SECTION 3

PRODUCTION IN THE AGRICULTURAL, EXTRACTIVE, FUELS AND CHEMICALS INDUSTRIES.

3.1 Introduction

In this section major individual products are considered in more detail, both on a country by country basis and on a regional one. The industrial sectors discussed are those major ones which have already been identified in previous sections, and which are considered to have the most significant environmental and health impacts, i.e.: agriculture; the extractive and metals industries; fuel production and processing; and the chemicals industry.

3.2 The Agricultural Sector

The agricultural sector's products can be considered under their main headings. Firstly, the production of staple foods and grains, basically for home consumption, although some large producers like Argentina, Canada and the United States produce staples both for home consumption and for export. Secondly, the production of commercial crops mainly for export, either after processing or in the raw state. The third category is livestock production.

3.2.1 Production of Staple Food Crops

The main staples produced in the Americas are maize, wheat, potatoes, and rice. In a few countries, or sections of countries, cassava (manioc) is also grown as a staple. This product is however of minor significance overall and has not been included in the tables.

Table 13 shows the production of the aforementioned staples, by country, and Table 14 shows them grouped by region. Excluding the United States of America and Canada, the Americas produced in 1978 a combined total of 77.8 millon tonnes of the four main staples, or approximately 235 kg per person. The per capita production for each crop is also shown in Table 14.

Since production figures by themselves give no indication of the actual or potential environmental stress produced by the activity, the production figures have also been related to the total surface area of the regions. This of course is not totally satisfactory since not all of the land is under cultivation nor are crop yields per unit area the same everywhere. However for a short overview such as this one the figures are useful for comparative purposes. Thus in LAFTA, for every square kilometer of land surface 3.78 tonnes of staple

foods are produced; the comparative figures for Central America and the Caribbean and for the USA and Canada are 4.05 and 14.43 respectively. These figures lead to the conclusion that in general the land in Latin America and the Caribbean is somewhat less intensively used for staple crops and feedstuffs than is that of the USA and Canada. However the picture changes somewhat when commercial crops are taken into consideration.

3.2.2. Production of Commercial Crops

The major commercial crops grown in the Americas are: cocoa, coffee, cotton, groundnuts, soybeans, sugar (cane) and tobacco. Table 15 shows the production of these crops on a country basis and Table 16 shows the production regionally.

The total production of commercial crops in LAFTA in 1978 was 122 kg. per person, whereas for Central America and Canada 233 kg. per person. The figures per unit of total surface area were: LAFTA - 1.8 tonnes/km^2.; Central America and the Caribbean - 10.7 tonnes/km^2.; and for the USA and Canada - 2.9 tonnes/$km.^2$ Combining the latter figures with those of the previous sections gives a total production per unit of land as: LAFTA - 5.6 tonnes/km^2; Central America and the Caribbean 14.8 tonnes/km^2; USA and Canada - 17.2 tonnes/km^2. These figures confirm one major difference between the agricultural sector of Central America and the Caribbean on the one hand, and Canada, the USA and the LAFTA countries on the other hand. That is the agricultural sector of Central America and the Caribbean is basically an export-oriented one. This would become even more apparent if other crops such as bananas were added to the figures; however data on those crops were not available.

During the last twenty years there has been one very significant development in the production of commercial crops in Canada, the USA and the LAFTA countries. Whereas production figures for most produce has increased relatively slowly, there has been a dramatic increase in the production of soybeans. Based on the average production for the years 1961 to 1965 and the 1978 figures, the increase for the USA and Canada was 156 per cent; for LAFTA the increase was 2 766 per cent, from just 459 thousand tonnes to over 13 million tonnes, or about 16.4 per cent of world production.

TABLE 13 - PRODUCTION OF STAPLE FOOD CROPS IN THE AMERICAS IN 1978 (THOUSANDS OF TONNES)

	MAIZE	POTATOES	RICE	WHEAT
ANTIGUA & BARBUDA	--	--	--	--
ARGENTINA	9700	1593	310	8100
BAHAMAS	--	--	--	--
BARBADOS	--	--	--	--
BELIZE	13	--	7	--
BOLIVIA	331	793	89	60
BRAZIL	13533	2015	7242	2677
CANADA	4215	2453	--	21246
CHILE	257	981	105	893
COLOMBIA	862	1996	1715	38
COSTA RICA	98	25	195	--
CUBA	95	155	460	--
DOMINICA	--	1	--	--
DOMINICAN REP.	42	23	--	--
ECUADOR	200	498	308	38
EL SALVADOR	540	16	60	--
GRENADA	--	--	--	--
GUATEMALA	760	68	26	55
GUYANA	--	--	300	--
HAITI	250	9	105	--
HONDURAS	340	5	21	1
JAMAICA	10	9	6	--
MEXICO	9616	837	397	2643
NICARAGUA	209	2	82	--
PANAMA	83	11	211	--
PARAGUAY	410	5	75	32
PERU	550	1650	400	90
ST. LUCIA	--	--	--	--
ST. VINCENT	--	--	--	--
SURINAME	--	--	190	--
TRINIDAD-TOBAGO	--	--	22	--
USA	179886	16356	6251	48954
URUGUAY	172	102	226	150
VENEZUELA	740	204	600	1

TABLE 14 PRODUCTION OF STAPLE FOOD CROPS (1978) IN THE AMERICAS

	MAIZE			POTATOES			RICE			WHEAT		
	10^3ton	kg/capita	ton/km^2	10^3ton	kg/capita	ton/km^2	10^3ton	kg/cap.	ton/km^2	10^3ton	kg/cap.	ton/km^2
LAFTA	36371=	1?6.80	1.88	10674	37.21	0.55	11467	39.98	0.59	14722	51.32	0.76
CENTRAL AMERICA & CARIBBEAN	2180	98.13	1.94	324	7.30	0.29	1993	44.86	1.77	55	1.24	0.05
USA & CANADA	184101	766.77	9.52	18809	78.34	0.97	6251	26.03	0.32	70100	291.96	3.62

TABLE 15 - PRODUCTION OF COMMERCIAL CROPS IN THE AMERICAS IN - 1978 (THOUSANDS OF TONNES)

