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TO: All Members of the World Commission on Environment and Development.

FROM: Kazu Kato

DATE: 24th November, 1986

RE: Draft Chapter 7 of the Final Report

Please find attached a draft of Chapter 7 entitled "Industry: Producing More from Less".

The present draft incorporates the changes in emphasis and substance suggested at the last meeting in Harare, while in form an attempt has been made to shorten it by eliminating redundancies and overlap with other chapters (e.g. the introductory section, the sections on natural resources and armament industry of the previous draft discussed at Harare). Specific recommendations are now placed in boxes under appropriate headings in the final section on "Strategies for Sustainable Industrial Development".

The present draft has been edited by Linda Starke, but a selection of quotations from the public hearings has not been made yet and is therefore not reflected in the present text.

ACTION REQUIRED: For Discussion and Approval

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INDUSTRY: PRODUCING MORE FROM LESS

1. Since the late 18the century, industry has been a key element in development, and its role has consistently expanded over the years in all national economies.[1/] Industry provides the material basis for the sustenance and well-being of people. It also provides jobs for people whose productive capacities are used to the benefit of both themselves and society: It is the driving force behind economic growth and human and social development.

2. Industry is essential to developing countries that must create and expand both heavy and light industrial sectors, to widen their development base and meet the growing needs of the population. It is also essential for developed countries, which are now said to be moving towards a post-industrial, information society. Providing sophisticated services even in an increasingly service-oriented economy will not be possible without a continuing generation of wealth from the industrial sector.

3. As indicated in Chapter 2, sustainable development requires, first and foremost, the satisfaction of essential needs of present as well as future generations. Many can only be met through goods and services provided by industry: textiles for clothing, building materials and construction for shelter, medical facilities for health care, educational aids, and so on. Although declining lately in its share in the developed economies, industry

is still today a major source of jobs for many people. Even food, the most basic of human needs, cannot be produced without substantial inputs of energy, agrochemicals, and machinery from the industrial sector, except in the crudest forms of subsistence farming. And the amount of food for human consumption industrially produced or processed is increasing almost daily. Beyond the satisfaction of basic needs, the products of industrial activity are an essential, though not the only component of the "standard of living" in contemporary societies.

4. Thus, industrialization is a legitimate aspiration and an imperative need of any developing country. The frustrations felt by many would-be industrial countries at the slow progress following decolonization led some to almost turn their backs on industrialization and instead advocate agricultural development and self-sufficient economic policies. Today, there is renewed interest in striking a suitable balance between industrial and agricultural development, between centralized and decentralized systems of production, and between self-reliance and interdependence.

I. IMPACTS ON THE ENVIRONMENT

5. At the same time, however, industry has a major impact on the natural resource base of civilization, through the entire cycle of raw materials exploration and extraction, transformation into products, energy consumption, waste generation, and the use and disposal of products by consumers - giving rise in its wake to both process and product pollution. Furthermore, by the very nature of their operations in an increasingly interdependent world, industrial policies of a country or

of large industrial enterprises can influence, and are influenced by, the patterns of international trade, investment, financing, technological innovations and even life-styles of other nations, thus profoundly affecting and altering the ecological base of each country's development.

6. Environmental impacts of industrial development take many different forms: pollution of the air and water, toxic and hazardous wastes, accidents at plants and during transportation. In all the areas discussed in this chapter, it is important to recognize that these are but different aspects of the same problem - degradation of the resource base of development. And they are closely interrelated.

1. Pollution of Environmental Resources

7. Historically speaking, the environmental impacts of industrial activity began to appear, and were perceived at first, typically as problems of air and water pollution and the related damages to the health of people and property, in most cases localized in scope. When the quality of air and water deteriorates due to pollution beyond natural thresholds of self-purification, these environmental resources may become scarce in a given watershed or a climatic regime, with dire results for the industries that depend on them.

8. Although industrial activities were not the only source of pollution, industry was generally considered the chief culprit. The post-World War II industrial expansion of developed countries took place at first without much regard for the environment and brought with it many of the worst cases of pollution the world has known, symbolized by the famous peasoup smogs of London and the mercury poisoning case in Minamata, Japan. The enormous expansion

of off-shore oil drilling and tanker traffic led to frequent mishaps on the sea, raising concerns about marine pollution by hydrocarbons and toxic chemicals.

9. Despite enormous efforts, expenditures, and considerable progress in pollution control, many "traditional" pollution problems of the air, water, and land still exist in developed countries. In air pollution control, for example, the problems of nitrogen oxides (NO_x), suspended particulate matter and hydrocarbons remain, and some of the problems are even on the increase. As emissions from major stationary sources began to be tightly controlled, mobile sources (automobiles in particular) have taken on a growing significance in all countries. Scant data are available about Eastern Europe, but the air and water in some of the cities are severely polluted, particularly where heavy industries use coal as the main fuel.[2/]

10. Although some well-known successes in water pollution control can be cited, such as the return of salmon to the Thames River and the restoration of water quality in Lake Erie, water quality of the world's major rivers has not markedly improved over the years.[3/] In smaller rivers, it is worsening in many regions. Fertilizer run-offs and sewage discharges into rivers, lakes, and coastal waters have accelerated the natural process of eutrophication in many waters, and are creating problems for fishing, drinking water supply, navigation, and scenic beauty. High levels of nitrates in groundwater, also caused by excessive application of fertilizers, are a source of growing concern to many developed countries.[4/]

11. These problems have also surfaced in many parts of the Third World as industrial growth, urbanization, and the use of automobiles have spread. Air and water quality

in many countries, particularly in or near urban centres of rapidly industrializing ones, are sometimes far worse than in the polluted cities of developed nations.[5/]

2. Growing Hazards

12. As the more direct and rampant forms of industrial pollution began gradually to be controlled in some countries, the sources and causes of pollution became more diffuse, insidious, and complex, and the effects of pollution more widespread, cumulative, and chronic. Contamination of soils, groundwater, and people by agrochemicals is pervasive, and chemical pollution has spread to every corner of the planet. New cases of pollution and health hazard that have come to light include the formation and fallout of extremely toxic dioxin and heavy metal compounds in the process of municipal waste incineration. Discoveries of hazardous waste disposal sites - at Love Canal and Times Beach in the United States, for example, and at Lekkerkek in the Netherlands, Vac in Hungary, and Georgswerder in West Germany - have attracted worldwide attention in recent years.

13. Chemical products have greatly improved our health and life expectancies; increased agricultural production; raised comfort, convenience, and the general quality of life; and expanded economic opportunities. The chemical industry is also one of the most rapidly growing branches of industrial activity. Yet this industry, together with its products, can have a particularly severe impact on the environment. It has given rise to a host of new problems both of product and process pollution. It continues to generate an increasingly wider range of products and wastes whose effects, especially long-term ones, on human health and the environment are not precisely known. Major accidents have taken place, and the safety record of the industry has been challenged in recent years.

14. In a world more and more dependent on chemical products and highly complex large-scale technologies, accidents with catastrophic consequences are likely to increase. Various hazardous products and processes are already built into current systems of industrial production and the technological structure of contemporary society, and it will be a long time before these can be replaced with less dangerous, inherently safer technologies and systems. The toxic gas leak of 1984 in Bhopal and the more recent nuclear reactor accident at Chernobyl have led to a new awareness about the disaster potential of industrial plants, products, and processes.

3. Degradation of the Natural Resource Base

15. Industry is the developer and consumer of the Earth's natural resources, both renewable and non-renewable. Non-renewable resources are by definition exhaustible, and the possibility that the process of industrial growth would run into material resource constraints has been an important theme in the environmental debate of the past 25 years. At the global level the debate is usually about fuels and about metallic minerals whose deposits are not widely distributed and are expensive to locate and develop. Although none of these minerals appears likely to be exhausted in the near future, it is now generally acknowledged that certain fossil fuels will approach the economic as well as technical limits of extraction early next century at the present rate of consumption. (See Chapter 6).

16. The major natural resources that provide energy and raw materials for world industry are clearly unevenly distributed. But the volume of a natural resource that a country possesses within its borders does not determine the use it can make of that resource. The availability of

capital, technology, a skilled workforce, management, and other infrastructure needed to explore, develop, transport, and process those resources, as well as access to international markets, are more decisive factors. Many of the so-called resource-rich developing countries depend heavily on export of minerals and other commodities, in most cases in raw or only intermediately processed form (see Table 7-1). As countries move increasingly into higher stages of processing and manufacture before commodities are exported, they will incur heavier costs of pollution and resource degradation unless maximum care is taken to prevent or reduce pollution and waste, to increase recycling and reuse, and especially to minimize the generation of hazardous wastes.

