

10 July 2000

MEMORANDUM FOR Chief, Civil HTRW Section, HTRW Branch
ATTN: Mr. Charles Basham

SUBJECT: Background Sampling Program, Lake Ontario Ordinance Works FUDS, Niagara
County, NY

1. Reference your request for review and comments on the subject activities.
2. The HTRW Industrial Hygiene & Chemistry Section has reviewed the subject document and provides the attached comments. A background-sampling program is required to establish a statistically valid data set that can be used to distinguish between site related and natural/anthropogenic sources of chemicals above screening criteria. Rather than use a single point estimate (i.e., a bright line), the difference between site and background concentrations should be determined using a statistical test (e.g., t-test or nonparametric alternative).
3. If there are any questions, please contact Andrew Rak at (4 10) 962-4068.

Encl

ANDREW RAK
Acting Chief, Industrial Hygiene
and Chemistry Section
HTRW Branch

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1. My initial analysis of the number of samples required was based on the four data points submitted in the faxed material from Mr. Ray Pilon. The process used to arrive at the minimum number of sample required is based on procedures set for in EPA's *Guidance for Data Usability in Risk Assessment*. The underlying assumption is that the site concentration would be compared to the background concentrations using a one tailed t-test. (Further discussion of test type is below). Based on that analysis, I determined that the following numbers of samples were required, for given levels of power and confidence:

Metal	Mean*	Stdev.	Coeff. Variation	MDRD	D	Req. Samples 1	Req. Samples 2
Sb	0.575	7.59E-02	13%	20%	1.5144	4	3
As	3.6	0.3367	9%	20%	2.1384	2	2
Be	0.5	0.3008	60%	20%	0.3324	82	52
Bo	2.225	1.0626	48%	20%	0.4188	52	33
Cd	7.25E-02	5.00E-03	7%	20%	2.9000	1	1
Cr (total)	16.075	6.4453	40%	20%	0.4988	37	23
Li	20.725	6.7223	32%	20%	0.6166	24	15
Hg	6.00E-02	1.16E-02	19%	20%	1.0390	9	6

*Units are mg/kg

1. Number of samples with 90% power and confidence 80%.
2. Number of samples with 80% power and confidence 80%.

The main point from the analysis is that Bo and Be are problematic because Bo and Be are close to detection limits. Therefore, it requires several samples if the project managers want to have confidence that we are within +/-20 percent of the background value. (a 20 percent different is EPA's rule of thumb.) However, given that Bo and Be will likely be in concentrations much greater than background (they were process materials), we should be able to see differences of +/- 50 percent with relative ease. If this is the case, the number of required samples drops to approximately 10.

Also evident from the analysis is that a large number of Cr samples should be collected. However, this conclusion is based on the analysis of Cr (total) samples only. Suggest that samples for Cr (VI) be collect so that the screening value (either TAGM or EPA Region IX) for trivalent or hexavalent Cr can be used. Once the Cr is speciated, the appropriate screening value can be applied and this issue should go away.

2. The faxed material from the Buffalo District shows that the background concentrations were compared to NY State TAGM values. This was confusing because there were various emails indicating EPA Region IX Preliminary Remediation Goals (PRGs) were to be used so that the LOOW project would be consistent with the adjacent NFSS. Clarification on this issue is required.

3. Subsequent my analysis, I received a copy of the background study report prepared by Golder Associates Inc., which was done for Chemical Waste Management Inc. (CWM). I have several concerns with the report
 - The copy quality is poor and in several locations it is impossible to read the results of the analysis. Therefore, we cannot replicate any of the data analysis or perform a new analysis of the entire data set. I strongly suggest that we obtain an electronic copy of the data set (or at least a good copy original).
 - The statistical analysis of the data assumed that the data was normally distributed (i.e., follows a bell curve). This assumption is probably wrong, because most environmental data sets follow a log-normal distribution. The normality assumption likely resulted in background concentrations being lower than they actually are. Therefore, I suggest that the background concentrations be recalculated using more appropriate assumptions about the shape of the distribution.
4. Based on a review of the Golder Assoc. report, we still need to perform a background study for the following reasons:
 - Polycyclic aromatic hydrocarbons (PAHs) were not examined in the Golder Assoc. report. However, PAHs were found in the previous background samples according to Mr. Richard Lenard
 - The list of target analytes for the Golder Assoc. report and the LOOW background table is inconsistent. (See Table 1) The Golder Assoc. report does not include all of the chemicals listed in the LOOW background table. Several chemicals (e.g., Al, V, Bo, Li) were not covered in the Golder report. However, Bo and Li are likely to be chemicals of concern at the LOOW site.
 - Internally, there is also an inconsistency between the LOOW Phase II Work Plan and the earlier background samples. It is unclear why background analyses were performed for metals that are not being investigated in the Phase II Work Plan.
 - The CWM report says that background concentrations for Se are overestimated based on data qualifiers applied by the laboratory and a comparison to literature-based levels in soils of the eastern US. Therefore, there is no valid background data set for Se in the CWM report.
 - Some sample locations were characterized as impacted with respect to non-CWM activities. For example, the background concentration for copper is likely skewed high because the sampled area was “used by the DoD for industrial operations.” Furthermore, “residual” impacts are reported to have increased the background concentration of lead. While CWM should not be held accountable for DOD contamination, the reverse argument is unlikely to be successful since DOD operations predated the CWM activities.

5. Since background soil samples must be collected to correct for the issues identified in item 4, it makes sense to analyze for all of the potential chemicals of concern. According to Mr. Alan Warminski, the CENAB-EN-HI chemist, there would be little to no cost savings from requesting analysis for only those metals not in the Golder Assocreport (e.g. Bo, Li, and Se).
6. The Final Work Plan suggests that a 95 percent upper confidence limit on the mean (95% UCL) be used as the background statistic. There are several problems with this as a point estimate usually is not a good way to develop background, unless you are willing to be wrong much of the time (i.e., cleanup contamination that is not *really* contamination). I suggest that a statistical comparison (two sample t- test or related nonparametric test) be used. This approach would be consistent with the approach used at DOD installations covered by CENAB.
7. The Final Phase II Work Plan states that the absolute value of the W statistic be used to determine the distribution of the data. The process of using the absolute value of the W statistic is unsupportable. I would suggest that data sets whose distributions fail to be normal or log normal, be assumed to be log normal.
8. I would be happy to work with Buffalo and/or EA to accomplish any or all of these suggestions. I plan to attend the RAB meeting next week and we could go over these issues in more depth during the TDY.

Table 1. Comparison of Inorganic Chemicals in Golder Assoc. and DOD Background Sampling Plan

<u>INORGANIC METAL</u>	<u>DOD BACKGROUND ANALYTES</u>	<u>GOLDER ASSOC. REPORT</u>
Al	X	
Sb	X	
As	X	X
Ba	X	
Be	X	X
Bo	X	
Cd	X	X
Ca	X	
Cr (total)	X	X
Cr. (VI)		
Co	X	
Cu	X	X
Fe	X	
Pb	X	X
Li	X	
Mg	X	
Mn	X	
Ni	X	
K	X	
Se	X	X
Ag	X	X
Na	X	
V	X	
Zn	X	
Hg	X	X
Th	X	X