PERSPECTIVES ON RISKS IN SOCIETY

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Keywords

Risks, perspective on risks, ranking risks, mortality statistics, the good old days, cost-benefit evaluation, environmental regulations, loss of life expectancy, causes of death.

Contents

Glossary

AIDS	Acquired Immuno-Deficiency Syndrome
BRC	Below Regulatory Concern: - below some defined level of risk.
BSE	Bovine Spongiform Encephalopathy- supposed cause of CJD in humans
CDC	Centers for Disease Control and Prevention.
CJD	Creutzfeldt-Jakob Disease (see BSE)
EMF	Electric and Magnetic Fields.
'Gras'	Generally regarded as (acceptably) safe.
LLE	Loss of Life Expectancy; a measure of social - rather than individual - harm.
MSDS	Material Safety Data Sheets.
SARS	Severe Acute Respiratory Syndrome (2003 occurrence).
WHMIS	Workplace Hazardous Material Information Sheets.

Summary

This article examines how society evaluates and addresses risks. Unfortunately, society mostly views risks from an emotional point of view, and rarely gets the ranking correct. As a result, trivial or non-existent risks become elevated out of all relation to their actual harm, and social spending - outside the obviously beneficial, yet politically sensitive activities of funding health, education and welfare - is often misdirected into areas of political or environmental interest. This also tends to be where there is the greatest

emotional misinformation (e.g. GM foods, Kyoto protocol), and the loudest clamor for action, yet the least risk to anyone in society or even to the environment.

Society needs to rationally re-consider how it spends its limited wealth and how it addresses risks. It must have the ability to be able to objectively and scientifically rank all of its defined risks. Societal spending should be targeted towards the top of the ranking, be justified in terms of cost-benefit determinations, and be in proportion to the expected benefit from addressing the defined risk.

1. Introduction

Risks are those circumstances that are forever intruding into the smooth and otherwise uneventful passage of life and try to cut short the thread of our existence. There are millions of risks and combinations of risks stemming from how we live, and what we choose to do, and what we choose not to do. They are more likely to lead to premature death in the undeveloped and poor countries, where life expectancy is still often only about 40 years, than in the developed and wealthy countries of the world where life expectancy is now at least 75 years.

Many risks are outside of our immediate control and they occur no matter what we choose to do, or not do. They occur from the moment of conception to the moment of death whenever that may be; whether from a few moments after conception, up to about 120 years later. It is not possible to achieve zero risk in society or we could live indefinitely. Despite what many people seem to believe is possible, absolute safety is neither possible nor achievable. And it is certainly not affordable.

Risks cannot, for the most part, be avoided, but some can, just by changing our habits and lifestyles. A few risks can be reduced by careful planning and doing things differently, and we generally strive to replace the most onerous risks with lesser ones. However, we sometimes tolerate very great risks in order to progress. For example in medicine, many medical advances, like the first heart transplants, were widely publicized failures, with the patient soon dying. There was a resulting clamor from even many medical doctors and ethicists to stop them altogether, as being too risky. This would have been demanded by the Precautionary Principle had it been in vogue at that time. Slavish application of the Precautionary Principle would also have proscribed all early vaccine uses such as those for smallpox and polio; the development of electricity in the home; the automobile; the steam engine and trains; all mining activity; and thousands of other relatively 'unsafe' developments that were essential for progress.

The risks that most interest us are those which affect us directly, though we are often sidetracked into considering indirect risks that may or may not adversely affect us at all and may not even exist in the way that is suggested. For example, those that are said to be associated with emotionally-charged environmental issues such as Ozone layer depletion, and Global Climate Change. Risks, despite the beliefs and efforts of much of the relatively ill-informed, and scientifically naïve media, are not defined by publicity; by strident allegations; by consensus or the loudest and most strident voices; nor by the opinion of the majority, but by verifiable facts, and by following the scientific method.

There are those who believe that poorly defined, and alleged environmental risks should have a greater priority than actual human and social risks. They do not seem to be aware that this is putting the cart before the horse. Only advanced and prosperous societies can afford to protect the environment - where it may need protecting - using knowledge, wealth and technology, as is happening today. Many poor and backward societies cannot afford to address even severe social issues such as clean water, adequate sewage treatment, or social medicine, and certainly cannot afford to address any environmental

issue in their fight just to survive. Therefore, we must protect social health, people, and the wealth base first, while developing technology, and making progress as rapidly as possible. Then, and only then, can we successfully identify and afford to address other issues, which might then be expanded to include the state of the environment.

2. Perspectives on Risks

Contrary to the usual mindset of far too many people, in which the dangers in society are assumed to be related to technological development, high, life-threatening and life-shortening risks are actually directly related to **lack** of technological development; to poverty and ignorance; unemployment; a low quality of life; and lack of scientific, medical and social development, as well as inadequate energy usage. Any society that seeks to advance, must recognize that it needs to meet its educational, scientific, technological, industrial, medical, and energy needs first, in order to provide the necessary wealth and skills to address all significant social problems, and to improve the quality of life.

Briefly referred to above, but often studiously ignored or widely unappreciated, though underlying all of them without exception, is our wise, efficient, and non-wasteful use of energy. The more energy we use effectively and efficiently, the faster we progress; the more wealthy and progressive we become; the safer is our society; and the less is the environmental destruction by our lifestyles. Unfortunately, the reverse of this is what the public can be persuaded to believe is more true.

Increasing energy use, rather than reducing it in the wrong way, is thus at the base of any effort to protect and improve the environment, and to reduce social risks, whatever they may be. Conversely, limiting our use of energy or making it unaffordable or unavailable, imposes many and massive risks upon all of society, but especially upon the poor, and imposes greater burdens upon the ability of the environment to support us.

2.1 Some Risk Basics

Risks are not a unique construction of modern society, as some people seem to believe. They have been with us since life began billions of years ago. They arise for all living things: humans, fish, plants etc., at the moment of conception, or however we begin life. They extend until individual life ends, when the risk that finally cuts our thread of life finishes us off, sometimes even before birth, sometimes in infancy, sometimes in old age. In primitive nature, such an end usually occurred in the jaws of a predator. It still does for many animals and plants.

The ancients used to believe that the course of one's life or fate was pre-ordained for each individual, no matter what course of action was taken, and that individuals were powerless to change it. They believed that such a course could be foretold by studying the planetary conjunctions and 'forces' at the exact moment of birth - Astrology. Such superstitions are still with us. The unfortunate reality is that risks throughout life are ever-present, many are unavoidable, but some are. However, death is inevitable. For each

birth there will be exactly one death. It has always been that way and we cannot change it. What we can influence, however, is **when** we die. And the older, the better.

2.1.1 The Realities of Risks

The most common causes of death, over which we have little influence, for different societies at different times are shown in Table 1. Only in modern times have we been able to significantly change the natural course of events.

Numerical data on early societies are mostly approximate, as there were obviously temporal variations, with little recorded information available, though some indications of age at death and probable cause of the death of those that were actually formally buried, can be gleaned from some early tribal burial sites.

Table 1. Very Approximate Demographic Data on Primitive and Modern Societies

	Primitive Man	Cohesive Tribal Societies of the past (America)	A Few Third World Societies Today	Circa 1650 Pre-industrial Society	Modern Advanced Society: defined data.
Average Life Expectancy	25 years	50 years	40 years	45 years	80 years
Maternal Mortality	5 to 10 percent	5 percent	5 to 10 percent	3 to 5 percent*	< 0.01 percent
Infant Mortality	50 percent	20 to 30 percent	50 percent	20 percent*	< 1 percent
Major Causes of Death	Violence, Starvation, Diseases, Natural events (Cold, floods, drought).	Diseases, Violence, Starvation, Natural weather events.	Diseases, Violence (including war), Starvation, Natural events (Floods, drought).	Diseases, Starvation, Violence (including war).	Heart Disease, Cancer, Stroke.

* An approximate average. Where surgeons were present at the birth, rather than midwives, especially in hospitals, the mortality rate was much higher for both mothers (puerperal fever) and infants because of the bacteria and filth the doctors carried from pathology to delivery, and without changing or washing.

Conditions in some parts of the third world show the stark effects of brutal poverty and ignorance, as well as the effects of weather and tyrants.

Historically, the greatest premature killers in society, at various times, have been numerous diseases, war, and famine, with each contributing to the others. The most devastating of the early disease epidemics which traveled through the earliest trading settlements and subsequently through the cities of Europe was the 'Plague' (black death). In the interval of AD 500 to 650, the plague prematurely killed about 100 million people. In the period between 1347 and 1351 it killed about 75 million in Europe - halving the population and killing entire communities - and probably many more millions in Asia. The great influenza pandemic (Spanish Flu) of 1918 to 1919 killed between 20 million and 50 million people, including about 675 000 in the U.S., and about 50 000 in Canada,

when returning soldiers brought it back from Europe. Earlier epidemics of the flu, are not readily defined, but probably existed.

Today (2004), in southern Africa, about 40 million people eat only one meal a day, and 14 million are starving, with millions dying of AIDS. Preventable health conditions kill about 40 000 children each day. They, and their parents suffer from conditions and diseases that should not exist today: - malaria, yellow fever, sleeping sickness, dengue fever, measles, gastroenteritis, internal parasites, and respiratory ailments caused by smoke from indoor cooking fires using mostly animal dung.

Throughout the world, 500 000 women die each year in childbirth (99 percent in the third world); 500 000 African children die each year from malaria. Total cases of malaria worldwide are about 270 million; of schistosomiasis - 200 million; of lymphatic filariasis - 90 million; of Chagas disease - 16 to 18 million; of onchocerciasis - 17 million; of leishmaniasis - 12 million; of leprosy - 10 to 12 million; of African sleeping sickness - 25 000 new cases a year. Worldwide, about 250 million children suffer from preventable vitamin-A deficiency; about 500 000 of whom go blind as a result each year. Three million children die each year (8 000 per day) for lack of about 2 cent's worth of vitamin A for each of them. Iodine deficiency causes millions of cases of mental impairment in children each year, despite it being easily remedied.

Obviously, primitive and deprived societies did not, and do not enjoy the same advantages, benefits and comforts (lower risks) that we take for granted. At the same time we, in our pampered and prosperous society, perversely close our eyes and minds to the plight and real suffering of the third world that is so readily evident, and can be persuaded to believe that we have never been so ill-used, unhealthy or so unfortunate, or have faced such extreme risks as we presently face, and all as a result of progress and technology.

2.1.2 The Public Perception of Risks.

Mythology distracts us everywhere. For the great enemy of the truth is very often not the lie: deliberate, contrived and dishonest. But the myth: persistent, persuasive, unrealistic." -- John F. Kennedy.

We accept and largely ignore the tragic realities, and become hysterically concerned about ‘mythology’; imagined and alleged risks, and those that are deliberately manipulated to seem significant. We are also capable of elevating our fears into global proportions, a few of which are outlined below.

