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Office of
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EPA

Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT")

GENERIC QUALITY ASSURANCE PROJECT PLAN FOR

LAND DISPOSAL RESTRICTIONS PROGRAM ("BDAT")

U.S. ENVIRONMENTAL PROTECTION AGENCY

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1. INTRODUCTION

The Hazardous and Solid Waste Amendments of 1984 (HSWA), enacted on November 8, 1984, imposed substantial new requirements for the handling and managing of solid wastes. One of the requirements specified by the statute is that EPA establish "levels or methods of treatment" for the land disposal of hazardous wastes. Land disposal is broadly defined to include the placement of a waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, or underground mine or cave. As explained in the preamble to the land disposal restrictions rule of November 7, 1986 (51 FR 40572), the levels of treatment that EPA is specifying for land disposal are technology based standards which represent best demonstrated available technology (BDAT).

This document details EPA's program for collecting treatment data and sets forth the specific quality assurance and quality control parameters EPA is establishing for its BDAT program. Section 2 explains all the elements of EPA's BDAT data collection program. Section 3 specifies the quality assurance elements that must be addressed in all site-specific sampling and analysis plans (SAP). Section 4 discusses other quality assurance elements of the BDAT data collection program.

Facilities wishing to submit data for consideration in the development of BDAT standards should review this document and pay particular attention to Sections 3 and 4. While the Agency requests that

facilities submit all pertinent data, EPA cautions that, to the extent possible, these facilities must comply with equivalent quality assurance/quality control procedures to those used by EPA.

2. EPA'S BDAT DATA COLLECTION PROGRAM

This section of the generic quality assurance plan discusses the various elements of the Agency's program for collecting data for the development of treatment standards (BDAT) for wastes subject to land disposal restrictions.

Section 2.1 describes data sources used to identify candidate plants for sampling, Sections 2.2 and 2.3 discuss the process by which a decision is made to sample any individual plant, and finally, Section 2.4 describes the reports that EPA will develop from these sampling and analysis visits and the data and information to be contained in these reports.

2.1 Data Sources Used to Identify Treatment Facilities

EPA uses a number of information sources in its initial plant selection including Stanford Research Institute's (SRI) Directory of Chemical Producers, EPA's Hazardous Waste Data Management System (HWDMS), 1986 TSDF National Screening Survey, and EPA's Industry Studies Data Base. In addition, EPA contacts trade associations to inform them that the Agency is considering visits to facilities in their industry and to solicit assistance in identifying facilities for EPA to consider in its treatment sampling program.

2.2 Initial Plant Selection

After EPA has identified waste codes for which inadequate treatment data exist, the Agency then decides which treatment facilities are potential sampling candidates for that waste.

Consistent with the regulatory approach described in the preamble to the November 7, 1986, land disposal restrictions rule, EPA has established a hierarchy of types of plants to sample for BDAT data collection. This hierarchy, described below, is only a general approach that the Agency prefers to follow. Final plant selection will be affected by a number of factors including the types of treatment technologies at particular facilities, the design and operation of these technologies, plant layout, whether technologies are full scale or pilot/bench operations, and statutory time constraints. A discussion of these factors is contained in the engineering site visit subsection 2.3 following.

Thus, subject to these constraints, the Agency's priority for facility sampling is (1) waste generators that also treat the waste, (2) commercial facilities (other than generators) that treat the waste of interest, and finally (3) EPA in-house treatment facilities.

Generators are the facilities most likely to treat a waste by itself or as a significant percentage component of a waste mixture. Accordingly, such treatment data will best reflect the waste matrix effects from all the various constituents in a waste, not just those that

may pose the most concern from the perspective of health and environmental effects. In addition, generators that routinely treat a waste have the best opportunity to have optimized treatment parameters for that waste.

Commercial facilities are favored over EPA in-house treatment facilities because they are probably more familiar with treatment of a particular waste than EPA and, therefore, would be able to better optimize treatment parameters. Also, these facilities demonstrate more directly the performance of technology under field conditions.

If, in the case of EPA in-house treatment facilities, we cannot reasonably obtain (i.e., within the Agency's mandated rulemaking time frame) the actual waste of interest, we will synthesize a waste which we believe best represents this waste. The types and amounts of chemical constituents of these wastes will be described in the site-specific sampling and analysis plans.

2.3 Engineering Site Visit

Once EPA has identified a plant as a potential sampling candidate, the Agency then arranges an engineering site visit to evaluate in detail whether the facility should be sampled. The engineering site visit provides the information that EPA uses for its detailed analysis such as:

(a) Does the waste being treated meet the definition of the waste code of interest as expressed in the waste code listing (40 CFR 261.31-261.33).

(b) If so, is the waste treated either separately or as a significant percentage component of a waste mixture.

(c) Is the waste treated on a schedule such that EPA could reasonably arrange a sampling visit to obtain treatment data on that waste.

(d) Are data available on the design of the system such that EPA can determine whether the system is well designed, as well as compare actual operating conditions to design parameters to assure that results represent operation at optimum levels.

(e) Are principal operating parameters measured or can they be obtained during sampling so that EPA can evaluate operating conditions during the data collection process.

(f) Are piping arrangements such that EPA can obtain all the samples it needs to evaluate treatment. Such samples include those necessary to verify operating conditions such as pH and excess reactant, as well as characterize untreated and treated streams. If piping layout is not as needed, what modifications are required and is the plant willing to modify piping systems.

