FOR FURTHER TRAN

PESTICIDE MONITORING REPORT NO. 44-0143-78
DEPARTMENT OF THE ARMY PESTICIDE MONITORING PROGRAM CONTRAST
OF A 12-INSTALLATION SUBSET OF THE
1975 DA PESTICIDE MONITORING PROGRAM DATA TO THE 34-INSTALLATION DATA

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SERVING THE ARMY IN ITS HEALTH AND ENVIRONMENT PROGRAM

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ABERDEEN PROVING GROUND, MD 21010

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 44-0143-78	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Pesticide Monitoring Rpt No. 44-0143-78, DA Pesticide Monitoring Program Contrast of a 12-installation Subset of the 34-Installation Data		5. TYPE OF REPORT & PERIOD COVERED January 1975-December 1975
		6. PERFORMING ORG. REPORT NUMBER 44-0143-78
7. AUTHOR(s) Kenneth L. Olds J. Howard Vinopal, Ph.D.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Environmental Hygiene Agency Aberdeen Proving Ground, MD 21010		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Commander USA Health Services Command Fort Sam Houston, TX 78234		12. REPORT DATE
		13. NUMBER OF PAGES 24
14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Pesticides	Sediment	Residues
Monitoring	Fish	Statistical Analysis
Environment	Birds	Soil

20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A 12-installation subset of the 34-installation 1975 DAPMP was evaluated to determine whether or not this 12-installation subset reflects the patterns observed from the 34 installations. The following findings were common in both the 12- and 34-installation data sets: differences in soil stratifications and the differences between top and bottom feeding fish. The differences in sediment stratifications observed in the 34-installation set were not confirmed in the 12-installation subsets. Interactions observed between fish and sediment were observed in both data sets and the transformed soil and sediment data sets.

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DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND. MARYLAND 21010

Mr. Olds/bb/584-3613

HSE-RP/WP

9 JUN 1978

SUBJECT: Pesticide Monitoring Report No. 44-0143-78, Department of the Army
Pesticide Monitoring Program (DAPMP) *Contrast of a 12-Installation*
Subset of the 1975 DAPMP Data to the 34-Installation Data

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A summary of the pertinent findings and recommendations of the inclosed
report follows.

    a. <u>Findings</u>. A 12-installation subset of the 34-installation 1975 DAPMP
was evaluated to determine whether or not this 12-installation subset
reflects the patterns observed from the 34 installations. The following
findings were common in both the 12- and 34-installation data set:
differences in soil stratification and the differences between top and bottom
feeding fish. The differences in sediment stratifications observed in the
34-installation set were not confirmed in the 12-installation subsets.
Interactions observed between fish and sediment were observed in both data
sets and the transformed soil and sediment data sets.

    b. <u>Recommendations</u>. Recommendations are made to expand the DAPMP to 16
installations to provide a less conservative and statistically more sensitive
data base.

FOR THE COMMANDER:

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PESTICIDE MONITORING REPORT NO. 44-0143-78
DEPARTMENT OF THE ARMY PESTICIDE MONITORING PROGRAM CONTRAST
OF A 12-INSTALLATION SUBSET OF THE
1975 DA PESTICIDE MONITORING PROGRAM DATA TO THE 34-INSTALLATION DATA.

1. AUTHORITY. (9) Rept. for Jan-Dec 75.

a. AR 40-5, Health and Environment, 25 September 1974.

b. AR 200-1, Environmental Protection and Enhancement, 20 January 1978.

c. Public Law 92-516, Federal Environmental Pesticide Control Act of 1972, 21 October 1972, as amended by Public Law 94-140, 28 November 1975.

2. REFERENCES.

a. USAEHA, Pesticide Monitoring Annual Report No. 44-0100-78, Department of the Army Pesticide Program Evaluation of Environmental Samples Collected in Calendar Year 1975, March 1978.

b. USAEHA, Pesticide Monitoring Special Study No. 44-0100-77, Department of the Army Pesticide Monitoring Program, Interim Evaluation of Soil and Sediment Samples Collected in CY 1975 from Fourteen Installations, January - December 1976, National Technical Information Service, ADA 036 998, 1977, 13 pages.

c. USAEHA, Entomological Special Study No. 44-004-74/75, Revised Department of the Army Pesticide Monitoring Program, National Technical Information Service, ADA 004 030, 1975, 38 pages.

3. PURPOSE. To evaluate a 12-installation subset of CY 1975 Department of the Army Pesticide Monitoring Program (DAPMP) data to determine whether or not this subset reflects the patterns observed from the complete 34-installation data set.

4. BACKGROUND.

a. Owing to manpower and physical constraints, the CY 1976 collection guidelines (reference 2c) were modified to include the collection of 12 installations on an annual basis and 11 installations on an alternate year basis for a total of 23 installations each year. This would allow complete monitoring of the 34 installations every 2 years. These same manpower and physical constraints allowed the processing and analysis of only 16 of these 23 installations in CY 1976 and necessitated a further reduction to only 12 installations to comprise the DAPMP for CY 1977. These 12 instal-lations were chosen prior to any statistical evaluation of the data from the 34 installations and were based upon geographical distribution and the availability of field entomologists to assist in sample collection. One

of the 34 installations from which samples were requested in CY 1975 did not submit samples. This installation was also selected as one of the 12 installations to comprise the revised DAPMP. There are, in fact, only 11 and 33 installations being compared.

b. The 12 installations selected are listed in the Appendix.

c. The statistical procedures used in this report are the same as those used in the 34-installation report, reference 2a.

5. RESULTS AND DISCUSSION. The pesticides analyzed for, the limits of detectability, and the analytical methodology used are the same as those in reference 2a. Based upon the lack of significance shown in the 34-installation data for the rain and runoff soil erosivity factor of the universal soil loss equation,* this parameter is not used for comparative purposes in this report.

a. <u>Soil</u>. Table 1 shows a comparison of all soil samples from the 12 installations versus the 34 installations. The soil samples are divided into three soil groups based upon functions of land use.

(1) Soil Group I is comprised of land use areas where pesticides are stored, mixed, disposed of; sewage treatment areas; and sanitary landfill areas.

(2) Soil Group II is comprised of residential areas, cantonment areas, golf courses, and other recreational areas.

(3) Soil Group III is comprised of out-leased lands and range and training areas.

(4) Comparisons of the 12 installations to the 34 installations based upon the three soil groups are presented in Table 2.

(5) The golf course subset of Soil Group II is contrasted to the overall Group II soils for the 12 and 34 installations in Table 3. The golf course subset is contrasted to Soil Group II minus the golf course data for the 12 and 34 installations in Table 4.

(6) Data based on the various soil site stratifications in reference 2c, are available for comparison between the 12 installations and the 34 installations. The mean pesticide residue concentrations for these sites are compared in Table 5.

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* US Department of Agriculture, Control of Water Pollution from Croplands, US Department of Agriculture, ARS, 1975.

