General Authority for Environmental Protection
National Capabilities for Preparation of N P for POPs

The Republic of Yemen

Ministry of Water and Environment

Environmental Protection Authority

NATIONAL CHEMICAL PROFILE

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List of Abbreviations

AAS	Atomic absorption spectroscopy
A.T.Pase	Adenosune triphosphatase
AQA	Analytical Quality Assurance
BOD	Bilogical oxygen demand
CFCs	Chloroflourocarbons
CO	Carbon oxide
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
EC	Electrical conductivity
FAO	Food and Agriculture Organization
GC	Gas chromatograph
GCC	Gulf Cooperation Council
GDP	Gross domestic product
gm	Gram
GTZ	German aid organization
H_2S	Hydrogen sulfide
HPLC	High performance liquid chromatograph
IFCS	International Forum on Chemical Safety
Kg	Kilogram
lit.	Liter
LPG	Liquefied petroleum gas,
M.A.O	Mono Amine Oxidizer
mg	Milligram
NGOs	Non-governmental organizations
NMR	Nuclear magnetic resonance
NO_x	Nitrogen oxides
PCBs	Polychlorophenyls
PCDD	Polychlorodibenzodioxin
PCDF	Polychlorodibenzofurans
Ph D	Doctor of philosophy
POPs	Persistent Organic Pollutants
TDS	Total dissolved Salt
TV	Television
UN	United Nations
UNDP	United Nations Development Program
UNEP	United nations Environmental Program
UV	Ultra violet
WB	World Bank
WHO	World Health Organization

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Chapter

1

A GENERAL PROFILE OF THE REPUBLIC OF YEMEN

1 A General Profile of the Republic of Yemen

Yemen was given different names in the history books. The former geographers called it "Arabia Felix". The Old Testament "Torah" recalls Yemen as a derivative of south and queen South (Queen Tymna). Formerly, Yemen was named after Ayman bin Ya'rub bin Qahtan. In the Arab tradition, Arabic literature, language and the people of Yemen themselves, the word "Yemen" is derived from "Yumen" which means blessings, consistent with the old name "Arabia Felix".

Others said Yemen is called "Yemen" because it is to the right of Kaba in Mecca. Arabs like the right and consider it the symbol of good hope. Still some people of Yemen use the word "sham" meaning north and "Yemen" to mean south. Yemen is called today "the Republic of Yemen".

1.1 Natural and Demographic Structure of the Republic of Yemen

Yemen is situated in south-west Asia, in the south of the Arabian Peninsula and is bordered to the north by Saudi Arabia, to the south by the Arabian Sea and the Gulf of Aden, to the east by the Sultanate of Oman and by the Red Sea to the west. There are a number of Yemeni islands spread across the coastline along the Red Sea and the Arabian Sea. The largest of the islands is Socotra, which lies 150 kilometers from the coast of Yemen, in the Arabian Sea.

The State's official religion is Islam and Arabic is the official language. The system of the government is republican and democratic, where people exercise their rights directly through referendums and general elections, as well as engage indirectly through the legislative, executive and judicial bodies and through the elected local councils. The political system in the Republic of Yemen is based on political and party pluralism. The devolution of power and participation is done peacefully through general elections.

The capital of Yemen is Sana'a city, called "the Capital" in this document. Aden is the commercial and economic capital of the Republic of Yemen. The administrative division of the Republic contains (21) governorates in addition to the Capital Sana'a. The most important ports of Yemen are Aden, Hodaida, Mukalla, and Al-Makha.

1.1.1 Population

Data population projections indicate that the resident population in 2003 reached approximately 20.4 million compared to 14.9 million, according to the General Population Census of 1994. The annual population growth rate is (3.5%) and the population density nationwide is generally (3.3) persons per square kilometer. The demographic composition of the population of the Republic of Yemen is divided almost as follows:

- The male population is 10.3 million, representing 50.1% of the total population.
- The female population is 10.1 million, representing 49.9% of the total population.
- The population between the ages (0-14 years) is representing 46.3% of the total population.
- The population between the ages (15-64 years) is representing 50.7% of the total population.
- The population over the age of 65 years is representing 3% of the total population.

1.1.1.1 Fertility and Mortality

The total fertility rate is 6.2 births per woman while the rate of infant mortality is 82.4 children per 1,000 children according to the Yemeni Family Health Survey of 2003. The average life expectancy at birth is 62.9 years.

The average size of the Yemeni family is 7.4 members while the average number of individuals per room is 3.1.

1.2 Education

Indicators of 1994 Census show that the proportion of school children in the ages (6-15 years) enrolled in schools are up to (56%), with the proportion of males is (71.5%) while the proportion of females is (27.5%). In general, the proportion of illiteracy among the adult population is up to (59.4%). In the face of this illiteracy, increasing annual expenditure on education in the establishment and expansion of educational facilities at various levels are noted. The latest statistics according to the Yemeni Family Health Survey show the following:

The illiteracy rate is still high generally hitting (47%) of the total population. It is high among females up to (67.1%), but amounting to approximately (27.3%) among males and

is concentrated in the countryside (53.2%) whereas in urban areas it is (27.7%). It also increases among females in rural areas, where it reached up to (75.7%) while it is (31.1%) among males. In urban areas it amounts to (40.5%) among females and (15.2%) among males. The Republic of Yemen passed a literacy and adult education law in 1998. It also endorsed the national strategy for literacy and adult education, as well as set up a special literacy system.

- The number of kindergartens mounted 172, where 42 kindergartens are governmental according to statistics of 2000/2001.
- The number of basic education schools is (10199), while the number of students at the primary stage is (3702571) in 2003.
- The number of secondary schools is 2801, while the number of students at the secondary level is (539925) in 2003.
- The number of professional and technical institutes is (25), and the total number of vocational education students is (4803) in 2003.
- The number of public universities is (7), while the number of students studying at the university governmental organizations is (175536).

1.3 Political and Geographical Structure of the Republic of Yemen

Yemen is characterized by the diversity of surface features and accordingly has been divided into five major geographic regions:

1) The Coastal Plain Territory

This territory extends sporadically along the coasts of Yemen; where the mountains and hills go up directly to the sea in more than one place, hence, the territory of the coastal plain of Yemen include the following plains:

- The Tehama Plain
- The plain of Tuban-Abyan
- The Plain of Mayfaa-Ahwar
- The Coastal Plain of Al-Mahra.

The territory of the coastal plain is characterized by a warm climate throughout the year with little rain ranging between 50-100 mm per annum. It is an agriculturally important territory, especially Tehama Plain, due to the large valleys that cut across the province and into the plain which is flooded by the precipitation on the mountain slopes.

2) The Mountainous Heights Territory

This region extends from the northern limits of Yemen to the far south. This territory has been subjected to tectonic plate movements resulting in major and minor faults, some of which are parallel to the Red Sea and some others are parallel to the Gulf of Aden, which resulted in jumping plateaus, kept among pools of mountains called Qiaan or fields.

The territory is rich in surface valleys that divide it into blocks with very steep slopes which continue as mountainous walls that overlook the Tehama Plain. The mountains of this region are the highest in the Arabian Peninsula and their average height is more than 2000 meters and their peaks ascend to more than 3500 meters. The highest mountain is Mt Prophet Shuaib which is 3666 meters high.

The line of water divides these mountains and lies where water stoops across a number of valleys eastward, westward, and southward. The most important of these valleys are Moore, Haradh, Zabeed, Siham and Rasian. All these valleys flow into the Red Sea. The valleys flowing into the Gulf of Aden and the Arabian Sea are Bana, Tuban, and Hadramaut.

3) Territory of Mountainous Basins

This territory consists of the basins and mountainous plains located in the mountainous heights, mostly located in the eastern section of the water dividing line that extends from the far north to the extreme south. The most important are mainly Yareem Field, Dhamar, Maabar, Sana'a basin, Amran and Sa'dah.

4) Territory of Plateau Basins

This territory is located to the east and north of the mountainous heights territory and parallel to it, however, it expands over the direction of the Empty Quarter and starts to decline gradually with surface sliding to the north and east sides slowly. Most of the surface of the territory is made of rocky desert with some valleys passing through it particularly Hadramaut and Hareeb valleys.

5) Territory of the Sahara

It is a sand territory almost devoid of vegetation except in the areas of streams of rainwater, which shed some fall in the mountainous areas adjacent to the territory ranges. The height of surface is between 500 and 1000 meters above sea level and descends without interruption markedly towards the northeast to the heart of the Empty Quarter. The climate here is harsh with the advantage of being warm and with a high heat range and scarce rainfall and low humidity.

1.3.1 The Yemeni Islands

The many islands of Yemen are scattered in the territorial waters and have their own special terrain, climate and environment. Most of these islands are located in the Red Sea. The most significant of which is Kamaran Island which is the largest inhabited island in the Red Sea. Islands of Hunaish Archipelago and the island of Mioon are of strategic location in the Strait of Bab Al-Mandab, the southern gate of the Red Sea.

Among the most important of the Islands in the Arabian Sea is Socotra Archipelago. Socotra is the largest island of the archipelago, which includes in addition to Socotra three islands: Samhah, Darsah and Abdel Korea. Socotra Archipelago is characterized by huge biodiversity, where the estimated Socotra rare and medical plants on land to be about 680.

1.3.2 Climate

Yemen oversees the Red Sea and the Arabian Sea. However, the climate of Yemen has not benefited much from the marine characteristics except in the high humidity in the air of the coasts. The impact of these marine characteristics of the two seas to modify the climate of the Republic is very limited and confined to the high humidity and modification of some of the characteristics of wind, while their role in the case of climate instability is limited.

The rain falls in Yemen in two seasons; the first season is the spring (March-April) and the second is the summer (July-August) which is the season where more rain falls than in the spring. The amount of rainfall in Yemen varies widely by location. The highest amount of annual rainfall is in the southern highlands and western regions: Ibb, Taiz, Al-Dhalea and Yareem. The amount of rainfall is between 600-1500 mm annually. The amount of rainfall is less in the western coastal plain such as Hodaida and Almakha, despite being in the way of the monsoon coming from the south-western Indian Ocean crossing the Red Sea because of the absence of the moist winds lifting factor. However, the average annual rainfall increases with the altitude from 50 mm on the coast to about 1000 mm in the highlands confronting the Red Sea.

The rainfall is not different in the southern and eastern coasts from the western shores of the country in amounting to about 50 mm per year in Aden, Al-Fiosh, Al-kode and Al-Rayyan. This is due to several factors; the most important of which is the direction of the moist wind along the coast without penetrating to the interior. Therefore, the impact would be very small and hence the rainfall was not of any economic significance.

In terms of temperatures, the plains of East and West are characterized by high degrees of temperature where they go up to 42 ^{o}C in the summer and down to 25 ^{o}C in the winter. The temperatures become lower at higher elevations gradually with height to reach a

maximum of 33 ^{o}C and a minimum of 20 ^{o}C in the summer. In winter the lower temperatures at the heights approach zero degrees. The winter of 1986 recorded a low temperature of -12 ^{o}C in Dhamar.

The humidity is high in the coastal plains; up to more than 80%, while goes down at the interior and reaches the lowest percentage in the desert areas, which accounts for a humidity of 15%.

1.4 Press

According to 2001 statistics, the total newspapers, magazines, pamphlets, civil government and party publications in the Republic amounted to 104.

1.5 Health

According to the data of 2001, the number of physicians in the Republic in general is (4073), which represents a physician for each (4631) persons of the population.

The total number of nurses is (7043), which represents an average of (1.7) nurses per physician.

The total number of beds in hospitals is (10766), which represents an average ratio of one bed for every (1752) individuals of the population.

Health indicators in the Republic of Yemen remain less than the average in comparable low-income countries. Those who get health services are only 50% of the population in general; 25% are in rural areas where the majority of the population lives, with the continuous spread of infectious diseases such as malaria, bilharzias, diarrhea, and typhoid. This is due to the relative low level of public health in Yemen attributed to the low spending on health care, which did not exceed 4% of the expenditures per year during the first five-year plan because of limited financial resources.

1.6 Economic Policy

The economic policy in Yemen is based on market mechanisms and economic freedom. It provides a catalyzed climate for private initiation and investment.

1.7 Industry and Agriculture

Yemen is classified among the least developed countries; however, it is viewed as a country of promised blessings and important economic resources. There are resources that have not so far been exploited economically, particularly in the field of oil, gas, fish, and different mineral wealth. In fact, most Yemeni economy indicators show currently the following:

Agriculture and fisheries constitute a ratio ranging between (15-20) % of the gross domestic product, where the area of arable land is (3%) of the total area of the Republic and the area already planted is (1,076,771 hectares) of the total area of arable land which is (1,668,858 hectares).

Table (1-1) summarizes the most important crops, and production volume and Table (1-2) summarizes the value of livestock production.

Table (1-1): The most important crops, and production volume.

The crop	Area planted / ha	Production / tons
Wheat	86520	103794
Maize	29982	32841
Sorghum and millet	378036	253367
Barley	37755	27935
Legumes	49237	59482
Tomatoes	19078	272696
Onions	82025	5652
Potatoes	17834	213324
Yellow watermelon (shammam)	3773	38129
Watermelon red	6591	86554
Other vegetables	18282	140621
Clover	26749	241592
Other feeds	88113	1190718
Cotton	28287	29091
Sesame	32515	18729
Tobacco	11861	5515
Coffee	33662	11608
Dates	23601	33312
Bananas	11280	99010
Grapes	22870	168824
Orange	17206	191420
Papaya	4779	73751
Other fruits	18581	169899

Table (1-2): The value of livestock production.

Type	Quantity / tons	Value/ million riyals
Meat	59761	24383
Milk	196245	8517
Poultry meat	87326	23141
Eggs	615	3653
Honey	681	544
Leather	9183	248
Wool	3419	14.4
Total	**357230**	**60500.4**

Extractive and manufacturing industries constitute between (30-40) percent of the GDP. In the framework of this ratio, the extraction and refining of oil represent the major part, where the contribution of the oil sector to GDP varies between (25-35) percent. Table (1-3) summarizes the industrial installations.

The Yemeni economy is growing steadily, with an average annual rate of growth of the ratio between (10-15) percent at current prices. While the rate calculated with the fixed prices is (2-4) % annually. The average per capita income of GNP in 2001 is (455) dollars.

The percentage of exports represented (36.26 %) of GDP in 2001, while the imports represented a percentage of (26.53%) of the gross domestic product in the same year. Therefore, the vulnerability of Yemeni economy is (62.82) %.

Yemen's main exports are concentrated in the area of intermediate goods, which represents (95-98) % of the total exports, while the direct consumer goods represent (1-3) %. In contrast, intermediate goods imports accounted for (55-60) % of the total imports. Direct consumer goods are (15-20) %, while capital goods are (20-25) percent. Yemen imports from Arab countries are (30-40) % of the total imports, while exports to the Arab countries are only (2-6) % of the total exports abroad. The non-Arab Asian countries are the largest market for exports in Yemen which ranged between (80-90) % of the total exports.

Table (1-3): The industrial installations.

Basic products	Total value of production / million riyals	Number of employees	POPs Emissions Yes / No	Emissions other than POPs
Extractive industries	2037	2300		Ash, SO2, NOx
Foodstuffs and beverages	112828	26281		
Tobacco products	24986	1642		Ash, smell
Textile industry	4184	4976		Noise, ash, pigments
Garment industry and fur pigment	4680	4314		Pigments
Bags, shoes, tanning	3778	1094		Pigments, different chemicals
Wood products (excluding furniture)	6214	1634		Ash
Paper and derivatives	1592	346		COD, BOD
Printing, publishing and copying	10839	1742		
Refined oil derivatives	193586	3356		
Chemical products and derivatives	3741	2001	Yes	Different emissions
Different plastic products	8899	3140	Yes	
Non-ferrous construction products	27275	9571		Ash, petroleum combustion products, CO, SO_2, NOx
Metal products forming	16883	5738		
Machinery and equipment	453	121		
Machinery and electrical equipment	125	41		
Other transport equipment	565	555		
Furniture	2567	1361		
Electricity supply	50046	4488		

Table (1-4) shows the livestock numbers for the years 2001-2003 and table (1-5) displays the quantity and value of fish and wildlife.

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Table (1-4): Livestock numbers for the years 2001-2003.

Type	2001	2002	2003
Mutton	6483	6548	6589
Goats	7246	7318	7311
Cattle	1342	1355	1358
Camel	264	267	277

Table (1-5): The quantity and value of fish and wildlife.

Type	Quantity / tons	Value / million riyals
Surface fish	202758	27777.8
Deep fish	10911	1146
Other marine life	14447	9582.8
Total	**228116**	**38506.6**

1.8 Persistent Organic Pollutants

None of the POPs is produced or manufactured in Yemen. The pesticides of such materials have been prohibited since 1990 except D. D. T. which is still used in limited quantities in the fight against malaria mosquitoes. The inventory of the materials held in 2004 clearly demonstrated that POPs do not exist in the environment of Yemen. The inventory included all governorates of the Republic, with the focus on all the places that deal with pesticides, both in terms of storage, use or sale.

There was also a program of cooperation and coordination with the United Nations Food and Agriculture Organization to get rid of all the materials left at three intervals where they found these materials mixed with soil. As a result, the existence and locations are divided into three categories:

A) High pollution sites

B) Medium pollution sites

C) Low pollution sites

These sites have been under liquidation of these materials in three stages, as shown in the following table (1-6):

Table (1-6): Phases of disposal of obsolete pesticides and their quantities.

Quantity, ton	Year	Category
262	1996	Highly contaminated soil with chemicals, including POPs (60% Chemicals + 40% high soil pollution by chemicals).
98	2002	Medium-contaminated soil with chemicals, including POPs
200	2004	Low contamination soil with chemicals and materials including POPs.

The dioxin and furan materials (PCDD/PCDF) are confined in the area of Al-Koddah, in the governorate of Hodaida (Sordod farm); as shown in the first year inventory of sources of these materials, which were conducted under the auspices of the United Nations Environment Program and supported by the Swiss Agency for Development as well as polychlorobiphenyls (PCBs). The results of this inventory showed the existence of 10740 transformers located in the Republic of Yemen, mostly without such materials. The General Electricity Corporation does not use oils containing PCBs except in some provinces, such as Hadhramaut Governorate where they are still using Askorel materials.

It was found that the main sources of dioxins and furans are:

- The landfills
- The different vehicles because of the use of leaded fuel
- The cement plants
- The electric power stations
- The plants that produce gypsum and lime

1.9 References

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4) The Family Budget Survey of 1998, the Central Bureau of Statistics.

5) A Comprehensive Survey of the Educational System, the Central Bureau of Statistics, September 1999.

6) The Final Report on an Inventory of Polychlorobiphenyl, Dioxins and Furans, January 2004.

Chapter

2

PRODUCTION, IMPORT, EXPORT AND USE OF CHEMICAL MATERIALS

2 Production, Import, Export and Use of Chemical Materials

Currently the number of brand names of pesticides circulating in the Yemeni market are (555) brand name, made from (118) active materials, imported by (33) accredited local agents, from (46) scientific manufacturing companies. According to statistics of the General Administration of Plant Protection from 1994 to 2002, the pesticides that have been imported represent the following types:

- Insecticides and fungicides.
- Pesticides and herbicides.
- Pesticides, grubs and sterilizers of soil, stores, seeds and oils as well as summer oils.
- Pesticides for public health.

It is noted from the list of pesticides permitted for handling in the country the lack of chlorinated hydrocarbons which include D. D. T., aldren, dialdren, jamaksan, chlordane, hexachlorobenzene and toxaphene. These are the most stable and accumulating compounds in the environment and the fatty layer of the human beings and animals, which may move to infants through filtering in mothers' milk. Table (2.1) lists the different imported pesticides in 2002 and table (2.2) shows the quantities of chemicals used. Table (2-3) lists the pesticides producing companies and their agents in Yemen.

Table (2.1): The different imported pesticides, in 2002.

Type	Quantity / tons
Pesticides	1177.6
Fungicides	603.3
Pesticides for spiders	33.0
Pesticides grubs	7.0
Sterilizers of soil and stores	10.0
Pesticides for Summer oils	3.0
Herbicides	11.0
Pesticides for public health	6.0
Total	**1846.9**

Table (2.2): The quantities of chemicals used.

Type of material	Quantity / tons
Agricultural pesticides	1200-1800
Public health pesticides	Use depends on quantities of water surfaces used, number and location
Consumptive use pesticides	No precise statistics available, but quantities will depend on the conditions of use, the presence of pests and weather.
Fertilizers	913557
Petrochemical products	no information
Industrial chemicals (used in manufacturing / processing)	no information
Chemicals consumed	no information
Other chemicals (unknown / mixed use)	no information

Table (2-3): Pesticides producing companies and their agents in Yemen.

NO.	Manufacturing Co.	Local Agent
1-	**Agrindustial ,S,H Avdu, princie de Asturias , 34 antio2 .Tel-2377121/2376647 08012 Barchalona- Spain**	**Mosleh Saleh Al-Hada and Brothers. General Trading and Imports. P. O. Box 381 Ibb Yemen. Adalil Tel-0433047- Fax-0433127**
2-	**Agrimar uk plc 6 Roland Qardenc London 2 w7 3PH. Tel- 0171-244-7431 Telfax-923032 Agrimag Fax-0171-835-1034**	**Agricultural Material and Consultation Ltd. Sana'a. P.O. Box 11938 - Tel.228055 - Fax. 228056 Email: Amcc@y.netye**
3-	**Agrides Crta.Contanti.KM . –3- polg ind. Nirsa 43206 Reus-Spain Tel-(34)-977-770211 - (37)-977-771419**	**Oasis Agriculture Co. Ltd. Sana'a P.O. Box 1196 Tel-208038 Fax 208037**
4-	**Agrochem Head office –471, El Horreya St. Bolkly –Alexandria- Egypt Tel-203- 54464011**	**Amran Center for Agr. Services Tel-229158 Fax-229159 P.O. Box 10578 Sana'a**
5-	**Agrichem Manufacturing Industries pty ltd. 4-8 chetwynd streat loganholme Brisban QLD –4129 Australia Tel-0738014888 Fax-0738014296 Middle East and North African ARD unifert Lebanon Tel/fax-00961- 1874805/7 Fax -961-1896474**	**Amran Center for General Trade and Agricultural Services, Sana'a Tel/fax: 227666**

NO.	Manufacturing Co.	Local Agent
6-	Agro-Chemie ltd Budapest 1225 Hungary Middle East Agent ARD unifert Lebanon Tel/fax 9611874805/7 Fax 961-1-896474	Amran Center for General Trade and Agricultural Services, Sana'a Tel/fax-227666
7-	Adonis S.Al lebenon p.oBox 90-226 Middle East Agent ARD unifert Lebanon Tel/fax –96118748017 Fax –961-1-896474	Amran Center for General Trade and Agricultural Services Sana'a Tel/fax-227666
8-	ASTRA Agricultural Co.ltd P.O. Box 54061 Riyad Saudi Arabia Tel- 4731130 Fax 4782102	(1) Sheba for industry Agricultural and Irrigation Sana'a P.O. Box 1253 Tel 206211/206217 Fax 203151
	ASTRA Agricultural Co. Ltd. P. O. Box 54061 Riyad Saudi Arabia, Tel- 4731130 Fax- 4782102	(2) Spring Flowers Center for Trade and Agriculture Sana'a - P.O. Box 10640 Tel/fax 231698
9-	ARAB Agricultural ltd Pesticides manufacture CO.(Mupedco) Jordan Tel 04685439 P.O. Box 930103	Al-Hadaha Trade and Agencies Est - Fax 9671241843 - Tel 9671241890 P.O Box 2867 Sana'a
10-	Akola Chemicals (India) Ltd. Manufactuers of Agricultural Chemicals. Tel. 2037230 – Fax. 2050885 Factory - Tel. 072458159 - Fax.072458160	Almujawid Co. for Agricultural Devp. and Trade Tel.223537
11-	ARBG (India) Ltd. 21D sukhdvala marg. P.O. Box 233 Mumbai 400001 Tel. 207731 Fax- 2077009	Yemen Agricultural Evolution Office Ltd. P.O. Box 5315 Taiz, Yemen Tel-226098 Fax-232400
12-	Aventis Cropscience Gmbh,D- 65926 Frankfurt Am main Tel + 49(0) 69 305 6699 Fax + 49(0) 69 305 40621 WWW.Aventis. com	(1) Yemen Green Oasis Sana'a Tel- 216589 Fax –205960
		(2) Gameel Ahmed Saif for General Trade and Imports Taiz – Al-Qaida P.O Box 6070 Tel 331019 Fax 331198
13-	BASF. AG. P. O. Box 120 67114 Limburg hot- Germany Fax-49-621-60-27123	1-Othman Ibrahim Sudam and Sons General Merchandise Seeds, insecticide and Agr. Equipment Tel. –245472 Fax-211747
		2-Abdo Salaam Alamery and Brothers Import- Export Hodaida-

NO.	Manufacturing Co.	Local Agent
		Republic of Yemen **P.O Box-3295** **Tel.: 246526** **Fax-234860**
14-	**Bayer- AG Mongeim** **D- 51368 Lerekusen Germany** **Tel. 49(0)2173 – 383387** **Fax. 49(0)2173 – 383469**	**Yemen Agricultural Evolution Office Ltd.** **P.O. Box 5315** **Taiz, Yemen** **(Al- Agbary)** **Tel-226098** **Fax-232400**
15-	**Bilag Industries ltd.** **Vapi 396195 WDIA India** **Tel: 91-2638-32062** **Fax : 91-2638-30781**	**Arab Center for Agricultural Development.** **Zayed street – Sana'a** **P. O. Box 25421** **Fax: 220311**
16-	**Chimac – Agripharsa** **Rue de Renory, 26,** **B- 4102 Ogre. Belguim** **Tel. 04/3859711**	**Sudam Center for Trading & Agriculture** **P.O. Box. 3371,** **Hodaida Yemen** **Tel. 03245741** **Fax. 211474.**
17-	**Cheminova Agr. A/S p.o Box 9** **Tel(+45)97834100 Fax(+45)9784555**	**AL-Ahwal General Trading Partnership Co. Sana'a** **P. O. Box 2712** **Tel 206201/3/4** **Fax 206520**
18-	**Devidayl Estate1st. floor** **Reay road ,** **Bombay 400010** **Tel- 3714913/3734817** **Fax-91-22-3742708**	**Almujawid Co. for Agricultural Devp. and Trade** **P.O BOX 25360** **Tel.223537**
19-	**Dupont DE Nemours France S.A.** **82 Rye DE Wittelsheim** **68700 Cernay / France** **Telex:205772 F Dupont** **Telefax: 01-45-50-65-50**	**Agricultural Material and Consultation .Ltd.** **Sana'a** **P.O Box 11938** **- Tel.228055** **- Fax. 228056** **Email: Amcc@y.net.ye**
20-	**Dow Agrosciences Ltd.** **Cross bank road King`s lynn** **Norrfolk pe30 JD** **United Kingdom** **P. O.BOX 7078** **Fax: +33 4 93 95 65 95** **Tel:+33 4 93 95 65 44** **E-mail: lchauvin@ dow.com**	**1-Agricultural Material and Consultation .Ltd.** **Sana'a.** **P.O Box 11938** **- Tel.228055** **- Fax. 228056** **Email Amcc @ y. netye** **2-Aman center for General Trade and Agricultural Services** **Sana'a** **Tel/fax 227666**
21-	**Elf Atochem Agri S.A** **B.P.9-78373 Plaisir cedex (france)** **Tel: 0130817300** **Fax:0130817250**	**Arab Center for Agricultural Development.** **Zayed street** **Sana'a**

