ERM-Southwest, inc.

#3

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March 10, 1987

Ms. Ruth Izraeli
U.S. Environmental Protection Agency
Region VI
1201 Elm Street
Dallas, TX 76270

W.O. #92-02

Re: Arkwood, Inc. Site

Dear Ms. Izraeli:

Per Mr. C. R. Barker's letter of March 5, 1987, transmitting the revised Work Plan documents, the QA/QC proceadures for Rocky Mountain Analytical Laboratory were promised to you. Attached please find copies of the Laboratory Quality Control Plan and Quality Assurance Plan.

Should you have any questions, please give me a call.

Sincerely yours,

ERM-SOUTHWEST, INC.

Richard H. Fuller

Richard H. Fuller, P.G.

RHF:cv

Attachments

1004487

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bcc: w/o attachments
Greg Franklin, McKesson Corp.
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A DIVISION OF
ENSECO
INCORPORATED

ENSECO, INC.

QUALITY ASSURANCE PLAN

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1. INTRODUCTION

ENSECO, Inc. consists of the combined resources of ERCO in Cambridge, Massachusetts and Houston, Texas; Gollob Analytical Service in Berkeley Heights, New Jersey; CAL Lab East (CLE) in Richmond, Virginia; Rocky Mountain Analytical Laboratory (RMAL) in Arvada, Colorado; and California Analytical Laboratory (CAL) in Sacramento, California. The merger of these organizations in June 1986 created the largest and most experienced independent environmental laboratory in the United States. The union also strengthened the existing laboratory structures by providing a national level of officers to oversee quality control and laboratory operations.

ENSECO provides analytical chemistry services to industry and government in a wide variety of technical areas. To ensure the production of reliable, accurate data, an extensive quality assurance and quality control (QA/QC) program monitors every aspect of analytical services.

The following Quality Assurance Plan describes, in general terms, the principal components and elements of ENSECO's QA/QC program, and supports ENSECO's commitment to produce analytical data of the highest quality. The QA Plan has been developed according to criteria described in "The Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," published by the EPA. A more specific and detailed preparatory QA/QC manual is on file at ENSECO laboratories.

2. ENSECO'S QUALITY ASSURANCE PHILOSOPHY

Parallel to quality laboratory work is a quality assurance and quality control program which effectively monitors and regulates the production of analytical data. Essential to the success of such a program are clearly defined objectives, documented standard operating procedures, management commitment and support, staff cooperation, and a comprehensive and thorough auditing system.

ENSECO has developed a rigorous QA/QC program which is closely supervised at both the corporate and laboratory levels. The principal components of this program are prevention, assessment, and correction, which, supported by the program elements (many of which are described in this QA Plan), encompass the entire activities of laboratory operations.

ENSECO's well-planned prevention program ensures that analytical systems are functioning properly through a coherent series of steps, which includes quality control planning, training programs, instrument calibration and maintenance, and frequent validation of standards. Because prevention and assessment are often intervolved, the program provides an elaborate system of checks and balances by which data production can be further controlled. Additionally, ENSECO studies the different principles involved in performing analytical methods and incorporates the most stringent criteria as a standard.

Precision and accuracy are controlled by the assessment of data through quality control checks. Under the direction and guidance of the Corporate Vice President of Quality Assurance, QA officers at each laboratory perform regular systems and performance audits to evaluate the data produced by the laboratory's analytical systems. Audits include laboratory site visits, analysis of QC samples (such as method blanks, sample spikes, and split samples), the review of calculations, and validation of methodology. ENSECO has developed extensive interlaboratory and intralaboratory performance evaluation studies and also participates in auditing programs conducted by regulatory agencies.

The ability to diagnose problems and implement corrective actions is critical to the generation of quality data. ENSECO's QA/QC program places particular emphasis on the identification of quality defects and the implementation of appropriate methods to restore proper functioning of the analytical system. This is accomplished through reevaluation of methodology, reexamination of check samples, instrument recalibration or repair, as well as the utilization of QC reports, historical QC databases, and instrument maintenance logs. Corrective actions are fully documented and reported to the Corporate Vice President of Quality Assurance.

In addition to receiving documented sample test results, clients also receive QA/QC data specifying the blank, duplicate, spike, holding times and control limits. Qualifying the reporting data is a bold and progressive step in the industry, and demonstrates ENSECO's leadership and confidence in the organization's analytical procedures and laboratory performance.

It is the steadfast goal of the Quality Assurance Group to uphold the integrity of ENSECO's analytical chemistry services through dedicated commitment to good laboratory practices and the production of the highest quality data.

3. THE QUALITY ASSURANCE GROUP

Executing an effective QA program in a large and complex laboratory system demands the skills of a highly trained and qualified staff. The organizational structure of ENSECO's Quality Assurance Group (Fig. 1) provides a disciplined national network of management which oversees and regulates all laboratory QA/QC functions.

ENSECO's Quality Assurance Group is headed by Dr. Anthony Wong, Corporate Vice President of Quality Assurance, who reports directly to the ENSECO Executive Committee and to the Chairman of the Board. As principal architect of ENSECO's QA program, Dr. Wong has charted a rigid course to monitor and control laboratory operations. This involves the intricate process of developing QA manuals, QC protocols, training programs, Standard Operating Procedures (SOP's), uniform statistical data, interlaboratory and intralaboratory performance evaluation studies, and internal auditing programs. Dr. Wong is responsible for the administration and implementation of the QA program at all ENSECO laboratories.

Laboratory QA/QC activities are specifically designed to fulfill the requirements of both the individual laboratory and ENSECO. Directing these activities is the responsibility of each laboratory president, who works closely with the laboratory Quality Assurance Officer to enforce and monitor the program.

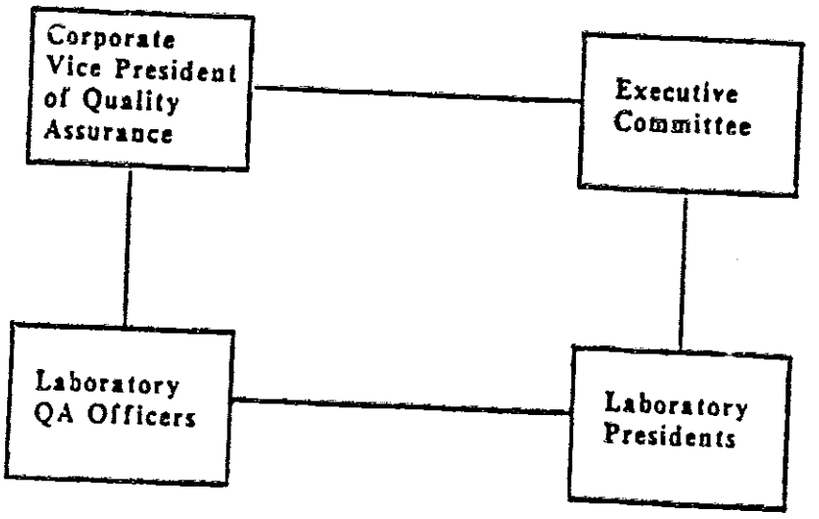
Because a QA program undergoes its most stringent test at the laboratory level, QA Officers hold a cornerstone position in the organizational structure. ENSECO QA Officers are highly skilled analytical scientists, knowledgeable in all aspects of laboratory operations. Their responsibilities include diagnosing quality defects and resolving problems with the analytical system; conducting performance evaluation studies, in-house audits, and walk-throughs; performing statistical analyses of data; auditing spike results; enforcing chain-of-custody procedures; assisting in the development of QA manuals, SOP's and QC protocols; conducting QA training programs; and maintaining extensive records and archives of all QA/QC data.

QA Officers report to both the laboratory president and to Dr. Wong. They also interface with one another in a peer evaluation and auditing system that encourages assistance and feedback, problem analysis, and collaboration on ways to improve laboratory performance.

In conjunction with the QA Department, laboratory vice presidents, directors, and managers are responsible for a subset of QA activities, and work closely with supervisors to evaluate daily laboratory functions.

Ultimately, no plan can succeed without the cooperation and support of the entire working force. ENSECO takes great pride in its most valuable resource---the men and women whose unwavering dedication to excellence forms the building blocks of our success.

Figure 1. ENSECO Quality Assurance Group Organization Chart



4. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS AND RELIABILITY

The effectiveness of a QA program is measured by the quality of the data generated by the laboratory. Data quality is judged in terms of its precision, accuracy, representativeness, completeness and comparability. These terms are defined and described as follows:

* Precision is the degree to which the measurement is reproducible. Actual control limits for precision will depend upon the specific project; in general, the relative percent difference (RPD) must be within 20%, the limit set by the EPA for the Contract Laboratory Program (CLP).

* Accuracy is a determination of how close the measurement is to the true value. Unless specified otherwise in special contracts and particular methods. ENSECO's parameter for accuracy is ± three standard deviations from the mean, with two standard deviations established as a warning for system check.

* Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Analytical data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix. For example, with samples consisting of several phases, it may be advisable to analyze each phase separately and to determine each phase proportionately in terms of the whole sample.

* Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions. The completeness of QC samples must be 100%.

* Comparability expresses the confidence with which one data set can be compared to another data set of the same property. Comparability is assured through the use of established and approved analytical methods, consistency in the basis of analysis (wet weight, volume, etc.), and consistency in reporting units (ppm, ppb, etc.).

5. STANDARD OPERATING PROCEDURES

Details of the analytical and QC protocols are contained in a set of standard operating procedures, commonly known as SOP's. SOP's incorporate the requirements of the analytical methods, the QA program, and good laboratory practices. An example of some typical SOP's are given below.

1. Method SOP

   (Method 613 is used)

   a. Project and method requirements (detection limits, precision and accuracy, blanks, spikes, duplicates, acceptance criteria)
   b. Reagent and standard preparation
   c. Equipment and glassware requirements
   d. Sample preparation
   e. Sample analysis (instrument calibration, standard, samples)
   f. Data and report generation
   g. Data and report approval
   h. Sample and extract disposal
   i. Special remarks (safety measures, special considerations, errors)

2. Instrument SOP

   (Example is for GC/MS laboratory)

   a. Operational protocols (start-up, settings, shut-down, calibration, tuning)
   b. Maintenance and service
   c. Sample log and service log

3. Sample Control SOP

   a. Receiving information (shipping documents, condition of samples)
   b. Log-in
   c. Storage
   d. Chain of custody
   e. Sample transfer
   f. Disposal

4. Reagents SOP

   a. Suppliers
   b. Records and labels
   c. Purity and interference checks
   d. Shelf life and storage requirements
   e. Precautions
   f. Disposal of excess reagents and containers

5. Glassware and Shipping Containers Preparation SOP

   a. Suppliers
   b. Cleaning procedures
   c. Preservatives
   d. Labeling of sample containers
   e. Records
   f. Shipping

6. Auditing SOP

   a. Purpose
   b. Checklist
   c. Summary
   d. Recommendations
   e. Corrective actions
   f. Follow-up

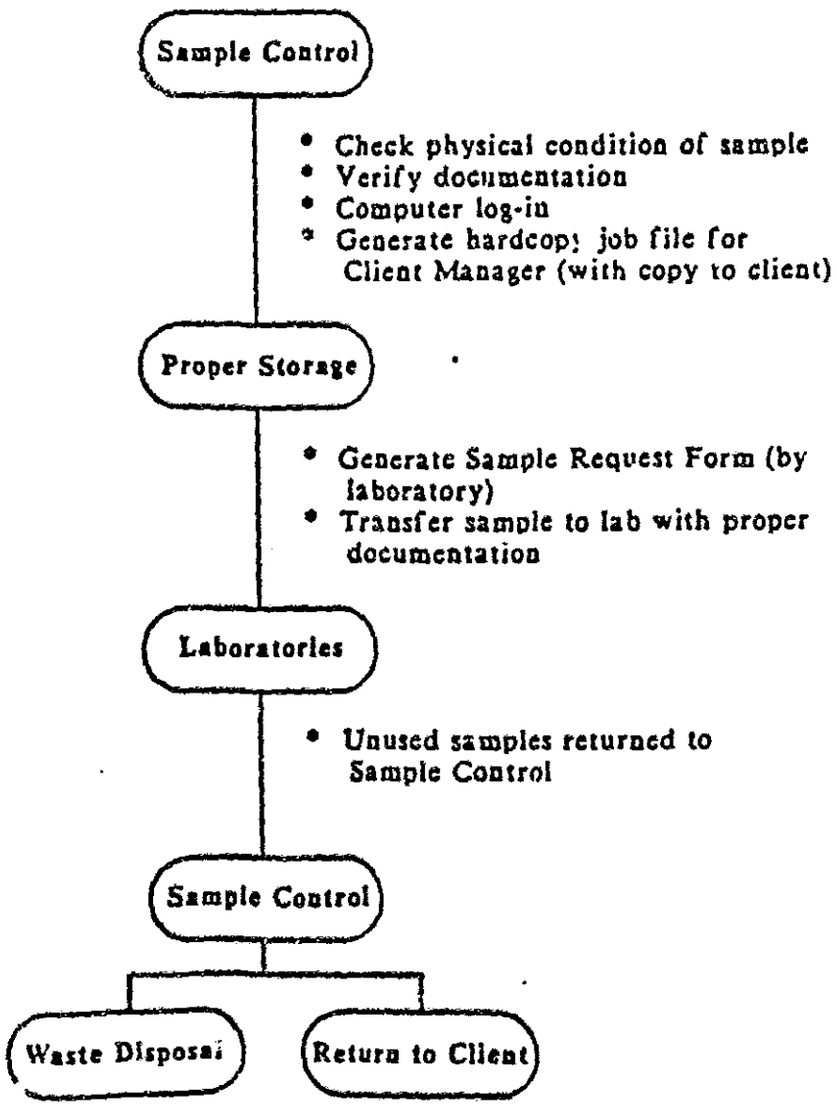
Specific methods are referenced and retained in the laboratory SOP's.

7. SAMPLE CHAIN OF CUSTODY

A sample enters the laboratory system upon its receipt and proceeds through an orderly chain-of-custody sequence specifically designed to ensure continual integrity of both the sample and documentation from, in the industry vernacular, "cradle-to-death."

All samples are received by the laboratory Sample Control Group and are carefully checked for label identification, chain-of-custody, and any discrepancies. Each sample is assigned a unique laboratory identification number through the computerized Laboratory Information Management System (LIMS), which generates a job file and stores all identifications and essential information; a duplicate of the job file is forwarded to the client. Internal chain-of-custody procedures track the sample from storage through the laboratory system until the analytical process is complete and the sample is back in the custody of Sample Control for disposal or return to the client.

The flow chart below describes ENSECO's chain-of-custody procedures.



8. METHOD VERIFICATION AND VALIDATION

Source of Methods

Since most of the analyses performed by ENSECO laboratories are regulatory-oriented, the methods selected are predominately ones sanctioned by government agencies. Generally, the methods used are those specified by the U. S. Environmental Protection Agency (EPA) and other federal or state agencies, as provided in the following references:

(1) Contract Laboratory Program Causus Protocol, U.S. EPA (revised July 1985).

(2) "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," 40 CFR, Part 136. Published in *Federal Register*, Vol. 49, No. 209 (October 26, 1984).

(3) Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 (revised March 1983).

(4) Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057 (July 1982).

(5) Test Methods for Evaluating Solid Waste (SW-846), 2nd Edition (revised), Update I (1984), Update II (1985), Office of Solid Waste and Emergency Response, U.S. EPA (April 1984).

(6) Standard Methods for the Examination of Water and Wastewater, 16th Edition, APHA, AWWA, WPCF, Washington, DC (1985).

(7) Official Methods of Analysis, 14th Edition, AOAC, Arlington, VA (1984).

(8) Current EPA Contract Laboratory Program (CLP) methods for the analysis of Organic Priority Pollutants, Inorganic Priority Pollutants and Chlorinated Dioxins and Dibenzofurans.

Method Verification and Validation

Before any methods are used to generate analytical data, the following method verification and validation criteria must be observed:

(1) The selection of a method must be performed by a senior staff member.

(2) The method must be a written one, accompanied by an SOP, and contain objectives, equipment and reagents, analytical procedures, calculations, reporting formats and special remarks.

(3) The method must be tested to achieve the claimed detection limits, precision and accuracy.

(4) Data acceptance criteria must be established and approved by a senior staff member and the QA Officer.

9. REAGENTS AND STANDARDS

A critical element in the generation of quality data is the purity and grades of the reagents and standard solutions that are used in analytical operations. Contaminated or improperly prepared reagents or standard solutions can cause errors in analytical results. ENSECO laboratories continually monitor the quality of reagents and standard solutions through a computer database and detailed log books which identify the supplier, lot number, purity, preparation date, solution and method of preparation, initial strength, quality checks, etc. These procedures are firmly established in SOP's for reagents and standards.

To insure the highest purity possible, all primary reference standards and standard solutions used by ENSECO laboratories are those recommended and obtained through the National Bureau of Standards (NBS), the EPA repository (Research Triangle Park, NC), and other reliable commerical sources. All secondary reference standards are validated prior to use. The validation may involve comparison to previous standards, a check for chromatographic purity, etc., as appropriate. Stock and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, and change of concentration. Care is exercised in the proper storage and handling of standard solutions, and all containers are labeled as to compound, concentration, solvent, expiration date and preparer.

Reagents are examined for purity by subjecting an aliquot or subsample to the analytical method correspondent to their intended use; for example, every lot of dichloromethane (for organic extractables) is analyzed prior to acceptance or shipment by commercial carriers.

