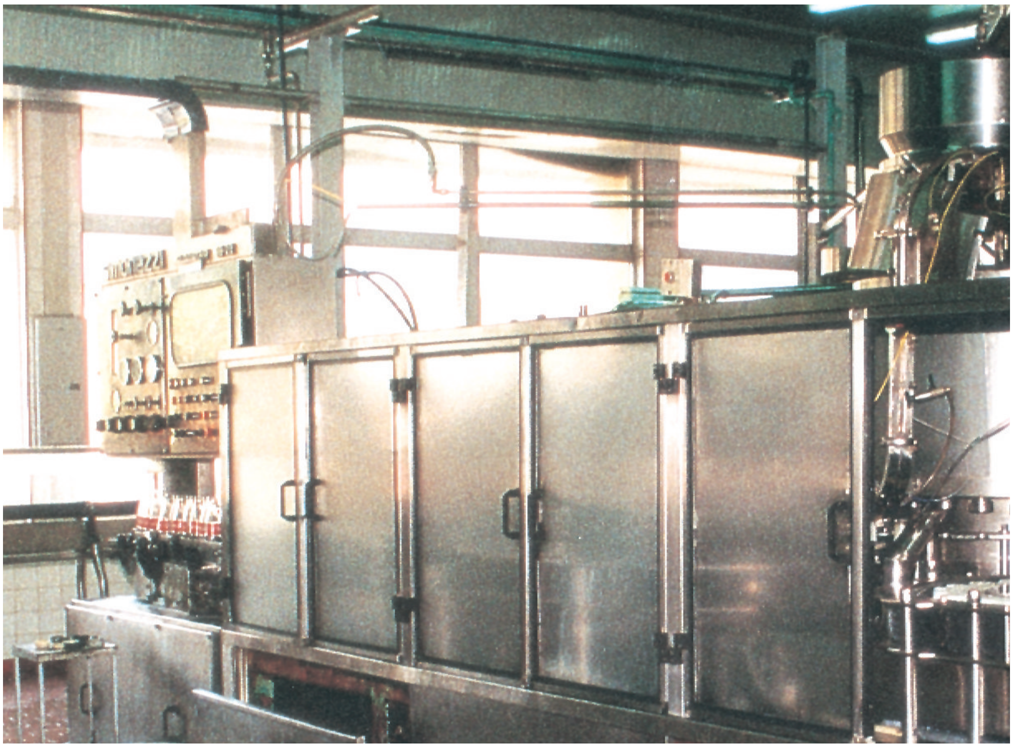
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency (EEAA)

Inspection Manual
Carbonated Beverages Industry



2002

Table of Contents

1. Introduction

The Egyptian Pollution Abatement Project (EPAP) sponsored by FINIDA has assigned Finish and Egyptian consultants for the task of developing sector-specific inspection and monitoring guidelines. This task is based on a previous collaboration between FINIDA and EPAP that resulted in the development of four Inspection Guidelines:

- Fundamentals and Background Manual that provides basic information about air pollution, wastewater characteristics, solid waste, hazardous materials and wastes and work environment.
- Guidelines for Inspectorate Management that discusses the strategy, objectives and tasks of the inspectorate management.
- Guidelines for Team Leaders that identifies the team leader resposibilities and tasks.
- Guidelines for Inspectors that presents a methodology for performing all types of inspection. Tasks during the various phases of planning, performing field inspection, report preparation and follow-up are discussed. Several checklists are included.

The three guidelines were later summarized into one that will be referred to as the General Inspection Manual (GIM EPAP, 2002), which was developed in order to cover aspects common to all sectors.

On the other hand, a Self-Monitoring manual was also developed to present the industrial community and government officials with the general principles, both managerial and technical, to be followed for self-monitoring. The textile industry was chosen as a case study for implementing and testing the manual and a self-monitoring manual for this industry was developed.

1.1 Preface

The developed manuals were tested through a number of training programs that targeted RBOs and EMUs. The inspectors involved in the training used these manuals to inspect a number of industrial facilities. Feedback from the concerned parties led to the improvement of these manuals and their continuous update. There was clearly a need for sector-specific guidelines and EPAP took the initiative to develop such manuals. Five sectors were chosen:

- Food Industry with specific reference to the five sub-sectors of Dairy products, Vegetables and Fruit processing, Grain Milling, Carbonated Beverages and Confectionery.
- Pulp and Paper Industry
- Metallurgical Industry with specific reference to the two sub-sectors of Iron and Steel and Aluminum.
- Engineering Industry
- Textile Industry.

1.1.1 Project Objectives

The project aims at the development of sector-specific guidelines for inspection and monitoring to be used by inspectors and plant personnel respectively. These manuals are meant to be simplified but without abstention of any information necessary to the targeted users. Flowcharts, tables and highlighted notes are used for easy representation of information.

With respect to the food industry, each sub-sector will have two distinct manuals one for inspection and the other for self-monitoring. Description of the industry, pollution aspects and relevant environmental laws will be similar for both manuals. Each manual will be, as much as possible a stand-alone with occasional cross-reference to the General Guidelines previously developed to avoid undue repetitions.

1.1.2 Organization of the Inspection Manual

The inspection manual for the carbonated beverages industry includes ten chapters. The first chapter represents an introduction to the whole project and to the specific sub-sector of the industry. Chapters two to five deal with the carbonated beverages industry and its environmental impacts.

The description of the industry in chapter 2 includes the inputs and outputs, a description of the different production lines with their specific inputs and outputs, a brief description of the service and auxiliary units that could be present at the industrial establishment with their potential sources of pollution and the various emissions, effluents and solid wastes generated from the different processes.

Chapter three describes the environmental and health impacts of the various pollutants whereas chapter four gives a summary of the articles in the Egyptian environmental laws relevant to the carbonated beverages industry. Chapter five gives examples of pollution abatement techniques and measures applicable to the carbonated beverages industry.

The inspection procedures are described in chapters 6 to 10 starting with a brief description of the inspection process in chapter 6 then the planning aspects that should be considered at the inspectorate level are explained in chapter 7. The different tasks at the inspectors level specific to the carbonated beverages industry, will be described in chapters 8 to 10. The tasks before field inspection are presented in chapter 8 whereas the inspection tasks for actually performing the field visit are defined in chapter 9. Chapter 10 is concerned with the conclusion of the field visit including inspection report writing, supporting the enforcement case and following-up the compliance status of the facility.

1.2 Introduction to the Carbonated Beverages Industry

The carbonated beverages industry is not a large enterprise in Egypt. This industry has been identified as a contributor to the pollution of waterways especially when large industrial establishments are involved. Major processes at this industry are automated and operated in the continuous mode. The production is subject to seasonal variation as production drops in winter. Wastewater is generated mainly from bottle washing and spills during filling operations as well as rejects.

1.2.1 Egyptian SIC code for the Carbonated Beverages Industry

The Standard Industrial Classification (SIC) code for the food industry is 15 and the carbonated beverages industries have a sub-sector code of 155.

The CAPMAS (Central Agency for Public Mobilization and Statistics) 1997 data, which is based on the 1996 census, shows that the total number of carbonated beverages facilities is 136.

1.2.2 Industry Size and Geographic Distribution

Table (1) presents a classification of the facilities by manpower for Egypt. Manpower is an indicator for the facility size, although modern facilities employ fewer workers for the same production rate. It is clear from that 45% of the facilities are operating with less than 4 workers and 26.5% have more than 40 employees. Table (2) shows the distribution of facilities by manpower for each governorate.

Table (1) Size Distribution of Carbonated Beverages Industries

Manpower	1	2	3	4	5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-100	101-500	501-1000
No of facilities	22	20	12	7	15	17	6	4	0	5	2	11	16	2	7

Table 2. Size distribution of Carbonated Beverages Industries (SIC 155) per Governorate

Manpower	Cairo	Alexandria	PortSaid	Suez	Damieta	Daqahlya	Sharkia	Qalyoubia	Kafr-el-	Gharbiya	Menoufia	Behera	Ismalia	Giza	Benisuef	Fayoum	Minia	Asyout	Sohag	Qena	Aswan	Luxor	RedSea	NewValley	Matrouh	Nsinai	SSinai	*Totat*
001	3				1	2	7			4				1				2					1				1	22
002	4	2	1		4		1			1	1	1		1						1			3					20
003	3	1	1				1					1		4					1									12
004	1	1			1									2						1			1					7
005	6	4								1				1		1				1			1					15
010	1	1	1				1	1								1							1					7
015						1	1							2		1											1	6
020	3													1														4
025																												0
030	1										1			1									1		1			5
040														1			1											2
050	1		1				1			1		1	1	1	1					1			1		1			11
100	2	5	1			1		1			1	1	1				2				1							16
500															1				1									2
1000	1							1		1				4														7
Total	26	14	5	0	6	4	12	3	0	8	3	4	2	19	2	3	3	2	2	4	1	0	9	0	2	0	2	**136**

2. Description of the Industry

The carbonated beverages industry is characterized by the production of a number of products in the same production lines. Additives control the kind of beverage produced. The production process in these plants can be divided into two general production lines:

- Carbonated beverages production line.
- Carbon dioxide production line.

Usually part of the produced carbon dioxide is used in the production of the carbonated beverages produced in the facility and the rest is sold in cylinders to be used in other facilities.

