N60200.AR.003586
NAS CECIL FIELD, FL
5090.3a

LETTER REGARDING UNIVERSITY OF FLORIDA REVIEW OF REVIEW OF 95% UPPER CONFIDENCE LEVELS RISK ASSESSMENT CALCULATION AT OPERABLE UNIT 10 (OU 10) SITE 21 WITH ATTACHMENTS NAS CECIL FIELD FL
4/7/2003
UNIVERSITY OF FLORIDA

UNIVERSITY OF
FLORIDA

Center for Environmental & Human Toxicology

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April 7, 2003

Ligia Mora-Applegate
Bureau of Waste Cleanup
Florida Department of Environmental Protection
Room 471A, Twin Towers Office Building
2600 Blair Stone Rd.
Tallahassee, FL 32399
United States of America

Dear Ms. Mora-Applegate,

At your request, we have reviewed documentation provided by Tetra Tech NUS explaining how 95% Upper Confidence Levels (UCL) were computed for Site 21, NAS Cecil Field. This documentation was provided by Ron Kotun in response to comments we made to the *Action Memorandum for PSC 21, NAS Cecil Field.* In our August 12, 2002 letter we commented on some inconsistencies in the data presented, the occurrence of relatively high detection limits for some contaminants in some samples, and that we could not reproduce the 95% UCL values presented in the in the report. The documentation sent to us by Ron Kotun explains that 95% UCLs were calculated using the Bootstrap-t method. A working example was also provided to demonstrate the use of this method. After reviewing this additional information, we have the following comments:

1. We think that the bootstrap method is not the most appropriate method to use, especially when the data fit a normal or log-normal distribution. Simulation studies using distributions with known parameters conducted by Dr. Ken Portier and other researchers at the University of Florida show that bootstrap methods often provide less than the true 95% confidence interval on the mean.

2. We still cannot reproduce the calculations presented by Tetra Tech NUS. We used ProUCL and a similar software tool developed by the University of Florida to calculate a 95% UCL for the dataset used in the example sent to us. Tetra Tech calculates a 95% UCL of 2.64 using the bootstrap-t method. ProUCL determines that the data fit a log-normal distribution. This tool calculates a 95% UCL of 5.38 using the bootstrap-t method, but recommends using instead 5.37 calculated using the Chevyshev (MVUE) method. Using the software developed by the University of

Florida, we calculate a 95% UCL of 5.41 using the bootstrap-t method. This software tool recommends using 5.22 calculated using the H-statistic. Interestingly, none of the many values calculated by both software tools were lower than 3.5, significantly higher than the value calculated by Tetra Tech NUS.

In conclusion, we recommend against using the bootstrap-t method, especially using the computation methodology discussed by Tetra Tech NUS. We are providing you with 95% UCLs for all contaminants and exposure units in the form of a modified version of the worksheet produced by Tetra Tech. Please let us know if you have any questions regarding the derivation of these values.

Sincerely,

Hugo G. Ochoa, D.V.M., Ph.D.

Stephen M. Roberts, Ph.D.

PSC 21
ATTAINMENT OF RESIDENTIAL SCTLS
RESIDENTIAL UNIT 1
PRE-REMEDIATION
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

