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Design and Implementation of ISO 14001 Environmental Management Systems

It is appropriate to start this chapter by repeating the guidance set out at the end of chapter one about the extent and sophistication of the environmental management system (EMS) adopted. There is much emphasis within ISO 14001 about the need to balance environmental protection needs with socioeconomic needs. The standard recognises that the cost of meeting some environmental targets could be almost unlimited if the targets were set too high. It is right that companies must have due regard to the cost of meeting environmental targets, and therefore they should not set targets where the financial burden of meeting them would require significant reduction in the number of people employed or might even threaten the survival of the company. Nevertheless, it is incumbent upon companies to implement all environment protection measures that can reasonably be achieved, and the reasons why higher targets are not set, whether for financial or other reasons, must be clearly stated in the EMS documentation.

In order to achieve its environmental goals, a company must develop administrative and technical systems to support its EMS and ensure that the required environmental targets are met and maintained. It is important that these administrative and technical systems identify all activities of a company that impact on the environment, whether in manufacturing operations or service provision, and combine to produce a cohesive and effective EMS. After such a system has been put into operation, it is also extremely important to monitor its continued effectiveness by generating and evaluating performance measurements.

The ISO 14001 standard prescribes a number of procedures, which, if applied correctly, successfully achieve these environmental protection goals. Sometimes, although unjustifiably, criticisms are directed at the standard, accusing it of being

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too bureaucratic, too costly to implement and requiring unnecessary documentation, especially when applied to small companies. In truth, the usual reason for such problems is that the consultant responsible for advising the company concerned about ISO 14001 certification has overspecified the requirements. The ISO 14001 standard has been drafted very carefully so as to leave room for intelligent interpretation according to the size of the company implementing it, the type of industry or activity involved and the circumstances prevailing. The only mandatory requirement is that the measures put in place are sufficient to satisfy legal requirements. Beyond that, the main requirement is that sufficient effort should be applied in implementing environmental protection procedures to satisfy both the company's customers and the general public. A good consultant will avoid unnecessary bureaucracy and cost as long as this main requirement is satisfied, but a bad consultant will overspecify the EMS and thus incur unnecessary cost. Thus, it is very important that companies adopting ISO 14001 choose their consultant with care and, if possible, seek recommendations about consultants from companies of a similar size who work in similar industries.

One matter of overriding importance in implementing an EMS is that of achieving the total involvement of all personnel in the company, and fostering a common commitment to environmental protection that is shared by everyone. Everyone must understand what is required of them and what effect their actions may have on the environment. The importance of engendering a commitment to the company's EMS cannot be overemphasised. Islands of good practice here and there are of no use at all: if workers in a few departments are achieving environmental protection targets but they see other departments who are not, they will quickly lose interest in working hard to achieve the targets themselves.

However, even when everyone in a company seems to be participating enthusiastically, one possible danger in operating an EMS is that complacency can creep in. Once this belief that 'our environmental performance is OK' has been adopted throughout a factory, a false sense of security can be generated. So the environmental performance is OK? But who has judged this to be so, and against what standards? Clearly, some independent confirmation that environmental performance is being maintained is necessary, and this is why regular audits of the EMS are essential.

2.1 Design of an Environmental Management System

Environmental policy must be more than a statement of intent: it must be manifest in a specific course of action designed to achieve the environmental objectives specified. To achieve this, the EMS must be designed and implemented according to a properly documented strategic plan. By using such a strategic plan, the required environmental targets will be met and maintained at minimum cost. The emphasis in the strategic plan should be on designing procedures that prevent environmental problems occurring, rather than on correcting defects after they have occurred. It is also important that a team approach is taken in developing the strategic plan. Whilst overall responsibility for the EMS must be in the hands of one person, there is much

merit in involving a team of relevant personnel to discuss details of the environmental plan and the way in which it will be implemented. As a minimum, the team should include representatives of engineering, production and accounting functions in the company. This optimises the chance of gaining full commitment to the EMS by all parts of the company.

The essential activities in establishing a strategic environmental plan are shown schematically in Figure 2.1. The first step is to set the environmental targets. To do this, a careful assessment needs to be made of all operations and activities in the company, to identify and quantify their environmental impact. Writing down all operations and activities in the form of a flow chart is often a useful aid in this. It enables a systematic approach to be taken, where the environmental impact of each is considered in turn. In doing this, the environmental impact must be considered in its widest sense. Thus, environmental protection must go beyond limiting pollution of air and water in the environment, and should include other aspects such as waste minimisation and reducing the use of energy and raw materials.