A computerized database is used to store essential information on specific standards or reagents. The system is designed to serve various functions; for instance, the computer will issue warnings on expiration dates, or allow the chemist to obtain a list of all working standard solutions prepared from the same stock solution. The program also facilitates the management and auditing of reagents and standards.

10. INSTRUMENT CALIBRATION

Calibration of instruments is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established detection limits. The complexity of modern instrumentation has created the demand for tighter quality control so that malfunctions may be quickly detected and the quality of analytical results is continually maintained. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. Frequency of calibration and concentration of standards is determined by the manufacturer's guidelines, the analytical method, and the requirements of special contracts.

Following are examples of calibration requirements for GC, GC/MS, AA and ICP instrumentation.

GC Calibration - The GC used for quantitation is calibrated according to the protocol that is used for a particular analysis. For the analysis of chlorinated pesticides and PCB's, the procedure outlined in the EPA-CLP "Organics Analysis Statement of Work" is followed. For the analysis of drinking water samples submitted for the determination of insecticides and herbicides, the procedure outlined in the corresponding method is followed.

GC/MS Calibration - All GC/MS instruments must undergo calibration to ensure the quality of the data acquired during any shift. Daily (or every 12 hours) the mass calibration standard is analyzed to demonstrate that the instrument meets the standard mass spectral abundance criteria. Whenever any action is taken which may affect the tuning parameters of the instrument (e.g., source cleaning or other maintenance) the mass calibration must be verified regardless of the 12-hour time period. Mass calibration criteria must be met before any analysis (standards, blanks or samples) using EPA protocols may be performed.

AA and ICP Calibration - Other instruments, such as atomic absorption spectrometers (AA) and Inductively Coupled Argon Plasma Emission Spectrometers (ICP), must be calibrated every 2 hours, or sooner if a check standard (one is run every 10 samples) falls more than ten percent off a calibration curve. Interference checks must also be performed every 8 hours.

The systematic criteria established for instrument calibration and certification by the EPA for the Contract Laboratory Program (CLP) has been adopted by ENSECO as the archetype for both EPA and non-EPA work; ENSECO also uses the calibration criteria specified in certain methods promulgated by regulatory agencies.

11. INSTRUMENT PREVENTIVE MAINTENANCE

To minimize downtime and interruption of production, preventive maintenance is routinely performed on each analytical instrument. Designated laboratory personnel are factory-trained in routine maintenance procedures of all major instrumentation. When repairs are necessary, they are performed by either the in-house engineers or the instrument manufacturer under service contracts and warranties.

Each laboratory is required to maintain detailed logbooks of preventive maintenance and repairs for each analytical instrument.

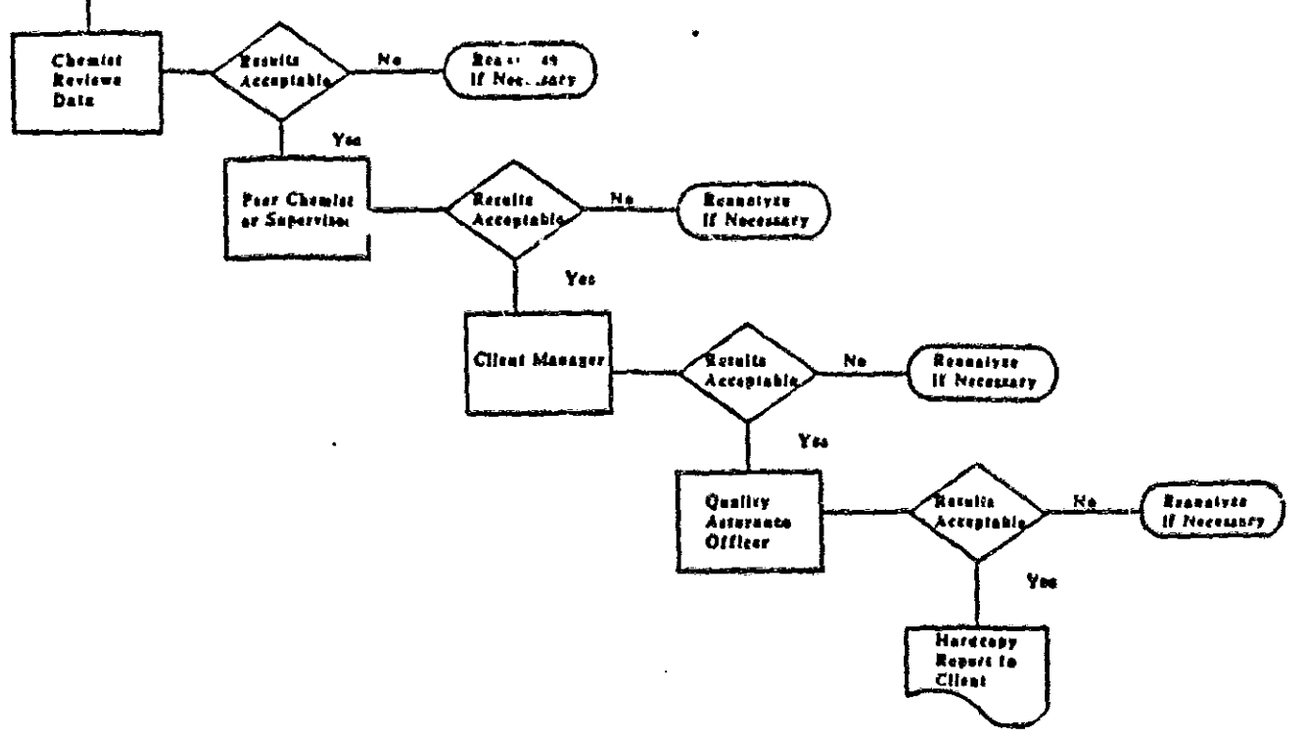
12. DATA REVIEW AND REPORTING

Laboratory data must pass the scrutiny of peer and supervisory review and evaluation before it is considered ready for client use. All data is reviewed first by another analyst or data specialist to ensure that it is complete, that precision, accuracy and detection limits have been met, that interpretation of raw data and calculations are correct, that contractual requirements have been fulfilled, and finally, that all information is well documented. The data is then examined by the laboratory supervisor or manager who will approve the results. Members of the QA staff may also check the results on selected data sets. (For a typical data reporting scheme, see Figure 2 below.)

ENSECO laboratories use the computerized Laboratory Information Management System (LIMS), as well as a variety of custom applications, to transfer data from instruments to computers, perform calculations, check results, generate reports, and to ensure data integrity and security.

A variety of reporting formats, from computerized data to complex regulatory reports, can be integrated into a client's existing information system. In addition to the regular hardcopy report, clients can also receive analytical results on a floppy disk, magnetic tapes or via electronic mail.

Figure 2. Data Reporting Scheme



13. CORRECTIVE ACTIONS

When errors, deficiencies or out-of-control situations exist, the QA plan provides systematic procedures, called "corrective actions," to resolve problems and restore proper functioning of the analytical system.

Laboratory personnel are alerted that corrective actions may be necessary if:

1) QC data is outside the warning or acceptable windows for precision and accuracy.

2) Undesirable trends in concentration, spike recoveries and relative percent difference (RPD) are detected.

3) There are unusual changes in detection limits.

4) Deficiencies are detected by the QA Officer during internal and external audits, weekly walk-throughs, or from the results of performance evaluation samples.

5) Complaints are received from clients.

Corrective action procedures are often handled at the bench level by the analyst, who will review the extraction procedure for possible errors, check the instrument calibration, spike mixes and standard mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA Officer, who will conduct further investigation. When the problem is resolved, the QA Officer is provided with full documentation, which is kept on file in the QA office. Corrective action documentation is routinely reviewed by the Corporate Vice President of Quality Assurance.

14. QA/QC REPORTS

The reporting system is a valuable tool for measuring the overall effectiveness of the QA program. It serves as an instrument for evaluating the program design, identifying problems and trends, and planning for future needs. Each laboratory QA Officer must submit extensive quarterly QA reports to the laboratory president and to the Corporate Vice President of Quality Assurance. These reports include:

1. A systems audit report.
2. Performance evaluation scores and commentary.
3. The number of quality control samples performed and test results.
4. Results of site visits and audits by regulatory agencies and other clients.
5. Status of major contracts, projects, and certifications.
6. Problems encountered and corrective actions taken.
7. Comments and recommendations.

In turn, the Corporate Vice President of Quality Assurance must also submit quarterly reports to the Executive Committee, the Chairman of the Board, and to each laboratory president. These reports summarize the information gathered through the laboratory reporting system; they also contain a thorough review and evaluation of laboratory operations as derived from inspections and audits the Corporate Vice President of Quality Assurance has personally conducted, and include any recommendations or comments.

LABORATORY QUALITY CONTROL PLAN

Enseco Incorporated

ROCKY MOUNTAIN ANALYTICAL LABORATORY

March 4, 1987

Revision 1.2

INTRODUCTION

Enseco Incorporated, Rocky Mountain Analytical Laboratory (RMAL) provides analytical chemistry services to industry and government in a wide variety of technical areas. RMAL specializes in solving both routine and highly challenging environmental problems with an approach that is both technically sound and cost effective. All analytical services are performed under the auspices of extensive quality assurance and quality control (QA/QC) programs. These programs control every aspect of analytical services to provide a product of high, documented quality.

The principal component of RMAL's QA program are described in a companion document "Enseco, Inc. Quality Assurance Plan." Enseco's comprehensive QA program meets or exceeds the rigorous criteria established by the EPA and major state agencies. To ensure the continuous production of the highest quality data, Enseco has integrated responsibility for the QA program into all staff and management levels, and includes a corporate QA oversight program. This sophisticated approach ensures that all data reported are scientifically valid, legally defensible and are of know precision and accuracy.

The Laboratory QC Plan contained in this document presents specific details of RMAL's standard operating procedures for quality control. This document is written for laboratory operations and contains highly specific details associated with the Laboratory Information Management Syste i (LIMS) used to record the QC results.

In addition to the internal QC measures described in this Laboratory QC Plan, RMAL participates in many performance evaluation studies each year at its own expense. These PE samples are analyzed to maintain laboratory certifications from major state and federal agencies. A current list of RMAL certifications is included as an appendix.

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I. Overview

The purpose of a QA/QC program is to monitor the performance of the laboratory and thereby assure that data generated is of known precision and accuracy.

The new Standard QA/QC program is based upon monitoring the performance of the laboratory using Laboratory Control Samples (LCS) as opposed to using the authenic samples as the QC matrix. In the past, RMAL has generated a substantial percentage of its QC data based on spike, duplicate, and surrogate recovery information obtained using the authenic samples. There are advantages and disadvantages to this approach. An advantage is that it provides data about the performance of the method on these samples and sometimes, therefore, facilitates data interpretation. A disadvantage of this approach is that matrix interferences and sample non-homogeneity often influence recoveries and make it difficult to assess whether recoveries which fall outside control limits are the result of laboratory problems and/or errors, or are the result of a matrix effect. This approach has led to a fairly high number of repreps and reanalyses.

The new Standard QA/QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of duplicate Laboratory Control Samples (LCS) which have been spiked with a set of target compounds. By analyzing, in duplicate, a set of samples which have been spiked with compounds at a defined level above the detection limit, both precision and accuracy information can be obtained with regularity. The LCS matrix for aqueous samples will consist of an appropriate clean water (deionized, carbon-filtered, etc.) and the LCS matrix for solid samples will consist of Celite (diatomaceous earth) which has been pre-cleaned. The purpose of the LCS is not to duplicate the sample matrix. Rather, the LCS provides an interference-free, homogeneous matrix from which to gather historical data to establish control limits which allows the monitoring of performance of the laboratory in using the method and, thereby, judge whether the data generated in the lab on any given day is valid.

An LCS sample has been established for each test performed. The LCS is analyzed at a frequency of one set of duplicate controls per 20 analyses for organic tests, and one set of duplicate analyses per analytical lot for inorganic tests. An analytical lot is defined as a set of samples analyzed at one time.

Control limits have been established for each of the analytes monitored in the LCS. Control limits for accuracy will be based on the average recovery +/- 3 standard deviation units. Control limits for precision range from 0 (no difference between duplicate LCS results) to the average relative percent difference + 3 standard deviation units.

Analytical data generated with an LCS which falls within the control limits will be judged to be in control (although data which falls within 2-3 standard deviation units will trigger an in-house investigation). Data generated with LCS samples which fall outside the control limits is considered suspect and will be redone or reported with qualifiers (see II.B.1. below).

The recovery data are entered by the analyst onto a control chart which is specific for the method and analyte. These control charts are updated on a quarterly basis by the QA/QC Department to generate new limits.

In addition to the LCS samples, both the Organic and Inorganic departments perform do some department-specific QC. In the Organic area, where samples are typically extracted in small batches due to holding time and other constraints, reliance on the LCS as the only QC check would lead to to a situation in which no QC data was being generated with a high percentage of our work. To alleviate this situation, a blank spiked with surrogates, called a Surrogate Control Sample (SCS), is analyzed with each analytical lot. This SCS also serves as the method blank and is not analyzed in addition to the method blank. The recovery of components in this SCS is monitored using control charts identical to those used for the LCS samples.

Data which is generated with an SCS which falls within the control limits is judged to be in control. Data which is generated with an SCS which falls outside the control limits is considered suspect and is redone or reported with qualifiers.

If surrogate recoveries in the client's samples are outside the established control limits, but the SCS is within the limits, the method was assumed to have been performed correctly and that the low recoveries are based on matrix effects.

If project specific criteria are established which dictate that the surrogates in a particular group samples be within the limits (either our lab limits or CLP limits), this is considered to be an element of project-specific QC. Our policy duplicates the EPA-CLP program: we will reanalyze a sample with surrogate recoveries outside the limits with the understanding that if, on reananalysis, the surrogates fall within the limits, the lab reports the new data at no charge to the client. If, however, the second analysis duplicates the results from the first analysis, indicating a matrix problem, the client is charged for the second analysis. The same policy applies to matrix spike data, both for Organic and Inorganic analyses.

In addition to the LCS samples in the Inorganic department, one blank, one matrix spike, and one matrix duplicate are analyzed with each analytical lot. This data is typically not reported and is used for internal information only. The information is kept on file and can be reported as an element of special QC Reportables at an additional charge to the client.

II. Internal Procedures

THE PRIME RESPONSIBILITY FOR IMPLEMENTING THE QC PROGRAM LIES WITH THE ANALYST. THE QA/QC DEPARTMENT SERVES IN AN AUDIT FUNCTION AND ALSO ADDRESSES SPECIAL QA NEEDS SUCH AS QA PROJECT PLANS AND SPECIAL QC NEEDS. QC INFORMATION NEEDED FOR STANDARD REPORTS WILL BE GENERATED, DOCUMENTED, AND INCLUDED IN THE PROJECT FILE BY THE ANALYST. NON-STANDARD QC INFORMATION WHICH MAY BE REQUIRED FOR PROJECT-SPECIFIC QC WILL BE THE RESPONSIBILITY OF THE PERSON ASSEMBLING THE REPORT. ALL INFORMATION SHOULD BE AVAILABLE TO THAT PERSON IN THE PROJECT FILE OR WITHIN LIMS.

A. QC Samples Required Under Standard Laboratory QC Program

1. Metals/Inorganic Departments

   a. Duplicate LCS samples per analytical lot. ENSECO LCS samples have been established for ICP metals, graphite furnace metals, and cyanide. ERA control samples will be used for all other parameters.

   b. One blank per analytical lot.

   c. One matrix spike per analytical lot.

   d. One sample duplicate per analytical lot.

2. GC/MS and Chromatography Departments

   a. Duplicate LCS samples analyzed at a frequency of one set of duplicates per 20 analyses. ENSECO LCS samples have been established for the routine methods (applicable to a variety of analyte lists): 624, 625, 608, PCB's, PNA's(610), Herbicides, organophosphate pesticides, 601/602.

      Non-routine tests will require a special spike and/or surrogate mix which will be defined by GC or GC/MS supervisors. These mixes are then spiked into the water and Celite matrices as defined in the standard QC protocol. Control charts will be generated for these special mixes after 10 points have been generated. Until control limits are generated, the recovery data from these mixes are reported in the QA/QC section of the report. After control limits have been generated, the test is treated as a routine test for purposes of QC reporting.

   b. One blank (carbon-filtered water for aqueous samples and a reagent blank for solid matrices) spiked with surrogate standards (SCS), per analytical lot. Once again, surrogates are only defined for routine analyses. Non-routine tests will follow the guidelines given above.

Note: it is not a requirement under this QC program to define surrogates for all non-routine tests. This is a judgement which must be made by the laboratory supervisors.

B. Generation of QC Data

1. Generation of QC Samples

All samples are associated with the appropriate QC analyses, (LCS, SCS and blanks) by QC lot. The QC lot is assigned to the samples at the time the QC samples are generated. Depending on the test being done, QC samples can be generated either at the time of extraction/digestion (example: BNA analysis) or at the time of analysis (example: TOX).

The QC lot is named by combining the 3 character method code for the analysis as listed in LIMS, with a sequential number assigned in the laboratory. The numbering scheme varies somewhat for Organic and Inorganic tests.

a. Inorganic tests

Duplicate LCS samples and a blank are generated with each analytical lot.

The QC lot is assigned based on the 3 character method code and a sequential 3 digit number modified with an alphabetic character. This modification needed to maintain consistency with the numbering of organic tests. Example: for ICP metals, water samples analyzed in one analytical lot could be assigned a QC lot of ICP001A.

