Agent Orange

Lasting Legacy of the American War in Vietnam

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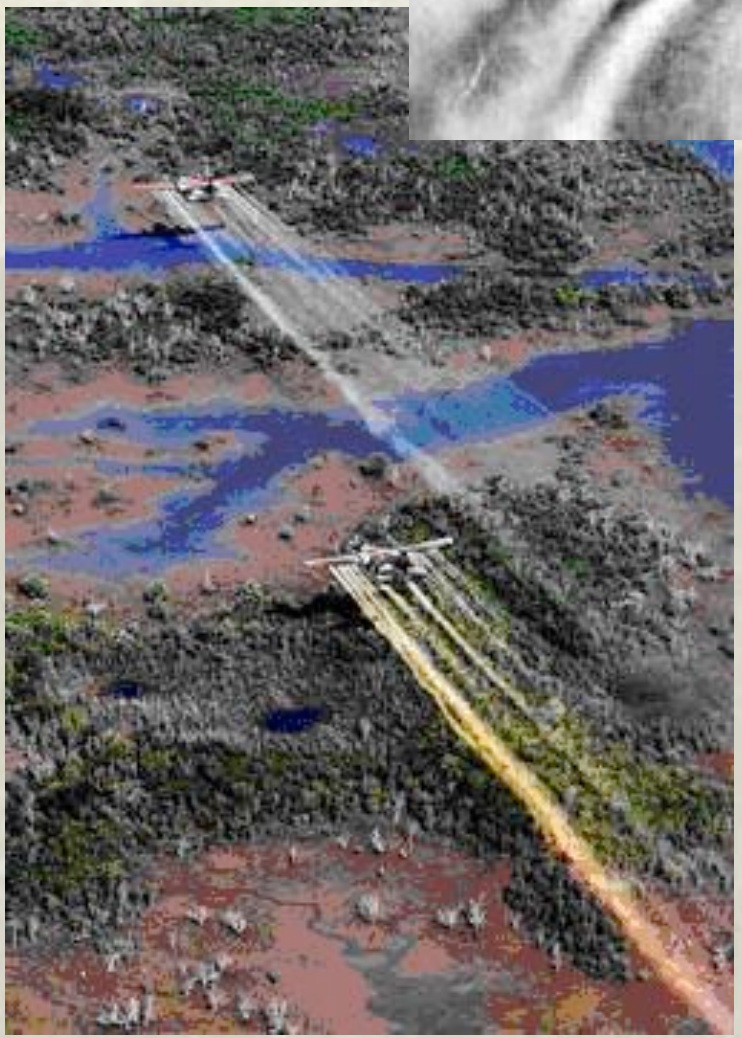


