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***If Veterans don't help Veterans, who will?***

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Request for Assistance With Veterans' Claims

*Establishing Agent Orange Exposure to Veterans of:*

- \* 74<sup>th</sup> Aeromedical Evacuation Squadron
- \* 731<sup>st</sup> Tactical Airlift Squadron
- \* 901<sup>st</sup> Organizational Maintenance Squadron

COMPILED BY WESLEY T. CARTER, MAJOR, USAF, RETIRED  
MARCH 2012

**OVERVIEW:**

**A**ir Force Reserve personnel from Hanscom AFB, Bedford Massachusetts and Westover Air Force Base, Chicopee Massachusetts (and other AFRES squadrons at Pittsburgh and Rickenbacker) were assigned to maintain and fly the C-123K/UC-123K "Provider" cargo aircraft between 1972-1982, as members of the 731<sup>st</sup> Tactical Airlift Squadron and the 74<sup>th</sup> Aeromedical Evacuation Squadron of the 439<sup>th</sup> Military Airlift Wing, and associated maintenance organizations, USAF Reserve. In 1982 the aircraft retired to Davis-Monthan AFB Arizona storage and with some provided to museums. Some toxic aircraft were sold for foreign military use and others to Walt Disney Films and various domestic interests.



Squadron airplanes had been used in missions throughout the Vietnam War and between six and eleven (Air Force records vary) of our squadron's aircraft were used in the Operation Ranch Hand operation spraying Agent Orange. With spray tanks and associated apparatus removed after the war some of the aircraft continued to be designated UC-123K while others, for reasons leaving Air Force historians permanently and officially confused, went back to the original C-123K designation. Post-war crews were unaware of dioxin exposure. When concerns did arise, veterans were left unaware of having been exposed to dioxin by flying the contaminated aircraft via policy made the Air Force Office of Environmental Law to keep such information "in official channels" only. Thus, exposed veterans' claims for medical care by the Department of Veterans Affairs continue to be denied for reasons of the Air Force restricting essential documents proving the aircraft's toxicity and the fact of the veterans' exposure to dioxin.



All [tests completed by the Air Force since 1993](#) have detailed the presence of dioxin and other toxic agents which remained on the stored, surplus C-123K aircraft, including "[Patches](#)", Tail #362 at the Air Force Museum, Wright-Patterson AFB Ohio. *Patches* required three professional decontamination efforts to make safer. These tests were completed over 20 years after the last spray missions in Vietnam. Military tests were also generated in 1994, [1996](#), 1998, 2000 and 2008, all confirming the earlier report. [In 2000 the Air Force and the General Services Administration in a court case](#) prohibited further sale of any

surplus aircraft. The remaining aircraft were moved to a secure area, specifically selected with instructions to make it "out of sight", within the Davis-Monthan storage area with restricted access to prevent dioxin exposure. [In April 2010](#) all remaining aircraft were decontaminated by being melted into scrap metal ingots. Three spray aircraft remain on USAF museum display at Pima Air Museum, the Air Force Museum and Warner-Robins AFB.

In May 2011, Air Force contamination reports were analyzed by the [Oregon Health Sciences University](#), which confirmed the toxicity reported by the tests. OSHU also confirmed that

personnel who maintained and flew the aircraft were “*most likely*” exposed to the toxins in Agent Orange. Members of the units have developed Agent Orange-related diseases clearly related to their exposure over a long period flying and maintaining their C-123K aircraft. OSHU issued a more comprehensive finding in March 2012 to the Secretary of Veterans Affairs, as did Columbia University. [On January 26 2012 the Deputy Director of the CDC Agency for Toxic Substance and Disease Registry](#) determined C-123 aircrew exposure to dioxin was “most likely.”

In a 2000 legal proceeding, particular note was made by the General Services Administration and the Air Force Material Command biomedical authorities’ designation of the aircraft as “heavily contaminated”, “extremely dangerous” and “extremely hazardous”, and mandating access only while wearing hazmat protection, respirators and goggles, followed by decontamination. Squadron aircraft tail numbers included 361, 362, 565, 571, 581, 583, 586, 592, 606, 607, 610, 629, 631, 633, 635, 656, 661, 663, 669, 680, 681, 683, 693, 695, 703, 706, and 707. While squadron management first understood that three aircraft had been used for Agent Orange missions, the AFMC examination of records in 2010 established that at between eight and eleven of the squadron’s aircraft were used for spraying Agent Orange in Vietnam.

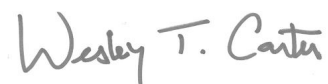
In 1996 Air Force documents included recommendations by senior leaders in the service, including the Air Force Judge Advocate General Corps, to restrict information about C-123K/UC-123K Agent Orange contamination to [“only official channels until more is known.”](#) No aircrew or maintenance veterans have received any information, via official channels or otherwise, in the years since Air Force tests that memo, or in the 18 years since the first tests proved contamination which put their health at risk.

Those veterans (or their survivors) with documents to establish aircrew duties (such as [flight orders](#), AF Form 5s, individual or aircraft flight logs, VA21-4138, etc) aboard the squadron’s dioxin-contaminated aircraft seek VA and USAF acknowledgement of exposure to Agent Orange dioxins so the Department of Veterans Affairs will evaluate illnesses for service-connected disabilities. Presently the Department of Veterans Affairs recognizes Agent Orange exposure only for personnel with “boots on the ground” during the Vietnam War, plus a handful of locations where Agent Orange was known to have been used. No other recognition is made of contamination, even by actual contact with Agent Orange. Current law permits the Secretary of Veterans Affairs to make such an administrative determination, an option he has recently exercised regarding another exposure incident, and also permits the Secretary of Defense to designate areas of Agent Orange exposure. Unlike Blue Water Navy whose exposure cannot be disproved, per the 2010 IOM report, our exposure is quite proven.

Like other military personnel we forfeit rights for civil redress of these injuries under *Feres*. It is proper and expected, however, that once injured through exposure to toxic substances like dioxin, we should at least be able to turn to the Department of Veterans Affairs for care of our illnesses.

COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE:

Wesley T. Carter, Major, USAF Retired  
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## AIRCREW EXPOSURE TO AGENT ORANGE TOXINS ON CONTAMINATED C-123K AIRCRAFT FLOWN POST-VIETNAM (1972-1982):

TO ESTABLISH THE FACT OF INDIVIDUAL VETERAN'S AGENT ORANGE EXPOSURE PER DEPARTMENT OF VETERANS AFFAIRS  
JUSTIFICATION OF DESIGNATION OF THESE AIRCRAFT AS AGENT ORANGE EXPOSURE SITES



***"Patches" Tail #362 Air Force Museum  
Wright-Patterson AFB, Ohio, after decontamination***



**Davis-Monthan AFB workers in HAZMAT protection  
1999-2010 as specified by USAF Surgeon General for  
work in stored Dioxin-Contaminated Aircraft**

***PREPARED BY:***

***MAJOR WESLEY T. CARTER, USAF RETIRED***

***MEMBER:*** Veterans of Foreign Wars of the United States, Vietnam Veterans of America, Air Force Association,  
Disabled American Veterans, Paralyzed Veterans of America, Association of Military Surgeons of the United States

**NARRATIVE:**

The Air Force used UC-123K “Provider” cargo aircraft in Vietnam to spray Agents Purple, White, Blue and Agent Orange, now known to contain harmful toxins, in Operation Ranch Hand. Many of the aircraft sustained severe anti-aircraft fire. In particular, UC-123K Tail Number 362 became famous throughout the Air Force and the aviation industry as “[Patches](#)”, surviving over 1500 hits and earning seven Purple Hearts for her crews.

After Ranch Hand concluded, most of the UC-123K aircraft were converted back to their original C-123K configuration, which was simply the same airframe less the Agent Orange tanks and spray apparatus, and controls for spraying. The aircraft were distributed to several Air Force Reserve squadrons in the Eastern US, and others went to allied military forces such as South Korea.

Between 1972 and 1982, the 731<sup>st</sup> Tactical Airlift Squadron, part of the 439 Military Airlift Wing at Westover AFB, Massachusetts was assigned 24 C-123K aircraft, at least eight to eleven of which identified by Air Force Material Command as former spray aircraft. According to officials at Hill AFB, UT it could be more as Air Force records were better at identifying those aircraft which *were* used than which *weren't* used, a degree of confusion existed until the very last airplane was destroyed by smelting, using an unrelated Navy scrap contract minimizing public notice.<sup>1</sup>

The 731<sup>st</sup>, based first at Hanscom AFB, MA and later at Westover AFB, MA, flew their C-123K aircraft throughout the United States and to several foreign countries in meeting their training and airlift mission. Also assigned to fly the C-123Ks with the 731<sup>st</sup> was Westover's 74<sup>th</sup> Aeromedical Evacuation Squadron, which conducted medical evacuation missions and training for currency in that aircraft. Each unit had students, qualified crewmembers, flight instructor and flight examiners, with flight examiners being considered the more experienced and qualified in their duties. Aircraft commanders were also separately rated as fully qualified to fly the C-123K in that crew position. The 901<sup>st</sup> OMS provided maintenance facilities at Westover AFB, MA.

The C-123Ks were eventually retired in favor of the C-130 “Hercules”, and the 731<sup>st</sup> relocated to Peterson AFB, Colorado. *Patches* was flown by members of the 731<sup>st</sup> to its retirement at the Air Force Museum at Wright-Patterson AFB, Ohio (Dayton) to be recognized for an outstanding war record and a unique background of surviving so many hits, many of which went through the spray pipes and Agent Orange tanks allowing the aircraft to become repeatedly saturated<sup>2</sup>. For some years after its delivery *Patches* sat outside on a parking apron, and was later inside a separate hangar away from the main museum, and eventually brought inside the museum proper.

