

The Long-term Biological Consequences of Nuclear War*

During the past year or so, there have been two significant developments on the above topic in the United States. First, there have been increasing noises from the Department of Defense to the effect that a nuclear war, even a major war, could be not only survivable but winnable. Secondly, a number of scientists, on both sides of the Atlantic, have been taking a careful look at the foreseeable aftermath of any possible nuclear war. Under the systematized scrutiny of several teams of research workers, both physical scientists and biological scientists, a stream of remarkable findings have emerged, which confirm the notion that a nuclear-war solution represents no solution of any acceptable sort.

Two workshops were held during 22–6 April 1983 at the American Academy of Arts and Sciences in Cambridge, Massachusetts—one to examine the long-term world-wide climatic consequences of nuclear war, and the other to assess the likely biological repercussions. Almost 100 scientists took part in the workshops, most of them from the United States, but about one dozen from Great Britain, West Germany, Egypt, Ghana, Venezuela, and—and!—the Soviet Union. Following the total of five days of intensive analyses at the workshops, the background papers were subjected to rigorous and widespread appraisal during the course of the summer, leading to various refinements.

A summarized account of the main findings was then presented at a two-days' 'media conference', at which two principal papers were reviewed—the first by Professor Carl Sagan, of Cornell University, dealing with the atmospheric and climatic dimensions of the issue, and the second by Professor Paul R. Ehrlich, of Stanford University, covering the biological repercussions.† In support were several dozen other distinguished scientists, representing a broad spectrum of opinion, both within the United States and beyond. The aim of the gathering was to present the scientific findings to the media, and also to Congressional leaders and other key officials in the Federal Government. The climax of the conference was a 90-minutes' television hook-up with Moscow,‡ when a

panel of Soviet scientists entered into dialogue with their American counterparts—and indicated that their own research efforts have come up with a very similar set of conclusions.

A 'Nuclear Winter'?

The main results of this large-scale scientific inquiry serve to counter much 'conventional wisdom' concerning nuclear war (to the effect that, while it would be dreadful, it would not be the ultimate disaster for humanity). Basing their models on a 5,000-megaton scenario (only about one-third of the projected arsenals of the super-powers in 1985), the scientists predict that a vast amount of dust, smoke, and soot—conceivably as much as a thousand million tons—would be lofted into the troposphere and the stratosphere. This could be sufficient to reduce sunlight to only a few percentage points of normal values, and cause temperatures to plunge as low as -23°C —thus precipitating a 'nuclear winter' that would persist for at least several months, and would not permit a return to normal sunlight levels for a whole year or more. Plainly this would bring an immediate halt to conventional agriculture, and to photosynthesis of whatever kind. When, as Ehrlich laconically but graphically expressed it, 'the lights were turned on again', human survivors would find that the ozone layer could well have suffered so much depletion that ultraviolet radiation would reach severely incapacitating if not lethal levels.

Furthermore, such a nuclear winter would not necessarily be confined to the main combatant territories in the northern temperate zone. Within just a few weeks, large pulses of cold air could well penetrate deep into the tropics, with all manner of adverse repercussions for their sensitive biotas. Worse still, a phenomenon of inter-hemispheric mixing could cause the dust-and-soot cloud to extend across the Equator and into the southern hemisphere. True, the more the cloud extended its range, the more its density would be dissipated, and the sunlight-excluding effect would become less powerful. Nonetheless, the scientists agreed that there could well be enough attenuation of light and warmth in the southern hemisphere to generate a grossly disruptive impact on photosynthetic processes, and hence on ecosystem dynamics of many kinds. Throughout the world, survivors would find themselves reduced to a level of subsistence agriculture at best, or probably to a hunter-gatherer way of life (supposing, of course, that there remained anything to be hunted or even gathered).

Likely Human and Other Biological Devastation

How many people would be likely to survive? According to the World Health Organization, a moderate-level nuclear exchange would probably kill around 1.1 thousand million people outright, while a further 1.1 thousand millions would be badly hurt or suffer radiation injuries which, in the absence of medical facilities, would quickly prove fatal. Thus almost half of humanity would be eliminated forthwith. As for the rest, the scientists assembled in Cambridge and Washington agreed that the number of eventual casualties through environmental repercussions could ultimately prove even far larger than the number of immediate casualties. With luck we might at best return to something akin to the Middle Ages.

To cite the summation of the biological paper, 'Whether any people would be able to persist for long in the face of highly modified biological communities; novel climates; high levels of radiation; shattered agricultural,

* Contributed commentary on 'The World After Nuclear War: Conference on the Long-term Worldwide Biological Consequences of Nuclear War', held in the Sheraton Washington Hotel, Washington, DC, USA, during 31 October and 1 November 1983, and, we feel, obviating the need for an account of that 'media event' in our Conferences & Meetings section. The Author has asked us to cite our own earlier treatments of aspects of this most horrendous topic, including those in our Winter issue of 1981 and 'The Environmental Imperative of Nuclear Disarmament' in our Summer issue of last year.—Ed.

† See 'Nuclear Winter: Global Consequences of Multiple Nuclear Explosions', by R.P. Turco, O.B. Toon, T.P. Ackerman, J.B. Pollack & Carl Sagan, *Science*, **222**, pp. 1283–92, 1983, and 'Long-term Biological Consequences of Nuclear War', by Paul R. Ehrlich and 19 others [including the Author of the present comment], *Science*, **222**, pp. 1293–300, 1983.