History of Use of Agent Orange

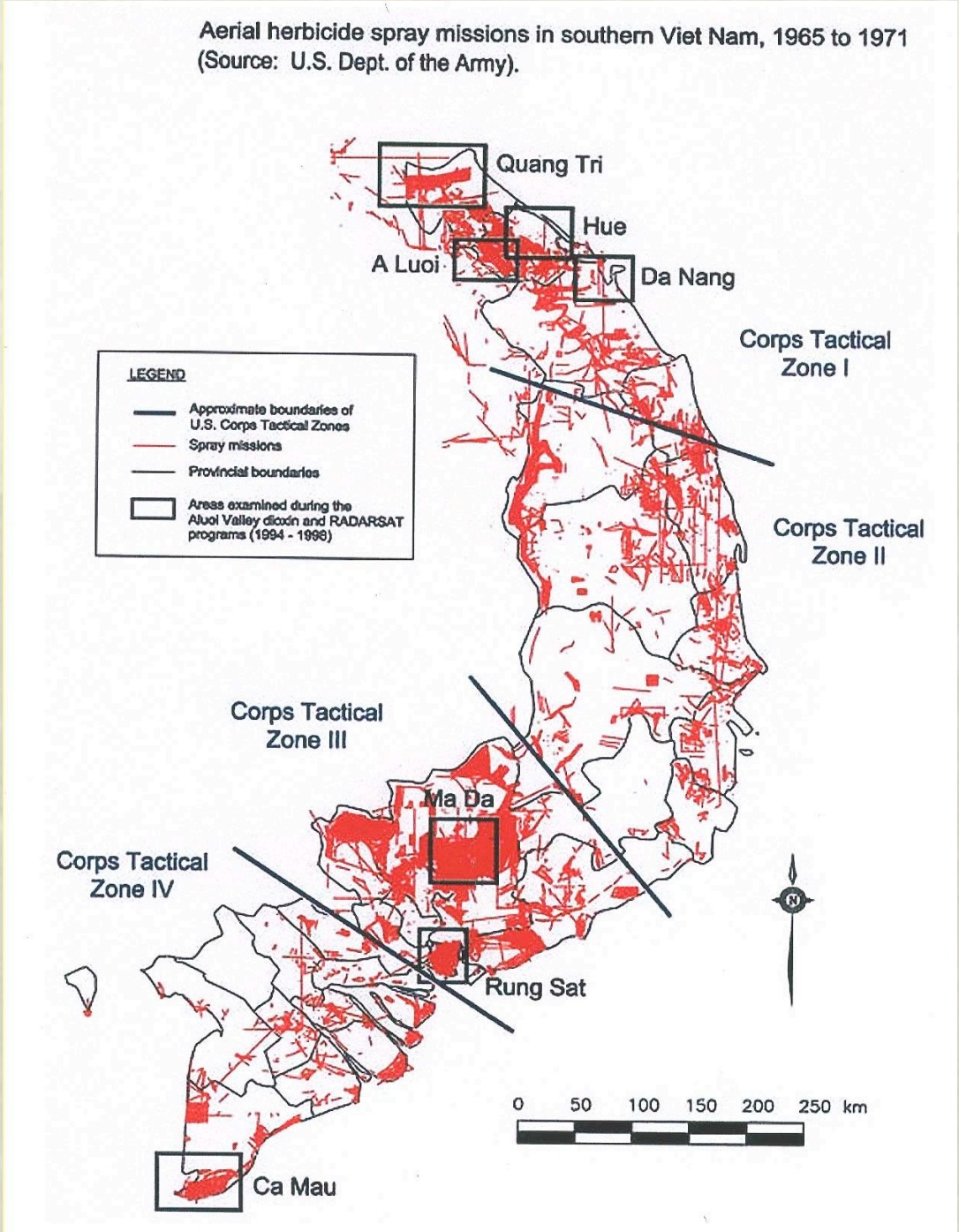
- During WWII several military research laboratories in England and the US conducted classified research on use of herbicides for military purposes
- 1943: Professor E.J. Krauss, chairman of Botany Department at University of Chicago signed a contract with Defense Department
  - Research conducted on damage to wet rice crops by 2,4,5-T
  - 1944: study transferred to Fort Dietrick army base in Maryland
  - About 700 products that could be used in war were discovered
  - Test flights to spray 2,4-D carried out in 1944-1945, then war ended

History of Development and Use

- 1950's: continuation of research regarding choice of chemicals to be used, effects of different kinds of plants, time required for leaves to drop, quantity of chemicals, altitude, humidity and temperature conditions, mode of spraying, and topography of areas sprayed
- 1959: Fort Dietrick organized demonstration at Fort Drum with planes spraying a compound of 2,4-D and 2,4,5-T over 4 square miles
- Plans drafted for spraying herbicides and defoliants on southeast Asia
- August 10, 1961: First spraying of chemicals carried out on northern side of Kontum along Highway 14 by H34 helicopter

History of Use

- It is estimated that between 1961 and 1971 about 77 million litres (20 million gallons) of herbicides, including 49.3 million litres (13 million gallons) of Agent Orange, containing more than 360 kg of 2,4,5-T dioxin (500 pounds) were sprayed multiple times over 5.5 million acres in south Vietnam.
- Dioxin is a toxic by-product of US herbicide manufacturing.
- Dioxin is capable of killing some species of newborn mammals and fish at levels of **five parts per trillion** (5 ppt equal to one drop of dioxin well-diluted in 4 Olympic-size swimming pools)
  - It can pass into the body through all major routes of entry: **skin** (by direct contact), **lungs** (by inhaling dust, fumes, or vapors), and **mouth**.
  - Toxicity: dioxin binds to the protein molecule receptors of the cell and is rapidly transported into the cytoplasm and nucleus of the cell, where it causes changes in cellular procession.


