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DRAFT LETTER REPORT SITE 8B AND SITE 8C VERIFICATION SAMPLING NCBC
GULFPORT MS (DRAFT ACTING AS FINAL)
12/9/2005
TETRA TECH



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December 9, 2005

Project Number 4615

Mr. Art Conrad, EIC
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, SC 29419
(843) 820-5520

Reference: Clean Contract No. N62467-02-D-0468
Contract Task Order No. 4615

Subject: Draft Letter Report, Site 8B and 8C Verification Sampling
Naval Construction Battalion Center Gulfport
Gulfport, Mississippi

Dear Mr. Conrad:

Tetra Tech NUS, Inc. (TtNUS) is pleased to submit this Draft Letter Report for Site 8B and 8C verification sampling. This report has been prepared for the U.S. Navy Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) under Contract Task Order (CTO) 4615, for the Comprehensive Long-term Environmental Action Navy (CLEAN) III Contract Number N62467-02-D-0468.

INTRODUCTION

This letter report summarizes the collection and analysis of samples from Site 8, Areas B and C. The primary objective was to characterize the levels and distribution the remaining HO-related dioxins to determine if the soil meets current MDEQ standards. This sampling became necessary because of the requirements of confirmation sampling have changed since the sites were remediated in 1985. In addition, the sampling data was used to determine if additional characterization or remedial activities are necessary.

Samples were collected in accordance with Mississippi Department of Environmental Quality (MDEQ) guidance as presented in the Verification of Soil Remediation Guidance Document (MDEQ, 1994) as modified by the Sampling Strategies and Statistics Training Materials for Part 201 Evaluations (S3TM) (MDEQ, 2002).

SITE BACKGROUND

Site 8 (Areas A, B, and C) comprises approximately 30 acres of (NCBC) Gulfport and lies in the north central portion of the installation. Site 8 topography is relatively flat with an undulating surface indicative of past remedial activities. Site layout is shown on Figures 1 and 2 (Attached).

From 1968 through 1977, Site 8 was used as a storage area for 850,000 gallons of the defoliant Herbicide Orange (HO) contained in 55-gallon drums. Based on the level of storage and handling of HO, Site 8 was subdivided into areas 8A, 8B and 8C during site environmental investigations; with Site 8A being the primary storage area and Sites 8B and 8C used to handle overflow HO stockpile. During the period of HO storage, damaged and leaking drums were removed from the site; however, limited documentation exists regarding the magnitude of any HO release or the conditions surrounding the disposal of the leaking drums.

The contaminated soil at Site 8 (Areas A, B and C) was remediated in the mid- 1980's and confirmed using regulations and sampling techniques appropriate for that time. However, that confirmation data for Site 8 surface soil was performed of lower resolution (Method 8280) dioxin methodology with a detection/reporting limit closer to 1 (ppb). This type of data was suitable for Site 8 when earlier plans included a cover or soil cement for the entire site. More recent developments (Remedial Design, Tetra Tech NUS, Inc.(TtNUS) 2004) indicate that only Site 8 A will have a cover and that B and C must be restored to pre-storage functionality. Given these circumstances, a higher resolution confirmation of the remedial activities conducted in the mid-1980s was completed to determine if the site meets current (MDEQ) guidelines. The data collected and presented in this letter report complies with all requirements necessary to support decisions regarding future site uses.

METHODOLOGY

The sample location and frequency employed was presented in the Site are based upon the Sampling Strategies and Statistics Training Materials for Part 201 Evaluations (S3TM) (MDEQ,

2002) as presented in the Sampling and Analysis Plan (TtNUS, December 2004). Given the unpredictable nature of the distribution of surface soil contamination at Site 8 a biased sampling

approach was not feasible. A statistically driven random sampling strategy was employed via the use of a grid to facilitate the unbiased selection of sampling points and accepted statistical tools

for evaluation of the resulting data. These strategies provide a 95% confidence level of determining any hot spot concentrations at this site. This strategy incorporated the use of bio-assay dioxin sampling and analysis techniques (USEPA Method 4025) in conjunction with high resolution (USEPA Method 8290) laboratory analysis to increase the sampling density and decrease the cost of analysis. The grid, and the accompanying sample locations, was established by Land Surveying, Inc.

ESTABLISHING THE GRID

The grid system established for a site must be proportional to the size of the site and incorporate the level of confidence desired, as well as the spatial variability of the media to be sampled. Given the large size and unpredictable distribution patterns of contamination at B and C, a grid interval using the following formula (S3TM MDEQ, 2002) was developed:

$$GI = ((A * \Pi)/SF)^{1/2}$$

Where: A = area to be grid (square feet)
 GI = grid interval
 SF = Site factor (unitless)
 Π = 3.14159

Given the uncontaminated roadway (and associated roadbed) between Areas B and C, the sites were treated separately in terms of establishing a grid to eliminate unnecessary sampling. The resulting grid interval is 36 feet for Area B and 26 feet for Area C as shown on Figures 1 and 2 (Attached).

