GSA Office of Governmentwide Policy

section 3

APPENDIX

The New Sustainable Frontier

PRINCIPLES OF SUSTAINABLE DEVELOPMENT

September 2009

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the state of the world

Where are we Now?

As a nation, our environment today is visibly cleaner than it was forty years ago. Water, air, land, and chemical pollution are being monitored and steps taken for their reduction and control. But the major problems that remain suggest that existing practices are not sustainable for the long-run. Our policies and tools, while ameliorating the situation, still require considerable improvement. In 1998, biologist Paul R. Ehrlich wrote:

> *"The last decade has also seen an accelerating loss of populations and species of other organisms that are involved in supplying crucial natural services to society, as natural areas are more and more displaced by human activities. Thus tropical forest destruction continues throughout most of the developing world. Destruction of oceanic fisheries has come to wide public attention in the same period, as stock after stock is overfished, and often the physical/biological infrastructure that supports the fisheries is destroyed. There are also growing signs that the toxification of the planet is causing serious effects on wildlife and human health through the release of hormone-mimicking synthetic organic chemicals, although demonstrating the causal links is difficult. And ecosystem services that are essential for maintaining agricultural production, such as pollination, are faltering in many areas."*[2]

And in 2008, James P. Leape, Director-General, WWF International, noted the lack of progress:

> *"… over the past 35 years alone the Earth's wildlife populations have declined by a third.*
>
> *"Yet our demands continue to escalate, driven by the relentless growth in human population and in individual consumption. Our global footprint now exceeds the world's capacity to regenerate by about 30 per cent. If our demands on the planet continue at the same rate, by the mid-2030s we will need the equivalent of two planets to maintain our lifestyles."*[2]

Climate Change

> *"The Industrial Revolution had profound impacts on the economy, society, and the global ecosystems. For the first time, human society became largely dependent on fossil fuels and other nonrenewable resources (particularly in response to the depletion of forests as fuel). Fossil fuels freed us from dependence on the fixed flow of energy from the sun, but it also allowed the replacement of both human and animal labor by chemical energy…New technologies and vast amounts of fossil energy allowed unprecedented production of consumer goods…The market economy evolved as an extremely efficient way of allocating such goods, and stimulating the production of even more.*[3]
>
> *"Used fuel does not disappear; it must return to the ecosystem as waste. Acid rain, global warming, carbon monoxide, heat pollution, and oil spills are unavoidably associated with the use of fossil fuels. On a small scale; some of these wastes could be readily processed by natural systems, but on the current scale. They pose serious threats. Indeed, the growing accumulation of waste products from fossil fuel use and the negative impacts these have on planetary ecosystems is probably a far more imminent threat to human welfare than depletion; the sink will be full before the source is empty."*[4]
>
> *Joshua Farley, Herman E. Daly*

According to the Intergovernmental Panel on Climate Change (IPCC), the global average temperature is expected to increase by about 0.2°C per decade over the next two decades.[5] Continuing greenhouse gas emissions at or above current rates would cause a further increase in global temperatures and many other climatic changes during the 21st century. We are seeing this through observations such as increasing air and ocean temperatures, widespread melting of snow and ice, rising sea levels, as well as more intense and frequent extreme weather events such as heat waves, floods and ice storms.

The IPCC points out that those who will be most affected are the poor people who are least responsible for increasing levels of greenhouse gas emissions in the atmosphere. Global warming is predicted to decrease agricultural yields in the low-latitudes and increase agricultural yields in the high latitudes, but yields will then decrease with higher global temperatures. Water availability in the moist tropics and in the high latitudes will increase, but will drop in the semi-arid low latitudes. And, a 2°C rise from today's temperatures will cause the extinction of 30% of species, and additional warming will lead to widespread coral deaths.

