



**DEPARTMENT OF VETERANS AFFAIRS
Veterans Health Administration
Washington DC 20420**

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UNDER SECRETARY FOR HEALTH'S INFORMATION LETTER

**HEALTH EFFECTS AMONG VETERANS EXPOSED TO
MUSTARD AND LEWISITE CHEMICAL WARFARE AGENTS**

1. This Under Secretary for Health's Information Letter provides information to clinicians who examine and provide care to veterans who may have been exposed to mustard and Lewisite chemical warfare agents ("mustard gas") as part of human experiments conducted by the Department of Defense (DoD) up to the end of World War II.

2. Background

a. In early March 2005, the Under Secretary for Benefits began mailing letters to veterans who were subjects in experiments conducted by DoD involving exposure to mustards and related chemical warfare agents, informing them of benefits they may be entitled to, and advising them to discuss any health concerns they may have with their Department of Veterans Affairs (VA) health care providers.

b. Mustard agents including sulfur and nitrogen mustard, and Lewisite, are chemical warfare agents that cause blistering and rashes to exposed individuals. DoD has had an active chemical warfare program since World War I, which included experiments using "soldier volunteers" designed to test protective clothing and masks, and the potential impact of chemical warfare agents on the operational readiness of military personnel. Service members were exposed in accidents, and in a single wartime incident from a German bombing attack in December 1943 on United States (U.S.) ships loaded with mustard agent in Bari, Italy. The resulting release of mustard agent resulted in thousands of injuries and hundreds of deaths among U.S. service members and others in the area.

c. Although all of these experiments were originally conducted by DoD in secret, today there is a great deal of information about them in open literature including congressional hearings, media accounts, and reviews from the National Academy of Sciences (NAS). The NAS reports, done at the request of VA and DoD, focused mainly upon the long-term health effect for service members experimentally-exposed to mustard, Lewisite, and other chemical warfare agents. Importantly, DoD has declassified essentially all the details of these experiments that could relate to health care and benefits claims of the veterans who participated.

d. Based upon the NAS reports, VA presumptively service connected certain illnesses for veterans who had been involved in "whole-body" exposures, e.g., in gas chambers or in field

exercises involving mustard and Lewisite chemical warfare agents. **NOTE:** *This does not apply to service members receiving smaller exposures such as droplets applied to skin.*

e. Although the details of these experiments are no longer secret, many health care providers are not aware of this history, and how these experiments may have affected veteran patients today. This Under Secretary for Health Information Letter is intended to inform health care providers who may see such veterans as patients, and is based upon a Veterans Health Initiative (VHI) independent study guide, "Health Effects from Chemical, Biological, and Radiological Weapons," available at: <http://www.va.gov/VHI>.

3. Guidance

a. Attachment A is to assist VA health care providers when they are providing care to veterans who may have been exposed to chemical warfare agents including mustard agents and Lewisite as part of human experiments conducted by DoD. There are no tests available today that can confirm exposure to these agents decades in the past. Therefore, medical care needs to focus upon the current health of the veteran, e.g., taking a thorough military and medical history including information on participation in chemical warfare agent experiments, along with a basic medical examination that includes appropriate laboratory tests relating to the veteran's complaints and medical findings.

b. Review of the literature and VA policy (described more fully in Att. A) does recognize a number of illnesses as presumptively service connected among veterans with "full-body" exposure to mustard agents and Lewisite, which need to be considered during a medical examination. These include:

(1) Chronic conjunctivitis, keratitis, corneal opacities, scar formation, or the following cancers: nasopharyngeal, laryngeal, lung (except mesothelioma), or squamous cell carcinoma of the skin (from exposure to nitrogen and sulfur mustard agents only).

(2) Chronic laryngitis, bronchitis, emphysema, asthma or chronic obstructive pulmonary disease (from exposure to nitrogen and sulfur mustard agents and to Lewisite).