1. Almost 200 years ago Thomas Malthus said the world's population was destined to starve as we would never be able to grow enough food to feed ourselves at the predicted rate of growth. He was not familiar with, and did not allow for either farm mechanization or more efficient, large-scale farming methods, better, high-yield crops, refrigeration, or GM foods.

2. The prestigious Club of Rome opined in the 1970s, that oil would soon run out – certainly before the year 2000 - that other resources would be over-exploited and would disappear, and that the world would therefore enter a period of severe deprivation from which we would be unlikely to recover if we did not conserve resources and scale back on our ambitious expectations. They seemed not to know that resources do not run out, but are price sensitive. When one particular resource becomes too expensive, it is replaced by an alternative.
3. The modern day Paul Ehrlich, an entemologist, captured the catastrophist imagination in his popular best-sellers when he echoed Malthus, and said that the world population would expand until it crashed because of widespread famine, and there would be resulting world chaos. This was supposed to happen more than a decade or so ago, and yet we are even now, still better able to feed ourselves than ever before.
4. Global warming is the current global concern. We know that it is happening, just as it has for billions of years, but there is as little firm science or knowledge behind it as for the other predictions. It has currency with most politicians and some climate scientists, but not with many others. Global Climate Change is a natural event and has taken place throughout all of earth's history. Most of the fears associated with any such climate event (spread of diseases, rising sea levels, species extinctions) are certainly not scientifically supported at this time.

There are many similar phobias and fears. Most, if not all of them are devoid of definitive science and rely upon what has come to be called 'junk science', yet they capture our emotions to the exclusion of the many real and rational risks that we could address if we would re-adjust our focus. Many of these concerns arise from the over-use of the word 'if'. If ***this*** happens, then ***this*** (usually something catastrophic and never beneficial) might be the outcome. Such catastrophist speculation is understandable and part of our fearful emergence from the Dark Ages, but to base any course of socially draconian action, as is usually suggested, upon the feared – but unlikely - outcome is rarely, if ever, scientifically justified.

Obviously, there was and is, something seriously wrong - both scientifically and morally - with these catastrophist beliefs and extreme risk perceptions, and the costly and usually ineffective actions that are typically called for to counteract them. Where did they arise and how do they manage to survive in an intelligent society?

Unfortunately, though society overall may be intelligent, that fact does not mean that all of its individual beliefs and actions are motivated by intelligence. We are an emotional species, and emotions outweigh rationality most of the time, as the relatively ill-informed news media constantly demonstrates. When those emotions are manipulated by a desire to do social mischief, or are stubbornly re-enforced by blind politics without consideration of either actual cost or actual benefit – though such an essential comparison it is usually required by law - it is not surprising that we become confused about the issues, as well as harmed by the inappropriate responses we usually make.

3. Emotional Perceptions Of Risk

The whole aim of practical politics is to keep the populace alarmed - and hence clamorous to be led to safety - by menacing it with endless series of hobgoblins, all of them imaginary. H.L.Mencken.

Possibly never, in all of history, has there been such a concerted effort to deliberately and consciously confuse society and manipulate it with emotional misinformation about risks as there is today.

One of the most shocking examples concerned the misinformation provided to those in Zimbabwe recently, concerning food aid which included GM maize. As a result, millions were put at risk of starvation, being denied food which the environmentalist rumor mills suggested was actually toxic, when it wasn't. It was already being consumed, and had been for many years, by the North American public.
A further example concerned the cutback on the use of chlorine to disinfect the water supply of some cities in Peru, in response to the misinformation provided by Greenpeace, on the dangers of using chlorine in the water supply. A predictable outbreak of cholera killed many thousands of Peruvians before the problem was redressed, but it was certain that politicians and local municipalities were held responsible rather than Greenpeace. Such irresponsible and even criminal misinformation leading to needless deaths, becomes all the more damaging because today we live in the communication age where, as Mark Twain noted, 'a lie can race its way around the world, while the truth is tying its shoelace.' Fortunately, the same communication revolution also provides us with the ability to provide factual information, despite the censorious efforts of the media.

What is very frustrating to most scientists, is that various highly emotional allegations can be made by anyone, and widely publicized in a matter of hours or days, but the definitive science and epidemiology to define the allegations or demolish them – almost invariably the latter - may take years to complete with the scientific rigor demanded of scientists.

Social confusion about risks is often deliberately created by various Special Interest Factions who wish to achieve some aspect of social change without going through the usual processes of either educational qualification, scientific argument, presentation of facts, justification, elected representation, or of being accountable to the public for their views and actions when they turn out to be far more harmful than beneficial.

They do this by constant repetition of anything that they want the public to accept as truth; working in the certain knowledge that anything repeated often enough takes on a truth of its own in the media, even if it is entirely false, as was the aim of many wartime 'Ministries of Propaganda'. They magnify supposed human and 'environmental' risks by alleging health injuries that often do not exist (the ALAR issue – a harmless chemical sprayed on apple trees in the U.S. - is a good example).

Unfortunately, the reality is that emotions can be and are manipulated to play a very large role in public perceptions of risk, especially if the facts are hidden, unknown, or deliberately distorted.

A fairly obvious progression from emotionally-loaded and implied adverse health effects, to a suggested cause - for a particularly dangerous food item - is shown in Table 2.

Table 2. This Particular Food is Closely Correlated with Many Severe, and Highly Emotional Social Effects, Including Illness, Injury and Death, and Should Probably be Banned.

The headlines read: - Daucus will kill you. The Facts!

The damning evidence: -

- About 30 percent of all children born to mothers who have eaten daucus, will eventually develop cancer.
- Nearly all sick people have eaten this particular food (Daucus) before their sickness.
- An estimated 99.9 percent of all of those who die from cancer have eaten Daucus prior to their death.
- Another 99.9 percent of those involved in auto accidents ate Daucus in the 60 days before the accident.
- Some 93.1 percent of juvenile delinquents come from homes where Daucus is regularly served.
- There has been 100 percent mortality in all of those born in 1880, who ate Daucus.
- All of those born between 1900 and 1910, who ate Daucus, suffer from wrinkled skin, have lost most of their teeth, have brittle bones, and suffer from failing eyesight.

What more damning persuasive evidence would we need to stir up anyone's emotions to decisively ban this food?

All of the statements are also entirely true. It almost does not matter that they are also entirely irrelevant to the argument and are careful to avoid providing any clarity, or the needed perspective or detail that would show how dishonestly they are being used; a very common, emotionally-manipulative technique.

Daucus carota is the common carrot, but it could also have been anything, even water, coffee, any food item, sleeping, or air.

Taken from the Miner Institute, New York, with minor modifications and additions.

Although the emotional manipulation in the above example becomes obvious (and thus it loses its main impact) after a significant fact is presented - that we are talking about the common carrot with which almost everyone is familiar - it is not so obvious when we do not have the same detailed familiarity or knowledge about a subject. In that case, the statements are not as closely questioned as they should be, and the technique is very likely to work; our emotions will be aroused and we can be stirred to action based upon fear, the absence of relevant facts, and our own ignorance of the subject. A listing of a few of the many unfounded and unscientific, and widely reported health scares of 2004 as listed by ACSH includes: *Childhood vaccines cause autism; Farmed salmon causes cancer; Cell phones cause brain tumors; Nightlights cause leukemia; Chemicals in cosmetics pose a health hazard; Mercury in seafood threatens health; Cheeseburgers cause heart disease; Antibiotics cause breast cancer; Teflon causes health problems; Soda causes esophageal cancer.*

We forget, that 'freedom of the press', does not oblige them to report only accountable and informed sources; to be relevant; free of bias; to be factual; to tell the truth; or even to be minimally informed on any of the subjects that they write about. Mostly they strive

to do all of them unless they have an alternative agenda, as some clearly do, that over-rides their journalistic responsibility to the public, but a widely reported story, where emotions run high, is often too good to pass up, even if it means ignoring the pedestrian scientific facts that would otherwise kill the story.

4. The Health of Society.

We have never been healthier in society, nor believed ourselves and society to be in such ailing health. The actual environment in which we live is also much less polluted than it was during the industrial revolution, and is continually improving, though we can be persuaded that we are somehow destroying it, and ourselves along with it.

The actual health of an advancing society is shown by the increasing longevity and health of its people. These are both improved when the ills of that society are accurately identified, cataloged in a national or international database, and are addressed by modern medicine. At the end of life, the specific individual cause of death is documented and collated so that what is actually injuring us and killing all of us becomes clearly understood across all of society with some indication of its rate of incidence and of its associated death rate.

The intent of any advanced society is not only to accurately define such causes of injury and death, but to ensure that they are dealt with realistically (blaming evil spirits, and burning witches may have seemed reasonable at one time, but not today) and cost-effectively, so that death is progressively pushed off to as late in life as possible, no matter how we may subsequently die.

In the past, population statistics concerning cause or time of death were mostly non-existent, with relatively few exceptions. There was nothing anyone could do about it. Everyone - without consciously thinking about it - worked hard to survive and progress beyond their all-too-brief time. Life was short, nasty and brutish, as Hobbes noted, though some few people managed to get to our supposedly allotted span of three score years and ten and even beyond that. Until about 150 years ago, very few actually made it to even 65 years, as shown in Table 3.

Table 3. Life Expectancy In Society.

Year	Percent of the Population Surviving to Age 65 years
1600	3
1861	33
1931	60
1951	71
1982	80

Gradual social improvement and progress was achieved through observation, increasing knowledge, and improving technology. It was not achieved by superstitious response, misinformation, fear, obstruction, enacting draconian laws or regulations, or by standing still.

The developing sciences, technology, industry, and mechanization, were a source of great wonder, benefit and progress, while nonetheless terrifying a few who could not understand any of it, nor could see any immediate benefit if they were not directly employed.

Many at the time of the first powered flight in 1903, thought that the Wright brothers were harmless cranks. They foresaw no use in being able to fly. Similarly, few people understood the immense social value of electricity as Faraday demonstrated it to his audiences, but where would we be today without either of these developments? Fortunately, the critics of progress, at that time, made little headway in changing its forward momentum, despite their fears and concerns. Like nearly everyone else, they were too busy just surviving.

Society had its critics and saboteurs (named after those who threw sabots – wooden clogs – into machinery) - luddites (named after their leader, Ned Ludd), who violently resisted change, as Ludd saw that the new technology would take away his job, no matter how many others it might create. Had they succeeded in holding the industrial revolution at bay, we would not have had the automobile, electricity, airplanes, modern medicine, X-rays, education, or newspapers, but would have been stuck forever in the age of the horse and buggy, massive local and regional pollution, manual farm labor, poverty, ignorance, superstition, high infant and maternal mortality, and a multiplicity of killer diseases, and starvation. We might never have been aware of what we had been denied, while congratulating ourselves on holding at bay the imagined destructive forces of progress, just as the Incas did as they prepared their next human sacrifice.