	SOYBEANS	TOBACCO	COCOA	COFFEE (green)	COTTON (lint)	GROUND NUTS	SUGAR
ANTIGUA & BARBUDA	--	-	-	-	-	-	-
ARGENTINA	2500	62.0	-	-	228	370	1666
BAHAMAS	--	-	-	-	-	-	-
BARBADOS	--	-	-	-	-	-	120
BELIZE	--	-	-	-	-	-	98
BOLIVIA	26	2.4	3.2	22.2	17	17.5	281
BRAZIL	9800	409.3	266.0	1200.4	460	325.5	8749
CANADA	475	114.7	-	-	-	-	-
CHILE	1	9.4	-	-	-	-	-
COLOMBIA	131	63.0	31.0	669.0	82	2.2	853
COSTA RICA	--	2.8	7.9	95.1	7	-	200
CUBA	--	46.0	2.0	27.0	1	15.0	6953
DOMINICA	--	-	0.2	-	-	--	-
DOMINICAN REP.	-	57.1	34.0	45.0	3	67.8	1258
ECUADOR	36	2.1	73.0	89.0	10	15.0	260
EL SALVADOR	--	2.1	0.3	131.7	74	0.9	364
GRENADA	--	-	2.5	-	-	--	-
GUATEMALA	--	9.8	2.4	139.3	133	0.7	487
GUYANA	--	0.1	0.1	-	-	0.5	253
HAITI	--	2.0	3.0	31.8	1	3.0	50
HONDURAS	--	7.1	0.3	59.4	9	--	100
JAMAICA	--	1.1	2.0	-	-	1.5	297
MEXICO	324	72.0	34.0	270.0	332	71.6	2790
NICARAGUA	1	3.1	0.5	59.5	144	7.8	226
PANAMA	--	1.4	1.0	5.5	-	--	181
PARAGUAY	300	40.0	-	8.5	81	26.8	55
PERU	3	3.0	4.5	66.0	81	6.2	900
ST.LUCIA	--	-	0.4	-	-	--	-
ST.VINCENT	--	-	0.1	-	-	0.0	-
SURINAME	--	-	0.0	-	-	0.3	10
TRINIDAD-TOBAGO	-	-	4.5	2.6	-	--	178
U.S.A.	50 149	914.3	-	-	2360	1809.2	-
URUGUAY	35	1.5	-	-	0	2.3	120
VENEZUELA	-	15.0	18.0	72.0	21	26.0	445

TABLE 16 - PRODUCTION OF COMMERCIAL AGRICULTURAL PRODUCTS (1977) IN THE AMERICAS

	SOYBEANS			TOBACCO			COTTON			COFFEE		
	10^3ton	kg/capita	ton/km^2	10^3ton	kg/capita	ton/km^2	10^3ton	kg/cap.	ton/km^2	10^3ton	Kg/cap.	ton/K
LAFTA	13156	45.86	0.68	679.7	2.37	0.04	429.7	1.50	0.02	2397.1	8.36	0.12
CENTRAL AMERICA & CARIBBEAN	1	0.02	0.00	132.6	2.34	0.12	61.2	1.08	0.05	596.9	13.43	0.53
USA & CANADA	50624	210.85	2.62	1029.0	4.28	0.05	0.0	0.0	0.00	0.0	0.00	0.00

	COTTON			GROUNDNUTS			SUGAR (1977)		
	10^3ton	kg/capita	ton/km^2	10^3ton	kg/capita	ton/km^2	10^3 ton	kg/capita	ton / km^2
LAFTA	1312	4.57	0.07	862.4	3.00	0.04	16119	56.19	0.83
CENTRAL AMERICA & CARIBBEAN	372	8.37	0.33	96.0	2.16	0.09	10775	242.51	9.59
USA & CANADA	2360	9.83	0.12	1809.2	7.54	0.09	--	--	--

3.2.3 Livestock Production

The region of the Americas is a major producer of beef cattle, much of it being grown for export as raw beef or processed and canned for export mainly as corned beef. The islands of the Caribbean are however an exception and they import a significant proportion of their requirements.

Large-scale cattle rearing implies the allocation of large areas of land, either directly for range feeding or indirectly for grain crops for feedlot rearing. Indeed it has been well documented that increased cattle rearing has been a principal cause of deforestation in Central America where cattle production increased by 56 percent between 1965 and 1978. During the period 1961 to 1978 pastureland increased by 65 percent and forest and woodland decreased by 39 percent, according to FAO statistics.

Table 17 shows the production of cattle, pigs, horses and sheep during 1978 for the countries of the Americas and Table 18 presents a summary by region. At close to 400 million head of cattle, the entire American Region produced 0.7 head per person (or about 300 kg per person). In addition 138 million pigs (29 kg per person), 125 million sheep (9.4 kg per person) and 32 million horses, were produced in 1978. Such figure imply the commitment of substantial financial and environmental resources to the livestock industry. For example Central America's and LAFTA's livestock production in 1974 amounted to a total of 1.57 head per person, and 1.54 per person respectively compared with only 0.89 in Canada and the USA whose inhabitants are the biggest beef eaters in the world.

3.2.4 Fertilizer and other Agricultural Chemicals Consumption

Considering the size of the agriculture industry in Latin America and the Caribbean, fertilizer consumption is comparatively modest.

Tables 19 and 20 show the consumption of nitrogenous, phosphates and potase fertilizers in the 1977/1978 production year. Only Brazil, Canada, Mexico and the USA can be considered to be large users of fertilizers. However over the preceeding ten years the LAFTA countries increased their fertilizer consumption by 263 percent compared with a 30 percent increase in Central America and the Caribbean and 26 percent in the USA and Canada.

With respect to the use of other agricultural chemicals such as pesticides, herbicides, fungicides, etc. data were not readily available. However it is known that their increased use has been significant probably at least matching the

TABLE 17. LIVESTOCK PRODUCTION IN THE AMERICAS 1978
(THOUSAND OF HEADS)

	CATTLE	PIGS	HORSES	SHEEP
ANTIGUA & BERMUDA	8	6	1	13
ARGENTINA	61 280	3 800	2 700	34 000
BAHAMAS	4	17	4	33
BARBADOS	18	38	1	50
BELIZE	50	22	5	3
BOLIVIA	3 772	1 351	380	8 462
BRAZIL	89 000	37 600	6 000	17 200
CANADA	12 877	6 714	350	392
CHILE	3 492	951	450	5 729
COLOMBIA	25 294	1 966	1 588	2 255
COSTA RICA	2 002	215	111	2
CUBA	5 700	1 800	818	350
DOMINICA	4	8	-	4
DOMINICAN REP.	2 050	810	203	52
ECUADOR	2 874	3 150	293	2 198
EL SALVADOR	1 333	435	88	4
GRENADA	5	11	1	8
GUATEMALA	2 417	704	100	600
GUYANA	270	135	2	112
HAITI	900	2 000	400	85
HONDURAS	1 700	530	290	5
JAMAICA	285	245	4	6
MEXICO	29 333	12 321	6 479	7 856
NICARAGUA	2 744	710	275	2
PANAMA	1 396	190	164	190
PARAGUAY	5 800	1 190	332	374
PERU	4 167	2 030	648	14 000
ST. LUCIA	15	10	1	11
ST. VINCENT	7	4	-	6
SURINAME	26	19	-	5
TRINIDAD-TOBAGO	75	57	1	10
U.S.A.	116 265	56 584	9 549	12 387
URUGUAY	9 424	445	520	18 854
VENEZUELA	10 231	2 057	466	105

TABLE 18. LIVESTOCK PRODUCTION IN THE AMERICAS, 1978

	BEEF			SWINE			SHEEP			HORSES		
	10^3animals	animals/capita	animals/km^2	10^3animals	animals/capita	animals/km^2	10^3animals	animals/capita	animals/km^2	10^3animals	animals/capita	animals/km^2
LAFTA	244 667	0 85	12.67	66 861	0.23	3.46	111 033	0.39	5.75	19 856	0.07	1.03
Central America and the Caribbean	21 039	0 47	18.72	7 966	0.18	7.09	1 636	0.04	1.46	2 469	0.06	2.20
USA and Canada	129 142	0.54	6.68	63 298	0.26	3.27	12 779	0.95	0.66	9 899	0.04	0.51

