

I Corps: 2,355,322					II Corps: 1,054,406				
	Orange	White	Blue	Total		Orange	White	Blue	Total
A Shau	53,550	2,550	6,128	62,228	An Khe, Camp Radcliff	37,810	6,400	5,610	49,820
An Hoa	6,500	1,800	11,250	19,550	An Lao, LZ Laramie	68,970	490	10,570	80,030
Binh Hoa	8,220		1,600	9,820	Ban Me Thuot	16,000	9,250		25,250
Cam Lo	80,375	8,660	12,785	101,820	Ben Het	80,495	7,230	3,000	90,725
Camp Carrol	78,200	5,400	5,050	88,650	Bon Song, LZ Two Bits	80,643	630	6,000	87,273
Camp Eagle	14,250			14,250	Bre Nhi	6,600			6,600
Camp Esso	53,410	5,600	5,500	64,510	Cam Ranh Bay	21,227	1,373		22,600
Camp Evans	18,690		880	19,570	Camp Granite	59,310	2,075	5,390	66,775
Camp Henderson	68,155	7,040	4,800	79,995	Che Oreo		1,800		1,800
Chu Lai	12,170	4,150	1,598	17,918	Da Lat	575			575
Con Thien	84,700	12,460	10,925	108,085	Dak To	49,460	600	34,800	84,860
Da Nang, China Beach	13,800		2,000	15,800	Firebase Pony	43,490		3,800	47,290
Dong Ha	54,385	5,060	9,935	69,380	Kontum		415		415
Duc Pho, LZ Bronco	46,225	14,400	1,175	61,800	LZ Dog, LZ English	63,073	630	6,000	69,703
Firebase Jack	140,875	11,900	3,280	156,055	LZ Oasis				No Data
Firebase Rakkassan	150,145	23,900	2,510	176,555	LZ Putter, Firebase Bird	50,095		7,200	57,295
Firebase West	15,405	3,690	18,480	37,575	LZ Uplift	43,455	3,220	275	46,950
Hill 63	20,500	3,200		23,700	Nha Trang	6,950	325		7,275
Hill 69	11,620	4,150	1,598	17,368	Pham Rang	110	2,075		2,185
Hoi An	17,520	3,000	13,950	34,470	Phan Thiet	5,000	330	220	5,550
Hue	41,395		5,070	46,465	Plei Ho, SF Camp	15,300	1,260	110	16,670
Khe Sanh, Firebase Smith	43,705	3,040	4,300	51,045	Plei Jerang	98,220	51,235	1,800	151,255
LangCo Bridge	50,610	5,600	3,500	59,710	Pleiku	1,210	11,640	1,950	14,800
LZ Baldy	15,430	3,000	13,950	32,380	Puh Cat, LZ Hammond	29,700	7,210		36,910
LZ Dogpatch, Hill 327	4,490		8,250	12,740	Qui Nhon	53,215	1,800	4,125	59,140
LZ Geronimo	22,535	14,000	468	37,003	Song Cau	5,650	55		5,705
LZ Jane, Firebase Barbara	91,150	6,750	3,700	101,600	Tuy An	13,215	3,740		16,955
LZ Langley, Firebase Shepard	72,105	7,040	4,800	83,945	Tuy Hoa	29,565	4,485		34,050
LZ Profess, Hill 55	39,300	13,000	17,209	69,509					
LZ Rockcrusher, Hill 85	47,800			47,800					
LZ Rockpile	110,050	15,440	7,650	133,140					
LZ Ross	15,405	6,720	18,508	40,633					
LZ Sandra	118,780	20,210	24,755	163,745					
LZ Snapper, Firebase Leather	11,350		3,000	14,350					
Marble, Hill 59	15,405	6,720	18,508	40,633					
Phu Bai	54,300	3,000	120	57,420					
Phu Loc, LZ Tommahawk	78,250	4,000		82,250					
Quang Nai	25,605		1,800	27,405					
Quang Tri, LZ Nancy	68,000	2,750	3,700	74,450					
III Corps: 4,086,229					IV Corps: 669,534				
An Loc	77,000	79,830		156,830	Ben Luc	45,900	14,838		60,738
Ben Cat	87,250	83,640	20,105	190,995	Ben Tre	24,800	24,750		49,550
Bien Hoa	35,045	124,525	3,950	163,520	Can Tho	15,160	13,915	11,685	40,760
Cholon	320			320	Cao Lanh	1,875	2,935	830	5,640
Cu Chi	59,150	67,540	14,105	140,795	Dong Tam	5,870	605	165	6,640
Dau Tieng (Michelin)	32,370	45,800	3,600	81,770	Firebase Grand Can(yon?)		1,540		1,540
Dien Duc, Firebase Elaine	66,850	25,500		92,350	Firebase Moore	9,820			9,820
Duc Hoa	750			750	Ham Long	3,275	1,620		4,895
Firebase Di An	6,000		1,595	7,595	Moc Hoa	12,400	6,590		18,990
Firebase Frenzel	13,445	57,560	900	71,905	My Tho	13,320	7,316	965	21,601
Firebase Jewel, LZ Snuffy	219,550	146,010	7,300	372,860	Nam Can	150,345	64,295		214,640
Firebase Mace	34,280	23,350	730	58,360	Phnom		184		184
Katum	299,420	239,395	20,000	558,815	Phu Quoc	19,000			19,000
Lai Khe	57,120	22,300	1,800	81,220	Rach Gia		2,155		2,155
Loc Ninh	46,660	103,710	1,800	152,170	Seafloat	4,700			4,700
Long Binh, Firebase Concord	13,445	57,560		71,005	Soc Trang	3,410	2,391	1,280	7,081
LZ Bearcat	17,840	75,470		93,310	Tan An	89,550	36,450		126,000
LZ Fish Nook	44,000	23,800		67,800	Tieu Con	8,700			8,700
LZ Schofield	38,640	17,210	7,800	63,650	Tra Vinh	9,885	8,000		17,885
Nha Be (Navy Base)	119,725	121,925	6,000	247,650	Vinh Loi	30,010			30,010
Nui Ba Den, Firebase Caroline	50,020	66,500	2,100	118,620	Vinh Long	8,360	9,755	890	19,005
Phouc Vinh	484,383	146,576	12,810	643,769					
Phu Cuong	39,845	62,230	12,055	114,130					
Phu Loi	79,000	83,430		162,430					
Qua Viet	50,610	5,600	3,500	59,710					
Quan Loi	44,190	34,300		78,490					
Saigon				No Data					
Song Be	1,900	9,220		11,120					
Tan Son Nhut	6,320		1,595	7,915					
Tay Ninh	720	3,225	600	4,545					
Trang Bang	32,365	39,560	6,000	77,925					
Vo Dat, Firebase Nancy	14,180	29,100		43,280					
Vung Tau	7,350			7,350					
Xuan Loc	23,865	58,750	660	83,275					

Note: This does NOT include the US Army helicopter or ground applications, or any form of the insecticide programs by GVN or the US military. The amount represents gallons within eight (8) kilometers of the area. Thus, each area is 9.6 miles in diameter.

