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Agent orange (vietnam) and cervical cancer

Expert: [Margot RN BScN CGN](#) - 9/12/2004

Question

Just dawned on me!!! Could the level of dioxin in my husbands blood stream from (Agent Orange in Vietnam) have caused my cervical cancer? There is NO cancer history in either family history. Thanks for your time!

Answer

Agent Orange and Cancer

About 3 million Americans served in the armed forces in Vietnam during the 1960s and early 1970s, the time of the Vietnam War. During that time, the military used large amounts of mixtures known as defoliants, which were chemicals that caused the leaves to fall off plants. One of these defoliants was Agent Orange, and some troops were exposed to it. Many years after US forces withdrew from Vietnam, questions still remain about the lasting health effects of those exposures, including increases in cancer risk. As the US veteran population ages, study results continue to emerge.

This article offers a brief overview of the health evidence on Agent Orange and cancer. It is intended to help doctors, Vietnam veterans, and their family members understand our current state of knowledge. The evidence comes from several sources, including studies of:

Vietnam veterans

Workers exposed to herbicides or dioxins in occupational (workplace) settings (since dioxins contaminated the herbicide mixtures used in Vietnam)

Vietnamese populations in the aftermath of the war

This article does not offer a complete review of all evidence - it is meant to be a brief summary. It also introduces readers to benefits programs and other issues that arise in caring for cancer patients or others concerned about the risks from exposure to Agent Orange during military service.

Background

During the Vietnam War, US military forces sprayed nearly 19 million gallons of herbicide on about 3.6 million acres of land in Vietnam and Laos to remove forest cover, destroy crops, and clear vegetation from the perimeters of US bases. This effort, known as Operation Ranch Hand, lasted from 1962 to 1971.

Various herbicidal (plant-killing) formulations were used, but most were mixtures of two herbicides known as phenoxy herbicides because of their chemical structures:

2,4-dichlorophenoxyacetic acid (2,4-D)

2,4,5-trichlorophenoxyacetic acid (2,4,5-T)

Each formulation was shipped in a chemical drum marked with an identifying colored stripe. The most widely used mixture contained equal parts 2,4-D and 2,4,5-T. Because this herbicide came in drums with orange stripes, it was called Agent Orange. Today, Agent Orange is used to refer generally to all the phenoxy herbicides sprayed at the time. (Other types of herbicides were also used, including cacodylic acid and picloram.)

The 2,4,5-T was contaminated with small amounts of dioxins, which were created unintentionally during the manufacturing process. Dioxins are a family of biologically active compounds formed during the manufacturing of paper and some other industrial processes. Because they can remain in the environment for years, they form part of a group of chemicals known as "persistent organic pollutants." The particular dioxin present in Agent Orange, 2,3,7,8-tetrachlorodibenzo-p-dioxin, or TCDD, is unusually toxic.

In studies that compared Vietnam veterans with veterans who had served at the same time elsewhere, TCDD (dioxin) levels were found to be elevated among those who had served in Vietnam, although the elevations diminished slowly over time.

After a scientific report in 1970 indicated that 2,4,5-T could cause birth defects in lab animals, the use of 2,4,5-T in Vietnam was suspended. A year later, all military herbicide use in Vietnam ended. During the 1970s, veterans returning from Vietnam began to report skin rashes, cancer, psychological symptoms, birth defects and handicaps in their children, and other health problems. Some veterans were concerned that Agent Orange exposure might have contributed to these

health problems. These concerns helped initiate a series of scientific studies, health care programs, and compensation programs directed to the exposed veterans.

A large class-action lawsuit was filed in 1979 against the herbicide manufacturers, and was settled out of court in 1984. It resulted in the Agent Orange Settlement Fund, which distributed nearly \$200 million to veterans between 1988 and 1996.

Although there is now quite a bit of evidence available about the health effects of Agent Orange, many questions have not yet been answered.

How Were People Exposed to Agent Orange?

About 3 million people served in the US military in Vietnam during the course of the war, of whom about 1.5 million served during the period of heaviest herbicide spraying from 1967 to 1969.

Exposure to Agent Orange varied a great deal. Most of the large-scale spraying operations in Operation Ranch Hand were done with airplanes and helicopters. However, some herbicides were sprayed from boats or trucks, and some were applied by soldiers with backpack sprayers. Those who loaded airplanes and helicopters may have been exposed the most. Members of the Army Chemical Corps, who stored and mixed herbicides and defoliated the perimeters of military bases, probably also had some of the heaviest exposures. Others with potentially heavy exposures included members of Special Forces units who defoliated remote campsites, and members of Navy river units who cleared base perimeters.