The site visit also provides an opportunity to obtain a sample prior to the sampling visit. Analysis of such a sample can minimize problems that a laboratory may have in analyzing a particular waste matrix. This is especially helpful in analyzing wastes for which no historical data are available.

The engineering site visit also plays a role in EPA's selection of the type of facility to sample (i.e., generator, commercial (other than a generator), or EPA in-house facility). If the site visit shows that the preferred plant is not well designed or operated or should not be sampled for other reasons discussed above, EPA will then investigate another plant consistent with the hierarchy previously described in Section 2.2.

2.4 EPA Reports Generated as Part of the Sampling Program

2.4.1 Sampling and Analysis Plan

If, after the engineering site visit, EPA decides to sample a particular plant, the Agency will then develop a site-specific Sampling and Analysis Plan (SAP). The contents of this plan are discussed in Section 3. In brief, the SAP discusses where the Agency plans to sample, how the samples will be taken, the frequency of sampling, the constituents to be analyzed and the method of analysis, operational parameters to be obtained, and specific laboratory quality control checks on the analytical results.

The Agency will generally produce a draft of the site-specific sampling and analysis plan within two to three weeks of the engineering visit. The draft of the SAP is then sent to the plant for review and comment; EPA usually provides one week for this review. With few exceptions, the draft SAP should be a confirmation of data collection activities discussed with the plant during the engineering site visit. EPA encourages plants to recommend any modifications to the SAP that they believe will improve the quality of the data.

It is important to point out that EPA's sampling of a plant does not automatically mean that the data will be used in the development of treatment standards for BDAT. EPA's final decision on whether or not to use data from a sampled plant will depend on the actual analysis of the waste being treated and on the operating conditions at the time of

sampling. Although EPA would not plan to sample a facility that was not ostensibly well designed and operated, there is no way to ensure that at the time of sampling the facility will not experience operating problems.

2.4.2 Onsite Engineering Report

Following the sampling visit, EPA will develop a report summarizing all data and information pertinent to evaluation of the treatment process; EPA refers to this report as the onsite engineering report. This report contains the following:

- Section 1 characterizes the wastes treated including a brief industry description and the manufacturing process or processes by which the wastes were generated.
- Section 2 presents a description of the treatment system including design parameters, physical equipment, chemical reagents, and control systems.
- Section 3 provides an operating log section which presents operating data during the data collection process as well as descriptions of any events that could impact the operation of the system.
- Section 4 describes all sample collection activities and all analytical procedures. This section will document the extent to which the sampling and analysis plan was conducted as designed. Any changes from the final SAP will be shown in this section as well as an explanation of why a change was required.
- Section 5 presents all analytical data.
- Section 6 presents all laboratory quality control results including laboratory precision and accuracy results.
- Section 7 provides plant correspondence. This section would include letters from the Agency requesting review by the plant of the SAP and on site engineering report. This section would also include the comments by the plant on the report as well as the Agency's response to these comments.

After the on site engineering report is completed, the report is submitted to the plant for review. This review also provides the plant with a final opportunity to claim any information contained in the report as confidential. EPA generally provides four weeks for this review. Following the review and incorporation of comments, as appropriate, the report is available to the public with the exception of any material claimed as confidential by the plant.

As indicated earlier, completion of the report does not mean that the data will be used to establish treatment standards. Certainly the Agency will consider these data but may, for various reasons including poor operating conditions at the time of sampling, reject these data as the basis for BDAT.

3. GENERIC QUALITY ASSURANCE ELEMENTS OF THE SITE-SPECIFIC SAMPLING AND ANALYSIS PLAN (SAP)

The section identifies generic quality assurance elements of the site specific sampling and analysis plan.

3.1 Test Objectives

The site-specific SAP will identify the specific waste code or codes under study and the specific treatment system being evaluated. In addition, this section of the SAP will describe the specific waste being examined in terms of the industry which generates it and the manufacturing process by which it is generated. This section of the SAP should also present sufficient information on the treatment system so it is clear what system is being evaluated. For example, treatment should be described as fluidized bed incineration, not simply as incineration.

A schematic diagram of the treatment process must be included in the section of the SAP which specifies the sampling locations.

3.2 Project Organization

The EPA Program Manager will have the overall quality assurance (QA) responsibility for all sampling and analysis data collected for the BDAT program. All sampling and analysis plans must be approved by the EPA Work Assignment Manager (WAM) and the EPA Program QA Officer. The prime contractor will be responsible for the subcontractor's implementation of this generic QAPP and any appropriate site-specific SAP sampling and

analysis plan. Figure 3-1 shows the general organization chart. An organization chart will be prepared for each sampling and analysis plan.

3.3 Sample Collection Plan

To determine the quality of data with respect to the characterization of the waste being treated and the treated residual, the site-specific sampling and analysis plan must contain the following information:

- Sampling point descriptions. Describe the sampling points and provide the justification for selection of these sampling points. All sampling points will be identified on the schematic diagram for the waste treatment system. (Sampling for operation parameters is discussed in Section 3.4.)

- Sample collection method. All samples will be collected as grab samples. Sample collection procedures will be described for each sample location.

- Frequency. Frequency of sample collection will vary depending upon the treatment system. The frequency of sample collection at each sampling location will be specified in the SAP and will be selected to best characterize the variability in (1) the waste stream, (2) the treatment process, and (3) the analytical results.