Prior to bringing *Patches* inside, in December 1994 the base conducted a [survey of the aircraft to determine its level of contamination](#), knowing it had been used in Operation Ranch Hand to spray Agent Orange. The 645 Medical Group/SGB contracted a qualified commercial firm specializing in such analysis, with the resulting determination that *Patches* was “*heavily contaminated*”. The report recommended personnel not enter or work inside the aircraft without Tyvek protective coveralls, respirators, and limitation of exposure time, followed by decontamination. It also pointed out concerns for contamination of the ground from rainwater washing off *Patches*.<sup>3</sup> In any case, the recommendation was that the aircraft not have unrestricted public access, either inside

<sup>1</sup> [Air Force Recycles Vietnam-Era Aircraft](#), Press Release, Hill AFB, UT, April 2010, Ms. Barbara Fisher DAFC

<sup>2</sup> See [Air Force Museum “Patches” Fact Sheet](#)

<sup>3</sup> [Memorandum](#) for 645 MedGrp/SGB from AL/OEMH, dated 19 Dec 94, principal writers Capt [Wade Weisman](#) USAF BSC, Dr. Ron Porter

or immediately around the aircraft, even following extensive exterior cleaning and removal of all paint, inside and out. The contamination was considered hazardous, even more than two decades following its last Agent Orange spray mission, and after years of routine cleaning while flown by the 731<sup>st</sup> and 74<sup>th</sup>. Toxins had soaked into the very metal surface, under even the paint, of the C-123K. Although cleaned up by a decontamination firms' \$53,000 contract and two other further decontamination efforts, *Patches* would remain toxic.

In 2000 a private lawsuit was brought against the General Services Administration<sup>4</sup> dealing with the sale of some surplus C-123K aircraft stored at Davis-Monthan AFB. The [Finding 14165](#) of the judge went against the complaint, however the government released numerous military documents referring to the contamination of the C-123K fleet being too hazardous to permit sale, and included as exhibits in the case several Air Force reports of the dioxin as well as the confusion about which aircraft were, and which were not, used for spray missions in Operation Ranch Hand during Vietnam. The Air Force officially concluded that it was necessary to consider all remaining C-123K/UC-123K aircraft as having been used for spraying Agent Orange. Indeed, most were. In 1999 base employees filed complaints demanding recognition of their Agent Orange exposure around the aircraft, escalating the issue the attention of the Air Force Surgeon General's office.

At some point between 2000 and 2003, the issue of the Air Force ownership and HASMAT-area quarantine of dioxin-contaminated C-123s surfaced at the Air Staff, with AMARG and AFMC documents referring to "Air Staff" attention and "presentation at the next Air Staff." Documents expressed concern about potential federal and state EPA fines approaching \$3.4 billion, and the best ways to categorize the contamination to avoid such fines.

In December of 2003, a [study of C-123K Agent Orange contamination was prepared by the Air Force Institute for Operational Health](#)<sup>5</sup> estimating the cost of sampling the stored C-123KUC-123K surplus aircraft at Davis-Monthan AFB, Arizona. That report included several recommendations that any aircraft considered for surplus disposal first be fully decontaminated, because tests of sample aircraft at random **all** tested positive for dioxin congeners. Even with earlier decontamination efforts and after the years of cleaning during operational use since Vietnam, the report stressed, the aircraft could never be considered actually decontaminated, and the report author was concerned that their testing procedures may have actually underestimated the actual levels of contamination. They were also concerned about contamination of the soil and ground water beneath the aircraft. The study specified that of the aircraft examined for one report, half were "clean" and the other aircraft contaminated badly enough to permit **only** short-term access without protective equipment.

In April 2010, the [Air Force eventually opted to address the contamination of the remaining C-123K aircraft by destruction of the entire fleet](#), taking special measures to protect the ground, shroud the aircraft, shred all metal, and melt the scraps into ingots. Some AFMARC research done at this time revealed that of the eighteen remaining aircraft, thirteen were found to be former spray ships,<sup>6</sup> a number far higher than the 505<sup>th</sup> at Hill and the veterans who'd flown the aircraft expected. It was assumed by everyone that only a few of the C-123Ks were spray aircraft, but the fact is that most were, and most were contaminated. An official with the Office of Secretary of Defense, Senior Consultant Alvin Young, stressed the need to minimize visibility to the media,

<sup>4</sup> [GSBCA 14165 Finding](#), GSA Board of Contract Appeals, 22 December 2000

<sup>5</sup> [Memorandum](#) from AFIOH/RSRE dated 31 Jul 03, by B. Cornell Long, Chief, Health Risk Assessment Branch

<sup>6</sup> [Press Release](#) dated April 2010, 75<sup>th</sup> Air Base Wing, Hill AFB Utah, by Ms. Barbara Fisher, USAF Civilian

stressed the need to remove the emotionally charged words like “Agent Orange” and “dioxin” and “contaminated” from the base press release in favor of accurate but gentler and misleading terms such as “herbicide”, and further stressed the need to speedily remove the aircraft because aircrews might approach the Department of Defense with Agent Orange claims,<sup>7</sup> following any media “storm” which might further publicize the contamination problem. His recommendations and the authority of his position were specified as justifications for actions taken by AMARG. The consultant publically referred to the exposed aircrew veterans as “trash-hauling freeloaders.”

[In November 2011 the Department of Veterans Affairs issued a statement that C-123 aircrews](#) “may” have been exposed to TCDD but the crews most likely weren’t exposed to *enough* dioxin to cause long-term health problems...that there wasn’t enough dioxin for the crews to be considered “exposed.” The 2008 IOM report equated the degree of contamination with a victim’s degree of exposure, thus this creation of “enough” seems new in toxicology. In [January 2012 the Deputy Director of CDC’s Agency for Toxic Substances and Disease Registry](#) challenged VA with his opinion that the aircrews were exposed to approximately a **200-fold greater cancer risk** than the “screening value” and “I believe that aircrew operating in this, and similar, environments were exposed to TCDD.” [This was also the conclusion of the February 2012 report by Columbia University’s Mailman School of Public Health](#) and [Dr. Fred Berman, Director of the Toxicology Department of Oregon Health Sciences University](#) in his 1 March 2012 letter to the Secretary of Veterans Affairs. The present situation has the VA’s position opposed by other federal agencies, in particular the Air Force and CDC, as well as reputable university experts.

**Summary:** C-123Ks, first used in Vietnam for spraying Agent Orange, remained contaminated with hazardous levels of dioxin, as established by multiple Air Force tests, throughout their service life while flown at various US bases between 1972-1982. No Air Force tests have addressed this period. Indeed, the only professional evaluations of it were prepared by the Toxicology Department of Oregon Health Sciences University and the School of Public Health at Columbia University, both of which **confirmed** the planes’ toxicity and concluded that dioxin exposure by the crew was “most likely.”

The aircraft, after 1982 stored as surplus, in 1998 were sealed and specifically ordered to be relocated to an out-of-sight, fenced remote quarantine area with HAZMAT signage and restricted access due to toxins. Aircraft were contaminated to the point of the Air Force and GSA taking special measures to reduce soil and ground water contamination, with the eventual decision to destroy them to eliminate the environmental hazard they represented. Base employees filed official complaints regarding their own exposure to dioxin while working on the stored aircraft.

Aircrews and maintenance personnel assigned to the C-123K aircraft, particularly those aircraft identified as Operation Ranch Hand Agent Orange spray aircraft, have been exposed to the various toxins referred to in the studies. Between 1972-1982 volunteer aircrew members flew these contaminated aircraft, in many cases, for hundreds of hours each. They spent hundreds, often even thousands of hours on the ground as well, as they prepared for missions, configured and repaired the aircraft, cleaned it, loaded and unloaded cargo, deployed worldwide, dropped paratroops and cargo, conducted ground training, supported air shows, flew aeromedical evacuation, ate their flight lunches, slept during crew rest hours, and frequently even slept in the aircraft overnight during tactical operations.

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<sup>7</sup> [Memorandum](#), Alvin Young, Office of Secretary of Defense to Mr. Jim Malngren of the 505<sup>th</sup> ACSS, Hill AFB, 26 June 2009



A number of different organizations and professional testing firms prepared many reports, memos and conference calls, and no alternate position has ever been suggested within the Air Force, EPA or GSA as to the numerous findings of the C-123Ks being described as **“heavily contaminated”**, **“extremely hazardous”** and **“extremely dangerous.”** Commercial and FAA aviation safety officials have confirmed that in a hypothetical situation, any commercial carrier describing one of their aircraft in such a way, would be obliged by law to remove that aircraft from service, inform multiple agencies and have the duty to inform and care for all who’d been exposed. The Air Force, however, allowed exposed aircrews to remain unaware of the dioxin exposure, a decision likely to subject a civilian carrier to both civil and criminal penalties. Understandably, passengers aware of the dioxin contamination of an airplane wouldn’t consider boarding an aircraft that the airline itself had tested to be **“heavily contaminated,” “extremely hazardous”** and **“extremely dangerous.”** Passengers and crew, and the media, and government regulators and the public as a whole would be very concerned with any such civil aircraft.

