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LETTER REGARDING RCRA FACILITY INVESTIGATION DETECTIONS OF THALLIUM AND ARSENIC NAS FORT WORTH TX
7/27/2000
CARSWELL AIR FORCE BASE

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Air Force Base Conversion Agency
Division C Regional Operating Location
Bergstrom AFB, TX

July 27, 2000

AFBCA/DC Bergstrom
3711 Fighter Drive, Suite 200
Austin, TX 78719-2557

Mr. Mark Weegar
Texas Natural Resource Conservation Commission
Correction Actions
P.O. Box 13087
Austin, TX 78711-3087

RE: RCRA Facility Investigation (RFI) of SWMUs 22, 23, 24, and 25
Advanced Copy of Sections Discussing Statistical Comparison of Investigative Detections of Thallium and Arsenic
Former Carswell Air Force Base, Texas
TNRCC Solid Waste Registration No. 65004

Dear Mark:

In an effort to support an expedited review of the forthcoming Draft RFI Report for SWMUs 22, 23, 24, and 25, we are providing the enclosed advanced copy of two sections of the Draft RFI Report. These sections discuss a statistical comparison performed between investigative results for thallium and arsenic, and concentrations of the two compounds resulting from the basewide background study sampling and analysis program. As presented at the July 18, 200 BRAC Cleanup Team (BCT) meeting held at Bergstrom AFB, our contention is that the statistical comparison suggests that investigative detections are either statistically equal to, or less than, the data sets produced during the basewide background study. Also, as mentioned at the BCT meeting, we contend that the significant factor causing the apparent discrepancy between the two data sets is related to the use of different analytical methods (i.e., SW6010A-standard method versus the SW6010A-trace method).

Thank you for your time and cooperation in this matter. If you have any questions or require additional information, please call Alvin Brown or me at (512) 386-5425 ext. 23 or 20, respectively.

Sincerely,

Rafael E. Vazquez

RAFAEL E. VAZQUEZ
Regional BRAC Environmental Coordinator

Attachment:
Draft RFI Report Sections – Advanced Copy

cc: Gary W. Miller, US EPA, Region VI
Charles Pringle, HQ AFCEE/ERB
Amy Hardberger, UNITEC

4.1.1 Statistical Significance of Thallium

In the Draft Base wide Background Study (BBS) (Jacobs, 1997), thallium background concentrations in surface, subsurface, and sediment soils were analyzed by the SW6010A ICP-regular and reported at 63.9 mg/kg, 64.5 mg/kg, and 69.74 mg/kg respectively. In the Final BBS (Jacobs, 1998), background concentrations of thallium in surface, subsurface, and sediment soils were reported at 2.43 mg/kg, 1.5 mg/kg, and 1.44 mg/kg respectively when analyzed by the SW6010A ICP-trace method. The initial thallium data (ICP-standard) are consistently higher than the Final BBS thallium concentration (ICP-trace). Because the Draft BBS and the RFI soil samples from SWMUs 22, 23, 24, and 25 (HydroGeoLogic, 1998c) were both analyzed by the SW6010A-standard method, a statistical analysis was performed to compare thallium soil concentrations in these two data sets. This direct comparison serves to minimize variation of results due to differing analytical methods.

The method used to conduct the statistical analysis of the two data sets was the non-parametric Wilcox Rank Sum Test described in USEPA's guidance manuals for statistical analysis of groundwater monitoring data at RCRA Facilities (USEPA, 1992 and 1989). The above method test was used because both data sets and their log-transformed data were not normally distributed, and the number of non-detects in the combined data set (background and investigative) were greater than 15%. All non-detects in both data sets were replaced with half the minimum detection limit as recommended in USEPA's guidance manuals (USEPA, 1992 and 1989). Results of the statistical analysis are summarized in Table 4.1.

