ISO 14001 and design for the environment: A strategy for proactive design in building design, construction and renovation

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This chapter describes the implementation of ISO 14001 at New York City Transit Authority (NYCTA)’s department of Capital Program Management (CPM). CPM designs and manages the construction of some $2 billion in capital projects per annum. The challenge of implementing ISO 14001 was to implement a system designed for a fixed manufacturing facility in a project-based organization where most of the work is delivered by contractors.

The challenges CPM faced were how to use ISO 14001 as an instrument to implement design for environment (DfE) principles, how to fit the ISO 14001 EMS model into a project-based, public-sector organization and, finally, how to use the EMS to manage contractors. These three challenges are described in this chapter.

Why implement ISO 14001 at CPM?

The catalyst and promoter of this project throughout was Ajay Singh, chief of internal controls and special projects. Singh’s motivation was a mixture of personal conviction and political acuity:

In my lifetime, I have seen the deleterious impact of industrialization and urbanization on the natural environment. Here at the Transit Authority, we face a paradox: we are working with an inherently sustainable product—public transportation in New York City. But we don’t think of making the process of delivering this product more environmentally sound. The potential for a significant impact on the whole of New York City and all its inhabitants and riders is just huge, and we were not even thinking about it.

What we had are environmental management activities focused on meeting regulatory requirements. Asbestos abatement was the focus of our environmental management work. We needed an EMS that could provide us with a structure to proactively control environmental issues across the whole life-cycle of our design and construction projects. It was especially crucial that we focus not reactively on abatement, but proactively on environmental issues from the pre-design stage. Such an EMS would allow us to control risks, costs, over-runs and so on. The question was, how could we achieve what was in fact a culture change in CPM, a typical public-sector organization?

In 1998, I saw an opportunity in ISO 14001. Here was a flag that we could put in the ground, something that we could rally troops around, and something that we could implement here at CPM and then roll out through the larger transit organization.
With these motivations, Singh not only named the flag but also waved it. He sold the vision to his manager, the senior vice-president and chief engineer of CPM, Mysore Nagaraja. Nagaraja responded with complete support. He was particularly interested in the implementation of a structured, measurable system to identify and quantify CPM’s environmental impacts. He responded with a challenge to Singh and his staff to obtain registration to ISO 14001 within nine months.

Step 1: Implementing DfE through ISO 14001

The first job was to shift the minds of the engineers from technical and regulatory compliance issues to the upstream design phase. One of the key implementers of the EMS was Tom Abdullah, senior engineer in the environmental engineering division (EED):

> When I was first asked to describe the life-cycle of a building and construction project, I said, well, first we dig a hole. Boy, have I—have we—changed our perspective since then. We have realized that our principal environmental impact is at the pre-design and master plan stage. The later in the project life-cycle that we try to manage environmental issues, the more difficult it is to be successful, and the less return you get on your effort.

As Nagaraja emphasized

> We have to think of ourselves as a design and construction management operation, not as construction engineers.

Fortunately for the EMS advocates, the concept of emphasizing the importance of getting things right at the design stage was, in any case, receiving attention at the highest levels in the organization. A new CPM procedure on master planning proved to be completely consistent with what the EMS was trying to do. A master plan is created for any large capital project, to define it and set a preliminary budget. It is on the basis of this that design alternatives are proposed, a design selected and budget fixed, and bids put out to architects. CPM’s new master plan procedure emphasized that careful thinking was required at the pre-design stage. It also provided an opportunity in the preliminary master plan budget for the master plan manager to project forward the quantitative and qualitative benefits of the facility in use. This provided an opportunity to make environmental performance issues a consideration in the selection of design alternatives. We were able to show how implementing the EMS was completely consistent with the master plan procedure—to show the organization that we were not introducing something new, but implementing with the EMS as a key existing strategic objective. This integration was stressed at all EMS training, and all training in the new procedure had a short session on the EMS.

What does DfE mean in design and construction? This issue is increasingly coming under discussion in the US and, particularly, in New York City as it enters the 21st century. Two helpful developments to CPM were, first, the development by the US Green Building Council of a certification system called LEED—Leadership in Energy and Environmental Design (LEED 1999). This provides a system to certify a building that has been designed and built to a level that exceeds those required by the best regulations in the US (state or federal). The advantage of this for CPM is that a facility

can apply for a LEED medal that could be placed on a building that recognizes design and construction, rather than improved environmental performance for the users. The second development was the production of a workbook, *High Performance Building Guidelines* (City of New York 1999), by the City of New York Office of Sustainable Design and Construction. Copies of this were circulated to environmental engineers and key other managers; Hilary Brown, assistant commissioner at the Office of Sustainable Design and Construction, briefed the EED.

