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JACI CORP.

ENVIRONMENTAL
CONSULTANTS
AND
ENGINEERS

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SAMPLING PLAN FOR UNDERGROUND WASTE OIL STORAGE TANK WEST OF BUILDING C14 REVISION A

Prepared for:

Naval Weapons Station Earle

Prepared by:

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Sampling and Analysis Plan
for
Underground Waste Oil Storage Tank
West of Building C14

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1.0 INTRODUCTION

On May 23, 1989 a 2000 gallon underground waste oil storage tank located west of building C14 at Naval Weapons Station Earle at Colts Neck New Jersey was removed. Two observers from the NJ DEP were in attendance. The soil beneath the tank was sampled at four locations. The samples were analyzed; the analyses were subsequently rejected by the NJ DEP on the grounds that the analytical laboratory had not followed the prescribed Tier I protocols.

1.1 Sampling Objective

The objective of this sampling plan is to resample the soil that was beneath the tank prior to its removal to determine if the soil has been contaminated due to a tank leak. The sampling and analysis will be carried out in strict accordance with NJ DEP Tier I protocols.

2.0 RCRA FACILITY INFORMATION

Naval Weapons Station Earle is located in Colts Neck, Monmouth County, New Jersey. Hazardous waste treatment storage and disposal is carried out under RCRA ID No. NJ 0170022172. The facility point of contact is Mr. William Matthaey, Environmental Engineer. Telephone (201) 577-2146.

3.0 SITE HISTORY

Construction at Naval Weapons Station Earle began in 1943. The Station consists of two separate parcels uncompassing a total of 10,870

acres. The tank which was removed was installed in 1964 and was used continuously since that time for storage of waste lubricating oil. Since the tank was 24 years old when removed it is possible it may have leaked and contaminated the soil.

4.0 SAMPLING AND ANALYTICAL PLAN

4.1 Site Map

A detailed site map of the Building C14 area is included as Figure 1. Figure 2 is a map showing the area immediately west of Building C14 and shows the planned sample locations and the location where the tank was.

4.2 Sampling Schedule

This sampling program will be initiated on approval of this plan by the NJ DEP. The Bureau of Hazardous Waste Engineering (BHWE) will be notified at least fourteen (14) days prior to the initiation of closure sampling activities so that a BHWE representative may be present.

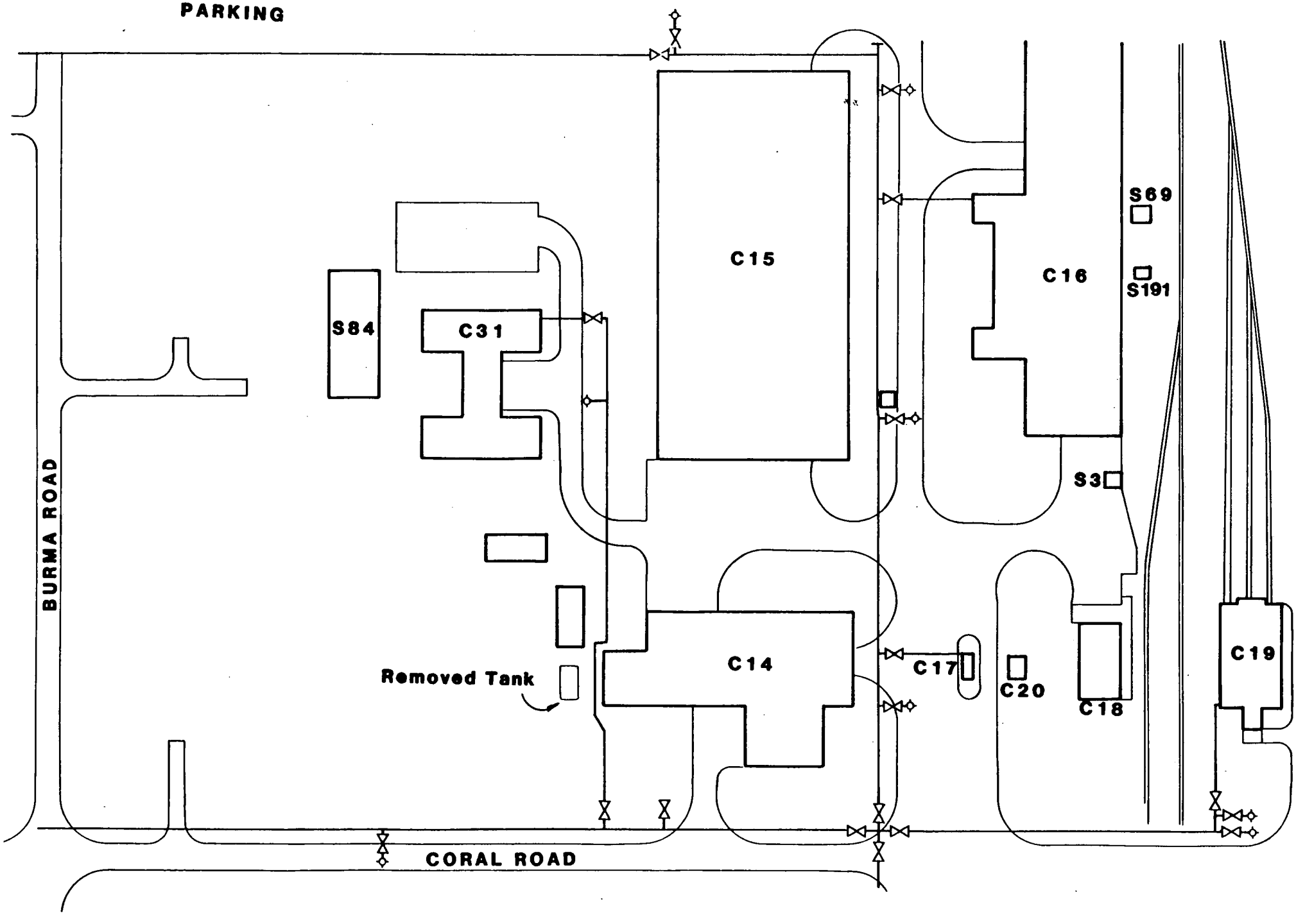
4.3 Sampling Locations, Frequency and Analytical Parameters