Service and ancillary units provide water and energy requirements as well as maintenance, storage, packaging, testing and analysis needs. Because of the nature of carbonated beverages, which are susceptible to microbial spoilage, equipment is characterized by designs, which facilitate hygienic operation, easy cleaning and sterilization. Most of the processes are automated and operated in continuous modes throughout one or more shifts. Shut down for cleaning is generally required at least once per day.

2.1 Raw Materials, Products and Utilities.

Water, carbon dioxide and concentrates are the main raw materials used in this industry.
Additives such as fructose, sucrose and flavors, are also used.
Chemicals such as sodium chloride, ferrous sulfate, calcium hypochlorite, lime, potassium permanganate and sodium hydroxide are used for water treatment. Mono ethanol-amine and sodium carbonate are used in the carbon dioxide production process for purifying the gas.

Chemicals are also used in the lab for quality control and analysis. Detergents and antiseptics are used for cleaning and sterilization purposes (sodium hydroxide, nitric acid sodium hypochlorite). Lube oil is used for the garage and workshops.
Steam is generated in boilers that use either mazot (fuel oil), solar (gas oil) or natural gas as fuel. Steam is used for providing heat requirements and in some plants for electric power generations. Water is used for cleaning equipment and floor washing, as boiler feed water, as cooling water and for domestic purposes. Boiler grade water is pretreated in softeners to prevent scale formation.
Water sources may be supplied from public water lines, wells or canal water. The type of water will dictate the type of pretreatment.
Big facilities could include a housing complex generating domestic wastewater.

Note: Defining the inputs and outputs helps predict the expected pollutants.

2.2 Production Lines

Table (3) presents the various production lines and service units that could be present in a facility producing carbonated beverages.

> ***Note**: Knowledge of the processes involved in each production line and units allows the prediction of pollution hazards and expected violations and helps determine possibilities for implementing cleaner technology.*

Table (3) Production Lines and Service Units in Carbonated Beverages Industry

Production Lines	Service Units
Carbonated beverages production line. Carbon dioxide production line.	Boilers Cooling towers Refrigerators Laboratory Mechanical & electrical workshops Garage Storage facilities. Wastewater Treatment Plant Restaurant and Housing complex

2.2.1 Carbonated Beverages Production Line

Fig (1) presents the main units in this process, the inputs to the units and the pollution sources. These units are:

Bottle Washing

An automatic bottle washing machine is usually used for this purpose. Washing occurs in a closed loop (CIP) through the following steps:

- Primary rinsing using soft water at 25 ^{0}C to remove dust.
- Disinfecting using indirect-steam at 70 ^{0}C.
- NaOH (3% concentration) rinsing at 80 ^{0}C.
- Direct cooling at 50 ^{0}C using soft water.
- Final rinsing at 25 ^{0}C with soft watre.

The soft water from cooling and final rinsing steps is recycled and used in the primary rinsing step.

Large amounts of alkaline wastewater is generated from the unit and dumped at once at the end of the shift to the plant sewer system.

Water Treatment

In this unit water supplied from public water lines, wells or canals is treated as follows:

- Raw water is pumped to an agitated reaction tank where alum, lime, ferrous sulfate and calcium hypochlorite are added.

- Sludge precipitates at the bottom and is discharged as solid waste once a day. Some facilities discharge the sludge to the sewer, causing blockage of the lines.
- Water is then passed through a sand bed filter that removes suspended solids.
- An activated carbon filter is then used to remove odor and taste from water.
- To ensure high purification quality, water passed through micro filters.

This unit is back-washed using treated water. The backwash wastewater is high in dissolved solids.

Treated water from this unit is used in the preparation of the primary and final syrup and in soft water production.

Some facilities use reverse osmosis for water treatment instead of the lime process. In this case the only pollutant would be the backwash of the unit which is high in dissolved solids (TDS).

Soft Water Production

This includes softening of treated water obtained from the water treatment units.

Calcium and magnesium ions are removed from hard water by cation exchange for sodium ions. When the exchange resin has removed the ions to the limits of its capacity, it is regenerated to the sodium form with a salt solution (sodium chloride) in the pH range of 6-8. This performed by taking the softener out of service, back-washing with the salt solution, rinsing to eliminate excess salt, and then returning it to service. The treated water has a hardness level of less than 1 ppm expressed as calcium carbonate.

Soft water from this unit is used as make up in cooling water, in boilers, in bottle washing units and in carbon dioxide production process (if facility contains this process)

Wastewater from this unit contains soluble salts.

Syrup Preparation

Fructose (or sucrose) is mixed with treated water to prepare the primary syrup. Fructose is usually used in facilities situated in the Delta region, while sucrose is used in Upper Egypt.

The final syrup is prepared by mixing the primary syrup with concentrates (depending on the type of beverage).

The final syrup is then diluted with water (1:4.9) to adjust the Brix. This is performed in containers at 5 ^{0}C. The solution is then injected with carbon dioxide and fed to the bottle-filling machine.

Brix is a unit used to express sugar concentration. It indicates the percent sucrose in water solution by weight.

Bottle Filling

Washed glass bottles are moved on a belt conveyor in front of lighted screens. Reject bottles are discarded as solid waste. Accepted bottles move to the filling machine that fills and encapsulates them.

The filled encapsulated bottles are tested again. Bottles are rejected when:

- effervescence is noticed
- liquid level is not as per specs (too high or too low)
- encapsulation was not performed
- bottle is fractured

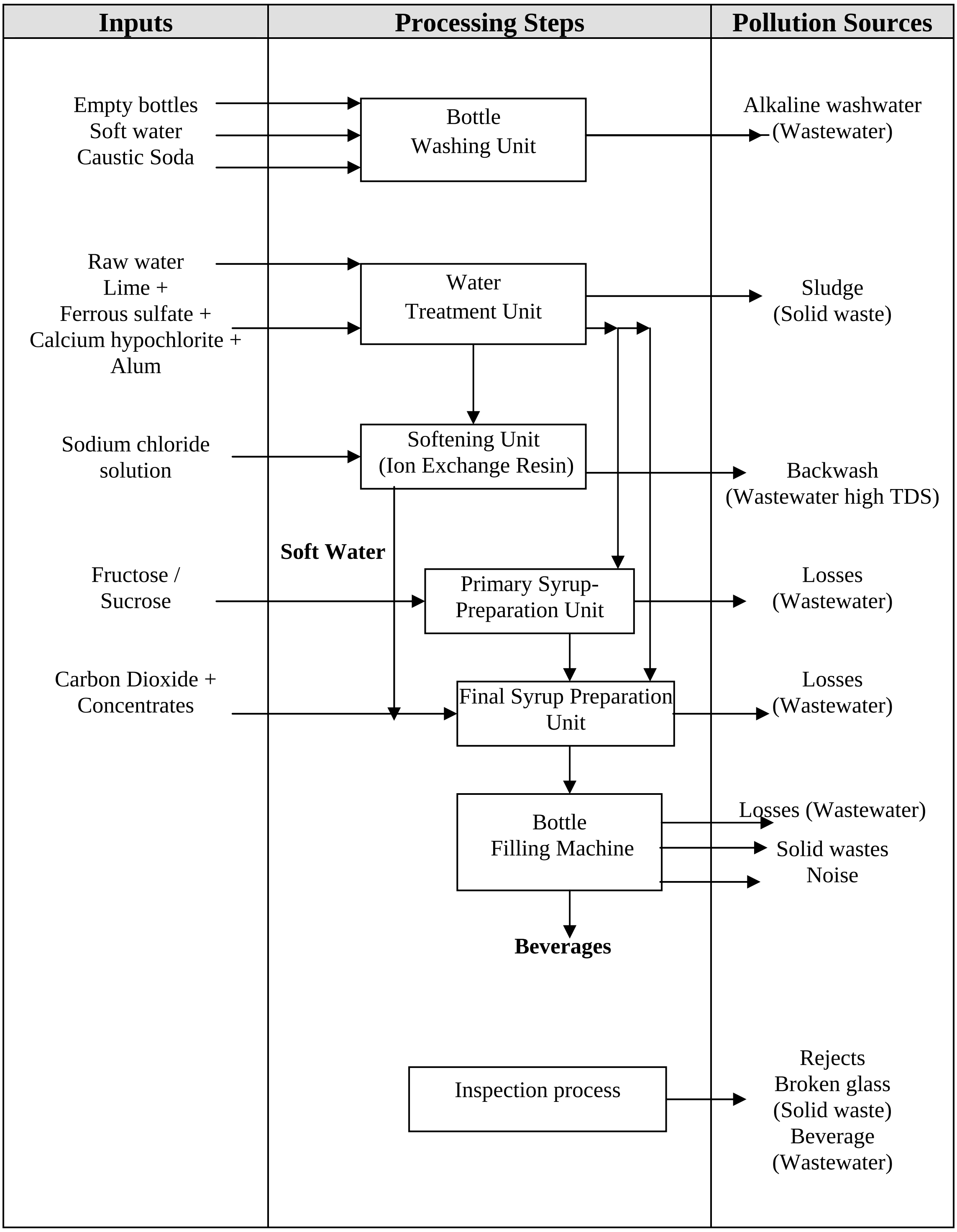
This is the most polluting step in the industry. The high BOD load in the wastewater is due to:

- Rejected bottles are emptied in the factory sewer system
- Losses of syrup during the filling operation
- Equipment wash when beverage type is changed.
- Losses during start-up and shut-down of machine.