nsample	Arsenic	4,4'DDT	Chlordanes	Toxaphene	TRPH	Dieldrin
MIN	0.2000	0.0000	0.0000	0.0000	0.0000	0.0000
MAX	9.60	0.00	0.00	0.00	0.00	0.00
MEAN	2.46	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
t 0.95, n-1	0.273430727	0.15347719	0.206439138	0.214692481	0.240298851	0.214677259
STANDARD DEVIATION	2.81	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
COEFFICIENT OF VARIATION	1.14	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
n	17	0	0	0	0	0
UCL $_{0.95}$	2.65	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
UF UCL0.95	5.221428757					
Goal	**3.70**	**13,000.00**	**12,000.00**	**3,700.00**	**2,500.00**	**300.00**
remediation level	**1**	**3.8**	**7**	**8.5**	**45**	**1.9**
90B00101	1					
90S00401 [08/28/98]	1					
90S01301 [08/28/98]	0.9					
90S02601	9.3					
90S02701	1.8					
CEF-P21-SS-018-01	3.2					
CEF-P21-SS-019-01	1.8					
CEF-P21-SS-020-01	*0.3*					
CEF-P21-SS-021-01	*0.2*					
CEF-P21-SS-112-01	1					
CEF-P21-SS-113-01	2.5					
CEF-P21-SS-215-01	9.6					
CEF-P21-SS-216-01	*0.9*					
CEF-P21-SS-217-01-AVG	*0.9*					
CEF-P21-SS-218-02	1.5					
CEF-P21-SS-307-01	4					
CEF-P21-SS-308-01	*2*					

Bolded samples are to be removed for attainment of industrial SCTLs.
Italicized values represent one-half the detection limit.

TABLE B-2

SITE 21
ATTAINMENT OF SCTLS
RESIDENTIAL UNIT 2
POST-REMEDIATION
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

nsample	Arsenic	4,4'DDT	Chlordanes	Toxaphene	TRPH	Dieldrin
MIN	0.2000	1.8000	1.9000	8.5000	45.0000	0.8500
MAX	7.30	547.00	3,860.00	11,500.00	45.00	115.00
MEAN	1.31	60.99	496.70	1,178.80	45.00	12.34
t 0.95, n-1	0.236372064	0.247052978	0.250181948	0.250675746	0.240298851	0.244421117
STANDARD DEVIATION	2.02	151.39	1,359.14	2,965.72	0.00	29.44
COEFFICIENT OF VARIATION	1.54	2.48	2.74	2.52	0.00	2.39
n	16	20	8	20	2	20
$UCL_{0.95}$	1.43	69.35	616.92	1,345.04	45.00	13.95
UFvUCL0.95	3.51453696	208.5426728	2591.275294	4069.422047	45.00	41.03259892
Goal	2.04	3,300.00	3,100.00	1,000.00	340.00	70.00
remediation level	1	3.8	7	8.5	45	1.9
90S01201 [08/28/98]	5.4					
90S01501	1					
90S01502	7.3					
90S01601	0.9					
90S01602	*0.3*					
90S01701	*0.3*					
90S01702	*0.3*					
90S01801	0.9					
90S01802	0.8					
90S01901	*0.3*					
90S01902	0.7					
90S03101	1	3.8	7	8.5	45	1.9
CEF-P21-SS-016-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-107-01	0.2					
CEF-P21-SS-506-01		3.8	7	8.5		1.9
CEF-P21-SS-509-01		547	3860	*11500*		*115*
CEF-P21-SS-702-01-AVG		9.05	64.7	*90*		*0.9*
CEF-P21-SS-809-02		433	*24*	*2400*		*24*
CEF-P21-SS-811-01		3.8		8.5		1.9
CEF-P21-SS-812-01		*1.8*		*90*		*0.9*
CEF-P21-SS-813-01		3.8		8.5		1.9
CEF-P21-SS-831-01		3.8		8.5		1.9
CEF-P21-SS-901-02		8.5		*95*		*1*
CEF-P21-SS-904-01		*150*		*7500*		*75*
CEF-P21-SS-905-01		*1.8*		*90*		0.85
CEF-P21-SS-906-01		*3.9*		*195*		*2*
CEF-P21-SS-907-01		*1.9*	*1.9*	*95*		*1*
CEF-P21-SU-404-03-AVG	*0.21*					
CEF-P21-SU-829-03	0.4					
CEF-P21-SU-902-03		12		*100*		*1*
CEF-P21-SU-903-04		*2*	*2*	*100*		*1*
CEF-P21-SU-908-02		*8*		*380*		*3.8*
CEF-P21-SU-909-03		*10*		*490*		*4.9*
CEF-P21-SU-910-04		*8*		*400*		*4*

Bolded samples are to be removed.
Italicized values represent one-half the detection limit.
Removal of samples to achieve industrial SCTLs resulted in attainment of residential SCTLs.
Of those samples remaining following removal, dieldrin, toxaphene and TRPH are not detected.