Description:	TCDD (Dioxin) Amounts:
Agent Orange	1.77 to 40 ppm
Agent Blue (Purple)	32.8 to 45 ppm
Agent Red (Pink)	65.6 ppm
Agent White (Green)	65.6 ppm
Silvex	1 to 70 ppm
2,4,5-T (Current)	0.1 ppm or less

USAF Ranch Hand Herb Tapes Herbicide Amounts from August 1965

[Download Herb Tape Information in Microsoft Excel \(XLS\) File](#)

[Download Chemical List in Microsoft Word Format](#)

Grand Total: 8,165,491 gallons

South Vietnam Quadrants:

[I Corp](#)

[II Corp](#)

[III Corp](#)

[IV Corp](#)

[Agent \(Herbicide\) Chart](#)

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I Corps - 2,355,322

Location	Orange	White	Blue	Total Gallons
A Shau	53,550	2,550	6,128	62,228
An Hoa	6,500	1,800	11,250	19,550
Binh Hoa	8,220	0	1,600	9,820
Cam Lo	80,375	8,660	12,785	101,820
Camp Carrol	78,200	5,400	5,050	88,650
Camp Eagle	14,250	0	0	14,250
Camp Esso	53,410	5,600	0	64,510
Camp Evans	18,690	0	880	19,570
Camp Henderson	68,155	7,040	4,800	79,995
Chu Lai	12,170	4,150	1,598	17,918
Con Thien	84,700	12,460	10,925	108,085
Da Nang, China Beach	13,800	0	2,000	15,800
Dong Ha	54,385	5,060	9,935	69,380
Duc Pho, LZ Bronco	46,225	14,400	1,175	61,800
Firebase Jack	140,875	11,900	3,280	156,055
Firebase Rakkassan	150,145	23,900	2,510	176,555
Firebase West	15,405	3,690	18,480	37,575

Hill 63	20,500	3,200	0	23,700
Hill 69	11,620	4,150	1,598	17,368
Hoi An	17,520	3,000	13,950	34,470
Hue	41,395	0	5,070	46,465
Khe Sanh, Firebase Smith	43,705	3,040	4,300	51,045
LangCo Bridge	50,610	5,600	3,500	59,710
LZ Baldy	15,430	3,000	13,950	32,380
LZ Dogpatch, Hill 327	4,490	0	8,250	12,740
LZ Geronimo	22,535	14,000	468	37,003
LZ Jane, Firebase Barbara	91,150	6,750	3,700	101,600
LZ Langley, Firebase Shepard	72,105	7,040	4,800	83,945
LZ Profess, Hill 55	39,300	13,000	17,209	69,509
LZ Rockcrusher, Hill 85	47,800	0	0	47,800
LZ Rockpile	110,050	15,440	7,650	133,140
LZ Ross	15,405	6,720	18,508	40,633
LZ Sandra	118,780	20,210	24,755	163,745
LZ Snapper, Firebase Leather	11,350	0	3,000	14,350
Marble, Hill 59	15,405	6,720	18,508	40,633
Phu Bai	54,300	3,000	120	57,420
Phu Luc, LZ Tommahawk	78,250	4,000	0	82,250
Quang Nai	25,605	0	1,800	27,405
Quang Tri, LZ Nancy	68,000	2,750	3,700	74,450
				2,355,322

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II Corps - 1,054,406

Location	Orange	White	Blue	Total Gallons
An Khe, Camp Radcliff	37,810	6,400	5,610	49,820
An Lao, LZ Laramie	68,970	490	10,570	80,030
Ban Me Thuot	16,000	9,250	0	25,250
Ben Het	80,495	7,230	3,000	90,725
Bon Song, LZ Two Bits	80,643	630	6,000	87,273
Bre Nhi	6,600	0	0	6,600
Cam Ranh Bay	21,227	1,373	0	22,600
Camp Granite	59,310	2,075	5,390	66,775
Che Oreo	0	1,800	0	1,800
Da Lat	575	0	0	575

Dak To	49,460	600	34,800	84,860
Firebase Pony	43,490	0	3,800	47,290
Kontum	0	415	0	415
LZ Dog, LZ English	63,073	630	6,000	69,703
LZ Oasis	No Data			
LZ Putter, Firebase Bird	50,095	0	7,200	57,295
LZ Uplift	43,455	3,220	275	46,950
Nha Trang	6,950	325	0	7,275
Phan Rang	110	2,075	0	2,185
Phan Thiet	5,000	330	220	5,550
Plei Ho, SF Camp	15,300	1,260	110	16,670
Plei Jerang	98,220	51,235	1,800	151,255
Pleiku	1,210	11,640	1,950	14,800
Puh Cat, LZ Hammond	29,700	7,210	0	36,910
Qui Nhon	53,215	1,800	4,125	59,140
Song Cau	5,650	55	0	5,705
Tuy An	13,215	3,740	0	16,955
Tuy Hoa	29,565	4,485	0	34,050
				1,054,406

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III Corps - 4,086,229

Location	Orange	White	Blue	Total Gallons
An Loc	77,000	79,830	0	156,830
Ben Cat	87,250	83,640	20,105	190,995
Ben Hoa	35,045	124,525	3,950	163,520
Cholon	320	0	0	320
Cu Chi	59,150	67,540	14,105	140,795
Dau Tieng (Michelin)	32,370	45,800	3,800	81,770
Dien Duc, Firebase Elaine	66,850	25,800	0	92,350
Duc Hoa	750	0	0	750
Firebase Di An	6,000	0	1,595	7,595
Firebase Frenzel	13,445	57,560	900	71,905
Firebase Jewel, LZ Snuffy	219,550	146,010	7,300	372,860
Firebase Mace	34,280	23,350	730	58,360
Katum	299,420	239,395	20,000	558,815
Lai Khe	57,120	22,300	1,800	81,220