Note: Find out:

- What happens to capsulated bottles rejected for out-of-spec liquid level?
- How and when does cleaning of equipment and floors occur?
- What type of detergent and/or antiseptic is used?
- What is the percentage loss of liquid during filling?
- What is the percentage of broken unfilled bottles?

Fig (1) Production Line for Carbonated Beverages and Related Pollution Sources



2.2.2 Carbon Dioxide Production Unit:

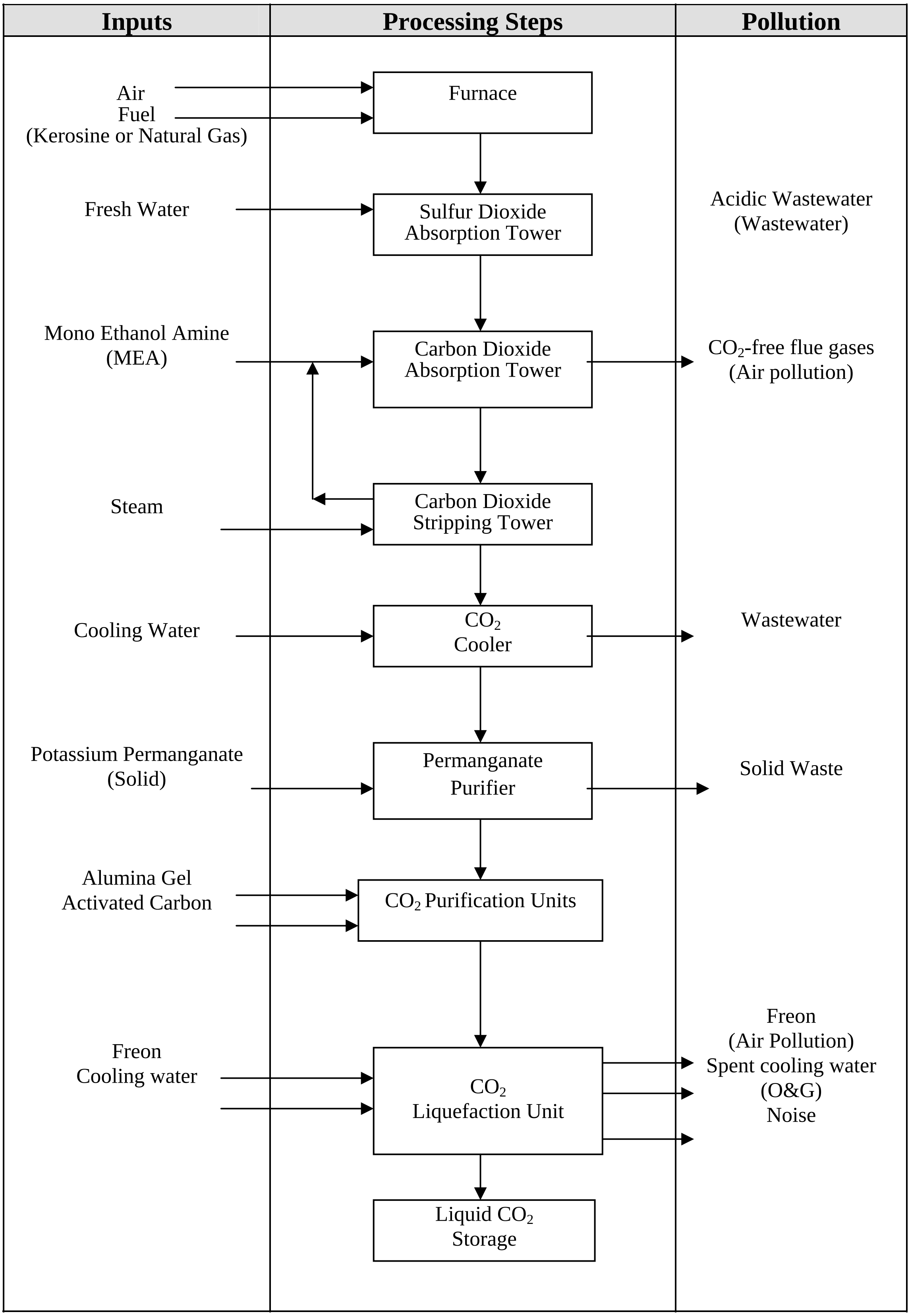
Fig (2) presents the processing steps for carbon dioxide production and its potential pollution sources. These steps involve the production of carbon dioxide by fuel combustion then its purification. The processes involved are:

Fuel Combustion	Combustion occurs in a furnace using kerosene or natural gas. If mazot (fuel oil) is used air pollution with sulfur oxides is expected.
Sulfur Dioxide Absorption	The resulting gases from fuel combustion unit are passed through an absorption tower where raw water is used to absorb sulfur dioxide (SO_2). The wastewater from this unit is acidic and is generated in large amounts.
Carbon Dioxide Extraction	The effluent gases from the absorption tower are introduced into a second absorption tower where Mono Ethanol Amine (MEA) is used to absorb and therefore extract carbon dioxide from the remaining gases which are discharged to the atmosphere. Carbon dioxide is de-sorbed by first pre-heating the solution then introducing it in a stripping tower using steam to heat and recover CO_2. The resulting regenerated MEA is recycled back to the carbon dioxide absorption tower. The heat generated in the furnace from the combustion reaction is used to supply the energy necessary for de-sorption. The extracted carbon dioxide needs to be purified from steam and traces of MEA vapors. The carbon dioxide stream is cooled by water in a heat exchanger to condense the steam. The gases are then passed through a scrubber consisting of a fixed bed of potassium permanganate that removes hydrogen sulfide and MEA. The remaining traces of MEA are removed by absorption in water or sodium carbonate solution. Potassium permanganate is being reduced during this operation and therefore looses its activity. It is replaced every two weeks and the spent permanganate is dumped as solid waste. Wastewater from the second scrubber is contaminated with traces of MEA.
Carbon Dioxide Purification	Carbon dioxide is passed through two columns containing alumina gel then a column filled with activated carbon. Carbon dioxide is then liquefied by a refrigeration cycle that uses Freon, which is an ozone depleting substance.

Note : There are two main sources of pollution :

- The CO_2 –free flue gases.
- The acidic wastewater from the sulfur dioxide absorption tower.

Fig (2) Carbon Dioxide Production Line and Related Pollution Sources



2.3 Service Units: Description and Potential Pollution Sources

Medium and large size plants will have some/all of the following service and auxiliary units. These units can be pollution sources and therefore should be inspected and monitored. Fig(3) shows the various units with their corresponding raw materials and potential pollution sources.

2.3.1 Boilers

Boilers are used to produce steam for:

- heat supply to the processes
- electric power generation

Boiler grade water must be low in TDS to minimize scale formation. Therefore soft water is used as feed to the boilers.

Conventional steam-producing thermal power plants generate electricity through a series of energy conversion stages. Fuel is burned in boilers to convert water to high-pressure steam, which is then used to drive the turbine to generate electricity.

The gaseous emissions generated by boilers are typical of those from combustion processes. The exhaust gases from burning fuel oil (Mazot) or gas oil (solar) contain primarily particulates (including heavy metals if they are present in significant concentrations in the fuel), sulfur and nitrogen oxides (SOx and NOx) and volatile organic compounds (VOCs).

The concentration of these pollutants in the exhaust gases is a function of firing configuration (nozzle design, chimney height), operating practices and fuel composition.

Gas-fired boilers generally produce negligible quantities of particulates and pollutants.

Wastewater is generated as blowdown purged from boilers to keep the concentration of dissolved salts at a level that prevents salt precipitation and consequently scale formation. The blowdown will be high in TDS.

In the case of power plants, water is used for cooling the turbines and is also generated as steam condensate. The amount of wastewater generated depends on whether cooling is performed in open or closed cycle and on the recycling of steam condensate. Contamination may arise from lubricating and fuel oil

2.3.2 Cooling Towers

Cooling water is used extensively in industry. During the cooling process, water heats up and can only be reused if cooled. Cooling towers provide the means for recycling water and thus minimizing its consumption. The cooling effect is performed through partial evaporation. This causes an increase in the concentration of dissolved salts which is controlled by purifying some water (blowdown). The blowdown will be high in TDS.

2.3.3 Refrigeration Systems

The term refrigeration usually applies to cooling below ambient temperature. Refrigeration operations involve a change in phase of a substance (refrigerant) so that it will be capable of abstracting heat. The refrigerant absorbs heat at low temperature by vaporization and gives it up at the condenser. Compressors are used for increasing the pressure of the vaporized refrigerant. The increase in pressure is accompanied by an increase in temperature that enables cooling water to condense the vapor, and the cycle is repeated.

The major pollutants can be:

- Noise from the compressors operation, which can be a violating parameter in the work and ambient environment.
- Waste cooling water, which could be contaminated with lube oil
- Hazardous materials, such as Chloro-Fluoro-Carbons (CFCs), if used as refrigerants. Freon is a CFC.