- Constituents to be analyzed. For all sampling points, specify which of the compounds shown in Table 3-1 (BDAT Pollutant List) will be analyzed. All analyses should be performed using SW-846 (3rd edition). Deviations from this list of compounds should be justified. (For example, if one sample of the untreated waste is analyzed, and the data show that particular compounds are not present, then further analysis of these compounds may not be required for the other samples from the plant.)

- Total composition and TCLP extracts. For the treated residuals, analysis will be completed on both the total composition sample and the TCLP extracts. For all other samples collected, analysis will only be completed for total composition.

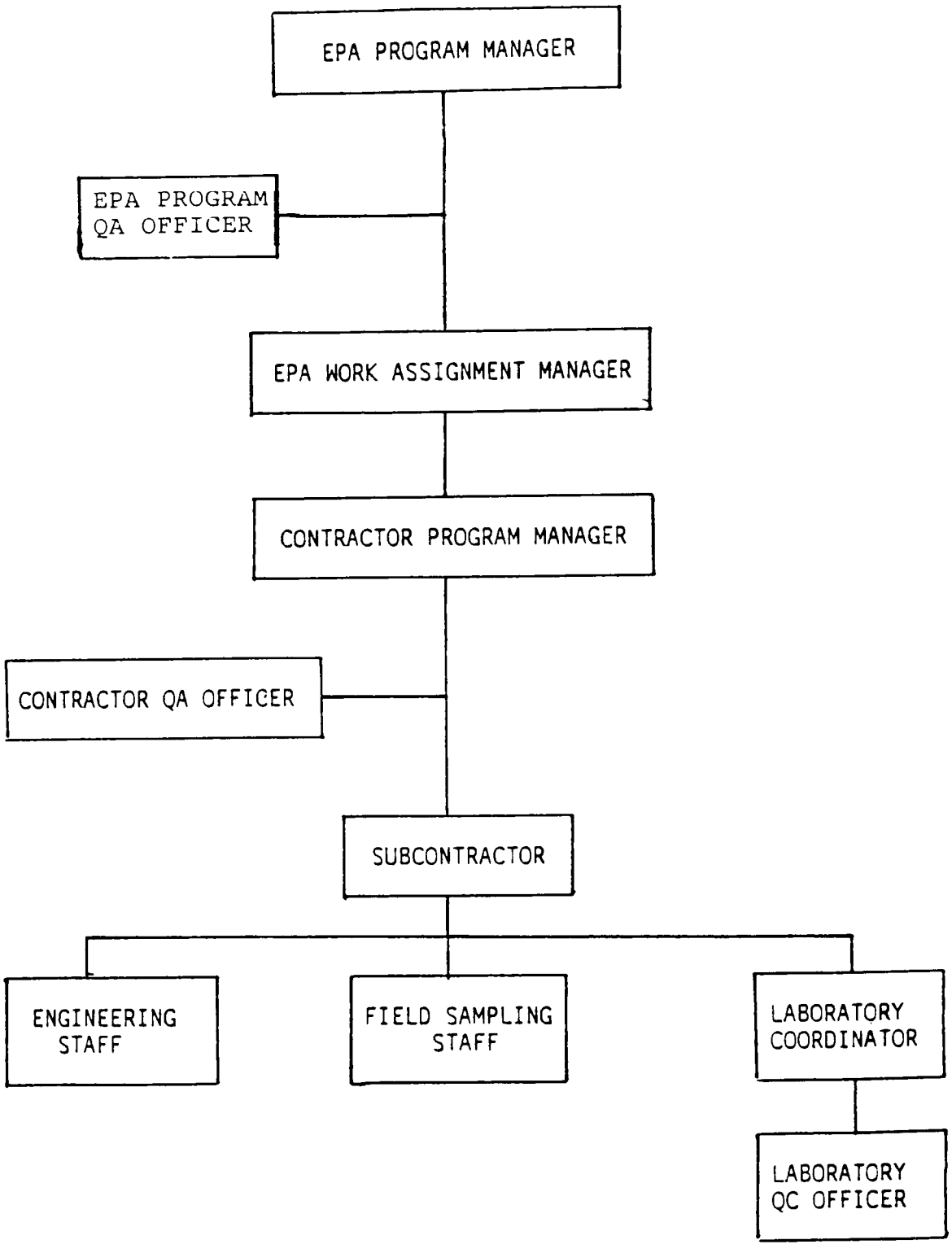

Figure 3-1 General project organization chart.

- Sample containerization and preservation. Procedures for sample containerization and preservation presented in SW-846 (3rd edition, Table 2-16) will be followed. Deviations from the SW-846 procedures will be documented and explained. All sampling vessels and containers will be cleaned prior to the sample collection. The procedures used will be specified in the site-specific SAP.

3.4 Design and Operating Data Collection

To evaluate the treatment design and operation, the SAP must contain the following:

- All design and operating data to be collected, the method of collecting these data, and the reason for collecting these data;
- The specific frequency for collecting the operating data; and
- Identified locations for collecting operating data on the treatment system schematic.

3.5 Analytical Quality Assurance/Quality Control Procedures

This section of the quality assurance plan addresses (1) the analytical methods to be used, (2) the QC required for determining the precision and accuracy of the analytical data, (3) the QC for determining field and laboratory contamination, (4) corrective actions if the QC objectives are not met, (5) procedures for instrument calibration, (6) data reduction and reporting, and (7) statistical QC procedures.

