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CLEAN II Program
Bechtel Job No. 22214.027
Contract No. N68711-92-D-4670
File Code: 0313

IN REPLY REFERENCE: CTO-0027/0025

September 22, 1993

Mr. Alan Lee
Regional Project Manager
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Coast Highway
San Diego, California 92132-5190

RE: Addendum to Final Removal Site Evaluation (RSE) Plan

Dear Mr. Lee:

The following are amendments to the Final RSE Plan:

Amendment #1

Statistical Tables (Table A.6) of Appendix A of Part II (Field Sampling Plan of the RSE Plan) has a footnote referring to Section 6.1 and Box 6.3 for the definitions of alpha, beta and tau. This reference is from the US Department of Commerce, National Technical Information Service publication entitled Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media, February 1989. The applicable section has been included as an attachment to this addendum.

Amendment #2

Line 3 of response 1, on sheet 6 of Appendix 1, Responses to Navy and Agency Comments on the Draft RSE Plan; "road crossing" should be corrected to read "railroad crossing".

Amendment #3

Line 7, of response 1, on sheet 6 of Appendix 1, Responses to Navy and Agency Comments on the Draft RSE Plan; "road construction" should be corrected to read "railroad construction".

Amendment #4

The title on sheet 13, Appendix 1, Responses to Navy and Agency Comments on the Draft RSE Plan; "Comments by: Craig O'Rourke, Department of the Navy Comments on RSE Plan" should be corrected to read "J.L. Snyder, Department of the Navy Comments on RSE Plan".

Should you have questions, please contact me at (310) 807-2571, or Aklile Gessesse at (310) 807-2892.

Very Truly Yours,

Krish Kapur
Project Manager

Attachment

cc: Distribution

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FINAL REMOVAL SITE EVALUATION (RSE)

DATED 13 SEPTEMBER 1993

IS ENTERED IN THE DATABASE AND FILED AT ADMINISTRATIVE RECORD NO. **N68311.000126**

Attachment

PB89-234959

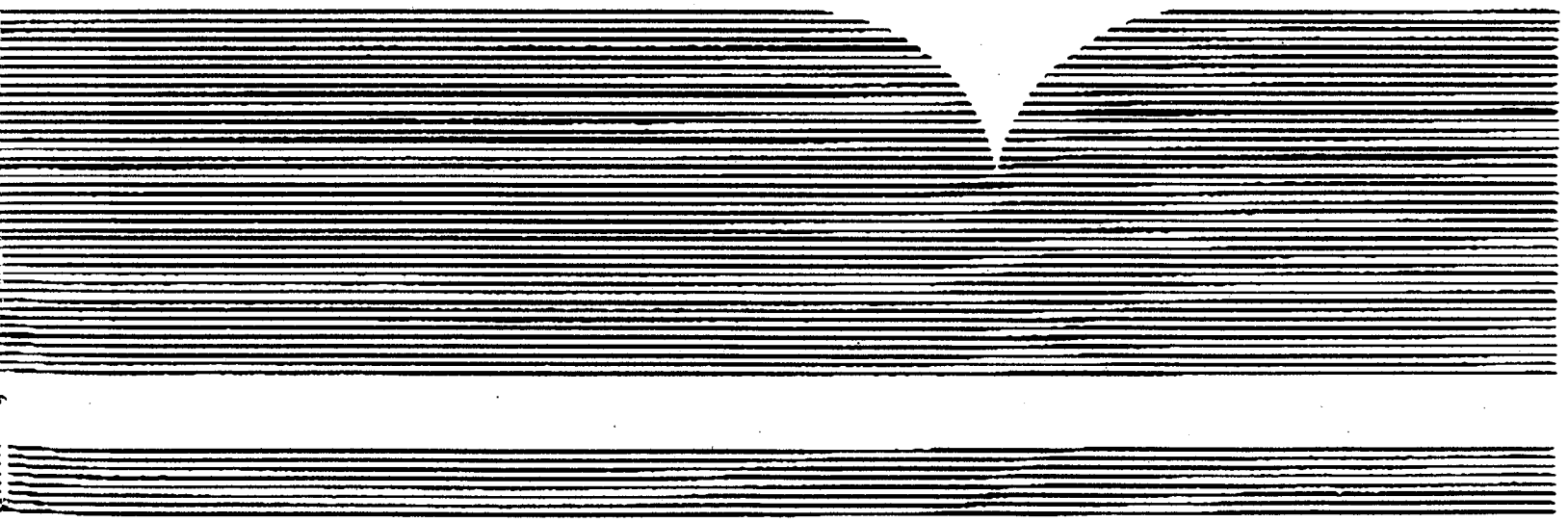
Methods for Evaluating the Attainment of Cleanup Standards. Volume 1. Soils and Solid Media