These grids result in a great number of nodes over the surface of Areas B and C; however this statistical technique does not require that every node be sampled as described in the following paragraph.

SAMPLING FREQUENCY

Based on the guidance in the S3TM, the sampling of the grid is accomplished by assigning coordinates to all of the nodes and randomly selecting nodes using a random number generator. A minimum of 12 samples is required or 25% (whichever is larger).

In this case, 25% of the nodes results in 145 sampling locations for Area B and 53 sampling locations for Area C. The randomly selected sampling nodes are shown on the Figure 1 and 2 (Attached). 10% of all primary locations were confirmed using Method 8290 at an offsite laboratory.

RESULTS

The results of the investigation are shown on Tables 1 and 2 (attached). The bio-assay analysis (USEPA Method 4025) shows that 1 of 145 samples at Site 8, Area B and 3 of 154 samples at Site 8, Area C exceed restricted MDEQ screening criteria for soil of 38 ppt. Further, the 95% UCL as determined using the EPA UCLPro (USEPA April 2004) is 11.07 at Site 8, Area B and 16.08 at Site 8, Area C. The statistical data sheets are attached.

The results of the high resolution laboratory analysis (USEPA Method 8290) were used to confirm the results of the bio-assay analysis (USEPA Method 4025) and are shown in Table 3 (attached).

CONCLUSIONS

The confirmation sampling completed at Site 8 Areas B and C verify that the removal of contaminated soil completed in 1986 meets current MDEQ standards for a restricted (non-residential) use area of 38 parts per trillion (ppt). Areas B and C are now compatible with this restricted use designation and are going to remain that way in the future.

Further, there were no discernable "hot spots" that will require additional delineation or removal actions to complete this project. Site restoration will require a significant volume of material to restore the surface to the pre-removal elevation.

Mr. Art Conrad
Naval Facilities Engineering Command
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If you have any questions regarding the information presented in this document, please contact me by phone at (850) 385-9899, or via e-mail at fisher@tnus.com

Sincerely,

A handwritten signature in black ink, appearing to be 'RFisher', with a long horizontal line extending to the right.

Robert Fisher, P.G.
Task Order Manager
Date: December 9, 2005

Enclosures

c: Raghu Arora, ECC
Prashant Khanna, ECC
Joe Shaiman, ECC
Art Conrad, SOUTHDIV
Gordon Crane, SOUTHDIV