In one of his electricity lectures in the early 1800s, Faraday was asked 'Pray sir, of what value is this electricity?' They didn't use it. They could see no use for it. They were not aware of how it could be used. The question, however, has been much more than adequately answered by our energy and electrically-dependant lifestyles today, though few people at that time thought this electrical fad would amount to anything of any value. This, of course raises the issue of how well we can anticipate future issues or future development. The obvious but unsatisfactory answer is that we cannot, just as our not-so-distant ancestors could not (they knew nothing of radio, TV, the camera, telephones, electronics, computers, airplanes, microwave ovens, nuclear power, etc.), and we should not presume to believe that we can.

The emotional rumors about electricity, at the beginning of the twentieth century, were that because of the introduction of this newfangled and extremely dangerous electricity (it could be used to kill criminals) into the home, the birth rate would plummet as people would not retire to their beds, and the inhabitants would go blind from staring at the light. None of this happened, though many people were convinced of its likely truth. Not much earlier, they had been convinced that the human body would be torn apart at any speed faster than that of a galloping horse; and they still believed that objects heavier than air could not possibly fly; and that anything as heavy as iron could not possibly float. More recently there were predictions that ‘The rivers of N. America may all be boiling by 1979!'

(Newman, NBS)), and `airplane contrails will soon cause the sky to be totally cloud covered'.

In reality, now, as much as then, the risks that are most likely to kill and injure us; the ones we are very familiar with, do not seem to concern us very much, while the risks that we do not understand, and which are actually least likely to injure us but receive 'bad press', are those that are invariably manipulated to terrify us the most.

There are risks from the things we do, and from the things we neglect, or decide not to do. For the most part we can quantify such risks by immediately counting bodies in the worst cases (an air crash, mine disaster or earthquake) where the correlation is obvious; to assessing injuries (smoking-related health effects), illness (influenza), hospitalization events (food poisoning), accidents (falls), loss of time from work (various), compensation claims (disability), or by conducting epidemiological studies, sometimes needing to span decades to define an answer. In most such studies, a presumed adverse health effect may be either not at all obvious or may not occur at all (Electric and magnetic fields (EMF) and cancer; and human health effects from exposure to PCBs, dioxin, DDT), or is entirely the opposite of what is suggested. For example, lower lung cancer rates are generally to be seen in areas with higher radon levels, rather than the higher rates that are still suggested from calculation.

Some of the mythology about dioxin, often described as one of the most dangerous cancer-causing chemicals (it is NOT carcinogenic in humans), was recently revealed when an apparent attempt to poison the Ukranian opposition candidate (Yushchenko (2004)) led to a severe, temporary case of disfiguring chloracne (the only defined human response) rather than to his death.

DDT was probably the most beneficial chemical ever discovered, even up to the present time. Before it was widely and unjustifiably banned by political interference, **DDT prevented more human death and disease than any other man-made chemical in all of recorded history**. Many of the widely ignored facts on DDT are readily available in a banner (DDTFAQ) on the home page of www.junkscience.com. Now, after several decades of misinformation and disinformation, stemming largely from the work of Rachel Carson and her book Silent Spring, DDT seems about to be re-instated as the most beneficial chemical with which to combat malaria.

There is such a predictable knee-jerk response from politicians when certain chemicals are publicized (dioxin, PCBs, DDT, and others) that they have become known as 'political chemicals'.

With the exception of lung cancer, which is mostly avoidable, a high cancer death rate in advanced societies is indicative of a healthy ageing society.

Unfamiliar things sometimes terrify us when they are described in frightening ways, even if they harm no one (nuclear wastes, pesticides) despite the imaginative and emotional allegations. Familiar things, even those that kill hundreds of thousands of us every year,

don't seem to frighten us at all (automobiles). We are also most likely to be afraid of low risk things that we perceive as lying outside of our control (the remote threat of meteorite impacts, global climate change, expectantly waiting for the next big earthquake or volcanic eruption, flying and plane crashes), than of high-risk things that are our own personal choice (downhill skiing, smoking, consuming alcohol in excess, driving, taking illegal drugs or relying exclusively upon herbal medications and natural healing).

Some of the more important of the fairly well-defined risks in our society are ranked in Table 4. Some affect an entire population (air pollution), others affect only those who fall into the group (miner, being overweight). It shows the ranking of some risks in the U.S. in terms of Loss of Life Expectancy across the population. They are averages, and do not apply to individuals. It suggests that those who live in poverty (for example), are likely to die about 3500 days sooner, on average, than those who do not live in poverty, though some who live in poverty die much more than 9 years prematurely and some live as long, or longer, than the rest of us.

Table 4. Ranking of Some Risks In the U.S. to Show Relative Loss of Life Expectancy (LLE)+
These are population statistics and are thus not directly applicable to individuals.

Individual Activity or risk	Population Average LLE (days)	Individual Activity or risk	Population Average LLE (days)
Living in poverty	3500	Pneumonia, influenza	130*
Being male (vs. female)	2800	Drug abuse	100*
Cigarettes (male)	2300	Suicide	95*
Heart disease	2100*	Homicide	90*
Being unmarried	2000	Air pollution	80*
Socio-economic status	1500	Married to smoker	50
Working as a coal miner	1100	Speed limit 65mph vs. 55 mph.	40*
Cancer	980*	Falls	39*
30 lb. overweight	900	Fire, burns	27*
Grade school dropout	800	Coffee (2.5 cups/d)	26
Sub-optimal medical care	550*	Firearms	11*
Stroke	520*	Birth control pills	5
15 lb. overweight	450	Peanut butter (1 Tbsp/d)	1.1
All accidents	400*	Hurricanes, tornadoes	1*
Mining construction	320	Airline crashes	1*
Alcohol	230*	Dam failures	1*
Motor vehicle accidents	180	All electricity - nuclear (NRC)	0.04*
		Nuclear waste disposal	0.00001*

* Averaged over total US population. The remaining risk assessments are for those who are uniquely exposed to the particular risk, either through choice, or being caught up in that particular lifestyle or circumstance.

Many individuals are captured by several risk circumstances, for example being poor, ill-educated, smoking, dangerous occupation, overweight, and others, can all apply to single individuals, though one should not try to assess individual risks from such population statistics. We are all individually different in our responses. The greatest risks, by far in any population, are those directly associated with both ignorance and poverty, and have nothing to do with popular environmental issues which are most often assumed to be of significant social or human risk, when they are not.

+ Data are mostly from several of the published works of Bernard Cohen, professor of physics at Pittsburgh University.

The last two in the table (electricity and nuclear waste) are placed there to show their estimated relative and approximately-defined population risk in terms of the more

significant risks, despite the torrent of adverse emotional publicity and general misinformation which blindly suggest they are near the top of any such ranking.

None of the 'political chemicals' show up in this or any other comprehensive scientific ranking of risks other than near the bottom. There are many similar and mostly trivial risks that are not shown, nearly all of which are the subject of government regulation, such as concerning artificial sweeteners, environmental pollutants, food additives, herbicides, pesticides, fumigants, medical drugs, preservatives, colorants, trace elements in drinking water, air quality, etc.

Other, major, 'potential' risks cannot be shown in this table, as one cannot count bodies that are **not** there from events that have **not** occurred. However, we need to be conscious of them lurking in the background. They are the risks that would arise in society if we stopped doing certain things. For example, the risks of coal mining are significant to coal miners and the action of burning coal and other fossil fuels imposes risks upon everyone from air pollution. On the other hand if we did not burn coal, or oil, then we would be free of the coal mining risks, free of transportation accident risks moving coal or oil, and free of pollution risks from burning these fuels. However, society would also be without sufficient energy and electricity; may not have the automobile (reducing automobile risks); would be cutting, transporting and burning wood, along with its pollution effects and high accident rates harvesting such a dilute source of energy. We would have the high accident rates and pollution effects associated with a horse and buggy society. We would also be relatively poor, less mobile, more unemployed, ill-fed, relatively less educated, and be much less socially secure. The incurred risks because of not having adequate energy, would be relatively large as we would lose perhaps 20 years or more of average life expectancy (about 8000 days of LLE across the entire population), which would make even the high risk for those living in poverty today in our society (3500 days of LLE), seem small.

Factual statistical information on societal risks; deaths, injuries and epidemiological studies, is collected by many governmental organizations and are used by actuaries, in order to assess - among other things - morbidity and mortality in society, to allow them to set realistic insurance premiums for certain activities, losses, or for life insurance. The data are widely available, but are usually forgotten when some emotional allegation is made about almost anything, as with blaming electric and magnetic fields (EMF) around power lines, with rare childhood leukemia. Even after thirty years of study of the entire electrical systems of many countries, and after observing hundreds of millions of people and having spent billions of dollars on these studies, no significant adverse health effect has been proved. If they were truly dangerous in any definable way, the body count would already be well known.

We cannot prove a negative (we cannot prove that water is safe, or that food is safe. People die from drinking water and from eating food. Vitamins are toxic, medication is dangerous). All we can do is to suggest that the risk may be remarkably small and difficult to define, but it is never zero.

Table 5. A Few of the Common and Emotionally-Loaded Myths of Our Society.
• We have never been so unhealthy and risks have never been so great. • Society is unhealthy, as more of us are dying of cancer than ever before. • We are unhealthy because of technology and man-made chemicals. • Anything repeated often enough must be true. Perception is reality. • Pollution and environmental degradation is at an all-time high. • We must regulate everything, and can demand and must achieve absolute safety. • We are running out of energy resources, and should tax energy use. • We must learn to use less energy and rely upon renewable resources of energy. • Global warming will be the greatest future risk to society. • The Arctic is melting. • Rising sea levels will flood our major coastal cities. • Society will soon run out of clean drinking water. • Overpopulation will cause mass starvation. • Nuclear wastes are lethally radioactive for 10 000 years. • We are destroying the planet. • We must return to a more gentle time, 'the good old days'.

5. The Good Old Days!

"We cannot prove that those are in error who tell us that society has reached a turning point, that we have seen our best days. But so said all before us and with just as much apparent reason. On what principle is it that when we see nothing but improvement behind us, we are to expect nothing but deterioration before us?" Lord MaCauley, 1830.

The 'good old days' consisted of societies so steeped in ignorance, fear and superstition that many of them made human sacrifice to propitiate their terrible gods who would otherwise inflict them with disease, floods, drought, famine, earthquakes and war. Others, somewhat more advanced, burned witches - a high-risk 'vocation' at the time - or were afraid of venturing too far out of sight of land in their ships lest they get lost and fall off the edge of the earth, or blundered into areas where sea monsters, mermaids or sirens were reported to lie in wait. The future was predicted by groping in the entrails of freshly slaughtered animals or throwing bones upon the ground and seeking some meaning from the way they fell.

