

PROYECTO ADMINISTRACIÓN AMBIENTAL MONTERREY (PAAM)

Final Report

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FINAL REPORT¹

From March 2001 through April 2002 the Lexington Group provided support to a group of small and mid-sized enterprises (SMEs) in the Monterrey, Nuevo Leon under a contract to the Instituto Protection Ambiental (IPA). Large companies in the Monterrey region sponsored the program Proyecto Administración Ambiental Monterrey (PAAM). In addition to support provided by the large companies, the program received financial support from the Multilateral Investment Fund (MIF) of the Inter American Development Bank (IADB).

PROJECT DESCRIPTION

PAAM was a supply chain environmental management project targeting small business suppliers to large Mexican companies in Monterrey. Its primary objective was to train the SMEs in the use and application of a modified environmental management system (EMS) based on the ISO 14001 model. Nineteen SMEs were invited by their large company customers to participate without cost in group EMS training. A team of local consultants trained by The Lexington Group provided EMS implementation support to the SMEs during the year-long project. The project differed from traditional ISO 14001 EMS training and implementation projects in three important respects.

1. Certification to ISO 14001 was not necessarily an objective of the project. It was, however, an objective that SMEs that participated in the project would be well positioned to obtain certification.
2. The training program included elements that are not traditionally considered part of an EMS. In particular, the training included sessions on process mapping, materials accounting and root cause analysis that are generally considered part of a Cleaner Production (CP) process, not an EMS. *It was a fundamental premise of the project that it is essential to integrate EMS and CP processes.*
3. The training was spread out over a 12-month period and included implementation support provided by IPA in contrast to traditional ISO 14001 implementation or audit training program that is provided in a single 4 or 5-day course.

The Lexington Group provided the SMEs group EMS training on a “just-in-time” basis. This support was supplemented by implementation support provided by a group of consultants working directly for IPA. The training program consisted of:

- Intensive consultant training (August 27-30, 2002)--a four day intensive course for the senior and junior consultants covering the essentials of EMSs and CP.

¹ This report was prepared by The Lexington Group in fulfillment of the requirements of contract #ATN/MH-6742-ME between Instituto Protección Ambiental and The Lexington Group.

- EMS Planning (September 10-12, 2001)-- a three day session providing an overview of core EMS concepts and a detailed investigation of (1) techniques for identifying significant environmental aspects (SEAs) including process mapping and materials accounting, (2) methods to establish priorities among SEAs, (3) considerations in establishing an environmental policy and objective and targets.²
- Implementation (November 11-15, 2001)-- the EMS implementation process, including: use of root cause analysis to identify the root causes of actual or potential environmental impacts, identification of key positions and responsibilities, development of work instructions, documentation and emergency response procedures.
- Objectives and targets and performance measurement (January 28-31, 2002)- establishment of objectives and targets, environmental performance indicators, corrective and preventive action, record keeping.
- Internal Auditing (April 22-25, 2002)--a 2 day course on internal auditing followed by day practice audits at selected SMEs.

These SME group training sessions were spaced about 8-10 weeks apart. In the period between the sessions the Monterrey-based consultants provided support to the SME s implementing the materials conveyed in the Lexington Group s previous training session. In addition, prior to each training session the Lexington Group conducted a review of the process attained by the SME s carrying out the tasks assigned at previous training sessions.

PROGRAM OBJECTIVES

Overall, the PAAM project had five objectives. These objectives reflect the learning and capacity building nature of the project:

1. To test certain improvements in the EMS implementation model made on the basis of earlier experience.
2. To determine whether EMSs are a useful tool to improve SME environmental performance,
3. To create capacity in Monterrey and within IPA specifically to further promote the application of EMSs among SMEs.

²Note: in contrast to the structure of ISO14001 and normal practice where objectives and targets are set in the initial "Planning" step, objective and targets were not set until the final "Measurement and Review" session. The reason for this change is that in the past we have found that SMEs often become aware of improvement opportunities during the implementation phase and we have found it useful to encourage them to account for these improvement opportunities in the implementation phase. Setting final objectives and target in the final step allows the SMEs to account for their learning in the implementation process as they set objectives and targets.

4. To improve the environmental performance of the 19 SME s participating in the project.
5. To learn more about the issues faced by SME s in implementing EMS and to further improve the training, implementation support model.

The results of the program in each of these four areas are described below:

1. To test certain improvements in the EMS implementation model made on the basis of earlier experience.

In a previous project in Guadalajara, Jalisco, also conducted by The Lexington Group, EMS s had been identified as a potentially very important means for addressing SME environmental issues.³ Among the key project findings were:

- ***EMSs “work” for SMEs.*** SMEs participating in the Guadalajara project had been able to implement an EMS and in many cases EMS implementation had led to substantial improvements in both economic and environmental performance.
- ***The ISO14001 model is an effective model.*** Even very small firms participating in the Guadalajara project had been able to use the ISO14001 EMS model with few of the difficulties that skeptics had predicted.
- ***On-going implementation support is crucial.*** Unlike conventional CP projects that identify specific process improvements, EMS projects focus on improving the organization’s internal management methods. While this approach can result in fundamental, long-lasting cultural changes, the process can appear excessively burdensome and its rewards too distant to organizations undergoing the implementation process. Support is needed to help SMEs get through this implementation process. Often, SMEs are also shorthanded; having an “extra set of hands” enables the organization while continuing its day-to-day operations. It is important to emphasize, however, that the consultants can help but they cannot take over implementation. It is important for the staff of the organization to learn the requirements of an EMS by actually putting them in place.

As a result of the Guadalajara project, the following changes were made in the design of PAAM:

- Consultant support was designed into the project at the outset and provision was made to set up a reporting and support structure for the consultants.
- Implementation support consultants, whose quality had been at best uneven, were provided an initial intensive training program.