Veterans of the 74<sup>th</sup> Aeromedical Evacuation Squadron (now the 439<sup>th</sup> Aeromedical Evacuation Squadron), and veterans of the 731<sup>st</sup> Tactical Airlift Squadron, and veterans of the 901<sup>st</sup> Organizational Maintenance Squadron, forming [The C-123 Veterans Association](#), observe:

1. Aircrews and maintenance personnel were exposed between 1972-1982 to Agent Orange and other hazardous toxins in the performance of aeronautical and maintenance duties aboard the contaminated C-123K/UC-123K aircraft
2. None of the military or GSA reports about the contamination mention concerns about the aircrews and maintenance personnel who’d previously been exposed in the years before those reports, conference calls and scientific studies were prepared. The Internet provides hundreds of juried articles and professional reports on similar contaminated workplaces or vehicles, and such articles typically deal not only with the hazard and its management, but also with the exposure (if any) of affected personnel. Yet, even the [Ranch Hand Summary delivered by an Air Force colonel, physician and flight surgeon](#)<sup>8</sup> failed to mention Air Force crews who flew the Provider post-Vietnam. Thus, several questions, obvious to experienced aircrew members and health professionals now considering the situation, arise about the C-123K and Agent Orange toxins and the many Air Force reports:
  - A. Did the writers not believe aircrews had been exposed even through the crews had hundreds of hours aloft and in some cases many hundreds of hours more on the ground inside the “heavily contaminated” and “extremely hazardous” aircraft over a period of many years, experiencing intense physical contact with the airplanes? Did the writers and their organizations not consider that aircrews assigned to the contaminated C-123K/UC-123K had suffered exposure to toxins?
  - B. Did the writers elect to avoid addressing the impact on assigned aircrews and for some reason, decide not to inform those aircrews of the harmful exposures?
  - C. Did the writers, although experienced members of the United States Air Force, not realize that aircrews had been flying the C-123K/UC-123K aircraft between the last time the airplanes were used for spraying Agent Orange in Vietnam and the time that the reports about the contamination were written? Did the writers’ breadth of professional knowledge not extend to understanding the aircraft they were examining and the use to which the Air Force had put it for those intervening years? Didn’t they notice airframe hours reported at the end of the

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<sup>8</sup> [Ranch Hand Advisory Committee Final Briefing](#), Colonel Karen Fox USAF MC, 7 Sept 2006

Vietnam War and compare with the hours on each airframe when it went into storage, and realize that the hours added on since Vietnam would represent continued exposure for the 1972-1982 aircrews?

- D. Did leaders throughout the Air Force not notice failure to attend to aircrew exposure once these reports were published? Attention was received from several different commands, several different bases, several different professional corps (line, JAG, BSC, MSC, MC), but no leader considered protection of the Air Force's most important asset...Air Force people who had been exposed to toxins. As mentioned above, Colonel Fox in her *Ranch Hand Report* doesn't discuss aircrews, an oversight for an experienced flight surgeon
  - E. Did the various JAG memos and other documents that recommended the contamination issue remain only "within official channels" and referenced "political implications" result in a determination not to alert exposed aircrews, or was the failure to notify the aircrews an oversight?
  - F. Was there a determination that the normal aircrew uniform of Nomex flight suit and boots typically worn by aircrews from 1970 to the present day protected the aircrews as well as the recommended Tyvek coveralls and respirators eventually recommended for personnel working around the aircraft, once toxins had been detected on the C-123K at Davis-Monthan and the Air Force Museum?
  - G. Air Force reports of the contamination recommended limiting exposure of workers, followed by decontamination. Would aircrews flying the aircraft for hundreds of hours and working in them for thousands of hours on the ground in preparation for flight (repairs, training, orientation, configuration, loading/unloading, even sleeping aboard overnight during tactical deployments) have benefited from limited exposure guidelines, followed by decontamination?
  - H. Why was a special alert sounded by Dr. Alvin Young of the Office of Secretary of Defense regarding the need for speedily destruction of the C-123st to prevent claims by crews to the Department of Veterans Affairs? Why did Young, in emails posted July 2011, refer to C-123 aircrews of the period 1972-1982 as "**freeloading trash haulers**" who, if the planes weren't destroyed, might learn of the contamination and seek service-connection "from the VA to pay them off" for their Agent Orange-related illnesses? Why were claims to be prevented?
3. Surviving members have Agent Orange medical conditions, including diabetes, prostate cancers, heart disease, acute peripheral neuropathy and other ailments.<sup>9</sup> Deaths (from AO-presumptive conditions) are excessive for this population. Children of some female crewmembers have leukemia. There was a cluster of breast cancer cases among women nurses and medical technicians who flew the C-123K.

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<sup>9</sup> [Memorandum](#), American Cancer Society, last revision May 2010

**CONCLUSION:**

**A**ircrews assigned these aircraft between 1972-1982 were intensely exposed to the dioxin (TCDD) identified in those studies. While leaders did not understand the health impact at the time, by 1993 the toxicity of the aircraft was clearly established. No effort was made to address the medical impact upon Air Force crews who were left unaware of the toxins they'd been exposed to in the performance of their already-hazardous aircrew and maintenance duties and that the VA, in a hasty and unscientific analysis, improperly described the aircraft's contamination, testing, and resultant aircrew exposure. There was no effort made to assist veterans in this process.

Considering that reports were generated between 1994-2010, with years spent addressing the mothballed contaminated C-123K/UC-123K fleet but with no concern for the health of aircrew and maintainers, this constitutes a serious failure of the General Services Administration, of Air Force MAJCOMs, the Air Staff, of the Air Force Medical Service, of senior line officers and of the SAF/IG. Even once issues were reported to the Secretary's office, no action was forthcoming and SAF/IG further determined no need or means existed to identify or notify the affected exposed personnel. Memoranda recommending restricting information about the contamination from exposed aircrews and foreign purchasers of the aircraft leaves questions about the medical, line and [JAG officers involved](#). The lack of concern shown by senior leadership and [general officers approving the reports](#) and by the Air Staff resulted in a negative health impact of the affected aircrews and their families. VA, clearly, is concerned principally with preventing veterans' claims.

*Patches*, the aircraft that first brought the C-123 contamination to veterans' attention, required three separate decontaminations, according to a 2 March 2012 statement from the USAF School of Aerospace Medicine. The last scientific testing done on the C-123 fleet revealed that about half were clean or slightly contaminated, but the other half of the fleet remained toxic with personnel required HAZMAT clothing and respirators...and this was in 2009, 38 years after the last Vietnam spray missions! ATSDR wrote that the toxicity level during the 1972-1982 period our crews flew was even **more** intense.

*Patches* is the only C-123 that had testing and subsequent decontamination. Other aircraft were inspected and still showed contamination even after sitting for decades in the Arizona desert. *Patches* flew its final Agent Orange missions a few years before the other C-123s stopped spraying so it is accepted that the others were somewhat more contaminated. Without contemporary testing on other aircraft, it must be accepted that *Patches'* high level of toxicity is roughly equal to or less than the rest of the C-123 spray fleet, and that service aboard other contaminated aircraft subjected crews to even greater exposure to TCDD.

Veterans lack the funds and staff to approach the Veterans Administration as effectively as they oppose us—the playing field is uneven and it's their ball. The Secretary of the Department of Veterans Affairs should accept the recommendation of the Air Force and the Agency for Toxic Substances and Disease Registry and recognize the dioxin exposure of these airmen. The Secretary should designate C-123s identified as having sprayed Agent Orange as Agent Orange Exposure Sites, or take other executive action to provide medical care for affected C-123 veterans suffering Agent Orange-presumptive illnesses.

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[Summary](#), C-123K Fleet, tail numbers, partial histories (70MB)

[Finding 14165](#), GSA Board of Contract Appeals, dated 22 Sep 00 (cover page only)

[Fairchild C-123K Provider Fact Sheet](#), National Museum of the US Air Force, posted 11 Feb 2011

[Flight Records](#), Wesley T. Carter, Paul Bailey, John Harris and other veterans

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[C-123K: Agent Orange Crew Exposure 1973-1991](#), web site printout & full document collection

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[Test Analyses and Validation, C-123K Dioxin Toxicity](#), F. Burman DVM PhD, Director Toxicology Program), 25 May 2011

[Memorandum](#) and Position Paper authored by Alvin Young, Agent Orange Senior Consultant to the Office of Secretary of Defense and by Mr. Buddy Boor, to arrange shredding and smelting of all AMARC C-123K aircraft due to dioxin toxicity, 9 Aug 2009. Young’s authority as part of the Office of the Secretary of Defense is stressed as authority and decision maker in this and in other correspondence dealing with destruction of the retired C123K fleet

[Statement](#), Department of Public Health, Department of Veterans Affairs, denying dioxin exposure by C-123 aircrews, November 2011

[Independent Scientific Opinion](#), Dr. J. Goepner (Lt.Col., US Army Chemical Corps, Ret.) confirming Agent Orange exposure by aircrews and refuting VA analysis, 19 Dec 2011

[Official Letter of Finding](#), Dr. T. Sinks, Deputy Director Nat'l Center for Environmental Health and Agency for Toxic Substances and Disease Registry (Center for Disease Control) confirming Agent Orange exposure by aircrews and confirming appropriateness of AF test results and procedures, and refuting VA analysis, 25 Jan 2012

[Independent Scientific Opinion](#), Dr. J. Stellman, Mailman School of Public Health, Columbia University, confirming Agent Orange exposure by aircrews and challenging VA testing procedures and conclusions, 11 Feb 2012



**PATCHES**

# VA denies benefits to veterans who flew in Agent Orange-contaminated planes

By Patricia Kime  
pkime@militarytimes.com

The Veterans Affairs Department has denied benefits and compensation to a group of Air Force Reserve veterans who sought relief for what they believe are service-connected illnesses tied to flying aircraft contaminated with Agent Orange.

During the Vietnam War, UC-123K Provider "spray birds" were used for chemical defoliation missions. VA ruled in November that aircrew members who flew the same planes after the war faced "minimal" long-term adverse health effects.

"Even if crew exposure did occur, it is unlikely that sufficient amounts of dried Agent Orange residue could have entered the body to have caused harm," VA officials said.

For one former crewman who suffers diseases that VA lists as associated with Agent Orange exposure, the decision comes as a blow.

"It's really tough for us to believe many of these grievous illnesses aren't service-related," said retiree Maj. Wesley Carter, 64, diagnosed with diabetes, peripheral neuropathy and prostate cancer. He flew C-123s from 1972 to 1982.

