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EXPOSURE ASSESSMENT FOR THE AGENT ORANGE STUDY

Interim Report Number 2

November 18, 1985

AGENT ORANGE PROJECTS
Division of Chronic Disease Control
Center for Environmental Health
Centers for Disease Control

SECTION I - SUMMARY AND INTRODUCTION

The design of the Agent Orange Study requires that we identify three cohorts of U.S. Army veterans that differ according to their likelihood of having been exposed to Agent Orange. Two of the cohorts consist of men who served in combat battalions in III Corps in Vietnam during 1967 and 1968 and the third cohort consists of men who served in service support units in areas of Vietnam that received no applications of Agent Orange.

In this report we discuss the following issues:

1. We demonstrate that many of the units under study were close enough to applications of Agent Orange to be classified as very likely to have been exposed to Agent Orange. This is discussed in Section II-A.

2. We demonstrate that the present selection criteria or a slight extension of these criteria will allow us to identify 17,000 U.S. Army Veterans who can be classified according to the probability that they were exposed to Agent Orange. This demonstration is provided in Section II-B.

3. We explain that it is probable that we will be able to identify 8,500 men who served in support units in Vietnam in areas free from applications of Agent Orange. This is discussed Section II-C.

4. We discuss the possibility that the data received from the U.S. Army and Joint Services Environmental Support Group (ESG) on the locations of combat companies is incomplete. We discuss several methods to address these problems. While we usually would not include a data collection problem in an interim report for scientific review, we believe this issue is critical for the validity of the exposure assessment index and believe it necessary to bring it to the panel's attention. This is discussed in Section III.

5. We demonstrate that company-level morning reports by themselves are not useful in establishing company locations. They require a review of additional documents, and the information available in them can be obtained more easily from other sources. This is demonstrated in Appendix I.

In summary, we believe that data exist which will allow ranking individual veterans likelihood of exposure with sufficient accuracy to warrant proceeding with the study. We believe, however, that AOP must have more direct responsibility for abstraction of units' locations if we are to ensure the reliability of these data.

SECTION II - EXPOSURE OPPORTUNITY AND COHORT SELECTION

The design of the Agent Orange Study requires that we identify three cohorts each containing 8,500 men. Two of the cohorts are to be selected from combat battalions that served for at least 18 months in III Corps during 1967 and 1968. The difference between these two cohorts will be their likelihood of having been exposed to Agent Orange as measured by their time and distance from known applications of the herbicide. We have a list of 65 combat battalions that served for at least 18 months in III Corps during 1967 and 1968. This list, called the AOP master list of battalions, records the battalions sequentially, and the order is such that units from a single division do not appear in a cluster. Units which served in different areas of III Corps will be chosen if the cohorts are selected according to this numerical sequence.

We have begun selecting men for these cohorts from morning reports of the line companies of the battalions according to their order on the AOP master list. Although the selection process was not based on the ranking of the units according to likelihood of exposure, we believe the process will provide units of both high and low likelihood of exposure in the sample. This belief is based on our knowledge of the general areas in which the units served and of the areas that received heaviest herbicide sprayings. Exposure analyses demonstrate that units of both high and low likelihood of exposure are included in the first group of men sampled.

Members of the third cohort are being selected from service support units that served in areas of Vietnam where Agent Orange was not applied. From our review of the data we now believe that we will be able to identify the 8,500 men to be included in this cohort. The selection process for these men will be discussed in Section II.C.

In this section we discuss the following conclusions:

1. Based on several different time and distance criteria, enough men were sufficiently close to applications of Agent Orange to identify a cohort of men who would be classified as very likely to have been exposed to Agent Orange. This demonstration is provided in part A.

2. The present selection criteria or a slight extension of these criteria will allow us to identify 17,000 U.S. Army Veterans who can be classified according to the likelihood that they were exposed to Agent Orange. This demonstration is provided in part B.

3. It is highly probable that we can identify 8,500 men who served in support units in Vietnam that were located in areas free from Agent Orange sprayings. This is discussed in part C.

A. Exposure opportunity.

Since the February 1985 Interim Report, we have tried to obtain information on the location of combat companies serving in III Corps for each day during the period January 1, 1967, to December 31, 1968. For every combat company, some days occur for which location

information is lacking using the various documents presently researched by the U.S. Army and Joint Services Environmental Support Group (ESG). Table 1 summarizes the available data. Many gaps remain in our ability to determine documented company-level locations. We discuss problems with the location information and our plans for solving these problems in Section III.

We define encounters with Agent Orange as reported unit locations being within specified times and distances from known applications of the herbicide. Since we have not decided upon the method for assigning company locations for days when we lack documented information, we made no attempt to impute locations for this analysis. We have matched all known locations to the data on Agent Orange applications and used various time and distance criteria to define encounters. We present data on four different analyses using the following specifications for encounters:

1. Applications within 59 days and 2 km of the location.

2. Applications within 1 day and 5 km of the location.

3. Applications within 3 days and 7 km of the location.

4. Applications within 5 days and 7 km of the location.

This method of analysis allows us to employ a single location for several different encounters and also a single spraying for several different encounters. Therefore, if we use 5 days and 7 km as time and distance limits and a company remained stationary for 5 days after being within 7 km of an herbicide application, the company would be assigned five encounters with Agent Orange. Similarly, if the company reported 3 locations in a single day and they were all within 5 days and 7 km of a herbicide application the company would be assigned 3 encounters with that application. It should be emphasized that, for this preliminary analysis of encounters, all recorded unit locations are considered. For the final analyses, which will be used to rank individual men's likelihood of exposure to Agent Orange, a summary of daily encounters for each company is likely to be used.

The results of these analyses are presented in Tables 2-5. They suggest a wide range of opportunity for exposure among the battalions, and the relative ranking of the battalions according to opportunity for exposure appears to be independent of the time and distance criterion chosen. The number of encounters is not correlated with the number of unique data points available for a unit. The rank correlation between the number of points available for matching and the number of encounters within 3 days and 7 km is .18 ($p=.28$). This is not surprising when we consider that on any given day there were very few herbicide applications while the number of locations at which men were operating was spread over an area of 30,000 square kilometers. Although the time and distance criteria chosen are somewhat arbitrary, various other combinations produced similar results. The fact that the relative ranking of the likelihood of exposure is not highly dependent on the choice of time and distance criteria is reassuring, since there is no consensus on the geographic dispersion of Agent Orange from Ranch Hand missions, nor its persistence in the environment of Vietnam.

We presently have information on 1,107 applications of Agent Orange in III Corps between October 1, 1966, and December 31, 1968. Table 6 presents the number of applications per month during this period. Ninety percent of the applications for which we have information were conducted by operation Ranch Hand. Therefore, the major source of opportunity for exposure among men in III Corps was aerial spraying by fixed wing aircraft. This assertion is based on the assumption that the information available on non-Ranch Hand applications of Agent Orange is virtually complete.

Based on these analyses we conclude that many veterans were in close enough proximity to applications of Agent Orange to be classified as highly likely to have been exposed to the herbicide and recommend proceeding with the Agent Orange Study component of the Agent Orange Projects.

Table 1

Number of Days for Which at Least One Location is Recorded for Infantry and Artillery Battalions

Battalion	A	B	C	D	Any (A-D)	Battalion Reference	Any Unit
				Infantry			
1	293	325	291	233	532	527	666
2	324	415	450	46	613	438	721
3	485	499	494	238	681	78	728
4	578	590	558	80	663	416	721
11	622	589	603	307	706	481	722
12	517	531	517	359	648	425	691
13	484	484	499	292	637	618	702
14	500	462	486	266	619	672	722
21	477	479	452	332	618	716	728
22	359	333	365	216	600	358	690
23	332	335	293	210	539	652	683
24	381	293	343	245	600	474	713
31	418	441	473	17	596	507	669
32	357	331	389	282	554	542	660
33	480	487	498	13	640	541	695
34	351	348	392	194	585	685	723
42	383	380	375	298	611	510	709
43	252	202	263	176	525	575	703
44	412	382	384	194	607	665	711
49	295	346	324	163	558	456	682
median	398	398	421	225	609	519	706
				Artillery			
6	719	665	679	572	723	2	723
7	163	137	20	122	300	44	615
8	42	28	48	25	100	220	312
9	284	292	288	72	368	704	715
16	284	290	296	0	671	341	548
18	29	60	80	0	100	306	313
26	71	47	59	59	156	726	156
36	109	78	58	0	155	725	725
37	43	50	42	8	114	603	635
38	593	596	586	0	632	678	727
39	403	383	379	91	447	718	720
median	163	137	80	25	300	603	635

