

# Population, waste and chemicals

**W**aste is an inevitable by-product of most human activities. People have been generating and discarding materials since hunter-gatherers threw bones and vegetable remains outside their caves. For many hundreds of years those wastes consisted exclusively of matter which biodegraded easily (such as vegetable and human wastes), or were inert (such as bones and wood ash). Given the relatively small population, the quantities of waste were minor and could be readily absorbed by the environment; indeed they had value in fertilizing the soil.

As the global population grew, and urban and industrial development accelerated, the opportunities to dispose of materials, including biodegradable ones, diminished while the quantities and nuisance value of wastes increased. Society now has large volumes of waste to deal with: in the United Kingdom, for example, more than 500 million tons of waste are generated each year, of which some 30 percent are mineral wastes, 20 percent industrial, 40 percent agricultural and 5 percent municipal. A sometimes inordinate focus on household waste has often disguised the much larger volumes generated by up-stream activities such as extraction, manufacture and distribution: it is often claimed that for every ton of finished product, ten tons of wastes are created.

Laws to raise waste management standards were first introduced at the beginning of the 20th century, and today there is a plethora of such regulation. As well as protecting public health and reducing local nuisance, these laws are increasingly aimed at protecting the wider global environment. Waste is no longer a local issue. There are global concerns about the consumption of finite resources and the impacts of their acquisition, as well as the effects of waste management and the transboundary nature of pollution.

Certain wastes – such as polychlorinated biphenyls (PCBs), now phased out, and those from the nuclear industry – take many years to reach a state where they pose no further threat. Concern about long-term harm has influenced disposal methods. We have learned, in theory, how to manage landfill sites to contain leakage, and how to seal radioactive waste in concrete tanks for safe, long-term storage. We have developed combustion technologies to minimize emissions, and found ways to clean those emissions. Yet despite the many advances, disposing of waste is still problematic. Some potential disposal sites are ruled out by geological factors and some by their distance from the point of arising, but almost all are opposed by nearby residents. Proposals to site a recycling collection point attract as much opposition as those to construct a high-tech incinerator. We all want the goods and services which industrialized society provides – from power supplies to computers, fast food to vitamin pills – yet we do not want the resulting waste to affect us as individuals. This is exacerbated by mistrust of waste management systems and the risk of accident.

Industrial waste reflects not only the type of industry, but also how efficiently it is operated, and whether “clean technologies” are adopted. It is estimated that 26 percent of Europe’s waste comes from manufacturing. In 1996, the United Kingdom generated 56 million tons of manufacturing

## Landfill and methane emissions

The primary disposal route for all wastes is landfill, with more than 80 percent being disposed of that way. The anaerobic decomposition of waste in landfill sites is a major source of methane emissions: of the total global emissions of methane, estimated in 1999 at 535 million tons annually, 375 million tons are the result of human activities, and 18 percent of those come from waste disposal<sup>1</sup>.

## MUNICIPAL WASTE IN OECD COUNTRIES, MID-1990s

	Municipal waste Kilos per capita	Of which household Kilos per capita
Australia	690	400
Austria	480	310
Belgium	470	id
Canada	630	310
Czech Rep.	230	150
Denmark	530	500
Finland	410	180
France	560	410
Germany	400	380
Greece	310	id
Hungary	420	270
Iceland	560	240
Ireland	430	290
Italy	470	400
Japan	400	id
Korea, Rep.	390	id
Luxembourg	530	250
Mexico	330	260
Netherlands	580	470
New Zealand	id	390
Norway	620	300
Poland	290	210
Portugal	350	id
Spain	370	id
Sweden	440	360
Switzerland	610	430
Turkey	590	id
UK	490	460
USA	720	id

	% re-cycled	% incinerated	% land-filled
Australia	id	id	id
Austria	38	14	48
Belgium	14	31	55
Canada	19	6	75
Czech Rep.	id	id	99
Denmark	23	54	22
Finland	33	2	65
France	9	32	59
Germany	29	17	51
Greece	7	-	93
Hungary	-	7	93
Iceland	14	17	69
Ireland	8	-	92
Italy	-	6	94
Japan	4	69	27
Korea, Rep.	24	4	72
Luxembourg	28	43	28
Mexico	1	-	99
Netherlands	38	27	35
New Zealand	id	id	id
Norway	15	16	69
Poland	2	-	98
Portugal	12	-	88
Spain	12	4	83
Sweden	19	42	39
Switzerland	40	46	14
Turkey	2	2	81
UK	7	9	83
USA	27	16	57

Source: OECD.