Exposures could have occurred through breathing the chemicals in, ingesting them in contaminated food or drink, or absorbing them through the skin. Other exposure pathways may have been possible as well, such as through the eyes or through breaks in the skin.

One of the challenges in assessing the health effects of Agent Orange exposure is determining the amount of exposure any individual veteran received (or even what they were exposed to), as there is very little information of this type available.

Does Agent Orange Cause Cancer?

Studies of Vietnam veterans potentially provide the most direct evidence of the health effects of Agent Orange exposure. However, because of the small number of highly exposed persons, these studies have yielded very limited information on cancer.

The Vietnam Experience Study (VES), conducted by the Centers for Disease Control (CDC), was a study that compared about 9,000 Vietnam Army veterans with about 9,000 Vietnam-era Army veterans who served elsewhere. A related effort was the CDC Selected Cancers Study, a study conducted in 8 cancer registries that provided data on non-Hodgkin lymphoma, sarcomas, and other cancers. In both of these studies, the number of veterans with heavy exposure to Agent Orange was too small to draw firm conclusions.

The Department of Veterans Affairs, formerly the Veterans Administration (VA), also conducted a series of studies beginning in the 1980s. The VA studies ranged from large-scale studies to studies of specific subgroups of veterans.

Both the CDC and the VA studies looked broadly at Vietnam veterans, without a special focus on Agent Orange exposure (although some VA studies focused on Chemical Corps veterans).

In contrast, the Air Force Health Study specifically compared about 1,200 Ranch Hand veterans directly involved in herbicide distribution to 1,300 veterans not involved. This 20-year study, launched in 1982, involved periodic physical exams, medical records reviews, and blood dioxin measurements. Although this study focused more directly on Agent Orange exposure, the relatively small number of subjects, and the even smaller number with elevated blood dioxin levels, greatly limited the study's power to detect increases in cancer incidence.

At the state level, about a dozen states, mostly in the Midwest and Northeast, have conducted studies of their veterans, some of which have yielded cancer information.

Finally, a series of studies of Australian Vietnam veterans has provided information on cancer risk. These studies, too, were limited by their small size, by the lack of detailed exposure assessment, and (at least initially) by the relatively young age of the veterans. As the veterans continue to age, additional research should yield more information about cancer risk.

Because of the limits of the Vietnam veteran studies, studies of 3 other groups have provided important information on the potential cancer-causing properties of Agent Orange exposure:

Vietnamese soldiers and civilians exposed to the same herbicides as United States service personnel, often for more prolonged periods (although there have been few systematic health studies in these populations)

Workers exposed to herbicides in other settings, such as herbicide manufacturing workers, herbicide applicators, farmers, lumberjacks, and forest and soil conservationists, who often had much higher serum dioxin levels than Vietnam veterans
People exposed to dioxins after industrial accidents in Germany, Seveso (Italy), and California, and after chronic exposures at work and in the environment

Each of these populations differs from the Vietnam veterans in the characteristics of the people exposed, the nature of the dioxin exposures, and other factors such as diet and other chemical exposures.

Based on this relatively large body of evidence, conclusions can be drawn about several cancers.

Soft Tissue Sarcoma: Studies of Vietnam veterans have not demonstrated an increase in soft tissue sarcomas.

In particular, no association with soft tissue sarcoma was seen in the Ranch Hand study, in a study of over 10,000 Marines who had served in Vietnam, a large study of sarcoma patients in VA hospitals, the Selected Cancers Study, or studies of veterans in Michigan, Massachusetts, or other states. A study of Australian Vietnam veterans suggested a large increase in soft tissue sarcomas, but this finding was based on a mail survey of self-reported diagnoses. In a follow-up study designed to confirm the diagnoses, the excess of soft tissue sarcomas could not be verified.

However, soft tissue sarcomas have been linked to phenoxy herbicide exposure by a series of studies in Sweden and by some studies of industrially exposed workers. Many studies of farmers and agricultural workers show an increase in soft tissue sarcomas, which may relate to herbicide exposure. Soft tissue sarcomas have also been linked to dioxin exposure in a study of over 5,000 chemical manufacturing workers in the United States, in some other workplace studies, and in some studies of environmental exposures.

Non-Hodgkin's (Non-Hodgkin) Lymphoma: Most studies of Vietnam veterans have not shown an increase in non-Hodgkin lymphoma (NHL).

