DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

INDUSTRIAL WASTE MANAGEMENT SYSTEM APPLICATIONS ACCORDING TO ISO 14000

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ABSTRACT

In the world, environmental impacts are the most important problems for governments recently. Because of that, ISO 14000 Environmental Management System has attracted interest from industries, international organizations and governments all over the world. Environmental Management System (EMS) is form a key role in environmental control. ISO 14000 EMS is a guideline for organizations controlling and decreasing the environmental impacts.

In this scope of thesis, the steps of improving an environmental management system according to ISO 14001 on a food industry and a white goods-refrigerator industry are explained.

In this study, the requirements of ISO 14001 Environmental Management System are determined and reported as an initial review for the mentioned industries.

Keywords: Environmental Management System, ISO 14000, initial review

ISO 14000 UYGULAMALARI İÇİN ENDÜSTRİYEL ATIK YÖNETİMİ

ÖZ

Son zamanlarda çevresel etkiler hükümetler için çözülmesi gereken en önemli problem olmuştur. Bu yüzden dolayı ISO 14000 Çevre Yönetim Sistemi dünya üzerinde hükümetlerin, uluslararası organizasyonlar ve endüstrilerin ilgisini çekmektedir. ISO 14000 Çevre Yönetim Sistemi dünyada çevresel etkileri kontrol altına almak ve azaltmak için bir kılavuzdur.

Tez kapsamında gıda endüstrisi ve beyaz eşya üretim tesisinde ISO 14001 standardına uygun olarak bir Çevre Yönetim Sistemi geliştirilmesi için izlenecek yollar anlatıldı.

Bu çalışmada ISO 14001 Çevre Yönetim Sistemi'nin gereklilikleri anlatılmış ve bir gıda endüstrisi ve buzdolabı endüstrisinde endüstriyel atık yönetimi ve ön çalışma raporu sunulan verilerle açıklanmıştır.

Anahtar kelimeler: Çevre Yönetim Sistemi, ISO 14001, ön çalışma

CONTENTS

Page

CHAPTER ONE
INTRODUCTION

1.1 Study Overview

Environmental Management System will play most important role in environmental control for world. Nowadays, decreasing of natural resources and big damages of environmental pollution generated from developing industries increase public consciousness about the environmental effecting of organizations. This consciousness of environment with the support of the legislations, force the organizations to be more responsible and sensitive about the environment.

Increasingly in this single world market, an organization needs to be demonstrated sound business management that includes concern for the environment. There is growing evidence that this results in advantages in financing, insurance, marketing, regulatory, and other areas of operations. An Environmental Management System (EMS) provides a solid framework for meeting environmental challenges and realizing the above benefits.

As the first standard of the environmental management system standard series, ISO 14001 standard was established in 1996 by international committee to provide industries with a structure for a universal and international environmental management system of standards and guidelines. It has been ensuring all operational processes and achieved environmental objectives of the organizations

In Turkey the draft of ISO 14001 standard was published in April 1997. The Standard became certain as “TSEN-14001 Environmental Management Systems, Facilities and Guidelines”.

1.2 Aim of the study

Developing industries and technology have been bringing us not only endless benefits but also uncontrolled environmental disasters. So it is obliged for organizations to implement an environmental management system, which identify all impacts of process and how to control them to improve environmental performance and to reduce damages caused by them.

The objectives of this thesis are:

- To identify the environmental management system according to ISO 14000 Standard,

- To evaluate a guideline for especially organizations that working on food and refrigerator facility, and to show the improving and implementing steps of an environmental management system for such organizations,

For this purpose; a food industry and a refrigerator-manufacturing factory are chosen as a case study area and ISO 14001 Environmental Management System requirements have been developed step by step for these facilities

CHAPTER TWO
ENVIRONMENTAL MANAGEMENT SYSTEM

2.1 Environmental Management System

The environmental management system is "that part of an overall management system which includes organizational structure, planning, activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy "(Cascio, et al, 1996, p.36).

ISO 14001 specifies a guideline for designing an EMS based on a commitment to pollution prevention, regulatory compliance, and continual improvement of the organization's EMS. If it is designed appropriately to an organization's business activities and environmental impacts, it can help to reduce environmental expenditures and improve environmental performance (Tekneci, Ç, 2004).

In 1992, the British Standards Institute (BSI) published BS 7750, the first national standard for environmental management systems. ISO 14001 was largely based on BS 7750, and the two standards share many similar requirements. However, the BS 7750 Standard is more stringent than ISO 14001. For example, BS 7750 requires that an organization establish a register of its significant environmental effects, and a register of all legislative, regulatory, and other policy requirements. In addition, BS 7750 requires an organization to make its environmental objectives publicly available. Following the publication of the United Kingdom's BS 7750, the national EMS standards emerged, including standards from some certain countries of world. These various EMS standards didn't share the all same requirements, and in some cases the requirements were contradictory. In order to solve these problems one international EMS standard would have to be developed.

In addition to the national EMS standards, European legislation was developed. The Eco- Management and Audit Scheme (EMAS) were adopted by the European Union

in 1993. EMAS is a regulation that enables industries to voluntarily implement formal environmental management systems in order to improve their environmental performance. While ISO 14001 and BS 7750 apply to organizations, EMAS is restricted to site-specific industrial activities (*National Center for Environmental Decision-Making Research.* Retrieved February 12, 2005 from http://www.ncedr.org,).

2.2 The Similarities between Environmental Management Standards

There is great similarity between ISO 14000, EMAS, BS 7750 applied on an International, European and National Basis.

All of these standards have a similar set of ingredients;

- An objective understanding of environmental aspects and their impacts.
- The need for an environmental policy, clarifying the environmental principles promoted by the company. Environmental policy must be appropriate to the nature and scale of the organization's activities, products and services.
- Objective and Targets defining the environmental goals and the path towards achieving them
- An environmental management system or program, defining how to be objectives and targets are to be realized.
- Internal audits of the environmental management system to ensure effectiveness and compliance.
- Management review of the system to ensure that it continues to be suitable and effective for the organization and it aims. (Y. Basar, 1998)

2.3 The Differences between EMAS & ISO 14001

While EMAS and ISO 14001 share the same objective, they are different in a number of ways. These differences illustrated on Table 2.1 showing in particular where EMAS goes beyond the ISO 14001 requirement.

Table 2.1 The differences between EMAS & ISO 14001 (*Gateway to the Europian Union*. Retrieved March 26, 2005 from http://europa.eu.int)

	EMAS	**ISO/ EN ISO 14001**
Preliminary Environmental Review	Verified initial review	No review
External communication and verification	Environmental policy, objectives, environmental management system and details of organization's performance made public	Environmental policy made public
Audits	Frequency and methodology of audits of the environmental management system and of environmental performance	Audits of the environmental management system (frequency or methodology not specified)
Contractors and suppliers	Required influence over contractors and suppliers	Relevant procedures are communicated to contractors and suppliers
Commitments and requirements	Employee involvement, continuous improvement of environmental performance and compliance with environmental legislation	Commitment of continual improvement of EMS rather than a demonstration of continual improvement of environmental performance

2.4 ISO 14000

For organizations that are faced with intricacies and costs of environmental practices such as disposing of hazardous waste, reducing emissions, or treating effluent the environmental management strategies can help to improve business and environmental performance. Achieving sound environmental management depends on good judgment, systematic planning, and a certain amount of trial (*Donald Bren*

School Environmental Science &Management University of California. Retrieved April 4, 2005 from http://www.esm.ucsb.edu,).

These standards reflect global consensus on good environmental practice in the international context that can be applied pragmatically by organizations all over the world in their particular situation. ISO has a two-pronged approach to meeting the needs of all stakeholders from business, industry, governmental authorities and non-governmental organizations, as well as consumers, in the field of the environment.

Firstly, ISO offers a wide-ranging portfolio of standards for sampling and test methods to deal with specific environmental challenges. It has developed more than 350 International Standards for the monitoring of such aspects as the quality of air, water and soil, as well as noise and radiation. They also serve in a number of countries as the technical basis for environmental regulations.

Secondly, ISO has developed standards that help organizations to take a more pro-active approach to managing environmental issues. These environmental management standards can be implemented in any type of organizations in either public or private sectors (from companies to administrations to public utilities).

To spearhead this strategic approach, ISO established a new technical committee, ISO/TC 207 in 1993, Environmental management. This move was a concrete manifestation of ISO's commitment to respond to the complex challenge of "sustainable development" articulated at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. It also stemmed from an intensive consultation process, carried out within the framework of the Strategic Advisory Group on Environment (SAGE). SAGE was set up in 1991 and brought together representatives of a variety of countries and international organizations – a total of more than 100 environmental experts – who helped to define how International Standards could support better environmental management.

As a result, the ISO 14000 family of standards on environmental management was developed to provide a practical toolbox to assist in the implementation of actions supportive to sustainable development.

Today, national delegations of environmental experts from 66 countries participate within ISO/TC 207, including 27 developing countries. In addition, 35 international non-governmental and business organizations participate as liaison organizations. The national delegations are chosen by the national standards institute concerned and they are required to bring to ISO/TC 207 a national consensus on issues being addressed by the technical committee. This national consensus is derived from a process of consultation with interested parties in each country.

From its beginning, it was recognized that ISO/TC 207 should cooperate closely with ISO/TC 176, Quality management and quality assurance – the ISO technical committee responsible for the ISO 9000 family of quality management standards –in the areas of management systems, auditing and related terminology. Successful steps have been taken to ensure compatibility of ISO environmental management and quality management standards. These include a common standard giving guidelines for environmental and/or quality auditing.

2.5 ISO 14000 Families

2.5.1 At the organizational level

2.5.1.1 Implementing Environmental Management System (EMS)

The members of the ISO 14000 series at the stage of implementing EMS are;

ISO 14001; ISO 14004 = Help an organization to establish a new or improve an existing EMS.

ISO 14001 = Specifies the requirements for an EMS that may be objectively audited for self-declaration, second or third-party certification \ registration purposes.

ISO 14004 = Provides guidance to help an organization establish and implement an EMS including guidance that goes beyond the requirements of ISO 14001.

ISO/TR 14061 = Contains information that assists in the implementation of ISO 14001 and ISO 14004 by forest management organizations and the forest products industry.

2.5.1.2 Conducting Environmental Audits and Other Related Investigations

The members of the ISO 14000 series at the stage of conducting environmental audits and other related investigations are;

ISO 14015 = Provides guidance on the general principles common to the conduct of any environmental audit.

ISO 14011 = Provides guidance on the procedures for the conduct of EMS audits, including the criteria for selection and composition of audit teams.

ISO 14010 = Provides guidance on the qualifications of internal or external environmental auditors and lead auditors.