With that lot is associated the following QC samples:

ICP001AQ01LCSICP00
ICP001AQ01LCSICP01
ICP001AQ01BLKICP

The first 7 characters identify the QC lot number. The next 3 characters signify the matrix type. The next 6 characters are the test assignment (LCS or blank). The final 2 characters are the replicate numbers.

The next analytical lot of water samples would be assigned a QC lot of ICP002A and QC samples would be numbered accordingly:

ICP002AQ01LCSICP00
ICP002AQ01LCSICP01
ICP002AQ01BLKICP

b. Organic tests

Duplicate LCS samples are generated after every 20 analyses. An SCS is generated with each analytical lot.

The QC lot is assigned based on the 3 character method code and a sequential 3 digit number, modified with an alphabetic character. This modification is needed to link the SCS with the most recent LCS.

For example: BNA soil analyses

Day 1: 10 samples prepped
QC needed: duplicate LCS and SCS
QC lot assigned: BNA001A
QC sample numbers in the lot:

BNA001AQ20LCSBNA00
BNA001AQ20LCSBNA01
BNA001AQ20SCSBNA

Day 2: 10 samples prepped
QC needed: SCS
QC lot assigned: BNA001B
QC sample numbers in the lot:

BNA001AQ20LCSBNA00
BNA001AQ20LCSBNA01
BNA001BQ20SCSBNA

Note: the LCS samples are not reanalyzed with this group of samples, but the results of the LCS samples from lot BNA001A are linked to the samples with lot BNA001B in the data base.

Day 3: 10 samples prepped
QC needed: duplicate LCS (because 20 samples have been analyzed since the last LCS) and SCS
QC lot assigned: BNA002A
QC sample numbers in the lot:

BNA002AQ20LCSBNA00
BNA002AQ20LCSBNA01
BNA002AQ20SCSBNA

2. Entering QC sample assignments into LIMS

The Results Entry Screen within LIMS for either prep or analytical results (depending on the test being performed) will ask for the QC lot number and associate it with all the samples being grouped in that lot. The Screen will also ask whether LCS, Blank, and/or SCS samples will be associated with the lot.

3. Scheduling QC samples for analysis

All samples with the same QC lot number should be carried through the entire analysis together. Backlog sheets from LIMS will include QC lot number information to aid in scheduling.

At times it may be impossible to analyze all samples with the same QC lot number together. In that case, the QC samples should be analyzed with the first set of samples analyzed from the lot.

The following priorities should be used to determine scheduling:

a. Meet holding times

b. Meet promised due date

c. Keep samples within a QC lot together

4. Analytical Protocol

THE QA/QC PROGRAM IS STRUCTURED SO THAT DECISIONS ABOUT THE ACCEPTABILITY OF THE DATA ARE MADE BY THE ANALYST.

All analytical work must be done using the following protocol in order to ensure that QC decisions are made in the most timely manner so as to generate quality data efficiently, minimize reruns, and thereby meet project due dates.

a. Calibrate instrument

b. Analyze all QC samples and plot recovery and precision information on control charts. If data is outside the control limits (based on guidelines given in Section II.C.) DO NOT PROCEED WITH ANALYZING THE SAMPLES. CONSULT YOUR SUPERVISOR. Analysts using auto-samplers MUST gather and plot all QC information before leaving the instrument for unattended operation.

c. If all QC checks out correctly, proceed with analysis of samples.

d. If QC does not check out, determine source of problem (standards, instrumentation, prep etc.). Each analyst should have a checklist to help in identifying problems. Determine whether analysis of samples should proceed based on the following criteria.

1. Validate instrument operational settings, sensitivity, and linearity. If problem is detected, correct the problem and reanalyze QC samples. If QC data is within control limits, proceed with the analysis of samples. If QC samples are still outside the limits, continue to troubleshoot or go to step 2.

2. Validate that analytical standards are good. If problem with standards is detected, use a different standard and reanalyze QC samples. If QC data is within control limits, recalibrate with the new standard solutions and proceed with the analysis of the samples. If QC data is still outside the limits, go to step 3.

3. Validate that prep was performed correctly. Check prep sheets for any anomalies. If no anomalies are found, reprep samples. If samples cannot be reprepped due to lack of sample, analyze samples and report data with the qualifier that "Laboratory QC performed with this sample was outside of normal control limits". If sufficient sample remains, but holding times have expired, reprep samples.

If problems with the prep are discovered based on examination of the prep sheets, notify your supervisor. The supervisor should decide whether to reprep the samples based on the following criteria:

a. If the problems identified with the prep of the QC sample clearly affected only the QC sample and none of the other samples prepped with it (example: QC sample taken to dryness in the KD), and a decision is made not to reprep the other samples, the sample results can be reported without qualifiers.

b. If the problems identified could have potentially affected all of the samples prepped with the QC sample, the samples should be reprepped. If the samples cannot be reprepped for some reason, the sample results must be reported with a qualifier.

The entire episode, including reasons to support the final decision, must be documented on a Warning/Out of Control form and forwarded to the QA Department.

C. Interpretation and Use of QC Information

1. Accuracy Data - Monitored by Spike and Surrogate Recoveries

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

For each of our routine analyses, control charts will be established for QC samples which will be method and analyte specific. The control limits will be based on the average recovery of the analyte +/- 3 standard deviation units. Only recovery data from QC samples will be monitored and charted. All recovery data that falls within the control limits is acceptable and all data generated with an acceptable QC sample is also considered to be acceptable.

For multi-analyte LCS and SCS samples, 80% of the analytes must be within the control limits for the QC data to be considered acceptable. Consistent recovery problems with one analyte in a multi-analyte LCS or SCS sample will become obvious from the control charts.

Initially, QC limits will be based on CLP limits. After 20 points have been generated under this program new limits will be calculated. These limits should be tighter than the CLP limits due to the consistency of the matrix which we are monitoring. The QA Department will be responsible for generating the control charts and updating them on a quarterly basis.

The control charts will be used as follows:

0-2 sigma - recovery data is in control. All systems are functioning well.

2-3 sigma - recovery data is in control. However, problems may be developing. Notify supervisor. Investigate problem and fill out a Warning/Out of Control Form.

over 3 sigma - recovery data is out of control. All data generated with this QC sample is suspect. Reprep may be necessary (consult your supervisor). If samples cannot be reprepped and/or reanalyzed due to lack of sample or other problems, the samples should be analyzed, but the data must be qualified when reported. A Warning/Out of Control Form must be filled out.

Data trends - recovery data is within control limits but is consistently increasing or decreasing. Five consecutive data points in one direction indicate that a problem may be developing. Investigate problem and fill out a Warning/Out of Control Form. Notify the QA Department immediately. Data generated with 5 trend points is still considered "in control" unless the QA Department, on investigation of the problem, concludes otherwise.

Recovery data is within control limits but is consistently above or below the mean. Five consecutive data points lying above or below the mean indicate that a problem may be developing. Investigate the problem and fill out a Warning/Out of Control Form. Notify the QA Department immediately. Data generated with 5 trend points is still considered "in control" unless the QA Department, on investigation of the problem, concludes otherwise.

2. Precision Data - Monitored by Relative Percent Difference between Duplicate LCS

For each set of duplicate LCS samples, the precision of the analysis will be calculated using the Relative Percent Difference (RPD).

$$RPD = \frac{\text{\% recovery LCS1 - \% recovery LCS2}}{(\text{\% recovery LCS1 + \% recovery LCS2})/2}$$

This precision information will also be tracked using control charts, similar to those described above. Control limits for precision (relative percent difference) range from 0 (identical duplicate LCS results) to the average relative percent difference + 3 standard deviation units. The decision process for accepting and rejecting data and the procedures for using the control charts are identical to those described above.

D. Tracking of QC Information

THE GENERATION, DOCUMENTATION, AND INCLUSION OF QC INFORMATION IN THE PROJECT FILE IS THE RESPONSIBILITY OF THE ANALYST. AN ANALYSIS IS NOT COMPLETE UNTIL THE QC INFORMATION IS COMPLETE.

1. QC information will be compiled by project using two sets of forms, one for prep information and one for analytical information (forms are attached). The purpose of these forms is to accumulate all of the standard reportable QC information in one place and accumulate it in the easiest possible manner, that is when it is generated.

   a. The prep form includes QC lot number, which projects and samples are part of the QC lot, the QC samples generated, the spike and surrogate solutions used, the date and time of prep, the analyst(s) involved, and anomalies observed.

      The prep form is filled out by the prep lab for samples which require prep and Xeroxed for inclusion in each lab/project folder which has samples associated with the QC lot. The ultimate responsibility for the accuracy, completeness, and timely inclusion of the information into the lab/project file lies with the Supervisor in the Prep Lab.

   b. The analysis form includes the QC lot number, which projects and samples are part of the analytical lot, whether the samples were analyzed with the QC samples from the same QC lot, and recoveries of spikes and surrogates from the LCS and SCS samples.

      The analysis form is filled out by the analyst and Xeroxed for inclusion in each project folder which has samples associated with the analytical lot. The ultimate responsibility for the accuracy, completeness, and timely inclusion of the information into the project file lies with the Supervisor of the analytical group generating the data.

ALL QC INFORMATION (COMPLETED PREP AND ANALYSIS FORMS) MUST BE IN THE PROJECT FILE WHEN DATA IS ENTERED INTO LIMS. THE PERSON SENDING OUT THE REPORT OR THE PROJECT MANAGER IS NOT RESPONSIBLE FOR TRACKING DOWN THIS INFORMATION.

2. QC results are logged into LIMS at the time that analytical results are entered. The Results Screen in LIMS will prompt the analyst for the results of the QC samples associated with the QC lot of the samples being entered.

   If the samples within a QC lot have been split up due to a scheduling problem, the first set of analyses within the lot should have had QC data associated with it. LIMS will not prompt for QC information if it has already been entered.

3. Control charts are located at each of the analytical instruments. A control chart is used in the laboratory for a period of one week (Sunday through Saturday). Analysts enter information onto the control charts each time analyses are performed. At the end of each week, the control charts are turned into the QA Department for inspection. A new control chart is put in use for the following week. The old charts are archived by the QA Department.

   The control charts are updated with new limits on a quarterly basis.

   In addition, all Warning/Out of Control forms generated during the week are turned into the QA Department. The QA Department will verify that a form is present for each QC data point outside the 0-2 sigma range and follow-up on the corrective actions which have been taken.

4. The QA Department will provide monthly QC summaries based on the QC database in LIMS. These summaries include a discussion of the performance of the laboratory and the methods and any corrective actions which have occurred during the month.

E. Reporting of QC Information

QC information will be reported in a standard format unless special project requirements dictate alternate formats.

The standard format includes a brief discussion of the QA/QC program, the current LCS and SCS control limits for the tests performed on the samples, and the results of the LCS and SCS samples associated with the QC lots of the samples being reported.

The standard report also includes GC/MS surrogate recovery information. This information is not included in the QC section, but rather on the individual sample results sheets.

The standard format does not include any information about recovery of spike compounds or duplicate results. This information is available only through project-specific QC and must be requested when the project is set up.

1. Standard Reporting Format

   a. Brief discussion of ENSECO QA/QC program as applied by RMAL

   b. A listing of the QC lot numbers of the samples reported, LCS and SCS recoveries from QC lots associated with the samples reported, and control limits for those lots. This QC data is reported by department by test, in the order that the tests are reported in the analytical results section of the report.

Order: GC/MS DEPARTMENT
- GC/MS VOA
- GC/MS BNA
- GC/MS MISC

CHROMATOGRAPHY DEPARTMENT
- GC VOA (601, 602, BTEX)
- GC PEST (OCP, OPP, TRIAZINES)
- PCB
- HERB
- 600 METHODS (603,604,605,606,607,609,610,611,612)
- GC HYD
- GC BPD
- GC MISC

METALS

INORGANICS
- pH
- SPECIFIC CONDUCTANCE
- SOLIDS (TDS, TSS, TS, TVS)
- Ca
- Mg
- K
- Na
- FLUORIDE

CHLORIDE
BROMIDE
N (NITRITE, NITRATE, NITRATE + NITRITE)
ORTHO-PHOSPHATE
S (SULFATE, SULFITE, SULFIDE, R SULFIDE)
ALKALINITY (TOTAL, HYDROXIDE, CARB, BICARB)
HARDNESS
ACIDITY
BOD
COD
TOC
TOX
AMMONIA
TOTAL KJELDAHL N
TOTAL ORGANIC N
OIL AND GREASE
CN (FREE, TOTAL, REACTIVE)
PHENOLICS
COLIFORM (FECAL, TOTAL)
RESIDUAL CL
HEX CR
TRIVALENT CR
COLOR
MBAS
TURBIDITY
FLASH POINT
% OIL
% WATER
% SOLIDS

2. Part I of QC Report - Discussion of ENSECO QA/QC Program

a. Text for Standard QA/QC Package

The ENSECO laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the ENSECO laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. The Rocky Mountain Analytical Division of ENSECO is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

The ENSECO QA/QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of duplicate Laboratory Control Samples (LCS) at frequent, well-defined intervals. An LCS is a well-charactized matrix which is spiked with target compounds at 5-100 times the repor ing limit, depending upon the methodology being monitored. The purpose of the LCS is not to duplicate the sample matrix, but rather to provide an interference-free, homogeneous matrix from which to gather data to establish control limits. These limits are used to determine whether data generated by the laboratory on any given day is in control.

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate LCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

Analytical data generated with an LCS which falls outside of the control limits is reported with the qualifier "Laboratory QC performed with this sample was outside of normal control limits".

For Organic analyses an additional control measure is taken in the form of a Surrogate Control Sample (SCS). The SCS is a control sample spiked with surrogate standards which is analyzed with every analytical lot. The recovery of the SCS is charted on control charts in exactly the same manner as described for the LCS, and provides a daily check on the performance of the method.

Accuracy for LCS and SCS is measur d by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for LCS is measured by Relative Percent Difference (RPD).

$$RPD = \frac{\%\text{ recovery LCS1} - \%\text{ recovery LCS2}}{(\%\text{ recovery LCS1} + \%\text{ recovery LCS2})/2}$$

All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with the samples reported, LCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test, in the order that the tests are reported in the analytical results section of this report.

3. Part II of QC Report - Tables of QC Results

a. QC data is reported in 4 sections (corresponding to departments within the company): GC/MS, GC, and METALS,and INORGANICS. Tests within these sections are reported in the order given in II.D.1.b. in tabular form. Data from all QC lots associated with the samples are reported for each test.

Order: GC/MS Sample, Test, QC lot description
LCS results for all GC/MS tests and QC lots
SCS results for all GC/MS tests and QC lots

GC Sample, Test, QC lot description
LCS results for all GC tests and QC lots
SCS results for all GC tests and QC lots

Metals Sample, Test, QC lot description
LCS results for all Metals tests and QC lots

Inorganics Sample, Test, QC lot description
LCS results for all Inorganic tests and QC lots

b. Example: Sample, Test, QC lot description (Organic Tests)

Laboratory Sample Number	Test	QC Lot Number LCS	SCS
63548-01	VOA	VOA045	VOA045D
	BNA	BNA098	BNA098D
63548-02	VOA	VOA045	VOA045A

c. Example: Sample, Test, QC lot description (Inorganic Tests)

Laboratory Sample Number	Test	QC Lot Number
63548-01	ICP	ICP154
	TOX	TOX137
63548-02	ICP	ICP154
	TOX	TOX138

d. Example: LCS Report (Both Organic and Inorganic Tests)

Test	QC Lot	Analyte	Concentration(ug/l) Spiking	Measured LCS1	LCS2	Accuracy(%) LCS1	LCS2	Limits	Precision(RPD) LCS	Limits

Note: Keep all analytes in a given test for the same QC Lot together

e. Example: SCS Report (Organic Tests Only)

Test	QC Lot	Analyte	Concentration(ug/l) Spiking	Measured	Accuracy(%) SCS	Limits

Note: Keep all analytes in a given test for the same QC Lot together

f. Example QC Report for a group of pesticide analyses

QUALITY CONTROL REPORT - CHROMATOGRAPHY DEPARTMENT

QC LOT ASSIGNMENT - CHROMATOGRAPHY DEPARTMENT

Laboratory Sample Number	QC Lot Number Test	LCS	SCS
65409-01	OCP OCP004	OCP004A	
65409-02	OCP OCP004	OCP004A	
65409-03	OCP OCP004	OCP004D	
65409-04	OCP OCP006	OCP006C	
65409-05	OCP OCP006	OCP006F	
65409-06	OCP OCP006	OCP006F	

LCS REPORT - CHROMATOGRAPHY DEPARTMENT

Test	QC Lot	Analyte	Concentration(ug/l) Spiking	Measured LCS1	Measured LCS2	Accuracy(%) LCS1	Accuracy(%) LCS2	Accuracy(%) Limits	Precision(RPD) LCS	Precision(RPD) Limits
OCP	OCP004	Lindane	0.2	0.18	0.19	90	95	85-105	5.4	10
OCP	OCP004	Heptachlor	0.2	0.19	0.17	95	85	82-102	11	15
OCP	OCP004	Aldrin	0.2	0.21	0.20	105	100	90-110	4.9	10
OCP	OCP004	Dieldrin	0.5	0.48	0.45	96	90	85-104	6.4	15
OCP	OCP004	Endrin	0.5	0.48	0.43	96	86	80-104	11	18
OCP	OCP004	p,p-DDT	0.5	0.51	0.45	102	90	83-105	12	19
OCP	OCP006	Lindane	0.2	0.20	0.19	100	95	85-105	5.1	10
OCP	OCP006	Heptachlor	0.2	0.19	0.21	951	105	82-102	10	15
OCP	OCP006	Aldrin	0.2	0.20	0.20	100	100	90-110	0.0	10
OCP	OCP006	Dieldrin	0.5	0.51	0.45	102	90	85-104	12	15
OCP	OCP006	Endrin	0.5	0.48	0.50	96	100	80-104	4.0	18
OCP	OCP006	p,p-DDT	0.5	0.51	0.48	102	96	83-105	6.1	19