Loc Ninh	46,660	103,710	1,800	152,170
Long Binh, Firebase Concord	13,445	57,560	0	71,005
LZ Bearcat	17,840	75,470	0	93,310
LZ Fish Nook	44,000	23,800	0	67,800
LZ Schofield	38,640	17,210	7,800	63,650
Nha Be (Navy Base)	119,725	121,925	6,000	247,650
Nui Ba Den, Firebase Carolin	50,020	66,500	2,100	118,620
Phouc Vinh	484,383	146,576	12,810	643,769
Phu Chong	39,848	62,230	12,055	114,130
Phu Loi	79,000	83,430	0	162,430
Qua Viet	50,610	5,600	3,500	59,710
Quan Loi	44,190	34,300	0	78,490
Saigon	No Data			
Song Be	1,900	9,220	0	11,120
Tan Son Nhut	6,320	0	1,595	7,915
Tay Ninh	720	3,225	600	4,545
Trang Bang	32,365	39,560	6,000	77,925
Vo Dat, Firebase Nancy	14,180	29,100	0	43,280
Vung Tau	7,350	0	0	7,350
Xuan Loc	23,865	58,750	660	83,275
				4,086,229

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IV Corps - 669,534

Location	Orange	White	Blue	Total Gallons
Ben Luc	45,900	14,838	0	60,738
Ben Tre	24,800	24,750	0	49,550
Can Tho	15,160	13,915	11,685	40,760
Cao Lanh	1,875	2,935	830	5,640
Dong Tam	5,870	605	165	6,640
Firebase Grand Can(yon?)	0	1,540	0	1,540
Firebase Moore	9,820	0	0	9,820
Ham Long	3,275	1,620	0	4,895
Moc Hoa	12,400	6,590	0	18,990
My Tho	13,320	7,316	965	21,601
Nam Can	150,345	64,295	0	214,640
Phnom	0	184	0	184

Phu Quoc	19,000	0	0	19,000
Rach Gia	0	2,155	0	2,155
Seafloat	4,700	0	0	4,700
Soc Trang	3,410	2,391	1,280	7,081
Tan An	89,550	36,450	0	126,000
Tieu Con	8,700	0	0	8,700
Tra Vinh	9,885	8,000	0	17,885
Vinh Loi	30,010	0	0	30,010
Vinh Long	8,360	9,755	890	19,005
				669,534

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Description	TCDD (Dioxin) Amounts
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Agent Blue (Purple)	32.8 to 45 ppm
Agent Red (Pink)	65.6 ppm
Agent White (Green)	65.6 ppm
Silvex	1 to 70 ppm
2,4,5-T (Current)	0.1 ppm or less

Gary D. Moore, (The Last) Chairman
Michigan Agent Orange Commission
5161 Howard Road
Smiths Creek, Michigan 48074-2023 USA

WebMaster: [Gary](#)

Update: April 17, 2003 -- Site established February 2002

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[\[Veteran email Address Listing\]](#)

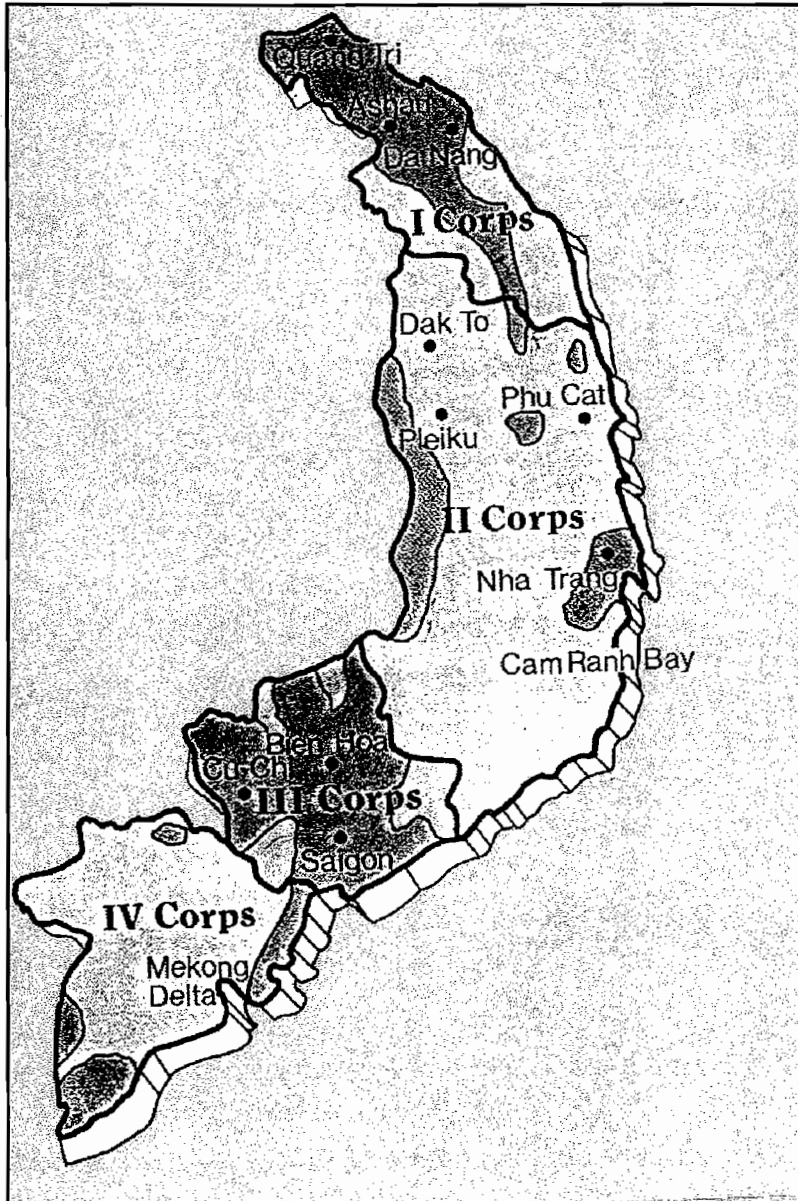
[\[Veteran Information\]](#)

