Environmental challenge in a French railway maintenance site

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Abstract

Transportation has become a sensitive environmental and economical issue in our society. Railroad transportation is seen nowadays as the best solution when considering the environmental economical and time aspect. Trains are able to transport vast quantities of people and run on electricity; therefore are not responsible for Greenhouse gases emissions and are more energy efficient.

However this simple analysis is done when only considering the active part of this service. In order to fully asses the impacts linked to railroad transportation one has to analyse also the environmental impacts linked to the maintenance facilities of these trains and determine the overall environmental status.

Environmental management system is a growing concern for companies around the world. This management system, which has been developed between the 1970's and the 1980's has evolved and declined itself in a few norms and standards: ISO 14001 and EMAS. The EMS guidelines described by these standards are adapted to the industry; however there are still dilemmas's that reside within the definition of the standards.

This study shows the problems linked to the implementation of an Environmental Management System within a train maintenance facility of the French national railway company: the SNCF. This thesis highlights the reasons why an early EMS faces difficulties when being implemented and how does the SNCF's internal organisations, the environmental agencies and communities act as barriers to EMS.

EMS is regarded as an additional expense by facilities executive managers but this study tends to show that it is a preconceived idea. An EMS in this specific case could become an adapted tool in order to improve the quality of the services provided, to decrease the consumption of resources, thus the cost of maintenance and finally permit the conduct of this activity in conformance with the legislation.

One of the major conclusions of this study is that there are various ways by which an EMS can shift from the status of an additional cost to the industry. The factors that influence this shift are: the environmental managers, the ability to implement an effective global EMS for the company and an important sense of communication.

Key words: EMS; environmental legislation; public company

Table of index

Introduction 7
1 Presentation of the company 9
1.1 A little history 9
1.1.1 Pre World War II 9
1.1.2 Rupture of the initial Agreement 10
1.1.3 The TGV 10
1.2 The SNCF nowadays 11
1.2.1 Key figures 12
1.3 The SNCF and Sustainable development 13
1.3.1 A continuous politic 13
1.3.2 Introduction of the environmental management system within the SNCF 13
2 Environmental management system 16
2.1 Definition 16
2.2 Different environmental approaches 18
2.3 Concept of environmental management system 18
2.4 Benefits of an environmental management system 20
2.5 Different standards of environmental management systems 20
2.5.1 ISO 14001 21
2.5.2 EMAS 28
2.6 Environmental management system in transportation 31
2.6.1 Canadian transportation 31
3 Presentation of the maintenance facility 34
3.1 The SNCFs organisation 34
3.2 The MONT BLANC site 35
3.3 The maintenance facility 36
3.3.1 Size of the facility 36
3.3.2 Human resources and activities of the facility 37
3.3.3 Material and environmental aspect 38
3.3.4 Sensitivity of the surrounding environment 39
4 Environmental Status 42
4.1 Presentation of the mission 42

4.2 The administrative analysis step by step 43
4.3 List of the main non conformities 46
4.3.1 Administrative non conformities 46
4.3.2 Technical non conformities 47
4.4 Environmental solutions 51
4.4.1 Environmental software 52
4.4.2 Improvement of the waste management 54
4.4.3 Products 57
5 Environmental management system in the public service 58
5.1 Barriers to environmental management systems 58
5.1.1 The company: 58
5.1.2 Public service vs. Public service 59
5.2 Clues of how to break barriers 61
5.2.1 Integrating environmental objectives in the SNCF 61
5.2.2 Legislative change 63
5.2.3 Reflexion on the ISO Norms 65
6 Facilitating the implementation of an environmental management system 69
6.1 Integrating the personnel in the EMS 69
6.1.1 Facilitating investments 72
7 Conclusion 74
8 Acknowledgements 77
9 Glossary 78
10 References 79

Introduction

This thesis work is based on a 20 week mission done in the Société Nationale des Chemins de Fer (SNCF); The French National Railway Company. As part of their national 2005 Industrial Project, this company has decided to integrate an environmental approach to their activities.

The SNCF has chosen to take engineering students on internships to carry out the first step of their environmental involvement: the environmental status of their facilities.

This initial task consists in:

- Evaluating the conformity of the facility to the legislation.
- Evaluating environmental impacts linked to a facility
- Ordering in a hierarchy environmental impacts
- Estimate the cost of conforming to the legislation
- Propose an initial environmental plan

Train transportation is regarded, nowadays, as one of the most "ecological" means of transportation, this because the greenhouse gas emissions linked to it are considered to be quite low. For example, when looking at the study done by the Fondation Nicola Hulot (FNH, 2002) which compares the amount of CO2 emitted by various means of transportation for a person travelling from Paris to Marseille (two important cities separated by approximately 900km); it shows that for this defined distance:

- A car emits 178kg of CO2 (considering only the driver, this results turns into 89 kg when considering a driver and a passenger)
- A plane emits 97 kg of CO2(considering the plane to be full)
- A high speed train emits 3 kg of CO2

However these studies only consider the "bottom end of the stick", as in the pollution linked to the train running and not the emissions linked to the maintenance of these trains.

The initial goal of this study is to answer the following question:

What types of environmental issues are linked to the maintenance of trains?

The SNCF has the responsibility of providing a public service to the French population. This company is partly government owned. Furthermore the CEO of the SNCF is a member of the National Counsel of Sustainable Development, which helps defining France's sustainable development policy.

Considering these facts it seems reasonable to think that the SNCF should be an example of legislation conformity and a strong advocate of EMS implementation in the industry.

The goal of this study will be to analyse to what extent an average SNCF facility assesses the French environmental regulations and what are the main barriers to the implementation of environmental management systems.

Having had the opportunity to work with EMS in both public and private companies, I have seen issues that are common to these two types of industries. There are many drawbacks in implementing an EMS that arise from preconceived ideas and many flaws in EMS that could be avoided.

The final goal of this work will be to present methods of how to break these pre-conceived ideas by showing that an EMS is an efficient industrial optimisation tool and to develop a few ideas on how to make its implementation and optimisation successful.

The final chapter of this study will be the conclusions in which suggestions for further work on the SNCF's EMS and environmental approach.

1 Presentation of the company

1.1 A little history

1.1.1 Pre World War II

The SNCF is created in 1938. At that time it is a limited company of mixed economy where the State owns 51 % of the capital and the 49% remaining belong to shareholders of various companies.

The original agreement specifies that the SNCF must be managed in an "industrial" way and that its prices must be fixed at a sufficient level to cover its expenditure. If the State opposes the increases in fees, which are considered to be necessary, it is committed to a pay a financial compensation equivalent to the loss resulting from it

For the exploitation of the rail network, the SNCF is subjected to a schedule of conditions, which fixes its obligations of public utility and the practical methods of its operation. These texts were designed to solve the financial difficulties of the railroads.

But the Second World War occurs. Requisitioned in August 1939, the SNCF, like the other public companies, is used by the German authorities pursuant to article 13 of the armistice convention. The directors of the SNCF battle to preserve the economic autonomy of the company (working force, machineries...) to be able to ensure the necessary transportation to the survival of the French population (passenger trains, supply) and for the operations of the companies; it must also accomplish priority transport dictated by the armistice convention.

The SNCF of the immediate post-war period must first of all rebuild the network to ensure essential transportation necessary to the reboot of the French economy.

It has, in same time, to face the increasing competition of the other means of transportation - road, aviation and pipelines - which have a technical and commercial freedom larger than his.

In this difficult context, the SNCF manages to reinforce the quality of the service offered to its customers, thanks in particular to a succession of technical performances which place it at the avant-garde of railway progress: resort to the AC current (1950) and first record of the world speed on rail, with 331km/h (1955), by two electric engines, record which is worth in France a prestige from which French railway industries profit to develop their exports.

1.1.2 Rupture of the initial Agreement

Since the competition is developing and becoming increasingly rough, the State alters the convention of 1937 by the endorsement of January 27, 1971, whose objective is to put the company on an equal level with the other conveyors. The SNCF becomes responsible for balancing its own budget. The State doesn't financially participate any more to the company's activity apart for contributions to certain specific charges: social contributions and loads in particular.

The SNCF begins an active marketing policy, as well in the traveling field as in the freight field. But it is confronted with two major economic shocks, which compromise its efforts durably: the crisis of oil and the change of heavy industry.

SNCF, whose main activity is road haulage operator, loses little by little the markets for which the rail had been created and which is then its field of excellence: the coal and iron ore. For it, the solution is to develop the market of the travelers. It invents an entirely new concept: the high-speed train. Initially railway gas turbine machine of the aeronautical type, the TGV becomes an electric railcar.

1.1.3 The TGV

The concept of the TGV is the synthesis of progress of the railway technology. It can be seen through the techniques of the material or rail construction: the aerodynamic look; the electricity collecting at high speed; cabin indicators; behavior of the train at high speed. The techniques of the TGV makes it possible for the SNCF to break the speed record on rail on

February 26, 1981, when traveling at a speed of 380 km/h on the new line Paris - Lyon, whose construction had been approved in 1974.

With the setting into service of the TGV, September 1981, commercial maximum speed is fixed at 260 km/h, and then carried to 270 km/h. In the commercial plan, the strong point of the TGV, in addition to its speed and its comfort, is to be able to circulate as well at high speed on new line than on traditional line. Little by little, the majority of the large cities are connected at high speed with frequent connections and a time of reduced course: Paris-Lyon in 2 hours, Paris-Montpellier in 4h48 and Paris-Marseilles in 4h43. *(SNCF-History, 2005)*

South East TGV connecting Paris to Lyon, Montpellier, Marseille

1.2 The SNCF nowadays

The SNCF, in 2005, is the first French transportation company. It has evolved and has managed to diversify its activities to answer to a growing demand of its consumer. Not only is it an important railway company but it is also the head of an important group which includes complementary activities such as tourism, travel agencies and hostelry. The SNCF is first service group in transportation and tourism; it ranks in the five most important European

leaders and is one of the three most important companies in the traveling sector.

1.2.1 Key figures

Human resources

- The SNCF represents 238 000 workers, 175000 of which work in the Paris region.
- The SNCF invests approximately 309 millions euros a year in formation plans for its workers, which corresponds to 6, 25% of personnel cost.

Traveler Traffic

- Main rails: 320 million travelers in 2003 of which 87 million where TGV travelers
- Ile de France rails : 572 million travelers
- Average TGV speed : 300 km/h

Transportation Traffic

- 121 millions tones of various material was transported in 2003
- Around 31000 km of rail is dedicated to this activity of which 14 462 km are electrified lines and, of which 1540 km are high speed rails

The SNCF, apart from developing its activities, has also developed its expertise. With 24500 agents, engineers and technicians, who work daily in maintaining and modifying the machinery and rail material, this company has developed a vast network of competence and industrial installations.

Benefiting from a century of experience and from the exploitation of its products, it has been able to improve the performances of its material activity, whether it is on designing new machinery and new trains or on optimizing its old material. Take for example the Train Express Regional: TER (Regional Express Train) which has seen many changes since it has been put in service. This train now integrates new seats and electrical outlets in answer to a

growing demand of business to power their traveling electrical supplies. *(SNCF, 2005)*

It's this experience which permits the SNCF to propose more comfort for travelers and a better maintainability of trains, thus a decrease in exploitation cost

1.3 The SNCF and Sustainable development

1.3.1 A continuous politic

The SNCF has increasingly involved itself in a sustainable development policy. In 1999 Louis Gallois, the head executive of the SNCF, signs the "Fundamental ethics of public companies for sustainable development". Three years later he creates a Direction for sustainable development and Environment which is related to the SNCF strategic Direction.

In 2004 Louis Gallois engages the SNCF more seriously in this policy. He become a member of the Conseil National du Développement Durable: CNDD (National Counsel of Sustainable Development), which is linked to the prime minister and actively participates to his projects therefore helping to define the country's sustainable development policy.

In the same year the SNCF becomes part of the Global Compact, which was launched on July 2000 by the UN. It invites companies to adopt nine universal principles, on humans rights, the working and environmental norms, in the spirit of a "responsible sustainable development". It is at that time that sustainable development becomes a priority program of the SNCF Industrial Project 2003-2005. *(SNCF Sus.Dev.,2005)*

1.3.2 Introduction of the environmental management system within the SNCF

Since the beginning of the years 1990, the SNCF recognizes the environment and the reduction of the impact of its activities on the environment like a strategic stake.

Sustainable development widens the responsibility of the company and its engagement in research of social equity and economic effectiveness. To optimize the ecological assets of the train and to minimize the environmental risks are not enough any more. From the consumption of the resources to the information of employees and of the interested parties, it is a global solution which is aimed at by the SNCF.

The exploitation of railways can be the source of various types of pollutions, which can be detected right away or seen along many years, such as the noise emissions, the emissions of greenhouse gases, the important production of waste linked to the maintenance of trains and to the growing age of certain installations.

The SNCF has developed six axes around which its politic evolves:

- Waste management
- Reduction of noise emissions
- Control over the gas emissions linked to diesel fuelled trains
- Water protection
- Industrial risks prevention
- Management of natural resources

An experimental program "Management of the Environment" has been launched in 2001, in partnership with the Environmental and energy control Agency (ADEME), to check the feasibility and the relevance of applying the ISO 14001 standard to the railway exploitation. Initially, about thirty establishments of the SNCF engaged voluntarily in the realization of an environmental diagnosis, then about fifteen of them decided, in 2002, to carry out an environmental management system (EMS). The environmental management is the subject of a specific axis of progress in the companies Industrialist Project 2003-2005.

This approach takes into consideration all the aspects and environmental impacts related to the activities of the SNCF: water, grounds, energy, waste, noise, risks.

The objective is to create the conditions needed for a possible ISO 14001 certification of the SNCF.