2.3.4 Laboratories

Laboratories have an important role in the food industry, as they are responsible for:

- Testing raw materials, chemicals, water, wastewater, packaging bottles, etc.
- Quality control of the different products and comparing the findings with the standard specifications for raw materials and final products
- The measured parameters are physical properties, chemical composition, and bacteriological counts.

Chemicals used for testing could be hazardous. Proper handling and storage are required for compliance with environmental law.

2.3.5 Workshops and Garage

Large facilities have electrical and mechanical workshops for maintenance and repair purposes. Environmental violations could be due to:

- Noise
- Rinse water contaminated with lube oil

Pollution in the garage area will depend upon the services offered. The presence of a gasoline or diesel station implies fuel storage in underground or over the ground tanks that require leak and spill control plans.

Replacing lube oil implies discharge of spent oil to the sewer lines or selling it to recycling stations.

2.3.6 Storage Facilities

The specifications for the storage facilities depend on the stored material.

- Water stored during beverage production.
- Bottles used in filling are stored in large shaded areas.
- Products are filled in bottles made of glass or plastic of predetermined weight.
- Chemicals are used as additives for the process, for washing and treatment processes. These chemicals require special handling, storage and management procedure as required by law.
- Fuel is used for the boilers, for the cars and delivery trucks. It is stored in underground or over ground tanks. The types of fuel usually used are fuel oil (Mazot), gas oil (solar), natural gas and gasoline.

2.3.7 Wastewater Treatment Plants

Although a WWTP is a pollution abatement measure, it has to be inspected and monitored for potential pollution. Pollution may be due to malfunctioning or improper management. A carbonated beverages facility discharges wastewater high in organic load. From time to time peak load will be discharged. They may be due to internal processes, to seasonal fluctuations, to lack of control or a "force majeur" situation such as power collapse.

The potential pollution sources are:

- Sludge which represents a solid waste problem
- Treated water, which could represent a water pollution problem if containing pollutants that exceed the limits set by relevant environmental laws.

2.3.8 Restaurants, Washrooms and Housing Complex

These facilities will generate domestic wastewater as well as domestic solid waste.

-

Fig (3) Service Units and Their Related Pollution Sources

Inputs	Service Units	Pollution
Fuel + air Water	Boilers (→ Steam)	Boiler Blow Down (TDS) Flue Gases
Hot Water	Cooling Towers	Cooling Tower Blowdown (TDS)
Chemicals	Laboratory	Wastewater Hazardous Materials (handling)
Lube Oil Floor and equipment rinse water Cleaning Chemicals	Electrical & Mechanical Workshops	Oily Rinse Water Solid Wastes
Fuel Oil Rinse Water	Garage	Oily rinse water Solid wastes
Raw materials Fuel Chemicals Products	Storage	Spills Raw material & product rejects Hazardous material
Wastewater	Wastewater Treatment Units	Treated water Sludge
Water	Restaurant and restrooms	Sanitary Wastewater

2.4 Emissions, Effluents and Solid Wastes

Table (4) summarizes the major polluting processes, their outputs and the violating parameters.

2.4.1 Air Emissions

There are two main sources of air emission in the carbonated beverages industry:

- Exhaust gases resulting from fuel consumption performed for:
  - producing carbon dioxide in facilities that have a carbon dioxide production line
  - generating steam from boilers for heat and/or electricity requirements.

The violating parameters would be: particulate matters, (PM10), sulfur oxides, nitrogen oxides, carbon monoxide.

- Freon resulting from leaks in refrigeration tubes of the carbon dioxide production line.

2.4.2 Effluents

The major pollution load of the carbonated beverages industry is generated from the following sources:

- Bottle washing unit (alkaline wastewater)
- Water treatment unit.
- Water softening unit (high TDS)
- Bottle filling unit as losses and out-of-spec product (BOD)
- Carbon dioxide production units (acidic wastewater form the sulfur dioxide absorption unit)
- Syrup preparation units as losses during change of beverage type.
- Blow down from cooling towers and boilers (high in TDS and TSS).
- Spent lube oil from garage and workshops if discharged to sewer will give oily wastewater (O&G).
- Floor and equipment washing and sanitation produces a wastewater containing organic matter, oil and grease, and traces of the chemicals used for neutralization and sanitation.

Typical effluent characteristics of the Egyptian carbonated beverages industry are shown in table (5). Typical pollution loads per ton of production are given in table (6).

Table (4) Pollutants Per Process

MAJOR POLLUTING PROCESS	PROCESS INPUTS	PROCESS OUTPUTS	POLLUTANTS	IMPACT
Bottle washing	Soft water NaOH	Alkaline wastewater	pH	Water
Testing	Empty and filled bottles	Accepted and rejected products	Rejected beverages (BOD) broken glass (solid waste)	Water Soil
Fuel combustion	Air Fuel	Flue gases (carbon dioxide)	Sulfur dioxide, carbon monoxide	Air
Sulfur dioxide absorption	Flue gases, Water	Acidic wastewater	pH	Water
Refrigeration with Freon	Carbon Dioxide	Cold carbon dioxide		
	Freon	Freon leaks	Freon (hazardous)	Air
Bottle filling	Carbonated beverages	Losses in wastewater	Wastewater of Relatively high values of BOD and COD. Noise Solid wastes from brocken bottles	Water
Water treatment	Raw water	Treated water	Sludge	Soil
Softeners	Treated water	Soft Water		
		Backwash	TDS, TSS	Water
Boilers	Soft Water + Condensate recycle	Blowdown	TDS, TSS	Water
	Fuel	Flue Gasses	CO, SO_x	Air
Cooling Towers	Water	Blowdown	TDS, TSS	Water
WWTP	Process WW	Treated effluent	BOD, COD, TSS, Color	Water
		Sludge	TSS	Soil

Table (5) Typical Chemical Analysis of Effluents from a Carbonated Beverages Plant.

Parameters	pH	BOD mg/1	COD mg/1	T.S.S mg/1	Oil& Grease mg/1
Final effluent	8	1150	1800	600	Nil

Table (6) Typical Organic Pollution Loads for a Production of 470 Cubic Meters Per Day

Parameters	Effluent flow rate, m^3/d	BOD, kg/d	COD, kg/d
Final effluent	800	920	1440

2.4.3 Solid Wastes

The main sources of solid wastes are broken bottles during handling, transportation and filling processes and from the workshops and garage. The water treatment and the biological wastewater treatment plant also generate sludge. There are no hazardous wastes discharged from the plants.

2.4.4 Hazardous Wastes

The beverages production facilities consume some hazardous substances including caustic soda, ammonia and ferion. Caustic soda is used in bottle washing operation, which results in an alkalie wastewater. On the other hand

2.5 Characteristics Specific to the Carbonated Beverages Industry

Proper inspection and monitoring of the carbonated beverages industry should take into consideration the following aspects:

- Production lines are operated on a continuous basis. However, due to the special nature of food processes, washing and sanitation are performed at least once a day for both operating modes.
- Shock loads are expected and are caused by emptying reject bottles to sewer. Although the wash water for the empty bottles is recycled (a clean in place, CIP system is usually applied), it is discharged to the sewer at the end of the shift.
- Carbonated beverages production rate is seasonal since it decreases in winter.
- Pollution loads are expected to be higher during start-up and shutdown.
- Wastewater is characterized by high BOD and COD.

3. Impact of Pollutants on Health and Environment

3.1 Impact of Air Emissions

Particulate matters Recent epidemiological evidence suggests that much of the health damage caused by exposure to particulates is associated with particulate matters smaller than 10μm (PM_{10}). These particles penetrate most deeply into the lungs, causing a large spectrum of illnesses (e.g. asthma attack, cough, and bronchitis). Emissions of particulates include ash, soot and carbon compounds, which are often the result of incomplete combustion. Acid condensate, sulphates and nitrates as well as lead, cadmium, and other metals can also be detected.

Sulfur Oxides Air pollution by sulfur oxides is a major environmental problem. This compound is harmful to plant and animal life, as well as many building materials. Another problem of great concern is acid rain, which is caused by the dissolution of sulfur oxides in atmospheric water droplets to form acidic solutions that can be very damaging when distributed in the form of rain. Acid rain is corrosive to metals, limestone, and other materials.

Nitrogen Oxides Nitrogen oxides also dissolve in atmospheric water droplets to form acid rain.

Carbon dioxide Combustion of fossil fuels to produce electricity and heat contribute to the green house effect caused by the formation of carbon dioxide. The greenhouse phenomenon occurs when heat radiation from earth is absorbed by the gases causing a surface temperature increase.

Freon Freon is a trade name for Chloro-Fluoro-Carbons (CFCs) which are considered to be Ozone Destroying Substances (ODSs). The Ozone Depleting Potential (ODP) for these substances reflects the ability to destroy the ozone layer (Table 7).

Water Vapor (humidity) Humidity in workplace is regulated by law 4/1994 due to its effect on the respiratory system especially for people suffering from asthma.

Table (7) Ozone Depletion Potential (ODP) of the Principal Ozone Depleting Substances (ODSs)

ODS	ODP
CFC-11,-12,-13	1.0
CFC-113	0.8
CFC-115	0.6
CFC-111,-112,-114	1.0
CFC-211,-212,-213,-214,-215,-216,-217	1.0

3.2 Impact of Effluents

It is clear that the main impact will be due to high organic loads. The effluent is violating Egyptian environmental laws as presented in section 4.2.