ISO 14012 = Helps an organization to identify and assess the environmental aspects and associated business consequences of sites and organizations to support the transfer of properties, responsibilities and obligations from one party to another

ISO 19011 = (replaces ISO 14010, 14011, and 14012) Provides guidance on the principles of auditing; the management of audit programmes; the conduct of management system audits as well as on the competence of auditor

2.5.1.3 Evaluating Environmental Performance

The members of the ISO 14000 series at the stage of evaluating environmental performance are;

ISO 14031 = Provides guidance on the selection and use of indicators to evaluate an organization's environmental performance.

ISO/TR 14032 = Provides examples from real organizations to illustrate the use of the guidance in ISO 14031.

2.5.1.4 Communicating results

The members of the ISO 14000 series at the stage of communicating results are;

ISO/WD 14063 = Will provide guidance on environmental communication related to an organization's environmental aspects and performance.

2.5.1.5 Understanding terms and definitions

The members of the ISO 14000 series at the stage of understanding terms and definitions are;

ISO 14050 = Helps an organization to understand the terms used in the ISO 14000 series standards.

2.5.2 To Products and Service

2.5.2.1 Using Environmental Declarations and Claims

ISO 14020 = Provides general principles which serve as a basis for the development of ISO guidelines and standards on environmental claims and declaration.

ISO 14021 = Provides guidance on the terminology, symbols and testing and verification methodologies an organization should use for self-declaration of the environmental aspects of its products and services (Type II Environmental Labelling)

ISO 14024 = Provides the guiding principles and procedures for third-party environmental labelling certification programs (Type I Environmental Labelling)

ISO/TR 14025 = Identifies and describes elements and issues for consideration when making declarations of quantified product information based on Life Cycle Inventory data (Type III Environmental declarations)

2.5.2.2 Conducting Life Cycle Assessment (LCA)

ISO 14040 = Provides the general principles, framework and methodological requirements for the LCA of products and services

ISO 14041 = Provides guidance for determining the goal and scope of an LCA study, and for conducting a life cycle inventory

ISO 14042 = Provides guidance for conducting the life cycle impact assessment phase of an LCA study.

ISO/TR 14043 = Provides guidance for the interpretation of results from an LCA study

ISO/TS 14048 = Provides information regarding the formatting of data to support life cycle assessment

ISO/TR 14049/14047 = Provide examples that illustrate how to apply the guidance in ISO 14041 and ISO 14042

2.5.2.3 Addressing Environmental Aspects In Products and Product Standards

ISO Guide 64 = Helps the writers of product standards address environmental aspects in those standards

ISO/TR 14062 = Provides concepts and current practices relating to integration of environmental aspects into product design and development

2.5.2.4 Understanding terms and definitions

ISO 14050 = Helps an organization to understand the terms used in the ISO 14000 series standards

2.6 Benefits of ISO 14001

The whole ISO 14000 family provides management tools for organizations to control their environmental aspects and to improve their environmental performance. Together, these tools can provide significant tangible economic benefits, including:

- Reduced raw material / resource use
- Reduced energy and other resource consumption
- Improved process efficiency
- Reduced waste generation and disposal costs, and
- Utilization of recoverable resources
- Improved environmental performance
- Reduced liability and risk
- Competitive advantage
- Improved consistent compliance with legislative & regulatory requirements
- Reduced distribution costs
- Fewer accidents
- Employee involvement
- Improved public image

- Enhanced customer trust
- More favourable credit terms
- Meet customers and shareholders requirements
- Improved cooperation and environmental awareness among employees
- Improved staff responsibility, commitment and motivation
- Better business performance
- Marketing advantage with foreign buyers (Stapleton, et al, 2001)

How quickly and how effective the return for investment by an organization in ISO 14001 occurs is a function of a variety of conditions that include:

- The status and level of sophistication of its existing management system;
- The degree of environmental challenge it faces, including the past, present and future situations;
- The amount and quality of resources it has access to, both internally or externally;
- Its state of preparedness – such as existing environmental management practices;
- The knowledge, skill and ability of its staff with responsibilities relating to environmental management and their relationship with those in other departments;
- The expectations that stakeholders have in relation to the EMS;
- The current status of compliance with legal requirements;
- Other requirements to which the organization may have made a commitment, and
- The level of verification required by the organization to meet market requirements or the expectations of stakeholders

CHAPTER THREE
ISO 14001 EMS REQUIREMENTS

3.1. How to start?

Standard is applied, size, type or level of industries not important, any organization. Most important principle is a voluntary, internal management tool and is intended to be able to be used as EMS criteria.

Elements of standard are based on five principles. These are;

- Commitment and policy
- Planning
- Implementation
- Measurement and evaluation
- Review and improvement

3.2 Commitment and Policy

The first principle of ISO 14001 contains three elements;

a) Commitment
b) Initial review
c) Environmental policy

3.2.1 Commitment

The first requirement for an EMS is commitment from top management. Without such a commitment it is highly possible to have problems in the continuity of the system. The support of management is also necessary, without any interruption, after having the certification.

3.2.2 Initial Review

Initial review is basic principle of ISO 14001. It is the starting point of EMS. The purpose of the initial review is to establish to current position of the organization with regard to the environment. Initial review should be objectivity.

Some common techniques for conducting a review include:

- Questionnaires
- Interviews
- Checklists
- Direct inspection and measurement
- Record review
- Benchmarking

The review report may be structured as follows:

-The past environmental problems on the site. (Torrent, earthquake. etc.)
-Environmental setting
-EMS matters
-Environmental factors such as;

- Emissions to Air
- Emissions to Water
- Waste Management
- Noise Management
- Storage and Handling
- Energy Usage
- Potential Incidents
- Emergency Procedures

-Recommendations

- EMS issues

- Environmental Factors
- Identification of Environmental Aspects
- Identification of Legislation

According to the results of initial review the environmental policy is defined as a statement by the organization, which provides a framework for action and for the setting of its environmental objectives and targets.

3.2.3. Environmental Policy

ISO 14001 defines environmental policy as "A statement by the organization of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of environmental objectives and targets"

ISO 14001 policies should;

- Be appropriate to the nature, logical and feasible.
- Be documented
- Contain a commitment to continual improvement and prevention of pollution
- Accept relevant environmental legislation and regulations
- Be available to the public
- Be implemented, maintained and communicated to all employees
- Support to set and review environmental objectives and targets.

The main important sources of information for input into the environmental policy development process include the following:

- The organization's values and beliefs, such as relationship with its employees, the local community and the general public.
- The organization's business strategy: elements relating to the organization's (environmental) direction, opportunities and risks, medium and long term

- planning including internal and external limits and opportunities in capabilities and resources.
- Any existing statement on environmental aspects: mission statements, old policies and previous statements of commitment in internal/external reports.
- Other policies in existence such as occupational health and safety, or quality.
- The views of stakeholders and other interested parties.
- Policy goals based on the initial environmental review.
- Legislation and regulations.
- Clear definition of the scope of the policy: which facilities, departments, activities, services or products are to be covered by the environmental policy.
- General statements of environmental principles; e.g. from government, public bodies, industry associations, which are relevant to the organization.
- Examples of environmental policy statements from similar organizations.

The issues addressed in the policy depend on the nature of the organization. All activities, products or services can cause impacts on the environment. The environmental policy should recognize this.

The environmental policy should direct the environmental management system to achieve improvements in overall environmental performance. The organization should begin where there is obvious benefit, for example, by focusing on regulatory compliance, by limiting sources of liability or by making more efficient use of materials (Tekneci, Ç, 2004).

Example of Environmental Policy:

Environmental Policy for Shell UK (1995)

Shell UK is committed to reducing its impact on the natural environment. It seeks to go beyond legal compliance and to be among the leading exponents of good environmental practice in the oil and chemical industries in the U.K

Specifically we are committed to:

- Achieving continuous improvement in our environmental performance, supported by the development and maintenance of appropriate management systems;
- Seeking the efficient use of energy and natural resources in all our activities;
- Pursuing the reduction of harmful emissions and effluents from our activities and where reasonably practicable, eliminating them;
- Reducing the waste created by our activities, promoting recycling or reuse, and managing the disposal of waste in accordance with best industry standards;
- Ensuring that all sites we relinquish are in an environmental condition consistent with their future use;
- Assessing the environmental effects of any new activities, and reassessing them when there are significant changes;
- Requiring contractors working for use to apply standards compatible with our own.
- Improving the environmental performance of our products and providing practical advice to users;
- Conducting and supporting research to improve the environmental effects of our activities and products;
- Sharing with others the environmental expertise developed by the Royal Dutch/Shell Group of Companies;
- Recognising the concerns of our customers, employees, shareholders and the public on environmental matters and being open and informative about our policies, practices and performance;
- Contributing constructively to the development of environmental policy, regulations and standards (G.McKay, 1998).

3.3 Planning

Planning is the second principle of Environmental Management System. After environmental policy, ISO 14001 requires that the company implement "environmental planning".

The second principle of ISO 14001 states that 'an organisation should formulate a plan to fulfil its environmental policy, and the environmental management system elements relating to planning include:

- Identification of environmental aspects and evaluation of associated environmental impacts;
- Legal requirements;
- Internal performance objectives and targets;
- Environmental plans and management programme;

3.3.1 Identification of Environmental Aspects

An environmental aspect refers to an element of an organization's activity, which can have a beneficial or adverse effect on the environment. For example, it could involve a discharge, an emission, consumption or reuse of a material, or noise. An impact refers to the change, which takes place in the environment as a result of the aspect. Examples of impacts might include contamination of water or depletion of a natural resource.

The identification of environmental aspects and evaluation of environmental impacts is a process that contains four steps:

- Select process or an activity
- Identify environmental aspects of the activity
- Identify environmental impacts
- Evaluate significance of impact.

The identification of the environmental aspects is an ongoing process that determines the past, current and potential impact of an organization's activities on the environment. This process also includes the identification of the potential regulatory, legal and business exposure affecting the organization. It can also include identification of health and safety impacts, and environmental risk assessment.
Example of environmental aspects (Cascio, et al, 1996, p.108).

- Waste generation
- Wastewater discharge
- Storm water discharge
- Point source air emissions
- Fugitive air emissions
- Automobile exhaust emissions
- Chemical use operations
- Water use operations
- Energy use operations
- Use of natural resources
- Product obsolescence
- Product disposal

The process should consider normal operating conditions, shut down and start up conditions, as well as potential significant impacts associated with foreseeable or emergency situations. Organizations do not have to evaluate each product, component or raw material input. They may select categories of activities, products or services to identify those aspects that are likely to have a significant impact.

Example of environmental impacts (Cascio, et al, 1996, p.109).