The ambitious objective that the company has fixed itself is to obtain the engagement of 100% of the establishments in this environmental approach by the end of 2005. *(SNCF Sus.Dev.,2005)*

Over the 10 next years, the SNCF has decided to devote each year 35 million euros to maintaining the legislative conformity of its activities and installations, but also to ensure a continuous progress in environmental field.

In order to diffuse a more respectful culture of the environment, an Intranet site has been set up. Training schemes were set up in order to anchor this environmental culture in the company.

2 Environmental management system

2.1 Definition

There are many definitions that have been formulated for environmental management systems since its early development in the United States between the 1970's and the 1980's. A lot of countries have made their own definition through the creation of EMS standards or norms (Lamprecht James, 2003).

An American definition of EMS has been formulated by the Public Entity Environmental Management System Resource Center (the Peer Center). The PEER Center is the result of the collaboration between the Office of Water at U.S. EPA and the Global Environment & Technology Foundation (GETF). This partly governmental center, which aims to promote tools and methods or the implementation of environmental management systems within public entities, proposes the following definition:

"A management approach which enables an organization to identify, monitor and control its environmental aspects. An EMS is part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy." (Peer Center, 2005)

However this definition is not complete because it omits various important points such as the respect of environmental regulations or the necessity to clearly define the various stakeholders in this management approach.

The French definition, which was included in the French norm NF X 30-200, included this legislative aspect of environmental management system in the definition of the environmental policy:

"Environmental policy: General orientations and objectives of an organization concerning the environment such as they are expressed formally by the direction at the highest level. The environmental policy is an element of the general policy. It is understood that the respect of the legislations and regulations relative to the environment part of this environmental policy."

(Meyronneinc, J. P., 1994)

Both of these definitions are acceptable but unfortunately they are not complete. James Lamprecht (2003), an author who has analysed many definitions of EMS, considers that we have to go back to the 1980's in order to find a more detailed and accurate definition of environmental management:

« *An environmental management system is a framework or a method to lead an organization in the realization and the maintenance of performances which correspond to established objectives in response to regulations in constant change, with the social, financials economical and competitive pressure and also to the environmental risk . When it is functioning efficiently, an organizations environmental management system provides the direction and the board of directors the insurance that:*

- *the company respects the federal environmental laws and regulations, of the States and the localities;*
- *the policies and the procedures are clearly defined and officially recognised within the organization;*
- *the risks incurred by then organization as regards to the environment are identified and controlled;*
- *the organization has the resources and the personnel suitable with the realisation of the spots related to the environment, it applies these resources and controls its become.*"

(Ladd Greeno, J., 1985)

The problem of the definition of EMS becomes visible once company has implemented it. As we have seen, some of these definitions omit important parts of EMS and therefore can turn into incomplete company environmental policies or into administrative non conformities.

Many authors emphasises the need for companies to look for and to consider many definitions of EMS in order to develop an accurate and effective environmental policy linked to their activity (Barachini, P., 2004; Salamitou, J., 2004, Lamprecht, J. 2003)

In this chapter we will present the concept of environmental management and the two main standards of EMS. We also present the limits and the dilemmas within these standards. Finally we will present an example of EMS within the transportation field.

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2.2 Different environmental approaches

Environmental management can be considered with two different points of view; thus deriving in two different forms of management.

- The "organizational" approach, developed on production sites, which can result for example in "Eco-audit", an ISO 14001 or EMAS certification. It constitutes an internal management tool for the company, founded on the principle of the continuous improvement philosophy.

- The "product" approach, also known as "Eco-conception" which exceeds the walls of the company since it consists in designing and improving the products so as to minimise their overall environmental impacts during their life cycle (i.e. since the production phase: "the cradle", to the elimination phase: "the grave".)

2.3 Concept of environmental management system

An EMS, in order to become effective, requires the involvement of all during its implementation. The involvement has to come from the basis and from the top of the pyramidal hierarchy of a company:

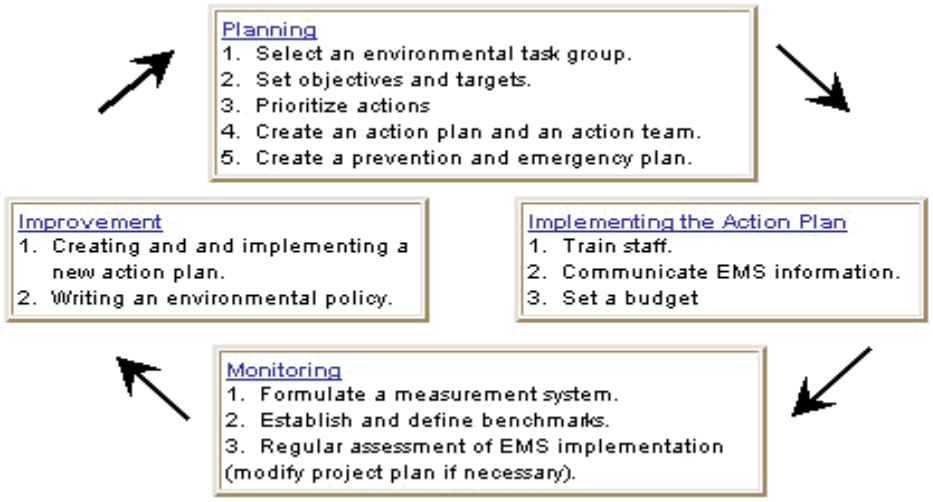
- **Top management involvement**: in order to clearly make the reduction of environmental impacts a company's goal, top management must involve itself in this environmental approach from the beginning. This is usually done by the publication of a "letter of involvement" in which the CEO defines its will to reduce environmental impacts and partly describes the environmental policy of the company.

- **Employee involvement**: The employees are the first actors of the environmental management system. In this sense their involvement in

the application of the environmental policy and their participation in the implementation of the EMS is a guarantee of a successful system.

Environmental management systems follow the guide lines of DEMINGs Wheel of continual improvement which is composed by these four basic steps. These steps are repeated over and over in order to continuously propose new improvements, but also to continuously adapt the system to the various changes that an industry goes through (change of organisations, of processes, of basic resources, etc)

This is an example of how the Deming Wheel has been adapted by the *International finance company*.



(Worldbank group, 2006)

Its purpose is to:

- Serves as a tool to improve environmental performance
- Provides a systematic way of managing an organization's environmental affairs
- Is the aspect of the organization's overall management structure that addresses immediate and long-term impacts of its products, services and processes on the environment
- Gives order and consistency for organizations to address environmental concerns through the allocation of resources,

assignment of responsibility and ongoing evaluation of practices, procedures and processes
- Focuses on continual improvement of the system

(N.C.Division of Pollution Prevention and Environmental Assistance, 2005)

2.4 Benefits of an environmental management system

Environmental management has many advantages for a company, whatever its size. It allows in particular:

- to manage its legal constraints (European, national and local environmental regulations);
- to fulfill the requirements of its clients (ISO certification, use of particular resources, etc.);
- to build a confident relationship with its partners (shareholders, banks, insurances...), thanks to the environmental declaration, a specificity of environmental management systems;
- to optimize its costs of production and to control its risks (reduction of resources involved in the production, optimisation of process using chemicals or dangerous products);
- to render its activity durable and improve its competitiveness;
- to mobilize its personnel around a uniting subject;
- to support its integration in the local life.

More specifically, the "products" approach makes it possible for companies to innovate and improve its products while satisfying or by anticipating the expectations of the market.

2.5 Different standards of environmental management systems

The emergence of the concept of environmental management system generated the need for standardisation in this specification. The commercial aspect of this standardisation resided in creating a norm that wouldn't

transform environmental value as a commercial barrier for any of the important international actors: USA, Europe and Asia (Barachini, P., 2004).

Environmental standards have been created in order to evaluate company's environmental involvement on common criteria's. By using common standards suppliers or clients have a clear view of what type of EMS a company has implemented and what are the requirements it has to respect.

Many standards have emerged in the last decade but two have been widely accepted: the ISO 14001 and EMAS

2.5.1 ISO 14001

The norm

The International Standards Organization (ISO) decided to create an environmental management standard, as result of the Uruguay round of the GATT negotiations and the Rio Summit on the Environment held in 1992.

Since these summits, many countries have developed their own environmental sat, such as the British standard: BS 7750, the European eco management and eco labelling, etc. (quality network, 2005). However the international aspect of the ISO norms has permitted the ISO 14001 to dominate other standards that were more specific, such as EMAS which was specific to Europe (Barachini, P., 2004).

It is important to first state that the ISO 14001 is a process standard, as ii describes specifications for a management system and does not give product characteristics or performance requirements. (Fryxell and Szeto, 2002).

This norm, like the quality norm ISO 9001, lies on the principle of *total quality management* (Lamprecht, J. 2003). The ISO 14001 can apply itself to any type of company without consideration to: its size, with no limitation to its geographical limitations.

The purpose of this Norm, is presented by the International Organization Standard (1996):

"The present international Standard is applicable at any organization which wishes:

1. to implement, to maintain and to improve an environmental management system;
2. to insure of its conformity with its environmental policy;
3. to demonstrates its conformity to others
4. to obtain certification/registration of its environmental management system by an external organization;

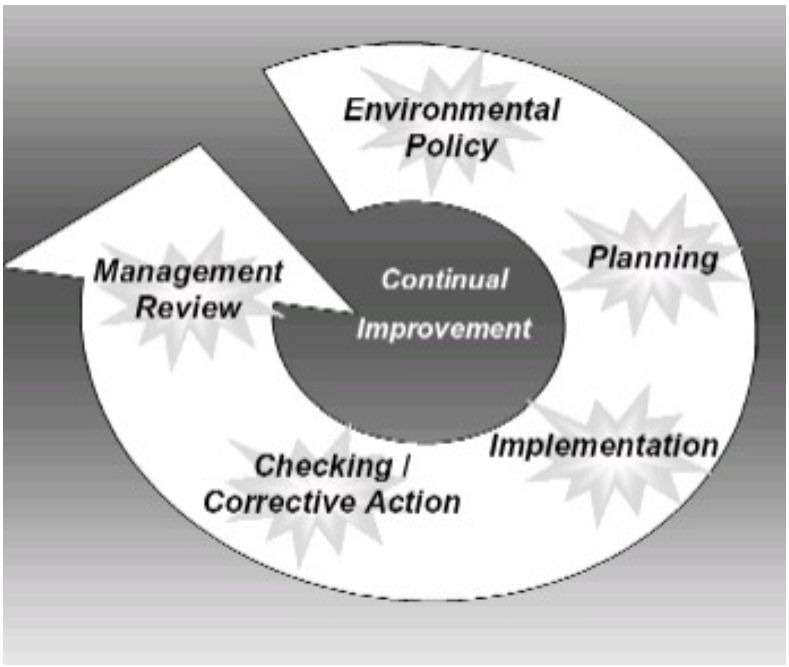
5. to carry out a self-evaluation and a self-declaration of conformity to
6. the present international standard."

The methodology

In order to reach the goals set previously the ISO 14001 gives numerous guidelines. It dictates priority requirements which aim to implement an effective EMS. These can be summed up as follows (Barachini, P., 2004):

- "Identification and analysis of significant impacts environmental impacts and aspects.
- Definition of the company's environmental policy.
- Involvement in respecting and managing the environmental legislation
- Definition of the objectives of improvement of the company's environmental programme.
- Continuous improvement of the company's environmental performances.
- Environmental communication.
- Control of the cases of emergency and management of environmental risks.

The norm then presents the step by step methodology to implement and improve an environmental management system. As mentioned, the norm lies on the *total improvement management* scheme and is based on Deming's wheel of continuous improvement. This methodology can be summed up in this graph.



Each of these steps represents one of the five requirements developed in the ISO 14001 Norm:

- **Environmental policy**: a statement of the organization's commitment to the environment. It can be in the form of a CEO's letter specifying his will to adopt
- **Planning**: An identification of significant environmental impacts - environmental attributes of products, activities and services and their effects on the environment. This done through an initial environmental status and revised on a yearly basis with the environmental analysis. These two studies permit to plan the environmental management goals and objectives for the organization
- **Implementation**: Application of the different plans to meet the goals and objectives of the environmental plan. This part also includes an employee's sensibilisation, in which they become aware and capable of their environmental responsibilities.
- **Checking / Corrective action**: Periodical evaluation of the management system and development of corrective actions.
- **Management Review**: evaluation of the veracity of the environmental management system.

Certification: The certification by an external party of an environmental management offers numerous internal and external advantages for a company (Salamitou, J., 2004).

Internal benefits:

- For the management of a company, an audit of certification can be an opportunity to point out management errors.
- Although an auditor isn't suppose to give away information he will always give useful indications on what is done in other companies during the audit.
- Finally, the certification can be used as a motivation tool for the personnel working with the EMS.

External benefits:

- Outside the company, a certification works as a reputation enhancer. The general public will tend to have a better image of a certified company.
- It helps communication with environmental organisations.
- Finally it demonstrates to governmental environmental agencies the will of a company to respect environmental legislation.

The certification process can be summed up in 7 steps (Salamitou, J., 2004, Barachini, P., 2004):

Perimeter definition: The company has the choice to either certify all its environmental management system, or part of it. However the part that his audited has to conform formally to the ISO 14001 specifications and the certification will indicate only the specific EMS part audited

Choice of external organization: A company ought to be certified by an accredited organization. In France accredited organizations are listed by the COFRAC (French Accreditation Committee). It should be understood that most countries have their own accreditation committee, for example China has their Certification and Accreditation Administration of the People's Republic of China (CNCA) China (Gerald E., Fryxell, Shan Shan Chung and Carlos W.H. Lo, 2004). The important factors to take in consideration when choosing an audit company is the price of course, but also the reputation, the experience in the specific activity in which the audited company evolves and the availability. This step is the basis for a well run audit.