Spent lube oil from garage and workshops could be a cause for concern if discharged into the sewer system.

The organic material in wastewater stimulates the growth of bacteria and fungi naturally present in water, which then consume dissolved oxygen.

The environmental impact of the wastewater depends on the receiving water body. The Ministry of Irrigation has set limits for the pollutants in the wastewater discharged into agriculture canals and drains as well as the Nile river for their detrimental effect on agriculture (Decree 8/1983). The parameters of relevance to the carbonated beverages industry are BOD, COD.

Discharge of polluted wastewater high in BOD into lakes and sea can cause eutrification and impact bio-diversity.

Sudden discharge of high BOD loads to the public sewer system will have an indirect environmental impact. Shock loads can cause malfunction of the domestic wastewater treatment plant.

3.3 Environmental Impact of Solid Wastes

Solid waste is mainly scrap that is collected and sold. Broken glass is sold to recycling plants. Sludge from the water treatment unit can cause blockage of the sewer lines if discharged to sewer. No major impacts are expected.

4. Egyptian Laws and Regulations

There are a number of laws and regulations that address the different environmental violations. The following are the laws applicable to the carbonated beverages industry.

4.1 Concerning Air Emissions

Article 40 of Law 4/1994, article 42 of the executive regulations and annex 6 deal with gaseous emissions from combustion of fuel. The statutes relevant to the fuel combustion are:

- The use of fuel oil (mazot) and other heavy oil products, as well crude oil shall be prohibited in dwelling zones.
- The sulfur percentage in fuel used in urban zones and near the dwelling zones shall not exceed 1.5%.
- The design of the burner and fire-house shall allow for complete mixing of fuel with the required amount of air, and for the uniform temperature distribution that ensure complete combustion and minimize gas emissions caused by incomplete combustion..
- Gases containing carbon dioxide shall be emitted through chimneys rising sufficiently high in order that these gases become lighter before reaching the ground surface, or using fuel that contains high proportions of sulfur in power generating stations, as well as in industry and other regions lying away from inhabited urban areas, providing that atmospheric factors and adequate distances to prevent these gases from reaching the dwelling and agricultural zones and regions, as well as the water courses shall be observed.
- Chimneys from which a total emission of wastes reaches 7000 – 15000 kg/hr, shall have heights ranging between 18 – 36 meters.
- Chimneys from which a total emission of gaseous wastes reaches more than 15000 kg/hour, shall have heights exceeding at least two and a half times the height of surrounding buildings, including the building served by the chimney.
- The permissible limits of emissions from sources of fuel combustion are given in table (8).

Table (8) Maximum Limits of Emissions from Sources of Fuel Combustion

parameters	Maximum limit, mg/m^3 of exhaust
Sulfur Dioxide.	3400
Carbon Monoxide.	250
Volatized ashes in urban regions.	250
Volatized ashes in remote regions.	500
Smoke.	50

4.2 Concerning Effluents

Limits for pollutants in wastewater vary depending on the type of receiving water body. The parameters that should be monitored and/or inspected are BOD, COD, pH, temperature, residual chlorine, TSS, TDS, Oil and Grease.

Table (9) presents the permissible limits for discharges to the different recipients (sea, Nile, canals, agricultural drains, public sewer) according to the different relevant laws.

Spent lube oil has a negative impact on water and soil and therefore its disposal should be monitored/inspected. A record should be kept for this purpose.

Table (9) Egyptian Environmental Legal Requirements for Industrial Wastewater

Parameter (mg/1 unless otherwise noted)	Law 4/94: Discharge Coastal Environment	Law 93/62 Discharge to Sewer System (as Decree 44/2000)	Law 48/82: Discharge into :			
			Underground Reservoir & Nile Branches/Canals	Nile (Main Stream)	Drains	
					Municipal	Industrial
BOD (5day,20 deg.)	60	<600	20	30	60	60
COD	100	<1100	30	40	80	100
pH (Grease)	6-9	6-9.5	6-9	6-9	6-9	6-9
Oil & Grease	15	<100	5	5	10	10
Temperature (deg.)	10C>avg. temp of receiving body	<43	35	35	35	35
Total Suspended Solids	60	<800	30	30	50	50
Settable Solids	—	<10	—	20	—	—
Total Dissolved Solids	2000	—	800	1200	2000	2000
Chlorine	—	<10	1	1	—	—

4.3 Concerning Solid Wastes

A number of laws address solid waste management. The following laws apply to scrap and sludge from the WWTP:

- Law 38/1967 which addresses public cleanliness, regulates the collection and disposal of solid wastes from houses, public places, commercial and industrial establishments.
- Ministry of Housing, Utilities and Urban Communities (MHUUC) decree No. 134 of 1968, which provides guidelines from domestic and industrial sources, including specifications for collection, transportation, composting, incineration and land disposal.
- Law 31/1976, which amended law 38/1967
- Law 43/1979, the Law of Local administration, which provided that city councils are responsible for “physical and social infrastructure”, effectively delegating responsibility for infrastructure functions.
- Law 4/1994 regulates incineration of solid waste

4.4 Concerning Work Environment

Violations of work environment could be encountered:

- In the boiler house: gas emissions, regulated by article 43 of Law 4/1994, article 45 of the executive regulations and annex 8.
- Wherever heating is performed: temperature and humidity are regulated by article 44 of Law 4/1994, article 46 of the executive regulations and annex 9.
- In refrigeration rooms: ammonia leaks are regulated by article 43 of Law 4/1994, article 45 of the executive regulations and annex 8.
- Near heavy machinery: noise is regulated by article 42 of Law 4/1994, article 44 of the executive regulations and table 1, annex 7.
- Ventilation is regulated by article 45 of Law 4/1994 and article 47 of the executive regulations.
- Smoking is regulated by article 46 of Law 4/1994 and article 48 of the executive regulations, and Law 52/1981.
- Work environment conditions are addressed in Law 137/1981 for Labor, Minister of Housing Decree 380/1983, Minister of Industry Decree 380/1982

The limits for the relevant pollutants are presented in Table (10)

Table (10) Permissible Limits as Time Average and for Short Periods

Material	Limits			
	Time average		Exposure limits for short periods	
	ppm	mg/m³	ppm	mg/m³
Ammonia	25	18	35	27
Carbon dioxide	5000	9000	15000	27000
Carbon monoxide	50	55	400	440
Sulfur dioxide	2	5	5	10

4.5 Concerning Hhazardous Material and Wastes

Law 4/1994 introduced the control of hazardous materials and wastes. The carbonated beverages industry does not generate any hazardous wastes. The hazardous chemicals used in the lab and the fuel for the boilers, fall under the provisions of Law 4/1994. Articles 29 and 33 of the law makes it mandatory for those who produce or handle dangerous materials in gaseous, liquid or solid form, to take precautions to ensure that no environmental damage shall occur. Articles 25, 31 and 32 of the executive regulations (decree 338/1995) specify the necessary precautions for handling hazardous materials. Storing of fuel for the boilers is covered by the Law 4 as hazardous material There is no explicit articles in Law 4/1994 or in decree 338/1995 (executive regulations), regarding holding a register for the hazardous materials; article 33 is concerned with hazardous wastes. However, keeping the register for the hazardous materials is implicit in article 25 of the executive regulations regarding the application for a license.

4.6 The Environmental Register

Article 22 of Law 4/1994 states that the owner of the establishment shall keep a register showing the impact of the establishment activity on the environment. Article 17 and Annex 3 of the executive regulations specify the type of data recorded in the register.

The emergency response plan and the hazardous materials register will also be part of the environmental register as stated in part 4.5.

5. Pollution Abatement Measures

This section deals with pollution abatement in the three media air, water and soil. Three types of interventions will be considered:

- In-plant modifications, which are changes that are performed in the plant to reduce pollutant concentrations in streams through recovery of materials, segregation and/or integration of streams, reducing the flow rate of the wastewater streams that need further treatment to reduce the hold-up of the required WWTP.
- In-Process modifications, which are changes performed on the process such as the introduction of newer technology, substitution of a hazardous raw material, performing process optimization and control.
- End-of-pipe (EoP) measures, which involve treatment of the pollutant or its separation for further disposal. Whereas in-plant and in-process modifications usually have an economic return on investment, end-of-pipe measures will be performed for the sole purpose of compliance with the laws without economic

Egyptian Environmental Laws do not require water and energy conservation measures. These measures have been considered in this manual since resource depletion and hence conservation is a worldwide-recognized environmental issue that could be implemented in Egypt in the near future. Water conservation measures can lead to higher concentrations of pollutants in the effluent streams. Both energy and water conservation measures will provide both financial and economic benefits.

The term Cleaner Production (CP) refers to the same concepts of pollution reduction through in-process, in-plant and resource conservation, in contradistinction to end-of-pipe treatment. In many cases, the adoption of CP can eliminate the need for (EoP) treatment.

The following CP and EoP measures have been identified for the carbonated beverages industry.

5.1 Air Pollution

Flue gases

Particulate matter in flue (exhaust) gases are due the ash and heavy metal content of the fuel, low combustion temperature, low excess oxygen level, high flow rate of flue gases. *Sulfur dioxide* is due to the sulfur content of the fuel. *Nitrogen oxides* are formed when maximum combustion temperature and high excess oxygen. *Carbon monoxide* is formed when incomplete combustion occurs at low air to fuel ratio.