They threw garbage and sewage into the streets, and ‘relieved’ themselves wherever it suited them. They used women and children to labor in the mines for long hours in dangerous conditions - a form of slave labor. When mine accidents killed many of them, as happened frequently, they were replaced. Children were forced to climb chimneys to clean them of soot, sometimes being encouraged along by lighting a fire beneath them. One could be executed or deported for stealing a loaf of bread. Public executions for trivial crimes were a regular occurrence.

They died prematurely in their thousands from simple diseases, food poisoning, starvation, cold and violence at the hands of masters, and because of a relatively unfeeling and uncaring society.

Simple social reforms could, and did do much to alleviate the problem of 'slave' labor, violence, indenturing and misuse of apprentices. But diseases and food poisoning have been an age-old problem, and are still with us. The problem is that if we do not know what diseases or conditions are killing or injuring us, then we will not be able to do very much to change them. This was the major impediment to improving life expectancy until relatively recently.

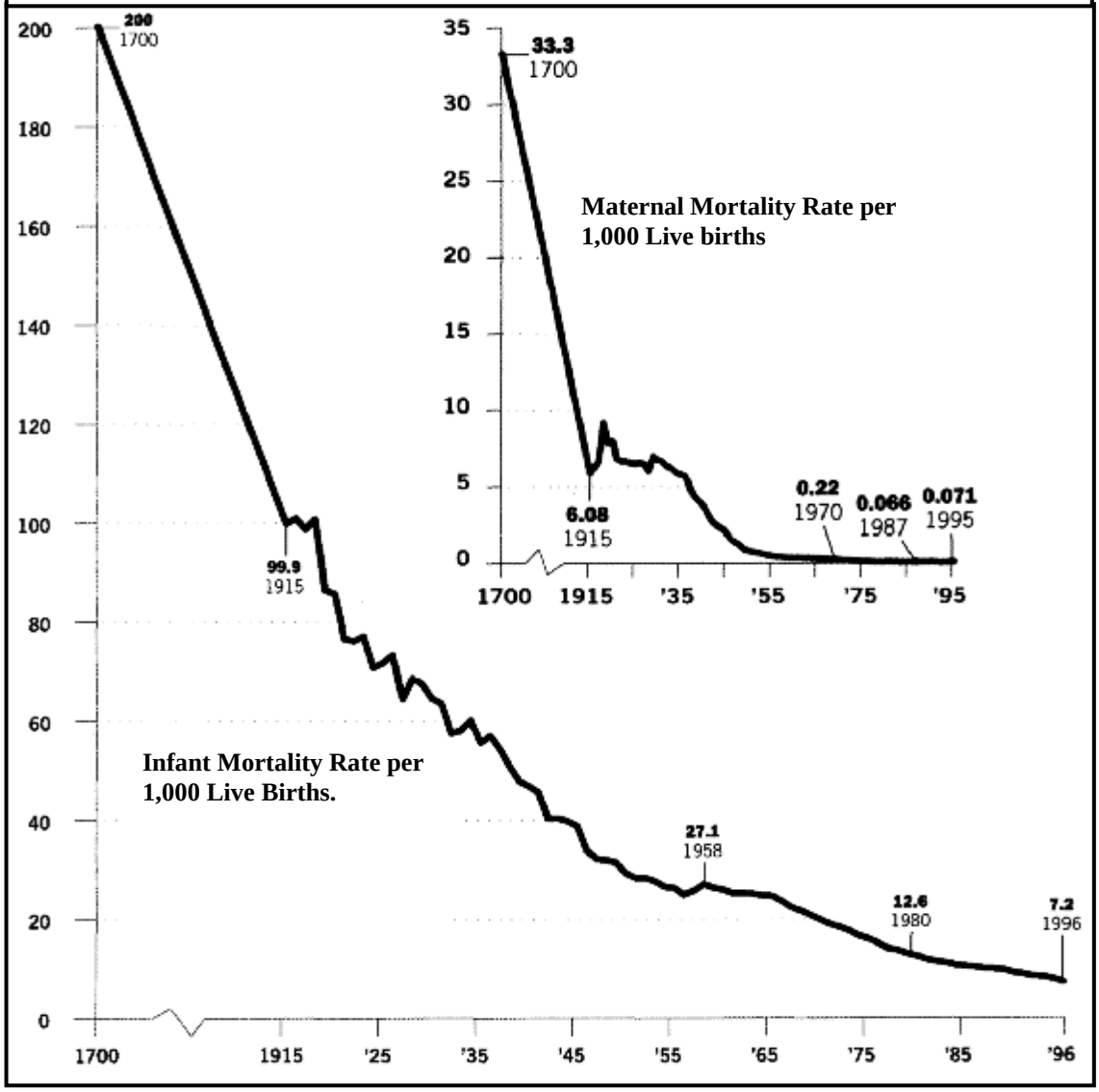
In the past, most risks were almost entirely natural for all animals, including humankind, and they took a terrible toll. The risks of a violent death or from numerous diseases or starvation were extraordinarily high. At that time, not many animals or humans died peacefully, or of old age. Every living thing was on the menu of one animal or another. Stone Age humans faced an ever-present risk of death every time they went after their next meal - facing the real risk of becoming some other animal's meal. Human life expectancy was a pitiful 25 to 30 years, leaving barely enough time to mature, and reproduce to replace those who were injured or died.

We were lucky to survive. Infant mortality was astronomically high, even in 1700, as shown in Figure 1. The usual causes of death were violence of one kind or another, diseases, infection, parasites, starvation and cold. Some developing countries still experience most of these as major causes of premature death.

Even up into the early 1800s No-one knew what caused most of the many deaths that were not due to violence, starvation or cold. They guessed that it was perhaps through having displeased a god, or it was caused by bad smells, evil spirits or immoral living. Because, in their abysmal ignorance, they did not know what caused disease or death, they were helpless to change anything, and they continued to die young.

Among the first major advances in consciously dealing with risk were those in medicine, as it was the devastatingly obvious effects of diseases in squalid overcrowded cities that cut short the thread of life for almost everyone, and were so common that they could not be ignored, especially when the plague visited as it regularly did. The birth rate was high, and maternal and infant mortality were high, as shown in Figure 1.

Figure 1. Infant and Maternal Mortality Rates Since 1700 for most Advanced Societies.



The Stuart Queen, Anne, in the last 17 years of the 1600s was pregnant 18 times. Five of her children were born alive; only one survived infancy. He died before adulthood. This was a commonly told tale. It still is, in many poorer countries whose patterns of risk are still those of the middle ages, and very different from ours.

There were hundreds of lessons being digested at this early time concerning the unique relationship between social conditions and certain health effects. For example the relationship between the occupation of sweeping chimneys and related scrotal cancer (Percival Potts); the felting of hats with mercury and the related tremors that gave rise to the

expression `as mad as a hatter'; the relationship between poor diet on long sea voyages and death from scurvy, until limes were mandated (hence the word `limey' for English sailors); between some cancers and chronic ingestion of large doses of arsenic; between unhygienic medical practices - going directly from autopsy to treatment of patients without changing or washing - and surgical, maternal, and infant deaths. But as the microscopic causes of disease were as yet unknown, indication and observation of the microbes that caused disease, and thus dealing with them, was out of the question until the work of Pasteur, Koch and Ehrlich more than 100 years ago.

Surgeons ('Leeches', 'pox doctors', quacks) of the day knew only the theory of the four humors - sanguine, phlegmatic, choleric and melancholic, and resorted to bleeding, physiking, purging, poulticing, and various quack remedies such as putting a hot roasted onion into the ear, to blowing roasted cuckoo up an epileptic patient's nose, or ingesting ground-up Egyptian mummies. The most unpleasant medications were designed to supposedly discomfort and drive out the evil spirits residing inside and causing illness. One of the most useful and frequently stated cautions to attending physicians at that time, was to exercise care in approaching the bedridden patient so as not to carelessly kick the chamber pot under the bed with all of its attendant, unpleasant consequences. The 'good old days' had some obvious drawbacks. Modern physicians do not generally encounter such conditions as 'scroff', 'the itch', or 'mange' among others, but they temporarily re-surfaced with the overall lack of personal hygiene in the back-to-the-land, communal lifestyle in some of the hippie movement in the 1960s.

The enormous health problems before and during the industrial revolution were all too obvious, but until they could be associated with specific contributory causes, little could be done about them and nothing was likely to change. Filth (harbouring bacteria), garbage (rodents and their fleas), internal parasites (tapeworms etc) and external parasites (fleas and the plague, and typhus, lice, bedbugs), food spoilage and food poisoning (salmonella and a host of other unsavoury bacteria), unsanitary food handling (typhoid), sewage and contaminated water (cholera and hepatitis), overcrowding (consumption - TB, and most other diseases), and endemic ignorance were the significant hazards of the day. These conditions are always hovering in the background waiting for poverty or stupidity to rear their heads, even in our society. Poverty, ignorance and low life expectancy go hand in hand. The common thread through all of these events is, of course, profound ignorance.

Earlier in history, rumour of an outbreak of smallpox (or plague) could empty a city overnight of those who could afford to go. The old saying about someone `having the complexion of a milkmaid' free of the common and disfiguring pockmarks of the smallpox, came to have special meaning for Dr. Jenner, if to no one else. His initial vaccination in 1792, of humans, with cowpox, to counter the more virulent human disease, was fiercely resisted and widely condemned from many pulpits as interfering in God's purpose – removing the ungodly and unworthy. The battle between ignorance - the status quo - and progress on any front is still going on. In 1979, the WHO declared that smallpox had been eradicated worldwide. This came about as a result of Jenner's initial observations and dogged efforts almost 200 years earlier, despite scorn, resistance, and vituperative condemnation of his efforts to move medical understanding of disease out of the dark ages.

In London in 1854, Dr. John Snow appeared before the Soho council and suggested that they counter an epidemic of cholera by removing the handle of the Broad Street water pump from which many people drew their household water. His unusual suggestion was met with incredulity and resistance. The risk was all too obvious, with hundreds dying prematurely over just a few days. Snow had seen that the epidemic, with rare outlying exceptions, was mostly associated with water supplied by the Southwark and Vauxhall Company which took water from the river below the major sewage outfall. Where households used water supplied by the Lambeth Company from further upriver, and thus containing less sewage, there were many fewer deaths from Cholera. It took the next 30 years before the actual cholera bacillus was identified, though Snow's work indicated something that had been learned and forgotten many times in history since the Roman occupation of the British Isles; the importance of clean, and sewage-free water. Cautious travellers today are well aware that poorer societies may be lax in looking after sewage treatment, and that it is therefore usually wiser not to drink the local water.

The benefits of scientific knowledge and the growing medical skills (treating smallpox and being 'clean'), were often immediately obvious, and were multiplied a hundred fold as the industrial, agricultural, educational, and scientific revolutions progressed. As the major risks were addressed and reduced, life gradually got better and longer, though there were severe setbacks when the plague came around, as it did with some regularity.