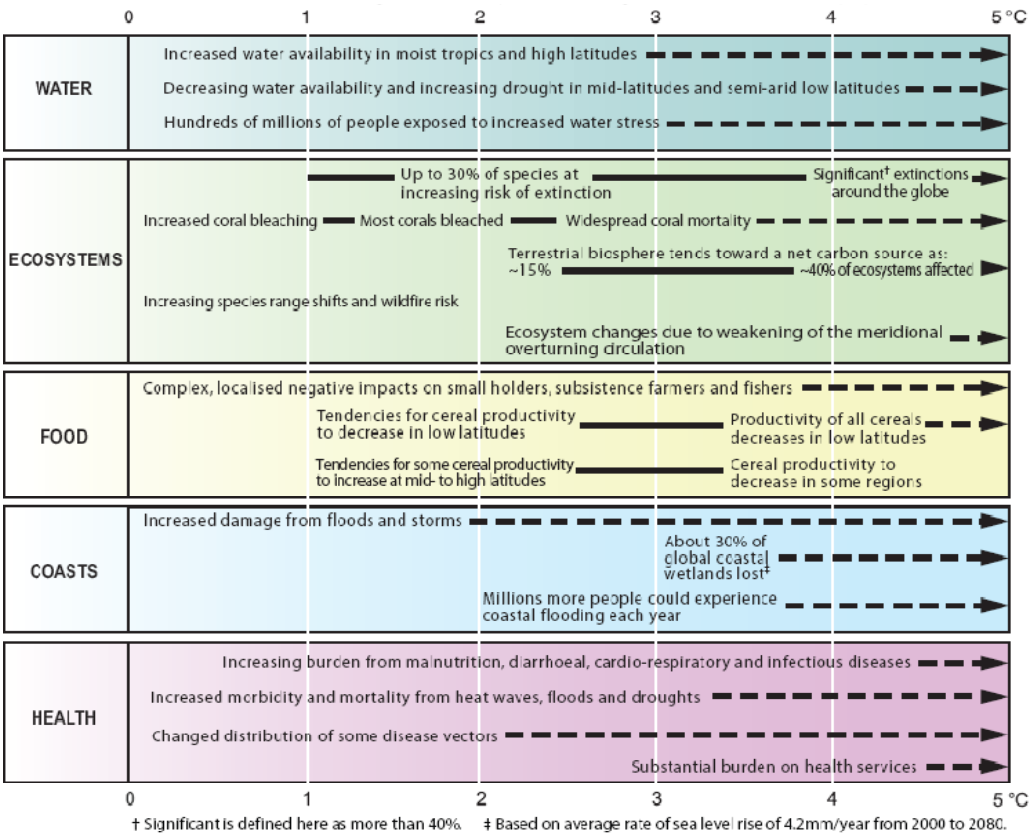
IPCC Climate Change 2007 Synthesis Report[6]

Global greenhouse gas (GHG) emissions due to human activities have increased markedly because of human activities since 1750. Global atmospheric concentrations of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), as determined from ice cores spanning many thousands of years, now far exceed pre-industrial values.

- Global GHG emissions due to human activities increased by 70% between and 2004
- CO2 (the most important anthropogenic GHG) emissions increased 80% between 1970 and 2004
- The long-term trend of declining CO2 emissions reversed after 2000
- Atmospheric concentrations of CO2 (379 ppm) and CH4 (1774 ppb) in 2005 exceed by far the natural range over the last 650,000 years

Global increases in CO2 concentrations are due primarily to fossil fuel use, with land-use change providing another significant but smaller contribution. It is very likely that the observed increase in CH4 concentration is predominantly due to agriculture and fossil fuel use. CH4 growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. The increase in N2O concentration is primarily due to agriculture.

GLOBAL AVERAGE ANNUAL TEMPERATURE CHANGE RELATIVE TO 1980-1999 (°C)[7]



† Significant is defined here as more than 40%. ‡ Based on average rate of sea level rise of 4.2mm/year from 2000 to 2080.