17. As for renewable resources, such as agricultural commodities, forest products, fisheries, and other marine or terrestrial living resources - which also provide food for industry as raw material - the threat of declining supply and eventual extinction is more immediate, as

TABLE 7-1

COUNTRIES HEAVILY DEPENDENT ON EXPORTS OF NON-FUEL MINERALS
1973 (to be updated to 1986)
(More than 25% of total exports)

Country	*Share of minerals in total exports in 1973 (%)*	*Value of mineral exports in 1973 (million dollars)*	*GNP per capita (dollars, 1976)*
New Caledonia	99	185	4 570
Zambia	98	1 117	440
Chile	90	1 116	1 050
Suriname	88	145	485
Mauritania	81	97	340
Liberia	76	247	450
Zaire	75	746	140
Bolivia	73	174	390
Jamaica	66	253	1 070
Guyana	60	80	640
Papua New Guinea	55	162	490
Togo	47	29	260
Peru	42	374	800
Niger	39	25	160
Lao People's Democratic Republic	31	2	90
Jordan	30	13	610
Morocco	28	246	540

Compiled by WCED from: UNCTAD Handbook of International Trade and Development Statistics 1986, United Nations, New York, 1986.

described in Chapter 2. Without due care to maintain their regenerative capacity, the industrial use of these primary commodities as input to the processing and manufacturing industries can overtax the existing stock of resources to a point of no return.

18. Industrial policies and activities affect the availability and the quality of the finite resource of land through siting decisions, extraction of other resources like minerals, the generation of pollution and waste, and the potential for accidents and accumulation of toxic substances in the soil. Damages inflicted on land by pollutants or hazardous wastes not only decrease its present value and utility but also severely restrict its future use. Effective land use planning and control measures such as zoning are a prerequisite to minimizing these risks, but the potential impact on the land and local environment needs to be assessed prior to, and as an integral part of any decision making on industrial development projects.

4. Transboundary and Global Reach

19. A good many of these environmental pollution problems have taken on a new dimension as they have crossed borders and impinged on the global commons. (See Chapter 1.) Air pollutants are now carried over great distances largely through the success of a pollution control policy of using higher smokestacks. And once localized air pollution has now acquired a much larger regional dimension in the form of acid deposition. The stratospheric ozone layer that shields the Earth from harmful ultraviolet rays is apparently being depleted by a combination of artificial and natural substances. The global warming induced by carbon dioxide and other greenhouse gases may permanently alter the Earth's climate regime, with untold consequences for world agricultural production. (See Chapter 6.)

20. No effective international mechanism currently exists whereby national governments and industries can coordinate policies and efforts to regulate various sources of pollution, including industrial activity, except in several specific cases of international river or lake commissions, marine pollution and ocean dumping conventions, and regional monitoring programmes. Even what already exists is quite inadequate for the urgent need to increase the capacity to prevent or deal with industrial accidents, as well as to provide prompt relief and compensation to victims of pollution-caused damage.

II. OPPORTUNITIES FOR IMPROVEMENTS

1. Response to Pollution and Resource Degradation

21. The developed world began to respond to the growing threat of industrial pollution in the late 1960s. Governments established "environmental protection" policies and programmes and agencies to administer them. Initially, the focus was on regulatory measures aimed at reducing emissions. Later, a range of economic instruments were considered, but only a few countries introduced them; the emphasis they placed on end-of-pipe regulatory measures targeted on the back-end of the production cycle remains to this day.

22. With the introduction of national regulatory regimes, industry also began to respond to these problems. In some pollution-intensive industries, expenditures on pollution control measures, low at first, began to rise rapidly; environmental policy and control units started to appear on organization charts. At first, both government and industry were very concerned about the

effect of proposed environmental measures on economic performance. Many were convinced that they would have a seriously negative impact, especially on investment and growth, inflation, jobs, competitiveness, and trade.

23. Subsequently, a large array of guidelines and codes of conduct were developed concerning safety of products and plant operations, trade practices, technology transfer, and international cooperation. Prime examples include those adopted by such bodies within the UN system as UNCTAD, UNEP, ILO, FAO, and WHO, and by regional organizations like OECD, EEC, and CMEA.[6/] Various industry associations, national or international, have also promulgated guidelines and voluntary codes of practice for their own activities, such as the "Environmental Guidelines for World Industry" adopted in 1976 and revised recently by the International Chamber of Commerce (ICC).[7/]

24. In economic terms, pollution is a form of waste, and waste of resources in industrial production is a symptom of inefficiency. Insofar as pollution is recognized as such and accounted for as a cost factor of production, industries can be motivated to make their best effort to reduce that inefficiency by reducing the level of pollution and waste they generate. In other words, industries can be expected to self-regulate, to a considerable extent, the process and amount of pollution and waste if their efforts result in profit or improved productivity.

25. The improvement that industrial enterprises can achieve through voluntary efforts is severely limited, however. Air and water have traditionally been regarded as "free" goods. But as is evident from the enormous costs to society of past and present pollution, they are not "free", and treating them as such transfers economic

benefits from those who bear the damage costs of pollution to those who enjoy cost-free air, water and other environmental resources.

26. To address this inherent limitation, OECD in 1971 agreed upon the Polluter Pays Principle (PPP).[8/] Essentially an economic efficiency measure, the PPP is designed to encourage industries to internalize environmental costs and reflect them in the prices of products. This principle places the costs of pollution prevention or clean-up on the industry and ultimately, through the price-setting mechanism of the marketplace, on the consumer of those products, thus providing economic incentives for production methods that are less polluting and for conservation efforts by consumers. Since it means government intervention in the functioning of the market in a not-so-ideal market system, the PPP can also be applied through government regulations and price controls in centrally planned economies.

27. Again, in a strictly economic interpretation, this is how various environmental regulations and other economic instruments for better resource management - such as taxation, pollution or waste charges, energy and other resource pricing, and subsidies or low-interest financing of pollution control equipment - are meant to perform. They are to tip the scale in favour of integrating environmental considerations into industrial planning and decision-making processes by establishing a minimum of norms and standards to be followed by all industries concerned and by providing a fair incentive or disincentive system to industries in order to prevent or minimize pollution.

28. International cooperation to harmonize environmental measures, including a broader Polluter Pays Principle, is important if these efforts are to be accepted by

industries that compete in international markets. Countries may adopt strong environmental measures, but they find it difficult to enforce them if other governments do not apply similar measures to the same industries. Few nations will force an industry into an avoidable loss of competitive position.

2. Benefits of Environmental Management in Industry

29. The benefits generated by environmental measures over the past two decades, including untold health, property, and ecosystem damages avoided, have been significant and generally greater than the costs. Expenditures on environmental measures, public and private, were quite small at the beginning of the 1970s - perhaps 0.3-0.4 per cent of gross domestic product GDP. As the new programmes gathered momentum, they increased gradually, depending on the country, to some 1.0-1.5 per cent of GDP. In a few nations, they reached 2.0 per cent by the end of the decade.[9/]

30. These expenditures had a positive short term effect on growth, as the increased demand they generated raised the output of economies operating at less than full capacity. In the longer term - if the benefits of environmental action that are not reflected in the current GDP measures are ignored, and if it is assumed that environmental expenditures will level off - the impact could become neutral or modestly negative. But this will not happen if expenditures increase, as they must given future trends, and if the society is to avoid the reversal of past gains and further deterioration of the environmental and resource basis of future growth.

31. As regards employment, more jobs have been created by environmental measures than have been lost, while the overall impact on inflation has been modest.[10/]

Benefits for industry have varied. Firms involved in food processing, iron and steel, non-ferrous metals, automobiles, pulp and paper, chemicals, and electric power generation, for example - all major polluters - have borne a significant proportion of the total pollution control investment by industry. In the United States, pollution control investments in 1977 represented more than 16 per cent of total plant and equipment investment in the iron and steel industry, 17 per cent in non-ferrous metals, and over 10 per cent for the electric utilities.[11/]

32. Faced with these comparatively heavy costs, many of these industries developed a broad range of new processes, clean technologies, and more environmentally efficient products. Indeed, industries that 10 years ago established research and development teams to come up with technologies to meet new environmental standards are today in the forefront of competition. They have benefited in terms of plant that is more resource- and energy-efficient and hence, today, more economical and competitive. Many have also found new opportunities for investment, sales, and exports.

