BASEL CONVENTION

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Vital Waste Graphics

Prepared by
Elaine Baker (University of Sydney)
Emmanuelle Bournay (GRID-Arendal)
Akiko Harayama (Dewa-Europe/GRID-Geneva)
Philippe Rekacewicz (GRID-Arendal)

In collaboration with
Milton Catelin (Basel Convention)
Nicole Dawe (Basel Convention)
Otto Simonett (GRID-Arendal)

vital waste graphics

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Rising mountains of waste have become a major issue of our time.

From dumped chemicals and pesticides in Africa to the electronic or e-wastes piling up in Asia, waste and the shipment of hazardous materials require urgent action on both environmental and health grounds.

At the heart of the issue are the production and consumption patterns operating on the globe. If we are to deliver a healthy and more prosperous planet, if we are to realize the Millennium Development Goals and if we are to meet the targets and time tables enshrined in the World Summit on Sustainable Development's Plan of Implementation, we need a new vision and political will to produce and consume the goods and services of the 21st century in more efficient and less polluting ways.

Vital Waste Graphics aims to give policymakers, experts, media professionals, teachers and students a comprehensive overview of relevant waste-related issues, causes, effects, as well as possible solutions. *Vital Waste Graphics* is based on the most recent data received by the Basel Convention Secretariat and by research undertaken especially for the production of the publication.

I hope the publication will encourage all stakeholders to think about what they can do to tackle the rising generation and inappropriate management of waste. Both producers and consumers of goods must work on the betterment of waste management. Industry has the tools, technologies and financial resources to adopt cleaner production methods. All sectors of society need to engage into an integrated life-cycle management of goods. The more efficient and the less wasteful manufacturing and consumption processes will be, the less pressure there will also be on essential resources and the better human health and the environment will be protected.

I hope that your personal copy of *Vital Waste Graphics* will encourage you to be part of a global network for improving the quality and quantity of information on how to address the global waste challenge.

I wish to thank all the experts involved in this project for their valuable contributions to the publication.

Klaus Toepfer
Executive Director
United Nations Environment Programme

Nairobi, 12 October 2004

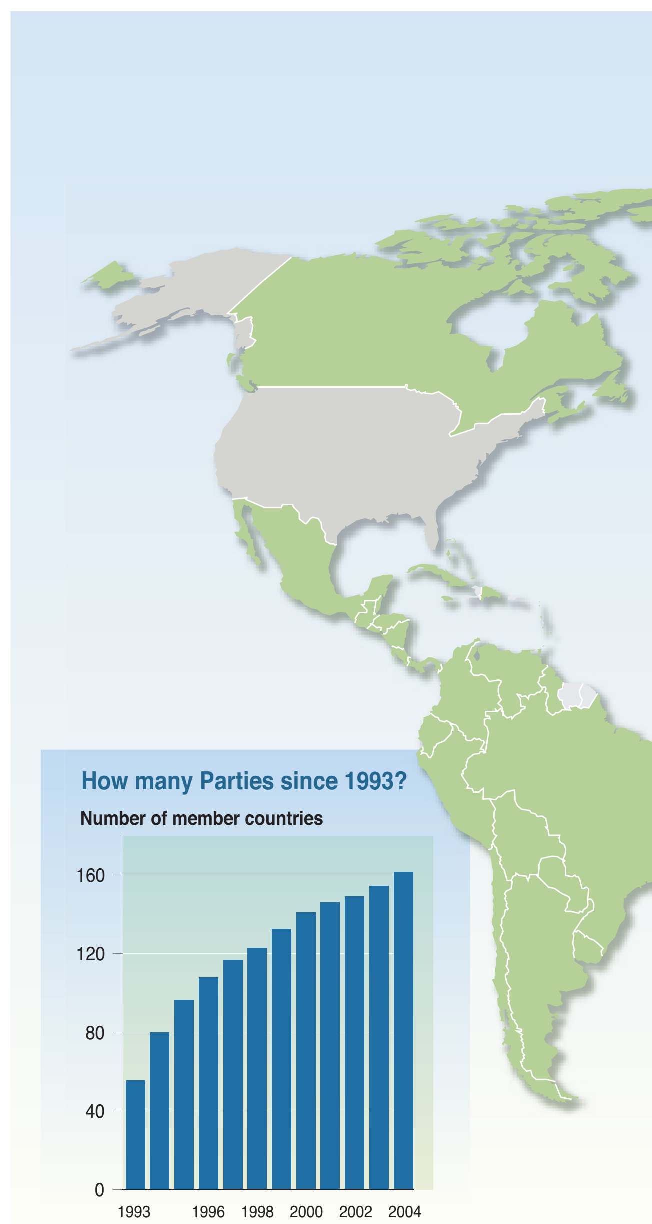
dear readers,

welcome to *Vital Waste Graphics*. This publication has been prepared by the United Nations Environment Programme (UNEP) in collaboration with the Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

It is clear that the data used and the definitions employed by the various “sources”, and other crucial factors such as reporting capacity and compliance, varies considerably between organizations and countries. This may lead in some cases to particular graphs and graphics that appear counter-intuitive. In some cases this is simply because some countries have reported accurately even when it contrasts them negatively with countries that have not reported at all or have reported using different definitions.

The document has been produced to raise awareness of the global waste challenge and stimulate debate. It helps to draw attention to the pressing need to improve national reporting capacity and to improve international reporting systems. If it does nothing more than this, it will be a major contribution to an important global challenge.

As data collection systems, definitions and reporting methodologies improve over time, so too will the quality and usefulness of this approach, and the quality of the debate it supports. In the meantime, please enjoy this work, join this debate, and think about how you can contribute to meeting the global waste challenge.



Source: Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the most comprehensive global environmental agreement on hazardous and other wastes. It has over 160 Parties and aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.

The Basel Convention regulates the transboundary movements of hazardous and other wastes and obliges its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. The Convention covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious wastes.

Parties are also expected to minimize the quantities that are transported, to treat and dispose of wastes as close as possible to their place of generation and to prevent or minimize the generation of wastes at source.

The Basel Convention has 13 Basel Convention Regional Centers in the following locations: Argentina, China, Egypt, El Salvador, Indonesia, Nigeria, Russian Federation, Senegal, Slovak Republic, South Pacific Regional Programme, South Africa, Trinidad and Tobago, Uruguay. They deliver training and technology transfer for the implementation of the Convention.

The Basel Convention came into force in 1992.

a multitude of approaches and definitions

What a waste! This is what we hear when we have spent more time, money or energy than was really necessary... It is disturbing to realize that we use the same word to indicate materials that have been used but are no longer wanted, either because they don't work or the valuable part has been removed. In both cases, the word "waste" is related to the way we behave in the context of the consumer society. In order for communities to function smoothly, people assume and accept the generation of a certain level of waste. A whole business has developed around waste management, in certain cases contrary to the preservation of the environment and natural resources, leaving little incentive to permanently reduce the volume of waste generated.

Waste is generated in all sorts of ways. Its composition and volume largely depend on consumption patterns and the industrial and economic structures in place. Air quality, water and soil contamination, space consumption and odors all affect our quality of life.

Definitions: **Waste according to**

the Basel convention:

Wastes are substances or objects which are disposed or are intended to be disposed or are required to be disposed of by the provisions of national laws.

the United Nations Statistics Division (UNSD):

Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose.

Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

OECD definitions for selected categories of waste

Municipal waste is collected and treated by, or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden, street sweepings, contents of litter containers, and market cleansing. Waste from municipal sewage networks and treatment, as well as municipal construction and demolition is excluded.

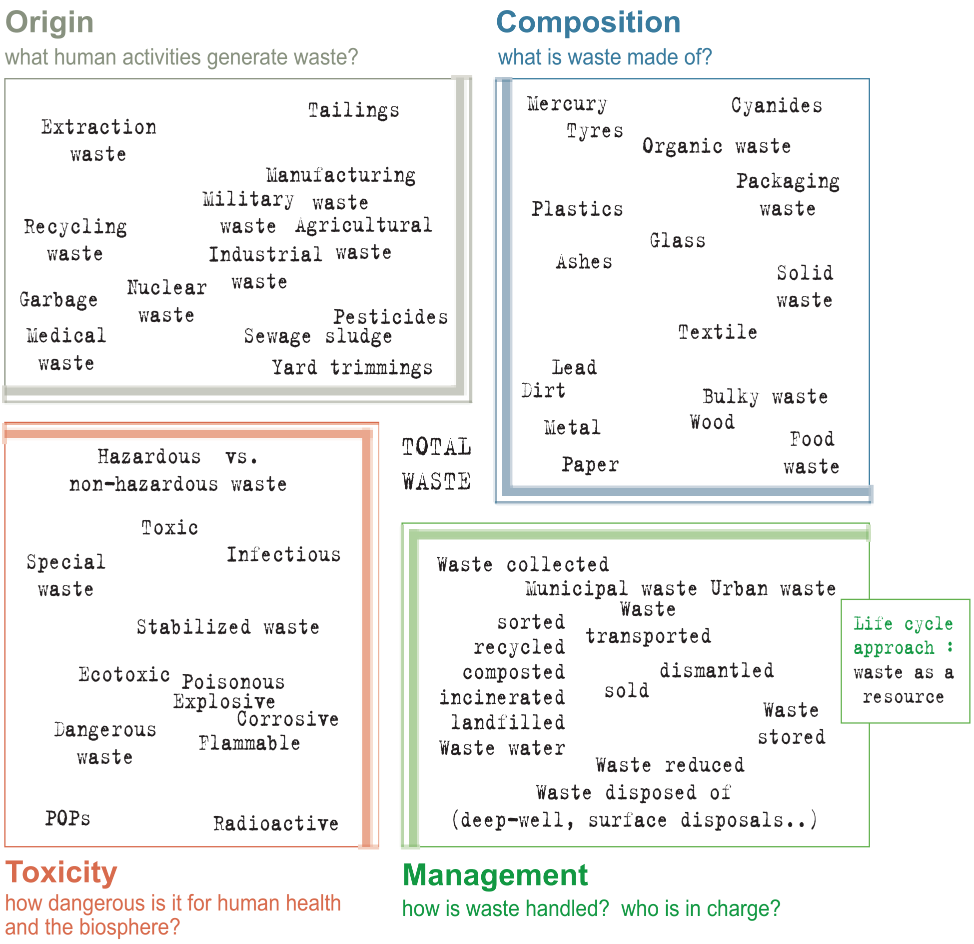
Hazardous waste is mostly generated by industrial activities and driven by specific patterns of production. It represents a major concern as it entails serious environmental risks if poorly managed: the impact on the environment relates mainly to toxic contamination of soil, water and air.

Nuclear (radioactive) waste is generated at various stages of the nuclear fuel cycle (uranium mining and milling, fuel enrichment, reactor operation, spent fuel reprocessing). It also arises from decontamination and decommissioning of nuclear facilities, and from other activities using isotopes, such as scientific research and medical activities.

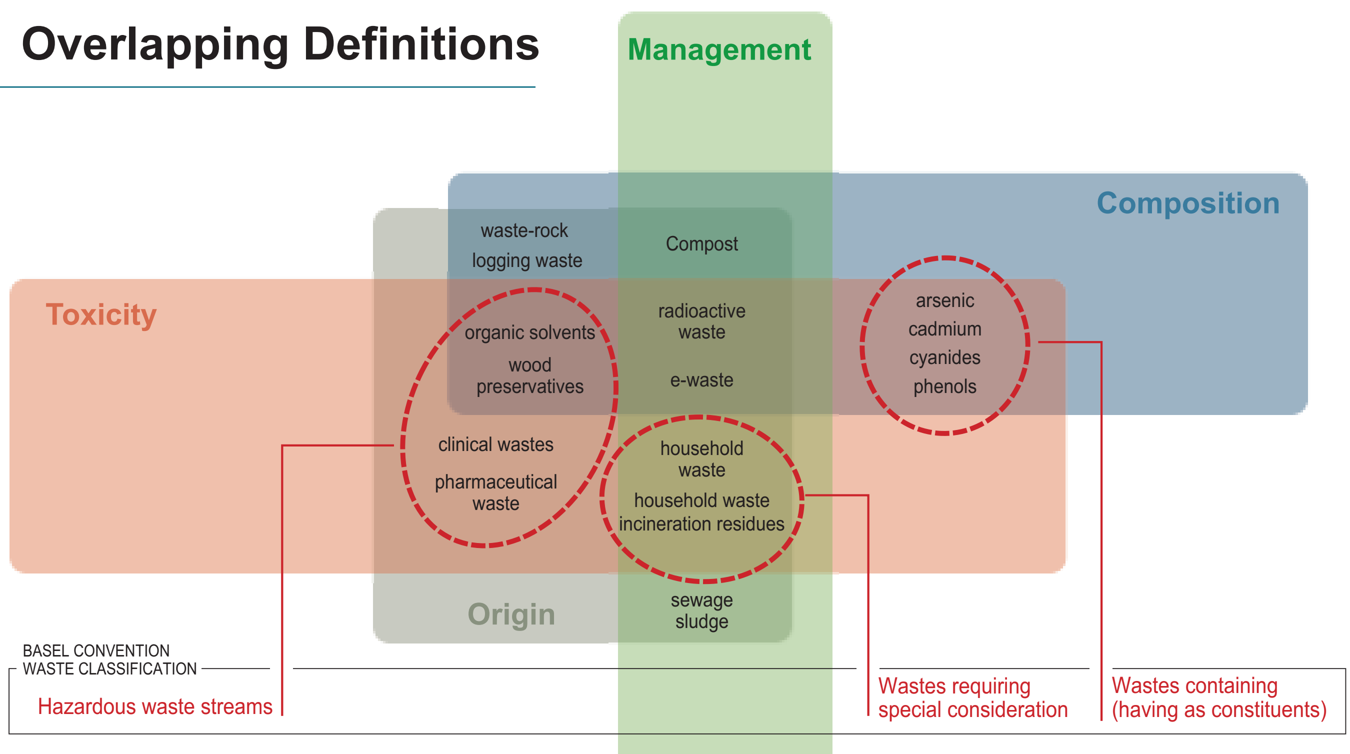
Waste data: Handle with care

Waste is a complex, subjective and sometimes controversial issue.
There are many ways to define, describe and count it depending on how you look at it. Citizens, technicians, businessmen, politicians, activists; all of them use a different approach, and this explains why it is often a challenge to gather comparable data. From one country to the next, statistical definitions vary a lot. It is notably difficult, for example, to compare waste in rich and poor countries. The topic is also sometimes political, especially when it comes to the trade and disposal of hazardous and nuclear wastes. All waste data should therefore be handled with care.

Different approaches



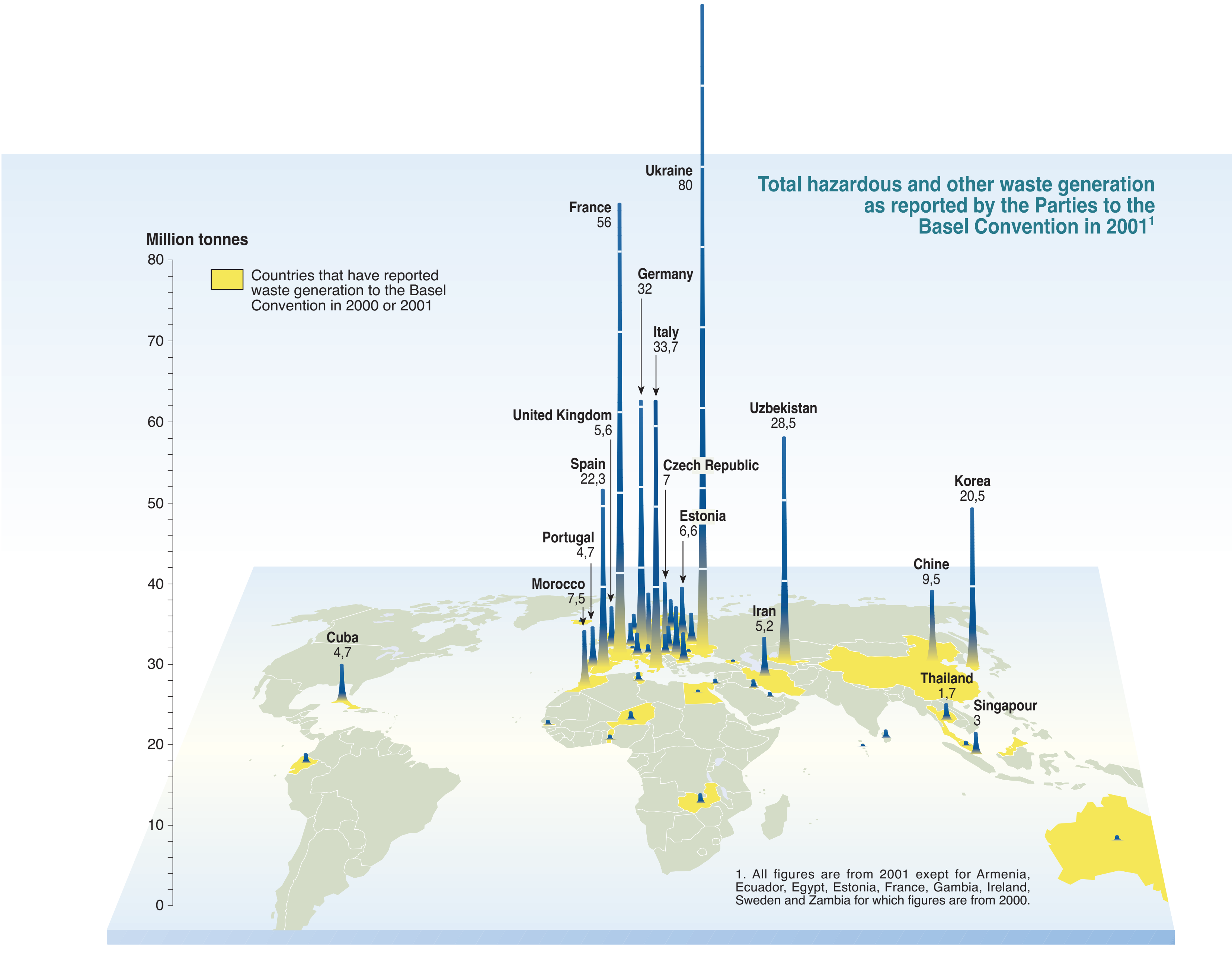
Overlapping Definitions



NB: in the following pages the boxes contain examples not exhaustive lists.

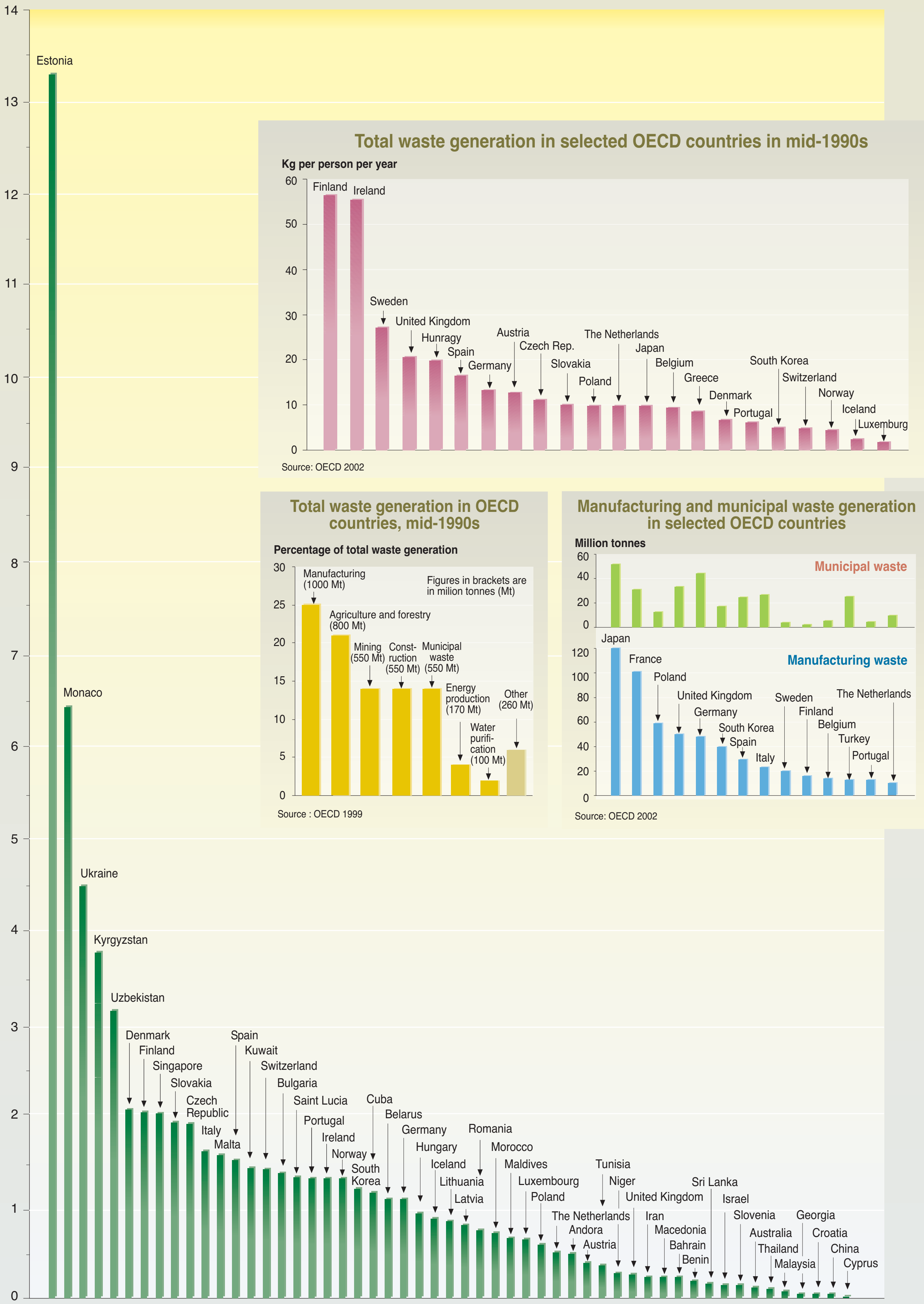
how many million tonnes, really?

On a global scale, calculating the amount of waste being generated presents a problem. There are a number of issues, including a lack of reporting by many countries and inconsistencies in the way countries report (definitions and surveying methods employed by countries vary considerably). The Basel Convention has estimated the amount of hazardous and other waste generated for 2000 and 2001 at 318 and 338 millions tonnes respectively. However these figures are based on reports from only a third of the countries that are currently members of the Convention (approximately 45 out of 162). Compare this with the almost 4 billion tonnes estimated by the Organisation for Economic Co-operation and Development as generated by their 25 member countries in 2001 (Environmental Outlook, OECD) and the problems of calculating a definitive number for global waste generation are obvious. Therefore the figures shown below should be used with caution.



1. All figures are from 2001 exept for Armenia, Ecuador, Egypt, Estonia, France, Gambia, Ireland, Sweden and Zambia for which figures are from 2000.

Total hazardous and other waste generation as reported by the Parties to the Basel Convention in 2001



Source : Basel Convention, 2001.