ATTACHMENTS

**TABLE 1
SITE 8, AREA B RESULTS
METHOD 4025**

SAMPLE_ID	4025 (ppt)	SAMPLE_ID	4025 (ppt)	SAMPLE_ID	4025 (ppt)
8BA1S14P	11	8BF23S14P	10	8BJ11S14P	10
8BA10S14P	10	8BF25S14P	12	8BJ24S14P	<10
8BA12S14P	12	8BF27S14P	<10	8BJ28S14P	50
8BA41S14P	<10	8BF28S14P	<10	8BJ31S14P	<10
8BA42S14P	10	8BF30S14P	<10	8BJ33S14P	<10
8BA43S14P	11	8BF31S14P	<10	8BJ35S14P	<10
8BA45S14P	<10	8BF32S14P	<10	8BJ37S14P	<10
8BB2S14P	<10	8BF36S14P	<10	8BJ39S14P	<10
8BB14S14P	<10	8BF42S14P	11	8BJ40S14P	<10
8BB17S14P	13	8BG3S14P	15	8BJ42S14P	10
8BB19S14P	14	8BG4S14P	<10	8BJ44S14P	<10
8BB29S14P	<10	8BG5S14P	<10	8BK4S14P	<10
8BB33S14P	10	8BG6S14P	<10	8BK6S14P	<10
8BB35S14P	18	8BG11S14P	<10	8BK27S14P	24
8BB36S14P	12	8BG19S14P	<10	8BK35S14P	<10
8BC5S14P	12	8BG23S14P	<10	8BK38S14P	<10
8BC6S14P	<10	8BG26S14P	<10	8BK43S14P	<10
8BC7S14P	12	8BG27S14P	11	8BK45S14P	<10
8BC8S14P	10	8BG34S14P	<10	8BL3S14P	<10
8BC9S14P	<10	8BG38S14P	<10	8BL6S14P	14
8BC16S14P	10	8BH2S14P	<10	8BL7S14P	11
8BC18S14P	21	8BH3S14P	<10	8BL8S14P	15
8BC20S14P	14	8BH8S14P	<10	8BL12S14P	11
8BC22S14P	<10	8BH12S14P	<10	8BL26S14P	27
8BC24S14P	<10	8BH13S14P	<10	8BL29S14P	<10
8BC26S14P	<10	8BH18S14P	<10	8BL31S14P	<10
8BC28S14P	<10	8BH20S14P	<10	8BL36S14P	16
8BC30S14P	<10	8BH26S14P	<10	8BL38S14P	14
8BC35S14P	16	8BH30S14P	10	8BL39S14P	10
8BC37S14P	10	8BH37S14P	<10	8BM1S14P	10
8BC38S14P	13	8BH40S14P	10	8BM2S14P	<10
8BC39S14P	13	8BH41S14P	<10	8BM3S14P	12
8BD4S14P	<10	8BH43S14P	<10	8BM10S14P	13
8BD9S14P	13	8BH45S14P	<10	8BM12S14P	18
8BD11S14P	<10	8BI1S14P	10	8BM14S14P	<10
8BD21S14P	10	8BI2S14P	<10	8BM15S14P	16
8BD32S149	10	8BI5S14P	15	8BM16S14P	<10
8BE10S14P	13	8BI9S14P	15	8BM18S14P	<10
8BE19S14P	<10	8BI10S14P	11	8BM19S14P	12
8BE21S14P	26	8BI14S14P	12	8BM22S14P	<10
8BE22S14P	<10	8BI16S14P	<10	8BM23S14P	<10
8BE29S14P	12	8BI17S14P	<10	8BM25S14P	<10
8BE33S14P	11	8BI22S14P	<10	8BM28S14P	<10
8BE40S14P	10	8BI24S14P	<10	8BM30S14P	<10
8BE43S14P	14	8BI25S14P	<10	8BM32S14P	19
8BE44S14P	13	8BI34S14P	<10	8BM33S14P	15
8BF8S14P	10	8BI41S14P	<10	8BM34S14P	<10
8BF17S14P	15	8BI43S14P	<10		

8BF18S14P	14	8BJ7S14P	10		
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**TABLE 2
SITE 8, AREA C RESULTS
4025 ANALYSIS**

SAMPLE_ID	4025 (ppt)	SAMPLE_ID	4025 (ppt)	SAMPLE_ID	4025 (ppt)
8CC5S149	27	8CD13S14P	<10	8CF17S14P	<10
8CC8S14P	<10	8CD15S14P	<10	8CF22S14P	47
8CC9S14P	12	8CD20S14P	<10	8CG2S14P	<10
8CC10S14P	<10	8CD27S14P	<10	8CG3S14P	<10
8CC15S14P	12	8CD29S14P	<10	8CG9S14P	<10
8CC20S14P	<10	8CE1S14P	<10	8CG11S14P	<10
8CC22S14P	<10	8CE8S14P	12	8CG12S14P	<10
8CC24S14P	<10	8CE18S14P	17	8CG14S14P	10
8CC28S14P	<10	8CE23S14P	<10	8CG19S14P	18
8CD4S14P	11	8CE25S149	14	8CG21S14P	<10
8CD5S14P	<10	8CF4S14P	<10	8CG24S14P	<10
8CD6S14P	50	8CF7S14P	10	8CG26S14P	<10
8CD10S14P	47	8CF16S14P	<10	8CG28S14P	<10

**TABLE 3
SITE 8, AREAS B and C RESULTS
8290 ANALYSIS**

SAMPLE_ID	4025 (ppt)	8290 (ppt)	SAMPLE_ID	4025 (ppt)	8290 (ppt)
8BA42S14P	10	6.71	8BK27S14P	24	36.6
8BC24S14P	<10	1.21	8BL26S14P	27	21.5
8BC35S14P	16	62.4	8BM12S14P	18	12.6
8BD21S14P	10	17.0	8BM30S14P	<10	7.99
8BF31S14P	<10	12.0	8CA3S14P	<10	2.98
8BG5S14P	<10	2.66	8CB29S14P	<10	1.96
8BH12S14P	<10	0.676	8CD13S14P	<10	0.637
8BH41S14P	<10	11.0	8CE1S14P	<10	1.99
8BI17S14P	<10	1.02	8CF16S14P	<10	0.0669
8BJ35S14P	<10	3.72	8CG28S14P	<10	23.4