Impacts on Ecology

- Impacts on flora
- Impacts on fauna

- Impacts on biological diversity
- Impacts on habitat
- Impacts on landscape and natural beauty

Impacts on Natural Resources

- Impacts on agricultural land
- Impacts on forest resources
- Impacts on water supplies
- Impacts on minerals
- Impacts on marine resources
- Impacts on energy resources
- Impacts on wetlands
- Impacts on rain forests
- Impacts on wilderness

Impacts on Pollution

- Impacts on air
- Impacts on water
- Impacts on radiation levels
- Impacts on soil erosion
- Impacts on waste generation
- Impacts on contamination levels

The control and influence over the environmental aspects of products vary significantly, depending on the market situation of the organization. A contractor or supplier to the organization may have comparatively control, while the organization responsible for product design can alter the aspects significantly by changing for example a single material input. While recognizing that organizations may have limited control over the use and disposal of their products, they should consider, where practical, proper handling and disposal mechanisms (Tekneci, Ç, 2004).

3.3.2 Legal Requirements

The organization should establish and maintain procedures to identify, have access to and understand all legal and other requirements to which it subscribes, directly attributable to the environmental aspects of its activities, products or services. To maintain regulatory compliance, the organization should identify and understand regulatory requirements applicable to its activities, products or services.

Several sources can be used to identify environmental regulations and ongoing changes, including all levels of government; industry associations or groups; commercial databases; and professional services. Internal priorities and criteria should be developed and implemented where external regulatory and other requirements do not meet the needs of the organization or are non-existent. Internal performance criteria, together with external standards, assist the organization in developing its own objectives and targets (Tekneci, Ç, 2004).

Examples are as where an organization can have internal performance (Tekneci, Ç, ISO 14000 EMS and Application on Recovery Facilities at Glass Packaging Industry, 2004).

- management systems;
- environmental measurement and improvement;
- employee responsibilities;
- process risk reduction;
- prevention of pollution and resource conservation;
- suppliers;
- capital projects;
- contractors;
- product stewardship, process change;

- hazardous material management/substitution;
- environmental communications;
- waste management;
- regulatory relationships;
- water management (e.g., waste, storm, ground);
- environmental incident response and preparedness;
- air quality management;
- environmental awareness and training;
- energy management; and transportation

3.3.3 Objectives and Targets

The environmental policy has to depend on results of the environmental review, to improve detailed objectives and targets. Objectives should be established to meet the organization's environmental policy. These objectives are the overall goals for environmental performance identified in the environmental policy. The relevant findings from environmental reviews, and the identified environmental aspects and associated environmental impacts should be taken care during objectives are being established. The priorities have to be identified during the period of passing through this information because the level of the priorities addresses the risks. The issues of vital importance, high priority, medium priority, and low priority should be identified. While the objectives are setting first the issues with the highest priority should be addressed. Environmental targets can be set to achieve these objectives within a specified time frame. The targets should be specific and measurable.

When the objectives and targets are set, the organization should consider establishing measurable environmental performance indicators. These indicators can are the basis for an environmental performance evaluation system and the environmental management and the operational systems.

Objectives and targets can apply broadly across an organization or site-specific or individual activities. Appropriate levels of management define objectives and targets. Objectives and targets should be periodically reviewed and revised.

The possibility of taking preventative measures have to be considered while establishing the objectives and targets, as well as. The legal and other requirements, the significant environmental aspects, the technological and financial options, operational and business requirements, and the views of interested party should be thought.

When considering the technological options, one may consider the use of best available technology where economically viable, cost effective and judged appropriate.

Objectives should include commitments to:

- Reduce waste and the depletion of resources,
- Reduce or eliminate the release the environmental pollution,
- Design products to minimize their environmental impact in production, use and disposal,
- Control the environmental impact of raw material sourcing,
- Minimize any significant adverse environmental impact of new developments,
- Give environmental awareness to the employees and the community (G.McKay, 1998).

3.3.4 Environmental Management Program

The translation of the policy into action takes the form of an environmental management program. An organization should establish an environmental management program that addresses all of its environmental objectives while planning of activities. To be most effective the environmental action programs

should be integrated into the organization's strategic plan. Environmental action programs should address schedules, resources and responsibilities for achieving the organization's environmental objectives and targets.

Within the framework provided by the environmental planning, an environmental action program requires specific actions in order of their priority to the organization. These actions may deal with individual processes, projects, products, services, sites or facilities within a site.

Environmental action programs help the organization to improve its environmental performance. They should be dynamic and revised regularly to reflect changes in organizational objectives and targets.

The creation and use of a program is a key element to the successful implementation of an environmental management system. The program should describe how the organization's targets would be achieved, including time-scales and personnel responsible for implementing the organization's environmental policy. This program may be sub-divided to address specific elements of the organization's operations. The program should include an environmental review for all new activities.

The program may include, where appropriate and practical, consideration of planning, design, production, and marketing and disposal stages. This may be undertaken for current and new activities, products or services (Tekneci, Ç, 2004).

3.4 Implementation and Operation

3.4.1 Structure and Responsibility

The commitment of all employees to the successful implementation of an environmental management system should begin at the highest top management. Top management should establish the organization's environmental policy and ensure

that the environmental management system is implemented. As part of this commitment, top management should designate a specific management representative with defined responsibility and authority for implementing the environmental management system. In large organizations there may be more than one representative. In small or medium sized organizations, one person may undertake these responsibilities.

It is also important that the key environmental management system responsibilities are well defined and communicated to personnel. The organizational structure usually consists of four main elements: the organizational charts, job descriptions, clear reporting lines and procedures, and performance targets. The organizational chart shows the organizational structure, main responsibilities and reporting lines.

Issues that could be considered in developing the organizational structure are:

- Provision of resources;
- Action to prevent non-compliance;
- Identifying potential problems;
- Recommending solutions to problems and verifying their implementation; and
- Acting in emergency situations.

It is often recommended that the environmental management responsibilities should follow the operational hierarchy. The environmental manager should be responsible for ensuring that the environmental management system is established, implemented and effective (Global Environmental Management Initiative. February 17, 2005 from http://www.gemi.org,).

3.4.2 Training, Awareness and Competence

To implement an effective EMS successful, responsibilities should be supported by the necessary authority and training to enable the individuals to carry out their

tasks effectively. An effective and on-going training program is necessary for all levels of the organization to ensure awareness of environmental issues.

Training should instruct on the organization's environmental policy, objectives and action program. It should address the significant environmental impacts, actual or potential, and the environmental benefits of improved personal performance. Equally, it should highlight the potential consequences of departure from specified operating procedures. A successful training program is an interactive process that provides the participants with information, awareness, knowledge, understanding and motivation. This interactive process requires managers to respond to suggestions and initiatives raised pursuant to the training sessions. Even if the suggestions are not appropriate, they need to be treated seriously so that the initiative and impetus of the training is maintained. The benefits of training can be quickly lost if the employees feel that the training is carried out in a vacuum, and that on the workflow managers are not interested in their attempts to apply new found knowledge and understanding. Complete records of all training provided and who participated in it, should be Maintained. (Global Environmental Management Initiative. February 17, 2005 from http://www.gemi.org,)

3.4.3 Communication

Communication with employees, with ISO 14001 members, and with customers is most important role for environmental management. ISO 14001 specifies that procedures be in place for;

a) Internal communication between the various levels and functions of the organization;
b) Receiving, documenting and responding to relevant communication from external interested parties.

To maintain a certain dynamic in the environmental management system, proper internal and external communication procedures are essential. Such a procedure may

include a dialogue with interested parties and consideration of their relevant concerns. In some circumstances responses to interested parties' concerns may include relevant information about the environmental impacts associated with the organizations operations. These procedures should also address necessary communications with public authorities regarding emergency planning and other relevant issues.

3.4.4 Documentation

The environmental documentation may be integrated and shared with documentation of other systems implemented by the organization, e.g. quality control and safety procedures. It does not have to be in the form of a single manual.

Environmental records may include:

a) Organizational charts;
b) Internal standards and operational procedures;
c) Site emergency plans;
d) Information on applicable environmental laws and other requirements;
e) Complaint records;
f) Training records;
g) Product process information;
h) Product information;
i) Inspection, maintenance and calibration records;
j) Pertinent contractor and supplier information;
k) Incident reports;
l) Information on emergency preparedness and response;
m) Records on significant environmental impacts;
n) Audit results; and
o) Management reviews.

Proper account should be taken of confidential business information. The procedures for identification, maintenance and disposition of records should focus on

those records needed for the implementation and operation of the environmental management system, as well as those records needed to record the extent to which planned objectives and targets have been met. (Global Environmental Management Initiative. February 17, 2005 from http://www.gemi.org).

3.4.5 Document Control

The organization shall establish and maintain information, in paper and electronic form,

a) To describe the core elements of the management system and their interaction;

b) To provide direction to related documentation.

Documenting an EMS can be as simple or as complex as the organization decides. EMS documents can and should be integrated with other management documents wherever possible. Cross-references with health and safety manuals and quality manuals are examples of this. Existing Procedures manuals may have environmentally related information in them.

Operational processes and procedures should be defined, documented and updated, especially those that establish operational control over significant environmental aspects.

The single-manual approach generally does not work for complete EMS documentation. Rather, the EMS Manual is a road map to other associated documents. The EMS Manual should describe what the EMS consists of, where other related documents are located, and where records of performance can be found.

All required tools, supplies, safety equipment and team support should be explained at the beginning of the instructions for any task. Measures of performance for a task should be clearly delineated, and the responsibilities for verification made

clear. Criteria for acceptance, non-conformity resolution, and corrective actions should also be clear (*The ISO 14001 Implementation Guide*. Retrieved April 16, 2005 from http://www.iso14001.homestead.com)

The organization shall establish document-controlling procedures to ensure that everyone is working with proper.

Suggested elements of document control (Stapleton, et al, 2001):

- issue/revision date
- effective date
- approval (i.e., signature)
- revision number
- document number (or other identifier)
- copy number
- cross-references

3.4.6 Operational Control

The organization shall identify those operations and activities associated with the identified significant environmental aspects in line with its policy, objectives and targets. The organization shall plan these activities, including maintenance, in order to ensure that they are carried out under specified conditions by;

a) Establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy and the objectives and targets;

b) Stipulating operating criteria in the procedures;

c) Establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and

communicating relevant procedures and requirements to suppliers and contractors (G.McKay, 1998).

Carefully written procedures are the basis for implementing the environmental management system. Procedures should specify who is to carry out what tasks, give step-by-step instructions for how tasks are to be accomplished, and include directions for dealing with departures from the procedures. Setting and maintaining effective environmental procedures involves five stages: identifying environmental aspects, assessing potential environmental impacts, identifying risk control measures, preparing and maintaining procedures to maintain control; and ongoing audit and review of these procedures. (*Global Environmental Management Initiative*. February 17, 2005 from http://www.gemi.org).