3.5.1 Analytical Methods

The following items must be addressed in the site-specific sampling and analysis plans:

A-1 The SW-846 methods (3rd edition) must be cited in the SAP for all compounds and compositional parameters to be analyzed. If SW-846 (3rd edition) methods are not available for a particular compound or compositional parameter, the method to be used must be cited in the SAP.

A-2 If for any reason upon receipt of the samples the methods cited in the SAP are not appropriate, the EPA WAM will be notified of the new method to be used.

A-3 The EPA WAM will be notified if sample cleanup methods not cited in the SAP are required to obtain detection levels of at least 1 ppm in the matrix for any of the compounds or compositional parameters to be analyzed. The laboratory is to inform the EPA WAM with regard to what additional cleanup may be necessary to eliminate interferences or matrix problems which could prevent achieving this level of detection for various compounds and the level of effort required for the additional cleanup procedures. The EPA WAM will determine whether the laboratory should proceed using these additional procedures or whether analytical work on the set of samples should be discontinued.

A-4 Any deviations from the sample preparation and cleanup methods cited in SW-846 or referenced in the site-specific SAP that were necessary to handle unusual matrix types will be fully documented in the final report for the site visit.

3.5.2 Precision and Accuracy QC Requirements

B-1 One laboratory duplicate injection of the spiked sample extract will be performed for each group of the treated residual samples taken from the same sampling point. The laboratory duplicate injection also be completed on the TCLP extract. Analytical results of the duplicate injection must be within $\pm$20 percent of each other for values greater than 200 ppb. For values less than or equal to 200 ppb, analytical results for the duplicate injection must be within $\pm$100 percent of each other. If duplicate analyses are not within these ranges, the samples must be reanalyzed. If these criteria are not met, the data are not acceptable. Precision will be calculated using relative percent difference as presented in Section 3.5.7.

B-2 One matrix spike duplicate for each group of treated residual samples will be performed. The spike constituents will be determined on a site-specific basis and will be reported in the SAP. Spiking will be completed at the laboratory prior to

extraction or digestion of the sample. The spike concentration must be within 5 times the measured concentration for the sample. If the spike concentration is not within 5 times the measured concentration, the laboratory will respike and reanalyze the sample. When the compounds of interest will not be present in the waste because of removal during treatment, samples shall be spiked at 5 times the target detection limit level for these compounds. The accuracy will be calculated using equations in Section 3.5.7. Laboratories must submit the analytical results for the spiked and unspiked samples so that EPA can adjust the data to reflect recovery

B-3 All laboratories must generate data for developing treatment standards for the BDAT program using instruments that have instrument detection limits* equal to the target detection limits specified in Table 3-1 (BDAT Pollutant List). The laboratory must provide the EPA WAM and EPA QA Officer with data demonstrating that the target detection limits can be obtained for the compounds of interest. Data must have been generated within one calendar year of the generation of the analytical data submitted to the BDAT program.

B-4 Surrogate recoveries must be performed for each sample as specified in SW-846. (Note: Because of limited experience with hazardous waste samples, EPA is not specifying at this time any precision or accuracy ranges as a condition for accepting the analysis of the treated residuals. EPA will use these data to establish precision and accuracy ranges in the future.)

B-5 A reagent blank must be performed for an analytical batch of samples with a minimum of one blank per twenty samples. The reagent blank must be carried throughout the entire analytical procedure. In cases where the concentration of any compound detected in the blank is 10 percent or greater than the concentration detected in any of the samples in the batch, the laboratory must at a minimum take the corrective action steps listed in 3.5.4.

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*Instrument detection limit for each compound is the lowest concentration that when measured by the instrument results in a reportable value of at least three times the standard deviation from the instrument noise level.

3.5.3 QC Procedures for Determining Field and Laboratory Contamination

The following QC procedures must be followed to determine whether field or laboratory contamination was introduced into the samples:

C 1 One trip blank which is not opened in the field will be analyzed to check for sample contamination originating from sample transport, shipping, or site conditions. The parameters for analysis will be specified in the SAP.

C-2 Equipment blanks will be taken as needed and specified in the site-specific SAP. Collection and frequency will be specified in the SAP. The equipment blank consists of laboratory pure water* or solvents brought to the field in a sealed container, opened in the field, and the contents poured over or through the sample collection device and then collected in the sample container. The parameters for analysis will be specified in the SAP. If contamination in the field blank is determined, documentation will be provided that will explain the effect of the contamination on the samples collected.

C-3 If samples are to be collected for analysis of volatile organic compounds, a volatile organic blank is collected once a day. This blank consists of laboratory pure water taken to the field and poured into a sample container in the area where the treatment system is located. The volatile organic blank is analyzed for the volatile compounds specified in the SAP. If volatile organic compounds are measured in this blank, documentation will be provided which will explain the effect of the contamination on the samples collected.

3.5.4 Corrective Actions

The following corrective actions must be taken as a first step, if the QC objectives in Sections B-1 and B-5 are not met:

D-1 Calculations will be reviewed for calculation and transcription errors;

D-2 The laboratory's QA officer will review the analysis with the analyst to determine whether procedural errors were made;

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*Laboratory pure water is defined in SW-846 as distilled or deionized water or Type II reagent water.