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TABLE 1. PESTICIDE RESIDUES (PPM) DETECTED IN SOIL SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

	Consolidated Data			
Number of Samples	241		697	
	12 Installations		34 Installations*	
Pesticide	*	Max	*	Max
p,p'-DDT	2.40	360.91	39.3	239.54
o,p'-DDT	0.46	75.26	2.39	842.4
p,p'-DDE	0.34	22.43	0.78	206.
o,p'-DDE	<0.01	0.06	0.02	8.96
p,p'-DDD	0.05	6.47	1.18	326.2
o,p'-DDD	0.01	1.75	0.18	40.
oxychlordane	<0.01	0.10	<0.01	0.10
chlordane	7.59	683.70	15.99	4979.
trans-chlordane	0.01	0.45	0.01	0.45
cis-chlordane	0.01	1.36	0.01	1.41
heptachlor epoxide	0.01	1.64	0.01	1.64
heptachlor	<0.01	0.08	<0.01	0.25
dieldrin	0.08	6.17	0.42	107.
aldrin	nd		0.05	34.4
endrin	<0.01	0.18	0.01	2.95
lindane	<0.01	0.02	<0.01	0.37
methoxychlor	nd		0.15	89.9
toxaphene	nd		0.03	21.5
mirex	nd		<0.01	0.05
parathion	nd		<0.01	0.09
malathion	<0.01	0.56	0.01	0.73
diazinon	<0.01	0.25	0.02	9.72
chlorpyrifos	<0.01	0.15	0.07	15.01
No. of Compounds	18		25	

* BHC at .02 ppm and BHC at .06 ppm maximum concentrations were also detected.
nd - not detected

TABLE 2. PESTICIDE RESIDUES (PPM) DETECTED IN SOIL SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

Number of Samples	Group I				Group II				Group III			
	37		107		129		385		75		205	
	12 Installations		34 Installations		12 Installations		34 Installations*		12 Installations		34 Installations	
Pesticide	X	Max	X	Max	X	Max	X	Max	X	Max	X	Max
p,p'-DDT	14.56	360.91	253.	239.54	0.31	15.62	0.57	45.60	0.02	0.23	0.08	4.57
o,p'-DDT	2.74	75.26	15.1	842.4	0.07	5.32	0.10	7.84	<0.01	0.04	0.01	1.21
p,p'-DDE	1.67	22.43	4.07	206.	0.14	3.09	0.27	8.51	<0.01	0.16	0.04	1.45
o,p'-DDE	nd		0.09	8.96	<0.01	0.06	<0.01	0.23	nd		nd	
p,p'-DDD	0.29	6.47	7.6	326.2	0.02	1.02	0.04	2.07	<0.01	0.02	<0.01	0.25
o,p'-DDD	0.07	1.75	1.1	40.	<0.01	0.33	0.02	1.24	nd		<0.01	0.13
oxychlordane	nd		<0.01	0.06	<0.01	0.10	<0.01	0.10	nd		<0.01	0.03
chlordane	48.48	683.70	101.	4979.	0.27	7.84	0.81	49.12	nd		0.01	1.07
trans-chlordane	<0.01	0.02	0.01	0.42	0.01	0.45	<0.01	0.45	nd		<0.01	0.02
cis-chlordane	nd		0.02	1.41	0.02	1.36	0.01	1.36	nd		<0.01	0.10
heptachlor epoxide	nd		0.01	0.67	0.02	1.64	0.02	1.64	nd		<0.01	0.22
heptachlor	nd		<0.01	0.02	<0.01	0.08	<0.01	0.25	nd		<0.01	<0.01
dieldrin	0.29	6.17	1.96	107.	0.06	3.14	0.22	19.63	nd		<0.01	0.06
aldrin	nd		0.33	34.4	nd		<0.01	0.89	nd		nd	
endrin	nd		0.04	2.95	nd		<0.01	0.13	nd		nd	
lindane	<0.01	0.18	<0.01	0.37	<0.01	0.02	<0.01	0.02	nd		nd	
methoxychlor	<0.01	0.01	0.91	89.9	nd		0.03	4.65	nd		nd	
toxaphene	nd		0.20	21.5	nd		<0.01	1.56	nd		nd	
mirex	nd		nd		nd		<0.01	0.05	nd		nd	
parathion	nd		nd		nd		nd		nd		nd	
malathion	0.03	0.56	0.04	0.73	nd		nd		nd		<0.01	0.09
diazinon	0.01	0.25	0.13	9.72	nd		nd		nd		nd	
chlorpyrifos	0.01	0.15	0.43	15.01	nd		nd	nd	nd		nd	
No. of Compounds	13.		21.		14.		21.		4.		13.	

* αBHC at .02 ppm and βBHC at .06 ppm maximum concentrations were also detected.
nd - not detected

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TABLE 3. PESTICIDE RESIDUE DATA (PPM) FOR SOIL GROUP II CONTRASTED WITH SOILS FROM THE GOLF COURSE SUBSET OF THIS GROUP FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

	Group II				Golf Courses			
	12 Installations		34 Installations		12 Installations		34 Installations	
Number of Samples	129		385		30		88	
Pesticides	*	Max	*	Max	*	Max	*	Max
p,p'-DDT	0.31	15.62	0.57	45.6	0.66	15.62	0.41	15.62
o,p'-DDT	0.07	5.32	0.10	7.84	0.20	5.32	0.10	5.32
p,p'-DDE	0.14	3.09	0.27	8.51	0.25	3.09	0.25	8.51
o,p'-DDE	<0.01	0.06	<0.01	0.23	<0.01	0.03	<0.01	0.03
p,p'-DDD	0.02	1.02	0.04	2.07	0.02	0.19	0.02	0.56
o,p'-DDD	<0.01	0.33	0.01	1.24	<0.01	0.03	0.01	0.50
oxychlordane	<0.01	0.10	<0.01	0.10	nd		<0.01	0.02
chlordane	0.27	7.84	0.81	49.12	0.73	7.84	2.40	49.12
trans-chlordane	0.01	0.45	0.01	0.45	0.04	0.45	0.02	0.45
cis-chlordane	0.02	1.36	0.01	1.36	0.02	0.73	0.01	0.73
heptachlor epoxide	0.02	1.64	0.02	1.64	0.01	0.29	0.03	0.84
heptachlor	<0.01	0.08	<0.01	0.25	nd		nd	
dieldrin	0.06	3.14	0.22	19.63	0.21	3.14	0.12	3.14
aldrin	nd		<0.01	0.89	nd		nd	
endrin	nd		<0.01	0.13	nd		nd	
lindane	<0.01	0.02	<0.01	0.02	nd		nd	
methoxychlor	nd		0.03	4.65	nd		nd	
toxaphene	nd		<0.01	1.56	nd		nd	
mirex	nd		<0.01	0.05	nd		nd	
parathion	nd		nd		nd		nd	
malathion	nd		nd		nd		nd	
diazinon	nd		nd		nd		nd	
chlorpyrifos	nd		nd		nd		nd	
Number of Compounds	14		21		11		12	

* αBHC at .02 ppm and βBHC at .06 ppm maximum concentrations were also detected.
nd - not detected

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TABLE 4. MEAN PESTICIDE RESIDUES (PPM) FOR GOLF COURSES AND SOIL GROUP II
MINUS THE GOLF COURSES FOR 12 INSTALLATIONS AND 34 INSTALLATIONS
(UNTRANSFORMED DATA)

	Soil Group II			Minus Golf Courses		
	$\bar{x}$	Max	No. of Samples	$\bar{x}$	Max	No. of Samples
12 Installations	0.55	7.85	99	0.73	2.14	30
		p,p'-DDT*			chlordane*	
34 Installations	1.74	57.73	305	3.31	49.12	88
		p,p'-DDT*			chlordane*	

* Predominate pesticide.