Table 2

Number of Herbicide Encounters within 59 days and 2 km
by Battalion and Company

Battalion	Company A	Company B	Company C	Company D	Total
1	52	46	62	6	268
2	276	276	224	6	1,053
3	17	22	17	0	75
4	192	60	74	11	377
5	46	11	41	0	200
6	2,128	7	107	5	2,251
7	20	5	14	5	81
8	4	5	47	7	71
9	14	120	10	4	453
10	35	27	8	26	172
11	3	101	31	69	209
12	15	37	44	0	99
13	66	82	73	0	331
14	12	8	1	0	38
15	0	0	0	0	60
16	18	13	16	0	72
18	0	0	3	0	16
20	856	1,426	671	15	4,442
21	55	55	52	24	212
22	239	17	97	105	683
23	116	120	79	16	504
24	250	115	174	54	776
26	18	15	1	12	119
31	106	105	66	0	355
32	127	110	103	4	440
33	15	13	4	0	43
34	136	171	180	14	585
36	1	3	2	0	6
37	4	2	5	0	153
38	2	8	129	0	145
39	25	1	2	3	32
42	42	53	29	5	139
43	38	39	61	17	323
44	987	1,309	1,184	9	4,001
49	118	129	101	0	389
51	115	222	253	1	871

NOTE: An encounter is any occurrence of a location for the unit being within the specified time and distance of an application of Agent Orange.

The total column includes any encounter of a noted battalion location within the specified time and distance of a herbicide application without regard to the size of the unit with which the location is associated.

Table 3

Number of Herbicide Encounters within 1 Day and and 5 Km
by Battalion and Company

Battalion	Company A	Company B	Company C	Company D	Total
1	4	17	6	7	102
2	31	10	24	0	87
3	17	7	4	0	29
5	1	0	0	0	8
6	204	2	25	3	236
7	2	2	2	3	9
8	2	2	0	0	4
9	4	4	0	0	18
10	1	1	1	1	6
11	0	1	0	0	1
12	0	0	1	0	1
13	6	0	0	4	13
14	0	2	0	0	2
15	0	0	0	0	10
16	0	0	4	0	4
20	143	2	142	0	328
22	26	3	17	36	120
23	33	22	17	1	87
24	11	0	10	7	38
26	0	0	0	0	2
31	2	4	6	0	25
32	2	4	1	1	16
33	0	1	1	0	2
34	10	12	15	0	51
37	1	0	0	0	13
38	11	2	0	0	13
42	0	0	2	2	6
43	38	16	28	38	149
44	32	20	11	0	69
49	1	0	1	0	8
51	16	14	38	0	82

NOTE: An encounter is any occurrence of a location for the unit being within the specified time and distance of an application of Agent Orange.

The total column includes any encounter of a noted battalion location within the specified time and distance of a herbicide application without regard to the size of the unit with which the location is associated.

Table 4

Number of Herbicide Encounters within 3 days and 7 km
by Battalion and Company

Battalion	Company A	Company B	Company C	Company D	Total
1	28	53	43	46	381
2	86	77	78	0	365
3	196	30	70	3	329
4	1	0	0	0	1
5	2	0	1	0	24
6	478	8	53	20	575
7	13	14	2	24	60
8	5	3	1	1	12
9	11	12	3	0	46
10	4	8	5	2	25
11	2	2	1	0	5
12	0	0	4	0	4
13	12	8	1	20	51
14	0	2	0	0	8
15	0	0	0	0	20
16	0	0	6	0	6
20	440	33	373	0	935
21	15	1	8	0	28
22	46	26	47	75	300
23	110	67	112	28	369
24	36	16	53	26	185
26	0	0	0	1	6
31	6	22	18	1	74
32	6	5	6	6	46
33	5	4	6	0	18
34	88	60	79	2	278
36	0	2	0	0	2
37	7	2	1	0	45
38	32	18	3	0	55
39	4	0	12	7	30
42	4	2	30	3	43
43	166	67	150	70	567
44	116	128	87	0	362
49	10	12	8	4	75
51	112	82	89	0	326

NOTE: An encounter is any occurrence of a location for the unit being within the specified time and distance of an application of Agent Orange.

The total column includes any encounter of a noted battalion location within the specified time and distance of a herbicide application without regard to the size of the unit with which the location is associated.

Table 5

Number of Herbicide Encounters within 5 days and 7 km
by Battalion and Company

Battalion	Company A	Company B	Company C	Company D	Total
1	54	81	52	74	551
2	155	111	125	4	571
3	280	58	117	8	497
4	17	6	0	0	29
5	2	0	4	0	39
6	717	12	78	28	859
7	19	19	5	34	91
8	8	3	3	2	18
9	17	18	4	0	69
10	5	20	16	4	53
11	8	2	1	0	11
12	0	1	4	0	5
13	14	10	6	22	69
14	4	4	0	0	15
15	0	0	0	0	31
16	0	0	9	0	11
20	556	45	560	7	1,307
21	23	6	14	3	53
22	60	39	110	93	454
23	164	84	181	45	573
24	69	31	76	35	290
26	0	2	0	2	12
31	7	36	29	1	114
32	10	6	8	12	72
33	5	7	8	0	23
34	139	116	146	2	474
36	0	5	0	0	5
37	9	2	1	0	57
38	37	24	3	0	66
39	10	1	14	13	47
42	15	18	36	3	77
43	199	87	247	87	761
44	141	160	114	0	462
49	18	29	32	6	138
51	155	107	99	0	427

NOTE: An encounter is any occurrence of a location for the unit being within the specified time and distance of an application of Agent Orange.

The total column includes any encounter of a noted battalion location within the specified time and distance of a herbicide application without regard to the size of the unit with which the location is associated.

Table 6

Number of Agent Orange Applications in III Corps
by Month and Year

Year	Month	Number of Sprayings
1966	10	31
1966	11	61
1966	12	83
1967	1	74
1967	2	128
1967	3	76
1967	4	35
1967	5	15
1967	6	34
1967	7	34
1967	8	38
1967	9	50
1967	10	55
1967	11	68
1967	12	69
1968	1	52
1968	2	3
1968	3	4
1968	4	33
1968	5	20
1968	6	28
1968	7	22
1968	8	22
1968	9	6
1968	10	43
1968	11	11
1968	12	12

B. Selection of men from combat line companies.

We have begun selecting men from line companies of battalions according to the order in which these battalions appear on the master list of battalions. We expected this procedure to provide men from units with either high or low likelihoods of exposure based on our knowledge of general areas of battalion operations and of areas of herbicide applications, and this appears to be the case (Tables 2-5). Additionally, our projections show that in order to obtain the required number of men (17,000 qualified veterans), it will be necessary to select men from almost all of the units on the list and the selection criteria may have to be changed.

Company morning reports exist on microfilm in St. Louis where personnel from the Reserve Component Personnel Action Center (RCPAC) abstract information from them. They provide one or more of the following: the veteran's name (either full or partially completed), his military service number, and only infrequently his social security number. Lists containing this information are sent to AOP and computerized. Duplicates are deleted and the resulting list is matched with other computer files to obtain an accession number for the veterans' personnel files at the National Personnel Records Center (NPRC) in St. Louis. AOP sends labeled forms to NPRC which locates the records and forwards them to RCPAC for initial review to determine qualification. Potentially qualified veterans' files are sent to ESG where basic military and demographic information is obtained as in the Vietnam Experience Study. ESG also provides a complete history of the units in which the veteran served while in Vietnam. These forms are sent to AOP where they are computerized, and a final qualification is determined on the basis of the following criteria:

1. Single term enlistment
2. Rank of E-5 or less at discharge
3. Entire Vietnam tour in 1967 and 1968.
4. Entire tour spent in units for which location data is being collected.
5. At least 180 days in a line company (A-E).

Although we originally intended to limit the cohort selection to men from infantry and artillery units, we found that the highest potential for exposure occurred for a cavalry unit (battalion #20), so this decision seems unwarranted. Also, as stated above, we may have to use all of the units to obtain the necessary 17,000 men. The present projections are based on insufficient data to make a formal recommendation at this time, but if necessary, we can modify criteria #3 and extend the time period of the veteran's tour to allow his time spent in Vietnam to include periods in either late 1966 or early 1969 or both. Additional information on unit locations for these additional periods will be needed, however, for this change.