The Selected Cancers Study showed that Vietnam service was associated with a 50% increased risk of NHL, but self-reported Agent Orange exposure was not linked with increased risk. Similarly, in the CDC's Vietnam Experience Study, there were seven NHL deaths among about 8,000 Vietnam veterans and only one NHL death among about 8,000 non-Vietnam veterans. Based on military job titles, there was no suggestion that the seven Vietnam veterans with NHL had sustained Agent Orange exposure. The Ranch Hand study showed no increase in NHL, nor did the VA mortality study of over 33,000 Army and Marine Vietnam veterans, a study of over 200 Vietnam veterans with NHL, or numerous state-level studies. A study of Australian Vietnam veterans suggested a large increase in NHL, but this finding was based on a mail survey of self-reported diagnoses. In a study that attempted to confirm the diagnoses, the number of NHL cases declined to the upper end of the expected range.

Several other studies have found a link between phenoxy herbicide exposure (usually on the job) and NHL. Many other studies of farmers and agricultural workers also suggest this association, although well-designed studies of herbicide production workers have generally found no link or report very small or uncertain associations based on very small numbers of cases.

Hodgkin's (Hodgkin) Disease: Studies of Vietnam veterans have not demonstrated an increase in Hodgkin disease.

In particular, the Ranch Hand study did not show an increase in these tumors, nor did a study of over 33,000 Army and Marine Vietnam veterans, the Selected Cancers Study, a study of more than 250 Vietnam-era veterans with Hodgkin disease, or studies of veterans in Michigan, New York, or other states.

However, Hodgkin disease was linked to phenoxy herbicide exposure in one study in Sweden. Another yielded similar results, although the numbers were small enough that they may have been due to chance. Many studies of farmers and agricultural workers show an increase in Hodgkin disease, which may relate to herbicide exposure.

The link between Hodgkin disease and dioxin exposure specifically is less clear. The large occupational study of over 5,000 chemical manufacturing workers in the US did not show an increase in Hodgkin disease. The Seveso, Italy study showed no cases of Hodgkin disease in the zone of greatest dioxin exposure, and a small excess of cases in the other zones. Other studies have given mixed results.

Lung and Other Respiratory Cancers: Studies of Vietnam veterans have not shown a consistent pattern of increases in respiratory cancers, such as those of the lung, trachea (windpipe), bronchus, and larynx (voice box).

The VA studies did not reveal increased risk of death from these cancers in Vietnam veterans, nor did the study of Army Chemical Corps veterans. The Ranch Hand study suggested an increase in lung cancer, but this finding was based on only 10 deaths, and a high prevalence of smoking in the group being studied may have accounted for this finding. In studies of Australian Vietnam veterans, self-reports suggested an increase in lung cancer (120 cases versus 65 expected), but only 46 of these self-reported cases could be confirmed, actually suggesting a decreased risk of lung cancer.

Most studies of workers with workplace herbicide exposure, such as herbicide manufacturing workers, herbicide applicators, farmers, and forest and soil conservationists have shown no excess risk of lung cancer. Similarly, follow-up of the Seveso accident has not shown a link between dioxin exposure and lung cancer, although follow-up of industrial accidents in Germany and California did suggest an increase in respiratory cancers, based on small numbers of cases.

Chronic workplace exposures to dioxin have also been associated with increased risk of respiratory cancers among those with high exposures.

Together, these data provide little support for the hypothesis that phenoxy herbicides increase the risk of lung cancer, but they suggest a possible association of dioxin exposure with lung cancer.

Prostate Cancer: While the VA and Ranch Hand studies did not show an excess of prostate cancer, the Australian veterans study did show an excess, with 212 cases observed and 147 expected.

Studies of other groups have yielded mixed results. Most studies of workers occupationally exposed to phenoxy herbicides do not show an excess of prostate cancer. However, there are exceptions. For example, recent studies of pesticide applicators in Florida (exposed to many agents other than herbicides) reported an approximate doubling of prostate cancer incidence and mortality. Follow-up of the Seveso accident revealed a small excess of prostate cancer (which may have been due to chance), as did a National Institute of Occupational Safety and Health (NIOSH) study of chronic dioxin exposure. However, follow-up of other acute dioxin exposure incidents showed no excess of prostate cancer.

Overall, the evidence of an association between Agent Orange and prostate cancer is not strong.