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TABLE 5. MEAN PESTICIDE RESIDUES (PPM) IN SOIL SITES COLLECTED IN CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

Site	12 Installations			34 Installations		
	No. Samples	X̄	Max	No. Samples	X̄	Max
400 Pesticide Disposal	2	1.19	2.02	2	1.19	2.02
401 Sewage Treatment	9	6.38	47.91	25	6.94	47.91
402 Sanitary Landfill	11	0.08	1.12	31	0.11	1.12
403 Pesticide Storage	10	209.64	808.79	27	1311.54	25332.75
404 Pesticide Shop	5	72.80	171.99	19	198.86	1448.29
405 Combined Shop/Storage	0			3	685.68	1097.86
410 Residential	33	0.20	1.42	99	3.40	57.73
411 Cantonment	33	0.69	12.02	99	0.76	12.02
412 Recreational	33	0.78	7.04	99	1.06	13.87
413 Golf Courses	30	2.14	29.44	88	3.31	49.12
421 Grazing/Agricultural	20	0.01	0.06	50	0.11	1.21
422 Range/Training	55	0.03	0.43	155	0.18	7.71

(7) Statistical Evaluation of Soil Data.

(a) The transformed data described in reference 2a and the analysis of variance shows a significant difference (p<.01) between the means of the three soil groups for the 12-installation data; Soil Group I = 1.92, Soil Group II = 0.90, and Soil Group III = 0.22. The difference between the three soil groups is in agreement with the conclusions drawn from the 34 installations.

(b) The hypothesis that golf courses contribute a greater pesticide burden to the environment than do the other sites in Soil Group II is confirmed by the 12-installation analysis of variance. The transformed mean for the nongolf course sites in Group II is 0.78 and the transformed mean for the golf course sites is 1.27. This difference between means is significant at the p<.05 level. This finding is also in agreement with the 34-installation data.

b. Sediment.

(1) These data are evaluated and tabulated on the basis of four functional stratifications; i.e., flowing streams at their entrance to the installation, flowing streams at their exit from the installation, streams originating on the installation, and impounded bodies of water. The data from the 12 installations are compared with the data from the 34 installations in Table 6. The data indicate that the 12 installations are a much less sensitive indicator of the sediment profile in that there are fewer pesticides observed and the mean concentrations are lower than those found from 34 installations.

(2) Statistical evaluation of pesticides in sediment by the use of the data transformation reveals that there is no significant difference (p<.05) among the four functional stratifications from the 12 installations. This is in direct conflict with the data from the 34 installations where the four functional stratifications were significantly different (p<.05). The transformed means for each of the sediment stratifications from the 12 installations are as follows; streams at their entrance = 0.19, streams at their exit = 0.19, streams originating = 0.06, and impounded bodies = 0.16. Although the originating streams show what appears to be a much lower mean pesticide residue concentration, the overall comparison of all four sites does not reflect a significant difference. The lack of comparability between the 12-and 34-installation data is probably accounted for by the decreased sample size from the 12 installations, thus giving decreased statistical sensitivity.

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TABLE 6. PESTICIDE RESIDUES (PPM) DETECTED IN SEDIMENT SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INST

	All Sites				Traversing/Entrance				Traversing	
	12 Installations		34 Installations		12 Installations		34 Installations		12 Installations	
Number of Samples	127		363		19		58		19	
Pesticides	x̄	Max	x̄	Max	x̄	Max	x̄	Max	*	Max
p,p'-DDT	<0.01	0.05	0.05	8.34	<0.01	0.05	<0.01	0.05	nd	
o,p'-DDT	nd		<0.01	0.76	nd		nd		nd	
p,p'-DDE	<0.01	0.08	0.03	6.71	0.01	0.08	<0.01	0.08	<0.01	0.03
o,p'-DDE	nd		<0.01	1.71	nd		nd		nd	
p,p'-DDD	0.01	0.32	0.03	67.08	0.01	0.13	0.01	0.13	0.01	0.11
o,p'-DDD	<0.01	0.05	0.06	18.25	<0.01	0.03	<0.01	0.03	<0.01	0.03
chlordane	<0.01	0.24	0.01	1.62	nd		0.01	0.26	0.01	0.12
oxychlordane	nd		<0.01	0.06	nd		nd		nd	
trans-chlordane	<0.01	0.09	<0.01	0.30	<0.01	0.09	<0.01	0.12	nd	
cis-chlordane	<0.01	0.05	0.01	2.53	<0.01	0.05	<0.01	0.05	nd	
dieldrin	<0.01	0.02	<0.01	0.10	<0.01	0.02	<0.01	0.02	nd	
aldrin	<0.01	0.01	<0.01	0.06	nd		<0.01	0.02	nd	
No. of Pesticides	9		12		7		9		4	

nd - not detected

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...ance Installations 58		Traversing/Exit 12 Installations 19		34 Installations 59		Originating 12 Installations 17		34 Installations 62		Impounded 12 Installations 72		34 Installations 184	
	Max	*	Max	x̄	Max	x	Max	x	Max	x̄	Max	x̄	Max
<0.01	0.05	nd		<0.01	0.04	nd		0.14	6.96	<0.01	0.05	0.06	8.34
nd		nd		nd		nd		0.02	0.76	nd		<0.01	0.20
<0.01	0.08	<0.01	0.03	<0.01	0.04	<0.01	0.03	0.11	6.71	<0.01	0.07	0.02	0.48
nd		nd		nd		nd		0.03	1.71	nd		<0.01	0.06
<0.01	0.13	0.01	0.11	<0.01	0.11	<0.01	0.06	1.10	67.08	0.01	0.32	0.07	4.26
<0.01	0.03	<0.01	0.03	<0.01	0.03	nd		0.30	18.25	<0.01	0.05	0.01	0.70
<0.01	0.26	0.01	0.12	0.01	0.14	nd		<0.01	0.13	<0.01	0.25	0.02	1.62
nd		nd		nd		nd		nd		nd		<0.01	0.06
<0.01	0.12	nd		<0.01	0.04	nd		nd		nd		<0.01	0.30
<0.01	0.05	nd		<0.01	0.10	nd		<0.01	0.01	nd		0.01	2.53
<0.01	0.02	nd		<0.01	0.04	nd		<0.01	0.05	<0.01	0.01	<0.01	0.10
<0.01	0.02	nd		<0.01	0.01	nd		<0.01	0.01	<0.01	0.01	<0.01	0.06
9		4		9		2		9		7		12	

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c. <u>Fish</u>.

(1) The fish data are evaluated by the arbitrary classifications of "top feeders" and "bottom feeders." A comparison of mean pesticide residues between the 12 and 34 installations appears in Table 7.

(2) Statistical evaluation of the transformed data from the 12 installations reveals that there is no significant difference between the top and bottom feeders. The transformed mean for the top feeders is 0.87 and the transformed mean for the bottom feeder is 0.82. This difference is not significant at the $p < .05$ level. The 34-installation data also showed no significant difference between the top and bottom feeders.

d. <u>Birds</u>. Owing to a sample loss from a freezer malfunction, there is only one bird sample available from the 12 installations. This makes any comparison between the 12 installations and the 34 installations impossible.

e. <u>Interaction Between Environmental Components</u>. Correlation coefficients "r" were calculated to determine any interactions between the environmental components.