SCS REPORT - CHROMATOGRAPHY DEPARTMENT

Test	QC Lot	Analyte	Concentration (ug/L) Spiking	Measured		Accuracy(%) SCS	Accuracy(%) Limits
OCP	OCP004A	DBC	1.0	0.95	95	85-105	
OCP	OCP004D	DBC	1.0	0.91	91	85-105	
OCP	OCP006C	DBC	1.0	0.96	96	85-105	
OCP	OCP006F	DBC	1.0	0.93	93	85-105	

ENSECO SCS INFORMATION (SURROGATE CONTROL SAMPLE)

A. Aqueous samples

METHOD	SURROGATE(s)	SPIKE CONC.	UNITS	CONTROL LIMITS
601	Bromochloromethane	30	ug/L	20-160
	2-Bromo-1-chlorpropane	30	ug/L	20-160
	1,4-Dichlorobutane	30	ug/L	20-160
602	a,a,a-Trifluorotoluene	30	ug/L	20-160
OCP	Dibutylchlorendate	1.0	ug/L	48-136
PCB	Dibutylchlorendate	1.0	ug/L	48-136
PNA	Naphthalene	3000	ug/L	20-160
	Dibenzo(a,h)anthracene	500	ug/L	20-160
OPP	DEF	100	ug/L	20-160
HRB	2,4-DB	5	ug/L	60-120
VOA	Toluene-D8	50	ug/L	86-119
	Bromofluorobenzene (BFB)	50	ug/L	85-121
	1,2-Dichloroethane-D4	50	ug/L	77-120
BNA	Phenol-D5	200	ug/L	15-103
	2-Fluorophenol	200	ug/L	23-121
	2,4,6-Tribromophenol	200	ug/L	10-130
	Nitrobenzene-D5	100	ug/L	41-120
	2-Fluorobiphenyl	100	ug/L	44-119
	Terphenyl-D14	100	ug/L	33-126

ENSECO SCS INFORMATION (SURROGATE CONTROL SAMPLE)

B. Solid samples

METHOD	SURROGATE(s)	SPIKE CONC.	UNITS	CONTROL LIMITS
601	Bromochloromethane	0.015	mg/kg	20-160
	2-Bromo-1-chlorpropane	0.015	mg/kg	20-160
	1,4-Dichlorobutane	0.015	mg/kg	20-160
602	a,a,a-Trifluorotoluene	0.015	mg/kg	20-160
OCP	Dibutylchlorendate	0.067	mg/kg	20-150
PCB	Dibutylchlorendate	0.067	mg/kg	20-150
PNA	Naphthalene	100	mg/kg	20-160
	Dibenzo(a,h)anthracene	16.67	mg/kg	20-160
OPP	DEF	3.33	mg/kg	20-160
HRS	2,4-DB	0.333	mg/kg	60-120
VOA	Toluene-D8	0.05	mg/kg	50-160
	Bromofluorobenzene (BFB)	0.05	mg/kg	50-160
	1,2-Dichloroethane-D4	0.05	mg/kg	50-160
BNA	Phenol-D5	3.33	mg/kg	20-140
	2-Fluorophenol	3.33	mg/kg	20-140
	2,4,6-Tribromophenol	3.33	mg/kg	10-140
	Nitrobenzene-D5	1.67	mg/kg	20-140
	2-Fluorobiphenyl	1.67	mg/kg	20-140
	Terphenyl-D14	1.67	mg/kg	20-150

ENSECO LCS INFORMATION (LABORATORY CONTROL SAMPLE)

I. ORGANIC ANALYSES

A. Aqueous samples

METHOD	SPIKE COMPOUND(S)	SPIKE CONC.	UNITS	ACCURACY CONTROL LIMITS	PRECISION CONTROL LIMIT
601	1,1-Dichloroethene	50	ug/L	61-145	14% RPD
	Trichloroethene	50	ug/L	71-120	14% RPD
	Chlorobenzene	50	ug/L	75-130	13% RPD
602	Chlorobenzene	50	ug/L	75-130	13% RPD
	Toluene	50	ug/L	76-125	13% RPD
	Benzene	50	ug/L	76-127	11% RPD
OCP	Lindane	0.2	ug/L	56-123	15% RPD
	Heptachlor	0.2	ug/L	40-131	20% RPD
	Aldrin	0.2	ug/L	40-120	22% RPD
	Dieldrin	0.5	ug/L	52-126	18% RPD
	Endrin	0.5	ug/L	56-121	21% RPD
	p,p'-DDT	0.5	ug/L	38-127	27% RPD
PCB	Arochlor 1254	5	ug/L	20-160	20% RPD
PNA	Naphthalene	3000	ug/L	20-160	20% RPD
	Phenanthrene	100	ug/L	20-160	20% RPD
	Pyrene	500	ug/L	20-160	20% RPD
	Benzo(b)fluoranthene	100	ug/L	20-160	20% RPD
	Dibenzo(a,h)anthracene	500	ug/L	20-160	20% RPD
OPP	Diazinon	10	ug/L	20-160	20% RPD
	Malathion	10	ug/L	20-160	20% RPD
	Methyl Parathion	10	ug/L	20-160	20% RPD
	Parathion	10	ug/L	20-160	20% RPD
HRB	2,4-D	0.25	ug/L	30-100	20% RPD
	Silvex	0.05	ug/L	30-100	20% RPD
VOA	1,1-Dichloroethene	50	ug/L	61-145	14% RPD
	Trichloroethene	50	ug/L	71-120	14% RPD
	Chlorobenzene	50	ug/L	75-130	13% RPD
	Toluene	50	ug/L	76-125	13% RPD
	Benzene	50	ug/L	76-127	11% RPD
BNA	Pentachlorophenol	200	ug/L	9-103	50% RPD
	Phenol	200	ug/L	12-89	42% RPD
	2-Chlorophenol	200	ug/L	27-123	40% RPD
	4-Chloro-3-cresol	200	ug/L	23-97	42% RPD
	4-Nitrophenol	200	ug/L	10-80	50% RPD
	1,2,4-Trichlorobenzene	100	ug/L	39-98	28% RPD
	Acenaphthene	100	ug/L	46-118	31% RPD
	2,4-Dinitrotoluene	100	ug/L	24-96	38% RPD
	Pyrene	100	ug/L	26-127	31% RPD
	N-nitrosodi-n-propylamine	100	ug/L	41-116	38% RPD
	1,4-Dichlorobenzene	100	ug/L	36-97	28% RPD

ENSECO LCS INFORMATION (LABORATORY CONTROL SAMPLE)

I. ORGANIC ANALYSES

B. Solid samples

METHOD	SPIKE COMPOUND(S)	SPIKE CONC.	UNITS	ACCURACY CONTROL LIMITS	PRECISION CONTROL LIMIT
601	1,1-Dichloroethene	0.05	mg/kg	59-172	22% RPD
	Trichloroethene	0.05	mg/kg	62-137	24% RPD
	Chlorobenzene	0.05	mg/kg	60-133	21% RPD
602	Chlorobenzene	0.05	mg/kg	60-133	21% RPD
	Toluene	0.05	mg/kg	59-139	21% RPD
	Benzene	0.05	mg/kg	66-142	21% RPD
OCP	Lindane	0.027	mg/kg	46-127	50% RPD
	Heptachlor	0.027	mg/kg	35-130	31% RPD
	Aldrin	0.027	mg/kg	34-132	43% RPD
	Dieldrin	0.067	mg/kg	31-134	38% RPD
	Endrin	0.067	mg/kg	42-139	45% RPD
	p,p'-DDT	0.067	mg/kg	23-134	50% RPD
PCB	Arochlor 1254	1.0	mg/kg	20-160	20% RPD
PNA	Naphthalene	100	mg/kg	20-160	20% RPD
	Phenanthrene		mg/kg	20-160	20% RPD
	Pyrene		mg/kg	20-160	20% RPD
	Benzo(b)fluoranthene	3.33	mg/kg	20-160	20% RPD
	Dibenzo(a,h)anthracene	16.67	mg/kg	20-160	20% RPD
OPP	Diazinon	0.33	mg/kg	20-160	20% RPD
	Malathion	0.33	mg/kg	20-160	20% RPD
	Methyl Parathion	0.33	mg/kg	20-160	20% RPD
	Parathion	0.33	mg/kg	20-160	20% RPD
HRB	2,4-D	0.083	mg/kg	30-100	20% RPD
	Silvex	0.017	mg/kg	30-100	20% RPD
VOA	1,1-Dichloroethene	0.05	mg/kg	59-172	22% RPD
	Trichloroethene	0.05	mg/kg	62-137	24% RPD
	Chlorobenzene	0.05	mg/kg	60-133	21% RPD
	Toluene	0.05	mg/kg	59-139	21% RPD
	Benzene	0.05	mg/kg	66-142	21% RPD
BNA	Pentachlorophenol	3.33	mg/kg	17-109	47% RPD
	Phenol	3.33	mg/kg	26-90	35% RPD
	2-Chlorophenol	3.33	mg/kg	25-102	50% RPD
	4-Chloro-3-cresol	3.33	mg/kg	26-103	33% RPD
	4-Nitrophenol	3.33	mg/kg	11-114	50% RPD
	1,2,4-Trichlorobenzene	1.67	mg/kg	38-107	23% RPD
	Acenaphthene	1.67	mg/kg	31-137	19% RPD
	2,4-Dinitrotoluene	1.67	mg/kg	28-89	47% RPD
	Pyrene	1.67	mg/kg	35-142	36% RPD
	N-nitrosodi-n-propylamine	1.67	mg/kg	41-126	38% RPD
	1,4-Dichlorobenzene	1.67	mg/kg	28-104	27% RPD

ENSECO LCS INFORMATION (LABORATORY CONTROL SAMPLE)

II. INORGANIC ANALYSES

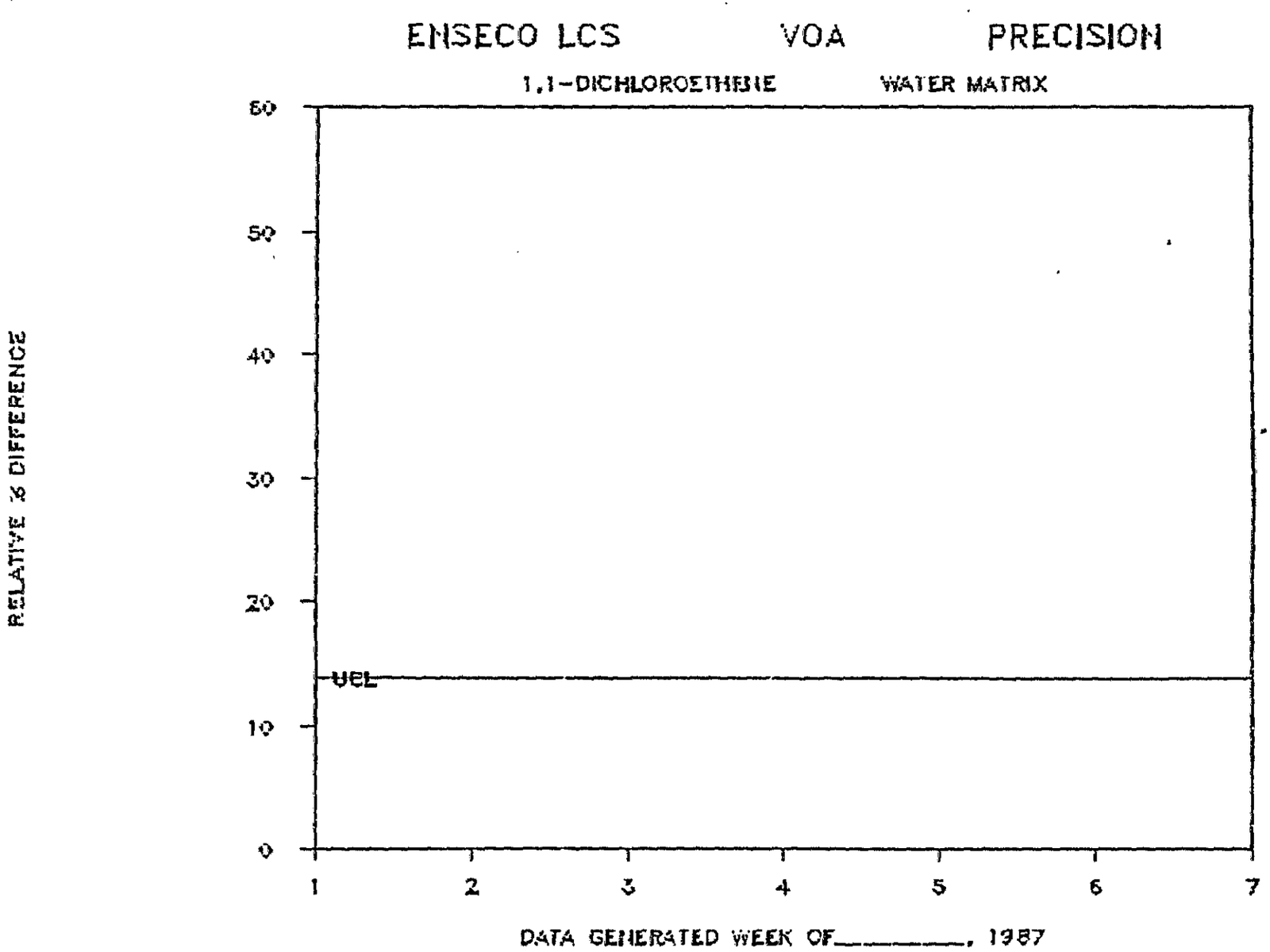
A. Aqueous samples

METHOD	SPIKE COMPOUND(S)	SPIKE CONC.	UNITS	ACCURACY CONTROL LIMITS	PRECISION CONTROL LIMIT
200.7 ICP METALS	ALUMINUM	2.0	mg/L	75-125	20% RPD
	ANTIMONY	0.6	mg/L	75-125	20% RPD
	ARSENIC	1.0	mg/L	75-125	20% RPD
	BARIUM	2.0	mg/L	75-125	20% RPD
	BERYLLIUM	0.1	mg/L	75-125	20% RPD
	CADMIUM	0.1	mg/L	75-125	20% RPD
	CALCIUM	100	mg/L	75-125	20% RPD
	CHROMIUM	0.2	mg/L	75-125	20% RPD
	COBALT	0.5	mg/L	75-125	20% RPD
	COPPER	0.3	mg/L	75-125	20% RPD
	IRON	1.0	mg/L	75-125	20% RPD
	LEAD	5.0	mg/L	75-125	20% RPD
	MAGNESIUM	50	mg/L	75-125	20% RPD
	MANGANESE	0.2	mg/L	75-125	20% RPD
	NICKEL	0.4	mg/L	75-125	20% RPD
	POTASSIUM	50	mg/L	75-125	20% RPD
	SELENIUM	1.0	mg/L	75-125	20% RPD
	SILVER	0.1	mg/L	75-125	20% RPD
	SODIUM	100	mg/L	75-125	20% RPD
	THALLIUM	1.0	mg/L	75-125	20% RPD
	TIN	0.4	mg/L	75-125	20% RPD
	VANADIUM	0.5	mg/L	75-125	20% RPD
	ZINC	0.2	mg/L	75-125	20% RPD
FURNACE METALS 206.2	ARSENIC	20	ug/L	75-125	20% RPD
239.2	LEAD	20	ug/L	75-125	20% RPD
270.2	SELENIUM	10	ug/L	75-125	20% RPD
279.2	THALLIUM	50	ug/L	75-125	20% RPD
	ANTIMONY	varies	mg/L	88-112	20% RPD
	TITANIUM	varies	mg/L	88-112	20% RPD
	CADMIUM	varies	mg/L	88-112	20% RPD
	SILVER	varies	mg/L	88-112	20% RPD
MERCURY 245.1	MERCURY	1.0	ug/L	75-125	20% RPD
CYANIDE 335.2	CYANIDE	100	ug/L	75-125	20% RPD
INORGANIC PARAMETERS	pH	varies	units	99-101	5% RPD
	Specific Conductance	varies	umhos	95-105	5% RPD
	Solids	varies	mg/L	90-110	10% RPD
	Fluoride	varies	mg/L	88-112	15% RPD
	Chloride	varies	mg/L	92-108	10% RPD
	Bromide	varies	mg/L	95-105	10% RPD
	Nitrogen-Ammonia	varies	mg/L	93-107	10% RPD
	Nitrogen-Nitrite	varies	mg/L	94-106	10% RPD
	Nitrogen-Nitrate	varies	mg/L	91-109	10% RPD
	Nitrogen-TKN	varies	mg/L	78-122	20% RPD
	Phosphate	varies	mg/L	85-115	15% RPD
	Sulfate	varies	mg/L	93-107	15% RPD
	Sulfide(React.,Tot.,Dis.)	varies	mg/L	80-120	20% RPD
	Alkalinity	varies	mg/L	90-110	10% RPD
	BOD	varies	mg/L	80-120	20% RPD
	COD	varies	mg/L	76-124	20% RPD
	TOC	varies	mg/L	91-109	20% RPD
	TOX	varies	ug/L	80-120	20% RPD
	Oil & Grease	varies	mg/L	75-125	20% RPD
	Phenolics	varies	mg/L	78-122	20% RPD
	Hex. Chromium	varies	mg/L	75-125	20% RPD
	Residual Chlorine	varies	mg/L	88-112	15% RPD
	Turbidity	varies	NTU	92-108	10% RPD

