The Secretary,

The House Standing Committee on Climate Change, Water, Environment and the Arts

## Inquiry into climate change and environmental impacts on coastal communities

**Submission by Dr Bill Laing**

# HOW DOES THE HOUSE COMMITTEE ASSESS, AND ACT ON, ITS INPUT SUBMISSIONS: THE NEW PARADIGM OF RISK ASSESSMENT UNDER GLOBAL WARMING

## WHERE MY SUBMISSION IS COMING FROM

I am Managing Director and Principal Consultant of Laing Exploration Pty Ltd, an Australian consultancy provider to the international metal mining industry for 20 years. I am an earth scientist with a vested financial interest in the mining industry. I was an academic scientist at James Cook University for 7 years. I also have a long history of sociopolitical activism, for example as North Queensland convenor and longtime member of the international organisation Scientists Against Nuclear Arms (with several thousand members in Australia). I was the producer and artistic director of the North Queensland Reconciliation Concert, one of 9 Australian events in the Sydney Olympic Sea Change Concerts in 1998. I have personal entries in "Who's Who in Asia and the Pacific" and "3500 Eminent Scientists and Engineers of Australia" (Australian Academy of Science). My company website is {www.laingex.com}.

Last year I traded investment house properties, for the express and sole reason that I wanted to eliminate my exposure to sea level rise. I sold a property on Magnetic Island, North Queensland, at 3.6m above Australian Height Datum (AHD), and bought a property at Catherine Hill Bay, New South Wales, at approximately 20m above AHD.

Nevertheless I recognise that global warming will have significant impact on my coastal property, and I want to minimise this impact.

### What my submission offers

My submission provides no new information on global warming. My submission offers advice to the House Committee on how to assess its inventory of submissions, and how to craft a message about the urgency of action to protect coastal communities. This is to use the concept of risk assessment and the risk equation, to clarify which responses to climate change are needed in the short term and which may be implemented later, when scientific information is more definite on the impacts of global warming.

My submission develops a framework of assessment, based on the new reality of global warming. It follows an initial analysis of the risk equation in global warming, which was published in the Australian Institute of Geoscientists Newsletter, 2005.

### The terms global warming and climate change: What they mean, and how they are (mis)used

The two terms are of great importance. They mean different things. Both are relevant and useful. They are also consciously selected by lobbyists (vested interests) in order to direct the debate agenda into one of two paradigms; "less frightening, and less real" and "more frightening, and more real".

*Global warming* is the fundamental dynamic, which drives *climate change*. Global warming is a planetary-scale phenomenon, while climate change is a more local phenomenon. The globe (atmosphere and oceans) is warming, and most, but not all, regional climates are changing.

Global warming: The scientific consensus in 2008 is that global warming is happening. The scientific consensus in 2008 is that it is happening because (a) Homo sapiens is adding chemicals to the atmosphere, and changing the biosphere and landscape, (b) this is consequently changing the heat-transfer

properties of the two main solar-heat sinks the planet possesses: the atmosphere, and the oceans, (c) this is consequently increasing the heat content of the atmosphere and the oceans.

Coastal communities are more vulnerable because they sit at the interface of those two parts of the globe. However coastal communities provide a vital positive. They are the "canary in the coalmine"; the impacts of global warming are so obvious along coastlines, that they give us advance warning of impacts which will ultimately be more pervasive across the landscape.

Climate change: This increased heat content of the atmosphere and oceans is producing changes in climate around the planet. The overall climate change is to a hotter planetary climate. However this is not uniform around the planet, because the planetary climate controls (principally latitude, landscape, distance from oceans, and the type of currents in that ocean) are not distributed uniformly. Most parts of the coastline are developing a hotter climate, and some parts a cooler climate.