(1) Correlations between fish data and sediment data collected from impounded bodies of water from the 12 installations give an r value of 0.40 which shows no significant correlation. However, the 34-installation comparison for the same data pair did show a significant correlation ($r = 0.57$ $p < .05$).

(2) Correlation between soil data and sediment data using untransformed means for the 12 installations does not show a significant correlation ($p < .05$). This is in agreement with the 34 installations which had no significant correlation ($p < .05$). However, the transformed data for both the 12 installations and the 34 installations do show significant correlations between soil and sediment, $r = 0.72$ ($p < .05$) for the 12 installations and $r = 0.63$ ($p < .05$) for the 34 installations. Correlations between soil data and sediment data using transformed means were not yet completed at the time the 34-installation report (reference 2a) was prepared. At that time, it was postulated that based on a lack of significant correlation between soil and sediment using untransformed data, it was improbable that a significant correlation using transformed data would be found. Surprisingly, however, the converse has turned out to be true, not only for the 34-installation data, but also for the 12-installation subset data.

(3) The paucity of bird data does not allow for any statistical correlations.

6. COMPARISON OF INTERIM ENVIRONMENTAL PESTICIDE CRITERIA. Utilizing the interim criteria levels established in reference 2a; 5.00 ppm for soil, 0.1

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TABLE 7. PESTICIDE RESIDUES (PPM) DETECTED IN FISH SAMPLES COLLECTED DURING CY 1975 FOR 12 INSTALLATIONS AND 34 INSTALLATIONS (UNTRANSFORMED DATA)

	All Fish				Top Feeders				Bottom Feeders			
	12 Installations		34 Installations		12 Installations		34 Installations		12 Installations		34 Installations	
Number of Samples	29		108		19		59		10		49	
Pesticide	x̄	Max	x̄	Max	x̄	Max	x̄	Max	x̄	Max	x̄	Max
p,p'-DDT	<0.01	0.02	0.01	0.37	<0.01	0.02	0.01	0.11	<0.01	0.02	0.03	0.37
o,p'-DDT	nd		<0.01	0.03	nd		nd		nd		nd	
p,p'-DDE	0.10	0.76	0.19	1.19	0.11	0.76	0.16	1.46	0.08	0.35	0.31	1.99
o,p'-DDE	nd		nd		nd		nd		nd		nd	
p,p'-DDD	0.08	0.54	0.15	1.95	0.10	0.54	0.10	0.74	0.05	0.22	0.21	1.95
o,p'-DDD	0.01	0.06	0.01	0.45	0.01	0.06	0.01	0.14	<0.01	0.02	0.03	0.45
oxychlordane	nd		<0.01	0.06	nd		<0.01	0.04	<0.01		<0.01	0.04
chlordane	nd		nd	0.64	nd		nd		nd		nd	
trans-chlordane	<0.01	0.08	0.03	0.35	<0.01	0.08	0.34	0.03	<0.01	0.01	0.03	0.34
cis-chlordane	<0.01	0.02	<0.01	0.02	nd		<0.01	0.04	<0.01	0.02	<0.01	0.04
heptachlor epoxide	<0.01	<0.01	<0.01	0.08	<0.01	<0.01	<0.01	0.02	nd		<0.01	0.02
heptachlor	0.01	0.17	0.07	2.84	0.01	0.17	0.09	2.84	0.03	0.12	0.03	0.38
dieldrin	nd		<0.01	0.24	nd		<0.01	0.24	nd		nd	
aldrin	nd		<0.01	0.11	nd		<0.01	0.09	nd		nd	
endrin	nd		<0.01	0.01	nd		<0.01	<0.01	nd		<0.01	0.11
lindane	nd		<0.01	1.01	nd		0.02	1.01	nd		nd	
methoxychlor	nd		0.01	1.01	nd		nd		nd		0.04	1.01
toxaphene	nd		0.02	1.52	nd		<0.01	0.10	nd		0.10	1.52
mirex	nd		0.01	0.17	nd		nd		nd		0.02	0.10
parathion	nd		nd		nd		nd		nd		nd	
malathion	nd		nd		nd		nd		nd		nd	
diazinon	<0.01	0.02	<0.01	0.02	<0.01	0.02	<0.01	0.02	<0.01	0.01	<0.01	<0.01
chlorpyrifos	nd		nd		nd		nd		nd		nd	
No. of Compounds	9		19		8							

nd - not detected

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ppm for sediment, and 1.0 ppm for fish and birds, the histograms (Figures 1 through 8) reveal the following data.

a. The total mean pesticide data for all samples for the 12 installations (Figure 1) shows a similar pattern to the 34-installation data (Figure 2). However, the 12 installations do not reflect those highly contaminated installations from the 34-installation data (those not plotted on the 34-installation histogram).

b. The mean pesticide data for the soil for the 12 installations (Figure 3) show a similar pattern as the histograms for all the samples indicating that the soil is the major contributor of the pesticide burden of those components studied. The 12 installations show that 72.7 percent of the installations fall below the 5.00 ppm criteria level as compared with 54.5 percent for the 34 installations (Figure 4). The absence of the more highly contaminated installations in the 12-installation data is clearly evident.

c. The mean pesticide data for the sediment (Figure 5) show that 90.9 percent of the 12 installations fall below the criteria level of 0.1 ppm, while the 34 installations (Figure 6) have 72.7 percent below this level. Once again, the 12 installations do not reflect the more highly contaminated installations.

d. The mean pesticide data for fish from the 12 installations (Figure 7) have 100 percent of the installations below the 1.00 ppm interim criteria level while the 34 installations have 79.2 percent below this level.

e. The small number of birds from the 12 installations precludes any type of comparison.

7. CONCLUSIONS. The differences observed between the 12-installation data and the 34-installation data reflect, in general, a lower pesticide residue level and a lower pesticide diversity for the 12 installations. These differences are probably accounted for in the decreased sensitivity of the 12-installation data due to sample size and the fact that installations selected did not represent those having higher pesticide concentrations.

a. The soil data reflect a lower residue pattern in the 12 installations as reflected by the percent of installations below the interim criteria level of 5.00 ppm as compared to the percent below for the 34 installations; 72.7 percent versus 54.5 percent, respectively. The pesticide diversity is lower for the 12 installations, 18 pesticides detected, than for the 34 installations, 25 pesticides detected.