NO.	Manufacturing Co.	Local Agent
		P.O. Box 25421 **Fax:220311**
22-	**EL-Nasr Co. for Intermediate Chemicals** **P.O. Box 86 Pyramids Giza Egypt** **Tel-3836679-3830402** **Fax –3835678**	**Abu Miska Enterprise for Trading & Contract** **P.O Box: 2566** **- Fax:230103** **- Tel: 230525/230549**
23-	**F.M.C** **Corporation** **W.N.Avenueloutes,480Bg,1050Brussels,Belgium** **Tel:3221645-9211**	**Agricultural Material and Consultation Ltd.** **Sana'a** **P.O. Box 11938** **- Tel.228055** **- Fax. 228056** **Email: Amcc@y.netye**
24-	**Fulon Chemical Industrial Co.ltd.** **51-10, T50-taglin, pao-chan chum, kuan-in** **Shiang Taoyuan Taiwan R.O.C** **Tel –8863-4834492** **Fax –8863-4830625**	**Spring Flowers Center for Trade and Agriculture** **Sana'a** **P.O. Box 10640** **Tel/Fax** **-231698 Sana'a** **-530109 Sadah**
25-	**Hube Sanonda Co.ltd. Hubei China** **Tel –0716-216975/214802** **Fax –215265 pos cod 43400**	**AL-Huraibi for General Trading** **Sana'a** **Tel-961-208746** **Fax-961-209368** **P. O. Box 19368**
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27-	**Idofil Chemical Co.** **P.O. Box 9772** **Mumbai India** **Tel- 498713761**	**Yemen Agricultural Evolution Office Ltd.** **P.O. Box 5315** **Taiz R. of Yemen** **(Al-Agbary)** **Tel-226098** **Fax-232400**
28-	**Kafr El Zayat Pesticides &Chemicals CO.** **Mobedat Kafr El Zayat A.R.E** **Fax: 040-325631** **Tel : 582444-582761**	**AL-Quhum Store for Import and General Trade.** **P.O. Box 19874** **Ahmed Abbas Al-Quhum** **Telefax/00967-1-227545**
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33-	**Phosfonia, S.L. P. Bonanova, 62-08017 Barcelona-Spain Tel:34-93-240.51.38 Fax:34-93-200-56-48**	**Agricultural Material and Consultation Ltd. Sana'a. Tel.228055 - Fax. 228056 P.O Box 11938 Email: Amcc@y.net.ye**
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37-	**Probeltec Trade Madrid KM 3846** **Apartado 4579** **Tel 0034-68-7250**	**Al-Huraibi for General Trade, Sana'a** **Tel-961-208746** **Fax-961-209368** **P.O. Box 19368**
38-	**Searle Limited** **21,D Sukhadvala Marg** **Mumbai –400001-India** **P.O. Box 233** **Tel:2077731 Fax:2077009**	
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41-	**Sulfur Mills Limited** **P.O. Box 19176** **Mumbai –400025 India** **Tel:491-1999/1920/4955077** **Fax:91-22-493-9586**	**IBN-ALHAJ For Agriculture Office** **Tel:222702,** **Fax:216578**
42-	**Sumex Chemicals Ltd.** **55 Manjrekar compound of Dr .E.Mosos Road Worli,Mumbai –400018 India** **Tel:4918401** **Fax:4918405**	**Spring Flowers Center for Trade and Agriculture** **Sana'a** **P.O. Box 10640** **Tel/Fax -231698 Sana'a** **-530109 Sadah**
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44-	**Sundat (S) Pte ltd** **26 Gul crescent** **Singapore 629532** **Tel(65) 861-2460** **Fax (65) 862-0287** **E-Mail: mailadmin@sundat.com.sg.**	**Amran Center for Agr. Services** **- Tel-229158** **- Fax-229159** **P.O Box 10578** **Sana'a**
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46-	**RPG Life Sciences ltd.** **21,D. sukhadvala Marg** **Mumbai –400001 -India**	**Yemen Agricultural Evolution Office Ltd.** **P.O. Box 5315 Taiz** **R. of Yemen** **(Al- Agbary)** **Tel-226098** **Fax-232400**
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48-	**VAPCO** **Veterinar & Mnufacturing Co.ltd** **Tel-(962-6)5694991-6/** **fax(962-6)5694998** **Tlx.21831vapco-jo** **P.O. Box 17058** **Amman –11195-jordan** **E-mail: vapc-@vapco.net**	**AL-Fedawi Places for Trading** **Head office: Hodaida, Sana'a st.** **P.O. Box 3592** **Tel-00967-3-212695** **Fax-00967-3-212694**
49-	**Yamama Agricultural Products Industrial Co. Ltd.** **Fax:962-6-606931** **Tel:962-6-606931** **P.O. Box 11941, Jordan**	**Ali Hiba Muslot and Sons Stores** **Tel: 967-03-245326/246240** **Fax: 967-03-211753** **P.O. Box 3004** **Hodaida**
50-	**United Phosphorus Ltd.** **Ready Money Terrace** **167Dr. Annie Besant Road.** **Worti Bombay-400018 India**	**Wadi Bani Qaws Association Agricultural Marketing & Products** **P.O. Box 25421** **Sana'a** **Tel:00967-1-233218** **Fax:220311**
51-	**United Phosphorus Ltd.**	**Wadi Bani Qaws Association Agricultural Marketing & Products** **P.O. Box 25421 Sana'a** **Tel:00967-1-233218 Fax:220311**
52-	**Zhechem Zhejaing Chemicals Import and Export Corporation** **109-117, Qingchun road,** **Hangzhou, China** **Tel: (86)571-7046269,7048755** **Fax: (86)571-7046332**	**Al-Sanabel Agri. Enterprise** **Tel:00967-1-226023** **P.O. Box 10613** **Fax:00967-1-238976** **Email:** **add.Alsanabil6@y.net.ye**

2.1 The Use of Pesticides in the Republic of Yemen

Yemen knew the use of pesticides for many years like other countries in the world. The historic references go back to 1935, when the agricultural expert Ahmed Wasfy Zakaria asked Saif Al-Islam Abdullah to import Black Soap to deal with the diseased apples and bring sulfur medical treatment of Chagas disease in the village of Alrodh, known recently as Algabil village. The report did not confirm import or not but could be referred to as the reference date suggesting that there are no pesticides at that time in the northern homeland.

The use of pesticides in the homeland in the southern provinces has been confirmed in the second half of the1800s after the advent of the British colonialism, were it was used to combat the scourges of public health like the vectors: bugs, flies and mosquitoes, in order to preserve the health of soldiers.

In the forties of the twentieth century, the chlorinated hydrocarbons emerged such as D. D. T. and Jamaxan, and their use expanded in the 1950s to combat locusts, cotton and palm pests in addition to the scourges of public health.

In the 1960s, expansion in the use of pesticides in Yemen increased through bilateral projects, where compounds like carbamates, organic phosphoric substances among others were introduced. The demand for pesticides increased together with the number of farms and farmers.

In the early 1980s, the synthesized parathion compounds appeared. The activity marked the emergence of the private sector in Yemen in the field of importing some types of pesticides, however in a limited way. Table (2-4) shows the chemical production and trade (Oil Sector) in 2001.

Table (2-4): Chemical production and trade (Oil Sector) in 2001.

No.	Type of Product	Production / barrel		Export / barrels	
		Quantity	Value $	Quantity	Value $
1	**Crude oil**	160053178	(2)	66919605	1537598951.33
2	**Gasoline**	9249618.8	38572(3)	unknown	unknown
3	**Kerosene**	1888585.8	09708(3)	unknown	unknown
4	**Diesel**	1631753.3	58424(3)	unknown	unknown
5	**Fuel oil**	1056954	21414(3)	unknown	unknown
6	**Naphtha**	674700.44	4600 (4)	unknown	unknown
7	**Asphalt**		(5)	unknown	unknown
8	**Liquefied petroleum gas LPG**	7397284		02286	unknown

Notes:

1. Crude oil was produced only from the above sectors (without exploratory production).
2. The total value of the crude oil produced from 2001 prices (average) = $ 3.678.022.030.
3. The value of 1 million Yemeni riyals (the local currency).
4. This value is only in 1,000 Yemeni riyals because the quantity is too small.
5. Unfinished data, especially in the Aden and Marib refineries.
6. Including the share of the quantity exported and the share of state producing companies for export.
7. Share of the State (Republic of Yemen) from oil exports (crude oil only) = 10.801.112.975 dollars.
8. There is no importation of any of the petroleum products.

2.2 Chemical Production, Export and Import

2.2.1 Contribution of the Oil and Minerals Sector in Local Production

The oil sector is the largest contributor to gross domestic production which gives an indication that oil is driving the economy and pushing forward development. Table (2-5) lists the contribution of the oil sector, minerals, and the number of users in 2001.

Table (2-5): Contribution of the oil and minerals sector, and the number of users in 2001.

Sector	Contribution to GDP	Number of users	Major product in each sector
Oil	39%	10351	Crude oil, gasoline, aviation fuel, diesel and fuel oil
Minerals	16%	658	Construction and ornamental stones

The oil sector includes:

A) Crude oil: production and exports.

B) Refining: production and marketing domestically and externally.

The number of users mentioned are only those working in the government sector. The information about the working power in the operating companies in the area of oil and minerals exploration and drilling is currently not available. Also this figure does not include the workforce in the local companies to produce construction and ornamental stones (quarries). Table (2-6) shows the amount of annual production of construction and ornamental stones according to the type in 2001.

Table (2-6): The amount of annual production of construction and ornamental stones according to the type in 2001.

No.	Types of rock	Quantity production tonnage	Value	remarks
1	**Tough and Wagnerite**	69	2,098,692	Limited exploitation as construction and ornamental stone
2,	**Limestone and dolomite**	24	248,300	Limited exploitation as construction stone
3	**Granite**	15	125,900	Limited exploitation as building stone
4	**Marble**	08	074,500	Broad exploitation as building and decoration stone
5	**Basalt**	08	067,840	Limited exploitation as building stone
	Total	124	2,615,232	

Note: The raw gabbro is available in great quantities and resources, however not exploited.

Apart from the major contribution of oil in GDP it also contributed by:

- 74% of the general budget resources.
- 50% of the resources of hard currency (foreign oil export).
- 95% of total exports (foreign trade, which represents 36.3% of GDP).

Table (2-7) summarizes the local consumption of petroleum products in 2001.

Table (2-7): The local consumption of petroleum products in 2001.

No.	Petroleum product	Quantity / ton	Remarks
1	**Crude oil / barrels**	32,441,291	For the local refineries (Aden and Marib)
2	**Petroleum products**		Sales of Yemen Petroleum company
	A- Gasoline	929,010,8	
	B- Kerosene	936,480	
	C- Diesel	126,942,09	
	D- Fuel oil	749,342,5	
	E- Aviation turbine	918,952	
	F- Liquefied petroleum gas, LPG	40,380,12	
	G- Lubricating oils and grease	3,962,54	Sales of Yemen Petroleum company only

Kerosene includes:

- Aviation fuel (Turbine).
- Lighting kerosene.

2.2.2 Manpower in the Oil and Minerals Sector

The total manpower in the oil and minerals sectors as a percentage is 4% of the total labor force in the country. This means that a limited number of workers produce the bulk of the wealth, according to economists expressions. The following table (2-8) details the distribution of manpower in the field of oil and minerals.

Table (2-8): The workforce in the oil and minerals sector.

Sector	The units	Number of Yemeni workers	Foreign workers	Total number of employees
Oil	1 Oil-producing companies 2- The Ministry of Oil and Minerals and its units	01761 08083	0507 --	02268 08083
Minerals	Geological Survey Authority (government)	00958	--	0958
Total		**10802**	**507**	**11309**

Notes:

1) No data are available on the number of workers in the companies involved in oil exploration and prospecting.

2) No data are available on the number of foreigners working in the Ministry and units of experts.

3) No data are currently available on the number of workers in companies prospecting for minerals and quarries; figures include only employees of the different government bodies and organizations of the Ministry.

4) The data provided did not contain the contribution of the minerals sector in the gross domestic product from the output of metal and non-metal minerals. The data presented is limited to the output from the construction and ornamental stones for the following reasons:

- The minerals sector activity until 2001 was exploratory and prospecting not producing.
- The actual production and export was begun in 2002 for limestone and is outside the scope of the table for 2001.

Table (2-9) shows the most metal-recoverable reserves in the Republic of Yemen.

Table (2-9): The most metal-recoverable reserves in the Republic of Yemen.

Ser. No.	The raw metal name	Whereabouts of the crude (provinces)
1	**Gold metal**	Hajjah, Hadhramout and Dhamar
2	**Zinc, lead and silver**	Sana'a (Nehem) and Shabwa
3	**Copper, nickel and cobalt**	Taiz, Hajjah, and Sa'dah
4	**Iron and titanium**	Abyan and Beidha
5	**Limestone and dolomite**	Sana'a, Taiz, Hodaida, Marib, Abyan, Amran, Hadramaut, and Shabwa
6	**Rock salt**	Hodaida, Shabwa and Marib
7	**Gypsum**	Taiz, Hodaida, Marib, Shabwa and Hadramaut
8	**Marble**	Taiz, Hajjah, Marib, Abyan and Shabwa
9	**Feldspar**	Hajja, Abyan and Shabwa
10	**Silica sand**	Sa'dah, Sana'a, Taiz, Shabwa, Beidha (Rada'a)
11	**Quartz**	Hajjah and Sa'dah
12	**Aluminum silicate, hydrated**	Sana'a, Sa'dah, Ibb, Hodaida, Aden and Hajjah
13	**Zeolite**	Taiz, Ibb and Dhamar
14	**Basalt**	Taiz, Ibb, Dhamar and Sa'dah
15	**Talcum**	Sa'dah, Marib, Abyan and Al-Dhalea
16	**Volcanic materials (ascorbic biomes, Berlet)**	Dhamar, Amran, Aden, Sana'a, Taiz, Abyan and Shabwa
17	**Granite**	Sa'dah, Marib, Al-Beidha, Hodaida, Taiz and Abyan
18	**Black sand**	Hadramaut, the Red Sea, Al-Mahrah and Hodaida
19	**Kaolin**	Sa'dah and Sana'a
20	**Mineral mud (except kaolin)**	Hodaida, Ibb, Sana'a, Sa'dah, Aden and Lahj
21	**Travertine**	Sana'a and Ibb
22	**Scoria**	Dhamar, Amran, Marib, Sana'a, Abyan and Shabwa
23	**Biomes**	Dhamar and Aden
24	**Berlet and Asdian**	Dhamar, Aden and Taiz
25	**Gabbro**	Sa'dah
26	**Fluorite**	Hadramaut (Mukalla)
27	**Tough and Wagnerite**	Taiz, Ibb, Sana'a and Dhamar

All of these materials are not exploited locally, and all are important industrial starting materials. What is in use currently is very limited and mostly in the production of construction and ornamental stones. Table (2-10) shows some internal minerals utilized in the local industries.

Table (2-10): Some local minerals utilized in the local industries.

Ser. No.	Mineral	Local industrial exploitation	Degree of exploitation
1	**Limestone**	Cement and limestone industry	Limited
2	**Salt rock**	Salt and leather	Limited
3	**Gypsum**	Cement industry	Limited
4	**Aluminum silicate, hydrated**	Cement and thermal bricks industries	Medium
5	**Scoria biomes and Berlet**	Road paving	Limited
6	**Mineral mud**	Cement industry, refractory bricks and pottery	Limited
7	**Scoria**	Cement industry and road paving	Limited

2.3 Production, Export and Import of POPs

Reference is made formerly that Yemen does not produce any of the POPs compounds, and does not export any of them. However, Yemen in the past imported some of these materials for use primarily in agriculture and in agricultural pest control. Because of the lack of clear records showing the imported quantities in the past and pesticide materials in general, great difficulty was found in producing a table to show these quantities. Later, only the quantities of pesticides, including persistent organic pollutants that have been disposed of as leftovers and those mixed with other materials and with soil will be reviewed.

2.3.1 Residues of POPs and Abandoned Materials

2.3.1.1 Project of Disposal of Abandoned and Damaged Pesticides in 1987-1996.

The old pesticides are those which existed for an extended period of time without use and which are not expected to be used and should be disposed of.

The damaged and abandoned pesticides are those which have expired or their use was suspended in Yemen like the desert locust control pesticides. Yemen was the regional store of locusts' pesticides for distribution in the region since the 1950s. Therefore, the remained quantities of those pesticides without use as a result of the decline of the desert locust situation in the region and the world, in addition to other types of pesticides that

entered the country through various bilateral projects, assistance or sample testing and were not used as a result of the expiration of the projects and the lack of adequate storage warehouses.

2.3.1.2 The Factors that Help Increase the Accumulation of Expired Pesticides.

The Food and Agriculture Organization outlined the factors that help to increase the accumulation of expired pesticides as follows:

1. Stop or prohibit the sale of a pesticide.
2. Declining demand for the compound among farmers for any reason.
3. Contamination of a filled pesticide by another (especially if the other is a herbicide).
4. Accumulation of a pesticide on the farm for any reason.
5. Increasing resistance of pest to a pesticide or certain types of pesticides.
6. Stop planting the crop that the pest got used to.
7. Expiration of the validity of pesticide or a clear decline in its effectiveness.
8. Destroying the package containing the pesticide to the extent of breakage or destruction.
9. Damage to the body of the packaging so that its contents can not be emptied.
10. Not disposing of empty containers.

Materials were disposed of, abandoned and damaged in three phases, as shown below:

2.3.1.3 Phase I: 1996

The total expired pesticides and contaminated materials and empty containers were (269) tons. The total cost of the survey and disposal amounted to (1, 338,000) dollars. Detailed results are shown in table (2-11).

Table (2.11): The names and the quantities of old, damaged, expired and abandoned pesticides, already disposed of in 1996, and their physical states.

Common name	Quantity ton	State
Dieldrin	77.451	Liquid
Dieldrin	1.155	Solid
Indosilfan	1.198	Liquid
Bisicuron	1.598	Solid
Heptachlor	7.9	Solid
Depimethiot	61.678	Liquid
Fintrothion	44.1	Liquid
Fintrothion	0.45	Solid
D D T	10	Solid
B T C	30.689	Solid
Tetrachlorofinfoss	1.26	Liquid
Tetrachlorofinfoss	0.554	Solid
Propoxore	12	Solid
Melathion	6.848	Liquid
Mrthyl Mercaptofoss	2.465	Liquid
Aluminium fosfide	3	Solid
Nitrofin	2	Liquid
Carboxin	0.646	Solid
Dazomit	1	Solid
Oxokonox	0.48	Solid
Populite	0.42	Liquid
Dichlofoss	0.404	Liquid
Quintozin	0.3	Solid
Pentazan	0.256	Liquid
Finamifoss	0.202	Liquid
Methyl Premfoss	0.271	Solid
Diazinon	0.293	Liquid
B M A	0.203	Liquid
Thioremid	0.204	Liquid
coperfat Ammonilal	0.182	Liquid
Barkwat	0.123	Liquid
Dichloflonide	0.102	Solid
Total	**269.372**	

2.3.1.4 The Project of Getting Rid of the Pesticides Buried in Sordod Productivity Farm 1992-2004, Phases II and III

During a visit of the evaluation surveyors carried out for the project, quantities of pesticides, fertilizers and other waste materials were found buried in the field (No. 27) in Sordod productivity farm in 1992. The problem has not been included to be solved in the project due to its high magnitude, the lack of information in a timely manner, as well as the amount of money required.

As a result, the State has requested FAO's assistance in disposing of these materials to be buried in safe and secure methods after site field studies, knowledge of its dimensions, and the depth of the pit, by the Dutch Tao Company, with funding from the World Bank (US $ 15000). An agreement was signed between the Yemeni Government and the Food and Agriculture Organization, according to which the field work was carried out for the disposal of these materials.

The first phase was completed in 2002 and the second phase in 2004. Tables (2-12) and table (2-13) show the results:

Table (2-12): The waste pesticides found in the first phase.

Serial #	Contents	No of containers	Net wt. Kg/Lit.	Gross wt.
1	**Highly pesticide polluted soil classified (6.1) UN # (2588)**	92 sacks 1 ton each	65734	74934
2	**Pesticides**	17 Drums (205 lit.) 10 Drums (310 lit.)	20219.5	21951.5
3	**Empty containers**	38 Drums (205 lit.) 3 sacks 1 ton each Steel container 1	1679	1992
4	**Total**	95 sacks 1 ton each 215 Drums (205 lit.) 10 Drums (310 lit.)	87632.5	98877.5

Table (2-13): The waste pesticides found in Sordod farm in the second phase.

Serial #	Contents	No of containers	Net wt. Kg/Lit.	Gross wt.
1	Solid waste DDT classified (6.1) UN # PGI (2761) ; designated pollutant of water life	92 Drums (205 lit.) open steel tops	9200	10120
2	Damaged hydrocarbon pesticides + empty DDT containers classified (6.1) UN # PGI (2761) ; designated pollutant of water life	125 Carton drums (205 lit.)	1000	1250
3	Sacks containing solid hydrocarbon pesticides + containers polluted with DDT classified (6.1) UN # Pg (2761) ; designated pollutant of water life.	63 Sacks 10 Kg each	315	315
4	Sacks 1 cubic meter each containing damaged solid pesticides + empty DDT and Falverate containers; classified UN #3077 9 pg 111	35 Sacks 1 ton each	1750 Kg	5250
5	Drums containing damaged solid pesticides + empty DDT mixed with Falverate containers, classified UN 9 # 3077 pg 111	3 Drums (205 lit.) open steel tops	120 Kg	150
6	Drums containing damaged solid hydrocarbon and chlorinated DDT pesticides + empty mixed with Falverate containers; classified UN 601 pg 2761	1 Drums (205 lit.) open steel tops	140 Kg	150 Kg

2.4 Chemical Waste

There are different types of chemical residues; most of the waste was produced from Aden and Marib refineries, and from the lubricating oils used in vehicles and power pumps, in addition to the industrial waste, such as from ghee and soap industries and the manufacture of cement, plastics, liquid batteries and foods. The team was unable to obtain information indicating quantities of these residues to reflect it in tables to show the production of these wastes by type and producer, as well as by year. In general, we can mention the following types of waste:

1. Remnants of Liquid Chemicals

These include alkaline hydroxides, acids, organic solvents, oils and oil distillates and the remnants of paints. This waste is generated from the activity of refineries, chemical laboratories, waste oil from vehicles and machinery, pumps, power production plants and production and mixing of paints.

The data indicate that the residues from waste lubricating oils from vehicles, machinery and power pumps are about 25000 tons, poured mostly on the sides of roads between cities and beside the farms (wells' water lifting pumps), causing soil contamination.

2. Residual Waste Water

These include remnants of chemical pollutants resulting from the activity of the laboratories, facilities, refineries and chemical plants and lubricant for car washing and some other industries. The output of these activities ends in the waste water. This is in addition to the activity of non-metal industries, such as liquid batteries, paint, industrial manufacturing of ghee, soap, food and other activities. According to the simple information available, there is not enough data with the Water and Sanitation Authority on the nature of chemical residues contained in waste water and the proportion present. This applies to the Capital, Aden, Marib and Rada'a cities that have facilities for a better capacity to deal with contaminated waste water.

2.5 Analysis

There were no accurate and comprehensive information about quantities of chemicals used in the Republic of Yemen as a result of the absence of accurate field studies. What enters the country through the official outlets is subjected to a thorough documentation system especially with regard to plant protection pesticides. In case of the rest of health pesticides, information available is scarce and limited to the agricultural sector only, as a result of the absence of the legislative aspects with the exception of those concerning the agricultural pesticides. The responsibility lies with organizations of ministries other than the Ministry of Agriculture.

2.6 Recommendations

1. An institution must established to become a special reference for pesticides and scourges of public health to return to in all matters related to import and use.

2. Activation of laws and regulations governing the circulation of pharmaceuticals, agricultural and industrial chemicals to guarantee reduction of leakage or entry of any prohibited ones.

3. Not to approve the acceptance of any quantities of chemicals or qualities whether as assistance, gift or subsidy by agreement or agreements for joint projects unless justified by the competent authorities to determine the actual requirements.

4. Work on the establishment of a system of authentication of poisoning cases caused by pesticides and chemicals in selected hospitals to benefit from the studies and design the necessary plans to raise awareness and risk reduction.

5. Work on the creation and activation of laboratories for determining the residual effect of pesticides in agricultural products.

6. The need to define the upper limits of the permissible residual pesticides and other chemicals in different agricultural crops, produced and imported foods, as well as in all components of the environment.

Chapter

3

PRIORITY CONCERNS FOR THE CHEMICAL PRODUCTION, EXPORT, IMPORT AND USE

3 Priority Concerns for the Chemical Production, Export, Import and use

Many environmental difficulties and problems arise as a result of dealing with chemicals. The following is a description of some of these problems, according to the nature of the problem and the province:

3.1 Air Pollution

Air pollution is one of the most important problems facing some governorates of the Republic, particularly in the following provinces:

3.1.1 The Capital

There is contamination throughout the Capital resulted from several factors:

- The plants are spread randomly in the neighborhood because of the lack of an industrial zone.
- The burning of waste.
- The burning of obsolete tires (especially in religious occasions and holidays).
- The proliferation of quarries and stone cutting quarries resulted in intensive dust pollution.
- The widely used diesel fuel vehicles blow heavy black smoke.
- The operation of 6 asphalt factories is resulting in total suspended materials pollution and emitting polluting gaseous pollutants from the heating of asphalt.
- There are 162 leather industry factories.
- The chemical industry, plastics and refined oil derivatives are 21.

3.1.2 Aden

- The presence of Aden Refinery.
- The widely used diesel fuel vehicles blow heavy black smoke.
- The burning of wastes.

- The electricity generating plants.
- There are 2 leather industries.
- The chemical industry, plastics and refined oil derivatives are 3.

3.1.3 Taiz

The chemical industry, plastics and refined oil derivatives are 13.

3.1.4 Hodaida

- The leather industries are 11.
- The chemical industry, plastics and oil derivatives refined are 9.
- The cement plant.
- The plants for extracting lead from car batteries are (2).
- The food and processing industries.

3.1.5 Hadramaut

The leather industries are 37.

3.1.6 Marib

The leather industry factories are 9.
The chemical industry, plastics and refined petroleum products are 3.

3.1.7 Sana’a

The leather industries are 12.

The chemical industry, plastics and refined petroleum products are 3.

3.1.8 Amran

Amran cement plant.

3.2 Water Pollution

Contamination of drinking water sources:

The study of 1997-1996 included collecting water samples from the wells of the Capital, Taiz, Yareem and Amran. The samples were analyzed in the laboratories of the Local Water and Sanitation Authorities at Taiz and Sana'a.

3.2.1 The Capital

- The wells near the Al-Rowdhah sewage treatment ponds caused mixing industrial waste water with the drinking water.

- The samples collected from 6 different wells were subjected to chemical and bacteriological analysis which showed that only one sample is uncontaminated.

- The total fluoride in sample (1) is 1.82 mg / liter, while the upper limit allowed is 1.5 mg / liter. Similarly, the concentration of nitrate in sample (2) was 56 mg / liter while the permissible is 50 mg / liter.

- The calcium carbonate in sample (3) was found to be 268 mg / liter, 204 mg / liter in sample (4) and 288 mg / liter in sample (6). The upper limit allowed is 200 mg / liter.

- The ion balance in the six samples was found to be as follows: sample (1), 11.37%; sample (2), 16.11%; sample (3), 19.77%; sample (4), 14.57%; sample (5), 6.72%; and sample (6), 6.42%; while the upper limit allowed is 5%.

3.2.2 Taiz

The samples collected from seven different wells were subjected to chemical and bacteriological analysis. Only one sample is found to be not contaminated.

- The fluoride in sample (4) hit 1.6 mg per liter, 1.8 mg / liter in sample (5) and 1.7 mg / liter in sample (6). The upper limit allowed is 1.5 mg / liter.

- The total concentration of nitrate in sample (4) was 154 mg / liter, 60 mg / liter in sample (5) and 1.7 mg / liter in sample (7). The permissible upper limit is 50 / liter.

- The concentration of calcium carbonate in sample (3) (Al-Houban) was found to be 900 mg / liter, 660 mg / liter; in sample (4) (Authority Water Project) and in sample (5) (treated water) amounted to 280 mg / liter, 380 mg / liter; in sample (6) (tanker from Al-Dhabab) and 600 mg / liter in sample (7) (Al-Abiadh special network). The upper limit allowed is only 200 mg / liter.

- The total concentration of calcium in sample (3) was found to be 600 mg / liter, 378 mg / liter, in sample (4) amounted to 270 mg / liter in sample (6) and 260 mg / liter in sample (7). The upper limit allowed is only 200 mg / liter.

- The total magnesium concentration in sample (3) is 300 mg / liter; the sample (4), 282 mg / liter; in sample (7) 220 mg / liter, while the upper limit allowed is 200 mg / liter.

- The total chlorine concentration in sample (1) is 268 mg / liter, in sample (3), 430 mg / liter, in sample (4), 380 mg / liter, while the upper limit allowed is 250 mg / liter.