33. Behind the pollution control success stories in some developed countries was a rapid advancement of clean and efficient production processes and pollution control technologies. Waste recycling and reuse has become an accepted practice in many industrial sectors.[12/] In fact, as discussed later in this chapter, the energy and resource content of manufactured goods has been dropping consistently over the years, and per capita material consumption in developed market economies seems at least to have levelled off, if not declined, recently.

34. In the automobile industry, for example, new fuel-efficient engine designs were developed in response both to strict pollution control regulations in a number of

developed countries and to higher oil prices. In Japan, technologies for fuel and flue-gas de-sulfurization and de-nitrification made remarkable advances relatively quickly. New combustion techniques simultaneously raise combustion efficiency and reduce pollutant emission. Low-NO_x burners, fluidized bed combustion, and many other novel technologies hold great promise for the future. Innovative products and process technologies are also currently under development that promise to move industry even further towards energy- and resource-efficient modes of production, reducing pollution and minimizing risks of health hazards and accidents.

35. "Prevention better than cure" is now a widely accepted motto among the world's leading industries.[13/] A new PPP - "Pollution Prevention Pays" - is becoming an essential element of strategic planning for industrial development policies and projects in both government and industry. It means integrating environmental considerations fully and at the earliest possible stage of development into the process of industrial planning and management. Thus, more than 500 representatives of government, industry, and labour from developed and developing countries gathered at the World Conference on Environmental Management in 1984 declared: "Environmental management should be an integral part of economic development. Environmental issues should be addressed in the earliest stages of the economic planning and development process".[14/] As a result of this meeting, the International Environmental Bureau was established in 1986 as a specialized branch of the ICC to promote information exchange on vital environmental concerns among governments, industry, and other groups.

III. NEW PATTERNS OF INDUSTRIAL GROWTH

1. The Changing Structure of World Industry

36. The combined GDP of the world topped ($11) trillion in (1983) (to be updated).[15/] Industrial output contributed a major share of that wealth virtually everywhere - ranging from an average of 34 per cent in the low-income developing countries to 65 per cent in high-income developing ones, with the industrial sector of developed market economies contributing 35 per cent.[16/] The relative share of manufacturing value added (MVA) in GDP (which removes the impact of resource extractive industries such as fossil fuels and minerals), ranged from 19 per cent in developing countries as a whole to 27 per cent in developed market economies, and to 51 per cent in centrally planned economies. (See Table 7-2)[17/]

37. For most developing countries, which started from a virtually non-existent industrial base immediately after decolonization, the 1960s and 1970s were a period of

TABLE 7-2

Share of manufacturing value added in gross domestic product, by economic grouping and by income group,[a] at constant (1975) prices, selected years

(Percentage)

	1960	1965	1970	1975	1980	1981	1982
Developing countries	14.2	15.4	16.6	17.7	19.0	19.0	19.0
Low income	11.2	13.6	13.8	14.1	15.0	15.2	15.0
Lower-middle income	11.0	12.3	13.5	14.6	16.4	16.5	16.6
Intermediate income	10.6	12.6	14.4	16.0	17.1	17.6	17.6
Upper-middle income	19.4	19.5	21.6	22.0	24.1	23.8	23.3
High income	17.2	16.4	16.2	17.0	17.2	17.0	17.9
Developed market economies	25.6	27.5	28.3	27.6	27.9	27.6	27.1
Centrally planned economies[b]	32.0	37.4	42.4	47.3	50.5	50.8	50.8

[a]Income groups are defined in terms of the 1978 levels of gross domestic product per capita as follows: low income, <$295; lower-middle income, $295 to $600; intermediate income, $600 to $1 320; upper-middle income, $1 320 to $2,415; and high income, >$2,415.

[b]Figures refer to the share of manufacturing value added (estimated) in net material product.

Source: UNIDO, World Industry: A Statistical Review 1985, Vienna, 1985

sustained growth in industrial production, employment, and trade and they consistently outperformed the developed market economies. From 1963 to 1981, world manufacturing output increased almost three times as fast as agricultural output, and developing countries have played an increasingly important role in this growth. By 1984, in aggregate terms, the developing-country share of world MVA had risen to 11.6 per cent (although it is still far below the "Lima target" of 25 per cent adopted by the General Conference of UNIDO in 1975). Similarly, centrally planned economies of Eastern Europe raised their share of world MVA from 15.2 per cent in 1963 to 24.9 per cent in 1984.[18/]

38. Thus, while recent problems of economic slow-down and recession beset every nation, industrial activity has assumed increased importance for a wide range of developing countries. A number of developing countries that made spectacular progress in industrialization came to be known as the newly industrialized countries.

39. In general, the pattern of developing-country industrial production is clearly becoming more diversified and moving towards capital-intensive activities. Growth in metal products, chemicals, machinery, and equipment has been particularly striking. The relative weight of heavy versus light industry in developing countries has also shifted more towards the former over the years. These industries, it must be noted, have generally been pollution-intensive in the past. At the same time, the share of industries involved in food products, and to a lesser extent in textiles and clothing, has fallen significantly. Changes in the industrial structure of national economies are also reflected in the changing share of various economic groupings in total world output in different branches of industry.

40. Structural change in the economies of resource-rich countries can also occur when they provide higher stages of raw material processing. Although the situation varies greatly depending on the type of raw material in question, some countries have been moderately successful in elevating the share of refined products in their exports. Taking the Third World as a whole, exports of manufactures have grown steadily relative to primary exports, rising from 13.3 per cent of total trade in 1960 to 48.4 per cent in 1980 (See Table 7-3).[19/]

41. Yet most of the "manufactured" goods undergo further processing in the developed country that imports them. Thus in 1980, only 39 per cent of all Third World exports of manufactures were ready for final use, while 43 per cent of the total exports by the developing countries that year were "unprocessed" items.[20/] In the case of several major minerals such as aluminium and nickel, the whole industry is organized hierarchically from mining to

TABLE 7-3

Composition of the merchandise trade of developing countries, selected years

Item	Exports				Imports			
	1960	1970	1973	1980	1960	1970	1973	1980
	billions of dollars							
Primary commodities	24.6	45.2	85.7	452.4	11.1	16.8	32.7	166.3
Non-oil	17.0	26.9	42.6	107.3	8.2	12.1	22.9	79.4
Petroleum	7.6	18.3	43.1	345.1	2.9	4.7	9.8	86.9
Manufactures	2.6	9.5	23.1	100.6	17.1	39.0	68.7	288.1
Total	27.2	54.7	108.8	553.0	28.0	55.8	101.4	454.4
Total non-oil	19.6	36.4	65.7	207.9	25.1	51.1	91.5	367.5
	percent							
Primary commodities, including oil	90.4	82.6	78.8	81.8	38.8	30.1	32.2	36.6
Non-oil	62.3	49.2	39.2	19.4	28.4	21.7	22.5	17.5
Petroleum	28.1	33.4	39.6	62.4	10.4	8.4	9.7	19.1
Manufactures	9.6	17.4	21.3	18.1	61.2	69.9	67.8	63.4
	Share in non-oil exports				*Share in non-oil imports*			
Primary commodities (non-oil)	86.7	73.9	64.8	51.6	32.7	23.7	25.0	21.6
Manufactures	13.3	26.1	35.2	48.4	68.3	76.3	75.1	78.4

Source: UNIDO Industry in the 1980s: Structural Change and Interdependence, New York: United Nations, 1985.

final processing under tight control of several transnational corporations.[21/]

42. Another feature of world industrial development in recent years is the relative decline of manufacturing in relation to the other sectors of the economy. In many countries the share of MVA in GDP has been slowly declining since 1973. Although this is most noticeable in the case of developed market economies, the share of MVA in GDP has declined also in nearly half the 95 developing countries surveyed by UNIDO.[22/] This may reflect the growing interaction between industry and all fields of science and technology, as well as the increasing integration of industry and services and changes in the role of energy and raw materials in industry.

2. Declining Role of Energy and Raw Materials

43. Until recently, it was widely believed that industrial growth was always accompanied by a corresponding increase in energy and raw material consumption. In the past two decades, however, there appears to have been a fundamental change in this pattern. In the developed market economies, economic growth continues - albeit more slowly in the last few years - but the demand for many basic materials, including energy and water, has levelled off and in some cases has actually declined in absolute terms. The developed market economies have apparently reached a turning point in their energy and raw material consumption.