(1) The conclusion from the 34-installation data that the three soil groups based on land use pattens are significantly different, is substantiated by the 12-installation data.
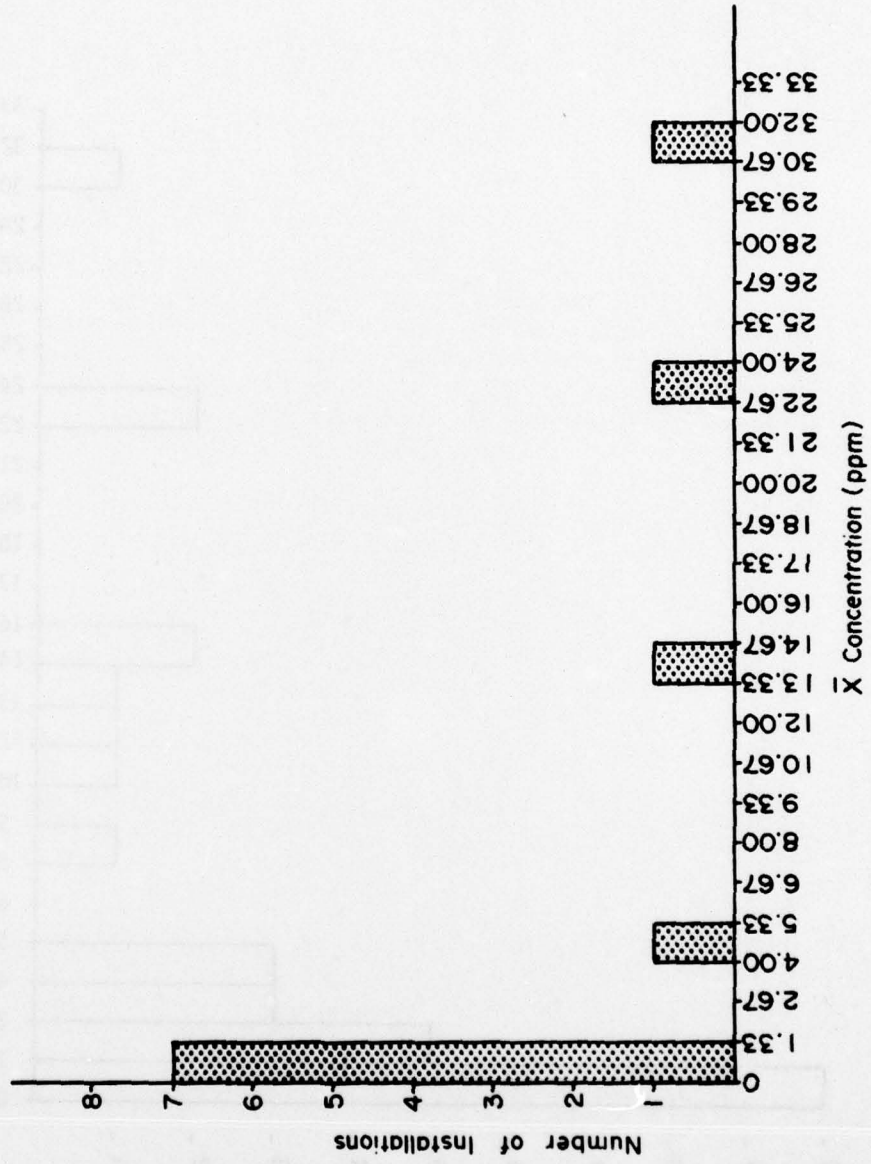