Dioxin in Vietnam: Fighting a Legacy of War

Singapore was the site of an East–West convergence over the week of 27 November–1 December 2000. At the behest of their respective governments, scientists from the United States and Vietnam came together for what promises to be the first of many meetings. Their mission: to explore the possibility of launching a joint research program to study the human and environmental health effects resulting from spraying Agent Orange and other herbicides during the Vietnam War.

The meeting came in response to a congressional request that the NIEHS work with Vietnamese scientists and government personnel to develop a collaborative research program for studying the effects of Agent Orange in Southeast Asia, particularly Vietnam. Kenneth Olden, director of the NIEHS, led the U.S. delegation. He was joined by scientists from the NIEHS, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention (CDC) and the Fogarty International Research Center of the National Institutes of Health. The Vietnamese delegation was led by Pham Khoi Nguyen, vice minister of the Vietnamese Ministry of Science, Technology, and the Environment (MOSTE). With him were scientists from MOSTE, the National Environment Institute, the National Center for Natural Science and Technology, the Ministry of Public Health, Hanoi Medical University, Ho Chi Minh City University of Medicine and Pharmacology, and the Vietnam–Russia Tropical Research Center.

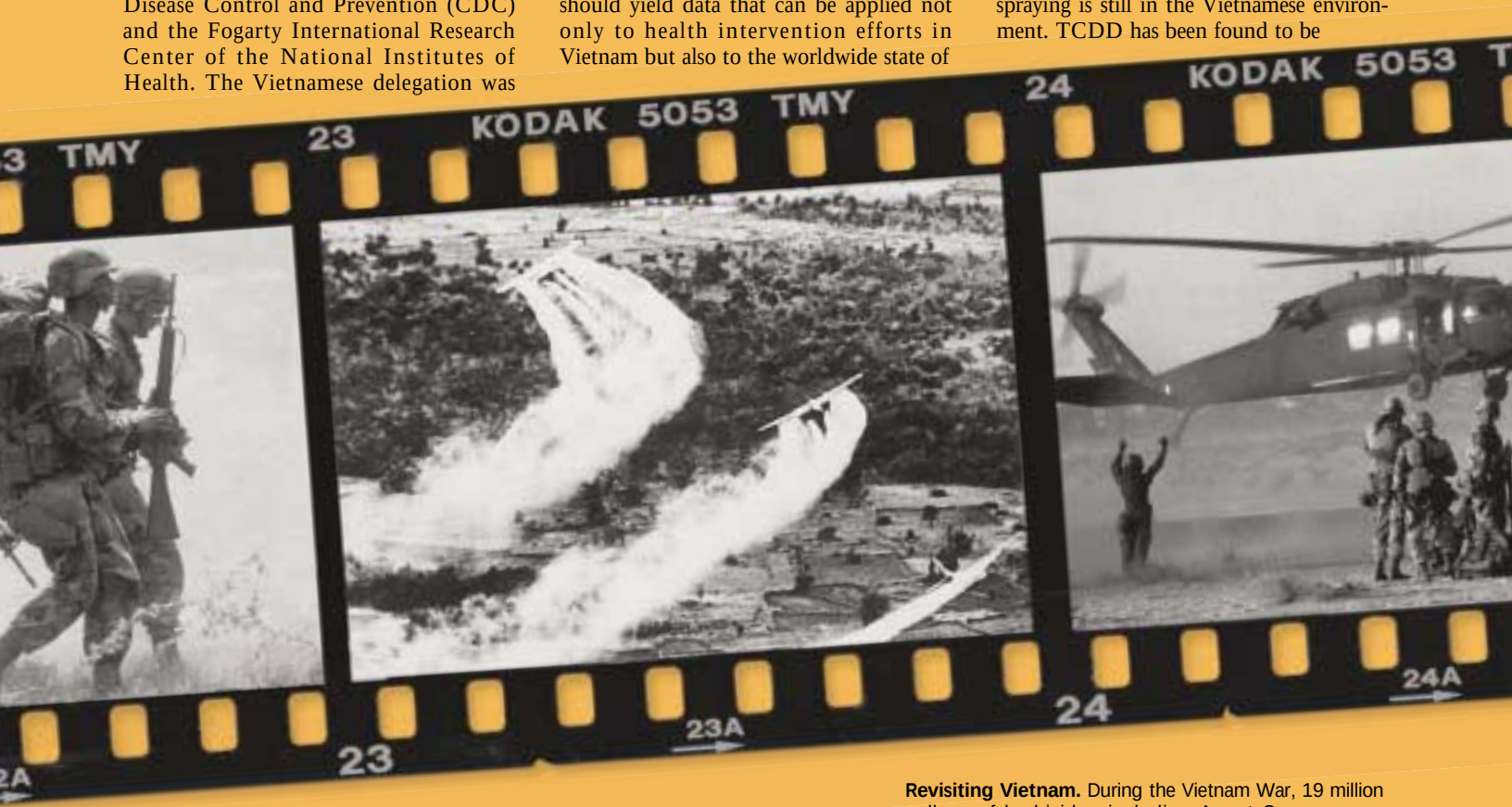
The meeting followed an 18 August 2000 public symposium in Monterey, California, in which a panel of invited experts and an open audience considered the scientific concerns that should be addressed in any such study of Agent Orange exposure. The ideas generated at Monterey helped define issues that would be broached at the Singapore meeting.