The following measures can be adopted to minimize air pollution from flue (exhaust) gases:

- Replace Mazot by solar or natural gas. Mazot is high in sulfur content.

- Regulate the fuel to air ratio for an optimum excess air that ensures complete combustion of carbon monoxide to dioxide.
- Keep the combustion temperature at a moderate value to minimize particulate matter and nitrogen oxides.

Gas leaks Freon and steam leaks are minimized through maintenance and repair. Freon should be replaced by another non-hazardous refrigerant.

5.2 Water Pollution Abatement Measures

In-plant modifications

- The installation of product-capture systems for filling machines can reduce product losses.
- Spent caustic soda wash stream from the bottle washing unit can be collected in a tank and slowly discharged over the 8 hour shift instead of suddenly discharging it to the sewer at the end of the shift.
- Implementation of a quality control system such as HACCP (Hazard Analysis & Critical Control Point) is recommended to minimize waste.
- Proper storage of the product as well good distribution networks minimizes product spoilage and hence rejects.`
- Integration and segregation of sewer lines to minimize treatment needs and ensure compliance with the environmental laws, can be an option for many factories. In some cases where there are several discharge points from the factory, mixing of the streams could lead to compliance. In other cases where treatment is imperative some streams could be segregated and discharged without violation. The remaining streams will require a smaller treatment unit.

In-process modifications

- Implementation of a control system involving pressure regulators on the steam lines, temperature controllers, flow controllers…
- Control carbon dioxide concentrations in order to prevent spillage and bottle bursts.
- Replace batch processes with continuous ones.
- Modernize the equipment.

End-of-pipe treatment Because of the typically high, COD and BOD in the carbonated beverages industry waste-streams, end-of-pipe treatment frequently involves biological treatment. Pretreatment of effluents consists of flow equalization, neutralization followed by biological treatment.

Some of the waste streams are alkaline (bottle washing unit) and can be used to neutralize the acidic waste streams from other units (syrup preparation, bottle filling, ..).

If space is available pond systems are potential treatment methods. Other possible biological treatment methods include trickling filters, rotating biological contactors and activated sludge treatment.

5.3 Abatement Measures for Solid Waste Pollution

Scrap Scrap is collected and sold.

Sludge

- Effluent treatment processes generate solids. On average 70-80% of the original carbon is converted to solids. This sludge is subject to putrefaction, is malodorous and offensive. It can also be hazardous to health by absorbing pathogens that multiply in this favorable medium and toxins. Raw sludge is saturated with bound water, should be de-watered and disposed of in sanitary landfills.
- Sludge is also be generated from water treatment when lime and chemicals are used. It should be dried and dumped in waste disposal sites.

5.4 Water and Energy Conservation

Water and sewer service costs have been rising, and these increases can cut into profits. Using water more efficiently can help counter these increases.

Water Conservation

- Install water meters and monitor water use
- Use automatic shut-off nozzles and mark hand-operated valves so that open, close and directed-flow positions are easily identified.
- Use high-pressure, low-volume cleaning systems, such as CIP (clean in place) for washing equipment.
- Install liquid level controls with automatic pump stops where overflow is likely to occur.
- Recycle cooling water through cooling towers.
- Minimize spills on the floor minimizes floor washing.
- Repair leaks.
- Handle solid waste dry.
- Recycle steam condensate whenever economically viable.

Energy conservation measures

- Insulation of steam lines.
- Installation of steam traps.
- Repair or replace steam valves.
- Maximize boiler efficiency.
- Install pressure regulators on steam lines.

6. Industrial Inspection

The inspection of the Carbonated beverages industry will follow the procedures described in the Inspection Guidelines. This chapter presents a summary of the inspection process regarding the purpose and scope of various types of inspection, and the proposed inspection procedure for the Carbonated Beverages Industry.

The overall purpose of inspections is to enforce environmental laws. Table (11) lists the various types of inspections and the objectives that have to be fulfilled for each type.

Table (11) The Different Types of Inspections and their Objectives

Inspection type	Objectives
Site Inspection	
1. Comprehensive	Evaluate compliance status regarding all aspects of Law 4
2. Specific	Evaluate compliance status regarding some aspects of Law 4 Review special conditions set by EEAA in EIA studies. Investigate complaints
3. Follow-up	Check environmental register and implementation of compliance measures
Inspection campaign	
1. Geographic	Check pollution sources to specific receiving media
2. Sector specific	Check aspects relevant to specific sector

As evident from the above table, comprehensive inspection deals with all aspects of environmental laws and therefore is considered in this manual. Other inspection types can be tailored accordingly.

Developing an inspection strategy and quarterly and/or monthly plans are the responsibility of the inspectorate management. Developing site-specific inspection plans for carrying out the scope of work that fulfills inspection objectives is the responsibility of the inspection team. Planning for inspections is presented in more detail in the General Inspection Manual, (GIM EPAP-2002).

7. Inspection Planning at the Inspectorate Level

The responsibilities of the inspectorate management regarding the specific inspection are to state clearly, in writing, the type of inspection and related objectives as well as the time schedule necessary to carry out inspection. The inspectorate management is also responsible for providing preliminary information about the facility, inspection tools, and logistics.

7.1 Activities Characteristic to the Beverages Industry

Taking the comprehensive inspection as an example, the objectives stated in Table 14 dictate the activities required for covering all aspects of compliance with environmental laws and regulations. The required personnel, equipment and logistics are determined accordingly.

As evident from the information presented in section 1.2 concerning the size of the carbonated beverages facilities, it is clear that 45% of the facilities are operating with less than 4 workers and 26.5% have more than 40 employees. The inspectorate management should have a clear idea about how to proceed with inspection of this type of facilities. The main problem in this industry are:

- The wastewater generated from the filling machine, washing of equipment and floor as well as the rejected capsulated bottles for out-of- spec liquid level which are emptied in the sewer.
- The solid waste produced from broken bottles during handling, transportation and filling processes.

Large facilities are expected to have most production lines and most service units.

> ***Note to inspectorate management:***
> *Usually small and medium size facilities cannot afford the cost of biological treatment. Repeated inspections and fines would not solve the problem. Inspectorate management should have a clear plan on how to proceed with these facilities even if the plan is to ignore temporarily these facilities.*

7.2 Providing Information about the Facility

Chapters (2-7) present the technical aspects regarding the carbonated beverages industry, its pollution sources and relevant environmental laws. Information regarding compliance history related to other inspecting parties (irrigation inspectors, occupational health inspectors, etc.) can be helpful in anticipating potential violations and preparing necessary equipment. Other sources of information can be found on the Internet at the following sites:

- http://www.tei.or.th/bep/ctic/danced.cfm
- http://www.lu.se/IIIEE/research/eastern_europe/lithuania/cp_kaunas_1993-95.html
- http://www.emcentre.com/unepweb/publication/food.html
- http://www.emcentre.com/unepweb/tec_case/food_15/house/casename.shtml

7.3 Providing Resources

The required personnel, tools and equipment depend on the size of the facility to be inspected. The inspection team leaders, in coordination with the inspectorate management, are responsible for assessing the inspection needs. The number of inspectors required depends on the size of the facility and the planned activities.

Usually the team members are split and assigned different tasks during the field visit to allow the required activities to be performed in parallel. Each task is rotated among the inspectors to diversify their experience.

Small facilities	This industry is not labor intensive since it requires equipment and automatic machines for its operation. The number of workers can be low even when production capacity is high. However the facilities that employ less than 4 workers could also be • Storage and distribution centers or workshops and garages affiliated to a larger company. • Part of a production line e.g one filling machine • Manually operated with small production capacity
Medium and large size facilities	The difference between medium and large facilities is expected to be in • Whether they produce carbon dioxide or buy it • The size of the carbonated beverage production line • The variety of products

> ***Note:***
> *To prepare an inspection plan for small facilities a survey on these facilities should be performed to determine the type of activity.*

8. Preparation for Field Inspection (Inspection Team)

As presented in the General Inspection Manual, (GIM EPAP-2002), tasks necessary for preparation for field inspection, are:

- Gathering information about the specific facility to be inspected
- Preparing of the inspection plan
- Preparing the checklists

This manual presents the case of a comprehensive multi-media site-inspection of a large carbonated beverages facility since it represents the highest level of inspection complexity. Tasks for carrying out less complicated inspections can be easily deduced.

8.1 Gathering and Reviewing Information

The inspection team should review the general information prepared for the carbonated beverages industry (chapters 2-5) and then check - if possible - what production lines and service units are present at the targeted facility. In addition to the required information listed in Annex (C) of the General Inspection Manual, (GIM EPAP-2002), it is important at this stage to determine the following:

- The type of receiving body for the industrial wastewater and review relevant Egyptian laws (Chapter 4).
- The scope of inspection and related activities based on the type and objectives of inspection required by the inspectorate management.
- The potential pollution hazards as addressed in section 2.4, and accordingly, define measurement and analyses needs.
- The characteristics of the carbonated beverages industry as presented in section 2.5, and their implications on the inspection process of the targeted facility.