CPM spent time learning about these initiatives and broadcasting this knowledge through the organization in its intensive training program for environmental engineers as well as master plan, design and construction managers.

**Step 2: Fitting ISO 14001 into a project-based, public-sector organization**

One of the biggest challenges of implementing ISO 14001 at CPM was that there was not an immediate fit between CPM’s operation and the organizational assumptions of the standard. Although the text of ISO 14001 notes that the standard was written for all sorts of organizations, it assumes that the EMS is being implemented in a fixed facility such as a manufacturing operation. The assumption is that the facility controls most of its operations—and consequently its environmental impacts. In contrast, CPM is a project-based, service organization. Most of the projects are delivered through third parties—architects and building contractors—who are subcontracted to do some of the design and all of the building. A typical CPM project might be a bus station design-and-build project in the Bronx, a project that could take five years, cost some $50 million, and involve both internal professionals and contracted specialists and service providers, e.g. an architect and the builder.

CPM did not believe that their organization was an old-fashioned public-sector organization. On the contrary, more and more organizations in the developed world are service- and project-based (Allenby 1999). These organizations cannot manage environmental issues only by managing issues within their facilities. They have to look upstream to design issues and downstream to supplier and contractor management. In doing so, CPM had to move way beyond the structure of ISO 14001. We believe that we created a state-of-the-art, highly effective and creative EMS that may have lessons for project-based, supplier-dependent, private- or public-sector entities. We used ISO as a backbone, but built a unique EMS organization.

The new CPM EMS organization was, from the start, managed by a core team, strongly supported by a cross-functional team (CFT) of managers from within and outside of CPM, including the NYCTA legal counsel, senior staff from the Office of System Safety (OSS), and program, design and construction managers. The CFT was critical in getting the message out about ISO 14001 and the CPM EMS, and winning support from groups that our EMS depends on for success. The EMS has also clearly defined the work of a cadre of environmental specialists within EED (see Fig. 1).

A key to project-based organizations is to understand that internal specialists move

between projects and are required to trade their expertise and exercise influence without having line authority. In organizations that combine project and line structures, such as CPM, there can be conflict between project specialists and the line. At CPM, there was already a structure that ‘matrixed’ quality specialists to projects for the purposes of integrating quality. The EMS organization we created made use of a model for integrating line and project functions through the use of in-house consultants that we called ‘environmental specialists’. Engineers from the EED already performed a variety of tasks such as investigating projects at pre-design stage to see what regulatory obligations it might have—in relation to natural resources, community disruption and air quality—and investigating whether a formal environmental impact assessment (EIA) was required by law. They also provided various support services to the construction manager once building had begun. This nascent structure was built on to create a unique role for environmental specialists within the CPM EMS organization.

**Figure 1: The CPM EMS structure and organization**  
*Source: NYCTA, Department of Capital Programs Management*

Tasks were defined for environmental specialists at all stages along the life-cycle of a project. The CPM EMS provided a procedure that requires environmental specialists to exercise their influence before and at the master plan stage. The job of environmental specialists now includes a number of specific tasks at the master plan stage (see Fig. 2). EED invested in training, not just of their own staff on process and technical skills, but on awareness training of the master plan and design and construction managers.

Another issue that quickly surfaced was how to show the environmental value of the EMS. Most of the value of an EMS as applied to building design and construction will be felt in the use of the building (reduced energy costs, better indoor air quality, and so on). But CPM is not involved in the use of the facility and reaps no benefits from the better environmental performance of the building in use. As we discovered in the process of EMS implementation, this is a dilemma frequently faced in public-sector and other organizations that are organized along strictly functional lines. Once a new program has been developed for users not in the originating department, it moves under the management of others, and the originators are cut off from program implementation and from enjoying the benefits of their investment. Over time, this builds in disincentives to initiative and thinking ‘out of the box’. It is also a standard problem in real estate development, where the developer is creating value for the tenant. In the world of real estate, if this additional value is reflected in additional capital costs, it is difficult to find buyers or renters willing to pay the premium on the selling or rental price of the unit. At the NYCTA, we were concerned that environmentally sound design would not necessarily result in users doing things in a more environmentally friendly way.