‡ In answer to a referee's questions Dr Myers replied (*in litt.* 21 December 1983), 'the television hook-up was indeed live, with scientists sitting in a studio in Moscow. Whether or not it was transmitted to the general viewing public in the Soviet Union, I do not know.' Yet we can guess that it may well have been, with Academician Evgueni Chazov still the Kremlin doctor, as it was he who earlier 'spelt out the horrors of nuclear war to audiences of 100 million on Soviet television'—see our comment in *Environmental Conservation*, **8**(4), pp. 261–2, 1981.—Ed.

social, and economic, systems; extraordinary psychological stresses, and a host of other difficulties, is open to question. It is clear that the ecosystem effects alone resulting from a large-scale thermonuclear war could be enough to destroy the current civilization in at least the northern hemisphere. Coupled with the direct casualties of perhaps 2 billion people, the combined intermediate and long-term effects of nuclear war suggest that eventually there might be no human survivors in the northern hemisphere. In almost any realistic case involving nuclear exchanges between the superpowers, global environmental changes sufficient to cause an extinction event equal to or more severe than that at the close of the Cretaceous, are likely. In that event, the possibility of the extinction of *Homo sapiens* cannot be excluded.'

Shall the Living Come to Envy the Dead?

During their investigations and presentations, the scientists were invariably scrupulous to remain objective, and to engage in no discussion of the policy implications of their findings. Nor is our Journal the place to gaze into a crystal ball of public affairs. But the reader may wish to

consider whether the scientific analysis does not indicate that a pre-emptive strike by one party against another, successful to the extent that it destroyed all retaliatory capacity of any kind, would still precipitate a climatic and environmental outcome that would leave little difference between so-called victor and vanquished.

Secondly, and in so far as the 'critical threshold' beyond which a nuclear winter could be triggered occurs as low as 100 megatons (Britain's arsenal alone is much larger than this), we may consider our survival prospects when, as is likely if current trends continue (and they may well accelerate), the end of the century will see perhaps 20 nations with nuclear weapons, including those that exist in 'less than stable circumstances'—not to mention the dissident groups of sundry sorts around the world, who take increasingly extreme measures to resolve their disputes and give vent to their grievances.

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Message of the late President Andropov to IPPNW

Despite our usual avoidance of any conscious republication, but believing as we always do that it takes two at least to make a quarrel, we print below the following message from the late Yuri V. Andropov which was received by the International Physicians for the Prevention of Nuclear War and published on the front page of their *Report* (Vol. 2, No. 1, Winter 1983). The circumstances were that, in October of last year, 'a delegation of IPPNW officers went to Moscow to present documents from the Third Congress of IPPNW to a representative of Yuri V. Andropov, President of the Presidium of the Supreme Soviet of the USSR. The delegation included IPPNW co-presidents Drs Bernard Lown and Evgueni Chazov, and IPPNW Vice-Presidents Drs Ole Wasz-Hockert and Dagmar Sørboe. In early November, President Andropov responded by transmitting the following message [through] the Soviet embassy in Washington, DC.'

* * * * *

'I have read with great interest and attention the appeal from your authoritative Congress to the leaders of the Soviet Union and the United States, which was recently conveyed to me. Unfortunately, having caught a cold, I could not meet with you personally in Moscow. Nevertheless, I would like to share with you some of my thoughts in connection with your appeal.

We view it as a highly humane call to avert a nuclear catastrophe. It is deeply consonant with the thinking and feelings of the Soviet leadership and of all our people.

I completely agree with your conclusion about the inevitability of truly devastating consequences of a nuclear war, should it occur. You are revealing the grave truth that people must know if they are to prevent the irremediable.

It is very important that both the work of your Congress and the documents it adopted reflect a growing

realization by the medical community of the necessity to actively oppose the nuclear threat. The program you formulated of the first steps which should be taken by the nuclear powers does not in fact differ from what our country has been consistently advocating and towards which we are directing our practical efforts.

The Soviet Union rejects the idea of unleashing a nuclear war, no matter what pretext it is disguised by, as reckless, and the calls for it as criminal. We are convinced that, in the world of today, the policy of national leaders, and, in particular, of leaders of nuclear nations, should be not to accustom people to the thought of the acceptability of nuclear war, nor to strive for nuclear superiority, but, rather, to concentrate on political will to prevent a nuclear catastrophe and to insure the right of people to live.

The Soviet Union has stated its unilateral obligation not to be the first to use nuclear weapons, has made a specific proposal to freeze all nuclear weapons, has made purposeful efforts to bring about an effective agreement on the limitation and reduction of nuclear weapons, and not to permit a new round of their build-up, in Europe in particular. These positions are graphic manifestations of the Soviet Union's contribution to resolving the problem which has also motivated your movement.

We are prepared for radical solutions. It is up to the other side. Together with all people of good will, you can rest assured that the USSR will continue to do everything in its power to relax international tensions, to halt the arms race—be that on Earth or in space—and to prevent a nuclear conflagration.

I would like to wish all the participants in the movement 'International Physicians for the Prevention of Nuclear War' success in their noble and very needed endeavor.

Sincerely,
Y. Andropov'