Westat Research, Inc., Rockville, MD

Prepared for:

Environmental Protection Agency, Washington, DC

Feb 89



U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
NTIS

6. DETERMINING WHETHER THE MEAN CONCENTRATION OF THE SITE IS LESS THAN A CLEANUP STANDARD

This chapter describes statistical procedures for determining whether the mean concentration in the sample area attains the cleanup standard. Testing whether the mean attains the cleanup standard is appropriate if the mean (or average) concentration is of particular interest and if the higher concentrations found in limited areas are not of concern. If the median concentration or the more extreme concentrations (e.g., the concentration for which 95 percent of the site is lower and 5 percent of the site is higher) are of interest, then see Chapter 7 for appropriate statistical techniques.

The statistical procedures given in this chapter for deciding if the mean concentration attains the cleanup standard are called "parametric" procedures. They usually require certain assumptions about the underlying distribution of the data. Fortunately, the procedures perform well even when these assumptions are not strictly true, and thus they are applicable in many different field conditions (see Conover, 1980).

The following topics--determination of sample size; calculation of the mean, standard deviation, and confidence interval; and deciding if the sample area attains the cleanup standard--are discussed for each of the following sample plans in the sections indicated:

- Simple random sampling (section 6.3);
- Stratified random sampling (section 6.4); and
- Systematic sampling (section 6.5).

6.1 Notation Used in This Chapter

The following notation is used throughout this chapter:

Cs The cleanup standard relevant to the sample area and the contaminant being tested.

μ The "true" but unknown mean contaminant concentrations across the sample area, the population mean.

H_0 The null hypothesis, which is assumed to be true in the absence of significant contradictory data. When testing the mean, the null hypothesis is that the sample area does not attain the cleanup standard: H_0: $\mu \geq Cs$.

α The desired false positive rate for the statistical test. The false positive rate for the statistical procedure is the probability that the sample area will be declared to be clean when it is actually dirty.

H_1 The alternative hypothesis, which is declared to be true only if the null hypothesis is shown to be false based on significant contradictory data. When testing the mean, the alternative hypothesis is that the sample area attains the cleanup standard: H_1: $\mu < Cs$.

μ_1 The value of μ under the alternative hypothesis for which a specified false negative rate is to be controlled ($\mu_1 < \mu$).

β The false negative rate for the statistical procedure is the probability that the sample area will be declared to be dirty when it is actually clean and the true mean is μ_1. The desired sample size n_d is selected so that the statistical procedure has a false negative rate of β at μ_1.

n_d The desired sample size for the statistical calculations.

n The final sample size, i.e., the number of data values available for statistical analysis including the concentrations that are below the detection level.

x_i The contaminant concentration measured for soil sample i, $i = 1$ to n. For measurements reported as below detection, x_i = the detection limit. See section 2.5.2 for more details.

6.3.2 Formulae for Determining Sample Size

The equations for determining sample size require the specification of equations 6.6 and 6.7, given in Box 6.3 and the following quantities: cleanup standard (Cs), the mean concentration where the site should be declared clean with a high probability (μ_1), the false positive rate (α), the false negative rate (β), and the standard deviation ($\hat{\sigma}$).

Box 6.3
Formulae for Calculating the Sample Size Needed to Estimate the Mean

$$n_d = \hat{\sigma}^2 \left\{ \frac{z_{1-\beta} + z_{1-\alpha}}{Cs - \mu_1} \right\}^2 \qquad (6.6)$$

where $z_{1-\beta}$ and $z_{1-\alpha}$ are the critical values for the normal distribution with probabilities of $1-\alpha$ and $1-\beta$ (Table A.2).

The sample size may also be written in the following equivalent form:

$$n_d = \frac{(z_{1-\beta} + z_{1-\alpha})^2}{\tau^2} \quad \text{where} \quad \tau = \frac{(Cs - \mu_1)}{\hat{\sigma}} \qquad (6.7)$$

The term τ (Greek letter tau) expresses the difference in units of standard deviation. For convenience, the values of n as computed from this formula are given in Table A.6 for selected values of α, β, and τ.

Table A.2 Table of z for selected alpha or beta

Use alpha or beta to determine which row to read. Obtain the z value from the $z_{1-\alpha}$ or $z_{1-\beta}$ column adjacent to the desired α or β value.

β / α	$z_{1-\beta}$ / $z_{1-\alpha}$
0.450	0.124
0.400	0.253
0.350	0.385
0.300	0.524
0.250	0.674
0.200	0.842
0.100	1.282
0.050	1.645
0.025	1.960
0.010	2.326
0.0050	2.576
0.0025	2.807
0.0010	3.090