# ASSESSING GLOBAL WARMING: A SPECIFIC PROCEDURE GOVERNED BY THE RISK EQUATION

Australia's assessment of global warming can be usefully portrayed as governed by the risk equation:

*Risk from* global warming = (*Probability of* global warming) x (*Damage* if it occurs)

The risk equation says "If the perceived damage from global warming is large enough in an area, the probability of it happening only has to be very small to generate a major risk for that area". If the probability of global warming by $2^{o}$ by the year 2050 is 1 in 100, and the estimated damage from this temperature rise is $100 trillion (in monetary terms), the risk becomes something worth spending say, $1 trillion to avert.

The risk from global warming is only partly an issue for science. The risk equation has *two variables* (on the right hand side) both of which combine to produce the risk. They are the only variables involved (as long as we have time factored in to the probability variable). If we can pin each of them down we have the answer to how serious global warming will be.

The *first* variable, the *probability* of global warming, is primarily a scientific question; the *second* variable, the *damage* to the human race from global warming, has aspects amenable to scientific conjecture but it is predominantly a human social question.

Scientists can advise on the probability variable; produce figures (for example on how much sea level may rise), and cite a range of supporting evidence. Submissions to the Inquiry from Geosciences Australia, and the Bureau of Meteorology has this character. However the damage variable is a question which requires informing by the full range of stakeholders: business, tourism, agriculturalists, scientists in different fields, the insurance industry, etc. Submissions to the inquiry from organisations like Engineers Australia, the Planning Institute of Australia and Professor Bruce Thom have this character of combining social perceptions, legal/economic constructs and scientific evidence.

And damage is not simply a question of survival, however that is defined. Damage involves commercial, environmental, community, and socio-psychological values. The Pacific atoll nations will have a very clear understanding of the risk equation, and of the subset role of science in the global warming issue. The psychological impact of global warming may already be upon us in our children's generation.

In the public debate *the probability and the damage are two separate and independent issues*. Citizens might disagree strongly about the probability (low or high), but the citizenry may well have consensus that if it happens, the damage will be very large. A low probability may well still produce an unacceptable risk to Homo sapiens.

Scientists who understand the risk equation may allow it inform and constrain their advice. These scientists are commonly also greenies, precisely because their science informs their social behaviour in that direction. These scientists understand that, beyond and unlike academic science, time is of the essence, as explained below. Planet earth may not wait until the next funding round for further research.

These scientists also understand that the risk is not for scientists to assess. It is for the citizenry to assess. The Inquiry in its report can help place the information before the citizenry so that political decisions can be informed by risk-aware organisations rather than those who have not absorbed the risk equation. A useful example of a paper which analyses the different types of scientific input into the global warming debate, can be found at {www.sgr.org.uk/climate/CCampMythNotes_Aug06.html}.

# THE CRITICAL ROLE OF TIME IN GLOBAL WARMING

## Homo sapiens has accelerated the geological rate of global warming

Homo sapiens has accelerated the geological timeframe in which global warming has occurred throughout the previous 4,000,000,000 years (most of the age of planet earth). The global warming which has taken place, and is projected to take place, after 300 years of Homo sapiens' "industrial" period, is the same as the global warming which took 3,000 years (give or take) in the various Quaternary warming events (Figure 1). And the Quaternary is acknowledged by scientists as faster-than-normal global warmings. A direct analogy for non-geological citizens is the accelerated evolution of domestic animals also caused by Homo sapiens. The wolf Canis lupus cruised along for 1,000,000 years without much change, then in 5,000 years Homo sapiens created a hundred dog subspecies many of which look nothing like a wolf.

Earth scientists understand more than most, the difference between geological time and "human time". However many earth scientists still do not appreciate the fact that Homo sapiens has created the capacity to transform a geological process, operating across the face of the planet, into "human time". It should not surprise us that the citizenry has not yet absorbed the frightening power of Homo sapiens in creating the global warming monster. Perhaps we do not want to, and most certainly we are not ready for it.