ENSECO LCS INFORMATION (LABORATORY CONTROL SAMPLE)

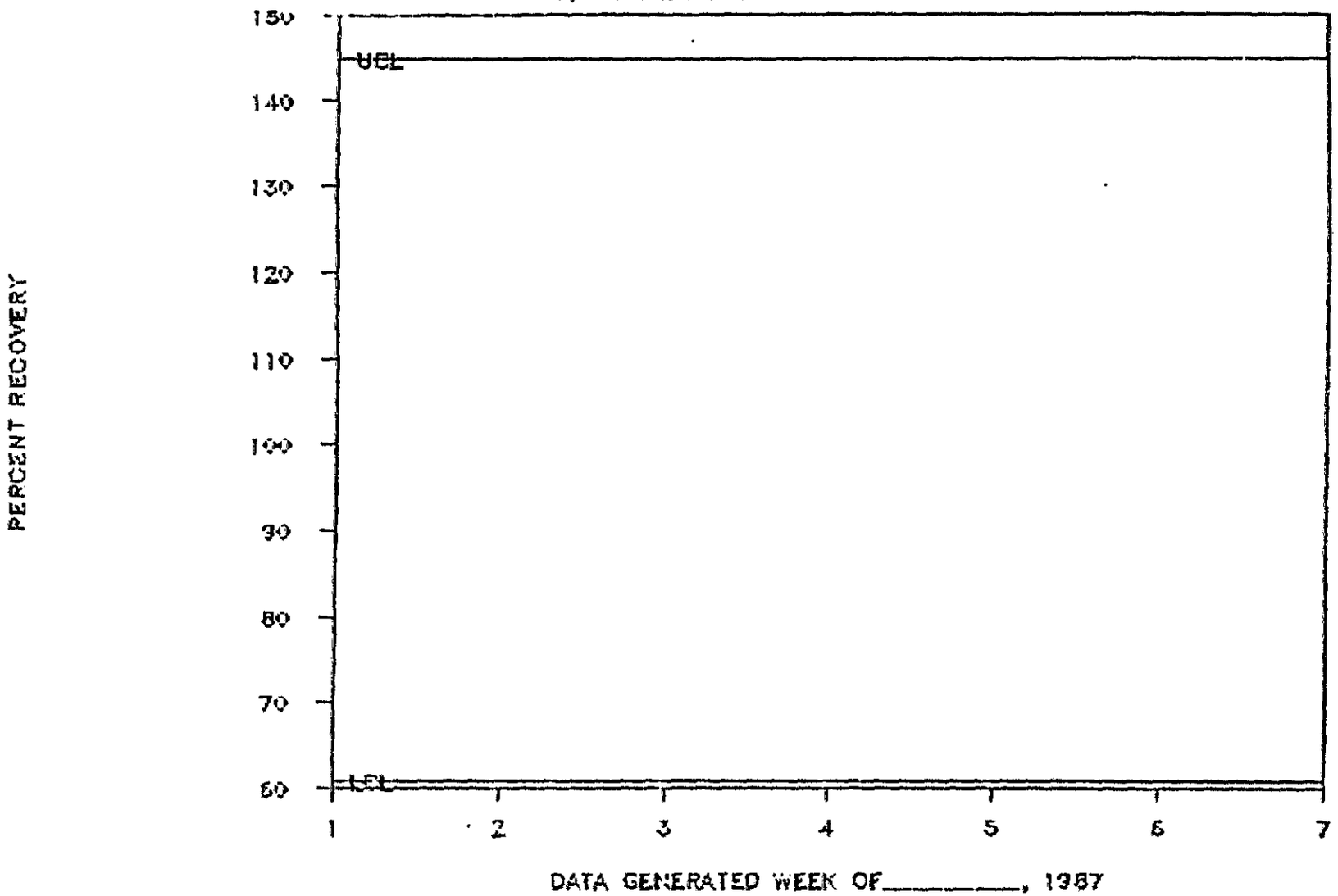
II. INORGANIC ANALYSES
B. Solid samples

METHOD	SPIKE COMPOUND(S)	SPIKE CONC.	UNITS	ACCURACY CONTROL LIMITS	PRECISION CONTROL LIMIT
200.7 ICP METALS	ALUMINUM	2.0	mg/kg	75-125	20% RPD
	ANTIMONY	0.6	mg/kg	75-125	20% RPD
	ARSENIC	1.0	mg/kg	75-125	20% RPD
	BARIUM	2.0	mg/kg	75-125	20% RPD
	BERYLLIUM	0.1	mg/kg	75-125	20% RPD
	CADMIUM	0.1	mg/kg	75-125	20% RPD
	CALCIUM	100	mg/kg	75-125	20% RPD
	CHROMIUM	0.2	mg/kg	75-125	20% RPD
	COBALT	0.5	mg/kg	75-125	20% RPD
	COPPER	0.3	mg/kg	75-125	20% RPD
	IRON	1.0	mg/kg	75-125	20% RPD
	LEAD	5.0	mg/kg	75-125	20% RPD
	MAGNESIUM	50	mg/kg	75-125	20% RPD
	MANGANESE	0.2	mg/kg	75-125	20% RPD
	NICKEL	0.4	mg/kg	75-125	20% RPD
	POTASSIUM	50	mg/kg	75-125	20% RPD
	SELENIUM	1.0	mg/kg	75-125	20% RPD
	SILVER	0.1	mg/kg	75-125	20% RPD
	SODIUM	100	mg/kg	75-125	20% RPD
	THALLIUM	1.0	mg/kg	75-125	20% RPD
	TIN	0.4	mg/kg	75-125	20% RPD
	VANADIUM	0.5	mg/kg	75-125	20% RPD
	ZINC	0.2	mg/kg	75-125	20% RPD
FURNACE METALS 206.2	ARSENIC	20	mg/kg	75-125	20% RPD
239.2	LEAD	20	mg/kg	75-125	20% RPD
270.2	SELENIUM	10	mg/kg	75-125	20% RPD
279.2	THALLIUM	50	mg/kg	75-125	20% RPD
	ANTIMONY	varies	mg/kg	88-112	20% RPD
	TITANIUM	varies	mg/kg	88-112	20% RPD
	CADMIUM	varies	mg/kg	88-112	20% RPD
	SILVER	varies	mg/kg	88-112	20% RPD
MERCURY 245.1	MERCURY	1.0	mg/kg	75-125	20% RPD
CYANIDE 335.2	CYANIDE	0.1	mg/kg	75-125	20% RPD
INORGANIC PARAMETERS	pH	varies	units	99-101	5% RPD
	Specific Conductance	varies	umhos	95-105	5% RPD
	Fluoride	varies	mg/kg	88-112	15% RPD
	Chloride	varies	mg/kg	92-108	10% RPD
	Bromide	varies	mg/kg	95-105	10% RPD
	Nitrogen-Ammonia	varies	mg/kg	93-107	10% RPD
	Nitrogen-Nitrite	varies	mg/kg	94-106	10% RPD
	Nitrogen-Nitrate	varies	mg/kg	91-109	10% RPD
	Nitrogen-TKN	varies	mg/kg	78-122	20% RPD
	Phosphate	varies	mg/kg	85-115	15% RPD
	Sulfate	varies	mg/kg	93-107	15% RPD
	Sulfide(React.,Tot.,Dis.)	varies	mg/kg	80-120	20% RPD
	Alkalinity	varies	mg/kg	90-110	10% RPD
	TOX	varies	mg/kg	80-120	20% RPD
	Oil & Grease	varies	mg/kg	75-125	20% RPD
	Phenolics	varies	mg/kg	78-122	20% RPD
	Hex. Chromium	varies	mg/kg	75-125	20% RPD

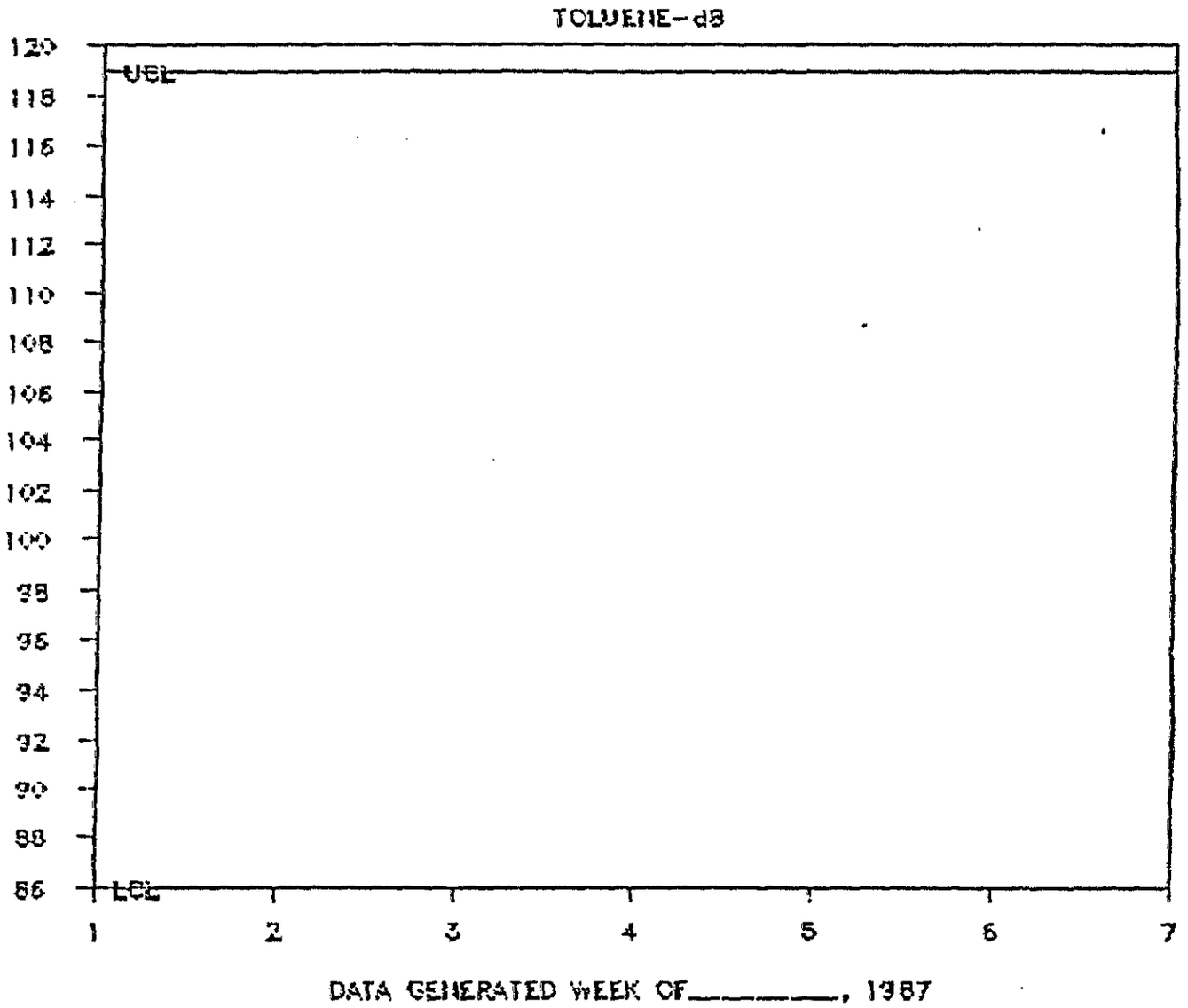

ENSECO LCS VOA PRECISION
1,1-DICHLOROETHENE WATER MATRIX
RELATIVE % DIFFERENCE
60
50
40
30
20
10
0
UCL
1
2
3
4
5
6
7
DATA GENERATED WEEK OF_____, 1987