- The total sulfate amounted to 880 mg / liter in sample (3) and 460 mg / liter in sample (4), while the upper limit allowed is 400 mg / liter.

- The ion balance in the six samples was as follows: sample (1) 11.53%; sample (2) 37.74%, sample (3) 15%, sample (4) 26.67%, sample (5) 41.21%, and sample (6) 52.31%. The upper limit allowed is 5%.

3.2.3 Amran

The 5 samples were collected from various wells and most samples are contaminated.

- The concentration of calcium carbonate in sample (1) is 307 mg / liter, in sample (2) 260 mg / liter, in sample (3) (general) 294 mg / liter, in sample (4) (general) 320 mg / liter and in sample (5) 242 mg / liter, while the upper limit allowed is 200 mg / liter.

- The total concentration of silicon in sample (1) is 42 mg / liter, in sample (2) amounted to 46 mg / liter, in sample (3) 40 mg / liter, in sample (4) 46 mg / liter and in sample (5) 41 mg / liters, while the upper limit allowed is 200 mg / liter.

- The ion balance in the five samples was as follows: sample (1), 46%, sample (2), 42.68%, sample (3), 46.77%, sample (4), 42.82% and sample (5), 41.30%, while the upper limit allowed is 5%.

3.2.4 Yareem

The samples were collected from 3 different wells. The analyses have shown that most samples are polluted.

- The total concentration of calcium carbonate in sample (1) is 242 mg / liter, in sample (3) 520 mg / liter, while the upper limit allowed is 200 mg / liter.

- The total calcium concentration in sample (3) is 304 mg / liter, while the upper permissible limit is 200 mg / liters.

- The total concentration of magnesium in sample (3) is 216 mg / liter, while the upper limit allowed is 200 mg / liter.

- The total concentration of nitrate in sample (3) is 85 mg / liter, while the upper limit allowed is 50 mg / liters.

- The silicon concentration in sample (1) amounted to 40 mg / liter, in sample (2) 40 mg / liter, in sample (3) 67 mg / liter, while the upper limit allowed is 200 mg / liter.

- The ion balance in the three samples is as follows: sample (1) 38.18%, sample (2) 37.94% and sample (3) 37.07%, while the upper limit allowed is 5%.

3.3 Soil Contamination

- Information available shows that the misuse of pesticides on farms, the direct discharge of waste oil and industrial drainage are the main causes of soil pollution.

- The Hodaida expired pesticides, buried in Sordod productivity farm, used in the fight against all kinds of vectors, contaminated 300 tons of pesticides and agricultural soils.

Table (3-1) summarizes the pesticides that have been disposed of in the Republic of Yemen, in 1996.

Table (3-1): The pesticides that have been disposed of in the Republic of Yemen, in 1996.

Prov.	No. of packets	Grand total	%	Pesticides contaminated soil *		Chlorinated hydrocarbon pesticides		Other pesticides		Empty pesticides packages	
				*ton	%	*ton	%	*ton	%	*ton	%
Sana'a	954	24.33	9.2	1.7	7.0	-	-	18.7	76.9	3.93	16.2
Hadramaut	74	10.03	3.8	0.17	1.7	5.68	56,6	4.16	41.4	0.03	0.3
Lahj	306	28.32	10.7	6.21	21.9	-	-	21.8	77.0	0.31	1.1
Taiz	159	20.21	7.7	1.08	5.3	-	-	18.1	89.6	1.03	5.1
Hodaida	1280	175.40	66.4	73.8	42.1	52.6	30,0	40.7	23.2	8.3	4.7
Abyan	109	5.72	2.2	-	-	1.8	31,5	3.44	60.1	0.48	8.4
Total	**2882**	**264.01**		**82.96**		**60.08**		**106.9**		**14.08**	

Source: Annual report of the development of Tehama, 1996.

* = % of the total for each governorate.

3.3.1 Analysis of the Results

The table shows that the quantity of expired pesticides resulted from the projects to combat desert locusts' which had been used since the 1980s. The quantity that has been disposed of these pesticides is expired and is estimated to be (262) tons.

- The quantity was exported to Britain for disposal according to an agreement between the Ministry of Agriculture and the Environmental Protection Council (formerly) by FAO on the basis of the Basel Convention on the Control of Across Border Movements of Hazardous Wastes and their Disposal, 1996.

- Another quantity of expired pesticides which was buried by an American company was exported too. The American company was supervising the management of Sordod productivity farm, Hodaida Province. The quantity exported of pesticides and contaminated soil amounted to (300) tons to Britain for disposal through a British company financed by the Dutch government through the FAO with the permission of the Ministry of Agriculture and Irrigation, the General Authority for Environmental Protection in August 2001, according to the Basel Convention on the Control of Across Boundary Movements of Hazardous Wastes and their Disposal.

3.4 Chemical Poisoning

As a result of ignorance of many people to the danger of chemicals and their toxicity, numerous chemical poisonings have been noticed:

- 99 different chemicals were kept for reservation in customs of Sana'a International Airport in 2002 by the team of the General Authority for Environmental Protection in cooperation with the competent authorities.

- Ten people were killed in Hajjah as a result of drinking methanol.

- Research was conducted on 288 people to find out the impact of residual organic phosphorus pesticides. The results showed that 72% of the sample examined has a negative impact of the emergence of enzyme activity remaining in the blood, 20% of the sample was under natural level, while mostly 8% were found below the level of danger.

- In recent years, qat trees consumed more than 70% of imported pesticides. This is evident from the studies conducted in the period from 91-94 of the impact of remaining pesticides on qat trees. It was found that 50% of the samples contained residual effect of pesticides greater than the allowable quantity; approximately 1 mg / kg causing health hazards to consumers (chewing qat), and morbidity of chronic diseases like cancer growths, birth defects, genetic behavioral changes and systemic disease (liver, spleen, kidney).

- The risks of pesticide residues on the leaves of qat on consumers.

- It overlaps with certain enzymes. A pilot study was conducted to test animals (mice) for evaluating the risks resulting from the abuse of qat alone or diluted with some residual pesticides on some biochemical-neuronal interactions. The results of the study showed a decline in activity of the enzyme Mono Amine Oxidizer (M.A.O) in the brain of male mice treated with qat extracts, and the so-called dimethoit pesticide (prohibitive). The results showed that the presence of residual pesticide in the qat extract caused strong reverse activity of Acetyl Colin (a nerve transmitter) in the heart of tested animals. The previous results gave an indication of the importance of the central nervous system (the brain) as a main objective of those compounds. In contrast, the influence of qat extract and the pesticide increased the activity of the enzyme Adenosine triphosphate (A.T.Pase) in the liver to support catalyze the liver enzyme as a reaction of the treated test animals to strengthen the ability of the liver to dispose of the remaining pesticide with the qat extract. The results showed that the combined impact of qat extract in the event of a residual endin pesticide contradicted moral discourage to activate MAO in the brain. The results also showed a decrease in the ability of qat extracts to stimulate the energy enzyme in the liver. Provided that the majority of pesticides used on qat trees dissolve in the system of the plant extract and are difficult to get rid of.

- In October 2003, there were a number of food poisonings. 154 citizens died in Hadhramaut Governorate in the following directorates:

    1. The Directorate of Ghail Bawazier: Poisoning serious wounded 92 people.

    2. The Directorate of Ghail bin Yumain: poisoning cases amounted to 41 people were rushed to hospitals.

3.5 Hazardous Waste

The many types and sources of hazardous waste in Yemen include the following:

- Industrial and petroleum activities: (industrial waste).
- Waste lubricants.
- Health-care facilities (hospitals and health units) Remnants of health.
- Remnants of damaged agricultural pesticides and insecticides.
- Expired batteries.
- Photography shops and labs
- Spoiled and expired foods.
- Animal waste.
- Pharmacies and drug stores (pharmaceutical residues)
- Domestic activities.
- Sewage and industrial sludge.

3.5.1 The Remnants of Industrial Activities

A) Based on a study conducted in 1990 and review of 46 hazardous waste treatment plant, the following notes were extracted:

A-1. The majority of hazardous waste resulted from the cement industry, the energy sector, oil refineries, textile industry and the plastics industry. The Aden refinery is considered the biggest producing source of hazardous waste.

A-2. The industrial hazardous waste includes:

- Waste oils and greases.
- Cyanide residues from polyurethanes producing factories.
- Remnants of acid and base (small quantities) of the laboratories attached to the small plant.
- Expired batteries.
- Liquid waste containing chromium, dyes, paints, tanneries, textile factories and food industries.

A-3. The quantity of hazardous waste is about 3500 tons / year, broken down as follows:

- 3000 tons / year from the large factories (10 plants).
- 2000 tons / year from medium factories (20 plants).
- 280 tons / year from the small plants (70 plants).

A-4. All the solid waste is dumped in landfills, while the liquid waste ends up in the sewage system.

Conclusion: It is clear from the survey conducted in 1990 that the average rates of hazardous industrial waste generated are as follows:

- 300 tons / year / big factory
- 100 tons / year / medium factory
- 4 tons / year / small factory

B) The first industrial survey of Yemen is conducted in 1996. It included the major industrial enterprises about 11% of the small enterprises and about 33% of medium-sized enterprises. However, this survey did not include any data on industrial waste.

C) A sample survey of the industrial installations in Yemen was pursued in 2002. It included 46 industrial establishments. The survey of data sheet included the sources and quantities of hazardous waste. However, in view of the inadequacy and limited data in the form, a conclusion was reached that the results are considered inaccurate and need to be reviewed and scrutinized. Table (3-2) summarizes the rates of waste generated from industrial installations (sample survey 2002).

Table (3-2): The rates of waste generated from industrial installations (sample survey 2002).

Type of industry	Rate of waste generated % of the quantity of production	
	Solid Industries	Consumed oils
1- plastic industries	10	1.15
2- Food industries :		0.1-0.3
Oils and ghee	0.36	
Juices and milk	0.87	
Potatoes	8.0	
Water	0.5	
3- Leather industries	28.0	0.53
4- Textile industries	x	0.37
5- Chemical industries	x	0.03
Overall average	5.39 With the exception of plastic industries	0.28

3.5.2 Waste Lubricants

A) A study conducted in 1990 indicated the following:

- The estimated annual consumption of lubricants is about 33 thousand tons. The industrial sector and the agricultural sector consume less than 15% of this quantity, while the rest represents the consumption of transportation and energy sectors.
- The quantity of waste oil annually is about 25 thousand tons.
- The majority of this quantity is produced by the transport and energy sectors.
- Only a very small percentage of waste oil is collected by the private sector which amounts to approximately 4400 tons per annum (approximately 17.6% of the total waste oil).
- A large proportion of this collected waste oil is recycled (3000 tons or 68%) as fuel in cement factories, brick kilns and other services.

B) The data report of the status of the environment in Yemen in 2000 indicated the following:

- The total quantity of lubricants and greases consumed in all governorates of the Republic of Yemen in 2000 is about 3545 tons.

C) Based on the results of the survey conducted in 2002 of some industrial activities, the average waste oils and fats generated is between 0.03 to 1.15% of the volume of industrial production with an overall average of 0.1%.

Accordingly, upon returning to the quantitative data of industrial production in 2000, the quantity of oil residues generated by certain industrial activities and the production of oil is estimated in 2000 to be around 40.000 tons.

3.5.3 The Remnants of Health Care

This waste is produced from all governmental health care facilities and non-governmental organizations, which include hospitals, public health centers, units of childhood and maternity care, clinics, labs and pharmacies.

Remnants of the health care waste contain wastes similar to municipal household (produced from the kitchen and administrative units), forensic pathological, infectious and contaminating waste, in addition to special radioactive and hazardous waste.

A) Based on the results of the survey conducted in 1990 in cooperation with the Dutch Government, including nine hospitals in the three provinces, comprising 1391 beds, the following can be noted:

- The total amount of solid waste (hazardous and non-hazardous) is 883 tons / year for an average of 1.74 kg / bed / day, which is disposed of without separation and treatment. The quantity of chemical liquid residues resulting from the laboratories attached to the hospitals, blood banks and X-ray sections amount to about 13 tons / year (i.e., at the rate of approximately 25.6 gm / bed / day). These residues contain highly toxic liquid materials, such as compounds of cyanide, chromium, phenol and mercury. The disposal of this liquid waste is in the sewers.

- The quantity of stocks of medicines and expired medicines is less than 10 tons.

B) Based on the results of the study conducted in 1996, which included 32 hospitals, clinics and health centers in 11 provinces, the following is noted:

- Total number of beds is 5466
- The total quantity of solid hazardous and non-hazardous waste is 6069 kg / day. (An average of 1.11 kg / bed / day).
- The quantity of waste resulting from the kitchen and administrative units is about 960 kg / day.

- The total quantity of hazardous waste generated by sections of the examination and treatment of patients is about 5105 kg / day with an average of 0.93 Kg / bed / day.
- The total quantity of liquid waste is 12.25 cubic meters / day (an average of about 224 gm / bed / day as considering the average density to be 1 g / cm 3).

C) The results of the study conducted on 49 health establishments in 2002 showed the following:

- The rate of solid waste generation ranges between 0.3 and 2.1 kg / bed / day.
- The overall average is 0.79 kg / bed / day.
- The rate of hazardous waste generated ranges between 0.1-1.9 kg / bed / day, with an overall average of 0.59 kg / bed / day.
- Taiz Governorate is the highest generating governorate of hazardous health waste, while Sana'a represented the lowest governorate in the study.

D) The majority of solid waste is disposed of (mixed) by dumping in landfills, while there are incinerators in some hospitals; mostly out of order.

3.5.4 Agricultural Pesticide Residues

The report prepared by USAID in 1987 refers to the following:

- The solid pesticides stock is estimated to be about 53 tons.
- The liquid pesticide stocks are estimated to be about 103 tons.
- The quantity of pesticide residues in 1990 is approximately 150 tons.
- The quantity of expired pesticides in 1996 is approximately 262 tons. It has been exported to Britain in coordination with the Ministry of Agriculture, in accordance with rules of the Basel Convention.
- Another quantity of obsolete pesticides was exported in 2001 and is estimated at about 300 tons.

3.5.5 Consumed Batteries (car batteries)

No statement on the quantity of worn batteries is available in Yemen, and therefore it would be approximated as follows:

- The total number of vehicles in Yemen (the 2000annual census) is 853419 including private cars, taxis and commercial trucks.
- Assuming car battery change every three years, the number of batteries consumed is estimated to be 284473 in 2000.

3.5.6 The Remnants of Photography Labs

- Based on the study conducted in 1990, the estimated average consumption of the chemicals in photography plant is about 4000 liters / year. These chemicals contain dangerous substances such as silver compounds. These chemicals are disposed of after use in sewerage systems.

- Based on the year 2000 census, the total number of photography labs in Yemen is 157 and the number of photography studios is 830 (987 total).

- Using the same rate of 1960 the quantity of chemicals used in photography can be estimated for the year 2000 to be about 3948 cubic meters / year.

3.5.7 Damaged Foods

Statistical data of 2000 indicates that the quantity of food unfit for human use and had been destroyed in 2000 in Yemen to be approximately 4678.27 tons.

3.5.8 Animal Residues

Animal waste is that generated by the slaughter of livestock for meat production. From this process are produced degradable and dangerous remnants.

In the absence of a statement of the quantity of such waste we will be using the global rates of the World Health Organization in1993:

- 35 kg organic remnants per cattle.
- 3 kg per head of livestock is dangerous waste.

According to census data of 2000, the total amount of livestock is estimated at the top of 10585000; hence the quantity of hazardous animal waste in 2000 is estimated to be 31755 tons.

3.5.9 Pharmaceutical Residues

- Based on a study of 1990, the average amount of expired pharmaceutical waste is about 70 kg / year / pharmacy.
- Based on the year 2000 census, the total number of pharmacies and drug stores in Yemen is 2155.
- Using indicators of 1990, the estimated total pharmaceutical residues from pharmacies and drug stores in 2000 would be about 150 metric tons / year (this figure does not include hospital pharmacies and existing health units).

3.5.10 Home-based Activities Residues (garbage)

Residues resulting from the domestic activities may contain remnants that can be considered hazardous waste. These wastes include, used syringes, expired medicines, empty containers and leftovers of pesticides and chemicals, used batteries.

There are no data on the quantity of hazardous waste, but they can be estimated as follows:

- The quantity of solid waste (garbage) in 2000 is estimated at 1.2666.084 tons provincial centers.
- Proportion of hazardous waste to some developing countries is estimated to be 0.1-1.3%.

3.5.11 Sewage and Industrial Sludge

In the absence of an adequate system for disposal of hazardous liquid waste resulting from industrial facilities, health, laboratories, etc.; thus are disbursed to the sewage system, the sludge resulting from sewage treatment fluids are hazardous waste.

Quantities of hazardous waste of the Republic of Yemen in 2000 are estimated as follows:

1) First: In the light of what has been introduced:

   According to the global estimates indicated by the study conducted in Yemen in 1990, with the support of the Dutch government, since Yemen is a developing state.

   Total GDP in 2000 is 1379812 billion Yemeni riyals, which is equivalent to 8116 billion US dollars (US dollar is about 170 Yemeni riyals).

   - The quantity of hazardous waste is about 8116000 tons.
   - Calculated at the rate of 1000 tons / $ billion of GDP.

2) Using the rates that have been learned from the previous studies carried out in Yemen in 1990, 1996, 2002, the quantities of certain types of hazardous waste can be estimated as follows:

3.5.11.1 Hazardous Industrial Wastes

- The number of large industrial establishments is 383; they would produce 114900 tons / year (as 300 tons / business).
- The number of medium-sized industries is 1304 would produce 130400 tons / year (100 tons per enterprise).
- The number of small Industries (number 32285) would produce 129140 tons / year (as 4 tons enterprise).

Accordingly, the estimated quantity of hazardous industrial waste is 374,440 tons / year (excluding crude oil and gas installations).

3.5.11.2 Health Care Residues

These are the residues resulting from the governmental installations only because of the lack of systems to separate hazardous from non-hazardous waste.

- Solid waste (0.8 kg / bed / day) is approximately 3000 tons / year.

- Liquid waste 100 tons / year.
- Medicine stock about 69 tons / year.
- Lubrication oils waste around 40.000 tons / year.
- Damaged food 4678.27 tons / year.
- Remnants of photographic labs: 3948 cubic meters / year.
- Pharmaceutical residues: 150 tons / year.
- Household garbage in provincial centers 16000 tons / year.
- Consumed batteries are estimated at about 284473.
- The estimated total hazardous waste in 2000 is 324925 tons in addition to the consumed batteries.
- These estimates do not include petroleum industries, non-governmental hazardous waste health care remnants, garbage in rural areas, industrial sewage residues and non-industrial and health establishments.
- The rates used are approximate and need to be reviewed and scrutinized.

3.5.11.3 WHO Transactions

Using transactions issued by the World Health Organization, WHO, in 1993, the following estimates will be found (taking into account the lack of recent transactions, their limitation and did not include all sources of hazardous waste):

3.5.11.3.1 Hazardous Industrial Residues

Extractive industries

- Gypsum 500 kg / ton x 43000 = 21500 tons / year.
- Stone 100 kg / ton x 2516000 = 251600 tons / year.
- Salt 3 kg / ton x 154000 = 462 tons / year.
- Others (average) 100 kg / ton x 819000 = 81900 tons / year (These residues are of weakly hazardous and a large proportion of them can be recycled).
- Textile industries amount to 95 kg / ton (estimated 100 tons / year).
- The total hazardous waste from the sources mentioned above is estimated to be 360 thousand tons in 2000.

3.5.11.3.2 Remnants of the Governmental Health Care

The quantity of hazardous waste from the governmental health care units in 2000 is around 3200 tons / year. (This figure is close to the figure obtained by using the rates of waste generation in accordance with the analysis of samples of study in 2002).

3.5.11.3.3 Animal Residues

The animal residues are estimated at about 31755 tons, based on the rate of generation of 3 kg / head of cattle.

3.5.11.3.4 Power Stations Residues

The estimated residue is about 32890 tons, based on a rate of 10 kg per million Watt.

In the absence of a modern data collection of all kinds of hazardous waste in Yemen, and due to the importance of the presence of indicative guideline numbers for the purpose of helping in the proper planning of integrated management of residues, a table have been compiled to show the estimates of the quantities of hazardous waste generated from various sources in 2000. The following table (3-3) shows estimates of the quantities of hazardous waste in 2000.

Table (3-3): The hazardous waste quantity estimates from various sources in 2000.

Ser. No.	Kind of waste	Quantity tons / year	Observations
1	**Hazardous industrial waste**	257080	Does not include installations of crude oil and gas
2	**Health care remnants:**		These do not include non-governmental installations
	1 Solid	3000	
	2 Liquid	100	
3	**Stocks of medicines**	69	from pharmacies and drug stores
4	**Waste lubricants**	40000	can be recycled and used
5	**Damaged food**	4678.27	
6	**Pharmaceutical residues**	150	pharmacies and drug stores
7	**Remnants of photography labs**	3948	almost as cubic meter = 1 ton
8	**Hazardous waste in garbage**	16000	in provincial centers only
9	**Remnants of massacres (slaughter houses)**	31755	The world rates are 3 kg / head of cattle.
10	**Power stations**	32890	the world rates are 10 kg / million Watt *
11	**Consumed batteries**	284473	
	Total	**395670 tons / year + 284473 car batteries**	

* The rates listed by the World Health Organization 1993.

In spite of the inaccuracy and limitations of data, this table is useful in the following:

I. The quantities of hazardous industrial waste is the biggest, hence should be given the priority in handling.

II. Waste oil comes is the second priority (in terms of quantity); it needs an integrated program for recycling and reuse.

III. Health care residue is a high priority in spite of the small quantity, since it is too dangerous.

All of these estimates need to be reviewed and scrutinized in addition to the lack of coverage of other types of waste, such as industrial waste, other non-industrial installations and sewerage.

Notes:

- The quantities of hazardous industrial waste is the biggest, hence should be given the priority in handling.
- Waste lubrication oil comes in the second priority in terms of quantity; it needs an integrated program for recycling and reuse.
- Health care residue is a high priority in spite of the small quantity, since it is too dangerous.

3.6 Ways of Dealing with Hazardous Waste

3.6.1 From Industrial Residues

Yemen is not a major industrial country and there are no heavy industries. The simple industries in Yemen are concentrated largely in the food industry (which represent about 40% of the total value of production), followed by metallurgical, engineering and textile industries followed by construction industries. However, with increasing environmental awareness and understanding of health and environmental risk resulting from these residues (especially since most of the existing industries have been established without taking into account the environmental dimensions and the proper choice of location), increased attention to the importance of the need to develop and implement tight controls and security of dealing with these wastes. Dealing with wastes is as follows:

Industrial waste is collected inside the plant and transported to open landfills or municipal landfills where they were disposed of. Some industrial waste is incinerated in special incinerators or in open pits.

Statistical data for 2000 showed the existence of 14 formal landfills in the provinces of Yemen:

- A common landfill to serve Aden and Lahj provinces.
- A common landfill to serve the Capital and Sana'a provinces.
- There is no formal landfills in each of Hajjah, Al-Jouf and Al-Dhalea
- The sample survey data conducted in 2002 showed the existence of 46 industrial establishments following methods in the recycling and the use of certain industrial wastes in general:

3.6.1.1 Reuse of Waste Plastic Inside Companies

- Some compressed residues, such as tin and plastic bags are sold to contractors for re-use, transferred to the government landfills or exported abroad.

- The use of certain industrial wastes in other industrial activities uses, thus salt waste from some industries is used in leather and footwear industries. This indicates a positive trend towards the intellectual processes and re-use of industrial waste.

3.6.1.2 Recycling of Plastic Waste

A- Manufacturing Operations Residues (before processing)

- Raw plastics are imported from abroad.
- The recycling of the manufacturing processes residues is done in the benefits of production. The defective products or non-compliant with specifications are processed by the appropriate machines such as crushing, pelleting or grinding machines to be suitable for recycling.
- The recycled plastics are mixed in specific proportions with the virgin raw materials.

B- Used Plastic Materials

The Ha-el Saeed Anam National Company and Associates at Taiz, established facilities for collecting waste plastic from several cities to be moved to the headquarters of the company for plastic recycling in the appropriate ways depending on the type of plastic.

The recycled plastic materials are used in the manufacture of certain products (non-food purposes), such as sewage and electrical connections pipes.

3.6.1.3 Recycling of Waste Metal

- Manufacturing processes residues: Remnants of manufacturing processes for metal packagings are gathered (made of imported metal sheets) compressed then re-exported.

- Used metal residues are re-manufactured in small foundries.

3.6.1.4 Recycling of Liquid Waste

The liquid hazardous waste from factories is dealt with in the following context:

- The industrial waste water is disposed of in sewage; in a few cases it is subjected to treatment before the discharge. However, no data is available on the type of treatments. A unit was established to deal with the liquid residues in an industrial establishment.

- Consumed oils are often sold to other plants for the company's benefit.

- A fraction is collected of the waste lubricants produced in large quantities in the transport and communications sector together with the industrial and agricultural sectors. The estimated amount of waste lubricants is at least 25 thousand tons per annum. The private sector is recovering a fraction of this waste oil to the extent of about 3 tons per year while the remaining quantity is disposed of in the soil.

3.6.2 Hazardous Medical Waste

- The majority of medical waste is dangerous: needles, injections, chemicals, dangerous expired drugs, and others, gathered without screening, dumped in containers in the municipal waste and then transferred to municipal landfills by private companies.

- Some hospitals have incinerators, but no longer work because of the lack of specialist cadres, spare parts and fuel.

- Some hospitals burn their waste in open pits, either inside or outside the hospital.

- Modern data (2002) through a survey conducted by the Environmental Protection Authority in Yemen stated that the number of hospitals and health units which the study covered is 49 health establishments.

- A number of health facilities that have installed incinerators:

    1. 1 incinerator is in good shape.
    2. 3 incinerators out of order.
    3. 1 kerosene heated incinerator at 50% efficiency only at the Tuberculosis Combat Center.

The following can be concluded from the aforementioned:

1- Hazardous medical waste is a big problem in Yemen, where there is no separate special system of operations including sorting, separation at source, collection, transport and treatment by ashing and incineration (or any other accredited way) followed by the final disposal of processed products.

2 - Lack of professional cadres with specialized knowledge and expertise to deal safely with these residues.

3 - There is a lack of public awareness of the seriousness and effect of this waste when disposed of with other municipal wastes. All transferred waste is mixed with the hazardous waste.

Table (3-4) summarizes the quantity of solid waste rates (garbage) 2000 to 2002.

Notes:

- Quantity of solid waste: It is clear that the quantity of solid waste in all governorates (20) in 2000 is estimated to be 1,266,084 tons, while the total amount of solid waste in the same districts 2002 is estimated to be 1,286,261 tons. There is an increase of 19653 tons, provided that there is a lack of data on solid waste in some provinces in 2000 (Al-Beidha, Al-Jouf and Al-Mahweet).

- The table shows that the capital was ranked first, followed by Aden then governorate of Taiz, Hadhramaut governorate ranked fourth, Hodaida Governorate was the fifth, Amran province occupied the seventh position, just

after Sana'a. Al-Dhalea province was the last. The three last provinces were the newly established provinces in latter administrative division.

Table (3-4): The quantity of solid waste rates (garbage) 2000 to 2002.

Province	2000 quantity Tons / year	2002 quantity tons / year	Arrangement by quantity
The Capital		453600	1
Sana'a		65000	6
Amran	58573	50400	7
Aden	240888	250000	2
Taiz	144000	105000	3
Hodaida	67202	81518	5
Lahj	9000	10200	14
Ibb	5400	6500	15
Abyan	9816	11000	13
Dhamar	15261	17300	12
Shabwa	5490	6050	16
Hajjah	25550	21310	10
Al-Beidha	not available	25000	9
Hadramaut	96792	98500	4
Sa'dah	20144	20000	11
Almahweet	not available	6043	17
Al-Mahrah	3744	4850	18
Marib	28080	28000	8
Al-Jouf	not available	2500	19
Al-Dhalea	144	1500	20
Total estimated	1266084.4	1,286,261	

Sources:

1. Annual Book of Statistics 2000, the Republic of Yemen, the Ministry of Planning and Development, Central Bureau of Statistics, Sana'a, June, 2001.