PSC 21
ATTAINMENT OF SCTLS
PRE-REMEDIATION
RESIDENTIAL UNIT 3
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

nsample	Arsenic	4,4'DDT	Chlordanes	Toxaphene	TRPH	Dieldrin
MIN	0.8000	1.8000	8.7000	36.0000	37.0000	0.9000
MAX	10.90	2.80	46.00	90.00	125.00	1.80
MEAN	1.99	2.30	27.35	63.00	81.00	1.35
t 0.95, n-1	0.228828841	0.347610894	0.272035273	0.214692481	0.240298851	0.214677259
STANDARD DEVIATION	2.49	0.71	26.38	38.18	62.23	0.64
COEFFICIENT OF VARIATION	1.25	0.31	0.96	0.61	0.77	0.47
n	19	2	2	2	2	2
$UCL_{0.95}$	2.13	2.47	32.42	68.80	91.57	1.45
UF UCL0.95	4.484599304	2.80	46.00	90.00	125.00	1.80
Goal	**3.70**	**13,000.00**	**12,000.00**	**3,700.00**	**2,500.00**	**300.00**
remediation level	**1**	**3.8**	**7**	**8.5**	**45**	**1.9**
90S02501	1.3	*1.8*	46	*36*	37	*1.8*
CEF-P21-SS-017-01	10.9	2.8	8.7	*90*	125	*0.9*
CEF-P21-SS-108-01	3					
CEF-P21-SS-109-01	1					
CEF-P21-SS-208-01	*0.8*					
CEF-P21-SS-209-01	6.2					
CEF-P21-SS-210-01	1					
CEF-P21-SS-304-01	*1.9*					
CEF-P21-SS-305-01	1					
CEF-P21-SS-306-01	*1*					
CEF-P21-SS-401-01	*1*					
CEF-P21-SS-504-01	1.2					
CEF-P21-SS-505-01	1.6					
CEF-P21-SS-919-02-AVG	1					
CEF-P21-SS-922-02	1					
CEF-P21-SU-920-03	1					
CEF-P21-SU-921-04	1					
CEF-P21-SU-923-03	1					
CEF-P21-SU-924-04	1					

Bolded samples are to be removed for attainment of industrial SCTLs.
Italicized values represent one-half the detection limit.

TABLE B-4

SITE 21
ATTAINMENT OF RESIDENTIAL SCTLS
RESIDENTIAL UNIT 4
POST-REMEDIATION
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