Fossil Fuel Use

Reducing use of carbon-based fossil fuel directly reduces greenhouse gas emissions, but more is needed than just reducing their use in transportation, heating and electrical power.

Many of the things we take for granted today are based on fossil fuel consuming processes. Most commercial food production pesticides are oil- based, and all commercial fertilizers are ammonia-based - made from natural gas. Oil powers machinery, food storage and transport systems. As oil production went up, so did food production. As food production went up, so did the population - from 1 billion at the middle of the 19th century to 6.3 billion at the turn of the 21st. As the population went up, the demand for food went up, which increased the demand for oil.

> *"After cars, the food system uses more fossil fuel than any other sector of the economy — 19 percent. And while the experts disagree about the exact amount, the way we feed ourselves contributes more greenhouse gases to the atmosphere than anything else we do — as much as 37 percent, according to one study. Whenever farmers clear land for crops and till the soil, large quantities of carbon are released into the air. But the 20th-century industrialization of agriculture has increased the amount*

of greenhouse gases emitted by the food system by an order of magnitude; chemical fertilizers (made from natural gas), pesticides (made from petroleum), farm machinery, modern food processing and packaging and transportation have together transformed a system that in 1940 produced 2.3 calories of food energy for every calorie of fossil-fuel energy it used into one that now takes 10 calories of fossil-fuel energy to produce a single calorie of modern supermarket food. Put another way, when we eat from the industrial-food system, we are eating oil and spewing greenhouse gases."[8]

Michael Pollan
University of California, Berkeley,

Oil is also largely responsible for the advances in medicine that have been made in the last 150 years, including the mass production of pharmaceuticals; and development of health care infrastructure, such as hospitals, ambulances, and roads.

There is little debate that the world is warming. According to the IPCC, the global average temperature is expected to increase around 0.2°C per decade over the next two decades. Despite these continued warming trends, there is little consensus into whom and how the climate issue should be addressed. While most governments are realizing that something must be done to protect the environment and its global communities, action is typically short-term and constrained within the typical economic approaches that have locked countries into the current climate quandary at present.

If countries continue to manufacture greenhouse gas emissions at or above the current rates, they will cause further increase in global temperatures and other climatic changes. The IPCC has highlighted overwhelming evidence of repercussions from rising temperatures through observations such as increasing air and ocean temperatures, widespread melting of snow and ice, and rising sea levels. Arctic sea ice cover continues to shrink and thin while death and disease rise through increased natural disasters, such as heat waves, floods and droughts. It is expected that those who will be most affected by the impact of climate change are the poor and developing nations, predominantly within tropical/subtropical countries, who are the least responsible for the current levels of greenhouse gas emissions in the atmosphere.