2. The Ministry of Public Works and Roads, June, 2003.

Table (3-5) shows the nature of the problem, its causes and the type of chemical contaminants as divided according to provinces.

Table (3-5): The nature of the problem, its causes and the type of chemical contaminants, according to provinces.

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
Air pollution	**The Capital**	- Indiscriminate proliferation of factories before the neighborhoods because of the lack of identifying industrial zone. - Asphalt factories resulting in increased pollution by the total suspended materials in addition to pollutants resulting from the asphalt heating and release of contaminating gases and residues. - Burning obsolete tires (especially in religious occasions and holidays). - Proliferation of quarries and stone cutting quarries resulting in heavy dust pollution. - Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - More than 15 quarries in the surrounding mountains - Red brick factories - Waste water treatment units - Tanneries and leather factories - Bricks production - The number of factories is 4951	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Aden	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - Electric power plants - Aden oil refinery - The number of other factories in 799.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Taiz	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - A cement plant at Al-barh - Power plants - The number of different factories is 2592.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Hodaida	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy	- H_2S - NOx

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
		black smoke - Burning waste. - A cement plant - Power plants - The number of other factories in 1969.	- CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Lahj	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories in 1466.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Al-Dhalea	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories is 355.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Sana'a	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning obsolete tires (especially in religious occasions and holidays). - The number of factories in 2838.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Marib	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories in 352.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Hadramawt	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - The number of factories in 2546.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Al-Mahrah	- Vehicles using diesel fuel spread	- H_2S

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
		dramatically, oil and heavy black smoke blown - Burning waste. - The number of factories is 125.	- NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons. .
	Sa'dah	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories is 1272.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons. .
	Almakha	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - Power plants	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons. -Diesel - Fuel oil
	Shabwa	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories is 1178.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Abyan	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories is 756	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Hajjah	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - Burning obsolete tires (especially in religious occasions and holidays). - The number of factories is 1256	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
			- Suspended particles - Hydrocarbons.
	Al-Mahweet	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - Burning obsolete tires (especially in religious occasions and holidays). - The number of factories is 511	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Amran	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - Burning obsolete tires (especially in religious occasions and holidays). - A cement plant.	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
	Ibb	- Vehicles using diesel fuel spread dramatically, blowing oil and heavy black smoke - Burning waste. - The number of factories is 3649	- H_2S - NOx - CO - CO_2 - Dust - Organic acids - Aldehydes - Suspended particles - Hydrocarbons.
Contamination of sources of drinking water wells	**The Capital**	Al-Rowdhah area, near the sewage treatment ponds, suffers from mixing of waste water with industrial sewage and drinking water Six samples were collected from the different wells and subjected to chemical and bacteriological analysis and found that only one sample is uncontaminated. The fluoride in one sample hit 1.82 mg / liter, while the maximum allowable is 1.5 mg / liter, as well as nitrate amounted to 56 mg / liter, while the maximum permissible is 50 mg / liter. For sample (3), the calcium carbonate is 268 mg / liter and in sample (4) 204 mg / liter, in sample (6) it is 288 mg / liter, while the upper limit allowed is 200 mg \ liter. The ion balance in the six samples is as follows: sample (1), 11.37%; sample (2), 16.11%; sample (3), 19.77%; sample (4), 14.57%; sample (5), 6.72%; sample (6), 6.42%; while the upper limit allowed is 5%	- Contamination of groundwater: - nitrate - phosphate - fluoride - nitrite - calcium - carbonate.

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
	Taiz	7 samples were collected from different wells for chemical and bacteriological analysis showed that only one sample is uncontaminated	- fluorides - calcium - magnesium - carbonate - chlorine
	Hadramaut	Restoring waste water	Waste water resulting from the water associated with oil production
	Amran	Seven samples were collected from different wells for chemical and bacteriological analysis and found that only one sample is uncontaminated	- fluorides - calcium - magnesium - carbonate - chlorine
	Sa'dah	Mixing sewage and industrial waste with drinking water	
	Hajjah	Mixing sewage and industrial waste with drinking water	
	Almahoet	Mixing sewage and industrial waste with drinking water	
	Yareem	Seven samples were collected from different wells for chemical and bacteriological analysis and found that only one sample is uncontaminated	- fluorides - calcium - magnesium - carbonate - chlorine
Marine Pollution	**Al-Makha**	- Waste water discharge - Oil of engines of fishing boats - Painting fishing boats - Dumping of solid waste	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics
	Mukalla	- Waste water discharge - Oil of engines of fishing boats - Painting fishing boats - Dumping of solid waste - Over oil pollution resulting from the leakage from Limburg French oil tanker	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics
	Shabwa	- Over oil pollution resulting from the leakage from Limburg French oil tanker - Waste water discharge	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics
	Aden	- Waste water discharge - Oil of engines of fishing boats - Painting fishing boats - Dumping of solid waste - Waste oil resulting from the electro-thermal power station - Oil waste from unloaded ships	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
	Abyan	- Waste water discharge - Oil of engines of fishing boats - Painting fishing boats - Dumping of solid waste	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics
	Hodaida	- Waste water discharge - Oil of engines of fishing boats - Painting fishing boats - Dumping of solid waste	- lubricating oils - paint - metallic materials - hydrocarbons - heavy elements - plastics
Chemical Poisoning	**Bani Hushaish**	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Almajhel	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Bait Al-Shatabi	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Bani Al-Harith	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Hamedan	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Haddain	same sample	Chemical poisoning with different pesticides

Nature of problem	The city / region	Cause of the problem	Chemical contaminants
			containing 51% of the organic phosphorus pesticide during spraying different groups
	Ramiat Hamid	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Sana'a	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
	Aden	same sample	Chemical poisoning with different pesticides containing 51% of the organic phosphorus pesticide during spraying different groups
Soil Pollution	**Hodaida**	Part of the Sordod farm	Buried obsolete pesticides

3.6.2.1 Analysis

There are different types of chemical residues; however most of the waste is produced from refineries of Aden and Marib. The waste also includes the lubricating oil used in vehicles and power generation as well as the industrial residues such as ghee and soap industries and the manufacture of cement, plastics, batteries and liquid foods.

3.6.3 Liquid Chemicals Residues

These include alkaline hydroxides, acids, organic solvents, oil distillates and oil paintings residues. The waste are generated from the activity of refineries and chemical laboratories, oil waste from vehicles and machinery, pumps, power production factories and mixing paints.

The data indicate that the residues from waste mineral oils for vehicles, machinery and power pumps is about 25000 tons, dumped mostly on the sides of roads between cities and near the farms (wells water lifting pumps), causing soil contamination.

3.6.4 Waste Water

These include remnants of chemical pollutants resulting from the activity of the laboratories, facilities and chemical plants and lubrication and greasing from car washing, where the products of this activity end up in the output of waste water. This is in addition to the activity of non-ferrous industries, such as batteries, paints, industrial manufacturing of ghee, soap, foods and other activities.

According to the information available, it is not easy for the Water and Sanitation Authority to give explanatory data on the nature of chemical residues contained in waste water and their present proportion. This applies to The Capital, Aden and Marib cities and facilities that have a better capacity to deal with waste water.

Table (3-6) shows additional information and analysis of specific problems including the prioritization of provincial interest.

Table (3-6): Additional information and analysis of specific problems including the prioritization of provincial interest.

Nature of problem	Measurement of problem / harm	Level of interest	Ability to control the problem	Statistical information available	Type of chemical confined	Priority ranking
Air Pollution	National	Average	Low	Tables annexed	Annex tables	1
Contamination of water supplies	Locally	Average	Average			
Marine pollution	National	Average	Weak			4
Contamination of groundwater	National	Weak	Average	Mixing industrial waste and sewage with drinking water	- nitrates -phosphate	2
Soil	Local	Good	Good		All sorts of obsolete control	5

Nature of problem	Measurement of problem / harm	Level of interest	Ability to control the problem	Statistical information available	Type of chemical confined	Priority ranking
					pesticides buried	
Food chemical waste	National	Average	Weak			3
Contamination of drinking water	National	Good	Average	Mixing industrial waste and sewage with drinking water		1
Hazardous waste treatment / disposal	National	Weak	Weak	Dumped in landfills		1
Occupational Health: agricultural	Local	Weak	Weak			
Occupational Health: Industrial	Local	Good	Good			
Public Health						
Chemical Accidents: industrial				Fire at Rothmans cigarette plant in Taiz in 2000		
Import unknown chemicals						
Storage / disposal of neglected chemicals	Local	Weak	Weak	99 different chemicals kept in the customs at Sana'a International Airport in 2002 by the General Authority Environmental Protection team	- Dyes – Glue – Paint - Pesticides - Toner - various other chemicals	7
Chemical poisoning / suicides	National	Weak	weak	Killed 10 people in Hajjah	Drank methanol	2
	National	Weak	Weak	Aden	Chemical	

Nature of problem	Measurement of problem / harm	Level of interest	Ability to control the problem	Statistical information available	Type of chemical confined	Priority ranking
	National	Weak	Weak	Almajhel	poisoning by different pesticides Chemical poisoning by different pesticides	
	National	weak	weak	Bait Al-Shatabi	Chemical poisoning by different pesticides	
	National	Weak	Weak	Bani Hushaish	Chemical poisoning by different pesticides	
	National	Weak	Weak	Bani Al-Harith	Chemical poisoning by different pesticides	
	National	Weak	Weak	Hamedan	Chemical poisoning by different pesticides	
	National	Weak	Weak	Haddain	Chemical poisoning by different pesticides	
	National	Weak	Weak	Ramiat Hamid	Chemical poisoning by different pesticides	
	National	Weak	Weak	Sana'a	Chemical poisoning by different pesticides	
POPs	National	Good	Good			

3.7 Analysis

Data available on air pollution in the provinces and cities in the Republic are insufficient and reflect national concerns, but dealing with some local areas or cities as explained below:

3.7.1 Air Pollution

- Level or inspired concern: substantially higher proportion of dust in the air and the high proportion of the presence of remnants of the exhausts of motor vehicles, particularly diesel vehicles, and the proliferation of quarries, stone crackers and stone saws.

- Ability to control is low for a number of reasons; most notably, I belief, is the weak financial funding and legal discipline mechanism. With regard to gasoline cars exhaust purification and introducing unleaded gasoline fuel, large finance is needed by refineries to modernize and develop their technologies.

- In case of exhausts of diesel cars, it is needed to vitalize the decisions taken to prevent the entry of diesel cars other than for transport (shipping) and the prevention of diversion (change) of gasoline engines to diesel; this in turn would require dealing with the price of fuel, which is linked to many factors, to be discussed elsewhere.

- Regarding dust (dust quarries), the proposals available to address the problem is that dust rising from the heavy equipment of the stone crushers passes in a water medium, filters or dry filters. The owners of the quarries considered that raising the cost (high production cost).

- Transfer of these quarries to areas far from the public is a proposal that also needs finance strong legal and procedural acts from the relevant actors, in particular the Capital.

- Activation of the current laws and decisions on the environment, mining, quarrying, and other relevant issues by the competent authorities concerned should be more than what is going on now.

3.7.2 Hazardous Waste

Level of concern is high because of concern or weakness of the procedures in dealing with it. It is one of the most important determinants of the problems faced by the integrated management of hazardous waste in Yemen. This can be defined as follows:

1 - Lack of complete data on the quantities and characteristics of hazardous waste generated from different sources.

2 - Mixing hazardous waste with other waste in the absence of independent systems each of which leads to the aggravation of the problem and increase the likelihood of contamination of sites to dispose of these wastes (landfill).

3 - Lack of adequate basic infrastructure, functional units of proper handling and disposal facilities and ultimate security of all hazardous waste together with coefficient tests and systems for monitoring and measurement.

4 - Lack of specialized technical cadres to deal with different sources of hazardous waste and the absence of training and education in this regard.

5 - The lack of detailed studies on the establishment-level to determine the volume of pollution and its effects.

6 - Inadequate recycling and reuse units of reusable residues.

7 - High investments required for the establishment and operation of equipment and machinery to deal with industrial waste per unit of production.

8 - Lack of awareness on the waste and methods of dealing with it securely at all levels.

9 - Inadequate awareness and knowledge of the Basel Convention and ways to take advantage of them.

10 - Absence of certain legal materials in the Environmental Law No. 26 for 1995 and its executive statute and the importance of updating.

3.8 Recommendations

1. The previous experience and the experiences of other states proved that the establishment of a sustainable system must be based on clear and declared national policies. The basic principles are the foundation of action at the national level that translate the legislative framework governing the assets of binding practices, association relationships, ways of control and accounting and supports the implementation of activities. All that is governed by aspects of technical, institutional and regulatory capacities of human achievements to work effectively and efficiently, capable of conscious participation and execution, in addition to sufficient funding to cover the various aspects of the expenditure required.

2. The creation of an integrated system of safe management of hazardous waste of all kinds and from all sources including Yemen systems of collection, transportation, treatment and final disposal and reducing the quantities of dangerous waste at the source, in an appropriate legislative, regulatory, institutional, technical, social and economic disadvantage framework.

3. Development of appropriate mechanisms to implement the Basel Convention and to promote the use of management objectives for safe hazardous waste in Yemen and protect the country from the illegal entry of dangerous residues.

4. Supporting and enhancing national capacities for the provision of national experience in the assessment and management of hazardous waste and the application of the Basel Convention.

5. Raising public awareness at all levels on issues of hazardous waste.

6. Raising awareness among individuals and stakeholders at all levels of the Basel Convention and related conventions such as the Rotterdam Convention and the Stockholm Convention.

7. Provide regulatory frameworks of technical, economic, legal and financial management of the safe residue and application of the Basel Convention, in accordance with the national strategy for integrated management of hazardous waste that has already been prepared and discussed at July 2003.

8. Establishment of a database and information system for hazardous waste materials.

9. The application of a decentralized management system based on the integrated curriculum.

10. Strengthen the participation of the private sector, NGOs and the local community, as well as producers of hazardous waste.

11. Taking into account the strategic coordination with the activities of the Basel Convention until 2010, and coordination with the United Nations Program for West Asia, Regional Center for the Arab States of the Basel Convention, headquartered in the Arab Republic of Egypt and coordination with international bodies to prevent the illicit traffic in hazardous wastes with the strengthening of national capacities.

12. To promote the use of cleaner production technology and reduce the quantities of waste and the degree of risk to a minimum.

13. Legislation and national laws, the most important is the environmental law No. 26 of 1995.

14. International conventions and treaties, notably the Basel Convention on the movement of hazardous waste across the border.

15. To ensure the establishment of sustainable integrated management of hazardous waste is essential to build basic infrastructure building blocks to be offered in consistency and compatibility among the goals of the target system.

16. Components or pillars represented in the appropriate technical infrastructure to deal with the produced quantities of hazardous waste as well as quantities accumulated and stored.

17. Institutional organizational structural components or pillars containing appropriate structures capable of doing their roles should be suggested with a clear definition of roles and responsibilities without overlapping powers and responsibilities, with the availability of adequate manpower and information system and database support.

18. Components or pillars of suitable economic systems should be suggested for funding and cost recovery in the light of current economic and social conditions.

19. Social elements should be represented in the participation of all civil society, with the civil government, in raising awareness and improving the behavior of dealing with materials and waste management.

20. Circulating the system of decentralization and support the role of the local authority in waste management and updating of funds for cleaning in all districts of the Republic.

21. Establish an information network on all pollutants.

22. Audit standards and specifications for the air pollution, soil pollution, water pollution, marine pollution, environment, noise…etc.

23. Application of the principle that the polluter should pay.

24. Activation of the role of oversight and environmental monitoring on all projects.

25. Appropriate adjustments of Law No. (26) for 1995, the executive statute (No. 14) for 2000, for a consistent and sustainable development.

26. Activation procedures for the environmental assessment of all projects and activities of government and private sectors on the basis of the text contained in the Act (No. 26) of 1995 and the executive statute (No. 148) for 2000.

27. Acceleration of the establishment of a fund to protect the environment.

28. Encourage recycling procedures.

Chapter

4

LEGAL TOOLS OF CHEMICALS MANAGEMENT

4 Legal Tools of Chemicals Management

There are many existing legislation that deal with the control and management of chemicals. However, they are scattered in several laws and there is a lack of coordination between stakeholders. Therefore, a mechanism must be found for coordination between these bodies in order to activate these laws and legislations and bring them into practical implementation.

4.1 Laws Concerning the Management of Chemicals

Table No. 4-1 summarizes a list of the laws and stakeholders responsible for applying the provisions of those laws and the type of chemical concerning each of them. This table contains the individual laws of articles and legal texts relating to the departments of chemical items of the relevant bodies.

It can be recalled here that the Yemeni legislations focused on the preservation of the environment from the risks of chemicals. It is a proof that the amended Yemeni Constitution, which is the highest echelons of the legislation, has given the environment special texts. It is a characteristic of Yemeni legislation compared to other States.

4.2 A Brief Description of the Legislative Instruments Relating to Chemicals

The legislative framework for the management of chemical residues in the Republic of Yemen includes:

- The national legislations.
- The international treaties and conventions signed by the Yemeni government.

4.2.1 The National Legislations

The national legislations include the following:

- The National Constitution of the Republic
- Act No. 26 of 1995 on environmental protection
- The executive regulation No. 148 of 2000 for water law

- Act No. 32 of 1992 on the conduct of the health professions
- The Maritime Law No. 15 of 1994 on maritime transport
- Act No. 25 of 1999 on the regulation of plant pesticides
- The executive regulation of the circulation of pesticides
- Act No. 37 of 1997 on the customs tariff
- Act No. 5 of 1995 as amended by Act No. 25 of 1997 on the control and inspection of industrial facilities and services.
- Act No. 42 of 1991 on the regulation of fishing and exploitation of marine biology
- Act No. 50 of 1991 on the mines and quarries
- Act No. 4 of 1993 on the free zones
- Act No. 12 of 1994 concerning crimes and punishments
- Act No. 1 of 1992 on foreign trade as amended by Law No. 16 of 1996
- Act No. 38 of 1992 on the control and regulation of food circulation
- Act No. 33 of 2003 on road transport
- Act No. 24 of 1990 as amended by Act No. 35 of 1997 on supply
- Act No. 3 of 1993 on combating trafficking and illicit use of narcotic drugs and psychotropic substances
- Act No. 39 of 1999 on the law of hygiene
- Act No. 20 of 1999 on the establishment of cleanliness funds and improving the shape of cities
- Act No. 33 Year 2002 on water.

4.2.1.1 The Basic National Legislative Tools Concerning Chemicals

1) The Constitution of the Republic of Yemen Amended Articles (No. 32 and 35) considered the preservation of the safety and health of the environment and making it safe is the responsibility of the State and society since what affects the environment is a threat to everyone.

2) Environmental Protection Act No. 26 of 1995 and its implementing regulations covers almost all the elements required for the management of chemicals. The executive regulations contained a list of the hazardous wastes in light of the law: materials (No. 3, 10, 19, 44, 56, 62, 63 and 65).

3) Law of the offences and penalties No. 12 of 1994 considered dealing with the chemicals illegally an offence punishable by law (Article No. 140) and entrusted the implementation to the Attorney General through the provision of public prosecutions.

4) Act No. 5 of 1995 as amended by Act No. 25 of 1997, articles (No. 113, 114, 115, 116, 117 and 118) gave the right to the Ministry of Labor, Inspection Department, to conduct surveillance and inspection of industrial and service installations where workers exist, to ensure the installations commitment to occupational health and safety and to ensure that the workers are safe from injury with hazardous materials.

5) Health Professions Practitioner Act, articles No. 32 of 1992, singled out in the articles (No. 12, 16 and 17) restrictions and special requirements for practitioners of health and the prohibition of the sale of any expired medicines or preparations and entrusted the responsibility of implementation to the Ministry of Public Health.

6) Shipping Act No. 15 of 1994 singled out in the articles (No. 224 / 2, 226 / 2, 228 / 1 and 425) the prevention of the shipment of prohibited goods unless permitted circulation in the framework of the laws in force in the Republic of Yemen. The law did not require chemicals only, even allowed goods as long as they are contaminated and gave examples such as cars, and entrusted the implementation to the Ministry of Transport.

7) Act No. 37 of the customs tariff of 1997 to be applied by the Ministry of Finance, Customs Department. In chapters twenty-ninth, thirty-first and thirty: inventory of chemicals permitted circulation in the Republic of Yemen in the light of the laws governing the importation.

8) Act No. 42 of 1991 on the regulation of fishing and the exploitation and protection of aquatic life. Materials (22 and 23) have touched the prevention of the use of offshore as dumping grounds for residues of toxins and chemicals in order to preserve the integrity of the marine environment, and entrusted the implementation to the Ministry of Fisheries.

9) Act No. 50 of 1990 on the mines and quarries. The Yemeni legislator was keen to find constraints of the disclosure and prospecting, as well as investors or exploiters of quarries raw materials. Among such restrictions that they must obtain a permit and prior approval from the competent authority for those who want to work in mines or quarries, as well as contracting with the competent authority. The conditions included in articles (50, 52 and 53) to empower staff of the commissioners in writing of the right of inspection and monitoring to ensure application of regulations of occupational health and safety and other means of surveillance, other investigative processes, the places of detection and the search for minerals and quarry raw materials.

10) Act No. 24 of 1993 on the free zones with the privileges and guarantees granted to the goods imported to the free zone and to all projects operating in the free zone.

However, the health and safety of human beings is the fulcrum of development as well as to preserve the integrity of the environment and the protection of society from polluting substances, banned chemicals and damaged goods. Therefore, articles (No. 9 and 10) stressed, as well as Article No. (27) of the Act, the prevention of the importation and circulation of damaged, stench and corrupt goods and waste materials harmful to the environment and not suitable to human and livestock consumption, as well as any actions or activities in contrary to the instructions on the protection of the environment.

11) Act No. 39 of 1999 on the law of public hygiene. A number of articles were included that would ensure the protection of the environment, the health of the community and the disposal of residues, wastes, toxic substances and chemicals. Penalties were imposed in case of breaking the law; those articles are (3, 4, 5, 8, 9, 10, 11, 12, 18, 19 and 31) of the code of hygiene.

12) Act No. 1 of 1992 on foreign trade, as amended by Act No. 16 of 1996, ban on the importation of foodstuffs that are contrary to the approved specifications by articles (3, 5 and 6), entrusted to the Ministry of Industry and Trade.

13) Act No. 38 of 1992 on the control and regulation of food circulation, authorized jurisdiction of the Ministry of Housing and Urban Planning the right to take the necessary action to punish those found violating the acquisition of foodstuffs detected through laboratory testing that they harm the health of human being. The law grants the inspectors of the ministry right of the justice and the power of seizure in Articles (7, 8, 12, 19 and 20).

14) Act No. 33 of 2003 on road transport, authorized the Ministry of Transport and Maritime Affairs the right to prohibit the transfer of any property or goods that can cause environmental damage, affect the safety of passengers or the environment in general, whether chemicals or toxic substances in the articles (8, 27 and 31).

15) Act No. 20 of 1999 on the establishment of cleanliness funds and improve the shapes of the cities, authorized the Department of Housing and Urban Planning and its offices in the capitals of provinces and cities and the Capital to prevent whatever can effect the environment of remnants of any sort, in the articles (3 and 5).

16) Act No. 24 of 1990 as amended by Act No. 35 of 1997 on supply, authorized the Ministry of Industry and Trade the right to control and confiscate corrupt goods and materials containing conservative chemicals that have an impact on human health, in the articles (4, 15, 16 and 21).

17) Act No. 3 of 1993 on combating trafficking and illicit use of narcotic drugs and psychotropic substances authorized the Ministry of Industry and the Ministry of Agriculture the right to protect the community from harms and the risks of chemicals, drugs and all psychotropic substances, through the organization of entry of materials allowed to the country and to prevent and to punish violators. The law included six

tables that organized the materials to be allowed entry and circulation in the country, according to the requirements and licensing authorized to the two ministries in the articles (No. 8, 9, 10, 11, 12, 13, 27, 33 and 34).

18) Law No. 25 of 1999 on the regulation of plant pesticides; the competent authority is the Ministry of Agriculture and Irrigation and tasked beside customs outlets, the Ministry of Industry and Commerce and members of the security, armed forces and mail, each in his place of work, on the country's border inlets, in order to prevent any scourge of plants, eliminating control or eradicated through expulsion or through the organization of the circulation and trafficking of pesticides, and how to import and export in a known and organized way because of the risk to human, animal and environmental health and safety and all the implications of articles (3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 16, 21, 22, 24, 25, 27 and 28).

19) Regulation Law No. 25 of 1999 on the regulation of pesticides circulation, traffic and trade, entrusted to the Ministry of Agriculture and Irrigation, to organize the legitimate trafficking and trade of pesticides for allowing entry to the impermissibility of any person trafficking unless holds a license from the Ministry of Agriculture. This is not only necessary but required informed consent of the ministry, the type and quantity of insecticide and to be registered in the records of the Ministry. It stressed the application of the sanctions specified in the law about dissent, and earmarked specifically not allow entry of any pesticides through Sana'a International Airport; articles (3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34 and 35).

20) Decree No. 12 of 1995 on the Regulation of the Ministry of Housing, Construction and Urban Planning. The competent authority is the Ministry of Housing, Construction and Urban Planning. The regulations texts included the responsibility of the Ministry to preserve the environmental integrity from any influences whether resulting from the remnants of human, animal or the product of the construction of industries, reconstruction or infrastructure. The articles of the regulation (2, 9, 21 and 22) outlined the responsibility of the Ministry in the reduction, the preparation of studies and planning of potential sites for reconstruction of urban areas.

21) Act No. 4 of 2000, articles (2, 4, 61 and 16) on the local authority, the jurisdiction of the Ministry of Local Administration, mandated by law the right to supervise the implementation of environmental legislations, by local authorities throughout the administrative units in the Republic of Yemen, which would surround the danger and eliminate it upon inception in any administrative unit.

22) Decree No. 269 of 2000; articles (7 / 11, 12, 18, 20, 6-8, 9 and 10) on the executive statute of the local authority. The competent authority is the Ministry of Local Administration and the administrative units in the governorates and districts. The texts of the Regulation conveyed wide powers to the local authority to take all necessary measures to preserve the integrity of the environment and the proper control of utilization of fisheries and watersheds. It should discuss and prepare the

environmental plans at the level of Boards of the Provinces and bring it to the power centers.

23) Act No. 33 of 2002 (Articles 2, 3, 7, 8, 10, 11, 12, 17, 21, 22, 27, 35 and 38) on the water. The competence authorities are the General Authority for Water Resources and other entities, such as The Ministry of Agriculture and the General Authority for Environment Protection. It aims to regulate the development and rational use of water resources and protection from depletion, pollution and upgrading the transfer, distribution and use, in addition to good maintenance and operation of facilities and planning of water resources, and the dividing the Republic into the water basins, as well as the granting of licenses to dig wells, determine their depth and provide support and facilities to farmers, the construction of dams and water barriers, the fight against desertification, the protection from flooding, carry out research and coordination with other relevant agencies. The law also gives the authority officials acknowledged the right of judicial seizure, penalties to violators and the users of water for other unspecified purposes.

4.2.2 International Treaties and Conventions Signed by the Government of the Republic of Yemen

1) The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal as ratified by Act No. 32 of 1995.

2) The Vienna Convention for 85 for the Protection of the Ozone Layer and the Montreal Protocol on Substances of 87 concerning the chloroflourocarbon pollutants that deplete the ozone layer.

3) Convention on Climate Change ratified by Act No. 30 of 1995.

4) The Convention on Biological Diversity ratified by Act No. 31 of 1995.

5) The Convention on Psychotropic Substances of 1971, ratified by Act No. 176 of 1995.

6) United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, ratified by Act No. 177 of 1995.

7) Single Convention on Narcotic Drugs of 1961 as amended by the Protocol signed in 1972, and ratified by Act No. 178.

8) Stockholm Convention on POPs and ratified on 5 / 12 / 2001.

9) Rotterdam Convention on the Application of the Prior Informed Procedure Consent for Chemicals and Certain Hazardous Pesticides Circulating in International Trade. Ratification is under process.

Table (4-1): A list of the laws responsible for applying the provisions of chemical.