ENSECO LCS VOA ACCURACY

1,1-DICHLOROETHENE WATER MATRIX

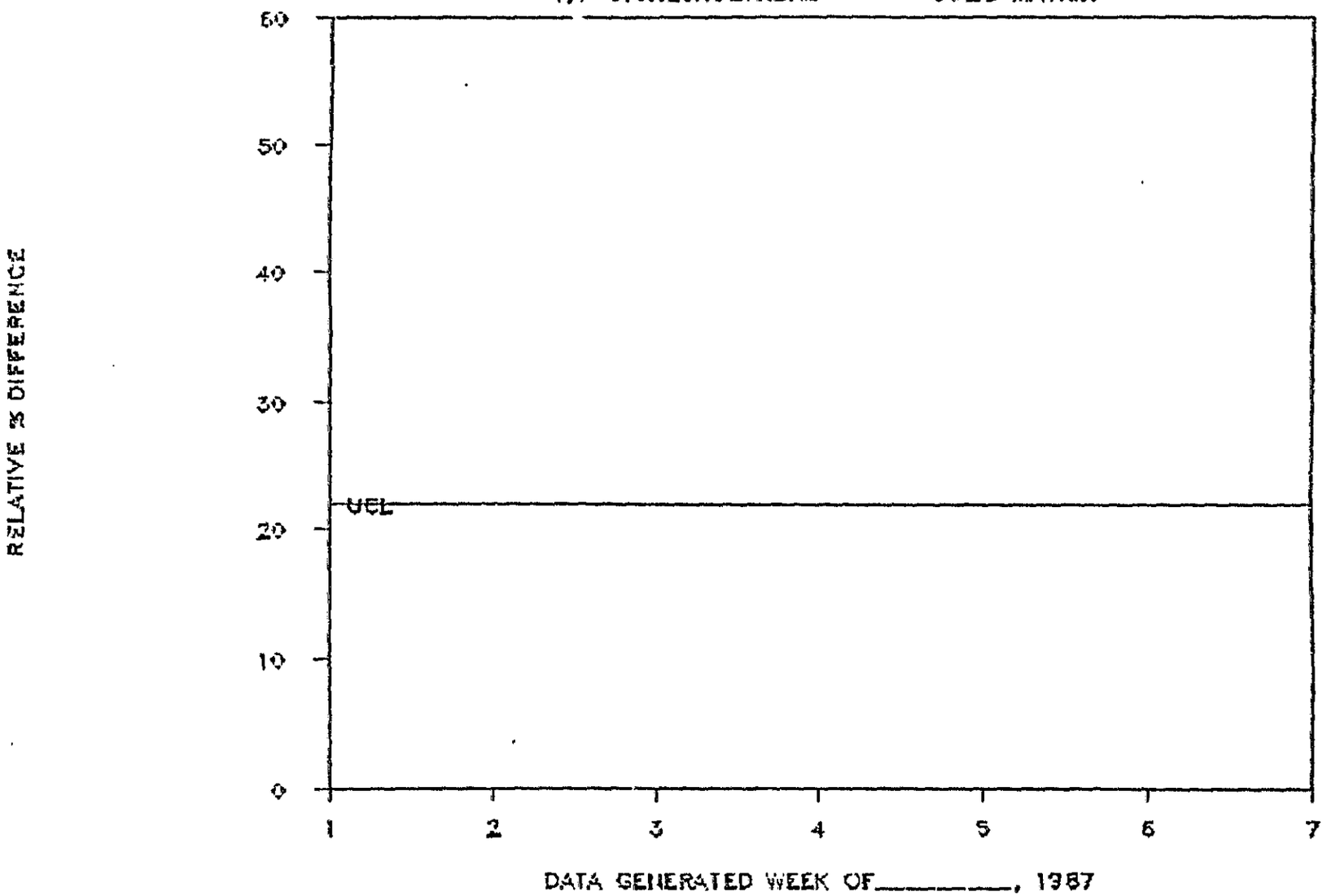


ENSECO SCS VOA WATER MATRIX



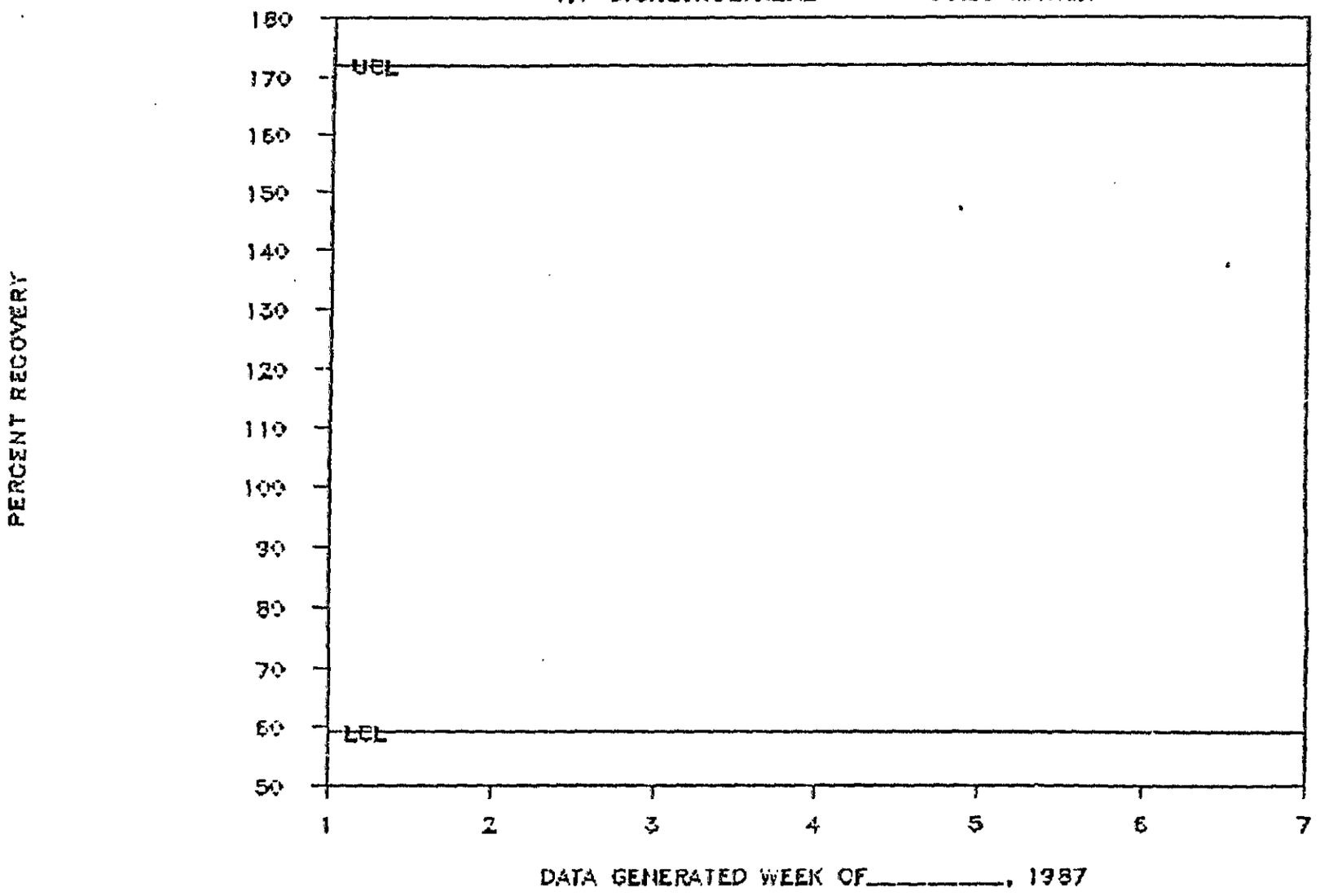
ENSECO LCS VOA PRECISION

1,1-DICHLOROETHENE SOLID MATRIX

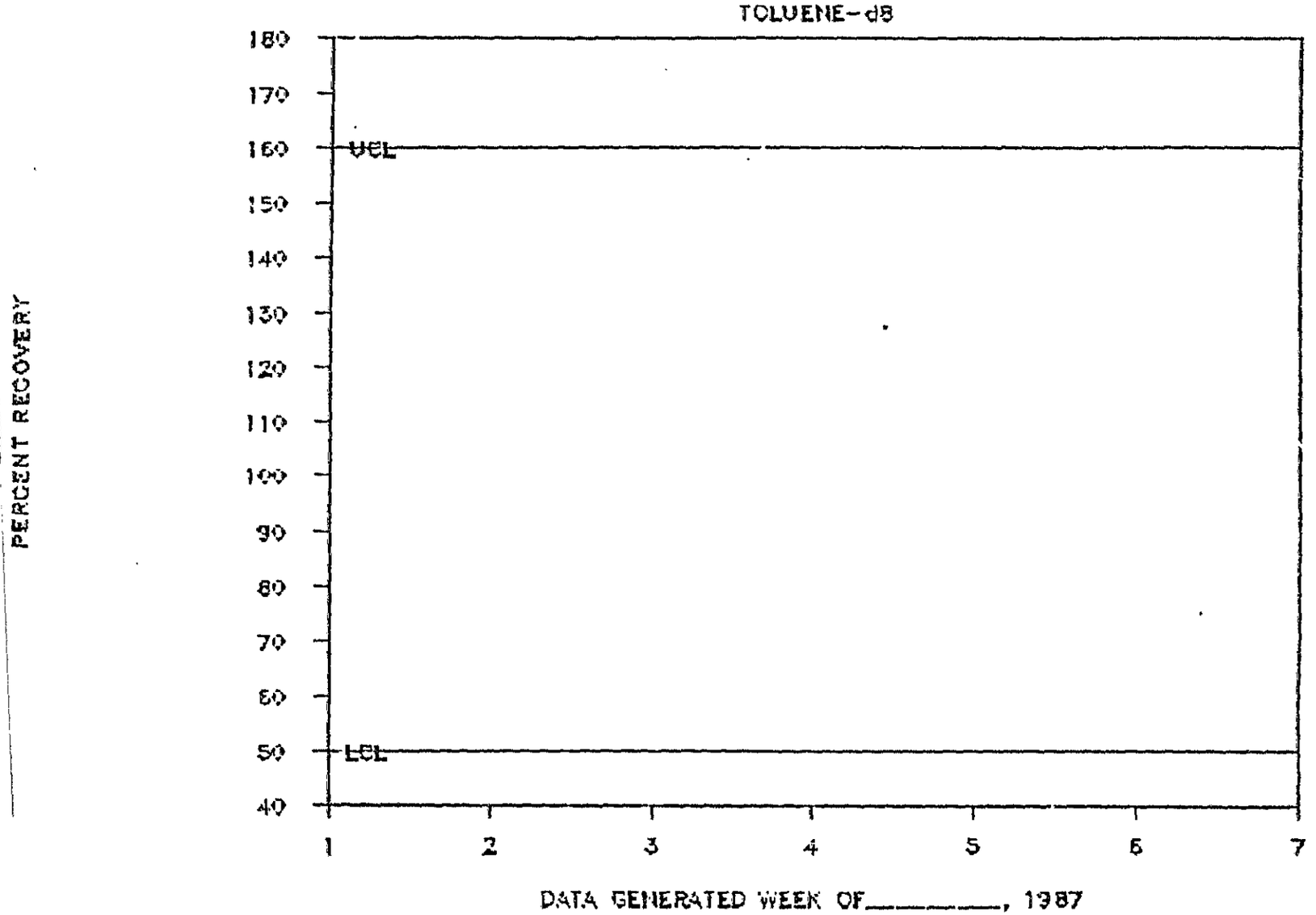


ENSECO LCS VOA ACCURACY

1,1-DICHLOROETHENE SOLID MATRIX



ENSECO SCS VOA SOLID MATRIX



ORGANIC PREP DEPARTMENT QC DOCUMENTATION

This form should be completed with every batch of samples requiring preparatory tests. If samples from several projects are to be prepped at the same time, a form with the appropriate information must be completed for each project and included in the project folder for the analyst and Project Manager to review.

I. GENERAL

PROJECT_____ SAMPLE NOS._____
PREP DATE & TIME_____ ANALYST(S)_____

****

II. ANALYSIS/MATRIX

Circle the appropriate method and matrix.

METHOD	MATRIX			
601: Volatiles by GC	Water	Soil	Sludge	Refinery
602: Volatiles by GC	Water	Soil	Sludge	Refinery
608: OC Pesticides	Water	Soil	Sludge	Refinery
608: PCB's	Water	Soil	Sludge	Refinery
610: PNA's	Water	Soil	Sludge	Refinery
614: OP Pesticides	Water	Soil	Sludge	Refinery
615: Herbicides	Water	Soil	Sludge	Refinery
624: Volatiles by GC/MS	Water	Soil	Sludge	Refinery
625: Semivolatiles	Water	Soil	Sludge	Refinery

****

III. STANDARD SOLUTIONS USED

A. Surrogate standard ID_____
Verification #_____ Prep Date_____ Exp. Date_____

B. Spike solution ID_____
Verification #_____ Prep Date_____ Exp. Date_____

****

IV. QC SAMPLES GENERATED

ENSECO SCS: QC Lot #_____
ENSECO SCS: QC Lot #_____

ENSECO LCS: QC Lot #_____

****

V. COMMENTS/OBSERVATIONS

_____
_____
_____
_____
_____

METHOD 601 — AQUEOUS MATRIX
VOLATILE HALOCARBONS by GC

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/L		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/L			ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery	Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1 LCS 2	Limits	Difference	Limits
	1,1-Dichloroethene	50				61-145		14%
	Trichloroethene	50				71-120		14%
	Chlorobenzene	50				75-130		13%
	1,1-Dichloroethene	50				61-145		14%
	Trichloroethene	50				71-120		14%
	Chlorobenzene	50				75-130		13%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 601 — SOLID
VOLATILE HALOCARBONS by GC — MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

QC Lot	Analyte	Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160
	Bromochloromethane	30			20-160
	2-Bromo-1-chloropropane	30			20-160
	1,4-Dichlorobutane	30			20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Units: ug/g Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	% Recovery LCS 1	% Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
	1,1-Dichloroethene	0.025					61-145		14%
	Trichloroethene	0.025					71-120		14%
	Chlorobenzene	0.025					75-130		13%
	1,1-Dichloroethene	0.025					61-145		14%
	Trichloroethene	0.025					71-120		14%
	Chlorobenzene	0.025					75-130		13%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 602
VOLATILE AROMATICS by GC

AQUEOUS
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

QC Lot	Analyte	Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Units: ug/L Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	ACCURACY % Recovery LCS 1	ACCURACY % Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
_____	Chlorobenzene	50	_____	_____	___	___	75-130	_____	13%
_____	Toluene	50	_____	_____	___	___	76-125	_____	13%
_____	Benzene	50	_____	_____	___	___	76-127	_____	11%
_____	Chlorobenzene	50	_____	_____	___	___	75-130	_____	13%
_____	Toluene	50	_____	_____	___	___	76-125	_____	13%
_____	Benzene	50	_____	_____	___	___	76-127	_____	11%

NOTE: 90% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 602
VOLATILE AROMATICS by GC

SOLID
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
QC Lot	Analyte				
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160
_____	a,a,a-Trifluorotoluene	30	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/g Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	% Recovery LCS 1	% Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
QC Lot	Analyte(s)								
_____	Chlorobenzene	0.025	_____	_____	___	___	75-130	_____	13%
_____	Toluene	0.025	_____	_____	___	___	76-125	_____	13%
_____	Benzene	0.025	_____	_____	___	___	76-127	_____	11%
_____	Chlorobenzene	0.025	_____	_____	___	___	75-130	_____	13%
_____	Toluene	0.025	_____	_____	___	___	76-125	_____	13%
_____	Benzene	0.025	_____	_____	___	___	76-127	_____	11%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 608 — AQUEOUS MATRIX

ORGANOCHLORINE PESTICIDES by GC

Analyst:_____

Date:_____

Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)

SCS data generated with these samples? ____YES ___NO

QC Lot	Analyte	Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
_____	Dibutylchlorendate	1.0	_____	_____	48-136
_____	Dibutylchlorendate	1.0	_____	_____	48-136
_____	Dibutylchlorendate	1.0	_____	_____	48-136
_____	Dibutylchlorendate	1.0	_____	_____	48-136

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Units: ug/L Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	ACCURACY % Recovery LCS 1	ACCURACY % Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
_____	Lindane	0.2	_____	_____	___	___	56-123	_____	15%
_____	Heptachlor	0.2	_____	_____	___	___	40-131	_____	20%
_____	Aldrin	0.2	_____	_____	___	___	40-120	_____	22%
_____	Dieldrin	0.3	_____	_____	___	___	52-126	_____	18%
_____	Endrin	0.3	_____	_____	___	___	56-121	_____	21%
_____	4,4'-DDT	0.3	_____	_____	___	___	38-127	_____	27%
_____	Lindane	0.027	_____	_____	___	___	56-123	_____	15%
_____	Heptachlor	0.027	_____	_____	___	___	40-131	_____	20%
_____	Aldrin	0.027	_____	_____	___	___	40-120	_____	22%
_____	Dieldrin	0.067	_____	_____	___	___	52-126	_____	18%
_____	Endrin	0.067	_____	_____	___	___	56-121	_____	21%
_____	4,4'-DDT	0.067	_____	_____	___	___	38-127	_____	27%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 608 — SOLID
ORGANOCHLORINE PESTICIDES by GC — MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/g		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	Dibutylchlorendate	0.05	_____	_____	50-160
_____	Dibutylchlorendate	0.05	_____	_____	50-160
_____	Dibutylchlorendate	0.05	_____	_____	50-160
_____	Dibutylchlorendate	0.05	_____	_____	50-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/g			ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery	Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1 / LCS 2	Limits	Difference	Limits
_____	Lindane	0.027	_____	_____	___ ___	46-127	_____	50%
_____	Heptachlor	0.027	_____	_____	___ ___	35-130	_____	31%
_____	Aldrin	0.027	_____	_____	___ ___	34-132	_____	43%
_____	Dieldrin	0.067	_____	_____	___ ___	31-134	_____	38%
_____	Endrin	0.067	_____	_____	___ ___	42-139	_____	45%
_____	4,4'-DDT	0.067	_____	_____	___ ___	23-134	_____	50%
_____	Lindane	0.027	_____	_____	___ ___	46-127	_____	50%
_____	Heptachlor	0.027	_____	_____	___ ___	35-130	_____	31%
_____	Aldrin	0.027	_____	_____	___ ___	34-132	_____	43%
_____	Dieldrin	0.067	_____	_____	___ ___	31-134	_____	38%
_____	Endrin	0.067	_____	_____	___ ___	42-139	_____	45%
_____	4,4'-DDT	0.067	_____	_____	___ ___	23-134	_____	50%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 608
POLYCHLORINATED BIPHENYLS (PCBs) by GC

AQUEOUS MATRIX

Analyst: _____
Date: _____
Instrument ID: _____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/L		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	Dibutylchlorendate	1.0	_____	_____	20-160
_____	Dibutylchlorendate	1.0	_____	_____	20-160
_____	Dibutylchlorendate	1.0	_____	_____	20-160
_____	Dibutylchlorendate	1.0	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/L			ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery	Control	Relative %	Control
QC Lot	Analytes!	Conc.	LCS 1	LCS 2	LCS 1 LCS 2	Limits	Difference	Limits
_____	Aroclor 1254	5.0	_____	_____	___ ___	20-160	_____	20%
_____	Aroclor 1254	5.0	_____	_____	___ ___	20-160	_____	20%
_____	Aroclor 1254	5.0	_____	_____	___ ___	20-160	_____	20%
_____	Aroclor 1254	5.0	_____	_____	___ ___	20-160	_____	20%

NOTE: 30% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 608 — SOLID MATRIX

POLYCHLORINATED BIPHENYLS (PCBs) by GC

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: mg/kg		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	Dibutylchlorendate	0.033	_____	_____	20-160
_____	Dibutylchlorendate	0.033	_____	_____	20-160
_____	Dibutylchlorendate	0.033	_____	_____	20-160
_____	Dibutylchlorendate	0.033	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/kg			ACCURACY			PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Aroclor 1254	1.0	_____	_____	___	___	20-150	_____	20%
_____	Aroclor 1254	1.0	_____	_____	___	___	20-160	_____	20%
_____	Aroclor 1254	1.0	_____	_____	___	___	20-160	_____	20%
_____	Aroclor 1254	1.0	_____	_____	___	___	20-160	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 610 — AQUEOUS MATRIX

POLYNUCLEAR AROMATIC HYDROCARBONS (PNA) by GC

Analyst: _____

Date: _____

Instrument ID: _____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)

SCS data generated with these samples? ____YES ___NO

		Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
QC Lot	Analyte				
	Naphthalene	3000			20-160
	Dibenzo(a,h)anthracene	500			20-160
	Naphthalene	3000			20-160
	Dibenzo(a,h)anthracene	500			20-160
	Naphthalene	3000			20-160
	Dibenzo(a,h)anthracene	500			20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

		Units: ug/L Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	ACCURACY % Recovery LCS 1	ACCURACY % Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
QC Lot	Analyte(s)								
	Naphthalene	3000					20-160		20%
	Phenanthrene	100					20-160		20%
	Pyrene	500					20-160		20%
	Benzo(b)fluoranthene	100					20-160		20%
	Dibenzo(a,h)anthracene	500					20-160		20%
	Naphthalene	3000					20-160		20%
	Phenanthrene	100					20-160		20%
	Pyrene	500					20-160		20%
	Benzo(b)fluoranthene	100					20-160		20%
	Dibenzo(a,h)anthracene	500					20-160		20%

NOTE: 90% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 610 — SOLID MATRIX

POLYNUCLEAR AROMATIC HYDROCARBONS (PNA) by GC

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: mg/kg		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
	Naphthalene	100			20-160
	Dibenzo(a,h)anthracene	16.67			20-160
	Naphthalene	100			20-160
	Dibenzo(a,h)anthracene	16.67			20-160
	Naphthalene	100			20-160
	Dibenzo(a,h)anthracene	16.67			20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/kg	ACCURACY				PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
	Naphthalene	100					20-160		20%
	Phenanthrene	3.33					20-160		20%
	Pyrene	16.67					20-160		20%
	Benzo(b)fluoranthene	3.33					20-160		20%
	Dibenzo(a,h)anthracene	16.67					20-160		20%
	Naphthalene	100					20-160		20%
	Phenanthrene	3.33					20-160		20%
	Pyrene	16.67					20-160		20%
	Benzo(b)fluoranthene	3.33					20-160		20%
	Dibenzo(a,h)anthracene	16.67					20-160		20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 614 — AQUEOUS MATRIX

ORGANOPHOSPHOROUS PESTICIDES by GC

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)