(3) Acute non-lymphocytic leukemia (from exposure to nitrogen mustard only).

c. Veterans need to be informed that seeking care for conditions possibly related to exposure to mustard agents and Lewisite does not constitute a claim for compensation. **NOTE:** *Veterans wishing to file a compensation claim need to be referred to a Veterans Benefits Counselor, or be advised to contact the appropriate VA Regional Office at 1-800-827-1000.*

d. Treatment of the diseases VA presumes to be from the long-term consequences of mustard agents and Lewisite exposure, such as bronchitis, cataracts, etc., is the same as the treatment of those same diseases from other causes.

e. For more information, veterans need to be informed about VA's Special Issues Help Line at 1-800-749-8387, or DoD's hotline number at 1-800-497-6261.

4. Contact. Questions regarding this information letter may be addressed to the Environmental Agents Service (131) at (202) 273-8579.

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ATTACHMENT A

**VETERANS EXPOSED TO MUSTARD AND LEWISITE CHEMICAL
WARFARE AGENTS**

1. Mustard agents including sulfur and nitrogen mustard, and Lewisite, are chemical warfare agents that cause blistering and rashes in exposed individuals. Originally developed during World War I, they have been used in various conflicts around the world, perhaps most recently during the 1980s in the Iran-Iraq war, creating thousands of casualties. Although these agents are sometimes referred to as mustard gas, in fact they are not very volatile, and exposure risk is mostly through contact with liquid or small droplets in air.
2. The United States (U.S.) has maintained an active biological and chemical warfare program since World War I. Although today this program is essentially only defensive, in the past, part of this large-scale program involved the manufacture, stockpiling, and testing of chemical and biological warfare agents, munitions, and protective clothing. Mustard and related agents were the primary focus between the two World Wars. After World War II, the program shifted to newer agents including the nerve agents such as sarin and VX.
3. From its beginning, up to about 1975, part of this program involved human experimentation with “soldier volunteers.” Many of the experiments focused upon developing defensive chemical warfare capabilities, such as tests of protective clothing or respiratory masks. Other experiments were designed to evaluate the impact of various agents upon the operational readiness of military personnel who might be exposed to chemical warfare agents. Although all of these experiments were originally conducted in secret, today there is a great deal of information about them in open literature including congressional hearings, media accounts, and reviews from the National Research Council (NRC) and the National Academy of Sciences (NAS). The NAS reports, done at the request of both the Departments of Veterans Affairs (VA) and Defense (DoD) have focused mainly upon the long-term health effect for service members experimentally exposed to mustard and other chemical warfare agents. Based upon these reports, VA has presumptively service connected certain illnesses for veterans involved in “full-body” exposures, e.g., in gas chambers or in field exercises involving mustard agents.
4. Even though the details of these experiments are no longer secret, many health care providers are not aware of this history, and how these experiments may have affected their veteran patients today. This Attachment was written to inform health care providers who may see as patients some of the veterans who participated in these experiments, and is based upon a Veterans Health Initiative (VHI) independent study guide, “Health Effects from Chemical, Biological, and Radiological Weapons,” available at: <http://www.va.gov/VHI>.
- 5. World War II Human Experiments.** Military use of sulfur mustard agent caused nearly 400,000 casualties during World War I, more than from any other chemical agent used during the war (see subpar. 16h). In response, the U.S. developed its own chemical warfare program, including a secret research program intended to develop better military protective equipment. From relatively small beginnings, the U.S. military chemical warfare program expanded significantly during World War II, driven largely by the need to develop protection against the

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chemical warfare agents mustard and Lewisite known to be possessed by Axis forces. During World War II, Germany was known to possess these agents, and in fact used them against the Poles in 1939 (see subpar. 16h). Ultimately, the U.S. military concluded that animal studies were not an adequate substitute for human studies, and in 1942, U.S. military chemical weapons program managers initiated formal authority to recruit and use volunteer subjects.