Toxification

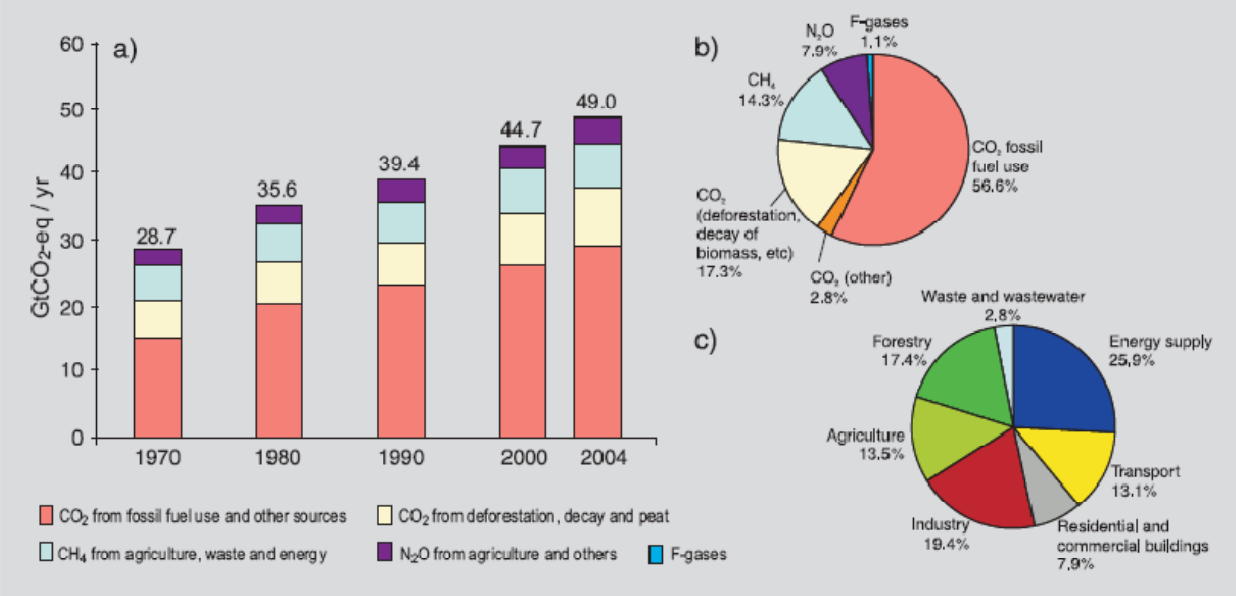
Preventing exposure to persistent, dangerous substances is at the core of sustainability. The reason is simple: toxics can cause severe illness, poisoning, birth defects, disease, or death.

> *"… so much of what comes into our factories, into our homes, into our offices, is replete with materials that never, ever should have been taken from the earth's crust. It took nature 3.8 billion years to put some of it there. In its presence, we never would have evolved into Homo sapiens, but now we're bringing that very stuff right into our living rooms, so to speak. It's very much suicidal."*[9]
>
> *Ray Anderson, Interface*

Human-made chemicals are in the air we breathe, the food we eat and the water we drink. Each one of us carries at least 250 chemical contaminants. Many artificial chemicals evade metabolic degradation and accumulate in our tissues, particularly body fat.[10] Polychlorinated biphenyls (PCBs), mercury and dioxins are in the blood and breast milk of Inuit mothers in the Canadian north. In the 1940s American farmers used about 22 thousand metric tonnes of insecticides. Now more than 450 thousand metric tonnes are used each year.[11]

As much as 80% of the pollution load in coastal waters and the deep oceans originates from land-based activities. This includes municipal, industrial and agricultural wastes and run-off, as well as the atmospheric deposition of pollutants from power generation, heavy industry, automobiles, etc.

GLOBAL ANTHROPOGENIC GHG EMISSIONS



(a) Global annual emissions of anthropogenic GHGs from 1970 to 2004. (b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of carbon dioxide equivalents. (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of carbon dioxide equivalents.

The pollutants include heavy metals and Persistent Organic Pollutants (POPs), litter, nuclear waste, hydrocarbons and chemicals. These contaminants, as well as changes to naturally occurring loads of nutrients and sediments affect the most productive areas of the marine environment, including estuaries and near-shore coastal waters.[12] The oceans contain more than 200 "dead" zones -- the largest, in the Gulf of Mexico, is the size of New Jersey -- caused by fertilizers and other pollutants being washed out to sea by rivers.

Toxic chemicals are widely used in manufacturing, suggesting that we must avoid strategies that simply shift hazardous materials from one place to another, rather than eliminating them. The choices we make in specifying products and services that generate toxics at any point in their lifecycle have equity consequences.