General Statistics

Data File: Site 8, Area B		Variable: 4025	
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	145	Lilliefors Test Statistic	0.294397
Number of Unique Samples	15	Lilliefors 5% Critical Value	0.073578
Minimum	5	Data not normal at 5% significance level	
Maximum	50		
Mean	8.944828	95% UCL (Assuming Normal Distribution)	
Median	5	Student's-t UCL	9.750526
Standard Deviation	5.860389		
Variance	34.34416	Gamma Distribution Test	
Coefficient of Variation	0.655171	A-D Test Statistic	13.30437
Skewness	3.038106	A-D 5% Critical Value	0.757785
Gamma Statistics		K-S Test Statistic	0.336075
k hat	3.530834	K-S 5% Critical Value	0.078247
k star (bias corrected)	3.46238	Data do not follow gamma distribution at 5% significance level	
Theta hat	2.533347		
Theta star	2.583433	95% UCLs (Assuming Gamma Distribution)	
nu hat	1023.942	Approximate Gamma UCL	9.641686
nu star	1004.09	Adjusted Gamma UCL	9.648868
Approx.Chi Square Value (.05)	931.519		
Adjusted Level of Significance	0.048345	Lognormal Distribution Test	
Adjusted Chi Square Value	930.8257	Lilliefors Test Statistic	0.344585
Log-transformed Statistics		Lilliefors 5% Critical Value	0.073578
Minimum of log data	1.609438	Data not lognormal at 5% significance level	
Maximum of log data	3.912023	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.042833	95% H-UCL	9.525901
Standard Deviation of log data	0.515484	95% Chebyshev (MVUE) UCL	10.54031
Variance of log data	0.265724	97.5% Chebyshev (MVUE) UCL	11.29369
		99% Chebyshev (MVUE) UCL	12.77356
		95% Non-parametric UCLs	
		CLT UCL	9.745343
		Adj-CLT UCL (Adjusted for skewness)	9.876545
		Mod-t UCL (Adjusted for skewness)	9.770991
		Jackknife UCL	9.750526
		Standard Bootstrap UCL	9.725982
		Bootstrap-t UCL	9.875678
RECOMMENDATION		Hall's Bootstrap UCL	9.967063
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	9.77931
		BCA Bootstrap UCL	9.875862
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	11.0662
		97.5% Chebyshev (Mean, Sd) UCL	11.98414
		99% Chebyshev (Mean, Sd) UCL	13.78722

General Statistics

Data File: Site 8, Area C		Variable: 4025	
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	54	Lilliefors Test Statistic	0.330609
Number of Unique Samples	12	Lilliefors 5% Critical Value	0.120569
Minimum	5	Data not normal at 5% significance level	
Maximum	50		
Mean	9.925926	95% UCL (Assuming Normal Distribution)	
Median	5	Student's-t UCL	12.29052
Standard Deviation	10.37932		
Variance	107.7303	Gamma Distribution Test	
Coefficient of Variation	1.045678	A-D Test Statistic	7.760645
Skewness	2.95099	A-D 5% Critical Value	0.763282
Gamma Statistics		K-S Test Statistic	0.377542
k hat	1.961086	K-S 5% Critical Value	0.122632
k star (bias corrected)	1.864482	Data do not follow gamma distribution at 5% significance level	
Theta hat	5.061444		
Theta star	5.32369	95% UCLs (Assuming Gamma Distribution)	
nu hat	211.7973	Approximate Gamma UCL	11.79021
nu star	201.3641	Adjusted Gamma UCL	11.84601
Approx. Chi Square Value (.05)	169.5241		
Adjusted Level of Significance	0.045556	Lognormal Distribution Test	
Adjusted Chi Square Value	168.7256	Lilliefors Test Statistic	0.385122
Log-transformed Statistics		Lilliefors 5% Critical Value	0.120569
Minimum of log data	1.609438	Data not lognormal at 5% significance level	
Maximum of log data	3.912023	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.019028	95% H-UCL	11.05629
Standard Deviation of log data	0.645996	95% Chebyshev (MVUE) UCL	13.06706
Variance of log data	0.417311	97.5% Chebyshev (MVUE) UCL	14.72494
		99% Chebyshev (MVUE) UCL	17.98153
		95% Non-parametric UCLs	
		CLT UCL	12.24919
		Adj-CLT UCL (Adjusted for skewness)	12.85526
		Mod-t UCL (Adjusted for skewness)	12.38506
		Jackknife UCL	12.29052
		Standard Bootstrap UCL	12.24175
		Bootstrap-t UCL	13.14339
RECOMMENDATION		Hall's Bootstrap UCL	12.57149
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	12.40741
		BCA Bootstrap UCL	12.94444
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	16.0826
		97.5% Chebyshev (Mean, Sd) UCL	18.74665
		99% Chebyshev (Mean, Sd) UCL	23.97959