No cause for alarm. *Blazing oil generates dense smoke, but even several hundred plumes would have limited impact.*

"Nuclear Winter" From Gulf War Discounted

Calculations of the climate effects of smoke from a major oil-field blaze indicate, at worst, minor local cooling

AS WAR LOOMED IN THE MIDDLE EAST EARLY in January, atmospheric scientists in the United States and Britain went scurrying to their computers to check out a potential nightmare scenario: Could a major conflagration in Kuwait's oil fields trigger a climate catastrophe akin to the hypothesized "nuclear winter" that got so much attention in the 1980s? They had reason to worry because back in 1986 and 1987, computer modelers had indicated that if bombs ignited enough oil refineries, the pall of dense smoke could cause a significant change in the weather, perhaps shutting down the Asian monsoon cycle. On the very day war erupted, however, the scientists came up with a reassuring preliminary answer: A local chill might be triggered, but there is scant likelihood that global cooling would result.

Among the scientists who raised the specter that soot from a huge fire in the Gulf would block out sunlight and cause a big chill were Richard Turco, a builder of atmospheric models at the University of California at Los Angeles, and Brian Toon, an atmospheric researcher at the National Aeronautics and Space Administration's Ames Research Center. Both collaborated with Carl Sagan of Cornell University on the original nuclear winter studies. A few others expressed similar concerns at a meeting in London in early January, according to *Nature* and *The New Scientist*. Paul Crutzen, an expert on biomass burning at the Max Planck Institute for Chemistry, and a British chemical engineering consultant named John Cox, who is also vice president of the Campaign for Nuclear Disarmament, suggested that battle smoke might cause a drop in temperatures over a quarter of the world's surface.

These predictions prompted the British Meteorological Office and a team of researchers at the Lawrence Livermore National Laboratory to dust off their nuclear winter models. The Met Office's conclusion, released in a statement on 17 January, is that there's no cause for alarm. In words that were themselves a bit cloudy, British officials declared that the "effect of smoke on global temperatures is likely to be small." However, the statement continued, "downwind of Kuwait, the obscuration of sunlight might significantly reduce surface temperatures locally. This, in turn could reduce rainfall over Southeast Asia during the period of the summer monsoon." The Met Office pointed out, however, that seasonal and local variations in rainfall are much greater than any effect that might be produced by soot from the Gulf.

An even stronger dismissal came from Michael MacCracken, leader of the atmospheric and geophysical sciences division at Livermore. He thinks that even the worst plausible oil fires in the Gulf would produce a cloud of pollution about as severe as that found on a bad day at the Los Angeles airport.

MacCracken and his colleagues resurrected an old computer model that had been assembled during the heyday of the nuclear winter debate and plugged in some assumptions about the amount of fuel likely to be burned and the elevation of the smoke plume. For example, MacCracken assumed that at most 3 million barrels a day would go up in smoke—an amount equivalent to Kuwait's total daily production capacity before the invasion and about one-third of the entire region's normal output. He ran the model with two assumptions, one sending the smoke up to 2 kilometers aloft and the other up to 5 kilometers aloft. He assumed the burning would continue for a month, and then asked the computer to calculate the outcome.

If the low-elevation scenario is right, says MacCracken, the model predicts that the smoke would remain airborne for only about 5 days. If the fires were more intense than he anticipates and the smoke were to climb to higher elevations, the computer says the soot might remain in the atmosphere for 9 days. "It doesn't look like there would be any climatic effect," MacCracken concludes, adding, however, that the sun would be obscured directly under the plume and temperatures in the immediate area would fluctuate. The worst-case scenario, he says, would produce a haze throughout the Gulf region resulting from a soot cloud that he says would reach a concentration of perhaps as much as 25 micrograms per cubic meter.

Tica Novakov, an expert on carbon aerosols at the Lawrence Livermore National Laboratory, says that the air around Los Angeles airport is often burdened with a soot cloud of roughly the same density—climbing on the worst days to 10 micrograms per cubic meter. The air in Eastern Europe is much worse in wintertime, Novakov says, often becoming clogged with soot from low-grade coal being burned in home heaters. In Yugoslavia, for example, the levels may rise to 100 micrograms per cubic meter. And the worst pollution on record occurred in peacetime London of the 1940s and 1950s, when airborne soot concentrations rose to 500 micrograms per cubic meter. ■ ELIOT MARSHALL