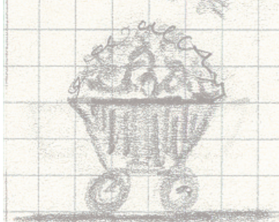
waste at every stage

Each stage of the production process generates a specific type of waste. Each waste product requires a specific management solution. We generally consider three groups of waste. Those generated as a result of:

- **extraction and transformation of raw materials**
- **manufacturing and production of goods (including building construction)**
- **distribution and consumption of manufactured products**

The Life cycle approach gives a more complete picture of the waste and energy associated with a product. Our daily choices determine the amount of waste we produce. As consumers, our relationship to a product happens only during a short phase of its existence. For example, if we purchase a Styrofoam cup, we just use it for a hot beverage and then throw it away. Most of the life cycle of this cup remains invisible to us (before as well as after we use it): we have no idea about the raw materials and energy extracted from the environment that are needed to produce, transport and distribute it. And probably even less about the real coast of its treatment when it becomes a waste. To get a comprehensive overview of the amount of waste we generate, and its financial and environmental costs, it is important to consider the full life cycle of products, and not only the period when they are useful to us. Rather than just looking at the amount of waste that ends up in a landfill or an incinerator, the life cycle analysis is a comprehensive approach: it also measures energy use, material inputs and waste generated from the production until the goods are delivered to the consumer.

Journey along the production of a car (from the extraction of natural resources to waste disposal and recycling)

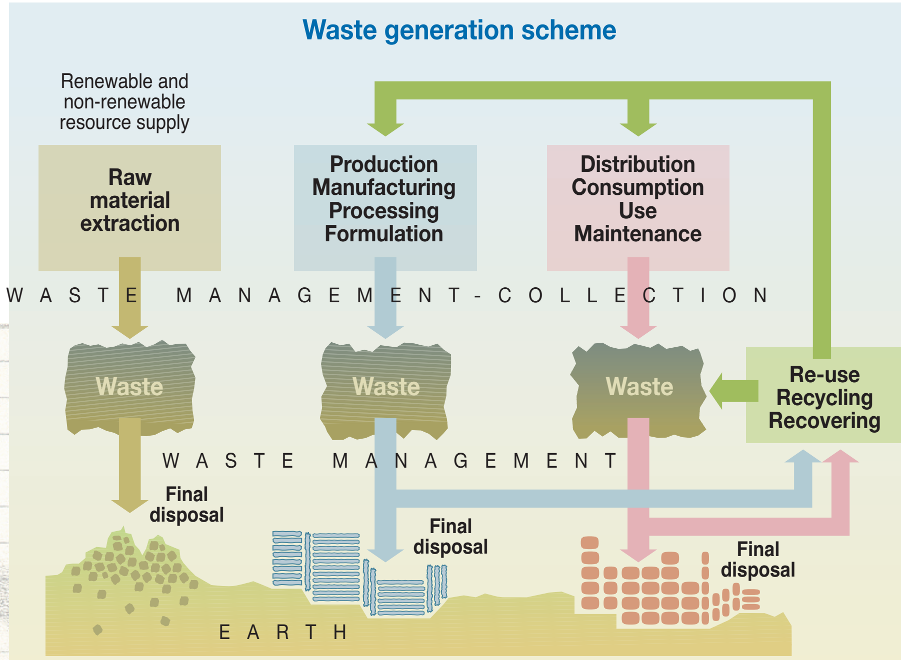


Raw Materials:
Mining of minerals: copper, iron, lead, zinc, and aluminum (generating waste in the neighborhood of the mines). Other raw materials (often non renewable) needed for electronic parts, interior surfaces, paint and finishes.

RECYCLING

Recycling or disposal:
Three quarters of a car is in theory recyclable, but far less is actually reclaimed. Cars are either partly recycled or simply disposed of (waste consuming large areas). The steel, iron, and aluminum rate highest in reuse. Plastics, which are increasingly used in cars, pose numerous problems for recycling because of the great variety of plastic formulations and the lack of an economically feasible processing program.

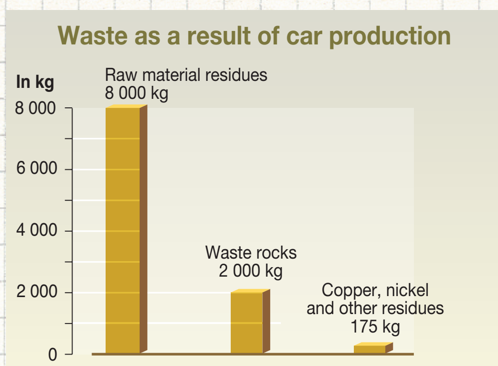
DISPOSAL



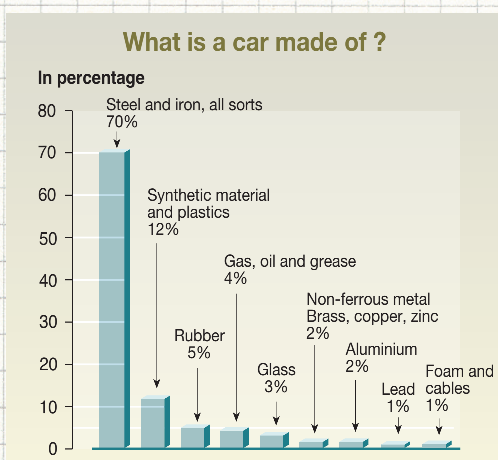
Compiled by the authors from various sources

Production:
During the final assembly: paints, coatings, lubricants and fluids (generating excess materials – a specific type of waste)

Distribution:
Assembled cars are transported by truck, train and cargo to dealerships (generating air emissions). Factories, assembly plants, road systems, parking places, dealerships and garages require land to be cleared, resulting in deforestation, degradation of habitat for wildlife and an increase in rainwater runoff.



Source : OFEFP, 2003.



Source : OFEFP, 2003.

Ecologic review for a 1 000 kilogram car produced in 1994; estimated over 10 years; assuming a total mileage of 150 000 kilometers and an average fuel consumption of 8.1 liters per hundred kilometers.

From production to disposal of the car

Energy produced and used

for the extraction of raw materials	6%
for the production of the car	4%
for running the car during its life time	90%

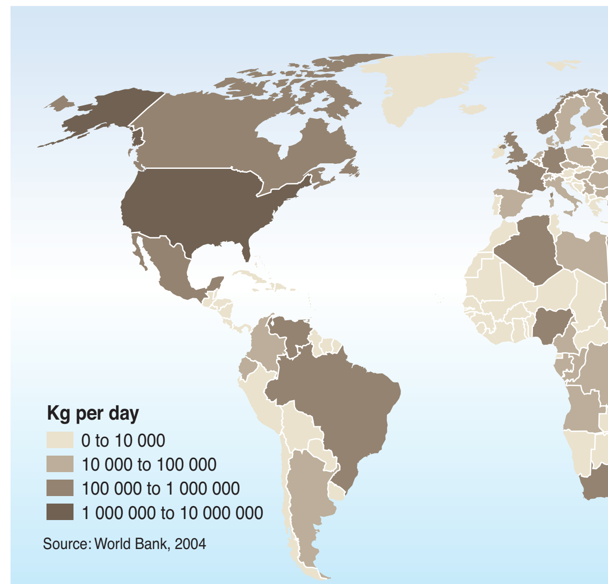
Air emissions

Carbon dioxide	36 000 kg
Carbon monoxide	413 kg
Volatile organic compounds (VOC)	192 kg
Sulfur dioxide	34 kg
Nitrogen oxides	28 kg

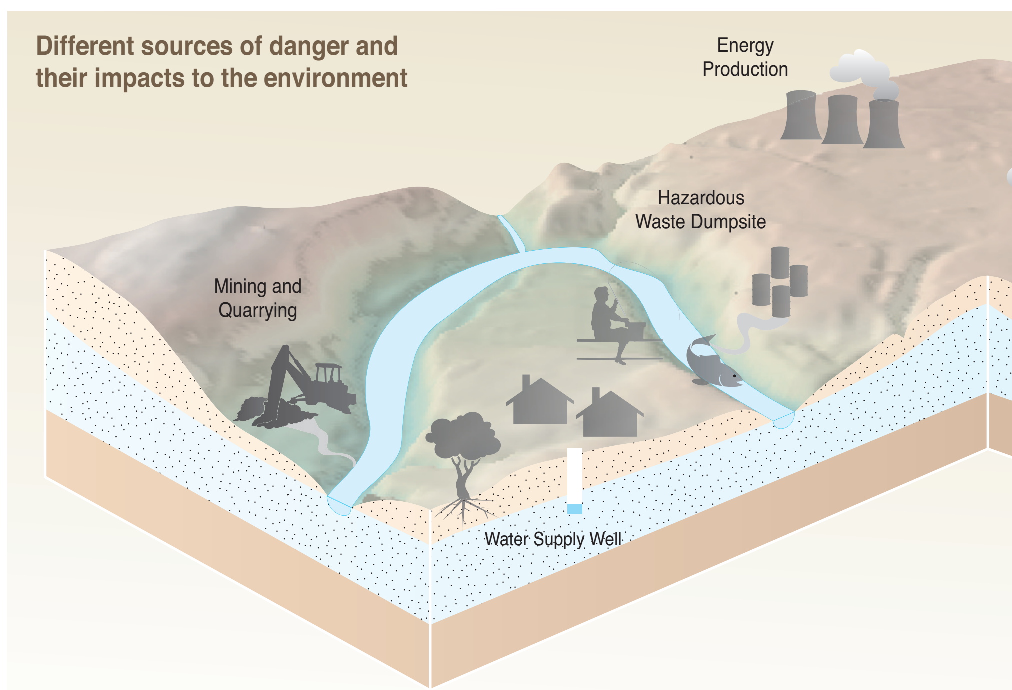
Consumption:
Maintenance and repair of cars generates a large range of hazardous waste: fuel, oil, lubricants, washing powder, wax, paint, rubber (tires), tar, anti-freeze liquid and other products such as acids and chemicals (used in batteries, air-conditioning systems, brake systems).

what are the dangers?

Pollution emitted in industrial areas represents a threat to human health and the surrounding natural resources. We have a tendency to believe that the production processes are the only source of environmental damage, and often forget about the possible long-term effects of harmful production practices.



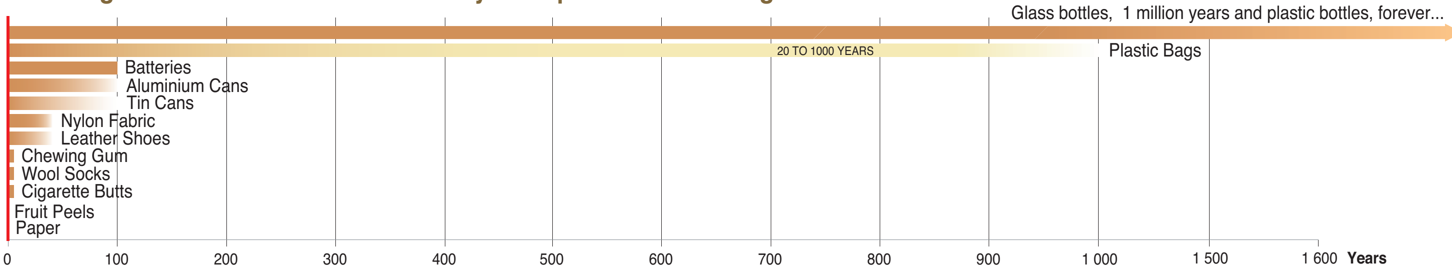
Surface Water Contamination
Changes in the water chemistry due to surface water contamination can affect all levels of an ecosystem. It can impact the health of lower food chain organisms and, consequently, the availability of food up through the food chain. It can damage the health of wetlands and impair their ability to support healthy ecosystems, control flooding, and filter pollutants from storm water runoff. The health of animals and humans are affected when they drink or bathe in contaminated water. In addition aquatic organisms, like fish and shellfish, can accumulate and concentrate contaminants in their bodies. When other animals or humans ingest these organisms, they receive a much higher dose of contaminant than they would have if they had been directly exposed to the original contamination.



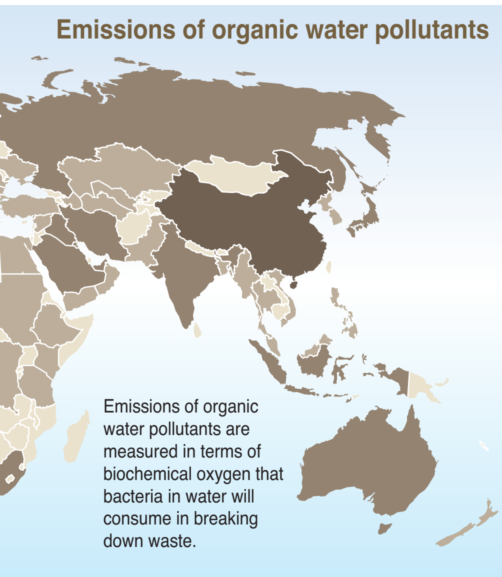
Source: Geological Survey of Canada, the Geological Society

Groundwater Contamination
Contaminated groundwater can adversely affect animals, plants and humans if it is removed from the ground by manmade or natural processes. Depending on the geology of the area, groundwater may rise to the surface through springs or seeps, flow laterally into nearby rivers, streams, or ponds, or sink deeper into the earth. In many parts of the world, groundwater is pumped out of the ground to be used for drinking, bathing, other household uses, agriculture, and industry.

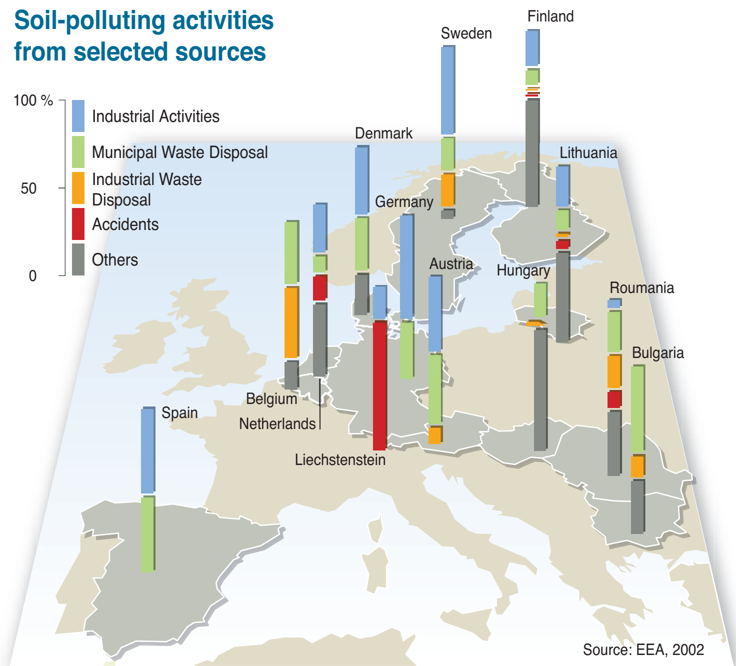
How long does it take for some commonly used products to biodegrade?

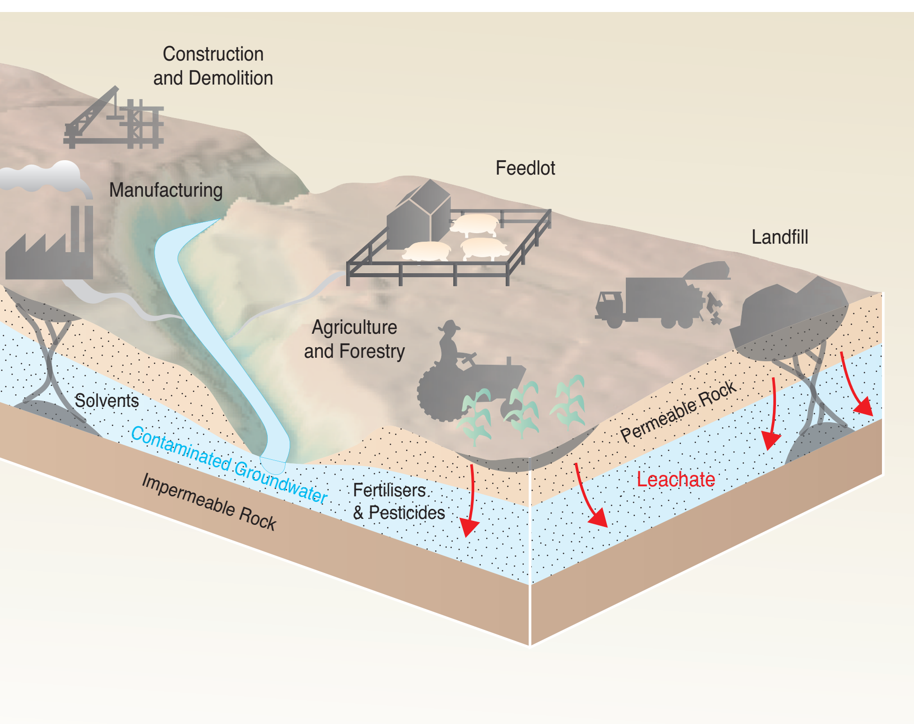


Source: The Coral Reef Alliance & Worldwise



Soil-polluting activities from selected sources





Air Contamination
Air pollution can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body. Certain air contaminants can also harm animals and humans when they contact the skin. Plants rely on respiration for their growth and can also be affected by exposure to contaminants transported in the air.

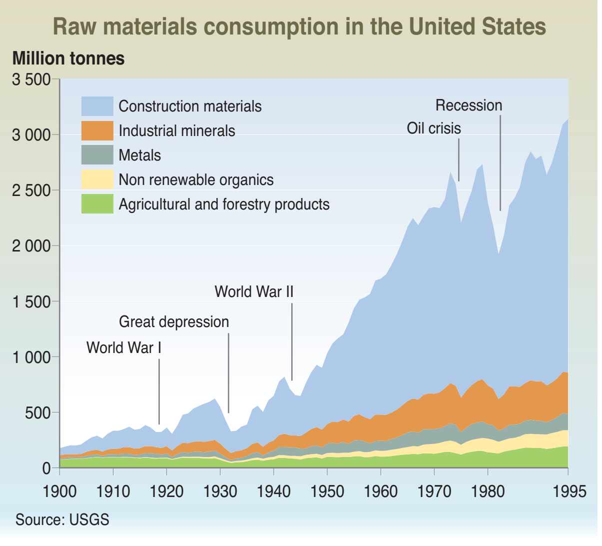
Leachate
Leachate is the liquid that forms as water trickles through contaminated areas leaching out the chemicals. For example, the leaching of landfill can result in a leachate containing a cocktail of chemicals. In agricultural areas leaching may concentrate pesticides or fertilizers and in feedlots bacteria may be leached from the soil. The movement of contaminated leachate may result in hazardous substances entering surface water, groundwater or soil.

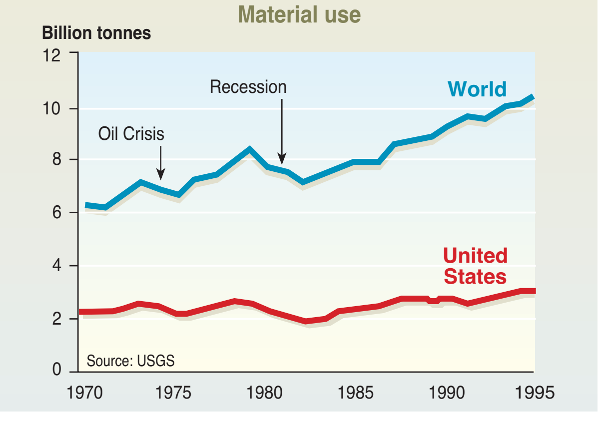
Soil Contamination
Contaminants in the soil can harm plants when they take up the contamination through their roots. Ingesting, inhaling, or touching contaminated soil, as well as eating plants or animals that have accumulated soil contaminants can adversely impact the health of humans and animals.

Our increasing appetite for natural resources

*"**How big is your pile?** Imagine a truck delivering to your house each morning all the materials you use in a day, except food and fuel. Piled at the front door are the wood in your newspaper, the chemicals in your shampoo, and the plastic in your grocery bags. A day's portion of the metal in your appliances and car, plus your daily fraction of shared materials, such as the stone and gravel in your office walls and in the streets you stroll. At the base of the pile are materials you never see, including the nitrogen and potash used to grow your food, and the earth and rock under which your metals and minerals were once buried."*

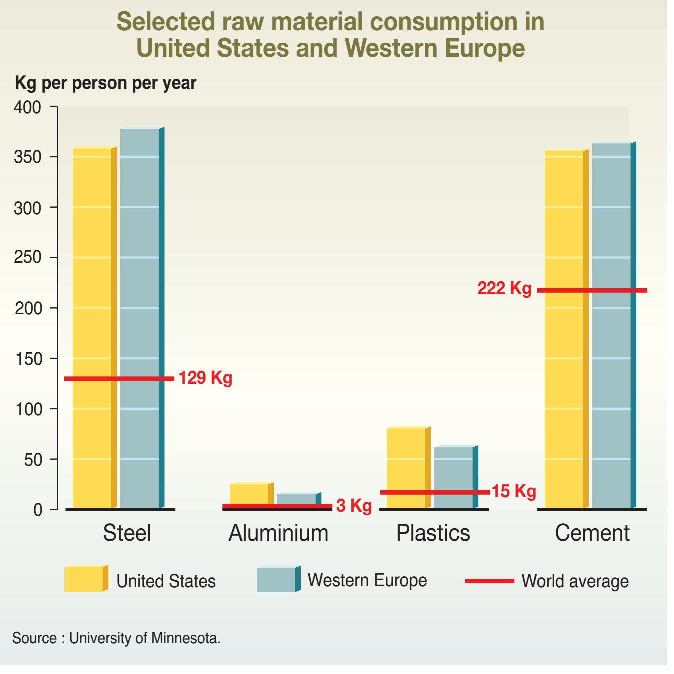
Worldwatch Institute, Washington DC.





Raw material demand trends

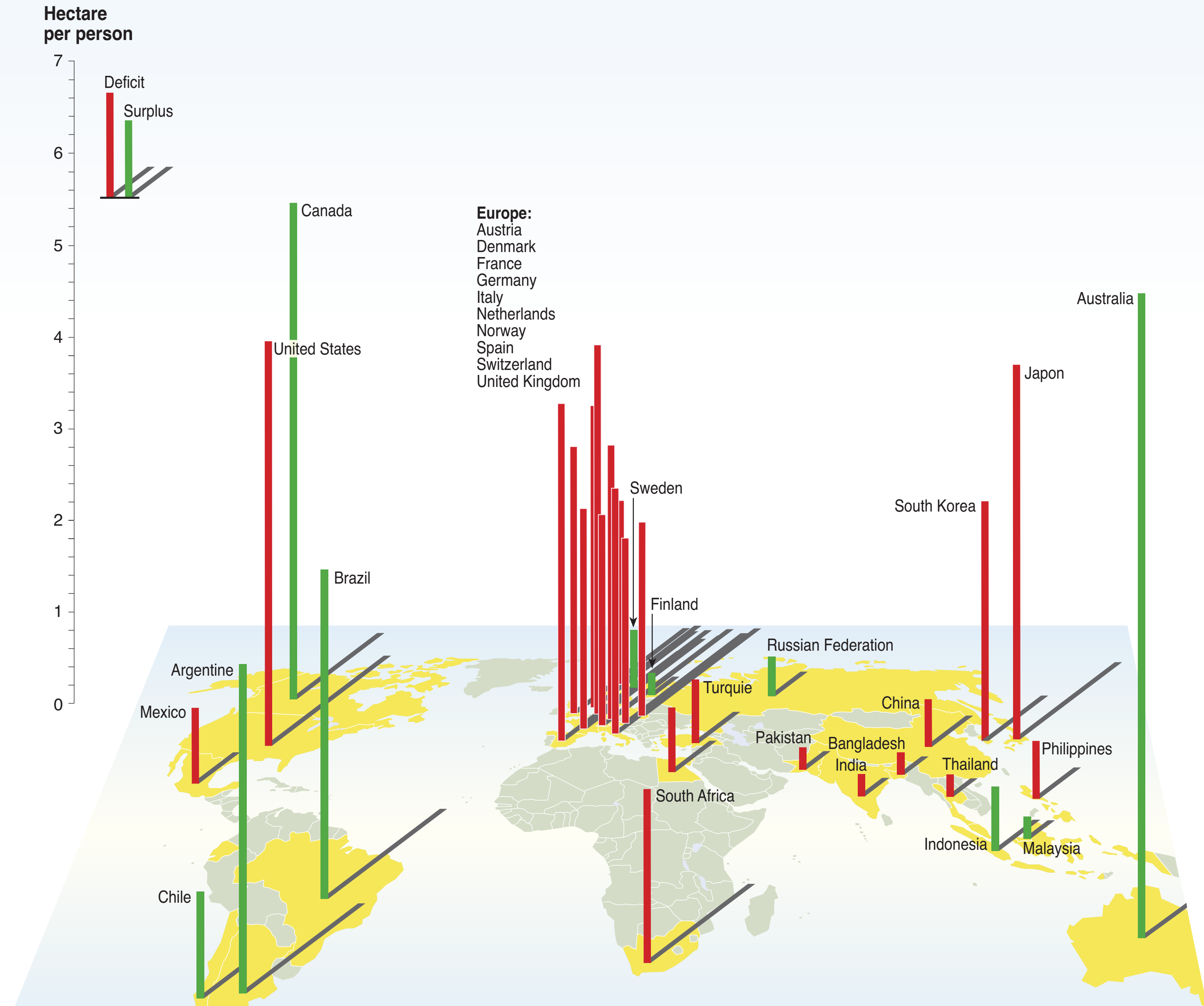
The global consumption of key raw materials is rising fast. Over the 20-year period ending in 1994, the world population increased by 40% – in that same period, the world consumption of cement increased by 77%, and plastics by just under 200%… Among raw materials used for construction, only crude steel registered a growth rate that was significantly lower (only 3% from 1974 to 1994) than the rate of population increase. (University of Minnesota, 1999).