D-3 Reagents and equipment will be examined to determine if they were functioning and used properly;

D-4 Instrumentation will be examined for calibration and signal response

3.5.5 Instrument Calibration Procedures

The following procedures will be used for instrument calibration:

E-1 Calibration procedures for all sampling and analytical equipment required for this project are provided in the SW-846 (3rd edition) methods.

E-2 Calibration standards are to have purities as reported in U.S. EPA's Quality Assurance Reference Materials Project: Analytical Reference Materials Inventories, July 1986 (SP-4440086-37). If compounds are not listed in this document, the calibration standards are to be prepared from reagent grade compounds. Reagent grade compounds are reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

3.5.6 Data Reduction and Reporting

Analytical results will be reported in the concentration units specified in the analytical procedure. If units are not specified in the analytical procedure, data from the analysis of samples will be reported in units of ug/l for all aqueous samples and mg/kg dry weight for all solid samples.

3.5.7 Statistical QC Procedures

The statistical QC procedures used for this work will include precision (relative percent difference) and percent recovery.

F-1 Precision will be estimated by calculating the relative percent difference when two values are being evaluated, using the following equation:

$$RPD = \frac{(D_1 \quad D_2)\ 100}{(D_1 + D_2)/2}$$

where

RPD = Relative Percent Difference
D_1 = The larger of the two observed values
D_2 = The smaller of the two observed values

F-2 Accuracy will be estimated according to the following equations:

For Surrogate Spikes:

$$\text{Percent Recovery} = 100\ \left(\frac{\text{Measured Value}}{\text{Spiked Value}}\right)$$

For Matrix Spikes:

$$\text{Percent Recovery} = 100\ \left(\frac{C_i \quad C_o}{C_t}\right)$$

where

C_o = Concentration of unspiked aliquot
C_i = Concentration of spiked aliquot
C_t = Concentration for spike added

Table 3-1 BDAT Pollutant List

	Parameter	CAS no.	Target detection limit (ug/l)
Volatiles			
1	Acetonitrile	75-05-8	100
2	Acrolein	107-02-8	100
3	Acrylonitrile	107-13-1	100
4	Benzene	71-43-2	5
5	Bromodichloromethane	75-27-4	5
6	Bromomethane	74-83-9	10
7	Carbon Tetrachloride	56-23-5	5
8	Carbon disulfide	75-15-0	5
9	Chlorobenzene	108-90-7	5
10	2-Chloro-1,3-butadiene	126-99-8	100
11	Chlorodibromomethane	124-48-1	5
12	Chloroethane	75-00-3	10
13	2-Chloroethyl vinyl ether	110-75-8	10
14	Chloroform	67-66-3	5
15	Chloromethane	74-87-3	10
16	3-Chloropropene	107-05-1	100
17	1,2-Dibromo-3-chloropropane	96-12-8	10
18	1,2-Dibromoethane	106-93-4	5
19	Dibromomethane	74-95-3	5
20	Trans-1,4-Dichloro-2-butene	110-57-6	100
21	Dichlorodifluoromethane	75-71-8	10
22	1,1-Dichloroethane	75-35-3	5
23	1,2-Dichloroethane	107-06-2	5
24	1,1-Dichloroethylene	75-35-4	5
25	Trans-1,2-Dichloroethene	156-60-5	5
26	1,2-Dichloropropane	78-87-5	5
27	Trans-1,3-Dichloropropene	10061-02-6	5
28	cis-1,3-Dichloropropene	10061-01-5	5
29	1,4-Dioxane	123-91-1	200
30	Ethyl cyanide	10712-0	100
31	Ethyl methacrylate	97-63-2	100
32	Iodomethane	74-88-4	50
33	Isobutyl alcohol	78-83-1	200
34	Methyl ethyl ketone	78-93-3	10
35	Methyl methacrylate	80-62-6	100
36	Methyl methanesulfonate	66-27-3	200
37	Methylacrylonitrile	126-98-7	100
38	Methylene chloride	75-09-2	5
39	Pyridine	110-86-1	400

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Volatiles (continued)			
40	1,1,1,2-Tetrachloroethane	630-20-6	5
41	1,1,2,2-Tetrachloroethane	79-34-5	5
42	Tetrachloroethene	127-18-4	5
43	Toluene	108-88-3	5
44	Tribromomethane	75-25-2	5
45	1,1,1-Trichloroethane	71-55-6	5
46	1,1,2-Trichloroethane	79-00-5	5
47	Trichloroethene	79-01-6	5
48	Trichloromonofluoromethane	75-69-4	5
49	1,2,3-Trichloropropane	96-18-4	5
50	Vinyl chloride	75-01-4	10
Semivolatiles			
51	Acenaphthalene	208-96-8	10
52	Acenaphthene	83-32-9	10
53	Acetophenone	96-86-2	10
54	2-Acetylaminofluorene	53-96-3	1,000
55	4-Aminobiphenyl	92-67-1	200
56	Aniline	62-53-3	20
57	Anthracene	120-12-7	10
58	Aramite	140-57-8	100
59	Benz(a)anthracene	56-55-3	10
60	Benzenethiol	108-98-6	1,000
61	Benzidine	92-87-5	1,000
62	Benzo(a)pyrene	50-32-8	10
63	Benzo(b)fluoranthene	205-99-2	10
64	Benzo(ghi)perylene	191-24-2	10
65	Benzo(k)fluoranthene	207-08-9	10
66	p-Benzoquinone	106-51-4	1,000
67	Bis(2-chloroethoxy)methane	111-91-1	10
68	Bis(2-chloroethyl)ether	111-44-4	10
69	Bis(2-chloroisopropyl)ether	39638-32-9	10
70	Bis(2-ethylhexyl)phthalate	117-81-7	10
71	4-Bromophenyl phenyl ether	101-55-3	10
72	Butyl benzyl phthalate	85-68-7	10
73	2-sec-Butyl-4,6-dinitrophenol	88-85-7	100
74	p-Chloroaniline	106-47-8	100
75	Chlorobenzilate	510-15-6	100
76	p-Chloro-m-cresol	59-50-7	10
77	2-Chloronaphthalene	91-58-7	10