[\[VA App\]](#) [\[VA Chapter Site List\]](#) [\[Veteran's Administration Web Site\]](#)

[\[VA 'Hepatitis-C' Web Site\]](#)

[\[Motorcycle Events List\]](#)

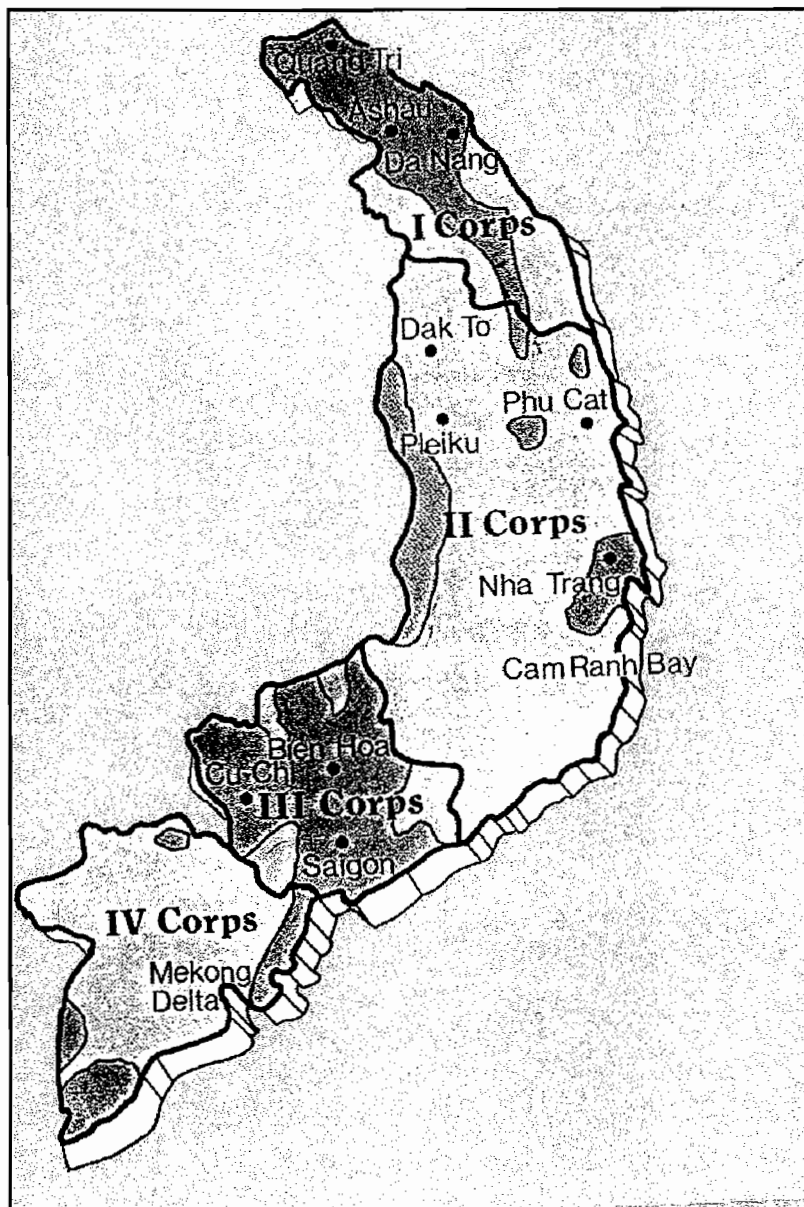
Herbicide Spray Map



This map is a representation of herbicide spray missions in Vietnam. The dark areas represent concentrated spraying areas. This map only represents fixed-wing aircraft spraying, and does not include helicopter spraying of perimeters, or other spray methods. The III Corps area received the heaviest concentrations of spraying, followed by I Corps, II Corps and IV Corps.

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Herbicide Spray Map



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Life in the Times Bases Known To Be Contaminated (ca. 1992)

The following 59 U.S. military bases were suffering from significant water or soil contamination a year ago, according to the Department of Defense's interpretation of its latest hazardous waste survey. DoD officials say not every base suffering such contamination is on the list, because information was not available for all bases. The list is based on the latest status report for DoD's Installation Restoration Program.

The IRP report contains no explanation of the problems at each base, so we asked each service to provide details. The Army did so. The Navy Chief of Information refused to help us gather the information. Air Force Public Affairs could not provide the information by our deadline, but we will publish it as soon as it becomes available. We gathered information on some of these missing bases from EPA and a DoD report to Congress on "Superfund" sites. LIFE IN THE TIMES cannot vouch for the accuracy or completeness of the information that was provided.

Army

Aberdeen Proving Ground, MD

Essentially every land portion of the Edgewood, MD, area (on which a portion of the base is located) is contaminated or potentially contaminated. Monitoring in 1977-78 indicated contamination of surface and ground water. Four standby wells were shut down in 1983 due to detected organic compounds. The base's active drinking water supplies come from two off-post sources. Deer Creek and Winters Run, unaffected by contamination on base.

Fort A.P. Hill, VA

There are three problems. A herbicide contaminated the soil near an old pesticide storage building. The soil has been placed in sealed drums. Second, herbicide and dioxin contaminated soil and debris are stored at a base warehouse in 33-gallon drums inside sealed 55-gallon drums. A study will be done to recommend an environmentally sound method of permanent disposal. Third, the base plans to remove some 70 tons of soil contaminated by DDT. The base water comes from a deep aquifer and is not contaminated, the Army says.

Fort Belvoir, VA

Several contaminants - benzene, trichloroethylene, chloroform, toluene, ethylbenzene, and 1-2-dichloroethane - have seeped from the Building 324 tank farm into an unnamed creek. None of these contaminants was detected in surface water at the installation boundary, and no health hazard is apparent, the Army, says. Post drinking water comes from the Fairfax County Water Authority.

Fort Devens, MA

A sanitary landfill that is a potential source of contamination is being closed. It was used as an open burning site, then for incineration of waste and burial of residues. Water quality meets state standards.

Fort Dix, NJ

Nine potentially contaminated sites are known. One, the sanitary landfill, was placed on the National Priority (Superfund) List due to the presence of organic solvents. However, the Army says no significant health hazards have been identified. To avoid any risk, the landfill may be capped with clean soil and vegetated with grass. The other eight sites were identified only recently. Organic solvents and/or petroleum products were located at an old magazine area, a tank farm, a fire station, the golf course, a motor pool, a firing range, a pesticide storage building, and a National Guard facility. Investigation is under way to determine any problems. The sites to not endanger the base water supply according to the Army.