Carter began researching the issue after he was diagnosed with several ailments. After contacting fellow crew members, he found at least five had similar diseases and several had died.

"I started wondering about the common denominator," he said. "It was the aircraft."

Carter located a 1994 Air Force report about his old aircraft, nicknamed "Patches" for the number of hits it took from enemy fire during the war. The historic aircraft was destined for a spot in the National Museum of the Air Force, but officials deemed it too contaminated with a known carcinogen to go on immediate display.

Patches was scrubbed by a hazardous materials crew at Wright-

Patterson Air Force Base, Ohio, before being moved indoors.

"We ate in that plane, slept on the floor, lived in it on tactical deployments, and it was too contaminated for public display?" Carter said.

In making its decision, VA said it reviewed Air Force reports of samples from the aircraft to test for dioxin. It concluded that because dioxin is not water soluble and the residue could be dislodged only by using the strong solvent hexane, the residual chemicals were unlikely to cause adverse health effects.

A Vietnam Veterans of America spokesman called the VA's conclusion "bull."

"It's flat outrageous. How many reports and studies will they have to review before they get this right?" said Rick Weidman, executive director for government relations for VVA. "It's another sign [that VA] hasn't changed its corporate culture of denial."



One of the planes used to spread Agent Orange, nicknamed "Patches," had to be scrubbed down by a hazardous materials crew before it could be displayed at the National Museum of the Air Force.

An estimated 1,500 to 2,000 service members flew C-123s in squadrons based at Westover Air Reserve Base, Mass.; Pittsburgh

Air Reserve Base, Pa.; and Rickenbacker Air Force Base, Ohio.

It's not known how many are still alive, Weidman said. □

# Law makes vets more competitive for jobs

By Rick Maze  
rmaze@militarytimes.com

A new veterans employment law signed Nov. 21 by President Obama creates no new jobs but attempts, instead, to make those who served in the military more competitive for jobs that are available.

The Vow to Hire Heroes Act encourages businesses to hire veterans by offering tax credits, improves transition assistance programs for separating service members to help prepare them to look for jobs, creates a new skill-retraining program for chronically unemployed veterans and attempts to streamline placement of separating troops in federal jobs.

The economy has slowly been growing jobs, but Obama said veterans need more help.

"While we've added more than 350,000 private-sector jobs over the last three months, we've got 850,000 veterans who can't find work," Obama said. "And even though the overall unemployment rate came down just a little bit last month, unemployment for veterans of Iraq and Afghanistan continued to rise. That isn't right."

In a message to businesses, he said, "If you are hiring, hire a veteran. It's the right thing to do for you, it's the right thing to do for them and it's the right thing to do for our economy."

First lady Michelle Obama, speaking at the signing ceremony, said the law might not create jobs, but pointed out that businesses have been hiring veterans as part of the Joining Forces campaign led by her and Jill Biden, wife of Vice President Joe Biden.

"Businesses have already hired more than 18,000 veterans and military families, and they've made commitments to hire at least 135,000 more," she said.

The law is a compromise between the White House and the House and Senate Veterans' Affairs committees, which melded proposals into a final package.

Rep. Jeff Miller, R-Fla., the House committee chairman, described the new law as putting "veterans of all eras on the path to meaningful employment."

"From the combat medic returning home from Afghanistan to the Vietnam veteran who has lost a job due to the struggling economy, the Vow to Hire Heroes Act tackles the barriers too many of our veterans face in today's job market," Miller said.

Ryan Gallucci, an Iraq War veteran and deputy director of the Veterans of Foreign Wars' national legislative service, said the law will have some impact right away on separating service members and veterans looking for work. But one of the most important things it does is try to measure the success of the myriad programs the government already provides.

"In the long run, the VFW believes the reporting metrics included in the bill will be critical to analyzing what works and what doesn't when helping veterans find quality jobs," Gallucci said. "As the wars in Iraq and Afghanistan wind down, more and more veterans will be entering the workforce. ... We need to know how to best serve their transitional needs." □



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# UNITED STATES DEPARTMENT OF VETERANS AFFAIRS



## PUBLIC HEALTH

### Scientific Review of Agent Orange in C-123 Aircraft

VA's Office of Public Health has investigated the potential exposure to Agent Orange among crew members of C-123 aircraft used previously in spraying missions during the Vietnam War.

Although residual TCDD – the toxic substance in Agent Orange – may be detected in C-123 aircraft by sophisticated laboratory techniques many years after its use, the Office of Public Health concluded that the existing scientific studies and reports support a low probability that TCDD was biologically available in these aircraft. Therefore, the potential for exposure to TCDD from flying or working in contaminated C-123 aircraft years after the Vietnam War is **unlikely to have occurred at levels that could affect health**.

To address the concerns expressed by crew members, the Office of Public Health reviewed available scientific reports and peer-reviewed literature related to potential adverse health effects, such as:

- Physical properties of TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin)
- Routes of exposure (inhalation, ingestion, dermal) and bioavailability (ability to enter the body) of TCDD over extended periods
- Known levels of safe exposure and threshold levels of TCDD toxicity

#### Properties of TCDD

TCDD may be inhaled as an aerosol. The reports and literature demonstrated that in the vapor stage, TCDD has an atmospheric lifetime of only about three days. Dried TCDD on interior aircraft surfaces does not aerosolize when exposed to temperatures found inside aircraft during any conceivable use. There is a low probability that dried TCDD would aerosolize during routine crew use and present a risk to health by inhalation. Also, there are no data from the U.S. Air Force or other sources confirming dioxins in air samples taken from post-Vietnam C-123 aircraft.

#### Routes of exposure

Ingestion as a route of exposure on these aircraft would require that TCDD would need to have entered the mouth through contaminated food or water or by hands contaminated with TCDD. There is a low probability that transfer of TCDD in food or water or from hand-to-mouth could occur among these crew members, especially given that the sampling for TCDD on the aircraft surfaces required use of a solvent (hexane) to displace and dissolve any residue.

Solid TCDD can be extremely stable in the absence of direct sunlight. Once TCDD dries on hard surfaces, such as on an aircraft, it does not readily cross through human skin. Even if the dried material were to come into contact with perspiration or oils on skin, the skin would act as a barrier prohibiting further penetration of TCDD. There is a low probability that TCDD penetrated through the skin of these aircrews.

#### Scientific review and analysis

The Office of Public Health reviewed the following studies and reports, and will continue to review new findings relevant to this issue as they become available.

##### Air Force sampling reports

- "Aircraft Sampling: Westover AFB, MA." Prepared by W.W. Conway, USAF Occupational and Environmental Health Laboratory, Brooks AFB, TX; 1979.
- "[Memorandum for 645 MedGrp/SGB: Consultative Letter AL/OE-CL-1994-0203, review of Dioxin Sampling results from C-123 Aircraft, Wright-Patterson AFB, OH and Recommendations for Protection of Aircraft restoration Personnel.](#)" (444 KB, PDF) Prepared by WH Weisman and RC Porter, Armstrong Laboratory, Brooks AFB, TX; 1994.
- "[Memorandum for HQ AFMC/SGC: Consultative Letter, AL/OE-CL-1997-0053, Cleanup of Contaminated Aircraft, Aerospace Maintenance and Regeneration Center.](#)" (140 KB, PDF) Prepared by RC Porter, Armstrong Laboratory, Brooks AFB, TX; 1997.
- "Dioxin and Herbicide Characterization of UC-123K Aircraft – Phase I." Prepared for Director of Operations, 505 Aircraft Sustainment Squadron and Hazardous Waste Program Manager, 75CEG/CEVC, Hill AFB, UT (prepared by Select Engineering Services, Layton, UT); 2009.

##### Peer-reviewed literature

- Buffler PA, Ginevan ME, Mandel JS, Watkins DK. [The Air Force health study: an epidemiologic retrospective](#). Ann Epidemiol 2011; 21:673-87.
- Diliberto JJ, Jackson JA, Birnbaum LS. [Comparison of 2,3,7,8-tetrachlorodibenzo-p-dioxin \(TCDD\) disposition following pulmonary, oral, dermal, and parenteral exposures to rats](#). Toxicol Appl Pharmacol 1996; 138:158-68.
- Karch NJ, Watkins DK, Young AL, Ginevan ME. Environmental fate of TCDD and Agent Orange and bioavailability to troops in Vietnam. Organohalogen Compounds 2004; 66:3689-94.
- Keenan RE, Paustenbach DJ, Wenning RJ, Parsons AH. [Pathology reevaluation of the Kociba et al. \(1978\) bioassay of 2,3,7,8-TCDD: implications for risk assessment](#). J Toxicol Environ Health 1991; 34:279-96.
- Michaud JM, Huntley SL, Sherer RA, Gray MN, Paustenbach DJ. [PCB and dioxin re-entry criteria for building surfaces and air](#). J Expo Anal Environ Epidemiol 1994; 4:197-227.
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- Weber LW, Zesch A, Rozman K. [Penetration, distribution and kinetics of 2,3,7,8-tetrachlorodibenzo-p-dioxin in human skin in vitro](#). Arch Toxicol 1991; 65:421-8.
- Young AL, Giesy JP, Jones PD, Newton M. [Environmental fate and bioavailability of Agent Orange and its associated dioxin during the Vietnam War](#). Environ Sci Pollut Res Int 2004;11:359-70.

#### Risk assessment reports

- Doull J. Acceptable levels of dioxin contamination in an office building following transformer fire. Washington, DC: National Academy Press, 1988.
- Kim NK, Hawley J. [Risk assessment: Binghamton State Office Building](#). (285 KB, PDF) Albany, NY: New York State Department of Health, 1982.
- University of California [Davis]. Department of Environmental Toxicology. Risk Science Program (RSP). [Intermedia transfer factors for contaminants found at hazardous waste sites: 2,3,7,8-Tetrachlorodibenzo-p-dioxin \(TCDD\)](#). (118 KB, PDF) Sacramento, CA: Department of Toxic Substances Control, 1994.