nsample	Arsenic	4,4'DDT	Chlordanes	Toxaphene	TRPH	Dieldrin
MIN	0.2000	3.8000	1.8000	8.5000	12.0000	0.9000
MAX	6.80	115.00	2,875.00	5,500.00	140.00	55.00
MEAN	1.23	9.44	172.55	244.80	55.79	5.19
t 0.95, n-1	0.233380395	0.219463	0.232997	0.209979	0.260395	0.223182
STANDARD DEVIATION	0.97	19.33	578.66	889.05	30.57	11.79
COEFFICIENT OF VARIATION	0.79	2.05	3.35	3.63	0.55	2.27
n	57	40	25	40	26	40
UCL $_{0.95}$	1.26	10.11	199.52	274.32	57.35	5.61
UF UCL0.95	1.568105252	22.75938376	677.0201968	857.5338726	70.61290853	13.31659858
Goal	**2.04**	**3,300.00**	**3,100.00**	**1,000.00**	**340.00**	**70.00**
remediation level	**1**	**3.8**	**7**	**8.5**	**45**	**1.9**
90B00201	1.8					
90S00101 [08/28/98]	1.2					
90S00201 [08/28/98]	1					
90S00501 [08/28/98]	2.2					
90S00601 [08/28/98]	1.6					
90S00701 [08/28/98]	0.9					
90S01001 [08/28/98]	1					
90S01101 [08/28/98]	1					
90S01401	1					
90S01402	1					
90S02001	1	3.8	7	8.5	45	1.9
90S02101	1	3.8	7	8.5	45	1.9
90S02201	1	3.8	7	8.5	45	1.9
90S02301	1	3.8	7	8.5	45	11
90S02401	1	3.8	7	8.5	45	1.9
90S03401	3	13	410	650	120	*1.8*
90S3201	1	3.8	7	8.5	45	1.9
90S3301	2.2	7.4	190	410	130	*1.9*
BOR-A-5-1 [11/05/91]	3	*55*	108	*550*		*55*
BOR-A-6-1 [11/05/91]	1	3.8	7	8.5		1.9
CEF-P21-SS-001-01	*0.6*	*7.5*	60	*370*	140	*3.7*
CEF-P21-SS-003-01-AVG	2.85	*115*	2875	*5500*	103.5	*55*
CEF-P21-SS-006-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-007-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-008-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-012-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-015-01		3.8	7	8.5	45	1.9
CEF-P21-SS-101-01	2.8					
CEF-P21-SS-102-01	*1.2*					
CEF-P21-SS-114-02	1					
CEF-P21-SS-114-03	1					
CEF-P21-SS-115-02	1					
CEF-P21-SS-115-03	1					
CEF-P21-SS-116-02	1					
CEF-P21-SS-116-03	1					
CEF-P21-SS-212-04	1					
CEF-P21-SS-213-04	1					
CEF-P21-SS-214-03-AVG	1					
CEF-P21-SS-301-01-AVG	1	3.8	7	8.5		1.9
CEF-P21-SS-315-07	*0.3*					
CEF-P21-SS-317-02		3.8	7	8.5		1.9
CEF-P21-SS-318-02		3.8	7	8.5		1.9
CEF-P21-SS-501-01		*23*	543	*1100*		*11*
CEF-P21-SS-603-03	1					
CEF-P21-SS-801-02	1	3.8		8.5	45	1.9
CEF-P21-SS-804-02		3.8		8.5	45	1.9
CEF-P21-SS-805-02		3.8		8.5	45	1.9
CEF-P21-SS-806-02-AVG		3.8		8.5	45	1.9
CEF-P21-SS-807-02		3.8	7	8.5	45	1.9
CEF-P21-SS-817-02-AVG	1	3.8		8.5	45	1.9
CEF-P21-SS-819-02-AVG	1	3.8		8.5	45	1.9
CEF-P21-SS-820-02	1	3.8	7	8.5	45	1.9
CEF-P21-SS-822-02	1	3.8		8.5	45	1.9
CEF-P21-SS-823-02	0.47					
CEF-P21-SS-825-02	0.87					
CEF-P21-SS-827-02	*0.2*					
CEF-P21-SU-311-5.5-AVG	*0.8*					
CEF-P21-SU-312-06	1					
CEF-P21-SU-313-07	*0.2*					
CEF-P21-SU-314-07	*0.2*					
CEF-P21-SU-403-03	*0.5*					
CEF-P21-SU-802-03	1.7	*18*	*1.8*	*90*	12	0.9
CEF-P21-SU-818-03	1	3.8		8.5	45	1.9
CEF-P21-SU-911-03-AVG		3.8		8.5		1.9
CEF-P21-SU-912-04		3.8		8.5		1.9
CEF-P21-SU-913-03		3.8		8.5		1.9
CEF-P21-SU-914-04		3.8		8.5		1.9
CEF-P21-SU-915-03		3.8		8.5		1.9
CEF-P21-SU-916-04		3.8		8.5		1.9
CEF-P21-SU-917-04	1	3.8	7	8.5		1.9
CEF-P21-SU-918-05	6.8	*17*		*850*		*8.5*

Bolded samples were proposed for removal to achieve industrial SCTLs.
Italicized samples represent one-half the detection limit.
Removal of samples to achieve industrial SCTLs resulted in attainment of residential SCTLs.