When we started putting the EMS in place, there was no incentive for CPM to deliver an environmentally efficient building. Nor, because NYCTA is a public-sector organization, does CPM measure or try to reduce the quantity of energy it uses. This issue will be partly addressed through the work of the environmental specialists at the master plan stage, where they have an opportunity to estimate the environmental costs of different design decisions and materials specifications. This change cannot be expected to happen overnight, as environmental accounting is a difficult job, and the subject is new to CPM.

At the Master Plan stage, it is the job of the Environmental Specialist to support the Master Plan Manager with the following:

1. **Recognition of environmental issues** through a report on potential environmental issues, and a judgment about whether an Environmental Impact Assessment (EIA) is legally required. This report should be provided in a timely manner to the Master Plan Manager, Program Managers, Chief, EED, and EMS Coordinator. It should take into account:
   - Legal and Other Requirements Database (first preliminary draft)
   - Aspects and Impacts Identification (first preliminary draft)
   - Ideas on the prevention of pollution and Design for Environment (DfE)
   - EMS criteria in Consultant and Contractor selection

2. **Prepare and submit an EIA, if required**, in a timely manner to the Master Plan Manager, the Design Manager, the Chief, EED, and the EMS Coordinator.

3. **Provide the Master Plan Manager with the following services and technical advice:**
   - Methods to understand the environmental and economic impact of various design alternatives. Methods to understand basic assumptions about Asset Useful Life and the lifespan of materials or substances under consideration for the project
   - Identify responsible parties, schedule, and methods for addressing external agency considerations. Items to be discussed/listed include: special approval and permits;

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environmental impact statements; historic preservation; community relations; access for the disabled.

☐ Working with the Field Services Representative, calculate the cost of proposed environmental-related materials, standards, codes or construction techniques; or the environmental cost of these. Supply enough environmental information so that design costing can be made accurately.

☐ Working with the Field Services Representative, provide information so that the financial impacts of environmental investments can be realized, and *vice versa* (the environmental impacts of financial investments). For example, reduced energy costs because of design efficiency.

☐ Provide information so that the non-financial environmental benefits of each project can be realized and a dollar value attributed. For example, improved airflow in a station could result in less requirement for heating and cooling technologies.

*Fig. 2: Environmental specialists: responsibilities at the master plan stage [extract]*

However, the ideas of the EMS have had a gratifying reception from some key players at all points in the organization. John Payyapilli is a design manager from the electrical programs area, who was not involved in the EMS until after ISO registration in March 1999. Since then, he has become an enthusiastic advocate. He comments:

> We [design managers] have been dealing with ‘environmental’ issues for years, but it was not until the EMS was introduced and broadcast through the organization that we started to think about green design, the concept of a high-performance building, and environmentally friendly technologies. We are looking at these aspects in projects going forward. We are presently looking at the CPM design guidelines to see how these can be modified to support DFES and the EMS.

**Step 3: Managing contractors**

A third issue that was complex for the integration of ISO 14001 into CPM was that most of CPM’s work is undertaken by third parties—consultants and contractors. ISO 14001 makes only passing reference to suppliers and contractors. We had to decide early on how to deal with this issue. Placing environmental conditions on contractors could not be done casually: CPM is the largest construction contractor in the New York City area and any message it sent would ripple through the construction community. As a public-sector organization, there were a myriad of legal issues to consider in altering procurement practices and the rules of competition. On the other hand, if it was the right message it could have a positive impact on building in the city.

There were several hurdles to overcome in this area, and in the end this was easily done. First was to get the agreement of the procurement department to the alteration of procurement conditions. This is currently in progress and we anticipate completion during 2000. We found support in a new NYCTA policy that came from the OSS which is a separate department from CPM. It manages safety across the organization, not only in construction projects but also passenger safety. At the end of 1998, it published a new policy/instruction (P/I) called TA P/I 8.3.2: *Environmental Management Program* (EMP).

Ajay Singh noted:

One of the new issues the EMP directs the whole Transit Authority to address is that of putting environmental issues into procurement and contracting decisions. As this OSS policy is applicable throughout the Transit Authority, CPM, a junior partner to OSS, was able to ride behind this initiative and claim that we were implementing what was now a requirement from OSS. A first step towards contractor environmental management was achieved with the drafting of a letter to contractors in June 1999 that informs them of CPM’s EMS initiative and encourages them to align their EMSs with ISO 14001 [see Fig. 3].