Raw material consumption facts

A small minority of rich countries are responsible for a large part of the raw material consumption. All together the developed countries comprise only 22% of the world population, but they consume more than 60% of the industrial raw materials.

Ability of countries to support their citizens from their own environment

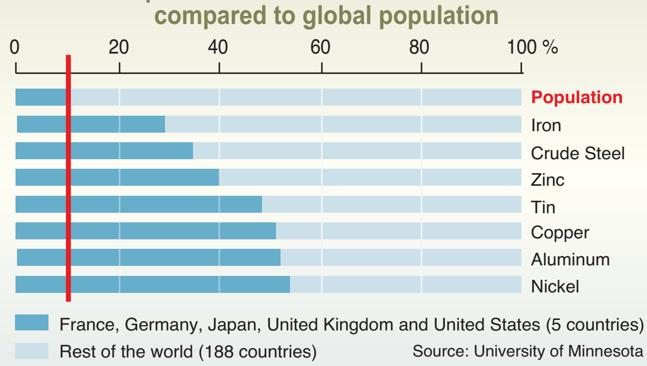


Source: Earthday Network

Will nature be able to supply all services that human beings need?

The Ecological Footprint measures the amount of productive land area needed to support a nation's consumption and waste. This indicator shows that in many countries, as well as for the planet as a whole, the demand for natural resources, or the "ecological capacity", exceeds the amount available. Countries that are not able to support their national consumption with their own natural resources are running at an "ecological deficit". Therefore these countries have to either import ecological capacity from other places, or take it from future generations.

Consumption of selected industrial raw materials compared to global population

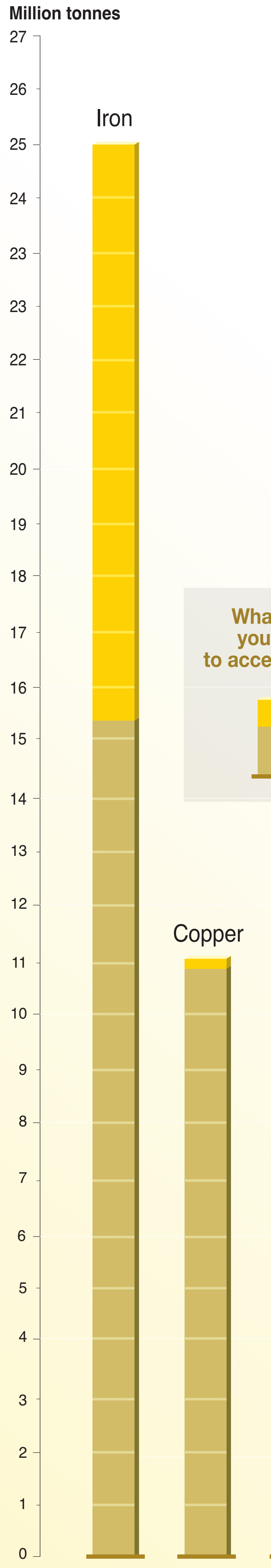


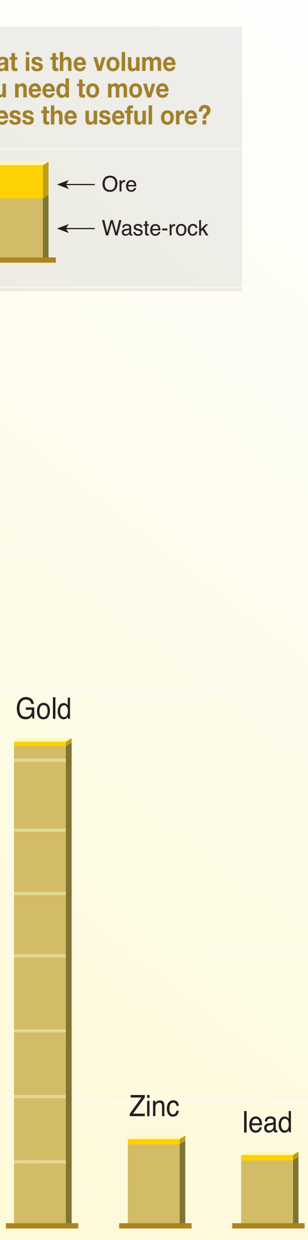
Source: University of Minnesota

WASTE FROM CONSUMPTION AND PRODUCTION

a threat to natural resources

Regardless of the type of raw material, its extraction always comes with an environmental cost. Most mining leaves a lasting and damaging environmental footprint. For example, during the extraction of common metals like copper, lead or zinc from the earth both metal-bearing rock, called ore, and “overburden”, the dirt and rock that covers the ore are removed. At a typical copper mine around 125 tonnes of ore are excavated to produce just one tonne of copper. The amount of earth moved is mind-boggling and mining now strips more of the Earth’s surface each year than does natural erosion.

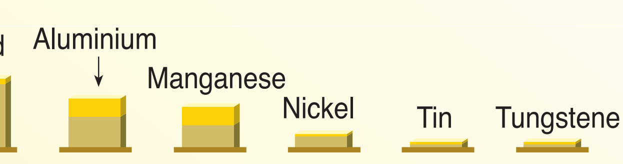




Waste rock includes the overburden and mine development rock. Industry uses the term “overburden” to refer to the soil and rock that covers an ore body. Similarly, mine development rock refers to material removed from underground mines to access the ore body. These waste rocks are non-mineralized, or contain insufficient minerals to process economically. They are typically hauled from the mine site to waste dumps for disposal.

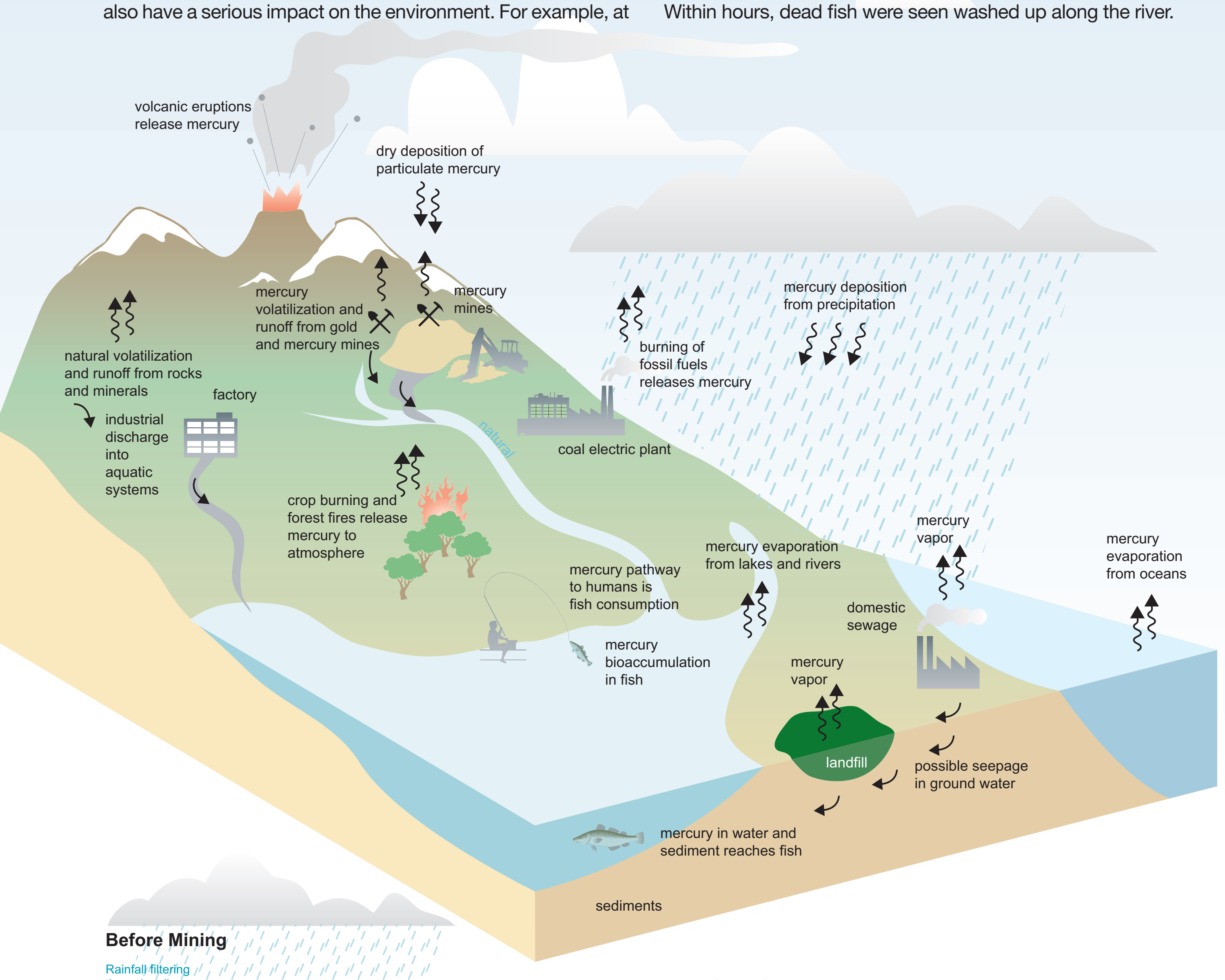
Tailings are the waste products generated during the recovery of the minerals. Typically, the ore is crushed or ground to a particle size of less than 0.1 mm in order to release the valuable constituents. Water and small amounts of chemical reagents are usually added during this process to enhance the separation of the minerals from the ore. (United Nations Environment Programme/ International Council on Metals and the Environment, 1998). The tailings are usually dumped into tailings dams or erodable dumps (the latter designed so that the tailings gradually wash into a nearby waterway).

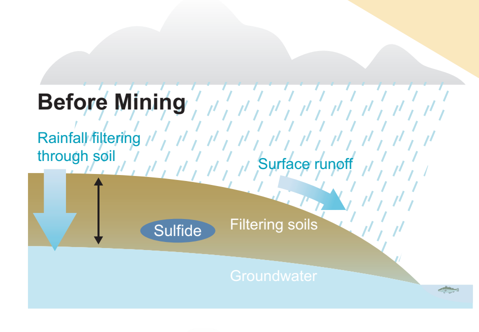
Mine water is the water that collects in both surface and underground mines. It comes from the inflow of rain or surface water and from groundwater seepage. During the active life of the mine, water is pumped out to keep the mine dry and to allow access to the ore body. Pumped water may be used in the extraction process, pumped to tailings impoundments, used for activities like dust control, or discharged as a waste (Environmental Protection Agency). The water can be of the same quality as drinking water, or it can be very acidic and laden with high concentrations of toxic heavy metals.

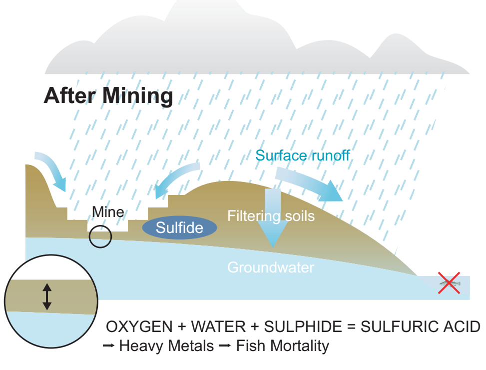


Source : Worldwatch Institute, 1997.

Mines use toxic chemicals including cyanide, mercury, and sulphuric acid, to separate metal from ore. The chemicals used in the processing are generally recycled, however residues may remain in the tailings, which in developing countries are often dumped directly into lakes or rivers with devastating consequences. The accidental spillage of processing chemicals can also have a serious impact on the environment. For example, at the Baia Mare mine in Romania cyanide is used to extract gold from slurry. In January 2000 a dam containing tens of thousands of tonnes of slurry burst, poisoning the local river with cyanide and heavy metals. Up to 100 tonnes of cyanide were released into the river, a tributary of the Danube. The drinking water supply for more than 2 million people was affected. Within hours, dead fish were seen washed up along the river.







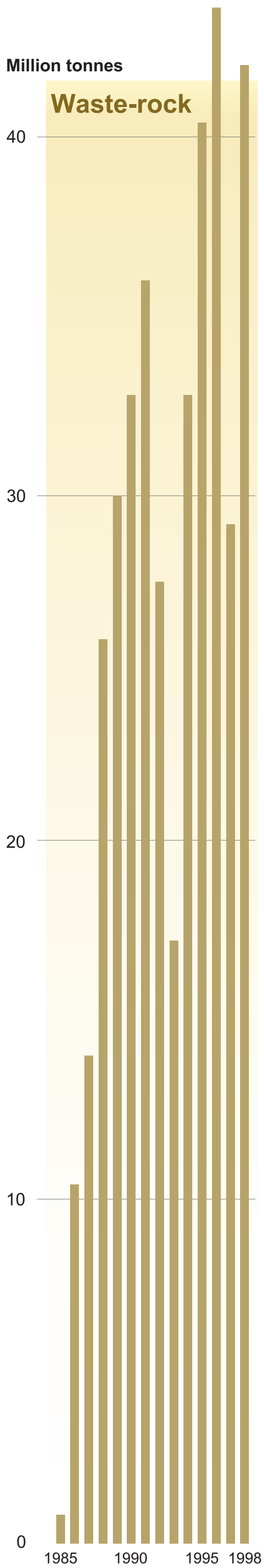
Extraction decreases groundwater depth and natural filtration, and increases the groundwater contamination.

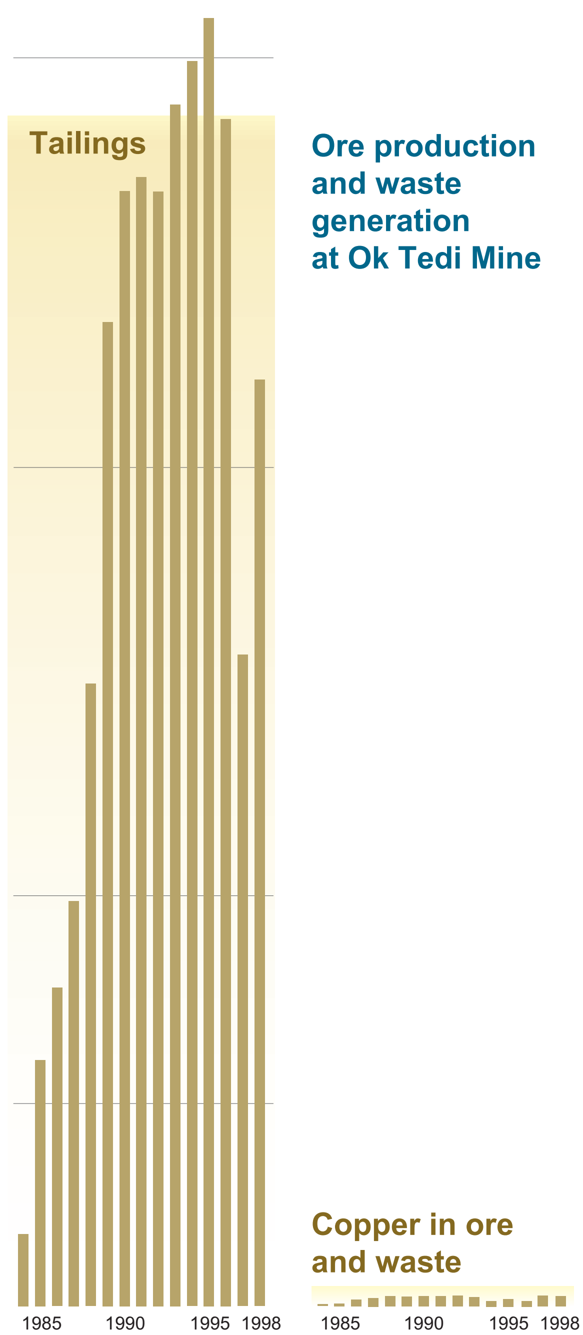
The Acid Mine Drainage (AMD) is the number one environmental problem facing the mining industry. AMD occurs when sulphide-bearing minerals in rock are exposed to air and water, changing the sulphide to sulphuric acid. It can devastate aquatic habitats, is difficult to treat with existing technology, and once started, can continue for centuries (Roman mine sites in Great Britain continue to generate acid drainage 2 000 years after mining ceased). Acid mine drainage can develop at several points throughout the mining process: in underground workings, open pit mine faces, waste rock dumps, tailings deposits, and ore stockpiles. (Miningwatch).

Artisanal small-scale gold mining of placer deposits occurs mostly in developing countries. Examples include Brazil, Venezuela, Colombia, Guyana, Suriname, Philippines and New Guinea. Between 10 and 15 million people worldwide produce 500 to 800 tonnes of gold per year, in the process emitting as much as 800-1000 tonnes of mercury. Gold recovery is performed by removing sediments from the river and adjacent areas and feeding them through a number of mercury-coated sieves. The mercury amalgamates with the gold in the sediments, separating the gold from the rest of the material. The gold-mercury amalgam is then heated. The heat drives off the mercury, leaving the gold product. While most of the mercury condenses and is recovered, some is emitted to the air and is eventually deposited on nearby land or water surfaces. Mercury deposited on land ultimately reaches streams and rivers through runoff. Roughly 1 kilogram of mercury enters the environment for every kilogram of gold produced by artisans. (United States Geological Survey).

a pot of gold

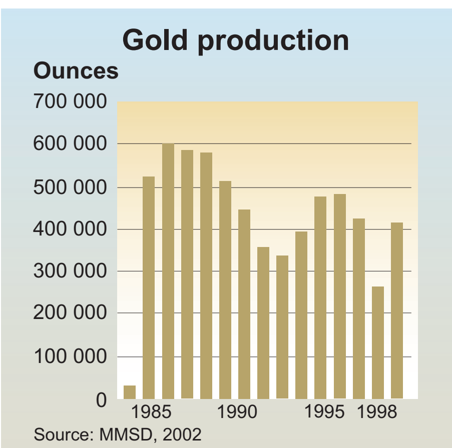
The Ok Tedi mine is located high in the rain forest covered Star Mountains of Papua New Guinea. Prior to 1981 the local Wopkaimin people lived a subsistence existence in one of the most isolated places on earth. That was before the 10 000 strong town of Tabubil suddenly appeared in the middle of their community. The Ok Tedi mine was built on the world's largest gold and copper deposit (gold ore capping the main copper deposit). From the very beginning things did not go according to plan. It was originally envisaged that the mine tailings would be stored in a dam, and after the settling of solid particles, clean water would flow down the Ok Tedi River, then into the Fly River for the 1 000 km journey to the sea. It would have been an engineering marvel to build such a dam on the side of a mountain where it rains more than 10 meters a year and earthquakes are common. The half-built tailings dam collapsed in 1984 and the mine went ahead without a waste disposal plan…





Where do you put 90 million tonnes of mine waste a year?
Without the tailings dam, riverine disposal of waste was the only option. The tailings are composed of fine-grained rock containing traces of copper sulphide and residual cyanide. The build up of tailings in the lower Ok Tedi has caused a rise in the river-bed, flooding and sediment deposition on the flood plain, leading to a smothering of vegetation ("dieback"). To date, about 1 300 square kilometres of dieback has been observed. Up to 2 040 square kilometres of forest may ultimately be affected. These forests are expected to take many years to recover after mine closure. (Ok Tedi Mining Limited).

Changing people's lives
Some 50 000 people live along the Ok Tedi-Fly River system. Sediment from the mine has reduced the amount of fish in the Ok Tedi and Middle Fly Rivers by 80%. Changes to the river-bed have increased flow rates in the river, producing dangerous rapids – a major hazard for locals whose main form of transport is a canoe. The thick mud that blankets the river banks in many places has destroyed the traditional gardens. This mud also makes it difficult to get down to the river to collect drinking water, bathe and fish. However, along with this hardship has come prosperity for many people. Health care and education have improved enormously and many local businesses have started.



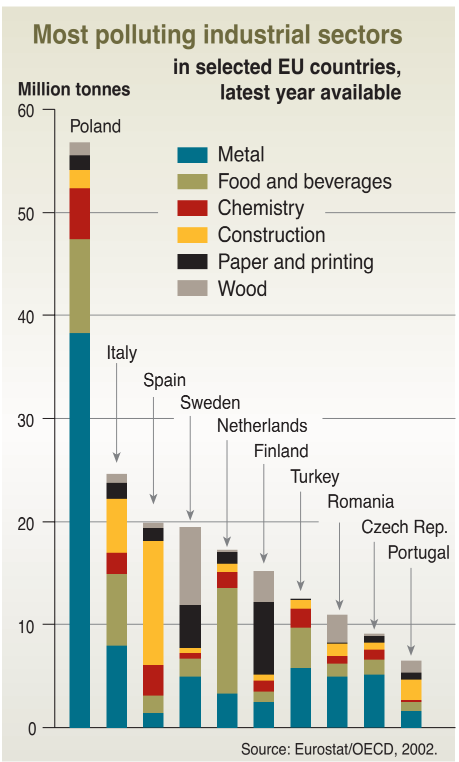
Clockwise from top left: **Massive aggradation of the Ok Tedi River downstream of Tabubil; three views of the forest dieback adjacent to the river; waste rock being unloaded at an erodable dump.** Heavy rainfall washes even coarse material downstream (photos courtesy of Ok Tedi Mining Limited).