At the Singapore meeting, both delegations agreed that any joint effort must aim to accurately assess the extent of Agent Orange exposure among the Vietnamese, as well as the human and environmental health effects of the compound. They also agreed that environmental assessment studies should be undertaken and that the research conducted under such an effort should yield data that can be applied not only to health intervention efforts in Vietnam but also to the worldwide state of the science regarding the human health effects of the chemicals in Agent Orange.

What Is Agent Orange?

During Operation Ranch Hand, which lasted from 1962 to the early days of 1971, some 19 million gallons of herbicide was sprayed on Vietnamese and Laotian lands to remove the forest cover that shielded the Viet Cong and to destroy crops. Various formulations were used; most were mixtures of the phenoxy herbicides 2,4-D and 2,4,5-T. The different formulations were named according to the color-coded drums they were shipped in; the most widely used—and perhaps the best remembered—was Agent Orange, composed of equal parts 2,4-D and 2,4,5-T. Today, the term "Agent Orange" is used as a catchall phrase to describe all of these compounds.

These herbicides were contaminated with minute amounts of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD, also known as dioxin), a by-product of the manufacturing process for 2,4,5-T. TCDD has a half-life of 8.7 years in humans. It is a persistent organic pollutant; after 25 years since the end of the Vietnam War, a quarter of the TCDD released through herbicide spraying is still in the Vietnamese environment. TCDD has been found to be



Revisiting Vietnam. During the Vietnam War, 19 million gallons of herbicide—including Agent Orange—was sprayed on forests and croplands in Southeast Asia.

biologically active at minuscule concentrations. The EPA currently regulates TCDD in drinking water at a concentration of 13 parts per quintillion. (The agency is currently reassessing this regulation, with a report due in early 2001.)

TCDD has been shown to suppress the immune system in animals, and has caused cleft palate and ureter defects in mice. Rats exposed to TCDD have shown hormonal imbalances, which may affect the development and function of the endocrine system. TCDD is also believed to cause cancers such as Hodgkin disease and soft-tissue sarcoma, liver damage, reproductive problems such as spina bifida and miscarriage, neurotoxicity, and skin effects such as chloracne, which causes severe acne-like lesions. In January 2001, the National Toxicology Program published an addendum to the *Report on Carcinogens, Ninth Edition*, listing TCDD as a known human carcinogen.