Consider that in 1665 - yet another year of the plague in London - about 70 percent of the almost 100 000 deaths that year, were of the plague, as shown in Table 6.

Table 6. Reported Causes of Death in London in 1665 - One of the Years when Plague Thrived.
The spellings and expressions in the original document of the day, have been retained.

Abortive & Stillborn	**617**	**Executed**	**21**	**Palsie**	**30**
Aged	**1545**	**Flox & Smallpox**	**2655**	**Plague**	**68596**
Ague & Feaver	**5257**	**Found Dead in Streets**	**20**	**Plannet**	**6**
Appoplex & Suddenly	**116**	**French Pox**	**86**	**Plurisie**	**15**
Bedrid	**10**	**Frightened**	**23**	**Poysoned**	**1**
Blasted	**5**	**Gout & Sciatica**	**27**	**Quinsie**	**35**
Bleeding	**16**	**Grief**	**46**	**Rickets**	**557**
Bloody Flux	**185**	**Griping in the Guts**	**1288**	**Rising of Lights**	**397**
Burnt & Scalded	**8**	**Hanged**	**7**	**Rupture**	**34**
Calenture	**3**	**Headmould**	**14**	**Scurvy**	**105**
Cancer, Gangrene	**86**	**Jaundies**	**110**	**Shingles, Swinepox**	**2**
Canker and Thrush	**111**	**Impostume**	**227**	**Sores, Ulcers**	**82**
Childbed	**625**	**Kild by Accidents**	**46**	**Spleen**	**14**
Chrisomes and Infants	**1258**	**Kings Evill**	**86**	**Spotted Feaver**	**1929**
Colds and Coughs	**68**	**Leprosie**	**2**	**Stopping of Stomach**	**332**
Collick and Winde	**134**	**Lethargy**	**14**	**Stone & Strangury**	**98**
Consumption & Tissick	**4608**	**Livergrown**	**20**	**Surfet**	**1251**
Convulsion & Mother	**2036**	**Meagram & Headach**	**12**	**Teeth & Worms**	**2614**
Distracted	**5**	**Measles**	**7**	**Vomiting**	**51**
Dropsie & Timpani1	**478**	**Murthered & Shot**	**5**	**Wenn**	**8**
Drowned	**50**	**Overlaid & Staved**	**45**		

The causes of death of the other 30 000, reads more like a Gilbert and Sullivan operetta, than medical science and was more superstition and old-wives-tale, than valid. And there were remarkably few cancers, both because it was difficult to diagnose, and because people were dying young of many other diseases and conditions before old-age cancer might get to them. This year was followed by the great fire of London, which probably did more to relieve the congested population of the accumulated filth and vermin of centuries, and household insect parasites, than any other event could have done.

In comparison, many of the minor and uncertain risks we fret and fume about today, would have appeared entirely insignificant then, as they should today, as most of them don't kill anybody. However, we would never know it from the degree of news coverage and the strident allegations of special interest groups about health effects that are either not unusual, or are not correlated with the target of concern, as for example with uncertain health effects covered by the name Gulf War Syndrome and depleted uranium, or childhood leukaemia supposedly directly associated with electrical lines.

By 1900 the situation had begun to improve notably, so that the statistics of improvements shown in Table 7, described the general life and conditions in the U.S. at that time, though they were still a long way from where we are today.

Table 7. Some U.S. Statistics for the Year 1902 (adapted from various sources)
The average life expectancy in the U.S. was about forty-seven years.
14 percent of homes had a bathtub.
8 percent of homes had a telephone.
A three-minute telephone call from Denver to New York City - viewed with amazement at that time - cost about eleven dollars.
There were about 8000 cars in the U.S. (two thirds of them electric) and about 150 miles of paved roads.
The land speed record was held by an electric car.
The maximum speed limit in most cities was set at 10 mph.
The tallest man-made structure in the world was the Eiffel Tower.
The average wage was about 20 cents an hour.
The average worker earned about $300 per year.
35 percent of the population was employed on the land to feed the nation (today less than 2 percent do so).
More than 95 percent of all births took place at home, usually with midwives present.
10 percent of all physicians had a college education (but 90 percent didn't)
About 15 000 dead horses were removed from the busy streets of New York City each year.
The five leading causes of death were: Pneumonia and influenza, Tuberculosis, Diarrhea, Heart disease and Stroke.
Nine out of ten adults could read or write. Almost 10 percent of all Americans had graduated from high school.
Marijuana, heroin, and morphine were all available over the counter at corner drugstores.
Eighteen percent of households had at least one full-time servant or domestic (a modern household in 2003, has the equivalent of several servants in the many labor-saving appliances and in the available energy).

We look at these statistics and smile at how primitive their society was. **They** looked at their changing living conditions and marvelled, and thought how much improved they were over what they had been.

And yet they were continually tormented by the fear that civilization was about to come to an end. Just as many of us are today, it seems.

6. How Did We Escape From The Good Old Days?

The simple general answer is that we continued to increase our use of energy and all of the wonderful conveniences that it brings. Energy is the platform from which all of the subsequent changes in education, health, science, industry, technology and medicine became possible.

Taking our use of energy as a 'given' in the progress that we see, how did we manage to increase our life expectancy from about 40 years up to 80, while the general impression today is that our health is more at risk than it has ever been, and that we will soon be dropping like flies of cancer?

This is where the WHEN - concerning death - is important. As we progressed, we pushed the average age of death further along. Coupled with that, however, has been an increase in the rate of incidence of most cancers (see section 7.1).

People used to die of everything except cancer as is particularly evident in Table 6, but at an average age of about 30 or 40. We, on the other hand, die mostly of three major diseases - heart disease, cancer and stroke, but mostly in very old age; 80 and beyond. As we push death into even older age, by more effectively dealing with heart disease and stroke (education, science, medical technology, diet, lifestyle), it is inevitable that more and more of us will be dying of cancer.

Nearly every modern advance that has been made in society - some of which are shown in Table 8 - has saved countless lives. The problem is that one cannot easily count lives saved, no matter how many millions of them there are, just as one cannot easily assess accidents that don't happen. And with every major advance that saves lives or reduces accidents, life expectancy receives a nudge to ever more years of longevity. We save lives by understanding what kills us. So we count bodies and evaluate deaths, but we had better remember that the real benefit is through saving lives.

Medical advances alone, especially in the recognition of what causes disease and the use of drugs, childhood vaccinations, X-rays and nuclear medicine, have added at least 20 years of average life expectancy to each of us in the last 100 years - an exceptional achievement - with major improvements still to come through understanding the human genome. At the same time, the use of medical drugs - which are dangerous items - kills a few people each year. It reduces the 20 years gained, by about an average of about 37 minutes, for a relative benefit to risk of about 300,000 times. Despite this, there are some people so afraid of the side effects of medications, that they are scared to take them. This must be hardly surprising when we cater to hysteria by mandated warnings that may speak of the risk of such possible side-effects as liver damage, stroke, constipation, increased blood pressure, etc. The mandated warnings tend to be out of all proportion to the problem or risk. Some mothers avoid measles, mumps, rubella (MMR) vaccinations for their children because of similar

hysteria of adverse reactions (rare), and put their children (and the broader population) at much greater risk, without recognizing it, or caring if they did. At least, not until an epidemic sweeps the unvaccinated population.

6.1 Medical Advances, Discoveries.

Some of the scientific developments, medical discoveries and technological marvels that have advanced our life expectancy, can be seen in the tables below. They are merely the tip of the iceberg of such developments.

Table 8. Some of the Major Medical Milestones Contributing Significantly to Increased Life Expectancy

1895	X-rays for diagnosis	1950	Nuclear Medicine
1899	First use of formulated aspirin	1952	Anti-hypertensive drug
1910	Salvarsan (for syphilis)	1953	Cardiac surgery
1911	Vitamins	1955	Kidney transplants
1921	Insulin	1960	Pacemaker
1936	Pernicious anaemia	1962	Beta blocker drug
1937	First sulfa drug	1970	Coronary bypass
1944	DDT (insecticide)	1975	Parenteral nutrition*
1945	Penicillin (antibiotic)	1976	CAT scan
1948	Streptomycin	1990	Genetic Engineering
1949	Tetracycline (antibiotic)	2000	Genome mapping
		* Total Parenteral Nutrition: Intravenous feeding.	

Other developments, and their generally ignored benefits are shown in table 9.

Table 9. A Very Few of the Major Risk-Reducing Advances* Achieved through Social, Science, Medicine, Engineering, and Nuclear Applications.	
Technological Advance (1) - Usually having a major positive affect that may not be at all obvious. The risk avoided by these developments far outweighs the low risk that might be incurred.	**Overall Societal Benefit. This is Largely Invisible, as Lives-Saved are not Usually Statistically Obvious, whereas Lives-Lost ARE statistically obvious. All of these are associated with improvement in the quality of life and thus with longevity.**
Safe drinking water (Chlorination from 1800)	Chlorination kills pathogens that kill millions without it.
Potable, controlled water supply	Pathogen-free water is at the basis of good health
Nutrition and diet (fruits and vegetables)	Adequate and balanced nutrition is notably beneficial to all
Quality of education	Anything which reduces poverty, saves and prolongs lives
Recognition of causes of disease	Combating disease, lengthens life.
Asepsis	Conquering septicemia, reduces surgical deaths
Development of the Chronometer (Harrison)	Improved navigation (longitude) saved thousands of sailors
Improvement in crop yields, varieties, and use of herbicides, fungicides and insecticides	Better nutrition and more abundant, clean, and affordable foods, leads to better overall health.
Hygienic food preparation	Food contamination, spoilage, are major causes of death
Food canning and preserves	Extends food supply, quality, and variety, without spoilage
Immunisation, vaccination	Major reduction in childhood and elder deaths
Medical drugs	Major reduction in ill health
Rodent and insect control (insecticides)	Improved living standard and reduction of disease
Parasitic disease control	Major improvement in individual health
Obstetrics	Reduction in child and maternal mortality
Infection protection - antibiotics	Major reduction in mortality from severe diseases
Surgical advances	Mortality reduction, health improvement
Anaesthesia	Allows more advanced, life-saving surgery
Radio-immuno-assay (RIA) (radio-isotopes)	Diagnosis of function outside of the body
Central heating	Comfort. Mortality rate from cold is reduced
Sanitary sewage disposal	Mortality from waste contamination and diseases, reduced
Farm mechanization and methods	Improved food production, lower food costs, better health
Workplace safety improvements	Fewer workplace accidents
Personal and social hygiene	Minimizes spread and effect of disease
Pasteurised milk	Eliminates certain pathogens, reduces infant mortality
Product sterilization (irradiation)	Eliminates more resistant pathogens - hospital supplies
Abundance of Energy (coal, oil, hydro, nuclear)	Energy provides security, jobs, education and prosperity
Transportation	Movement of goods to improve quality of life
Electrification	Our entire lifestyles, and services depend upon electricity
Refrigeration	Food storage (years) without spoilage
Food irradiation (cobalt-60)	Eliminates salmonella, other pathogens, avoids spoilage
Intensive care units (ICU)	Provides medical attention to those who most need it
X-rays (since 1895)	One of the most beneficial and useful medical tools
Medical diagnostic procedures (radio-isotopes)	Major modern diagnostic procedures
Cancer therapy treatments (cobalt-60)	Eliminates cancers and prolongs survival
Blood transfusions	Saves lives during major surgery and from certain diseases
Organ transplants	Provides a second chance at life
GM Foods and crops (shorter growing-season, frost, drought & insect resistant)	Improves the quality and abundance of the food supply while eliminating the need to use insecticides and herbicides
Communications and information	Improved information flow, education
Literacy	Literacy is at the base of education and prosperity
* Remember that NONE of these advances is risk-free. 1. Millions of lives are continually improved and saved by the use of these, resulting in overall increased average life expectancy by at least 30 years. Many were objected to initially, and some are still the subject of misinformation campaigns.	