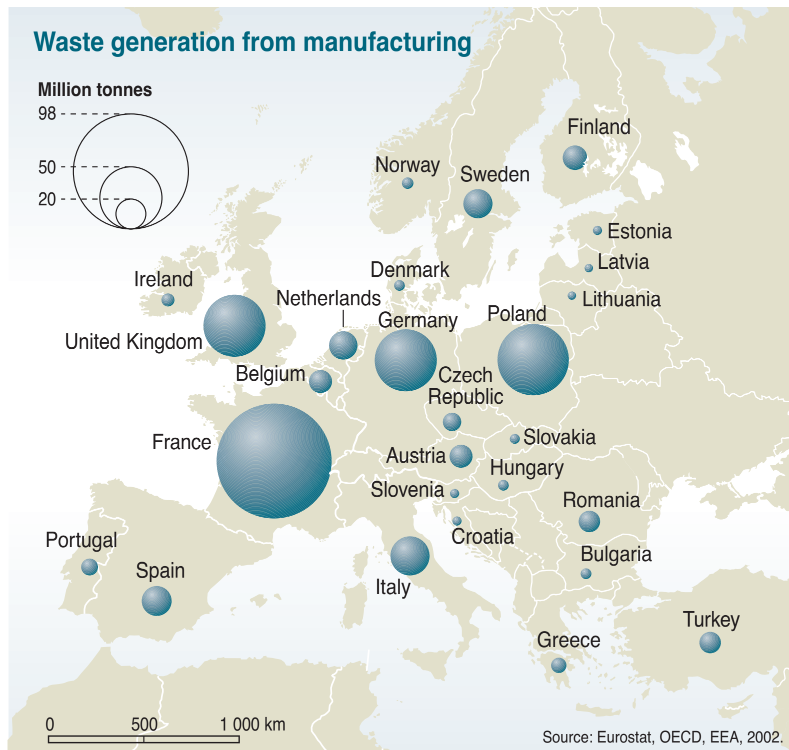
What can the people of the Ok Tedi and Fly Rivers expect

The mine is due to close in 2010. The Papua New Guinea Sustainable Development Program Company currently receives dividends of millions of dollars. Two thirds of this revenue is invested in a long-term fund (that will enable the company to contribute for at least four decades after the mine closes). The remaining third is spent on current development projects in the Western Province (home of the mine) and other areas in PNG. It is two early to tell whether the fund will be able to successfully address the continuing environmental damage or achieve significant sustainable development and job creation. If not, the legacy of 30 years of mining in the clouds may be lasting environmental damage and cultural upheaval.

making products makes waste

Turning raw materials into consumer products generates waste. This production waste includes waste from both agricultural and manufacturing. Agricultural waste consists of things like pesticide waste, discarded pesticide containers, plastics such as silage wrap, bags and sheets, packaging waste, old machinery, oil and waste veterinary medicines. Manufacturing waste, as you would expect from the vast range of products produced and processes involved, is a very diverse group. The waste generated depends on the technology used, the nature of the raw material processed and how much of it is discarded at the end of the chain. Very often manufacturing wastes end up in the hazardous category.



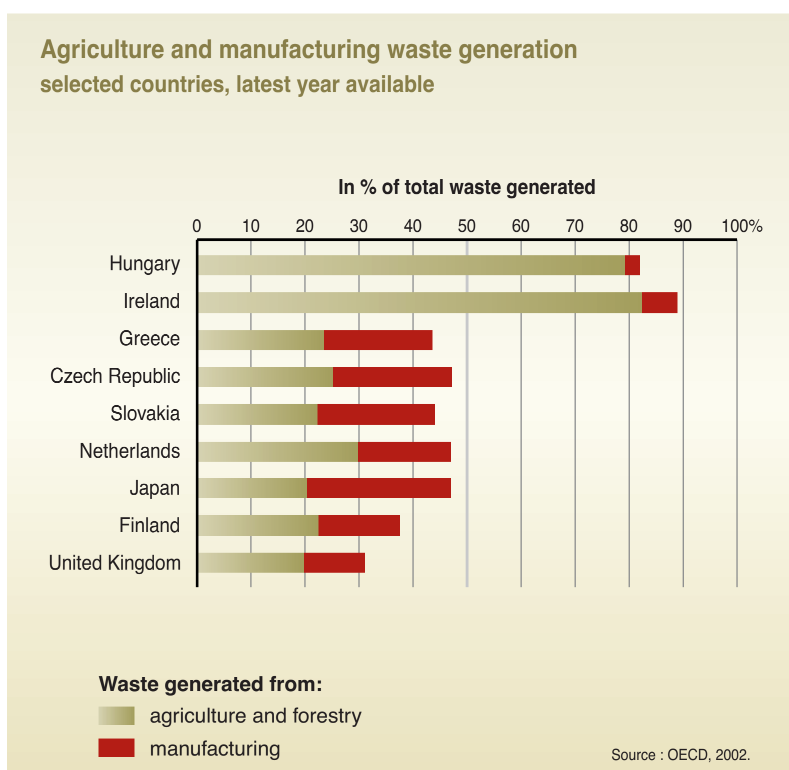


The big waste factory

Typical hazardous wastes generated by selected manufacturing industries

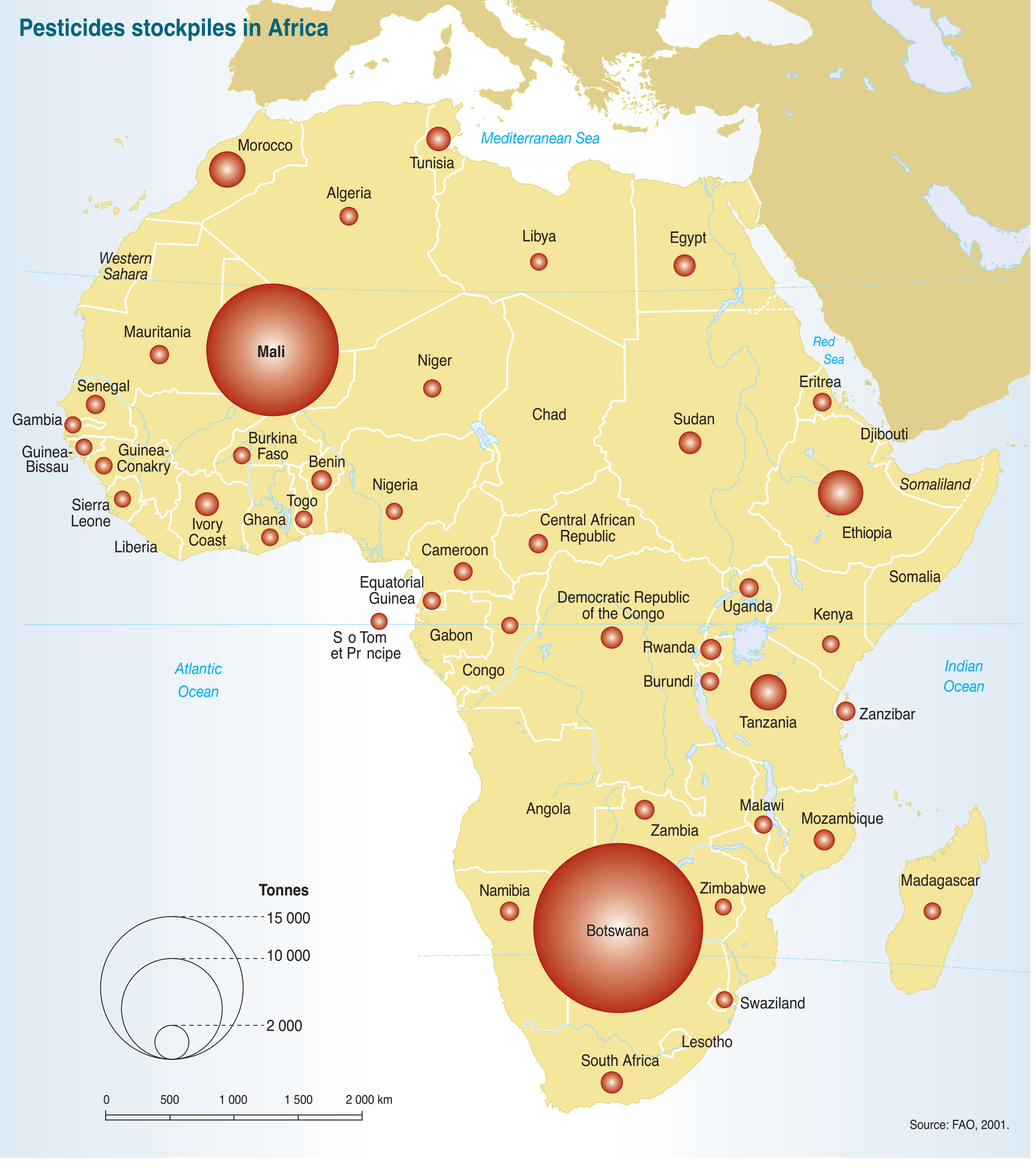
Typical hazardous wastes	Industry
Animal waste Cleaning wastes Refrigerents	**Food and beverages**
Strong acids and bases Reactive wastes Ignitable wastes Discarded commercial chemical products	**Chemistry**
Paint wastes containing heavy metals Strong acids and bases Cyanide wastes Sludges containing heavy metals	**Metal**
Ink wastes, including solvents and metals Photography waste with heavy metals Ignitable and corrosive wastes Heavy metal solutions	**Paper and printing**
Ignitable wastes Paint wastes Spent solvents Strong acids and bases	**Construction**
Ignitable wastes Spent solvents Paint wastes	**Furniture and wood**
Paint wastes Ignitable wastes Spent solvents Acids and bases	**Vehicle maintenance shops**
Heavy metal dusts and sludges Ignitable wastes Solvents Strong acids and bases	**Cleaning and cosmetic**

Source : UACPA, 2002.



Mountains of obsolete pesticides are stockpiled in Africa. Problems with labelling, storage, and the supply of unsuitable products, means that they sit around unused, some for as long as 40 years. They include poisons long ago banned (e.g. DDT, aldrin, dieldrin, chlordane, heptachlor, and others). In some cases the pesticides have leaked from damaged containers. Unable to dispose of them safely the likelihood is that the piles will continue to grow.

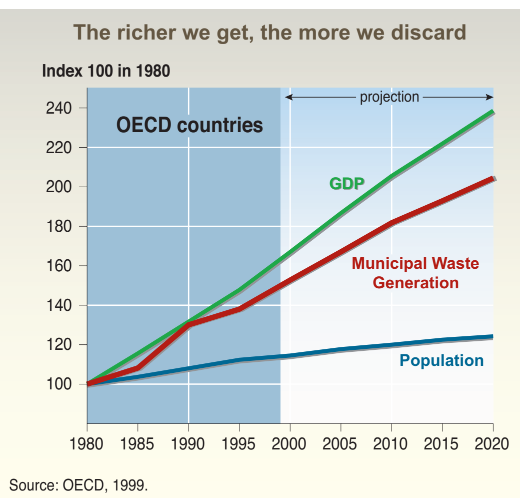
Pesticides stockpiles in Africa

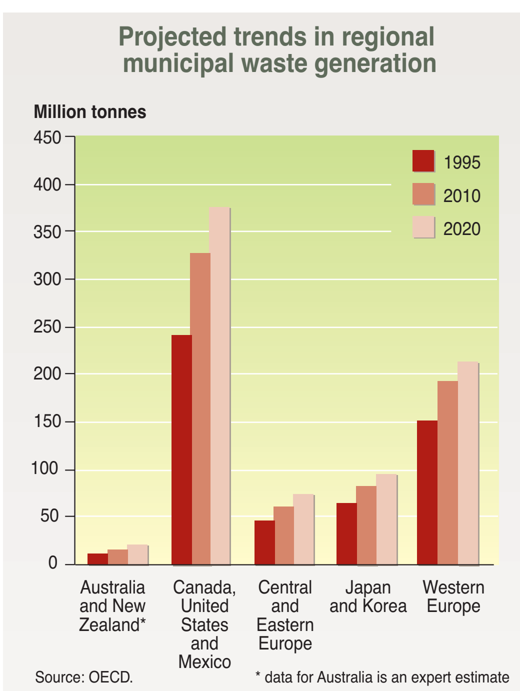


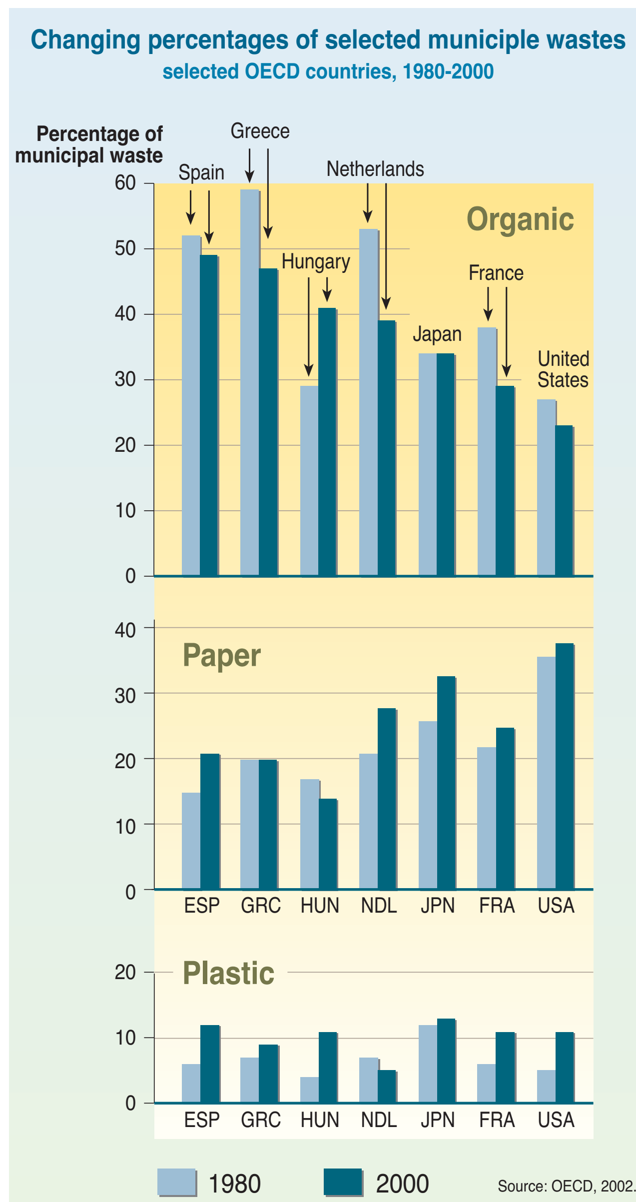
Source: FAO, 2001.

On the rise

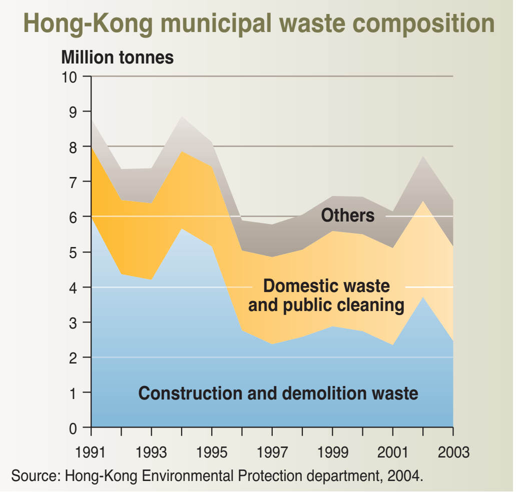
Municipal waste is everything collected and treated by municipalities. Only part of it is comes from households, the rest is generated by small businesses, commercial and other municipal activities. So it is produced from both consumption and production processes. Like all waste, municipal waste is on the rise and it is growing faster than the population, a natural result of our increasing consumption rate and the shortening of product life-spans. According to various scenarios, it will most likely continue for the next decades – but at a slower pace for those countries that can afford advanced waste management strategies. As 1.3 billion Chinese thunder into the great pleasures of consumption, municipal waste is certainly a major environmental concern.



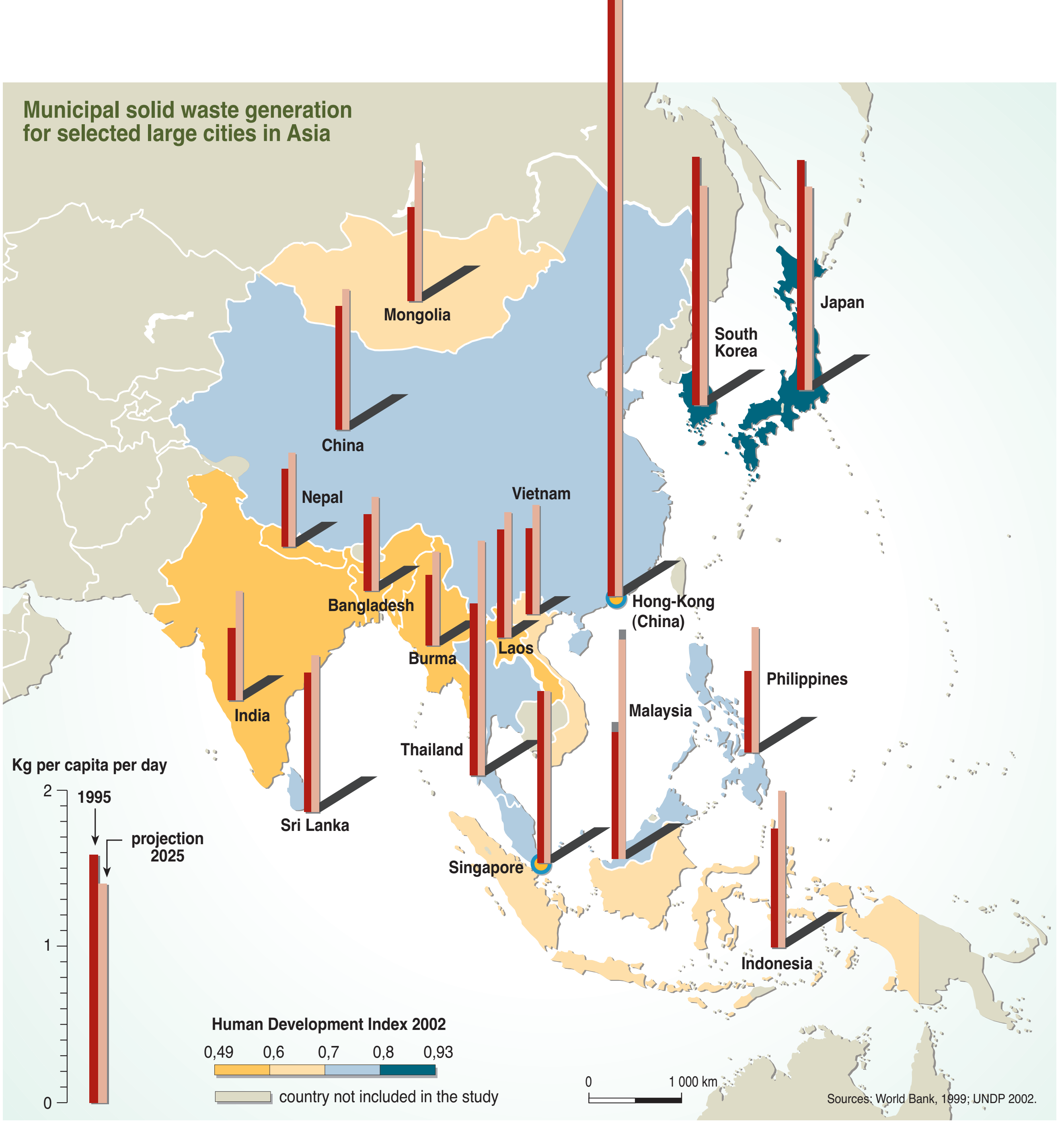




A typical trend: as countries get richer, the organic share decreases whereas the paper and plastic ones increase.



Source: Hong-Kong Environmental Protection department, 2004.

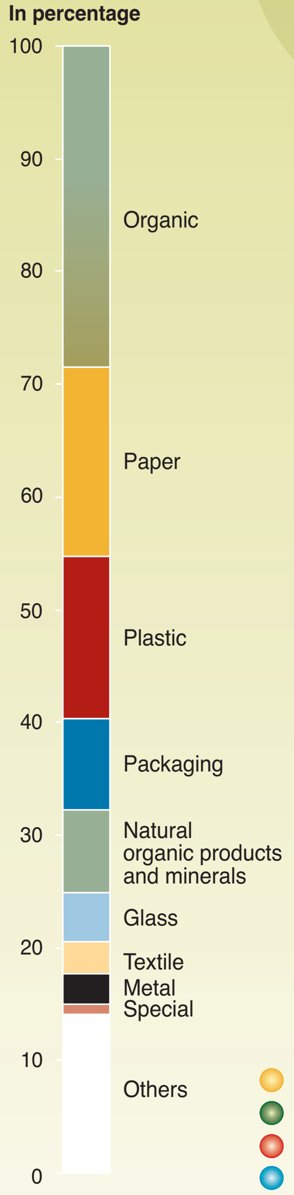


Sources: World Bank, 1999; UNDP 2002.

You and your trashbin: its guilty secret

The amount and composition of municipal waste depends on a variety of factors. It is related to our living standard but wealth does not explain everything. It is also correlated with levels of urbanization, energy choices, waste management strategies and the “good” or “bad” habits of consumers. Although our garbage bins represent only a small part of the total waste generated, it is an important part: the one in which everyone can take action. The part where we can take responsibility by deciding to reduce waste – by recycling and avoiding the purchase of over-packaged goods.

What is in a swiss rubbish bag?



Organic 60,3 kg
Waste suitable for composting or fermentation
Kitchen waste, food, food residues, unopened food with expired date
Garden and balcony plants.

Minerals 11,1 kg
Crockery, flower pots, cat litter, vacuum cleaner bags
Bones, corkstoppers, leather clothing (shoes, belts, etc.).

Non-ferrous metal 2,6 kg
Brass and pressure mouldings of appliances and toys
Animal food containers
Occasionally beverage cans

Iron 3,3 kg
Primarily cans, bottle tops.

Electronics and electrical 1,2 kg
White goods (e.g. refrigerator)
Primarily appliance components and cable residues
Special waste (0,4 kg): mainly pharmaceuticals, occasionally used oil and paints
Batteries 0,2 kg

Paper 35,5 kg
Serviettes, handkerchiefs,
Household paper, paper bags,
Newspapers, brochures, catalogues
Notebooks, books,
Print paper, envelopes

Packaging 8,7 kg
Tetra-Brik
Plastic-aluminium composites
Cardboard
Primarily packagings

Total Plastics 30,4 kg
Plastics with heavily fluctuating percentage of PET (10 to 50%)
Bottles and containers for cleaning and washing fluids, fertilisers, etc.

Cardboard 8,7 kg
Primarily packaging

Composite materials 25,7 kg
Nappies
Toys
Sanitary towels,
Cotton wool
Occasionally cushions
Fibreglass
...
...