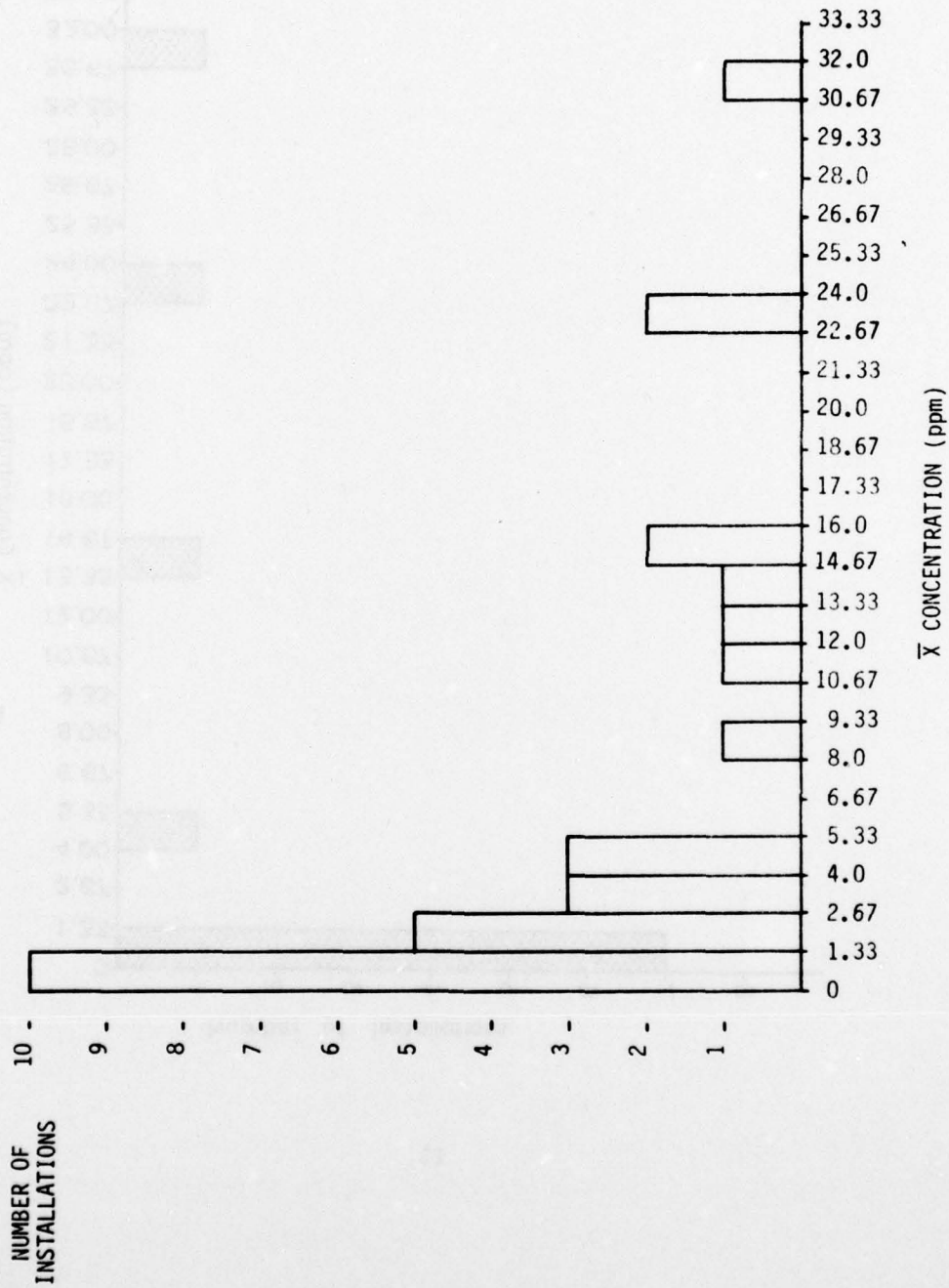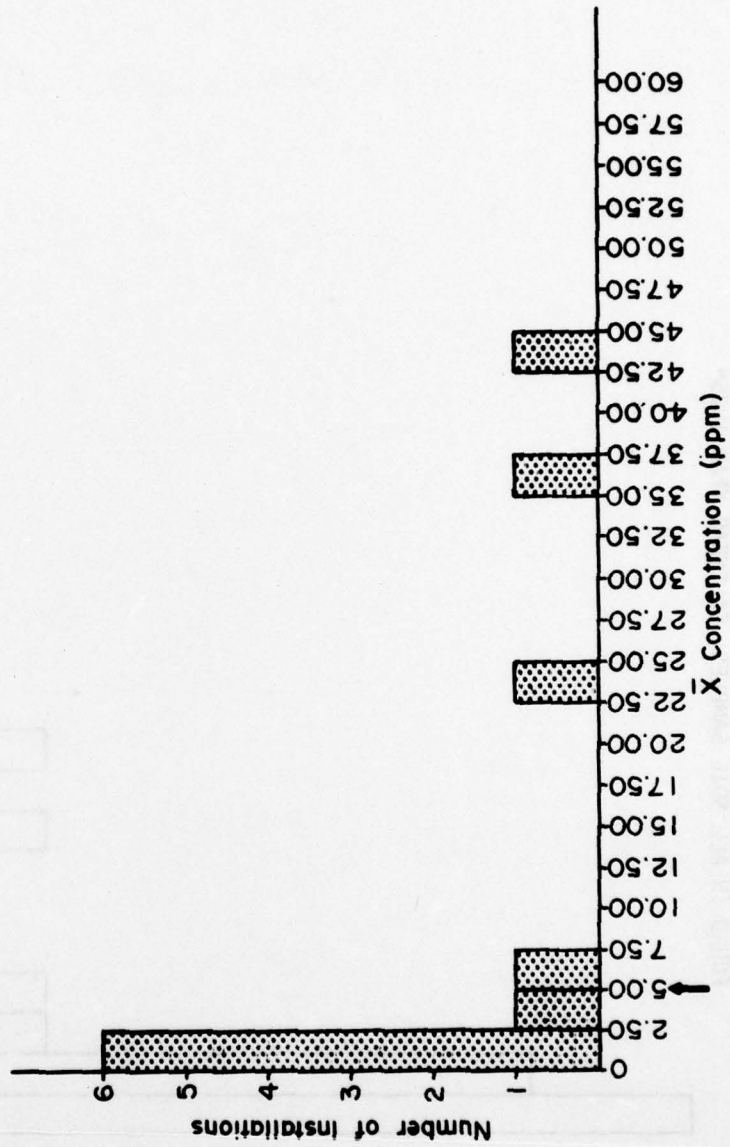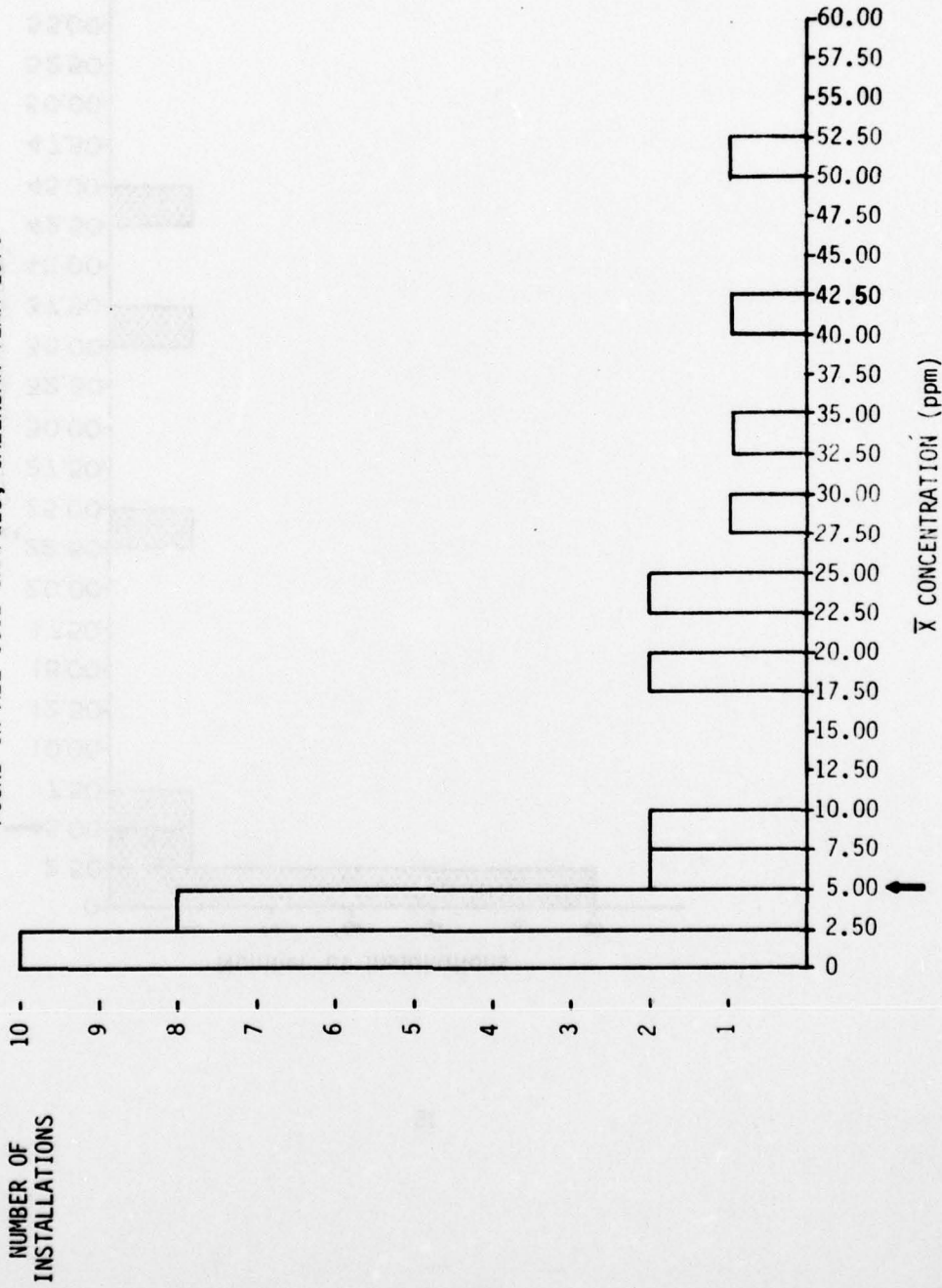
FIGURE 1: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SAMPLES, CY 1975 – 12 INSTALLATION DATA

