner production training sessions are usually experienced professionals, participatory techniques that rely on their combined experience and interest in each other are the most effective for training. Although some technical subjects or short presentations must for practical purposes be delivered in a lecture format, this format does not work well for intensive full day training sessions. EIP developed a training approach that used group discussions and exercises, combined with workbooks for individual tasks, that provides effective participation while maintaining a steady flow of information.

Many of the topics in cleaner production are already familiar to the participants. EIP trainers often acted as discussion guides, posing a question for the audience to answer as a group. The instructors pointed out that the techniques being used in the class can also be used by the participants to teach others in their own companies when they return. This encourages participation and interaction. Some of the topics covered in participatory exercises used in cleaner production training include:

- The many cost categories of pollution
- Causes of waste
- Motivations of different staff levels to implement changes
- Successful communication tools for environmental awareness
- Process analysis tools
- Work team strategies

Through group discussion and presentation of case studies, managers see how these subjects can be applied in establishing their own programs. A basic principle of professional training is that the participants usually know more than the instructor about various issues, so using their group knowledge provides the greatest level of information.

Quality Improvement Tools

Quality improvement programs in companies focus on reducing wastes and defects. Thus they are very similar in their goals to CP programs. If pollution is defined as waste and a defect of production, then quality improvement tools can be successfully applied for CP solutions. Some of these tools include process flow diagramming, cause-and-effect anal-

ysis using fishbone or Ishikawa diagrams, run charts for waste generation, Pareto diagrams to identify top priorities, quality circles, and the Japanese 5-S method for improving shop floor productivity. This approach is important because it shows participants that CP is not a new set of skills to be learned, rather it is the application of well-known and proven tools and skills to a new set of priorities. Also, it shows that CP can be implemented within an existing quality program, which is very important to business people who are reluctant to try implementing a new program because of the time and management required.

Resources

Training serves as both as a skill-building exercise and a catalyst for action. But participants need to know what resources are available to help their programs keep going months and years after the training. EIP developed a directory of industry environmental information resources, which covers eighteen industries and identifies a wide range of industry-specific environmental information sources. This directory was used to help industry managers identify information partners and sources for research, funding and further training. Training was also provided in the various international programs that provide cleaner production assistance. The United Nations, the World Bank, and many national governments extend technical and financial assistance for cleaner production to businesses in developing countries.

Focus on Management

Many people enroll in cleaner production training programs because they know it is a good idea but they don't know how to make it happen. Perhaps the comment most often heard by trainers is: "I want to implement a cleaner production program but I can't get any support." This is a management issue rather than a technical one. EIP found that technical cleaner production workshops that provide specific technical solutions to industry problems, even very-low-cost ones, do not commonly lead to implementation by the participants. This appears to be due to the fact that there are many management obstacles to making changes in the daily production process and human resources system.

Table 2 lists comments taken *verbatim* from surveys completed by participants in EIP's two-day workshop on Industrial Pollution Prevention. Note the strong interest of the participants in management and communication approaches. It is clear that cleaner production training must include a significant number of basic business management tools. Although some might consider this to be off the subject of CP, in fact CP is really the application of basic business management methods using a set of priorities established in the CP Hierarchy. It should not be assumed that training participants have a good understanding of business management tools. Often the line managers and even senior managers of industrial companies have risen through the ranks and have had little formal training in these tools. Simple concepts such as cause-and-effect analysis, pareto diagrams, team-building exercises, and cash-flow analysis may be very unfamiliar to them, and yet these tools are very effective means for implementing CP.

Table 2
Comments Received from CP Training Participants

What was most helpful part of the training course?

- learning to quantify the costs of waste
- TQM tools
- process analysis, team building, motivation to pollution prevention, the pollution prevention hierarchy
- it helps me to further refine my knowledge of sources of environmental impact
- understanding environmental stakeholder philosophy
- the TQM program
- looking into the expenses of the company and starting the evaluation from there
- success stories shared by participants
- process analysis tools
- pollution prevention success stories
- open forum/discussion on P2 implementation
- systematic approach of forming maintaining committee
- resources for implementation, and success stories
- total quality management approach
- the discussion of strategic environmental management, life cycle analysis, and lots of examples
- team building and resources for implementation

What were the most important skills you learned?

- presentation skills for convincing management of the potential benefits and savings for the company
- use of accounting figures to assist in putting value, instead of intangibles only
- total quality management, process analysis/cause and effect, motivation tools, costs
- getting management support for strategic environmental management projects
- how I can reinforce our Pollution Control Officer in the strict implementation of our environmental projects
- doing step by step by planning all the necessary things and have more communication with our management
- management tools to convince management
- process mapping, communication tools
- tools to get what I wanted from my boss
- motivation under the role of management
- learned the role of management in implementation
- a new and systematic way of addressing wastage
- how to convince top management on waste reduction program
- why waste happens and prevention
- role of management for team building
- how to motivate people to get involved in program
- communication skills
- ability to share knowledge of what I have learned to other companies
- role of management for team building

- ers to adopt a P2 program
- learned action plan for information dissemination implementation of P2 in different section of the local community
- total quality management on environment
- the art of motivating
- systematic evaluation/auditing to improve pollution prevention in industry
- to anticipate what would motivate the participation of members of P2 team
- ways of convincing top management to implement the project
- to communicate to president and board members about pollution problem
- communication skills - to communicate from the management down to the lowest-level operator
- how to save time and materials in production

Training Implementation

Training programs for individual companies should follow a schedule that builds top management support, identifies opportunities, and provides the middle managers with the skills needed to implement cleaner production. The following schedule is recommended for implementing a cleaner production training program in a corporation:

Top Executive Seminar: The president/owner and the senior managers of all departments are trained in the motivation and philosophy of cleaner production, and their role in supporting improvements. Discussion elements include the many types of cleaner production strategy and their theoretical underpinnings, such as life cycle analysis and total cost account, and the potential contributions of each business function manager. Specific coverage is given to ISO 14000 and the importance of an environmental management system for long-term industrial environmental sustainability.

Walk-Through Assessment: Plant managers are trained in an actual walk-through of the plant how to conduct a production-flow assessment to identify cost-effective cleaner production opportunities. The walk-through identifies areas for potential improvement that can be used as examples in the next training session.

Clean Production Analysis and Implementation: Plant managers and engineers are trained to understand how all the elements of cleaner production fit together, how to analyze a production process using TQM tools, strategies for implementing a CP program, and cleaner production information resources.

Financial Analysis of Clean Production Options: Financial managers and production engineers are trained how to work together to create a baseline of current environmental and pollution costs, allocate costs to responsible processes, and develop cash flow models to forecast cost differentials between current and alternative cleaner production processes.

Top Management Review: The training process will usually itself identify a number of potential areas of improvement for the company. The top management needs to be debriefed on these areas and given more training in strategies to ensure that cost-effective

solutions are in fact implemented in a reasonable time frame. Recommendations should be given in within an Environmental Management System framework that enables the implementation process to prepare the company for ISO 14001 certification.

Successful training is an evolutionary process both for the trainer and the trainee. EIP found it was necessary to have an increasing focus on top management. Without top management support, technical training usually cannot be implemented by participants. When top executives understand the basic strategies of cleaner production, and provide the right management system for their employees, technical training is sometimes unnecessary because the employees find the low-cost and no-cost solutions on their own.