Implementation of the EMS begins with the establishment of operational controls to verify that an organization's policy, targets, and objectives are achieved. Training, procedures and instructions are all inclusive components of this operational control.

Operational Controls can be of three basic types:

a) Those activities assigned to prevent pollution or conserve resources. Process reengineering, capital project design and new product development are a few examples.
b) Compliance management activities designed to ensure adherence to regulations, or internal operational requirements to ensure efficiently meeting regulations.
c) Strategic Environmental Management activities designed to identify environmental opportunities, to anticipate change, and to respond to emergent trends.

Operational control can be broken down into two plans: a technical control plan and a management control plan. These plans describe technical and management controls identified during the initial review. They delineate responsibilities and authorities for those controls and mention milestones and deliverables in the planning

of improvements. The plans can also quantify expected cost benefits derived from the improvements.

Employees who actually work with procedures should develop new instructions, and modify existing ones. Preparation of documentation to establish EMS Operational Control is delegated to departmental work groups under the direction of the department manager. The department should review environmental requirements and effects within their area of operation as defined in the Aspects, Objectives and Targets. The project team usually accomplishes this activity.

3.4.7 Emergency Preparedness and Response

The organization shall establish and maintain procedures to identify potential for and respond to accidents and emergency situations, and for preventing and mitigating the environmental impacts that may be associated with them. The organization shall review and revise, where necessary, its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations. The organization shall also periodically test such procedures where practicable."

The emergency plans can include:

- Emergency organization and responsibilities;
- A list of key personnel;
- Details of emergency services (e.g. fire department, spill clean-up services);
- An internal and external communication plan;
- Actions taken in the event of different types of emergencies;
- Information on hazardous materials, including each material's potential impact on the environment, and measures to be taken in the event of accidental release;
- Training plans and testing for effectiveness (*Global Environmental Management Initiative*. February 17, 2005 from http://www.gemi.org).

Although typically addressed through conventional emergency response plans, this element also requires that a process exist for identifying the potential

emergencies, in addition to planning and mitigating them. A linkage to the aspects analysis, where impacts are assessed, is appropriate. Emergency incidents include those that may not be regulated, but may still cause significant impact as defined by the organization.

3.5 Checking and Corrective Action

3.5.1 Monitoring and Measurement

Procedures are required describing how the organization will monitor and measure key parameters of operations. These parameters relate to the significant aspects, objectives and targets and legal and regulatory compliance. In order to properly manage the system, measurements must be taken of its performance to provide data for action. Responses to this element usually cross reference too many other specific procedures and work instructions describing measurement and equipment calibration. It is in this element that we find the requirement for what is commonly referred to as a compliance audit. Monitoring

3.5.2 Non-conformance, Corrective, and Preventive Action

This element requires procedures for acting on non-conformance identified in the system, including corrective and preventive action. Non-conformance may be identified through audits, monitoring and measurement, and communications. The intent is to correct the system flaws. Typically, Corrective Action Report (CAR) forms are the norm, noting the non-conformance, the suggested fix, and closure of the action when completed. Note that this requirement does not imply in any way that the party identifying the non-conformance must be the one to suggest the fix. Instead, it is expected that the system provide for the information to be routed to the most appropriate party to address the concern.

In establishing and maintaining procedures for investigating and correcting non-conformance, the organization should include the following basic elements:

a) Identifying the cause of the non-conformance,

b) Identifying and implementing the necessary corrective action,
c) Implementing controls necessary to avoid repetition of the non-conformance,
d) Recording changes in procedures resulting from corrective action (*Global Environmental Management Initiative*. February 17, 2005 from http://www.gemi.org).

3.5.3 Records

The organization shall establish and maintain procedures for the identification, maintenance and disposition of environmental records. These records shall include training records and the results of audits and reviews.

Records are expected to exist to serve as verification of the system operating. For example, records include audit reports and training records. Unlike controlled documents, records are "once and done" documents, resulting from the execution of some process or procedure. Procedures in this element are required for the maintenance of records.

Records are required to demonstrate compliance with the EMS. They're collected within the framework of the EMS, and they record the extent to which the EMS design is performing. Procedures are developed to maintain, identify, collect, index, and store records. Included in the records being maintained by the system are contractor, procurement, audit, management review, and training records necessary for the confirmation of the EMS.

3.5.4 EMS Audits

The organization shall establish and maintain (a) programme(s) and procedures for periodic environmental management systems audits to be carried out, in order to:
a) Determine whether or not the environmental management system

1. Conforms to planned arrangements for environmental management including the requirements of this International Standard; and
2. Has been properly implemented and maintained; and

b) Provide information on the results of audits to management. The organization's audit programme, including any schedule, shall be based on the environmental importance of the activity concerned and the results of previous audits. In order to be comprehensive, the audit procedures shall cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results.

ISO 14001 requires that the system provide for internal audits. This procedure(s) will include methodologies, schedules, and processes to conduct the audits. Interestingly, the EMS audit will in essence, audit the audit process itself!

External auditing is recommended for ISO 14001 EMS. The neutral vision of the auditor is at the core of this concern. The intent of auditing is to supply management with better vision from which they make decisions. In-house staff may not be comfortable delivering completely objective information critical enough to be useful for system modification. This is not at issue with third party auditors. But, one of the best ways to train internal facility staff in operating their EMS is to involve staff from one department in the audits of another. This can be performed in conjunction with independent third party auditors to gain "internal" perspective as well as external.

3.6 Management Review

This element requires that periodically, top management will review the EMS to ensure it is operating as planned. If not, resources must be provided for corrective action. For areas where there are no problems, the expectation is that with time, management will provide for improvement programs. Usually there is no detailed

procedure for this element, although records of agendas, attendance, and agreed upon action items are maintained as verification.

Some issues to be considered in the review are:

- Review of the environmental objectives and targets;
- Audit findings;
- Concerns amongst relevant interested parties; and
- Evaluation of the effectiveness of the environmental management system;
- Evaluation of the suitability of the environmental policy and the need for

changes in the light of changing legislation, changing expectations and requirements of interested parties, changes in the products or activities of the organization, developments in technology, lessons learned from environmental incidents, market preferences, reporting and communication (*Global Environmental Management Initiative*. February 17, 2005 from http://www.gemi.org)

CHAPTER FOUR
GENERAL INFORMATION ABOUT THE INDUSTRIES

4.1 Food Industry

The food company, which is located in Torbalı-İzmir, produces pizza and packaged foods such as puddings, baking powders and cake mixes. The company has many factories in different parts of the world and they are managed by head office in Germany. Company has 21 industries and 450 products worldwide now**.** Their production is based on powdered food.

The mentioned food industry was established in 1987 in İzmir and then moved to new industrial area at Torbalı in 1999. Company in the Turkey is active on frozen food and powder food. There are 200 workers present in the industry. The factory has got a domestic wastewater treatment plant present which includes a biological system. A waste storage area has been planned to be constructed for the all wastes generated from the factory. The factory does not have an air pollution prevention system at present. Approximate product capacity of industry is 7700 tonnes total (powdered and frozen) food per year.

4.2 Refrigerator Industry

The refrigerator company, which is located in Manisa, produces refrigerator. The company has many factories in the different parts of the world and they are managed by head office in Italy. The refrigerator factory was established in 1994 at Manisa. There are 500 workers present in the industry. Approximate product capacity of industry 250.000 refrigerator/year. The factory does not have any treatment plant, the wastewater is transported to the wastewater treatment plant of Manisa Organized Industrial District.