In quantifying the effect of each environmental impact, due regard must be made not only to the magnitude of the effect, but also to the frequency or likelihood of

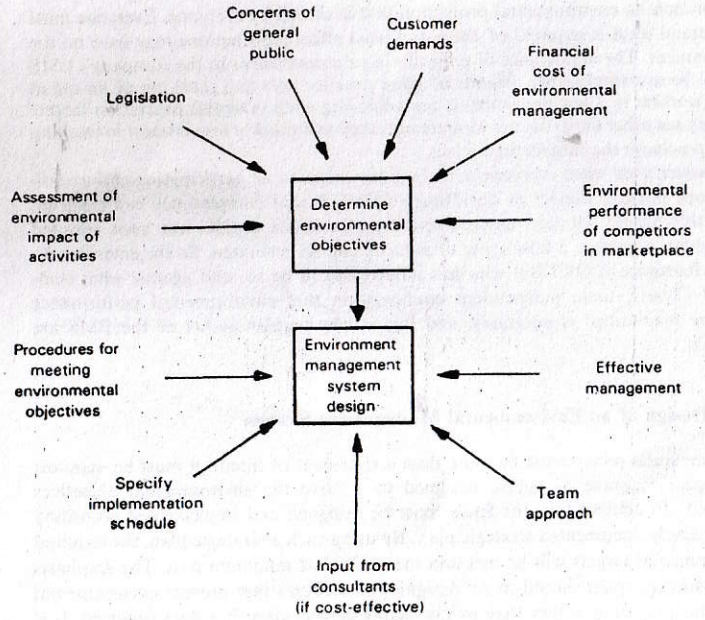

Figure 2.1 *Elements in a strategic environmental management plan.*

the impact occurring, and, if pollution is involved, the size and significance of the geographical area affected. Clearly, frequent environmental impacts are much more serious than infrequent ones, and pollution affecting areas with a large human population is more serious than pollution affecting areas with sparse or no human population. Further useful guidance on environmental impact assessment can be found in ISO 14015[1].

Once the impact of each operation and activity in the company has been quantified, the issues to be addressed by the EMS should be prioritised according to the environmental impact of each activity, and according to whether any legislative requirements have to be satisfied. Prioritisation of environmental issues to be addressed is necessary, because a company clearly cannot address every environmental issue simultaneously, due to the limitations of both staff and financial resources. Hence, the achievement of particular environmental targets has to be carefully balanced against the cost of meeting the targets, and due regard also has to be given to what the company's competitors are doing. The ISO 14001 standard recognises these limitations and allows a step-by-step approach, with the worst problems being addressed first. ISO 14001 does not neglect lesser environmental effects, but allows these to be addressed over a period of time, as part of the ongoing improvement of the EMS.

Legislation obviously has to be taken into account in shaping the EMS developed. Unfortunately, it is impossible to give specific guidance, since the statutory environmental requirements vary from country to country. However, due regard for these differences must be taken by any company involved in, or likely to become involved in, export markets. Whilst the fines imposed as a penalty for failing to comply with legislation might be seen as only a minor irritation that does not have any significant effect on the financial well-being of a company, a very much more serious penalty is involved in respect of the inevitable loss of reputation that a company would suffer when prosecuted.

Once appropriate environmental targets have been set, the next step is to examine each operation and activity included in the EMS, to determine how the targets can be achieved and maintained at minimum cost. To do this properly, each operation and activity must be broken down into separate elements. Each of these elements must have clearly defined environmental objectives and strategies that contribute towards a cohesive EMS for the whole company. Only when such a corporate strategy of environmental planning is instigated, will the full potential benefits of the EMS be realised.

The strategic aspects of environmental management cannot be considered in isolation, but must be part of a cohesive overall management plan. In other words, environmental management should not be considered as being fundamentally different from any other area of management, except in so far as the details of its practical implementation differ. The standard management procedures of planning, organising, directing and controlling should be applied equally in environmental management, as in any other management function. This allows environmental considerations to be managed in an effective way, whereby planning provides a basis for organising, which in turn enables the established EMS to be directed and controlled in an efficient manner.