Aerial herbicide spray missions in southern Viet Nam, 1965 to 1971
(Source: U.S. Dept. of the Army).
Quang Tri
Hue
A Luoi
Da Nang
Corps Tactical Zone I
Corps Tactical Zone II
Corps Tactical Zone III
Corps Tactical Zone IV
Ma Da
Rung Sat
Ca Mau
LEGEND
Approximate boundaries of U.S. Corps Tactical Zones
Spray missions
Provincial boundaries
Areas examined during the Aluoi Valley dioxin and RADARSAT programs (1994 - 1998)
0 50 100 150 200 250 km

History of Use

- Originally called Project Hades, name was changed to Operation Ranch Hand
- Spraying intended to kill foliage to deny cover to guerrillas and to destroy crops that could be used to feed the guerrillas
- Spraying also intended to make whole areas unlivable and drive villagers into "pacified" areas and "strategic hamlets"
- Main victims were civilians in villages who were repeatedly contaminated when they ate crops and drank ground water that had been sprayed
- Military sprayed herbicides in Vietnam six to 25 times the rate suggested by manufacturer
- Provided no long- or short-term military or psychological benefits
  - 1968: Col. John Moran, chief of the Chemical Operations Division of MACV wrote: "The effect of defoliation on the enemy, in itself, is of little military value….There are indications that US herbicide operations have had a negligible effect on NVA infiltration and combat operations."

History of Use

- Mist Drift: bulk of herbicide damage occurred after the spray was released from aircraft and before it reached the ground and/or when herbicide that has already reached the ground vaporizes during heat of day, is carried aloft, then moved by surface winds and deposited elsewhere (memo from Eugene M. Locke, deputy US ambassador in Saigon, Nov.8, 1967).
- Dumps of herbicides—planned and accidental occurred over populated areas and into water supplies
- Impact on American troops: ground troops slept with it, drank it in their water, ate it in their food and breathed it when it dropped out of the air
  - Some troops used empty agent orange drums for barbeque pits
  - Some stored watermelons and potatoes in them
  - Others rigged the residue laden drums for showers

Danger to Humans

- Chemical companies: Dow, Monsanto, Diamond Shamrock, Hercules, Uniroyal, Thompson Chemicals, etc.--what did they know about toxic effects?
- **February 22, 1965** Dow Chemical internal memorandum provided summary of a meeting in which 13 executives discussed potential hazards of dioxin 2,4,5-T.
- **March, 1965** Dow official V.K. Rowe convened a meeting to: discuss the toxicological problems caused by the presence of certain highly toxic impurities in samples of 2,4,5-T.
- **June, 1965**: Rowe sent memo to Ross Mulholland, manager with Dow in Canada telling him that dioxin "is exceptionally toxic, it has a tremendous potential for producing chloracne and systemic injury. Under no circumstances may this letter be reproduced, shown, or sent to anyone outside of Dow."
- **1965**: John Frowley, a toxicologist for Hercules wrote: Dow was concerned that "the whole industry will suffer. Dow was extremely frightened that this situation might explode" and lead to government restrictions.
- **1960's**: Dr. Roger Brodkin, head of Dermatology at University of Medicine and Dentistry of New Jersey alerted state health officials of painful and disfiguring skin diseases of employees at Diamond Alkali Co. in New Jersey. "We discovered that not only were these people getting skin disease, but they were also showing some indication of liver damage."