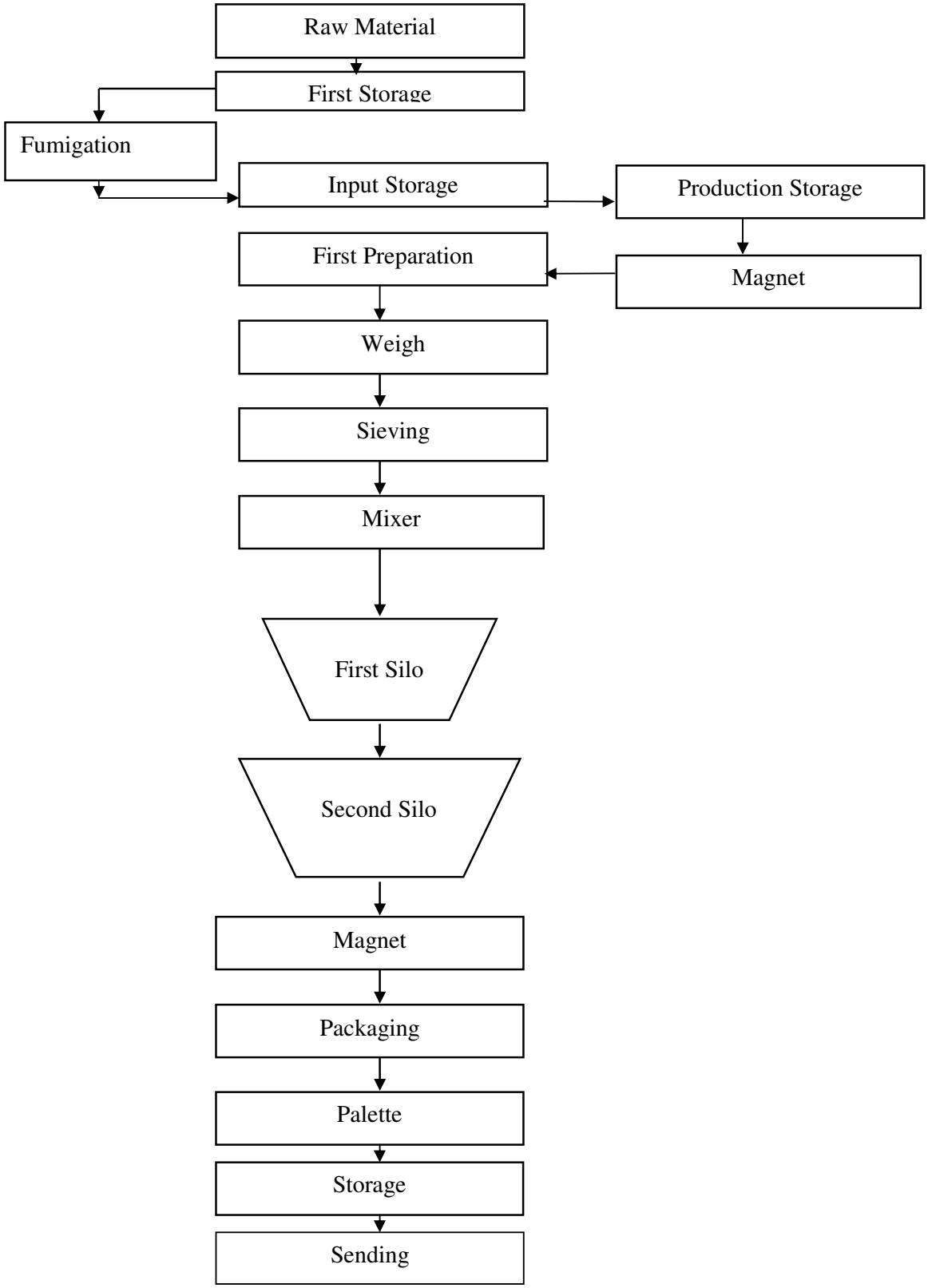

Figure 4.1 Workflow of Powder Product

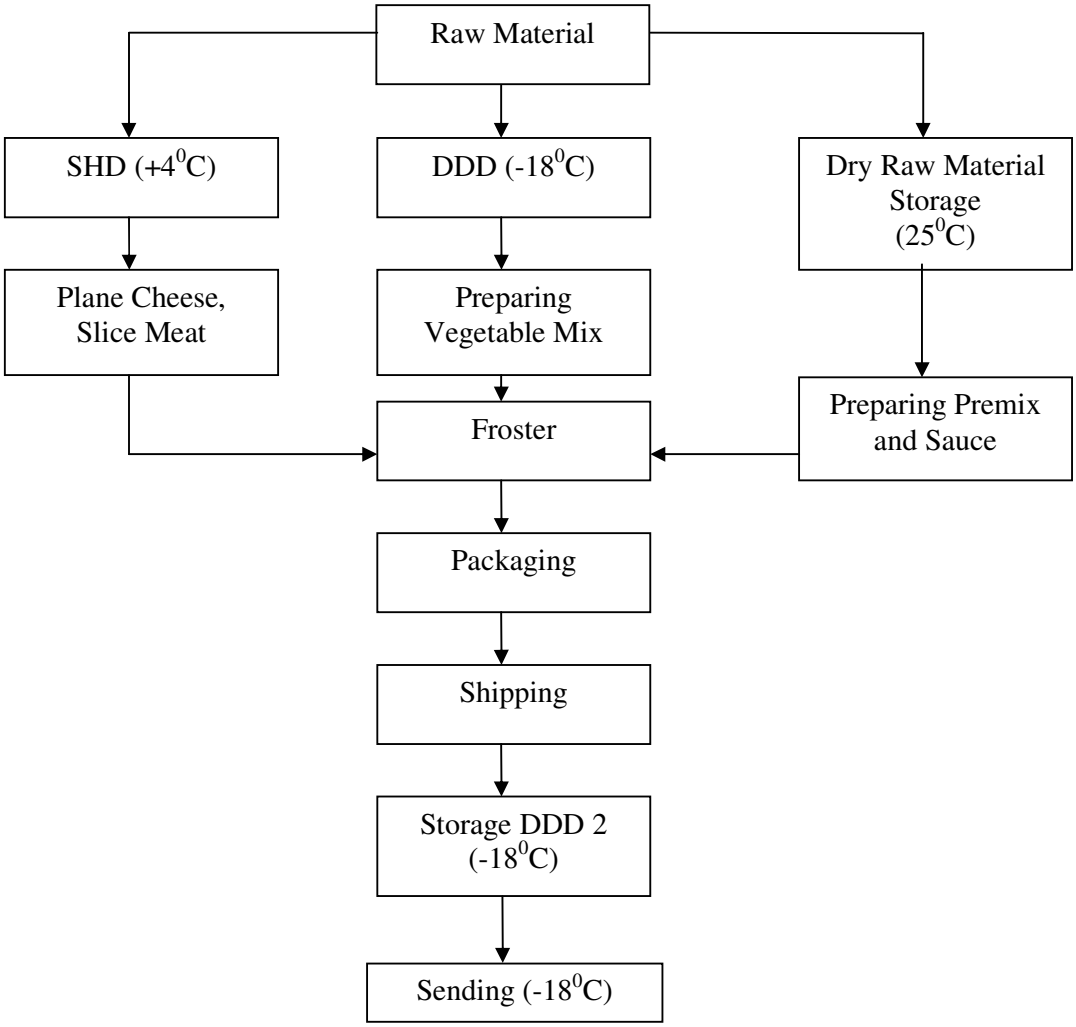

Figure 4.2 Workflow of Pizza Product

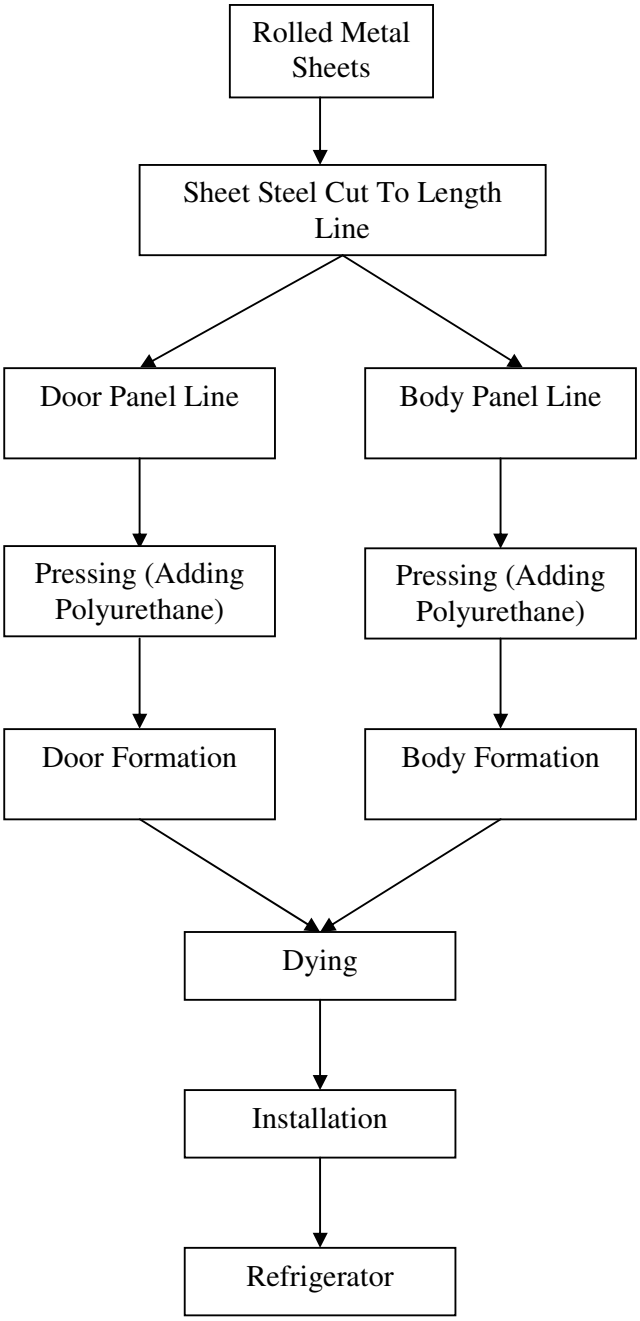

Figure 4.3 Work flow of refrigerator industry

CHAPTER FIVE
AN ISO 14000 STUDY ON A FOOD INDUSTRY

5.1 Food Industry Process

As mentioned in the previous chapter, there are two main process lines in the factory; pizza manufacturing and powder food manufacturing. Both these processes are handled under separate sub topics

5.1.1 Powder Product Manufacturing Process

This process has three steps. These steps:

1. Sieving
2. Mixture Preparation
3. Packaging

Related to the production, the materials in the products are weighed and then they are sieved in order to separate undesired large materials. Sieved materials are homogenized in the mixer until obtaining the required mixture. After that, they are sent to the first silo to package the product. Then, they are transferred to another silo. The help of a magnet system in the silo part cleans the possible metal chips present in the material. Material is transferred to the packaging part of the factory and when the packaging is completed in the products are put into the larger packs and are sent shipping and storage area.

5.1.2 Pizza Product

This unit has four steps. These steps are;

a) Preparing pizza dough
b) Preparing pizza base
c) Pizza frosting
d) Packaging

The raw materials, which are going to be used for pizza production, are kept in storage under suitable conditions according to their properties. The most important step in the pizza production is the preparation of pizza dough and the pizza base. The second step is the preparation of the sauces and foods by slicing or grating. Workers according the type of production planned for the day add the prepared sauces and other ingredients to the pizza base. This step is called as the pizza frosting. After that, the prepared pizzas are allowed in – 10 ^{0}C to make them frozen. The frozen pizzas are packaged and are kept in -18°C to bring them shipping conditions. Then they are shipped to the specially cooled vehicles to be delivered.

5.2 Environmental Management System at Food Industry

Depending on the improving importance of environmental quality issues nowadays and the customers' requests; the food industry top management consider to obtain the ISO 14001 certificate. The willingness of the factory management is the first important step of this process. Following this, organizing the cooperation between the workers and the engineers will be the other important issue to realize this purpose.

Initial environmental review should be done by the factory management an then the steps of ISO 14001 application need to be applied by all staff from the top to bottom.

In this case, the food industry is taken in to consideration, and the author made observations in the factory in three months period. During this observation period, the required data was collected from the factory and the facilities to improve

environmental concerns were investigated. The present situation and the deficiencies will be discussed under the following subtopics.

5.2.1 Initial Environmental Review

Before implementing environmental management system, the food industry environmental situation should be considered. At the initial review section the environmental situation of the factory is considered via these steps,

- To decide necessaries according to the laws and regulations,
- To find out important environmental effects in the past.
- To learn and deliberate the environmental non-conformance,
- To examine the nowadays environmental implementations.

At the initial review section of EMS, environmental situation of food industry is interviewed below three topics; mass balance in each unit, classification of wastes and legal requirements of industry.

Waste management of food industry contains three steps. These steps;

- Classification of food industry wastes
- Legal requirement
- Mass balance

5.2.1.1 Classification of Wastes

The classification of food industry wastes according to the departments and units are explained below;

Powder Food Product**:**

- Organic wastes
- Package wastes: Cardboard, corrugated cardboard, nylon, aluminium folio, band, bobbin, ink case, product package, glue case, porcelain

- Other: Bonnet, Plastic glove, machine oil
- Waste water
- Noise pollution

Pizza Product:

- Organic wastes
- Package wastes: Cardboard, corrugated cardboard, nylon, aluminium folio, band, bobbin, ink case, product package, glue case, tin
- Other: Bonnet, Plastic glove, machine oil
- Gas emissions
- Waste water
- Noise pollution

Technical Service:

- Packing wastes (metal, paper, plastic, nylon)
- Waste machine oil box
- Contaminated textile production
- Electricity circuit
- Cable
- Bone, used gloves
- Chemical material cans
- Liquid wastes (Oil from machines)

Offices:

- Paper
- Used toner
- Used batteries
- Plastic, nylon
- Organic wastes
- Wood

- Medical wastes

Vehicle Transfer Unit:

- Gas emissions
- Noise pollution
- Packing wastes

Wastewater Treatment Plant:

Wastewater is sourced by domestic use in the food industry. Wastewater is treated by biological treatment.