Multiple Myeloma: None of the studies of Vietnam veterans are helpful in determining risk of multiple myeloma (a type of immune system cancer that affects the bones), because the numbers of cases have been consistently small.

However, other studies of people exposed to pesticides, herbicides, and/or dioxins have been suggestive. For example, several studies of farmers and agricultural workers have reported a small increase in risk of multiple myeloma, although other studies show no excess risk. Follow-up of the Seveso accident shows a decreased risk of multiple myeloma among exposed males but an increased risk among females, a disparity that remains unexplained. Similarly, the NIOSH study of over 5,000 workers exposed to dioxins showed about a doubling of multiple myeloma risk, based on 10 cases.

Overall the evidence linking Agent Orange to multiple myeloma is sparse and indirect.

Acute Myelogenous Leukemia (AML) in the Children of Veterans: Three studies have pointed to an association between paternal Agent Orange exposure and acute myeloid leukemia (also called acute myelogenous leukemia) in children.

The first study, reported by the Children's Cancer Study Group, compared more than 200 children with AML (cases) to a similar group of children without AML (controls). Children with AML were about 2 ½ times more likely to have a father with long-term pesticide exposure in the workplace. As for maternal exposure, seven mothers of children with AML and no control mothers reported such exposure. The risk was elevated for children diagnosed before the age of six and for children who had sustained direct pesticide exposure. "Pesticides" in this study included both insecticides and herbicides, so it is not clear which agents were associated with the increased risk.

The second study was a survey of nearly 50,000 Australian Vietnam veterans. This study also found about a four-fold increase in AML among the children of Vietnam veterans. The risk of acute lymphocytic leukemia (ALL) was not increased in this study.

The third study, a study of more than 1,800 cases of ALL and more than 500 cases of AML, was reported from the Children's Cancer Group. Although a parent's military service in general conferred no increased risk of childhood leukemia, service in Vietnam or Cambodia was associated with a 70% increased risk for AML (and no increased risk of ALL). Self-reported exposure to Agent Orange was not associated with increased risk.

Gastrointestinal (GI) Cancer: Cancers of the GI tract--esophagus, stomach, pancreas, colon, and rectum--have been extensively studied in Vietnam veterans, occupational groups with herbicide exposure, and people exposed to dioxins. These studies have yielded a fairly consistent pattern of no association between these exposures and any GI cancer.

One case-control study in Hanoi suggested that former military service, presumably entailing Agent Orange exposure, was associated with increased risk of hepatocellular carcinoma (liver cancer), but the risk was far smaller than that associated with hepatitis B virus infection.

Brain Cancer: Similarly, there is a fairly consistent pattern suggesting no association between Vietnam service, occupational herbicide exposure, or dioxin exposure, and brain cancer.

Other Cancers: There is not enough evidence to draw conclusions regarding a link between Agent Orange exposure and other cancers, including cancers of the nose and nasopharynx (upper part of the throat), breast, cervix, endometrium (uterine corpus), ovaries, liver and bile ducts, bone, kidneys, urinary bladder, testicles, or skin, or leukemias other than chronic lymphocytic leukemia (in veterans themselves, as opposed to their children).

Animal and Laboratory Studies

Herbicides such as 2,4,5-T and 2,4-D are not considered highly toxic compounds, and high doses are required to cause effects in animals. These compounds have not been associated with cancer in animal studies. Studies of cells in lab dishes have also generally been negative, although 2,4-D caused mutations (changes in DNA) in one study.

Cacodylic acid is reported to cause lung and bladder tumors, to promote skin cancer in mice, and to cause DNA mutations in some laboratory tests. Picloram has caused increases in benign liver tumors and in benign thyroid tumors in rats, but has not caused DNA mutations in cells in lab dishes.

2,3,7,8-TCDD (dioxin) is carcinogenic (cancer-causing) in animal tests, increasing a wide variety of tumors in rats, mice, and hamsters. In lab dish studies, dioxin does not seem to damage DNA directly, but helps tumors to grow instead.

What Do the Expert Agencies Say?

Institute of Medicine

The "Agent Orange Act of 1991" directed the Secretary of Veterans Affairs to request the National Academy of Sciences (NAS) to review and evaluate the effects of Agent Orange exposure. The Institute of Medicine (IOM), part of the NAS, responded by forming the Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides. The Committee has issued a series of studies, beginning with its 1994 Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam.