The most significant of the major engineering and energy advances of the twentieth century, which contributed directly to these medical advances and improvement of life expectancy, are shown in Table 10. If we do not recognize where society would be without them, and others still to come, we could all to easily lose ground to those who try to block all technological progress and throw us back into the dark ages.

Table 10. Ranking Of Some Of The Major Engineering Advances In The 20th Century. (National Academy Of Engineering)

1. Electrification	11. Highways
2. Automobile	12. Spacecraft
3. Airplane	13. Internet
4. Water Supply and Distribution	14. Imaging
5. Electronics	15. Household Appliances
6. Radio and Television	16. Health Technologies
7. Agricultural Mechanization	17. Petroleum and Petrochemical Technologies
8. Computers	18. Laser and Fiber Optics
9. Telephone	19. Nuclear Technologies
10. Air Conditioning and Refrigeration	20. High-Performance Materials

None of these would have been possible in a society that was fixated with reducing or controlling its use of energy. All of these advances without exception are scientific, technological and energy-based. Without adequate (meaning surplus) energy, we don't have any of them.

Fortunately, despite the Jonahs and Luddites and the anti-progress, anti-technology factions, society generally surges forward, though there are times and circumstances where we appear to stand still or even to lose ground in some countries and some areas. Why?

Most often, it is because we spend scarce social resources (wealth) upon the wrong things; low risk issues that often deserve very little attention, but get too much. We get sidetracked by headlines, noise, hysterical allegations, misinformation about social and environmental risks, political unaccountability, needless regulations by the thousand, mis-spending, taxation, inadequate funding of health care, unaffordable energy, and a general downturn in economic health and disposable wealth. But it is also suddenly obvious after economic collapse of a society, leading to unemployment, mental stress, and the inability to purchase the basic necessities of life. This was one of the outcomes of the collapse of the Soviet Union more than a decade ago, resulting in life expectancy dropping almost 10 years.

7. Modern society.

Despite all of the major social and technical progress in the last 100 years and more, the bad news is that we are still going to die no matter how much progress we make. The paradoxically-good news is that more of us will be dying of cancer! The better news is that the average life expectancy in our advanced society today is close to 80 years; a little lower for men. How did we get to live this long while being convinced - despite the unarguable evidence to the contrary; long life expectancy - that society has become more dangerous and more risky?

That society has become much less safe, is not a widely-held belief, or one for which there is any scientific support or justification (except in some areas of the non-developed world). However, it is one that is often widely publicized, especially through the efforts of special interest organizations who are intent upon arousing our emotions. This belief is bolstered, because the focus of society is on causes of death, as shown in Tables 11 to 13, and because bad news is always more riveting of our attention and concern, than is the good news which is less interesting to the media from which most of us get our – usually unreliable and deeply biased - information.

Table 11. Data on a very few of the Various Causes of Death in the United States - 1986, with indication of Probability and thus of Approximate Risk of Death from this Cause.

Cause of death	Approximate Number of Americans who died this year from this cause.	Approximate Odds that when the Average American dies it will be from this cause.
Disease (all)	2,000,000	1 in 1.1
Heart disease	770,000	1 in 2.7
Smoking related diseases*	500,000	1 in 4.2
Cancer (all)	480,000	1 in 4.4
Accidents (all)	95,000	1 in 22
Auto accidents	48,000	1 in 44
Diabetes	37,000	1 in 57
Suicide	31,000	1 in 68
Homicide	21,000	1 in 100
Drowning	5,900	1 in 360
Fire	4,800	1 in 440
Asthma	4,000	1 in 530
Firearm accidents	1,500	1 in 1400
Viral hepatitis	1,000	1 in 2100
Electrocution	850	1 in 2500
Car-train accidents	570	1 in 3700
Appendicitis	510	1 in 4100
Pregnancy and related	470	1 in 2200
Lightning	78	1 in 27,000
Floods	58	1 in 36,000
Tornado	58	1 in 36,000
Bites and Stings (insects)	40	1 in 53,000
Fireworks	8	1 in 260,000
Botulism and choking on toothpicks	2	1 in 1,100,000

* Smoking-related diseases include many of the cancers, including lung cancer.
Vital Statistics for the United States, 1986, U.S. Dept. of Health and Human Services publication PHS88-1122, Washington D.C, 1988.

Such a detailed focus on diseases and conditions that were never documented until recently, and certainly never in the past or in such detail, leads some few people who are not as well informed as they should be, to believe that we are worse off today than ever before.

They look at increasing rates of cancer (but generally ignore lung cancer which is mostly smoking related) and they decide that there is an obvious correlation with technological and industrial progress; pollution, modern chemicals, food additives, preservatives, and any one of hundreds of new items that never existed in the past when cancer rates were much lower, and despite the obvious and damning data on the 'good old days' they naively believe that people were healthier and better off back then. They may even be naïve enough to say so, not being familiar with the information that any social historian and risk researcher is well aware of. They are wrong for many reasons, but the most obvious are those that are evident in the rankings, where these supposed risks essentially do not show up.

What is NOT on this list, except well off the bottom of it, are such highly emotional, but very low risk issues as pesticides, herbicides, fungicides, food irradiation, GM foods, cell phones, EMF, asbestos, PCBs, DDT, dioxin, nuclear waste, etc, all of which can, and have created considerable social hysteria and massive diversion of public funds over the last few decades. At the same time, the major benefits of most of them have far outweighed any harm they may have caused, as most of them are still not implicated in any defined human injury or deaths.

Table 12. The Top Eleven Causes of Death in the US in 1999.

Cause of death	Approximate Number of Americans who die each year from this cause.	As a percentage of all deaths
All deaths	**2,391,399**	**100**
1. Heart disease	725,192	30.3
2. Cancers	549,838	23
3. Stroke	167,366	7
4. Respiratory diseases	124,181	5.2
5. Accidents	97,860	4.1
6. Diabetes mellitus	68,399	2.9
7. Flu and pneumonia	63,730	2.7
8. Medical errors	**44,000 to 98,000**	**About 2 to 5**
9. Alzheimers	44,536	1.9
10. Kidney diseases	35,525	1.5
11. Septicemia	30,680	1.3
All other causes	**484,092**	**20.2**
All maternal deaths	**100**	**0.005**
All infant deaths	**12,000**	**0.7**

Most data are from the Centers for Disease Control. The recently published figures on medical errors were not in the original list of ten causes of death.

By identifying such causes of death, and their frequency, we are able to do something about them, especially those involving medical errors, which are embarrassing and largely avoidable (and probably understated). However, does one correct medical errors by punishing doctors through extreme medical insurance and litigation (many lawyers prefer

this way of course) or by identifying the cause of such errors. Litigation is the least desirable method, as it ultimately penalizes patients by reducing the number of doctors in certain specialties, or drives them to practice in countries that are less litigious. This is why it is humorously, but nonetheless cynically and disturbingly stated, that there are those running from any accident (doctors) and those running to it (lawyers - ambulance chasers).

The greatest benefit to developing society, and the reason why there are more of us dying now in old age rather than in childhood, is that we have identified and reduced the major causes of childhood and adolescent death. However, those few childhood deaths remaining, as tragic as they are (Table 13), are still open to improvement.

Table 13. Major Causes of Infant Death (at birth) - 1999 (Centers for Disease Control)	
1. Congenital malformations	6. Cord and Placental Complications
2. Low Birth-weight	7. Accidents
3. Sudden Infant Death Syndrome (SIDS)	8. Bacterial Sepsis
4. Maternal Complications	9. Circulatory Diseases
5. Respiratory Distress Syndrome	10. Atelectasis

There are also rare and tragic examples of childhood cancers which appear to be mostly genetically related. One of these - Acute Lymphocytic Leukemia - is treatable with radiation. The success rate of curing this disease was no better than about 50 percent in the 1960s, but this is now close to 85 percent. Many childhood cancers are now almost 100 percent curable. Now, consider that application of the Precautionary Principle – seeing only the 15% of failures – would insists that the procedure be halted.

Because most of the population today dies as adults rather than as children, as in the past, the predominance of causes of death are those that affect adults. However, the causes of death in children is still of especial importance to us as there is nothing more tragic or wasteful in society than losing a child. When 20 percent and more of children did not survive infancy - as in about 1700 - this was obviously a critical exercise. Now that we lose less than 1 percent of children at birth, it is much less of an issue, though it still is unacceptable to lose any child from any avoidable or treatable cause.

7.1 The Great Cancer Epidemic.

Cancer is a large group of terrible and terrifying diseases whose causes and progressions are not yet all that well understood. It happens when the body's own defense mechanisms cannot stop rogue cells multiplying out of control as they usually do. What causes this change, and perhaps how to counter it, is only now beginning to be vaguely grasped.

Mostly, cancer happens in old age when cells also forget how to commit suicide, as they normally do when they sense that they are not replicating accurately, but it can also happen much earlier from genetic predisposition (for example some childhood leukemia). Science today has the ability to identify those individuals who are especially at risk from certain genetic cancers. Most people do not feel comfortable finding out about their genetically related risk of such disease and would rather not know.

Perhaps not-so-rarely, cancer is also correlated with things we do or do not do in life, our diet, smoking, eating or avoiding certain foods such as fruits and vegetables (which can be known cancer fighters), especially green leafy vegetables (including broccoli and cabbage), and workplace risks.

Today we are caught up in a disturbing phase of assessing risk and addressing risk that seems to rely more upon emotional perspective than scientific fact. We scurry around trying to blame every adverse health effect, or tragic death, or injury, upon some aspect of society of which we disapprove; the garbage dump down the road, the factory next door, the work-place, the air, the water supply, the electrical lines, the cell phone, the microwave, the food supply, MMR vaccines. There are a multiplicity of such marginal social issues and 'normal' health effects, all looking for something to blame.