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FIGURE 2 — DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL SAMPLES, CALENDAR YEAR 1975*

$\bar{X}$ CONCENTRATION (ppm)

NUMBER OF
INSTALLATIONS

* Three installations not plotted $\bar{X}$ concentration, 53.83 ppm, 171.12 ppm, 615.34 ppm

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FIGURE 3: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SOIL SAMPLES, CY 1975 - 12 INSTALLATION DATA

Pesticide Monitoring Rpt No. 44-0143-76

FIGURE 4 - DISTRUBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS
FOUND IN ALL SOIL SAMPLES, CALENDAR YEAR 1975*

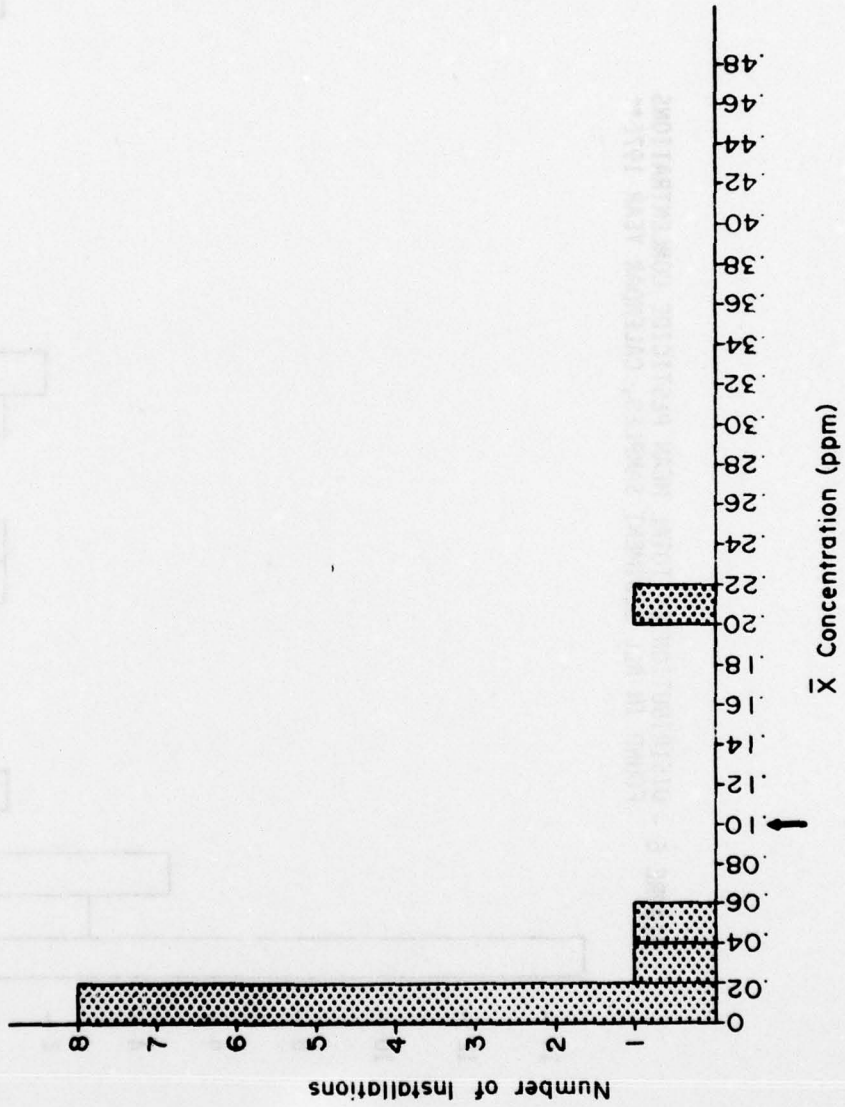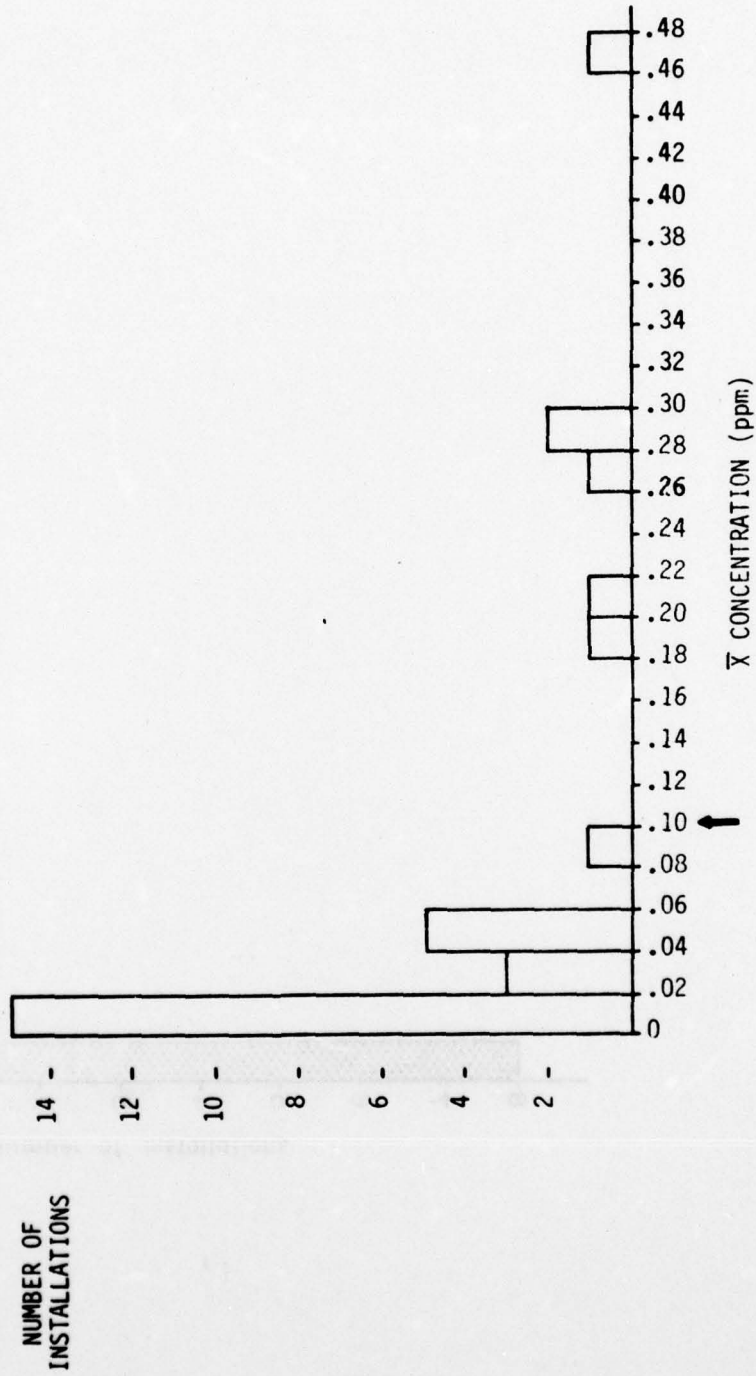* Three values not plotted, $\overline{X}$ concentration, 90.42 ppm, 310.80 ppm, 1017.59 ppm

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Number of Installations

$\bar{X}$ Concentration (ppm)
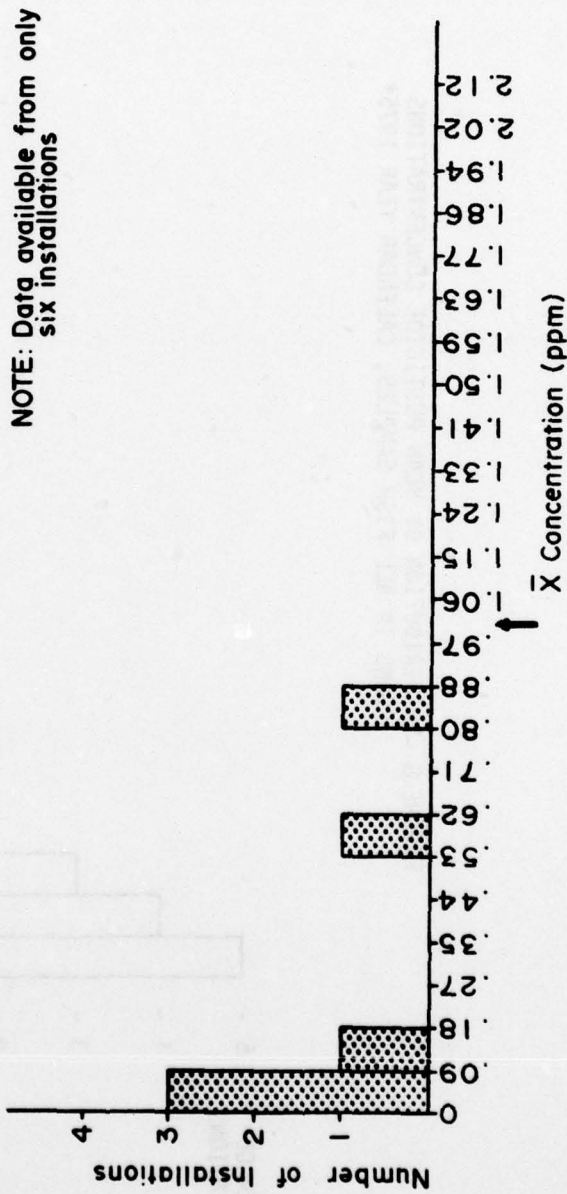
FIGURE 5: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SEDIMENT SAMPLES, CY 1975 - 12 INSTALLATION DATA