Fort Lewis, WA

There are two problems. One, is Landfill No. 5. Plans call for a landfill liner and leachate collection to preclude ground water contamination. There are also plans for a refuse-fired incinerator to reduce reliance in the landfill. Also trichloroethylene (TCE) has been found in the ground water beneath the Logistics Center. Post drinking water comes from a spring unrelated to that aquifer.

Fort McClellan, AL

Ten old training areas and three former disposal sites have a slight chance of subsurface contamination from mustard agent and its breakdown products and possible byproducts of chemical agent decontamination. Only very small quantities of agent were used and all sites have been closed, decontaminated and fenced. No evidence of any surface or surface water contamination has been found in the past, the Army says. The post receives its water from the city of Anniston.

Redstone Arsenal, AL

A \$30 million cleanup was recently completed by Olin Corp., which made DDT in a leased factory that was closed in 1970 for environmental reasons. Manufacturing waste was contaminating soils and streams. DDT was found in the wildlife food chain but not in potable water supplies inside or outside the base. In addition, the presence of PCBs, heavy metals, while phosphorous and other organic compounds is known or suspected. An investigation is under way to determine if they contaminated the active sanitary landfill, a DDT waste landfill, open burning and detonation grounds, and 22 old disposal sites. Also, a \$5 million program is in progress to remove all asbestos from post buildings.

Navy

Brunswick NAS, ME

A study is under way to determine contaminants and their migration habits.

Lakehurst Naval Air Engineering Center, NJ

Soil and shallow ground water at the tetraethyl lead disposal site are contaminated, perhaps from aviation fuel. The ground water in some areas is covered with a 6-inch layer of JP-Fuel. Elsewhere, the carcinogen nitronomine may be present. Waste oils, battery acid, and solvents are suspected of having been discharged into some dry wells. The soil stabilization field test received 362 gallons of aniline and 161 of furfural (toxic by ingestion, inhalation, or skin absorption), and ferric choride solution; personnel and animals that come in contact with the soil may be endangered. A landfill received thousands of gallons of hydraulic fluids, five tons of asbestos, and also cutting oils, solvents, sludge, and heavy metals. A site for PCB testing and storage is near the environmentally sensitive Ridgeway Branch. The western portion of the base may be contaminated by ordnance: shells, gas-loaded projectiles, phosgene, phosphorus, mustard agent, explosives, flares, and depth bombs. The shallow aquifer in this area may also be contaminated.

Moffett Field NAS, CA

The major contaminants in the ground water are volatile organic compounds.

Whidbey Island NAS, WA

The ground water could be contaminated. Waste oil, solvents, fuel, and caustic rinse water containing heavy metals have been discharged through the storm sewer system and into Dugella Bay. Waterfowl and fish that feed or live in drainage's may be affected. Subsurface migration at the seaplane base may have affected fish or shellfish in Oak and Crescent Harbors. A backup well at Ault Field is threatened by potential migration of contaminants.

Other Navy bases:

China Lake, CA

Indian Head NOS, MD

Jacksonville NAS, FL

Miramar NAS, CA

Pabmont River NAS, MD

Roosevelt Roads NS, Puerto Rico

Air Force**Castle AFB, CA**

On-base drinking water supply has been contaminated with trichloroethylene (TCE). Work is under way to install a new well drawing from a deeper, uncontaminated aquifer.

Dover AFB, DE

Ground on the is contaminated with arsenic and other metals, and a stream on base is contaminated with trichloroethylene (TCE). The base well, however, is free of these contaminants. Remedial action has been under way since 1985.

Griffiss AFB, NY

Phenols, ethyl benzene, and benzene have been detected in ground water on base, and toluene in surface water on base.

Hill AFB, UT

Seepage water near two disposal areas contains toxic organic chemicals, such as trichloroethylene (TCE), 1-2 dichloroethane, and 1,1,1 trichlorethane. None of the affected water is used for human consumption. Remedial action to date includes construction of a slurry wall and landfill covers as well as pumping and treating contaminated ground water.

Mather AFB, CA

Water in 36 homes was affected by trichloroethylene (TCE) contamination of a well on base. A new permanent water supply is to be provided to these homes.

McChord AFB, WA

Various chemicals -- methylene chloride, chloroform, benzene, arsenic, chromium, and mercury -- have been detected in test wells and in surface drainage leaving the base. One site is a liquid waste spill next to the wash rack and industrial waste treatment system. Contracted work for the American Lake

Gardens Water Supply Project began in 1985; a contractor installed shallow wells and one deep well.

McClellan AFB, CA

An estimated 160 sites have been identified. Contaminants include organic compounds, such as trichloroethylene (TCE), methylene chloride, and 1-1 dichloroethylene. Those wells both on and off base that had contaminants exceeding government standards have been shut down. McClellan is considered a leader in cleanup efforts. Completed projects include alternate water supply for off base residents and a ground water containment system and treatment plant.

Norton AFB, CA

Trichloroethylene (TCE) was detected in concentrations exceeding state drinking water standards. All base wells were contaminated to various degrees with silver and tetrachloroethylene (PCE). Closure of a lagoon and sludge removal was begun several years ago.

Robins AFB, GA

Contaminants include halogenated solvents, heavy metals, pesticides (DDT, chlordane, etc.), cyanide, and oil products. The toxic organic compounds trichloroethylene (TCE), and tetrachloroethylene (PCE) have been detected in ground water on base. Ground water is not used as drinking water, but the contaminants could eventually appear in surface water.

Tinker AFB, OK

Some base wells were closed due to contamination from chlorinated solvents. Chlorinated solvents were also detected in the aquifer that is the primary water source in the region. Organic compounds have been detected at all sites, though migration is limited. Remedial action begun in 1984, includes capping landfill No. 6, and stopping leaks from underground storage tanks at the fuel farm.

Wright-Patterson AFB, Ohio

Fourteen organic compounds, including trichloroethylene (TCE) and tetrachloroethylene (PCE) in relatively high quantities have been found in wells serving the base. Nearly half the 17 wells have been shut down due to contamination or age. An air stripper has been put on two wells to remove the organics, and installation of two other strippers is planned.