The letter recommended that contractors align their EMS with ISO 14001.

**Early results from ISO 14001 implementation**

The CPM EMS manual has been published; CPM achieved registration to ISO 14001 in March 1999 and successfully passed the review audit in September 1999. The auditor, Underwriters’ Laboratories, who also audit CPM’s ISO 14001 conformance, commented that the degree of improvement and implementation in the six months since the previous audit was highly impressive. Apart from the intensive commitment to the education and training of environmental specialists within the EED, the process of integrating environmental management into the earliest phases of the project is now well under way.

nycta–cpm

June 10, 1999

Re: NYC–Capital Program Management–Environmental Policy

Dear Sir or Madam,

The New York City Transit Authority Department of Capital Program Management (CPM) has a longstanding commitment to compliance with applicable environmental laws and regulations. Recently, we have raised the bar and have implemented an Environmental Management System (EMS) that conforms to the September 1996 International Organization for Standardization (ISO) 14001 EMS Standard. This is the sister standard to ISO 9001, the Quality Management Systems Standard to which we have been already certified. Our EMS has been certified as being in conformance with ISO 14001.

ISO 14001 is a voluntary standard that identifies the core elements of a system necessary for an organization to achieve its environmental goals and effectively manage its impacts on the environment. The ultimate objective of the standard is to integrate that system with the organization’s overall business processes and systems so that environmental considerations are a routine factor in its business decisions. The ISO 14001 EMS Standard has quickly become recognized as the benchmark of sound industry environmental management practices.

The foundation of our CPM’s EMS is our recently issued Environmental Policy Statement, a copy of which is enclosed.

CPM’s commitment to environmental leadership includes doing business with suppliers and contractors who fulfill their environmental obligations responsibly. Our
contracts with you require that you comply with all applicable environmental laws and regulations when you perform work for CPM, including the provision of services and materials. In the future, as in the past, you will be responsible for conducting necessary environmental training of your personnel and for assuring that they are competent to perform work for CPM. Although this does not affect your ongoing contracts, in future, in order to assure conformance with our new EMS, we will be communicating to you any additional CPM EMS requirements we determine are applicable to your work for CPM.

CPM encourages you to align your EMS with the criteria of ISO 14001 and to pursue registration under this International Standard. In our view, doing so will not only be an act of good corporate citizenship, but also a good business decision.

Should you have any questions regarding CPM’s new EMS or ISO 14001, please contact Ajay Singh, Director, Internal Controls and Special Projects, at 718 243 7039.

Sincerely,

Mysore Nagaraja Senior Vice-President and Chief Engineer

Fig. 3 CPM letter to contractors informing them of CPM’s ISO 14001 registration

Environmental specialists began working to integrate environmental issues into the master plan for several new projects. Managers putting together bids send their drafts to the EMS organization for suggestions and comments. Further downstream, there are opportunities for the integration of environmental technologies into construction. The most obvious is the use of photovoltaic cells as solar energy sources for NYCTA facilities. Discussion of the integration of photo-voltaics into two bus station building projects and one subway station rehabilitation are now under way. Most importantly, consultants and contractors now see this as a ‘value added’ contribution that they can make to NYCTA projects, and some of them have made presentations to CPM about their technical resources in this area.

Lessons learned

Several lessons were clear from this experience:

1. **A visionary or champion at the top is crucial.** A senior manager well placed in the organization is absolutely key to the success of any program of organizational change. His or her task is to set stretching goals and to garner political support both within and beyond the organization or division getting registered. Mysore Nagaraja, senior vice-president and chief engineer of CPM, supported by Ajay Singh, chief of internal controls and special projects, played these roles admirably.

2. **Define the EMS organization carefully and gather allies on whom the success of the EMS will ultimately depend.** Given the rather unique challenges we faced of fitting an EMS designed for a fixed industrial facility onto a project-based, design and contractor management organization, the structure of the EMS organization was not obvious. In the case of CPM, the core team was the architect of the EMS organization. It made careful use of the broader political resources of the cross-functional team. The CFT achieved the political objectives of getting buy-in from users and other departments that could have become obstacles if they had not
been involved in the design of the EMS organization from the start.