#### Summaries of TCDD

- [2,3,7,8-Tetrachlorodibenzo-p-dioxin \(2,3,7,8-TCDD\)](#) - US Environmental Protection Agency, Air Toxics Website
- [Chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans chronic toxicity summary](#) (46 KB, PDF) - California Environmental Protection Agency, Office of Environmental Health Hazard Assessment
- [Intermedia transfer factors for contaminants found at hazardous waste sites: 2,3,7,8-Tetrachlorodibenzo-p-dioxin \(TCDD\)](#) (118 KB, PDF) - California Department of Toxic Substances Control; Risk Science Program, University of California, Davis

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U.S. Department of Veterans Affairs - 810 Vermont Avenue, NW - Washington, DC 20420

Reviewed/Updated Date: February 22, 2012





Agency for Toxic Substances  
and Disease Registry  
Atlanta, GA 30341

January 25, 2012

Wesley T. Carter, Major, USAF, Retired  
2349 Nut Tree Lane  
McMinnville, Oregon 97128

Dear Major Carter:

Thank you for your letter of November 17, 2011 regarding past Agent Orange exposures to Air Force C-123 aircrews operating this equipment outside of the Vietnam War theatre from 1972-1982. You describe a recent conversation with a representative of the United States Veterans Administration (VA). You were told ... *aircrews inside a 'heavily contaminated' airplane could not be exposed via dermal contact because the skin is a good barrier. Neither could exposure occur via inhalation because there wasn't much dust for the dioxin to adhere to*. You ask that the Agency for Toxic Substances and Disease Registry (ATSDR) provide you our opinion if you have been exposed.

In this letter, I provide a summary of my discussions with the United States Air Force (USAF), our review of screening criteria used by the Department of Defense for exposure to 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD), and a comparison of the screening criteria to the measured results from wipe samples taken from a contaminated plane on November 20, 1994. I summarize the limitations of the data and provide an opinion about exposure to TCDD in contaminated C-123 aircraft.

I contacted our liaisons for the Department of the Army and the USAF. I was referred to the following information currently posted on the VA website. It states ... *(the) VA has concluded the potential for long-term adverse health effects from Agent Orange residues in these planes is minimal. Even if crew exposure did occur, it is unlikely that sufficient amounts of dried Agent Orange residue could have entered the body to have caused harm*<sup>1</sup>. I was also put in contact with Captain Kendra Fletcher at Air Force Medical Support Agency Bioenvironmental Engineering. I offered this agency's expertise to the USAF in reviewing the available data, determining the likelihood of exposure, and (if possible) the health risks from the exposures that had occurred. Captain Fletcher stated that she would share this offer within the USAF and contact me should the USAF desire our assistance.

Following that initial conversation, ATSDR staff located a technical guidance from the United States Army Center for Health Promotion and Preventive Medicine - *Technical Guide 312 - Health Risk Assessment Methods and Screening Levels for Evaluating Office Worker Exposures to Contaminants on Indoor Surfaces Using Surface Wipe Data (June 2009)*.<sup>2</sup> In this document, the Army derives screening levels for long-term office workers using surface

<sup>1</sup> <http://www.publichealth.va.gov/exposures/agentorange/residue-c123-aircraft.asp>

<sup>2</sup> [http://phc.amedd.army.mil/topics/envirohealth/traum/Pages/EHRAP\\_TechGuide.aspx](http://phc.amedd.army.mil/topics/envirohealth/traum/Pages/EHRAP_TechGuide.aspx)

wipe samples analyzed for TCDD concentrations. Technical Guide 312 includes a screening value for TCDD of  $3.5E-05 \mu\text{g}/100\text{cm}^2$ , or  $0.035 \text{ ng}/100\text{cm}^2$ . This screening level incorporates incidental ingestion, dermal, and inhalation (both particulate and vapor) pathways. The screening level is set at a threshold of  $1E-06$  cancer risk, (equivalent to a one-in-a-million increase in the risk of cancer). ATSDR calculated an average value  $6.36 \text{ ng}/100\text{cm}^2$  for the three C-123 interior wipe samples collected on November 20, 1994.<sup>3</sup> This average value exceeds the Army screening level by 182 times and is equivalent to a 200-fold greater cancer risk than the screening value. I shared this information with Captain Fletcher.

There are many limitations to the information available to us. We know of only 3 wipe samples taken from a single aircraft in 1994. We do not know if these samples are representative of TCDD contamination in other contaminated C-123 aircraft in 1994 or earlier when contamination levels were likely higher. Additional air or wipe sampling or analyses of aircrew blood TCDD levels would have more accurately established past exposures. It is probably too late to analyze current blood TCDD levels because twenty to forty years have passed since these exposures occurred. I understand that the contaminated aircraft have been destroyed and further environmental sampling (air or wipe) is impossible. Finally, the office worker scenario used in Technical Guidance 312 likely underestimates the daily exposures of Air Force flight personnel inside confined contaminated aircraft, but this depends upon exposed skin surface area, duration of exposure, hand washing, and food intake.

In summary, I cannot exclude inhalation exposures to TCDD in these aircraft. The only available environmental samples indicate that the sampled aircraft was contaminated with TCDD at a level greatly exceeding current screening levels established by the Department of Defense. Given the available information, I believe that aircrew operating in this, and similar, environments were exposed to TCDD. The information available is insufficient to establish with accuracy the degree of exposure (low or high) or the risk of adverse health effects to this population. However, it is important to note that even precise environmental or biologic testing data are not predictive of adverse health effects in any individual.

I have provided a copy of this letter to Captain Fletcher. I hope this information is helpful.

Sincerely yours,



Thomas Sinks, Ph.D.  
Deputy Director, National Center for  
Environmental Health and  
Agency for Toxic Substances and  
Disease Registry

cc:  
CAPT Fletcher, R. Shackelford, D. Carillo

<sup>3</sup> See Consultative Letter from Capt Wade Weisman & Ronald Porter; Department of Air Force Armstrong Laboratory Memorandum FOR 645 MedGrp/508 Dated 19 Dec 94



Department of Health Policy and Management  
600 West 168th Street – 6th Floor  
New York, NY 10032

February 7, 2012

Wesley T. Carter (Major, retired)  
2349 NW Nut Tree Lane  
McMinnville, OR 97128

Dear Major Carter,

I am writing this letter in response to your request for assistance in establishing evidence of likely exposure to Agent Orange and other military herbicides during your years of service as a crew member on C-123 “Provider” aircraft. A large number of the Provider aircraft on which you flew had previously been used for herbicide missions in Operation Ranch Hand in Vietnam. They returned from Vietnam heavily contaminated with herbicide residues. Indeed, their contamination levels were so great that, as a final resolution to the contamination problem, it is my understanding that the aircraft were shredded

and manner of exposure is analogous to that experienced by many Vietnam veterans, with service in-country. Such in-country Veterans are eligible for Agent Orange-related compensation should they develop a disease that the VA deems to be related to such exposures. My further understanding is that you have developed one or more eligible conditions and thus, in my opinion, you should qualify for appropriate compensation, just as if you were an in-country Vietnam veteran.

I feel well qualified to render this opinion. I have extensive experience in evaluating exposure opportunity arising from military herbicide exposures. I served for nearly a decade as the Exposure Consultant to the Special Master for the Eastern District Court’s Agent Orange Veterans Payment Program. I was the Principal Investigator of the National Academy of Sciences contract for a \$5 million dollar study on developing a methodology for evaluating exposure to herbicides in Vietnam. The funding for this study was from the Veterans Administration. My methodology has been strongly endorsed by the Institute of Medicine in three separate major published reviews. I am currently the exposure

consultant on several federally funded health studies that involve evaluating herbicide exposures. I have recently been appointed by the Province of Ontario to a special panel to evaluate the historical use of 2,4,5-T in the province. My work on military herbicides and other occupational and environmental health issues has been widely published and cited in prestigious peer reviewed journals. My professional expertise has been recognized in the academic community, as well. I am Professor Emerita and Special Lecturer at Columbia University and since 2007 I have also held the position of Professor of Environmental and Occupational Health Sciences at the SUNY-Downstate Medical Center in Brooklyn N.Y.

In order to render this opinion, I have carefully examined several scientific studies of contamination of C-123 aircraft that had been deployed to Vietnam in Operation Ranch Hand, as well as technical guidance documents issued by the Department of Defense with regard to indoor and surface contaminants. I am also relying on my extensive research of existing records of herbicides used and their consequent exposures in Vietnam (see for example, 1).

In my opinion, it is highly likely that you and other crew members were exposed to the herbicides and to their highly toxic contaminant, 2,3,7,8-tetrachlorodibenzodioxin (dioxin, for short), although it is not possible to estimate the precise levels of exposure because of the failure of the Air Force to carry out proper assessments of contamination levels prior to assigning the contaminated aircraft to post-Vietnam military operations. I base my opinion on several sets of measurements that were eventually carried out by United States Air Force technical personnel (references 2 and 3). The 1979 Air Force air samples clearly establish that the herbicides were airborne and hence could be inhaled. The 1994 wipe samples of surface residues show that the levels of dioxin present greatly exceeded the maximum recommended levels of exposure set in the technical guidance provided by the U.S. Army Center For Health Promotion And Preventive Medicine regarding potential exposure to indoor contaminants (reference 4 ). The Agency for Toxic Substances and Disease Registry concurs in this opinion (reference 5).