TABLE 19. CONSUMPTION OF FERTILIZERS (THOUSAND OF TONNES) 1977/1978

	NITROGENOUS	PHOSPHATES	POTASH	TOTAL
ANTIGUA & BERMUDA	...	...	...	...
ARGENTINA	41.7	31.2	4.4	77.3
BAHAMAS	0.9	0.6	0.6	2.1
BARBADOS	1.5	1.0	1.1	3.6
BELIZE	0.6	0.8	-	1.4
BOLIVIA	1.9	1.8	0.3	4.0
BRAZIL	689.2	1533.5	927.2	3149.9
CANADA	650.0	579.6	269.0	1498.6
CHILE	40.0	55.2	9.8	105.0
COLOMBIA	155.2	67.2	51.4	273.8
COSTA RICA	29.0	12.0	21.0	62.0
CUBA	223.0	55.0	140.0	418.0
DOMINICA	...	...	...	...
DOMINICAN REP.	40.0	15.7	20.0	75.7
ECUADOR	58.3	23.1	23.4	104.8
EL SALVADOR	77.1	17.0	6.0	100.1
GRENADA	...	...	...	...
GUATEMALA	61.3	26.8	24.6	112.7
GUYANA	5.5	2.0	1.3	8.8
HAITI	0.1	0.1	0.1	0.3
HONDURAS	15.2	5.5	7.2	27.9
JAMAICA	4.5	4.3	6.0	14.8
MEXICO	794.2	248.0	55.5	1097.7
NICARAGUA	36.0	15.2	12.2	63.4
PANAMA	9.0	6.2	7.5	22.7
PARAGUAY	0.3	0.7	0.1	1.1
PERU	107.1	18.2	13.8	139.1
ST. LUCIA	2.0	1.4	1.2	4.6
ST. VINCENT	2.4	0.5	1.0	3.9
SURINAME	3.7	0.2	0.1	4.0
TRINIDAD-TOBAGO	3.5	0.3	1.2	5.0
U.S.A.	9037.2	4618.2	5006.4	18661.8
URUGUAY	17.8	42.3	3.1	63.2
VENEZUELA	147.7	53.6	39.1	240.4

TABLE 20. CONSUMPTION OF FERTILIZERS (1977/1978) IN THE AMERICAS

	NITROGENOUS			PHOSPHATES			POTASH			TOTAL		
	10^3ton	kg/capita	kg/km^2	10^3ton	kg/capita	kg/km^2	10^3ton	kg/capita	kg/km^2	10^3ton	kg/capita	kg/km^2
LAFTA	2053.4	7.16	106.34	2074.8	7.23	107.45	1128.1	3.93	58.42	5256	18.3	272
CENTRAL AMERICA & CARIBBEAN	515.3	11.60	458.45	164.6	3.70	146.44	251.1	5.65	223.40	931	21.0	828
USA & CANADA	9687.2	40.34	500.92	5197.8	21.65	268.77	5275.4	21.97	272.80	20160	84.0	1042

TABLE 21. SUMMARY OF 1977 PRODUCTION OF MAJOR MINERALS BY LATIN AMERICAN AND CARIBBEAN COUNTRIES AS A PROPORTION OF TOTAL PRODUCTION IN THE WORLD.

MINERAL	NO. OF PRODUCING COUNTRIES	AMERICAS AS % OF WORLD	L.A. & CARIBBEAN AS % OF WORLD
IRON ORE	9	30.1	16.2
BAUXITE	7	30.4	27.4
CHROMIUM	2	8.3	8.3
COPPER	13	49.1	18.8
LEAD	10	38.5	13.4
MANGANESE	7	12.1	11.8
TIN	7	20.7	20.5
MERCURY	7	28.2	13 1
MOLYBDENUM	5	87.8	29.8
NICKEL	6	39.4	8.4
GOLD	16	43.9*	14.3*
SILVER	14	54.4	29.4
TUNGSTEN	8	23.0	11.7
ZINC	11	41.3	15 7

* The world production figure used excludes China, South Africa and Russia.

TABLE 22a. PRODUCTION OF SELECTED EXTRACTIVE INDUSTRIES IN THE AMERICAS (1977)

	Iron Ore 000's mt.	Bauxite 000'smt.	Chromium 000's mt.	Copper 000's mt.	Lead 000's mt.	Manganese 000's mt.	Tin 000's mt.
ANTIGUA & BARBUDA							
ARGENTINA	321			0.1	33.7	10.0	600
BAHAMAS							
BARBADOS							
BELIZE							
BOLIVIA				3.7	18.4		30 782
BRAZIL	56 600	1 000	336.9[a]	1.9[b]	21.0	900	6 400
CANADA	31 828			780.6	284.1		340
CHILE	4 879			1 053.7	0.1	7.0	
COLOMBIA	460						
COSTA RICA							
CUBA			10.0	6.0		27.9[c]	
DOMINICA							
DOMINICAN REP.		576		0.4[d]			
ECUADOR				0.3			
EL SALVADOR							
GRENADA							
GUATEMALA					0.1		
GUYANA		3 223					
HAITI		701		6.6[e]			
HONDURAS					20.6		
JAMAICA		11 420					
MEXICO	3 587			89.7	163.5	175.2	117
NICARAGUA				0.5			
PANAMA							
PARAGUAY							
PERU	4 021			343.6	181.5	2.0[a]	20
ST. LUCIA							
ST. VINCENT							
SURINAME		4 856					
TRINIDAD TOBAGO							
U.S.A.	35 042	2 456		1 364.4	537.5	24.6	96
URUGUAY							
VENEZUELA	8 490						

a - 1976 ; b - 1975 ; c - 1968 ; d - 1970 ; e - 1971

TABLE 22b. PRODUCTION OF SELECTED EXTRACTIVE INDUSTRIES IN THE AMERICAS (1977)

	Mercury tonnes	Molybdenum tonnes	Nickel tonnes	Gold kg	Silver tonnes	Tungsten tonnes	Zinc 000's mt
ANTIGUA & BARBUDA							
ARGENTINA				321	56	59	39.4
BAHAMAS							
BARBADOS							
BELIZE							
BOLIVIA	4[b]			756	183	3 759	49.7
BRAZIL	456[b]	16 431	5 500	4 935	7	1 236	47.0
CANADA			235 361	52 979	1 330	2 284	1 054.5
CHILE	1[f]	10 940		3 968	261		2.8[a]
COLOMBIA	3[f]			7 997	3		0.1[a]
COSTA RICA			37 000				
CUBA							
DOMINICA							
DOMINICAN REP.			24 899	10 824			
ECUADOR				238	1		
EL SALVADOR					4		
GRENADA							
GUATEMALA						1	
GUYANA				370			1 0
HAITI					1		
HONDURAS				97	90		19.8
JAMAICA							
MEXICO	333	1	34	6 484	1 463	191	265.5
NICARAGUA				1 904	5		
PANAMA							
PARAGUAY							
PERU	53[b]	1 021		2 993	936	663	477.5
ST. LUCIA							
ST. VINCENT							
SURINAME				1			
TRINIDAD TOBAGO							
U.S.A.	974	55 205	13 015	32 547	1 227	3 436	415.5
URUGUAY							
VENEZUELA				541			