44. According to OECD, energy consumption per unit of GDP in member countries has been dropping at a rate of 1-3 per cent every year since the late 1960s. Between 1973 and 1983, these countries improved energy efficiency by 1.7 per cent annually.[23/] Water is an essential requirement in almost all industrial operations. In

older pulp and paper mills, typical water usage was about 180 cubic metres per tonne of pulp; for those constructed during the 1970s, however, effluent discharge was reduced to 70. With advanced system closure techniques and proper staff training, discharge rates could be lowered further to 20-30 cubic metres per tonne of pulp.[24/]

45. In an integrated steel mill, about 80-200 tonnes of water are required per tonne of crude steel. However, since only about 3 tonnes of water per tonne of crude steel are lost, mostly by evaporation, the demand can be reduced to a figure far below the total requirement.[25/] Closed water circulation systems are not unique to the steel industry or to developed market economies. In 1975 the USSR chemical industry recycled 80 per cent of its water. Between 1975 and 1980 chemical industry output increased by 76 per cent, but the total consumption of fresh water remained at the 1975 level.[26/]

46. Declines in demand and consumption of other raw materials essential for industrial growth started much earlier. In fact, the amount of raw material needed for a given unit of economic output has been dropping for this entire century, except in wartime, for practically all non-agricultural commodities.[27/] This is much more than a simple reflection of the increasing shift from manufacturing to services in the developed market economies, for the output of the manufacturing sector still continues to grow. The productivity and efficiency of resource use are constantly improving.

47. The two oil price hikes of the 1970s undoubtedly had a marked effect in inducing energy consumer countries to make major efforts to save fuel costs by improving conversion efficiency, promoting conservation measures, fuel-switching, and raising overall energy efficiency, which in turn led to generally reduced levels of

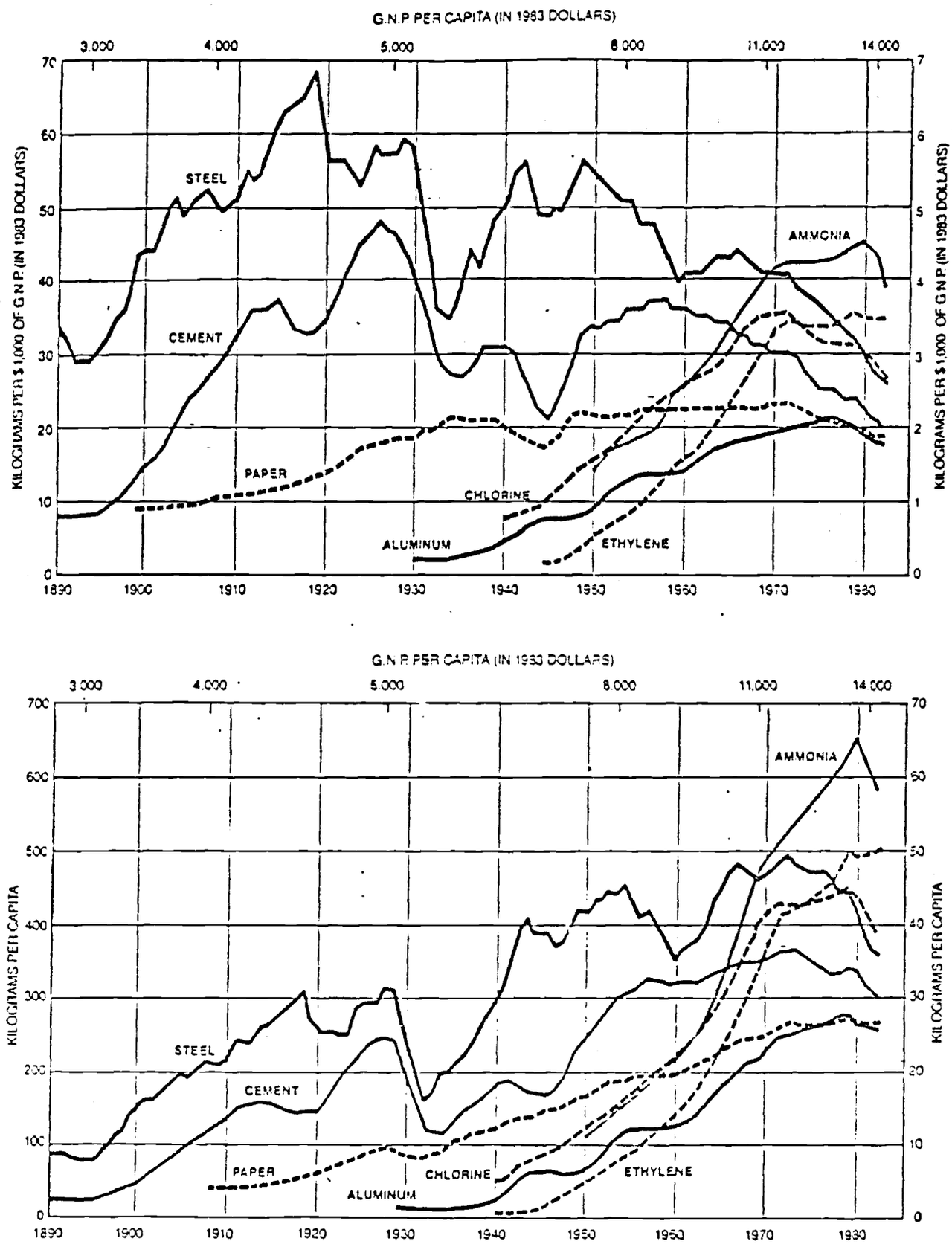
pollution. These events have demonstrated the importance of policies on the price of energy (or, for that matter, of any other raw material) that reflect a more realistic cost of those natural resources, taking into account their current stock, depletion rates, the technical availability of substitutes, and any unavoidable environmental damage associated with their extraction or processing.

48. A recent study of consumption trends of seven materials in the United States (see Figure 7-1) identified four causes of these trends:

* Substitution of one material for another has slowed the growth of demand for particular materials.
* Product design changes that increase the efficiency of materials use have had a similar effect.
* The markets for resource-intensive products in advanced economies, such as for steel, cement, synthetic fibers, and heavy consumer goods, are by and large saturated.
* New markets tend to involve products and services that have a relatively low materials content, such as video-casette recorders, personal computers and software, and health clubs.[28/]

49. In promoting at least one of these influences - namely that of improved energy and resource efficiency of production - environmental controls have played a major role by stimulating innovations in a particular product, process, or technology. From the viewpoint of individual enterprises, measures to improve energy and resource efficiency were thus adopted not only because of environmental considerations but also (and primarily) because they made economic sense. The past record of achievements in industry confirms the view that resource efficiency reinforces both environmental efficiency and economic efficiency.

FIGURE 7-1



TRENDS IN CONSUMPTION of seven materials exemplify the overall fate of basic materials in the U.S. Among the seven are two "traditional" materials in addition to steel: cement and paper. The others are "modern" materials: aluminum, ammonia, chlorine and ethylene. Consumption of the traditional materials peaked long before that of the modern ones, but use of all seven is now declining relative to G.N.P. (*upper panel*). For most of these materials per capita consumption is also declining (*lower panel*). The scale at the top of each panel shows G.N.P. per capita. As it suggests, the diminished role of basic materials is related to increasing affluence.

Source: Larson E.D. et al, "Beyond the Era of Materials, Scientific American, June 1986

50. Another kind of decoupling that has been quite noticeable is that of employment from industrial growth, or rather from the industrial sector itself, in developed economies. Although this is part of a long observed historical trend, the increasing adoption of new production processes and technologies has accelerated the pace of this shift to the service sector over the last 15 years.[29/] Whether the advent of a knowledge-based economy will further depress employment in industry or, as some economists argue, will improve and expand job opportunities in general is still widely debated.[30/] One important consequence of this process of decoupling, however - particularly for developing countries hoping to attract foreign investment in their industrial development is that cheap labour is becoming less important as a comparative cost advantage and as a factor in international competitiveness.

51. Some observers have referred to these processes as the increasing "de-materialization" of society and the world economy.[31/] Yet even the most industrially advanced economies still depend on a continued supply of basic goods; although these indeed may be no longer produced by those countries but have to be imported, their production will continue to require large inputs of raw material and energy unless developing countries achieve similar productivity gains through the adoption of clean and resource-efficient technologies. To sustain the momentum on a global level, therefore, policies that inject resource efficiency considerations into economic, trade, and other related policy domains are urgently needed, particular in developed countries, along with environmental regulations in strict adherence to the Polluter Pays Principle.