We initially suspected that a high transfer rate among units would result in individual exposure classifications differing from those of the units from which the men were selected. Based on approximately

2000 records of men selected for the study, it appears that this may not be the case. Although almost 50 percent of the men transferred at least once (including transfers to a new company within the same battalion), 88 percent spent their entire Vietnam tour of duty with a single battalion. In any case, based on the wide range of herbicide encounters experienced by different companies, it seems reasonable to assume that we will be able to identify individual men with both high and low likelihoods of exposure.

Based on our experience in obtaining the names of men who served in the combat units of III Corps during 1967-1968 we believe we will be able to identify 17,000 veterans and classify them according to their exposure to Agent Orange. Further data are necessary before we determine whether the selection criteria must be changed and additional location information collected. This change, if necessary, should not effect the analyses presented in this report.

C. Selection of the third cohort.

The protocol specifies that one third of the men selected for the Agent Orange Study (approximately 8,500) come from non-combat units which were stationed in areas in Vietnam known to have received very little herbicide application. To meet this criterion we must demonstrate that the units selected were stationary during the period of interest and that the men selected from these units spent their entire Vietnam tour in areas free from heavy herbicide application.

ESG states that locating non-exposed service support and combat service support units requires a different methodology from that currently being used to locate U.S. Army combat units. Support-type units remained in base camp installations and did not go on combat missions. Therefore, they did not maintain Daily Journals and ESG believes that company morning reports provide the best available information for tracking these units and specifying daily locations.

ESG provided AOP on May 27, 1983, with a roster of units that were stationed at Cam Ranh and Vung Tau, possible examples of areas in Vietnam where there is believed to be no evidence of herbicide usage prior to 1969. On July 23, 1985, ESG provided us with a roster of units stationed throughout Vietnam, including Cam Ranh and Vung Tau, that are believed to have received minimal or no herbicide sprayings. These lists include 286 units to be considered for the third cohort and account for an estimated 48,112 soldiers (the estimates are provided by ESG or obtained from the Vietnam Order of Battle). These should provide substantially more than the 8,500 men required for the third cohort if most of the men either spent their entire Vietnam tour in the unit from which they were selected or transferred only to other such units. To date ESG has provided CDC a list of 22 units for the third cohort with dates, place names, and grid coordinates "verified via Morning Reports." Our initial analysis of the areas to which these units were assigned indicates that there is little likelihood that units serving in most of these locations were exposed to Agent Orange.

Our analytic results and the information provided by ESG indicate that there were areas in South Vietnam free from exposure and that enough men served in units that operated in these areas to constitute a third cohort. The issue concerning whether men remained in their units for the entire period of their Vietnam tour can be addressed only after we have begun receiving data abstracted from their personnel files. However, if the Vietnam tours of these individuals resembles those of the men from the combat units already selected then the units should yield enough men for a third cohort.

SECTION III - QUALITY AND COMPLETENESS OF LOCATION INFORMATION.

Since the February 1985 Interim Report, we have worked to obtain information on the location of combat companies serving in III Corps for each day during the period January 1, 1967, to December 31, 1968. A veteran's military personnel file (201 file) tells us to which company he was assigned for each day during his tour in Vietnam. Once we know the daily locations of the companies and where and when herbicides were applied, we can assess the likelihood of the individual's exposure to Agent Orange. We discussed the available data on herbicide applications in detail in the February 1985 interim report.

For every combat company, some days occur for which location information is lacking using the various documents presently researched by ESG (Table 1). It appears that some gaps will remain in the company-level location information, but that we should be able to obtain more information from the military records than is presently being supplied by ESG.

In this section we discuss the problem of completeness and accuracy of the location information being supplied by ESG. Limited reproducibility studies conducted by AOP lead us to conclude that the data are incomplete and inaccurate. We also discuss the alternatives we are considering to improve the quality of the location information.

We have explored ESG's suggestion that company-level morning reports would provide valuable additional information, but unfortunately, this is not the case. A discussion of the data collection process used by ESG, the proposed use of company-level morning reports, and our reasons for rejecting their use is presented in Appendix I.

A. Completeness and accuracy of available location data.

The ability to reproduce data is essential to establish the integrity and credibility of a scientific study. Therefore, in March 1985, members of the AOP staff began reabstracting data previously abstracted by ESG on selected units. These AOP staff members were trained by the ESG abstraction supervisor prior to beginning the process. We now have completed data for four months on three different battalions and present the results in Table 7. Our initial analysis compares only the information on the battalions and does not address the issue of additional company-level information that might be available. We compare the distance between the average of the locations found in the two independent abstractions of the data on the battalions, the abstraction originally supplied by ESG and the reabstraction completed by AOP. If the number of points representing unit locations and the general area in which they occurred were similar for the two independent abstractions, we would expect this distance between the centroids to be small. This, however, was not the case for many of the days within the period studied.

We discuss the differences between our quality control reabstraction and the original data with ESG before deciding whether the data from a battalion is acceptable. Since the completion of our analysis, the location information from one unit (Battalion #4) has been discussed in detail with ESG, and they have agreed to reabstract the

records for this battalion. We have not yet received the reabstracted data and therefore cannot comment on the quality of the new data. We have also discussed the reabstraction of other units, but ESG has been unwilling to commit themselves to reabstracting additional data.

The approach used by ESG to abstract military documents is mechanical: the abstractors are not allowed to make inferences based on the content of the military records, but only to list explicit entries that mention a UTM coordinate or a place name. For example, if a unit is recorded to have returned to a base camp, the coordinate for the base camp is abstracted for the day on which this information appears in the document. However, if no further mention of the unit appears in the record until the unit leaves the base camp, the abstractors do not infer that the unit is at the base camp for this period, but rather list no coordinates for those days when information is lacking. AOP has requested that ESG involve other military experts in decisions concerning the best methods for locating units, but ESG considered this unnecessary.

After problems with the abstraction process were identified, we requested that a committee consisting of members of the U.S. Army War College and Military History Institute conduct an independent review of the procedures used by ESG. When we discussed this plan with ESG, they objected to an Army group reviewing their procedures. All parties then agreed to the establishment of a group consisting of persons outside the Army.

Table 7

Between-centroid distance and number of locations for ESG and CDC abstractions and for ESG abstraction before and after editing, by battalion and data.

Battalion 4: Date	(ESG, CDC) Distance (km)	Number of Locations	
May 1	1.1	16	16
May 2	0.6	12	15
May 3	–	0	24
May 4	0.04	14	20
May 5	0.3	20	24
May 6	0.03	22	32
May 7	0.0	7	7
May 8	4.1	11	4
May 9	22.0	2	1
May 10	–	0	0
May 11	–	1	0
May 12	–	1	0
May 13	30.3	10	9
May 14	3.1	17	16
May 15	24.5	13	8
May 16	1.6	5	9
May 17	0.3	35	15
May 18	–	0	25
May 19	1.1	17	22
May 20	0.4	15	6
May 21	0.04	22	18
May 22	3.7	12	5
May 23	6.0	24	5
May 24	17.5	25	10
May 25	3.0	16	7
May 26	2.7	23	10
May 27	2.3	13	3
May 28	18.5	20	7
May 29	4.5	13	1
May 30	1.4	14	7
May 31	1.8	26	11
Subtotal		426	337

Table 7 (Continued)

Between-centroid distance and number of locations for ESG and CDC abstractions and for ESG abstraction before and after editing, by battalion and data.

Battalion 4: Date	(ESG, CDC) Distance (km)	Number of Locations	
June 1	0.7	14	3
June 2	1.9	38	13
June 3	0.5	17	12
June 4	19.7	27	23
June 5	1.1	46	12
June 6	17.1	41	8
June 7	19.3	25	6
June 8	3.1	30	10
June 9	42.8	25	2
June 10	21.7	23	6
June 11	22.1	21	8
June 12	3.6	20	6
June 13	24.6	13	4
June 14	19.5	32	12
June 15	22.4	17	7
June 16	23.5	29	15
June 17	24.1	18	10
June 18	21.6	25	17
June 19	24.2	30	4
June 20	36.4	39	29
June 21	28.3	26	14
June 22	19.7	48	30
June 23	21.8	41	27
June 24	23.2	37	19
June 25	1.5	30	12
June 26	46.8	20	20
June 27	24.0	35	9
June 28	4.3	50	33
June 29	3.1	37	28
June 30	22.7	31	22
Subtotal		885	421

Table 7 (Continued)

Between-centroid distance and number of locations for ESG and CDC abstractions and for ESG abstraction before and after editing, by battalion and data.