5.2.1.2 Legal Requirements

The legal obligations of the industries constitute the skeleton of the ISO 14001 studies. In the first step of the studies, the related laws and regulations must be determined and noted; according to these legal aspects, the required permission reports must be obtained. The related regulations that the industries must follow are given in Table 5.1.

NO	LAW / REGULATIONS	O.G.NO	O.G. DATE
1	Environmental Law	2872	11.08.1983
2	Air Quality Protection Regulation	19269	02.11.1986
3	Noise Control Regulation	19308	11.12.1986
4	Water Pollution Control Regulation	25687	31.12.2004
5	Solid Waste Control Regulation	20814	14.03.1991
6	Medical Waste Control Regulation	21586	20.05.1993
7	Hazardous Chemical Medical and Product Control Regulation	21634	11.07.1993
8	Hazardous Waste Control Regulation	25755	14.03.2005
9	Regulation Non-Sanitary Enterprises	22416	26.09.1995
11	Environmental Impact Assessment Regulation	24777	06.06.2002
13	Soil Pollution Control Regulation	24609	10.12.2001
14	Environmental Auditing Regulation	24631	05.01.2002
15	Waste Oil Control Regulation	25353	21.01.2004
16	Industrial Air Pollution Control Regulation	25606	07.10.2004
17	Package and Package Waste Control Regulation	25538	30.07.2004
18	Waste Battery and Accumulators Control Regulation	25569	31.08.2004

Figure 5.5 Legal requirement lists of food industry

5.2.1.3 Mass Balance:

For each unit product in an industry, the mass balance can simply be defined as followed:

Raw Material = Product + Wastes

In this study, a flow diagram (Fig 5.3) is recommended for the manufacturing process. Due to the simple equation above, the mass values are calculated monthly. Pizza and powder production flow diagrams are given in Figure 5.4.

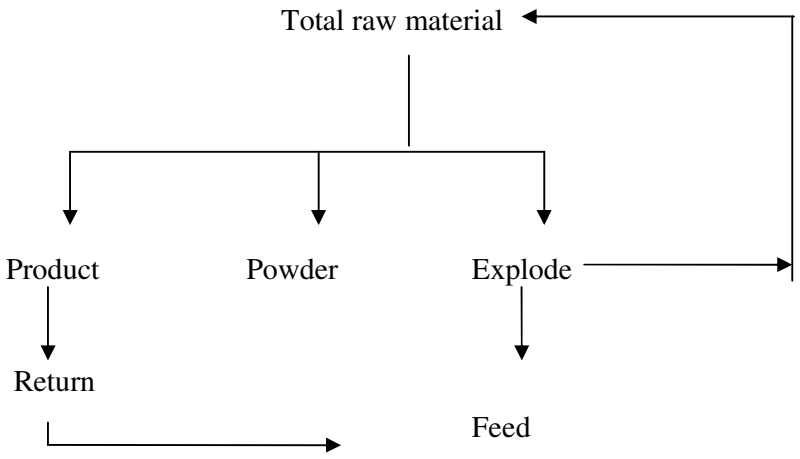

Figure 5.3.Schematic diagram mass balance of powder product

According the scheme, the data of raw materials used for monthly product of industry, the data of powdered food which are brought out because of the weighing problems and which are sent for reproduction, the data of the sold products we are resent to the industry because of the over date and the data of spreading powder around the machines during packaging and sieving, have been taken into the consider. Besides, returned products and spreading powder around the machines are sold in the markets as feed.

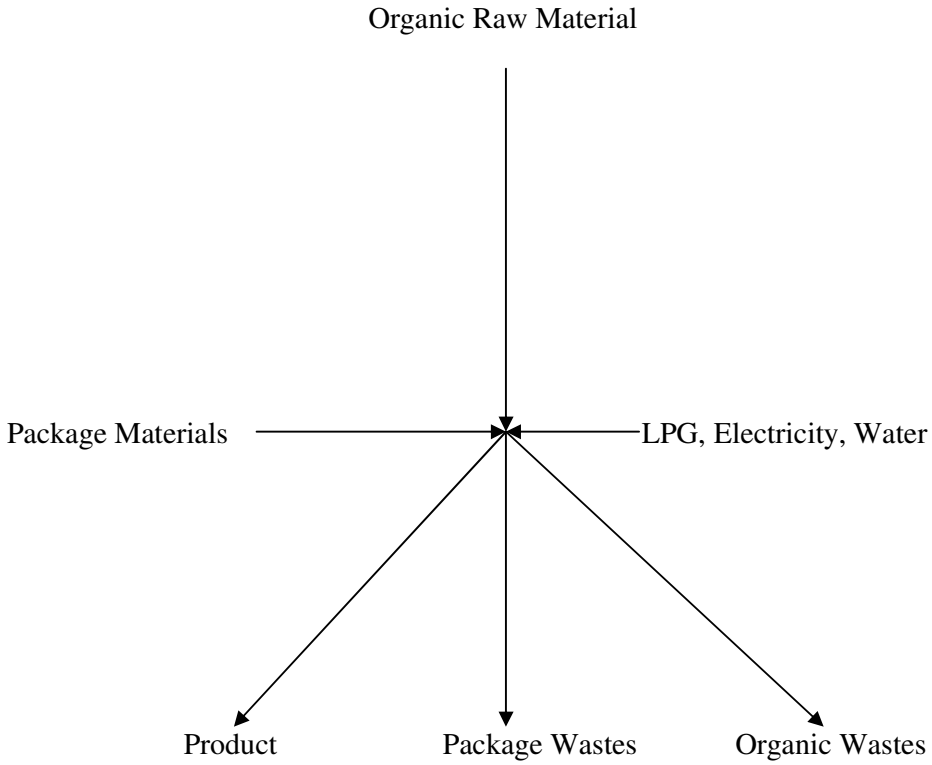

Figure 5.4 Schematic diagram mass balance of pizza product

While preparing the mass balance of the pizza production, LPG filling moments have been taken into the consideration. Considering the organic raw materials, which are taken into production in every LPG filling, packaging materials and created products, the data have been searched and a table has been formed related to this. This table enables us to see the wastes and amount of wastes of the industry easily.

5.3 ISO 14001 Requirements

5.3.1 Environmental Policy

After the environmental performances are considered at initial review food industry top management should prepare an environmental policy. The policy is published and communicated to all employees. The formed environmental policy of food industry is shown Figure 5.5.

- Achieving continuous improvement in our environmental performance, supported by the development and maintenance of appropriate management systems;
- Seeking the efficient use of energy and natural resources in all our activities;
- Pursuing the reduction of harmful emissions and effluents from our activities and where reasonably practicable, eliminating them;
- Reducing the waste created by our activities, promoting recycling or reuse, and managing the disposal of waste in accordance with best industry standards;
- Ensuring that all sites we relinquish are in an environmental condition consistent with their future use;
- Assessing the environmental effects of any new activities, and reassessing them when there are significant changes;
- Requiring contractors working for use to apply standards compatible with our own.
- Improving the environmental performance of our products and providing practical advice to users;
- Conducting and supporting research to improve the environmental effects of our activities and products;
- Recognising the concerns of our customers, employees, shareholders and the public on environmental matters and being open and informative about our policies, practices and performance.

General Manager

Figure 5.5 Environmental policy of food industry

5.3.2 Planning

5.3.2.1 Environmental Aspects & Impacts

After the present environmental condition has been determined, environmental aspect determination form is prepared. At the food industry the environmental impacts are considered under the topics of legal requirements, past problems, informational defects, use of environmental resources and then an environmental impact evaluation forms is established. The sample environmental aspect determination forms of food industry are given in Table 5.2(Turkish Standards Institute, 2004).

While the environmental impact evaluation form is established the probability and effect scores are determined for each environmental aspect and the risk scores are calculated. The scoring method is obtained from Turkish Standard Institution (2004). ISO 14000 EMS publication. Occurring probability scores explain the risks of each aspects, it rises with increasing risks. Prevention probability scores explain the availability to stop that risk and the scores increases with decreasing availability. Dose of effect scores represent the intensity of the aspect in the facility if it happens.

Table 5.1 Criteria of environmental dimension

Occurring Probability	**Prevention Probability**	**Dose of Effect**
5: very high probability	0: certainly prevention	0: no effect
4: high probability	1: very high probability	2: minor effect
3: average probability	2: high probability	4: low effect
2: low probability	3: average probability	6: average effect
1: very low probability	4: low probability	8: high effect
0: no occurring probability	5: very low probability	10: major effect

Two different environmental aspect determination approaches for of food factory are given in the Tables 5.2 and 5.3. The approaches are used to build different scenarios for solving the environmental problems of the facility. In the first scenario the scores of occurring probability and prevention probability are added and the result is multiplied by the dose of effect to calculate the environmental effect value. In the second scenario the occurring probability score is multiplied by the score of prevention probability score and then the result is multiplied by dose of effect score to calculate the environmental effect value. The tables of related scenarios are given as follows.