Certification demand: The chosen certifying organization sends a questionnary, in which the characteristics of the company and various documents linked to their environmental management are demanded. The organization then studies the company's case and if the initial

requirements have not been fulfilled, it rejects the demand. The company is informed of the organizations decision; if the audit is rejected explanations are given, if not the organizations specifies the length in time of the audit, the size of the auditing team and the price of the service. At this point the company and the certifying organizations have to define the specific perimeter of activities that will be audited.

Administrative review and audit plan: The documents linked to the company's environmental management system are reviewed by the organizations. If the organizations considers that the administrative review is inconclusive for certification (too few documents, absence of vital documentation) the certifying process ends. If the organization is satisfied with the administrative review, then the final arrangements are made with the specification of dates, people to interrogate and crucial points of the facility to view. The company gives the final agreement for the conduct of the audit and designates appropriate personnel to follow the auditing team. Finally it informs the personnel of the audit plan.

Conduct of the audit certification: This is part is generally done in four steps.

_ The opening session: in which the auditors specify how they will do the audit.

_ The field work: in which they visit the facility, interrogate workers and finalise their administrative review.

_ The synthesis: auditors create variation posts in which they note the non conformities they have seen on the field. At that point the personnel has the right to answer and to provide justification for the recorded non conformities.

_ The Closing session: Presentation by the auditing team of their conclusions to the executive management.

Audit Report: The auditing team writes a report in which it specifies the non conformities and mistakes observed on the field. This report is viewed by the company who proposes actions to remedy to these mistakes. Finally this report is viewed by a decision committee, independent of the auditing team. It is this committee, in view of the report who can either:

_ deliver the organisations certification;

_ deliver the organisations certification under specific conditions: production of complementary administrative documents or new audit in limited period of time;

_ refuse certification.

Renewing: The certification is delivered for a limited period of time. New audits have to be conducted in order to renew the certification; however these are lighter and adapted to the evolution of the company.

Motivations for an ISO 14001: The literature gives many reasons for companies to acquire an ISO 14001 certification. These are varied and sometimes recurrent (e.g. Kim, 1996; Tibor and Feldman, 1996; Johannson, 1998; Harrington and Knight, 1999; Woodside, 2000):

- Improved regulation compliance,
- Incentive to increase the market share and opportunities for premium pricing within a certain market segment,
- Possible access to new markets
- Answer to the pressure of customers,
- Cost reduction induced by better production efficiency,
- Better reputation,
- demonstration of conformation to the legislation,

These reasons should not be considered to be a generality as business is conducted differently in other parts of the world and therefore have a different approach of ISO 14001 than Western views. A good example to illustrate this point is China (Gerald E., Fryxell, Shan Shan Chung and Carlos W.H. Lo, 2004). Businesses, in this country, find their motivation in implementing an EMS and getting an ISO 14001 certification through the state. The government has been pushing state-owned companies to seek the certification through various pilot projects and thorough monitoring from the state environmental agency (Zhu, 1999 an Chen, 2001). Others like Korea seek ISO 14001 certification for product recognition or enforcement of competitiveness (Dong_Myung Kwon, Min Seok Seo and Yong-Chil Seo, 2002).

Dilemmas linked to the ISO 14001

The literature provides many examples of paradoxes that lie within the ISO 14001 definition.

The reputation of registrars is an interesting issue of the ISO 14001 and has been investigated by Gerald E., Fryxell, Shan Shan Chung and Carlos W.H. Lo, 2004). Fombrun and Shanley (1990) define reputation as "a widely shared perception about attributes or other characteristics that either add or subtract value from good or services." In this way of thinking, one would estimate that a company that has been certified by a registrar know to be rigorous has a better environmental management system that a company that has been certified by a registrar known to be lenient. However studies have shown that environmental performances and registrar reputation are not always linked and that the choice of a prestigious registrar is not synonym of quality EMS. In other terms it is difficult to determine the value of certified company's EMS. Company's, with the help of lenient registrars and easy accreditation committees, can easily get certified at their national level but still be recognised internationally as ISO 14001 certified. This issue is difficult to tackle: standardizing the audit procedure seems difficult because audits differ from each other because of the: type of facility audited, the auditing team, the difference of cultural value between countries and the different accreditation bodies. One possible answer would be to rewrite the definition of the ISO 14001 standard with requirements in terms of accreditation committee, registrar standards and new requirements for a more effective EMS.

James Lamprecht (2003) shows another example of dilemma within the ISO 14001 with northern American chemical industries. Some of these industries still produce, for the exportation market, pesticides and substances that has been banned from the United States such as DDT, DBCP ((dibromo chloropropane),etc. These chemicals are exported to other countries which use them to protect their harvest, such as coffee, pineapple or strawberries. These are same products that then exported in the United States. This is where the absurdity of the situation lies: northern American ISO 14001 certified chemical plants produce and export forbidden chemicals which end up on the American consumers' plate, in the form of a chemical residue.

However the ISO 14001 norm is not completely responsible of this kind of situation. It clearly stipulates that a company has to conform to the countries environmental laws. It is the laws which permit these types of chemical companies to produce and export such chemicals it ought to be changed. This point leads to another issue. If the legislation is changed in order to eliminate the absurd situation described above, will these companies delocalize their industry? Northern American companies could, for example, move their

facilities to Mexico. At this point every nation would be exposed to these pesticides.

2.5.2 EMAS

The norm

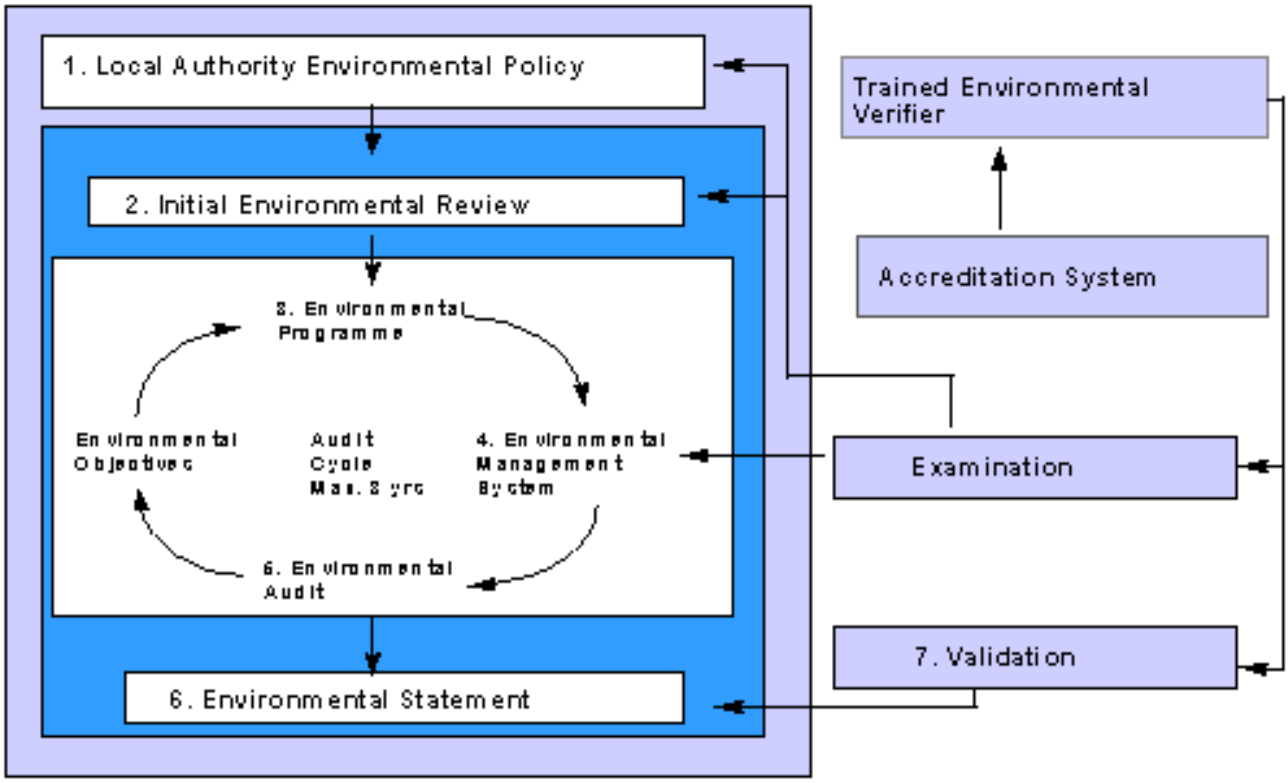
The European Union had in the early 1990's the will to develop an environmental standard with very few constraints linked to it and who would also concern imported products.

This lead to the publication, on the 29th of June 1993, of the EU Council n° 1836/93 regulations concerning the participation of industrial companies to a comminatory of management and environmental audits, known as EMAS (Environmental Management and audit System) (Barachini, P., 2004). The basic idea behind this regulation was to provide an appropriate tool for industrials in the EU to decrease the pollutions linked to their activities in a voluntary way in respect of the legislation. EMAS had the particularity of not being an obligation or a law, but a voluntary system which permitted companies to engage themselves in a process of continuous improvement of their environmental performances. This norm was only applicable to specific industrial facilities, which meant that a company had to certify its sites one by one.

This problem was solved in 2001 with a new regulation known as EMAS 271/2001, which took into consideration environmental management in the management of a company. This means that any type of organization, which desires to improve their environmental performance, can follow EMAS.

The methodology

The environmental management system described in EMAS is close to the one described in the ISO 14001 as in they have many requirements in common.



(Euronet, 2006)

The first step is the realisation of the environmental analysis, which has to be done by competent personnel which have the necessary environmental and industrial knowledge.

This step is crucial as it is the basis of the evaluation of significant environmental aspects, of the definition of the environmental policy, of the definition of environmental objectives and environmental performance to reach these goals.

Like the ISO 14001, the system and its performances have to be regularly audited and evaluated.

However EMAS has set additional requirements which are only implicitly described in the ISO 14001.

- Included in the environmental aspects, the aspects linked to purchase, the aspects linked to the suppliers and subcontractors habits, the aspects linked to transportation of products and personnel.
- Analysis of the environmental aspects linked to the product
- Influence of economical parameters (investments, insurance) within the environmental aspects
- Impacts of the activity on the biodiversity

(Salamitou, J., 2004)

The additional requirement that is dictated by EMAS is the necessity to produce an "environmental declaration" annually. This document is composed of the following elements:

- Description of the company and the activities linked to it,
- Results of the environmental evaluation,
- Environmental policy,
- Relevant data on the obtained environmental performances,
- Environmental program with its results,
- Name of the verifier and date of validity of the document

(Barachini, P., 2004).

This is where the main criticism of the ISO certification lies. If the standard is a tool for the companies to set up a system of dealing with environmental issues, it generates on the other hand criticisms on certain points. It does not mention in any point a durable obligation of development. An also important point, if a company is certified ISO 14001, it does not necessarily mean that it does not pollute, but that it respects the principles of the standard: observance of the regulation, engagement of a continuous progress, engagement of the prevention of pollution. This point is not always very clearly in the communication of certain certified companies and is a necessity of EMAS.

EMAS recording process

In order to be EMAS recorded, the company need to uses the services of an external neutral expert, known as a "verifier", which will verify the implemented environmental management system and environmental declaration. These verifiers are accredited by national organisms of EU states. In France it is the "Association des Chambres Françaises de Commerce et d'industrie: ACFCI" (French Chamber of Business and Industry Association) who takes care of this procedure.

These verifiers have the responsibility of:

- Evaluate and verify the environmental management system and its conformity to the EMAS requirements then to validate the environmental declaration,
- Produce an official declaration guaranteeing the conformity to the EMAS requirements of the environmental management system and the exactitude of the data written in the environmental declaration.

The EMAS committee, after consulting if the national environmental agency posses any opposition for legislative reasons, decides, after consultation of all the relevant facts provided by the verifiers, of the recording of the audited company

Motivations for EMAS

The fact that these two norms are very similar explains why the motivations are the same for both norms. However EMAS has the advantage of giving the right for recorded companies to post the European logo on their products.

2.6 Environmental management system in transportation

2.6.1 Canadian transportation

Initial step

Canada has developed, in relation with its sustainable development program, an EMS for its various transportation means, with the constant concern of security regulation and environmental responsibility.

This program started in November 1998 with a first experience conducted at the Aircraft Services Directorate (ASD) (ASD, 2005), where a pilot project of EMS was implemented within the ASD's facilities.

This project's goals were:

- *to assess both the time and costs required to implement an EMS comparable to ISO 14001; and*
- *to share lessons learned from the experience with other federal departments.*

(Canadian transportation, 2005)

This initial program lasted 18 months and was able to give the Canadian government of:

- The financial and time investment necessary for the implementation of an EMS
- An initial experience with the tools of an EMS (Environmental documentation, Environmental review, Environmental audit
- A clear views of the main difficulties linked to the implementation of an EMS

Nowadays

Transport Canada is now using the principles of ISO 14000 to construct its environmental management system.

The goal for this EMS (which corresponds to the **Planning** phase) is to integrate environmental considerations in the decision making process within Transport Canada (choice of vehicles, choice of urban transportation project in consideration of future environmental impacts, etc.)

In order to monitor this EMS (which corresponds to the **Checking** phase) an environmental monitoring program ha been set up. Its aim is to:

- *to ensure compliance with applicable legislation and regulations;*
- *to promote conformance with federal government and Transport Canada policies and practices;*
- *to ensure environmental clauses in lease agreements are being met; and*
- *to ensure operations are consistent with good environmental practices and sustainable development objectives.*

(Canadian transportation, 2005)

Finally the review and the results of this environmental management system are available to the general public with the annual Environmental Performance Report (Transport Canada EPR, 2005).