Table 4.1
Thallium Statistical Data
Surface and Subsurface Soil

Data Source	Sample Count	Mean	Standard Deviation	Ranked Sum	Mann-Witney Static	Approximate z-score for Mann-Whitney Static
Background Surface Soil 1997	30	35.44	25.03	1168	709	4.154
SWMUs 22-25 Surface Soil '98 RFI data	29	8.39	8.70	596		
Background Subsurface Soil 1997	30	34.66	19.98	2516	2182	6.092
SWMUs 22-25 Subsurface Soil '98 RFI data	83	6.40	10.09	3794		

Table 4.1 illustrates that the mean thallium concentration in the background soils is significantly

greater than that of the SWMU 22, 23, 24, and 25 RFI soil data collected in 1998. The difference in the means was confirmed by the result of the z-static test based on the assumption that there is no difference between the means at the 0.01 confidence level of significance. The approximate z-scores (4.154-surface and 6.092-subsurface) represents a normal approximation of the distribution of the Mann-Witney Static value (709-surface and 2182-subsurface).

To accept or reject the above assumption, the upper z-score is compared against the tabulated critical z-value of the upper 0.01 percentile (i.e. 99% level of confidence) of the normal distribution. The critical z-value is 2.326. Since 4.154 and 6.092 are greater than 2.326, the assumption that the means are the same is rejected. Therefore, it is concluded that the two means are statistically different and that the thallium concentration values in the RFI data set for SWMUs 22, 23, 24 and 25 are significantly lower than those of the Draft BBS. It can be inferred from this analysis that, if the RFI samples collected at these SWMUs were re-analyzed using the ICP-trace method, as were the Draft BBS, the results of these analyses would not exceed background.

4.1.2 Statistical Significance of Arsenic

A statistical analysis was also performed to compare arsenic soil concentrations in the RFI data set to arsenic concentrations in the background data set.

As with thallium, the method used to conduct the arsenic statistical analysis of the two data sets was the non-parametric Wilcox Rank Sum Test described in USEPA's guidance manuals for statistical analysis of groundwater monitoring data at RCRA Facilities (USEPA, 1992 and 1989). The above test method was used because both data sets and their log-transformed data were not normally distributed, and the number of non-detects in the combined data set (background and investigative) were greater than 15%. All non-detects in both data sets were replaced with half the minimum detection limit as recommended in USEPA's guidance manuals (USEPA, 1992 and 1989). Results of the statistical analysis are summarized in Table 4.2.

Table 4.2
Arsenic Statistical Data
Surface and Subsurface Soil

Data Source	Sample Count	Mean	Standard Deviation	Ranked Sum	Mann-Witney Static	Approximate z-score for Mann-Whitney Static
Background Surface Soil 1997	30	3.50	1.06	813	348	1.319
SWMUs 22-25 Surface Soil '98 RFI data	29	5.39	5.06	957		
Background Subsurface Soil 1997	30	3.03	1.13	2069	1452	1.346
SWMUs 22-25 Subsurface Soil '98 RFI data	83	4.71	6.52	4524		

Table 4.2 illustrates that the mean arsenic concentration in the background soils is statistically the same as that of the RFI soil samples collected at SWMUs 22, 23, 24, and 25 in 1998. The agreement in the means was confirmed by the result of the z-static test based on the assumption that there is no difference between the means at the 0.01 confidence level of significance. The approximate z-scores (1.319-surface and 1.346-subsurface) represents a normal approximation of the distribution of the Mann-Witney Static value (348-surface and 1452-subsurface).

To accept or reject the above assumption, the upper z-score is compared against the tabulated critical z-value of the upper 0.01 percentile (i.e. 99% level of confidence) of the normal distribution. The critical z-value is 2.326. Since 1.319 and 1.346 are less than 2.326, the

assumption that the means are the same is accepted. Therefore, it is concluded that the since two means are statistically the same, the arsenic concentration values in the RFI data set for SWMUs 22, 23, 24 and 25 are interpreted as being consistent with those of the Draft BBS.

FINAL PAGE

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FINAL PAGE