There is a human tendency to try and blame all such illness and disease - as rare as they are - upon some local effect, even if they are mostly the result of our own habits, and are inevitable, though we hate to admit this. We usually hold ourselves blameless for a lifetime of smoking or over-eating and choose to sue tobacco companies, or fast-food outlets. There is no reward from blaming lung cancer or obesity upon ones own lack of willpower and stupidity and ignorance; better to go after the deep pockets of industry.

Anyone who looks only superficially at the history of disease, notices that as society progresses, the cancer death rates mostly increase. Obviously, some of this is related to better diagnosis of this disease, and some is related to how we live and behave. For example the most avoidable kind of cancer is lung cancer from smoking, with other kinds of cancer from using snuff and from chewing tobacco. Others - very few - are related to certain occupations with dangerous chemicals such as benzene, from chemicals used in PVC manufacturing, from certain valency forms of chromium, from large and continuous doses of arsenic, and even from prolonged exposure to sawdust and woodsmoke. However, remember that it is the dose that makes the poison - chromium and arsenic and many other toxic metals are also essential trace elements in the body.

The late Dixie Lee Ray - a former governor of Washington State, and a biologist - noted that there was sufficient natural arsenic, cadmium and chromium in every human body, that if it were evenly distributed, it would mean that each cell contained about 100 000 atoms of arsenic, 2 000 000 atoms of cadmium and 700 000 atoms of chromium, all without causing any obvious injury or harm.

We die from too much of anything, and we die from too little of many things. We seem to be at a stage in society where we have a tendency to blame cancer upon everything we can, rather than upon the true cause of at least 90 percent of all cancers (outside of smoking) - a combination of genetics and a lifetime of living into 'ripe' old age.
In the good old days people didn't die in large numbers of cancer because they didn't live long enough to get it.

We cannot prove anything to be totally safe, not even food, but we can give a label of 'gras' (generally regarded as safe) to many items. We can usually show that anything and

everything has some degree of danger or risk associated with it. We even go so far as to try and prove this by conducting experiments on mice and rats to show that certain food additives, sweeteners, medications, chemicals, can all produce cancer in various test animals and under various extreme conditions.

Unfortunately, politics responds to noise and such perceptions, more than to substance, and often drafts popular, but unworkable, and extremely costly regulations (for example concerning the impossible 'zero tolerance' - as for dioxin in pulp mill effluent (there are also natural sources of dioxin - forest fires), and for other man-made chemicals: PCBs, DDT etc,) without considering the scientific ranking of the assumed risk, or even the benefit. DDT saved about 500 million lives from malaria and other insect-borne diseases since it was first used, and was not associated with a single human death, yet was banned in the U.S. for purely unscientific, environmentalist, and political reasons.

8. In This Age of Misinformation and Environmental Hysteria, How Do We Progress?

We should do several necessary things that we have mostly ignored:

1. Understand social history and social risks.
2. Place risks in perspective and demand good science and accountability of everyone who tries to influence the public and politicians.
3. Recognize that the greatest risks in society are those associated with ignorance and poverty, despite those supposed risks that 'work' on our emotions.
4. Recognize what has allowed us to progress and thrive (energy, wealth).
5. Decide what is a fair value of a human life in our society (between 2 million and 5 million U.S. dollars), even though it may be less than a thousand dollars in others.
6. Rank **all** social risks including **everything** we do, while considering the risks of alternative actions or inactions.
7. Allocate resources mostly to the top of the rankings where they will have the greatest human - and therefore environmental - benefit.
8. Justify the allocations in terms of cost versus benefit.
9. Do not chase phantom, and emotional risks that cannot be scientifically defined. Demand accountability of those who raise any new issues as being a significant risk, and demand that they scientifically and openly justify their pronouncements.
10. Make it difficult for political bodies to pass new regulations without scientific justification and detailed cost/benefit evaluations.
11. Identify and abolish all regulations that are too costly and provide little or no benefit.
12. Give regulations a lifetime of no more than 5 years, before mandatory re-evaluation, taking into account both defined costs and benefits.

8.1 Rank the Risks

How do we get away from the litany of misinformation about risks, inappropriate litigation to deal with them, spending out of all proportion to the risk, unworkable regulations targeting them and emotional misperceptions that confuse us about them? We should understand what are the significant, defined, risks in our society and we should rank those risks. We then should concentrate our amelioration efforts towards the top of the ranking, rather than towards the bottom!

We are prone to damage society by being distracted by minor, but highly emotional, politically sensitive, loudly trumpeted, and extremely expensive issues, some of which are detailed in Table 14 and Figure 2. We damage it by spending money on the wrong issues. Money used for one purpose, cannot also be used for another.

Education, medicine and welfare are critically important in the health of any society. When we take some of the money needed for those programs to use in any of the thousands of highly emotional and competing issues, usually where associated risks are either non-existent or so small as to be worth ignoring, then we damage society.

Our politicians often go to fatuous lengths in spending public money in the most frivolous and unaccountable ways. For example, there are government rules to ensure that bananas sold into some markets are curved to a certain degree and are of a certain size; that margarine shall not be as yellow as butter ('cosmetic' farm-lobby regulations); that a certain percentage of gasoline shall be made up of farm ethanol (political-benefit corn-belt farm-lobby regulation); that drinking water shall contain less than 50 parts per billion of arsenic (an emotional, but not a health issue –'It is the dose that makes the poison') etc. These are only a few examples of thousands of such cosmetic, emotional and counter-productive regulations that need revision, as they do not benefit society one iota, but are extremely expensive.

Who decides what is necessary for society, and what influences their decision? The simple answer is: Politicians, acting mostly out of political self interest, when pressured by lobbyists for industry, farmers or other groups that might jeopardize their chances at re-election. They have long learned to tell the public and the noisy special interest groups what they want to hear. They strive to keep as much of the public as possible, happy. They walk a fine line between addressing the public's emotional concerns about almost everything - some of the current major issues are shown in Table 14 - while tiptoeing at the edge of a minefield of getting caught in a bad decision, which almost all of the concerns represent.

Most are highly emotional issues that have spawned numerous costly regulations, and represent billion dollar drains upon society. Most are also based upon poor or non-existent science.

Table 14. Highly Funded, Widely Publicized, Emotionally-Loaded, Environmental Issues, with Indication of their Actual, most Probable Effect on the Overall Health and Well-being of the Population.		
Most widely publicized and poorly-defined emotional issues or risks - 'Mania of the moment'	**Character of risk. Assumed/alleged effect. (see numbered footnotes)**	**Estimated impact on population Loss of Life Expectancy, where it is possible to determine it without emotional bias is mostly less than 5 days LLE (exception *). Many have a positive effect.**
Ozone depletion CFCs	Undefined, no reliable data, 1, 2, 3, 5	Emotional issue. minor, if any human effect
Climate change	Natural, 1, 2, 3, 5	Unknown, emotionally speculative effects
Global Warming	Unsubstantiated beliefs, 1, 2, 3, 5, 6	Likely to be more beneficial than harmful
Water pollution	Severe third world problem, 4	* Major adverse effects in the third world
Air pollution	Political issue, some validity	Adverse effect from use of fossil fuels. About 4 days LLE globally.
Sea level rise	Poor science, undefined, 3	Emotionally speculative effects
Species extinctions	Presumption of causality, 1, 3	Undesirable, exaggerated, minor effect
Forest clearing	Forestation predominating	Undesirable, minor, if any effect
Habitat preservation	Political issue, some validity	Desirable, though minor, if any effect
Wetland protection	Political issue, some validity	Minor, if any effect, except for mosquitoes and the diseases they spread.
Herbicides	1, 2, 3, 5, 6	Positive effect on the food supply
Pesticides	1, 2, 3, 5, 6	Positive effect on the food supply
Nuclear wastes	1, 2, 3, 5	Net positive effect, displaces FF pollution
Nuclear winter	Largely forgotten, 3	*Speculative outcome of cold war
Cloning	Misinformation, 1, 2, 3, 5	Major net positive effect, despite so-called 'ethical' concerns.
Over-fishing	Valid concern, though lack of data	Loss of livelihood
Fish farming	6, 1	Positive effect on the food supply
Resource depletion	Emotional issue, 2, 1, 3, 5	Emotional issue, ignores substitution
GM crops	Emotional issue, 6, 3, 1	Positive effect on the food supply
GM foods	Emotional issue, 6, 3, 1	Positive effect on the food supply, saving millions of people from starvation.
Farm chemicals	Emotional issue, 6, 5, 3, 2, 1	Positive effect on the food supply
PCBs/Dioxin	Emotional issue, 5, 3, 2, 1	Emotional misinformative issues. Low risk.
Food Irradiation	Emotional issue, 6, 5, 3, 2, 1	Kills pathogens. Improves the food quality
DDT	Emotional and political, 6, 5, 3, 2, 1	Major positive effect on world health
Chlorination	6, 5, 3	Kills pathogens. Saves millions of lives/a.
Fluoridation	6, 5, 3	Positive effect on overall health
Ice age	Temporarily forgotten, 1	Emotionally speculative future issue
Meteorite impact	Occasional hysterical issue, 1.	Feared out of all proportion to its small risk.

1. Assumed adverse effects are based upon fear and wilful misunderstanding - little supportive science.
2. Politically manipulated issue, based upon fear, out of all proportion to its actual social impact
3. Environmental extremism issue, based upon emotional manipulation and with little, or no scientifically supportable adverse data.
4. Valid concern though with minor social effect in the industrial societies
5. Mostly an emotionally manipulated issue with minor, if any adverse effects
6. Mostly beneficial on balance rather than socially detrimental, though manipulated by emotional misinformation to seem detrimental.

Pandemic and serious issues not addressed in the table, are ignorance and poverty. These two are recognized by the WHO and many other comparable human health groups to pose by far the greatest risks to humanity and the environment.

But as neither ignorance nor poverty can readily be manipulated or miss-used to enrage or emotionally mislead many people, they are strenuously ignored by most extremist organizations and politicians.

9. Control Spending Upon Emotional Issues.

Some of the most expensive regulatory issues are shown in Figure 2 and Table 15. They are merely the tip of the iceberg concerning the unwarranted and wasteful expense associated with dealing with highly emotional environmental and other issues.