Example of the outcome Transport Canada's EMS

As said previously, the goal of the EMS of Transport Canada is to integrate environmental considerations in the decision making process within Transport Canada. In relation with this a significant project for urban transportation has been created **The Urban Transportation Showcase Program**; a five year program in which five communities demonstrate, through showcases, transportation programs permitting to reduce the emissions of green house gases. Programs vary from setting up a bicycle renting service to the creation of new bus express corridors to promote the use of public transportation. *(Transport Canada showcase, 2005)*

3 Presentation of the maintenance facility

3.1 The SNCFs organisation

The SNCF has divided the French territory in 23 regions. Each region has established a regional direction, managing all the surrounding facilities.

The MONT BLANC site, which I was working for, was affiliated to the Haute Savoie region, with headquarters in Chambery.

The SNCF has divided all its activities linked to their production of locomotion service, in four main Operational Units (UO: Unité opérationnelle)

- UO Exploitation: This unit operates the commercial aspect of the locomotion service. It manages all the ticket booths, sets the personnel requirements in train station according to the periods of time when the increase in demand can be expected. It also manages all the extra services within the train station: the Information booths or the "Help Service" which takes care of helping handicapped or aged people to get on or off the train.

- UO traction: This unit operates all the onboard personnel. It manages the conductors' team and makes sure that they all respect the security measures and have the appropriate qualifications. It also takes care of the ticket collectors. It assures the logistics of both teams in accordance of their schedule and geographical place of residence. Finally it has the obligation to manage all the infrastructures required for both of these teams such as sleeping or resting accommodation in the railroad station for overnight stay or short resting period.

- UO Equipement: This unit operates all the maintenance activity on the railroad network. It makes sure that tracks are in proper condition to ensure the mobility of trains at a specific speed limit. It makes sure that the surrounding vegetation doesn't interfere with the trains. Furthermore it is a "life saver" in case of rail rupture or weather induced line damage with a team ready to act on a round the clock basis.

- UO Matériel: This operational unit takes care of the maintenance of trains. The activities involved in this particular sector are varied. It ranges from the basic maintenance of trains such as oil change and replacements of different used parts such as brake pads, to the creation or the modification of parts in order to adapt the train to particular environmental conditions: rocky areas, frequently frozen tracks, etc.

Most frequently the sites are specialized only one of these activities. This means that all these operational units are rarely in direct contact with each other and evolve in different location.

The MONT BLANC site is an exception.

3.2 The MONT BLANC site

The MONT BLANC site trains run in the "Haute Vallée de l'Arve" (High Valley of the Arve) linking St-Gervais-Le Fayet to Châtelard and then on into Switzerland

This site is in charge of the only line with a metric spacing in France. One of the additional idiosyncrasies of this line is that there are three rails: two rails distant from each other by a meter, (the normal French rail spacing between rails is 1,435 meters). The third rail is an electrified rail with 800 volts going through it on a continuous flow. This rail supplies the energy to the trains circulating on this line. The contact is made with a wiper which is placed on the boggie (metallic structure that constitutes the base of the train holding the wheels, the brakes, and all the forces transmission system) of the motor coach.

The line follows a 37 kilometer long mountainous track. The trains are entirely dedicated to the regional traveler transportation, approximately 300000 persons per year, of which the majority are tourists, students from the surrounding villages and employees.

The MONT BLANC site presents a unique organizational and technical particularity. It is one of the rare multifunctional sites within the SNCF.

This means that all four operational units are present on site: UO Equipement, UO Traction, UO Exploitation and UO Matériel.

The installation employs 150 agents with reinforcement during seasonal peaks (winter time and summer time).

All the services coexist in the same installation and require additional units to ensure a good organization between them. The structure with the MONT BLANC site is as follows:

- UO Exploitation: which, in this installation, is composed of both sedentary and traveling commercial agents.
- UO Material: maintaining only the trains of this specific metric rail
- UO Traction: composed of sedentary conductors and ticket controllers
- UO Equipement: which are dispatched in through four brigades in order to respond quickly to any problem, which are quite frequent due to climate conditions.
- The PC éclair: This is the service that manages the regulation of trains on the metric line and the normal line
- Human resources pole: deals with administrative management, working clothes, medical services, working accidents, payment of employees, etc.
- GEF Pole: Financial management

3.3 The maintenance facility

3.3.1 Size of the facility

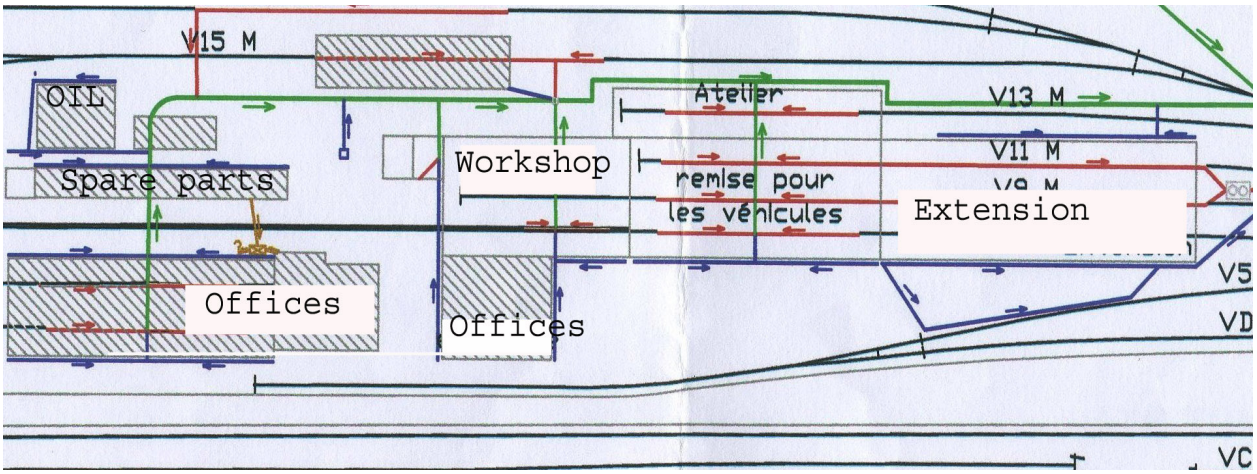
The workshop was built in 1901. It has always been a workshop for train maintenance. Originally covering a space of 1000 sq. meters it has been extended twice: in 1974 and 1997. The workshop now covers 1700 sq. meters.

In addition to this there are two other buildings used for this maintenance activity:

1. Spare parts storage building next to the chemical products storage

2. The Oil "cabin" where the oil used for the brake pads and for the electrical contact wipers is stored.

This is a scan of one of the few maps of the present MONT BLANC installation:



Map of the MONT BLANC installation 2003

3.3.2 Human resources and activities of the facility

The workshop has 26 permanent employees which work on two time shifts:

- Morning shift: 5:00 - 13:00
- Afternoon shift: 13:00 - 16: 30

The main activities carried out in this workshop are the following:

- Motor maintenance: Every six months the trains are systematically dissembled and the machinery is checked. This is also the case if a mechanical problem occurs or with a newly delivered machinery. This activity is a big source of waste because not only it generates large quantities of used drainage oil before working on the engines, but there are also many stained cloth, considered to be hazardous waste, that come out of this maintenance.

- Plasma cutting and soldering: This activity is one of the basic activities of the workshop. It is used to create or to repair parts of the machinery. There are three types of soldering used within the workshop:

:

  - Heat Soldering: which is the commonly used soldering. It uses a blowtorch to heat the metals and meld them together
  - Electrical Soldering: This procedure uses an: electrical arc to mend the metals together
  - MIG MAG: this procedure is similar to the previous one except it uses a gaseous environment which is composed of Acetylene and oxygen

  This activity is the only source of gas emissions in the workshop. However the amount of gas emitted by it is almost negligible. There are only about 28kg of oxygen and 11 kg of Acetylene used per year which are very small quantities

- Painting: The trains need to be regularly cleansed of graffities or need repainting after winter time. A part of the workshop has been especially dedicated for this activity. This procedure generates a lot of waste:

  - Annual repainting: the main residues coming out of this procedure is the scrap paint that has been scratched of the trains, the empty paint buckets , that are considered to be hazardous waste along with the contaminated cloths
  - Graffiti removal: this activity generates a bigger diversity of waste than the previous one. In order to remove the fresh spayed paint an important amount of solvents is used.

3.3.3 Material and environmental aspect

On the metric line, run three types of train: Z600, Z800, and Z850.

- The Z600 is the oldest trains and came into circulation in 1958. They are going to be phased out of commercial service over the next couple of years. The main problem is the age of the equipment. The frequent repairs and the lack of spare parts make it more and more difficult to maintain these trains. These trains have a high consumption of oil partly due to the age of the technology and to the recurrent leaks.

Z600 in the maintenance facility at le

- The Z800 is much more recent. It was put in circulation in 1997 and is the only model able to continue on to Swiss tracks because it is equipped with a pantograph and toothed rack system. The MONT BLANC Site share five of these with the Swiss rail company: two of them are French, two of them are Swiss and the last one is financed by the regional Council of Haute Savoie.

Z800 in the Chedde station

- The Z850 is to be put in circulation in March 2006. They are to replace of the Z600. Four them on test in le Fayet. They have been completely financed by the Council of Haute Savoie.

  (SNCF region Chambéry., 2003)

Z850 in testing in the Vallorcine station

3.3.4 Sensitivity of the surrounding environment

In order to assess the potential environmental impact of the workshop, it is necessary also to describe its surrounding environment. When analyzing the

different aspects of these surroundings, one can get a clear picture of this environments sensitivity. These are the conclusion I came to during my environmental review:

- Air: Le Fayet , where the workshop is located, in a bowl. It is situated at a low altitude and the air stagnates above this town blocked by a chain of mountains. This is clearly outlined by the high frequency of fog . Moreover the workshop is right in the middle of the town directly in contact with the population. All of this makes the air sensitivity of the workshop high

- Noise: As mentioned previously, the workshop is in the midst of residential areas. The noise it generates is therefore a problem. The sensitivity to noise increases to a high level with the presence of a primary school right next to the MONT BLANC site.

- Water: The water sensitivity is high in this area. This is due to the presence of various sources of water:

  - A river, the Bonnant , flows some 50 meters away from the workshop. This stream is used by the local population as a recreational area and as a fishing spot; it meets further down with the Arve, another rivers that passes through the valley of the Arve.

  - The installation is situated above a water supply network which is used by an equestrian centre and a soccer stadium, situated at the periphery of the MONT BLANC site.

  - Finally, five kilometers away from the installation, there is the Dommancy water well which provides water for industrial and public purposes.

- Landscape: this sensitivity is also quite high.

  - Le Fayet is situated in a quality mountainous landscape.

  - The valley counts numerous regional natural parks

- It is a tourist area with many activities linked to it such as, mountain biking, mountain hiking, canoeing, etc.

All these points go to show that the environment in which the MONT BLANC site is pursuing its activities is highly sensitive, thus making the consequences of an eventual ecological accident quite disastrous.

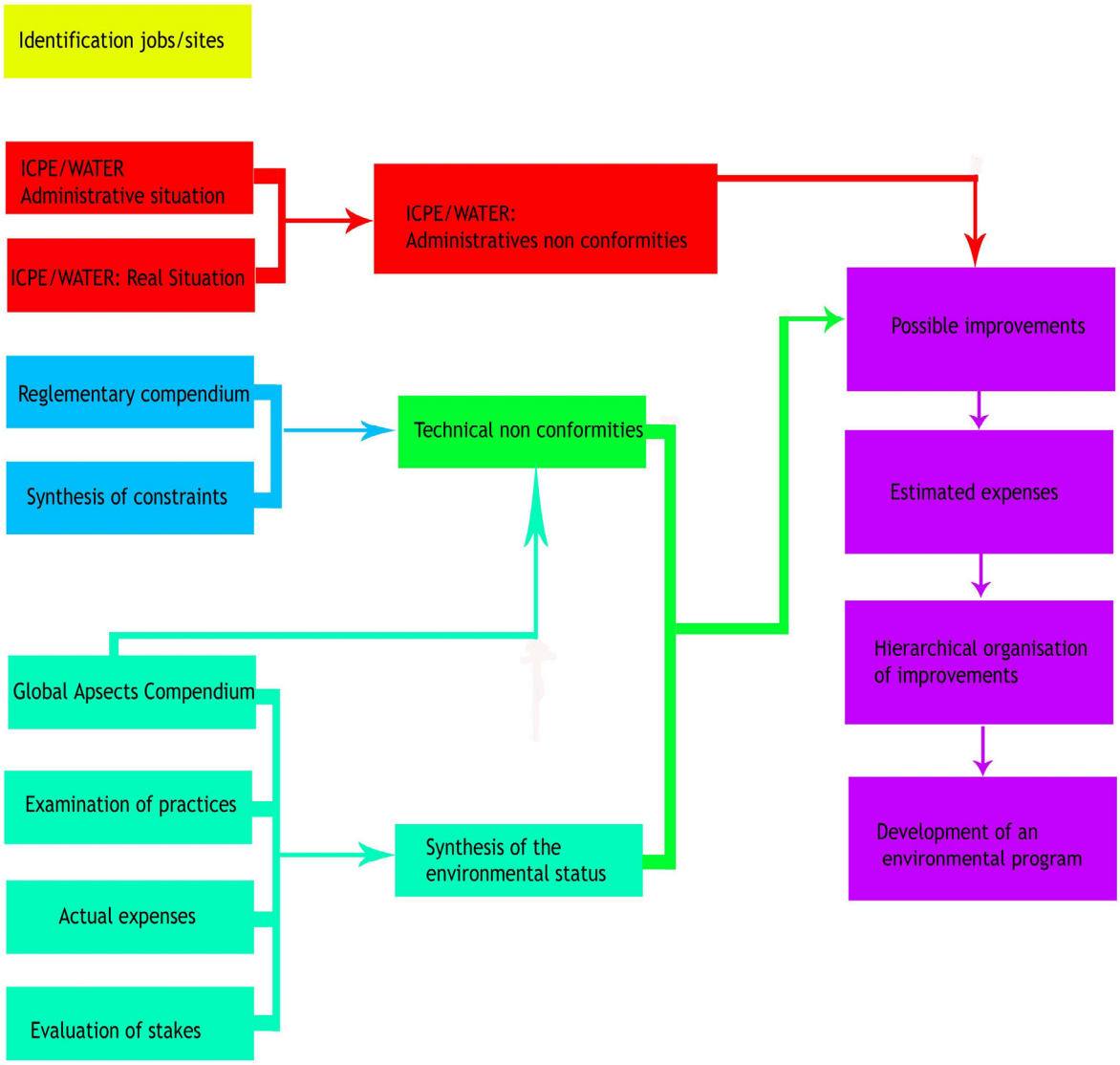
4 Environmental Status

4.1 Presentation of the mission

My mission, within the 4DE, was to define the environmental status of the maintenance facility managed by the UO Matériel within the MONT BLANC SNCF site. The analysis of their resource consumption, their waste elimination and their procedure, was the first step towards the implementation of a viable environmental management system.