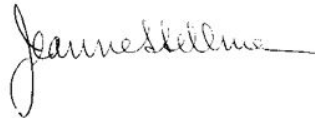
I have reviewed the Veterans Administration website (reference 6), which states: *“VA has concluded the potential for long-term adverse health effects from Agent Orange residues in these planes is minimal. Even IF crew exposure did occur, it is unlikely that sufficient amounts of dried Agent Orange residue could have entered the body to have caused harm.”* The VA further states *“But in the dry form – for example, adhered to a surface – Agent Orange residue cannot be inhaled or absorbed through the skin, and would be difficult to ingest.”* These statements, to be blunt, are technically flawed and show insufficient understanding of surface contamination and its potential toxic effects, as well as of the various routes of entry of toxic substances. The VA statements appear to have been made without knowledge of standard practice for assessment of

contaminated surfaces and uses terminology, like “dried Agent Orange residue,” that does not reflect insight into the nature of surface contamination. The VA also states “*Crew members had reported smelling strong odors but these odors may be attributed to various chemicals associated with aircraft. TCDD, the contaminant in Agent Orange, is odorless.*” In fact, the investigations carried out by the Air Force, following the crew complaints of odors, showed measureable quantities of the military herbicides in the air. (See reference 2.) There is no requirement that dioxin be the only exposure that qualifies for compensation. Indeed, nothing more than the 1979 measurements are needed in order to establish that crew that flew the C-123 Provider aircraft were likely to have been exposed to military herbicides.

The inconsistency in the VA’s policy with respect to military herbicide exposures is not defensible. No minimal levels of exposure to herbicides have been set for veterans who served in-country, Vietnam and exposures have NOT been limited to dioxin.

Please let me know if I can be of further assistance.

Sincerely,



Jeanne Mager Stellman, PhD  
Professor Emerita & Special Lecturer  
jms13@columbia.edu

#### References cited

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<sup>1</sup> Stellman, JM, Stellman, SD, Christian RC, Weber, TW and Tomasallo, C. The extent and patterns of usage of Agent Orange and other herbicides in Vietnam. *Nature*, 422, 681-687, 2003.

<sup>2</sup> Conway, William W. Aircraft Sampling Westover AFB MA. Technical Report 79-59. USAF Occupational & Environmental Health Laboratory. Brooks AFB TX. September 1979.

<sup>3</sup> Weisman, WH and Porter, RC. Consultative Letter AL/OE-CL-1994-0203, Review of Dioxin Sampling Results from C-123 Aircraft, Wright-Patterson AFB, OH and Recommendations for Protection of Aircraft Restoration Personnel. USAF, Armstrong Laboratory, Brooks AFB, TX. 19 December 1994.

<sup>4</sup> U.S. Army Center For Health Promotion and Preventive Medicine. *Technical Guide 312 Health Risk Assessment Methods and Screening Levels for Evaluating Office Worker Exposures to Contaminants on Indoor Surfaces Using Surface Wipe Data*. June 2009 ([http://phc.amedd.army.mil/topics/envirohealth/hrasm/Pages/EH\\_RAP\\_TechGuide.aspx](http://phc.amedd.army.mil/topics/envirohealth/hrasm/Pages/EH_RAP_TechGuide.aspx))

<sup>5</sup> Sinks, Thomas. Official Correspondence to Wesley T. Carter. Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta GA. January 25, 2012.

<sup>6</sup> <http://www.publichealth.va.gov/exposures/agentorange/residue-c123-aircraft.asp>



DEPARTMENT OF THE AIR FORCE  
ARMSTRONG LABORATORY (AFMC)  
2402 E. Drive  
BROOKS AFB, TEXAS 78235-5114

MEMORANDUM FOR 645 MedGrp/SGB

19 Dec 94

FROM: AL/OEMH

SUBJ: Consultative Letter AL/OE-CL-1994-0203, Review of Dioxin Sampling Results from C-123 Aircraft, Wright-Patterson AFB, OH and Recommendations for Protection of Aircraft Restoration Personnel.

1. 645 Med Group/SGB requested we review the dioxin swipe sampling results from a C-123 aircraft located in the museum annex at Wright Patterson AFB, OH. Restoration efforts are planned for the aircraft for eventual display at the museum. The complete restoration process could take 18 months to complete. Initial concern was raised by museum staff to 645 Med Group/SGB prior to restoration since the aircraft was reportedly used in defoliation efforts in Viet Nam and carried agent orange. Three swipe samples were collected from horizontal surfaces within the interior of the aircraft and one sample was collected on the underside of the port side wing. All four samples tested positive for dioxin congeners. The museum staff have secured the aircraft to prevent entry.
2. On 20 Nov 94, AL/OEMH personnel viewed the aircraft and were shown actual sample locations. At that time, museum staff reported that the tanks used for the actual spraying operation were also located on the installation along with the spraying booms. The museum also planned to restore the tank and booms and connect them back to the aircraft. The tank and control mechanism were found in a restoration staging area near the museum. Access to the tank is not limited. The tank is sealed with no indication about the contents. Swipe samples have yet to be collected from the tank.
3. The samples were analyzed by Pace Incorporated Environmental Laboratories for congeners of dioxin, the polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Because 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is the most toxic PCDD congener, the results from the swipe samples were used with the congener specific Toxicity Equivalence Factors (TEFs) to calculate the 2,3,7,8-TCDD toxicity equivalence (TEQ) for each swipe sample. The sample results, TEF, and TEQ for each sample are reported in Table 1. An independent review of the data by Dr John Stanley, Midwest Research Institute, verified the accuracy of the results and indicated that, based on the relative abundance of specific congeners, the source was likely from agent orange (Atch 3).
4. The state of New York (Department of Health) developed recommended re-entry exposure guidelines for PCDDs and PCDFs after the infamous Binghamton State Office Building fire

involving wide spread contamination of PCDDs and PCDFs through the ventilation system resultant from PCB transformer fires. The New York concentrations, expressed as nanograms per meter square of surface area, were developed using the EPA risk assessment paradigm based on results of toxicity studies completed by the National Toxicology Program (NTP). The method used by New York to develop their recommended concentrations and the values were validated by the Subcommittee on Dioxin, Committee on Toxicology (COT) in their 1988 report "Acceptable Levels of Dioxin Contamination in an Office Building Following a Transformer Fire". The value for re-entry is 25 ng/m<sup>2</sup> (for surface contamination), and was calculated based on exposure parameters of 2 pg/kg per day ingestion (surface ingestion and/or inhalation) by a 50 kg person working 250 days per year for 30 years. The accumulated lifetime ingestion would be 750 ng. In the COT report, it is recognized that the lifetime ingestion would not likely be reached with the requisite exposure parameters for office workers and, therefore, the 25 ng/m<sup>2</sup> level is considered conservative. The guideline was based on reproductive risks and carcinogenesis with cancer risks derived from the studies conducted and reported by Kociba et al. (1978) and the 1982 NTP bioassay data.

5. According to the COT report, humans can exhibit chloracne from short-term exposures to high concentrations of PCDDs. Other, less well established effects in humans include: altered heme synthesis, changes in liver function tests, peripheral neuropathy and changes in serum lipid concentrations. Cancer study results are inconsistent, with some showing an increase in soft tissue sarcoma and no increase in others. Additionally, studies of industrial workers who were exposed to higher concentration of PCDDs have not shown a consistent pattern of increased risk of cancer. None the less, the New York re-entry level of 25 ng/m<sup>2</sup> is correlated to a reported lifetime cancer risk estimate of  $9 \times 10^{-8}$  to  $2 \times 10^{-4}$ .

6. Interpretation of Sample Results: The results from the samples collected within the interior surfaces of the aircraft are likely to be representative of other locations of limited traffic near the agent orange spraying equipment. The swipes were collected from locations somewhat protective of routine crew movement and routine historical maintenance. Therefore, these samples are most likely not indicative of the surface contamination throughout the entire cargo area of the aircraft. Extensive sampling of the interior of the aircraft to fully characterize the extent of contamination would be prohibitively expensive. Based on the exposure parameters used by the state of New York, and using 18 months as the entire exposure period for aircraft restoration crew and a 70 kg man, exposed for 250 days per year for 1.5 years, the calculated daily intake concentration would be 29 pg/kg with a corresponding surface contamination level of almost 360 ng/m<sup>2</sup>. This would only be an acceptable level for a lifetime exposure if restoration personnel had no additional lifetime exposure. Additionally, the 25ng/m<sup>2</sup> exposure concentration was calculated based on an office worker's casual contact with contaminated surfaces. What this calculation does show is that the re-entry guideline of 25 ng/m<sup>2</sup> is based on very specific exposure parameters and measured concentrations, and a higher surface contamination could be acceptable.

7. Safety and Health Recommendations for Restoration Personnel: Due to the uncertainty in measured PCDD concentrations on the interior of the aircraft representing the average contaminant concentrations, the anticipated aggressive restoration techniques, the length of time restoration personnel will be involved in the project and the identified potential adverse human

health impacts, exposure to restoration personnel from contaminated dirt and paint should be maintained at the lowest possible exposure levels. This would include a combination of personal protective equipment, modified work practices, and containment of the contaminated dusts within the aircraft and appropriate decontamination. Because of the nature of contamination and the irregular nature of the contaminated surfaces, decontamination of the entire interior of the aircraft (either with or without additional sampling), is not recommended. Additional controls that should be implemented for the duration of the interior surface preparation of the aircraft are as follows:

a. Provide a containment for the aircraft to reduce the transport of dusts to the exterior. This would include thoroughly masking cracks and small holes, and sealing off other portions of the aircraft presumed to be free from contamination (i.e the cockpit). The containment should also include an area for decontamination of clothing and hands for the workers.

b. Restoration personnel actively involved with interior surface preparation should wear Tyvek coveralls and full-faced high efficiency particulate air filters (HEPA). In general, controls implemented during an asbestos removal project would be appropriate in this situation.

c. Air should be sampled for total dusts during surface preparation activities to document the levels of dust.

d. Collect at least one additional swipe sample in an area thought to be free from PCDD contamination (i.e the cockpit area).

e. Provide appropriate training as required for respirator use (and fit-testing if needed), decontamination of protective clothing and self after removal of protective clothing, and appropriate work practices to minimize dust. These work practices include:

1. Remove stored items from the interior bay of the aircraft and decontamination with either hexane soaked rags, or soap and water. The bags of material stored in the bay should be removed, and the plastic bags discarded. The aircraft canopy should be decontaminated with soap and (minimal) water. Any decontamination materials should be handled as dioxin contaminated wastes.