As the EMS evolves over a period of time, the environmental performance of suppliers of materials to the company becomes a relevant matter for consideration. This is an area that a company often has control over, and this provides it with an opportunity to encourage better environmental consideration by its suppliers. Thus, as part of the continual improvement to the EMS demanded by ISO 14001, a company can move towards including ISO 14001 conformance as a requirement in the contract signed with suppliers. This requirement is most easily met if the supplier also operates a certified EMS. Indeed, in industries like automobile manufacture, it is becoming mandatory that all components are traceable to a chain of suppliers who are all certified to ISO 14001 or equivalent standards.

Mention must also be made of the need for the EMS to include specification of the planned programme of measurements designed to ensure that the environmental targets are being met. The details of all inspection procedures specified, their prescribed frequency, and the measurement techniques required, must also be fully documented.

Finally, one important concluding comment should be made about the design of the EMS and the development of a strategic plan to implement it. This comment is that the EMS must not be allowed to become stagnant. Technological change brings about continual improvements in the potential for reducing the environmental impact of a company's operations, and it is essential to take full advantage of these, as long as the economic cost is not too great. Also, the company's actual operations may change, with a consequent change in the environmental impact. Thus, all aspects of the EMS must be reviewed regularly, and changes made as necessary. This requirement to carry out reviews and seek regular enhancements to the system is enshrined in ISO 14001.

2.2 Environmental Management System Implementation

The EMS designed must be implemented such that the environmental targets set are met. It has already been noted that the targets set will not necessarily limit environmental impacts to the minimum possible according to the best technological capabilities, since ISO 14001 recognises that a company has to operate in an international market and must keep costs within strict financial constraints. These economic constraints may prevent the company from implementing very costly pollution-reduction technology. ISO 14001 only requires a company to strive to reduce environmental damage as far as possible, but within the constraints of what is economically reasonable and technically possible.

The key components in implementing an EMS that satisfies ISO 14001 (see Figure 2.2) are: commitment of company executives, cooperation of all company personnel, effective management, establishment of effective communication systems, appropriate training, design and implementation of supporting equipment, planning of emergency procedures, collection of data to monitor performance, regular system reviews and maintaining full documentation of the system. These components can be divided into general requirements, measurement and calibration requirements and other engineering considerations.

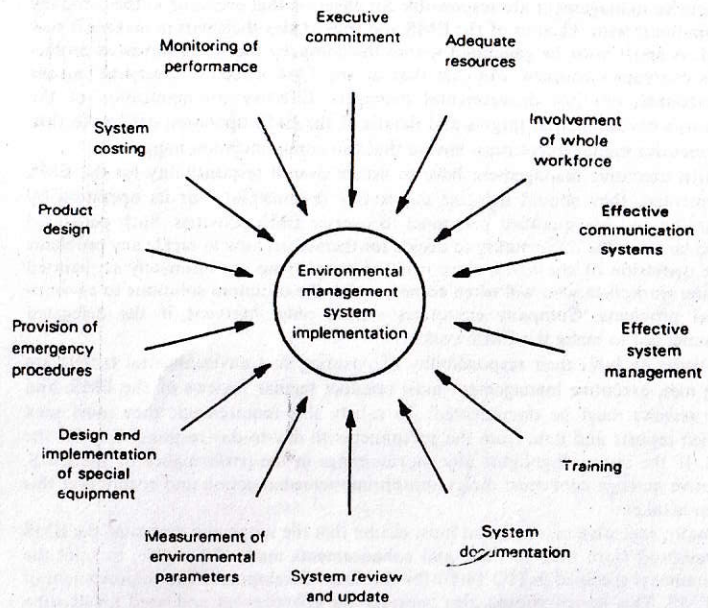

Figure 2.2 Key components in environmental management system design and implementation.

2.2.1 General requirements in implementing an ISO 14001-approved EMS

The general, nonengineering requirements specified by ISO 14001 to ensure that the EMS is implemented and maintained in an efficient and effective manner, include: executive commitment, total involvement of all company personnel, effective communication systems, managerial responsibility, adequate training, system documentation, and system review and update. These issues will be discussed in more detail in the following paragraphs.

Executive commitment

Full commitment by the executive management of a company is an essential requirement for successful implementation and operation of an EMS. They must fully support it by providing all financial resources necessary, and they must be the driving force behind the EMS. This commitment of the company executives to the EMS must also be highly visible, because any apparent lack of commitment on their part will spread like a plague through the rest of the company.

Executive management are responsible for ensuring that everyone in the company is sympathetic with the aims of the EMS and tries to play their part in making it successful. A spirit must be generated within the company that environmental protection is everyone's concern, not just that of the EMS director. 'Everyone' means all personnel, not just departmental managers. Effective communication of the company's environmental targets and details of the EMS operation are key to this, and executive management must ensure that this communication happens.