In order to do such a study I was given a tool known as the PEE method. This method was developed in relation with the Chamber of Business and Industry and the ADEME. It is composed of a series of blank cards to fill in. It is a step by step procedure to draw an environmental status and to elaborate an initial plan of action. It also proposes a method to build an EMS in accordance to the prescriptions of the ISO 14001 or Eco Audit. Finally it permits to implement continuous improvement in one or many fields (waste, energy, water, air, etc.) *(ADEME, 2002)*

The following graph sums up the procedure done when using the PEE method:



4.2 The administrative analysis step by step

The PEE method gives a chronological order of how to fill in the cards. My first step was to gather all the existing documents of previous I.C.P.E declarations. This was done quite fast considering there was none present on site. This first experience lead me to the following conclusion: the chronology given by the PEE doesn't have to be entirely respected. This simple observation permitted me to realize that numerous cards could be done simultaneously and some others required filling in previous cards. This proved to be helpful in the progress of my mission because gathering information within a big company like the SNCF can turn to be quite complicated and time consuming. This is due to the fact that there are many ramifications within the SNCF, many different departments and all of them can possibly withhold the particular data you require. Moreover the person

liable to have the information might be various reason unavailable or might take time to send it back.

My first effective assignment was to evaluate the activities and the installations within the maintenance facility that fit the definition of the I.C.P.E nomenclature. The main difficulty in this task resided in the definition of these norms, one has to pay attention to each word composing them and to all the links redirecting to other norms. Let me clarify my point by illustrating it by an example.

Take for example the I.C.P.E nomenclature number 1432 relative to the storing of flammable liquids in manufactured tanks. It states that "an installation with an equivalent capacity on site greater than 10m3, but inferior to 100 m3 is subject to a declaration regime". I casually started to evaluate the sum of all the volumes of flammable liquids on site. Unfortunately it is only after finishing this task that I realized that the term "equivalent capacity" was defined, in the nomenclature number 1430, in a form of a algorithm Ceq= 10A+B+C/5+D/15 where A, B, C and D are classes of flammable liquids defined by their flash point.

This little mistake compelled me to list once more all the flammable liquids on the site this time according to their flash point in order to evaluate if the site was subject to declaration.

This type of mistake is quite frequent when first dealing with such texts but I soon developed reflexes when analyzing them.

It is after some such misinterpretations that I finally managed to evaluate the activities that were subjected to a declaration, which where the following:

- Storing of flammable liquids in manufactured tanks
- Storing of natural gas in manufactured tanks
- Mechanical work of steel and alloys
- Cleaning, removing grease of metallic surfaces, plastics, etc. by using processes involving organhalogenated substances or organic solvents.

This part of the administrative analysis was the visible part of the iceberg. Indeed the analysis was broken down into two parts: the I.C.P.E evaluation and the evaluation of the decrees out of the I.C.P.E context. This second part

was more tedious because the amount of legal texts was much more important. In order to simplify this task I looked for an internet site which compiled all the environmental legal texts. This site was called "aida.ineris.fr". It made my job easier because the legal texts were classified by type (waste, chemical products, etc.). This permitted an initial sorting of the texts linked to completely different activities (construction, waste management, etc.). The second step, which took almost a month and a half, was to analyze each text remotely linked to the activities and tools handled by the maintenance facility. For each text I determined if it concerned the facility and if so I had to verify if each article was respected.

Although this part was very long, it had a vital importance for this internship:

- During my academic years I had no legal training; yet this internship required I refer massively to the EEC and French legislation. This gave me the opportunity to acquire a better understanding of the legal domain and develop reflexes when dealing with legal texts. This knowledge is essential for an environmental engineer since it is the basis to sustain an effective EMS.

- This task is also essential in order to have a good understanding and knowledge of the maintenance facility. When going through the legal texts that concerned the maintenance facility and verifying their good application, I came across all the activities performed within the site. I listed all the products used on site and all waste generated by the facility. Finally, I verified all the legal controls done on the machinery located on site.

This administrative analysis constitutes the basis of the environmental status. It is by doing this legislative review that I clearly understood the weak points of the maintenance facility. Thanks to this initial step, I gradually developed solutions to rectify these non conformities.

4.3 List of the main non conformities

When considering non conformities two main families should be considered:

4.3.1 Administrative non conformities

My analysis revealed two administrative non conformities:

- I.C.P.E: No receipt of previous declarations of activities was found on site. This means that all the activities subject to I.C.P.E declaration that I listed, were administrative non conformities.

- Lack of control of their waste management: The law stipulates that, an industry is responsible for their waste from its source to its elimination. In order to satisfy this obligation, companies need to use the services of certified contractors, with the necessary authorization to perform waste transportation and waste treatment. In order to prove it has conformed to the law, a facility must have on file the receipts of their contractors' authorization to carry out elimination activity. In this case I realized that none of these documents were on site. At first I considered this to be a simple mistake. It was after checking with different contractors that I understood that this administrative absence could be a problem. In one instance the contractor handling the transportation was not authorized to handle the transportation of used oil: further more he still had the last shipment of used oil in his tanks. The trouble resided with the fact that the SNCF was using a non certified contractor but also that the SNCF was responsible for any kind of environmental pollution that could occur in their contractor's facility.

These two main administrative non conformities are quite relevant of the absence of legislative awareness within the site.

This lack of knowledge and interest in the legal texts is the principal cause for their non conformities.

4.3.2 Technical non conformities

Technical non conformities were varied and could be classified as listed below:

Water: This is the most important technical non conformity:

I noticed when I arrived that the workshop had installed a hydrocarbon separator. I assumed that it treated all the oil waste such as, leftovers from oil drainage and hydrocarbon from other oil usage (oil for brakes, oil for electrical contact pads, etc.). I then realized that this was not entirely true.

The workshop has been extended in 1997 and the hydrocarbon separator has been installed not long after. This separator is only linked to the industrial water evacuation system of the new annex. I managed to find a map of the industrial water evacuation system at the regional SNCF centre in Annecy. It's after studying this plan that I realized that all the water evacuated from the original workshop was going directly to the nearby river: the Bonnant. This means that all the hydrocarbons emitted from the oil filters, which are washed outside the workshop, and the surplus oil spurting while filing the trains on the outside tracks, are directly emitted into the environment.

Furthermore, the site has no water management. This installation, due to its various activities submitted to declaration, has numerous obligations including the evaluation of water consumption. On this site, the consumption of water is based on the total amount delivered. The water delivery point supplies the train station, the metric rail workshop and the normal rail train washing station: their waters usage was then estimated on a yearly basis by applying fixed rates. This procedure is erroneous. The water usage varies proportionally to the level of activity. During the winter time, the frequency of train services increases because of the important amount of tourists, thus increasing the usage of water.

The percentage, allocated to the workshop, is even more flawed because it considers only the consumption of water within the workshop and not the water used outside, to wash the filter for instance.

I.C.P.E: The principal technical non conformities are directly linked to the absence of I.C.P.E declaration. Indeed, once an installation is subjected to declaration, it has to respect the decree of application linked to this particular nomenclature. In this case the activities have never been declared and the site has no knowledge of which prescriptions they are suppose to respect, thus by analyzing the proper decrees I found multiple technical non conformities ranging from the absence of a sandbox in the workshop for fire prevention, to the absence of water flow counters in order to evaluate the consumption of this primary resource. Interestingly enough, the different decrees, corresponding to the different nomenclatures, all follow a main line of prescriptions. This means that there are very few differences between them. Once an installation conforms to one decree then it's easier to respect the next one since they are similar. By using this train of thought, similar technical non conformities can be easily taken care of.

Waste: As I pointed out earlier, the maintenance facility has a lack of legislative knowledge. This is an important issue because it reflects itself through out all the activities within the workshop.

The French regulation has edited a decree on the 18th of April 2002 called "the decree relative to waste classification". This decree provides guidance when defining the family and type of waste. There are two main families when considering waste: the DIBs (Common industrial Waste) and the DDs (Hazardous Waste), formally known as the DISs (Special Industrial Waste). This decree stipulates which type of waste fits in which category.

I was surprised to notice that, although the management had not implemented any kind of waste management, the technicians did sort part of the waste produced by the workshop:

- Metals and alloys
- Cardboard from packaging
- Batteries
- Halogen tubes

This sorting procedure is very basic but it shows that the technicians have an environmental oriented mind, or at least they care to preserve the beauty of their region. Regardless of their reasons, one can project they will readily cooperate during the implementation of an environmental management system.

Unfortunately their lack of knowledge of the specific regulation leads them to major technical non conformities. Indeed a Common Industrial Waste can be considered a Hazardous Waste if it is contaminated by any type of dangerous product. This point is essential and if unconsidered can easily lead to mistakes and possibly to illegalities. The technicians of the maintenance facility have no formal waste management training and were not aware of this contamination process. The different types of contaminated waste in the workshop are the following:

- Empty metallic containers of dangerous products
- Empty plastic containers of dangerous products
- Oil contaminated cloth
- Oil absorbent products.

These were not correctly eliminated as in they were mixed up with Common Industrial Waste.

Air: This issue was the final example of bad knowledge management.

As I was verifying the correct application of the legislative texts, I started to develop a critical view of the maintenance facility. When I started out this study I had a candid belief that most companies respect the law; I had had a single experience within company where every aspect of the activity was controlled analyzed and conform to the law and regional prescriptions. After discovering the first technical non conformities, I realized that everything needed to be checked three or four times because people tend to curb reality.

This is exactly what happened when I got interested in the activity of air conditioning circuit verification. This activity is quite important because it is linked to an important potential environmental aspect: Chlorofluorocarbons (CFCs).

In order to assure the confinement of this gas, a minimum annual verification is made on the air conditioning circuit. This is done by passing a leak detector on the pipes of the system to prevent or repair any abnormalities or leaks. The frequency of verification was respected but the problem was at the tool level. The leak detector is supposed to be calibrated annually. Indeed if the 5 gramme sensitivity, which is the minimum prescribed, isn't respected, then all tests results are flawed. It

is when I asked to see the receipts of calibration that I discovered that none had been done in the past seven years; that is since the procedure was implemented.

This fact is shocking in many ways because it also reveals a lack of will to understand the purpose of these legislations, which is to help companies to have a better environmental management. In this case, the facility took time and effort to carry out a legal control which was in fact completely useless and it still constituted an illegality.

Products: Every chemical products has a FDS (Security Data Sheet) linked to it. This document gives various informations, the most useful ones are:

- Main hazards
- Physical characteristics of the product: flash point, freezing point, Ph, etc.
- Storing recommendation: incompatible products, level of humidity or temperature to be respected, etc.
- Accident recommendation: instructions as to what to do in case of contact with different body parts, inhalation or ingestion
- Accidental dispersal recommendation: instructions as the first steps to be taken in case of dispersal

The producers and the sellers of chemical products are obligated by law to deliver this document to the buyers. The final users of the products are themselves, obligated to have these on site, in order to help prevent any physical or environmental accident.

In order to list all the products on site, I initially started by going through all the FDS that I found. I soon realized that these were absolutely not updated. Some products had no FDS and some FDS were present but the products weren't used anymore. This constitutes a technical non conformity, the consequence of which can be quite disastrous.

These initial observations lead me into to enquire into the product store within the maintenance facility. I didn't find any non conformity but quite a few "malpractices".

My first observation was done on the storage facility itself. All the products were stored in a metallic dugout. The walls were made of wire netting, which means that the products were all stored at outside temperature. Furthermore the products were in direct contact with the ground without any retention device in case of spill. The consequences could even be greater when

considering the permeability of the ground: the site is over a century old and the concrete paving has many cracks, thus permitting the emission of chemical products into the soil.

The main family of products stored there is oil.

Le Fayet maintenance facility is located in Haute Savoie, which is a mountainous region, where the average temperature is below 0°celsius during the winter time. This means that the oil stored outside are regularly frozen and that their physical properties suffer from this change of physical state, possibly precluding their effectiveness. This creates, indirectly, further waste because it damages the machines and leads to more repairs and oil drainage.