³The World Bank, Project Guadalajara

- CP elements such as process mapping, root cause analysis and process improvement were emphasized. These elements tend to result in tangible, near-term benefits that encourage participation through the implementation process until the longer-term benefits of an EMS become apparent.

In general, the changes described above were successful. The consultant support in PAAM was substantially more effective than that in Guadalajara. The key reason of this success was recruiting. IPA selected consultants with a better understanding than was the case in Guadalajara of the characteristics that would contribute most effectively to the success of the project. IPA was less concerned with the academic credentials of the participants (the majority of the consultants in Guadalajara had been university faculty with advanced degrees) and paid greater attention to the candidate's knowledge of and interest in industrial environmental management. While the Monterrey consultants were younger and less experienced than their Guadalajara counterparts, as a rule they made up for this inexperience by their greater industrial knowledge and their enthusiasm and willingness to learn. This is an important lesson learned.

The training course given at the beginning of the project performed two important functions. First, it provided the consultants a firm grounding in EMS concepts before they entered the project. In Guadalajara a strong objection on the part of the industry participants had been that the consultants were, "learning alongside us." There was no evidence that the consultants in Guadalajara (with a few exceptions) had more knowledge of EMSs than their industry counterparts, and in the majority of cases academically - trained consultants had little industrial experience. Second, the initial training provided an opportunity for the consultants to become acquainted among themselves established their own internal organization. This informal element in fact turned out to be extremely important.⁴

The introduction of CP elements in the second session proved very beneficial. It enabled participants to see tangible benefits from their participation in the project and maintained their interest through subsequent drier sessions. As will be discussed below under project findings, however, there exists a need to balance the "action" elements of an EMS which result in near-term environmental improvements and the "systems" elements that promote cultural change, consistent procedures and long-term improvement. An excessive focus on action results in a poorly documented, informal system that is unlikely to remain in place after the initial period of enthusiasm. An excessive focus on systems elements can result in a system that is thoroughly documented but does not yield significant environmental improvements.

The case study and interactive workgroup sessions proved extremely useful. They were used in all training sessions and, as anticipated, provided an opportunity for participants to work "hands on." Participants commented very positively on the case study and group project sessions in the program. They felt they learned more from these sessions and they retained the material better. In addition, from the instructor's perspective, it was possible to use participation in group projects and case study discussions to monitor whether participants had fully understood the

⁴ Another important element was the fact that the consultants all worked for the same organization rather than working for rival organizations.

topics conveyed in lecture sessions. Interestingly, because participants were grouped in subgroups, working together also provided much greater interaction among participants than had been the case in Guadalajara. In numerous cases the participating SME, established business relationships that have been maintained outside of the project.

Because of the success of the case study and group project sessions, we suggest that the course could benefit from additional case studies. These case studies should target concepts that emerged as important in Monterrey: the balance between documentation and action; the need for on-going senior management support; how to sustain an EMS during an economic downturn; using an EMS to identify or create new business opportunities.

2. ***To determine whether EMSs are a useful tool to improve SME environmental performance,***

As in the case of the Guadalajara project and a similar project also funded by the IADB/MIF in Lima, Peru, we found that EMSs are an extremely powerful tool to improve SME environmental performance. The usefulness of EMSs for SMEs relates to three principal factors:

- ***EMSs tie into existing customer requirements.*** Major corporations in many sectors, most notably the automotive and electronics industries but others as well, have established environmental requirements for suppliers. In the case of major automotive industry companies (e.g. Ford and General Motors) these requirements are explicitly linked to ISO 14001. In other cases ISO 14001 or EMSs based on ISO 14001 are familiar to customer purchasing departments because of their similarity to ISO 9001. Having an EMS based on the ISO 14001 model provides a significant advantage to SMEs in their relationships with their important customers. The “business case” for an EMS is, therefore, apparent to senior management. Numerous of the SMEs that participated in the projects indicated to us that customers in addition to their sponsors in the project had commented favorably on their participation in the project. At least two pointed to specific new customer acquired by participating in the project.
- ***EMSs tie into existing or desired business process models in SMEs.*** In the Monterrey region, perhaps more than in other regions of Latin America, the concept of structured management systems that yield consistent reliable results is well established. Many SMEs have ISO 9001 systems in place; those that do not have ISO 9001 recognize the need to put such systems in place. Consequently, “systems thinking” is well recognized as valuable, even if it is not followed in practice in all cases. Because ISO 14001 is in most respects a less cumbersome standard to put in place than ISO 9001, it can serve as an initial step in the application of systems thinking to management issues. At least one firm in the project extended the systems elements learned in implementing an EMS to other aspects of its operations. About one third of the companies in the project already had or were working on ISO 9001. This experience clearly helped them in some respects, but as discussed below, it was also a hindrance.

- ***EMSs focus on management practices solutions that are within the capabilities of SMEs.*** As will be discussed below, the vast majority of the “root causes” of significant environmental aspects identified by firms participating in the project involved improvements in management practices: improved maintenance, improved procedures, better training. Relatively few of the solutions identified required significant capital expenditures. Since capital is relatively costly and labor is relatively inexpensive in Mexico, and all of Latin America for that matter, the solutions identified by the EMSs were feasible to implement. Unquestionably, environmentally more preferable solutions could have been identified, but they would have been difficult to implement given the financial constraints that Latin American SMEs operate under. In this sense, the EMSs as implemented in PAAM took an incremental approach that avoided making “the best the enemy of the good.”
- ***EMSs are accessible to SMEs.*** As has been demonstrated in various other projects, including those in Guadalajara and Lima, Peru, EMSs are well within the capabilities of SMEs. In general, they are more easily implemented by SMEs whose operations are much simpler than those at larger firms. Many of the training, communications and documentation issues that are most onerous for larger firms are much simpler for SMEs. While not all the SMEs developed EMSs that would meet ISO 14001 certification requirements, virtually all could develop a certifiable system if needed.
- ***The Mexican government’s attitude toward EMSs has changed, providing greater recognition for firms that put in place EMSs.*** Under the previous administration the government’s attitude toward EMSs could at best be considered lukewarm. ISO 14001 was seen as a rival to the government’s “Industria Limpia” program. The current administration is much more receptive to EMS approaches and is developing programs of “Cumplimiento Ambiental” and “Excelencia Ambiental” that are explicitly based on EMS principles. As a result firms implementing EMSs in programs similar to PAAM could receive official recognition from the Mexican authorities.