> *Note to inspector:*
> - *Some facilities dilute its polluted wastewater with water before discharging to sewer. Degree 44/2000 explicitly prohibits this behavior.*

8.2 Preparation of the Inspection Plan

An example of an inspection plan is included in Annex (E) of the General Inspection Manual (GIM EPAP-2002). The plan should take into account the following:

- For large carbonated beverages facilities, the inspection team could be divided into smaller groups. Each group will be responsible for inspecting a number of production lines and service units.
- At the beginning of the field visit, the inspection team should check the environmental register for completeness using the checklist provided in Annex (G) of the General Inspection Manual, (GIM EPAP-2002).

- The results of the analyses included in the environmental register should be checked at the end of the field visit (if suspicion arises about them) and copies of these results should be obtained.

Notes to inspector:

- *When the final effluent is expected to be in violation of environmental laws, sampling should be planned.*
- *Because of possible shock loads a grab sample at the time of discharge should be performed. If grab samples are taken when no shock load is discharged the results will not reflect the actual pollutants loads.*
- *To prove that a shock load has been discharged, a composite sample over the shift duration should be analyzed. If the results show higher pollutant concentrations than those of the grab sample, then a shock load was discharged.*
- *Make sure that the polluting production lines are in operation since some factory management resort to halting the polluting lines during the inspection.*

8.3 Preparation of the Required Checklists

The checklist for the carbonated beverages industry is presented in Annex 1 of this manual. The checklist has been prepared in such a way that it starts with general information about the facility and its operation. Separate checklists are then filled for each production line/service unit independently for relevant environmental aspects and media. The inspection team will compile the checklists relevant to existing production lines and service units in the targeted facility.

The development of the checklists goes through the following steps:

- Draw the block flow diagrams for the production lines with their pollution sources as presented in figures (1-3) Similar figures can be developed for other beverage production lines that were not covered by this manual.
- Identify the areas of possible non-compliance and the parameters that need checking. For example, noise should be checked near the compressors and temperature and humidity where steam leaks occur.
- Identify what to observe, ask and/or estimate that can convey information about pollutants. For example :
  - The type of detergent or antiseptic determines the contaminant in the wash streams,
  - Oily effluents from production lines or oily cooling water indicates the contamination of the plant effluent with oil

Note to inspector:

*Law 4 does not specify standards for effluent from production lines but only for final disposal points. However, effluent quality from production lines is an important indicator of the final discharge quality***.**

8.4 Legal Aspects

As evident from chapter 2, a large carbonated beverages facility is expected to be in violation of several environmental laws, specifically with respect to wastewater if no treatment is performed. The inspection team should be prepared for legally establishing such a violation.

Note to inspector:

It is the responsibility of the inspector to assess the seriousness of the violation upon which the enforcement action will be based. His information about the nature and cause of the violation must be well documented and the evidence sound. The case could be contested in court and the inspector will be asked to defend his technical judgement.

9. Performing the Field Inspection

9.1 Starting the Field Visit

The General Inspection Manual, (GIM EPAP, 2002) describes the procedures involved for entering an industrial facility. The inspector's attitude and behavior are very important from the start and will dictate the factory's personnel response to the inspection tasks.

Note to inspector:

- *It is better at this stage not to ask direct questions about the rejected capsulated bottles and broken bottles. Interviewing the workers on-site in an indirect manner can give better results.*
- *Check the results of effluent analyses, time and place of sampling. If suspicious make your own analyses.*
- *The type of detergent and antiseptic used for cleaning and sanitation is important information for determining the type of pollutant in the effluent. In this case a direct question is preferred.*
- *Get a sketch of the factory layout with sewer lines and final disposal points.*

9.2 Proceeding with the Field Visit

Information gathered during the facility tour is dependent on interviews of facility personnel and visual observation. Annex (H) in the General Inspection Manual (GIM EPAP, 2002) presents some useful interviewing techniques.
Using the facility layout, start by checking the final disposal points and the various plants and/or service units connected to each point. This will determine where and how to take the effluent samples. Visual observations about the condition of the sewer manholes should be recorded. In some facilities the discharge to the receiving body is performed through a bayyara (cesspit), septic tanks or holding tanks. If the holding tank is not properly lined, contamination of the underground water could occur.

Note to inspectors:
Cesspits, septic tanks and holding tanks are a form of pre-treatment that generates settled sludge. Check:

- *The presence of accumulated sludge and related hygienic conditions*
- *The disposal of the sludge*

Inspection of the production lines should start with the feeding of raw materials and end with the product packaging and storage. Referring to Fig 1 to 3, check the following:

Production Lines

Carbonated Beverages production line	-	Are there any chemicals or hazardous material used ?
	-	What happens to capsulated bottles rejected for out-of-spec liquid level ?
	-	How and When does cleaning of equipment and floors occur ?
	-	What type of detergent is used?
	-	What is the percentage loss of liquid during filling ?
	-	What is the percentage of broken unfilled bottles ?
	-	What happen to the broken bottles on the floor ?
	-	Is cooling water, recycled through cooling towers ?
Carbon Dioxide production line	-	What kind of fuel is used in the furnace ?
	-	What is the surrounding area (when using fuel oil (mazot) in the furnace) ?
	-	Check for the quantity and quality of wastewater produced ?
	-	Check for heat from furnace
	-	What type of refrigerant is used ?
For all lines	-	Check for steam leaks, which affect humidity and temperature in the work environment.
	-	Check for losses during filling and spill prevention measures.
	-	Check for noise near filling machines and compressors in refrigeration units.
	-	How is solid waste managed? Is it washed down to the sewer? This housekeeping practice increases the pollution load in the effluents.

Service Units

Water treatment units	-	If chemicals and coagulants are used, such as lime, alum and ferric sulfate, inorganic sludge will be generated. Check the amount and method of disposal.
	-	In case of ion-exchange units and reverse osmosis the effluent wastewater will be high in dissolved solids.
Boilers	-	Check the height of the chimney in relation to surrounding buildings.
	-	Perform flue gas analysis if mazot is used as fuel or if suspicious about results of analysis presented by facility management in the opening meeting.
	-	Check for fuel storage regulations and spill prevention.
Cooling towers	-	The amount of blowdown from the cooling towers is about 10-15% of the make-up water and is low in BOD and high in TDS.

Refrigeration systems	- Check the type of refrigerant. - Check amount of cooling water (open or closed cycle)
Garage, and Workshops	- Check for noise and take measurements if necessary. - Check solid waste handling and disposal practices. - Check for spent lube oil disposal method. Ask for receipt if resold.
Storage facilities	- Check storage of hazardous materials and fuel as per Law 4. - Check spill prevention and containment measures for storage of liquids.
WWTP	- Check for sludge accumulation and disposal. - Analyze the treated wastewater.

Effluent analysis

Receiving body	- The nature of the receiving body determines the applicable laws. - Check if effluent discharge is to public sewer, canals and Nile branches, agricultural drains, sea or main River Nile. - Accordingly, define applicable laws, relevant parameters and their limits.
Sampling	- A composite sample must be taken from each final disposal point over the duration of the shift or a grab sample at peak discharge. Each sample will be analyzed independently. - According to legal procedures in Egypt, the effluent sample is spilt and one of them is sealed and kept untouched.

9.3 Ending the Field Visit

When violations are detected a legal report is prepared stating information pertaining to sampling location and time. Violations of work environment regulations should also state location and time of measurements. Other visual violations such as solid waste accumulation, hazardous material and waste handling and storage, and material spills should be photographed and documented. It is preferable that the facility management signs the field-inspection report but this is not a necessary procedure.

A closing meeting with the facility management can be held to discuss findings and observations.

Note to inspector:

- *The less certain the team leader is about a specific violation the more reason not to discuss it at the closing meeting.*

10. Conclusion of the Field Inspection

The activities performed during the site inspection are essential for preparation of the inspection report, for assessing the seriousness of the violations, for pursuing a criminal or civil suit against the facility, for presenting the legal case and making it stand in court without being contested, and for further follow-up of the compliance status of the facility.

10.1 Preparing the Inspection Report

An example of an inspection report is included in Annex (K) of the General Inspection Manual (GIM EPAP, 2002). The inspection report presents the findings, conclusions, recommendations and supporting information in an organized manner. It provides the inspectorate management with the basis for proposing enforcement measures and follow-up activities.

10.2 Supporting the Enforcement Case

Many issues may be raised and disputed in typical enforcement actions. Enforcement officials should always be prepared to:

- Prove that a violation has occurred. The inspector must provide information that can be used as evidence in a court of law.
- Establish that the procedures were fairly followed.
- Demonstrate the environmental and health effect of the violating parameter.