Whilst executive management have to accept overall responsibility for the EMS implemented, they should delegate day-to-day responsibility for its operation by appointing suitably qualified personnel to oversee EMS activities. Such personnel should be given the opportunity to decide for themselves how to tackle any problems in the operation of the EMS, since it is the people who are intimately acquainted with the workplace who will often come up with the optimum solutions to environmental problems. Company executives should only intervene if the delegated personnel fail to make the EMS work.

In order to fulfil their responsibility of ensuring that environmental targets are being met, executive management must conduct regular reviews of the EMS, and these reviews must be documented. To satisfy this requirement, they must seek detailed reports and data from the personnel with day-to-day responsibility for the EMS. If the review highlights any shortcomings in the performance of the EMS, executive management must direct appropriate remedial action and ensure that this action is taken.

Finally, executive management must ensure that the scope and design of the EMS are reviewed from time to time, and enhancements made if possible, to fulfil the requirements specified in ISO 14001 for continual development and improvement of the EMS. This review should also consider the effectiveness and need for existing EMS procedures. Thus, as a consequence of the review, 'improvement' might involve removing some existing procedures that are ineffective or unnecessary, as well as adding new procedures.

Total involvement

As discussed earlier, ISO 14001 requires that the responsibility for successfully operating the company's EMS should be shared by everyone in the company. Everyone has a contribution to make, even if it is just turning taps off to avoid wasting water and turning lights off to reduce energy consumption when they are not needed. Executive management are ultimately responsible for ensuring that this motivation towards environmental protection is generated in their employees.

The maintenance of such motivation in all employees to meet the standards set by the EMS is often assisted by the use of anonymous questionnaires from time to time to measure the morale of the workforce – to remove any irritants in the workplace and also assess the attitudes and degree of cooperation between different departments in the company. Schemes whereby workers are rewarded for making suggestions that lead to environmental improvements or elimination of environmental problems are also generally very useful. Display boards, where successes in meeting environmental targets are reported, can also be strong motivators in

fostering the correct culture in environmental matters. Posters in the workplace encouraging things like reducing waste production and energy consumption can also be helpful.

Quality circles, which now exist in many companies as part of an ISO 9000 certified quality assurance system, can usually be extended to consider environmental matters, and are a good way of getting everyone in the company involved in the EMS. A quality circle consists of a group of people who collectively represent all functions within the company that can have an effect on quality. For instance, such a group must represent goods packing and delivery sections as well as shop-floor operatives from the production departments. The discussion that takes place at periodic meetings of the quality circle fulfils several functions. Firstly, it ensures that thoughts about quality maintain a high profile throughout the company. Secondly, it provides a feedback mechanism whereby breakdowns in or difficulties with the quality system can be reported and suggestions for improvement made. Thirdly, by giving everyone such a personal involvement in meeting quality targets, an atmosphere is generated where people have a pride in their work, understand the reasons for the quality control procedures implemented and are fully committed to their operation. These same benefits can usually be obtained for the company's EMS if this is discussed within the quality circle.

Communication

Whether achieved by quality circles or otherwise, communication paths are extremely important for achieving environmental targets, and they must exist from the shop floor right to the top of the company. Personnel on the shop floor involved in production operations are a valuable source of information with regard to production problems that may impinge on the environment and their likely causes, and mechanisms must exist for this information to be transmitted rapidly to the company management. Communication in the reverse direction is also very important, with management arranging meetings to explain environmental issues, describe improvement plans, discuss performance targets and report on progress made.

On top of this communication upward and downward in a company, sideways communication between different departments is also essential. It is not sufficient for each department to operate its own environmental protection scheme; the EMS must operate as a cohesive whole across the whole company. This can only be achieved by complete cooperation and constant dialogue between the different parts of a company.

At departmental level within a company, it can be very useful to ask every member of the department the following questions on an annual basis: 'What process are you involved in?'; 'What are the potential adverse effects of the process on the environment?'; 'How do you monitor performance of the process with respect to its environmental effects?' and 'What can you do to improve performance?' A further useful annual exercise is to construct a flowchart of the processes that each department is responsible for and ask, 'Why do you carry out each operation?'; 'Is each operation necessary?' and 'Can the process route be simplified to reduce adverse effects on the environment?'