SCS data generated with these samples? ____YES ___NO

QC Lot	Analyte	Units: ug/L Spike Conc.	Meas. Conc.	Percent Recovery	ACCURACY Control Limits
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Spike Conc.	Measured Conc. LCS 1	LCS 2	% Recovery LCS 1	LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	Control Limits
_____	Diazinon	10	_____	_____	____	____	20-160	_____	20%
_____	Malathion	10	_____	_____	____	____	20-160	_____	20%
_____	Methyl Parathion	10	_____	_____	____	____	20-160	_____	20%
_____	Parathion	10	_____	_____	____	____	20-160	_____	20%
_____	Diazinon	10	_____	_____	____	____	20-160	_____	20%
_____	Malathion	10	_____	_____	____	____	20-160	_____	20%
_____	Methyl Parathion	10	_____	_____	____	____	20-160	_____	20%
_____	Parathion	10	_____	_____	____	____	20-160	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 614 — SOLID MATRIX

ORGANOPHOSPHOROUS PESTICIDES by GC

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
QC Lot	Analyte				
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160
_____	DEF	100	_____	_____	20-160

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/L Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	ACCURACY % Recovery LCS 1	ACCURACY % Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
QC Lot	Analyte(s)								
_____	Diazinon	0.33	_____	_____	___	___	20-160	_____	20%
_____	Malathion	0.33	_____	_____	___	___	20-160	_____	20%
_____	Methyl Parathion	0.33	_____	_____	___	___	20-160	_____	20%
_____	Parathion	0.33	_____	_____	___	___	20-160	_____	20%
_____	Diazinon	0.33	_____	_____	___	___	20-160	_____	20%
_____	Malathion	0.33	_____	_____	___	___	20-160	_____	20%
_____	Methyl Parathion	0.33	_____	_____	___	___	20-160	_____	20%
_____	Parathion	0.33	_____	_____	___	___	20-160	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 615 — AQUEOUS MATRIX

PHENOXY ACID HERBICIDES by GC

Analyst:_____

Date:_____

Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO SCS (Surrogate Control Sample)

SCS data generated with these samples? ____YES ___NO

		Units: ug/L		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	2,4-DB	5.0	_____	_____	60-120
_____	2,4-DB	5.0	_____	_____	60-120
_____	2,4-DB	5.0	_____	_____	60-120
_____	2,4-DB	5.0	_____	_____	60-120

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

		Units: ug/L			ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery	Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	2,4-D	1.25	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.25	_____	_____	___	___	30-100	_____	50%
_____	2,4-D	1.25	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.25	_____	_____	___	___	30-100	_____	50%
_____	2,4-D	1.25	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.25	_____	_____	___	___	30-100	_____	50%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 615
PHENOXY ACID HERBICIDES by GC

SOLID
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

		Units: ug/g		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	2,4-DB	0.33	_____	_____	60-120
_____	2,4-DB	0.33	_____	_____	60-120
_____	2,4-DB	0.33	_____	_____	60-120
_____	2,4-DB	0.33	_____	_____	60-120

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/g			ACCURACY			PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	2,4-D	0.083	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.017	_____	_____	___	___	30-100	_____	50%
_____	2,4-D	0.083	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.017	_____	_____	___	___	30-100	_____	50%
_____	2,4-D	0.083	_____	_____	___	___	30-100	_____	50%
_____	Silvex	0.017	_____	_____	___	___	30-100	_____	50%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 624
VOLATILE ORGANICS by GC/MS

AQUEOUS
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ___NO

QC Lot	Analyte	Units: ug/L Spike Conc.	Meas. Conc.	ACCURACY Percent Recovery	ACCURACY Control Limits
_____	D8-Toluene	50	_____	_____	86-119
_____	BFB	50	_____	_____	85-121
_____	D4-1,2-Dichloroethane	50	_____	_____	77-120
_____	D8-Toluene	50	_____	_____	86-119
_____	BFB	50	_____	_____	85-121
_____	D4-1,2-Dichloroethane	50	_____	_____	77-120
_____	D8-Toluene	50	_____	_____	86-119
_____	BFB	50	_____	_____	85-121
_____	D4-1,2-Dichloroethane	50	_____	_____	77-120

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Units: ug/L Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	% Recovery LCS 1	% Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
_____	1,1-Dichloroethene	50	_____	_____	___	___	61-145	_____	14%
_____	Trichloroethene	50	_____	_____	___	___	71-120	_____	14%
_____	Chlorobenzene	50	_____	_____	___	___	75-130	_____	13%
_____	Toluene	50	_____	_____	___	___	76-125	_____	13%
_____	Benzene	50	_____	_____	___	___	76-127	_____	11%
_____	1,1-Dichloroethene	50	_____	_____	___	___	61-145	_____	14%
_____	Trichloroethene	50	_____	_____	___	___	71-120	_____	14%
_____	Chlorobenzene	50	_____	_____	___	___	75-130	_____	13%
_____	Toluene	50	_____	_____	___	___	76-125	_____	13%
_____	Benzene	50	_____	_____	___	___	76-127	_____	11%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 624
VOLATILE ORGANICS by GC/MS

SOLID
MATRIX

Analyst:______________
Date:________________
Instrument ID:_________

Sample #	QC Lot #	Sample #	QC Lot #
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________

ENSECO SCS (Surrogate Control Sample)

SCS data generated with these samples? ____YES ___NO

		Units: ug/g		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_______	D8-Toluene	0.05	________	________	50-160
_______	BFB	0.05	________	________	50-160
_______	D4-1,2-Dichloroethane	0.05	________	________	50-160
_______	D8-Toluene	0.05	________	________	50-160
_______	BFB	0.05	________	________	50-160
_______	D4-1,2-Dichloroethane	0.05	________	________	50-160
_______	D8-Toluene	0.05	________	________	50-160
_______	BFB	0.05	________	________	50-160
_______	D4-1,2-Dichloroethane	0.05	________	________	50-160

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

		Units: ug/g		ACCURACY			PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
______	1,1-Dichloroethene	0.05	______	______	____	____	59-172	______	22%
______	Trichloroethene	0.05	______	______	____	____	62-137	______	24%
______	Chlorobenzene	0.05	______	______	____	____	60-133	______	21%
______	Toluene	0.05	______	______	____	____	59-139	______	21%
______	Benzene	0.05	______	______	____	____	66-142	______	21%
______	1,1-Dichloroethene	0.05	______	______	____	____	59-172	______	22%
______	Trichloroethene	0.05	______	______	____	____	62-137	______	24%
______	Chlorobenzene	0.05	______	______	____	____	60-133	______	21%
______	Toluene	0.05	______	______	____	____	59-139	______	21%
______	Benzene	0.05	______	______	____	____	66-142	______	21%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

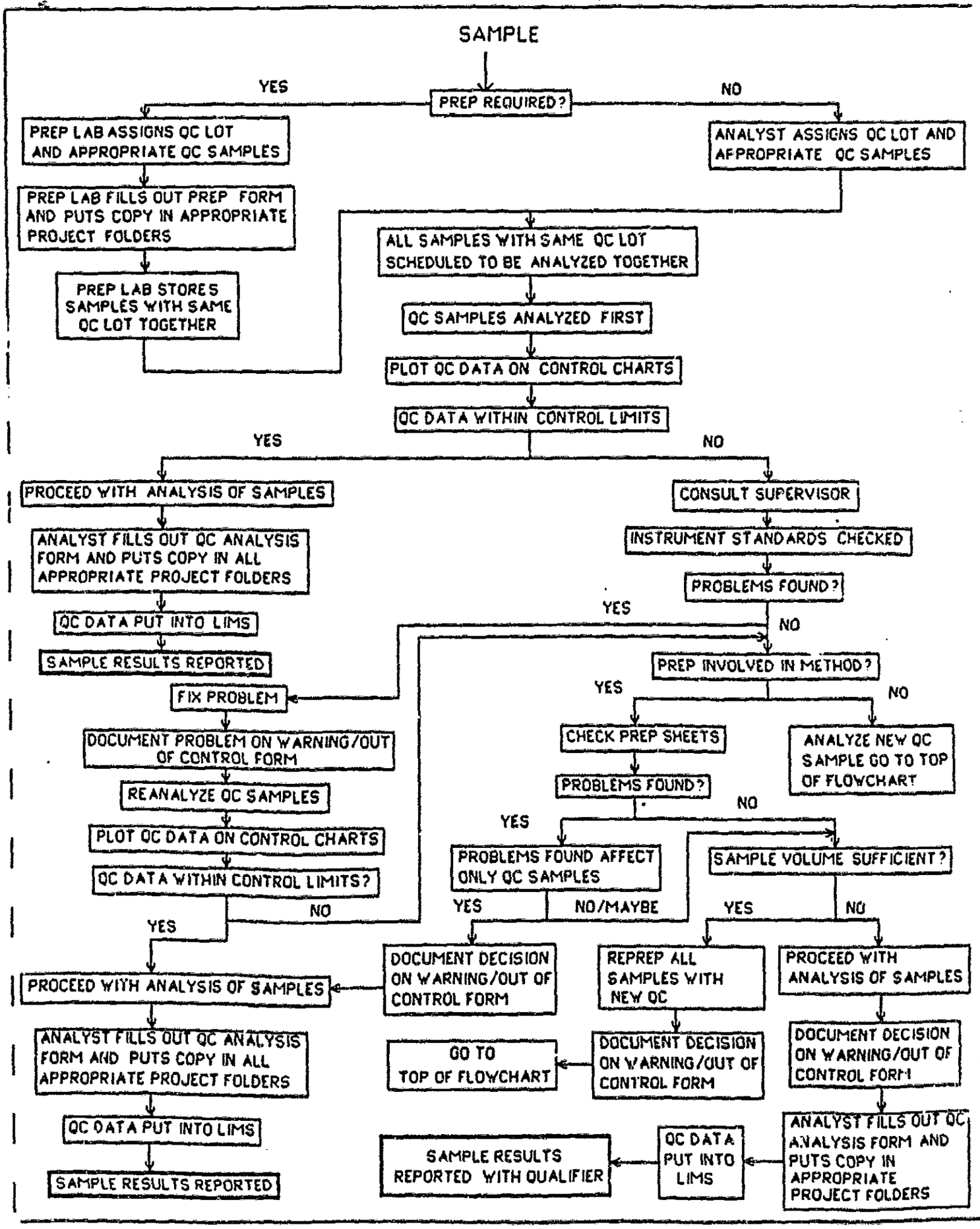
(9) Contract Laboratory Program (CLP):
Agency: USEPA
Lab ID: N/A...All contracts registered under RMAL
Effective Date: RMAL has been involved since inception in 1980
Expiration: Certification is obtained on a contract basis and expires with that contract. Each contract requires a pre-award evaluation.
Permit for: RAS work for Organic Inorganic parameters and Dioxin. We also have performed SAS work on occassion. All environmental samples
Analyses: Work under CLP guidelines consists of:
All priority pollutants listed under Clean Water Act
HSL compounds:
Volatile Organics.....Purge/Trap--GC/MS
Semivolatile Organics...Extraction--GC/MS
Pesticides and PCB's....Extraction--GC/ECD
Metals (&Cyanide)....ICP/GFAAS
Comments: RMAL is one of only five laboratories that have participated in all three areas. RMAL is frequently consulted regarding changes in methodologies, and is a well respected participant.

(10) CDC Toxicology Blood Lead Proficiency Program
Agency: OSHA-Center for Disease Control (CDC)
Lab ID: 050043
Effective Date: 3rd quarter 1986
Expiration Date: This program is being deleted in 1987
Permit for: Analysis of Blood Lead Content
Analysis: Lead in Blood (GFAAS)
Comments: The most recent list of approved laboratories (March 3, 1986) is titled the September 1985 List and covers Quarters 1,2 & 3 for 1985) this list expired March 7. In order to be an approved laboratory, a minimum of 8 out of 9 PE samples in 3 consecutive quarters must fall within acceptance limits. RMAL scored 2 of 3 correct for Quarter 4, 1985, as well as 3 of 3 for Quarters 1 & 2, 1986. This qualifies RMAL for certification, and the next list will reflect this. The CDC will confirm certification status by phone in the interim. This program will end with the first quarter, 1987.

(3) State of UTAH:
Agency: Utah Department of Health
Lab ID: Certificate No. E-83 Class I
Effective Date: June 27, 1986
Expiration Date: renewal annually pending successful completion of WS, WP and/or Utah Dept. of Health PE samples.
Permit for: Analysis of Environmental samples
Analyses:
Trace metals
Minerals
Nutrients
Demand
Organic: Herbicides, Pesticides, PCB's, TOX, Priority Pollutants, Trihalomethanes, Volatile Organics
Miscellaneous: EP-Toxicity, Solids, Sulfides, Phenols, Turbidity, Corrosivity, Res. Chlorine
Comments: Letter and certificate on file in QA office.

(4) State of NEW YORK
Agency: Department of Health
Lab ID: 10809
Effective Date: September 23, 1986
Expiration Date: 12:01 AM April 1, 1987
Permit for: Approval for Potable and Non-Potable analyses
Comments: Ned Smith, Program Administrator, informed me that this certification must be recognized by all agencies in New York. A six page list of parameters included in this certification is on file in the QA office. This certification is INTERIM pending successful analysis of PE samples twice annually. An audit was conducted Februray 3-4, 1987.

(5) State of NEW YORK
Agency: Department of Environmental Conservation
Lab ID:
Effective Date:
Expiration Date:
Permit for:
Comments: IN PROGRESS. PE sample results (RMAL # 61942) submitted 9/23/86. Certification granted by this agency is NOT recognized by the State Dept. of Health, and is only valid for contracts awarded by this agency. Laboratory audit is scheduled for January 21, 1987. Performance evaluation samples were satisfactorily analyzed. On January 22, 1987, representatives of this agency were at RMAL to discuss the possibility of extending ERCO's current contract to have RMAL absorb the overflow work. This arrangement most likely will begin March, 1987.


SAMPLE
PREP REQUIRED?
YES
NO
PREP LAB ASSIGNS QC LOT AND APPROPRIATE QC SAMPLES
ANALYST ASSIGNS QC LOT AND APPROPRIATE QC SAMPLES
PREP LAB FILLS OUT PREP FORM AND PUTS COPY IN APPROPRIATE PROJECT FOLDERS
PREP LAB STORES SAMPLES WITH SAME QC LOT TOGETHER
ALL SAMPLES WITH SAME QC LOT SCHEDULED TO BE ANALYZED TOGETHER
QC SAMPLES ANALYZED FIRST
PLOT QC DATA ON CONTROL CHARTS
QC DATA WITHIN CONTROL LIMITS
YES
NO
PROCEED WITH ANALYSIS OF SAMPLES
CONSULT SUPERVISOR
ANALYST FILLS OUT QC ANALYSIS FORM AND PUTS COPY IN ALL APPROPRIATE PROJECT FOLDERS
INSTRUMENT STANDARDS CHECKED
QC DATA PUT INTO LIMS
PROBLEMS FOUND?
SAMPLE RESULTS REPORTED
YES
NO
FIX PROBLEM
PREP INVOLVED IN METHOD?
DOCUMENT PROBLEM ON WARNING/OUT OF CONTROL FORM
YES
NO
CHECK PREP SHEETS
ANALYZE NEW QC SAMPLE GO TO TOP OF FLOWCHART
REANALYZE QC SAMPLES
PROBLEMS FOUND?
PLOT QC DATA ON CONTROL CHARTS
NO
YES
QC DATA WITHIN CONTROL LIMITS?
PROBLEMS FOUND AFFECT ONLY QC SAMPLES
SAMPLE VOLUME SUFFICIENT?
NO
YES
YES
NO/MAYBE
YES
NO
DOCUMENT DECISION ON WARNING/OUT OF CONTROL FORM
REPREP ALL SAMPLES WITH NEW QC
PROCEED WITH ANALYSIS OF SAMPLES
PROCEED WITH ANALYSIS OF SAMPLES
DOCUMENT DECISION ON WARNING/OUT OF CONTROL FORM
ANALYST FILLS OUT QC ANALYSIS FORM AND PUTS COPY IN ALL APPROPRIATE PROJECT FOLDERS
GO TO TOP OF FLOWCHART
DOCUMENT DECISION ON WARNING/OUT OF CONTROL FORM
DOCUMENT DECISION ON WARNING/OUT OF CONTROL FORM
QC DATA PUT INTO LIMS
SAMPLE RESULTS REPORTED WITH QUALIFIER
QC DATA PUT INTO LIMS
ANALYST FILLS OUT QC ANALYSIS FORM AND PUTS COPY IN APPROPRIATE PROJECT FOLDERS
SAMPLE RESULTS REPORTED

APPENDIX

RMAL CERTIFICATION

ROCKY MOUNTAIN ANALYTICAL
a Division of ENSECO INC.