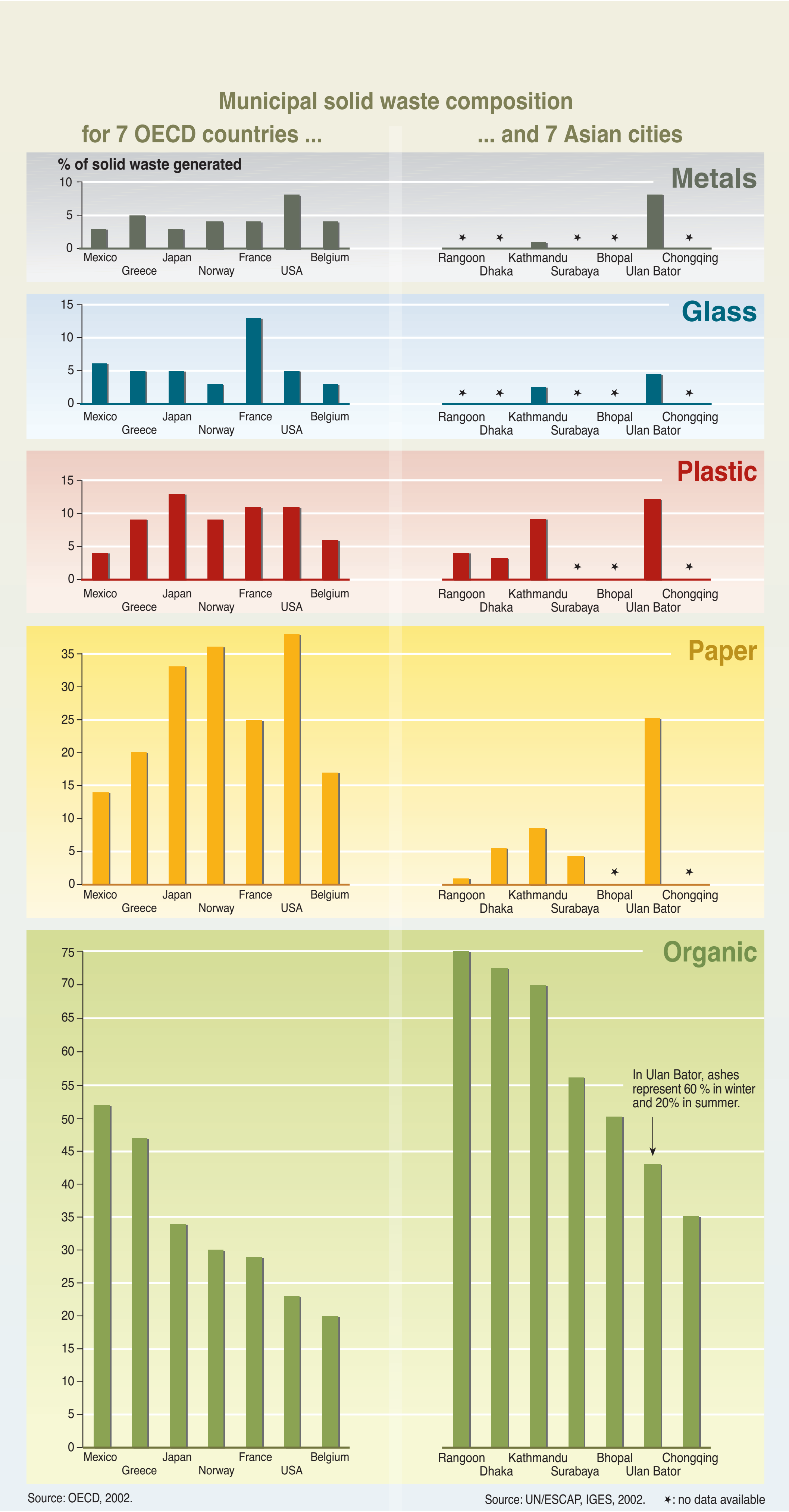
Glass 9 kg
Primarily bottles sub quantity broken glass (drinking glasses, lamp bulbs, etc.)

Textiles 6 kg
Textiles 6kg
Mainly clothes or parts of clothes
Rags
Pieces of carpet.

- Potentially sorted and collected
- Potentially compostable / recyclable
- Hazardous / potentially hazardous
- Main volume contributor

Circles are proportional to the average weight of waste generated in kilograms per person for the year 2001.

Source: Composition of waste in rubbish bags in Switzerland (2001/2002), Swiss Agency for the Environment, Forests and Landscape (SAEFL)



Composition of solid waste for 7 OECD countries / 7 Asian cities (by sector).
In most countries in the world, organic materials and paper are the main contributors to municipal waste. In developing countries, large cities generate most of the municipal waste. Data are rarely available for rural areas, but factors like the type of energy source used for cooking and heating and seasonal differences play a part in the composition of waste (for example in rural communities in Mongolia there is a large difference between the volume of wood ash produced in summer and winter).

what choices for managing waste?

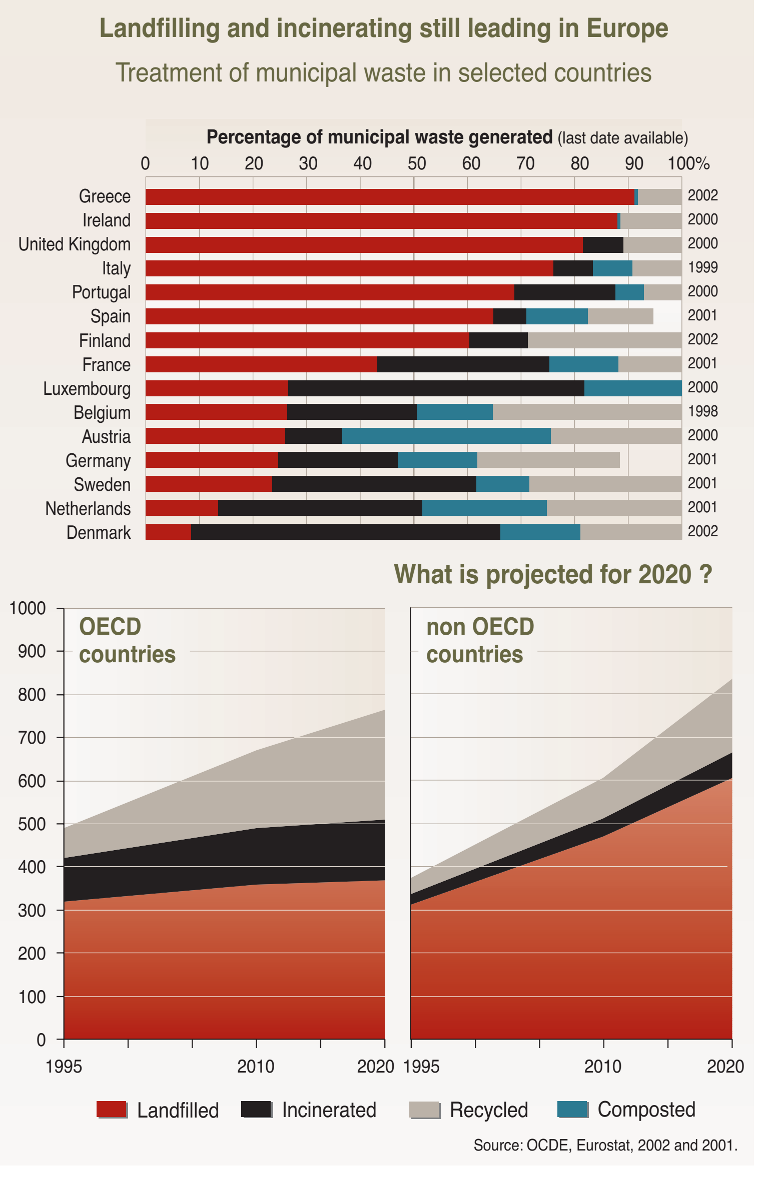
From “dilute and disperse” …

Once upon a time, the amount of waste generated was considered small enough to be diluted in the environment. With massive industrialization and urbanization, a new concept followed this somewhat optimistic view: “concentrate and contain”. Its objective was to eliminate the waste or at least protect the population from its grasp, which generally involved either incineration or disposal in landfills. In most countries today this is still the solution.

… to “integrated waste management”

As the garbage pile gets higher and the environmental conscience sharpens, it is now recognized that producing waste at this rate is no longer acceptable. Now is the time for “integrated waste management” and its motto – “Reduce, Reuse, Recycle” (the famous 3 Rs) – a practice that most developing countries started to apply long before it was even formulated.

As waste disposal strategies evolve, the consumption rates in the developed world are questioned and a surprisingly reasonable solution appears: why not consume less, or at least better?



Many solutions …

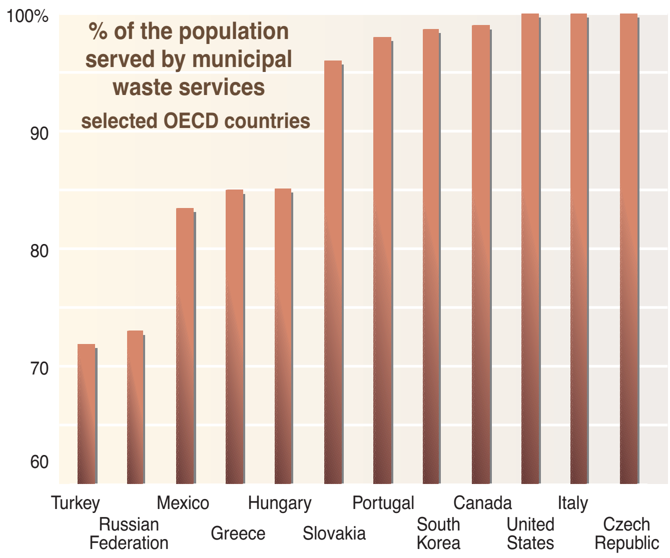
The range of waste management strategies is as wide as waste is diverse.

The basic steps are *source reduction* (educating, sorting, recycling, composting); *collection and transport*; *treatment* (incineration, chemical and biological treatments, etc.); and *disposal* (open dumps, sanitary landfills, deep-well geological disposals).

These processes themselves generate what we could call “the waste of the waste” (incineration residues for example).

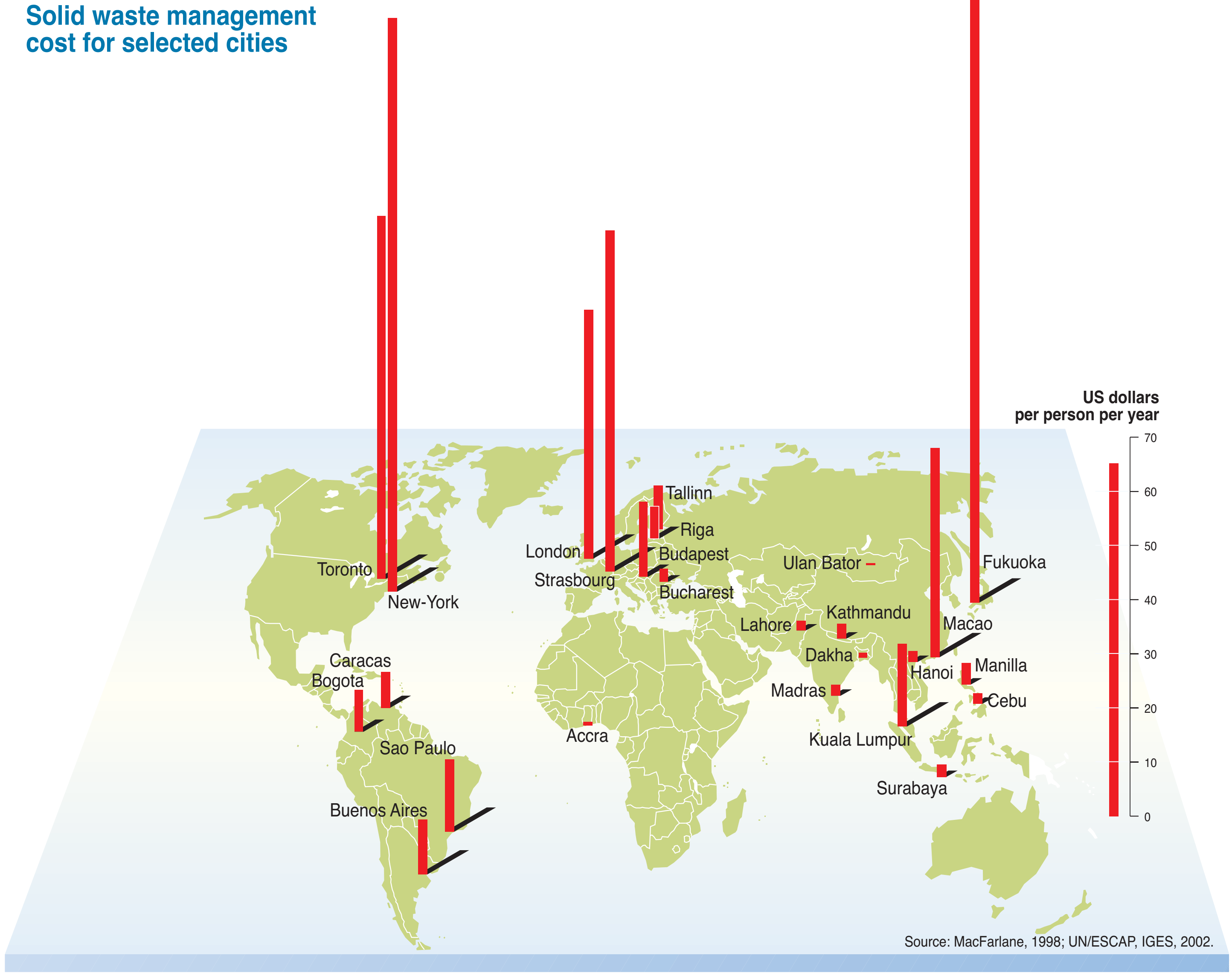
… but at what cost?

Sound waste management requires a high level of technology and a significant budget. What Japan and Germany can afford today, most countries will have to wait a long time for. Developed countries have a lot to learn from the recycling and reuse levels in developing countries.



Is your waste collected?
Waste collection is a basic public service performed for everyone in OECD countries. Everyone? Well, a closer look reveals that this is not the case for a significant number of people. If these developed countries can't collect all their waste, imagine the situation in many developing countries, where resources are much scarcer and access is sometimes problematic.

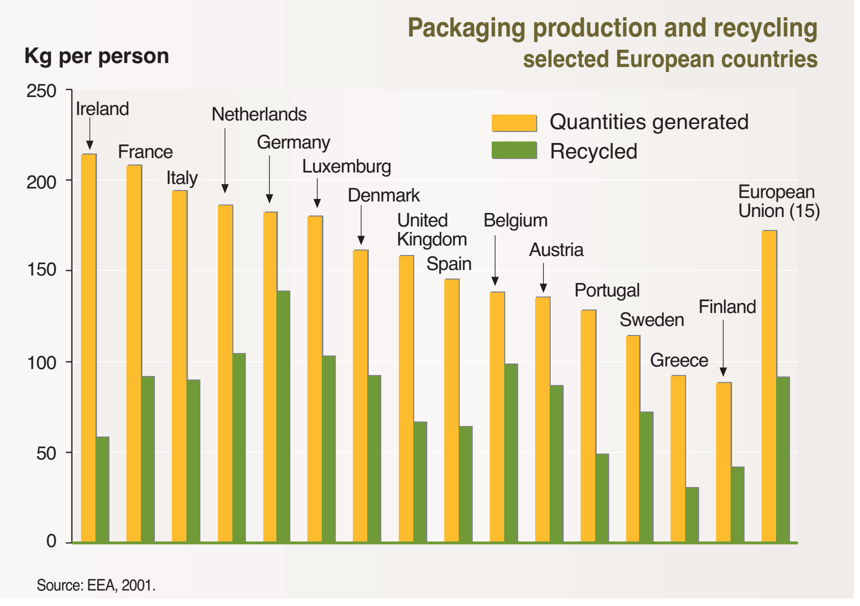
Solid waste management cost for selected cities



Source: MacFarlane, 1998; UN/ESCAP, IGES, 2002.

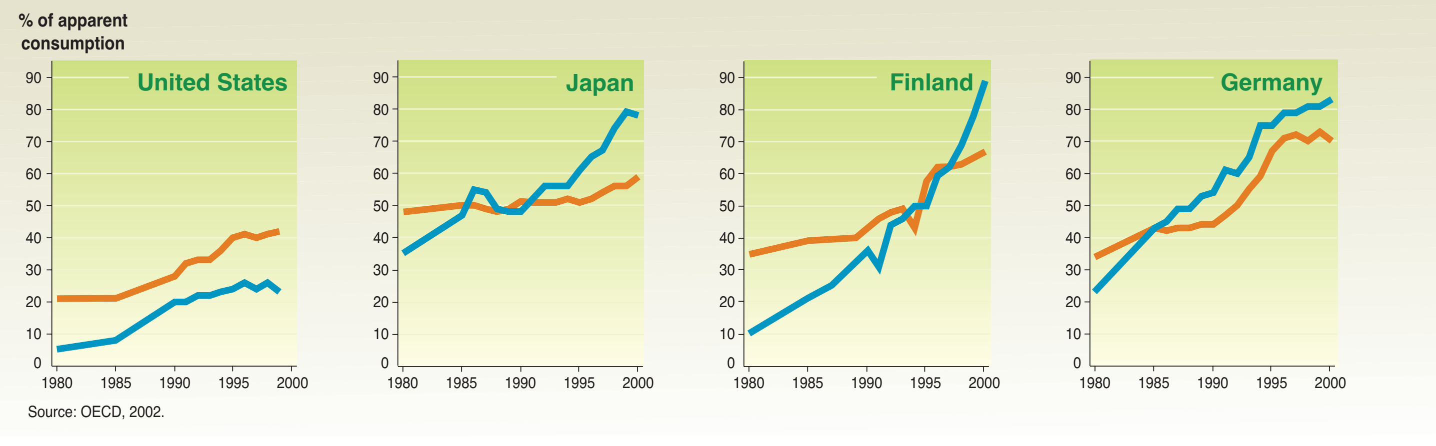
Small is beautiful

The priority now is to decrease the amount of waste we generate. That means changing our consumption patterns, for example by choosing products that use recyclable material, market fresh produce instead of canned food, less packaging and easily recyclable containers (for example glass instead of plastic). It also means recycling – sorting, collecting, processing and reusing materials that would otherwise be handled as wastes.
Many organizations are now engaged in education campaigns, and they seem to be working – in the last two decades, the amount of material being recycled in rich countries has grown dramatically. Most of it is paper, followed by glass, metals, aluminium, plastic, and organic waste.



The economy of recycling
Recycling activities are economically important. Collection, sorting and reprocessing represent job opportunities (especially in the paper recycling sector). They also lower energy and municipal waste disposal costs. Recycling and reprocessing are growth industries, which also support some downstream sectors like the steel industry.

It is difficult to quantify, because of a lack of data, but the informal recycling sector in developing countries is known to be economically important.



Recycling questioned

Many recycling paths go from rich to poor countries. Low labour costs, fewer regulations, little import control and the existence of a market for reuse (scrap metals for example) are the main reasons. Lacking the capacity to deal safely with much of this material, significant damage is being done to human health and the environment. These issues need to be addressed at the international level.

Counter-productive recycling

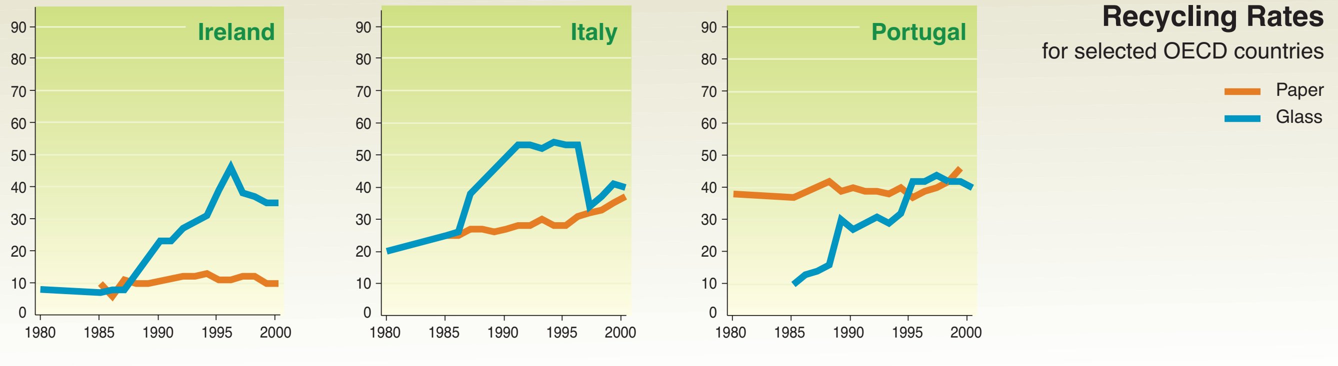
Some recycling strategies, although well intentioned, can use more energy, or themselves produce new types of waste or pollution. For example, air emissions from aluminium recycling can contain particulate matter in the form of metallic chlorides and oxides, as well as acid gases and chlorine gas.

Waste scavengers

In developing countries, waste management is reduced to what the community can afford (usually not very much). Waste is mostly a big city problem and complications start with waste collection and continue with open dumps, open burning, and incinerators in the middle of towns. In rural areas, the great majority of waste is organic. Here composting is a very valuable strategy.

In poor cities of Asia, Africa, Central and South America, many people make a living by sorting through municipal landfills. They are called “waste scavengers”. Mostly coming from rural areas, mostly female and often children, these workers are on the lowest level of the social scale. They experience very dangerous working conditions, handling hazardous waste without physical or social protection. Waste wise, their contribution is very important, for the proportion of solid waste they recycle is significant. Not only does it reduce the mountain of waste, but it also creates wealth and offers a second life to materials.

As global waste policies are progressively implemented, these cities have the opportunity to learn from the mistakes of developed countries. And including the scavenger’s activity in the waste management plans (providing them with a status, decent working conditions and revenue) is now a consideration.

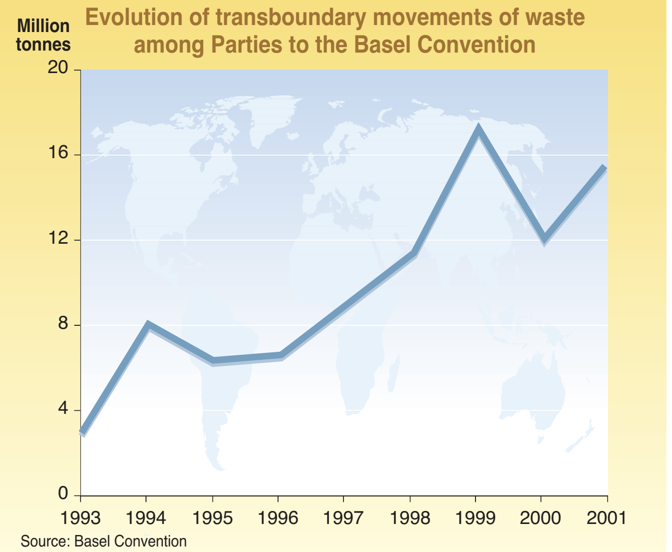


Recycling Rates
for selected OECD countries

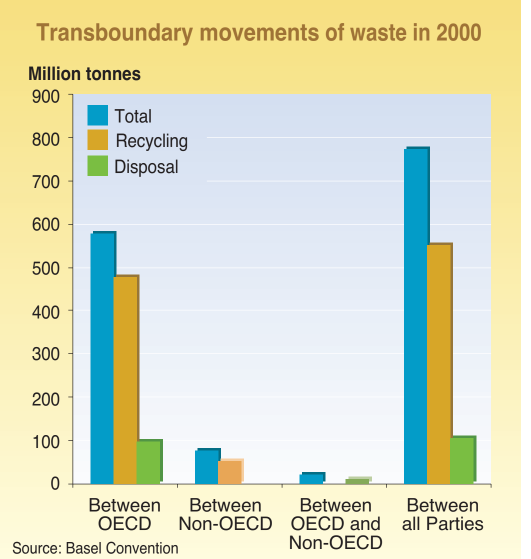
waste on the move

The amount of waste on the move is increasing rapidly. Reports to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal suggest that between 1993 and 2001 the amount of waste crisscrossing the globe increased from 2 million tonnes to more than 8.5 million tonnes. What is this material that is being traded between countries, where is it from and where is it going? Unfortunately data on waste movements are incomplete – not all countries report waste movements to the Basel Convention. However, we do know that the movement of waste is big business.

NB: The Basel Convention does not cover radioactive waste.



