

Climate scientist Michael Mills describes the devastation of a nuclear detonation

People get “melted into burning pools of fat”

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“I do not know with what weapons World War III will be fought, but World War IV will be fought with sticks and stones.” – attributed to Albert Einstein

In 2017, the *World Socialist Web Site* published a series of interviews with leading experts on the subject of nuclear war. They spoke on both the inherent dangers of such a conflict, even of a “limited” nuclear exchange, as well as the decades-long effort by the American military, media and political establishment, to conceal the true horror that such a war would bring.

On Monday, we published an interview with scientist and anti-nuclear activist Steven Starr. On Tuesday, we published an interview with Greg Mello, who spoke on the underlying political and economic interests driving the world toward nuclear war.

Today we are republishing the third of these interviews, conducted with Michael Mills, a project scientist at the National Center for Atmospheric Research who has studied the climatic effects of nuclear detonations for more than a decade. Dr. Mills spoke on how nuclear weapons can create firestorms, turning whole cities and their inhabitants into nothing more than ash, soot and debris.

The threat of nuclear war is now more acute than at any time in history. The continuous eastward expansion of NATO following the dissolution of the Soviet Union in 1991 has culminated in the US-NATO provocation of Russia’s invasion of Ukraine, which has already had immense global repercussions.

Thousands of soldiers and civilians have been killed in Ukraine and nearly 3 million people have been displaced. The Western media and sections of the political establishment recklessly demand that NATO impose a “no-fly zone” over Ukraine in which NATO aircraft would attempt to shoot down their Russian counterparts. This would immediately provoke a direct confrontation between the world’s two largest nuclear-armed powers, with incalculable consequences.

Amid the war in Eastern Europe, the coronavirus pandemic continues unabated. According to estimates of excess deaths, between 18 and 20 million people have likely died directly or indirectly from COVID-19 during the past two years. A nuclear war would raise such a scale of death from the millions to the *billions*.

The pandemic—which amounts to a social crime of staggering dimensions—has proven once again the willingness of the capitalist ruling elites to sacrifice the lives of millions of people, as took place in World War I and World War II. The same ruling elites are entirely capable of starting a nuclear war, which could quickly snuff out all human life and potentially all life on Earth.

The fundamental conclusion that must be drawn from the present drive to World War III and the ongoing pandemic is that capitalism is a bankrupt social system which threatens the health and very existence of

humanity. The international working class must overthrow world capitalism and build a new society upon socialist foundations, based on nuclear and military disarmament, social equality and scientific planning.

All workers who understand the present dangers and the need to build a revolutionary movement to stop the drive to war and stop the pandemic should make the decision to join and build the International Committee of the Fourth International (ICFI) as the world party of socialist revolution.

Bryan Dyne: What would happen to a city in a nuclear exchange between the US and North Korea? [*This interview was conducted in mid-April 2017, when the Trump administration was ratcheting up tensions with North Korea*]

Michael Mills: Our work is based on the idea that if a nuclear bomb exploded over a large modern city, the explosion would cause fires that would ignite over the entire area, eventually becoming what is known as a firestorm. This means that the fires have become so hot that the city itself becomes fuel for the fire, which releases much more energy than the nuclear weapon itself. This is what happened during the incendiary bombings of Hamburg, Dresden and Tokyo and the atomic bombing of Hiroshima during World War II.

Essentially, if a city is ignited on this scale, the fires produce millions of tons of black smoke, also called soot, from the burning buildings and other materials. Heat from the fires causes the soot-filled air to rise, and the soot absorbs sunlight, further heating the air so that it rises into the stratosphere, 10 to 30 miles above Earth’s surface. These particles are so high that they don’t get rained out, since there is no weather in the stratosphere. So it can take decades for the soot to settle back down to the surface.

The main effect from all this soot being trapped in the stratosphere is that it continuously absorbs sunlight. In our models, which are based off of the detonation of 100 small nuclear weapons by India and Pakistan, global temperatures become the coldest they’ve been in the past 1,000 years. In a big exchange between major powers, you basically get ice age temperatures.

The second problem is that heating up the stratosphere destroys up to 50 percent the ozone layer by producing changes in the chemical reaction rates that produce ozone. While this happens today in Antarctica, that is a seasonal effect that occurs in the Antarctic spring and early summer. The loss of ozone from stratospheric heating is constant and worldwide. As a result, crops and ecosystems face not only freezing temperatures, but also intense ultraviolet light from the Sun as a result of a diminished ozone layer.

This research is not something that I’ve ever been funded to study. I’ve been able to pursue this in my spare time because I work on models of atmospheric chemistry and climate and it seemed like a very important

issue to me.

I usually work on the climatic effects of particles from volcanoes, which are liquid droplets that tend to scatter light rather than absorbing it. They have a similar cooling effect in that after a volcanic eruption, these droplets are ejected into the stratosphere and reflect sunlight away from Earth. But the black absorbing smoke particles are much more effective at the same thing. They have a bigger effect on the Sun's radiation than the volcanic particles.

BD: What's the significance of using a model of a nuclear war between India and Pakistan?