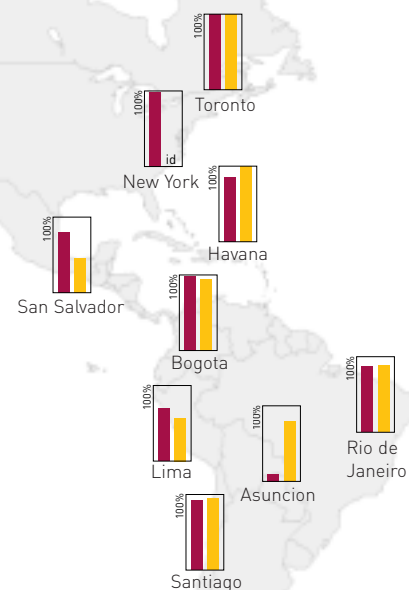
## WORLD WASTE MANAGEMENT, 1990s Selected cities

■ Proportion of inhabitants with connection to sewerage systems

■ Proportion of inhabitants with regular refuse collection services

id Insufficient data

Data on waste management and pollution are extremely sparse, particularly at the global level. However, data on rates of urban refuse collection and drainage, even when few and far between, are a reasonable indicator of the overall ability of a nation or region to regulate waste and pollution.



## USA: MATERIALS IN THE MUNICIPAL WASTE STREAM, 1960-90

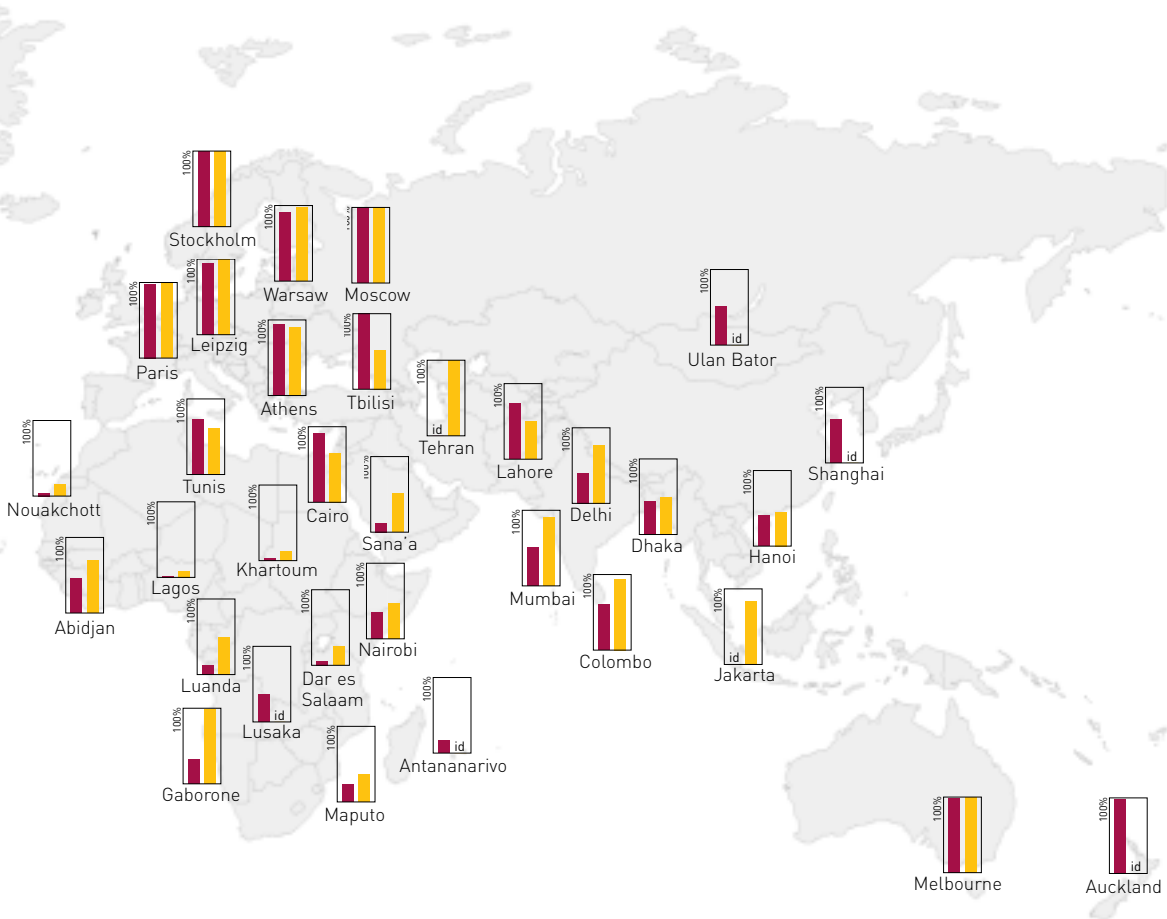
	Paper and paperboard		Glass		Metal		Aluminum		Plastics	
	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled
1960	29.9	18	6.7	1	10.1	1	0.4	n	0.4	n
1970	44.2	17	12.7	2	13.3	3	0.8	n	3.1	n
1980	54.7	22	15.0	5	12.7	7	1.8	17	6.8	n
1990	73.3	29	13.2	20	13.5	20	2.7	37	16.2	2