Danger to Humans

In humans and other vertebrates, dioxins have been shown to be risk factors in the following conditions:

- Cancer
- Immune deficiency
- Reproductive and developmental abnormalities
- Central and peripheral nervous system pathology
- Endocrine disruption
- Diabetes
- Thyroid disorders
- Decreased pulmonary functions and bronchitis
- Altered serum testosterone levels
- Eyelid pathology
- Gum pigmentation
- Nausea, vomiting, loss of appetite
- Skin rashes
- Liver damage
- Elevated serum cholesterol and triglycerides
- At risk mortality associated with high levels of occupational exposure to dioxins with acute ischemic cardiovascular events
- Transient acute health effects include headache, pruritis, fatigue,
- Irritability, personality changes, pain in abdomen or extremities, diarrhea, insomnia

Admiral Elmo Zumwalt

- Chief of Naval Operatons (CNO) during war in Vietnam from 1968-1971, and in charge of the blue-water navy.
- Made decision to use Agent Orange and spray along canals and ditches
- Captain Elmo Zumwalt, his son, commanded a river patrol boat on rivers in Quang Nam, Da Nang and Ca Mau
- Captain Zumwalt developed two forms of cancer and died in 1988; his son was born with multiple abnormalities

Danger to Humans

- If there is definite evidence of dioxin contamination based on exposure history and elevated dioxin level, the physician can only treat the disorders as there is no good way to reduce the body burden of dioxins

Early Studies

- Late in 1969 a study done by Bionetics Research Laboratories showed that dioxin caused deaths and stillbirths in laboratory animals
- November 4, 1969 in a message from Joint Chiefs of Staff to Commander in Chief, Pacific and MACV:
  - "A report prepared for the National Institute of Health presents evidence that 2,4,5-T can cause malformation of offspring and stillbirths in mice, when given on relatively high doses. This material is present in the defoliant Agent Orange.
  - Pending decision by the appropriate department on whether this herbicide can remain on the domestic market, defoliation missions in South Vietnam using Orange should be targeted only for areas remote from population."

Early Studies

- **1979**: Representative (before he became a senator) Tom Daschle commissioned a large scale epidemiological study of veterans who had been exposed to Agent Orange/dioxin
- **1982**: veterans filed class action suit against the chemical companies that made Agent Orange
- **1983**: Times Beach, Missouri: dioxin laced oil had been sprayed on roads to keep dust down; government spent $33 million buying homes and relocating residents to prevent further damage
- **June, 1983**: AMA adopted a resolution calling for a public information campaign on dioxin to "prevent irrational reaction and unjustified public fright."
- **December, 1983**: EPA announced a nationwide plan to clean up more than 200 dioxin contaminated sites, including 50 plants where 2,4,5-T had been manufactured

next…

Early Studies…

- **February, 1984**: US Air Force released first of three part study on Operation Ranch Hand pilots and crew involved in herbicide spraying, finding no higher death or serious illness rates than general population
- **Late 1984**: Congress passed Public Law 98-542 to provide compensation for soft tissue sarcoma and required the VA to establish standards for Agent Orange and atomic radiation compensation
- **December, 1985**: Air Force released third Operation Ranch Hand study stating that there was no evidence Agent Orange had adverse effects on those who handled it during the war
- **April, 1986**: CDC released report on liver and immune system damage as result of exposure to dioxin chemicals in a mobile home park near St. Louis, Missouri
- **Summer, 1986**: CDC complained that records were too spotty to make a scientific study of impact of Agent Orange on US veterans
- **March, 1990**: CDC admitted that Vietnam veterans have higher risk of non Hodgkin's lymphoma.

The Agent Orange Scientific Task Force Report on Reproductive and Developmental Effects

"Following review of the scientific literature, it is concluded that the evidence supporting the existence of a significant statistical association between exposure to phenoxyacetic acid herbicides and/or their associated contaminants (chlorinated dioxins) and reproductive and developmental effects is at least as strong as the evidence of a lack of the association.

- **Fertility**: CDC Vietnam Experience Study (1988) found Vietnam veterans to have significantly lower mean sperm concentration and significantly lower levels of morphologically "normal" sperm than non Vietnam veterans.
- **Miscarriage**: Percentage of spouses' pregnancies which resulted in miscarriages was significantly higher for Vietnam veterans than controls (Stellman et al. 1989). Vietnamese studies support hypothesis that paternal exposure to components of Agent Orange can adversely affect products of conception , showing elevated incidences of spontaneous abortion and congenital malformation.
- **Birth defects**: several studies report a higher incidence of selected birth defects in children of Vietnam veterans than controls.