After looking at the storage facility, I looked into the products themselves. I noticed that although most of the products were recent, there quite a few that showed signs of aging. After asking the material manager, I learned that these products were unused because they were the leftovers of an old batch. The SNCFs purchasing department is constantly negotiating products or trying to find more efficient ones. Once they find a better deal or product, they abandon, instead of phasing out, the old products. Unfortunately maintenance personnel don't know if the change it is due to lack of performance of the old product or to financial reason. Cautiously, facilities avoid using leftovers. With time they are unusable, the containers oxidize and they become potential environmental risks requiring further investment to be properly eliminated: for lack of internal communication the SNCF increases its amount of waste and waste management cost.

In the present case the SNCF could make financial savings by optimizing the use of its products and by reducing its overall waste generation. All products specification cards are available on the intranet site. When a product is changed it would be easy to add additional information to this card specifying if the product should be phased out or abandoned.

4.4 Environmental solutions

Implementing solutions was not a part of my mission within the SNCF. The mission, as stated above, was to analyze and list all the non conformities, find and evaluate the cost of environmental solutions and from this base create different environmental plans in order to trigger a basic environmental management system.

However it seemed to me ludicrous not to implement any solutions. There are numerous non conformities that necessitate an investment in order to be addressed correctly. On the other hand, there are many that only require time investment. Therefore I began to tackle some such issues.

4.4.1 Environmental software

In order to get a good understanding of the facility and the impacts related to it, I had to list all the products used in the various activities. It is during this part of the study that I realized that nobody knew exactly what products where stored or used within the facility and that FDSs were not automatically asked for or used. I began wondering what kind of solution I could install in order to guarantee:

- The automatic demand of the FDS to the suppliers.
- The listing all the products on site and information related to them (supplier, purpose of product, etc.)
- The usage of the information within the FDS

I was trying to come up with a solution that would require no investment and that would be durable. SNCF, like most companies, had an office XP license that includes a Visual Basic compilator easily used by non programmers like me. I came to the conclusion that Microsoft Access would be appropriate as long as I created a few additional functions in order to make this solution work and more user friendly.

I knew that that one of the problems I would face, when installing a solution, would be the reluctance of the workers. When changing a system you automatically change the working habits. Their first reflex is generally to be in complete opposition with the proposed solution. I was aware this would be even more the case in a public service company like SNCF. In order to overcome such a reaction, I decided to work with the person in charge of the purchase office. Obviously, the 20 year long experience of this technician cannot be compared to the book knowledge of a young engineer however prompt to learn and adapt he may be: by recognizing this, I automatically endeared the technician to helping me out to define the basic requirements that this software should fulfill.

One of the problems he encountered regularly was the loss of suppliers' phone number. His second problem is that he didn't always know what was the purpose of the products he bought (oil for the snow plower, primer paint, etc.).

Apart from the specific requirements defined with him, the program needed to simplify the use the FDS to ensure it would be used. My purpose was to make it understandable to the users and to eliminate the information that was of no use to the daily chores of the technician.

From this basic investigation, I created a double database within the same program:

- Products database: This database lists all the products in use or stored within the facility. Every entry is defined by:
  _ the name of the product,
  _ the type of product,
  _ the storage place,
  _ the name of the supplier
  _ the phone number of the supplier.

  It gives basic product information and storing zones which can be used to define the high risks zones of the maintenance facility. This is something I added which will be useful since the clear location of the high risk zones is one of the requirements that a site needs to comply with when submitting an I.C.P.E declaration. In order to make this program durable I created SQL macros, which is the database programming code used in Visual Basic. These allow creating, finding and deleting products entries. With these functions the user is able to dynamically manage the products on site.

- FDS database: Every entry in the product database automatically creates an entry in the FDS database. This database contains information derived from the products FDS. In order to keep this document simple, only the basic information is shown. An entry in this database automatically triggers the appearance of the FDS card to fill in. This insures that the FDS is present on site. When the user fills in the products database, when acquiring a new product, he will remember to ask for the FDS needed to fill in this specific database. It works as a memo, or a Poka-Yoke as it is defined in the Kaïzen philosophy of constant amelioration.

  The second purpose behind this task is to make this document appropriate for the technicians. The FDS gives numerous informations that are useless to the technician, making it look complicated and not reader friendly. I decide it would be important to show only the following information:

  - Storing conditions
  - Hazards
  - First step to take in case of contact with a technician

- First step to take in case of accidental spill
- Basic protections to respect when manipulating the product
- Phone numbers of waste companies, doctors, fire squad, etc.

These are the informations that are absolutely necessary when manipulating products.

I added to this the same functions that I had created for the Products database. I also created a dynamic report generator that prints a copy of this simplified FDS, displaying all these information on A4 sheet. This document is more reader friendly and is placed on a wall folder next to products storage. By this mean it is directly at reach when needed and in this sense really serves its purpose.

This solution has two important advantages.

On the one hand, this program was tailored exactly to the needs of the site in cooperation with the future users, thus making its introduction easier.

On the other hand, it is dynamic: I started of with an idea but it evolved constantly and the basic software was modified accordingly. For example while looking through the legislation, I noticed that one of the non conformities of the painting activity was that the technician in charge poured his paint in smaller receptacles. By law, these receptacles need to display the name of the product and the hazards pictograms.

Asking the suppliers for the appropriate stickers was useless as they would never be able to distribute enough of them. Instead, I decided to use the FDS Database to generate these stickers since it held all the necessary information. Once the technician knew how the program worked and he was able to print and stick the stickers on his paint receptacles as required.

4.4.2 Improvement of the waste management

DIB: Common Industrial Waste

Waste management was almost inexistent when I arrived in the maintenance facility in September. It took some time to get a good understanding of the

elimination procedures. But I had supposed as no proper waste management was in action, there was improvement and savings to be made.

My first concern was to verify the conformity of all the actors involved in the waste treatment. In order to do this I "mapped" the different roads taken by the waste generated by the maintenance facility.

I first dealt with the common industrial waste. It was actually a coincidence that I started by this.

The facility has a contract with SUEZ, a waste elimination company ; it provides a dumper into which the Common Industrial Waste is stocked. The dumper is regularly transported to the local municipal waste incinerator by a local transport company known as Mabboux transport.

SUEZ met with me in order to talk about the procedure: They pointed out they felt it was ludicrous for them to rent the dumper and not insure its transport to the waste incinerator. They wanted to do both activities or none at all. Suez is a reputable and efficient company . It holds all the proper authorizations.

SUEZ is based in Lyon, approximately 300 kilometers away from le Fayet and their trucks, out of Lyon, service many installations in the region. However I wasn't satisfied with this solution: I was trying to start a viable environmental management system not increase the facility's indirect CO2 emission; every time the facility would need to discard their common industrial waste, SUEZ would have a truck coming from Lyon. But I had also to take into account that Suez had a contract on a national level with the SNCF that facilities were required to use the services of this company.

They eventually made an offer which didn't fit at all the needs of the facility. SUEZ was asking twice as much as the previous contractor to perform a task they were doing twice as slow: they needed ten days to come and take care of the dumpster. During the winter time, due to the increase of activity, it can take less than five days to fill it up.

The purchasing department in Paris, in charge of the contract, told me that I could bypass this exclusivity rule if I was able to find a cheaper service.

I subsequently contacted Mabboux, the original transporter who suggested I resort to Excoffier another dumpster rental company with whom he worked closely. They were able to make an offer compliant with our needs that satisfied the environmental, financial, and organizational aspect of the maintenance facility. Indeed the company providing this service were local companies, thus diminishing the emissions due to the transportation. The price was half of what was asked by SUEZ, and the dumpster was taken care of in a maximum time of 48 hours.

DD: Hazardous Waste

This task was far more simple than the previous one. It took a few letters to the original contractor requesting a copy of his authorization to handle Special Industrial Waste, to discover that he had no proper authorization to perform this service. The SNCF had framework contracts with many potentially suitable successors.

My main concern in embarking with a new contractor was the garbage sorting. The technicians were in the habit of mixing the different waste without separating Hazardous Waste from Common Industrial Waste. This is how the facility ended up with contaminated waste in the wrong bin and contaminated containers in the municipal incinerator.

It was important to provide the installation with proper sorting bins and tools. SEVIA ONYX, one of the SNCFs group contractors, had the advantage of providing proper sorting equipment along with their services. I met one of sales representatives to define the equipment provided within the scope of the contract. We installed the following material on the facility:

- An oil collector: the previous oil collector had no retention capacity and was in direct contact with the ground. It seemed important to have a container to limit the pollution in case of accidental rupture of the tank, thus the installation of a double skin tank.

- Sorting bins for contaminated waste: These bins were especially made for this purpose. The main type of Hazardous waste that is generated within the facility is contaminated cloth. In this case four bins were installed inside the workshop to be easily accessible to the technicians.

- Two 1m3 container:

    - In order to prevent an overflow of the contaminated waste within the workshop, a larger container was placed outside to empty the inside bins. The contaminated cloth is not the only contaminated waste on site.
    - Another container was ordered for the empty chemical containers

SEVIA ONYX also offers an efficient administrative organization: They immediately provided copies of their authorizations and guaranteed by contract the respect of elimination delay and the administrative follow-up of the official receipts for these.

It is important to underline that these actions in favor of a better waste management were always implemented with the technicians and the people in charge of these new procedures.

4.4.3 Products

The storage of products was completely unfit to the climate of the region as mentioned previously. My original idea was to extend part of the workshop in order to create a storage room that would benefit from the heating system of the facility. This proved later to be too costly and too complicated. The main drawbacks of this solution came from the fact that the storage needed an important retention capacity. The maximum volume of chemical products possibly present on site was around 4000 liters. The technical investment it required wasn't worth it.

I then turned to the others industries in the region. I knew the SNCF wasn't the only one with this kind of technical difficulty. After visiting a few factories, I noticed that many had exterior closets for their storage products.

I looked through the companies' contract and I found two supplier for this type of product. I chose to propose the acquisition of a bungalow rather than a closet.

The bungalow would require integrated ventilation and a heating system and a retention capacity volume of 5000 liters.

Although, this solution necessitated an initial important investment, it solved the product issue once and for all.

5 Environmental management system in the public service

My previous experience of an environmental management system in the industrial world was in the midst of a private company. Both Dalkia and SNCF were service providers. They didn't sell any physical products but instead they provided a service. The industrial aspect of the companies was to maintain the means that produced their particular service. Dalkia's activity, a heating company, was to maintain the burners and the water network through which the heat they produced was delivered to the clients building. SNCF's industry is to maintain the trains and rail network to permit their clients to travel from a point A to a point B without any breakdowns or unnecessary waste of time.

At first hand one would have thought that implementing an environmental management system at SNCF would basically follow the same rules it did at Dalkia.

This could have been true if the SNCF had been a private company, but it is a public company and there are major differences

5.1 Barriers to environmental management systems

The paradox is that the SNCF, a public service company, would be expected to d be an example when it comes to environmental management: however this is not the case should be the

Here are a few explanations of why this is not the case:

5.1.1 The company:

The SNCF is a vast company and manages around 238000 people. An employee has the possibility of changing location and/or job every three years, through intra-company job proposals. For the executive managers, this usually entails a promotion. Therefore maintenance facilities are usually

managed by the same executive manager for a period of only three years. This is a major drawback where implementing environmental solutions is concerned. Indeed, many solutions, in order to limit the consumption of energy or products and still produce the same quality service, require an important initial investment: in most cases, a change of equipment or the installation of a new system. An executive has no interest in making this initial investment if the pay back period of this investment is superior to his probable presence. Moreover, as things stand, the reduction of a facility's environmental impact is not regarded as additional credit to one's evaluation and managers tend to leave this problem to their successors. This becomes quite clear when you define the environmental status of the maintenance facility: the MONT BLANC site has, over the past nine years, had three different managers and none of them cared to invest on the time necessary to investigate which of their activities should be considered as I.C.P.E activities.

One would then think that, even if the executives prefer to leave the problem to their successors, there is always a chance that the installation can be controlled by the D.R.I.R.E.

This environmental government agency would then list all the technical and administrative non conformities. They would then sum up all the illegalities and the director of the maintenance facility would have to pay quite a few fines and be liable to, at least, a 2 year period of time of imprisonment.

5.1.2 Public service vs. Public service

It seems reasonable to believe that, hypothetically, this scenario would become real. Unfortunately it overlooks the fact that the SNCF is a public company and the DRIRE is apparently more lenient than in other circumstances. One can find this fact surprising and even absurd but when taking the time to consider it, there are two main reasons for this:

- Public agencies are headed by public servants evaluated by the same set of rules and therefore have a better understanding of each other. It is clear, after talking with numerous environmental coordinators and executives that the D.R.I.R.E will be lenient with the S.N.C.F establishments inasmuch as it will oblige these establishments to level up their activities to respect the current legal norms but won't apply the usual penalties, such as putting a complete stop to the activity until their installations are modified or setting a list of fines according to all the legal non conformities.

  Nevertheless this behavior of the D.R.I.R.E shouldn't be considered to be a generality. There are reports of an installation in the same region as Le Fayet that had been caught by the D.R.I.R.E and whose manager had faced harsh penalties, such as imprisonment and multiple fines.

The surprising aspect of this event is that this governmental agency limited itself to inspect only one installation and never tried to investigate the others in the same region. The rarity of inspection and the lenient behavior of the D.R.I.R.E, has led some establishments managers to regard environmental regulations as an option. This was, for example, the case in Le Fayet.

- This indulgence of the D.R.I.R.E can be explained by another fact. The SNCF provides locomotion services for all of France and parts of Europe. An important part of the rural population depends on the SNCF to travel to go to their jobs or their universities, to reach cities and business centers, and so on. This contributes to the absence of verifications or penalties by the D.R.I.R.E.