The IOM reports have assessed the risk of both cancer and non-cancer health effects. Each health effect is categorized as having one of the following:

"sufficient evidence of an association"

"limited/suggestive evidence of an association"

"inadequate/insufficient evidence to determine whether an association exists"

"limited/suggestive evidence of no association"

This framework provides a basis for government policy decisions in the face of uncertainty. As of the most recent update, the links between Agent Orange exposure and cancer were designated as shown. (Note that this table shows only cancers.)

Institute of Medicine: Associations Between Agent Orange and Cancer

Sufficient evidence of an association

Soft tissue sarcoma

Non-Hodgkin lymphoma (NHL)

Hodgkin disease
Chronic lymphocytic leukemia (CLL)

Limited/suggestive evidence of an association

Respiratory cancers (lung, trachea, bronchus, larynx)
Prostate cancer
Multiple myeloma

Inadequate/insufficient evidence to determine whether an association exists

Liver and bile duct cancers
Nasal/nasopharyngeal cancer
Bone cancer
Breast cancer
Female reproductive cancers (cervical, uterine, ovarian)
Urinary bladder cancer
Kidney cancer
Testicular cancer
Leukemia (other than CLL)
Skin cancers
Acute myelogenous leukemia (AML) in the children of veterans

Limited/suggestive evidence of no association

Gastrointestinal cancers (stomach, pancreas, colon, rectum)
Brain tumors

National Toxicology Program

The US National Toxicology Program (NTP), formed from parts of several government agencies, evaluates exposures that may be carcinogenic (cancer-causing). Those exposures thought to be carcinogenic are included in the "Report on Carcinogens," published every two years. Each exposure is assigned to one of two categories:

"known to be a human carcinogen"

"reasonably anticipated to be a human carcinogen"

The first category includes substances for which human studies provide "sufficient evidence" of cancer causation in humans. The second category includes substances for which there is limited evidence of cancer causation in humans and/or sufficient evidence of cancer causation in experimental animals.

The National Toxicology Program has not listed the phenoxy herbicides, including Agent Orange, as carcinogens, but 2,3,7,8-TCDD (dioxin) is classified as "known to be a human carcinogen."

International Agency for Research on Cancer

The International Agency for Research on Cancer (IARC) also evaluates exposures that may be carcinogenic. IARC classifies exposures into one of four categories:

Group 1 exposures are those "known to be carcinogenic to humans," usually based on "sufficient" human evidence, but sometimes based on "sufficient" evidence in experimental animals and "strong" human evidence.

Group 2 exposures are divided into two categories. Group 2A ("probably carcinogenic to humans") has stronger evidence, and Group 2B ("possibly carcinogenic to humans") has weaker evidence.

Group 3 exposures are not considered classifiable, because available evidence is limited or inadequate.

Group 4 exposures are "probably not carcinogenic to humans" based on evidence suggesting lack of carcinogenicity in humans and in experimental animals.

IARC has not rated Agent Orange per se, but the phenoxy herbicides, including 2,4-D and 2,4,5-T, are categorized as "possibly carcinogenic to humans" (Group 2B), and 2,3,7,8-TCDD (dioxin) is categorized as "known to be carcinogenic to humans" (Group 1).

Environmental Protection Agency

The US Environmental Protection Agency (EPA) uses a classification scheme very similar to that of IARC. It classifies exposures into one of five categories:

- (1) human carcinogen
 - (2) probable human carcinogen
 - (3) possible human carcinogen
 - (4) not classifiable as to human carcinogenicity
 - (5) evidence of non-carcinogenicity for humans.
- The EPA has not classified either phenoxy herbicides or TCDD as to carcinogenicity.

Does Agent Orange Cause Any Other Health Problems?

Vietnam service and Agent Orange exposure in particular have been extensively studied in relation to health problems other than cancer.

High levels of dioxin exposure are associated with chloracne, an acne-like rash caused by exposure to high levels of chlorine-containing chemicals.

Dioxin exposures are also linked to a condition called porphyria cutanea tarda (PCT), which can result in liver damage and hypersensitivity of the skin to light. This disorder has not been found in excess in Vietnam veterans, however.

For other health effects, the evidence is more variable.

There has been a good deal of concern about reproductive effects such as birth defects in the children of exposed veterans. Some data are suggestive, especially with regard to neural tube defects (such as spina bifida), but this is an area that continues to be marked by great uncertainty.

There has also been concern about toxicity to the nervous system, including psychiatric illnesses and problems with the nerves responsible for movement and sensation, especially in the hands and feet. Again, these links are uncertain.

Although the immune system is a target of dioxin, evidence to date has not demonstrated an increase in immune disorders in veterans.

