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The coldest winter is still to come

Although fallout would be a major early hazard after a nuclear war, the most serious and immediate problem would be mass starvation. Anthony Tucker examines the latest studies of the first — and probably last — nuclear winter.

THE DARKNESS of a nuclear moon would be blacker than can be imagined. The most prestigious scientific group yet to study the once controversial nuclear winter hypothesis — that a major nuclear exchange would trigger disastrous worldwide climatic and environmental changes — has come down firmly in its favour. In addition, new analyses of the atmospheric and climatic consequences, published by two of the world's most able laboratories, have revealed that all earlier assessments are underestimates.

Validation of the nuclear winter hypothesis began in the US with the unveiling of a two-year study carried out by the independent international body known as SCOPE (Scientific Committee on Problems of the Environment) which operates within the framework of the International Council of Scientific Unions. Its membership is drawn from the highest level on both sides of the Iron Curtain. Under the chairmanship of Sir Frederick Warner, an Establishment scientist of such stature that even the most savage of hawks could not hope to smear him as an eco-nut, a series of committees examined the separate facets of climatic change that might be initiated by the injection of massive volumes of dust and smoke into the atmosphere.

The SCOPE study deliberately avoided the pitfall of putting in a notional figure for the total yield of a nuclear exchange, a source of endless but pointless debate. The choice seemed to baffle defence analysts who tend to think of effects in terms of warheads. Instead, the study took as its basis a relatively modest assumption — the destruction by blast and fire of 100 cities. With around 20,000 megatons to play with, the Great Powers could manage this, at least on paper, several times over. Once would be more than enough.

In its initial studies of the injection of smoke, soot and dust into the upper atmosphere, the SCOPE committee found that some earlier assumptions about the importance of different sources were not sound. It had been thought, for example, that the smoke injection from massive forest fires could play a critical role in the blocking of sunlight and the lowering of surface temperatures — the basis of the notion of nuclear winter. The SCOPE calculations revealed that nuclear winter could be real enough — at its peak the dust veil would block about 90 per cent of the solar energy normally reaching the earth's surface with temperature reductions of around 20 deg C — but that the major sources of soot and smoke would arise from the rapid combustion of urban areas and their huge stores of fossil fuels.

It is assumed that the nuclear exchange would be in the northern hemisphere. Within two weeks, the huge dust veil would begin to drift into the southern hemisphere where crucially important atmospheric circulation patterns would be disrupted. Specifically the important monsoon circulation, underpinning all sub-tropical ecosystems and agriculture "could be essentially eliminated," the study warns. Rainfall would occur mainly over the sea instead of over land, and large areas of Africa, India, South-east Asia, China, Japan, and Australasia would suffer prolonged periods of low temperature and drought.

Major oceanic currents, which are crucial to marine productivity and climatic stability, could be disrupted.

These disruptions appear, from the dynamic models available, highly sensitive to seasonal effects. Whichever hemisphere happened to be in winter at the time of the holocaust would probably be least affected. But the first nuclear winter, in either hemisphere, could be devastating and — for most of humanity — the last.

For although environmental radiation from fallout would be a major early hazard and a substantial cause of death among survivors in the northern hemisphere, the most serious and immediate worldwide problem would be that of mass starvation, even in countries such as Australia which have a large food surplus. Agricultural production would not only be disrupted by climatic change but by collateral factors from the nuclear destruction — the loss of fertiliser production, uncontrollable fires, the destruction of major ports, the absence of transport fuels and of the normal facilities of the world's food distribution network.

In many countries, such as China, Japan, India and even countries in South America, such as Brazil, the loss of a single season's agricultural production would result in disastrous mass starvation. "This vulnerability of the world to mass starvation through climatic and other effects is not currently a part of our general understanding of nuclear war," says the SCOPE report.

This is bad enough, perhaps, but it is by no means all. The SCOPE report found that the effects of the smoke and dust veil would moderate fairly rapidly — perhaps within a couple of months. Unfortunately this rather optimistic view has since been shown to be false. The models of atmospheric effects used in the SCOPE study were simple in that they examined the results of a massive injection into an atmosphere whose energy budget was otherwise stable and from which soot and dust would be scavenged in the normal way by rain and snow.

But these calculations excluded the effects of solar heating of the upper layers of the injected material and the effect this would have on the dynamics of the dust itself. In studies since carried out at Los Alamos National Laboratory and at the Space Science Division of NASA's Ames Research Centre, it has been shown that solar heating effects would amplify the adverse climatic effects quite dramatically.

It was assumed in all earlier studies that material injected into the upper atmosphere would steadily fall from its original injection ceiling, an assumption which traps the dust and smoke below the tropopause where it will eventually be washed out by precipitation. But the Los Alamos — Ames study shows that solar heating of the high dust veil will induce vertical movements that will carry a substantial proportion of the fine soot and dust particles upward through the tropopause. This material would then become virtually isolated from the precipitation cycle below.

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This means that the climatic effects producing nuclear winter would not be — indeed could not be — short lived. The notion that climatic recovery could occur after a short disruptive period is unsound. Effects producing abnormally low temperatures in the central regions of the major continents could persist into the second season. The tropopause itself would be dissipated but would reform at a much lower altitude than is normal and only the material trapped below it at the time of its reformation would be washed rapidly from the atmosphere. All this points to effects — in particular to mass starvation through the disruption of the world's agriculture — which are not dreamed of in NATO (or Moscow) military philosophy. Not only the combatants but all the people of the world are hostage to this global nuclear spectre.

Of course, nuclear winter studies can be used to justify Strategic Defence Initiative on the grounds that intercepting and destroying warheads in flight would be less devastating than allowing them to arrive. Sadly, and this is the nub of the problem, the argument is flawed because it assumes the absence of counter-measures and the escalation of weaponry and its sophistication which SDI will inevitably stimulate and which history tells us must occur. SDI cannot avoid nuclear winter: it can merely make such devastation more impossibly costly than the present mass of nuclear armaments.

NOTES AND REFERENCES:

The notion of a nuclear winter effect was first voiced by Dr Paul Crutzen (Director, Air Chemistry Division, Max-Planck Institute for Chemistry, Mainz) and Professor John Birks (Institute for Research in Environmental Sciences, University of Colorado) in AMBIO: 1982: vol.10: No.2. The Aftermath of Nuclear War: Twilight at Noon. This paper provides a detailed examination of the problems and remains seminal.

SCOPE report: 1985: The Environmental Consequences of Nuclear War: Wiley, New York: two volumes. To be published in Russian, German, French and other foreign languages before the end of the year.

Influence of solar heating and precipitation scavenging on the lifetime of post-nuclear war smoke: Malone et al: Science: 1985: vol.230: pp.317-9.