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Semivolatiles (continued)			
78	2-Chlorophenol	95-57-8	10
79	3-Chloropropionitrile	54-27-67	10,000
80	Chrysene	218-01-9	10
81	ortho-Cresol	95-48-7	10
82	para-Cresol	106-44-5	10
83	Dibenz(a,h)anthracene	53-70-3	10
84	Dibenzo(a,e)pyrene	192-65-4	50
85	Dibenzo(a,i)pyrene	189-55-9	50
86	m-Dichlorobenzene	541-73-1	10
87	o-Dichlorobenzene	95-50-1	10
88	p-Dichlorobenzene	106-46-7	10
89	3,3'-Dichlorobenzidine	91-94-1	20
90	2,4-Dichlorophenol	120-83-2	10
91	2,6-Dichlorophenol	87-65-0	10
92	Diethyl phthalate	84-66-2	10
93	3,3'-Dimethoxybenzidine	119-90-4	10,000
94	p-Dimethylaminoazobenzene	60-11-7	200
95	3,3'-Dimethylbenzidine	119-93-7	10,000
96	2,4-Dimethylphenol	105-67-9	10
97	Dimethyl phthalate	131-11-3	10
98	Di-n-butyl phthalate	84-74-2	10
99	1,4-Dinitrobenzene	100-25-4	100
100	4,6-Dinitro-o-cresol	534-52-1	50
101	2,4-Dinitrophenol	51-28-5	50
102	2,4-Dinitrotoluene	121-14-2	10
103	2,6-Dinitrotoluene	606-20-2	10
104	Di-n-octyl phthalate	117-84-0	10
105	Di-n-propylnitrosamine	621-64-7	10
106	Diphenylamine*/ diphenylnitrosamine*	122-39-4/86-30-6	10
107	1,2-Diphenylhydrazine	122-66-7	10
108	Fluoranthene	206-44-0	10
109	Fluorene	86-73-7	10
110	Hexachlorobenzene	118-74-1	10
111	Hexachlorobutadiene	87-68-3	10
112	Hexachlorocyclopentadiene	77-47-4	10

*In GC/MS analysis, these compounds cannot be differentiated.

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Semivolatiles (continued)			
113	Hexachloroethane	67-72-1	10
114	Hexachlorophene	70-30-4	20,000
115	Hexachloropropene	1888-71-7	10
116	Indeno(1,2,3-cd)pyrene	193-39-5	10
117	Isosafrole	120-58-1	100
118	Methapyrilene	91-80-5	200
119	3-Methylcholanthrene	56-49-5	100
120	4,4'-Methylenebis (2-chloroaniline)	101-14-4	200
121	Naphthalene	91-20-3	10
122	1,4-Naphthoquinone	130-15-4	100
123	1-Naphthylamine	134-32-7	100
124	2-Naphthylamine	91-59-8	100
125	p-Nitroaniline	100-01-6	50
126	Nitrobenzene	98-95-3	10
127	4-Nitrophenol	100-02-7	50
128	N-Nitrosodi-n-butylamine	924-16-3	100
129	N-Nitrosodiethylamine	55-18-5	100
130	N-Nitrosodimethylamine	62-75-9	100
131	N-Nitrosomethylethylamine	10595-95-6	100
132	N-Nitrosomorpholine	59-89-2	200
133	N-Nitrosopiperidine	100-75-4	200
134	n-Nitrosopyrrolidine	930-55-2	200
135	5-Nitro-o-toluidine	99-55-8	200
136	Pentachlorobenzene	608-93-5	10
137	Pentachloroethane	76-01-7	10
138	Pentachloronitrobenzene	82-68-8	100
139	Pentachlorophenol	87-86-5	50
140	Phenacetin	62-44-2	100
141	Phenanthrene	85-01-8	10
142	Phenol	108-95-2	10
143	2-Picoline	109-06-8	100
144	Pronamide	23950-58-5	100
145	Pyrene	129-00-0	10
146	Resorcinol	108-46-3	1,000
147	Safrole	94-59-7	100
148	1,2,4,5-Tetrachlorobenzene	95-94-3	10

