

## **Climate and Health Effects of Regional Nuclear War**

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The prospect of a nuclear winter—a catastrophic global cooling caused by the release of smoke and soot from the explosion of thousands of nuclear weapons and resulting in the collapse of the Earth's life supporting ecosystems—contributed greatly to the realization by the US and the former Soviet Union that a nuclear war could not be won and must not be fought.

While that danger now seems remote, it has not disappeared. US-Russian arms accords have reduced by two-thirds the total number of nuclear weapons in the world's arsenals since nuclear winter was first described in the 1980s. Nonetheless, there are still more than 25,000 nuclear weapons in the world, enough to precipitate nuclear winter several times over.

Until recently, however, there was an unexamined assumption that a smaller, regional nuclear war, while it would cause unacceptable millions of casualties and unprecedented local devastation, would not produce ecological effects at the global level. Those assumptions have been proven false in new research studies conducted by climate scientists who have concluded that a nuclear war involving no more than 100 Hiroshima-sized nuclear weapons—about 0.3% of the global nuclear arsenal—could have terrifying, long-lasting effects on the global climate.

In this presentation, we will summarize very briefly the findings of US scientists Richard B. Turco, O. B. Toon, Alan Robock, and their colleagues<sup>1, 2, 3</sup> as well as public health implications derived from their research by International Physicians for the Prevention of Nuclear War. We urge you to read the full studies, and we would be happy to refer you to online sites where you can obtain them.

The studies looked at the consequences of a possible regional nuclear war in South Asia, using numbers of weapons currently estimated to exist in the combined arsenals of India and Pakistan. This scenario is only exemplary. In addition to the nine countries that already possess nuclear weapons, 32 own sufficient fissionable nuclear materials to construct them, placing several other regions of the world at risk of nuclear war on the scale described here should the non-proliferation regime unravel.

Population and economic activity in India and Pakistan are congregated in megacities, which probably would be targeted in a nuclear conflict. An examination of the likely outcome of a nuclear exchange in South Asia involving the 100 15-kt weapons available in the combined Indian and Pakistani arsenals shows that such an exchange could have devastating immediate

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<sup>1</sup> Toon, Owen B., Richard P. Turco, Alan Robock, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, 2007: Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism. *Atm. Chem. Phys.*, 7, 1973-2002.

<sup>2</sup> Robock, Alan, Luke Oman, Georgiy L. Stenchikov, Owen B. Toon, Charles Bardeen, and Richard P. Turco, 2007: Climatic consequences of regional nuclear conflicts. *Atm. Chem. Phys.*, 7, 2003-2012.

<sup>3</sup> Helfand, I An assessment of the extent of projected global famine resulting from limited ,regional nuclear war, Royal Society of Medicine, October 3, 2007.

effects, killing 20 million people, a number equal to half of all those killed worldwide during the six years of World War II. In addition, there would be tremendous economic consequences with the megacities exposed to atmospheric fallout likely abandoned indefinitely.

As horrible as these regional effects would be, however, they might well be dwarfed by the global climate consequences of this conflict.

Smoke and soot from urban firestorms caused by the multiple nuclear explosions—1–5 million metric tons—would rise into the upper troposphere and, due to atmospheric heating, would subsequently be boosted deep into the stratosphere. The resulting soot cloud would block the sun leading to significant cooling and reductions in precipitation lasting for over a decade. Within 10 days following the explosions, there would be a drop in average surface temperature of 1.25° C. Over the following year, a 10% decline in average global rainfall and a large reduction in the Asian summer monsoon is predicted. Even 10 years out, there would be a persistent 0.5° C average surface cooling. In a matter of days, temperatures around the Earth would become colder than those experienced during the pre-industrial Little Ice Age (which occurred from approximately 1400 to 1850).

To make matters even worse, such amounts of smoke injected into the stratosphere would cause a huge reduction in the Earth's protective ozone. A study published in April by the National Academy of Sciences, using a similar nuclear war scenario involving 100 Hiroshima-size bombs, shows ozone losses in excess of 20% globally, 25–45% at midlatitudes, and 50–70% at northern high latitudes persisting for 5 years, with substantial losses continuing for 5 additional years. The resulting increases in UV radiation would have serious consequences for human health.

The sudden climate changes predicted by these studies would have a significant impact on agricultural production. The growing season would be shortened by 10 to 20 days in many of the most important grain producing areas in the world which might completely eliminate crops that have insufficient time to reach maturity. Large quantities of food might also need to be destroyed and significant areas of crop land might need to be taken out of production because of radioactive contamination.

There are currently more than 800 million people in the world who are chronically malnourished and several hundred million more live in countries which are dependent on imported grain. Even a modest, sudden decline in agricultural production could trigger significant increases in the prices for basic foods and hoarding on a global scale, both of which would make food inaccessible to poor people in much of the world. While it is not possible to estimate the precise extent of the global famine that would follow a regional nuclear war, it seems reasonable to fear a total global death toll in the range of one billion from starvation alone. Famine on this scale would also lead to major epidemics of infectious diseases, and would create immense potential for war and civil conflict.

As of mid-August of last year, global grain stocks were approximately 322 million tons with annual consumption at 2,098 million tons. Expressed as days of consumption world grain stocks are therefore approximately 49 days, lower than at any point in the last 50 years, and dramatically lower than the 100 to 120 days of consumption available in the 1980's and 1990's.

These stocks would not provide any significant reserve in the event of a sharp decline in global production. In this setting we would expect to see much greater rises in grain prices worldwide. These price increases would put a crippling burden on whole countries which import large portions of their food supply and would make food unaffordable for hundreds of millions of individuals who are already malnourished precisely because of their inability to afford adequate food even at current world prices. In addition we would probably see hoarding on a global scale. In the event of a regional nuclear war, the grain exporting states would be faced with major crop losses and the prospect of bad harvests for the next several years. It is probable that they would refuse to export whatever grain surplus they might have, retaining it instead as a domestic reserve.

It is, of course, impossible to estimate with accuracy the full extent of the global famine that would follow a regional nuclear war. But it seems reasonable to conclude that few of the 800 million people who are already malnourished would survive if their already substandard intake decreased by even 10% for a whole year. If the crop failures and resulting food shortages persisted for several years their fate would be sealed.

Two other issues need to be considered as well. First, the vast megacities of the developing world, crowded, and often lacking adequate sanitation in the best of times, would almost certainly see major outbreaks of infectious diseases; and illnesses such as plague, which have not been prevalent in recent years, might again become major health threats.

Second, an immense potential for war and civil conflict would be created by famine on this scale. Within nations where famine is widespread there would almost certainly be food riots, and competition for limited food resources might well exacerbate ethnic and regional animosities. Among nations, armed conflict seems highly likely as states dependent on imports adopt whatever means are at their disposal in an attempt to maintain access to food supplies.

It is likewise impossible to estimate the additional global death toll from disease and further warfare that this “limited” regional nuclear war might cause but, given the worldwide scope of the climate effects, the dead from these causes might well number in the hundreds of millions.

These findings, while they need to be elucidated and refined, argue for a fundamental reassessment of the role of nuclear weapons in the world, and should inform the deliberations and proposals of this NPT Review cycle. If even a small nuclear war could trigger a global catastrophe, the only viable response is the complete abolition of nuclear weapons.