6. What Experiments were Performed? By the end of World War II, over 60,000 U.S. service members had been used as human subjects in the U.S. chemical warfare defense research program (see subpar. 16h). This mostly secret research focused upon the development of better weapons and better methods for protecting against these weapons.

a. Human subjects were exposed to mustard agents and Lewisite using a wide variety of exposure protocols. Experimental treatments ranged from exposure to a small drop of agent on the arm or clothing, to quite severe exposures, such as from repeated gas chamber trials, occasionally without the benefit of protective clothing (see subpar. 16h).

b. At least 4,000 subjects were used in tests involving exposure to high-levels of mustard and related chemical warfare agents in “full body” exposures carried out in gas chambers, or as a part of field exercises over contaminated ground areas.

c. With gas chamber exposures, subjects were repeatedly placed in gas chambers filled with mustard agent or Lewisite vapor until their skin reddened as an indication of exposure or until their protective suit failed (see subpar. 16h). Commonly, subjects were given protective equipment including a gas mask, and then placed in chambers from 60 minutes to 4 hours. Twenty-four hours following such exposures, subjects were examined for reddening of the skin (erythema), i.e., evidence that the vapor had penetrated the protective clothing. Subjects were required to repeat the procedure and enter the chambers either every day, or every other day, until they developed moderate to intense erythema.

d. Most subjects apparently experienced intense erythema widespread over their bodies, especially in moist areas of skin folds, such as:

- (1) Behind the knees and under the arms;
- (2) In large areas of the chest and shoulders; and
- (3) On their arms and legs.

e. Some of these experiments involved subjects who were not provided with complete protective equipment. In those cases, exposures could be much higher, and some of these subjects experienced burns to the genital areas, including instances of crusted lesions to the scrotum that were characterized by researchers as severe (see subpar. 16h).

7. Exposures Other than from Experiments

a. **Workers.** Human experimental subjects were not the only individuals who were injured by chemical warfare agents during this period. Preparations for actual chemical warfare combat before and during World War II, involved many military and civilian personnel in the production, handling, shipping, and training to use this form of weapon (see subpar. 16h).

(1) By the end of World War II, the U.S. had produced more than 87,000 tons of sulfur mustard, 20,000 tons of Lewisite, and 100 tons of nitrogen mustard at Edgewood Arsenal, MD; Huntsville Arsenal, AL; Pine Bluff Arsenal, AR; and Rocky Mountain Arsenal, CO (see subpar. 16h). Not surprisingly, producing these large amounts of materials for the U.S. military required tens of thousands of workers, both military and civilian. Many military service members were trained to handle these weapons or were assigned to jobs that put them in contact with mustard agents or Lewisite (see subpar. 16h).

(2) The number of documented injuries among those involved with this program was initially “quite high” (see subpar. 16h). According to the NAS, one study of accidental injuries among this group reported over 1,000 cases over a 2-year period at Edgewood Arsenal of mustard poisoning resulting in eye, ear, nose, and throat symptoms.

b. **War-Time Exposure.** By the end of World War II, there was only a single military incident involving these weapons. A German bombing attack in December 1943 on U.S. ships loaded with mustard agent docked in the Italian harbor of Bari, Italy, released mustard agent into the air and water. This incident resulted in thousands of injuries and hundreds of deaths among U.S. service members and others in the area. In the immediate area of the harbor, over 600 victims of mustard poisoning were treated, 83 died (see subpar. 16h). Close to 1,000 civilians from the nearby town also died. Because the presence of the mustard agent in these ships was secret, many of the victims did not receive rapid appropriate decontamination, and thus, severe exposures continued over many hours. Long-term health effects in this population have not been evaluated (see subpar. 16h).

8. Secrecy and a Growing Awareness

a. Most of the soldier-volunteer subjects of these experiments conducted by the U.S. military were told at the time that they should never reveal the nature of the tests, and apparently, almost to a man, they kept this secret for the next 40 or more years (see subpar. 16h). Nevertheless, the experiments began to generate public attention as some World War II veterans began to seek compensation from VA for health problems that they believed were caused by their experimental exposures to mustard agents or Lewisite.

b. Because of the secrecy in which these experiments were conducted, veterans faced significant difficulties in obtaining the documentation they needed to support their disability claims for long-term health problems resulting from the experiments. Commonly, the periods of time spent as volunteers in the World War II mustard agents and Lewisite experiments were

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unaccounted for in official service records. Veterans filing compensation claims therefore had significant difficulty providing any documentation of their participation (see subpar. 16h).