3. Promises and Risks of New Technologies

52. Numerous new and emerging technologies undoubtedly offer enormous opportunities for raising productivity and the standard of living, for improving human health, and for conserving the natural resource base. Unless carefully guided and designed, however, these technologies may also bring new hazards, cause environmental degradation, and induce subtle but irreversible changes in the social, cultural, and economic fabric of a nation and the world community.

53. Some call it the advent of a post-industrial economy; others have referred to it as the information society.[32/] And indeed, information technology based chiefly on advancements in microelectronics and computer science is of particular importance. Coupled with rapidly advancing means of communication, it has the capacity to make a major contribution to improving the productivity, energy and resource efficiency, and organizational structure of industrial operations. Information technology is already affecting international trade and investment patterns, often reducing the advantage of cheap labour in developing countries.

54. New materials such as fine ceramics, rare metals and metal alloys, high-performance plastics, and new composite materials are enabling a more flexible approach to production. They also contribute to energy and resource conservation, as in general they require less energy to manufacture and are lighter than conventional materials.

55. Biotechnology, perhaps far more than others, will have major implications for the environment. Using the products of genetic engineering techniques, human and animal health could be dramatically improved. New drugs, new therapies, and new ways of controlling disease vectors

are likely to be found. Biomass-based energy could increasingly substitute for other non-renewable fossil fuels. New high-yield strains and weather- or pest-resistant species could revolutionize agriculture. Biological methods of pest control will become more common. Biotechnology could also yield cleaner and more efficient alternatives to many wasteful processes and polluting products. New techniques to treat solid and liquid wastes could solve one of the world's most pressing problems - the disposal of hazardous wastes.

56. Advances in space technology, now the almost exclusive domain of developed countries, will also have an impact in the Third World, even on primarily agriculture-based economies. Agrometeorological services provided through a satellite and communications network can help farmers enormously in deciding when to plant, water, fertilize, and harvest crops. Remote sensing and satellite imagery could permit optimal use of the Earth's resources, in addition to making it possible to monitor and assess long-term trends in climatic change, marine pollution, soil erosion rates and plant cover, and so on.

57. Yet new technologies are not all intrinsically benign, nor will they have only positive impacts on the environment. The large-scale production and widespread use of new materials, for example, may create hitherto unknown hazards to human health (e.g., the use of gallium arsenate in microchip industry.)[33/] More risky research might be carried out and products might be manufactured in situations where safeguards and regulations are weak or when people are unaware of the dangers. New life forms - the products of genetic engineering - need to be carefully tested and assessed for their potential impact on human health and on the maintenance of genetic diversity and ecological balance before they are introduced to the market or released into the natural environment.[34/] The

need for caution in introducing a new technology is reinforced by the experience of the Green Revolution, which, despite formidable achievements, led to concern over dependence on relatively few crop strains and high inputs of agrochemicals.

58. Research and development (R&D) for technological innovations is becoming extremely expensive and financially risky, and the market for high technology products is becoming international and increasingly competitive, which is the only way to cover these high expenditures. Furthermore, the process and product shifts have to be made quickly and early enough to be competitive and to gain a reasonable share of world market. This factor also tends to make high technology products obsolete very quickly. The costs of such shifts can be enormous, and only large industrial firms, especially transnational corporations and state-owned enterprises, can afford to undertake them, even then only with direct or indirect government support.[35/]

59. These new technologies and the Green Revolution have accelerated the blurring and loss of the traditional distinction between agriculture, industry, and services. Agriculture has become an advanced sector in developed countries. Agriculture-related services are becoming ever more important, especially for regional weather forecasting, storage, and transport. Genetic engineering could soon generate new strains of plants directly able to fix nitrogen at the root, which would affect the fertilizer market and reduce the threat of pollution by agrochemicals. But great care will be needed: Even biological methods of pest control may bring some unintended side-effects.

60. A major seed industry with close links to the chemical and energy industries is developing, providing

new seeds bred to meet specific local conditions and requirements. Even here R&D, production, and marketing need to be carefully guided so as not to make the world even more dependent on a few crop varieties. A new international mechanism could ensure that the benefits of a new crop strain developed from the wild habitats of a developing country are returned to that nation. Developing countries themselves need to consider setting up biological reserves or gene banks and to promote their own R&D efforts in agro-industrial biotechnology. (See Chapters 5 and 9.)

IV. A RESPONSIVE POLICY FRAMEWORK

61. Economic growth will no doubt continue to be a primary objective of world development strategy for many decades to come. For the future growth path to be sustainable over the long-term, however, it will have to be qualitatively different than in the past. (See Chapter 2.) Even on the basis of the situation today, wherein developing countries have roughly twice as many people as developed countries, world industrial output would have to be increased by a factor of 2.6 if per capita consumption levels of all manufactures are to be equalized between the two groups of countries.[36/] This will in effect mean a five- to tenfold increase in the industrial output of the world as a whole by the time the world population is stabilized sometime in the next century, with enormous implications for the health of the world's ecosystems and the natural resource base.

62. This scenario also implies far greater expansion of economic activity in the developing countries where most of the future population growth will occur, and where both the need and the potential for development are great. In

particular, it will entail a massive increase in the production of basic consumer goods and the concomitant build-up of industrial infrastructure - iron and steel, paper, chemicals, building material, transportation, and so on - with all that implies about energy and raw material use, industrial hazards and wastes, accidents, and resource depletion. The strains will be particularly heavy on developing countries hoping to industrialize between now and the year 2000.

63. Nevertheless, the prospects for sustainable industrial development are good. The advent of a new generation of technologies, coupled with a steadily growing awareness of the need to ensure that development enhances rather than undermines its resource base, provides enormous opportunities for the future.

64. A number of far-sighted yet practical changes in current approaches will be required to ensure sustainable industrial growth and, in particular, to accelerate the development of industry appropriate to the wide range of preferences and situations in the Third World. The precise form of these changes will, of course, vary greatly. But the overriding objective must be to integrate resource and environmental considerations fully and effectively into decision-making processes within both government and industry.

65. Such integration will allow a steady reduction in the environmental and resource content of future growth by increasing the efficiency of resource use, reducing waste, and encouraging resource recovery and recycling. It will enable the adaptation of new and emerging technologies to facilitate the development of human resources and to improve existing, traditional work patterns. In general, it will permit government and industry to shift to more cost effective anticipate-and-prevent approaches that will

sustaining the resource and environmental base of development, gradually reducing the current heavy reliance on economically and socially inefficient react-and-cure measures.

66. The transition from react and cure to anticipate and prevent will not be easy for either government or industry, particularly in developing countries and small or medium-sized industries everywhere. For some time to come, curative measures will still be needed to address many environmental problems and to clean up the backlog of damages already inflicted on the environment and natural resource base. For the concept of sustainable development to be put into practice by industries throughout the world, a clearly defined policy and institutional framework needs to be established, both nationally and internationally.

67. Six objectives of this new policy framework should guide government and industry:

* an integrated approach to industrial development planning, so that measures to prevent adverse effects on human health and the environment can be incorporated at the most effective and least costly stage;

* improved resource management, with special attention to industrial development in areas where the continuing or anticipated erosion of natural resource base is critical and in environmentally sensitive areas;

* pollution abatement and waste minimization in all branches of industry and throughout the world, especially where rapid industrialization in or near major population centres poses critical public health and safety problems;

* improved environmental and risk assessment methodologies as well as risk management capabilities involving plant siting, design, and choice of product or technology;

* increased international cooperation between government and industry to address transboundary, regional, or global environmental problems related to industrial emissions, products, and processes; and

* increased technical, financial, and institutional assistance to and among developing countries, aimed at improving their capacity to assess their own natural resource base and the sustainability of industrial projects or technologies, as well as to deal with pollution, accidents, and other industrial hazards.

V. STRATEGIES FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT

1. Establish Environmental Goals, Regulations, and Standards

68. In dealing with these problems of both industrial pollution and resource degradation it is essential that industry, government, and the public have clear benchmarks by which to plan, evaluate, and act. Moreover, if appropriately designed and effectively enforced in an integrative manner, environmental regulations can be both consistent with resource efficiency and conservation and supportive of economic efficiency and productivity. National governments must therefore establish clear environmental goals, regulations, and standards. Among

the various policy goals, public health and safety must receive top priority, and for economic efficiency measures, the PPP must become the guiding spirit.

69. The regulations and standards should govern such matters as air and water pollution, waste management, occupational health and safety of workers, energy and resource efficiency of products or processes, and the manufacture, marketing, use, and disposal of toxic substances. This should normally be done at the national level, with local governments being empowered to exceed, but not to lower, national norms. In addition, the fundamental right of citizens to a healthy environment should be recognized by law or constitution, and the broadest possible representation of people affected or likely to be affected by pollutant emissions should be given a standing in court. The application of strict liability in pollution-related litigation, which is consistent with the PPP, will encourage industry not to cause such harm.