Pesticide Monitoring Rpt No. 44-0143-78

FIGURE 6 - DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL SEDIMENT SAMPLES, CALENDAR YEAR 1975*†

NUMBER OF INSTALLATIONS

$\overline{X}$ CONCENTRATION (ppm)

* Two values not plotted, $\overline{X}$ concentration, 1.55 ppm, 6.77 ppm
† One installation with no sediment

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NOTE: Data available from only six installations

FIGURE 7: DISTRIBUTION BY TOTAL MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL FISH SAMPLES, CY 1975 - 12 INSTALLATION DATA

$\bar{X}$ Concentration (ppm)

Number of Installations

0 .09 .18 .27 .35 .44 .53 .62 .71 .80 .88 .97 1.06 1.15 1.24 1.33 1.41 1.50 1.59 1.63 1.77 1.86 1.94 2.02 2.12

FIGURE 8 - DISTRIBUTION BY MEAN PESTICIDE CONCENTRATIONS FOUND IN ALL FISH SAMPLES, CALENDAR YEAR 1975*
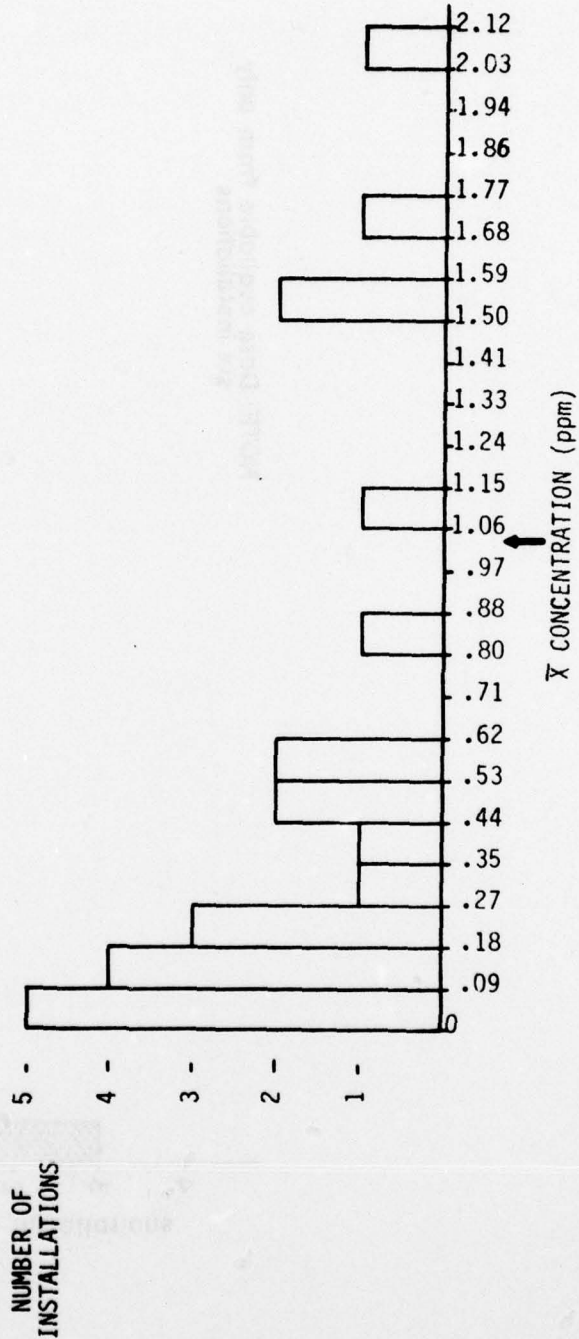
* Samples available from only 24 installations

(2) The conclusion from the 34-installation data that golf courses are significantly different from the remaining sites in the Group II soils is substantiated by the 12-installation data.

b. The sediment data display the same pattern as the soil: lower pesticide residue concentrations, 90.9 percent of the 12 installations fall below the interim criteria level of 0.10 ppm as compared to the 72.7 percent below for the 34 installations; and fewer residues observed, 9 for the 12 installations and 12 for the 34 installations. The conclusion drawn from the 34-installation data that the four functional stratifications of sediment are *significantly different* is not *substantiated by the 12-installation data.*

c. The fish data from 12 installations reflect a lower pesticide residue level (100 percent below the interim criteria level of 1.00 ppm) than the data from the 34 installations (79.2 percent below). The data from the 12-installation subset is in agreement with the 34-installation data regarding the finding of no significant difference between top and bottom feeders.

d. The small number of bird samples from both the 12-installation and 34-installation data does not allow any comparison of data or any conclusions about the data.

e. With regard to interaction between environmental components, the following conclusions can be stated.

(1) Significant correlation between fish and sediment data from the 12-installation subset was not found; this was in contrast to the 34-installation data where a significant correlation was noted.

(2) Both the 12-installation and 34-installation data showed no significant correlation between soil and sedient using untransformed means; however, when transformed means were used in this comparison, both the 12-installation and 34-installation data showed significant correlations.

e. The 12-installation data set appears to be a more conservative and statistically less sensitive estimate of the pesticide impact on the environment than the 34 installations. These 12 installations were chosen prior to the availability of the statistical analysis of the 34 installations and only partially reflect the overall patterns shown by the 34-installation data. However, the necessity for geographical distribution and the availability of field support personnel are factors which must be considered in any selection process.

8. RECOMMENDATIONS. It is recommended that the DAPMP be expanded to 16 installations. The selective addition of four installations would provide a less conservative (i.e., more representative) and more statistically more sensitive data base. These 16 installations would provide essential geographical distribution, necessary field support personnel, and provide a basis for year-to-year comparisons.

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APPENDIX

INSTALLATIONS COMPRISING THE DA PESTICIDE MONITORING PROGRAM
(CY 1977 - PRESENT)
BY MAJOR COMMAND

USACC
Fort Huachuca, AZ

FORSCOM
Fort Bragg, NC
Fort Carson, CO
Fort Devens, MA
Fort Sam Houston, TX
Fort Lewis, WA
Fort McCoy, WI
Fort Ord, CA
Fort Polk, LA

TRADOC
Fort Jackson, SC
Fort Knox, KY
Fort Leonard Wood, MO