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THE GREENHOUSE CHAIN REACTION

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Back in the 1940's, much of the public discussion about Nuclear Energy centred around the possibility that the splitting of an atom could trigger a chain reaction that would be both uncontrollable and cataclysmic. What has gone largely unnoticed in the present debate about global climate change thus far, is the fact that it as well has the potential to start a chain reaction which could also be uncontrollable and could add massively to the level of carbon presently in the atmosphere and consequently to global warming as well

The problem I refer to is not one that we know much about in the Southern Hemisphere because it barely occurs in that area, It relates in fact wholly to the Northern Hemisphere for reasons that will become apparent later. The effect of the problem never the less will be felt everywhere, as it occurs.

The Northern Hemisphere contains about 3 billion hectares of what is known as permafrost. Technically this is underlying ground that has remained frozen for at least 2 years although most of it has remained in this state for about 120,000 years. In terms of depth, the permafrost varies from about 60 metres in thickness to about 1.5 kilometres. It occurs both within the Arctic Circle and outside it and extends right around the globe through Siberia, Northern Europe Canada and Alaska.

Permafrost by its very nature is stable and its temperature measurements therefore provide a more reliable measure of global warming than air temperature which has a propensity to vary frequently and rapidly. This is why scientists keep a close watch on whether the permafrost is warming up or not and to what extent. In most parts of Alaska, for example, their findings are that the permafrost has warmed about 3 degrees over the last 25 years or so Although in some parts the warming has been nearly 6 degrees.

Permafrost is normally warmer the deeper one penetrates into it because of the heat flux emanating from the earth's centre, just as occurs in any mine. Under 'normal conditions' the permafrost's surface is its coldest point and it gets progressively warmer down to its lower reaches. But this, so the scientists tell us, has been changing and the upper levels have warmed significantly. The coldest part of the permafrost has gone deeper and now, probably lies around the mid way mark.

Above the permafrost lies what scientists refer to as an 'active layer' which ranges from a few centimetres in width to about a metre. The active layer freezes in the winter but thaws out in summer which enables it to support plant growth from large trees through shrubs and grasses down to lichen. This plant life dies off in due course like plant life anywhere but because of the low temperatures, it never fully decomposes and new plants continually keep growing out of their rotting predecessors. Over time, this organic matter is gradually pressed down below the active layer and into the permafrost where it has remained for thousands of years in a sort of suspended animation.

As a means for permanently retaining sequestered carbon dioxide from the atmosphere, this process, which is called cryoturbation, works very effectively. The only problem is that the process can be reversed. Under certain circumstances, the organic material stored in the permafrost in the way I have described will break down and emit not only CO_2 but the far more potent methane. Methane, as a greenhouse gas, has a warming potential 21 times that of CO_2. In the first 10 years or so of its existence as a gas, a single kilogram of methane possesses the global warming capacity of about a tonne of CO_2. although its life expectancy is substantially less.

Observers have recorded the warming of the upper levels of the permafrost at many sites in different countries around the Arctic Circle. But it is not the warming of the permafrost itself that causes concern so much as the warming of the organic material lying

at the top of the permafrost. Global warming has triggered the warming process and, in doing so has started a 'chain reaction' that can have the effect of dramatically increasing the carbon content of the atmosphere and the rapid acceleration of climate change. The similarities between this situation and a nuclear chain reaction are inescapable. That becomes all the more apparent when it is understood that the quantity of carbon stored in the organic material cryoturbated into the permafrost is estimated to be as high as 450 billion tonnes; and that's carbon we are talking about, not CO_2.

If you can envisage the release of that much carbon or a sizable quantity of it into the atmosphere in addition to all other emissions, you will appreciate the magnitude of the problem. Now take the thought one step further by reflecting that all that is now required is for the permafrost to get just a little bit warmer. Take those thoughts through the final step which is that CO_2 once emitted remains in the atmosphere for about a century which in turn means there is nothing we can do to stop the earth warming for that period of time or, it would now appear, to prevent the permafrost emissions from occurring.

The purpose of this paper is not to alarm but to suggest we must move much faster than we are to reduce greenhouse gas emissions. Australia does not have time to wait until the processes of geo-sequestration have been fashioned into a cost effective commercial reality; that will take another 20 years at least. Even the massive introduction of nuclear power stations that we are likely to have, cannot be completed for about the same time. In any event we need more ways of reducing greenhouse emissions than both of these together can provide. What this country needs is an Emissions Trading Market and we need that market to commence no later than 1 January 2008, just like the Kyoto Treaty requires.

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