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
1	**Constitution of the Republic of Yemen 2001**	State and society		To protect the society from all that harms the health and pollutes the environment by cooperation between the State and society	Articles (32) and (35) of the Constitution		1
2	**Crimes and penalties Act No. 12 of 1994**	Attorney General	Toxic materials, or putting people in poisonous jeopardy or harmful Status in the territorial waters or ports, or a tank of water or anything else	To protect the lives of people and preserve the public health, which may endanger their lives, injury or death by deterring any obstacle that may endanger people's lives, safety and simply danger by imprisonment for a term not exceeding ten years,		Article (140) of the Crimes and Penalties Act	1
3	**Labor Act No. 25 of 1997 as amended by Act No. 5 of 1995**	Ministry of Labor	Department of Public Health and Occupational Safety	In the workplace and all pollutants to ensure the health and safety of workers during work, as well as to ensure public health and safety	Materials (113, 114, 115, 116, 117 and 118) of the Labor Act		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
4	**Law on health professions practitioner No. 32 of 1992**	Ministry of Public Health and Population	Restrictions on engaging of the health professions practitioner in the use of materials, equipment and medical supplies except in accordance with the conditions set forth by the regulation issued, as well as deprive the sale of medicines or medical preparations after the expiry of the use	Concern for the safety and health of patients, as well as health professionals and through the requirements established in the building of health and patient rooms, as well as quality supplies, medical supplies and outlaw the sale of expired medicines	Materials (12, 16 and 17) of the Code of engaging in the health professions		
5	**Maritime Law No. 15 of 1994**	Ministry of Transport	Not ship prohibited cargo in accordance with the laws in force	To protect the environment and the share of the individuals of the community of any contaminated goods whether baggage, machines, cars or others		Materials (No. 224 / 2, 226 / 2, 228 / 2, 425) of the Maritime Law	
6	**Harmonized customs tariff law No. 37 of 1997**	Ministry of Finance (Customs)	The twenty-ninth chapter of the Law No. 37 of 1997 on customs tariff addressed the Standards and items which may be used and set the quality of organic chemical materials imported. Chapter thirty dealt with the pharmaceutical products and chapter thirty one dealt with all	The legislator has two aims from the many qualities and quantities mentioned; the first objective is the qualities that may be imported organized according to their special legislations and the second aim is the custom tariff for each type.	Chapters 29, 30 and 31 of the customs tariff law		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
			fertilizers as explained in the attached tables				
7	**Act No. 42 of 1991 Regulation of Fishing, Exploitation and Protection of Aquatic Life**	The Ministry of Fisheries	Protection of aquatic life from disposal of pollutants, poisons and chemicals	To protect aquatic life from any harm, cause of destruction or killing due to waste disposal, toxic substances or chemical materials in the sea or ocean water	Materials (22 and 23) of Act No. 42 of 1991. Regulation of Fishing, Exploitation and Protection of Aquatic Life		
8	**Act No. 50 of 1991 on the mines and quarries**	Ministry of Oil and Mineral Resources	It did not indicate the materials allowable use and exploration, however, in summary, decided to ban the use of any material harmful to health and public safety, particularly to ensure the health and safety of workers in mines	Maintain the health and safety of workers at the mines and quarries as well as ensure the protection of the environment and society from any risks that arise from the exploration and manufacturing.	Materials (50, 52 and 53) of the Law of Mines and Quarries		
9	**Act No. 4 of 1993 on the Free Zones**	General Authority for Free Zones	Prohibit the introduction and circulation of corrupt goods, rotten, radioactive substances, drugs, waste and material harmful to environment and not suitable for the human and animal consumption	The free zones are considered the world product market, hence the Yemeni legislator has created restrictions to protect the environment and human beings in the free zones and the outside from all harmful compounds and products	Materials (9, 10 / d, 27) of the Act of Free Zones		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
10	**Law No. 1 of 1992 on Foreign Trade, as amended by Act No. 16 of 1996**	Ministry of Supply and Trade	Ban on the importation of foodstuffs that are contrary to the approved specifications and all exports and imports are subject to the supervision of the Ministry	Ban damaged foodstuffs exported from foreign countries, as well as ensure the safety of the exported goods to maintain the reputation of the Yemeni national product	Materials (3, 5 and 7) of the Foreign Trade Law		
11	**Law No. 26 of 1995 on Environmental Protection**	General Authority for Environmental Protection (previously Environmental Protection Council)	Non-use of any pesticides without a license. The stores and shops selling pesticides should be away from the residential areas as well as the ban on the circulation of toxic materials and hazardous wastes without a license.	Protection of environmental components; cosmic and human; from contaminating materials and toxic chemicals that may cause risk or harm to living organisms and human beings in the geographical surroundings	Articles (3, 15, 19, 44, 56, 62, 63 and 65) of the Environmental Protection Act		
12	**Law No. 38 Year 1992 on the Control of Food Circulation and Handling**	Ministry of Housing and Urban Planning	The procuring competent have the right to take action according to law against any food or diet proves harmful to human consumption through laboratory screening	The ministry is entrusted the right of inspection and control of all goods and items used in the consumption of food and the right to undergo laboratory tests and take the necessary legal actions	Materials (7, 8, 12, 19 and 20) of the Act on the Control of Food Circulation and Handling		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
13	**Law No. 33 Year 2003 on Road Transport**	Ministry of Transport and Maritime Affairs	May not transfer baggage or unlicensed cargo, bears responsibility for any damage to the carrier in inflicted psychology or health and also what cause the contamination of the environment and harm to public health	To protect traveling passengers from any damage caused by the carrier such as having a quantity of poisons or chemicals, leaking and affecting the health of passengers or that contravenes Article No. (8) of the Code of Road Transport, which requires compliance with traffic law and the law of weights and the technical specifications of means of transportation. This help protect the environment and the public from pollutants resulting from the fuel used such as diesel etc.	Articles (8, 27 and 31) of the Road Transport Act		
14	**Law No. 39 of 1999 on the Law of the Hygiene**		Disposal of waste in cities as well as the work necessary to get rid of the waste, which is believed poisonous or chemical such as remnants of hospitals, laboratories, pharmacies and factories	Protect the environment and health of the community and not damage them and the realization of the principle of decentralization in hygiene in order to organize jurisdiction and thereby eliminate polluting and harmful substances and to take all necessary measures to avoid what may be detrimental to the environment and health of the community such as disposal of residues and the planting of trees and to oblige the owners of the chemical, therapeutic and industrial residues to do the required work in their transmission, burial and disposal.	Materials (3, 4, 5, 8, 9, 10,11, 12, 18, 19 and 31) of the Code of Hygiene		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
15	**Law No. 20 of 1999 on the Establishment of Funds Cleaner and Better Cities**	The Ministry of Construction and Urban Planning, and the Capital	All that may cause pollution of the environment from types of waste	financing cleaner and improved urban beautification	Materials (3 and 5) of the Fund Act to Improve Cleanliness and Cities		
16	**Law No. 24 of 1990 as amended by Law No. 35 Year 1997 on Supply**	Ministry of Supply and Trade	Each damaged or corrupt commodity and unfit for human consumption	To protect consumers from bad food, harmful to health, especially obsolete, because of the interaction of preserving chemicals with materials and its impact on human health	Materials (4, 15, 16 and 21) of the Supply Law		
17	**Law No. 3 of 1993 on Combating Trafficking and Illicit Use of Narcotic Drugs and Psychotropic Substances**	Ministry of Public Health, Yemen Company for Manufacturing and Trade of Medicines, National Foundation of Medicine, the Ministry of Agriculture	The items seen in the six tables according to the law	To protect society from harm and risks of chemicals, drugs and all psychotropic substances	Tables (1, 2, 3, 4, 5 and 6) Materials (8, 9, 10, 11, 12, 13, 27, 33 and 34) of the Law on Fight Against Drugs		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
18	**Law No. 25 Year 1999 on the Regulation of plant pesticide**	Ministry of Agriculture and Irrigation	Prevention of plant pests, elimination or control through the destruction or expulsion	Organization of the circulation of plant pesticides. Arranging registration, control and inspection of plant pesticide, as well as the risks of pesticides to plant and toxic effects on human and animal health, the environment and nature, and protection of economic beneficial insects. The law assigned to all the competent authorities, such as customs, security and the armed forces cooperation in law enforcement each in his respect	Articles (3, 4, 5, 6, 7, 8, 11, 12, 14, 15, 16, 21, 22, 14, 25, 27 and 28) Regulation of plant pesticides		
19	**Act No. 25 of 1999 on the Handling of Pesticides**	Ministry of Agriculture and Irrigation	Prevention of plant pests, elimination or control through the destruction or expulsion	Organization of the circulation of plant pesticide. Arranging registration, control and inspection of plant pesticide, as well as the risks of pesticides to plant and toxic effects on human and animal health, the environment and nature, protection of economic beneficial insects. The law assigned to all the competent authorities, such as customs, security and the armed forces cooperation in law enforcement each in his respect	Articles (3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 21, 22, 13, 14, 15, 16, 17, 28, 29, 30, 32, 33, 24 and 35)		

	Legislative instrument (Type, Ref., Year)	Ministries or agencies responsible	Chemical use, items covered	The aim of legislation	Related Materials / Provisions	Allocated resources	Arrange application
20	**Decree No. 12 of 95 on the Regulation of Construction, Housing and Urban Planning**	The Ministry of Construction, Housing, Urban Planning and Development	Designs to maintain the environment of all kinds	To maintain the environmental integrity of any flew that would affect it, whether the result of the industry or the remnants of human and animal. Preparation of studies and research in this aspect, especially in the area of reconstruction, city planning and the creation of infrastructure.	Articles (2, 9, 21 and 22)		
21	**Law No. 4 of 2000 on Local Authority**	The Ministry of Local Administration	All types of chemicals with environmental impact and all that have impact on the environment	To maintain the integrity of the normal environmental situation through the local authority throughout the republic so as to eliminate the danger level at the administrative unit and directorate	Articles (2, 4, 6 and 16)		
22	**Decree No. 269 of 2000 on the Execution of the Local Authority**	The Ministry of Local Administration and the administrative units in governorates and districts	To supervise the implementation of policies and environmental legislations	To oversee the implementation of environmental legislations and to take measures to preserve sound environment, as well as good control of the exploitation of fish stocks and protection of watersheds, discuss and approve plans on the level of environmental preservation and informing the central authority	Articles (6, 7,8, 9, 10, 11, 12, 18 and 20)		
23	**of Law No. 33 of 2002 on the Waters**	The General Authority for Water Resources and other relevant agencies	Aimed at regulating the management of water	Development and rational use of water, natural resource must be preserved and prevent tampering by the use of optimum utilization through installations, organization and working, to support farmers	Articles (2 3, 7, 8, 10,11, 12, 21, 22, 27, 35 and 38)		

4.3 Analysis

Researcher must be aware of the Yemeni legislations' richness in legal texts.

Through the number of 23 legislations; laws and regulations, all designed to create a clean environment, to enjoy a balanced safe life, for every living creature existing on the ground. There is no doubt; there have been some shortcomings as a modern institution is caring for the environment represented in the General Authority for Environmental protection.

The date of the adoption of the Republic of Yemen and its concerns in these areas started since 1995, while the world has made great strides, and others almost reached perfection in this area, through monitoring data and statistics of residues of human positive and negative interaction with the surroundings. This is in addition to evaluating the policy of the responsible departments that deal mostly with the environmental effects: Ministries of Industry, Trade, Planning and International Cooperation, Public Works and Roads, Health and Population, Agriculture and Irrigation, etc. of the relevant authorities.

These actors are in need from time to time to assess the extent of the application of the provisions of legislations, the usefulness, and the obstacles which transmit application, the deficiencies and modernize the legislation to prevent duplication.

Examples of this are many that need to be addressed such as the indiscriminate construction in urban cities, and underdeveloped land planning. Plans should be made available equivalent to the territory of the planned reconstruction for ten years. Another example is the lack of industrial cities, or even projects to establish industrial cities. The practice and conduct of the authorities and their functions to provide services to the public is another problem that needs to be addressed.

Recently, digging in the streets has become a commonplace to the general public because of indiscriminate random implementation, on the day of a street or neighborhood have surrendered to the other hand, such as electricity or water authority. This is due to the absence of legislation requiring the creation of a unified plan. That only is enough to enrich the sake of the environment and save the money squandered in vain considerable environmental legislation and administration, which is spent from the Treasury. This money need to be preserved to other services in the field of a natural environmental secure balance enjoyed by every living thing. Legislation provides for the need to maintain the flu, air, tree and all natural resources in sea and land, particularly endangered species. This means that the responsibility is large and the failure of treatment leads to the creation of an environmental problem with compounded negative effects doubled from one day to another, but every moment.

4.4 Recommendations

1. Prevent duplication of jurisdiction among management authorities.

2. Modernizing legislation through actors and what suits the needs of work.

3. Benefit from the Arab legislation in this area.

4. Impregnate the existing legislations with relevant texts that necessitate the services providing authorities on a mechanism of action for the implementation of projects at the same time.

5. Create special legislation for POPs, especially PCBs, dioxins, and furans (PCDD/PCDF).

Chapter

5

MINISTRIES, AUTHORITIES AND INSTITUTIONS CONCERNED WITH THE MANAGEMENT OF CHEMICALS

5 Ministries, Authorities and Institutions Concerned with the Management of Chemicals

5.1 The Ministry of Water and Environment and its Organizations

The following authorities are affiliated to the Ministry of Water and Environment:

- The General Authority for Environmental Protection
- The General Authority for Water Resources
- The General Authority for Water and Sewerage
- The General Authority for Rural Water Projects
- The Local Authorities for Water and Sanitation.

The Environmental Protection Act No. 26 of 1995 singled out the following:

- The section on the protection of water, soil and pesticide use and protection is entrusted to the relative parties (Part II).

- A complete section on metrology, standards and technical specifications (Chapter II, Part III) entrusted the preparation of specifications to concerned parties.

- A chapter on the handling of hazardous materials and waste; the task is entrusted to the competent authorities (Chapter IV of Part III).

5.1.1 The General Authority for Environmental Protection

The General Authority for Environmental Protection is responsible for the following:

- To follow up the issues of chemicals and hazardous wastes with other relevant agencies through the implementation of the articles of the law on the protection of the environment and participate in many relative committees such as the committee of circulation of pesticides and the committee of water basins.

- To follow up the issues of disposal of hazardous materials such as obsolete pesticides.

- To follow up the issues of public health pesticides.

- To follow up international conventions on chemicals, such as the Basel Convention on the transport of hazardous materials across the borders, Stockholm Convention on POPs substances, the Rotterdam Convention and the Convention on the protection of the ozone layer, domestically and externally.

The Environmental Protection Act includes materials to punish violators; however, no effective application of this law is seen. It needs to be amended in line with the functions of the Ministry of Water and Environment and its authorities. The application of the law requires an integrated mechanism, coordination with stakeholders, judicial seizure, penal regulations and fines, adequate cadre, general rehabilitation process control, the application of the law with regard to the Yemeni specifications of the hazardous materials.

Water Act devoted a whole chapter on the protection of water resources from pollution (Chapter III of Part VI, contained seven articles)

5.2 The Ministry of Finance (Customs Directorate)

- All chemical materials enter to major outlets across the country under the supervision of customs, which possesses a technical team in all outlets using the classification of international trade.

- The majority of chemicals imported are raw materials used in different industries. As for exports, there are no exports of chemicals except for limited quantities of damaged pesticides to be disposed of in accordance with international conventions.

- Permission to import pesticides is only possible after the approval of the Ministry of Agriculture and Irrigation.

- To enter ozone layer depleting materials, the approval of the General Authority for Environmental Protect is required, through cooperation between the Authority and Customs where there is a qualified and trained professional cadre.

5.3 The Ministry of Social Affairs and Labor (General Directorate for Occupational Health and Safety)

The General Directorate for Occupational Health and Safety is practicing the management of chemicals through labor law and legislations of occupational health and safety as follows:

The Department of Occupational Poisons is responsible for the following tasks:

1. Assessment of chemical and vital risk in the work environment.
2. Performing laboratory analyses of occupational poisons.
3. Participating in studies and research in this area and all matters relating to this aspect.
4. Developing the work in the poisons laboratory.
5. Providing professional advice in all matters relating to chemical carcinogens.
6. Educating the farmers about the dangers of pesticides they are using and the proper use of first aid to be taken in case of poisoning and to not use these pesticides except by persons well trained to use properly and the prevention of risks.

5.3.1 The Functions and Terms of Reference of the Ministry of Social Affairs and Labor in the Area of Occupational Health and Safety

These functions were mentioned in the interior regulations of the Ministry of Labor and Vocational Training (No. 82) for 1999. Chapters III and IV included the special part for the work of juvenile and women in paragraphs related to chemicals.

The types of jobs that juvenile are not allowed to practice (article 5):

The employer should commend to the following conditions when employing juvenile:

- It is not allowed to employ juveniles of both sexes in non-hazardous industrial businesses prior to the completion of the age of fifteen. Also it is not allowed to employ juveniles of both sexes prior to the completion of the age of eighteen in hazardous or harmful to health industrial businesses.

- A juvenile may not be employed in jobs that cause occupational, infectious diseases or dangerous poisoning.

- The employer may not employ juvenile in the following jobs:

    1. The manufacture and storage of flammable or explosive materials.
    2. The work in the mines and quarries.
    3. The auto industry and engines.
    4. The work in radioactive materials and exposure to them.

5. The canned meat as well as the mechanical bakery.
6. The lead and its compounds industries.
7. The petroleum and petrochemical industries.

The types of jobs that women are not allowed taking (Chapter IV, Article 6):

- The underground work in different mines.
- To work in furnaces for melting metals because of the high temperature.
- The welding work, which include: manufacturing of lead oxide, yellow lead oxide, lead dioxide, silicon, lead carbonate, orange lead oxide, lead sulfate, lead chromates and silicates.
- The process of mixing and slurry making in the manufacture and repair of dry and liquid batteries, as well as lead compounds industry
- Jobs which have an impact on the growth of the fetus and causing birth defects during pregnancy because of contact with some hazardous substances such as radioactive materials or hazardous chemicals.
- Other occupations harmful to the health of women and the fetus or the manufacture of explosives and explosive materials and related business.
- Tackle, prepare or reduce ash content of lead and silver extracted from lead.
- Asphalt Industry.
- The manufacture of fertilizers derived from the human or animal waste or bone and work in such fertilizer warehouses.
- Work in the tanneries and all the preparation work on leather.

Chapters V, VIII and IX of the rules of occupational health and safety also devoted to the duties of the employer in the area of occupational health and safety, including articles on the dangers of chemicals and the methods of protection from these materials in the work environment.

According to rule (7), the employer is to carry out the following tasks and duties:

- The employer is responsible for providing adequate protection to workers from occupational hazards and diseases caused by the working environment and provide the means of individual prevention.

According to article (10) of Chapter VIII for the prevention of hazards in the workplace, the following should be considered:

- It must be taken into account to provide the necessary means of fire and explosion prevention in the premises.
- The workplace must be secure from the dangers of storing, transporting and handling of hazardous materials, explosives and flammables or otherwise.
- Integrity must be preserved for the steam boilers, pressure vessels and the vessels of compressed gases, liquids and solutions in addition to conducting periodic checks.
- Disposal of industrial waste must be done with the suitable and proper methods to avoid environmental pollution and damage to human, animal and plant life, soil and water.

According to article (11) of Chapter IX, the employer must comply with the following rules of storage:

1 - Quality warehousing and storage by allocation of a store for each type of the different types of materials for the ease of the fire safety precautions for each of them separately, according to the nature and properties of these materials.

2 - Storing the items in an organized and arranged way.

3 - Commitment to the altitude permitted for stacking items.

4 - The presence of sufficiently wide corridors between items stacks to allow easy movement of firefighters, to save the biggest portion of the burning article.

5 - The provision of the means of adequate ventilation inside the stores to avoid the accumulation of fumes, gases or dust.

6 - Commitment to store flammable liquids in tanks with the requirements of safety, away from production sites.

7 – Presence of instructions and fire extinguishers at the entrances and exits of stores.

Article (12) of Chapter IX stressed the duties of workers in the area of occupational health and safety of chemicals:

1. Consider the rules and instructions relating to reserving safety precautions and the safety of the establishment, housing, installations or other places

2. Making use of the direction of the prevailing winds in the region to achieve maximum efficiency of ventilation inside the premises, so as to blow what winds up from the industry whether dusts, gases or harmful fumes, away from the plant and away from the neighboring living complexes established near the necessary facilities such as potable water and sewerage.

3. The article also mentioned providing a list of the requirements of occupational health and safety when planning the establishment to avoid occupational hazards in the work environment.

Article (15) of Chapter IX necessitated taking the following into account when planning the establishment:

- Appropriate size and form of buildings for the industrial processes that will be pursued.

- Sequence of industrial process so that the complementary divisions are next to each other, whenever possible.

- Provide adequate space for future expansions so as not to affect the sequence of the industrial process.

- Provide adequate space between the premises, the various sections and automotive roads within the establishment and stores.

Article (20) of Chapter IX highlighted the general requirements for prevention of the risks of chemicals.

The employer must take into account the following:

1 - A medical examination of the workers prior to the employment and then periodically after employment, for early detection of any occupational diseases as a result of dealing with chemicals.

2 - Notify workers before employment about the dangers of using chemicals to which they will be exposed, the ways of prevention, the symptoms and signs of the early stages of the disease or poisoning caused by these substances.

3 - Replacement of toxic chemicals and carcinogenic substances generally involved in manufacturing with less serious materials.

4- Use adequate ventilation, whether general or spot ventilation, near the places of evolving gases, fumes, smokes or dust to expel them before they reach the place where workers breathe.

5 - Commitment to signals and warnings issued by companies producing the chemicals.

6 - Care for providing adequate water for washing and bathing of workers after the completion of the work and not leave the premises before removing anything attached to their bodies of the material, with the need to provide cleaning equipment such as soap and towels. For enterprises producing chemicals, body and eyes washers must be ensured in the premises for easy access in the case of any emergency.

7- Special dinning rooms must be provided for workers away from the working places and prohibit handling any food, drink or smoke inside the premises.

8 - The employer must obtain sufficient information from the supplier concerning the chemicals used at work to enable them to implement effective programs to protect the workers from the chemical hazards.

9 - The employer must provide employees sufficient information on the safe use of chemicals used in their workplaces including the preventive measures.

10 - The employer must find or create a special way for the classification of chemicals according to the type and degree of risk in storage. In the case of transfer of these materials, the United Nations Recommendations on the Transport of Dangerous Goods are to be taken into account.

11 - The occupational health and safety inspector should care for the safety of workers, in particular the following matters:

- in the production or handling of hazardous chemicals,
- in the storage of dangerous chemicals,
- in the disposal of chemicals and hazardous wastes,
- in the transfer of hazardous chemicals in accordance with national and international transport regulations,
- workers must take caution and prudence to remove danger from themselves in the case of the use of chemicals,
- the supplier commitment to put labels of all chemicals and be classified in accordance with the regulations and standards approved by the relevant competent authority.

In this regard, the General Directorate of General Occupational Health and Safety issued the Ministerial decree (No. 138) of 1995 on the tables of occupational diseases. The resolution singled out special tables of occupational diseases caused by chemical agents. Table (5-1) lists the occupational diseases caused by chemicals (elements and compounds). Table (5-2) summarizes the occupational cancers caused by the work in contact with carcinogenic substances.

Table (5-1): Occupational diseases caused by chemicals (elements and compounds).

Ser. No.	Type of illness	Business or process that causes the disease
1	**Poisoning by lead, its compounds and repercussions**	Any action requiring the use or handling of lead compounds or materials containing lead, including handling of lead-containing materials, casting of lead and old zinc (scrap), the lead compounds industry and lead smelting, the lead preparation and use in the porcelain mina containing lead, polishing by lead dust or powders containing lead. preparation or use of dyes, colors or paints containing lead, as well as any work requiring exposure to dust, vapors, compounds or materials containing it.
2	**Poisoning by mercury, its compounds and repercussions**	Any action that requires the use or circulation of mercury, compounds or materials containing mercury, as well as any work requires exposure to dust or vapors of mercury or its compounds or materials containing it, as well as any work requires exposure to dust or vapors of mercury or its compounds or materials containing it, including the work in the manufacture of mercury and its compounds, the industry of laboratory instruments, mercury standards and the preparation of the raw material in manufacturing processes in caps and gold paint industries, the gold-mining industry and mercury explosives.
3	**Poisoning by cadmium, its compounds and repercussions**	Exposure to cadmium vapors, dust, metal mixes, alkaline reserves, dyes, atomic reactors, hot cadmium smoke and protective packaging works.
4	**Poisoning by antimony, its compounds and repercussions**	Any action requiring the use or handling of antimony, its compounds or materials containing it, as well as any work requiring exposure to dust, vapors of antimony, its compounds or materials containing it.
5	**Poisoning by manganese, its compounds and repercussions**	Every action requires the use of manganese, its compounds or materials containing it, as well as any work requiring exposure to vapors, dust of manganese, its compounds or materials containing it, including its extraction, processing or manganese compounds, milling or packaging.
6	**Poisoning by chromium, its compounds and repercussions**	Every action requires preparation or generation, use or handling of chromium, chromic acid, sodium, potassium or zinc dichromate or any substance containing it.
7	**Poisoning by nickel, its compounds and repercussions**	Every action requires preparation or handling, use or generation of nickel, its compounds or any material containing nickel, or its compounds, including exposure to dust of nickel carbonyl.
8	**Poisoning by platinum, its compounds and repercussions**	Intermediate chemical operations, coking operations, working in oil refineries, sulfuric acid industry, nitric acid and mixtures industry.

Ser. No.	Type of illness	Business or process that causes the disease
9	**Poisoning by vanadium**	Intermediate chemical operations, quick steel mixtures industries, sulfuric acid industry, anhydrous phthalic acid industries, petrochemical industries, photography, paints and dyes industries.
10	**Illnesses resulting from beryllium**	The works in which workers get exposed to beryllium dust or salts (such as milling beryllium), preparation of beryllium salts and compounds, industries of fluorescent tubes and mixtures of mineral industry and beryllium containing porcelains.
11	**Poisoning by arsenic, its compounds and repercussions**	Any action requiring the use or handling of arsenic its compounds or materials containing it, as well as any work requiring exposure to dust or vapors of arsenic, its compounds or materials containing it, including processes generating arsenic or its compounds, as well as working in the production of arsenic, its compounds or industries.
12	**Poisoning by phosphorous, its compounds and repercussions**	Any action requiring the use or handling of phosphorus, its compounds or materials containing it, as well as any work requiring exposure to dust or vapors of phosphorus, its compounds or materials containing it.
13	**Poisoning by sulfur, its compounds and repercussions including carbon disulfide and hydrogen sulfide**	Every action requires the use or handling of sulfur, its compounds or materials containing it, as well as any work requires exposure to dust, sulfur gases, compounds or materials containing it, including exposure to gaseous and non-gaseous sulfur compounds.
	The Organic Compounds	
14	**Poisoning by petroleum, gas, its derivatives and repercussions**	Every action requires the use or handling of petroleum, gas or its derivatives, as well as any work requires exposure to such solid, liquid or gaseous materials.
15	**Poisoning by benzol, its isomers, amides, nitrogenous compounds or derivatives and repercussions**	Every action requires the use or handling of these materials, as well as all work requires exposure to their vapors or dusts.
16	**Poisoning by chloroform and carbon tetrachloride**	Any work requiring the use or handling of chloroform or carbon tetrachloride, as well as any work requiring exposure to their vapors, or fumes containing them.
17	**Poisoning by tetrachloroethane, trichloroethylene and other halogen derivatives of aliphatic hydrocarbon compounds**	Any work requiring the use, handling or exposure to their vapors, or fumes containing them.
18	**Poisoning by methyl bromide**	Any work requires dealing with methyl bromide as killer of insects, fungi and as an antiseptic.
19	**Poisoning by dinitrophenol**	Any work requiring the use of dinitrophenol dyes in the manufacture and preserving of wool.