Source: Basel Convention



Source: Basel Convention

Well travelled waste

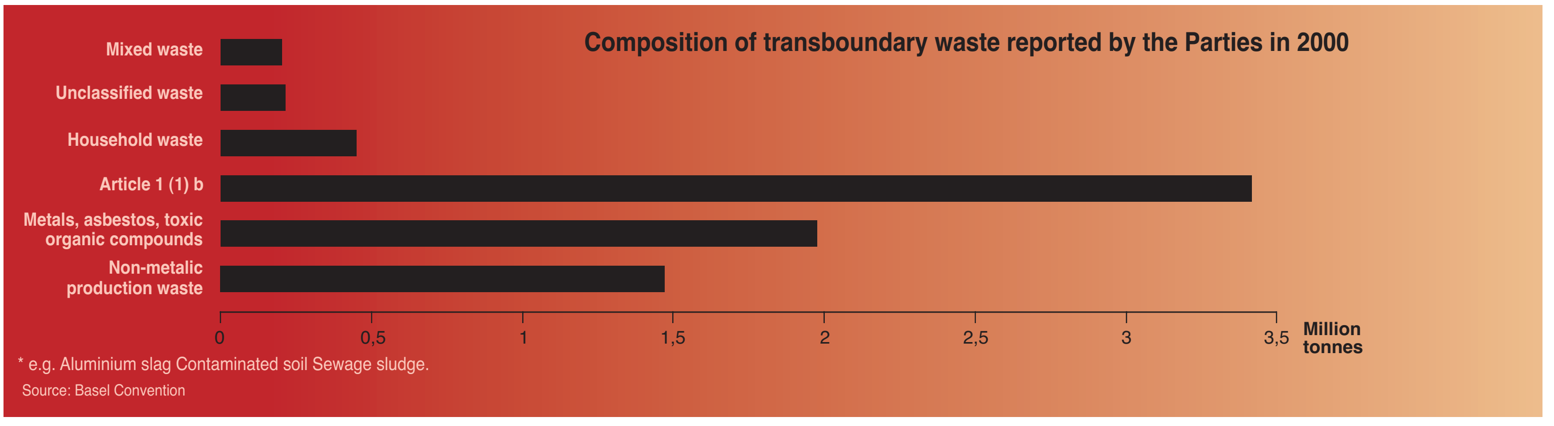
Waste, including extremely hazardous waste like radioactive material, toxic heavy metals and poisonous PCBs are routinely being loaded into trucks, and transported across continents. Some is loaded onto ships and exported to other countries. Often the waste is being sent for recycling but some is just dumped. Between 1993 and 1999 122 countries reported nearly 30 000 waste exports. During this period Germany was the top exporter (nearly 7 million tonnes) and France was the leading importer (just over 3 million tonnes).

The traders

Approximately 75% of the total volume of waste is traded between developed countries (OECD members). At the second conference of the parties to the Basel Convention, Parties adopted a ban on the export of hazardous waste for final disposal from OECD countries to non-OECD countries (which has not entered into force). The shipment of wastes intended for reuse or recycling is currently negotiated between individual countries, ensuring that OECD countries can still export hazardous material for this purpose to non-OECD countries.

What is being traded?

According to the Basel Convention reports, of more than 300 million tonnes of waste (including hazardous and other waste) generated worldwide in 2000, a little less that 2% was exported. However 90% of the exported waste was classified as hazardous. The principal waste export by volume was lead and lead compounds bound for recycling.

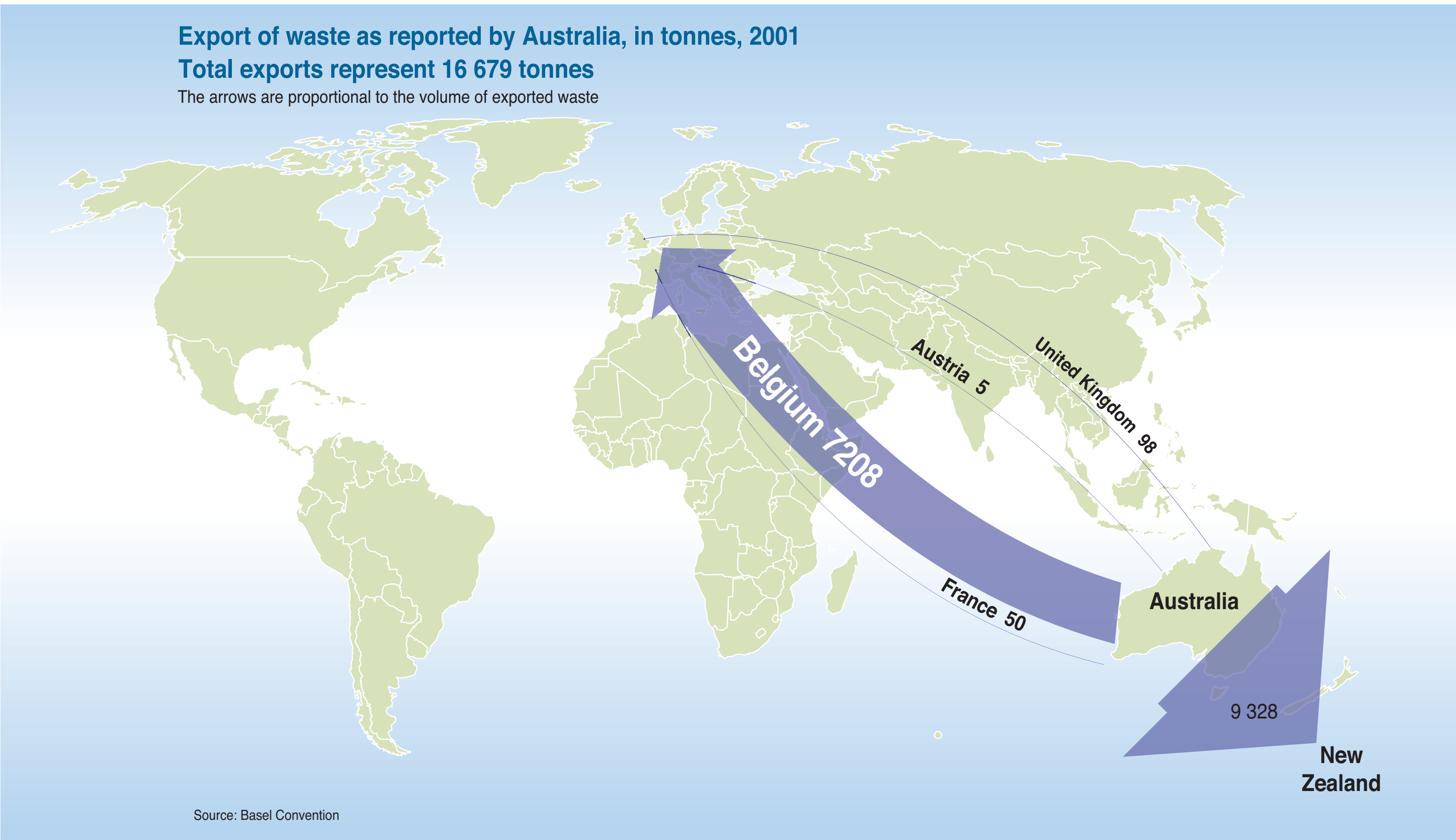


Transport of radioactive waste

Over 50 countries currently have spent fuel stored in temporary locations, awaiting reprocessing or disposal. Major commercial reprocessing plants operate in France, the United Kingdom, and Russian Federation with a capacity of some 5000 tonnes per year. Countries like Japan have sent 140 shipments of spent fuel for reprocessing to Europe since 1979. In October 2004 France took possession of 660 kilograms of weapons-grade plutonium from the United States for reprocessing into fuel. Two ships carried the radioactive material from South Carolina to the French port of Cherbourg. It was then loaded onto lorries and driven 18 km to La Hague for the first stage of reprocessing. It is currently at a plant in the south-east France and is expected to be transported back to the United States in 2005.

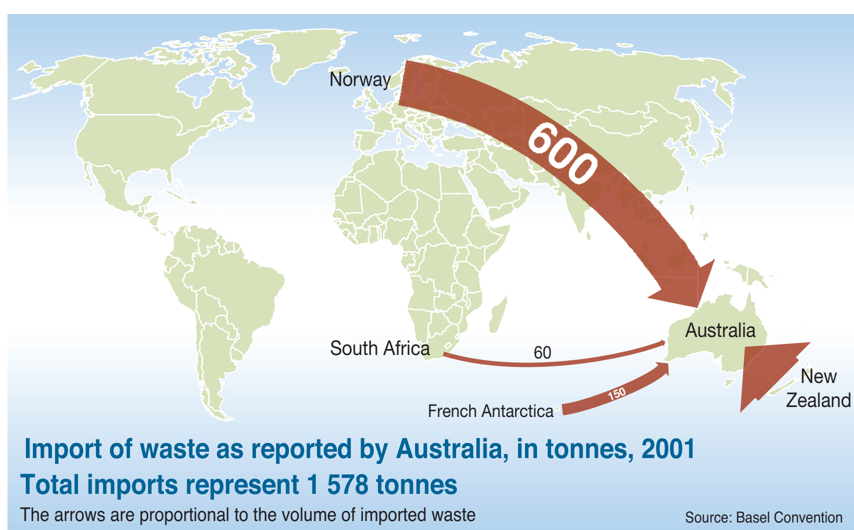
While reprocessing is an option, others are looking for disposal sites for their nuclear waste. For example the Taiwan Power Company (Taipower) has been negotiating since 1997 to dispose of low-level nuclear waste at a site in North Korea – something that alarms many in the rest of the world. Problems with the environmental safety of the site offered by the North Koreans have slowed progress on the deal.

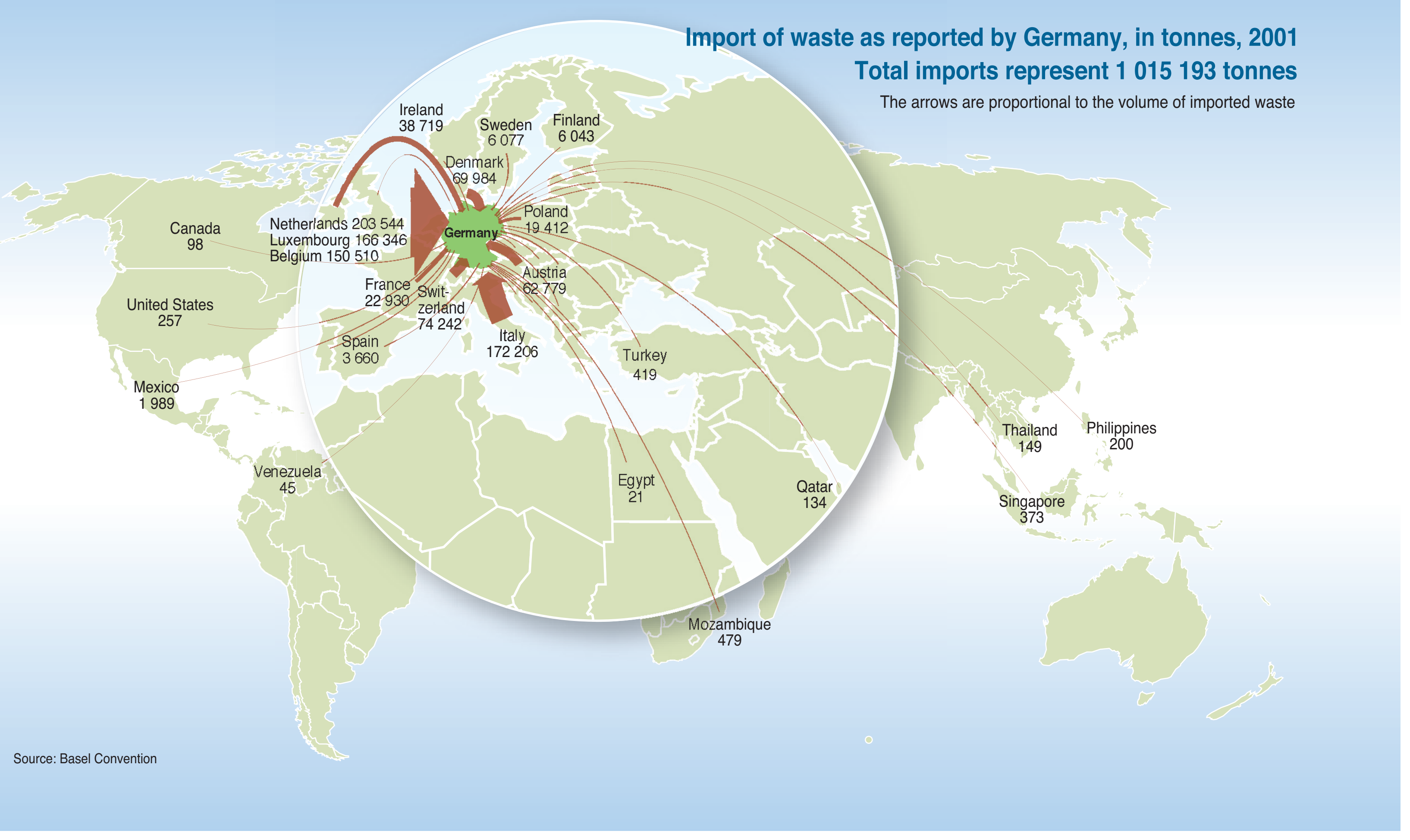
trading waste



Export-Import case study

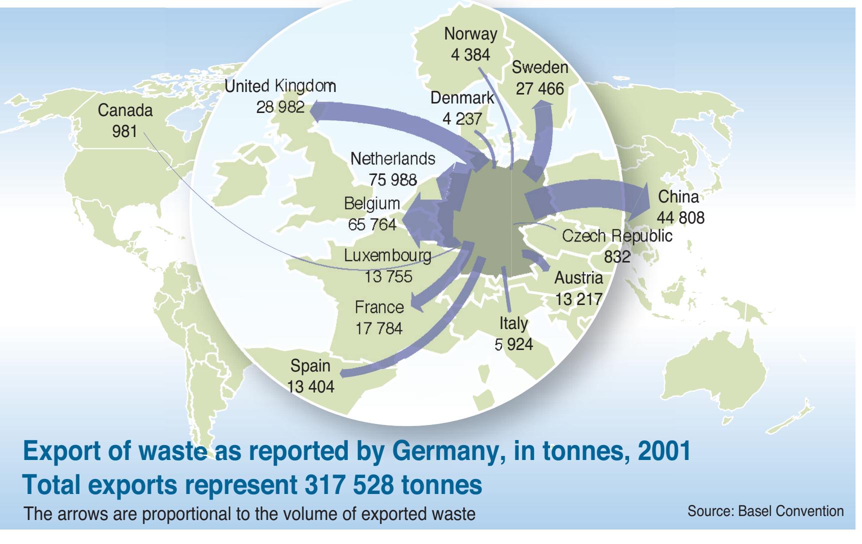
Australia is not a big player in the waste trade, but a good percentage of its exports are shipped all the way to Europe. In 2000 Australia reported the export of 16 689 tonnes of waste (all classified as hazardous) to New Zealand, Belgium, Great Britain, France and Austria. More than half the waste consisted of used lead acid batteries, which were moved across the Tasman Sea to New Zealand. Most of the rest of the waste (described as lead dross) was exported to Belgium. During that same period Australia imported 1600 tonnes of waste from New Zealand, Norway, French Antarctic and South Africa. This included mostly copper and lead compounds from New Zealand, selenium from Norway and household waste from the French Antarctic base.





Import of waste as reported by Germany, in tonnes, 2001
Total imports represent 1 015 193 tonnes
The arrows are proportional to the volume of imported waste

Source: Basel Convention



Export of waste as reported by Germany, in tonnes, 2001
Total exports represent 317 528 tonnes
The arrows are proportional to the volume of exported waste

Source: Basel Convention

Export-Import case study

In 2000 Germany reported sending 317 528 tonnes of waste to 14 countries. All countries appeared to receive a broad combination of hazardous waste apart from China, which received nearly 50 tonnes of household waste. During 2000 Germany was amongst the top importers, bringing in over 1 million tonnes of waste from 38 countries. Most of the waste came from the Netherlands, Italy Luxemburg and Belgium and contained a combination of waste streams.

caution, hazardous waste!

Industrialization has brought us the benefits of a comfortable modern lifestyle: health-giving pharmaceuticals, labour-saving household appliances, automobiles and ships, paints and detergents, synthetic fibres and polythene packaging, personal computers and TVs, just to name a few out of an endless list of manufactured goods. However, behind the luxury and convenience of modern living lies the real price of this industrial production – the generation of hundreds of million tonnes of hazardous waste every year. Wastes that too often pour out of smokestacks and outtake pipes, lie abandoned in dumps or leaky storage drums, or are shipped off illegally to distant places, exposing local communities to great dangers.

How much hazardous waste?
Countries that report to the Basel Convention produced around 108 million tonnes of hazardous waste in 2001.

What makes a waste hazardous?
Hazardous wastes come in many shapes and forms. They can be liquids, solids, contained gases, or sludges. They can be the byproducts of manufacturing processes or simply discarded commercial products, like cleaning fluids or pesticides. Four defining characteristics of hazardous waste are:

Ignitability. Ignitable wastes can create fires under certain conditions or are spontaneously combustible. Examples include waste oils and used solvents.

Corrosivity. Corrosive wastes are acids or bases that are capable of corroding metal, like storage tanks, containers, drums, and barrels. Battery acid is a good example.

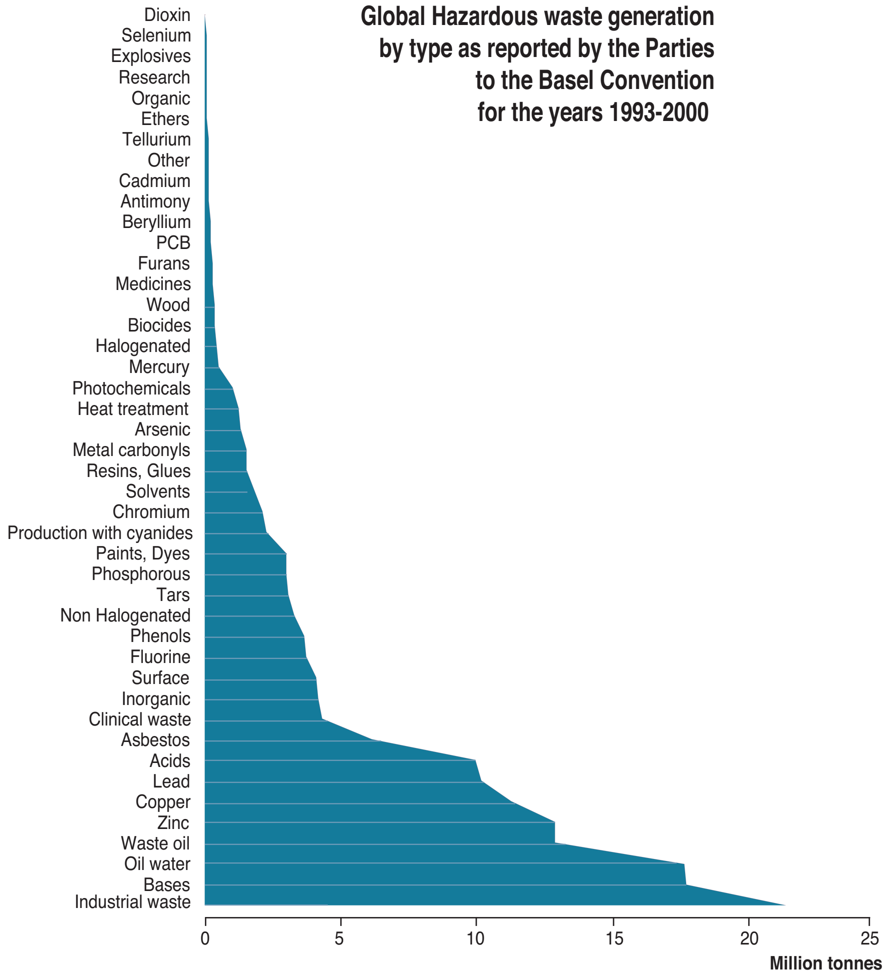
Reactivity. Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when mixed with water. Examples include lithium-sulfur batteries and explosives.

Toxicity. Toxic wastes are harmful or fatal when ingested or absorbed. When toxic wastes are disposed of on land, contaminated liquid may drain (leach) from the waste and pollute ground water. Certain chemical wastes and heavy metals are examples of potential toxic wastes. (US Environmental Protection Agency).

Abandoned munitions in Kopitnari, Ponichala and Vartcihe in Georgia (photos courtesy of Ministry of Environment, Georgia)

Economic conditions have led to the almost complete closure of old Soviet era industrial complexes. Neither the Rustavi and Zestafoni chemical and metallurgy plants or the Chiatura and Tkibuli mines still function. However, the piles of unused chemicals and heavy metal stocks that still litter these sites pose a very real threat to the local people and environment. In addition, about 300 military sites fulfilling various purposes – including rocket ranges, tank storage, chemical production and places where radioactive devices were used – were established in Georgia during the Soviet period. After the withdrawal of the Russian military, some of these areas were simply abandoned. Also of great concern are the 230 radioactive sources discovered since the mid-1990s. (Ministry of Environment, Georgia).

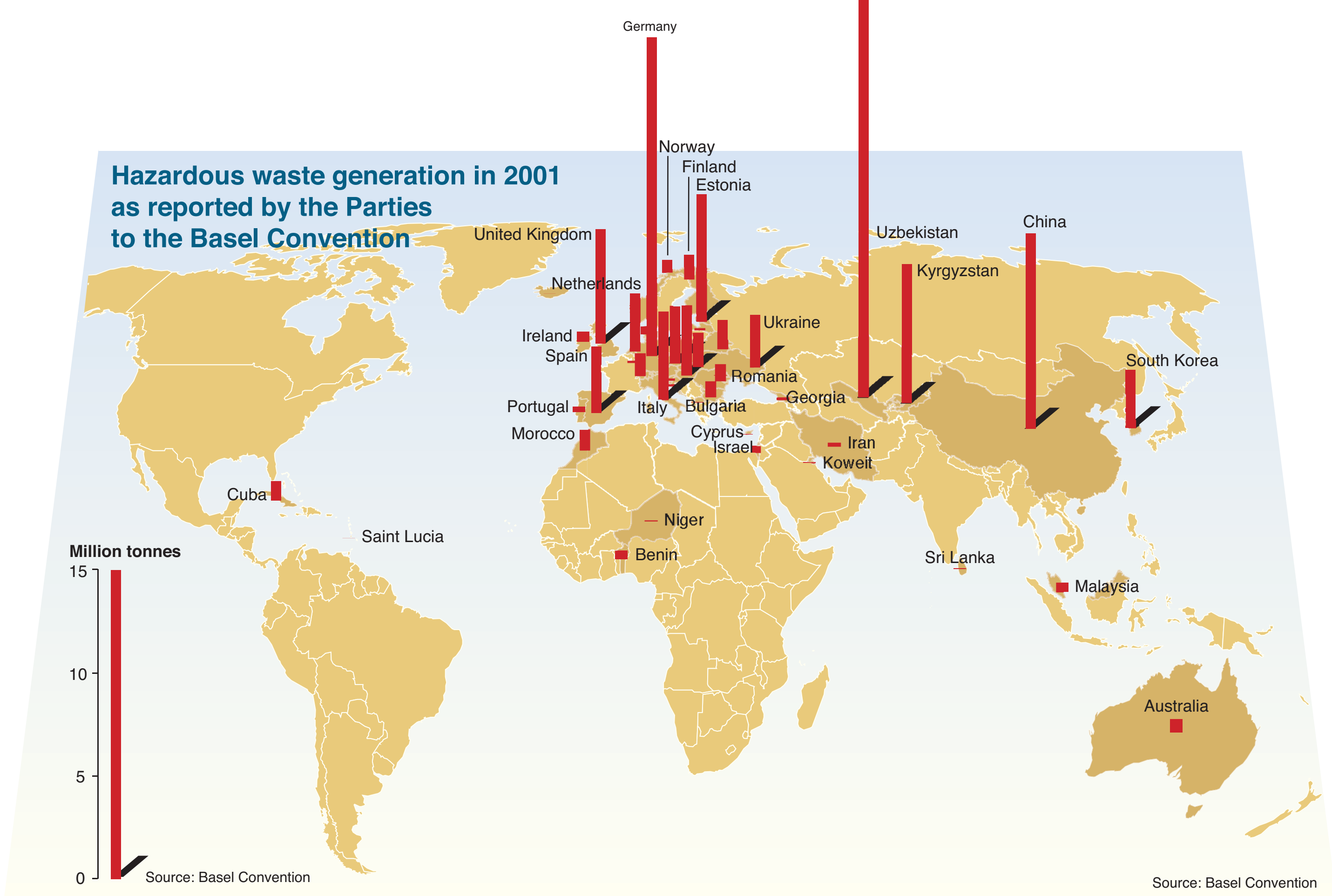
Global Hazardous waste generation by type as reported by the Parties to the Basel Convention for the years 1993-2000



Controlling hazardous waste

Hazardous waste needs to be monitored and controlled from the moment the waste is generated until its ultimate disposal. Proper hazardous waste control requires a plan to reduce the amount of waste generated or the toxicity of the waste produced. The most environmentally sound and economically efficient way of managing any waste is not to generate it in the first place (source reduction). The creation of hazardous waste can be avoided, or limited, by not mixing hazardous and non-hazardous wastes or by changing some materials or processes. Hazardous wastes can often be recycled in an environmentally sound manner. Wastes that cannot be recycled must be treated to reduce the toxicity and the ability of the constituents to move throughout the environment. Treatment residues must be safely stored to avoid spills and leaks. (US Environmental Protection Agency).