Early Studies

- August, 1990: House Committee report found that the 1987 CDC study was ordered canceled by the White House, compromising the independence of the CDC and undermining "the study by controlling crucial decisions and guiding the course of research at the same time it had secretly taken a legal position to resist demands to compensate victims of Agent Orange exposure and industrial accidents."

Institute of Medicine

- Agent Orange Act of 1991: Public Law 102-4 directed the Secretary of Veterans Affairs to request the National Academy of Sciences to conduct comprehensive review and evaluation of scientific and medical information regarding health effects of exposure to Agent Orange herbicides used in Vietnam, and various chemical component of these herbicides, including dioxin.
- Distinctions between categories are based on statistical association, not on causality, as is common with scientific reviews
- For each disease, IOM determines to the extent that data permits meaningful determinations:
  - **Sufficient Evidence of an Association**: Evidence is sufficient to conclude that there is a positive association between the herbicides and the outcome in studies in which chance, bias, and confounding could be ruled out with sufficient confidence.
  - **Limited or Suggestive Evidence of an Association**: Evidence is suggestive of an association between herbicides and the outcome but is limited because chance, bias, and confounding could not be ruled out with confidence.
  - **Inadequate or Insufficient Evidence To Determine Whether an Association Exists**: The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of an association.
  - **Limited or Suggestive Evidence of No Association**: Several adequate studies, covering the full range of exposure that human beings are known to encounter, are consistent is not showing a positive association between any magnitude of exposure to herbicides and the outcome. The possibility of a very small increase in risk at the exposure can never be excluded.

Institute of Medicine

- Sufficient Evidence of an Association
  - Chronic lymphocytic leukemia (added 2002)
  - Soft-tissue sarcoma
  - Non-Hodgkin's lymphoma
  - Hodgkin's disease
  - Chloracne (added 1988)
- Limited or Suggestive Evidence of an Association
  - Respiratory cancer (lung and bronchus, larynx, trachea)
  - Prostatic Cancer
  - Multiple myeloma
  - Acute and subacute transient peripheral neuropathy (added 1996)
  - Porphyria cutanea tarda (added 1996)
  - Type 2 diabetes (mellitis)
  - Spina bifida in offspring of exposed individuals
  - AL amyloidosis
  - High blood pressure
- Inadequate of Insufficient Evidence to Determine an Association Exists
  - Hepatobiliary cancer, oral, nasal, and pharyngeal cancer, skin cancers,
  - Breast cancer, female reproductive cancer, testicular cancer, urinary bladder cancer, renal cancer, leukemia (other than CLL), abnormal sperm characteristics and infertility, spontaneous abortion, neonatal or infant death and stillbirth in offspring of exposed individuals

Veterans Affairs

- VA presumes that all military personnel who served in Vietnam from 1962-1975 were exposed to Agent Orange and federal law presumes that the following illnesses are a result of that exposure:
  - Acute and subacute peripheral neuropathy
  - Chloracne
  - Chronic lymphocytic leukemia
  - Hodgkin's disease
  - Multiple myeloma
  - Non-Hodgkin's lymphoma
  - Prostate cancer
  - Respiratory cancers (lung, bronchus, larynx, trachea)
  - Soft tissue sarcoma, acute
  - Type II diabetes mellitus

Veterans Affairs

- Certain birth defects in children of women Vietnam veterans, including, but not limited to:
  - Achondroplasia
  - Cleft lip
  - Cleft palate
  - Congenital heart disease
  - Congentialtalipesequinovarus (club foot)
  - Esophageal and intestinal atresia
  - Hallerman-Streiff syndrome
  - Hip dysplasia
  - Hirschprung's disease (congenital megacolon)
  - Hydrocephalus due to aqueductalstenosis
  - Hypospadias
  - Imperforate anus
  - Neural tube defects
  - Poland syndrome
  - Pyloric stenosis
  - Sundactyly (fused digits)
  - Tracheoesophageal fistula
  - Undescendedtestical
  - Williams syndrome

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  - Birth defects: several studies report a higher incidence of selected birth defects in children of Vietnam veterans than controls.