Ser. No.	Type of illness	Business or process that causes the disease
20	**Poisoning by acryl amide**	Any work that requires exposure to acryl amide such as to protect the soil from water in tunnel digging and industries of paper, dyes and treatment of metals.
21	**Poisoning by chlorophenyls**	Any work requires exposure to chlorophenyls such as cables packaging industry, the manufacture of pipes, flooring materials, toys and medical materials as well as the preparation and industry of polychlorophenyls.
22	**Poisoning by alcohols, glycols and ketones**	Any work requires exposure to one of these materials or compounds of alcohols and ketones industry.
23	**Poisoning by nitroglycerine and other nitric acid esters**	Any work that requires exposure to nitroglycerine industry medicines and explosives.
24	**Poisoning by dioxins**	Any exposure to fumes of dioxins or compounds containing it such as in dissolution and dyeing.
	Other Chemical Compounds	
25	**Poisoning by halogens (fluorine, chlorine bromine) and their compounds and repercussions**	Every action requires preparation, the use or handling of fluorine, chlorine or bromine and their compounds, as well as all work requires exposure to such material, their vapors or dusts.
26	**Poisoning by hydrogen cyanide, its compounds and repercussions**	Every action requires preparation, the use or handling of hydrogen cyanide and its compounds, as well as all work requires exposure to its vapors, mist, compounds dusts or materials containing them.
27	**Poisoning by ozone**	Any work requires exposure to ozone, including paper industry, oil, flour, effervescence water and flights at an altitude over (10 km), work in UV radiations and ozone sterilization.
28	**Carbon monoxide poisoning and its repercussions**	Every action requires carbon monoxide, including preparation, use and generation as in garages, bricks and lime production.
29	**Poisoning by nitrogen oxides**	Operations require exposure to nitrogen oxides.

Table (5-2): The occupational cancers caused by the work in contact with carcinogenic substances.

Serial number	Causing material	Type of cancer
1	**Asbestos**	Bronchi and lung cancer.
		Cancer of the middle class (sidearm etc.)
2	**Benzol**	Blood bleaching
3	**Arsenic**	Lung cancer and skin cancer
4	**Coal tar distillates**	skin cancer
5	**Chromium**	Bronchi and lung cancer.
		The cancer of the nose
6	**Benzidine**	Bladder cancer
	Alpha naphthylamine	Bladder cancer
	Beta naphthylamine	Bladder cancer
7	**Beryllium**	Lung cancer
		Kidney cancer
8	**Zinc chromate**	Bronchi and lung cancer
9	**Chloromethyl ether**	Lung cancer
10	**Chlorophenyls**	Tumor in the liver vessels
		Liver cancer.
		Lung cancer.
		Lymphatic blood cancer.
11	**4-Aminobiphenyl**	Bladder cancer
12	**4-Nitrobiphenyl**	Bladder cancer
13	**Nickel sulfide**	Bronchi and lung cancer
14	**Ionizing radiation**	Blood bleaching and Skin cancer
15	**UV**	Skin cancer
16	**Hard wood dusts**	Enclaves cancer

Circular No. (1) of 1995 necessitated the circulation of the instructions of occupational health and safety and the rules to be offered to employees in the profession of printing as a result of this profession's risks for workers of the working environment in the public and private printing. The employers must comply with the following instructions:

1. Commitment to provide the means for individual protection for all workers in this profession.

2. The workplace must be ventilated, naturally or industrially.

3. Protection of all parts of the mobile machines with protective barriers to avoid any injury.

4. Must provide the necessary first aid according to instructions issued by the General Department of Occupational Health and Safety, in addition to providing fire extinguishers depending on the type of flammable materials.

5. Must subject the workers to a medical examination directly before job and prevent the operation of any worker found through the medical examination that he suffers from a disease in the blood, skin eczema, asthma, kidney failure, pregnant or lactating women since the work in printing makes them at risk.

6. The lead smelting furnaces must be separate entirely from all sections of the press, because of the proliferation of vapors during the process of lead smelting?

7. Must not touch ink, dyes, organic solvents and cleaning materials by bare hand without the use of gloves because of their content of harmful chemical substances that lead to allergy diseases and skin blistering which needs prolonged healing.

8. Workers of printing should be subjected to periodic medical examination at least once every six months to make sure that there is no exposure to occupational diseases.

9. Lighting should be good in the halls of work to avoid any sight stress and must also reduce noise limits to the permitted level.

10. Must not store raw materials for printing work in the hall to avoid fires and any other disasters.

11. Need to have more than one exit for emergency escape to avoid any danger threatens the safety of workers.

12. Training the worker of safety rules before operating the machine.

Circular (No. 2) of 1995 on the implementation of instructions of occupational health and safety necessitated the requirements which should be provided at all workshops and special laboratories by the Ministry of Social Affairs and Labor for the sake of continued production, in the industrial regular and irregular sectors and its development, where the employers and workers must follow the instructions and guidelines on occupational health and safety, as follows:

1. The employer must provide the means of prevention for all workers and each individual, depending on the nature of work.

2. Premises must be ventilated through natural purification of the various pollutants in the industrial work environments.

3. To protect all parts of the machines and mobile vehicle barriers and shields to avoid any injury and allocate enough space for each worker to be able to move within it to perform his work without any hindrance.

4. Must provide fire extinguishers depending on the type of flammable materials.

5. Must provide the necessary first aid for various equipment, according to instructions issued by the General Administration for Occupational health and safety.

6. Conduct initial and periodic examinations before and after the operation.

7. Must not store raw materials for work production inside the hall to avoid fires, with the need to find emergency exits.

5.4 The Ministry of Public Works and Roads

Proceeding from the role of the Ministry of Public Works and Roads in the functions of environmental sanitation, and what health and environmental mean in disease and environmental pollution control, the Ministry has been keen to provide all distinguished services in the area of environmental sanitation at the level of the Capital and all governorates of the Republic. Among the most important tasks to perform are the following:

1. Import pesticides with a variety of specialized and general health, as well as poisons for misguided dogs and the distribution of these pesticides in all offices of the Ministry in the provinces.

2. Coordination with the Ministry of Agriculture (General Directorate of Plant Protection) to examine the technical specifications and identification of public health pesticides and the extent of their use.

3. Participating in national campaigns to combat diseases and different epidemics and dispatch a number of specialists to supervise the spraying locations and the training of a number of personnel on how to use the pumps and how to deal with pesticides during spraying.

4. The Ministry implements campaigns to spray certain infected areas in all governorates.

5. Suction of stagnant water resulting from rainfall especially in the sites where there is no sewage and water disposal and spray pesticides in the markets and public places to prevent malaria and create a healthy environment free from diseases.

6. Training and qualification of cadres in the area of spraying pesticides and users of public health pesticides, where no less than (30) trainee were trained annually through a variety of short courses and acquire scientific methods of control, and then select the appropriate pesticides to eliminate the different stages of insect vectors.

7. Coordination with international organizations to provide support in the area of environmental sanitation.

8. Adopt awareness programs and outreach through the field trips to the infected areas to organize meetings directly with the citizens, deliver lectures and distribute awareness materials such as posters and slogans urging citizens to pay attention to environmental sanitation and the creation of a healthy and clean environment.

Table (5-3) summarizes the responsibilities of The Ministry of Public Works and Roads on pesticides.

Table (5-3): The responsibilities of The Ministry of Public Works and Roads on pesticides.

	Production	Import	Storage	Transport	Marketing	Use	Disposal
The Ministry of Public Works and Roads	*		*		*	*	

5.5 The Ministry of Agriculture and Irrigation

The Ministry of Agriculture and Irrigation controls the imported plant pesticides, agricultural fertilizers and veterinary medicines. Agricultural plant pesticides are subject to the conditions outlined in the executive Law No. 25 of 1999 on the regulations of circulation of plant pesticides:

- Part II, under the title registration of pesticides, contains ten articles concerning pesticide registration.
- Part III, under the title circulation of plant pesticides and regulation of professions practitioners, import and export of pesticides, as well as the sale and storage of pesticides.
- Part IV, under the heading control, inspection and seizure of irregularities.

Table (5-4) shows the responsibilities of the Ministry of Agriculture and Irrigation on pesticides.

Table (5-4): The responsibilities of the Ministry of Agriculture and Irrigation on pesticides.

	Production	Import	Storage	Transport	Marketing	Use	Disposal
Ministry of Agriculture and Irrigation	*		*	*		*	*

5.6 The Ministry of Health and Population

There is more than one party at the Ministry of Health responsible for chemicals. With regard to the health and environment impact is the responsibility unclear. Among these actors are the following:

1. The Supreme Authority of Pharmaceutical and Medical Supplies.

2. The Medicine Control Laboratory which is affiliated to the Supreme Authority.

3. The General Directorate for Medical Supply.

The Supreme Authority of Pharmaceutical and Medical Supplies is responsible for registration and the opening of import licenses, supervision and control of the local drug manufacturers and quality control to make sure of the specifications and components in the Laboratory of Pharmaceutical Control Commission.

The Medical Supply is responsible for the storage, transport, control and supervision of institutions for periodic circulation.

Information is available at the Supreme Authority of Pharmaceutical and Medical Supplies on the drugs, the diagnostic chemicals and some chemicals such as certain acids (potassium permanganate etc.) chemical feed and artificial flavors.

However, most of the chemicals used in industry do not pass through the Supreme Authority, as well as hazardous wastes and pesticides.

It is worth mentioning that the General Directorate of Environmental Health and the General Directorate for Occupational Health, Mental Health and School Health are not affiliated to the Ministry of Health, but restructured to exist in other ministries and therefore they function within of their ministries.

The chemical poisoning is not of interest and hence no information is given in this regard. Finally, it was agreed to open a Department at Al-Thawrah General Hospital particularly for chemical poisons and is in the process of establishment right now.

The main task of the Ministry of Health is preparing a list of drugs and chemicals used in different health institutions, the registration, opening importation permits, storage, transportation and disposal of damaged medicines only, as well as pharmaceutical control and oversee the local drug plants and their quality, issuance of therapeutic manuals and list of the principal drugs and update it periodically.

Table (5-5) lists the responsibilities of the Ministry of Public Health and Population for medicines.

Table (5-5): The responsibilities of the Ministry of Public Health and Population for medicines.

	Import	Production	Storage	Transport	Marketing	Use	Disposal
Ministry of Public Health and Population	*		*	*		*	*

Table (5-6) summarizes the responsibilities of the Ministry of Public Health and Population for pesticides (Program of malaria and Schistosomiasis)

Table (5-6): The responsibilities of Ministry of Public Health and Population for pesticides (Program of malaria and Schistosomiasis).

	Import	Production	Storage	Transport	Marketing	Use	Disposal
Ministry of Public Health and Population	*		*	*		*	

Table (5-7) shows the responsibilities of the Ministry of Public Health and Population on petrochemicals.

Table (5-7): The responsibilities of the Ministry of Public Health and Population on petrochemicals.

	Registration	Licensing	Use	Disposal of
The Ministry of Public Health and Population	**x**	**x**	**x**	

Table (5-8) shows the responsibilities of Ministry of Health and Population on hazardous waste and chemicals disposal, use, marketing, transport, storage, import, and production.

Table (5-8): The responsibilities of Ministry of Health and Population on hazardous waste and chemicals disposal, use, marketing, transport, storage, import, and production.

	Import	Production	Storage	Transport	Marketing	Use	Disposal	Control
The Ministry of Public Health and Population	*	*	*	*	*	*	*	*

Table (5-9) summarizes the responsibilities of the Ministry of Oil and Minerals, its agencies and institutions dealing with various chemicals.

Table (5-9): The responsibilities of the Ministry of Oil and Minerals, its agencies and institutions dealing with various chemicals.

	Import	Production	Storage	Transport	Distribution	Use	Disposal
1 The Ministry of Oil and Minerals		*	*	*	*	*	*
2 Exploration and Production Authority		*	*				*
3 Geological Survey Authority		*	*	*	*	*	
4 Yemen General Corp. for Oil and Gas		*	*	*	*	*	
5 Yemen Petroleum Company	*	*	*	*	*	*	
6 Aden Refinery	*	*	*	*	*	*	*
7 Yemeni Oil Refining Company (Marib refinery)		*	*	*	*	*	*
8 Yemen Gas Company		*	*	*	*	*	
9 The Yemeni Investments company for Oil and Minerals		*	*	*	*	*	*

Table (5-10) lists the responsibilities of other ministries.

Table (5-10): The responsibilities of other ministries.

	Import	Production	Storage	Transport	Distribution	Use	Disposal
General Authority for Environmental Protection							*
The Ministry of Public Health and Population	*	*	*	*	*	*	
The Ministry of Agriculture and Irrigation	*		*	*	*	*	*
Ministry of Labor							
Customs	*		*				*
The Ministry of Trade and Industry							
The Ministry of Electricity	*		*	*	*	*	
The Ministry of Interior (Civil Defense)	*		*			*	

Table (5-11) summarizes the responsibilities of government ministries, agencies and institutions dealing with the different POPs materials.

Table (5-11): The responsibilities of government ministries, agencies and institutions dealing with the different POPs materials

	Import	Production	Storage	Transport	Distribution	Use	Disposal	Control
General Authority for Environmental Protection							*	*
The Ministry of Public Health and Population	*		*	*		*	*	
The Ministry of Agriculture and Irrigation	*		*	*		*	*	*
Ministry of Labor								*
Customs							*	*
The Ministry of Trade and Industry			*	*	*	*		
The Ministry of Electricity	*		*	*	*	*	*	
The Ministry of Interior (Civil Defense)								*

Table (5-12) shows the responsibilities of government ministries on chemicals consumed (hazardous waste materials including POPs).

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Table (5-12): The responsibilities of government ministries on chemicals consumed (hazardous waste materials including POPs).

	Import	Production	Storage	Transport	Distribution	Use	Disposal	Control
General Authority for Environmental Protection							*	*
The Ministry of Public Health and Population		*	*	*		*	*	*
The Ministry of Agriculture and Irrigation					*	*	*	*
Customs			*				*	*
The Ministry of Electricity		*	*	*	*	*	*	
The Ministry of Public Works and Roads		*					*	*

5.7 Analysis

- There is a lot of overlap in the work of the relevant bodies in respect with the management of chemicals other than pesticides, where there is a clear mechanism, list and cooperation between the governmental authorities concerned in the importation and disposal of damaged pesticides.

- There is no clear mechanism for public health pesticides, which raises many problems between importers and stakeholders.

- The role of the Ministry of Health includes the registration, import, licensing and use of medicines and some chemicals (such as some acids and artificial flavors, in a limited number).

- The environmental health and occupational health are non-existent in the Ministry of Health but affiliated to other ministries and thereby their functions overlap with the functions of the Ministry of Health and Population.

- The regulations and penalties for laws abusers of chemicals are not clear except for pesticides.

- The laws and regulations on chemicals need to be adjusted and given more attention according to the local and international State's commitments, through the admission of the State in many international conventions.

- Weak rehabilitation and training for workers in all quarters concerned in this area.

- The awareness programs are not clear in this area.

- There are no contingency plans for hazardous materials incidents.

5.8 Recommendations

- The need to amend the Environmental Protection Act to commensurate with the functions of the General Authority for the Environmental Protection in the area of chemicals with the introduction of special materials with regard to POPs.

- The need for attention to the management of chemical materials through its inclusion within the priorities of the coming national environmental plan as it threatens the environment and human health.

- The need for the formation of a monitoring team and provide the necessary means to carry out the monitoring process.

- To work on a clear coordination mechanism between the chemicals stakeholders, especially coordination between the Customs and the General Authority for Environmental Protection and others in addition to the solution of the problem of any overlap between the actors in this field, such as the formation of a special committee for chemicals from the relevant parties and guarantee license only with the consent of this committee.

- The need for a national comprehensive contingency plan for the management of chemicals, including POPs materials involving all chemicals stakeholders and provide the funds needed to implement the rehabilitation of implementing supervisors.

- The General Authority for Environmental Protection needs to prepare a special strategy for chemical materials in general and POPs in particular.

- The General Authority for Environmental Protection needs to prepare a special program to build the capacity of its workers in the area of chemicals in the Republic.

Chapter

6

THE ACTIVITIES OF NON-GOVERNMENTAL ACTORS IN THE MANAGEMENT OF CHEMICALS

6 The Activities of Non-Governmental Actors in the Management of Chemicals

6.1 The Yemeni Consumer Protection Society

6.1.1 Establishment and Objectives

The Society was founded on 20 September 1997.

The main objectives of the Society are:

- Quality consumer education with regard to health and safety.
- Preparation of studies, research and laboratory testing in collaboration with governmental authorities.
- Promote legislation to protect the consumer.
- Control of the goods and products offered in the market.
- Receive complaints from consumers, represent their interests and establish relationships with the various actors involved.

The main activities relating to management of chemicals of the Society is follow-up and monitoring of cases of environmental pollution or damage arising from the misuse of chemicals, whether these chemicals are used directly or added to food, medicines or food crops.

The Society has received numerous complaints about consumers poisoning occurring as a result of the use of chemical pesticides in agricultural crops. Also, it directed the attention to the specifications of chemicals, their safety, the monitoring methods used, preventing the use of some chemicals and to inform about the relevant government irregularities found.

The Society participated in many related symposia and workshops and regulated such activities.

6.1.2 Expertise Available

The Society is compiling data on chemicals through the received complaints and the field visits and then prepares files for each group separately, such as pesticides file, detergents file... Etc. This is in addition to the existence of global organizations bulletins related to chemicals. Upon discovery of the Society of any material found through references to cause damage to the global consumer, the Society will screen it at accredited governmental laboratories.

With regard to training and education, it is done through holding seminars, workshops and training sessions of the Society, through the appropriate follow-up of everything new in relation to chemicals in local and global bulletins, exchange of information with regional and international civil society organizations.

The Society seeks to encourage the alternatives that do not have an adverse effect on the environment or the consumer, through the information available, such as the use of natural fertilizers, rather than chemicals, as well as the use of natural materials added to foods such as colors, flavors and others instead of the manufactured chemicals.

The role of Society in the control process through its specialized cadres and field visits for follow up of the complaints to ensure the quality of materials, its proper use and optimization, the information of the relevant government agencies about the harm to the environment or consumer, to take legal action and follow-up the implementation.

The Society played a major role in the process of environmental education for workers and the general terms by the Society bulletins, brochures distributed and flashes broadcasted across different media, in addition to warning advertisements and extension of relevant health and safety of consumers as well as the delivering of awareness lectures by specialist cadres that targeted schools and universities.

6.1.3 Activities and Their Relationship with Governmental Programs

Cooperation and coordination between the Society and the government allows the Society to obtain information on the management of chemicals. Opportunities are available to the Society as a non-governmental organization to provide the government with information on chemicals and also the role of the large participation in the process of government decision-making on the management of chemicals to produce legislations, specifications and standards and urge the government to expedite the issuance, adoption or awareness, especially that the Society plays a key role in informing the public through publications and direct outreach in the various information media.

6.2 National Society to Combat the Damage of Qat

6.2.1 Establishment and Objectives

This Society is founded in 1992. It aims to:

- Create awareness of not chewing qat.
- Pursue every legal means to curb the cultivation of qat.
- Conversion of the time and energy wasted by the community in qat to production.
- An attempt to change the rigid patterns of life.

In terms of activities related to the management of chemicals, they are confined to the compilation of information on the chemistry of qat and the chemistry of pesticides used in its treatment, for the purpose of dissemination and use in raising awareness and facilitating its delivery to researchers. The main interest of the Society is awareness of the general public to the dangers of pesticides used in qat through awareness campaigns and national programs to raise awareness of damage caused by qat conducted by the Society.

As for access to information and the degree of cooperation with the relevant government agencies, the Society can interface with the government to obtain information, as well as coordinate with the government authorities to hold conferences, which result in recommendations transferred to the higher authorities for implementation or suggestion of binding laws.

6.3 The Commercial and Industrial Chamber (the Capital Sana'a)

6.3.1 Establishment and Objectives

The Commercial and Industrial Chamber was founded in the Capital Sana’a, in 1958.

The Commercial and Industrial Chamber aims to:

- Contribute to the process of social and economic development.
- Prepare economic studies.

- Provide views and proposals to government authorities.

- It also aims to defend the interests of its members and business men within the limits of the laws of the organization.

In terms of activities related to the management of chemicals, it has been spreading awareness in the commercial center about the risks of industrial chemicals to the individual and the society in general, as well as the search for specialized industrial zones in order to curb the waste and industrial hazards to the environment so as to make it easier to control.

6.3.2 Expertise Available

Data source for the management of chemicals from industrial facilities, as well as confining the installations importing relevant materials. The Chamber has no activity in the examination of chemicals or assessment of their risk; however, it depends on the accredited laboratory of the government authorities.

In the absence of qualified and specialized cadre in the Chamber, the research for alternatives and the workers awareness are not of the activities of the chamber and rely on activities of the governmental authorities and the industrial installations members in this area.

6.3.3 Activities and their Relationship with Governmental Programs

The Chamber of Commerce can obtain information on the management of chemicals from the relevant government agencies and the Chamber does not have a role in the process of government decision-making on the management of chemicals, application and implementation. Within the limits of the Chamber of Commerce, the possibilities are for educating the public through publication in newspapers.

6.4 The Yemeni Industrialists Society

6.4.1 Establishment and Objectives

The Yemeni Industrialists Society was founded on 24 March 1996.

The Society aims to:

- Sponsorship of the interests of the Yemeni Industrials.

- Organize and upgrade the performance of individuals and collective efforts to achieve the goals of the industrial development in particular.

- Defend the member's interests and represent them in front of others and work with competent authorities to curb unfair competition.

The most important activities related to chemicals management is the management of food safety, plastic materials and their role in the pollution of the environment, finding solutions and alternatives in addition to the environmental awareness about the appropriate methods of dealing with these substances.

6.4.2 Expertise Available

The Society relied upon the member companies in the Society as source of data and information. The advisors collect data on chemicals. The Society does not examine chemicals however adopts the role of the Specifications and Standards Authority in this regard.

In order to assess the impact of the risk of the management of chemicals, the Society prepared the studies, seminars and panel discussions needed, in order to find the practical applicable and necessary solutions needed for the awareness of this aspect.

The Society seeks with the relevant government agencies to implement the laws and decisions concerning chemicals that will not lead to damage of industrial facilities and their activities, and the need for public awareness about the nature use and risks of the chemicals. That is the approach taken by the Society. It urged manufacturers to educate workers on how to deal with the risks of chemicals. This is in addition to the TV flashes that the Society produced in cooperation with some private companies that are sector members in the Society, as well as the issuance of Society magazine (Industry), which is published regularly from June-September 2002. "Industry" is a periodical specialized magazine containing a permanent column named "Quality and the Environment."

6.4.3 Activities and their Relationship with Government Programs

- The government authorities rarely have access to information on the management of chemicals. They rarely have the opportunity to provide the government with information on chemicals. The Society has no role in the process of governmental decision-making on chemicals.

- The most important role that can be played by the Society is to stimulate environmental awareness for the cooperation of public on dealing properly with chemicals.

- The relevant government agencies responsible for the management of chemicals in various areas should intensify their efforts to protect the producer, consumer and the Yemen environment.

6.5 The University of Science and Technology

6.5.1 Establishment and Objectives

The University of Science and Technology was established on 12 / 1 / 1994. It aims to:

- Provide students with high-quality programs to be able to pursue creative thinking, logical analysis of problems, propose the appropriate solutions and take the responsible decisions.

- Encourage faculty at the University and scholars to carry out research and studies with high-level applications in various fields to provide exceptional service to society.

The most important activities related to management of chemicals are:

- To teach students the methods of laboratory safety and how to deal with the chemicals and the risks that can be faced in the event of mishandling of such materials.

- To train students to conduct experiments and tests of various chemicals.

- Inform students of different chemicals and how to deal with the use of the seriousness of each article.

- To train students on how to prepare the quantities and specifications of each chemical laboratory.

6.5.2 Expertise Available

The source of data at the University is the lists of classification of chemicals used in the University in accord to the seriousness of each material, how to conserve and to deal with it.

All chemicals before introduction to the stores are subjected to examination to confirm their conformation with the specifications and quality and then determine the seriousness of each chemical in terms of toxicity, flammability or other hazards. The report deals with each of these materials with the need to identify specific and appropriate storage of chemicals away from high temperature, humidity or exposure to sun.

Training and education is provided to all workers in the chemical area, in addition to all the new information, risk prevention and protection of the environment.

In the case of chemicals that have a negative impact on the environment, they can be replaced by other materials that are environmentally friendly or less damaging than the first. There must be permanent control over the chemicals used and it is emphasized that the use of these materials is permitted in concentrations acceptable universally in the laboratory.

The workers must be supervised in this area, to ensure the safety of methods used in dealing with chemicals, the preparation of the quantities permitted so as not to lead to environmental damage, and to make all workers aware in this area, both members of the faculty, professional staff or cleaners in chemical labs. The public is made aware of the danger of dealing with the chemicals because of their poisoning ability, flammability and carcinogenicity or has a negative affect on the environment, in all respects.

6.5.3 Activities of the University and its Relationship with Government Programs

- The University can not obtain information on the management of chemicals from the relevant government agencies. The government did not ask the University to provide information on chemicals.
- There is no role of the university in the process of government decision-making on this matter while the University participates in courses, workshops or awareness programs in this area and do research and show results across different media to highlight the general dangers of these substances.
- here are no studies, information or previous research conducted by the University with regard to the strengthening of government capacity in the management of chemicals.

Table (6-1): Specialized cadres in some non-government organizations, related to management of chemicals.

Ser. No.	Authority	Number of qualified cadres		Qualification/Experience
		Specialization	No. of cadres	
1	**Yemeni Society for Consumer Protection**	Pharmacist / chemist	1	Pharmacy Bachelors
		Food industries	5	Bachelors
		Food industries	1	Masters
		Food industries	1	Ph D
		Microbiology	2	Bachelors
		Microbiology	1	Ph D
		Veterinary medicine	3	Bachelors
		Veterinary medicine	1	Ph D
		General agricultural engineering	15	Bachelors
		Chemist	4	Bachelors
		Information	20	Bachelors
		Economy	4	Bachelors
		Economy	1	Masters
		Economy	1	Ph D
2	**Yemeni Industrialists Society**	Chemist	1	Masters
3	**University of Science and Technology**	Drugs and poisons	2	Ph.D. Medical drugs
		Drugs and poisons	1	Teaching assistant
		Chemistry	1	Ph.D. Analytical Chemistry
			1	Ph D Organic Chemistry
			1	Masters Organic Chemistry
			1	Master of Physical Chemistry
			1	Ph.D. in Biochemistry
			1	Teaching assistant in chemistry
		Chemistry	2	Technical chemistry
		Pharmaceutical Science	1	Ph D
		Pharmaceutical Science	1	Masters
		Drug Science	1	Ph D
		Pharmacology	1	Ph D
		Pharmacy	1	Technician

In terms of cooperation between the sectors of government and the others with regard to the management of chemicals, there is absolutely nothing,. They are supposed to arrange together workshops, and joint sessions for those working in this area. Table (6-1) lists the specialized cadres in some non-government organizations, related to the management of chemicals. Table (6-2) lists the points of contact for some non-governmental organizations concerned with the management of chemicals. Table (6-3) summarizes the activity and the experiences of organizations and their relationship to the management of chemicals

Table (6-2): Points of contact for some non-governmental organizations concerned with the management of chemicals.

Ser. No.	Organization	Address	Telephone	Fax	P. O. Box	E-mail
1	**Consumer Protection Society**	Al-Qiadah Street, Sana'a-Yemen	22600	256639	8608	-
2	**National Society to Combat the Damage of Qat**	Sana'a, Mujahid Street in front of the French Embassy	240148	505201	12484	Alafif@y.net.ye
3	**Chamber of Commerce and Industry**	Sana'a – The Capital, region 8	232412	232361	195	-
4	**University of Science Technology**	Sixty street circus	408242	373234	15201	-
5	**Yemeni Industrialists Association**	Al-Zubiri Street Sana'a - Marib Insurance Company Building	402316	402315	4453	Yia@y.net.ye

Table (6-3): The activity and the experiences of organizations and their relationship to the management of chemicals.

Organization and the area of expertise	Universities	Environmental associations and consumers	Chambers industrial	Specialized Unions associations
Compile data	Yes *	Yes **	Yes ***	Yes ****
Test chemicals	Yes *	No	no	no
Risk assessment	Yes *	Yes **	No	Yes ****
Analysis of strategic policy	No	No	No	No
Training and education	Yes*	Yes **	No	Yes ****
Search for alternatives	Yes*	Yes **	No	Yes ****
Control	Yes*	Yes **	Yes ***	Yes ****
Implementation and application	Yes*	Yes **	No	Yes ****
Educate workers	Yes*	Yes **	No	Yes ****
Public awareness	Yes*	Yes **	Yes ***	Yes ****
Other				

Notes:

(*) related to the management of chemicals within the interests of the organization, scientific and awareness goals.