Battalion 4: Date	(ESG, CDC) Distance (km)	Number of Locations	
April 1	7.6	5	10
April 2	0.07	15	22
April 3	3.6	8	7
April 4	–	0	0
April 5	7.9	5	5
April 6	–	0	0
April 7	0.3	4	5
April 8	1.5	10	13
April 9	1.9	8	8
April 10	0.1	8	9
April 11	0.02	18	24
April 12	49.1	6	11
April 13	0.04	18	21
April 14	2.3	16	20
April 15	5.3	19	16
April 16	0.2	13	18
April 17	9.9	7	13
April 18	12.3	5	2
April 19	–	1	0
April 20	1.7	2	1
April 21	–	0	0
April 22	–	0	0
April 23	4.1	1	11
April 24	3.7	8	15
April 25	5.6	11	22
April 26	3.2	11	16
April 27	15.3	7	15
April 28	0.1	10	14
April 29	0.2	9	14
April 30	5.1	10	19
Subtotal		235	331

Table 7 (Continued)

Between-centroid distance and number of locations for ESG and CDC abstractions and for ESG abstraction before and after editing, by battalion and data.

Battalion 4: Date	(ESG, CDC) Distance (km)	Number of Locations	
June 1	1.5	2	1
June 2	1.1	16	19
June 3	0.1	12	12
June 4	0.1	17	18
June 5	3.1	1	9
June 6	7.7	12	18
June 7	0.1	27	35
June 8	1.6	18	32
June 9	0.6	2	5
June 10	0.1	21	28
June 11	3.2	16	20
June 12	2.3	1	7
June 13	0.4	25	20
June 14	1.3	18	10
June 15	2.5	7	10
June 16	0.2	7	14
June 17	0.3	6	7
June 18	1.6	4	9
June 19	2.6	4	4
June 20	3.3	5	11
June 21	1.1	11	15
June 22	0.1	16	27
June 23	2.1	12	17
June 24	1.8	8	16
June 25	0.5	13	20
June 26	2.1	1	4
June 27	9.2	18	16
June 28	1.4	5	15
June 29	0.006	19	11
June 30	5.7	2	3
Subtotal		326	433
Total	1,872 1,522		

We asked Mr. Tavia Gordon, a consultant with AOP, to establish the review group. Mr. Gordon is a renowned statistician and epidemiologist who has worked with AOP for over 18 months. He is well informed concerning most aspects of the study. We suggested that he contact Mr. Shelby L. Stanton, J.D., as a possible consultant possessing expertise in the areas of military records and Vietnam.

Mr. Gordon did contact Mr. Stanton, and after further problems were discovered with the location data supplied by ESG, AOP employed Mr. Stanton as an AOP staff member. Mr. Stanton is an acknowledged expert on the military history of the Vietnam War, on the deployment and movement of units within the war zone, and on the research documents available in this area. He is himself a Vietnam combat veteran and has written two books about the Vietnam war, The Vietnam Order of Battle, and The Rise and Fall of an American Army. A third book on the history of the Special Forces Units in Vietnam is in press. The Vietnam Order of Battle is the source book used by the Army for indexing the records from Southeast Asia. His references included a strong recommendation from the Archivist of the U.S. Army.

ESG had suggested after submission of the February 1985 interim1report that the locations for the days for which we had no information were available from documents not previously abstracted. These documents were the company-level morning reports. Based on our discussions with other experts in military records (including Mr. Stanton) and an analysis of over 40,000 morning reports abstracted by AOP staff, we concluded that the information on these reports could be obtained more easily from other sources and that the locations referred to in the reports could not be used without a review of other documents to determine whether a company was in the field or in a brigade or division base camp. Because of differences between AOP and ESG on the use of morning reports, Congressional staff requested that AOP and ESG meet to discuss their differences. Both groups were later told to be prepared to discuss data involving a single company from battalion #14 for the month of April 1967.

A meeting took place between ESG and AOP on November 12, 1985. We discussed the information available for battalion #14 for April 1967. ESG had reabstracted the information on the unit for presentation at this meeting. In this reabstraction, locations were found where none had been supplied to AOP by ESG from their original abstraction. In the data originally sent, AOP had location information for only 4 of 30 days, while after reabstraction, information was obtained for 27 of 30 days. It also appears that there were numerous abstraction errors in the data AOP originally received, some of which resulted in placing units almost 100 kilometers from where they actually were.

Based on the reabstraction of military records for four different months involving three different battalions mentioned above, we suspected that we were not receiving all possible information on a company's location on all days during 1967 and 1968. While we had concerns about the quality of location data being received from ESG prior to this meeting, the data presented at the meeting indicate that they may be of such poor quality that they may compromise the

scientific credibility of the study. We also believe, based on our own research and the reabstraction of data presented by ESG, that it is possible to obtain a data set of reasonably high quality if the abstraction process is changed to collect more of the available information from the military records. Moreover, we believe that unit location information of sufficient completeness, accuracy, and reproducibility to withstand the scientific scrutiny which will occur at the completion of the study is more likely to be obtained if the abstraction process is directed by AOP scientists, rather than ESG.

AOP generally would not describe a meeting in a scientific report, but we believe this information is necessary to justify our recommendation that AOP needs more direct control over the abstraction process. In this way AOP can be responsible for the validity of the exposure indices and can enlist the services of additional experts in the areas of military operations and records. These comments are not intended to minimize the contribution that ESG has made to the study through the abstraction of information on individual study participants from military personnel files, and we trust that this contribution will continue throughout the remainder of the study.

B. Recommendations for obtaining valid location information.

AOP is considering several options for obtaining valid information on the location of units in Vietnam for the period under consideration.

1. Transfer responsibility for the collection of the location data to AOP.

   We believe it would benefit the Agent Orange Study to transfer the responsibility for the collection of data on unit locations to AOP. It is our judgment based on past experience and statistical analysis that with current resources ESG cannot, on a timely basis, abstract information with sufficient accuracy and completeness to withstand scientific scrutiny the completion of the study.

   AOP would hire a contractor to abstract all the unit location data needed for the study according to uniform procedures specified by AOP. Performances standards would be written into the contract and payment would depend on the quality of service. AOP does not foresee the need to request an additional Congressional appropriation for this work. We understand that the records being used for unit locations are controlled by the National Archives and are available to the public. Therefore, we do not foresee any difficulties with continuing to gain access to military information. However, we would ask DOD to help expedite the process. We also would renew our request to DOD for short term consultative services from members of the Military History Institute and the War College. AOP would develop a data collection procedure based on knowledge already possessed and information on the design from the experts on the available military documents and the conduct of the Vietnam War.

2. Attempt to define critical information using the data available and focus reabstraction efforts to obtain this information.

   At the November 12, 1985, meeting described above the concept of critical information was raised. Critical information is defined as information available (but not contained in our present data set) that might affect the classification of exposure. We would use present information and define periods of exposure by extending the distance criterion to 25 km. All locations available for the battalion would be matched with the available herbicide data. Whenever a herbicide application occurred within 59 days and 25 kilometers of any of the noted battalion locations, we would completely reabstract the data on companies for which a location is not known.

   This approach may have some merit, but we do not yet know how much of the location data would have to be reabstracted. If this approach necessitates a substantial amount of reabstraction, it would be preferable to reabstract all of the information as outlined in option 1. AOP does not recommend this approach since everyone agrees (ESG, AOP, and others involved in recent discussions) that more location information exists in the records than is being collected presently and this new approach ignores those data. Furthermore, since this approach requires that we reabstract only a subset of the data, we are left with the inaccuracies in the remainder. If AOP adopts this approach we would increase the quality control on the data being collected and have the reabstraction done through a contractor supervised by AOP as with the first alternative. The scope of work, however, would be more limited than that described in option 1.

3. Cancel the Agent Orange Study.

   While we believe that there is sufficient justification for continuing the study and that the location of companies in Vietnam can be determined, we also believe that the study must be based on the most complete and accurate information available. AOP cannot suggest that the study be conducted with less than good quality unit location data since these data are critical to accurate exposure assessment and since so much money and effort are going into assuring that all other aspects of the study result in valid data.

SECTION IV - CONCLUSIONS

We have presented evidence that some of the units under study, which served in III Corps during 1967-1968, operated in close proximity to Agent Orange spraying missions and that, therefore, the men who served in these units were very likely to have been exposed to the herbicide. Adequate numbers of single term enlisted men from these units can be identified, using current criteria or a slight modification which will not affect the validity of the study. Our major concern is the completeness, accuracy, and reproducibility of the unit location information supplied to us by ESG. Therefore, AOP would like to discuss the assumption of direct responsibility for the collection of unit location information.