c. Further, many of these veterans experienced the denial of government agencies that such tests and related activities had actually ever occurred (see subpar. 16h). Compounding veterans' difficulties, there was little scientific or medical information on long-term health effects from exposure to the chemical warfare agents used in these experiments; existing literature focused almost exclusively on short-term effects.

d. During their investigation into the history of World War II era experiments, the 1993 Institute of Medicine (IOM) Committee complained that "an atmosphere of secrecy still exists to some extent regarding the World War II testing program." Further, "[a]s a result, the committee often had great difficulty obtaining information." "The committee is certain that other relevant information exists that was never obtained." Finally, "[i]t is also clear that there may be many exposed veterans and workers who took an oath of secrecy . . . and remain true to that oath even today."

e. Nevertheless, mounting pressure from veterans, the press, and Congress on VA to resolve these issues led Secretary of Veterans Affairs, Edward J. Derwinski, on June 11, 1991, to announce new guidelines for compensation of veterans who had been subjects of the World War II mustard agents and Lewisite experiments. These new guidelines were helpful for these veterans because they loosened the normal requirements for documentation of participation in such activities, and clearly identified certain specific illnesses that VA acknowledged as being long-term effects from exposure to the chemical warfare agents involved.

f. As part of this overall response, in 1991 the Secretary of Veterans Affairs requested that the IOM conduct their 1993 review of the relevant medical literature on human health effects from exposure to mustard agents and Lewisite experiments conducted by the U.S. military during World War II on over 60,000 U.S. service members.

9. Long-Term Health Effects among Experimental Subjects

a. The 1993 NAS review "Veterans at Risk: Health Effects of Mustard Gas and Lewisite," concluded that there was no doubt that some involved in those World War II era mustard agents and Lewisite chemical warfare agent experiments had been coping with serious and debilitating diseases for decades (see subpar. 16h).

b. According to the earlier 1984 NRC report, records indicate that many human subjects exposed to mustard agents and Lewisite in these experiments sustained dermal injuries possibly severe enough to cause permanent scarring (see subpar. 16e).

c. The NAS Committee further complained that there were no epidemiological studies done of chemical weapons production workers, chemical warfare munitions handlers and trainers, or chemical weapon combat casualties from World War II (see subpar. 16h). Lack of relevant follow-up health assessments of the human subjects in these experiments limited the assessment and understanding of long-term health consequences.

10. Immediate Health Effects

a. Cases of actual military use of mustard agents, including during World War I and the Iran-Iraq war, provides some insights into the health effects from exposure to these materials. Probably the largest military application of mustard agent was during the 1980's Iran-Iraq war (see subpar. 16h).

b. Some of the Iranian mustard agent casualties from that conflict were treated in European hospitals, and their medical status and treatments were well documented.

(1) In that example, casualties suffered from pulmonary, eye, and skin lesions at similar incidence levels as observed among mustard agent casualties during World War I:

- (a) Eighty percent to ninety percent of sulfur mustard casualties suffered skin lesions,
- (b) Eighty-six percent suffered eye involvement, and
- (c) Seventy-five percent had pulmonary damage (see subpar. 16h).

(2) Among the Iranian casualties:

- (a) Eighty-three percent suffered skin lesions,
- (b) Ninety-two percent had eye problems, and
- (c) Ninety-five percent had pulmonary damage (see subpar. 16h).

11. Long-Term Health Effects. Despite having only limited medical literature on long-term health effects from exposure to mustard agents and Lewisite, in their 1993 review, the NAS Committee concluded that there was some information linking exposure to these agents and certain long-term health effects. They broke down their findings based on the strength of the supporting evidence as:

a. **Causal Relationships.** The NAS Committee found evidence indicating a causal relationship between exposure to mustard and Lewisite chemical warfare agents and the following health conditions:

- (1) Respiratory cancers including:
 - (a) Nasopharyngeal,
 - (b) Laryngeal, and
 - (c) Lung.