3. *To create capacity in Monterrey and within IPA specifically to further promote the application of EMSs among SMEs.*

A fundamental program objective was that the program should be “sustainable,” that is to say that the program should build the internal capacity in IPA to maintain the program after the completion of the initial phase supported by IADB/MIF. The project trained 44 industry participants (excluding the large company participants) 5 consultants and 7 junior consultants. These individuals have both classroom training and extensive implementation experience. Seven of these consultants and junior consultants remain with IPA and provide an internal capability to carry on the program. The consultants now have sufficient knowledge to provide training and the junior consultants could easily move up to the role of consultants. In addition, one consultant and several junior consultants have taken other jobs after passing through the training program. In at least one case the new job has related directly to the experience gained from participating in the

project. Although IPA was not a direct beneficiary of the training received by these individuals, the fact that they received training increases the overall capacity available in Monterrey to provide EMS training. Based on past experience, we also suggest that the 44 individuals from companies that participated in the projects will continue to utilize their skills either in their current firms or in other firms requiring or providing similar services.

4. *To improve the environmental performance of the 19 SMEs participating in the project.*

The results in improving the environmental performance of the participating companies are somewhat mixed. The Lexington Group's responsibility in the project did not involve tracking the performance of the plants participating and we do not have sufficient data to make definitive statements concerning whether the participating companies improved their performance. Nevertheless, we can make the following observations. One year after the project started up, of the 19 companies that entered the project,

- at least 7 SMEs have well developed EMSs and have attained substantial performance improvements. Three of these are close to obtaining ISO 14001 certification, and the remainder realized some of the key benefits of implementing an EMS. Case studies of four of these SMEs are contained in Appendix A
- implementation was delayed at 6 SMEs, but most of these have said they intend to begin work again. The reasons given for the delays reflect the difficult condition of much of the Monterrey economy:
 - " three indicated that economic necessity had required them to suspend implementation, one of these has the system fully documented but decided to delay implementation until its economic condition improved,
 - " two indicated that significant staff changes, including the departure of the EMS coordinator had required them to delay implementation
 - " one said it would be submitting a letter saying why it had been delayed
- two SMEs have suspended work on the EMS to focus greater effort on ISO 9001. In both cases the company was already certified to ISO 9001 and needed to change its ISO 9001 system from the 1996 to the 2000 version of the standard. One of these companies also indicated it had suspended effort on its EMS for economic reasons
- one company has gone out of business
- three have provided no information to date.

The past year has been a particularly difficult one for small companies in Monterrey. Many are suppliers to large companies that have been hard hit by a combination of macroeconomic factors. First, the downturn of the world economy has decreased demand for their customer's products and subsequently for their products. Second, the entry of China into the World Trade Organization has introduced a new player with a very low cost structure into the economy. In the past companies in northern Mexico and the border region have competed successfully in markets

in the U.S. and other OECD countries by supplying products that are built with a low cost structure but meet demanding quality standards (this fact is reflected in the prevalence of ISO 9001 among SMEs in Monterrey). With recent quality improvements, Chinese companies often can equal the Mexican companies in terms of quality. But they invariably beat Mexican manufacturers on price. China's entry into the WTO, moreover, means that it has greatly increased access to precisely those markets that many of the large company customers of the SMEs have been targeting. Declining markets for large companies have in turn meant even more steeply declining markets for their SME suppliers.

The ISO 9001/2000 standard also has had an interesting effect on EMSs. In addition to the two companies that specifically said they were delaying EMS implementation until they could update their systems to the ISO 9001/2000 standard, several others mentioned that they were delaying their EMS implementation until they could figure out what to do about ISO 9001.

5. ***To learn more about the issues faced by SMEs in implementing EMS and to further improve the training, implementation support model.***

Lastly, PAAM provided important information that should contribute to the state of the art in SME EMS implementation. The following are some of the key lessons learned:

- ***Senior management support is essential.*** It is a too often-repeated truism that the support of the senior management/owner support. In some cases, we have argued that the need for senior management support is overstated: there can be an excess reliance on senior management support and a tendency for lower level staff to believe, incorrectly, that without senior management's backing they are powerless. Nevertheless, there is also a great deal of truth in the statement that a key contributor to the success of EMS implementation is the involvement of senior management.

In conditions of an economic downturn, we found another reason for the importance of senior management involvement that we had not seen to the same extent in previous projects: when projects are cut back during an economic downturn those that the senior manager personally supports tend to be "protected." In almost all cases, the firms that maintained their EMS projects despite the economic downturn were those where the senior manager had taken a personal role in the EMS; in those cases where the senior manager was not personally involved, EMS implementation was suspended "until economic conditions improve."