APPENDIX I. OBTAINING UNIT LOCATION INFORMATION.

We discussed the accuracy and completeness of the data supplied by ESG in Section III. In this appendix we describe documents and methods presently employed by ESG and AOP to obtain company-level location information. The methods used to abstract the data do not provide a location for every company on each day of the period of the study. Consequently, gaps exist in our knowledge of company locations for approximately 50 percent of the days. In part A of this appendix we describe data available from battalion, brigade, and division level documents. In part B we evaluate ESG's suggestion that company-level morning reports be used to fill gaps in unit location information.

A. Data available from battalion- and higher-level documents.

As reported in our previous Interim Report, the algorithm used by ESG to abstract battalion- and higher-level documents involves a hierarchical search of available military records for location information. The abstractor records all place names and map coordinates describing the locations of the units of a battalion, the dates for which these coordinates or place names are entered into the military record, the size of the unit to which the coordinates or place names are attached, and the type of document from which the information is abstracted. ESG currently is tracing the daily locations of 65 U.S. Army battalions that served in III Corps for at least 18 months during 1967 and 1968. AOP has received data for 37 of these battalions.

The map coordinates gleaned from these records are in the Universal Transverse Mercator (UTM) system which uses a two letter and six digit designation of location. The letters refer to a 100 km by 100 km grid on the map of Vietnam. The first three and the last three digits divide the east-west and north-south directions respectively into 0.1 km grids.

Each battalion maintained several types of documents describing its activities: daily journals, situation reports (SITREPS), Operational Reports-Lessons Learned (ORLLs), Combat Operation After Action Reports (COAARs), and other documents. A battalion also reported its daily activities to its brigade and division, and these larger units incorporated the battalion activities into their daily journals. The brigade and division also maintained daily journals on intelligence activities and operations, along with SITREPS, ORLLs, and COAARs.

Daily journals were required at battalion, brigade and division levels. They include the place names or map coordinates of the unit's troops, the number of wounded and killed in action, battle descriptions, locations of enemy camps, and general information. Battalion daily journals provide the most accurate location information since they describe the units activities first hand on a daily basis.

SITREPS also were required at battalion, brigade, and division levels. These situation reports are summaries of the major combat activities of the units. They contain coordinates and military acronyms with little narration. Situation reports are used when attached to the daily journals or when the journals are incomplete.

The intelligence summaries provide specific map coordinates for US, Army of the Republic of Vietnam, and Viet Cong troop movements. They are used when both the daily journals and the situation reports are incomplete. These reports sometimes were required at the battalion and brigade levels, but usually are found at the division level.

ORLLs were completed quarterly, sometimes at the battalion level but usually at the division level. They are narrative in style and describe areas of operation and specific grid coordinates. They also contain descriptions of battles and construction projects and general administrative information.

COAARs provide general information but contain few coordinates, so are seldom used. These records were required when the units were involved in major combat operations.

The higher the level of the unit responsible for the particular type of document within the military organizational structure from battalion to division, the less specific the location information found in that document. When searching for company locations, the battalion records are read first because they contain the most detailed information and are a first hand account. When information is missing from the battalion records, the brigade- and division-level records are examined. ESG uses the following inverted hierarchical sequence when reviewing the military records:

1. Battalion
   a. Daily journal
   b. Situation reports

2. Brigade
   a. Daily journal
   b. Situation reports

3. Division
   a. Daily journals for intelligence activity and for operations
   b. Situation reports

4. Other
   a. Information from other brigades
   b. Brigade and division ORLLs, COAARs, etc.

Table 1 shows the number of days for which at least one location was obtained from the abstraction process. The table presents the number of days by battalion and by company within a battalion. The table also presents the number of days for which at least one location is recorded for any line company, the number of days for which a

reference to the entire battalion is noted, and the number of days for which at least one location is known for any unit of the battalion. Unfortunately, the review of the utilized records does not provide a location for company-sized units for all 731 days during 1967 and 1968. However, we have at least some information as to the location of units within the battalions on most days.

B. Evaluation of company morning reports.

After reviewers expressed concern about the ability to obtain company-level location information, ESG stated that additional documents exist that might help place companies on a daily basis. The suggested documents were company morning reports completed daily by companies and containing information about their administrative activities. AOP has been computerizing the location information from morning reports since June 1985 and has completed abstracting over 40,000 morning reports. Unfortunately, a detailed analysis of their contents leads us to conclude that they do not offer additional useful information since they supply the location of a brigade or division base camp, and this location is determined more readily from other sources.

The morning reports contain two entries that we had hoped would establish the daily location of the company: Item 10 states the company's permanent station or location, and Item 11 states the present station or location. Figures 1 through 6 provide examples of completed morning reports.

Items 10 and 11 of the morning reports may contain three different pieces of location information in various combinations: a UTM grid coordinate, an Army Post Office (APO) number, and a place name. Figure 1 represents an example of a morning report that contains all three pieces of information: an APO—96225, a place name—Cu Chi, and a UTM coordinate—XT646162. Cu Chi was a division-level base camp northwest of Siagon and was the headquarters of the 25th Infantry Division for the entire period being studied. The coordinate listed is consistent with the known location of Cu Chi which was approximately 25 km in diameter.

When a place name occurs alone in the morning reports, we refer to a gazetteer and employ prior knowledge of the unit's location to assign a coordinate. The gazetteer provides an alphabetical listing of location names in Vietnam and their associated coordinates. Often the same name refers to several geographic locations, and an informed guess is required to determine which of multiple entries in the gazetteer should be associated with the particular place name.

When an APO number is the only information available, we use a station list to find the place name associated with it. The Army published station lists monthly containing the geographic locations of the battalions serving in Vietnam for the purpose of distributing mail. We assign coordinates to the place names on the station lists using the same procedure described above. Difficulties occur since a single APO can refer to different geographic locations depending on

the unit to which it was attached. We, therefore, must use APOs in conjunction with the station lists and then use the gazetteer in conjunction with the station lists. Due to this two-step process, we conclude that APOs provide the least reliable information available.

AOP began using the morning reports in June 1985 to create a computerized file that contains each company's location obtained from the morning report for each day during 1967 and 1968. The file contains all information available from the morning reports: APOs, place names, grid coordinates. The morning reports exist on microfilm which ESG sends to AOP in batches. AOP has found, however, that morning reports do not exist for every company for each day during 1967 and 1968, and often only an APO is given on the morning report. As stated previously, an APO by itself provides the least reliable information available concerning a company's location.

ESG suggested an algorithm to obtain information from the morning reports and to assign a daily location to each company for which a location is not available from higher level documents. The algorithm requires the derivation of a UTM coordinate based on the information in the morning report and the assignment of this coordinate to the company for those days for which other information is lacking.

Unfortunately, AOP finds that it is not always clear as to what the location information listed in the morning report refers, particularly when only an APO is available. We believe, based on our discussions with military experts and the analysis of over 40,000 morning reports, that the location refers to the point of mail distribution which was the base camp of the company's brigade or division. If this information is to be used for days when no information is presently available, it is more easily retrieved from USARV station lists.

Before assigning a location to a company, we must decide whether the company generally was located in the same area as the battalion to which it was attached or whether it was located at a brigade or division base camp, and this information is not obtainable from data presently provided by ESG. Though there were no absolute rules determining unit movements in Vietnam, a few general principles applied. Most military experts and the U. S. Army Vietnam Studies, for instance, state that the infantry battalions usually operated as units, particularly inside the war zones, and the war zones are where most Agent Orange applications occurred. Artillery units present a special problem and will be dealt with independently of decisions made regarding infantry companies. If we do assume that the companies were located close to their battalions then location information is available for most days. If we assume the companies were located in a brigade or division base camp then the location listed on the morning reports may be correct but, again, this location is obtained more easily from other sources.

The term "base camp" had a particular meaning in Vietnam. It referred to an installation containing the headquarters for a unit above the battalion level, either at the brigade or division level (Major General David Ewing Ott: Vietnam Studies: Field Artillery 1954-1973,

pg. 73, published by the Department of the Army, 1975). Division base camps were large semi-permanent installations such as that constructed at Cu Chi mentioned above. Generally, one of the three brigades of the division was dedicated to the support and defense of the base camp with the brigade commander being appointed as the base commander (Lieutenant General John H. Hay Jr.: Vietnam Studies: Tactical and Materiel Innovations, pp 148-61, published by the Department of the Army, 1974).