TABLE 23. PRODUCTION OF SELECTED METALS IN THE AMERICAS 1977 (THOUSAND OF TONS)

	Pig iron and Ferro alloys	Crude steel	Al	Smelter Cu	Refined Cu	Pb	Sn	Zn
ANTIGUA & BARBUDA								
ARGENTINA	1 100	2 676				45.0	120	29.3
BAHAMAS								
BARBADOS								
BELIZE								
BOLIVIA							13 048	
BRAZIL	9 324	11 165	167		28.6	48.3	7 400	47.0
CANADA	9 854	13 581	983	482	509	187.5		494.9
CHILE	427	506		888	614			
COLOMBIA	223	210						
COSTA RICA								
CUBA		341						
DOMINICA								
DOMINICAN RLP.								
ECUADOR								
EL SALVADOR								
GRENADA								
GUATEMALA						0.1		
GUYANA								
HAITI								
HONDURAS								
JAMAICA								
MEXICO	4 206	5 529	42.7	87.5	79	137.5	800	174.4
NICARAGUA								
PANAMA								
PARAGUAY								
PERU	244	379		321.1	172.5	79.2		67.0
ST. LUCIA								
ST. VINCENT								
SURINAME			50.0					
TRINIDAD-TOBAGO								
U.S.A	75 398	113 701	4 118	1 302	1 357	555.6	6 724	372.1
URUGUAY								
VENEZUELA	352	809	47					

increased fertilizer consumption. It is also known that frequent changes from organochlorides to organophosphates, carbamates and pyrethroids have also ocurred as a result of pest resistance. Frequently also there has been conflicting use of pesticides in agriculture and public health.

3.3 Production of Minerals and Metals

Latin America (more so than the Caribbean) is particularly well endowed with mineral resources of world importance. The major minerals commercially exploited are: iron ore, bauxite, chromium, copper, lead, manganese, tin, mercury, molybdenum, nickel, gold, silver, tungsten, and zinc. With the exception of chromium and nickel, regional production of all of the above-mentioned minerals exceeds ten percent of the reported world totals. Table 21 below summarizes the regional figures and gives them in terms of world production.

Tables 22 a & b show the actual production figures by mineral and by country for 1977. These tables clearly demonstrate that mining is a significant economic and environmental activity in the region.

Although mining activity is considerable, the actual production of metals from the minerals is comparatively limited. This of course is in keeping with the fact that in general as shown in Section 2 developing countries are basically exporters of raw materials and importers of finished products. Table 23 shows the main metals that are produced in the region while Table 24 shows Latin American and Caribbean production as a percentage of world and developing countries' production.

TABLE 24 - PRODUCTION OF METALS IN LATIN AMERICA AND THE CARIBBEAN AS A PERCENTAGE OF WORLD AND DEVELOPING COUNTRIES' PRODUCTION

METAL	No. OF PRODUCING COUNTRIES (OF WHICH LAFTA COUNTRIES)	L.A. & CARIBBEAN AS % OF WORLD	L.A. & CARIBBEAN % OF DEV. COUNTRIES
PIG IRON & FERRO ALLOYS	7 (7)	3.2	54.9
CRUDE STEEL	8 (7)	3.2	61.3
ALUMINIUM	4 (3)	2.3	39.2
SMELTER COPPER	3 (3)	15.9	51.2
REFINED COPPER	4 (4)	10.4	46.3
LEAD	5 (4)	9.2	81.5
TIN	3 (3)	11.9	15.3
ZINC	4 (4)	6.1	66.5

Thus it may be observed that in relation to other developing countries Latin America's metal output is considerable, although limited to a small number of countries almost all of which are LAFTA members. The implication of this is that many of the countries in LAFTA are not truly typical of developing countries.

3.4 Crude Oil Production and Processing

Apart from Mexico and Venezuela, Latin America and the Caribbean do not possess a very significant proportion of the world's petroleum reserves. As can be seen from Table 25, excluding those two countries, only 10 other countries have any proven reserves, amounting to 1.35 percent of the world total in 1977. However the exploitation of those reserves is fairly intense and oil production from those same ten countries amounted to 2.19 percent of world production in 1977, when Canada, Mexico and the USA, and Venezuela are included, the Americas produced 23.32 per cent of total world production that year. It should be noted here that the 1977 figure for Mexico is considerably less than that country's present figure which is now about 40 percent higher. Excluding Canada and the USA the summary table 26 shows a total regional production in 1977 of more than 231 million metric tons.

With the exception of some of the smaller Caribbean countries, all of the Latin American and Caribbean countries have a petroleum refining industry. Table 27 shows a summary of the refinery capacities for 1968 and 1977 for different subregions of the Americas. In 1977 LAFTA had 7.6 per cent of total world installed capacity, the Caribbean had 3.0 percent. During the ten year period, world installed capacity increased by 84.5 percent compared with an average of 52.7 percent for the Americas and the world per capita figure was 1.11 tons compared with 2.34 in the Americas.

One interesting point is the very high refinery capacity in the Caribbean. This is due to the existence of "off-shore" refining carried out by transnational companies which import crude oil, refine it and ship it to the US market. Thus of the 100.7 million tons installed capacity in the Caribbean 89.9 million tons is to be found in the Bahamas, Netherlands Antilles and Trinidad and Tobago. For this reason, those countries, together with Antigua and Barbuda appear at or near the top of Table 28 which shows the per capita energy consumption in 1976.

Figure 9 shows graphically the growth of petroleum refinery capacity in Latin America and the Caribbean over the ten year period 1968 to 1977.

TABLE 25 - PETROLEUM PRODUCTION AND RESERVES IN THE AMERICAS

	RESERVES 1977 10^6 mt	% OF WORLD	PRODUCTION THOUSANDS OF TONS. 1970	1977	%OF WORLD 1977
ANTIGUA & BARBUDA	---	0.00	--	--	0.00
ARGENTINA	318	0.43	20 026	22 167	0.74
BAHAMAS	---	0.00	--	--	0.00
BARBADOS	- -	- -	--	17	0.00
BELIZE	- -	0.00	--	--	0.00
BOLIVIA	24	0.03	1 122	1 612	0.05
BRAZIL	149	0.20	7 980	7 810	0.26
CANADA	816	1.10	60 375	62 021	2.08
CHILE	70	0.09	1 468	928	0.03
COLOMBIA	120	0.16	11 327	7 106	0.24
COSTA RICA	- -	0.00	--	--	0.00
CUBA	- -	- -	159	150	0.01
DOMINICA	- -	0.00	--	--	0.00
DOMINICAN REP.	- -	0.00	--	--	0.00
ECUADOR	173	0.23	193	9 280	0.31
EL SALVADOR	- -	0.00	--	--	0.00
GRENADA	- -	0.00	--	--	0.00
GUATEMALA	- -	- -	--	15	0.00
GUYANA	- -	0.00	--	--	0.00
HAITI	- -	0.00	--	--	0.00
HONDURAS	- -	0.00	--	--	0.00
JAMAICA	- -	0.00	--	--	0.00
MEXICO	1 425	1.91	21 508	49 279	1.65
NICARAGUA	---	0.00	--	--	0.00
PANAMA	- -	0.00	--	--	0.00
PARAGUAY	- -	0.00	--	--	0.00
PERU	102	0.13	2 550	4 496	0.15
ST.LUCIA	- -	0.00	--	--	0.00
ST.VINCENT	- -	0.00	--	--	0.00
SURINAME	- -	0.00	--	--	0.00
TRINIDAD-TOBAGO	68	0.09	7 223	11 832	0.40
U.S.A.	4 031	5.40	475 289	402 489	13.48
URUGUAY	- -	0 00	--	--	0.00
VENEZUELA	2 466	3.30	194 306	117 007	3.92
TOTAL	9 762	13.09	803 526	696 209	23.32