(**) related to the management of chemicals through guidance and awareness.

(***) related to the management of chemicals through the actions and projects, which serve the interests of members.

(****) related to the management of chemicals through the work and projects that serve the management of chemicals.

6.6 Analysis

- The role of the government in raising awareness of others is very limited, especially in the area of chemicals.

- There are no clear mechanisms and cooperation among peoples, government and the existing research centers in the State in the field of chemicals.

6.7 Recommendations

- The need for more cooperation and coordination between governmental and non-governmental organizations with a greater relationship in information and expertise exchange in the management of chemicals.

- Making use of the experience, research and studies of governmental and non-governmental universities as long as the final aim is to serve the nation and citizens.

- Participation in campaigns to sensitize the public from all the pertinent parties to the management of chemicals.

Chapter

7

MECHANISMS FOR COORDINATION AND COOPERATION BETWEEN MINISTRIES

7 Mechanisms for Coordination and Cooperation between Ministries

7.1 The Ministry of Social Affairs and Labor

The Ministry of Social Affairs and Labor issued a decision from the Council of Ministers, which carries the number (13) for the year 1998 to form the Higher Committee for Occupational Health and Safety to connect relevant authorities to take certain decisions concerning health and safety. It must be noted here that the decision was issued before changing the name of some ministries and other authorities, but can be changed to the current name of ministries, such as the Ministry of Labor and Vocational Training, which had its name changed to the Ministry of Social Affairs and Labor and the Council of Environmental Protection which was changed to the Ministry of Water and Environment, but the concerned body of this Committee is the General Authority for Environmental Protection. The Committee is composed as follows:

- The Minister of Labor and Vocational Training — Chairman
- The Head of the Environmental Protection Council — member
- The Undersecretary of the Ministry of Labor for Labor Relations — member
- The Undersecretary of the Ministry of Public Health — member
- The Representative of the Federation of Chambers of Commerce and Industry — member
- The Undersecretary of the Ministry of Industry — member
- The Representative of the Ministry of Construction — member
- The Representative of the Federation of Trade Unions — member
- The Deputy of the General Authority for Insurance and Pensions — member
- The General Manager of Occupational Health and Safety — member

The Committee is assigned to implement the following tasks:

- To review the legislations on occupational health and safety and to propose modification and development.
- To discuss and approve the annual work plan.

- To propose appropriate measures to reduce accidents at work and widespread occupational diseases.
- To take the appropriate decisions to remove threats to the safety of workers, including premises, machinery and equipment and ensure the provision, application of measures and means of individual and collective prevention of occupational hazards.
- To propose measures of physical, technical and human resources for the upgrading of health services and safety.
- To take the appropriate decisions to stop working entirely, or partially or vacate the workplace and workers in the event of a serious threat in the workplace, which are not likely to be delayed.
- Increase the number of seminars and training courses to upgrade education and guidance within the enterprise aimed at how to use the individual prevention and its importance.
- To take appropriate decisions on the early diagnosis of occupational diseases and occupational poisoning.
- Take actions for activating the role of health and safety so as to enable it to fulfill its role in the area of occupational medicine and chemical and physical control.
- Examining plans for the establishment of new facilities and ratify if identical to the conditions of public health and occupational safety.
- To take appropriate decisions against employers who are committed to the non-application of legislations, regulations and ministerial decrees in the occupational health and safety.
- Coordinate with other relevant agencies in making occupational health and safety curriculum taught in various stages of vocational and technical education.
- To make the necessary remarks to the conventions of the International and Arabic Labor Organizations in the field of occupational health and safety prior to ratification.

Coordination is not limited to this in the Higher Committee for Occupational Health and Safety, but there are other types of coordination with the General Authority for Environmental Protection in participating in committees for the management of chemicals, workshops and training courses as well as field studies, to assess the occupational hazards, including chemical hazards in the work environment and the general environment especially those neighboring industrial facilities.

There is also cooperation and coordination with the Ministry of Agriculture in relation to occupational hazards faced by workers in the agricultural sector, as well as the risk of pesticides and toxic effects on workers.

There is also coordination with the Ministry of Public Health and Population on the occupational hazards facing the workers in the health sector, especially workers exposed to chemical hazards in the work environment, such as laboratories operation theatres, sterilization workers and workers in medicines manufacturing. Table (7-1) shows the qualifications of the cadre of the Ministry of Labor.

Table (7-1): The qualifications of the cadre of the Ministry of Labor.

Administration	Number of scientific cadres		Experience / qualification
	Specialization	Number	
Public Administration of Occupational Health and Safety	**Chemist**	3	Bachelor
	Occupational and environmental toxins	1	Diploma
	Public health	2	Diploma
	Occupational safety specialist	3	Diploma
	Laboratory technician	7	Bachelor
	Occupational medicine specialists	2	Masters

7.2 The Ministry of Public Works and Roads

There is no committees formed for chemicals, but there are meetings between stakeholders to discuss the handling of pesticides. Table (7-2) shows the number of specialized cadres in the Ministry of Public Works.

Table (7-2): The number of specialized cadres in the Ministry of Public Works.

Administration	Number of scientific cadres		Experience / qualification
	Specialization	Number	
Public Administration of Environmental Sanitation	Plant protection	1	Bachelor
	Chemist	1	Bachelor

7.3 The Ministry of Agriculture and Irrigation

The Ministry of Agriculture and Irrigation has formed a special committee for handling the registration of pesticides. This committee of registration and circulation of plant disease pesticides will also oversee the implementation of the law No. 25 of 1999 on the regulation of pesticides. The Committee has a secretariat composed of the Public Administration for Plant Protection. The committee consists of the following relevant actors:

1. Undersecretary of the Ministry of Agriculture and Irrigation.
2. Assistant Undersecretary of Agricultural Affairs.
3. The General Manager of Plant Protection.
4. Head of the Department of Pesticides
5. Head of Department of the Analysis and Registration of Pesticides.
6. Head of Department of the Selection of Pesticides and Control Mechanisms.
7. Representative of the Ministry of Health.
8. General Environmental Protection Authority.
9. Yemeni Society for Consumer Protection.
10. Yemeni Social Society for Agricultural Supplies.
11. The General Authority for Agricultural Research and Guidance.
12. The Director General of Legal Affairs.

7.4 Other Committees

1. Water and the Environment Committee of the House of Representatives.
2. Committee on Agriculture and Fisheries of the House of Representatives
3. Committee on Health and Population of the Parliament Council
4. Preparatory Committee for the National Cleaner Production Centers consisting of:

- The General Authority for Environmental Protection
- The Ministry of Industry and Trade
- The General Authority for Investment

- The Federation of Chambers of Commerce and Industry
- The Ministry of Public Works and Roads (General Administration for Environmental Sanitation)
- The University of Sana'a (College of Engineering)
- The Yemen Authority for Standardization and Metrology
- The Yemeni Industrialists Society
- The Ministry of Social Affairs and Labor (General Administration for Occupational health and safety)

5. Decision of the Minister of Industry and Commerce, Chairman of the Board of Directors (No. 1) for the year 2004 on the formation of a technical team to study the Gulf's standard specifications of the following:

    - The General Manager of the Yemeni Specifications and Quality Control Authority
    - Specifications Director of the Yemeni Specifications and Quality Control Authority
    - The Representative of the Supreme Council for Exports Development
    - The Representative of the Yemen Industrialists Association
    - The Representative of the General Union of Chambers of Commerce
    - The Representative of the Ministry of public Works and Roads (Environmental Sanitation Sector)
    - The Representative of the University of Sana'a
    - The Representative of the Chamber of Industrial Commerce
    - The Representative of the General Electricity Corporation
    - The Representative of the Water and Sanitation Authority
    - The Representative of the Consumer Protection Society
    - The Representative of the Ministry of Public Health and Population

6. Committee on importing the prohibited goods (including chemicals banned import). The Committee is composed of:

    - The Ministry of Industry and Trade
    - The Ministry of Finance
    - General Authority for Environmental Protection

- Customs Services
- The Ministry of Agriculture and Irrigation
- The Ministry of Health and Population

7. Cabinet Decision number 100 of 2002 on the adoption of standard specifications from the Gulf Cooperation Council:

    1. The Council Of Ministers approved the adoption of standard specifications issued by the Specifications and Standards Authority of the Gulf Cooperation Council and considers their use as Yemeni standard specifications.

    2. The Minister of Industry and Commerce and Director General of the General Authority for Standardization and Metrology are to take the necessary actions to use these specifications and to start to apply them on imports to the country, starting from 16 August 2002.

    3. The Minister of Foreign Affairs in coordination with the Minister of Industry and Trade have to carry out the necessary contacts with the Gulf Cooperation Council on the content of the resolution and the arrangements for its implementation.

8. Cabinet Decision No. 10 of 99 to prohibit the importation of vehicles over five years from manufacture, and eight years for heavy equipment.

9. Cabinet Order No. 11 of 2003 on the review of the adverse effects of the phenomenon of the proliferation of the use of means of transport using diesel.

10. Cabinet Decision No. 223 of 2001 on the campus identification and protection of wells farms of some drinking water projects in the Republic. The resolution has identified the protection of the layout of wells of drinking water projects in the following areas:

    - Nasser water field, Lahj governorate, supplying drinking water project in the city of Aden.
    - Yethmah water field, Hadramaut valley, supplying drinking water project in the city of Sayoon
    - Ibb water field, supplying drinking water project in Ibb
    - Telmes and Kahlan water field, Sa'dah, supplying drinking water project in the city of Sa'dah

It has also directed the Water Resources General Authority and its public offices in the governorates to prepare studies of the public drinking water basins in cooperation with the relevant authorities concerned.

11. Cabinet Decision No. 363 of 2002 on the formation of the Sana'a basin committee of the following:

    - Secretary of the Capital
    - Deputy Minister of Planning and Development
    - Governor of Sana’a
    - Chairman of the General Authority for Water Resources
    - Undersecretary of the Ministry of Agriculture and Irrigation
    - Undersecretary of the Ministry of Finance
    - Undersecretary of the Ministry of Public Works and Urban Planning
    - President of the Federation of Agricultural Cooperative
    - President of General Environmental Protection Authority
    - The Heads of local councils in the geographical scope of the project
    - Representatives of groups of water users
    - Undersecretary of Geological Survey
    - Three personalities selected by the Prime Minister

12. Prime Minister's decision No. 45 of 2003 amending the Council of Ministers Resolution No. 263 of 2002 concerning the establishment of the Sana'a basin committee of the following:

    - Secretary of the Capital
    - Deputy Minister of Planning and Development
    - Governor of Sana’a
    - Chairman of the General Authority for Water Resources
    - Undersecretary of the Ministry of Agriculture and Irrigation
    - Undersecretary of the Ministry of Finance
    - Undersecretary of the Ministry of Public Works and Urban Development
    - Undersecretary of the Ministry of Interior for security
    - Undersecretary of the Ministry of Information

- President of the Federation of Agricultural Cooperatives
- President of General Environmental Protection Authority
- President of the Geological Survey and Mineral Resources
- The Heads of local councils in the geographical scope of the project
- Representatives of groups of water users
- Undersecretary of Geological Survey
- Three personalities selected by the Prime Minister

13. Cabinet Decision No. 20 of 2000 on combating the spread of the Newcastle poultry epidemic

14. Cabinet Decision No. 89 of 1993 on the adoption of the report of the environmental impact of projects.

15. Cabinet Decision No. 146 of 1998 on mitigation of environmental impacts resulting from the misuse of plastic bags and films.

16. Decision of the Minister of Water and Environment and the Governor of Sana'a on the formation of a joint committee established to discuss the issue of tanneries in the region (Masiab, Bani Matar, Sana'a Governorate) of the following:

- The General Authority for Environmental Protection
- The General Authority of Water Resources
- Sana'a Governorate

17. Cabinet Decision No. 167 of 2003 on the project to establish industrial zones in the Republic of Yemen.

18. Cabinet Order No. 83 of 2003 on the constraints and problems faced by the control of food, medicines industrial and agricultural products and supporting the export and approved the formation of a committee headed by Deputy Prime Minister and Minister of Planning and International Cooperation and the membership of each of:

- The Minister of Public Health and Population
- The Minister of Fisheries
- The Minister of Industry and Trade
- The Minister of Agriculture and Irrigation

The Commission handles the following tasks:

A- Study of the constraints and problems related to the control of food safety, medicines and all industrial and agricultural products, fish and water-related consumer and user safety, directed to local use or export.

B- Presenting technical and financial management proposals that will enhance the safety of consumer goods used for domestic and import use, to strengthen export capabilities of Yemeni goods and raise their quality, and to ensure the implementation of the cabinet decree No. 100 of 2002 for the adoption of standard specifications of the Gulf Cooperation Council as Yemeni specifications through the identification of the national control mechanism for the safety of consumer goods used for producing, importing and exporting and suggesting ways to strengthen the role of control, specifications and testing, including the following:

- The provision of laboratories, centers and modern means of screening, processing, preparation, storage and marketing of consumer goods for domestic or export use.

- Presence of control equipment in the locations and outlets to verify the safety of the goods produced, imported or exported and ensure conformity to specifications and standards adopted.

- To assist the committee to accomplish its mission as follows:

  A- Formation of a technical committee of the relevant authorities and in particular, the General Authority for Standardization and Metrology, the Supreme Council of the Export Development and the General Authority for Agricultural Research.

  B- Benefit from the experience of neighboring countries, regional and international organizations.

19. Cabinet Decision No. 263 of 2003 on the lifting of the ban on exports of Yemeni vegetables and fresh fruit, which is assigned to the following:

- The Ministry of Water and Environment for treatment of sewage output in the Capital, and collection of sewage in Taiz Governorate; because animals drink it. The owners of the farms near the sewage pools used it to irrigate their farms for animals feed.

- The Ministry of Public Works and Roads has to pave roads linking the farms of agricultural production for export and the main roads to minimize damage to the agricultural products exported.

20. The decision of the President of the Environmental Protection Council No. 38 of 1999 on the establishment of a poison and hazardous wastes unit.

21. The decision of the President of the General Authority for Environmental Protection No. 36 of 2003 on the formation of a standing committee to review, evaluate and approve the environmental impact assessment studies of the various development projects.

22. The decision of the President of the General Authority for Environmental Protection No. 42 of 2002 on the formation of a working group to study the environmental situation in the Capital.

23. Cabinet Order No. 132 of 2003 on the revision of the draft regulation to apply standard specifications and technical rules of Yemen, through the formation of a committee headed by Deputy Prime Minister and Minister of Planning and International Cooperation and the membership of each of:

    - The Minister of Youth and Sports
    - The Minister of Public Works and Roads
    - The Minister of Oil and Minerals
    - The Minister of Legal Affairs
    - The Minister of Public Health and Population
    - The Minister of Industry and Trade
    - The Minister of Agriculture and Irrigation
    - The Minister of State for Parliament and Shura
    - Undersecretary of the Ministry of Finance
    - President of the Customs Authority
    - The President of the General Authority for Standardization and Metrology

The main functions of the Committee are to review the draft regulation to apply the Yemeni standard specifications and technical rules and the Yemeni certificates of conformity in the country of origin. The committee is entitled to the use of any professionals and specialists needed to assist in accomplishing its mission.

7.5 Analysis

Remarkably, there is no clear interest by stakeholders of chemicals, and there are only very limited committees. Yemen imports lots of chemicals because of the proliferation of many national industries that use such chemicals. Thus, there is a need for intensification

of efforts to coordinate all clear and transparent procedures for the application of the safety of chemicals. We, in the Republic of Yemen, need more effective cooperation and coordination in the identification of tasks and responsibilities with the provision of all resources necessary to effectuate this coordination.

7.6 Recommendations

Establishment of a national committee for the management of chemicals from the relevant governmental and local organizations to be responsible for all the chemicals locally, regionally and internationally, and identify a clear mechanism of the action of the committee with the provision of physical and moral capability.

Chapter

8

AVAILABILITY AND USE OF INFORMATION

8 Availability and Use of Information

Due to the lack of effective information centers, it is difficult to obtain information about chemical materials, particularly that there is a limited awareness of the management of chemicals. Full information must be provided on chemicals in the Republic of Yemen, so that the management of chemicals in a transparent and sound way without any overlaps between the relevant authorities and the know how to use this information, to reduce the risk of problems resulting from the hazards and misuse of chemicals.

8.1 Availability of Information on the Management of Chemicals

- The absence of necessary information to determine the priorities clearly and the location of this information. If available it is limited, such as in the sectors of agriculture and health.
- The lack of adequate research on the impact of these chemicals on the surrounding environment.
- The lack of classification of chemicals clearly to all concerned authorities except agriculture and customs.
- The lack of information to register chemicals.
- Lack of adequate information to certify chemicals except in agriculture, industry and trade in a limited way.
- Availability of information on the import to the customs in a good way, in addition to absence of clear designation of the materials except the international classification.
- Availability of information on the decisions taken to reduce the risk for some pesticides, industrial materials and some ozone depleting materials in cooperation between the customs and the Environmental Protection Authority.
- Availability of some clear information particularly in agriculture in the field of the agricultural pesticides and Traders' Society of Agricultural Requisites.
- There is no information on chemical accidents and how to deal with them.
- There is no poison information or centers to follow up toxicity accidents except the efforts of the Ministry of Health and Population, Civil Defense, the Ministry of Public Works and Roads, and Local Councils.
- There is no information on the chemicals emitting hazardous gases.
- There is no clear information concerning the control of factories.

- There are no clear and specific mechanisms for the control of environmental, health and occupational activities.
- There is no clear information concerning the education of private institutions' workers in the different industrial establishments.
- Limited information to the general public on the management of chemicals.

Remarkably, there is no clear mechanism so far with regard to the following:

- Chemical resources management, availability and priorities.
- The evaluation of the environmental and health impact assessment of chemicals.
- Classification of chemicals and labels on them.
- Registration and licensing and permission system for the entry of chemicals except in the Ministry of Agriculture which is approaching completion and application.
- Lack of legislations to prohibit the importation of chemicals except the resolution to prevent hazardous chemicals and chlorinated pesticides.
- There are no precise statistics on the registration of accidents and how to deal with them and how to control poisoning cases occurring and keep them under control.
- Previously there are no clear and correct inventory lists of chemicals affecting the health and the environment.
- Lack of information concerning the management of chemicals for workers in the different industrial enterprises.
- Lack of a process to provide public information.

- Every governmental or non-governmental organization in association with the quality and volume of information available could deliver it to different organizations.

8.2 Analysis

- There are clear gaps with regard to references containing information and the problem of its availability in a permanent and non-arrival of most of organizations to them.

- The weak coordination between governmental authorities and non-governmental organizations with respect to chemicals.

- There is no real impact assessment of the effects of chemicals.

- There are no databases in the various government and popular bodies and if available are very limited and within the same institution or ministry.

8.3 Recommendations

- The establishment of a national information center of chemicals including a special section on education for chemicals.

- The need for a full and effective coordination between the popular and governmental actors in the field of chemicals.

- Exchange of experiences and information between the various stakeholders.

- The need to establish a center for poisons.
- The need for the establishment of a cleaner production center.

Chapter

9

TECHNICAL INFRASTRUCTURE

9 Technical Infrastructure

9.1 An Overview of the Laboratory Infrastructure

There are many laboratories of the ministries and the various institutions that have the technical possibilities for chemical analysis and the identification of the different identities, whether raw materials, manufactured or waste chemicals in order to maintain control over the application of the national specifications through these laboratories. Table (9-1) summarizes an overview of the infrastructure of laboratories for the systematic chemical analysis.

Table (9-1): An overview of the infrastructure of laboratories for the systematic chemical analysis.

Ser. No.	Laboratory	Authority	Location / city	Purpose
1	**laboratory of the Yemeni specifications, standards and quality control**	The Ministry of Industry and Trade, Yemen Authority for Specifications, Standards and Quality Control	The capital Sana'a	Screening and quality control of foodstuffs and conformity with the Certificate of Origin and the local and general specifications and validity for human consumption
2	**The Central laboratory**	Ministry of Oil and Minerals	The Capital Sana'a,	The disclosure of mineral components using different equipment.
3	**The Geological Laboratory**	Ministry of Oil and Minerals, branch of Aden	Aden	The disclosure of mineral and geological examination of rocks and soil
4	**Central Laboratory of Yemen Petroleum Company**	Yemeni Petroleum Company	Hodaida	Screening and quality control of petroleum products (fuel and lubricants)
5	**Aden Refinery Laboratory**	Aden refinery company	Aden	Screening, monitoring and controlling the quality of the products of the refinery.

Ser. No.	Laboratory	Authority	Location / city	Purpose
6	**Central Laboratory of Pesticides Analysis**	The Ministry of Agriculture and Irrigation	Sana'a	Screening and quality control of imported pesticides submitted for registration
7	**Health Central Laboratory and the Blood Bank**	The Ministry of Public Health and Population	The capital Sana'a	Analysis of samples of patients, quality control of blood maintained to ensure the safety specifications
8	**The Central Laboratory**	Ministry of Public Health and Population	Aden	Ensure product specifications, Aden branch
9	**The Food Laboratory**	Ministry of Public Health and Population	Aden	Food consumption and its validity, Aden branch
10	**Central Public Health Laboratory**		Hadramaut	
11	**Central Public Health Laboratory**		Hodaida	
12	**Laboratories of Occupational Health and Safety**	Ministry of Social Affairs and Labor	Sana'a	
13	**Laboratories of Occupational Health and Safety**	Branches laboratories Occupational Health and Safety		
14	**General Laboratory of Water and Sewerage**	Sana'a, Local Authority for Water and Sewerage	Sana'a	
15	**Laboratory of Authority for Water and Sewerage**	Aden Foundation Branch	Aden	Monitor and control specifications of liquid sewage before discharging in the soil or the sea for Aden
16	**Laboratory of the Authority for Water and Sewerage**		Mukalla	
17	**Laboratory of the Authority for Water and Sewerage**		Sayoon	
18	**Laboratory of the Authority for Water and Sewerage**		Taiz	
19	**Laboratory of the Authority for Water and Sewerage**		Hodaida	

Ser. No.	Laboratory	Authority	Location / city	Purpose
20	**Laboratory of Fish and Wildlife**	General Authority for services and marketing of fish	Aden	Screening and quality control of fish. Certification of quality of Aden
21	**Laboratory of Research Center of Marine Sciences**		Aden	
22	**Laboratory of Research Center of Marine Sciences**		Mukalla	
23	**Laboratory of the Agricultural Research**	Launched by the Ministry of Agriculture and Irrigation	Dhamar	
24	**Laboratory of Research Center of Kode**	The Ministry of Agriculture and Irrigation	Kode-Abyan	
25	**Sayoon Laboratory Authority for Agricultural Research**		Sayoon	
26	**Laboratory of Tehama Development Authority**	Tehama Development Authority	Hodaida	1-soil testing 2-check water for drinking, well drilling and irrigation
27	**Laboratories of Sana'a University A-Faculty of Science Laboratory.** **B-Laboratory of Faculty of Agriculture** **C-Laboratory of Faculty of Engineering** **D Laboratory of the Faculty of Medicine**	Sana'a University	Sana'a	1-Educational laboratories 2-Scientific research 3-Analysis of materials in an advisory capacity
28	**Laboratories of Hadhramaut University of Science and Technology**	Hadhramout University of Science and Technology	Hadhramout, Mukalla	Educational
29	**Aden University laboratories, Aden University**		Aden	1-educational 2- research 2-consultancy
30	**Laboratories of the University of Hodaida**	University of Hodaida	Hodaida	Educational
31	**Ibb University**		Ibb	Educational
32	**Laboratory of the University College of Agriculture**	University laboratories	Lahj - Aden	Educational and consultancy

9.1.1 The Infrastructure of the Central Laboratory for Analysis and Registration of Pesticides (Ministry of Agriculture and Irrigation)

Establishment and operation of the Central Laboratory for Analysis and Registration of Pesticides, which is responsible for the quality control and conformity to standard specifications adopted by the FAO and WHO Organization. It started the implementation of its work in October 1993 in cooperation with the German GTZ Organization with a cost of 650.000 dollars. It became easy to control the movement of pesticides that are entering the country through official import, so as not to release any shipment from the port of entry before the analysis of random samples taken from the port of entry and the certificate of analysis granted to demonstrate compliance with the specifications. In the case of non-compliance with specifications the pesticides will be returned to the country of origin

This laboratory is one of the international laboratories which are subject to periodic control, every two years, to assess the performance of professionals and the commitment to the methods of analysis commonly referred to. The laboratory has acquired the ranks 11 and 9 in 1996 and 1998, respectively among 45 global laboratories that participated in the Analytical Quality Assurance (AQA).

The number of samples analyzed since the laboratory started operation until 13 / 6 / 2003 amounted to (2300) samples. Table (9-2) lists the major equipment available in the Central Laboratory for Analysis and Registration of Pesticides (Ministry of Agriculture).

Table (9-2): The major equipment available in the Central Laboratory for Analysis and Registration of Pesticides (Ministry of Agriculture).

Laboratory and location	Equipment available	Aim of lab	Number of workers	How to obtain information	Cooperation and coordination
The Ministry of Agriculture and Irrigation, Public Administration for Plant Protection (Sana'a)	1. Gas Chromatography 2. HPLC (1) 3. Spectrophotometer (1) 4. Viscosity meter 5. Flash Point (1) 6. Oven (3) 7. PH-meter (1) 8. Fume hood (2) 9. Analytical balance (3)	To ensure conformity to specifications of pesticides	8	Reference approved by the Scientific and progress of the companies files for analysis	Governmental and non-governmental sectors

	10.	Centrifuge (3)
	11.	Refrigerator 1

9.1.2 The Pharmaceutical Control Laboratory

The Pharmaceutical Control Laboratory was established in 1990 and was opened on 5 June 1991.

The cost of the building and furnishing the laboratory amounted to (2.500.000) Yemeni Riyals at that time which was equivalent to (208.000) US dollars at the expense of the State.

Cooperation and support from the World Health Organization, for the furnishing of laboratory and processing equipment, machinery, chemicals and reagents as well as to provide the library with some basic references, training of pharmacists to serve during phase I amounted to (1.200.000) Yemeni Riyals which was equivalent at that time to (100.000) US dollars.

The early work of the laboratory was the physical and chemical analyses. In 1994, for the opening of the microbiological analysis was provided with machinery, equipment, chemicals and the necessary reagents in coordination with the WHO and its support. The first high performance liquid chromatograph (HPLC) was operated and the number of this type of devices became six.

The items analyzed in the laboratory exceeded (1000) in 1998. Another story has been built and added to the laboratory and is currently under furnishing. This story was built be World Health Organization. Negotiation is going on to add the supplement departments: The Unit of Drugs and Poisons, The Unit of Vaccines, and the Unit of the Medical Requirements and Cosmetics.

Upon completion of processing, the quality laboratory will be able to complete the analysis of all the various kinds and forms of medicines and pharmaceuticals and be comparable to the most recent quality control laboratories in the world, as the only national reference laboratory.

There is a project to set up two units of analysis in Hadramaut and Hodaida because these cities are ports, across which medicines are imported. Right now, there is an Analysis Unit in Aden.

Currently, the laboratory is pursuing physical and chemical analyses, such as tests of the packaging, shape, color, taste, smell, consistency, serenity, pH, the average weight and size, viscosity, density, firmness, weakness, the time of disintegration, the time of melting and the concentration of the active substance.

The laboratory is also pursuing the microbiological analyses, to confirm the effectiveness of antibiotics, testing for bacterial contamination, the search for toxic microbial substances and testing of sterility.

For equipment, there are some major equipment such as the high performance liquid chromatograph (HPLC) (6 units), a gas chromatograph and two spectrophotometers.

There are also some assisting devices such as the pH meter, a device for the determination of moisture, an instrument for the measurement of solubility, a melting point apparatus for raw materials, and a device for the measurement of viscosity, among others.

The number of cadre in the laboratory is 40 staff members, including 30 pharmacists, 2 assistant pharmacists, a chemist and 1 chemical laboratory technician and 6 secretaries for printing and cleaning. Table (9-3) lists the major equipment in the Pharmaceutical Control Laboratory (Ministry of Health)

Table (9-3): The major equipment in the Pharmaceutical Control Laboratory (Ministry of Health).