Other Air Force bases:

Beale AFB, CA

Chanute AFB, IL

Charleston AFB, SC

Columbus AFB, MS

Edwards AFB, CA

England AFB, LA

F.E. Warren AFB, WY

George AFB, CA

Hanscom AFB, MA

Hickam AFB, HI

Kelly AFB, TX

Lowery AFB, CO

Luke AFB, AZ

Kirtland AFB, NM

Langley AFB, VA

MacDill AFB, FL
McGuire AFB, NJ
Moody AFB, GA
Mountain Home AFB, ID
Otis AG Base, MA
Pope AFB, NC
Pease AFB, NH
Plattsburgh AFB, NY
Reese AFB, TX
Seymour Johnson AFB, NC
Shemya, AL
Travis AFB, CA
Vandenburg AFB, CA
Wurtsmith AFB, MI

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OPERATION RANCH HAND

The Air Force and Herbicides
in Southeast Asia
1961-1971

WILLIAM A. BUCKINGHAM, JR.

OFFICE OF AIR FORCE HISTORY
UNITED STATES AIR FORCE
WASHINGTON, D.C. 1982

THE AIR FORCE AND HERBICIDES IN SOUTHEAST ASIA

would consume the 112,000 gallons of defoliant currently remaining in South Vietnam.*

A similar recommendation from General LeMay, having just concluded a visit to South Vietnam, supported Delmore's idea. Hetherington warned TAC that if spray operations did resume, Ranch Hand might not leave Southeast Asia until July, and he advised a delay in executing OPOD 49-62.³² One day later, PACAF recommended to CINCPAC that two spray-equipped C-123s remain in South Vietnam at least until they had disposed of all herbicides then in the country and that the other two Ranch Hand aircraft be swapped for cargo versions.³³ TAC ordered the deployment of the four cargo C-123s halted on April 25, leaving them at Luke AFB awaiting further orders.³⁴

CINCPAC approved the PACAF proposal to swap only two of the Ranch Hand planes, and two C-123s departed Luke for Southeast Asia on April 28 while the other two planes returned to Pope.³⁵ In early May, one of the Ranch Hand C-123s returned to the United States by the Pacific route while another, under the command of Capt. Charles F. Hagerty, flew to Iran and Afghanistan to spray locusts. This aircraft returned to the United States on June 10, 1962 by way of Europe, thereby completing the first "around-the-world" flight by a C-123.³⁶

On June 13, 1962 another package of proposed spray missions left Saigon on its journey up the chain of command. General Harkins indicated that officials of the South Vietnamese government were pleased with the defoliation results they had seen so far, and they had demonstrated their continuing interest by submitting requests for further missions. As he had said in his operational evaluation of the earlier missions, the American commander noted that herbicides had proven to be successful in clearing vegetation around military installations and in mangrove areas. Therefore, his proposal for renewed operational use concentrated on clearing an area surrounding the air base at Bien Hoa and improving security along roads, rivers, and canals in mangrove areas. In total, he nominated six targets totaling 15,486 acres for spraying, an effort which would consume 46,458 gallons of herbicide. The acreage, however, was later reduced around Bien Hoa from 786 to only 160 acres. Harkins said that Vietnamese helicopters would spray near Bien Hoa, but that Ranch Hand C-123s would handle the other five targets.³⁷

Admiral Felt's response to the MACV proposal came within 72 hours. He readily endorsed the operation around Bien Hoa, but he sent the other targets back to Saigon for more justification. He requested information on

*Evidently around April 1962 President Kennedy approved an additional operational herbicide test along seven kilometers of road in South Vietnam. However, he rescinded this authorization on May 2, 1962 before Ranch Hand had flown any missions and stated that Thailand would be a better place for such a test. See Michael V. Forrestal, Memorandum of the President's Instructions at the Laos/Vietnam Briefing, May 2, 1962.

CROP DESTRUCTION BEGINS

While the State Department mulled over a final position on the issue, officials in the Department of Defense moved with greater haste. On August 4, Dr. Harold Brown, the Director of Defense Research and Engineering, while taking no position on the political or operational advisability of crop destruction, said that there was a substantial probability that the operation in Phu Yen Province would fail unless additional technical expertise entered into its planning and execution. Dr. Brown recommended that if the program were approved, General Delmore and a small staff of Army, Air Force, and Agriculture Department personnel should go to Vietnam to assist General Harkins in the technical aspects of the operation. Dr. Brown also expressed his technical concern over the "first-of-its-kind" character of the Phu Yen spraying which would be part of a larger military operation and would take place before testing the chemicals, personnel, spray equipment, and tactics in a controlled area. He said that such a test should take place in Vietnam or Thailand if possible before the operation in Phu Yen.¹⁴

At the recommendation of William P. Bundy and the ISA staff, Secretary McNamara on August 8, 1962, signed a memorandum to President Kennedy which incorporated the Joint Chiefs' position in favor of crop destruction. Basically, he repeated the arguments for the Phu Yen operation originated by Saigon planners. He also noted that herbicide spraying would be closely coordinated with the Hai Yen II clear-and-hold operation then in progress, and that this would be the first time since the successful campaign of the British in Malaya that a strategic hamlet program had been combined with complementary food denial operations. McNamara promptly pointed out that there was ample precedent for destroying crops in South Vietnam—both government and Viet Cong forces had been burning fields routinely for a number of years. He noted that a helicopter could destroy an acre of crops in about five seconds, and as a result the Defense Department's position paralleled the South Vietnamese view that herbicides were merely a more efficient way of accomplishing a familiar end. The only possible negative aspect acknowledged in the memorandum was the psychological and propaganda fallout from crop spraying, and Secretary McNamara cited Ambassador Nolting's estimate that such reaction would be relatively negligible.¹⁵

Meanwhile, the State Department was pressured for its official position. On August 8, 1962, Ambassador Nolting again emphasized in a message to Washington that time was becoming a crucial factor. He warned that if the operations did not begin in the next few weeks, many of the crops would be too mature to be seriously affected. In this event, he said, the crop destruction operations might bring propaganda disadvantages with no offsetting military or psychological gains.¹⁶ Admiral Felt dispatched an additional plea on August 21.¹⁷ On the same date, Ambassador Nolting informed the State Department that South Vietnamese Secretary of State Thuan had formally requested 5,000 gallons of chemicals for crop destruction, and Nolting said that it was becoming increasingly urgent to receive a decision on this proposed "trial run."¹⁸