Management of EMS

The responsibility for implementation, operation and review of an EMS must be assigned to one designated person. This person may subcontract responsibility for particular aspects of environmental policy in certain areas to other designated personnel, but a clear chain of persons with designated responsibility must exist, and the one named person with overall responsibility must be at the head of the chain. The existence of one named person in charge of the EMS is crucial. It is entirely insufficient to just assign responsibility to a department or group of people in an organisation, as this leads to people blaming each other when things go wrong.

As well as having one named individual with full responsibility for the EMS, it is also essential that this person has sufficient authority to do the job effectively. This is normally achieved by giving the person concerned a place on the management board of a company, usually with a title like Environmental Management System Director. This level of authority is necessary so that the person concerned can control the EMS system fully, and shut down manufacturing processes or other systems as necessary if there is a risk of serious environmental damage occurring, however much the managers of these processes or systems may protest.

Management of EMS implementation and operation has to fulfil several functions. The most obvious function is ensuring that all hardware and personnel involved in environmental protection activities operate efficiently and within the cost-estimates established at the design stage of the system. Ensuring that all staff involved have been properly trained is a necessary part of this. A second role is to make sure that the EMS interacts properly with all other general company management functions. To accomplish these two roles effectively requires that all the tasks involved are identified and carried out by assigning responsibility, delegating authority and creating accountability for each separate task.

Training

To satisfy ISO 14001, the documentation provided with the EMS must specify the training needs of everyone in the company whose activities may impact on the environment. The amount of training necessary will depend on the extent to which a person's activities can affect the environment. Clearly, personnel who are involved in designing, implementing, operating or maintaining an EMS will require in-depth training about particular aspects of the EMS, whereas other people will require much less training. However, the aim should be to ensure that the whole workforce in a company, including any contractors that are used, receives some training, even if the training for some only consists of a short half- or one-day course that acquaints them with the general environmental policy of the company, explains why the company operates an environmental policy, summarises the EMS, expounds the intended benefits of the EMS and emphasises the importance of everyone conforming with it. ISO 14001 also requires that, irrespective of the amount of training given to company personnel, all training undergone should be recorded in the EMS documentation.

Workers' attitude to training is almost as important as the training itself. Making people go on training courses is relatively easy, but ensuring that they assimilate the necessary knowledge is considerably more difficult. If the training courses are not

managed properly, there is a strong likelihood that they will be treated as a welcome break from the normal working environment but their purpose will not be taken seriously. To prevent this happening, workers must see the need for courses and positively want to go on them. In some cases, this can be achieved by setting environmental targets and procedures to meet them that the workforce knows can only be achieved once they have obtained the necessary knowledge from a training course.

To be effective, training needs must be formulated and driven at departmental level within a company, and targeted towards meeting the department's environmental objectives. Figure 2.3 shows some necessary procedures in an effective departmental training plan. Training plans must be formulated individually for each member of a department so that he/she understands the relationship between their activities and the potential environmental effect. Appropriate people also need training about the proper response to make when unexpected events occur. This response may take various forms, such as implementing emergency procedures, taking remedial action to avoid pollution and plant shutdown procedures. Each training plan must be fully discussed with the person it is designed for, while obtaining the person's full agreement about the details of the training plan. It is also important that the effectiveness of the training is reviewed after it has taken place. Internal EMS audits can be a good time to do this, by asking employees questions about the environmental impact of what they do and about the actions that they take to avoid environmental damage. Their answers will determine whether training has been effective or whether further

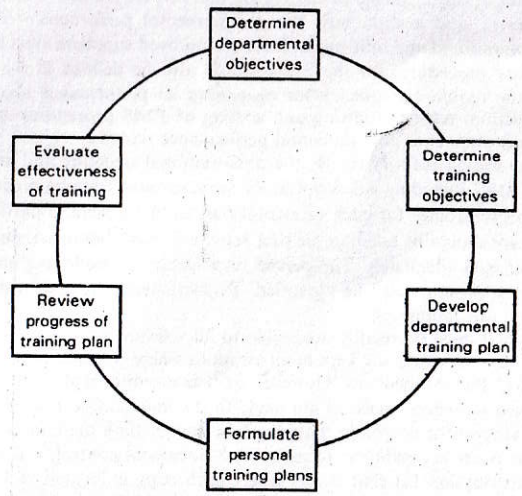

Figure 2.3 Necessary procedures for an effective training plan.

training is needed. Finally, because production methods change over time and the EMS has to evolve, training schemes need to be periodically reviewed, since the competence of the workforce may also need to improve through further training. It is also often beneficial to extend training to customers. By offering courses to users of the equipment that companies produce, the incidence of misuse of equipment by the customer can be greatly reduced and consequential adverse environmental effects avoided.