Sample locations are shown in Figure 2. A cross sectional view of the location formerly occupied by the tank is shown on Figure 3. Samples will be taken by split spoon at the following depths: 9'2" below the surface for Sample CN1, 11'7" for sample CN2, 10'5" for samples CN3, and 8'7" for sample CN4. This will place the sampling locations 12 inches below where the bottom of the tank was located.

Because previous sampling detected a high concentration of PHC, sample CN2 will also be taken using an Auger at 13'7" and 16'7" below the surface which is 3' and 6' below where the bottom of the tank was located.

Site Map Building C14 Area

FIGURE 1



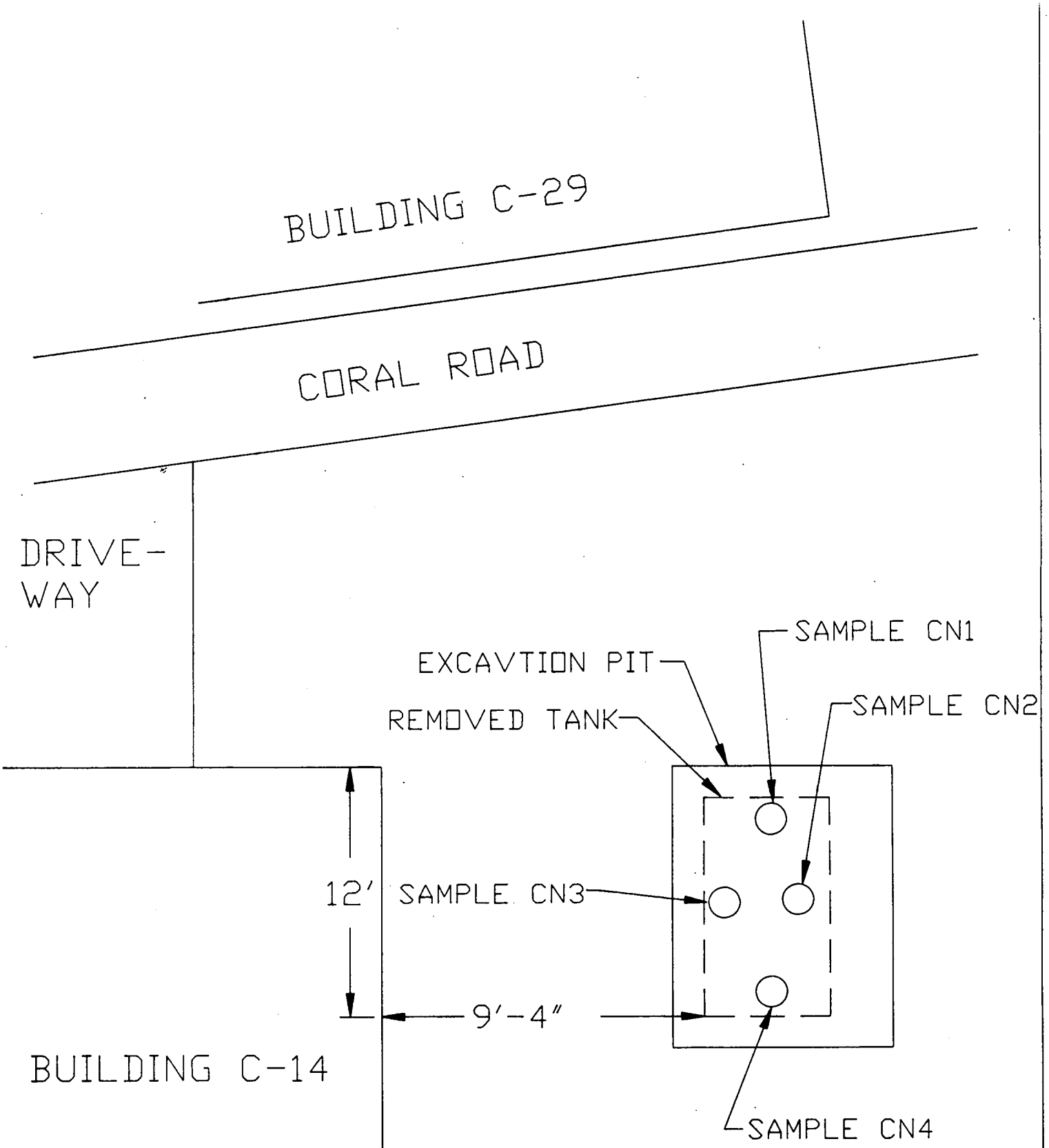
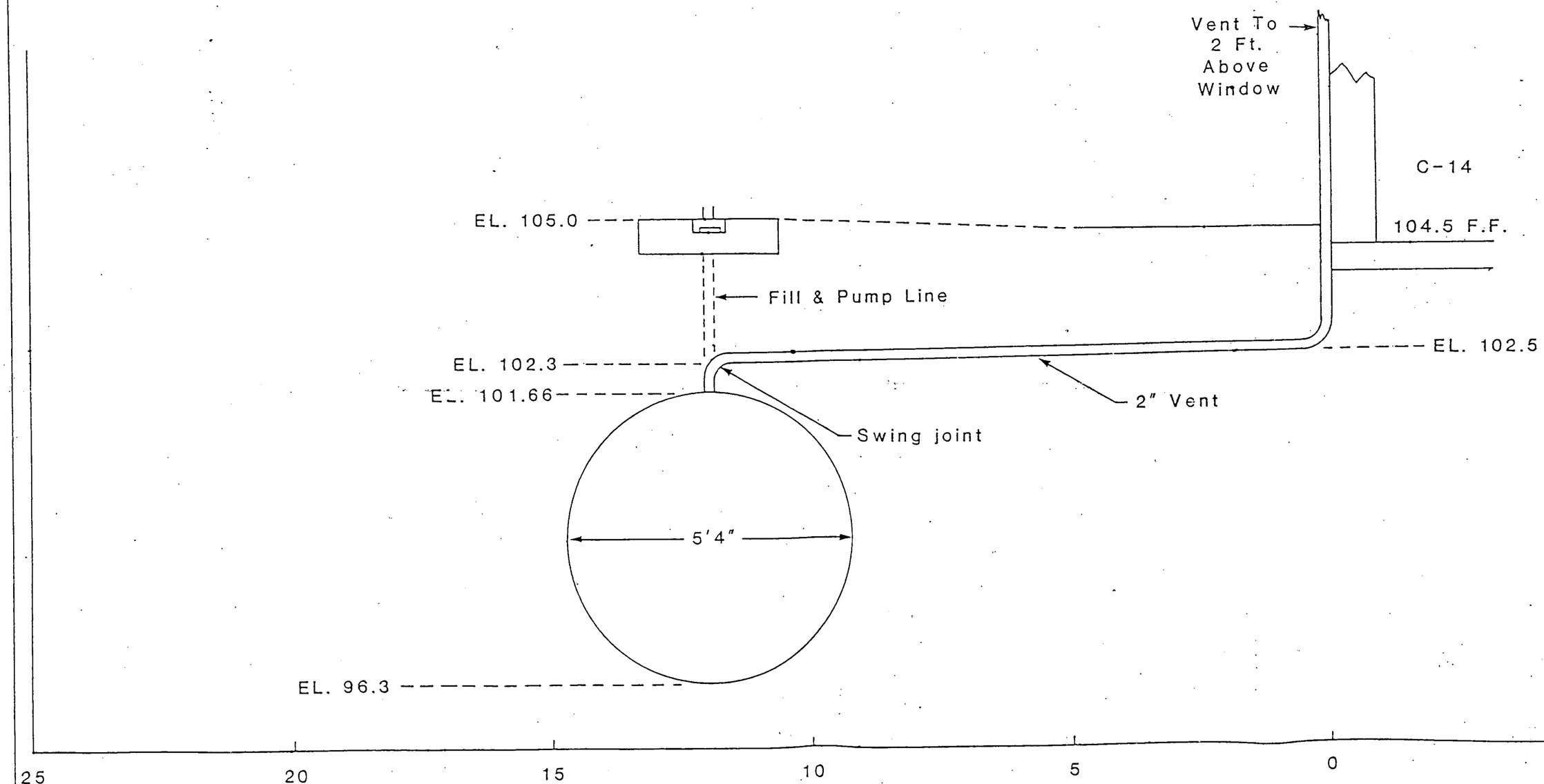