  If they applied strictly the law, it would entail a complete stop of the activity, application of fines and possible imprisonment of the head of the establishment: they would choke a part of the region: part of the population depending on this mean of transportation would end up using their cars, and the rest, that do not have a car or are not able to drive anymore, would simply not be able to travel anymore. In one case you would observe a transfer of pollution, due to the increase of utilization of cars and in the other case an obliged confinement. When regarding the 'sustainability equation' (Man and Material Flows Towards sustainable materials management) : I = i x m x u x p, the vector m, known as the dematerialization Mean, which corresponds to the material & energy flow /utility or service would increase due to the increase of energy, gas for cars, and to the increase of utility, less people transported. The impact on nature "I" due to this situation could then be greater than the impact on nature linked to the SNCFs activity, depending on the size of their activity.

  This possible scenario, frequently used within the SNCF to justify their need for a special treatment by the D.R.I.R.E, is far too simple.

- In the same line of thought, there is another entity that should be taken into consideration: the main client of the SNCF is the Region. This is even more the case when considering the establishment I was working for. The maintenance facility I was analyzing took care of the trains of the metric rails, which are the trains that lead into many skiing stations.

Many tourists from all over Europe use these trains when they go skiing. This generates a lot of customers, not only for the SNCF but also indirectly for the departmental businesses, such as restaurants, shops, newspaper stands, rental business etc. Condemning the facility to a shut down for renovations means closing down this metric line. The region is responsible for the wealth of the businesses and the population. They can not allow the maintenance facility to close down because they need the income from tourism and other economic activities dependant on public transports. In this sense, the Region becomes a lobby supporting the SNCF with all its discrepancies.

5.2 Clues of how to break barriers

5.2.1 Integrating environmental objectives in the SNCF

After making these initial observations, I came to ponder the reasons for the lack of environmental implication. The goal was to find solutions to break this initial "lack of faith" in the environmental management system.

It is clear that the first step, in order to make the SNCF environmental policy applied at a national level, there must be a large and clear company involvement. We mentioned that managers lack interest in investing in an environmental management system, due to the short time they stay in each position.

However this is not necessarily the case. A manager has the possibility to change position every three years, but it happens that, according to his evaluation, he is not proposed a better one. In this case he ends up staying in the same installation but still doesn't want to invest in an EMS for the same initial reason. Basically the same cycle starts over.

In this line of thought, my initial idea was that; lengthening the managing period of executives might work as a stimulant for environmental implication. Nevertheless this scenario doesn't hold because it does not take into consideration the SNCFs strong trade unions. Since the period of holding position is applied for every worker in the SNCF, this change would create a bustle through out the entire SNCF which would, consequently, lead to strike movements.

However this problem can be analyzed from a different angle. Executive managers don't want to invest because they know their evaluation sheet will

look better if they invest on short term views, hence increasing their chances to get a promotion. Part of the problem is the way these evaluations are made. The SNCF, unlike private companies, does not yet include in its personnel evaluation, environmental risks nor the fine or the risk of compulsory interruption of activity for renovation due to non conformance to environmental norms.

Daniel Tyteca (1996), in this line of thoughts, had defined environmental performance indicators which took into account three factors: inputs, desirable productions outputs and "undesirable" outputs (pollutants). One of the difficulties, as pointed out by James (1994), with this exercise would be to convert the important load of information in useful managerial data. The SNCF has many activities and all generates different types of undesirable outputs

The benefit of environmental performance measurement would be the possibility of comparing different SNCF installation between them, but also it would permit to convert performances in economical values.

In order to promote and apply their environmental policy the SNCF has to put forward incentives programs for their managers as well as non managerial staff in accordance to environmental local programs.

Non conformation to the company's environmental policy would be synonym to bad result, hence diminishing the chances for promotion to a better position.

The lack of action on behalf of the D.R.I.R.E really constitutes an important handicap and not a help to the SNCF and generally to the global environmental welfare of the region. As mentioned above, the possible scenario frequently used within the SNCF to justify their need for a special treatment by the D.R.I.R.E, is far too simple because it takes into consideration the train as the only means of transportation and, as such, essential to local economy. This is true on a long term basis. However, most of these train stations have a bus service for short distance links in between the surrounding villages. A bus company can and has, on a temporary basis, replaced the activity of the train station by maintaining a steady service or by connecting the users to the next station. SNCF has even, in the past and for economic reasons, set permanent bus links in low activity regions.

It seems that the argument against shutting down a station in order to renovate some or all of it's installations, is really hypocritical as, if necessary, it can and has been done. So, if the legal consequences of non conformity of the SNCF sites, were to be imposed, the financial loss due to the absence of

activity and the growing dissatisfaction of the clients and the region, can and should encourage sites to conform themselves to the environmental laws.

5.2.2 Legislative change

The Porter hypothesis develops the idea that well conceived environmental regulations can trigger innovation which can eventually provide a complete payback on the cost of complying with them. (Porter, 1990a; Porter, 1990b, and Porter, 1991; Porter and van der Linde, 1995). Although some authors have argued on this hypothesis (Palmer et. al., 1995), they do not disagree about a possible relation between strong environmental regulation and production efficiency.

France has developed its environmental regulation through a series of taxes and permits linked to the environment, energy and transportation (Ifen, 1999). One these taxes known as *la taxe intérérieur sur les produits pétroliers:* TIPP (Interior Tax on Petroleum Products) has led a few companies to make their energy consumption more efficient. Take for example Veolia environment, which has tried to lower the cost linked to this particular tax in all its activities: in heat generation with the development of cogenerations facilities (Dalkia, cogeneration) in order to minimize the losses of energy linked to the heating process, or with the usage of GPL and Aquazole in its urban transportation services (Ametis, 2006). The implementations of these environmental solutions have proven to be successful thanks to the ratification of the Kyoto protocol.

However this case has been feasible due to the economic success of this big group. It is generally understood that one of the most important factor for a company to improve its environmental performances is a good financial condition (Ytterhus and Sjaker, 1998).

In order to tackle the issue of smaller businesses and other exceptional cases case like the SNCF, French Environmental Regulations are changing strategies. We are not seeing anymore the context where environmental agencies have to track down illegal activities and emissions in the industry. We are now seeing laws obliging industries to justify the righteousness of their management system.

Take for example the 30th of May decree relative to the control of waste elimination (French decree-635, 2005). This law came into application on the

31st of December 2005 and describes the basic on site documentation necessary to the annual declaration of waste emission.

This law stipulates the need for a company to keep a registry of all BSDD (Bordereau de Suivi de Déchets dangereux). The BSDD is a follow-up form to ensure the traceability of hazardous waste and constitute a proof of their elimination for the responsible producer. It comprises of indications on the source of waste, their characteristics, the methods of collection, of transport and storage, the identity of the companies concerned and the destination of waste. The form accompanies the waste to the recipient installation which can be a center of elimination, a center of regrouping or a center of pre-treatment.

These elimination receipts need to be kept in a specific registry on the site which has generated the waste. The installation needs to be able to provide these documents to the authorities at first request.

This registry is also the base of the compulsory annual waste declaration, the MONT BLANC maintenance facility is obligated to do, because of its activities submitted to ICPE Declaration.

This waste declaration is submitted to the D.R.I.R.E and stipulates the nature, the quantity, the destination and the origin of the waste produced by an industrial facility.

It is now up to the waste producer to prove to the D.R.I.R.E that he has correctly eliminated the waste generated by his activity and to clarify the means of valorization or elimination.

However this change of legislative trend is useless because not completely adapted. The problem that the French environmental agency faces constantly is the lack of personnel. The D.R.I.R.E has to make sure that all the French industrial park respects environmental laws, but the amount of personnel in charge of this task is too few. This means that the probability that an industry will face a surprise inspection of its sites is quite small. Some companies would rather pollute than treat their waste properly as the money thus saved in using inappropriate waste elimination methods will largely cover the fines they would have to pay if they eventually get caught by the environmental agency. C. P. Bellas and M.S. Skourtos (1996) developed the value of the costs of compliance and enforcement as ‘the number of days the firms is detected to be in non compliance during the year multiplied by the expected penalty imposed on the firm for each violation’. In our case the number of days in a year where a firm is detected to be in non compliance is close to zero.

From now on, companies have to justify their waste have been properly eliminated thus reducing the French environmental agency on site inspection workload. The D.R.I.R.E.

However the D.R.I.R.E still needs a bigger force task in order to be able to control that all the required industries have submitted the proper declaration and proceed to "spot checks" to verify the veracity of these declarations.

It is only by increasing the probability of environmental investigation (or increasing the number of days in a year where a firm is detected to be in non compliance) within the industry, that executives will consider that it is economically sound to conform to environmental regulations than to avoid them.

5.2.3 Reflexion on the ISO Norms

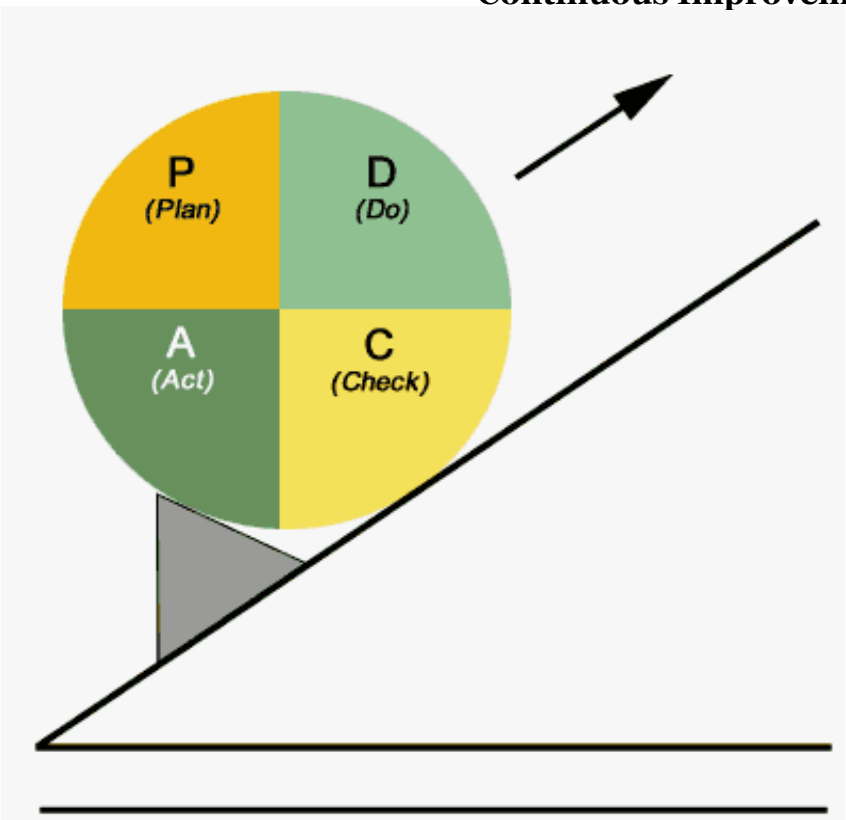
Avoiding the case of Quality versus Environment

The ISO 14001 is based on the principle of continuous improvement of environmental performances by the control of the impacts linked to the activity of a company. A company takes a double commitment to continuous progress and to legislative conformity.

This procedure enables the company to:

- Structurize its initial approach of an environmental management system
- to ensure a valid traceability of its system history
- to gain credibility deriving from the certification provided by an accredited exterior organism.

The Deming wheel is the basic principal on which the prescriptions of the ISO 14001 norms are based on. Furthermore this wheel is drawn in accordance with the continuous improvement spiral.



THE DEMING WHEEL

The most widely used ISO's in the industry are the 9001, for the quality norm, the 18001, for the security norm, and the 14001, for the environmental norm. All of them are based on this Deming wheel of continuous improvement.

This is why, when looking at quality management systems and environmental management systems, one can see numerous common points between these types of management in their structure and in their operational modes.

During my internship, I have time and again witnessed the following situation:

The MONT BLANC site director was set on getting an ISO 9001 quality certification. In order to do this, he first took a student, on an internship, to compile and write the initial quality manual. This experience eventually failed because the student lost interest in this task and was asked to leave. The director then created a quality manager position and hired a young engineer to continue the students' task.

The director's objective was solely focused on getting an ISO 9001 certification; it resulted in the fact that he had very little interest in my work and the goals I had set out to achieve for the installation: the first steps

towards the implementation of an environmental management system in view of a future ISO 14001 certification.

It is the not the first time that I have been witness to the fact that industrials are more interested in quality norms than in environmental norms. In some ways, this is understandable because their job is aimed at increasing the efficiency of their production and they are constantly demanded by their clients to be 9001 certified.

This situation was peculiar because the director had the responsibility to get both of these certifications. As I mentioned when presenting the SNCF, the environmental objectives of all the facilities, set by the headquarters, is to carry out the first steps of an environmental policy and to attain ISO 14001 certification of a vast majority of sites by the year 2007.

This is where the paradox lies: On one hand the MONT BLANC head manager is trying to obtain a good evaluation by running his site at a minimum cost while providing a quality service. On the other hand his intention is to set up a quality management system sequentially with an environmental management system, which is more expensive. Since both of these management systems are similar it would be time saving and cheaper to fulfill these two objectives simultaneously and not sequentially.

By ignoring the possible benefits of an environmental management system, the head manager misses possible economic opportunities and logistical improvements for his facilities. His environmental ignorance and his lack of incentive to see the potential business opportunities linked to it makes him a bad manager (S. Schaltegger and T. Synnestvedt, 2002)

If he was to forget the preconceived idea that quality certification is more important than environmental certification and decide to do them simultaneously, it would require only one person for both of these tasks. Theses systems would be far more similar, thus decreasing the cost linked to the installation of both systems and facilitating their conduct.

Focusing the ISO 14001 definition

The situation I described above is interesting inasmuch it shows the “pitfall “a large company like the SNCF has not avoided. Indeed when looking at the top of the management, Louis Gallois, the CEO of the SNCF, has invested in an environmental policy. He published his environmental engagement letter

and fixed environmental objectives within the Industrial Project 2005, which is the guideline of the company's activity. Now when looking at the bottom of the management, we find the technicians. After working with technicians for five months; I can witness they ware quite interested in the environmental approach and are willing to participate.