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(2) Skin effects including:

- (a) Cancer,
- (b) Pigmentation abnormalities of the skin,
- (c) Chronic skin ulceration and scar formation, and
- (d) Leukemia (typically acute non-lymphocytic type, from nitrogen mustard).

(3) Chronic respiratory diseases including:

- (a) Asthma,
- (b) Chronic bronchitis,
- (c) Emphysema,
- (d) Chronic obstructive pulmonary disease, and
- (e) Chronic laryngitis.

(4) Occular effects including:

- (a) Recurrent corneal ulcerative disease (includes corneal opacities; acute severe injuries to eye from Lewisite will also persist);
- (b) Delayed recurrent keratitis of the eye; and
- (c) Chronic conjunctivitis.

(5) Bone marrow depression and (resulting) immunosuppression (an acute effect that may result in greater susceptibility to serious infections with secondary permanent damage to vital organ systems).

(6) Psychological disorders including:

- (a) Mood disorders,
- (b) Anxiety disorders (including post-traumatic stress disorder), and
- (c) Other traumatic stress disorder responses. **NOTE:** *These may result from traumatic or stressful features of the exposure experience, not a toxic effect of the agents themselves.*

(7) Sexual dysfunction (scrotal and penile scarring that may prevent or inhibit normal sexual performance or activity).

b. **Suggested Causal Relationship.** The NAS Committee found evidence indicating suggested a causal relationship between exposure and the following health conditions:

- (1) Leukemia (acute non-lymphocytic type, sulfur mustard); and
- (2) Reproductive dysfunction (genotoxicity, mutagenicity, etc., from mustard agents).

c. **Insufficient Evidence of a Causal Relationship.** The NAS committee found insufficient evidence found to demonstrate a causal relationship between exposure and the following health conditions:

- (1) Gastrointestinal diseases;
- (2) Hematologic diseases;
- (3) Neurological diseases;
- (4) Reproductive dysfunction (from Lewisite); and
- (5) Cardiovascular diseases (except for those that may result from serious infections shortly following exposure; for example, heart disease resulting from rheumatic fever).

12. VA Presumptive Service Connections. Based upon these findings, VA announced that a variety of diseases would be presumptively connected to military service, among military members with “full body” exposures to mustard agents during military service (Title 38 Code of Federal Regulations (CFR) §3.316, “Claims based on chronic effects of exposure to mustard gas”). Exposure to nitrogen and sulfur mustard agents or to Lewisite during active military service with the subsequent development of certain illnesses are now presumed to be service connected (except if the condition is due to willful misconduct or there is clear evidence establishing a non-service related connection). Thus, service connection is presumed for veterans who experienced full-body exposure to certain chemical warfare blister agents during active military service and subsequently develop:

- a. Chronic conjunctivitis, keratitis, corneal opacities, scar formation, or the following cancers: nasopharyngeal, laryngeal, lung (except mesothelioma), or squamous cell carcinoma of the skin (from exposure to nitrogen and sulfur mustard agents only).
- b. Chronic laryngitis, bronchitis, emphysema, asthma or chronic obstructive pulmonary disease (from exposure to nitrogen and sulfur mustard agents and to Lewisite).
- c. Acute non-lymphocytic leukemia (from exposure to nitrogen mustard only).

13. Recent Epidemiological Studies on Long-Term Health Effects

a. The 1993 NAS Committee's call for new high-quality epidemiological research on these veterans was answered when in 2000 VA's Environmental Epidemiology Service reported a retrospective mortality study of 1,545 World War II Navy veterans experimentally exposed to low-levels of mustard agent at U.S. military facilities in Edgewood, MD. Previously, there had not been studies to evaluate possible long-term health affects among this group. Mortality among these subjects was compared to 2,663 similar Navy veterans who were not part of these experiments (see subpar. 16a). These test participants were ideal for this study, because every one of them had been stationed at the same location in Bainbridge, MD, between 1943 and 1945, when these experiments had occurred. This feature made it relatively straightforward to locate participants years later.