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Semivolatiles			
149	2,3,4,6-Tetrachlorophenol	58-90-2	100
150	1,2,4-Trichlorobenzene	120-82-1	10
151	2,4,5-Trichlorophenol	95-95-4	50
152	2,4,6-Trichlorophenol	88-06-2	10
153	Tris(2,3-dibromopropyl) phosphate	126-72-7	10,000
Metals			
154	Antimony	7440-36-0	60
155	Arsenic	7440-38-2	10
156	Barium	7440-39-3	200
157	Beryllium	7440-41-7	5
158	Cadmium	7440-43-9	5
159	Chromium (total)	7440-47-3	10
160	Chromium (hexavalent)		10
161	Copper	7440-50-8	25
162	Lead	7439-92-1	5
163	Mercury	7439-97-6	0.2
164	Nickel	7440-02-0	40
165	Selenium	7782-49-2	5
166	Silver	7440-22-4	10
167	Thallium	7440-28-0	10
168	Vanadium	7440-62-2	50
169	Zinc	7440-66-6	20
Inorganics			
170	Cyanide	57-12-5	10
171	Fluoride	16964-48-8	500
172	Sulfide	8496-25-8	1000
Organochlorine Pesticides			
173	Aldrin	309-00-2	0.05
174	alpha-BHC	319-84-6	0.05
175	beta-BHC	319-85-7	0.05
176	delta-BHC	319-86-8	0.05

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Organochlorine Pesticides (continued)			
177	gamma-BHC	58-89-9	0.05
178	Chlordane	57-74-9	0.5
179	DDD	72-54-8	0.01
180	DDE	72-55-9	0.10
181	DDT	50-29-3	0.10
182	Dieldrin	60-57-1	0.10
183	Endosulfan I	959-98-8	0.05
184	Endosulfan II	33213-6-5	0.10
185	Endrin	72-20-8	0.10
186	Endrin aldehyde	7421-93-4	0.1
187	Heptachlor	76-44-8	0.05
188	Heptachlor epoxide	1024-57-3	0.05
189	Isodrin	465-73-6	0.1
190	Kepone	43-50-0	0.5
191	Methoxyclor	72-43-5	0.5
192	Toxaphene	8001-35-2	1.0
Phenoxyacetic Acid Herbicides			
193	2,4-Dichlorophenoxyacetic acid	94-75-7	0.5
194	Silvex	93-72-1	0.5
195	2,4,5-T	93-76-5	0.5
Organophosphorous Insecticides			
196	Disulfoton	298-04-0	1.0
197	Famphur	52-85-7	1.0
198	Methyl parathion	298-00-0	1.0
199	Parathion	56-38-2	1.0
200	Phorate	298-02-2	1.0
PCBs			
201	Aroclor 1016	12674-11-2	0.5
202	Aroclor 1221	11104-28-2	0.5
203	Aroclor 1232	11141-16-5	0.5
204	Aroclor 1242	53469-21-9	0.5
205	Aroclor 1248	12672-29-6	0.5
206	Aroclor 1254	11097-69-1	1.0
207	Aroclor 1260	11096-82-5	1.0

Table 3-1 (Continued)

	Parameter	CAS no.	Target detection limit (ug/l)
Dioxins and Furans			
208	Hexachlorodibenzo-p-dioxins		0.02
209	Hexachlorodibenzofuran		0.02
210	Pentachlorodibenzo-p-dioxins		0.02
211	Pentachlorodibenzofuran		0.02
212	Tetrachlorodibenzo-p-dioxins		0.02
213	Tetrachlorodibenzofuran		0.02
214	2,3,7,8-Tetrachlorodibenzo-p-dioxin		0.02

4. OTHER QUALITY ASSURANCE ELEMENTS OF THE BDAT DATA COLLECTION PROGRAM

4.1 Chain of Custody Procedures

Chain of custody procedures must be followed during sample collection and sample analysis to maintain the integrity of the data. The individual samples must be maintained under custody and all handling of the sample must be traceable continuously from the time of collection until all analytical work is completed. In the event that chain of custody procedures are broken, a written explanation providing an analysis of the risk to the data integrity.

4.1.1 Field Sampling Operations

The field sampler must initiate the chain of custody procedures by documenting when sampling activities are started. Once the sample is obtained, the sampler should keep the sample either in view or in a locked or sealed storage area, or in a secure area until custody is relinquished and formal documentation of such transfer is completed. The initial documentation should include the following information necessary for sample identification and custody records:

- Project identifier code;
- Plant;
- Sample location;
- Sample type or matrix;
- Sample date and time;
- Signature of sampler;
- Analysis required;
- Remarks (e.g., preservatives used)

Sample custody documentation is maintained until the samples are delivered to the laboratory or to a common carrier for shipment to the laboratory. Samples are identified by adhesive backed labels (Figure 4-1) containing the preceding information. The labels must be either waterproof or covered with waterproof tape.

The field custodian is responsible for the proper documentation, preservation, storage, and shipment of the samples until they are delivered to the laboratory. The field custodian fills out a sample chain of custody record (Figure 4-2); this record sheet is prepared in duplicate; one copy is sent with the samples; the other is maintained by the field sample custodian. A tamperproof seal (Figure 4-3) is attached to each sample package prior to transmittal to the laboratory to ensure that the integrity of the samples has been maintained during shipment.

4.1.2 Sample Receiving

Upon delivery to the laboratory, custody is transferred to the laboratory sample custodian. After verifying the number of samples, their identification, and their integrity, the laboratory custodian signs the appropriate sample documentation if delivered personally, or completes the sample shipping/receiving record if delivered by common carrier. Any discrepancies are noted on the appropriate form.

Every sample entering the laboratory for analysis is assigned a unique identity in the laboratory's sample log-in book.