- ***Worker involvement can be highly beneficial.*** Attitudes toward workers were strikingly different among the SMEs. Two examples: at one of the review sessions the quality manager of one of the firms complained of absenteeism, turnover and "Monday morning sickness" on the part of the workforce. When asked if any of the workers had participated in the development of work instructions, he responded that the workers were "too uneducated and too unreliable." This firm encountered major workforce problems and was one of the firms that effectively dropped out of the project. At another company (Tintas y Quimicos, one of the case study companies in Appendix A), the owner showed us a career development plan for workers. He

introduced us to a key employee in the quality control laboratory who had entered the company as a low-level employee without an elementary school education. The company had provided him courses and over time he had progressed through various jobs until he was in the most demanding staff position in the company. Turnover in this company is extremely low (most employees have been with the company for 8-10 years). As a result, training costs are low and worker skills are very high.

By involving its workers, the company developed a number of ingenious solutions to address its significant environmental aspects. Employees had been directly involved in identifying the significant environmental aspects (many of which related directly to work conditions), developing the solutions and designing work instructions. Not surprisingly, this company, despite the economic downturn has maintained its key supplier status in Mexico.

- ***Balancing action and procedures is important.*** Possibly because many of the participating companies already had ISO 9001 certification, in Monterrey we encountered an issue that we had not encountered in previous EMS implementation projects: the need to balance actions and procedures. The need for this balance is apparent in the contrast between the comments of two companies. The owner of one, Servicio de Reciclado Textil (Sertex) - a case study company in Appendix A - characterized his attitude as *Hay que hacerlo, ya* (We must do it, now); the management representative of another that had developed very comprehensive procedures responded to the question, “Have you seen any improvements in your performance as a result of putting in place your EMS?” by saying, “We have focused on developing the procedures, we have not yet started operating the system.”

This contrast illustrates a tension we observed throughout the project between the companies that had an ISO 9001 or equivalent quality management system and those that did not. The firms that already had ISO 9001, tended to focus on the procedural and systems aspects of the EMS: they developed detailed procedures and work instructions and thoroughly documented their activities. But in the early stages of the project they did not take actions to address their significant environmental aspects. By contrast, the firms that did not have ISO 9001 tended to emphasize the identification of significant aspects, the root cause analysis and the development of programs to address their significant aspects. They tended to implement programs that resulted in immediate environmental improvement.

In reality, both action and procedure are important. The basis of EMSs, and to some extent the factor that differentiates them from CP, is their focus on the firm's management system. By affecting the management system and through senior management involvement, employee awareness development, and training EMSs are intended to affect the underlying culture of the organization. In Monterrey, as in Guadalajara, we also identified employee turnover as a reality that EMSs help companies address: employee turnover is a fact of life that can seriously affect a firm

when a key employee departs with his or her institutional memory. Well-documented procedures can assist firms in establishing a smooth transition in the event of personnel turnover.

On the other hand, we also observed in numerous cases that a single-minded focus on procedures retards action. With one exception, none of the companies that made significant environmental progress had an existing ISO 9001 system prior to entering the project. This fact appears to be more than coincidental. Firms that have a strong systems orientation tend to want to get all the details of their procedures right before implementing changes. The problem, we found in several cases, was that this approach made the system time-consuming and onerous, but it did not necessarily result in near-term improvements. Without a near-term demonstration of the usefulness of the EMS, senior management frequently decided to delay EMS implementation when the firm encountered economic difficulties or when it became necessary to update their ISO 9001 system to the 2000 version. While we do not suggest the above as a statistically supported project finding, we do suggest it as a cautionary note and something that future projects should anticipate.

- ***“Technology Innovation” can take many forms.*** The project was perhaps most interesting in terms of the solutions to significant environmental aspects that the participants identified. As shown in Figure 1, over 70 percent of the root causes of significant environmental aspects were identified as having to do with the absence of adequate procedures, inadequate worker training and inadequate maintenance. Only six percent of the root causes related to a lack of capital equipment. The solutions, therefore, tended to emphasize labor (which is relatively cheap in Monterrey) over capital (which is expensive).

Moreover, when the companies implemented equipment solutions, they did not use so-called “environmental technologies” imported from the United States and Europe. Rather, they displayed a great deal of ingenuity either designing piece of equipment to address particular problems or adapting imported equipment to meet their needs. The case studies of Tintas y Quimicos and Sertex in Appendix A contain several examples of this type of homegrown equipment design and development and of adaptation of foreign equipment.

In several cases the firms went outside their “fence lines” to solve problems caused by their customers. Ecoquim, a waste treatment and disposal firm, for example, found that inadequate customer identification and storage of waste materials caused serious inventory space problems and environmental risks at the plant (see the Ecoquim case study in Appendix A). To solve this problem they worked with their customers to improve the labeling and condition of waste drums that were picked up by Ecoquim. As part of this process they extended the service that they provide to their customers and established long-term customer relationships.

Finally, the companies changed their business processes to address environmental

problems. Quimicos y Papeles, Ecoquim and Tintas y Quimicos for example all changed their inventory management processes to reduce the environmental risks inherent in maintaining large volumes of potentially environmentally damaging materials on-site. A related benefit of these actions in all three companies was that inventory management and working capital costs declined.

THE FUTURE

In the past decade industry in northern Mexico has developed an effective business model to address the opportunities created by NAFTA. Focusing on quality management and cost control, it has taken advantage of a large pool of low cost skilled and semi-skilled labor and its proximity to the U.S. market to provide high quality, low cost products to that market. This business model has been undermined by the recent economic downturn in the United States and the saturation of developed country markets, and threatened by the entry of China into the WTO. The SMEs that supply the large manufacturing enterprises in Mexico are being dragged down by the difficult economic conditions facing their large customers. (About --% of small firms in and --% of mid-sized firms in Mexico depend on large firms for at least 25% of their revenues and --% and --% of small and large firms respectively depend on large firms for at least 75% of their revenues).