Battalions and companies usually operated from fire support bases while in the field. Fire support bases were smaller, temporary installations that usually contained an infantry battalion's headquarters and an artillery battery for direct support of the battalion. The area of operations for the battalion was around the fire base but within the effective firing range of its artillery support. The effective firing range of the 105 mm Howitzer (the cannon most often used in a direct support role) was about 11 km. Typically, the three brigades composing a division rotated through the division headquarters, and the three battalions composing a brigade rotated through the brigade headquarters. Therefore we are presented with four combat companies A-D in a battalion, three battalions in a brigade, and three brigades in a division. At any point in time there were 12 companies at the division base camp, 8 companies at the two brigade base camps and 16 companies operating out of the four battalion fire bases. These different locations were not necessarily in close proximity to one another; and though we now believe that the locations in the morning reports refer to either the brigade of division base camps, without further documents, we cannot determine which.

Table 8 summarizes some of the data on infantry companies collected from morning reports by AOP thus far. In this table, we classify the days for which information is available so that they fall into one category based on the reliability of the information. If a morning report contains a UTM coordinate, it is placed in that category of most reliable information no matter how much additional information is available. A day is placed in the APO category only when this piece of information occurs alone in the morning report. The number of unique coordinates and place names found in the reports occurs within parentheses in the table. For example, the morning reports from battalion #22 contain coordinates for most of the days for which reports were available. But, with the exception of one day, the same coordinate was found in all of the morning reports of each company and it was the same coordinate for all of the companies, indicating that this coordinate referred to the brigade or division base camp.

Table 8

Number of Morning Reports Abstracted by Type of Information Available - Infantry Battalions.

		REPORT				NO REPORT
Battalion	Company	Grid Coord	Place Name	APO	None	
1	A	172 (1)	0	482	0	77
	B	177 (1)	0	457	0	97
	C	178 (2)	0	438	0	115
	D	0	0	370	0	361
	E	0	0	156	0	575
	H	173 (1)	0	453	0	105
2	A	146 (1)	0	464	0	121
	B	172 (1)	0	276	2	281
	C	181 (1)	0	159	0	391
	H	167 (1)	0	176	0	388
3	A	0	0	652	0	79
	B	0	0	612	0	119
	C	0	0	644	0	87
	D	0	0	313	0	418
	E	0	0	504	0	227
	H	0	0	656	0	75
4	A	700 (6)	0	0	1	30
	B	709 (4)	0	0	0	22
	C	717 (4)	0	0	0	14
	D	128 (5)	0	0	0	603
	H	709 (7)	0	0	0	22
12	A	323 (2)	0	0	0	408
	B	329 (2)	0	0	0	402
	C	320 (2)	0	0	0	411
	D	123 (2)	0	0	0	608
	E	15 (2)	0	0	0	716
	H	357 (2)	0	0	0	374
13	A	0	340 (1)	0	0	391
	B	128 (1)	396 (2)	0	0	207
	C	63 (1)	493 (3)	79	0	96
	D	106 (1)	274 (3)	1	0	350
	E	47 (1)	82 (2)	0	0	602
	H	133 (1)	560 (3)	0	0	38

This information available on the Morning Reports is classified:
Grid Coord - if a grid coordinate is present.
Place Name - If a place name but no grid coordinate is present.
APO - If only an APO is present.
None - If the Morning report contains no location information.
No Report - If no Morning Report could be found.

Parenthetical number is the number of unique grid coordinates.

Table 8 (continued)

Number of Morning Reports Abstracted by Type of Information Available - Infantry Battalions.

		REPORT				NO REPORT
Battalion	Company	Grid Coord	Place Name	APO	None	
14	A	0	0	351	0	380
	B	0	0	350	0	381
	C	0	0	348	0	383
	E	0	0	322	0	409
	H	0	0	337	0	394
21	A	680 (2)	0	0	0	51
	B	661 (2)	0	0	0	70
	C	698 (2)	0	0	0	33
	D	476 (2)	0	0	0	255
	E	123 (2)	7 (1)	0	0	601
	H	693 (2)	1	0	0	37
22	A	651 (2)	0	0	0	80
	B	658 (1)	0	0	0	73
	C	663 (1)	0	0	0	68
	D	396 (1)	0	3	0	332
	E	254 (1)	0	0	0	477
	H	682 (1)	0	0	8	41
23	A	0	140 (1)	465	0	126
	B	0	0	664	0	67
	C	0	35 (1)	549	0	147
	D	0	0	381	0	350
	E	0	0	224	0	507
	H	0	137 (1)	184	0	410
24	A	0	0	616	0	115
	B	15 (1)	0	555	1	160
	C	0	0	516	0	215
	D	0	0	318	0	413
	E	0	0	231	0	500
	H	0	0	491	0	240
31	A	0	336 (1)	0	0	395
	B	0	281 (1)	0	0	450
	C	0	263 (1)	0	0	468
	D	0	113 (1)	0	0	618
	H	0	333 (2)	0	0	398

This information available on the Morning Reports is classified:
Grid Coord - if a grid coordinate is present.
Place Name - If a place name but no grid coordinate is present.
APO - If only an APO is present.
None - If the Morning report contains no location information.
No Report - If no Morning Report could be found.

Parenthetical number is the number of unique grid coordinates.

Table 8 (continued)

Number of Morning Reports Abstracted by Type of Information Available - Infantry Battalions.

		REPORT				NO REPORT
Battalion	Company	Grid Coord	Place Name	APO	None	
34	A	163	0	151	0	417
	B	170	0	115	0	446
	C	140	0	140	0	451
	D	0	0	100	0	631
	E	0	0	34	0	697
	H	163	0	184	0	384
44	A	349	0	0	0	382
	B	308	0	0	0	423
	C	176	0	166	0	389
	D	0	0	107	0	624
	E	0	0	34	0	697
	H	58	0	0	0	673
49	A	181	0	484	0	66
	B	179	0	456	0	96
	C	175	0	501	0	55
	D	0	0	404	0	327
	E	3	0	234	1	493
	H	180	0	500	0	51
Totals	85 Cos.	15,168	3,791	17,410	13	25,753
Percentage of Available Reports		42	10	48	-	

This information available on the Morning Reports is classified:
Grid Coord - if a grid coordinate is present.
Place Name - If a place name but no grid coordinate is present.
APO - If only an APO is present.
None - If the Morning report contains no location information.
No Report - If no Morning Report could be found.

Parenthetical number is the number of unique grid coordinates.

One major problem with obtaining locations from morning reports is that we have been unable to locate these reports for 40 percent of the days being studied. When the reports are available, only an APO number occurs 48 percent of the time. Even when coordinates are listed the coordinates often occur again and again for the entire time period which indicates that the coordinates refer to a fixed location such as that of a division base camp and not the actual location of the company.

Statistical analysis of the morning report algorithm.

AOP conducted two analyses to examine the accuracy of the morning reports in determining company locations. First, we compared the distances from the locations noted in the morning reports to the known company locations obtained from the abstraction of higher-level documents for days when both locations are known. Table 9 presents the averages of these distances. The table also presents the 25th percentile, the median, the 75th percentile, and the 90th percentile. The average distance between the two locations for A company 1st battalion, 2nd infantry (battalion number 1 on the AOP master list of combat battalions) was 35 km. Twenty-five percent of the distances were 14 km or less, 50 percent were 38 km or less, 75 percent were 47 km or less, and 90 percent were 81 km or less. ESG, other military experts, and the Army Vietnam Studies state that infantry companies usually worked in the area of fire support bases. If the locations obtained from morning reports represent these locations, they should, on average, be reasonably close to the field locations noted for the companies in other documents. This analysis, however, indicates that the locations obtained from the morning reports are not truly representative of the physical location of the company.

Our second analysis compared the distances from the locations given in the morning reports to the known locations of the infantry battalions when no locations were abstracted for Companies A-E. ESG, other military experts and the Army Vietnam Studies state that infantry battalions usually operated as a unit. If this is the case, we would expect the distance from the morning report locations to the known battalion locations to be small. Table 10 presents the distribution of the distances between these two locations for infantry battalions. There is much more agreement between these two locations than between the morning report locations and those company locations found in higher-level documents, but the distances are still quite large for at least 25 percent of the time.

We conclude that the morning report locations refer to the point of mail distribution, that is to division or brigade base camps, and not to the actual location of the infantry companies. We also conclude that if the information on morning reports is to be used, it can be obtained with much less effort from the USARV Station Lists and that this information can only be used when supported by other documents.

Table 9
Distribution of Distance from Morning Report Locations to Centroid Locations of Those Obtained from Other Documents.