FIGURE 2

SOIL SAMPLE LOCATION
NOT TO SCALE



Cross-Section at CL of Tank West of C-14

FIGURE 3

JACA CORP. Environmental Consultants & Engineers, Ft. Washington, PA 19034	For Naval Weapons Station Earle Sampling Plan		
	Title Cross Section of CL of Tank West of C-14		Rev.
	Date	Drawn by:	
	Scale 1" to 2'	Checked by:	
	Drawing No.	Sheet of	

All samples will be analyzed for the same analytes. Table 1 lists the analytes, the matrix, the analytical method to be used, the sample container, the preservation method and the holding time.

The analytical program has been chosen to insure that soil contamination from a tank leak will be detected.

Should the soil sampling and analysis show significant contamination, a program to further evaluate the site and clean up any contamination will be developed and presented to NJDEP.

4.4 Data Results

Data results will be reported according to the Regulatory Deliverable format (Appendix 1) that is to be utilized for analysis conducted by SW-946 3rd. Edition.

The Submittal of Inorganics data will include all raw data and the QA/QC data required for the method. Information reported by the laboratory for Total Petroleum Hydrocarbons analysis will include: calibration data, method blank results, sample results, date of analysis, and IR spectra for calibration standards, all blanks, all samples.

To ensure that the proper level of extraction and analysis is conducted, the laboratory will screen all samples prior to analysis. The screening results will be maintained by the laboratory until the analytical results are approved by the NJDEP.

Table 1

SAMPLE ANALYSIS, METHOD AND PRESERVATION

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Volatile organics*	See Pages 8, 9, and 10				
Semi-volatile organics*	See Pages 10-17				
Total petroleum hydrocarbons	Soil	E.P.A. Method 418.1 modified for soils	500 cc soil jar with tef-lon lined lid	Ice	7 days
Chromium	Soil	SW846 3rd Ed. Method 6010	500 cc soil jar with tef-lon lined lid	Ice	6 months
Lead	Soil	SW846 3rd Ed. Method 7241	500 cc soil jar with tef-lon lined lid	Ice	6 months
Nickel	Soil	SW846 3rd Ed. Method 6010	500 cc soil jar with tef-lon lined lid	Ice	6 months
Vanadium	Soil	SW846 3rd Ed. Method 6010	500 cc soil jar with tef-lon lined lid	Ice	6 months
Zinc	Soil	SW846 3rd Ed. Method 6010	500 cc soil jar with tef-lon lined lid	Ice	6 months

*Parameters for analyusis will be taken from the Target Compound List (TCL) plus thirty.