Figure 2. Estimated Social Costs in the U.S. of Environmental Hysteria, Imposed through mostly Unjustified and Unnecessary Regulations and Political Actions.
Environmentalist-manipulated scare - ALAR in apples: Cost, about $500 million
Unjustified and Non-Cost-Effective Recycling: Cost, many billions of dollars
Unjustified PCB replacement in Transformers: Cost, many billions of dollars
Hysterical Hazardous Waste Regulations: Cost, about 200 billion dollars and climbing
Unjustified CFC replacement: Cost, about 200 billion dollars
Unscientific Radon Hysteria: Cost, about 1 trillion dollars
Manipulated Dioxin Hysteria: Cost, between 1 and 10 trillion dollars and climbing
Unnecessarily Extreme Clean Air and Clean Water: Cost, about 2.2 trillion dollars and climbing
Needless Asbestos Hysteria, and Asbestos Removal: Cost, 2.6 trillion dollars
Unnecessary, Hazardous Waste Site Cleanup (Superfund): Cost, 12 trillion dollars and climbing
Overall Cost of Regulation Administration in 1997: About 690 billion dollars. Lives saved: few
The Regulatory Cost to each U.S. household, is about 7 thousand dollars each year, and rising

9.1 Regulatory Costs.

The purpose of regulations is supposedly to protect public health and the environment; to prohibit the use of 'dangerous' (taken to mean only man-made) materials and; to control the use of `hazardous' materials. There is of course, too much subjective leeway in deciding the meaning of the words 'dangerous' and 'hazardous' to the point where zealous application could result in the control of almost anything in the name of protecting public health.

They can also be used to strangle competition from abroad (imports of fruit, meat, vegetables, tropical oils, rice, dairy products, lumber, potatoes, GM foods), to put imports at a disadvantage, and to target certain industries in order to achieve social change. Some targeted industries include pulp and paper, steel, energy (hydro), coal, oil, nuclear, petrochemicals (plastics and chemicals), drug manufacturers, foreign automakers etc.

The most expensive and the most ineffective of these are Environmental Regulations, where nine of the ten most expensive regulatory interventions are environmental. These are far less cost-effective than any other type of risk management policy and are about 150 times more expensive than most medical intervention actions. That is, the money spent on environmental regulations, supposedly to save even one (usually hypothetical) life, would save about 150 real lives, if it were used in some areas of health care.

Table 15. Very Approximate Social Costs (Per Life-Year Saved) of Selected Life-Saving Interventions

The Least Costly (Prevention)	**Social Cost ($US)**	**The Most Costly (Regulation)**	**Cost $US**
Smoke detectors in homes	< $0 *	EPA Regulations	$7.6E6
Childhood immunization (U.S.)	< $0 *	Asbestos control	$ 1.4E9
Most medical screening (U.S.)	< $0 *	Radionuclide Emissions Control at Coal Plants	$2E9
Drug/alcohol treatments (U.S.)	< $0 *	Benzene emissions (Tire Plants)	$20E9
Anti-smoking programs	< $0 *	Radionuclide emissions	$34E9
		Chloroform emissions (Pulp Mills)	$99E9

*What does < $0 mean? It means, for example, that the cost of having smoke detectors in homes is highly cost-effective, and is much less socially costly than not having smoke detectors in homes

Approximate Costs of Saving a Life (mostly medical) Versus Costs of Avoiding a Fatality (mostly Regulatory.

Costs of Saving a Life	**Costs $US**	**Costs of Avoiding a Fatality.**	**Costs $US**
Immunization, Third World Countries	< $100	Sulphur Scrubbers in Power Plants	$500E3
Medical X-Ray Equipment	$3.6E3	Coalmine safety	$22E6
MICU: Mobile Intensive Care Units	$30E3	Radioactive Waste Storage U.S.	$10E6
Medical Screening and Care in the U.S.	$10E3 to $70E3	Radioactive Waste - Iodine-131	$100E6
		Defence High Level Waste	$200E6
		Hazardous waste incineration (EPA estimated)	$288E6
Breast cancer Screening	$80E3		
Traffic Safety Measures	$20E3 to $300E3	U.K. Radioactive Waste Storage	$25E9

Rescinding all of the obviously ineffective regulations on the right, and transferring that money to the obviously highly effective measures on the left would result in a major overall improvement in public health, wealth, quality of life, safety, and survival. And therefore, of the environment.

'There is no free lunch', so what does < $0 mean in Table 15? It means that it saves lives at essentially no cost to society. For example, the cost of having smoke detectors in homes is highly effective, and much less socially costly than not having smoke detectors in homes. As for the items to the right in Table 15 - despite emotionally misleading publicity - they generally kill few, if any people, therefore the money spent saves few, if any lives. Addressing them to ANY degree is highly in-effective. Rescinding all of these and most comparable regulations and switching money from right to left would directly benefit millions of people, while harming relatively few. The overall health of society would improve.

Unfortunately, such a progressive and socially desirable and protective change is not likely to take place without considerable political fireworks and casualties, and therefore it probably will not happen.

Many regulations were adopted at a time when analytical capability was minimal and when the limits of detection for most substances was at the level of parts per thousand, to about 50 parts per million. The responsible intent of the various acts was to ensure that sewage, noxious materials, industrial effluents, garbage and other substances were not haphazardly dumped into waterways, many of which were the sources of public drinking water. At that time, prior to about 1900, Outbreaks of cholera, bacterial blooms, smells and fish kills were obvious problems that needed to be addressed.

Many of the normal constituents of most water supplies, present in trace quantities in most waters, could not be analysed or, if they could, could not be detected, and those that were detected were not recognizably or significantly hazardous at the concentrations that were present.

Today, because analytical capability has improved a million fold we can now detect traces of just about any chemical in everything - even down to 1 molecule – where it had never previously been detectable, though it was certainly present. We then mistakenly assume that our water supply is more polluted than ever before, and is therefore hazardous. In truth it is usually LESS polluted and less hazardous. We also assume that almost everything that might be detected is dangerous and should be banned. We invoke the unworkable, highly costly, and unscientific 'zero tolerance' and the equally flawed 'Precautionary Principle'.

Fewer and fewer waters can meet the ever-tighter requirements. We have cleaner water today (with few exceptions, especially with regard to sewage) than ever before, but because of the continuously lowering baseline of detection, and ever-tighter standards (usually based upon politically correct desires and public fear, fanned by special interest factions), we classify more of them as being unacceptably polluted, when they are not.

In terms of drug approval regulations, although the US Food and Drug Administration (FDA) is required by law to issue a ruling in 90 days or less, it takes about 900 days or almost 3 years for the FDA to rule upon the approval or not of a new drug. After seven years of one such delay, it eventually gave approval for the beta-blocker drugs, and the commissioner pointed to the 17,000 lives per year expected to be saved. He missed

mentioning that over 100,000 people had very likely died in the seven years waiting for the drug to be approved!

The workplace is flooded with counterproductive regulations that supposedly are designed to improve safety in the work environment, but usually don't. Strangely, the most dangerous place for anyone to be is at home, which is mostly unregulated. Just look under the kitchen sink or in the bathroom cabinet. There are about 250 hazardous chemicals in the average home. We have safety bulletins and safety sheets (WHMIS, MSDS) for everything at work, such that information on the truly dangerous materials (some chemicals) is buried in a mountain of trivializing information on relatively innocuous materials. For example, there are several pages devoted to safely handling and dealing with stearates (soaps) and other relatively harmless cleaning materials.

Spending because of regulation, costs Americans about $1 trillion each year. This is about 10 percent of the annual value of the entire economy. There is minuscule corresponding benefit.

Over one recent twenty year interval, U.S. businesses were forced to divert almost 15 percent of their total fixed investment to what was described as non-productive environmental equipment, forced on them by regulation. Such costs, cause many more deaths than they save lives, because they waste wealth on the wrong issues, limit employment, put people out of work and are draining society of its wealth and of its ability to cover the costs of health, education and welfare, from which the greatest benefits to society and the environment arise.

9.2 Cost-Benefit Considerations

In this ever-changing society, humanity and the environment would all be better off, if most regulations were enacted with a life span of no more than a few years, with the option of modifying them, renewing them, or abandoning them as required.

The White House Office of Management and Budget once estimated, for example, that the EPA's regulation of **pentachlorophenol**, a wood preservative used on telephone poles, might prevent a single death from cancer but at a cost of $5 trillion! One critic of the EPA and other regulatory authorities in the U.S. noted that if the intent of the regulations were to save lives then, considering the costs of regulations relative to lives saved (on average, about $100 million dollars per life saved - meaning that implementation takes about 20 lives for each one saved, for this example!), that society would be better off if the EPA performed a cost-benefit evaluation of each and all of its many rulings and recognised that it was not a socially cost-effective organization, and disbanded itself. The same is true of most governmental 'departments of the environment'. However, political empires rarely seek a reduction in their influence or power, no matter how ineffective they are.

Getting society to objectively rank its risks and apply cost-benefit considerations **before** it engages in any efforts to address them, is obviously a forlorn hope outside of the scientific community.

One court recently came to a revealing conclusion concerning an obviously political aspect of research in the EPA. It noted that the EPA had been publicly committed to a conclusion upon one of its most widely publicized projects, for about four years before the research to support that conclusion had begun. The same criticism could be levelled at most environmental regulations in which an 'Alice-in-Wonderland' disconnect applies, as epitomized by the pronouncement of the Queen of Hearts 'Sentence first, verdict afterwards'. Which also turns out to be an exact analogy of the Precautionary Principle.

Society will continue to pay an extreme price for its blind ignorance concerning most risks and how best to address them.

Bibliography.

American Council on Science and Health. Web site www.acsh.org. This site is one of the most scientifically qualified of all web sites to cover many scientific and health issues. The contributing and reviewing scientists include many Nobel prize winners, and it is a highly respected source of information.

The Centers for Disease Control and Prevention. Web site www.cdc.gov. This site provides extensive high quality coverage of health issues across the nation and provides numerous linkages to other reliable and qualified government and industry sites where reliable demographic data can be obtained.

Energy Risk Assessment. Herbert Inhaber. 1982. Gordon and Breach Science Publishers. This book created a flurry of criticism in some environmental circles when it appeared, as it exhaustively compared the risks of all significant energy options and showed that many energy sources assumed to be 'safe' were much less safe than was being suggested, and that others were relatively much safer than was being publicized.

Environmental Protection Agency. Web site www.epa.gov. This site provides details of many of the regulatory actions of the EPA and provides linkages to other sites.

Keeney, R. L. Mortality Risks Induced By Economic Expenditures. Risk Analysis, Vol. 10, No. 1, 1990. This document shows how financial expenditures must take into account cost benefit evaluations of responses to risk in order to ensure that financial expenditures do not take more lives than they save overall.

Pacific Research Institute. Index of Leading Environmental Indicators. 7th Edition, April 2002. This is a downloadable report available from www.pacificresearch.org. This report factually examines changing energy and environmental issues with special focus upon Air Quality, Water Quality, Toxic Chemicals and Biodiversity.

Tengs, T. O, et al. **Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness.** Risk Analysis, Vol. 15, No 3, 1995. This document examines the cost-effectiveness of many supposedly life saving regulatory interventions and shows that

many of them overall, take more lives than they save, by wasting wealth (most EPA and NIOSH regulations). They are thus not cost-effective, while others are very cost effective (preventive medicine and childhood vaccinations), but are relatively under funded.

The Science and Environmental Policy Project (SEPP) web site. www.sepp.org. This site provides informed commentary upon many scientific and environmental issues that is often at complete variance with the views of the establishment and many special interest factions.

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