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NAS KEY WEST
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LETTER AND CONCURRENCE FROM FLORIDA DEPARTMENT OF ENVIRONMENTAL
PROTECTION REGARDING PESTICIDE BACKGROUND ASSESSMENT WITH
ATTACHMENTS NAS KEY WEST FL
4/20/2010
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



Florida Department of Environmental Protection

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Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

April 2, 2010

**Mr. Dana Hayworth, P.G.
Department of the Navy
Naval Facilities Engineering Command Southeast
Building 135, Ajax Street
Naval Air Station Jacksonville
Jacksonville, Florida, 32212-0030**

**Re: NAS Key West Pesticide Background Assessment, Naval Air Station Key West,
Florida**

Dear Mr. Hayworth:

The Department has completed the technical review of the above referenced document dated November 9, 2009 (received November 12, 2009). The Department supports and concurs with the attached comments provided by Dr. Leah D. Stuchal and Dr. Stephen M. Roberts from the University of Florida on this document. If I can be of any further assistance with this matter, please contact me at (850) 245-8998.

Sincerely

Tracie Lynn Bolanos
Remedial Project Manager
Federal Programs Section
Bureau of Waste Cleanup

Enclosures

cc: Mr. Robert Courtright, Naval Air Station Key West, Key West, Florida
Mr. Chuck Bryan, Tetra Tech, Aiken South Carolina

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April 16, 2010

Ligia Mora-Applegate
Bureau of Waste Cleanup
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399

Re: NAS Key West Pesticide Background Assessment

Dear Ms. Mora-Applegate:

We have reviewed at your request the *NAS Key West Pesticide Background Assessment*. Because this background assessment is based upon statistical analysis of contaminant concentration data, we asked Dr. Linda Young, Professor and Associate Chair in the Department of Statistics, to review the report. Her comments are attached. As you can see from her comments, there are problems with the way this analysis was conducted. We recommend that the FDEP not accept this analysis until it has been substantially revised. If needed, we can arrange a teleconference or meeting with the responsible parties and their consultants to discuss in greater detail this review and possible solutions.

Sincerely,



Stephen M. Roberts, Ph.D.



Leah D. Stuchal, Ph.D.

Attachment

Review of NAS Key West Pesticide Background Assessment

A background data set was developed using data from seven different sites. Three different pesticides were considered: DDD, DDE, and DDT. Each pesticide was analyzed separately. For each analysis, a Q-Q plot, a histogram, a box plot, and summary statistics were developed. The distribution was consistently found to be skewed with outliers. So that the data would be more nearly normal, the logarithms of the results were taken. To assess the transformed data for normality, non-detects were dropped, and the remaining values were assessed for normality. For DDD and DDE, the remaining transformed data were well described by the normal distribution. For DDT, the 8 largest observations also had to be dropped before the remaining transformed data were well modeled by the normal distribution.