2. Minimal scraping of painted surfaces in preparation for painting. Mechanical sanding should be completely avoided, and hand sanding minimized. Surface areas covered with grease or oil should be decontaminated with hexane and cloths and treated as dioxin contaminated wastes.

3. Sealing of scraped surfaces with commercially available sealing mixture. Once the interior of the aircraft is painted, appropriate labeling should indicate that surfaces beneath the painted surfaces are dioxin contaminated.


f. Once the aircraft is restored, viewing by tourists should be limited to the exterior of the aircraft only. The interior of the aircraft should not be used to store any materials or spare parts.

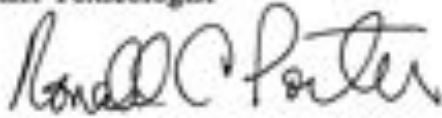


g. We recognize that our recommendations do not result in the complete decontamination of the aircraft. These recommendations are made to limit exposure to aircraft restoration personnel, limit the amount of dioxin contaminated wastes generated, and not require extensive, additional dioxin sampling. However, the interior of the aircraft must be conspicuously labeled so that personnel involved in any future restoration of the aircraft will be aware of the dioxin contamination under the painted surfaces.

8. Spray Solution Tank and Associated control equipment: Since the tank has not been sampled and the interior contents are unknown, the first step would be to collect surface swipe samples from the exterior of the tank and the distribution control equipment. The interior of the tank should be inspected, if there is no standing liquid, the tank should be assumed to be heavily contaminated and swipe sampling is not recommended. If there is free standing liquid in the tank, a sample should be collected for analysis, and if positive for PCDD, removal of the liquid would be necessary. Since the tank has been exposed to UV radiation from being stored outside, it is possible that any contamination on the exterior that was exposed to sunlight may have been adequately degraded. Therefore swipe samples should be collected from less accessible locations. The stainless steel webbing covering the flexible pipe and permeable surfaces could be assumed to be heavily contaminated. A representative swipe sample should be collected from these surfaces. These recommendations for the tank are based on the assumption that the tank will be included in the restored aircraft or will be turned into DRMO for excess. For either of these scenarios, it will be necessary to measure the extent of surface contamination.

9. Conclusions: The interior of the C-123 aircraft under discussion is heavily contaminated with PCDDs. The aircraft is scheduled for repair by museum personnel with eventual plans to put it on display. During restoration, museum personnel could be exposed to dioxin contaminated dusts. The cost of congener specific dioxin analysis and the slight increase in characterization of contamination in the aircraft, limits the additional samples that should be collected. Swipe samples should be collected from the exterior of the tank and spraying equipment. All work practices should be conducted to limit the generation of dust, following the recommendations discussed in this report.

  
WADE H. WEISMAN, Capt, USAF, BSC  
Staff Toxicologist

  
RONALD C. PORTER, GS-11  
Staff Toxicologist

#### Attachments

1. References
2. Table 1 - Sample Results
3. Letter, Midwest Research Institute

## References

1. Kim, Nancy K., and Hawley, John, 1985. Re-Entry Guidelines, Binghamton State Office Building. Bureau of Toxic Substances Assessment. Division of Environmental Health Assessment, New York State Department of Health, 22 pp.
2. Doull, John, et al. 1988. Acceptable Levels of Dioxin Contamination in an Office Building Following a Transformer Fire. National Academy Press, Washington, D.C. 24 pp.
3. Kominsky, J.R., 1988. Health Hazard Evaluation Report No. HETA-86-092-1870, 50 Staniford Street Office Building, Boston, Massachusetts. 55pp.
4. Kociba, R.J., et al. 1978. Results of Two-year Chronic Toxicity and Oncogenicity Study of 2,3,7,8-tetrachlorodibenzo-p-dioxin in Rats. Toxicology and Applied Pharmacology, 46:279-303.

Table 1

Dioxin Sampling Results C-123 Aircraft  
Wright Patterson, AFB, Converted to 2,3,7,8-TCDD Equivalents  
Reported in Nanograms per sample

Congener	TEF	IK1355-1 Reported	IK1355-1 Equivalent	IK1355-2 Reported	IK1355-2 Equivalent	IK1355-3 Reported	IK1355-3 Equivalent	IK1355-4 Reported	IK1355-4 Equivalent	IK1355-5 Reported	IK1355-5 Equivalent
2378 TCDD	1	14.22098	14.22098	2.06846	2.06846	2.40728	2.40728	0.04015	0.04015	0.00255	0.00255
12378 PeCDD	0.5	0.32149	0.16075	0.12507	0.06254	0.12687	0.06344	nd	nd	0.001	0.0005
123478 HxCDD	0.1	0.16579	0.01658	0.0482	0.00482	0.04856	0.00486	0.00072	0.00072	nd	nd
123678 HxCDD	0.1	0.13799	0.01380	0.04	0.00400	0.03734	0.00373	nd	nd	nd	nd
123789 HxCDD	0.1	0.09205	0.00921	0.02299	0.00230	0.0167	0.00167	nd	nd	nd	nd
1234678 HpCDD	0.01	0.58138	0.00581	0.12867	0.00129	0.08619	0.00086	nd	nd	nd	nd
OCDD	0.001	1.5384	0.00154	0.60159	0.00060	0.31904	0.00032	0.03717	3.72E-05	0.00697	6.97E-06
2378 TCDF	0.1	0.09596	0.00960	0.02567	0.00257	0.02618	0.00262	nd	nd	0.00061	0.000061
12378 PeCDF	0.05	0.01578	0.00079	nd	nd	0.0045	0.00023	nd	nd	nd	nd
23478 PeCDF	0.5	0.01995	0.00998	0.00542	0.00271	0.00582	0.00341	nd	nd	nd	nd
123478 HxCDF	0.1	0.04878	0.00488	0.01603	0.00160	0.01472	0.00147	0.0034	0.00034	nd	nd
123678 HxCDF	0.1	nd	nd	0.00513	0.00051	0.0049	0.00049	0.0024	0.00024	0.00021	0.000021
123789 HxCDF	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
234678 HxCDF	0.1	0.02658	0.00266	0.00512	0.00051	0.00615	0.00062	0.00261	0.000261	nd	nd
1234678 HpCDF	0.01	0.11585	0.00116	0.0448	0.00045	0.03968	0.00040	0.00928	9.28E-05	nd	nd
1234789 HpCDF	0.01	0.01388	0.00014	nd	nd	0.00366	0.00004	nd	nd	nd	nd
OCDF	0.001	0.14735	0.00015	0.04777	0.00005	0.04129	0.00004	nd	nd	nd	nd
<b>Total TEQ</b>			<b>14.458</b>		<b>2.152</b>		<b>2.491</b>		<b>0.641</b>		<b>0.003</b>
Sample Area			100cm <sup>2</sup>		100cm <sup>2</sup>		100cm <sup>2</sup>		100cm <sup>2</sup>		100cm <sup>2</sup>
Mass/Area			1400ng/m <sup>2</sup>		200ng/m <sup>2</sup>		250ng/m <sup>2</sup>		4.1ng/m <sup>2</sup>		0.3ng/m <sup>2</sup>

FROM: **MRI**

Midwest Research Institute  
425 Volker Boulevard  
Kansas City, MO 64110 USA

Pages, including cover page:

TO: Ron Porter, PhD  
Armstrong Laboratory  
Brooks AFB, TX

Date: November 19, 1994

FAX NUMBER: 210-536-2315

VOICE NUMBER: 210-536-6127

FROM: John Stanley

FAX NUMBER: (816) 753-5359

VOICE NUMBER: (816) 753-7600 ext 1160

REFERENCE: Review of Data for Dioxins

Ron

I have reviewed the data summaries that you provided to meet on Friday, November 18, 1994. The data were generated via method 8290 (a high resolution MS approach) using a VG Autospec (an instrument of high quality and good sensitivity). Samples analyzed were swipes (or wipes) and data appears to be reported in units of picograms/wipe or pg/WP.

Based on the data presented and the information on the method and instrumentation, my impression is that you have a reliable data set from which to work. Some observations regarding the data indicate that the primary source for some samples (such as IK1355-1) is likely from an agent orange type background. This is based on the fact of the prominence of the 2,3,7,8-TCDD in relation to total TCDD and the relative contribution from the other PCDD and PCDF congeners and homologs. The other response for PCDDs and PCDFs are likely from a different but contributing source. It is difficult to say much more from the data presented. The fingerprints from the detailed HRMS data packages would provide much more input regarding the potential sources of the other compounds.

The levels reported for samples IK1355-2 through 4 should be easily seen, particularly for 2,3,7,8-TCDD. The levels reported for the method blank (MB-IK1355) and sample IK1355-5 are likely approaching detection levels. I am presuming that sample IK1355-5 is a field blank as the levels are very close to the laboratory method blank (prepared from filter paper). It is not possible to say much about the MB level or number 5. However, I am assuming that the tetra and penta levels are reflective more of background in the filter matrix rather than glassware carryover cited in the narrative.

Hope this information is useful to you. If there are questions, please call.