Hazardous waste generation in 2001 as reported by the Parties to the Basel Convention



the great e-waste recycling debate

The high tech boom has brought with it a new type of waste – electronic waste, a category that barely existed 20 years ago. Now e-waste represents the biggest and fastest growing manufacturing waste. The black and white TV turned to colour, the basic mobile phone needed a camera, personal organizer and music, and who wants last year's computer when it can't handle the latest software? As we continually update and invent new products the life of the old ones is getting shorter and shorter. Like shipbreaking, e-waste recycling involves the major producers and users, shipping the obsolete products to Asia, Eastern Europe, and Africa. But instead of being "green" we are exporting a sack full of problems to people who have to choose between poverty or poison.

A story of e-waste – the computer

On average a computer is 23% plastic, 32% ferrous metals, 18% non-ferrous metals (lead, cadmium, antimony, beryllium, chromium and mercury), 12% electronic boards (gold, palladium, silver and platinum) and 15% glass. Only about 50% of the computer is recycled, the rest is dumped. The toxicity of the waste is mostly due to the lead, mercury and cadmium – non-recyclable components of a single computer may contain almost 2 kilograms of lead. Much of the plastic used contains flame retardants, which makes it difficult to recycle.

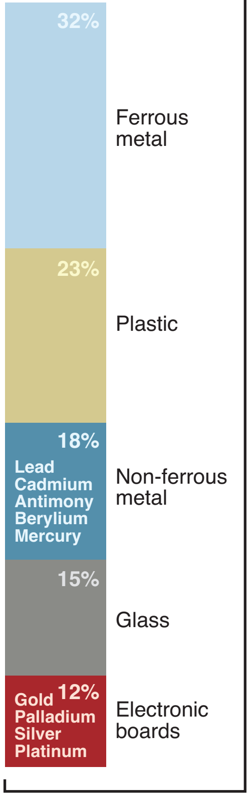
How do you recycle a computer?

In many countries entire communities, including children, earn their livelihoods by scavenging metals, glass and plastic from old computers. To extract the small quantity of gold, capacitors are melted down over a charcoal fire. The plastic on the electrical cords is burnt in barrels to expose the copper wires. All in all each computer yields about US $6 worth of material (Basel Action Network). Not very much when you consider that burning the plastic sends dioxin and other toxic gases into the air. And the large volume of worthless parts are dumped nearby, allowing the remaining heavy metals to contaminate the area.

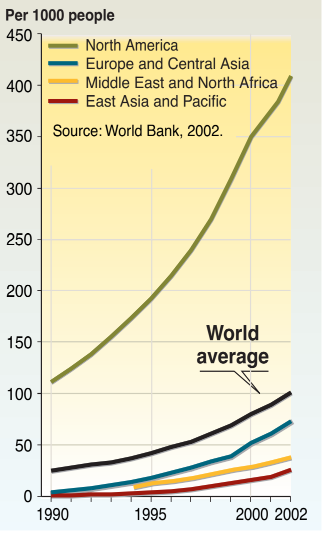
Let me give you a computer

Communities in West Africa receive used computers from donors in developed countries. However, what was intended as a useful gift quickly becomes a waste product. When things go wrong, as they often do with computers (especially old ones), the lack of technical support means they end up on the scrap heap.

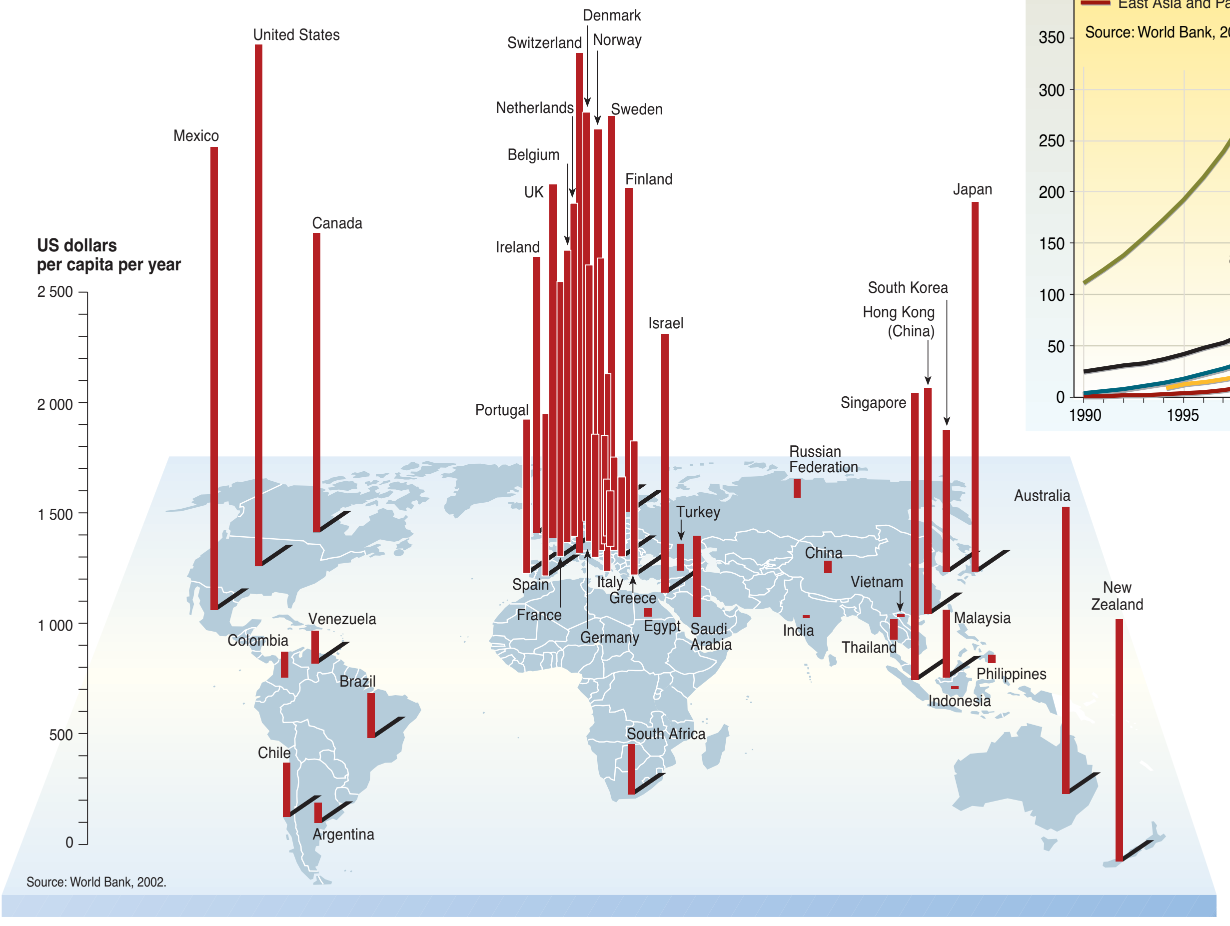
What is in a computer



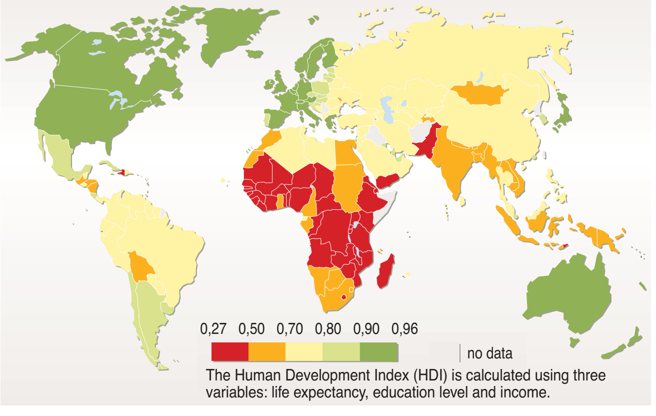
Number of personal computers



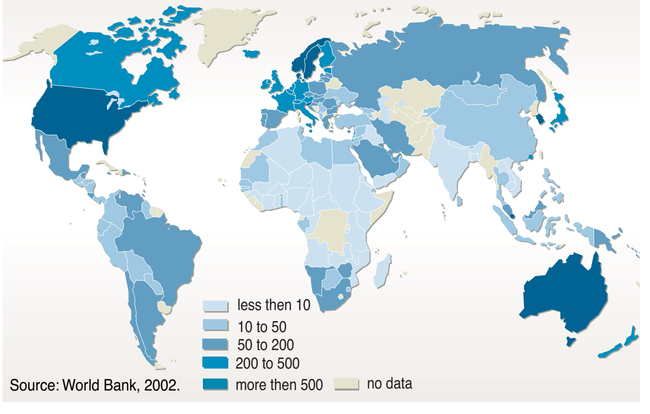
Information and communication technology expenditures



As a comparison... Human Development Index (HDI) in 2002



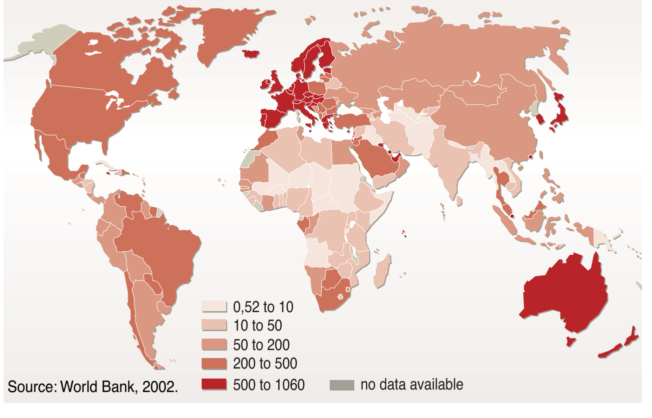
Personal computers per 1 000 people



It is estimated that there are over a billion personal computers in the world at present. In developed countries these have an average life span of only 2 years. In the United States alone there are over 300 million obsolete computers. (US National Safety Council).

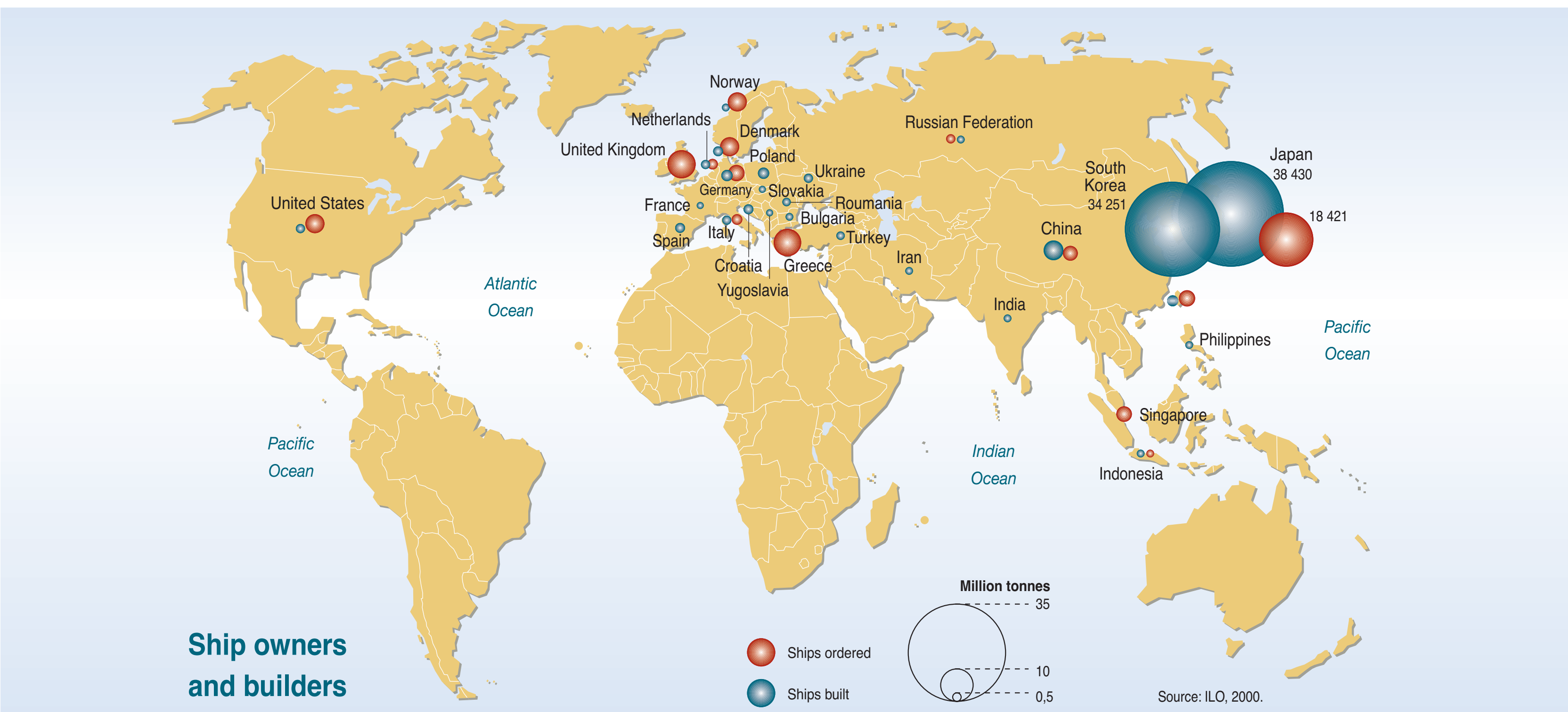
The Basel Convention has before it an amendment which would ban the export of hazardous waste for disposal to developing countries. Some countries (for example those in the European Union) have already implemented this proposed amendment. In addition countries like China have banned the importation of e-waste, although significant volumes are still entering the country illegally.

Mobile phones per 1 000 people



breaking more than ships

When ships like oil tankers and cargo vessels pass their use by date they are broken up for scrap. Large ships are generally built by companies in countries like Japan, South Korea and Germany, but when it comes time for recycling and disposal they are sent to Pakistan, Bangladesh, India... Here thousands of low paid workers use basic tools to strip and break up the pollution-saturated hulls. The activities can take place on beaches – at high tide ships are driven up onto the sand. It takes between 5 weeks and 6 months to dismantle a tanker. After 25-30 years ships are at the end of their life and every year about 600-700 make their final voyage to the scrap yards of Asia. Signs are that scrapping rates will increase as our existing fleet ages and regulations are introduced to update ship design.

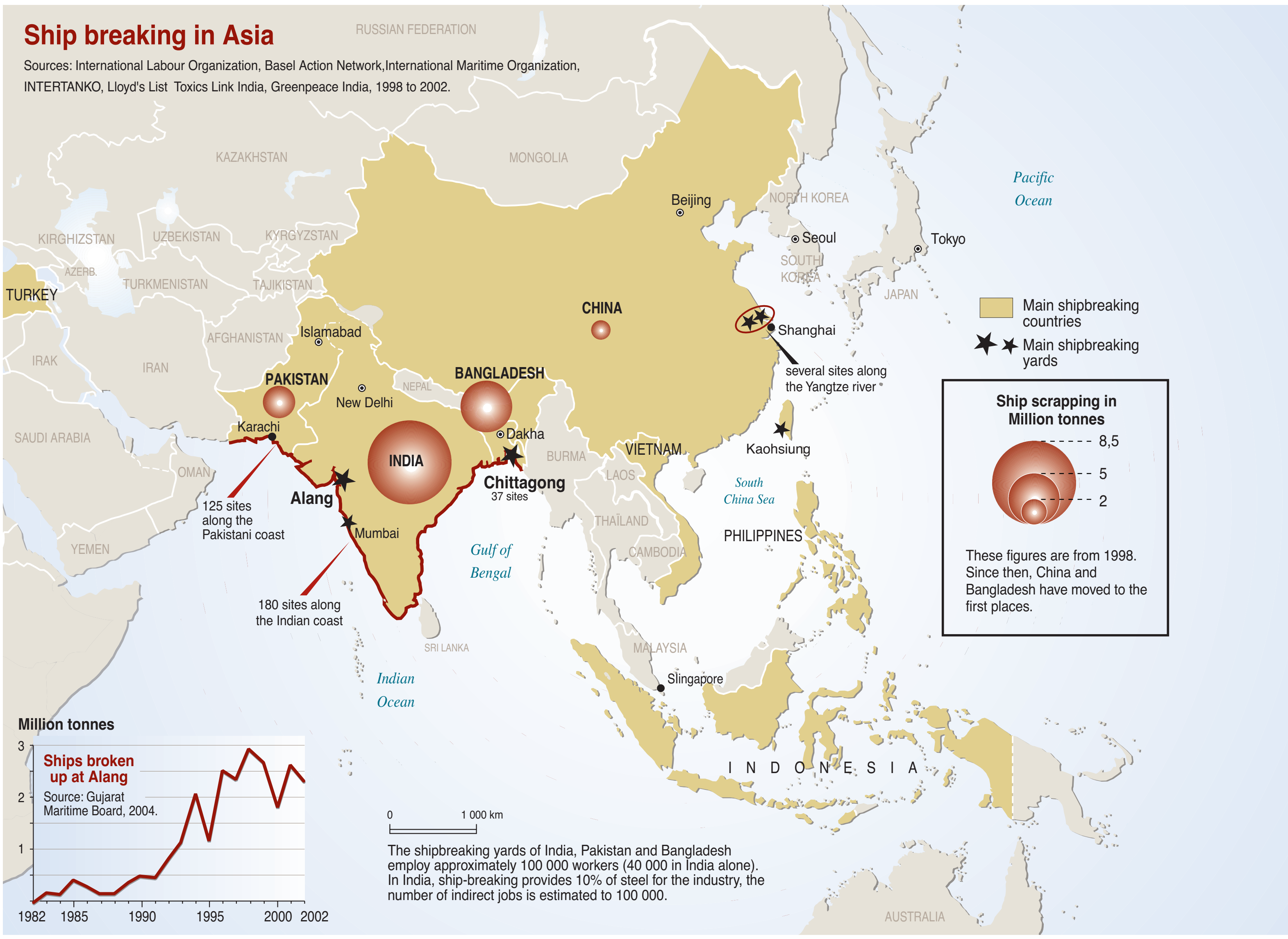


A rusting toxic hulk

Ships sent to the Asian scrap yards carry with them a cargo of toxic chemicals and components. In most instances ship owners do not identify the potential toxins. These include asbestos from insulation and gasket seals, polychlorinated biphenyls contained in hoses, foam insulation and paint, and a range of heavy metals like lead, mercury and cadmium. Gases are supposed to be removed before the ships are delivered, but accidents from leaking gas, like the one that occurred in Bangladesh in 2003 (exposing 100's of people to toxic fumes), are all too common. If ships are not dismantled in an environmentally sound manner, the area around the ships absorbs the toxins, permanently contaminating the sediments.

The ship breakers

Prior to 1970, shipbeaking was concentrated in Europe. It was a highly mechanised activity carried out at docks by skilled workers. However the increasing cost of upholding environmental health and safety guidelines made it unprofitable. So the industry moved from the steel capped boots and hard hats of Europe to the bare footed workers of Asia. It is estimated that approximately 100 000 Asians are employed as ship breakers. (International Labour Organisation). Workers are exposed to toxic fumes, excessive noise and heat, all in a climate of low wages, poor job security (changes in the scrap price can see thousands laid off) and an almost total absence of occupational safety and health regulations.



A new lease of life

About 95% of a ship's body is made of mild steel with the rest made up of stainless steel, and miscellaneous metals, such as brass, aluminium, copper and other alloys. Places like Bangladesh and India are dependent on shipbreaking for their domestic steel. The steel scrap supports a multitude of industries, employing millions of people. Ship fittings and stores are also traded. These may include engines, boilers, furniture, electronics, clothing, foodstuffs and first aid equipment. Prices paid for old ships vary enormously. Between 2001 and 2003 the price fluctuated between US $48 and US $240 (Greenpeace 2003).