VI. Ranch Hand's Mission Expands and Becomes Routine

Ranch Hand's three spray planes had flown their last herbicide mission in December 1962, prior to the issuance of the May 7, 1963, guidelines. The South Vietnamese dry season and the confusion over high-level policy limited Ranch Hand's activities during the intervening five months to assignments not related to the spray work for which the unit had come to Vietnam. In this interim period, they flew transport, navigational aid testing, and radar target missions. The transport flights were in support of the Mule Train logistics mission and included the delivery of cargo, munitions, and personnel. Ranch Hand aircraft and crews also participated in some combat parachute drops. Two of the unit's C-123s had special radio gear installed to test the British-designed Tactical Air Positioning System (TAPS), and they flew a total of 65 sorties in support of the TAPS testing program. As part of an effort to develop a ground controlled intercept (GCI) capability in South Vietnam, Ranch Hand crews and aircraft flew simulated hostile aerial penetration flights during this period. They generally flew at low level and provided excellent GCI practice to both ground radar operators and U.S. and Vietnamese pilots.¹

Ranch Hand finally got back into the spray business in June 1963, when the unit began applying herbicides along 46 kilometers of canals on the Ca Mau peninsula. Eight sorties, dispensing 7,200 gallons of chemicals, were flown in this region of IV Corps between June 6 and 9. Only light enemy ground fire harassed the crews over these targets, with no damage to Ranch Hand's C-123s. The unit flew spray missions again in July, this time along a power line extending from Da Lat to Bien Hoa. From July 3 through 27, Ranch Hand sprayed 10,722 gallons of herbicide during 19 sorties along 58 kilometers of the transmission line right-of-way. Because the line traversed mountainous terrain, Ranch Hand crews first surveyed its entire length to determine which portions were suitable for spraying by their C-123s, and which would have to be covered by slower, more maneuverable VNAF helicopters. Ranch Hand sprayed this series of targets without incident, except for delays because of adverse weather conditions.²

* In August 1963, Thailand requested Ranch Hand's aerial spray services through the U.S. State Department. This neighboring Southeast Asian country was suffering widespread and serious crop damage from locusts. One Ranch Hand aircraft and crew flew to Thailand on August 30 to coordinate the requested insect eradication project. On the following day, they flew the first of 17 insecticide missions which continued until September 16.

A second Ranch Hand aircraft arrived to help on September 8. Thai officials considered Ranch Hand's work, which demonstrated the unit's diversified aerial spray capabilities, extremely successful.³

The May 7 message from the Secretary of State required that a full report and evaluation of all 1963 herbicide operations to date be sent to Washington by the first week in July. Because Ranch Hand had not resumed spraying until June and because the crop destruction spraying in 1963 had been very limited, American officials asked for and received authorization to move the due date back to October 1.⁴

On September 4, 1963, MACV appointed a team to conduct this evaluation and prepare a report. U.S. Army Lt. Col. Peter G. Olenchuk headed the team. He was assisted by Army Lt. Col. Oran K. Henderson, Air Force Maj. Wayne E. Davis, and Mr. Robert T. Burke of the Political Section of the American Embassy in Saigon. This team of Americans had the mission of evaluating the technical adequacy, military worth, psychological and civil affairs aspects, policy, and procedures of herbicide operations which had taken place in South Vietnam since September 1962. They selected this broader base period covering ten defoliation and two crop destruction targets to provide a sufficient amount of data for evaluation.

Using C-123 aircraft, team members and their assistants flew over all sections of the defoliated targets under study at 75 to 150 feet in order to assess vertical and horizontal visibility in the defoliated strips in comparison with contiguous unsprayed areas. At least five observers rated each target on standardized forms, and they tested inter-observer reliability by overflying non-defoliated areas, obtaining close correlation of observer visibility estimates. The team estimated the average vertical and horizontal visibility over non-sprayed areas adjoining the nine defoliated targets as 40% and 30%, respectively. However, over the defoliated areas, average vertical visibility had improved to 80%, and horizontal visibility had increased to 75%. They found no major technical deficiencies in the Ranch Hand spray equipment or aircraft, but they did note that the effectiveness of the spray was sometimes degraded by the inherent inability of the C-123s to follow precisely the sharply twisting and turning paths of roads, rivers, canals, and the power line. Although they did not personally inspect the crop destruction targets, they noted that conclusive reports indicated that except perhaps for some root crops, the sprayed fields had been 100% destroyed.

The Olenchuk Report rated the military worth of defoliation and crop destruction as high. The team found that improved visibility had eased the problem of providing security in defoliated areas, had made aerial surveillance much more effective, and had enabled ground security forces to be reduced.⁵ Defoliation had also created an increased field of fire for

⁵This latter result would have been a questionable benefit in the eyes of some critics of U.S.-GVN counterinsurgency strategy because it reduced the government presence on the ground in contested areas and increased Saigon's reliance on remote technological means of control.

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THE AIR FORCE AND HERBICIDES IN SOUTHEAST ASIA

Zone D began in August. In August and September, UC-123s flew many missions over the Iron Triangle. On October 31, 1966, a Ranch Hand aircraft crashed in the Iron Triangle and, although the plane was totally destroyed, the crew was rescued. Spraying in War Zone C got underway in early September and continued for the remainder of the year. August also saw the start of activity in the Mekong Delta region of IV Corps. Many smaller defoliation targets along roads were sprayed from time to time. By the end of the year, herbicide operations were routinely taking place in all regions of South Vietnam.

Hostile fire was present over most targets, but Ranch Hand's increasing level of operations made fighter cover difficult to obtain during part of the period from September through November 1966. Lack of fighter escort caused cancellation of some missions, especially in III and IV Corps. In August, Ranch Hand received three new spray planes, and four more were added in September bringing the total number of UC-123s available to fourteen. Ranch Hand crews, eager to accomplish as much as possible with the new aircraft, occasionally tried to do too much. Clear weather in the area just south of the Demilitarized Zone (DMZ) in September 1966 allowed Ranch Hand to fly as many as four sorties per aircraft per day. Predictably, the herbicide supply ran low and the planes fell behind on their maintenance schedules. These circumstances forced the crews to stretch out their operations so that maintenance and supply could catch up.