Like their large counterparts, SMEs are facing a need to reinvent themselves if they are to thrive in a global economy. The firms that thrive will be those that are able to innovate in business concepts and technology, developing products that remain competitive in international markets or reducing their dependence on international markets. We saw examples in PAAM of firms that will continue to thrive because they are innovative and aggressive, but we also saw examples of firms that were ill prepared to adapt to a rapidly changing market despite well-developed quality systems. In these circumstances, while it is important to provide firms with EMS training, it may be more important to provide them training in the basic business skills they will need to survive in a much more complex economy.

One area that shows particular promise is the so-called "base of the pyramid." An article in the September 2002 issue of *Harvard Business Review* by C.K. Prahalad and Allen Hammond suggests that the largest and the most rapidly growing market in the world is the "base of the pyramid," the 4 billion or so people with annual incomes of less than \$2000. Prahalad and Hammond as well as others such as Stuart Hart and Clayton Christensen suggest that the very poor are served by high cost, low quality, high environmental footprint products and services. Companies that can develop low cost, high quality, low footprint products will find a "fortune at the base of the pyramid." ⁵ To address the opportunities in the "base of the pyramid," however, multinational corporations will have to alter their existing business models, products and services radically. They will have to: develop simple, robust, low cost products; understand the needs of the very poor and the markets where they shop and develop new profit models and marketing and distribution channels.

To a great extent the multinational companies' challenge is the SMEs opportunity. Unlike the

⁵ See for example C.K. Prahalad and Allen Hammond, "Serving the World's Poor, Profitably," *Harvard Business Review*, September 2002 and Stuart Hart and C.K. Prahalad, "The Fortune at the Bottom of the Pyramid," *Corporate Strategy*, *****

multinationals, SMEs understand and live in base of the pyramid markets and have direct access to these markets. They have, as several firms in PAAM demonstrated, the capacity to adapt and simplify products and processes. They can develop products and services to serve these markets on their own or they can link up with large domestic firms or with some of the international firms that are addressing base of the pyramid opportunities. The SMEs positioning in the value chain will change. Whereas in the traditional model SMEs have been suppliers of ancillary inputs or services in the operational stages of the supply chain, in the base of the pyramid model they will act in the customer interface because they will have the knowledge of how the market works.

Appendix A

Case Studies

QUIMICOS Y PAPELES DEL NORTE:

Developing Management Control Systems and Improving Customer Relations

Quimicos y Papeles del Norte is a 90-employee company specializing in the formulation, sale and distribution of industrial cleaning materials (detergents, disinfectants) and the sale and distribution of cleaning and restroom supplies (paper towels, toilet paper, dispensers, brooms, commercial cleaning products, cleaning rags etc.). A sister company that did not participate in the project provides cleaning services to some of Quimicos y Papeles' clients using Q&P products. Both companies are suppliers to large industrial clients and frequently to government clients, for example, Pemex, the Treasury Department (Hacienda) and the Mexican Social Security Institute. We spoke with Ing. Aberto Ramirez Perez, head of production and Ing. Abelardo Cabriaes Fuente, head of sales.

Q&P identified three significant environmental aspects:

1. Excess waste rinse water resulting from process interruptions during product changeovers.
2. Waste cardboard boxes and product supplies caused by frequent collapses of cardboard boxes containing bottles of liquid cleaning materials. The collapse of stacks of these boxes often resulted in wasted product and worker risk.
3. Evaporative and fugitive emissions of hypochlorite used in formulating cleaning products resulting in unpleasant odors and worker and neighbor complaints.

The implementation committee consisted of the managers of Q&P's five main areas and the management representative. Ing. Ramirez described the following root causes and corrective and preventive actions significant environmental aspects identified by the implementation committee:

1. Rinse water waste. Root cause: very short production runs of incompatible products requiring equipment rinsing between products. Limited storage and production capacity means longer runs are frequently interrupted by the need to fill emergency customer orders. Corrective action: systematic production programming to eliminate product changeovers, increased product storage capacity. Results: more efficient utilization of production and storage space, water savings, reduced product waste, improved labor utilization.
2. Waste cardboard and finished products. Root cause: excessively high stacks of boxes containing bottles of finished products. Corrective action: allocation of increased storage space and improved production programming so boxes never have to be stacked more than four high. Results: reduced cardboard and product waste, reduced trash pick up (from two times per week to one time per week), reduced worker risk.
3. Hypochlorite emissions. Root Cause: uncovered hypochlorite containers not

properly monitored or controlled. Corrective action: installation of large valve-controlled, covered hypochlorite tanks that eliminate evaporative emissions. Results: greatly reduced materials handling, evaporative emissions virtually eliminated, more effective monitoring of hypochlorite levels (improving materials handling and logistics).

In addition to the environmental and cost reduction benefits noted above Q&P also attained substantial customer relations benefits by putting in place an EMS. Ing. Cabriales Fuentes noted that key customer purchasing agents had commented favorably on their EMS and they could attribute about Mex\$ 600 thousand of sales to the fact that they had an EMS in place (they were able to compete successfully for contracts that were previously not open to them because they did not have an adequate environmental program). In addition, they have begun to apply environmental criteria in their product selection (biodegradability, less damaging chemicals). Their environmental knowledge and sensitivity has also appealed to more environmentally aware customers.