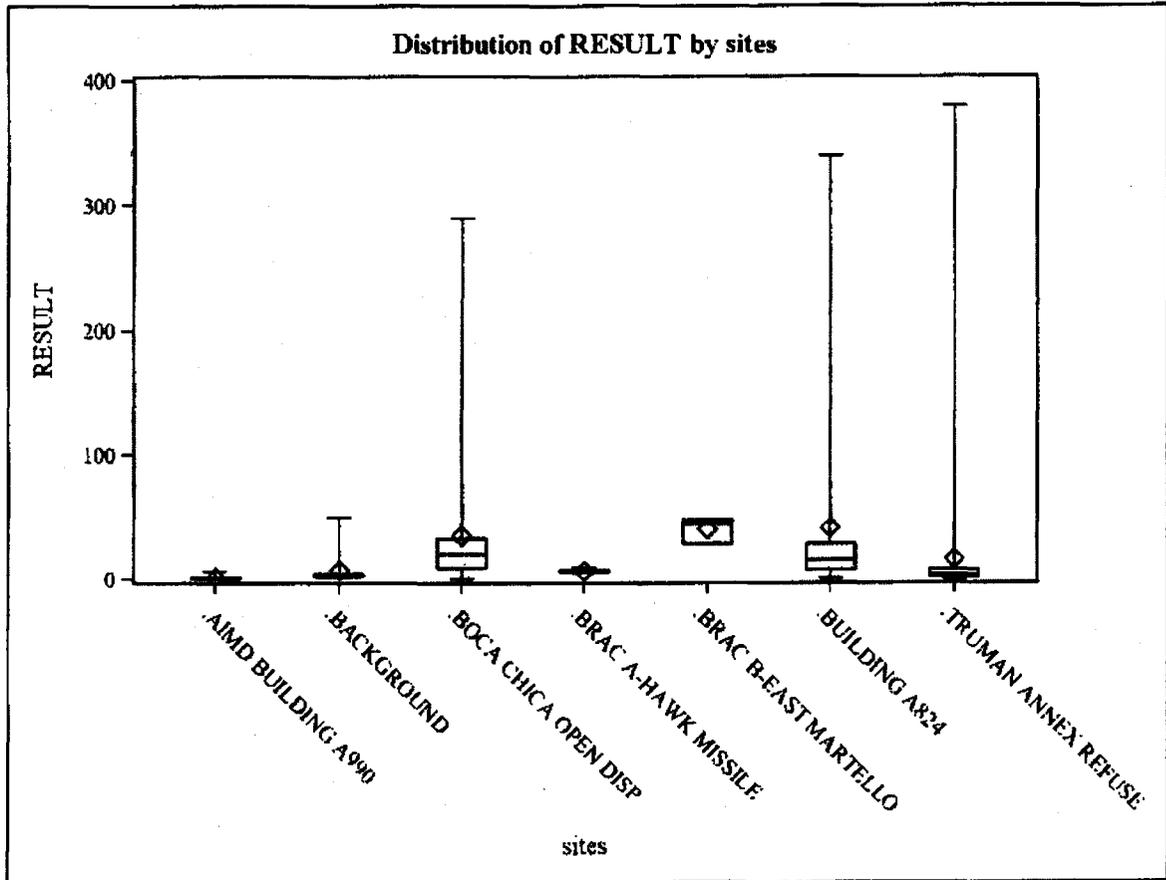
Dropping the non-detects before assessing the distribution is not statistically appropriate here because such a large percentage of the values (66%) are non-detects. To illustrate, suppose that all observations in this data set were a random sample from the same site so that the concerns discussed below are not relevant. Sixty-six percent (66%) of the observations are below the detection limit. For a normal distribution, the distribution has a "bell" shape, with half of the observations below the mean and half above the mean. Thus, if the log transformed data are normally distributed and a third of the values are fully observed, only a portion of the right tail of the distribution is observable; that is, the peak of the distribution should fall among the non-detects. If only the right tail is seen, the detects should not appear to be normally distributed as they do in this report. Methods do exist for assessing the mean and variance in this setting, but they require information on the proportion of non-detects, which was not incorporated in the analysis. The consequences of ignoring the non-detects are that the mean is estimated to be larger than its true value and the variance is estimated to be smaller than its true value. Thus, assessing the fit of the normal distribution after transformation and dropping non-detects may lead to incorrect conclusions.

In the Procedural Guidance for Statistically Analyzing Environmental Background Data, five key checks are suggested before combining data sets (p. 37):

- 1) "Data sets have similar chemical composition representing the geographic or hydrologic units;
- 2) Data sets are of similar type with regard to sampling and analysis protocols;
- 3) Data sets have been analyzed with similar analytic methods and similar detection limits;
- 4) Data quality (validated and non-validated data) is relatively constant among data sets;
- 5) Descriptive statistics (means, medians, etc.) and graphical plots such as the cumulative frequency distribution plots .. are similar for each data set."

Because this is a statistical review, the focus is on the final check in this list. An assessment for DDD is given. Similar analyses are needed for DDE and DDT.

Initially, boxplots can be used to compare the sites visually.



The distributions appear to differ from site to site. This will now be explored more formally. First, consider the estimates of variance shown in the table below.

Site	Estimate	Standard Error
SITE AIMD BUILDING A990	4.8932	2.8251
SITE BACKGROUND	166.17	67.8406
SITE BOCA CHICA OPEN DISPOSAL AREA	2671.45	414.69
SITE BRAC A-HAWK MISSILE SITE (KW65)	2.0944	1.0472
SITE BRAC B-EAST MARTELLO BATTERY	104.33	104.33
SITE BUILDING A824	5670.84	1417.71
SITE TRUMAN ANNEX REFUSE DISPOSAL AREA	2293.38	345.74

The estimated variances range from about 2 to 5671 and are certainly not the same for all sites. Allowing for differences in variances, consider whether the means are equal. The results of the analysis of variance test for differences in site means is shown below.

Type III Tests of Fixed Effects				
Effect	DF	Den DF	F Value	Pr > F
SITE	6	231	17.45	<.0001

The estimated means are as follows:

SITE	Estimate	Standard Error
AIMD BUILDING A990	1.8057	0.8361
BACKGROUND	7.3154	3.5753
BOCA CHICA OPEN DISPOSAL AREA	35.5942	5.6394
BRAC A-HAWK MISSILE SITE (KW65)	7.2222	0.4824
BRAC B-EAST MARTELLO BATTERY	40.6667	5.8973
BUILDING A824	41.2370	13.1089
TRUMAN ANNEX REFUSE DISPOSAL AREA	16.4690	5.0763

Comparing the means, adjusting for multiple testing using simulation, results in the following:

SITE	SITE	Estimate	Standard Error	Pr > t	Adj P
AIMD BUILDING A990	BACKGROUND	-5.5097	3.6717	0.1348	0.6799
AIMD BUILDING A990	BOCA CHICA OPEN DISPOSAL AREA	-33.7885	5.7011	<.0001	<.0001
AIMD BUILDING A990	BRAC A-HAWK MISSILE SITE (KW65)	-5.4165	0.9653	<.0001	<.0001
AIMD BUILDING A990	BRAC B-EAST MARTELLO BATTERY	-38.8610	5.9562	<.0001	<.0001
AIMD BUILDING A990	BUILDING A824	-39.4313	13.1356	0.0030	0.0333
AIMD BUILDING A990	TRUMAN ANNEX REFUSE DISPOSAL AREA	-14.6633	5.1446	0.0048	0.0514
BACKGROUND	BOCA CHICA OPEN DISPOSAL AREA	-28.2788	6.6773	<.0001	0.0008

SITE	SITE	Estimate	Standard Error	Pr > t	Adj P
BACKGROUND	BRAC A-HAWK MISSILE SITE (KW65)	0.09316	3.6077	0.9794	1.0000
BACKGROUND	BRAC B-EAST MARTELLO BATTERY	-33.3513	6.8964	<.0001	<.0001
BACKGROUND	BUILDING A824	-33.9216	13.5877	0.0132	0.1235
BACKGROUND	TRUMAN ANNEX REFUSE DISPOSAL AREA	-9.1536	6.2089	0.1418	0.6988
BOCA CHICA OPEN DISPOSAL AREA	BRAC A-HAWK MISSILE SITE (KW65)	28.3719	5.6600	<.0001	<.0001
BOCA CHICA OPEN DISPOSAL AREA	BRAC B-EAST MARTELLO BATTERY	-5.0725	8.1597	0.5348	0.9942
BOCA CHICA OPEN DISPOSAL AREA	BUILDING A824	-5.6428	14.2705	0.6929	0.9993
BOCA CHICA OPEN DISPOSAL AREA	TRUMAN ANNEX REFUSE DISPOSAL AREA	19.1252	7.5876	0.0124	0.1154
BRAC A-HAWK MISSILE SITE (KW65)	BRAC B-EAST MARTELLO BATTERY	-33.4444	5.9170	<.0001	<.0001
BRAC A-HAWK MISSILE SITE (KW65)	BUILDING A824	-34.0147	13.1178	0.0101	0.0970
BRAC A-HAWK MISSILE SITE (KW65)	TRUMAN ANNEX REFUSE DISPOSAL AREA	-9.2468	5.0991	0.0711	0.4653
BRAC B-EAST MARTELLO BATTERY	BUILDING A824	-0.5703	14.3743	0.9684	1.0000
BRAC B-EAST MARTELLO BATTERY	TRUMAN ANNEX REFUSE DISPOSAL AREA	24.1977	7.7811	0.0021	0.0250
BUILDING A824	TRUMAN ANNEX REFUSE DISPOSAL AREA	24.7680	14.0575	0.0794	0.4998

Based on the above, the Boca Chica Open Disposal Area, Brac B-East Martello Battery and Building A824 sites have similar distributions and tend to be different from the others. Background, Aimd Building A990, and Brac A-Hawk Missile Site (KW65) have similar distributions and tend to be different from the others. Truman Annex Refuse

Disposal Area is intermediate to the other two sets of distributions, having some similarities and differences with each group.

The distribution functions can be compared directly using the Kolmogorov-Smirnov test (results not shown here). This test indicates that the distributions of samples from Boca Chica Open Disposal Area, Brac B-East Martello Battery and Building A824 are not significantly different from each other, but each of the other sites has a distribution of samples that differ from the distribution of samples at every other site. This implies that whereas Aird Building A990, and Brac A-Hawk Missile Site (KW65) have similar distributions, they are statistically significantly different from each other, from the other set of sites, and from the Truman Annex Refuse Disposal Area.

In summary, combining data from these seven sites for background assessment is extremely questionable because the distributions are not the same, or even similar, for all sites. Assuming that samples Boca Chica Open Disposal Area, Brac B-East Martello Battery and Building A824 come from a similar distribution can be supported statistically, and their distribution is significantly different from the distributions from other sites. Although samples from Aird Building A990, and Brac A-Hawk Missile Site (KW65) have similar distributions, they are statistically significantly different from each other and from the distribution of samples associated with the other group of sites. Truman Annex Refuse Disposal Area is significantly different from all other sites.

This analysis considers only DDD. Similar analyses are needed for DDE and DDT. The analyses presented in the NAS Key West Pesticide Background Assessment report are not sufficient to draw the conclusions presented there.