NATIONAL CERTIFICATION STATUS

(1) State of COLORADO:
Agency: Colorado Department of Health
Lab ID: C0026
Effective Date: August 10, 1984
Expiration Date: renewal in January, 1987
Permit for: Monitoring Drinking Water samples (SDWA)
Analyses:
Nitrate
Fluoride
Trace Metals (As,Ba,Cd,Cr,Pb,Hg,NO3,Ag,Na)
Chlorinated hydrocarbons (Endrin, Lindane, Methoxychlor, Toxaphene)
Chlorophenoxys (2,4-D; 2,4,5-TP (Silvex))
Total Trihalomethanes (Bromodichloromethane, Dibromochloromethane, Bromoform, Chloroform)
Comments: Letter on file in QA office

(2) State of FLORIDA:
Agency: Department of Health and Rehabilitative Services
Lab ID: 87278
Effective Date: July 1, 1986
Expiration Date: renewal June 30, 1987
Permit for: Monitoring Drinking Water samples (SDWA)
Analyses:
Primary Inorganic: Fluoride
Trace Metals as in (1) above
Secondary Inorganic Parameters
Organic: Chlorinated hydrocarbons as in (1) above
Chlorophenoxy acids as in (1) above
Trihalomethanes: As in (1) above
Volatile Organic Compounds
Purgeables
Pesticides
Base Neutral/Acid Extractables

Comments: Letter, certificate on file in QA office

(6) State of NEW JERSEY:
Agency: Department of Environmental Protection
Lab ID: 45556
Effective Date:
Expiration Date:
Permit for: Perform Water Pollution Analyses
Comments: IN PPOGRESS. We are currently certified for EPA-CLP work ONLY. Performance evaluation samples (RMAL nos. 62071, 62104) currently in house were satisfactorily analyzed. Full certification pending receipt of method validation work for methds 601,602,608,612,624,625 and an unannounced lab baudit between now and Jan. 31, 1987. Method validation work for 601,602,608,624, and 625 complete. Awaiting results for 612.

(7) US Army Corps of Engineers:
Agency: US Army Corps of Engineers
Lab ID:
Effective date: [will be processed based on RMAL performance on 61647 PE, and a lab audit]
Expiration Date: [unknown at present]
Permit for: Analysis of water and soil samples
Analyses:
RCRA Metals (Sb,As,Ba,Be,Cd,Pb,Hg,Ni,Se,Ag,Tl)
Organochlorine Pesticides, Method 608 (Aldrin, BHC, Chlordane, DDD, DDE, DDT, Dieldrin, Endosulfans, Endrin, Heptachlor, Heptachlor epoxide, Toxaphene
PCBs
Volatiles, Method 624
Base/Neutral/Acids, Method 625
Comments: PE samples completed and results submitted 7/21 and 8/1. Richard Karn from the Corps of Engineers informed RMAL on 8/20/86 that all results for the performance samples [RMAL project 61647] were within acceptance criteria.

(8) US Army Toxic and Hazardous Materials Agency (USATHAMA)
Agency: USATHAMA, Aberdeen Proving Ground, MD
Lab ID: N/A
Effective Date: June 1986 (retroactive to July 1985)
Expiration Date: N/A
Permit for: Extraction and analysis of Soil samples
Analyses:
Semivolatile Organics in soils/sediments
Volatile Organics in soils/sediments
Metals in soil by ICP
Arsenic in soil by Graphite Furnace AAS
Mercury in soil by Cold Vapor AAS
DBCP in soil by GC/ECD
Fluoride in soils by ISE

Comments: USATHAMA certification is only applicable to USATHAMA projects. Once obtained, certification can be used in conjunction with any project identified by the project commander.

(11) NPDES: Discharge Monitoring & Reporting QA (DMRQA)
Agency: USEPA
Lab ID: Anaconda Minerals (CO0029793)
Effective Date:
Expiration Date: Annual re-evalutaion
Permit for: Analysis of water samples for NPDES Inorganics
Analyses:
Metals: Sb,As,Be,Cd,Cr,Cu,Pb,Hg,Ni,Se,Ag,Tl,Zn (Total)
Cyanides
Phenols
Conventional Pollutants: Br,Res. Cl,Color,Coliforms,
F,NO3,Org. N,O&G,TP,SO4,S=,SO3,MBAS,Al,Ba,B,Co,Fe,
Mg.Mo,Mn,Sn,Ti (Total)
Comments: The results for DMR QA studies 004, 005, and 006 are on file in the QA office. We analyze PE samples annually and use the multiple permit option to report the results to several clients. An audit was performed by the Region VIII EPA and Frontier Oil on Dec. 9 and 15, 1986. Several minor compliance problems were discovered. These problems have since been corrected.

(12) State of Oklahoma
Agency: Water Resources Board
Lab ID: 8614
Effective Date: January 1, 1987 (PENDING)
Expiration Date: June 30, 1987
Permit for: Analysis of environmental samples
Comments: A complete list of certified parameters is avilable in the QA office as well as a certificate from the state, and a complete report on performance evaluation results.

(13) State of Oregon
Agency: Department of Health
Lab ID:
Effective Date:
Expiration Date:
Permit for:
Comments: IN PROGRESS. I have contacted this office, and was told that repiprocal certification may be granted if Colorado's regulatory criteria are as stringent as those in Oregon. Acceptable performance on all parameters within the USEPA Water Supply Series (WS) and Water Pollution Series (WP) is required at least once annually. An application was filed in October 1986. A follow-up telephone call in January of 1987 was made to inquire about the status. The Agency Director informed me that the issue of allowing out-of-state laboratories had been passed to the Attorney General for a ruling. An off the record opinion was offered that such certifications would only be given to contiguous states

(14) State of California
Agency: Department of Health Services
Lab ID:
Effective Date:
Expiration Date:
Permit for: Hazardous Waste Testing Certification
Comments: Tony Wong has been negotiating for all ENSECO labs to be certified by this agency. He is only awaiting their acceptance of his proposal that all labs will meet CAL's QA windows for accuracy and precision.

(15) Permit to Move Quarantined Soil
Agency: US Department of Agriculture
Permit No.: S-2899
Lab ID:
Effective Date: November 15, 1985
Expiration Date: November 30, 1990
Permit for: To receive shipments of soil samples from foreign countries for laboratory analysis. Applicable quarantines are: (80) Witchweed, (81) Imported Fire Ant, and (85) Golden Nematode
Comments: Soil samples received under this permit must be enclosed in polyethylene containers, and be less than 1 lb. in weight. All samples must be kept under locked chain of custody while in possession, and must be disposed of by incineration at a hazardous waste facility.

METHOD 625
SEMIVOLATILE ORGANICS by GC/MS

AQUEOUS
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ____NO

		Units: ug/L		!----ACCURACY----!
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	D5-Phenol	200	_____	_____	15-103
_____	2-Fluorophenol	200	_____	_____	23-121
_____	2,4,6-Tribromophenol	200	_____	_____	10-130
_____	D5-Nitrobenzene	100	_____	_____	41-120
_____	2-Fluorobiphenyl	100	_____	_____	44-119
_____	D14-Terphenyl	100	_____	_____	33-128
_____	D6-Phenol	200	_____	_____	15-103
_____	2-Fluorophenol	200	_____	_____	23-121
_____	2,4,6-Tribromophenol	200	_____	_____	10-130
_____	D5-Nitrobenzene	100	_____	_____	41-120
_____	2-Fluorobiphenyl	100	_____	_____	44-119
_____	D14-Terphenyl	100	_____	_____	33-128

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/L			!----ACCURACY----!		
		Spike	Measured Conc.		% Recovery		Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits
_____	Pentachlorophenol	100	_____	_____	___	___	9-103
_____	Phenol	100	_____	_____	___	___	12-89
_____	2-Chlorophenol	100	_____	_____	___	___	27-123
_____	4-Chloro-3-cresol	100	_____	_____	___	___	23-97
_____	4-Nitrophenol	100	_____	_____	___	___	10-80
_____	1,2,4-Trichlorobenzene	50	_____	_____	___	___	39-98
_____	Acenaphthene	50	_____	_____	___	___	46-118
_____	2,4-Dinitrotoluene	50	_____	_____	___	___	24-96
_____	Pyrene	50	_____	_____	___	___	26-127
_____	N-nitrosodi-n-propylamine	50	_____	_____	___	___	41-116
_____	1,4-Dichlorobenzene	50	_____	_____	___	___	36-97

NOTE: 90% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 625 SOLID
SEMIVOLATILE ORGANICS by GC/MS MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO SCS (Surrogate Control Sample)
SCS data generated with these samples? ____YES ____NO

		Units: ug/L		ACCURACY	
QC Lot	Analyte	Spike Conc.	Meas. Conc.	Percent Recovery	Control Limits
_____	D6-Phenol	200	_____	_____	20-140
_____	2-Fluorophenol	200	_____	_____	20-140
_____	2,4,6-Tribromophenol	200	_____	_____	10-140
_____	D5-Nitrobenzene	100	_____	_____	20-140
_____	2-Fluorobiphenyl	100	_____	_____	20-140
_____	D14-Terphenyl	100	_____	_____	20-150
_____	D6-Phenol	200	_____	_____	20-140
_____	2-Fluorophenol	200	_____	_____	20-140
_____	2,4,6-Tribromophenol	200	_____	_____	10-140
_____	D5-Nitrobenzene	100	_____	_____	20-140
_____	2-Fluorobiphenyl	100	_____	_____	20-140
_____	D14-Terphenyl	100	_____	_____	20-150

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/kg	Measured Conc.		ACCURACY % Recovery		ACCURACY	PRECISION	
QC Lot	Analyte(s)	Spike Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Control Limits	Relative % Difference	Control Limits
_____	Pentachlorophenol	3.33	_____	_____	___	___	17-109	_____	47%
_____	Phenol	3.33	_____	_____	___	___	26-90	_____	35%
_____	2-Chlorophenol	3.33	_____	_____	___	___	25-102	_____	50%
_____	4-Chloro-3-cresol	3.33	_____	_____	___	___	26-103	_____	33%
_____	4-Nitrophenol	3.33	_____	_____	___	___	11-114	_____	50%
_____	1,2,4-Trichlorobenzene	1.67	_____	_____	___	___	38-107	_____	23%
_____	Acenaphthene	1.67	_____	_____	___	___	31-137	_____	19%
_____	2,4-Dinitrotoluene	1.67	_____	_____	___	___	28-89	_____	47%
_____	Pyrene	1.67	_____	_____	___	___	35-142	_____	36%
_____	N-nitrosodi-n-propylamine	1.67	_____	_____	___	___	41-126	_____	38%
_____	1,4-Dichlorobenzene	1.67	_____	_____	___	___	28-104	_____	27%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

INORGANIC & METALS PREP QC DOCUMENTATION

This form should be completed with every batch of samples requiring preparatory tests. If samples from several projects are to be prepped at the same time, a form with the appropriate information must be completed for each project and included in the project folder for the analyst and Project Manager to review.

I. GENERAL

PROJECT_____ SAMPLE NOS._____
PREP DATE & TIME_____ PREP ANALYST(S)_____

****

II. ANALYSIS/MATRIX

List the appropriate method and matrix. (EX. Sulfide, Soils)

METHOD (ANALYSIS)	MATRIX

****

III. STANDARD SOLUTIONS USED

A. Spike solution ID_____
Verification #_____ Prep Date_____ Exp. Date_____

****

IV. QC SAMPLES GENERATED

Method Blank: Lab ID_____
ENSECO LCS: QC Lot #_____
Matrix Spike(s): Lab ID _____
Matrix Duplicates: Lab ID _____
Controls: Lab ID_____

****

V. COMMENTS

_____
_____
_____
_____
_____
_____

METHOD 200.7

METALS by ICP EMISSION SPECTROSCOPY

AQUEOUS MATRIX

Analyst:_____

Date:_____

Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO LCS (Laboratory Control Sample)

		<<<<< Units: ug/L >>>>>						
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Al (Aluminum)	2.0	_____	_____	_____	_____	85-115	_____	20%
_____	Sb (Antimony)	0.6	_____	_____	_____	_____	85-115	_____	20%
_____	As (Arsenic)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Ba (Barium)	2.0	_____	_____	_____	_____	85-115	_____	20%
_____	Be (Beryllium)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Cd (Cadmium)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Ca (Calcium)	100	_____	_____	_____	_____	85-115	_____	20%
_____	Cr (Chromium)	0.2	_____	_____	_____	_____	85-115	_____	20%
_____	Co (Cobalt)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Cu (Copper)	0.25	_____	_____	_____	_____	85-115	_____	20%
_____	Fe (Iron)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Pb (Lead)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Mg (Magnesium)	50	_____	_____	_____	_____	85-115	_____	20%
_____	Mn (Manganese)	0.2	_____	_____	_____	_____	85-115	_____	20%
_____	Ni (Nickel)	0.4	_____	_____	_____	_____	85-115	_____	20%
_____	K (Potassium)	50	_____	_____	_____	_____	85-115	_____	20%
_____	Se (Selenium)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Ag (Silver)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Na (Sodium)	100	_____	_____	_____	_____	85-115	_____	20%
_____	Tl (Thallium)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Sn (Tin)	0.4	_____	_____	_____	_____	85-115	_____	20%
_____	V (Vanadium)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Zn (Zinc)	0.2	_____	_____	_____	_____	85-115	_____	20%

METHOD 200.7
METALS by ICP EMISSION SPECTROSCOPY

SOLID
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO LCS (Laboratory Control Sample)

		<<<<< Units: ug/Lg >>>>>						
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Al (Aluminum)	2.0	_____	_____	_____	_____	85-115	_____	20%
_____	Sb (Antimony)	0.6	_____	_____	_____	_____	85-115	_____	20%
_____	As (Arsenic)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Ba (Barium)	2.0	_____	_____	_____	_____	85-115	_____	20%
_____	Be (Beryllium)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Cd (Cadmium)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Ca (Calcium)	100	_____	_____	_____	_____	85-115	_____	20%
_____	Cr (Chromium)	0.2	_____	_____	_____	_____	85-115	_____	20%
_____	Co (Cobalt)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Cu (Copper)	0.25	_____	_____	_____	_____	85-115	_____	20%
_____	Fe (Iron)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Pb (Lead)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Mg (Magnesium)	50	_____	_____	_____	_____	85-115	_____	20%
_____	Mn (Manganese)	0.2	_____	_____	_____	_____	85-115	_____	20%
_____	Ni (Nickel)	0.4	_____	_____	_____	_____	85-115	_____	20%
_____	K (Potassium)	50	_____	_____	_____	_____	85-115	_____	20%
_____	Se (Selenium)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Ag (Silver)	0.05	_____	_____	_____	_____	85-115	_____	20%
_____	Na (Sodium)	100	_____	_____	_____	_____	85-115	_____	20%
_____	Tl (Thallium)	1.0	_____	_____	_____	_____	85-115	_____	20%
_____	Sn (Tin)	0.4	_____	_____	_____	_____	85-115	_____	20%
_____	V (Vanadium)	0.5	_____	_____	_____	_____	85-115	_____	20%
_____	Zn (Zinc)	0.2	_____	_____	_____	_____	85-115	_____	20%

NOTE: 80% OF THE ANALYTES MUST FALL WITHIN CONTROL LIMITS

AQUEOUS MATRIX

METALS by GRAPHITE FURNACE ATOMIC ABSORPTION

Analyte: ____ARSENIC __ _LEAD ____SELENIUM ____THALLIUM
Analyst:______________
Date:________________
Instrument ID:_________

Sample #	QC Lot #	Sample #	QC Lot #
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

Units: ug/L

QC Lot	Analyte(s)	Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	ACCURACY % Recovery LCS 1	ACCURACY % Recovery LCS 2	ACCURACY Control Limits	PRECISION Relative % Difference	PRECISION Control Limits
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

SOLID MATRIX

METALS by GRAPHITE FURNACE ATOMIC ABSORPTION

Analyte: ____ARSENIC ____LEAD ____SELENIUM ____THALLIUM

Analyst:______________

Date:_________________

Instrument ID:_________

Sample #	QC Lot #	Sample #	QC Lot #
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

QC Lot	Analyte(s)	Spike Conc.	Units: ug/g Measured Conc. LCS 1	LCS 2	ACCURACY % Recovery LCS 1	LCS 2	Control Limits	PRECISION Relative % Difference	Control Limits
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%
_____	Arsenic	20	_____	_____	___	___	75-125	_____	20%
_____	Lead	20	_____	_____	___	___	75-125	_____	20%
_____	Selenium	10	_____	_____	___	___	75-125	_____	20%
_____	Thallium	50	_____	_____	___	___	75-125	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 245.1
MERCURY by COLD VAPOR ATOMIC ABSORPTION

AQUEOUS MATRIX

Analyst: _____
Date: _____
Instrument ID: _____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES ___NO

		Units: ug/L				ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 245.5
MERCURY by COLD VAPOR ATOMIC ABSORPTION

SOLID
MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES __NO

		Units: ug/g				ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%
_____	Mercury	1.00	_____	_____	___	___	75-125	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 335.2

TOTAL CYANIDE by COLORIMETRIC; SPECTROPHOTOMETRY

AQUEOUS MATRIX

Analyst:_____

Date:_____

Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO LCS (Laboratory Control Sample)

LCS data generated with these samples? ___YES __NO

		Units: ug/L				ACCURACY		PRECISION	
		Spike	Measured Conc.		% Recovery		Control	Relative %	Control
QC Lot	Analyte(s)	Conc.	LCS 1	LCS 2	LCS 1	LCS 2	Limits	Difference	Limits
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%

NOTE: 80% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS

METHOD 335.2 SOLID
TOTAL CYANIDE by COLORIMETRIC; SPECTROPHOTOMETRY MATRIX

Analyst:_____
Date:_____
Instrument ID:_____

Sample #	QC Lot #	Sample #	QC Lot #
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ENSECO LCS (Laboratory Control Sample)
LCS data generated with these samples? ___YES ___NO

Units: ug/L | ACCURACY | PRECISION

QC Lot	Analyte(s)	Spike Conc.	Measured Conc. LCS 1	Measured Conc. LCS 2	% Recovery LCS 1	% Recovery LCS 2	Control Limits	Relative % Difference	Control Limits
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%
_____	Cyanide	100	_____	_____	___	___	75-125	_____	20%

NOTE: 90% OF THE SPIKE ANALYTES MUST FALL WITHIN CONTROL LIMITS