## The probability of non-uniform rates of global warming and its effects

Humans think generally in terms of linear rates of phenomena; our domestic measurements are all linear, the sun transects uniform angles per hour across the sky, weather and air masses travel across continents at the same rates as 1000 years ago, and so on. Indeed most humans may be incapable of understanding non-linear rates (logarithmic, square or cubic functions, etc). Until recently scientists have framed their global warming analysis in linear rates of change (eg a fixed projected sea level rise per annum, for every decade into the future), simply because the available data and models were too sparse and simple to flag, or require, non-linear rates of change. However with increasingly large and reliable data, the models are pointing to the real possibility of non-linear rates of change, with accelerating rates of increase in sea level and atmospheric temperature (eg a projected sea level rise per annum, which increases every decade into the future).

This means that (a) the scientists are in mathematically more uncertain territory, as they try to pin down (for example) the non-linear function which governs sea level rises, and (b) we are pushing more into the territory of unstable equilibrium; a local planetary event, such as the disappearance of the Greenland icecap, might trigger larger and faster icecap meltings in Antarctica and precipitate never-before-seen rates of sea level rise.

All this means two additional things, on top of the reality of global warming:

1. Increasing uncertainty, in all the impacts of planet earth on our species and our society.
2. The damage-causing sea level and temperature increases are likely to get worse, rather than remain at their current rates. "You think it's bad now....."

**The risk equation contains time as a factor**

The probability variable in the risk equation has an "elephant in the room". The probability is not a static index; because Homo sapiens is creating global warming via our actions, the probability of (a specified amount of ) global warming *increases with time whilever these actions continue.* In other words (using the mathematical symbol $\propto$ for "increases with"):

*Probability* $\propto$ *time wasted in inaction*

Hence the risk equation takes on time, as a variable impacting on the risk:

*Risk from* global warming $\propto$ (*Time wasted in inaction*) x (Damage if it occurs)

The impact of time-wasting, in increasing the probability of global warming, is a fundamental *scientific fact* which no amount ot politicking can change.

**How does this relate to the House Committee?**

All submissions to the Committee which (inadvertently or purposefully) seek to delay the urgent consideration of, and action on, global warming, are contributing to global warming. *The risk equation shows that, far from "scaremongering", this is a scientific fact.* The House Committee can, with scientific confidence, charge these submissions with contributing to the very problem which the Australian Government is committed to averting or minimising.

All such submissions can be classified as "delaying" submissions.

The scientific reality of time impacting on global warming can be encapsulated in a political message to the citizenry: "Global warming: Are you ready for it?"

## ASSESSING THE INQUIRY'S SUBMISSIONS: HOW DOES THE HOUSE COMMITTEE MANAGE ITS INFORMATION?

### Do submissions to the Committee all go into the same "variable" box?

No. One (small) group of submissions provides input into the probability variable, while another (much larger) group provides input into the damage variable (Figure 1).

| PROBABILITY VARIABLE | DAMAGE VARIABLE |
|---|---|
| Quaternary geologists | Environmental scientists |
| Marine (sea level) geologists | Engineers |
| Climate scientists | Planners |
| Palaeontologists | Hydrologists, soil scientists |
| Biologists and ecologists | Biologists and ecologists |
| Anthropologists | Insurance technicians |
| | Local Councils |
| | Medical scientists, epidemiologists |
| | Emergency agencies and services |

**Figure 1** The two different groups of inputting professionals into the two variables of the risk equation.

### Which submissions may not be so helpful?

The submissions can be ranked as follows, from high to lower value in dealing with the question of risk:

1. Authorities and individuals who are experts in either the probability or the damage variable, and confine their input to this variable.
2. Authorities and individuals who are not experts in either variable, but who offer a perspective which helps the Committee understand, filter, and draw conclusions from the scientist input.
3. Layperson with a reasoned position on the damage variable.
4. Authorities and individuals who are experts in either probability or damage, but spread their input across both variables; their input is hopefully amenable to being separation into each variable, and in this way rendered of value to the Committee.