Table 5.2 Environmental risk analysis for food industry-Scenario I

NO	ENVRONMENTAL DIMENSION	ENVIRONMENTAL RISK	OCCURING PROBABALITY	PREVENTION PROBABALITY	TOTAL	DOSE OF EFFECT	ENVIRONMENTAL IMPACT POWER
1	Fire risk	Air, water, soil pollution	1	5	6	10	60
2	Earthquake risk	Air, water, soil pollution	1	5	6	10	60
3	Fugitives on the LPG pipes	Air, water, soil pollution	1	5	6	10	60
4	Fire risk in the ovens	Air, water, soil pollution, acid rain	1	5	6	10	60
5	Burning the packaging wastes	Air and soil pollution	1	5	6	10	60
6	Insufficient wastewater treatment plant	Water and soil pollution	1	5	6	10	60
7	High noises from the machines	Noise pollution and human health	5	1	6	8	48
8	Waste oil storage problems	Groundwater and soil pollution	5	1	6	8	48
9	Solid wastes	Recycling	5	1	6	6	36
10	Gas emissions	Air and soil pollution	1	5	6	6	36
11	Burying the hazardous wastes	Water and soil pollution	1	5	6	6	36
12	Sludge storage problems	Water and soil pollution	1	3	4	8	32
13	Instrument accidents in the plant	Air and soil pollution	1	3	4	8	32
14	Groundwater usage	Natural sources reduction	2	4	6	4	24
15	Reverse osmosis	Water pollution and natural resources consumption	4	1	5	4	20
16	Medical Wastes	Soil pollution and human health	1	1	2	8	16

Table 5.3 Environmental risk analysis for food industry-Scenario II

NO	ENVRONMENTAL DIMENSION	ENVIRONMENTAL RISK	OCCURING PROBABALITY	PREVENTION PROBABALITY	DOSE OF EFFECT	ENVIRONMENTAL IMPACT POWER
1	Fire risk	Air, water, soil pollution	1	5	10	50
2	Earthquake risk	Air, water, soil pollution	1	5	10	50
3	Fugitives on the LPG pipes	Air, water, soil pollution	1	5	10	50
4	Fire risk in the ovens	Air, water, soil pollution, acid rain	1	5	10	50
5	Burning the packaging wastes	Air and soil pollution	1	5	10	50
6	Insufficient wastewater treatment plant	Water and soil pollution	1	5	10	50
7	High noises from the machines	Noise pollution and human health	5	1	8	40
8	Waste oil storage problems	Groundwater and soil pollution	5	1	8	40
9	Groundwater usage	Natural sources reduction	2	4	4	32
10	Solid wastes	Recycling	5	1	6	30
11	Gas emissions	Air and soil pollution	1	5	6	30
12	Burying the hazardous wastes	Water and soil pollution	1	5	6	30
13	Sludge storage problems	Water and soil pollution	1	3	8	24
14	Instrument accidents in the plant	Air and soil pollution	1	3	8	24
15	Reverse osmosis	Water pollution and natural resources consumption	4	1	4	16
16	Medical Wastes	Soil pollution and human health	1	1	8	8

Both the scenarios mark the similar priorities for the food factory. The primary environmental risks are the fire risks; earthquake risks and the fugitives which may result as the fire.

There are 7 priority environmental risk groups in both of the scenarios. Different than the first scenario, groundwater usage has got a larger environmental impact in the second case. Since the factory area is located in the agricultural region, the groundwater usage gains a prior importance for this scenario. So, the second evaluation seems more convenient for this factory.

5.3.2.2 Environmental Objectives and Targets

Environmental objectives and targets chosen from Risk Analysis Table are determined due to their priorities. When choosing the priority tasks, some factors are considered according to the industry. These factors are;

1. Having high environmental impact power
2. Economical aspects of the industry
3. Practicability of the targets
4. Compatibility with the legal obligations
5. Sufficient education facilities for the responsible personnel

The environmental objectives and targets of food factory are,

- **Objective 1:** Preventing the leaks on the LPG Pipes
    - **Target 1:** Changing the location of the LPG Storage Tank
    - **Target 2:** Repair of LPG Storage Tank
    - **Target 3:** Development of automatic action steps for abnormal conditions (fire, earthquake etc.)

- **Objective 2:** Overhauling the wastewater treatment plant.
    - **Target 1:** Decreasing the BOD (Biological Oxygen Demand) concentration of the effluent at least 10% in one year

  - **Target 2:** Decreasing the TSS (Total Suspended Solid) concentration of the effluent under 70 mg/l

- **Objective 3:** Reuse of package wastes.
  - **Target 1**: Maintenance of the related machines to reduce the amount of the packaging wastes
  - **Target 2**: Providing the acceptable disposal of the packaging wastes
  - **Target 3**: Recycling of the packaging wastes in order to be used as raw material for other industries
- **Objective 4:** Management of Solid Wastes
  - **Target 1:** Providing a 10% increase of the recycling ratio
  - **Target 2:** Providing the separate collection of all the solid wastes
  - **Target 3:** Reducing the amount of contaminated waste (10%)

CHAPTER SIX
AN ISO 14000 STUDY ON A REFRIGERATOR INDUSTRY

6.1 Refrigerator Industry Process

The process of the industry includes 3 different steps followed by each other;

1. The main production process
2. Dying process
3. Installation

6.1.1. Process Steps

Door and body formation for refrigerator production constitutes this first step of the process. At the start of production line, the rolled metal sheets as raw materials are cut in the cutting machine to adjust the suitable dimensions. The process than separates in to two lines; door panel line and body panel line. Pressing is applied by using fluid polyurethane to combine the metal and plastic materials for both door and body formation lines. At the end of the first step, doors and bodies are sent to powder paint shop for the dying process. The products are painted separately. There are two lines of the installation process. Door installations and body installations are performed separately. Finally, the inner accessories are installed to the final products according to their models. The process of the refrigerator industry is summarized in Figure 4.3.

6.2 Environmental Management System at Refrigerator Industry

According to improving importance of environmental quality issues nowadays and the customers' requests made the refrigerator industry top management consider the Environmental Management System. For this purpose the top management want ISO 14001 EMS Initial Environmental Review Report for own industry

After the Initial Environmental Review Report about the general identification, benefits and certification process of ISO 14001 the top management is going to be taken ISO 14001 EMS Certification in 2006.

6.2.1 Initial Environmental Review

Before implementing environmental management system, the refrigerator industry environmental situation should be considered. At the initial review section the environmental situation of the factory is considered via these steps,

- To decide necessaries according to the laws and regulations,
- To find out important environmental effects in the past.
- To learn and deliberate the environmental non-conformance,
- To examine the nowadays environmental implementations.

6.2.1.1 Legal Requirements:

The legal obligations of the industries constitute the skeleton of the ISO 14001 studies. In the first step of the studies, the related laws and regulations must be determined and noted; according to these legal aspects, the required permission reports must be obtained. The related regulations that the industries must follow are given in Table 6.1.

NO	LAW / REGULATIONS	O.G.NO	O.G. DATE
1	Environmental Law	2872	11.08.1983
2	Air Quality Protection Regulation	19269	02.11.1986
3	Noise Control Regulation	19308	11.12.1986
4	Water Pollution Control Regulation	25687	31.12.2004
5	Solid Waste Control Regulation	20814	14.03.1991
6	Medical Waste Control Regulation	21586	20.05.1993
7	Hazardous Chemical Medical and Product Control Regulation	21634	11.07.1993
8	Hazardous Waste Control Regulation	25755	14.03.2005
9	Regulation Non-Sanitary Enterprises	22416	26.09.1995
11	Environmental Impact Assessment Regulation	24777	06.06.2002
13	Soil Pollution Control Regulation	24609	10.12.2001
14	Environmental Auditing Regulation	24631	05.01.2002
15	Waste Oil Control Regulation	25353	21.01.2004
16	Industrial Air Pollution Control Regulation	25606	07.10.2004
17	Package and Package Waste Control Regulation	25538	30.07.2004
18	Waste Battery and Accumulators Control Regulation	25569	31.08.2004

Table 6.1 Legal requirement lists of refrigerator industry

6.3 ISO 14001 Requirements

6.3.1 Environmental Policy

After the environmental performances are considered at initial review food industry top management should prepare an environmental policy. The policy is published and communicated to all employees

- Achieving continuous improvement in our environmental performance, supported by the development and maintenance of appropriate management systems;
- Seeking the efficient use of energy and natural resources in all our activities;
- Pursuing the reduction of harmful emissions and effluents from our activities and where reasonably practicable, eliminating them;
- Reducing the waste created by our activities, promoting recycling or reuse, and managing the disposal of waste in accordance with best industry standards;
- Ensuring that all sites we relinquish are in an environmental condition consistent with their future use;
- Assessing the environmental effects of any new activities, and reassessing them when there are significant changes;
- Requiring contractors working for use to apply standards compatible with our own.
- Improving the environmental performance of our products and providing practical advice to users;
- Conducting and supporting research to improve the environmental effects of our activities and products;
- Recognising the concerns of our customers, employees, shareholders and the public on environmental matters and being open and informative about our policies, practices and performance.

General Manager

Figure 6.1 Environmental policy of refrigerator industry

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6.3.2 Planning

6.3.2.1 Environmental Aspects & Impacts

After the present environmental condition has been determined, environmental aspect determination form is prepared. At the food industry the environmental impacts are considered under the topics of legal requirements, past problems, informational defects, use of environmental resources and then an environmental impact evaluation forms is established. The sample environmental aspect determination forms of food industry are given in Table 5.2(Turkish Standards Institute, 2004).

While the environmental impact evaluation form is established the probability and effect scores are determined for each environmental aspect and the risk scores are calculated. The scoring method is obtained from Turkish Standard Institution (2004). ISO 14000 EMS publication. Occurring probability scores explain the risks of each aspects, it rises with increasing risks. Prevention probability scores explain the availability to stop that risk and the scores increases with decreasing availability. Dose of effect scores represent the intensity of the aspect in the facility if it happens.

Table 6.1 Criteria of environmental dimension

Occurring Probability	**Prevention Probability**	**Dose of Effect**
5: very high probability	0: certainly prevention	0: no effect
4: high probability	1: very high probability	2: minor effect
3: average probability	2: high probability	4: low effect
2: low probability	3: average probability	6: average effect
1: very low probability	4: low probability	8: high effect
0: no occurring probability	5: very low probability	10: major effect

Two different environmental aspect determination approaches for of refrigerator factory are given in the Tables 6.2 and 6.3. The approaches are used to build different scenarios for solving the environmental problems of the facility. In the first scenario the scores of occurring probability and prevention probability are added and the result is multiplied by the dose of effect to calculate the environmental effect value. In the second scenario the occurring probability score is multiplied by the score of prevention probability score and then the result is multiplied by dose of effect score to calculate the environmental effect value. The tables of related scenarios are given as follows.