	Rubber and leather		Textiles		Wood		Food waste		Garden waste	
	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled	Million tons	% recycled
1960	2.0	15	1.7	n	3.0	n	12.2	n	20.0	n
1970	3.2	9	2.0	n	4.0	n	12.8	n	23.2	n
1980	4.3	2	2.6	n	6.7	n	13.2	n	27.5	n
1990	4.6	4	5.6	4	12.3	3	13.2	n	35.0	12

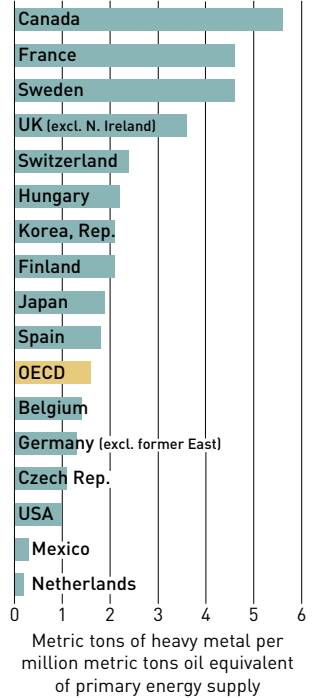
n = negligible: less than 50 000 tons or 0.05 percent

Source: EPA.



Source: World Bank.

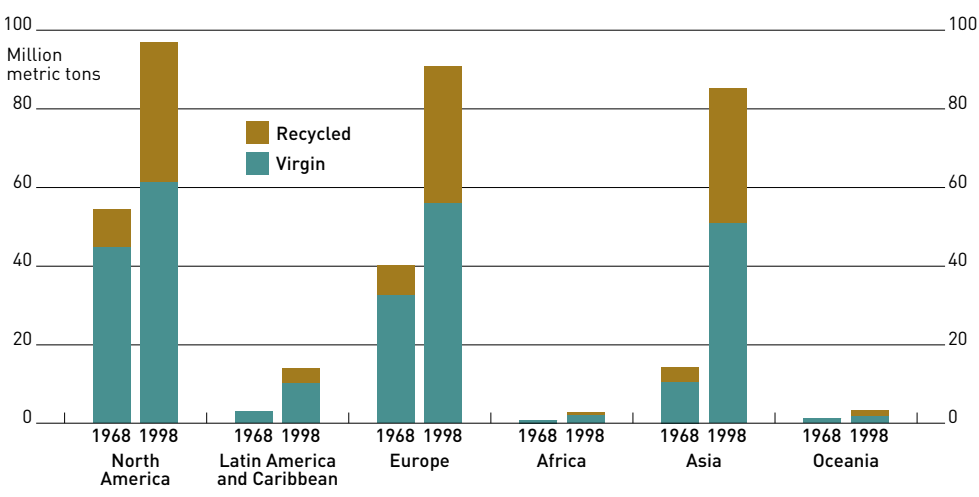
**NUCLEAR WASTE FROM SPENT FUEL IN NUCLEAR POWER PLANTS Selected OECD countries\***



\* Latest available data

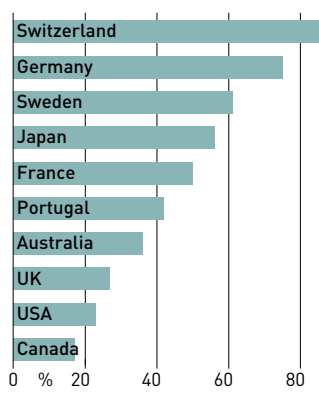
Source: OECD.