As an example, a submission from Dr Bill Laing to the Committee, would be entitled to include three categories of information, and the Committee would rank it as follows:

A What I have provided in this submission: Type 2 - scientific perspective
B Information on damage to the resource industry: Type 1 - scientific (expert) information
C Information on damage generally: Type 3 - layperson with a reasoned position

**How does the House Committee best assess its submissions and input?**

The House Committee might best manage its submissions in the following way:

Classify each submission into the following categories:

1. Its value - Types 1 to 4 above.
2. The variable it addresses – Probability or Damage.
3. Its credibility - Does it step beyond the one variable field? Does it offer input or an opinion (perhaps implicit) on damage, which is outside its field of speciality?
4. Its "time-related" impact – A "Delaying" or a "Non-delaying" submission

## A NEW PARADIGM OF RISK ASSESSMENT TO ACCOMMODATE GLOBAL WARMING

### Global warming requires a new paradigm of risk assessment and damage estimation

Government and business have developed different paradigms in which they make decisions on global warming. Government, by inertia, maintains its historical conservative approach to decision-making for the future: project the same risk factors into the future, and if the risks are too uncertain, either retain a conservative risk assessment which doesn't upset too many constituent applecarts, or do nothing. On the other hand business is being led by companies who consciously, and courageously, have "cleared the deck" and adopted a new paradigm. They dispassionately absorb the scientific data, and project their own risk and damage assessment into their decision making for the future. They are doing so on less certain damage estimations, and they are doing so nevertheless.

As a socialist, I believe there is a wonderful source of reality in the real powerbrokers, the capitalist owners of production. We can bet our boots that with their commercial self-interest paramount, they will know more about the risk equation in global warming than Government and many expert scientists. The G8 Summit in 2005 (the IAEA, IMF, UN, WTO, and the World Bank, in partnership with the USA, UK, France, Germany, Japan, Canada, Italy, Japan, Russia, China, Brazil, India, Mexico, and South Africa) stated in its final manifesto: "All of us agreed that climate change is happening now, that human activity is contributing to it, and that it could affect every part of the globe. We know that increased need and use of energy from fossil fuels, and other human activities, contribute in large part to increases in greenhouse gases associated with the warming of the earth's surface".

This was a commercially radical message at the time, and the world learned from it. The present House Committee, and the citizenry, can assess the multitude of submissions and positions on global warming, via the risk equation with its inbuilt time-dependency. Information on its first variable, the probabilities of global warming and its associated effects, is appropriately sought from scientists with credibility. Information on its second variable, the damage to the planet and to Homo sapiens from global warming, is appropriately sought from us all. The risk is time-dependent, and increasing every day. The probability debate can be left behind as an unnecessary distraction, leaving the risk actuaries to argue over the numbers. We must rapidly develop at Government level, procedures to estimate global warming damage.

This requires a new, non-linear paradigm of global warming, to replace the past and current conservative paradigm, of modelling based on static rates of environmental process. The new paradigm has the characteristics outlined in Figures 2 and 3. The old paradigm answers the question "What is the risk of a repeat of the already-experienced event?" The new paradigm has to answer the question "What is the risk of this new, never-experienced event?"

To illustrate the depth of the problem of risk assessment in the new global warming environment, we can imagine the City of Sydney asking Lloyds of London "Can you insure Sydney against a meteorite destroying the city?" The answer is "Yes"; Lloyds has the resources to do this: (ii) the geological probability data (many thousands of meteorites have struck planet earth, in known locations, and their mass, velocity and destructive capacity are reasonably well known), and (ii) the demographic and property-value data for Sydney. In contrast, the data which are required for global warming risk assessment (which are in principle the same kinds of probability and damage data as for the meteorite impact) are much more complex, and less well known, than for the more unlikely event of a major meteorite impact on a large city.