Lastly, Q&P's more formal, systematic management procedures, introduced originally to improve its environmental performance, led to a review of its management processes and carried over to other aspects of its operations. Improved production programming, designed to reduce environmental waste, has reduced cycle time (the between a customer's initial order and the delivery of the product to customers) and working capital requirements and improved customer satisfaction. Most importantly, Q&P reorganized its inventory management system to reflect EMS systematic management principles (a very important aspect of the operations of a firm most of whose revenues come from sales and distribution). It improved inventory storage by building additional storage racks that greatly utilize floor space more effectively; it improved security by policing high-value products, removing inventory to a secure areas reducing loss through theft and processing; it improved inventory controls, enhancing inventory utilization and reducing working capital needs and it improved the cleanliness and orderliness of its storage areas, reducing accidents and spills. These benefits, though not directly related to the EMS, came about because in putting an EMS in place, Q&P recognized that the same approach could improve the effectiveness of other aspects of its operations.

Was it worth the effort? Q&P personnel respond emphatically that it was worth the effort. EMS implementation required 2 to 3 hours per week of effort on the part of each of the five members of the implementation committee and relatively minor equipment investment hypochlorite tanks and storage racks. Most of the improvement came from improved procedures and improved management and worker awareness and training. As in other cases of successful EMS implementation, strong senior management support was essential. In return Q&P has obtained more efficient operations, reduced waste, a more attractive, orderly work place. Perhaps most importantly, Q&P improved its image with customers who consider environmentally sound products and services delivered by environmentally conscious suppliers increasingly important.

Q&P recognizes that while it has accomplished a great deal, it also has very far to go. With the exception of the internal system audit, it has completed all the EMS elements. Nevertheless, its information concerning performance improvements is still primarily qualitative and its system is not fully documented. It has, however, made an impressive start and it is well

on the road to obtaining certification for Environmental Excellence and it has established a strong basis for ISO14001 certification if it chooses to take that step.

ECOQUIM SA DE CV:

Using an EMS to address customer requirements.

Ecoquim is a 95-employee company specializing in the collection, transport, treatment and disposal of industrial solid and hazardous wastes. It operates its own solvent recovery system which it uses to recycle customer's solvents and an oil-water separation facility used to prepare water-contaminated industrial oils for thermal destruction. It also collects industrial solid and hazardous wastes and transports these wastes to appropriate disposal facilities. Its customers include many of the largest national and multinational companies operating in the Monterrey area. We spoke with Ing. Rogelio Villanueva Longoria, chief of quality assurance.

When Ecoquim was asked by Zinc Nacional to participate in the PAAM project according to Ing. Villanueva, the management representative, the decision to participate was immediate. Company management regarded participation in PAAM as a means to consolidate its position in a market where reliable environmental performance is a key consideration in the minds of existing and potential clients. According to Villanueva 75 percent sales, particularly to large companies, require evidence of a strong environmental management program (though not necessarily an EMS). In particular, customers are very insistent on the existence of an effective emergency and preparedness and response. Since their participation in PAAM, Ecoquim welcomes customer inspections and their EMS has been a key factor in their recent rapid growth. Interestingly, two companies that participated in PAAM have approached Ecoquim as a potential supplier.

The implementation committee involves the heads of each of the five operating areas (laboratory, solvent recovery, solids disposal, oil/water, administration, and sales). The director general regards the EMS as a key initiative and participates actively in all the implementation committee meetings (he also participated personally in the PAAM training sessions).

Each of the members of the implementation committee put in about four hours per week in the design and development of EMS over a six-month period from September 2001 to February 2002. Since February, the company has been actively engaged in deploying an awareness program (initially provided to supervisors and subsequently to all workers) and it is developing a competency program to be delivered by the heads of each area to the employees occupying key positions under their supervision.⁶

A central issue has been how to motivate workers, who generally have a very little education, in the EMS. This has been accomplished by actively seeking input from the workers, working closely with the union and focusing strongly on issues of concern to workers - - safety and working conditions.

Currently, the program is 90 percent implemented (September 2002). The policy is in place and disseminated; significant environmental aspects have been identified and their root

⁶A "key position" is defined as one that does or may affect a significant environmental aspect.

causes have been defined; responsibilities, procedures, documentation and records have been established; performance is monitored relative to operational and management indicators and several management reviews have been conducted. The only missing element is an internal audit that will be conducted in October 2002. Eventually, Ecoquim hopes to have its program certified to ISO14001 and to participate in Mexico's "Environmental Excellence" program.

The implementation committed identified four categories of significant environmental aspects:

1. accidents and incidents involving worker safety
2. spills and leaks
3. regulatory compliance and
4. hazardous material storage

Ecoquim uses highly visibly displayed performance indicators to track each of these categories. In addition, the company tracks absenteeism as an indicator of employee morale. In all cases it has seen very substantial reductions. For example, prior to establishing the program the company had three or four injuries per month. Since the program was fully implemented, it has gone three months with no injuries.

A particularly important program with significant environmental and business implications is Ecoquim's program to reduce on-site storage of hazardous materials. When Ecoquim entered PAAM a key problem was that its hazardous materials storage area that contains materials awaiting identification, treatment and/or disposal was filled to capacity and posed a continuing risk of accidental releases. In particular, the large inventory of hazardous materials, often in inadequate containers, created a significant risk of an environmental incident. In addition, it created a significant cash flow problem because the company could not bill its customers until it could demonstrate that materials received had been adequately treated and/or disposed.

A root cause analysis of the excess storage problem indicated that the root cause problem was inadequate identification and/or containerization by customers. In both cases materials had to be held in storage awaiting identification and proper containerization.

To address the issue, Ecoquim developed a customer feedbacks form to be completed by drivers on picking up a shipment from customers. The form was described as a "mini audit" of the shipment, checking for proper labeling and containerization. This form is then provided to client account representatives who discuss it with customers who are billed for additional costs incurred identifying and containerizing materials.