System documentation

Full documentation of all aspects of an EMS is essential. This should take the form of a manual, which can be in either electronic or paper form, in which every EMS procedure is carefully set out and the whole philosophy and purpose of the system is described. The environment targets and their justification in terms of balancing the cost/benefit equation is a very necessary part of this. Whilst there is no particular format defined for the manual, the information must be presented in a clear, systematic and orderly way. In the case of a small company, all EMS documentation would typically be bound within one manual. However, for larger companies, it is often more appropriate to maintain separate corporate and divisional EMS manuals. A suggested structure for the EMS manual is given in Appendix 2.

Each identified element in the EMS should be documented such that the details of hardware designs (with full drawings), operational instructions, purpose, running cost and interaction with other elements are all expressed clearly. All documentation should be dated and have the version number clearly marked. The documentation must include details of any elements of the system that involve the activities of suppliers and customers, and explain how the environmental performance of such outside bodies is monitored and influenced. Lists of approved suppliers must also be maintained. Review procedures for the EMS should also be defined in the documentation, and the required frequency for measuring its performance should be given. Such inspection, testing, auditing and costing of EMS procedures must be included within the manual as environmental performance records.

Documentation should identify clearly the organisational structure and mode of operation of the EMS, including a description of the associated training procedures. Assignment of responsibility for each elemental part of the system is particularly important, and care should be taken to see that activities on the boundaries between functions are managed adequately. The person responsible for modifying and controlling documentation must also be identified. To summarise, the system must be foolproof, without any loopholes!

The EMS manual must be readily accessible to all relevant personnel, and it is therefore important that copies are kept at all locations where operations are carried out that can affect the environment. However, as it is essential that all the copies issued are changed whenever revisions are made to the manual, the number issued and distributed around the company should not be greater than the minimum necessary to provide ready accessibility. To assist with document control, it is sensible to maintain a distribution list that shows where each copy is located and who is responsible for it. Of course, the problems of needing multiple copies and making

sure each one is the latest version are avoided if the manual is produced in electronic form. This allows a single copy to be accessed from all locations, via the company's computer network.

As implied above, modifications and additions have to be made to the manual from time to time following periodic reviews of EMS operation, and it is essential that efficient, documented procedures exist for effecting such changes. To draw attention to the changes made, it is beneficial to highlight them in some way in the documentation. This can be achieved in various ways. One way would be to put a box around revised procedures, prefaced by the words, 'Revised procedure' in bold type. To ensure that there is no ambiguity about which is the latest version of the manual, it is essential that all pages within the manual are marked with a date and revision number. This should ensure that only the correct version of the manual can be used. Normal practice would always be to dispose of immediately any parts of the documentation that have become redundant or outdated. However, it is sometimes necessary to keep obsolete documentation for legal purposes, usually to demonstrate the extent of environmental protection efforts at some past date. This is acceptable as long as a system is in place to clearly mark such documentation as obsolete, so that it is not used accidentally in place of the current documentation.

System review and update

One factor complicating the design and operation of an EMS is that the environmental targets change continually under the influence of technological developments, market forces and new/revised legislation. This requires the EMS to be updated at various points in time in order to meet the changed requirements. Modifications to the system also become necessary if the monitoring exercise about costs and performance shows a deviation from the target cost and performance goals. A regular review of the EMS is therefore required to determine whether changes to the system are necessary. Such reviews should be additional to, and not instead of, the regular system audits specified by ISO 14001.

Even if reviews do not identify improved technological procedures for avoiding environmental damage or changes in legislation, ISO14001 still requires that the EMS should evolve and be continually improved. When a company implements an EMS for the first time, it is accepted that it has to prioritise its efforts towards reducing the worst environmental impacts of its operations first. However, once the worst problems have been dealt with, ISO 14001 expects future system reviews to identify lesser problems that can be given attention to further improve the company's environmental performance. At this stage, attention can also be given to other things that the company can influence, such as the environmental performance of its suppliers and customers. Increasingly, in order to attain higher standards in their own EMS, companies are putting suppliers under contractual obligation to implement an EMS. In many cases, suppliers are actually required to obtain certification of their EMS, to confirm that it conforms to ISO 14001. Companies can also influence the environmental performance of customers by giving them advice and training in the use of their products and also advice about safe disposal when the products come to the end of their life.