TABLE 27 - PETROLEUM REFINERY CAPACITY IN THE AMERICAS
(THOUSANDS OF TONS PER ANNUM)

	1968	1977	% INCREASE	PER CAPITA 1977 (Tonnes)
LAFTA COUNTRIES	163 170	250 375	53.4	0.87
C. AMERICA	6 640	13 420	102.1	0 .68
CARIBBEAN	68 590	100 675	46.8	4.06
U.S.A. & CANADA	637 530	973 045	52.6	4 06
TOTAL	875 930	1 337 515	52.7	2.34

TABLE 26 - PETROLEUM RESERVES AND PRODUCTION IN THE AMERICAS

	RESERVES 1977		PRODUCTION			%of World
	10^6mT	% of World	1970 10^3ton	% of World	1977 10^3ton	
LAFTA COUNTRIES	4 847	6.50	260 480	11.44	219 685	7.36
C. AMERICA	--	--	0	0.00	15	0.00
CARIBBEAN	68	0.09	7.382	0.32	11 999	0.40
U.S.A. & CANADA	4 847	6.50	535 664	23.53	464 510	15.56
TOTAL	9 762	13.09	803 526	35.29	696 209	23.32

Table 28 shows the per capita consumption of commercial energy for 1976. The use of non-commercial firewood and charcoal is not included in the calculations. Such figures are useful in determining the level of development of a country in a very general way and are often correlated with per capita GNP. Two points should however be noted: firstly the consumption of energy in tropical countries is generally less than in temperate ones since energy is not consumed for winter space-heating and for hot water, although this is often offset by air conditioning; secondly just as with per capita GNP, the figures say nothing about the structure of the economy. Nevertheless per capita energy consumption figures give a better idea of the inherent environmental and health dangers in a country relative

TABLE 28. PER CAPITA ENERGY CONSUMPTION (1976)
(KG OF COAL EQUIVALENT)

NETHERLANDS ANTILLES	22 836
UNITED STATES OF AMERICA	11 554
CANADA	9 950
BAHAMAS	7 286
TRINIDAD & TOBAGO	4 272
VENEZUELA	2 838
ANTIGUA & BARBUDA	2 438
SURINAME	2 406
WORLD AVERAGE	2 069
JAMAICA	1 937
ARGENTINA	1 804
C. AMERICA & CARIB. AVE.	1 265
MEXICO	1 227
CUBA	1 225
GUYANA	1 072
URUGUAY	1 000
CHILE	987
BARBADOS	974
PANAMA	885
S. AMERICA AVERAGE	868
BRAZIL	731
COLOMBIA	685
DOMINICAN REPUBLIC	653
PERU	642
BELIZE	602
NICARAGUA	478
COSTA RICA	448
ECUADOR	455
SAINT LUCIA	366
BOLIVIA	318
HONDURAS	264
EL SALVADOR	260
GUATEMALA	257
GRENADA	211
DOMINICA	207
ST. VINCENT & GRENADINES	200
PARAGUAY	189
HAITI	28

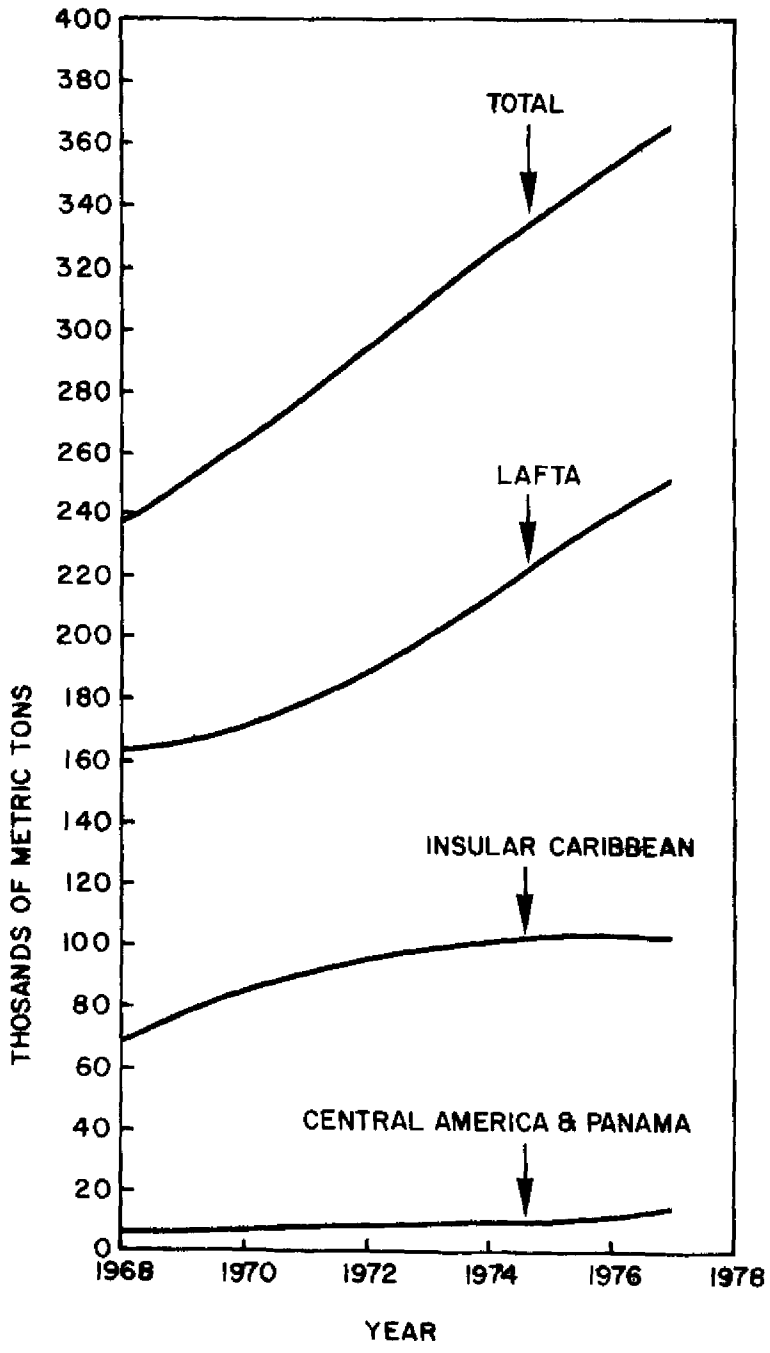

Fig. 9 PETROLEUM REFINERY CAPACITY - 1968 TO 1977

to its total population. Thus for example although countries like Trinidad and Tobago, Bahamas, Jamaica and the Netherlands Antilles have only a few industries, those industries are very large inproportion to the size of the countries and their populations. Therefore the risk to the environment in general and to a large proportion of the population is very high.