The program has been both environmentally and economically successful. Environmentally, it has improved the condition of materials when they are picked up from customers, reducing the risks of spills and leaks during transport and storage as well as reducing the time materials spend in storage and, consequently, the amount of hazardous material storage space required. Economically, it has enabled Ecoquim to document instances of inadequate containerization and labeling and to bill customers for its services. It has also improved throughput, put enabling Ecoquim to bill customers for disposal sooner improving cash flow.

Ecoquim, however, has not quantified these economic benefits.

Overall, Ecoquim believe it gained substantial benefits from participating in PAAM. Most of the improvements obtained were improved through changes in procedures or worker training (in some cases provided by equipment suppliers with no cost to Ecoquim). Total cash costs for lightening rods (to reduce the risk of an explosion in a lightening storm given the presence of flammable and explosive materials), for vapor detectors and for personal safety equipment were minor. The total labor hour's investment to date has been about 1000 hours but this investment is heavily weighted toward senior staff. In return Ecoquim has greatly improved its image with customers, improved its environmental performance and work force morale and improved its business performance.

SERTEX:

Using an EMS to promote innovation in business concepts and process design.

Sertex is a commercial and industrial laundry owned by its Director General, Ing. Gerardo A. De Hoyos de Luna. At one time it had 46 employees, but with the decline in its main market in the metal working industry, Sertex has declined to half that number of employees. It is now entering new markets in the electronics and auto industry. Most recently, it has set up a “clean room” where uniforms for workers working in dust free operations at automotive plants are cleaned in a dust free environment.

Ing. De Hoyos established the Monterrey plant explicitly as a pilot operation to test both market concepts and technologies. For this reason new processes and concepts are constantly being tested. In many respects, participation in PAAM allowed Sertex to experiment technologies adapted to reduce the environmental impacts of industrial laundry operations.

Since its founding, Sertex, Ing. De Hoyos has sought standardize quality and reduce environmental and worker risk as a means to develop a competitive business model. When he was first interested in converting Sertex, then a small commercial laundry, into an industrial laundry, Ing. De Hoyos reached an agreement with facility neighbors who were concerned about the impact on the community of increased noise, emissions and risks associated with a large-scale industrial laundry operation. In converting to an industrial-scale operation he would reduce the total impacts of Sertex’s operations. He accomplished this by streamlining his operations from 23 machines to 4 more modern machines and concentrating on “the efficient part of the operation.” In the process, he also gained the confidence of the authorities.

Participation in PAAM was a further part of Sertex’s campaign to develop more efficient, environmentally sound business and operating processes. Nevertheless, participation in PAAM has been difficult because it has coincided with a decreased demand from key clients, particularly in the metal working industry, following a downturn in the Mexican economy. Despite these obstacles, PAAM has provided the occasion to “throw ourselves in” with limited resources. In the longer run, Ing. De Hoyos expects to gain a competitive advantage from: 1) Sertex’s focus on high technology and clean room operations for the automotive and microelectronics industry and 2) Sertex’s environmental performance which he expects will give him a positive image with authorities, neighbors and customers.

Sertex identified three “significant environmental aspects” in the development of its EMS:

1. use of R22, an ozone depleting substance in its solvent (perchloroethylene) recovery operations
2. high emissions of perchloroethylene in its dry cleaning operations
3. use of asbestos gaskets in its boilers

The significant environmental aspects identification process and the root cause analysis

conducted following the identification of significant environmental aspects triggered intensive efforts to mitigate significant environmental aspects. Ing De Hoyos described his impatience to get started as “Hay que hacerlo, ya.” (“We must do it now”).

Perchloroethylene recovery and elimination of R22 are closely related. R22 is used in a refrigeration process that rapidly cools perchloroethylene to convert as much as of it as possible to a liquid form, reducing gaseous emissions. Therefore, Sertex revamped the cooling system both to eliminate the use of R22 and to improve perchloroethylene recovery. The revamped cooling system permits the use of a non-ozone depleting coolant, “407” and easier servicing (In the past the difficulty of accessing key parts of the cooling system resulted in the loss of most of the R22 in servicing). The new system, which Sertex designed, allows modular replacement of refrigerant canisters, virtually eliminating refrigerant losses during servicing. This is an important consideration because 407 is more than 100 times more expensive than R22. As Ing. De Hoyos described it, the new system was an important investment that will have long-term benefits in terms of reduced costs and an improved image.

During the EMS implementation process, Sertex became aware that the asbestos gaskets used in its boiler systems posed a significant worker safety risk and an environmental program. These gaskets tended to deteriorate rapidly over time, becoming friable (the form of asbestos that is most damaging to health) and require periodic disposal and replacement. Sertex identified Kevlar-based substitute gaskets that are somewhat more costly, but last much longer and contain no asbestos. These substitute gaskets are now used in all of Sertex’s boilers.

A key point to keep in mind about Sertex is that it is essentially a pilot operation to test both technologies and a business concept that Ing. De Hoyos hopes to extend to a large-scale operation, probably in the industrial area of central Mexico. The concept is to provide full-service uniform supply to large manufacturing operations. Ultimately, this is a much broader concept than merely providing uniform cleaning: it involves purchasing and owning the uniforms, delivering them in the customer’s operation (Sertex currently places clean uniforms in workers’ lockers for one customer) and taking responsibility for end of life disposal of the uniforms. The latter may provides an important opportunity. As Ing. De Hoyos points out, his Ing. Gerardo A. De Hoyos de Luna clean room customers dispose of uniforms when they show even minor signs of wear. Small shops where operations are not as sensitive as in clean rooms could reuse these high-quality uniforms. The importance of the EMS in this context is that it could provide an organizing structure for the entire uniform life cycle.