The last quarter of 1966 saw further expansion of the Ranch Hand mission and the unit's establishment as a separate squadron. On October 15, the Special Aerial Spray Flight of the 309th Air Commando Squadron was discontinued and the 12th Air Commando Squadron (ACS) came into being, retaining the code name Ranch Hand which had been applied to USAF herbicide activities in Southeast Asia since 1961. Lt. Col. Robert Dennis was the first commander of the 12th ACS which became a permanent part of the 315th Air Commando Wing (ACW), Troop Carrier. On December 1, the 12th ACS moved its base of operations from Tan Son Nhut to Bien Hoa.

Prior to its redesignation, Ranch Hand took on a secondary mission, spraying insecticide to control malaria carrying mosquitos. This public health mission continued even after herbicide operations ceased in 1971. Employing "Patches," the UC-123 used against locusts in 1962, a test program began in Bangkok, Thailand, on October 14, 1966. Three days later insecticide spraying began in South Vietnam. Workers had stripped "Patches" of all camouflage paint and coated it with an alodine compound to guard against the insecticide's corrosive effects. In the air, insecticide work also differed from herbicide missions. Insecticide missions were longer, making fuel conservation critical. The low rate of application, 8 ounces per acre, enabled one insecticide sortie to cover about 15,000 acres. Insecticide missions, however, did not require the precise navigation of herbicide spray runs. In any event, by the middle of 1967, Ranch Hand was flying about 20 insecticide sorties per month.

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HERBICIDES REACH THEIR PEAK

During October, as the insecticide program got underway, the squadron continued its primary mission. Weather conditions hampered Ranch Hand's defoliation activities in the A Shau Valley and near the Demilitarized Zone, allowing increased spraying in Laos. To the south, in Vietnam, they tested the effectiveness of a reduced rate (1½ gallons per acre) of orange herbicide on mangrove trees in the Rung Sat Special Zone (south of Saigon) and in the Mekong Delta. The results were disappointing, and the targets had to be resprayed to achieve the desired results.³²

In 1966 Ranch Hand received permission to spray an area that, though small geographically, was very important militarily—the southern portion of the Demilitarized Zone separating North Vietnam from South Vietnam. Infiltration by North Vietnamese troops across the DMZ was a significant threat to U.S. and South Vietnamese troops in I Corps. Defoliation there would help to uncover infiltration routes and supply stockpiles. On August 16, 1966, Ambassador Lodge informed the Secretary of State that General Westmoreland had proposed defoliation in and immediately south of the southern half of the DMZ, that is, that portion of the DMZ south of the Provisional Military Demarcation Line (PMDL), all of which was in South Vietnam. Ambassador Lodge had the authority to approve herbicide missions in South Vietnam, but, because of the political sensitivity surrounding the DMZ, he requested both State and Defense Department views on the matter. Recognizing that there were several key military advantages to be realized from defoliation in the DMZ, he expressed three major political reservations: a potential for North Vietnamese charges of chemical warfare, possible adverse impact on efforts to expand the influence of the International Control Commission, and untimeliness.³³

On August 27, Admiral Sharp endorsed General Westmoreland's proposal. On October 4, the Secretary of Defense wrote the Secretary of State to add his endorsement, noting that the Joint Chiefs also felt that defoliation in the DMZ was highly desirable from a military standpoint. Secretary McNamara said that the North Vietnamese Army had recently sent its 324B Division through the DMZ directly into South Vietnam and was building a supply base in the DMZ for future operations. He cited the fact that defoliation had been conducted in South Vietnam since 1961 and in Laos since 1965, and stated his view that the political risks of defoliation missions in or near the DMZ would be less than the military risks of failing to take reasonable measures to deny the Viet Cong and North Vietnamese Army the use of the DMZ as sanctuary. Including a draft authorization for Saigon, the Defense Secretary asked Secretary Rusk to authorize defoliation missions to begin immediately.³⁴

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A further tightening of the limitations on herbicides occurred in March, although it had little, if any, practical impact. The authority granted in previous years to COMUSMACV to conduct herbicide operations outside South Vietnam was still valid, and the Assistant Secretary of Defense for International Security Affairs, G. Warren Nutter, felt that it should be withdrawn for two reasons: first, any use of herbicides in Laos or elsewhere after the phase-out in South Vietnam might incite public criticism, and, second, recent Senate inquiries had asked whether the new herbicide policies applied to Laos and Cambodia.³ Laird adopted the ISA advice and on March 18, 1971, requested the Chairman of the JCS to insure that any proposal for U.S. herbicide operations in Laos, Cambodia, or Thailand be submitted to Laird for his approval.⁴

Secretary Rogers was justified in his fears that herbicide policies in Vietnam would cause problems during the Senate Foreign Relations Committee hearings. These public hearings, held March 5-26, 1971, provided a forum for several opponents of herbicides such as Meselson and Westing to present their views. The committee decided to take no immediate action on ratification. Senator J.W. Fulbright, the chairman, wrote to President Nixon on April 15 saying that after listening to the testimony, many members of his committee felt that the United States should not ratify the Geneva Protocol with understandings attached exempting herbicides and tear gas from its coverage. Fulbright urged Nixon to drop these exemptions, saying, ". . . I personally believe that were you to take this initiative your action would be regarded as truly courageous and possessed of real moral force."⁵

Packard's directive of January 16, 1971, ending crop destruction operations had also asked the Joint Chiefs to produce by April 15 a plan for disposing of herbicide orange stocks.⁶ MACV forwarded its views on a range of alternatives on March 8. General Abrams' preferred option was to remove all orange stocks from Vietnam. His second preference was to have the orange incinerated in South Vietnam under the control of the U.S.⁷ Admiral McCain viewed having U.S. forces spray the orange in support of the South Vietnamese as the best alternative, with removing the chemical from the country as his second choice.⁸ The plan the Joint Chiefs forwarded to the Secretary of Defense on April 23, 1971, generally followed CINCPAC's preferences. The Chiefs asked once more for the lifting of the ban on herbicide orange so that it could be sprayed in remote areas. And, they said that the stocks of orange in Vietnam should remain the property of the South Vietnamese government for future use after they acquired spray capabilities under the Vietnamization program. If the ban on orange had to remain in effect, the Chiefs wanted the orange returned to the United States for destruction by burning. For stocks of orange stored at Gulfport, Mississippi, the Air Force had developed a plan to offer that portion with an acceptably low dioxin content for use by the government or for commercial sale and to destroy the rest by controlled burning.⁹