3.5 The Chemicals Industry

As mentioned in previous sections, the chemicals industry grew considerable in Latin America during the decade of the 1970's, and most of it has developed in the LAFTA countries.

Table 29 shows that the production of the major inorganic chemicals during 1977 was over six million tonnes which represented an increase of nearly 84 percent over the production ten years earlier. Apart from nitrogenous fertilizers all of the chemicals listed are basic to any chemicals industry, and the fact that so much is being produced is indicative of a large and growing industry.

From the same table it can be seen that synthetic rubber production increased by 263 percent, resins and plastic increased by 194 percent, that of ethyl alcohol was 180 percent and production of other basic organic chemicals was up by 86 percent.

TABLE 29 - SELECTED CHEMICALS PRODUCED IN LATIN AMERICA AND THE CARIBBEAN 1968 AND 1977.

	LAFTA		CENTRAL AMERICA		CARIBBEAN	
	1968	1977	1968	1977	1968	1977.
I. INORGANIC						
Sulphur (000's Tonnes)+	144	265	--	--	23	75
Sulphuric acid (000's Tonnes)	1 752	3 417	12	28	322	402
Hydrochloric acid (000's Tonnes)	134	183	--	--	4	5
Nitric acid (000's Tonnes)	265	360	--	--	--	--
Sodium hydroxide (000's Tonnes)	434	702	--	--	2	2
N fertilizer (000's Tonnes)	617	1 218	22	51	93	93
TOTAL	3 346	6 145	34	79	444	577

	LAFTA		CENTRAL AMERICA		CARIBBEAN	
	1968	1977	1968	1977	1968	1977
II. RUBBER						
Synthetic (000's Tonnes)	115	417	--	--	--	--
Tyres (000's)	15 134	30374	35	58	277	405
III. RESINS AND PLASTICS						
Condensation (000's Tonnes)	32	66	--	--	--	---
Polymerisation (000's Tonnes)	220	675	--	--	--	--
IV. BASIC ORGANIC CHEMICALS						
Ethyl alcohol (000's hlitres)	5 407	15 163	55	92	2 350	1 579
Others** (000's Tonnes)	378	703	--	--	1	2

** These include: acetylene, ethylene, benzene, toluene,xylenes methanol and ethylene oxide.

Table 30 confirms that the LAFTA countries are now significant producers of chemicals. Although on a per capita basis, the region lags a long way behind the developed market economy countries, it is a long way ahead of the other developing regions of Africa and Asia. Also Latin America produces substantial quantities of every type of basic chemicals.

The significance of these industries in terms of human health and the possibility of emergency situations is taken up in the next section.

TABLE 30. PER CAPITA PRODUCTION OF SELECTED CHEMICAL IN LATIN AMERICA, THE CARIBBEAN AND OTHER REGIONS OF THE WORLD IN 1977 (kg per person)

		LAFTA	C. AMERICA	CARIBN	AFRICA	ASIA	CANADA	EUROPE	U.S.A.	JAPAN
I.	INORGANIC									
	Sulphur	0.92	--	3.03	0.04	0.45	243.8	10.33	16.71	9.46
	Sulphuric acid	11.91	1.43	16.22	5.17	3 00	134.88	78.80	149.88	56.07
	Hydrochloric acid	0.64	--	0.19	0.01	0.33	5.85	6.26	10.75	4.28
	Nitric acid	1.26	--	--	0.19	0.04	15.68	35.76	32.96	5.67
	Sodium hydroxide	2.45	--	0.08	0.08	0.58	43.17	20.46	43.85	24.43
	N. Fertilizer	4.25	2.61	3.75	0.86	3.75	57.65	27.68	45.84	12.68
	TOTAL	21.43	4.04	23.27	6.34	8.14	501.03	179.27	299.99	112.59
II.	RUBBER									
	Synthetic	1.45	--	--	--	0.06	10.22	5.54	11.66	8.52
	Tyres	0.11	0.003	0.02	0.06	0.02	0.86	0.47	0.86	0.76
III.	RESINS AND PLASTICS									
	Condensation	0.23	--	--	--	0.03	1.63	14.26	3.55	10.89
	Polymerisation	2.35	--	--	--	0.20	22.76	39.62	37.51	32.78
IV.	BASIC ORGANIC									
	Ethyl alcohol	52.86	4.68	63.70	1.15	1.57	10.52	37.09	87.22	19.46
	Others*	2.45	--	0.07	0.03	0.20	54.67	62.78	143.02	106.18

[1] Excluding the Republic of South Africa; [2] Excluding Japan and centrally planned economy countries; [3] Excluding all centrally planned economy countries.

SECTION 4

ENVIRONMENTAL HEALTH IMPLICATIONS OF THE INDUSTRIAL DEVELOPMENT OF LATIN AMERICA AND THE CARIBBEAN

4.1 Introduction

The previous three sections have briefly highlighted the major sectorsof the economies of the countries of Latin America and the Caribbean, i.e. agro-industry the minerals extractive and metal processing industries fuel production and processing and the manufacture of chemicals. The main reason for carrying out the analysis was to relate the industrial development of the region to the environmental health implications of that development.

The existing and potential health problems are as varied as the industries in operation. The problems to be expected in countries where sixty or seventy percent of the labour force is engaged in agriculture or the processing of agricultural products, is quite different to those in which a large proportion of the labour force is engaged in mining and metal production or chemicals manufacture. Even within the chemicals industry there are big differences between inorganic and organic chemicals production, most of the carcinogens, mutagens and teratogens are to be found in the latter.

This preliminary analysis has however identified those countries which are still basically agricultural and those which are more industrial. Tables 11 and 12 serve as a useful basis for determining the emphasis to be placed on environmental and occupational health programmes.

This section is presented under three main headings, according to type of industry; i.e.: agro-industry; mining and metal production; and chemicals industry.

4.2 Agro-industry and Health Hazards

The major worker-related health problem associated with agricultural activities are accidents and traumas. In the USA in 1977, 11.2 injuries and 77.0 lost workdays per 100 fulltime workers were reported.*

Table 31 shows the main occupational health hazards associated with agricultural production.

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* In this section, unless otherwise stated, all USA data and tables were taken from "Profiles of Industry-Occupational Health and Safety Chartbook" - February 1981, prepared by The Mitre Corporation, Virginia, USA, for the US Environmental Protection Agency and the National Institute of Occupational Safety & Health.

For the population in general, the hazards are almost exclusively those associated with the handling, transport and use of agricultural chemicals. These include, run-off and contamination of surface and underground water, residues in foodstuffs, accidental food contamination, aerial drift due to aircraft spraying practices and the constant threat post by accidents during the transport of such chemicals or fires in storage bonds.

TABLE 31 - OCCUPATION HEALTH HAZARDS IN AGRICULTURE

The major category of workplace hazards in agriculture is accidents.