TINTAS Y QUÍMICOS: Driving Process and Product Innovation

Tintas y Químicos is a 95-person firm supplying printing inks and chemicals to printers primarily in the Monterrey area. Its customers are engaged in printing onto flexible plastic film for packaging materials. Its business is to mix powdered pigments with alcohol-based solvents to its customer's precise specifications. For this reason quality control is extremely important. The firm also provides "full service" its customers, taking responsibility for storing inks; delivering them to the customer as needed and retrieving used ink containers (generally, 55 gallon barrels and 5 gallon pails).

The owner/manager of Tintas y Químicos, Ing. Luis Homero Cañamar Volante, is clearly extremely engaged in the running of the business and is a continuing source of energy in the company. He personally participated in all the training sessions along with his key staff and drove the EMS implementation process. His influence is apparent in other areas as well. He has established a program for primary and secondary education for his workers, many of whom arrived with very little education. He indicated with obvious pride that his work force is very stable with most of his employees having worked for T&Q for numerous years. At one point he showed us a picture of a young employee working at the lowest-level job in the plant and then introduced us to the same gentleman (now in his 30's) who is now director of the laboratory. The concern for the employees and the owner/manger's involvement in the business has clearly paid off. Even during an economic downturn in Monterrey, the firm has continued to grow, and its key concern now is to use its space more effectively so that it can increase production without having to change the plant's physical location.

T&Q entered the project because of the owner/manager's long-standing concern about introducing more formal management systems into the plant. As noted above, achieving consistent quality is an important concern for the firm. Environmentally, T&Q had taken some actions (eliminating heavy metal-based pigments and toluene) but they felt they had a long way to go. They did not expect to obtain significant customer benefits in the short run because customers are focused on quality and cost. On the other hand, they do expect to obtain customer benefits from the improvements in quality and service that have resulted indirectly from the environmentally motivated actions they have taken.

T&Q identified three significant environmental aspects:

1. Very high solvent emissions from the pigment grinding process (powdered pigments are ground with solvents to produce a smooth paste that is then further dissolved to a liquid form prior to being placed in containers for shipment to the customer),
2. Waste filters from the final filtering of formulated inks as they are transferred to containers destined to customers,
3. Waste solvent from the hand cleaning of used barrels returned by customers. (T&Q acquired this problem when for business service as well as environmental reasons it offered its customers to provide "full service" ink supply, retrieving and cleaning used ink containers in addition to delivering new product.

T&Q addressed each of the problems as follows:

Solvent Emissions from Grinding.

The current system involves grinding pigments mixed with solvents by working the mixture through a series of rollers. Although the rollers are partially covered, solvent fumes from the process are very high, resulting in worker exposure, high organic solvent emissions (that convert into smog in the atmosphere) and the loss of significant quantities of costly solvent.

T&Q could not identify a non-equipment solution to the solvent emissions problem and purchased, for approximately \$10,000, a closed-system grinding machine that they are adapting to their use. The machine has reduced solvent and losses by about 60%, reduced pigment losses and resulted in higher quality product. In addition, the closed system takes up less space than the previous roller system and has a higher throughput. This has enabled T&Q to utilize space more efficiently and to increase production without having to move to a new facility. Overall, the owner manager said that they should recover the investment cost in the “medium term.”

Filter Waste

After grinding, the solvent-pigment paste is further diluted in large containers where it is mixed with solvent using large industrial mixers. The diluted ink is then filtered to remove impurities and transferred to containers for delivery to customers. In analyzing its significant environmental aspects T&Q found that one of its major solid waste streams was spent filters. A root cause analysis of the spent filter problem indicated that the filters were being clogged not by impurities, but by undiluted solvent/pigment paste. The cause of the undiluted solvent/pigment paste was further traced to an inefficient mixing process, in turn caused by improper sizing of the mixing canisters.

To solve the spent filter problem T&Q replaced the mixing containers with stainless steel containers designed specifically for the size of mixer blades and the consistency of the inks being used. The result has been greatly reduced generation of spent filters, reduced product waste and improved product quality.

Used Container Cleaning

As noted above, in an effort to provide better service for customers T&Q has been taking back used ink containers from customers. This has resulted in reduced container waste and in improved customer service. But it has also created an additional problem of cleaning containers covered with dried ink. When they entered the project, T&Q was hand-cleaning containers by partially filling the container with solvent and having a worker scrub the interior with a brush on the end of a broomstick. This was a slow, arduous process, by far the least pleasant job in the plant. It also created a bottleneck where many containers had to be stored prior to cleaning, taking up valuable space.

T&Q experimented with numerous container-cleaning approaches. Ultimately they designed and had built a container-cleaning machine that consists of a bed where three containers can be placed horizontally. As system of rollers rotates the containers and the bed itself tilts every four minutes (first horizontal and subsequently about 30 degrees off horizontal in each direction). The

containers are filled about 1/3 full of solvent, a weighted abrasive cloth is inserted, the containers are covered tightly and they are placed on the bed. As the containers rotate on the bed, the solvent and the weighted cloth clean the interior. The tilting ensures that all parts of the containers are covered.

The improvements from using the flat bed-tilting-rotating machine are dramatic. Since the solvent is continually reused, solvent waste sent to a solvent recycler for recovery has been reduced from 3 to 8 barrels per day. In addition, the plant has effectively eliminated the most unpleasant and labor intensive job on the plant, the speed of container cleaning has increased from about 20 containers a day to over 20 containers per shift (there are three shifts per day), and because of the increased efficiency of the cleaning process less space is wasted for used barrel storage.

Overall, T&Q is a highly dynamic plant, constantly in a state of experimentation promoted by its owner/manager. As he pointed out to us, much of what they do is home grown invention adapted to their and their customer's needs and to their company's particular situation. While in some respects the company has a long way to go, it has demonstrated effectively what a small company can accomplish by investing time, enthusiasm and ingenuity, but relatively little capital.