Some evidence exists of an association between Agent Orange exposure and diabetes.

For other disorders--asthma, GI disease, circulatory disorders, and others--there is little solid evidence of a link with Agent Orange.

Advice for Vietnam Veterans

Vietnam veterans with Agent Orange exposure may be eligible for three kinds of benefits. Doctors who are familiar with these benefits can counsel their patients who are veterans accordingly.

Agent Orange Registry

The first benefit is the Agent Orange Registry, a health examination program administered by the VA since 1978. Veterans who participate in this program receive medical examinations, basic laboratory evaluations, and specialty referrals if appropriate.

Disability Compensation

The second benefit is disability compensation payments. Such payments are available to veterans with service-related illnesses or illnesses that were incurred or aggravated by military service.

The amount of the payments is determined by the extent of disability. Because past Agent Orange exposure is difficult to quantify, the VA uses a presumption-based system. If a veteran served in Vietnam between 1962 and 1975 and becomes disabled with one of the conditions designated as Agent Orange-related, the VA classifies his or her disability as service-related.

The diseases considered related to Agent Orange exposure correspond closely to the conditions found by the IOM to have "sufficient" or "limited/suggestive" evidence of an association. The cancers on the list include:

Hodgkin disease
multiple myeloma
non-Hodgkin lymphoma
prostate cancer
cancer of the lung, bronchus, larynx, or trachea
soft tissue sarcoma (other than osteosarcoma, chondrosarcoma, Kaposi sarcoma, or mesothelioma)
chronic lymphocytic leukemia
(Some conditions other than cancer, such as diabetes, are also on this list.)

Medical Benefits

Third, some veterans qualify for medical care following Agent Orange exposure. According to the Veterans' Health Care Eligibility Reform Act of 1996 (Public Law 104-262), the VA must provide its Medical Benefits Package--including outpatient and inpatient medical care at VA facilities, prescription medications, and home health and hospice care--to veterans with disorders associated with herbicide exposure in Vietnam (to the extent that Congress appropriates funds to provide this care).

These disorders include the cancers presumed to be Agent Orange-related, as well as any other disorder that a VA physician determines is possibly associated with Agent Orange exposure during service in Vietnam. Under this law, two categories of disability are excluded from care:

A disability that the VA determines did not result from Agent Orange exposures (such as appendicitis or an injury from an automobile crash)
A disease that the National Academy of Sciences classifies as having limited/suggestive evidence of no association with Agent Orange (GI tumors and brain tumors).
Veterans may want to check the VA Web site (www.vba.va.gov/bln/21/benefits/herbicide/) or their local VA hospitals for further information on any of these Agent Orange-related benefits.

Doctors should also provide medical advice and careful routine medical care to patients with a history of Agent Orange exposure. Because of the possibility of excess cancer risk, veterans should be advised to seek recommended cancer screening tests and should promptly seek medical evaluation of suspicious symptoms. Veterans should also be advised to quit smoking, to avoid exposures to other carcinogens, to eat a diet primarily from plant sources, and to maintain a healthy body weight.

Veterans concerned about past exposure to Agent Orange may want to join a support group at the local VA hospital and/or consult an occupational and environmental medicine clinic. These clinics can help assess past exposures and any risk that may persist, and can recommend appropriate steps to health protection. They may be located through the Association of Occupational and Environmental Clinics at www.aoec.org

Additional Resources

For medical information on this subject, the definitive source is the series of Institute of Medicine (IOM) reports, Veterans and Agent Orange. These can be found at the National Academies Press Web site. The most recent update is available at: <http://bob.nap.edu/books/0309086167/html>

US Department of Veterans Affairs
www.va.gov/agentorange

This Web page also has a link to the benefits site noted above. A useful brochure found here is "Agent Orange: Information for Veterans Who Served in Vietnam," www.va.gov/agentorange/docs/IDAO_Brochure.PDF.

Vietnam Veterans of America
www.vva.org/benefits/vvgagent.htm

References

Note: This document is adapted from the article "Agent Orange and Cancer: An Overview for Clinicians" by Howard Frumkin, MD, DrPh, which appeared in *CA--A Cancer Journal for Clinicians*. Vol. 53; 4: 245-255. The original article is available online at: <http://caonline.amcancersoc.org/cgi/content/full/53/4/245>.

from: http://www.cancer.org/docroot/PED/content/PED_1_3x_Agent_Orange_and_Cancer.asp?s...