| PARAMETER | OLD RISK PARADIGM - BUSINESS AS USUAL | NEW RISK PARADIGM - GLOBAL WARMING |
|---|---|---|
| Natural events/rates | Linear | Non-linear |
| Equilibrium | Stable | Unstable |
| Cause of event | Far field - natural | Near field - human |
| Event cycle | 100 years | 10,000 to 10,000,000 years |
| Risk event | Seen/experienced | Never experienced |
| Damage | Known and predictable | Unknown but modellable |
| Financial cost | Known and quantifiable | Unknown but modellable |
| Capacity to destroy things | 100% | 100% |
| Capacity to destroy society | 0% | 100% |
| Psychological readiness | Yes | No |

**Figure 2** Characteristics of the two paradigms, historic and future, in which risk assessment has been, and needs to be, assessed.

The new risk paradigm is implied in the Insurance Council of Australia's submission, when they state in their covering letter:

> We further submit that measures designed to increase community resilience to inundation and in a broader sense, extreme weather events should be central to a national program of reform and resilience building and adaptation, including changes to planning and development regimes as well as national coastal defence, coastal retreat and back-zoning policies.

They expand this and connect the ideas of non-linear change, disequilibrium, and reliance on modelling, to risk assessment on page 5, in stating:

> This spectrum of regulations and arrangements have been formed over time and have been based upon historical assumptions about the nature, frequency and intensity of extreme weather events and coastal sea levels. For example coastal planning guidelines have been based in part on the assumption of a certain mean sea level for the life of a development. Building codes and standards have also been based upon static assumptions of historic gust wind speeds, and many stormwater mitigation and drainage systems have been designed for historic 1:100 inundation events.
>
> So far, this approach has delivered a fitting balance between the risks and costs to the community. However, present day climate change modelling indicates that many historic assumptions used in making decisions for life-cycle management of the built environment and community operation, are no longer appropriate.

These are the people whose business success depends most on making good risk assessment. The nation as a whole can also profit from listening to their view.

**Recommendation**

I recommend that the Federal Government, through COAG and its Ministerial Councils, adopt the policy

*that Governments at all levels as a matter of urgency regulate planning decisions on the basis of the new risk-assessment paradigm of non-linear changes to the natural and built environments due to global warming: .*

- *a moratorium be instigated on all currently under-way or newly-proposed development in coastal areas, with exceptions to be made only on the basis of an acceptable risk assessment.*
- *planning decision-makers such as Ministers for Planning through their national peak bodies to adopt a code of practice which incorporates a new ethic that the likelihood of land subject to a development application becoming uninhabitable in the next say 50 years (due to global warming impacts) is sufficient reason for a government not to allow the development.*
- *local councils be empowered by regulation to use the likelihood of land becoming uninhabitable in the next say 50 years as a factor in making decisions about development proposals.*
- *protection from future compensation claims on the state for damage from global warming impacts to be built into government practice via*
    1. *full disclosure of all data held by government relating to local or general impacts of global warming, and*
    2. *all prospective government planning decisions to be assessed and rated for global warming risk before they are determined.*