**Report OEHL 79-59**  
**USAF OEHL TECHNICAL REPORT**



**AIRCRAFT SAMPLING**  
**WESTOVER AFB MA**

**SEPTEMBER 1979**

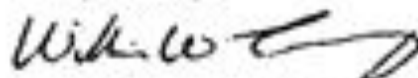
**USAF Occupational and Environmental Health Laboratory**  
**Aerospace Medical Division (AFSC)**  
**Brooks Air Force Base, Texas 78235**

AIRCRAFT SAMPLING

WESTOVER AFB MA

SEPTEMBER 1979

Prepared by:

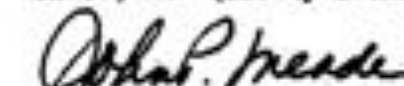


WILLIAM W. CONWAY, SSgt, USAF  
Air Quality Technician

Reviewed by:

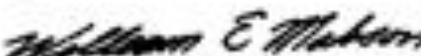


JOHN J. GOKELMAN, LtCol, USAF, BSC  
Chief, Air Quality Branch



JOHN P. MEADE, Colonel, USAF, BSC  
Chief, Consultant Services Division

Approved by:



WILLIAM E. MABSON, Colonel, USAF, BSC  
Commander

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## ABSTRACT

This report presents the results of sampling conducted inside a C-123-K aircraft to determine possible health hazards from Herbicide Orange and Malathion contamination. Sample results show contamination levels to be below amounts considered to be possible health hazards.

## Survey Team Personnel

Captain William E. Norrington

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## SECTION I

### Introduction and Purpose

At the request of the 439th TAC Hospital/SGPM, air samples were taken inside C-123-K aircraft, S/N 564362 ("Patches"), on 9 March 1979. The purpose was to determine the source of chemical odor experienced by the crew while flying the aircraft.

## SECTION II

### Aircraft Historical Information

Information concerning the aircraft's usage prior to 1967 is based primarily on hearsay. The aircraft maintenance log has a gap from November 1965 to January 1967 during which time the aircraft logged in excess of 1100 hours. During this period, the aircraft may have sprayed Herbicide Orange while attached to the 12th Special Operations Squadron (SOS). Beginning in March 1967, the aircraft sprayed the insecticide Malathion in Southeast Asia. In November 1972, the aircraft was transferred to the 901st Tactical Air Group (TAG), L.G. Hanscomb Field MA, and moved with the unit to its present location at Westover AFB MA.

In April 1975, while at Hayes International, Dothan AL, for a depot level wing modification, a "black, viscous, odorous residue" was found in the wing. A sample was sent to the USAF Environmental Health Laboratory (EHL-K), Kelly AFB TX, for analysis. The sample contained a high concentration of the insecticide Malathion but no Herbicide Orange (H.O.).

## SECTION III

### Sampling Methods and Procedures

Based on the findings of the residue analysis, as well as the suspected Herbicide Orange spraying, the air inside the aircraft was sampled for both Herbicide Orange and Malathion. Air samples were taken at three (3) positions inside the aircraft, using MSA Model "S" personnel samplers and chromosorb (C-102) tubes. These samples were drawn over a five-hour period at a rate of 740 cc/min. Flow and temperature readings were taken every 15 minutes and barometric pressure readings every hour. The readings were used to determine sample volume at Standard Temperature and Pressure (25°C and 29.92 inches of Hg).

Personnel of the 901st Consolidated Aircraft Maintenance Squadron (CAMS), Westover AFB, also furnished two samples of a brown material which was removed from two cargo tiedown rings (D-10). The locations are shown on Figure 1.

## SECTION IV

### Conclusions and Recommendations

Table 1 shows the results of the airborne sampling. Levels of Herbicide Orange range from 0.243 mg/m<sup>3</sup> to 0.428 mg/m<sup>3</sup> (combined 2,4-D/2,4,5-T). The TLV for both compounds is 10 mg/m<sup>3</sup>. Levels of Malathion were somewhat higher, ranging from 1.7 mg/m<sup>3</sup> to 3.0 mg/m<sup>3</sup>. The TLV for Malathion is 10 mg/m<sup>3</sup>. The levels indicate no health hazard from either Herbicide Orange or Malathion.

One of the residue samples contained small amounts of 2,4-D/2,4,5-T and Malathion. The analyzed amount of 2,4-D was <60 µg/Kg, and 2,4,5-T was <60 µg/Kg. The analyzed amount of Malathion was =145 mg/Kg of the sample. Only one sample was analyzed because one was lost in handling (data are shown in Table 2).

If the problems persist, additional sampling should be conducted under actual inflight conditions to determine what effect changes in altitude and temperature have upon the levels of contaminant concentrations and to better define the source. It may ultimately be necessary to completely deodorize the aircraft. This would require depot level maintenance to remove the contaminant from the aircraft wing box and involve removal of the aircraft skin to gain access to the contaminated area.

Table 1

Analysis of Interior Air Samples  
 C-123 Aircraft No 564362  
 9 March 1979

Sample ID	Time	Total Time in min	Total Volume m <sup>3</sup>	Ave Temp OF	Ave Press In Hg	STP Volume m <sup>3</sup>	2,4-D mg/m <sup>3</sup>	2,4,5-T mg/m <sup>3</sup>	Malathion mg/m <sup>3</sup>
09-1	0940	300	0.222	61.0	29.81	0.224	0.108	0.135	1.701
09-2	0955	300	0.209	61.6	29.81	0.211	N.D	N.D	N.D
09-3	0940	300	0.222	61.0	29.81	0.224	0.234	0.194	3.051
09-4 (Blank)	--	--	--	61.0	29.81	--	N.D	N.D	N.D

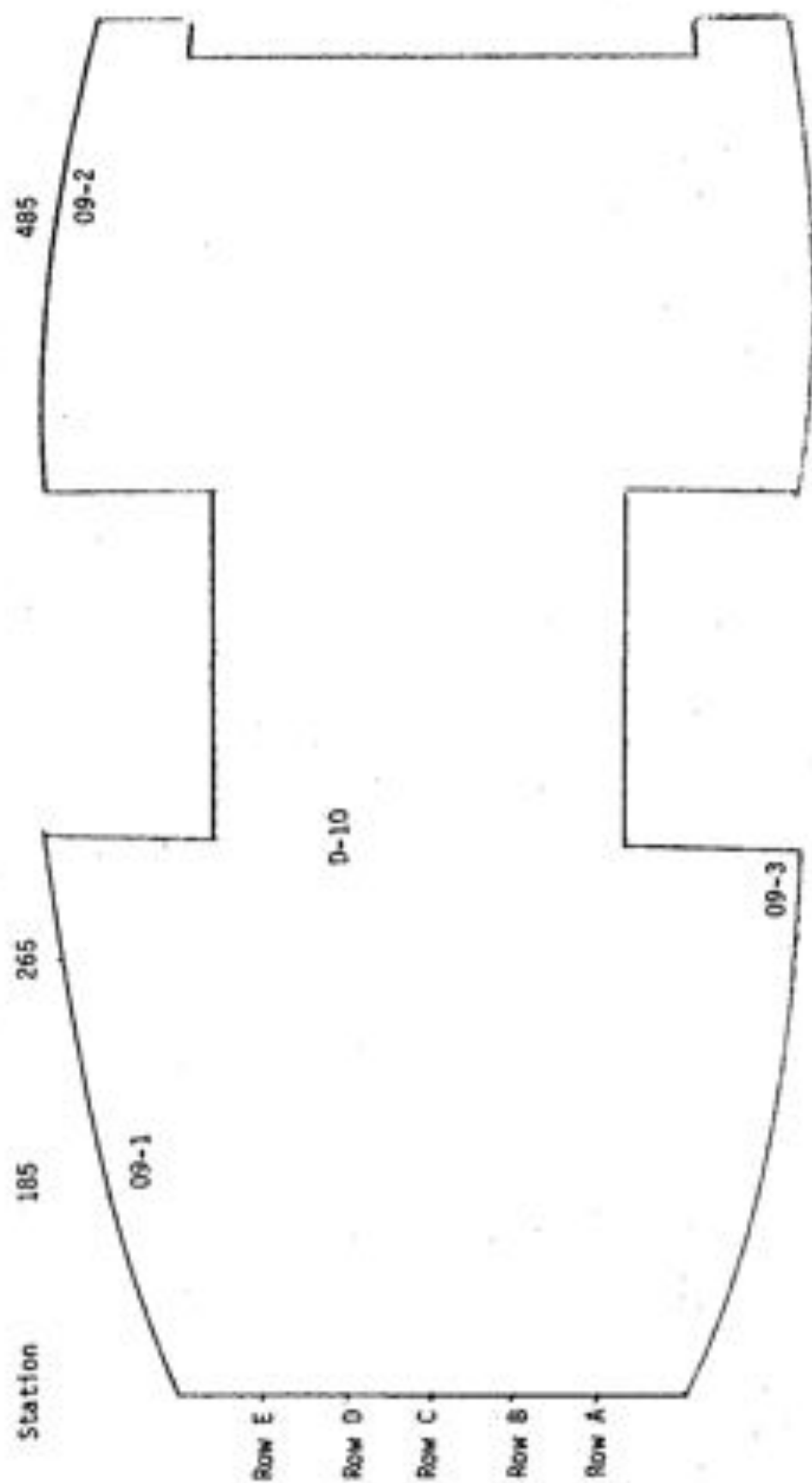
Table 2

Analysis of Scraping Samples  
C-123 Aircraft No 564362  
9 March 1979

Sample ID	2,4-D Butyl Ester $\mu\text{g}/\text{Kg}^*$	2,4-D Isooctyl Ester $\mu\text{g}/\text{Kg}$	2,4,5-T Butyl Ester $\mu\text{g}/\text{Kg}$	2,4,5-T Isooctyl Ester $\mu\text{g}/\text{Kg}^*$	Malathion $\mu\text{g}/\text{Kg}$
D-10	<60	-92	-149	<60	~145

\*Detection Limit 60  $\mu\text{g}/\text{Kg}$ .

FIGURE 1  
SAMPLING LOCATIONS



NOTE: All samples were taken 3 ft above floor level.



**AGENT  
ORANGE**



**AGENT ORANGE**