Laboratory and location	Equipment available	Aim of lab	Number of workers	How to obtain information	Cooperation and coordination
Pharmaceutical Control Laboratory of the Ministry of Health, Sana'a	1. Ultrasonic (1) 2. Integrator (4) 3. Distillation (1) 4. Wet chemistry 5. Analysis (1) 6. Karl fisher titration (1) 1 7. 40 HPLC (6) 8. GHC (1) 9. PH meter 10. Viscosity meter 11. Flash point 12. Analytical balance 13. Humidity measurement system 14. The fragmentation 15. Solubility measuring device	Quality control of pharmaceutical medicines	40	Scientific references and Internet	The supreme Authority for pharmaceutical medicines companies, imported and local factories

Table (9-4) lists the major laboratories in the Republic of Yemen.

Table (9-4): The major laboratories in the Republic of Yemen.

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
Central Laboratories of the Geological Survey -Sana'a	1- Atomic absorption (Flame) 2- Spectrophotometer 3- Gas Chromatograph (GC) 4- X-Rary Fluorescent 5- X-Ray diffraction (one only and damaged) 6- UV-spectrum (Single bear) 7- UV-light 8- Refractometer 9- Inspector radiation monitor 10- Microscope 11- pH meter 12- Distillation unit 13- Hot plate with magnetic stirrer 14- Centerifuge 15- Furnace 16- Muffle Furnace 17- Oven 18- Vaccum pump 19- Analytical balance 20- Fume hood 21- X-Ray 22- Co-60 Corsi 5500 University 23-Co-60	Geological samples analysis and disclosure of mineral components in the various preparations	1982	37	No	1-There is a library in the laboratory. 2- Participating in scientific journals and periodicals. 3-Personal communication. 4-Training courses.	1-The General Authority for Standardization and Metrology. 2-University of Sana'a. 3-Air Force laboratories. 4-Weapon maintenance. 5-The Environmental Protection Authority 6-Blood Bank. 7-Auhtrity of water and sanitation. laboratories 8-Ljunhaltagh Agency. 9- Egyptian Authority for General Survey. 10 - The Syrian survey. 11 - The survey of Jordan. 12-The International Atomic Energy Agency. 13-The Egyptian nuclear resources.

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	24- Spectrophotometer						
Central Laboratory for Quality Control of Pesticides	1- Gas Chromatography (4), with all accessories H and Nitrogen, computers, printers 2- Auto-injection Supplement Body GC 3- HPLC (1) 4- UV-Spectrophotometer With all the computers and printer accessories 5- Melting point instrument 6- Karl fisher titrator 7- Digital pH meter 8- Flashpoint (1) 9- Viscosity meter (1) 10- Oven (3) 11- Fume hood (2) 12- Analytical balance	Audit and control of the quality of pesticides and conformity to specifications of standard (import official)	93		Won two positions, 9 and 11 for the years 96 and 98 of the Analytical Quality Assurance (AQA)		(GTZ) Germany
Pharmaceutical Control Laboratory, The General Authority for Pharmaceuticals	1- HPLC (6-1) 2- GC (1) 3- Spectrophotometer (2) 4– pH meter (2) 5- Mittler (Karl Fischer Titrator) device to measure humidity 6-Spectronic Zid 7- Melting points Apparatus Measuring the degree of fusion 8- Betting + Stanley limited	Analysis of the various kinds of pharmaceutical medicines, different types and forms. Laboratory performs also the physical examinations: 1-Test package 2 - Consistency	5/6 /1991	40			WHO

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	Refractometer 9- Viscotester 10- High temperature Gravimetric Furnace	3- Color 4- Taste 5- Odor 6- Homogeneity 7- Clearness 8- pH 9- Average weight and size 10- Density 11- Rigidity and fragility 12- Time of disintegration 13- Time of solubility (instrument) 14- Concentration of the active substance					
Laboratory of the Pharmaceutical Factory, Yemen pharmaceutical Company Yedco Sana'a	1-Uv-Vis Spectrophotometer (2) 2-Infrared Spectrophotometer 3 - HPLC 4- Memo titrator meter 5-Refrective index (Refractometer) 6 – pH meter 7- Viscometer 8- Melting point 9- Flame photometer (Li-K-	Check product quality of pharmaceutical factory					

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	Na) - Corning Ciba 10- Extraction Apparatus						
Health Laboratory and the Blood Bank The Ministry of Public Health and Population	1- Uv-Visible Spectrophotometer. 2- Flame photometer 3- Biofuge 4- Kijldahl apparatus Gallenkamp 3 5- Refractometer Fisher Scientific. 6- GC with all attachments (hydrogen generator and Nitrogen, computers and printers) 7- pH meter (2) 8 - HPLC 9- Atomic absorption Spectrophotometer computerized 10- Berthold (the Becquerel Monitor LB 2003) to measure radioactive materials 11- Gelman Sciences PS-500 protocol hazardous voltage Central	1- Analysis of samples of patients 2- Quality control of filed blood to ensure integrity					
Laboratories of the General Authority for Standardization and Metrology	1-GC-9A Hydrogen generator with accessories instrument 2- 875-type 3- HPLC (VIS detector) 4-UV-2100 (Visible						

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	spectrophotometer recording) 5-Spectr AA-10 (Atomic Absorption Spectrophotometer).						
Central laboratories, Faculty of Science, University of Sana'a, Ring Road	1- HPLC (Pye Unicam 4020 UV detector Philips). Not working because of the blockage of the column and the lack of other columns. 2- GC (Pye Unicam series chromatograph Philips 304), damaged 3- Atomic absorption spectrophotometer (Perkin-Elmer 2380) with a special supplement to the measurement of mercury, arsenic 4- UV-Spectrophotometer. 5- Fisher Titrator 6.- CHN, damaged O-Rapid Heracus 7.- Perkin Elmer 1310 Spectrophotometer 8- Sp3-300 Infrared spectrophotometer 9- Automatic Scanning spectrophotometer 10- NMR, damaged 11- X-Ray Fluorescence,	1- Scientific research 2- Consultancy on imported and manufactured materials 3- Educational laboratories					

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	damaged 12- pH meter (6) 13- Conductivity meter 14- Computerized Thermal Analysis 15- GC-AAS 16- Polarograph, Computerized 17- CHNO Analyzer						
Laboratory of Water and the Environment (Dutch project) College of Engineering University of Sana'a	1- Conductivity Meter 2 – pH Meter 3- Conductivity Hach, fields instrument 4- Conductivity meter, field instrument 5- Motor 6- Turbidimeter (Ratio/XR Hach) 7- Hach COD Reactor (Chemical Oxygen Demand) 8- Spectrophometer (3) 9- Oxi-92 dissolve Oxygen field device 10-Bilogical oxygen demand (BOD) Hach.						
Laboratory of testing of construction materials, College of Engineering	1- The tensile test and bending of iron. 2- The pressure test of concrete and stone. 3- Cement Testing device (uncertainty period)						

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	4- Integrated sieves of different sizes for sand and rubble. 5- Measurement of smoothness of polished marble and granite 6- Non-destructive tests (such as the hammer, the revolver and ultrasonic). 7- Test of ruble cracker. 8- Rubble impact test 9- Density quality 10- Bilogical Oxygen demand 11- OR/3 Hach Spectrophotometer 12- Spectrophometer Pharmacia biotech Novapec II 13- Spectrophotometer (Portable data logging) 14- Hach Colorimeter to measure all elements, field device. 15- Memmert incubator 16- Portable incubator. 17- Total dissolved Salt (TDS) 18- Colony counter Galenkamp 19- Bacterial incubator (2) 20- Centor Heraeus sepatch.						

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	21- Galenkamp - Oven (1200 duties) 22- Flame Photometer						
Road Laboratory, College of Engineering	1- Los Angeles rubble test. 2- Rubble impact test. 3- Test of the soil bearing capacity. 4- California test, Proctor test 5- Asphalt screening test. 6- Asphalt flash point test. 7- Asphalt viscosity test. 8- Asphalt mixture cubes test (Marchat) 9- Extraction of asphalt mixtures.						
Laboratory of the local Corporation of water and sewage, Sana'a, Ministry of Water and Environment	1- Atomic absorption (Flame) 2- Spectrophotometer 3- Flamephotometer 4- UV Spectrophotometer 5- Chemical oxygen demand Reactor (COD-reactor). 6- Biological oxygen demand apparatus (BOD-incubator) 7- TDS-meter 8- EC/TDC-meter 9- Microbiological incubator (For microbial water analysis test) 10- Turbidity photometer 11- Colony counter Anderman		1980	5 Bachelors	Water analysis		1-Central Laboratory of the Geological Survey 2-Laboratory of the specifications and standards. 3- Laboratories of the University of Sana'a

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
	12- Autoclave 13- Kijldal system 14- pH meter 15- Dissolved oxygen meter. 16- Distiller 17- Distillation unit 18- Titroprocessor 19 - Electrical conductivity 20- Furnace 21- Muffle Furnace 22 - Oven 23- Vaccum pump 24- Analytical Balance 25- Laboratory Fume hood						
Laboratory of foodstuffs, Faculty of Agriculture, University of Sana'a	1- Atomic Absorption Spectrophotometer. 2- Roy Milton Spectoronic 3- UV Spectrophotometer 4- Perkin Elmer Atomic Absorption Spectrometer (1) 5- Flame photometer 6- Conductivity meter (2) 7- Digital pH meter 8– pH meter l (Fisher Scientific) (No. 2) 9- Metrohm 655 dosimat Swiss made 10. Perkin Elmer Atomic Absorption Spectrometer (7)						

Laboratory and location	Equipment available	Activities of laboratory	Date of construction	Number of workers	GLP certified	Access to information	Relations of cooperation and coordination
Laboratory of Rural Water Projects	1-Spectrophotometer DR 2- Spectrophotometer (Computerized) 3- pH meter 4- Conductometer 5- Digital titrator 6- Colorimeter						

9.2 Analysis

- We note that there are a lot of laboratories that have the potential of devices capable of dealing with chemicals effectively; as seen in the laboratories of the Ministry of Agriculture and Health. Some laboratories are in need of maintenance and rehabilitation of employees in addition to operating expenses and the provision of consumable items such as the different reagents and glassware according to their need.

- The presence of lots of equipment that are not operating properly due poor maintenance. The maintenance engineers in laboratories must be highly trained and qualified.

- The laboratories need confirmatory analysis between laboratories in order to obtain certificates of recognition and the need for reference laboratories, for example, in the water, environment and chemicals. They need to intensify the weak coordination between laboratories.

9.3 Recommendations

1. The need for coordination and exchange of experiences between the existing laboratories.
2. The need for integration between the existing laboratories.
3. The need for support of existing laboratories.
4. The need for professional training and continuous rehabilitation of cadres working in the laboratories.
5. The need to raise the salaries of workers in laboratories in general, rather than leak the professionals to other laboratories in need to obtain international recognition certificates.

Chapter

10

INTERNATIONAL LINKAGES

10 International Linkages

10.1 International Linkages

The Republic of Yemen is keen to join the international conventions on chemicals and to participate in the international forums for chemical materials. The following tables illustrate that. Table 10-1 shows the membership in the programs and the international organizations. The 10-2 summarizes the participation in international conventions and the procedures for the management of chemicals.

Table (10-1): The membership in the programs and the international organizations.

International Organization / procuring Activity	Joint National Contact Point (Ministry / body)	Relevant national and other ministries / bodies	Relevant national activities
International Forum on Chemical Safety IFCS	The General Authority for Environmental Protection Brother / Salim Abdullah Baguhaizel)	Relevant bodies	
UNEP, Cleaner production	General Authority for Environmental Protection Brother / Mohammed Ahmed Ali	General Authority for Environmental Protection	A national preparatory committee for the establishment of the center has held several meetings to draw up the statute of the center.
WHO, World Health Organization, Dr. Hashim Ali Al-Zain	General Authority for Environmental Protection Brother / Ahmed Salim Melqat	Other relevant agencies	Support and training in the area of laboratory
UNIDO	Ministry of Trade and Supply		
World Bank (regional bank for development)			
FAO, Food and Agriculture Organization, Mr. Hashim Al-Shami	The Ministry of Agriculture and Irrigation, Mr. Mohammed Al-Ansi, Director of Projects		

Table (10-2): Participation in international conventions and the procedures for the management of chemicals.

International conventions	Relevant national body in charge	National relevant activities
Agenda 21 of the Commission on Sustainable Development.	The General Authority for Environmental Protection (the Socotra project). Brother / Ahmad Wazzani The General Authority for Water Resources Dr. Khalid Riyadh. UNDP Brother / Fuad al-Qadasi and Brother / Wahib Al-Iryani.	• Support in the area of laboratory quantities with small quantities. • The Socotra project. • The General Authority for Water resources.
Rotterdam Convention	The General Authority for Environmental Protection	
Montreal Protocol	The General Authority for Environmental Protection (Ozone Unit), Engineer / Faisal Nasir	• Many awareness issues. • Ending the use of ozone-depleting substances in the foam sector. • Ending 80% of the use of the ozone-depleting substances in the direction and work under way to terminate the remaining 20%. • Working to end the use of nearly 14 tons of ozone-depleting substances in the commercial sector (Refrigeration). • Action underway to reduce dependence on ozone-depleting substances in the maintenance of refrigerators.
ILO Convention 170	Ministry of Social Affairs and Labor	
Recommendation of the United Nations on Special Transport of Dangerous Goods		
The Basel Convention	The General Authority for Environmental Protection (Poisons and hazardous waste unit - Engineer / Ali Abdullah Al-Thobhani)	• A 1990 inventory of hazardous waste (industrial waste water, plastics, photography factories, medical and health pesticides, expired pesticides, expired medicines and waste oils). • A 1997 inventory of hazardous medical waste, plastic bags and sheets. • March 2002 survey of three types of hazardous waste. • Coordination with UNEP-ROWA) and the secretariat of the Convention on the financing of the preparation of a

International conventions	Relevant national body in charge	National relevant activities
		draft national strategy in 2002. • A workshop to introduce the discussion of the draft Convention, the National Strategy 17-18 July 2003 - Taiz. • Completing the preparation of a draft national strategy for the integrated management of hazardous residues 2003. • Action is underway to submit it to the Cabinet for approval.
Stockholm Convention for POPs Material	The General Authority for Environmental Protection (Dr. Jamal Al-Lawzi)	Implementation of the the inventory of PCBs, dioxins and furans / preparation of the Implementation Plan of the National Convention (under progress)

10.2 Projects

The ozone unit (the General Authority for the Environmental Protection) managed to establish two projects in the refrigeration sector benefiting two manufacturers (Nagman and Sterko) that are located in Sana'a. The two projects entered are currently under implementation. The two projects, in addition to a range of high-technology devices that will be linked through the computer system, will benefit from the improvement of the line of production, in both factories. It will allow these devices to dispense the CFC11 and 12 gases, which are ozone depleting substances used in the refrigeration industry, in the commercial sectors. The substitute will be the friendly gases CFC 134a/141b.

Those responsible for these manufacturers will attend other courses in Italy with the machinery manufacturing company, to enable the efficient operation of the new system in view of its delicate and sensitive nature.

Two other factories, one in Sana'a and the other in Taiz, will benefit from two new projects in the sector of aerosols; which is a material used within the odors and perfumes industry.

All of these projects received approval and support from the Multilateral Fund of the Montreal.

Table 10-3 summarizes the future participation in the projects and related technical assistance.

Table (10-3): The future participation in the projects and related technical assistance.

Project name	The donor / international / bilateral assistance	The national contact point	Relevant activities
Reducing the use of CFCs	UNIDO - Multilateral Fund.	The General Authority for Environmental Protection (Ozone Unit) Engineer / Faisal Nasir	Two projects for Al-Saeed, Taiz and Al-Thawrah Industrial Complex, Sana'a, for the disposal of 200 metric tons, all that remains of CFCs
End the use of CFCs foams sector	Yemeni private sector working in foams.	The General Authority for Environmental Protection (Ozone Unit) Engineer / Faisal Nasir	Costs of the use of ozone-friendly alternatives.

10.3 Analysis

- The Republic of Yemen is keen to join the international conventions on chemicals and participate in international forums for chemicals.
- There is no effective coordination at the national level between local government institutions, donors and international organizations with regard to chemicals.
- Weak coordination between local institutions and international organizations with regard to the importation of chemicals required in the analysis and examination, assistance in the disposal of obsolete chemicals and the isolation of agreements items in limited programs.
- Lack of good links between local institutions associated with the environmental aspects, due to the lack of qualified personnel in this area.

10.4 Recommendations

1. The need for coordination with donors to fund projects on chemicals.
2. The intensification of national efforts and coordination between the relevant authorities.
3. Activation of international conventions on chemical items and expansion of the participation of stakeholders associated with chemicals.

Chapter

11

OUTREACH WORKERS AND THE PUBLIC

11 Outreach Workers and the Public

11.1 Mechanisms Available to Provide Information to Workers and the Public on the Potential Risks Associated with the Production, Import, Export and Circulation, Use and Disposal of Chemicals.

Listed below are the key foundations that work in the field of education and provide workers and the public with information and awareness of chemical hazards that affect their health.

- The Ministry of Social Affairs and Labor (General Directorate of Occupational Health and Safety).
- The Ministry of Health (National Center for Health)
- The Ministry of Agriculture (General Directorate of Plant Protection)
- The General Authority for Environmental Protection (Department of Environmental Awareness and Information)
- The Civil Defense
- The Ministry of Education
- The Ministry of Information (media video, audio and journalism)
- The organizations and non-governmental entities

11.2 The Ministry of Social Affairs and Labor (Directorate General of Occupational Health and Safety).

Under the regulation of public health and occupational safety in Chapter Twelve, the general requirements for prevention of the risks of chemicals, as well as educating employees especially in the industrial establishments dealing with chemicals are the following:

- Provision of sessions of awareness on how to deal with chemicals and the risks that they will be exposed to in case of the improper use and ways of prevention by the use of personal protection equipment.

- To make periodic field inspection by occupational safety inspectors to monitor the proper application of the employer guidance on chemical safety, as well as the commitment of workers urged to use devices of individual protection.

- The distribution of posters on chemical safety and ways of dealing with chemicals safely, including preventive measures and first aid in case of contact with these substances.

- Provide the employer with information on methods of safe storage and transport of chemicals according to national and international regulations on hazardous chemicals.

- Enforcing employers not to remove the signs, warnings and advisories issued by the chemicals producing companies, which are usually affixed on the products and the commitment to stick to these advisories and warnings.

- Requiring suppliers to develop labels for all chemicals and classify them in accordance with the regulations and standards approved by the relative competent authority.

- Alerting the employer to develop a contingency plan to deal with flammable and explosive chemicals.

- The Directorate issued a guide for occupational health and safety. Some chapters of the book addressed information on the risks of chemicals, methods of prevention, the high-risk chemicals and carcinogens.

- The Department of Public Health and Occupational Safety in coordination with the General Workers Union of the Republic arranged indicative workshops for the workers in industrial establishments on safety and methods of dealing with chemicals.

- Conducting interviews and feature stories that reflect the risks of chemicals and their effects on the health of male and female workers and make them aware of the guidance to follow occupational safety in the work environment as to handling food, drink and smoking away from the premises.

- To educate employers of chemical waste disposal, according to national regulations and international conventions relating to waste management.

- The Ministry of Labor through the Unit of the Fight against Child Labor, in collaboration with the General Directorate for Occupational Health and Safety and the Federation of Trade Unions of the Republic of educating young workers in the field of agriculture and those who deal with pesticides for agricultural use, especially in the qat farms through field trips to the farms and to the schools, and

meeting the parents of these children and educate and guide them to the health risks posed to children by dealing with these toxic chemicals, that affect the health of children and their unsafe use, which may expose and introduce children and the public to serious diseases.

- The distribution of posters and leaflets indicative of the safe ways in the use of children in spraying pesticides.

- The Labor of Children Unit developed an awareness program in the summer holidays by gathering the children in summer centers for lecturing about the dangers of occupational exposure, particularly in workshops that deal with chemicals and farms dealing with pesticides, especially the qat farms.

- The Department of Working Women in coordination with the Department of Occupational Health and the National Commission for Women and other relevant agencies arranged to raise awareness of industrial installations workers and various other sectors that deal with chemicals through the holding of training courses of awareness, known as working women occupational hazards, to her or her fetus, if pregnant, as a result of dealing with these chemicals. The lectures outreach includes knowledge of the health hazards caused by chemical contaminants, whether liquid, gaseous or solid and methods of prevention and safety and methods of dealing with these materials in the work environment.

- The National Commission for Women conducted awareness through writing essays in women feature magazines who give service information monthly at the National Committee, which sometimes address occupational problems facing working women, especially chemicals in the work environment in some industrial plants and educate housewives the safe ways of use of chemicals in cleaning, laundry and other domestic activities.

11.3 Ministry of Agriculture

The Ministry of Agriculture educated farmers and workers in the agricultural sector and defined the risks of chemicals that they deal with, particularly agricultural pesticides and fertilizers, and how to deal with them through the Department of Preventive Guidance of the Public Administration of Plants Protection and education and guidance through:

- Production of a manual on methods of dealing with pesticides.

- The distribution of indicative posters on methods of dealing with pesticides and practice of prevention measures.

- The training sessions on the dangers of dealing with pesticides securely.

- Develop plans quarterly each year in the field for the purpose of educating farmers on the proper use and handling of pesticides and fertilizers.

- To hold workshops and symposia with other relevant agencies on pesticides and methods of circulation and dealing with them in accordance with the laws and regulations.

- To educate farmers and the public through outreach programs on television and radio, and feature articles on dealing with pesticides and the dangers they may face in the event of improper use.

- Alerting farmers through extensive instructions and advisories to be found on the packaging of pesticides because of its usefulness to maintain the health and public health.

11.4 The Ministry of Health and Population

The Ministry of Health and Population practices education and awareness in the area of chemical safety through the National Health Education Center, as follows:

- Develop programs of awareness and guidance information on radio and television to alert the public of methods of dealing with chemical products, especially medicines.

- Create alerts and warning posters in hospital medical laboratories and operation theatres on dealing with the chemicals they are using.

- To hold workshops and courses related to chemicals affecting the health of the individual as well as the safety of drugs.

- To inform the public through articles and feature stories on toxic chemicals affecting human health.

11.5 General Authority for Environmental Protection

The General Authority for Environmental Protection educates awareness on chemical safety through the Department of Environmental Awareness and Information and the Unit of Women and the Environment, within which they operate, according to the following mechanisms:

- The public education and coordination with the media in the production of radio and television programs intended to increase environmental awareness in the community.

- To make the field awareness through interviews with local personalities and social figures and delivering of lectures in different varieties of people to raise their environmental awareness.

- The focus in the sector of women particularly through guidance and concentrate through lectures at the women's centers and women's groups.

- To activate the role of environmentalists in schools through giving awareness lectures for school students that will enrich their minds and increase their awareness in issues relating to the risks of chemicals and their effects on the environment and human beings.

- Coordinate with the various media.

- The Department issued the Environment Journal which includes some prepared essays on chemical safety by competent university professors, as well as the publication of weekly publications to address some topics on chemical risks to the environment.

11.6 Ministry of Education

The Ministry of Education practiced education and awareness in the area of chemical safety, through the following:

- To educate the school laboratory technicians on chemical hazards in the laboratory.

- Develop demonstration and warning plates in the laboratories to alert students and employees on methods of dealing with chemical materials during the scientific experiments and use.

- Labeling warnings on each chemical, on their own packaging.

- Provide training courses for school employees about the dangers of chemicals in the laboratory.

- Coordinate with the child labor through the management of the national project to educate school students about the dangers resulting from the exposure to chemicals at their work, particularly in the carpentry workshops, welding and spraying pesticides on farms.

11.7 Civil Defense

There is a role for the General Administration of the Civil Defense in raising awareness, especially in terms of prevention. This is done in accordance with a certified plan prepared by the High Council of Civil Defense, which includes several ministries and is chaired by the relevant Minister of the Interior.

The plan aims to reduce accidents and how to cope in the event of a sudden catastrophe and notification of the plan to the general public as well as owners of major industrial enterprises.

11.8 Ministry of Information

The role of the Ministry of Information is the public awareness of chemical hazards through presenting scientific articles in some scientific programs and health education in television and radio channels. Also, writing journal articles in the official daily newspapers about the health problems caused by chemicals used in industrial, agricultural and personal uses.

11.9 Analysis

- Failure to meet the covering of awareness education to all governorates of the Republic.
- The absence of some relevant actors who should have a role in raising awareness in the field of chemical safety.
- The lack of coordination between some concerned responsible parties with the chemical safety program.
- The deficiencies in the awareness programs, especially folders and bulletins related information on chemicals and chemical safety programs.
- Weak media coverage.

11.10 Recommendations

- To produce a united typical manual on chemical safety in coordination with other relevant agencies.

- Urging employers to develop workers awareness plans in all industrial establishments throughout the year in coordination with the Ministry of Labor (Occupational Health and Safety) and the General Authority for Environmental Protection to cover all governorates.

- To activate the role of media to prepare guidance programs for the public awareness showing the dangers of chemicals and safety in dealing with these materials and methods of prevention, in television and radio.

- To qualify the cadre of other relevant agencies to play an active role in awareness programs.

- To provide financial support to implement the programs of chemical safety in all industrial enterprises and other sectors.

- Create teams for field awareness of industrial enterprises, the agricultural sector, oil and other sectors with the provision of means of transport and financial incentives.

- Increasing communication and coordination with non-governmental and official bodies to activate the programs and plans of common public awareness in the area of chemical safety.

- Producing and printing of brochures and folders on chemical safety.

- The establishment of a center for information on chemicals and chemical safety programs.

- Exchange of information and visits with the GCC and other Arab countries of converging awareness programs in the field of chemical safety.

Chapter

12

AVAILABLE SOURCES NEEDED IN THE MANAGEMENT OF CHEMICALS

12 Available Sources Needed in the Management of Chemicals

Ministries and relevant institutions in the Republic of Yemen, have many qualified cadres on the subject of chemicals. Table (12-1) lists some of the qualified cadres in the relevant authorities in Yemen.

Table (12-1): Some of the qualified cadres in the relevant authorities in Yemen.

Ser. No.	Ministry / Institution	Number of existing qualified scientific cadres		Experience/ Qualification
		Qualification	Number	
	The Ministry of Water and Environment			
	The General Authority for Environmental Protect			
	Water Resources			
	Water and Sewerage Authority			
	The Ministry of Agriculture and Irrigation			
	The Ministry of Public Health / Pharmaceutical Control Laboratory	Pharmacist	30	Bachelors
		Assistant pharmacist	2	Diploma
		chemical	1	Bachelors
		Laboratory Technician	1	Bachelors
	Ministry of Industry and Trade			
	The Ministry of Social Affairs and Labor			
	Customs Service			
	Chambers of Commerce and Industry			
	The Ministry of Oil and Minerals			
	Yemeni Universities			
	The Ministry of Public Works and Roads			
	Yemen Authority for Specifications, Standards and Quality Control			
	Centers			
	Pesticide Management (Central Laboratory for Analysis and Registration of Pesticides)	Pesticides analysis	1	Ph D
		chemist	4	Bachelors
		Agronomist	8	Bachelors

Ser. No.	Ministry / Institution	Number of existing qualified scientific cadres		Experience/ Qualification
		Qualification	Number	
		Laboratory technician	1	Diploma
		Agricultural science	3	Bachelors
	Quality Control Management (Control Unit for fertilizers)			
	Central Laboratories of the Geological Survey			
	Plenary Laboratory Medicine,			
	Pharmaceutical Control Laboratory			
	Laboratory of Plant Medicines (Pharmaceutical company Yemen)			
	Central Health Laboratory and the Blood Bank (Ministry of Health and Population)			
	Laboratories of the General Authority for Standardization and Metrology			
	Central Laboratory (Faculty of Sciences, University of Sana'a)			
	Laboratory of Water and the environment (Water and the Environment, University of Sana'a)			
	Building Materials Laboratory (College of Engineering, University of Sana'a)			
	Road Laboratory (College of Engineering, University of Sana'a)			
	Soil and Water Laboratory (College of Agriculture, University of Sana'a)			
	Laboratory of Foodstuffs (College of Agriculture, University of Sana'a)			
	Laboratory of the Local Water and Sanitation Authority			