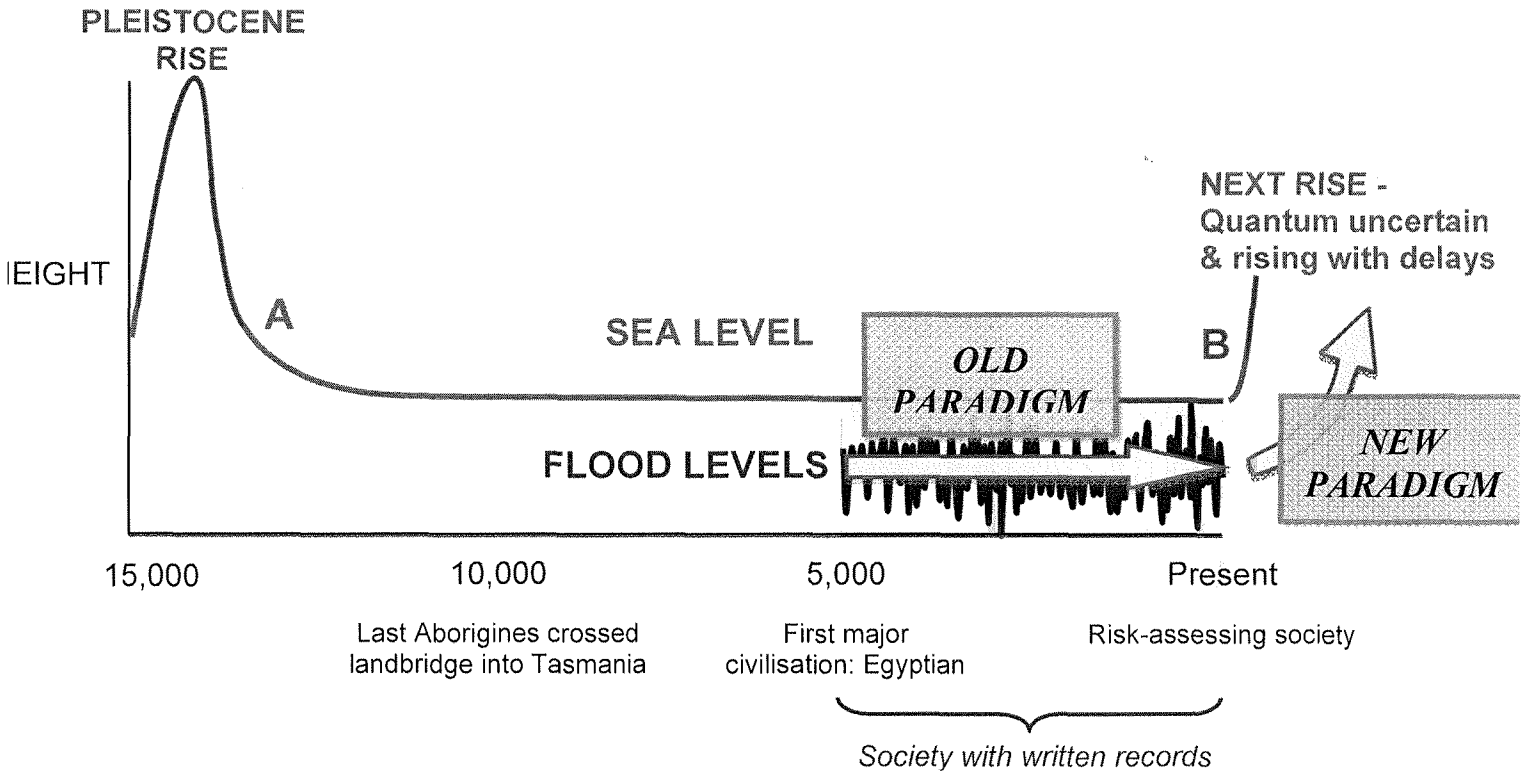


**Figure 3** Graph of the two risk events (flooding and global warming) which best illustrate the fundamentally different bases of risk assessment: current practice (the old paradigm), and the new practice to deal with global warming (the new paradigm):

**Flood events** (blue): Historic (depicted notionally as 100 year flood events), experienced by Homo sapiens, linear (non-varying) rates (that is, the mean historic flood level in one place – the straight arrow - is constant), stable equilibrium, predictable – THE OLD PARADIGM

**Global warming sea level change** (red): Prehistoric and post-present; not recorded by Homo sapiens, non-linear (the curved arrow), probably unstable equilibrium, not readily predictable - THE NEW PARADIGM

The graph shows the last sea level change, at "A", with a duration over "geological" time measured in 1,000's of years, while the next sea level rise, at "B", will take place over "human time" of 100 years. This is expressed as a much tighter curve at B.

It is interesting to speculate that if Aborigines had written records, or if their dreamtime stories were specific, they would be able to provide information on the last sea level rise.