70. With limited resources at their disposal, small and medium-sized industries often find themselves unable to afford the process changes or other technical adjustments necessary to meet environmental regulations and product controls. Small-scale businesses such as metal working, machine tools, printing, and tanning and dying are frequently among the worst offenders of environmental regulations in any country. New technologies, especially micro-electronics, already allow small industries to control an entire production process at low cost.

71. Since small and medium-scale enterprises make up the largest segment of industry in most nations, especially in developing countries, they need to be provided with information and both financial and technical assistance in this field.

Management and worker training can help incorporate clean technologies and environmental planning into work patterns. As a matter of principle, however, environmental regulations should apply equally to large and small companies, be they foreign-owned, joint ventures, or purely domestic.

(Rec. 7-1)

Governments should:

* require industrial enterprises, irrespective of ownership or size, to meet environmental regulations and standards to protect public health and the environment.

* in formulating policies or regulations or in funding such environmental controls, give priority to public health problems associated with industrial pollution or hazardous wastes.

* encourage cooperative efforts among smaller firms - for example, in joint R&D on environmental issues and joint use of pollution control or waste treatment facilities, so that the limited resources available could be applied collectively to pollution prevention and waste minimization approaches.

All industrial enterprises, and especially TNCs, should:

* establish company-wide policies concerning resource and environmental management, including compliance with laws and requirements of the country in which they operate.

72. Regulations to control the impacts of industrial activity across national boundaries and on the international commons are also needed. The principles of state responsibility to not harm the health and environment of other nations, of liability and compensation for any damage caused by transfrontier pollution, and of equal right of access to remedial measures by all parties concerned should be firmly established and written into existing or future

international conventions dealing with transfrontier pollution or management of shared natural resources.

(Rec 7-2)

All governments and relevant international organizations that are parties to, or depositaries of, international conventions and protocols concerning pollution prevention or management of shared natural resources, including the global commons, should:

* review those treaties in order to establish whether and how the relevant provisions might be strengthened.

The United Nations should:

* consider incorporating environmental rights into the Universal Declaration of Human Rights.

2. Make More Effective Use of Economic Instruments

73. Better management of the real costs of using environmental resources for production and consumption calls for more effective use of economic policy instruments and regulatory standards that will induce industries to emphasize energy and resource efficiency, recycling, and waste minimization, and generally aim to prevent pollution rather that cure it after the fact. Energy and water pricing policies, for example, can significantly push industries to consume less. Product redesign and technological innovations leading to safer products, more efficient processes, and recycling of raw materials can also be promoted by a more effective, integrated use of economic incentives and disincentives, such as investment tax breaks, low-interest loans, depreciation allowances, pollution or waste charges, and non-compliance fees.

74. In using such economic instruments, however, great care will be needed to ensure that the PPP itself is not

breached. Disincentives such as user fees and effluent charges will generally allow individual industries to seek out least-cost options for reducing pollutant emissions and increasing recycling. But subsidies and direct R&D grants for developing or installing new pollution control technologies may violate the PPP by putting public funds into a polluting industry's activity, thus changing the relative competitiveness of the industry and distorting international trade. Other subsidies to achieve other legitimate policy goals can have similar unintended effect of reducing the effectiveness of environmental programmes. In formulating environmental regulations, it is important that flexible systems such as intermittent controls and marketable permits (emissions trading) are adopted without specifying a particular process or technology.

(Rec 7-3)

Governments and industry should:

* adhere to the Polluter Pays Principle - that polluters and producers of hazardous products, including wastes, should bear the cost of preventing or cleaning up the environmental harm caused by those pollutants and products.

Governments should:

* consider whether existing economic policies, instruments, or subsidies provided to various industry-based programmes and projects contribute effectively to the promotion of environmentally sound and resource-efficient practices in industry, or whether they instead run counter to the PPP, inducing precisely opposite effects on industrial planning and management.

3. Expand and Extend Sustainability Assessments

75. Investment can destroy as well as enhance the basis for future development. Unless societies are prepared to accept a drop in living standards - and no government is prepared to contemplate that - new investment must enhance positive feedbacks and reduce negative ones from the ecosystems on whose sustainability it depends. To this end, new investment must be increasingly resource-efficient and ecologically as well as economically sustainable.

76. The limited policies now in effect in some developed countries - under which major investments are subject to prior environmental assessment - need to be extended within those countries. And the assessment needs to be broadened significantly: Sustainability assessments of investments are needed. Such assessments need to be applied to policies, programmes, and projects that have a major impact on a neighbouring country, on developing countries, and on the global commons. This approach should be applied equally to cases of transboundary pollution, international trade, foreign investment, and technology transfers, including projects involving exploration and development of natural resources and of the global commons. (See Chapter 10.) To avoid long and costly delays that usually end up frustrating the purpose of the assessment, they have to be undertaken at the earliest possible stage. Economic agencies initiating the investment, rather than an after-the-fact, add-on environment agency or group, should therefore be responsible for sustainability assessments.

77. Many developing countries, particularly in Asia and Latin America, have also adopted systems for environmental impact assessment. But the lack of institutional capacity

and skilled personnel mean those assessments are often conducted by outside consultants, and a quality check is often missing. In some cases, government authorities would benefit from a second opinion on the environmental documentation they receive.

(Rec 7-4)

Governments should:

* require an environmental/sustainability assessment for all major investments as an integral part of licensing, funding, or other permit-granting procedure.

Developed country governments should:

* create an independent international assessment body to help developing countries, upon request, evaluate the environmental impact and sustainability of planned development projects.

International trade associations should:

* establish and make widely available sectoral guidelines for assessing the sustainability and potential hazards of new facilities, for developing accident contingency plans, and for selecting pollution control or waste treatment technologies.

4. Increase Capacity to Deal with Industrial Hazards

4.1 Chemicals

78. The chemicals industry is one of the most dynamic sectors in most countries, and chemicals represent about 10 per cent of total world trade in value.[37/] The demand for more and new chemicals and the concomitant risk of misuse and accidents are expected to rise well into the 21st century.

79. Some 70,000-80,000 chemicals are now on the market, and hence in the environment.[38/] The figure is

indefinite because no complete inventory has been done. About 10 per cent of these are thought to be hazardous to human health and to the environment, but that too is uncertain, based just on a sampling of the small number of chemicals tested to date. In addition, 1,000-2,000 new chemicals enter the commercial market each year, most without adequate prior testing or evaluation of effects.[39/]

80. According to a US National Research Council study of 65,725 chemicals in common use, data required for complete health hazard evaluations were available for only 10 per cent of pesticides and 18 per cent of drugs, whereas no toxicity data existed for nearly 80 per cent of the chemicals used in commercial products and processes inventoried under the Toxic Substances Control Act.[40/] This situation is now beginning to change as governments move gradually from a system of post-market testing to one of pre-market testing of all new chemicals.

81. To date, more than 500 chemicals and chemical products have been banned altogether or had their uses restricted in the country of origin.[41/] In developed countries, an increasingly interdependent and effective system of chemical control agencies share test results and notify each other of new restrictions on chemicals. A ban in one country is thus often quickly followed by similar action by other developed country governments.

82. But few, if any, effective restrictions exist on the export of banned chemicals and chemical products to other countries. In addition, an unknown number of chemicals are withdrawn from clearance processes every year in the light of control agency concerns, or are never submitted to national control agencies for clearance. Many of these are produced for export, however.

83. While most developed countries are now tightening their regulatory systems, most developing countries have no effective control over this trade. Many are simply unable to establish such systems because of a combination of institutional and financial limitations and a shortage of professional staff. Developing-country imports of chemicals banned elsewhere are virtually unrestricted.

84. As the source of the risks associated with increasing use of chemical products as well as the greatest beneficiary of their use, the chemical industry should bear the responsibility for ensuring (and the ultimate liability for not ensuring) that its products meet the highest standards of safety, have the fewest adverse side-effects on human health and environment, and are handled with appropriate care by workers and consumers everywhere through every stage of production and use. This will require the fullest possible disclosure of information about the production processes and properties of chemical substances, not only to the regulatory authorities but also to the workers, consumers, and residents of the community in which a chemical industry operates.