b. The VA study reported no increased risk associated with mustard agent exposure, for any cause of death, and no increased risk in cause-specific mortality associated with level of mustard agent exposure among exposed veterans (see subpar. 16a). In contrast, earlier studies of World War I veterans exposed to mustard agents during that war reported increased risk of death from lung cancers and respiratory related diseases. The 1984 NRC Committee reported that studies of these mustard agent exposed World War I veterans determined that 10 years after their wartime exposure, veterans had residual disabilities including chronic bronchitis (usually associated with emphysema), bronchial asthma, chronic conjunctivitis, blepharitis, keratitis, and corneal opacities (see subpar. 16e).

c. VA researchers speculated that apparent differences between theirs and the earlier studies could reflect that the veterans in the Edgewood Arsenal experiments that they studied, in contrast to many World War I veterans, wore protective clothing and were exposed for relatively short periods of time to relatively lower levels of agents (see subpar. 16a). Because of the large sample size available for this VA study, it had substantial statistical power, with a 95 percent power to detect a two or greater increase of risk of deaths due to respiratory cancers (see subpar. 16a). Moreover, since exposures occurred over 40 years before this study, all possible long-term health effect would have had time to reveal themselves.

14. Psychological Impact of Test Participation

a. Not surprisingly, the mere act of participation in experiments such as these can lead to long-term psychological effects. For example, the evaluation of veteran subjects of DoD's mustard agent experiments found significant rates of Post-traumatic Stress Disorder (PTSD) when compared to controls that did not participate in those experiments.

b. For example, researchers at VA's National Center for PTSD used structured interviews to assess PTSD and other psychosocial outcomes among twenty-four subjects of World War II mustard agent experiments (see subpar. 16f).

(1) Ninety-two percent reported they had volunteered for the original mustard experiments.

(2) Ninety-six percent had participated in gas chamber exposure tests during the mustard agent tests.

(3) Twenty-two percent of the subjects reported that they understood the dangers involved.

(4) Sixty-seven percent were ordered to not discuss their participation with anyone.

c. Similar effects have also been reported among survivors of the 1995 terrorist attack with the chemical warfare agent sarin against civilians in the Tokyo subway system (see subpar. 16c, and subpar. 16d).

d. Most of these human subjects (83 percent) reported experiencing physical symptoms following the experimental mustard agent exposures. These same subjects were examined by researchers again nearly 5 decades later. In comparison with men of similar age, they were found to still be suffering effects including being less psychologically and physically healthy. Similarly, they were also found to suffer a remarkably high PTSD prevalence of 17 percent. The current-prevalence of sub-diagnostic mustard-gas-related PTSD was 25 percent. Lifetime estimates for full and sub-diagnostic PTSD were reported to be 17 and 33 percent, respectively. Strikingly, the only mustard gas experience that predicted lifetime full or sub-diagnostic PTSD was the number of exposures to the gas (see subpar. 16g).

e. A related study evaluated PTSD among 363 veterans randomly selected from a VA list of veterans who had been subjects in DoD's mustard agent experiments during World War II. Investigators reported:

(1) Thirty-two percent of these veterans suffered from full-PTSD, and

(2) Ten percent for partial-PTSD.

(3) PTSD prevalence among these subjects was found to be a function of risk and protective factors, including:

(a) Volunteering,

(b) Physical symptoms during the tests, and

(c) Participants were forbidden from disclosing what happened to them.

(4) Veterans with full PTSD reported:

(a) Poorer physical health,

(b) A higher likelihood of several chronic illnesses,

(c) Health-related disability,

- (d) Greater functional impairment, and
- (e) Higher likelihood of health care use than those with no PTSD.

(5) Veterans with partial PTSD also had poorer outcomes than did veterans with no PTSD in some of these health areas (see subpar. 16f).

15. Is There a Test to Verify Exposure to Mustard And Lewisite? Mustard agents and Lewisite are rapidly absorbed, metabolized, and excreted from the body. Metabolites indicating exposure can be detected in urine within minutes to hours following exposure. However, metabolism and excretion of these compounds is generally complete within days of an exposure in cases where the individual survives the initial exposure. Consequently, there is no test available today that can confirm exposure to these chemical warfare agents that may have occurred months or years in the past.

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