**RECYCLED PAPER PRODUCTION Relative to total paper production**



Source: FAO.

**GLASS WASTE RECYCLING, 1992-95 As a proportion of total consumption, selected countries**



Source: UNDP.

## Trends in recycling

Poor communities recover every valuable item from waste: Asian recyclers use rubber from scrap tyres to make shoes, make their own recycled paper and flatten cans to make metal sheets for roofing. Annually 200 million tons of waste cross OECD borders en route to reprocessing facilities, a business worth over US\$20 billion. Waste paper travels from North America to the Far East; Europe's surplus glass is sent to South America; some of the West's waste plastics are shipped to China. A shortage of reprocessing capacity limits recycling, and industries established to process consistently clean virgin materials cannot readily adapt to the vagaries of secondary materials. Cost is another issue: collecting small quantities of materials from many locations is logistically and economically more difficult than obtaining large quantities from a single source. Indeed recycling may not always be resource-efficient when collection and reprocessing involve long-haul transport. Recycling is not keeping pace with waste increases in most countries.

waste<sup>2</sup>. These quantities are diminishing, but not fast enough to counteract the rises caused by increased consumption. Pressure for industry to reduce wastage comes from both internal and external economic drivers. Producer responsibility initiatives – already in place or proposed for a range of goods from batteries and packaging to vehicles and electronic equipment – make industry responsible for its products after use, and should result in fewer harmful components, as well as design decisions which will make disassembly and recycling easier.

Industrialization and level of affluence influence both the composition and quantity of waste generated by society. Research shows that in lower income regions of the world (such as Jakarta, Indonesia or Lucknow, India) 73 to 96 percent of the typical family's waste comprises food and biodegradable material, while in the higher income area of Brooklyn, New York, that figure is 26 percent<sup>3</sup>. Waste densities vary too: in high income countries, waste density is lower because it contains more lighter materials and manufactured goods, more paper and less food waste.

The link between affluence and municipal waste generation is surprisingly close: a 40 percent increase in the GDP of countries belonging to the Organisation for Economic Co-operation and Development (OECD) since 1980 has been accompanied by the same percentage growth in municipal waste. The OECD predicts that there will be a further 70 to 100 percent increase in GDP in its region by 2020. Unless the link between waste generation and GDP is severed, there could be a commensurate increase in waste. This is likely to be further exacerbated by certain social trends, such as the increase in single-person households due to higher divorce rates and the ageing population, particularly in the developed world. As the developing world industrializes and grows more affluent, it too can be expected to increase waste generation.

How can the links be broken? Technological developments in materials have already helped to reduce waste: food cans and glass milk bottles are each half the weight they were 50 years ago. This, alongside new materials, is reflected in the composition of household waste. In the United States, for example, the combined percentage of glass and metals in the waste stream diminished from 22 percent in 1970 to around 16 percent in 1990. Plastics rose from 2 percent to 9 percent, while paper and card remained fairly constant at around 38 percent<sup>4</sup>. By contrast, paper makes up just 5 percent of the waste in Ghana<sup>5</sup>.

Trial schemes which charge householders for the waste they produce have raised awareness, although they have also thrown up a few new problems, such as wastes being dumped by roadsides to avoid the charges. The Swiss Environment Ministry reports that another method of avoiding waste charges – the burning of domestic refuse in gardens or fireplaces – is now the country's biggest cause of dioxin pollution. While the national emissions of dioxin from municipal incineration facilities are just 16 grams per year, uncontrolled burning of waste by householders emits between 27 and 30 grams of dioxin each year, despite the fact that only 1 to 2 percent of Switzerland's municipal waste is burned illegally, while 46 percent is burned in properly managed plants.

Sustainable development policies require us to take a more holistic view of waste and resources. We need to change attitudes, and to husband resources more carefully, particularly those which are finite. Observing the proximity principle and providing waste treatment and disposal facilities within a region's boundaries can do a great deal to reduce the environmental impact of managing waste.

## TOXIC WASTE

The international community is working to strengthen legislation on the use, movement and disposal of toxic and hazardous waste, and to rid the developing world and countries in transition of dumps of dangerous and obsolete pesticides, which frequently expose local communities to poisons in their air, food and water. To date just 3 500 tons have been removed from Africa and the Near East at a cost of US\$24 million. But estimates suggest that a further 20 000 tons remain in Africa, 80 000 tons in Asia and Latin America, and up to 200 000 tons in Central and Eastern Europe<sup>6</sup>.