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NAS CECIL FIELD, FL
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MEMORANDUM REGARDING DETERMINATION OF A BACKGROUND SCREENING LEVEL FOR MANGANESE IN GROUNDWATER NAS CECIL FIELD FL

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UNITED STATES ENVIRONMENTAL PROTECTION AGEN
REGION 4

61 Forsyth Street
Atlanta, Georgia 30303-3104

December 20, 1999

4WD-OTS

MEMORANDUM

SUBJECT: Determination of a background screening level for manganese in groundwater,
NAS Cecil Field, Jacksonville, FL

FROM: Ted W. Simon, PhD, DABT
Toxicologist
Office of Technical Services

TO: Debbie Vaughn-Wright
RPM, FFB

CC: Elmer W. Akin,
Chief, OTS

Per the request of the Cecil Field Base Cleanup Team (BCT) and yourself, I have performed a statistical evaluation of the dataset that represents background concentrations of manganese in groundwater at Cecil Field. "Hi-cut" values have been used in the past for comparison of site and background conditions. A "hi-cut" value is an upper percentile of the background distribution of concentration such that exceedances of the "hi-cut" values in site-related datasets require further consideration.

Although, at Cecil Field, background comparison for manganese has already been performed using the Wilcoxon rank sum test, the BCT wanted a value for manganese in groundwater to be used in a similar fashion to the "hi-cut" values.

☞ *The value for manganese in groundwater corresponding to a hit cut value lies between 371 and 510 μg/L*

The BCT should choose a value from this range to serve as the "hi-cut" for manganese in groundwater. Please note that these background screening levels are all below the health-based level of 730 μg/L from the Region 3 RBC table.

Method

The background dataset is shown in the table below along with the corresponding well locations.

Well ID	Conc. (μg/L)	Well ID	Conc. (μg/L)	Well ID	Conc. (μg/L)
CEF-BK-12DD	110	CEF-682-01	33.5	CEF-682-02	111
CEF-682-03	10.8	CEF-682-04	9.2	CEF-NAGS-2S	300
CEF-NAGS-5S	12.5 (25U)	CEF-NAGS-1S	81	CEF-364-01S	54.3
CEF-500-1S	5.5	CEF-019-01S	112	CEF-018-01S	45.6
CEF-018-02S	105.0				

The value of 300 μg/L from CEF-NAGS-2S was tested with Dixon's Extreme Value Test[1] and did not appear to be an outlier. Using the Filliben test[2], the assumption of lognormality could not be rejected whether or not the value of 300 μg/L was included in the dataset. In fact, with the value of 300 μg/L included, the distribution, there was a lower probability that the distribution was not lognormal. Therefore, this value was included in the dataset.

10000 bootstrap simulation was performed by selecting at random and with replacement 13 values from the background dataset. Briefly, bootstrap simulation involves resampling the data in hand and then calculating the statistic of interest from each resampled group. The underlying assumption is that each datum is equivalent in its contribution to the quantity of interest. The bootstrap method is used here to evaluate the uncertainty in the quantiles of the background dataset in order to evaluate these quantiles as background screening levels equivalent to the "hi-cut" values.

From each bootstrap iteration, maximum likelihood estimates (MLE) of the geometric mean and geometric standard deviation were determined. From the GM and GSD, both the 90th and 95th percentiles were calculated using $\varphi(0.90) = 1.28$ and $\varphi(0.95) = 1.645$. The table below shows various percentiles of uncertainty in the 0.90 and 0.95 quantiles of the background dataset. The table below shows the results

[1]EPA QA/G-9, Guidance for Data Quality Assessment, QA97 Version, Final, Jan, 1998, p. 4.3-3

[2]Interim Draft Region 4 Guidance Bulletin on Statistical Tests for Background Comparison at Hazardous Waste Sites, November, 1998, Appendix A.3, pp. A-3 to A-5

Uncertainty Percentiles	Background Dataset Quantiles	
	0.90	0.95
95%	319 μg/L	510 μg/l
90%	289 μg/L	454 μg/l
75%	239 μg/l	371 μg/l
50%	194 μg/l	295 μg/l
5%	106 μg/l	158 μg/l

The table above indicates the large range of uncertainty in estimating the upper quantiles of the background dataset. For example, there is a 90% chance that the 95th percentile lies between 158 μg/L and 510 μg/L. I believe the most appropriate range for a choice of a background screening level or "bright line" would be from 371 to 510 μg/L, between the 75th and 95th uncertainty percentiles of the 0.95 quantile.

Please let me know if you need further help.

T.W. Simon/tws:4WD-OTS:28642/12/22/99/A:\DISK8\DEC99\CECIL-MN.WPD