(Rec 7-5)

All governments, especially those of countries where chemicals are produced and exported, and relevant international organizations should:

* agree that no new chemicals will be placed on the market until the health and environmental impacts have been appropriately tested and assessed in accordance with internationally agreed guidelines, laboratory practices, and procedures.

* reinforce efforts to obtain international agreement on selection for priority testing of existing chemicals, on criteria and procedures for their assessment, and on a system for international sharing of the tasks and the resources required.

* develop information for policy makers, users, and consumers on comparative risk of chemical products.

* encourage non-governmental organizations to take the lead in collecting and distributing comparative risk information on chemicals in consumer products such as cleaning agents and pesticides.

* encourage the establishment of information centers on consumer chemical products.

* support and strengthen the international networks of information exchange, assessment, or data banks that are now evolving in the UN and other regional organizations (e.g., the International Programme on Chemicals Safety and the International Registry of Potentially Toxic Chemicals), and make the networks more accessible.

* strictly regulate the export of banned or severely restricted chemicals to other countries, in particular to developing countries, by requiring prior notification of the intent to export; the provision of all available information concerning health, environmental, and other effects of the chemicals as well as methods for safe use and disposal; and the prior consent of the importing country government.

* adopt and enforce regulations to require the packaging and labelling of chemicals whose use may be potentially harmful, and ensure that in marketing such products, clear directions are provided in common local languages.

4.2 Hazardous Wastes

85. Developed countries probably generate about 90 per cent of the world's hazardous wastes. All estimates have wide margin of error, given considerable differences in definitions of "hazardous waste", but in 1984 some 325-375 million tonnes were generated worldwide, of which European market economies accounted for about 20 million tonnes.[42/] The United States reported that 264 million tonnes (wet weight) were created in 1981.[43/] Around 5 million tonnes of hazardous wastes are being generated in

the newly industrialized and developing areas of the world. During the 1980s, North American and European market economies are expected to experience an annual growth in hazardous wastes of 2-4 per cent.[44/]

86. In member countries of OECD alone, thousands of waste disposal sites exist, many of which are likely to require some form of remedial action. Clean-up is expensive: Estimates include (DM 17 billion) for West Germany, more than (Gld 3 billion) for the Netherlands, $20-100 billion for the United States, and at least (DK`400 million) for Denmark.[45/] A large number of potentially hazardous sites may also exist in concentrated industrial-urban areas in centrally planned economies as well as in developing countries. Clean-up costs are so high that at present no insurance policies would adequately cover such operations. Some form of government intervention is invariably required through regulatory action or financial support.[46/]

87. The overriding policy objective must be to reduce the amount of waste generated and to transform an increasing amount into resources for use and reuse, in order to reduce the volume that will otherwise have to be treated or disposed of through incineration, land disposal, or dumping at sea. This is first and foremost a problem of the developed countries. It is also, however, a problem of newly industrializing and developing countries. Rapid industrialization is bringing them the same severe problems of hazardous waste management. Indeed, the situation is perhaps more severe per unit of waste generated because more people are exposed; because much of the wastes are released directly into sewers, surface waters, and open dumps; and because of the political, institutional, and financial capacity to control and manage the problems is much weaker.

88. According to UNEP, waste management in developing countries suffers from a variety of problems. For example, countries in or near the tropical rain belt must cope with frequent and heavy rains, so land-fills are subject to rapid leaching or even direct overflow. With little or no pre-treatment of wastes, this could lead to contamination of water supplies as well as to direct exposure of people living nearby. Land-filling generally occurs close to industrial estates that are surrounded by poor neighbourhoods or shanty towns.[47/] These dangers point up the clear need for land use planning in developing countries, and the more urgent need to actually implement and enforce such plans.

(Rec 7-6)

National and local governments should:

* survey hazardous industrial operations and adopt and enforce regulations or guidelines on the safe operation of industrial plants and on the transport, handling, and disposal of hazardous materials.

* adopt land use policies or regional development plans that would regulate or provide incentives to industries that have a high pollution or accident potential to locate away from population centres, and that would discourage people from moving close to plants and waste disposal sites.

89. The amount of wastes crossing national frontiers is increasing and is likely to continue doing so. Between 1982 and 1983, wastes transported in Europe for disposal in another country virtually doubled, reaching some 250,000-425,000 tonnes (about 1-2 per cent of the wastes generated).[48/] This increase may be attributed partly to the availability of relatively low-cost, legal, land-based disposal facilities in certain planned economy countries. For example, about 4,000 shipments of hazardous wastes went from the Netherlands to East Germany

in 1984. And West Germany sent about 20,000 shipments to East Germany the preceding year. International transport of wastes meant for disposal at sea, either by incineration or dumping, amounted to about 1.8 million tonnes in 1983.[49/]

90. Some developing countries have recently proposed what amounts to a commodity trade in hazardous (including radioactive) wastes. For example, China has recently offered to accept hazardous wastes from West Germany in return for heavy machine tools and equipment.[50/] In other cases, the importation of hazardous waste may be seen as a way to obtain foreign currency. Many developing countries are experiencing rapid industrialization and a corresponding increase in hazardous wastes. The potential for trade in these materials, between developed and developing countries as well as within the Third World, thus exists and is likely to grow.

91. Strengthened international cooperation in this area is therefore vitally important, and several international bodies are now concerned with relevant policies. In 1984, the Council of Ministers of the European Community adopted a directive on the "supervision and control of transfrontier shipments of hazardous waste".[51/] An international agreement aimed at effective control of transfrontier movements of hazardous wastes is currently being developed by OECD. In a June 1986 Council Decision, it adopted three important principles that are to be incorporated in the international agreement to be prepared by 1987: (1) equally strict controls on hazardous wastes apply for shipments to non-member countries; (2) prior notification to and prior consent from the country of final destination, whether member or non-member country; and (3) guarantees of adequate disposal facility in the recipient country. UNEP has drawn up extensive draft guidelines, which include provisions for transfrontier

movements, safety, packaging, labelling, licensing, documentation, and international cooperation to minimize exports from developed to developing countries.[52/]

(Rec 7-7)

Governments and relevant international bodies should:

* require the exporter of hazardous wastes to obtain the informed consent of relevant authorities in both importing and exporting countries, as well as countries of transit, prior to shipment.

* actively support current negotiations to achieve an effective international regime to control the transfrontier movement of hazardous wastes.

4.3 Industrial Accidents

92. As described earlier, the accidents at Bhopal[53/] and Chernobyl raised public awareness about industrial disasters. Accidents involving toxic chemicals are not limited to plants located in developing countries, however. Only months after the tragedy at Bhopal, an accident at a U.S. plant in West Virginia operated by the parent company of the Bhopal facility resulted in a large-scale evacuation of people and some risk to human health. According to a survey carried out by the U.S. Environmental Protection Agency, 6,928 accidents occurred at U.S. plants between 1980 and 1985 - an average of five a day.[54/] The accidental release in 1976 of a highly toxic and mutagenic chemical, dioxin, into the air over Seveso in Northern Italy, and the ensuing saga of drums of contaminated soil moving around Europe, showed that in developed countries too, regulations can be evaded and minimum safety standards breached.[55/]

93. Both Bhopal and Chernobyl have clearly demonstrated the likelihood of significant increases in the frequency and magnitude of industrial accidents with catastrophic consequences. The explosion at Chernobyl has thrown into

question the whole basis of various estimates of the probability of major accidents in a nuclear plant, in addition to changing scientists' understanding of the possible extent of damages and radiation effects of a nuclear accident. In early November 1986, a fire at a warehouse of a chemicals manufacturer in Basel, Switzerland, sent toxic fumes into France and West Germany and released toxic chemicals into the Rhine, causing massive fishkills and affecting the vital water supply in countries downstream, all the way to the Netherlands. Scientists in all countries involved agree that it will be many years before the damaged Rhine ecosystems can be fully restored to their former status.[56/]

94. These recent events - all within the short lifetime of this Commission - point to the need to create or strengthen the framework for bilateral and regional cooperation in matters of contingency planning, early warning and consultation, provision of relief and compensation, and possible dispute settlement mechanisms. Coherent land use policies need to be adopted and implemented consistently, perhaps relying on zoning ordinances, town planning commissions, and development advisory councils. In addition to mandatory environmental impact assessments, risk assessment and management methodologies sorely need to be improved. Plant workers need to be provided with full information about the products and technologies they handle, and given adequate training in safe operational procedures and emergency preparedness. Local governments and community residents should also be informed and involved as much as possible in major siting decisions and emergency preparedness planning. The specific recommendations on plant safety and land use planning made earlier regarding hazardous wastes apply equally in this area.