Battalion	CO	N*	Mean	SD	25%	50%	75%	90%
1	A	62	35	25	14	38	47	81
	B	65	41	24	17	42	48	89
	C	58	35	26	12	38	47	88
2	A	112	20	21	3	14	29	62
	B	127	20	20	6	13	25	65
	C	125	18	19	5	11	23	62
4	A	563	13	18	0	8	20	24
	B	577	12	16	0	8	19	24
	C	553	10	12	0	10	17	23
	D	71	1	3	0	0	0	1
5	A	78	22	26	5	7	46	68
	B	10	24	2	24	24	24	24
7	A	86	8	15	0	0	8	37
	D	76	7	15	0	0	4	29
8	A	2	7	6	4	7	11	11
	B	84	105	12	100	100	100	126
10	A	267	13	14	3	7	19	36
	B	289	13	12	5	10	19	29
	C	127	23	10	18	21	25	34
	D	418	14	13	5	11	19	32
12	A	227	20	11	11	22	26	37
	B	238	20	11	11	20	24	41
	C	229	19	10	11	18	22	36
	D	93	15	13	7	11	19	42
13	B	106	42	27	24	51	54	73
	C	57	34	30	4	39	53	68
	D	73	48	24	39	52	54	74
16	A	210	25	20	13	17	34	53
	B	204	25	28	10	18	20	80
	C	228	19	17	8	19	24	24
20	A	67	35	27	11	26	62	76
	C	76	27	19	8	23	45	55
	D	12	23	16	13	19	25	59
21	A	446	37	27	13	30	63	73
	B	431	34	26	12	23	55	70
	C	431	38	28	12	40	61	81
	D	315	48	27	19	55	68	82

Table 9 (continued)
Distribution of Distance from Morning Report Locations to Centroid Locations of Those Obtained from Other Documents.

Battalion	CO	N*	Mean	SD	25%	50%	75%	90%
22	A	321	34	26	18	25	36	83
	B	308	34	26	17	25	33	82
	C	336	32	27	13	24	33	83
	D	174	25	17	12	25	29	38
24	B	11	31	22	7	36	40	71
26	A	43	32	30	9	24	48	82
	B	36	18	17	7	14	21	60
	C	43	11	14	1	4	19	31
	D	33	20	25	0	10	33	76
34	A	105	57	29	37	49	85	89
	B	120	36	19	24	39	46	54
	C	100	34	21	17	34	48	54
44	C	152	22	21	3	17	34	66
49	A	106	23	25	3	10	49	61
	B	100	25	25	3	15	50	70
	C	108	30	27	4	19	60	74

*Number of days on which both types of information is available.

Table 10

Distribution of distance between base camp location in Morning Report and centroid computed from field locations from entire battalion

Battn	#Pts	Mean	Std	25%	50%	75%	90%
1	79	14.0	20.3	1.2	1.3	37.6	43.9
2	22	10.5	11.7	0.8	2.5	23.8	23.9
4	146	20.8	20.8	6.8	18.9	23.2	61.3
12	42	11.2	13.0	0.8	2.6	23.9	31.5
21	151	29.9	24.5	7.4	34.9	47.2	67.1
22	128	20.7	26.9	0.2	10.2	24.6	83.5
24	2	7.0	8.8	0.8	7.0	13.2	13.2
34	53	28.7	16.5	18.6	25.7	31.7	48.9
44	24	23.3	15.7	1.3	31.4	31.4	40.8
49	70	19.3	28.3	1.0	1.5	24.3	60.2

NOTE: Comparisons are on days when no locations are reported for Companies A-D.

EVERYTHING: APO: 96225

LOCATION: CU CHI

COORDINATE: XT 646 162

1 Jul 68 | WALIF-AO | A | Btry A | 3d Bn 13th Arty | 1(30Jun68) | PP

25th Inf Div | USARPAC | APO SF 96225 | Cu Chi Vietnam XT646162 | 1 | 1

STRENGTH SECTION

IDENTITY	ACCOUNTABLE: PREVIOUS DAY'S STRENGTH	GAINS	LOSSES	TODAY'S STRENGTH	OPERATING: PRESENT	TDY	LEAVE	POW	SORRY CHF	AWOL	MISSING	TOTAL	INTRANSIT: INCOMING	OUTGOING	TOTAL	ATTACHED: PRESENT	ABSENT	TOTAL
COMMISSIONED	3			3	3							3				1		1
WARRANT																		
ENLISTED	99	1		100	98	1	1					100						

14 GR DISTRIBUTION	CPT	1LT	2LT	TOTAL	WO	E9	E8	E7	E6	E5	E4	E3	E2	E1	TOTAL	ENL	E9	E8	E7	E6	E5	E4	E3	E2	E1	TOTAL
a. OPERATING	1	2		3														2	7	15	33	43				100
b. INTRANSIT																										

CHANGES SECTION

STRENGTH NAME LINE: NAME	SERVICE NUMBER	GRADE	ACTION	STATUS	OPERATIONAL DATA: PARA	SUB	AUTHORIZATION: ISSUED BY	EFF DATE
[redacted]	[redacted]	SP4	REC'D TEMPORARY GAINS RFAA Fr HQ HHB Btry 3d Bn 13th Arty	Pres	38	180	HQ 25th Inf Div APO 96225 PMOS 13A10	29Jun68

AUTHENTICATION SECTION: [redacted] Adjutant | GRADE AND BRANCH: CPT ARTY | SIGNATURE: [redacted]