Birth Defects

- Air Force study of Ranch Hand personnel responsible for herbicide spraying reported statistically significant increase in reported birth defects in Ranch Hand group (Albanese, 1988). Defects included:
  - Skin defects
  - Neural tube defects
  - Heart defects
  - Oral clefts
  - Kidney defects
- Erickson, et al (1984) reported that risks for fathering an infant with spina bifida, cleft lip, and certain "neoplasms" were higher for Vietnam veterans than controls.
- Increased incidence of birth defects also reported in a population of Vietnam veterans living in Tasmania (Field and Kerr, 1988).

Impact on Vietnam

- Over 5.5 million acres (12%) of south Vietnam were sprayed, with over 90% hit twice. Records show that 2,4,5-T herbicide was used in concentrations as much as 13 times higher than recommended for use in US
- Stellman et al. estimate that as many as 4.8 million Vietnamese were directly exposed
- An estimated 800,000 people suffer serious health problems and in need of constant medical attention
- An estimated 50,000 deformed children born to parents who were directly sprayed or were exposed through food and water
- Risk of death from cancer among people exposed to dioxin: 30%
- Parents exposed to Agent Orange 2.2 times more likely to have deformed child

Impact on Vietnam

- Agent Orange still contaminates the soil and environment in many "hot spots" near former US military installations
- Soil from heavily contaminated areas remain a reservoir/source of TCDD (hot spot)
- Recent studies around Da Nang found dioxin levels 300-400 times higher than internationally accepted limits
- Rainwater has carried dioxin into city drains in a neighboring community where over 100,000 people live

Impact on Environment

- Destruction of evergreen forests, mangrove forests, rubber trees, and farmland
- Destruction of several million acres of forests caused loss of ecological equilibrium
  - Loss of wood, wild life, forest products
  - Loss of capacity to retain surface water caused flash flooding in rainy season and drought in dry season and damaged agricultural production
  - Birds and animals destroyed with the forests either by direct spraying or result of loss of food
  - Barren, dry lands where nothing can be planted still exist in provinces in south Vietnam

A Luoi Valley

Impact on the People

- A study of veterans who served in the south revealed:
  - Those exposed to chemicals have a statistically significant incidence of:
    - Digestive illnesses
    - Neural disorders
    - Skin diseases
    - cancers
  - There is a higher incidence of :
    - Neurasthenia, weight loss, frequent headaches, movement difficulties, blurred vision
    - Liver function
    - Digestive disorders
    - Arteriosclerosis
    - Immune deficiency
    - Chloracne
    - High blood pressure
    - Oral-pharynx cancer, leukemia, liver cancer

Impact on the People

- Many studies at hospitals (Gynecology and Obstetrics Hospital, Ho Chi Minh City; Song Be Hospital; Tay Ninh Hospital; Institute for the Protection of Mothers and Newborns, Ha Noi) show the following:
  - Higher incidence of reproductive abnormalities among residents of sprayed regions and in families of veterans who fought in the south:
    - Spontaneous abortions and premature births
    - Fetal deaths
    - Molar pregnancies and chorio-carcinoma
    - Severe birth defects


THAI DỊ DẠNG
Bệnh Viện phụ sản

Impact on the People

- Birth Defects:
  - Ancephaly
  - Hydrocephaly
  - Encephalocele
  - Cleft lip/palate
  - Cystic hygroma
  - Myleomeningocele
  - Spina bifida
  - Dactylar disease
  - Short limbs, lack of limbs
  - Down Syndrome
  - Many with multiple birth defects

Microcephaly

Lack of limbs

Spina bifida

Phocomelia

Disabled children in Tu Du Hospital

Disabled children in Tu Du Hospital

What is to be Done?

- Continue to address the enduring psychological and physical health effects of Agent Orange and dioxin on US veterans of the American War in Vietnam and their families
- Demand that the US government and involved chemical companies provide resources for services for the disabled in areas where dioxin victims are concentrated; provide medical services and nursing services for those harmed by Agent Orange; develop community support organizations, including health care and educational and chronic care services and medical equipment to care for American and Vietnamese people harmed, including additional services as they are identified
- Recommend continuing collegial exchange between US organizations, in both the public and private sector to improve the health of the Vietnamese people and US veterans and their families
- Demand that the US government and involved chemical companies remediate those areas in Vietnam containing high levels of dioxin.