(Rec 7-8)

Governments of countries bordering on or downstream of industrial plants and other potentially hazardous facilities should:

* start negotiations and agree on criteria for selection of such industrial facilities and sites, which will then be subject to pre-construction consultation, joint review, and emergency preparedness planning among countries affected.

* jointly prepare emergency preparedness plans for existing plants and sites.

Developed country governments and relevant international organizations should:

* promote further development of technology or risk assessment methodologies, establish data banks on cases of such assessments conducted, and make them easily accessible to other countries.

5. Strengthen International Efforts to Help Developing Countries

95. Environmental conditions differ greatly among different countries, and industrialization has widened the gap in incomes and standards of living within the Third World. Although generalizations about developing countries are therefore inappropriate, it may still be said that they are often deficient in exercising effective environmental control on industrial activities. Even where the most elaborate environmental programmes, laws, and regulations exist, it often proves difficult to implement and enforce them. Though about 110 developing countries have established environmental agencies of some sort,[57/] most lack resources, staff, and effective political power. Except in a few of the newly industrialized nations, environmental protection has often taken second priority in government policies and programmes.

96. Many nations have begun to develop the educational and scientific infrastructure, but their technical and institutional capacity for absorption, adaptation, extension, and practical application of imported or new technologies remains small. Some countries thus continue to depend on outside technical and managerial skills for the maintenance of industrial operations. For lack of capital, they often find that a new industry can only be started with the support of foreign aid, commercial loans, a direct investment, or a joint venture with a transnational corporation. These foreign institutions do not always attach highest priority to ensuring sound environmental management or to providing the cleanest and safest technology to the local industry.

97. Furthermore, their problems are compounded by the vagaries of the international economic system, which is currently not conducive to giving environmental protection and resource management a higher priority among competing demands made on the meagre resources of Third World governments. Witness the sharply deteriorating terms of trade of primary commodities that so many countries depend on as a source of foreign currency for imported goods and technologies. In addition, many are suffering under the weight of mounting foreign debt. Debt servicing alone forces nations to sell off natural resource assets (i.e., their commodities) on the oversupplied buyer's market. This depresses the terms of trade further and accelerates the erosion of their natural resource base. (See Chapter 3.)

98. Given developing countries' continuing need to build up their industrial capacities so as to provide a wide range of basic consumer goods, the weight of increased industrial activities and the resultant pollution and erosion of natural resource base is bound to fall on a large number of these nations. They seem to be caught in

a double (or even a triple) bind. Just as they are striving hard to develop and diversify their economy through industrialization, and while some of them in the midst of debt crisis, they have to bear the heavy burden of capital-intensive and generally pollution-intensive industries at a time when advanced industrial economies are moving away from such industries to knowledge-intensive, high-technology modes of production.

99. The developing countries themselves will have to bear the consequences of inappropriate patterns of industrialization, and the ultimate responsibility for ensuring sustainable industrial development rests with each government. They must define their own environmental goals and objectives of development, and establish clear priorities among competing demands on their scarce resources. They will also need to search for more self-reliant means of industrial and technological development.

100. Nevertheless, regional organizations can promote R&D activities on environmentally sound technologies and their adaptation to local conditions, including environmental monitoring and assessment techniques, plant and process design, and policies governing the siting of industrial plants and projects. They can also encourage close working relationships between individual companies and regional institutions so as to provide training, technical assistance, and finance to local industries. Existing regional or subregional organizations, such as the Andean Pact, ASEAN, ECOWAS, and SADCC, should be further strengthened to provide a channel for effective industry-to-industry cooperation on environmental and resource management.

(Rec 7-9)

Developing country governments, the scientific community, financial institutions, and development aid agencies should:

* use and strengthen regional or sub-regional organizations - whether governmental, non-governmental, or industry based - to increase cooperation on environmental and resource management questions related to industrial development, including information exchange, joint research, and technical assistance on industrial location, environmental assessment, resource leases, and trade negotiations.

Regional organizations should:

* give priority to identifying successful industrial development strategies based on sound environmental planning that can be applied in other areas, and to developing guidelines for assessing environmental impacts of industrial facilities, for granting leases, for planning site locations, and for operating plants safely.

101. Natural resources should be regarded as the national endowment of each country, and terms of access to these resources should reflect this concept. Resource management policies in developing countries can prevent overexploitation through the use of improved lease terms, trade agreements, export regulations, and codes of conduct, with industry's acceptance of the obligations to ensure that renewable resources be allowed to regenerate and to restore land damaged by resource extraction or use. (See Chapter 3.)

102. In addition, many developing countries face an acute need for information on the nature of industry-based resource and environmental problems, on risks associated with certain processes and products, and on standards and other measures to protect human health and ensure environmental sustainability. They also need trained people to apply such information to local circumstances.

There is at the same time a need to make industrial management, employees, and the public more aware of the risks and benefits of industrial activity, and of the importance of sound environmental practice in industry.

(Rec 7-10)

Large industrial enterprises, and transnational corporations in particular, should:

* adopt the highest safety and health protection standards practicable and acceptable to the host country, and assume responsibility for safe plant and process design, staff training, and so on.

* institute environmental and safety audits of their plants, where they are not already under way (environmental and workplace conditions and measures at local subsidiaries should be compared with standards at other subsidiaries, not just with other local companies, which may have less stringent requirements).

* actively seek the input of non-governmental organizations and the local community in planning new industrial facilities.

* take steps to ensure that the relevant national and local authorities are fully informed about the properties and potentially harmful effects of the technology, process, or product being introduced, including emissions, wastes, and any potential risks to the community.

* ensure that authorities are fully informed about the measures needed for effective monitoring, regulation, and management; this would include disclosing all necessary information to the nearby residents in an easily understandable manner and cooperating with the local government and community in contingency planning and in devising clearly defined mechanisms and procedures for relief and compensation to potential victims.

* explore with local governments the possibility of joint water supply and waste treatment facilities in areas where adequate systems do not exist.

International trade associations and labour unions should:

* take the lead in developing special environmental training programmes for developing countries and in disseminating information on pollution control, waste minimization, and emergency preparedness plans through local chapters.

Bilateral and multilateral development assistance agencies and commercial banks should:

* establish operational guidelines and procedures for incorporating environmental considerations into their policy research and investment strategies.

* establish joint review teams with recipient countries to evaluate impacts of proposed projects and to monitor compliance with guidelines.

* base their pre-investment planning grants and feasibility studies on environmental guidelines that would ensure sustainability of the full project.

Developing-country governments should:

* designate a national body to which banks, transnational corporations, and development assistance agencies can address environmental questions when industrial investments are being negotiated.

NOTES AND REFERENCES

1/ As will be noted later in this chapter, the conventional classification of economic activities into 3 sectors - namely primary (agriculture and mining), secondary (manufacturing) and tertiary (commerce and other services) - has become increasingly ambiguous, as economic activities began to involve and cut across all 3 sectors, and furthermore as services began to occupy an important place in some developed economies. In this chapter, however, the term "industry" will be used in the traditional sense to include mining and quarrying, manufacturing, construction, electricity, water and gas.

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4/ See, for example, U.S. Council on Environmental Quality, Environmental Quality, Washington, D.C. 1985 and V.J. Pye et al., Groundwater Contamination in the United States, Philadelphia, 1983.

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6/ The UN Commission on Transnational Corporations has been working on a comprehensive code since 1977 but has failed so far to agree on a final text. For other examples, see FAO, Code of Conduct on the Distribution and Use of Pesticides, Rome, 1985; ILO, Safety and Health Practices of Multinational Enterprises, Geneva, 1984; UNEP, Guidelines on Risk Management and Accident Prevention in the Chemical Industry, adopted in 1982; and OECD, Declaration of OECD Member Countries on International Investment and Multinational Enterprise, Paris, 1976.

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8/ See OECD Council Decision ( ) "Guiding Principles .....", Paris, 1971.

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23/ Op. cit., OECD, The State of the Environment 1985, Paris, 1985.

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25/ ibid.

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28/ Larson, E.D. et al, "Beyond the Era of Materials" in Scientific American, June 1986, Vol. 254, No. 6.

29/ Op. cit., UNIDO, Global Report 1985.

30/ See for example W.W. Leontief, The Impact of Automation, New York, 1986; J. Rada, The Impact of Micro-electronics, Geneva, 1980; D. Werneke, Microelectronics and Office Jobs, ILO, Geneva, 1983; and F. Duchin, "Automation and its Effects on Employment" in Employment Implications of the Changing Industrial Base, New York, 1984.

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