DA FORM 1 MORNING REPORT (AR 335-40) DA COPY THRU DPA 1

Figure 1

LOCATION INFORMATION ONLY: CHU LAI, VIETNAM

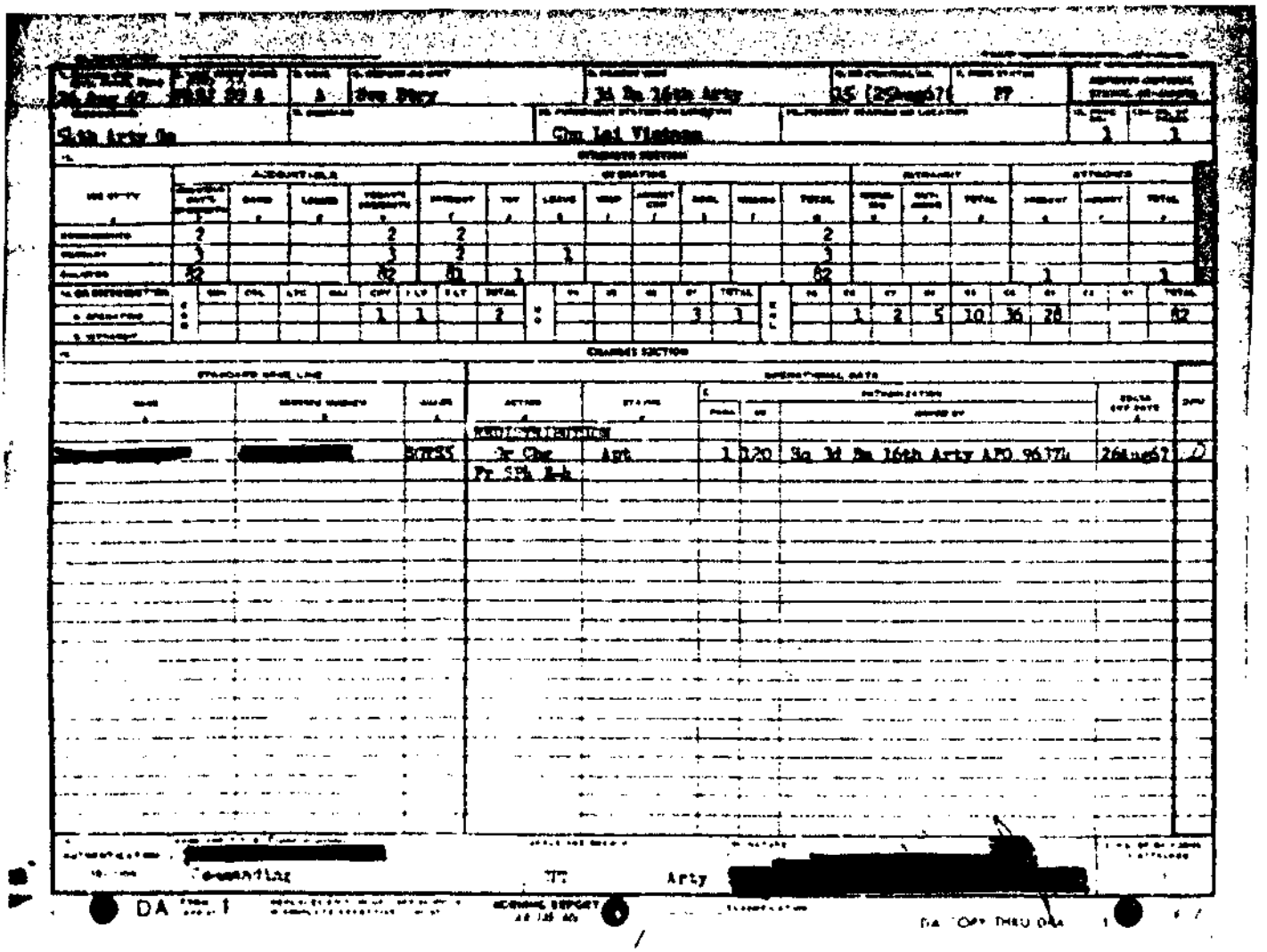

Figure 2

APO INFORMATION ONLY: 96345

11 July 67 | Co C | 1st Bn 2nd Inf | 11(10Jul67) | P P

1st Inf Div | USARPAC | APO SF Calif 96345

STRENGTH SECTION

IDENTITY	PREVIOUS DAY'S STRENGTH	GAINS	LOSSES	TODAY'S STRENGTH	PRESENT	TDY	LEAVE	HOSP	ARREST CHP	AWOL	MISSING	TOTAL	NON-RES	OUT-COMM	TOTAL	PRESENT	ABSENT	TOTAL
COMMISSIONED	3			3	3							3				2		2
WARRANT																		
ENLISTED	183			183	178	4			1			183				9		9

	GEN	COL	LTC	MAJ	CPT	1 LT	2 LT	TOTAL	WO	W4	W3	W2	W1	TOTAL	E9	E8	E7	E6	E5	E4	E3	E2	E1	TOTAL
a. OPERATING						3		3								1	3	6	14	58	97	3	1	183
b. INTRANSIT																								

CHANGES SECTION

STANDARD NAME LINE: NAME	SERVICE NUMBER	GRADE	ACTION	STATUS	OPERATIONAL DATA: AUTHORIZATION: PARA	NO	ISSUED BY	EFF DATE	DPW
[redacted]	[redacted]	PFC3	REDISTRIBUTION						
			Rtn	Pres					
			Fr TDY (R&R) Hong Kong HCC 1XX1 hrs for 9 days						
[redacted]	[redacted]	JET-5	ATTACHED PERSONNEL						
			RPAT	Dprt					
			To USARV Rtna APO 96307						

AUTHENTICATION SECTION: [redacted] Adjutant | GT (NY) | [redacted]

DA FORM 1 | DA COPY THRU DPA 1

Figure 3

GRID COORDINATE ONLY: XT 645 143

21 Jul 68 | M-ALT-TO | A | Hq Hq & SVC BTRY | 3d Bn 13th Artly | [redacted] | PP

25th Inf Div | USARPAC | APO SF | 48P XT 645143 KVN | 1 | 1

STRENGTH SECTION

| | | |

TWO ITEMS: APO: 96225

COORDINATE: XT 743 993

21 Mar 62 | Y-ALT-AO | A | Btry 1 | 3d Bn 13th Arty | 15(19Mar62) | PP

25th Inf Div | USARV | APO 96225 | XT743993 RVN | 1 | 1

IDENTITY	ACCOUNTABLE: BEGINNING STRENGTH	GAINS	LOSSES	TODAY'S STRENGTH	OPERATING: PRESENT	TDY	LEAVE	HOSP	ABSENT GAP	AWOL	MISSING	TOTAL	INTRANSIT: INCOMING	OUT-GOING	TOTAL	ATTACHED: PRESENT	ABSENT	TOTAL
COMMISSIONED	3			3	3							3						
WARRANT																		
ENLISTED	93	2		95	93	2						95				1		1

14. DA DISTRIBUTION	CO	GAO	COA	STC	MAJ	CPT	1LT	2LT	TOTAL	WO	DA	DS	DO	DI	TOTAL	TRL	DO	DO	DT	DA	DO	DO	DO	DO	DI	TOTAL
a. OPERATING						1	2		3										1	7	14	41	29	1		95
b. INTRANSIT																										

15. CHANGES SECTION

STANDARD NAME LINE: NAME	SERVICE NUMBER	GRADE	ACTION	STATUS	OPERATIONAL DATA: AUTHORIZATION: PARA	DO	ISSUED BY	EFF DATE	DPU
			REASSIGNMENT GAINS						
[redacted]	[redacted]	FC3	Rep	Trea	54	76	HQ 25th Inf Div APO 96225	21Mar62	
			Fr USARV Trans Det APO 96307				MCS 13A10		
[redacted]	[redacted]	FC3	Rep	Trea	54	76	HQ 25th Inf Div APO 96225	21Mar62	
			Fr USARV Trans Det APO 96307				PHOC 13A10		
			ATTACHED PERSONNEL						
[redacted]	[redacted]	FC3	RFAT	Trea					
[redacted]	[redacted]	FC3	RFAT	Trea					
			RECORD OF UNIT ATTACKS/WARNING						
			21 Mar 62 Du Ch Base Camp received unknown number of mortar and rocket rounds						

STAT
BR

16. AUTHENTICATION SECTION: [redacted] Executive Officer | GRADE AND BRANCH: 1LT RTY | SIGNATURE: [redacted]

DA FORM 1 | MORNING REPORT (AR 220-60) | DA COPY THRU DPA 1

Figure 5

TWO ITEMS: APO: 96225

LOCATION: TAY NINH

[illegible]	[illegible]	A	B Btry	7th Bn 11th Arty	27 ([illegible])	PP	
25th Inf Div		USARV		APO 96225	Tay Ninh	1	1

STRENGTH SECTION

IDENTITY	ACCOUNTABLE				OPERATING								INTRANSIT			ATTACHED		
	PREVIOUS DAYS STRENGTH	GAINS	LOSSES	TODAY'S STRENGTH	PRESENT	TDY	LEAVE	HOSP	ABSENT OTH	AWOL	MISSING	TOTAL	INCOMING	OUTGOING	TOTAL	PRESENT	ABSENT	TOTAL
COMMISSIONED	8			8	8							8						
WARRANT																		
ENLISTED	92			92	86	3	2					91	1		1			

10. DISTRIBUTION	CMD	MAN	OFFL	LTC	MAJ	CPT	1LT	2LT	TOTAL	WO	W4	W3	W2	W1	TOTAL	ENL	E9	E8	E7	E6	E5	E4	E3	E2	E1	TOTAL
a. OPERATING						1	6	1	8									1	1	7	7	24	16	3	2	91
b. INTRANSIT																							1			1

11. CHANGES SECTION

STANDARD NAME LINE			OPERATIONAL DATA						
NAME	SERVICE NUMBER	GRADE	ACTION	STATUS	AUTHENTICATION PARA	AUTHENTICATION	AUTHENTICATION ORDER BY	EFFECTIVE DATE	DPTY
			REDISTRIBUTION						
[redacted]	[redacted]	SP4E4	Rtn	Pres					
			fr TDY 1000 hrs fr Bangkok for 9 days R&R						
[redacted]	[redacted]	SP4E4	Rtn	Pres					
			fr TDY 1001 hrs fr Bangkok for 9 days R&R						
[redacted]	[redacted]	PFC3	Arr	Pres					
			fr intrbn fr USARV trans Det						

12. AUTHENTICATION SECTION: [redacted] Assistant Adjutant — GRADE AND BRANCH: DA — SIGNATURE: [redacted] — 13. NO. OF CONTINUATION SHEETS ATTACHED

DA FORM 1 — REPLACES EDITION OF 1 SEP 60 WHICH IS OBSOLETE EFFECTIVE 1 JUL 61 — MORNING REPORT (AR 335-60) — DA COPY THRU DPA

Figure 6

EXPRESS MAIL POST OFFICE TO ADDRESSEE

ORIGIN

Hour of Processing Clerk

P.O. ZIP Code 30021

Date 11/8/85 Time 16:40

Return Receipt Service

To Whom & Date Del.

To Whom, Date & Address of Del.

Weight Lbs. Postage & Fees $10.05

B 39 6931

DESTINATION

Date Delivered

Time Delivered

Delivered by

Signature

DELIVERY WAS ATTEMPTED

Date Time

Reason

EXPRESS MAIL SERVICE

LABEL 11B JAN/82 ★ U.S.G.P.O. 1981-357-478