Unfortunately between these two entities, some managers have little will to invest themselves and do not priorities environmental management. This is not necessarily a generality. There are many installations where directors participated to the initial environmental status and the overall experience was a success.

The SNCF's approach wasn't wrong since it respected the prescriptions of the ISO 14001. The ISO 14001 stipulates that the company, which chooses to engage itself in an environmental policy, has to show proof of its engagement at the highest executive level. However, in order to ensure the complete involvement of the company, it is perhaps preferable to require a letter of engagement at every level. This would entice facilities directors to get more involved in the company's environmental policy and to set objectives adapted to their particular site.

6 Facilitating the implementation of an environmental management system

The benefits of environmental protection are an issue which has been discussed by a few authors. The main question being: does the cost for environmental protection generate direct or indirect economic performance for the firm. (e.g. Cohen *et al.*,1995; Porter and van der Linde, 1995; WBCSD,1997).

During both of my experiences in environmental management systems, I noticed that there are a few factors that can facilitate the improvement of an EMS and the good cooperation of the parties involved.

The perception of the industry is that the competition induces every player to reduce its cost of production; in this perspective, the environmental management is not seen as an important factor toward this goal nor is the impact of their activity on the environment considered as cost effective. Generally, managers have not understood the economic reality which is linked to environmental issues (e.g. Buchholz, 1993; Porter and van der Linde, 1995; Welford, 1994).

External factors are not the only variable that determines if a company's environmental policy pays off; internal variables also have an important role. Managerial qualities is a key factor in making an environmental management system effective leading to competitive advantages (Christmann, 2000; Karagozolu and Lindell, 2000)

In order to maintain a dynamic EMS, it is the environmental engineer's responsibility to find new ways to find ideal solutions in order to convince the executives of the benefit of the environmental management system.

Here are a few methods that I developed during this internship.

6.1 Integrating the personnel in the EMS

Quite a few of my acquaintances are technicians in various big public companies, such as GDF (Gaz De France) or EDF (Electricité de France), which are, respectively the French gas and electricity company. I regularly talk with them about how the environmental management system is declined within their daily activity.

One recurrent remark I get is that they are usually quite fed up with the EMS. They see it as a burden and have no will to participate.

I was a bit surprised by their reaction. Usually the environment is perceived as beneficial by the layman. It is after talking with them that I understood why they didn't want to participate to the environmental management system.

The fact is that every time the environmental coordinators came to check their installations they always find non conformities and clearly point them out to the technicians.

The problem is that it's that there is no explanation given to the technicians, just criticisms.

When working with the actors of the maintenance facility I adopted a few basic rules:

- Listening and learning: I can never emphasize enough the fact that I am in no way an expert in the field of train maintenance. The important point in understanding this simple fact is that one should always try at first to learn about an installation before formulating any propositions of solutions. This is what I did during my first few weeks at the MONT BLANC site. I listened to the exchanges between technicians and managers. I was interested in learning about the factors that influenced their activity, the main problems that they encountered, and finally what was the "company's spirit". It is by knowing these specific details that I was able to find appropriate solutions adapted to this site.

  However it is also important not to fully identify yourself to the general spirit of the company and to select part of the information you are given. For example, while I was developing the computer program that generated simple FDS, one of my colleagues kept on telling me that the idea was a waste of time and that it wouldn't work. In a sense he was right, if I had designed this program for one of the usual technicians he would have never used it. Yet I knew that the assistant purchase manager was the person that was going to be in charge of using it. I had spoken with him and I knew that he was interested in it and that he would use this tool.

  It is in these types of case where it is necessary to select information source.

- Explanation: Implementing a new management system rimes with modifying people's organization. When somebody has been set in his working habits he is usually reluctant to change them. This is why I

feel it is always important to explain the reason for this change. When asking for information on the facility from the technicians, I knew they were going to be shy and avoid some important points. They knew that some of their working habits were wrong and they had problems revealing them. This is due to the fact they are used to be criticized when they face, working inspections, quality reviews and so on.

This is why I always tried to explain the goal of the environmental review to the technicians since the whole purpose of it is to have a clear view of all the procedures in order to change them when necessary. By always taking the time to explain why I needed specific information, not only did I get a lot more feedback coming from the technicians, but they also felt a lot more involved in the environmental approach and showed more interest for it.

- Patience: This point is linked to the previous one: Workers of an installation object to having their working habits changed. I once had a hostile technician arguing that environmental regulations were nonsense and that it was absurd to do annual verifications. He considered that all these verifications where holding back the maintenance activity. This argument had started because I pointed out the fact that it was necessary to annually calibrate the leak detector used to verify the air conditioning system. He didn't like the remark and decided it was easier for him to argue.

  I let him speak his mind. Once he was done, I explained the purpose of such verification. I also explained that the gas, CFC's contained in the air conditioned systems is linked to important environmental hazards. He was finally admitted that it was important to test this system.

  It is after being patient with the technician, and taking the time to listen to him, that we found a ground for agreement.

- Verifying Information: As is said previously, the team working at the maintenance facility had a tendency to avoid certain important details linked to their activity. Take for example the used industrial water evacuation system: the first time I asked where all the waste water ended I was told that it went to a hydrocarbon separator. It is after struggling to find a precise map showing the evacuation network that I discovered that a part of this waste water was going directly in the nearby river.

  I also had the same problem when looking into the waste elimination process. It is only after asking five different technicians that I managed to get a clear view of how the different type of waste, generated by the maintenance facility, was eliminated.

It is constantly necessary to ask the same recurrent questions and to try to get as more information support as possible, in order to fully understand an installation.

Those basic rules that I applied all along my internship helped me to install a better communication with the different actors within the maintenance facility. This is the basis, in my opinion, to introduce a good cooperation spirit with the team that will work with the future environmental management system.

6.1.1 Facilitating investments

One of the difficulties, when setting up an initial environmental plan, is the cost of the relevant investments. The introduction of the environmental domain in an activity has a cost and it is the responsibility of an environmental engineer to find the best ways to minimize this cost by proposing the best adapted solutions to improve the production by minimizing the resource and product consumption.

S.Schaltegger and T. Synnestvedt (2002) define a good environmental management as concept characterized by:

_'Firstly being able to exhaust benefits and cost savings of environmental protections measures and,

_Secondly, by being able to identify the optimal amount of environmental protection to realize the maximum economic success.

In this line of thought here is a method that I have encountered and applied during both of my internships in environmental management

Eliminate all the unnecessary costs: This is a difficult task. One way to eliminate unnecessary costs it to optimize the utilization of all the tools on site. One of these is the software. Many people view algorithm as a series of complicated lines with unusual words. The idea that everybody can develop a single program seems ludicrous. This is why a lot of industrials feel safer if they invest in expensive software. They will not easily take the responsibility of developing in house tools how ever simple. Often these softwares are not fully adapted to the specificity of the activity, too sophisticated or may

eventually block the companies' organization once they crash. These problems might not occur if properly developed in house.

It is necessary to fully use the software licenses.

If we make a parallel with Sten Karlssons Dematerialization principle (Karlsson , 1997) we could name it: Software dematerialization. It is reducing software investments to a minimum.

Most companies own an Office XP or plain Office license. This is a good example to illustrate my point. All the application of Office includes a Visual Basic compilator, which is one the simplest programming code. The possibility of this is quite important because it has the potential to create basic tools to optimize a management system at a minimum cost, thus eliminating the cost of unnecessary additional software.

I have already mentioned the database example, but it wasn't the first time that I witness the benefit of this software dematerialization.

During my previous internship within Dalkia I had noticed that their activity required frequent emissions analysis, such as machinery calibration and other regulation controls. One of their first reflexes was to contact a company to buy software that would act as a reminder. I simply took into account the frequency of all the tests and contractors in charge of them and programmed a small algorithm in an excel sheet and the problem was solved. This excel sheet was integrated in their monthly environmental review and stated every month controls that were to be done. The cost of this was virtually nil since the license of this software had already been bought a few years before.

The interesting out coming of this experience is that, at that time I had proposed a few ideas of environmental improvements that needed a little investment, such as the installation of rain water recuperation system. Once I had installed my software, and made a consequent saving for the heating plant, I managed to get investment for this project.

7 Conclusion

Although the picture that has be drawn through out this whole study seems somewhat obscure (emissions of oil directly in the river, many non conformities regarding the environmental legislations, very few controls, etc.) it is important to highlight the fact that the SNCF is just starting to integrate the environment to its activity.

In this sense it is normal that there is an abundance of environmental issues. The main goal of the initial environmental status is to identify all of these in order to be dealt with correctly.

One of the strong points of the MONT BLANC installation resides in the participation of its workforce. As I explained when defining the concept of environmental management, an EMS, in order to be successful, requires the involvement of all the technician team, which are the first ones to apply the actions aiming to reduce the environmental impacts.

This involvement was present since the beginning and this permitted me to:

- Clearly view the facilities environmental issues
- Understand the reasons leading to these environmental issues
- Get an initial feedback on the possibilities of implementing environmental solutions

Furthermore, this involvement of the technicians should not be underestimated. Many environmental issues and non conformities only require financial investments to be dealt with (installation of a hydrocarbon separator, contracting valid subcontractors, acquiring a leak detector, etc.), however the involvement of technicians is not tangible and is priceless.

Many companies have invested a lot in communication programs to make their employees aware of their environmental responsibilities with little results.

Although the SNCF shows potential, there are many points on which it should work to render there EMS viable and efficient:

- Setting up a steady responsibility: the SNCF has chosen to employ young engineers to perform the first step towards the implementation of an EMS, which is the opportunity for a good training.

  One of the first requirements of an EMS is to define the main operator of the system. The SNCF gives the responsibility of continuing this environmental approach to non specialised personnel.

  The problem with this management behaviour is multiple.

  Implementing an EMS does require a qualified employee. As shown in this study, an important source of non conformities is the lack of legal knowledge and capacity to interpret such texts. By choosing a non trained employee, the SNCF risks facing the same non conformities.

  An EMS manager needs an environmental culture. The general opinion defines the term "pollution" as the dumping of visible waste in nature. However noise and light are not considered to be "pollution" even though environmental engineers or specialists consider they are, due to their culture in this specific domain. By choosing a non trained employee, the SNCF takes the risk of omitting certain environmental aspects of their activity.

  Finally, it is important to choose an operator that will be in the charge of the EMS from the beginning of the implementation until the system is running correctly. As explained in the study, the SNCF employees have the opportunity to change location every three years. The change of manager will lengthen the implementation of the EMS

  The SNCF by not taking this fact into account, risks to not meet its delay of EMS implementation and to increase the overall cost of it.

- Integrating EMS at a higher level: The SNCF's goal is to certify ISO 14001 all its installations by the end of 2007. The time limit for this objective seems to be short and unrealistic; the SNCF will have to revaluate its objective in order to make them feasible.

  However the SNCF shouldn't consider the realisation of this goal as a final achievement in EMS. As shown by the example of EMS in Transport Canada, EMS in an important structure like the SNCF should be integrated in the decision making process.

  The possibilities of reducing the SNCF's environmental impact are numerous if an environmental consideration is integrated in the decision making process at many levels:

- Suppliers: the SNCF has the possibility to promote EMS by choosing only certified suppliers. Furthermore a politic of environmentally adapted products purchase can be implemented. This would permit the SNCF to decrease the cost of eliminating hazardous waste or contaminated containers of dangerous products

- Trains: there are many innovations that can still be made on trains. By integrating an environmental concern when defining the necessities that a new train will need to satisfy, the SNCF has the possibility to reduce its environmental impact directly to the source of its emissions.

  For example, the purchasing department can impose maximum oil consumptions for their new trains. They can also ask for innovations such as, the installation of solar cells on trains in order to reduce the electricity consumption linked to on board accessories (lighting systems in wagons, electrical outlets, etc.).

EMS in the French railroad transportation service is at its earliest step. The errors of mismanagement and environmental mal practices are numerous. Modifying the habits and the working practices of a century old company is a complicated task that will necessitate innovations, thorough analysis of each case and an involvement of each participant. However the results can be interesting for the SNCF but also for France, as we have seen that Louis Gallois, the SNCF's CEO, helps to define France's sustainable development policy.

The implementation of an EMS within the activities of the SNCF will be a difficult task but this experience will permit a better understanding of the barriers to it in France's public companies, and will also permit the creation of general guidelines for future environmental approaches.

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9 Glossary

- **ADEME** (Agence de l'Environnement et de la Maîtrise de l'Energie): Environmental and Energy Control Agency. French environmental agency which promotes tools for environmental management systems and environmental techniques.

- **DRIRE** (Directions Régionales de l'Industrie, de la Recherche et de l'Environnement) : Regional Direction of Industry and Environmental Research. Environmental agency which controls the conformity of companies to the environmental legislations.

- **EMS**: Environmental Management System.

  "A management approach which enables an organization to identify, monitor and control its environmental aspects. An EMS is part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy." (Peer Center, 2005)

- **FDS** (Fiche de Données de Sécurité): Security Data Sheet. Information support sheet which accompanies products

- **ICPE** (Installation Classé Pour l'Environnement) : Environnementaly Classified Installations. Specific environmental regulations for installations that fit in the definition defined in the ICPE norm.

- **ISO 14001:** International Standards Organization for environmental management system

- **SNCF** (Société Nationale des Chemins de Fers) : French National Railroad Company

- **TGV** (Train à Grande Vitesse): High Speed Train. Train which was constructed on the sum of the experience of the SNCF and technical innovations, which gave a determinant advantage to the SNCF in the traveller transportation

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