3. **Find existing initiatives within the organization that support the EMS, and ride on their coat-tails.** In order to achieve the CPM EMS, it was important to support the new procedure on master planning, gaining allies in that area and accelerating its acceptance. We were also able to gain support from the OSS’s new EMP and its directive that environmental issues should be integrated into procurement. In both cases, we emphasized as often as possible that ISO 14001 was consistent with what was already being promoted in the NYCTA, sometimes by more powerful players than those spearheading the CPM EMS. By emphasizing that we were followers rather than leaders, we were able to win support and push both the other program and our EMS, more quickly than if we had insisted on going it alone. The EMS structure also used and built on nascent organizational structures—for example, where the environmental specialists ‘matrixed’ to projects—to create the EMS organization.

4. **Seek out and use external resources.** We sought out and discovered very helpful external initiatives that were coming out at the perfect time for our needs. In our case, there was a great deal that we could use and learn from, particularly the LEED and the high-performance building design principles. Scouting out and using materials that had already been piloted elsewhere saved time, risk and resources.

5. **Develop a pool of recognized internal technical competence.** The wholehearted support of the EED to the EMS initiative gave the project hands and feet. It committed significant resources and energy to refining the procedures for inserting environmental issues into CPM projects, from the refinement of the methodology for aspect and impact identification, to starting to allocate environmental specialists to projects at the master plan stage. In addition, it has embarked on a comprehensive training program, delivered to its own staff of environmental specialists as well as to master plan, design and construction managers.

The combination of the above bore fruit. The EMS has become warmly endorsed throughout the NYCTA and there is active discussion about rolling ISO 14001 out in more departments.

**Conclusions**

The most important enduring lesson for CPM was that it does not perform just an engineering function, but a design and contractor management function too. This understanding has helped it to redefine the focus of its activities from operations and compliance management to DfE and contractor management. In principle, the new emphasis on design made sense to the organization. It was consistent with the quality management adage of ‘get it right first time.’ It was consistent with the new guidelines on master planning. And the engineers understood well the logic that it always costs more time and money to have to redo work. But, in practice, proactive environmental management and the introduction of DfE tools would not have happened without the introduction of ISO 14001.
As intended, the implementation of ISO 14001 in the organization became the rallying ‘flag’. Senior management endorsed ISO 14001 and provided resources for the EMS design and implementation. Even though some professionals at first failed to understand the applicability of ISO 14001 to CPM, it was easier to justify the effort by reference to an international EMS standard with status than simply to another consulting or organizational change effort. Gradually, some of the most skeptical managers have become enthusiasts for the EMS and the broader ISO 14001 objectives.

This raises the question of what ISO 14001 itself achieved at CPM. It is clear to us that the particular design and results we have achieved would not necessarily have come about from any implementation of the standard. Other consultants and advocates may have ended up with a different EMS design that could have still achieved registration. In practice, it was absolutely key that we did not implement ISO 14001 by the letter. By doing so, we might have conscientiously created aspects and impacts that met the requirement of the standard but were not of practical use for CPM. For example, we might have simply replicated the existing organizational biases that required work to start by ‘digging a hole’. It was vital that we always stopped to reflect on what the standard gave us and, if the process didn’t give us results that felt right, we stopped and thought ‘out of the box’ and then forced this logic back onto the standard. The result was the best kind of use of the ISO 14001 standard—as a language with which we created a fully customized EMS.

Moreover, in an environment where the dominant reaction at the start ranged from lack of interest to antagonism, the fact that we could wave an external standard was essential to our success. The EMS structure that we created, and the management system, will remain crucial to the maintenance and continual improvement of the EMS. We will design performance objectives that relate to DfE, but retain the architecture of our ISO 14001-compliant EMS.

The LEED certificate provided us with a way of achieving our objective of installing DfE by simply specifying at the master plan stage that the project should be designed and built to achieve this. This can then be reflected in the scope of work. How this is accomplished becomes the job of the consultant architect and the contractor (builder). The job of the CPM EMS leadership in the coming period will be to define a management plan that specifies how many LEED certificates should be achieved each year. In time, they will become routine for building and rehabilitation of the large real estate inventory managed by the NYCTA. We also hope that the combination of these requirements for architects and the ensuing requirements of contractors that will come from new design and material specifications, as well as the requirement that they align their EMS with ISO 14001, will have positive results for the residents and riding public of New York City.
References


Biographies

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