Taking the First Step

According to Christopher Portier, acting director of the NIEHS Environmental Toxicology Program and a member of the U.S. delegation, the two sides are largely in agreement regarding many aspects of a prospective partnership. The delegates identified three key areas of study—human health effects, effects on the environment, and capacity building for TCDD research in Vietnam—and met in breakout groups to exchange ideas on how to explore these areas.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Walter J. Rogan, an investigator in the NIEHS Epidemiology Branch, headed up discussions on human health effects. "The main idea of the discussions was to identify which research topics the Vietnamese scientists considered most important," says Rogan. The Vietnamese identified four general human health areas as priority topics. First is epidemiologic studies of diseases known to be linked to TCDD, as well as of diseases among the Vietnamese that could turn out to be caused by TCDD exposure. The second area is specific biologic effects of TCDD exposure among the Vietnamese, including immunologic, reproductive, and genetic problems. The third area is prevention and intervention studies to find ways to address the needs of exposed people through education and rehabilitation at the community level. Finally, the Vietnamese are interested in developing and evaluating new treatment methods to address the effects of TCDD exposure, with an emphasis on looking at how Vietnamese traditional herbal medicine may be incorporated.

William H. Farland, director of the EPA's National Center for Environmental Assessment, led discussions on research into the extent and remediation of environmental effects of Agent Orange. Both sides agreed on the need to identify contamination "hot spots" throughout Vietnam, but the bulk of the discussion centered on emerging remediation technologies and how they can be shared between the countries. For instance, faster, cheaper methods for analyzing dioxin residues in environmental samples, such as immunofluorescence and gene expression assays, could accelerate the process of identifying highly contaminated areas and monitoring migration of dioxin through the environment.

Both human effects and remediation research will benefit from capacity building in Vietnam. Labs, equipment, systems, and training are all needed, but available resources may go a long way toward meeting some of these needs. For instance, Vietnamese scientists could come to the United States to train in the methodologies used here, and the Internet could be explored as a means for long-distance training. Thomas H. Sinks, associate director for science at the CDC's National Center for Environmental Health, who led the infrastructure breakout group, says the group agreed on a number of key areas to be explored: building Vietnamese laboratory capacity for measuring health effects and measuring dioxin in environmental and human samples, provision of quality assurance and performance testing for Vietnamese laboratories, scientist exchanges, and training for Vietnamese scientists in skills and technology that can aid in TCDD-related research.

A Next Step

The plan on both sides is to initiate collaborative activities as soon as possible. The next step is for each side to recommend to its respective government that an arrangement be formalized under the Agreement on Scientific and Technological Cooperation. This agreement, signed on 17 November 2000 by Vietnamese and U.S. officials, is designed to bring scientists from the two nations together in areas such as health, technological innovation and entrepreneurship, disaster mitigation, and marine and water resource management.

The agreement will work by creating a joint Committee on Scientific and Technical Cooperation to define and review areas of cooperation under the agreement, defining ways for Vietnam and the United States to cooperate in scientific research, designating how intellectual property resulting from collaborative projects should be shared, and setting up procedures for dispute resolution. Although this agreement does not specifically apply to Agent Orange research, the two delegations in Singapore felt an implementing arrangement (a formal type of arrangement defined by the signed agreement) could facilitate research on Agent Orange.

On the part of the United States, a collaboration with Vietnam will almost surely involve the efforts of several federal agencies. "The CDC is interested in assisting in this activity," says Sinks. "Likely, our assistance would focus on areas in which we have expertise—epidemiology, surveillance of health effects, measuring human exposure to dioxin and dioxin-like compounds, and related training. However, until specific goals and priorities are established, it isn't possible to predict the exact nature of our assistance."

At this point, nothing has been finalized, no funds have been allocated, but both sides walked away from the meeting with plenty to mull over. According to Olden, the next logical step toward building a collaboration is for the two nations to exchange data. He hopes that in a matter of months, the two sides can begin reconvening in a series of workshops and seminars. There, scientists can get down to the business of comparing data and designing studies. "I am optimistic that things are going to go forward, and at least we broke the ice in terms of interest on the parts of both the Vietnamese and the U.S. governments to address the health effects that are still lingering," says Olden. "We should be able to unravel [these effects] through rigorous scientific study."

–Susan M. Booker