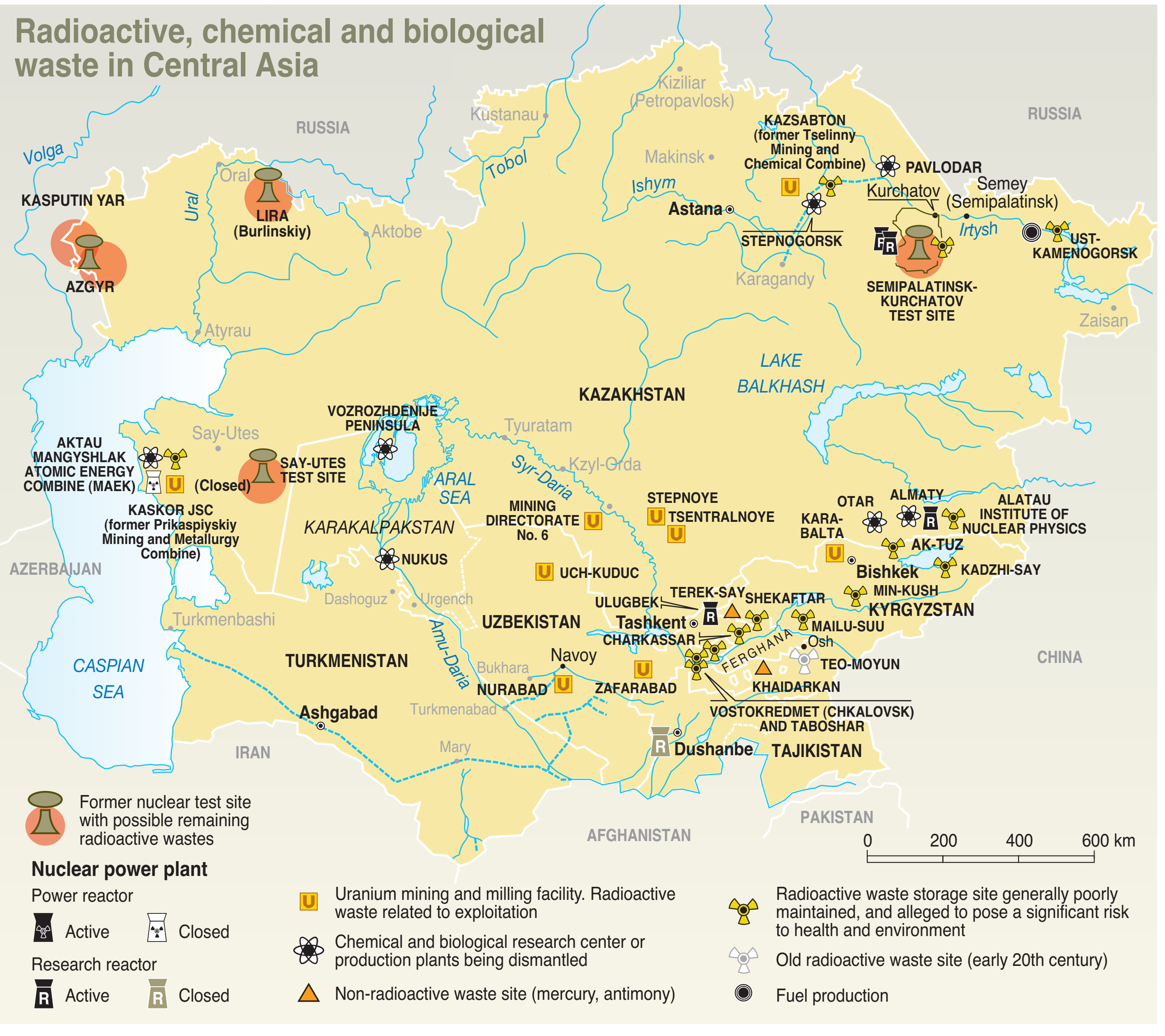
Finding a safer way

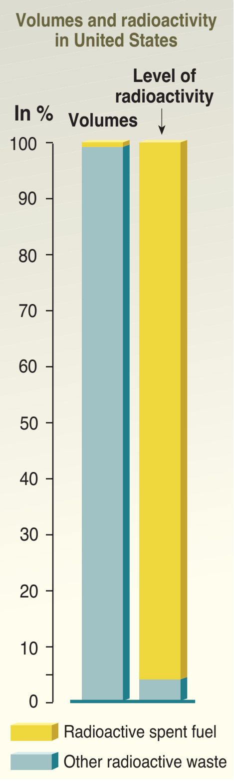
A number of international organisations like the Basel Convention, the International Maritime Organisation, and the International Labour Organisation are working to find a safer way to recycle old ships. Ship owners have agreed in principal to provide buyers with a gas free certificate and a list of hazardous materials and their location. Some western countries are investigating the possibility of establishing high tech, environmentally safe shipbreaking yards.

"Never without my Geiger counter!"

Thus jokes Oleg, the leader of an NGO in Central Asia when he plans field trips through the region. In fact, this is almost not a joke considering that the area is home to many radioactive dumps. This specific type of waste, inherited from the Soviet era, poses serious management problem, recognized both by governments and international organizations. For example, around the Fergana Valley, in a region prone to landslides, radioactive tailing ponds have the potential to flow into rivers and contaminate the drinking water of millions of people. Radioactive waste exits in many other areas – dumped in the Barents Sea, or simply abandoned in forests and fields all over the territory of Georgia.

What is radioactive waste?
Radioactive waste is any material that contains a concentration of radionuclides greater than those deemed safe by national authorities, and for which no use is foreseen. Because of the wide variety of nuclear applications, the amounts, types and even physical forms of radioactive waste vary considerably – some waste remain radioactive for hundreds or thousands of years, while others may require storage for only a short period, while they decay, prior to conventional disposal. (International Atomic Energy Agency).



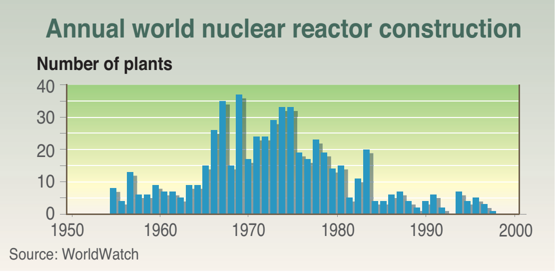


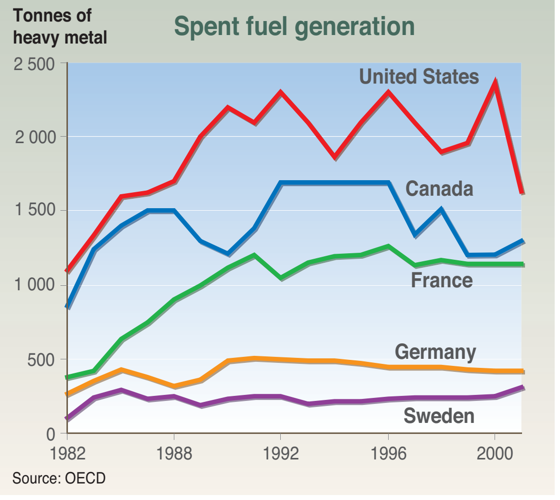
Types of Radioactive Waste

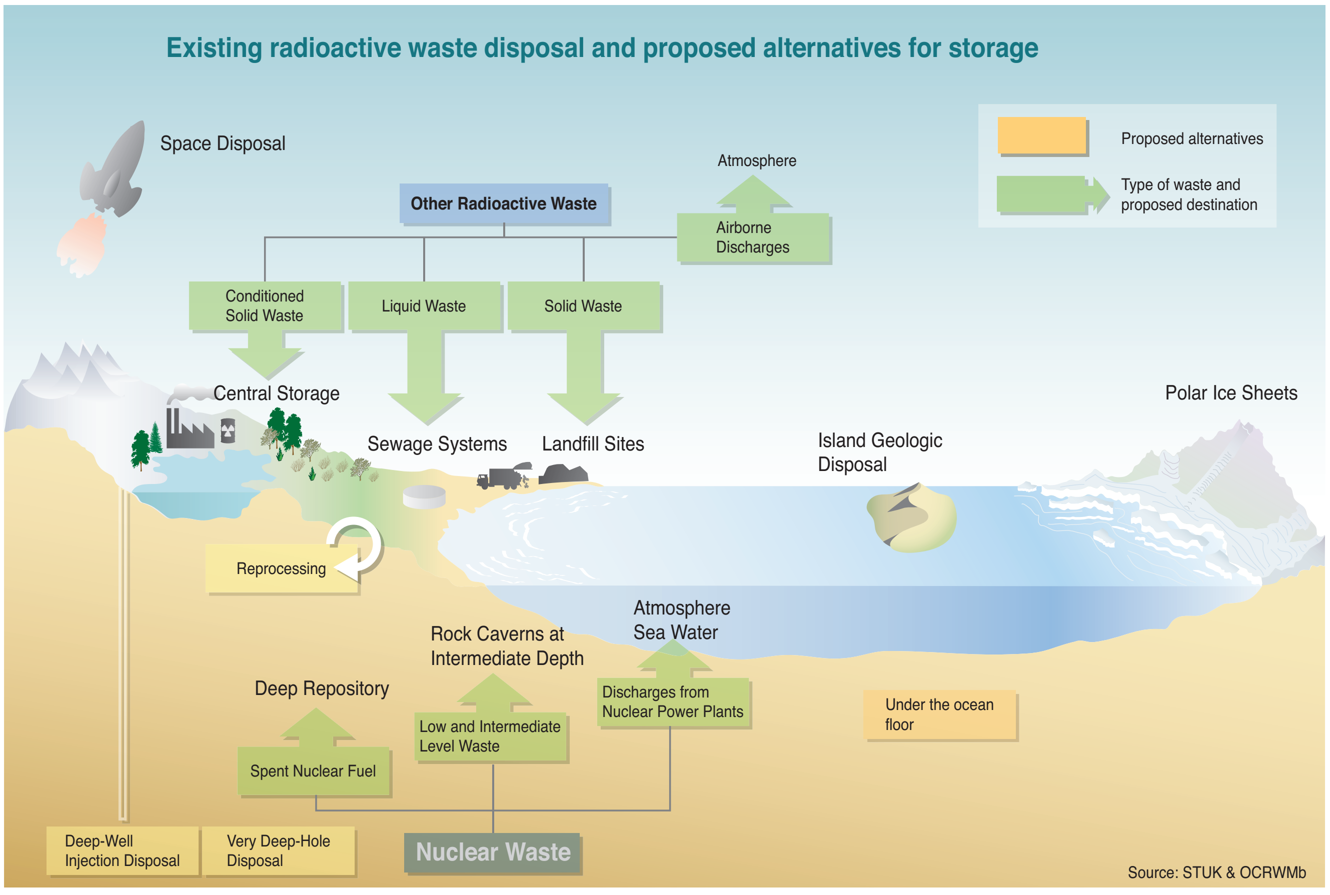
High-level waste includes the spent fuel from nuclear power generation, or the residual waste from reprocessing the spent fuel. The military also produce high-level waste.

Low and intermediate level waste includes items that have come into contact with some radiation. This may be at nuclear power plants, hospitals, dentists, research laboratories and other commercial operations.

Both the volume and the level of radioactivity have to be considered – a large volume of waste with a low-level of radioactivity presents less danger than a smaller amount of waste with a high-level of radioactivity. For example, spent fuel (elements that have been removed from a reactor after use) makes up less than 1% of the volume of radioactive waste, but contains almost 95% of the total radioactivity. (Office of Civilian Radioactive Waste Management).







Source of radioactivity

1. Produced during all phases of nuclear energy production (nuclear fuel cycle)
2. Defence activities
3. Hospitals, universities, and research laboratories
4. Industry
5. Mining and milling uranium ore

gas emissions from waste disposal

The disposal and treatment of waste can produce emissions of several greenhouse gases (GHGs), which contribute to global climate change. The most significant GHG gas produced from waste is methane. It is released during the breakdown of organic matter in landfills. Other forms of waste disposal also produce GHGs but these are mainly in the form of carbon dioxide (a less powerful GHG). Even the recycling of waste produces some emissions (although these are offset by the reduction in fossil fuels that would be required to obtain new raw materials). Waste prevention and recycling help address global climate change by decreasing the amount of greenhouse gas emissions and saving energy. (Environmental Protection Agency).

GHG emissions and waste management

Composting (an option for organic materials such as food scraps, yard waste and agricultural waste). Composting is the natural biological breakdown of organic material. During the process of aerobic composting (in the presence of oxygen), microorganisms consume the organic matter and release heat and carbon dioxide (CO^2). However, most of the carbon contained in the organic matter is retained in the compost and therefore not released into the atmosphere. Composting is a waste management system that creates a recycled product that can be used in place of inorganic fertilizer. The net GHG emission is reduced because the energy intensive fertilizer production and associated GHGs are reduced.

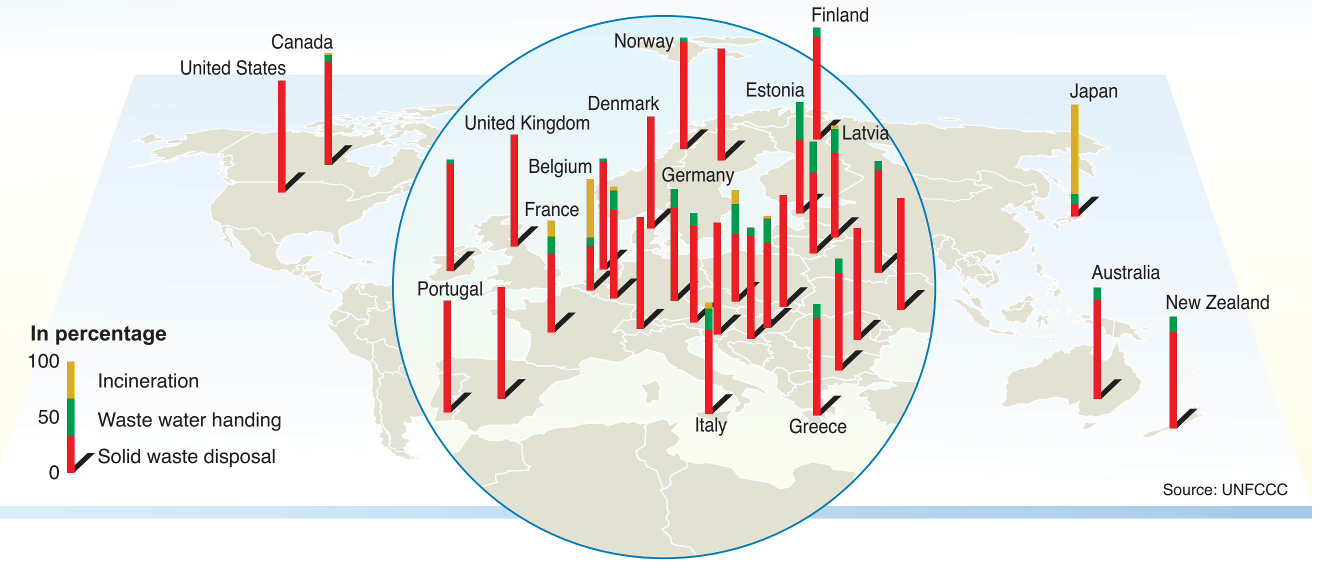
Combustion releases both carbon dioxide and nitrous oxide (around 300 time more potent a GHG than carbon dioxide, but making up only a small percentage of the total emissions). Energy released during combustion can be harnessed and used to power other processes, which results in an offset of GHG emissions from a reduction fossil fuel use. In addition combustion diverts waste from landfill, reducing the amount of methane produced. However burning garbage also produces waste in the form of ash. Most of this ash is sent to landfill but some is used to make products like building materials and road base.

Contribution of various waste management systems to greenhouse gas emissions, 2002

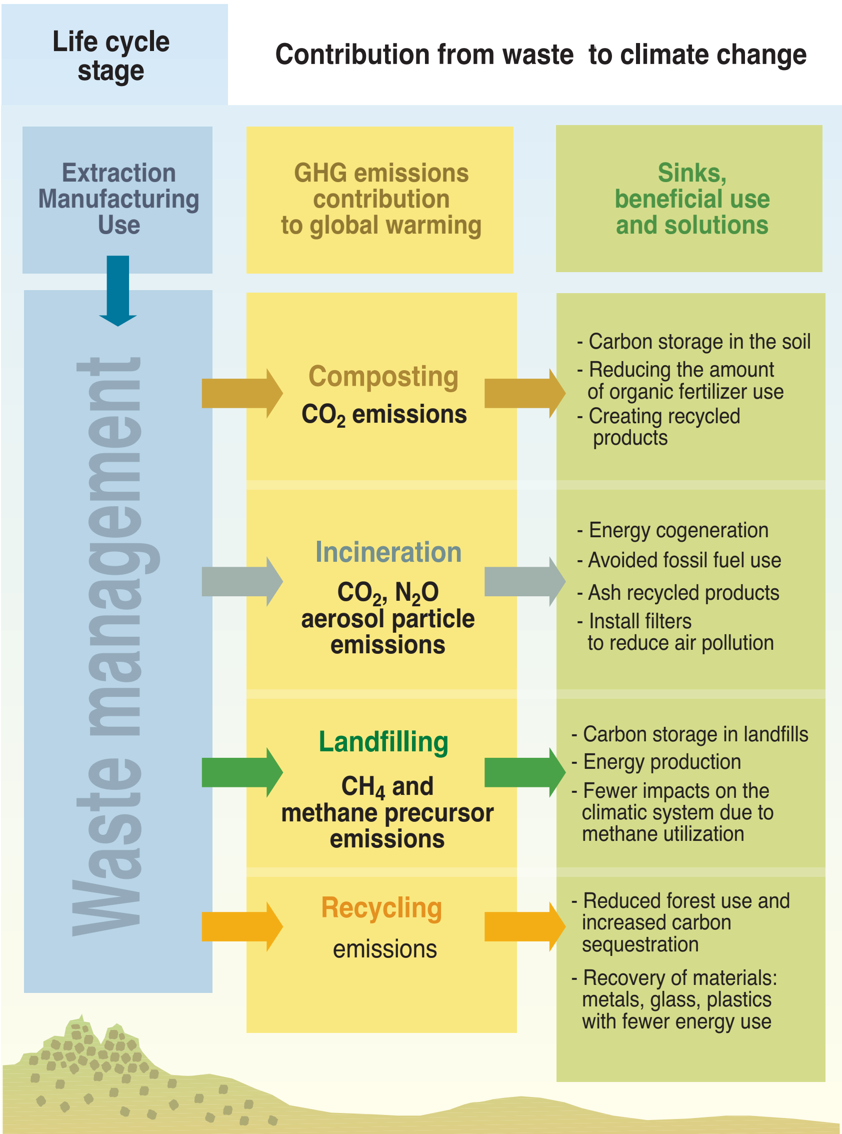
In developed countries, the contribution of waste sector to total greenhouse gas emissions varies between 1% and 8%

Regional GHG emissions from waste in 2002:

- North America - over 200 million tonnes
- European Community - over 100 million tonnes
- Japan, Australia and New Zealand - over 50 million tonnes

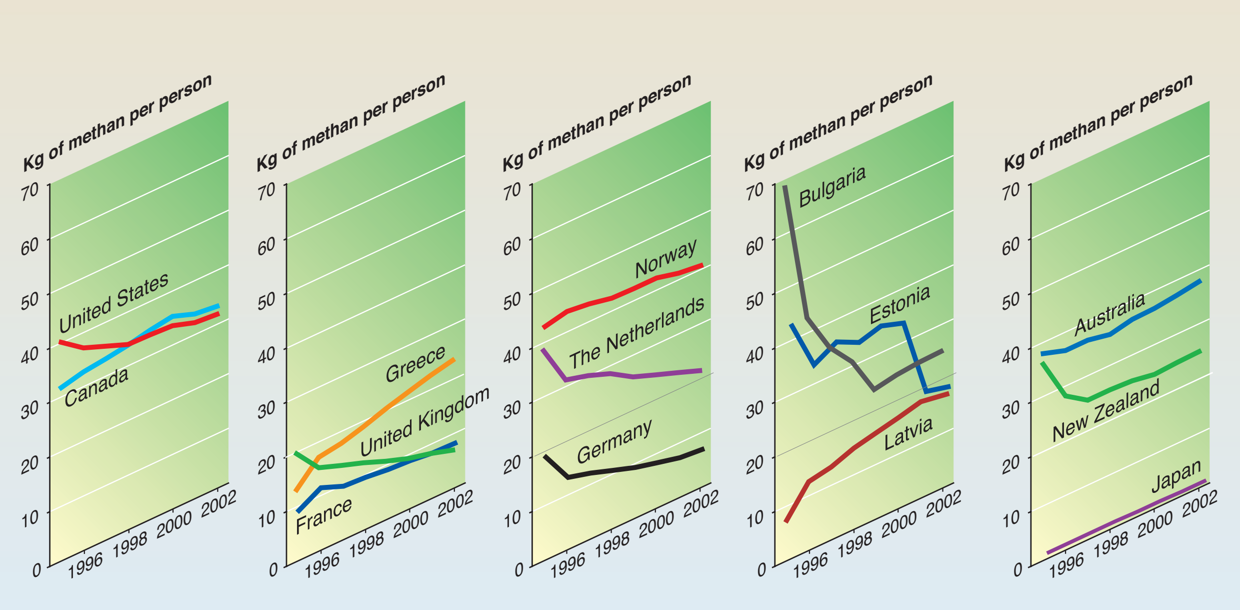


Source: UNFCCC



Landfilling is the most common waste management practice, and results in the release of methane from the anaerobic decomposition of organic materials. Methane is around 20 times more potent as a GHG than carbon dioxide. If the disposal of organic matter were decreased (for example by composting or combustion) it would be possible to reduce the amount of methane emissions. However, landfill methane is also a source of energy, and some landfills capture and use it for energy. In addition, many materials in landfills do not decompose fully, and the carbon that remains is sequestered in the landfill and not released into the atmosphere.

Emissions due to solid waste disposal on land



Source: UNFCCC

the alchemy of waste, turning trash into gold

A continuing rise in the rate of waste production is no longer acceptable – hazardous waste affects the health of millions of people and poisons large areas of our planet. In many places people live surrounded by garbage and landfills. It is essential that governments and corporations face up to waste, using what we know about reduction, recycling and reuse, but also developing new technologies that eliminate waste.

To sign or not to sign

There are four major international treaties that deal with toxic material. The first of these, the Basel Convention was adopted in 1989 to regulate the transboundary movements of hazardous and other wastes. An amendment was adopted in 1995 (the Basel Ban Amendment) to ban the export of hazardous waste from OECD countries and Liechtenstein to non-OECD countries; the 1996 London Convention Protocol, which prevents most forms of ocean dumping; and the Stockholm Convention, designed to phase out the production of persistent organic pollutants (POPs). Some countries have signed and implemented all four treaties, some countries are yet to sign any.

Waste not, want not

A number of international and national regulations now state that producers have to be held accountable for the amount and toxicity of the waste they produce. However, even though this principle of "polluter-pays" started a few decades ago, the price of many products, like computers, still does not include the full cost of recycling and disposal. As an alternative, some businesses and governments (mostly in developed countries) are moving to "clean production" and eco-design principles. These include the intelligent use of raw materials and steering production towards the use of durable non-toxic components that are easy to reuse, remanufacture, or recycle.

Zero waste initiatives are also gathering speed. The idea of zero waste is based on the belief that all discarded materials have resource potential (and hence they are not really waste). This approach looks for alternatives to incineration and landfills. Some countries, like New Zealand, are promoting zero waste in their economic development agenda – building on their image as an exporter of clean green products. (zero waste, NZ).

Smart waste

High tech research in the world of waste is looking for ways to clean up the mess. Enzyme producing bacteria can convert toxic products like oils and pesticides into carbon dioxide and other byproducts. And bacteria may one day be harnessed to deal with non-organic waste like heavy metals. Scientists have discovered unusual bacteria that live deep in the earth. They use chemicals in the rocks to produce energy, in the process concentrating heavy metals. Biotechnology applications include the remediation of contaminated sediments and the development of innovative mining techniques. (Ocean Drilling Program, Commonwealth Scientific and Industrial Research Organisation).

Science is also focused on finding ways to minimize waste by turning it into products. The plastic bag made from animal excrement or food waste is a reality (Environmental Biotechnology Cooperative Research Centre), along with bricks, insulation, carpet, shoes, clothes and a whole range of other products, all made from some sort of waste. Another strategy is to develop ways to replace products made from non-renewable and non-recyclable materials in order to eliminate waste. Potential products made from renewable resources include the soybean car, in which the petroleum-based plastics are replaced with a durable soybean composite, or the chicken feather microchip which utilizes chicken feathers and plant oils in place of silicon (University of Delaware-ACRES).

Beyond waste

Waste is a crisis of our own doing, (the result of a collision between rising living standards and insufficiently regulated capitalism). It is becoming more and more difficult to just run faster, catch up and solve the problem. There are just too many of us, producing too much waste. Long-term, viable solutions require action at every level – personal, corporate and government. It must start with acceptance of responsibility for waste, whether we are consumers or manufacturers. Once this happens the next step is anticipation. The eventual fate of every product must be anticipated at the outset, costed, and this cost built into the production process and/or the life of the product. Finally it requires a co-ordinated series of legislative measures, research funding and public education, and the development of public-private partnerships that can bring additional technical and financial resources and innovative solutions to the 21st century challenges.

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