TABLE B-5

SITE 21
ATTAINMENT OF RESIDENTIALSCTLS
RESIDENTIAL UNIT 5
POST-REMEDIATION
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

nsample	Arsenic	4,4'DDT	Chlordanes	Toxaphene	TRPH	Dieldrin
MIN	0.0000	2.1000	2.0000	8.5000	44.0000	1.1000
MAX	0.00	5,740.00	505.00	3,620.00	150.00	210.00
MEAN	1.17	266.16	85.15	483.08	78.60	15.22
t 0.95, n-1	0.261130915	0.196551841	0.260480007	0.242411016	0.278618872	0.217681701
STANDARD DEVIATION	1.00	1,167.68	150.63	838.59	48.68	42.19
COEFFICIENT OF VARIATION	0.85	4.39	1.77	1.74	0.62	2.77
n	18	24	20	24	5	24
$UCL_{0.95}$	1.23	313.01	93.92	524.58	84.67	17.10
UF UCL0.95	2.08	1,305.00	199.00	1062.223514	150.00	2.76
Goal	**2.04**	**3,300.00**	**3,100.00**	**1,000.00**	**340.00**	**70.00**
remediation level	**1**	**3.8**	**7**	**8.5**	**45**	**1.9**
BOR-A-1-1 [11/05/91]	1	3.8	7	8.5		1.9
BOR-A-2-1 [11/05/91] - AVG	0.375	10.85	55	112.5		11.5
BOR-A-3-1 [11/05/91]	0.44	*25*	82	*245*		*25*
BOR-A-4-1 [11/05/91]	0.94	*27*	41	*265*		*27*
CEF-P21-SS-002-01	*0.6*	*18*	468	*900*	150	*9*
CEF-P21-SS-004-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-005-01	1.9	*3.8*	16.3	*190*	109	*1.9*
CEF-P21-SS-010-01	1	3.8	7	8.5	45	1.9
CEF-P21-SS-011-01	3.1	*35*	505	*1750*	*44*	*18*
CEF-P21-SS-110-01	2.7	311	211	*1800*		*18*
CEF-P21-SS-110-02	*0.2*	15.7	19.1	*445*		*4.5*
CEF-P21-SS-111-01-AVG	*0.26*	*7*	*7*	*345*		*3.5*
CEF-P21-SS-111-02	*0.2*	33.7		*450*		*4.5*
CEF-P21-SS-211-01	*0.8*					
CEF-P21-SS-302-01	*1*	11	*2*	*100*		1.8
CEF-P21-SS-303-01	1	3.8	7	8.5		1.9
CEF-P21-SS-316-02		5740	*210*	3620		*210*
CEF-P21-SS-502-01		*2.1*	30.5	*105*		*1.1*
CEF-P21-SS-503-01-AVG	1	3.8	7	8.5		1.9
CEF-P21-SS-602-01		3.8	7	8.5		1.9
CEF-P21-SS-701-01	3.6					
CEF-P21-SS-803-03		3.8	7	8.5		1.9
CEF-P21-SS-814-02		3.8		8.5		1.9
CEF-P21-SS-815-01		104		*340*		*3.4*
CEF-P21-SS-816-01		9.5		*850*		*9*
CEF-P21-SU-402-03		3.8	7	8.5		1.9

Bolded samples were proposed for removal to achieve industrial SCTLs.
Italicized values represent one-half the detection limit.
Removal of samples to achieve industrial SCTLs resulted in attainment of residential SCTLs.