AGRICULTURAL PRODUCTION OPERATION	AGENT OR CONTAMINANT	HEALTH HAZARDS MEDICAL CONDITION
Silo Filling	Nitrogen Dioxide	"Silo Filler's --- Disease"-mild to severe pulmonary-illnesses
Silage Storage	Moldy Silage Dust	"Farmer's Lung"- mild to severe - pulmonary illnesses; can progress to pulmonary - - fibrosis,emphysema, and total incapacitation.
Pesticides Application	Chlorinated Hydro-carbons.	Skin disorders,mild to severe central - nervous system - disorders,liver or kidney damage
	Organophosphates	Mild to severe - central nervous - system disorders, pulmonary edema, - respiratory paralysis
Livestock Handling	Virus Rickettsia Bacteria Fungus	Various infectious diseases

Cont. Table - 31

AGRICULTURAL PRODUCTION OPERATION	AGENT OR CONTAMINANT	HEALTH HAZARDS MEDICAL CONDITION
Plant Handling	Allergens	Dermatitis Photosensitization Asthma Hay Fever
Extreme Weather Handling	Cold	Trenchfoot, Frostbite
	Heat	Heat Exhaustion, Heat Stroke
Working In Confined Spaces (e.g., silos)	Carbon Dioxide	Asphyxiation
Operating Equipment	Accidents	Mild to Severe Injuries

Source: Harvard University, 1977, Planning for Occupational Health Needs in a Health Service Area. Harvard School of Public Health, Boston, Massachusetts.

4.3 Mining and Primary Metal Production

Mining of metallic minerals, petroleum and gas is of considerable economic importance. In section 3.3 it was shown that fourteen major metallic minerals were mined in a total of twenty countries and that the region produced a large proportion of the world's total supply of many of those minerals.

The general environmental effects of mining operations are usually restricted to the areas in which the mineral deposits occur, since often reasonably large towns develop in the vicinity. If the metal is extracted and refined in the same country, often but not always, is carried near to the source. The major problems for the population living nearby are: noise; large quantities of dust and fumes; and often there is substantial water pollution mainly of the surface water.

For the workers, accidents and exposure to dusts are the major workplace hazards, although there are many other hazards as shown in Table 32.

In Latin America other potential health hazards are posed by the fact that many mineral deposits are worked at very high altitudes, sometimes in excess of 3 000 metres. New mining operations also often lead to the migration of people from lowlying tropical areas to high tropical mountain or temperate areas or vice-versa, thereby exposing themselves to completely different climatic conditions to which they are not accustomed.

TABLE 32 - MAJOR OCCUPATIONAL HEALTH HAZARDS ASSOCIATED WITH MINING

Accidents and exposure to dusts are major categories of workplace hazards.

M I N I N G		HEALTH HAZARDS
OPERATION	AGENT OR CONTAMINANT	MEDICAL CONDITION
All Mining	Accidents	Mild to Severe Injuries
	Carbon Monoxide	Chronic Cardiac Disorders Blood Carboxyhemoglobin
	Nitrogen Oxides	Eye Irritation Mucous Membrane Irritation Bronchial Irritation Pulmonary Edema Branchiectasia Emphysema
	Lack of Oxygen	Asphyxiation
	Heat, Humidity	Discomfort Heat Stroke, Exhaustion Joint Disease
	Noise	Hearing Loss
	Vibration	Joint Disease Raynaud's Phenomena
	Radiation	Cancer
	Silica Dust	Silicosis
Metal Mining	Metal Dust	Acute and Chronic Respiratory Illnesses and Disease
Coal Mining	Coal Dust	Pneumoconiosis
Nonmetal Mineral Mining	Examples: Rock Salt	Mucous Membrane Irritation
	Talc	Chronic Lung Diseases
	Asbestos	Cancer
	Uranium	Cancer
All Milling	Accidents	Various Mild to Severe Injuries
	Dust	Acute and Chronic Respiratory Illnesses and Disease
	Noise	Hearing Loss

Source: Harvard University, 1977. Planning for Occupational Health Needs in a Health Service Area. Harvard School of Public Health, Boston, Massachusetts.

The occupational health hazards to which primary metal workers have not been set out for every type of metal. However they are typifyed by those encountered by iron and steel workers and are presented in Table 33,

4.4 The Chemicals Industry

In terms of health hazards, direct and indirect, both to the general population and to the workers, the chemicals industry is the most pervasive. The number of different chemicals used and produced is so diverse that a discussion of them individually is virtually impossible.

The chemicals industry or industries which use large quantities of chemicals are unfortunately normally found: in or around large metropolitan areas; or on the coast, particularly if the raw materials are imported or the products exported or if very large quantities of cooling water are required. Large petrochemical complexes also tend increasingly to be built on coastlines in association with offshore oil and gas production.

In general throughout Latin America and the Caribbean, pollution control laws are non-existent, very weak or not enforced. Air pollutants such as sulphur dioxide, oxides of nitrogen, hydrocarbons and particulates are discharged into the atmosphere virtually unchecked. The rivers are suffocated with high BOD, COD and suspended solid loads, and are poisoned by phenols, solvents and heavy metals. Industrial wastes are disposed of improperly leading to the thread of underground water contamination by toxic leachates.

Large quantities of hazardous or toxic chemicals are transported through metropolitan areas by road or rail tanker. Yet most Latin American and Caribbean countries have no legal standards for the transport of such goods, no do they have formal emergency plans for dealing with the inevitable accidents.

Very few epidemiological studies in the Region have been undertaken to determine whether pollution related health disorders are significant.

Table 34 gives an indication of the large number of chemicals and allied products which can be made in any large urban conglomeration such as Mexico City(Mexico), Sao Paulo (Brazil), or Buenos Aires (Argentina).

In Table 35 can be found the major occupational health hazards associated with the chemicals, petroleum, rubber and related products industries.

TABLE 33 - MAJOR OCCUPATIONAL HEALTH HAZARDS IN THE IRON AND STEEL INDUSTRY

Steelworkers are exposed to a greater variety of harmful emissions than is the general population.

IRON AND STEEL INDUSTRY		HEALTH HAZARDS
OCUPATION	CONTAMINANTS	MEDICAL CONDITION
Coking	Coke Oven Emissions	Cancer and Respiratory Disease
	Heat	Heat Stroke and Heat Exhaustion
	Silica	Silicosis
Byproduct	Benzene	Leukemia and Lymphoma
	Coal Tar Pitch	Skin Cancer
	Organic Chemicals	Liver and Nervous System Damage
Blast Furnace	Blast Furnace Gas	Carbon Monoxide Poisoning
	Iron Oxide Fumes	Siderosis
	Heat	Heat Exhaustion
Steelmaking Furnaces	Metal Fumes	Possible Cancer and Siderosis
	Noise	
	Heat	
Molten Metal Pouring	Metal Fumes	
	Heat	
	Lead	
	Fluorides	
	Asbestos	Asbestosis and Mesothelioma
	Silica	Silicosis
Rolling Hill	Noise	
	Heat	
	Oil Mist	Nose and Throat Irritation Dermatitis
Steel Conditioning	Metal Fumes	
	Metal Dust	
Pickling	Hydrochloric Acid	Mucous Membrane Irritation
	Sulfuric Acid	Mucous Membrane Irritation
	Chromic Acid	Chemical Pneumonitis
		Heart Disease
Maintenance	All Hazards	

Cont. Table - 33

Galvanizing	Zinc Oxide Fumes	Metal Fume Fever
	Lead	
	Cadmium	
Forging	Noise	
	Heat	
	Oil Mist	Dermatitis
Foundry	Silica	
	Heat	
	Noise	
	Oil Mist	
	Organic Chemicals	
	Metal Fumes	
	Resins	Dermatitis

As was seen in sections 2.3 and 2.5 a very large number of workers in Latin America and the Caribbean work in the chemicals industry and are therefore exposed to the health hazards indicated in Table 35.