MM: The initial motivation for our recent studies is that we wanted to revisit the nuclear war studies that were done in the 1980s, using the vastly more sophisticated climate models that had been developed since. So Alan Robock looked at impacts of a war between the US and Russia using a NASA climate model.

But we also wanted to look at the increasing number of new nuclear powers and their expanding arsenals. The India-Pakistan scenario served to show that even relatively small nuclear weapons can have a global effect. In 2007, when I was working on this with Brian Toon, each country had only about 50 Hiroshima-sized weapons each, the smallest nuclear weapons in existence. Even an exchange with these weapons, which are much smaller than those used by the US, Russia, Britain or France, can still cause global planetary environmental damage from the smoke that's released.

Brian Toon was trying to get the people in the military interested in paying attention to this issue. The United States has a current arsenal of about 1,700 nuclear weapons. It's difficult to justify having so many because even if you used them and no enemy retaliated, you would suffer from the global effects.

BD: In that vein, is there such a thing as a 'limited nuclear war'?

MM: We obviously had a 'limited nuclear war' in World War II when the US used its entire stockpile of nuclear weapons, which was two. Given the number of weapons that now exist, however, once you start using them you quickly reach a point where you are producing so much damage to millions of people. And then there are the smoke effects, which damage the whole planet. I think people in charge of making military decisions need to be well aware that the idea of a 'limited nuclear war' is a very dangerous concept.

BD: Could you go a bit more into the science of how the cities are turned into smoke?

MM: The firestorm was something that the Allies intentionally devised in World War II in raids against Hamburg, Dresden and Tokyo, with many, many incendiary bombs designed to ignite fires close to one another. When you have fires all over a city, they tend to join together and intensify, creating temperatures so hot that even asphalt and concrete become fuel. That's where the black smoke comes from.

As we saw with Hiroshima, when you detonate a nuclear weapon in the air above a city, it has the same effect of igniting fires all over the city.

The heat from the fires then acts like a thunderstorm, lifting air up very quickly. This means that air has to come in from below to replace it. So from all directions, air gets sucked in, adding more oxygen to the fire. Moreover, the air is so fast that it carries with it debris, animals and even people.

To quote from the book *Fire and Ice* by David Fisher:

"On July 27, 1943 nearly a thousand British bombers dropped over two thousand tons of bombs on Hamburg, most of them incendiaries, turning that city into a burning, melting quagmire of horror. The temperature reached one thousand degrees in the center of town, igniting the world's first firestorm. The superheated air rose so fast it sucked in outside air in the form of hurricane-strength winds, which force-fed the fire still further and blew helpless people like leaves into the burning center of destruction where they actually melted into pools of burning fat. On the outskirts of

the storm other people were stuck in molten asphalt, suffocating and igniting. More than 40,000 people died that night. In the early spring of 1945 the American Twentieth Air Force topped the RAF's record by burning Tokyo, starting a conflagration that totaled sixteen square miles of intensely populated city, killing more than 80,000 people."

BD: Are the fires something that can be started by radioactive fallout or is it just the initial explosion of the bomb?

MM: There are two kinds of ways of dropping a nuclear bomb over a city: there is an airburst, where it explodes high, and there is a ground burst, when it explodes when it hits the ground. Airbursts are most effective at creating firestorms, igniting cities. And it's much more widespread damage than a ground burst. Ground bursts are what create fallout, which is when it sends up material from the ground that is radioactive, which can spread in the wind. There would be more fallout from a ground burst, and more fire from an airburst.

BD: What would the world look like after a nuclear exchange between the US and China?

MM: In that case, you're talking about two powers with very large stockpiles of nuclear weapons. You could get a tremendous amount of smoke if you started dropping bombs in cities across the US and China. That's the sort of thing that Alan Robock modeled in a US/Russia war.

It's what we call a true nuclear winter, in the sense that in some places in the interior of continents, for example in Ukraine, the temperatures remain below freezing all year long, so you can't grow crops at all under those conditions. Similar things happen in the center of the US and China. On all continents, basically. You have global average temperatures that get basically as cold, for a year or so, as what we had in the last ice age.

BD: What would happen after the first year?

MM: When we modeled an India/Pakistan war in 2014, we found that when you include interactive components in your model, such as the effects of the full ocean, expanding sea ice, that the changes to climate are more prolonged. This is largely thanks to the ocean's ability to store lots of heat. Although global temperatures cool more slowly when one considers the ocean, the lower temperatures are more prolonged.

After 24 years of our simulation, temperatures were still below normal, whereas in other studies that didn't include the full impact of the oceans, they showed that the temperatures had recovered in ten years. And this is a small nuclear war.

It's really hard to say how much destruction something like this would cause, how many species would be wiped out and if ours would be among them or not. What I've studied shows that even a small event could cascade. We've seen food shortages in the past few decades that have been intensified by societal reactions. There was a global rice crisis in 2008 after India and Vietnam stopped exporting rice, for example, leading to a severe shortage in the Philippines and food riots in Haiti. Certainly food shortages have been tied to uprisings in the Arab Spring. So all sorts of things could happen that are destabilizing.

But with a large war, it's somewhat unknowable, but also so horrific it doesn't matter exactly how damaging it is.



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