In the past 25 years, childhood cancers have increased another 25 per cent. There has also been a 400 percent increase in child asthma, behavioral problems and other childhood diseases. In North America, more than 100,000 chemicals are in use with 1,000 new synthetic compounds introduced each year, about 700 biologically active compounds are used to make some 50,000 pesticide products. Lester Brown of the Earth Policy Institute, believes that we are in a new world. He writes:

> *"Nature has many thresholds that we discover only when it is too late. In our fast-forward world, we learn that we have crossed them only after the fact, leaving little time to adjust. For example, when we exceed the sustainable catch of a fishery, the stocks begin to shrink. Once this threshold is crossed, we have a limited time in which to back off and lighten the catch. If we fail to meet this deadline, breeding populations shrink to where the fishery is no longer viable, and it collapses… the world is in what ecologists call an "overshoot-and-collapse" mode. Demand has exceeded the sustainable yield of natural systems at the local level countless times in the past. Now, for the first time, it is doing so at the global level."*[13]

And sustaining a healthy quality of life is vital, as well. Everyone should be safe making and using products the products we specify at every stage of their life-cycle. Wherever possible, less environmentally harmful substitutes and processes should be used. And, to the extent that no reasonable substitutes can be found, toxics should be subject to strict, plant-wide monitoring under closed-loop control, including sensor fault detection, loop performance monitoring and disturbance detection.

"… so much of what comes into our factories, into our homes, into our offices, is replete with materials that never, ever should have been taken from the earth's crust. It took nature 3.8 billion years to put some of it there. In its presence, we never would have evolved into homo sapiens, but now we're bringing that very stuff right into our living rooms, so to speak. It's very much suicidal."

Ray Anderson, Interface

U.S. EPA TOXICS RELEASE INVENTORY 2007 REPORT (TRI materials released or disposed of)

- 32% (1.31 billion pounds) as air emissions
- 23% (947 million pounds) in underground injection wells and landfills
- 19% (771 million pounds) in surface impoundments
- 15% (622 million pounds) as waste piles, spills or leaks, and
- 6% (246 million pounds) as surface water discharges

The largest sources are mining operations, followed by hazardous waste management facilities; primary metals facilities, chemical manufacturers, and electric utilities. Federal facilities accounted for 2.32% (95 million pounds) of disposal or other releases and 257 million pounds of total production-related waste managed.

Persistent Bioaccumulative Toxic (PBT) Chemicals and Carcinogens

PBT chemicals remain in the environment for long periods, are not readily destroyed (they persist), and accumulate in body tissues (they are bioaccumulative). In 2007, 506 million pounds of PBT chemicals were disposed of or otherwise released, including lead and lead compounds, mercury and mercury compounds, polychlorinated biphenyls (PCBs), and dioxin and dioxin-like compounds. Of the 179 known or suspected carcinogens on the TRI list, 835 million pounds were disposed of or released; including lead and lead compounds, arsenic and arsenic compounds, chromium compounds, and styrene.

According to the U.S. EPA Toxics Release Inventory, which tracks their releases and transfers, almost 4.1 billion pounds of certain toxic chemicals were disposed of or otherwise released in 2007.[14] The material released or disposed of in 2007 came to almost 4.1 billion pounds. More than 20 billion pounds, about five times as much material, was recycled, treated to render it nontoxic or burned for energy, the agency said.[15]

Executive Order (EO) 13148, "Greening the Government through Leadership in Environmental Management" (April 2000), directed the Environmental Protection Agency (EPA) to develop a list of priority chemicals used by the federal Government "that may result in significant harm to human health or the environment and that have known, readily available, less harmful substitutes." In developing the list, the EPA considered toxicity, persistence, and bioaccumulation, availability of less environmentally harmful substitutes and processes, relative costs of alternatives, and the potential risk from chemicals used by federal agencies. The EO directed federal agencies to reduce the usage of these chemicals by 50% by December 31, 2006.

The first five chemicals to be identified are cadmium, lead, polychlorinated biphenyls (PCBs), mercury, and naphthalene. The Office of the Federal Environmental Executive (OFEE) notes that there are known alternatives to the five priority chemicals or products containing them. For example, electronic thermostats can be used in place of mercury-bearing switches. Solders containing copper or silver can substitute for solder containing lead, and, integrated pest management can be used in place of naphthalene.

Endnotes

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