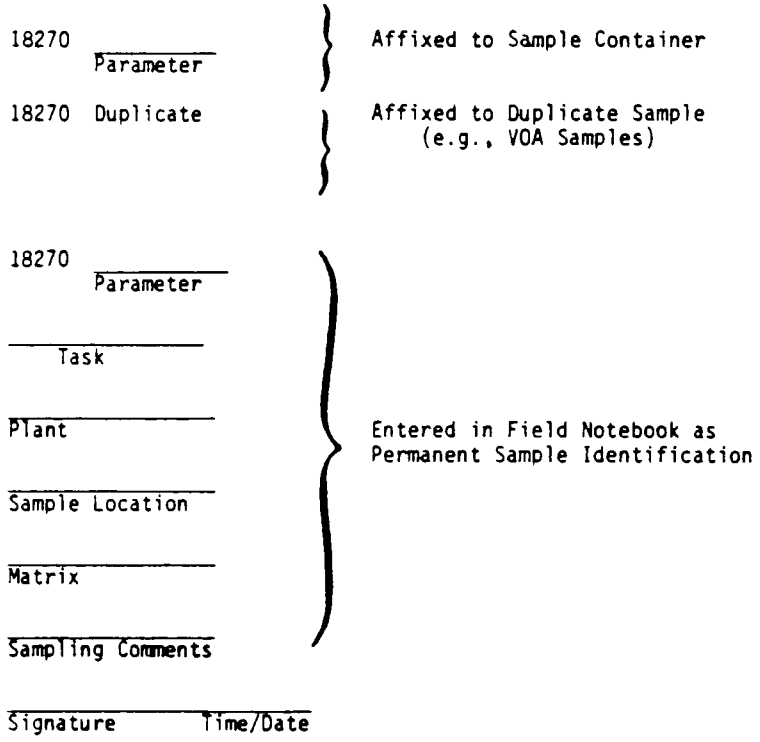

Figure 4-1 Example of sample label.

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME					PARAMETERS									
SAMPLERS: *(Signature)*					(Printed)										
FIELD SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE LOCATION	NO. OF CONTAINERS									REMARKS

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
(Printed)		(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

Figure 4-2 Example Chain of Custody Form

Figure 4-3 Example of Tamperproof Seal.

The samples are refrigerated at or below 4 C. The refrigerators are either kept in locked limited access area or the refrigerators are locked

4.1.3 Sample Analyses

The laboratory analyst prepares the laboratory data sheet which includes the following information:

- Sample numbers;
- Date sample received by the analyst;
- Analysis and method number;
- Portion required for analysis;
- Initials of analyst and dates sample handled;
- Initials of chemist checking calculations; and
- Detection levels desired.

After obtaining the sample, the analyst verifies the information on the laboratory data sheet with the information on the sample container and annotates the records appropriately. If a question arises, it is first discussed with the sample custodian. If this does not resolve the problem, it is brought to the attention of the person submitting the sample for analysis. If the problem cannot be resolved, the EPA WAM should be notified before the sample is voided. The analyst keeps the samples in view or under limited access locked storage. The analyst visually inspects the sample to determine that the physical condition is suitable for analysis. For any sample whose condition is questionable, the EPA WAM is to be notified prior to analysis. The analyst must maintain proper custodial procedures while analyzing a sample. Samples or intermediate solutions must either be in the analyst's physical

possession, in view, or in a limited access locked area. The laboratories are locked so that only authorized personnel have access.

Analyses should be conducted in accordance with the procedures specified in the contract statement of work and referenced by number to the standard method in the laboratory procedures manual. Any deviation from these procedures must be annotated. All data are recorded on the data sheet. Associated calibrations must be recorded either directly on or attached to the data sheet or indirectly by reference to the standard solution number or instrument number.

4.1.4 Sample Recordkeeping

The sample identification is used on all data sheets, containers, beakers, etc. The sample number or name can be used for extra information, if desired. Exceptions are instances in which a set of numbered containers, such as Kjeldahl flasks or ashing crucibles, is used; here the container number must be matched on the data sheet with the sample identification.

Associated calibration curves and charts should be signed and dated. The exact method of analysis must be readily ascertainable. This is most easily done by making reference to the standard analytical procedure used when a method allows for a choice of procedures. If any portion of the sample remains after analysis is completed and if storage is required, the analyst must return it to the laboratory sample storage area.

The analyst's calculations are checked as required by an internal audit. The person checking the calculations signs and dates the data sheet. The data sheet is returned to the file. All records must be in ink. Errors are corrected by drawing a straight line through the error, recording the correct entry, initialing, and dating the correction. Completed records are maintained by the designated laboratory document control officer.

When all analyses are completed, the report is prepared and delivered. A copy of the report, the raw data, and other documents are provided to the EPA WAM, as well as placed in the files, which are kept in either locked file cabinets or in a secure limited access area.

4.2 Performance and System Audits

Data generated as part of the analytical quality control program will be reviewed by the QA Coordinator or a subcontractor's QA officer and the appropriate site team leader to assure the absence of systematic bias or trends and that appropriate corrective actions are taken as required. Quality problems identified and corrective actions taken because of these reviews will be included in the site report.

Field activities of each contractor will be audited at least once by a third party representative designated by EPA to assure that required equipment and procedures for sample collection, preservation, shipping, handling, laboratory, and documentation are used.

REFERENCES

1. U.S. EPA. 1986. U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846*, Washington, D.C.: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, November 1986.

2. U.S. EPA. 1986. U.S. Environmental Protection Agency. *Quality Assurance Reference Materials Project: Analytical Reference Materials Inventories*, Washington, D.C.: U.S. Environmental Protection Agency, July 1986, SP-4440-86-37.