TABLE 34 - MAJOR CHEMICALS, PETROLEUM, RUBBER AND RELATED PRODUCTS.

CHEMICALS AND ALLIED PRODUCTS

Industrial Inorganic Chemicals
- Alkalies and Chlorine
- Industrial Gases
- Inorganic Pigments
- Industrial Inorganic Chemicals, Not Elsewhere Classified

Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-made Fibers, Except Glass

- Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers
- Synthetic Rubber (Vulcanizable Elastomers)
- Cellulosic Man-Made Fibers
- Synthetic Organic Fibers, Except Cellulosic

Drugs

- Biological Products
- Medicinal Chemicals and Botanical Products
- Pharmaceutical Preparations

Soap, Detergents, and Cleaning Preparations, Perfumes, Cosmetics and other Toilet Prepatations.

- Soap and Other Detergents, Except Specialty Cleaners
- Specialty Cleaning, Polishing, and Sanitation Preparations
- Surface Active Agents, Finishing Agents Suffonated Oils and Assistants
- Perfumes, Cosmetics, and Other Toilet Preparations

Paints, Varnishes, Lacquers, Enamels, and Allied Products.

- Paints, Varnishes, Lacquers, Enamels, and Allied Products

Industrial Organic Chemicals

- Gum and Wood Chemicals
- Cyclic (Coal Tar) Crudes, and Cyclic Intermediates, Dyes, and Organic Pigments (Lakes and Toners)
- Industrial Organic Chemicals, Not Elsewhere Classified

Agricultural Chemicals

- Nitrogenous Fertilizers
- Phosphatic Fertilizers
- Fertilizers, Mixing Only
- Pesticides and Agricultural Chemicals, Not Elsewhere Classified

Miscellaneous Chemical Products.

- Adhesives and Sealants
- Explosives
- Printing Ink
- Carbon Black
- Chemicals and Chemical Preparations, Not Elsewhere Classified

PETROLEUM AND COAL PRODUCTS

Petroleum Refining and Related Industries

Petroleum Refining

Paving and Roofing Materials

- Paving Mixtures and Blocks
- Asphalt Felts and Coatings

Miscellaneous Products of Petroleum and Coal

- Lubricating Oils and Greases
- Products of Petroleum and Coal, Not Elsewhere Classified

RUBBER AND MISCELLANEOUS PLASTICS

Rubber and Miscellaneous Plastics Products

Tires and Inner Tubes

Rubber and Plastics Footwear

Reclaimed Rubber

Rubber and Plastics Hose and Belting

Fabricated Rubber Products, Not Elsewhere Classified

Miscellaneous Plastics Products

TABLE 35 - MAJOR OCCUPATIONAL HEALTH HAZARDS IN THE CHEMICALS INDUSTRY

1 - CHEMICALS AND ALLIED PRODUCTS.
Due to the variety of processes and diseases, each industry and each material needs to be evaluated separately.

OPERATION	AGENT OR CONTAMINANT	MEDICAL CONDITION
- Chemicals Production Crushing Grinding Size Separation Filtration Drying Heating Cooling Solvent Extraction Absorption Distillation Fractionation Electrolysis Blending Analysis	Various,including but not limited to corrosive agents, respiratory irritants,narcotics, gaseous compounds,toxic chemicals,carcinogens.	Various,including but not limited to corrosive effects, respiratory irritation, metabolic disturbances, allergies,organ toxicity,carcinogenicity, skin diseases.
- Process Control of Chemical Products.		

Source: Garolfolo, Annette, David H. Wegman, Anthony Robbins, and Jay Noren, 1977. Planning for Occupational Health Needs in a Health Service Area. Harvard School of Public Health, Boston, Massachusetts.

Cont. Table - 35

II - PETROLEUM REFINING AND RELATED INDUSTRIES

Workers in these industries are exposed to a wide variety of potentially harmful liquid, solid, and gaseous substances.

OPERATION	AGENT OR CONTAMINANT	POTENTIAL MEDICAL CONDITION.
Refining	Volatiles	
	Solvents	Acute Intoxication Chronic Respiratory Disease Dermatitis Skin Cancer Systemic Poisonings
	Carbon Monoxide	Blood Carboxyhemoglobin
	Sulfur Dioxide	Eye and Respiratory Irritation Blindness Asphyxiation
	Hydrogen Sulfide	Respiratory Paralysis
	Metal Carbonyl and Metal Fumes	Metal Fume Fever Dermatitis Central Nervous System Damage Pulmonary Irritation Severe Delayed Pulmonary-Edema Circulatory Respiratory-Collapse
	Nitrogen Oxides	Eye Irritation Mucous Membrane Irritation Bronchial Irritation Pulmonary Edema Bronchiectasis Emphysema
	Lead	Lead Colic Anemia Peripheral Neuropathy Encephalopathy
	Hydrogen Chloride	Eye and Skin Irritation Upper Respiratory Tract-Irritation Pulmonary Edema

Cont. Table - 35

	Formaldehyde	Dermatitis Conjunctivitis
	Hydrogen Fluoride	Respiratory Irritation Delayed Pulmonary Edema
	Noise	Hearing Loss
Maintenance	All Hazards	

Source: Garolfolo, Annette, David H. Wegman, Anthony Robbins, and Jay Noren, 1977, Planning for Occupational Health Needs in a Health Service Area. Harvard School of Public Health, Boston, Massachusetts.

III - RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS INDUSTRIES

Workers in these industries are exposed to a variety of liquids, vapors, and particulate matter; serious toxic problems are associated with many of these substances.

OPERATION	AGENT OR CONTAMINANT	MEDICAL CONDITION
Rubber Processing	Noise	Hearing Loss
	Heat	Heat Stroke, Heat Exhaustion
	Dust, Curing Fumes	Chronic Respiratory - Illnesses Cancer
Plastic Processing	Polymers	Respiratory Irritation Chronic Respiratory - Illness Skin Cancer Neurologic Disorder
	Volatiles	Neurologic Disorder
	Solvents	Acute Intoxication Chronic Respiratory - Disease Dermatitis Skin Cancer Systemic Poisoning
Maintenance	All Hazards	

Source: Harvard University, 1977. Planning for Occupational Health Needs in a Health Service Area. Harvard School of Public Heald, Boston, Massachusetts.

CONCLUDING REMARKS

This document has been based on a "desk-top" survey and the author's own knowledge of the Region. The statistics used are global in nature and often are estimates prepared by various United Nations specialised agencies. However for a general overview they can be considered to be satisfactory.

Nevertheless, in order to obtain a more precise picture, particularly from a health perspective, a more detailed follow-up study is required, particularly for the more industrialised countries. Such studies should concentrate more on the types and sizes of chemical plants and their location in order to determine the areas and populations at greatest risk and also for the development of sound emergency plans. Epidemiological studies will also be able to be designed with a better focus.

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