Note to inspectorate management:

- *Although the inspector is not required to suggest pollution abatement measures, the inspectorate management should be able to demonstrate that a remedy for the violation is available.*
- *Enforcement should not cause financial collapse of the facility and inspectorate management should demonstrate the ability of the violator to pay.*

10.3 Following-Up Compliance Status of Violating Facility

After performing the comprehensive inspection and detecting the violations the inspectorate management should:

- Decide on the sanctions and send the legal report to the judicial authority.
- Plan routine follow-up inspections. This type of inspection focuses on the violating source and its related pollution abatement measure. Self-monitoring results are reviewed during the visit.
- Follow-up the enforcement case (legal department)

Annex (1)

Inspection Checklist for Beverages Processing Facility

Checklist for Carbonated Beverages Production Line

1. General	
1.1 The housekeeping status Floor condition Wash water leaks Piling of solid waste	 -- -- --
1.2 Make sure that the production line is operated	--
1.3 Amount of raw material processed per day and per shift	-- -- --
1.4 What is the percentage loss of liquid during filling	--
2. Status of the Work Environment	
2.1 Are there steam leaks in the bottles washing unit ?	☐ Yes ☐ No
<u>If Yes</u> 2.2 Does the facility have humidity and /or temperature records If not and/or suspicious make your own	☐ Yes ☐ No
2.3 Does the facility have noise records near the filling machine If not and/or suspicious make your own and check exposure time	☐ Yes ☐ No
3. Status of Effluents (Wastewater)	
3.1 Is there a CIP system for equipment washing?	☐ Yes ☐ No
3.2When during the shift is equipment & floor washing performed ? 3.3 When during the shift, is the CIP discharged to sewer ?	-- --
3.4 How much rinse water is used for equipment and floor washing ?	-- --
3.5 What type of detergent is used for floor washing ?	-- --
3.6 Which chemicals are used in CIP ?	-- -- --
Note : *Shock load on the sewer is expected during start-up and shut down. Take the effluent sample when dumping takes place and composite sample over the shift*	
4. Status of Solid Waste	
4.1 What is the percentage of broken unfilled bottles ?	--

4.2 What happens to the broken bottles on the floor ?	--
4.3 Is it washed down to the sewer ?	--
4.4 What happens to the capsulated bottles rejected for out-of- spec liquid level ?	--
5. Chemicals and Hazardous Materials	
5.1 Are there any chemicals or hazardous materials used ?	☐ Yes ☐ No
5.2 List these chemicals and hazardous materials	-- -- -- --
Note : *Check EEAA list of hazardous substances before deciding which substance is hazardous.*	

Check list for Carbon Dioxide Production Line

1. General	
1.1The housekeeping status Floor condition Water leaks	 --- ---
1.2 Make sure that the production line is operated	---
1.3 What type of fuel is used in the furnace?	---
1.4 If mazot is used, what is the surrounding area?	---
Note : *Mazot is prohibited in residential areas*	
1.5 What type of refrigerant is used?	---
2. Status of the Work Environment	
2.1 Check for heat generation near furnace?	☐ Yes ☐ No
2.2 Does the facility have temperature records	☐ Yes ☐ No
2.3 Does the heat generate from the furnace reused again?	---
2.4 Are there steam leaks near Co_2 stripping tower	☐ Yes ☐ No
2.5 Do you feel heat stress near the stripping tower ?	---
Note : If suspicious perform your own measurements	
3. Status of Effluents (Wastewater)	
3.1 Check the mono ethanol amine (MEA) leaks	---
3.2 What is the amount of wastewater produced?	---
3.3 When during the shift is equipment & floor washing performed?	--- ---
4. Chemicals and Hazardous Materials	
4.1 Are there any chemicals or hazardous materials used?	☐ Yes ☐ No
4.2 List these chemicals and hazardous materials	---
5. Status of Solid Waste	
5.1 What happens to potassium permanganate after loosing its activity	---
5.2 if it is disposed of as solid waste, check its disposal method	---

Checklist for Boilers and Water Treatment Units

1. General	
1.1 Boiler number and capacity	-- -- -- --
1.2 Type of fuel used for boilers In case of using mazot for boilers Is it a dwelling zone?	☐ Mazot ☐ Solar ☐ others ☐ Yes ☐ No --
Note : The use of mazot as fuel in the dwelling zone is prohibited by law.	
1.3 What is the method used for water treatment	☐ Lime method ☐ Ion exchange ☐ Reverse osmosis
2. Status of Air Pollution	
2.1 What is the height of the chimney	--
Note : the height of the chimney must be 2.5 times the height of adjacent buildings.	
2.2 If mazot is used in non dwelling regions, or smoke is detected	Are there analyses of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter ☐ Yes ☐ No If Yes Are they enclosed in the environmental register ☐ Yes ☐ No If No Ask for preparation of these records and their inclusion in the environmental register
Note : Perform analysis, if necessary	
3. Status of Effluent	
3.1 What is the blow down rate from the boilers	-- m^3/d
3.2 What are the blow down and backwash rates for the treatment units	-- m^3/d
3.3 Steam condensate is	☐ Recycled to the boiler ☐ Discharged to the sewer
4. Status of Solid Waste	
4.1 If the lime method is used, sludge is generated. What is the amount of sludge produced per day	 --
4.2 What is the sludge disposal method	--

5. Storage and Handling of Hazardous Material	
5.1 Check the storage of chemicals used in the treatment process. Is it in compliance with law 4 ?	☐ Yes ☐ No
5.2 Is there any fuel leaks from fuel tanks	☐ Yes ☐ No
5.3 Is there any fire extinguishing devices and equipment	☐ Yes ☐ No
5.4 Is there a spill prevention plan	☐ Yes ☐ No
5.5 Do you notice anything that can provoke a fire? Such as the presence of a pump underneath the fuel tank (the start-up of the engine can produce a spark)	☐ Yes ☐ No Comment --- --- ---
6. Status of Work Environment	
6.1 Measure the noise near the boilers	Results --- ---
6.2 Measure noise and check exposure time	Results --- ---

Checklist for Cooling Towers and Refrigeration Systems

1.General	
1.1 Number and capacity of cooling towers	-- -- -- --
1.2 Cooling tower make-up rate Note : Blow down = 10-15% of make-up	Rate = --- m^3/d Blowdown = ----------------------------------- m^3/d
1.3 What is the type of refrigerant used in the refrigeration system	☐ Ammonia ☐ Freon ☐ Other
1.4 If Freon is used which is prohibited by the law, is there a possibility for replacement	☐ Yes ☐ No
2. Status of Work Environment	
2.1 Measure the noise next to the compressors of the refrigeration unit	Result -- -- --
2.2 Measure noise and check exposure time	--
2.3 Do you smell ammonia odor If yes perform analysis to check compliance	☐ Yes ☐ No
3. Status of the Effluent	
3.1 Cooling water for the compressors is performed in	☐ Open cycle ☐ Closed cycle
Note : If performed in open cycle it will dilute the final effluent	
3.2 Record the amount of open cycle cooling water of the refrigeration system	-- --

Checklist for Garage

1. General	
1.1 Is there any detergent or solvent used for washing equipment parts, trucks, floor,….etc	☐ Yes ☐ No
1.2 What is the amount of oil and grease used per day?	--
1.3 What is the amount of spent lube oil produced per day ?	--
1.4 How does the facility dispose of the spent oil ?	--
2. Status of the Effluent	
2.1 What is the amount of wastewater produced ?	--
2.2 Do you observe any oil / foams / solid matter in the inspection manhole ?	☐ Yes ☐ No

Checklist for Workshops

1. Status for the Effluent	
What is the amount of wastewater produced ?	--
1.2 What is your visual observation for the inspection manhole of the workshop ?	--
1.3 Check for O&G	--
2. Status of solid waste	
2.1 What is the amount of solid waste produced	--
2.2 How does the facility get rid of the solid waste produced ?	--
3. Status Of the Work Environment	
3.1 Are there any noise in work place If yes 3.2 Are there any measurements for noise If not Perform measurements 3.3 Check exposure time	☐ Yes ☐ No ☐ Yes ☐ No --

Check list for Laboratories

1. General	
1.1 What is the amount of wastewater produced per day	---
1.2 List the chemicals and materials used in the laboratories	--- --- --- ---
2. Status of the work Environment	
2.1 Are there any odor/ gases/noise in the work environment 2.2 Check exposure time	☐ Yes ☐ No ---
3. Handling of Hazardous Material	
3.1 Inspect storage of hazardous material. Is it in compliance with the requirements of law 4	☐ Yes ☐ No
3.2 Are there any first aid measures in place	☐ Yes ☐ No

Checklist for Wastewater Treatment

1. General		
1.1 What is the capacity of WWTP	--	
1.2 Specify the units included in WWTP :		
Pumping station	☐ Found	☐ Not found
Equalization tank	☐ Found	☐ Not found
Aeration tank (ditch or channel)	☐ Found	☐ Not found
Final sedimentation tank	☐ Found	☐ Not found
Sludge thickening tank	☐ Found	☐ Not found
Sludge drying	☐ Found	☐ Not found
Others	☐ Found	☐ Not found
1.3 List any chemical and their quantity used for wastewater treatment	-- -- -- -- -- --	
2. Status of Effluent		
2.1 Are there analyses for the effluent If not Make your own	☐ Yes	☐ No
2.2 Are the results of the analysis included in the environmental register	☐ Yes	☐ No
3. Status of Solid Waste		
3.1 Determine the sludge disposal method	--	
Note : It can be use in liquid or dry form, in agriculture		
If a third party is involved in disposal, get documents for proof	☐ Found Comment -- -- --	☐ Not found

Annex (1- A)

Basic Data Sheet

(To be fed to the database of the inspection units)

Annex (1- B)

Inspection Checklist for Hazardous Materials and Wastes

Annex (1- C)

Inspection Checklist for Production Lines and Service Units