Table 6.2 Environmental risk analysis for refrigerator industry-Scenario I

NO	ENVRONMENTAL DIMENSION	ENVIRONMENTAL RISK	OCCURING PROBABILITY	PREVENTION PROBABALITY	TOTAL	DOSE OF EFFECT	ENVIRONMENTAL IMPACT POWER
1	Fire risk	Air, water, soil pollution	1	5	6	10	**60**
2	Earthquake risk	Air, water, soil pollution	1	5	6	10	**60**
3	Fugitives on the natural gas pipes	Air, water, soil pollution	1	5	6	10	**60**
4	Fire in the furnace room	Air, water, soil pollution, acid rain	1	5	6	10	**60**
5	Explosion in the Wet-Part Department	Air pollution	1	5	6	10	**60**
6	Explosion in the dye house oven	Air pollution	1	5	6	10	**60**
7	Hazardous chemical usage in the wet dye-house	Air pollution	5	2	7	8	**56**
8	Phosphate sludge in the wastewater treatment plant	Water pollution	5	2	7	8	**56**
9	Fugitives in the mix room pipes	Air and soil pollution	1	4	5	10	**50**
10	Polyurethane waste	Water and soil pollution	4	2	6	8	**48**
11	Waste oil discharge to the sewage	Groundwater and soil pollution	5	1	6	8	**48**
12	Cadmium included electronic cards	Groundwater, soil pollution	1	5	6	8	**48**
13	High noise from the machines	Noise pollution and human health	5	1	6	8	**48**
14	Water discharge leaks	Groundwater and soil pollution	2	5	7	6	**42**
15	Gas emissions	Air and soil pollution	1	5	6	6	**36**
16	Solid wastes	Recycling	5	1	6	6	**36**
17	Groundwater usage	Natural resources reduction	5	4	9	4	**36**
18	Fugitives on the LPG tank	Air and soil pollution	1	3	4	8	**32**
19	Fugitives on the R600 usage area	Air and soil pollution	1	3	4	8	**32**
20	Instrument accidents in the plant	Air and soil pollution	1	3	4	8	**32**
21	Fugitives on the R134 usage area	Air and soil pollution	1	3	4	6	**24**
22	Fugitives in the chemical storage areas	Air and soil pollution	1	3	4	6	**24**
23	Reverse osmosis	Natural resources	4	1	5	4	**20**
24	Medical Wastes	Soil pollution	1	1	2	8	**16**

Table 6.2 Environmental risk analysis for refrigerator industry-Scenario II

NO	ENVRONMENTAL DIMENSION	ENVIRONMENTAL RISK	OCCURING PROBABILITY	PREVENTION PROBABALITY	DOSE OF EFFECT	ENVIRONMENTAL IMPACT POWER
1	Fire risk	Air, water, soil pollution	1	5	10	**50**
2	Earthquake risk	Air, water, soil pollution	1	5	10	**50**
3	Fugitives on the natural gas pipes	Air, water, soil pollution	1	5	10	**50**
4	Fire in the furnace room	Air, water, soil pollution, acid rain	1	5	10	**50**
5	Explosion in the Wet-Part Department	Air pollution	1	5	10	**50**
6	Explosion in the dye house oven	Air pollution	1	5	10	**50**
7	Hazardous chemical usage in the wet dye-house	Air pollution	5	2	8	**56**
8	Phosphate sludge in the wastewater treatment plant	Water pollution	5	2	8	**56**
9	Fugitives in the mix room pipes	Air and soil pollution	1	4	10	**40**
10	Polyurethane waste	Water and soil pollution	4	2	8	**64**
11	Waste oil discharge to the sewage	Groundwater and soil pollution	5	1	8	**40**
12	Cadmium included electronic cards	Groundwater, soil pollution	1	5	8	**40**
13	High noise from the machines	Noise pollution and human health	5	1	8	**40**
14	Water discharge leaks	Groundwater and soil pollution	2	5	6	**60**
15	Gas emissions	Air and soil pollution	1	5	6	**30**
16	Solid wastes	Recycling	5	1	6	**30**
17	Groundwater usage	Natural resources reduction	5	4	4	**80**
18	Fugitives on the LPG tank	Air and soil pollution	1	3	8	**24**
19	Fugitives on the R600 usage area	Air and soil pollution	1	3	8	**24**
20	Instrument accidents in the plant	Air and soil pollution	1	3	8	**24**
21	Fugitives on the R134 usage area	Air and soil pollution	1	3	6	**18**
22	Fugitives in the chemical storage areas	Air and soil pollution	1	3	6	**18**
23	Reverse osmosis	Natural resources	4	1	4	**16**
24	Medical Wastes	Soil pollution	1	1	8	**8**

In this industry, the two scenarios are studied to decide the better one. The first scenario has got 10 priority groups and the second one has got 11. Just like food industry, the refrigerator factory scenarios show similarities with each other. The differences between the two scenarios are;

- The polyurethane wastes gained a prior importance in the second scenario. Since this type of waste is the most specific waste of this factory, this level increase is convenient in the second scenario.
- In the second scenario, water discharge leaks are more important because of defects in the infrastructure system of the area.
- Groundwater usage has got an increasing environmental impact in the second scenario. Since the factory is located in the organized industrial zone, the factories in this zone may require the groundwater to be used in their processes. So, the importance of groundwater usage is more significant in this case.
- In the first scenario, the fire, explosion and the fugitives has got the prior importance. The preventive actions for these impacts may decrease the probability so the impact of these risks. When this is considered, these risks have got decreasing impacts in the second scenario.

6.3.2.2 Environmental Objectives and Targets

Environmental objectives and targets chosen from Risk Analysis Table are determined due to their priorities. When choosing the priority tasks, some factors are considered according to the industry. These factors are;

1. Having high environmental impact power
2. Economical aspects of the industry
3. Practicability of the targets
4. Compatibility with the legal obligations
5. Sufficient education facilities for the responsible personnel

The environmental objectives and targets of food factory are,

- **Objective 1:** Management of hazardous chemical in the wet dye-house
    - **Target 1:** Usage of environmental friendly materials
    - **Target 2**: Use of preventative equipment to avoid the fugitives

- **Objective 2:** Management of phosphate sludge in the wastewater treatment plant
    - **Target 1:** Decreasing the water content of the sludge by using belt press in order to decrease COD concentration in the sludge
    - **Target 2:** Appropriate disposal of the sludge coming from the belt press unit or filter press.

- **Objective 3**: Management of the Polyurethane waste
    - **Target 1**: Recycling the polyurethane waste
    - **Target 2**: Use of the recycled polyurethane elements as the raw material of the new products
    - **Target 3**: Use of 30% less raw material usage as a result of the recycling process

- **Objective 4:** Management of the Waste oil discharge to the sewage

  - **Target 1**: Providing the storage of the waste oil instead of discharging to the sewerage
  - **Target 2**: Appropriate disposal of the stored waste oil according to the legal aspects

- **Objective 5:** Management of the Cadmium included electronic cards
  - **Target 1**: Developing alternative technologies to avoid the use of cadmium in the process
  - **Target 2**: Reducing use of cadmium included electronic cards for about 20%.

CHAPTER SEVEN
RESULTS AND DISCUSSION

The International Organization for Standardization that was founded in 1946 in Geneva is responsible for the development of the ISO 14000 series of international environmental management standards. ISO has developed international voluntary consensus standards for manufacturing, communication, trade, and management systems and its mission is to promote international trade by harmonizing international standards.

ISO 14001 specifies a guideline for designing an EMS based on a commitment to pollution prevention, regulatory compliance, and continual improvement of the organization's EMS. If it is designed appropriately to an organization's business activities and environmental impacts, it can help to reduce environmental expenditures and improve environmental performance.

While establishing and implementing ISO 14001 EMS the all environmental aspects of organization must be identified carefully and the control mechanisms for preventing and minimizing of the significant environmental impacts must be established. Then the environmental management programs that include the environmental action plans and time schedules are prepared. The environmental responsibilities in EMS and the impacts of work activities must be understand clearly by all employees and managers of organizations. It is very important for improving an effective EMS.

When these two industries are considered and compared the food industry has got a simple manufacturing process so the steps during the ISO 14001 Certificate process will be shorter. In both of the industries, the major defect is the lack of a relevant personal to organize the system.

After all the observations and studies completed in the food industry, the required actions are determined as follows:

a) Executing the related legal obligations is the most important criteria for ISO 14001 aspects. It's observed that some of the necessary certificates are not present among the documents in the industry. Providing these certificates should be the primary duty of the authorities.

b) Temporary waste storage area is an urgent need of the plant for a better waste management in the factory. There is a study related with that subject in the plant. An increase in the waste-recycling ratio of the plant is expected after this storage area is provided.

c) The present biological wastewater treatment plant is not qualified for sufficient treatment after the increase of the workers in the factory. Therefore, the discharged pollution parameters of the effluent are over the values given in the regulation. Because of that reason, the capacity of the biological plant should be increased. At present, there is a study of the industry related with the subject.

d) The recycling possibilities of the chemicals present in the packaging wastes should be investigated and determined. The industry is informed that some other firms have the appropriate recycling facilities of the equivalent chemicals. Such a disposal method is one of the necessary actions for a better waste management in the factory.

e) The firm does not have the documentation about the environmental legal aspects. This is an important lack of the industry. An arrangement is necessary about this.

f) A serious study about mass balance must be improved to activate waste management studies.

g) A personnel should be assigned to deal with the legal proceedings (following the regulations, updating the related topics.etc.) of environmental concerns.

After the observations and studies carried out in the food industry, an initial report is arranged and presented for the industry to be a guide to create environmental policies for further ISO 14001 studies

After all the observations and studies completed in the refrigerator industry, the required actions are determined as follows:

a) Depending on its manufacturing process, the industry has got legal obligations to realize. The related legal arrangements should be provided for the applicability of ISO 14001 studies.

b) A personnel should be assigned to deal with the legal proceedings (following the regulations, updating the related topics.etc.) of environmental concerns

c) The solid wastes should be collected where they are generated. Some specific tanks should be provided for a better collection and recycling facilities.

d) The polyurethane wastes generated from the manufacturing process can be used as raw material for polyurethane production after a sufficient recycling procedure. Studies related with this subject should be improved and the feasibility of these studies must be considered.

e) The alternatives to some of the hazardous chemicals used I various stages of the process must be determined and exchanged.

f) Electronic cards used in the process contain cadmium element. Therefore, cadmium containing electronic wastes must be reduced and environmentally friendly

technologies should be improved. In addition, recycling studies for such wastes should be taken in to consideration.

g) To reduce the phosphate load of the treatment sludge, belt press or filter press units should be used for dewatering of the sludge.

h) To prevent the oil leakages to wastewater pipes, oily wastewaters should be collected in separate tanks for a better disposal facility

After the observations and studies carried out in the food industry, an initial report is arranged and presented for the industry to be a guide to create environmental policies for further ISO 14001 studies

CHAPTER EIGHT
CONCLUSION

The Environmental Management System basic principle is initial review in the chosen industries was presented in this study. The purpose of the initial review is to establish to current position of the organization with regard to the environment

At this study we have chosen a food industry, a refrigerator industry as a case study area evaluated the requirements of EMS according to ISO 14001 standard at there because there was no implementation of ISO 14001 EMS on these industries. Our goal was to establish implementation guideline of Environmental Management System for both of industries.

This research provided an approach to implement EMS according to the ISO 14001 standard. I wish companies pursue to ISO 140001 Environmental Management Systems and maintain business excellence while considering environmental quality.

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