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Volatile Organics					
Chloromethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Bromomethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Vinyl Chloride	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Chloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Methylene Chloride	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Acetone	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Carbon Disulfide	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,1-Dichloroethene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,1-Dichloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,2-Dichloroethene (total)	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Chloroform	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,2-Dichloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
2-Butanone	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,1,1-Trichloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Carbon Tetrachloride	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Vinyl Acetate	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Bromodichloromethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,2-Dichloropropane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
cis-1,3-Dichloropropane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Trichloroethene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Dibromochloromethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
1,1,2-Trichloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Benzene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
trans-1,3-Dichloropropene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Bromoform	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
4-Methyl-2-pentanone	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
2-Hexanone	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Tetrachloroethene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Toluene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
1,1,2,2-Tetrachloroethane	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Chlorobenzene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Ethyl Benzene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Styrene	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Xylenes (Total)	Soil	SW846 3rd Ed. Method 8240	200 cc soil VO	Ice	14 days
Semi-Volatile Organics					
Phenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
bis(2-Chloroethyl) ether	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Chlorophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
1,3-Dichlorobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
1,4-Dichlorobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Benzyl alcohol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
1,2-Dichlorobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Methylphenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
bis(2-Chloroisopropyl) ether	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Methylphenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
N-Nitroso-di-n-dipropylamine	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Hexachloroethane	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Nitrobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Isophorone	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Nitrophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4-Dimethylphenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzoic acid	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
bis(2-Chloroethoxy)methane	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4-Dichlorophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
1,2,4-Trichlorobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Naphthalene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Chloroaniline	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Hexachlorobutadiene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Chloro-3-Methylphenol (para-chloro-meta-cresol)	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Methylnaphthalene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Hexachlorocyclopentadiene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4,6-Trichlorophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4,5-Trichlorophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Chloronaphthalene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2-Nitroaniline	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Dimethylphthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Acenaphthylene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,6-Dinitrotoluene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
3-Nitroaniline	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Acenaphthene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4-Dinitrophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Nitrophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Dibenzofuran	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
2,4-Dinitrotoluene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Diethylphthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Chlorophenyl-phenyl ether	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Fluorene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Nitroaniline	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4,6-Dinitro-2-methylphenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
N-nitrosodiphenylamine	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
4-Bromophenyl-phenylether	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Hexachlorobenzene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Pentachlorophenol	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Phenanthrene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Anthracene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Di-n-butylphthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Fluoroanthene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Pyrene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Butylbenzylphthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
3,3'-Dichlorobenzidine	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzo(a)anthracene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

Target Compounds for
Volatile and Semi-Volatile Organics

Table 1
(Continued)

Analysis	Matrix	Method	Bottle	Preser-vation	Holding Time
Chrysene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
bis(2-Ethylhexyl)phthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Di-n-octylphthalate	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzo(b)fluoranthene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzo(k)fluoranetne	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzo(a)pyrene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Indeno(1,2,3-cd)pyrene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Dibenz(a,h)anthracene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction
Benzo(g,h,i)perylene	Soil	SW846 3rd Ed. Method 8270	Jar with teflon-lined lid	Ice	7 days until extraction 40 days from extraction

4.5 Sampling Methodology

The goal of the program is to obtain representative samples, free from contamination introduced by sampling equipment or other samples. The sampling program is taken from the guidance in Chapter 9, Volume 2, 3rd edition SW 846. Samples will be taken by trained personnel. Disposable gloves will be worn during sampling and will be changed between samples.

4.5.1 Soil Sampling

The samples will be obtained using a carbon steel split spoon sampling rig or auger. All required sample containers will be cleaned and prepared by the analytical laboratory. The split spoon sampling rig and Auger will be steam cleaned before use on site. Augers will be steam cleaned between each boring. Sampling procedures will be as follows:

a. Layout plastic apron and arrange equipment, bottles and logging information.

b. Inspect sample containers and chain-of-custody forms and check consistency with sample location number.

c. Set up solutions and equipment to decontaminate split spoon on separate plastic apron.

d. Decontaminate split spoon according to section 4.5.2.

e. Samples will be obtained with the split spoon at a depth of 1 foot below the point where the bottom of the tank was located. An Auger will be used for sample CN2 at a depth of 3 feet and 6 feet below the bottom of tank --See Figure 3.

f. The spoon will be opened on a clean plastic apron and the various sample containers filled. The vials for volatile organics will be filled first. Probes or tools necessary to break up the sample and/or remove it from the spoon will be decontaminated carbon steel.

g. After placing the sample into the bottle, any soil particles will be cleaned off the lip, and the lid screwed on tightly.

h. The chain-of-custody form will be filled out for each sample.

i. The split spoon will be decontaminated according to section 4.5.2.

4.5.2 Decontamination Procedures

Where possible, sampling equipment will be laboratory-cleaned and wrapped in autoclaved aluminum foil for transportation to the sampling site. The drill rig and augers will be steam cleaned prior to use on-site. Where not possible and when it is necessary to re-use the equipment, the following decontamination procedure will be used.

a. Wash with an Alconox solution

b. Rinse with tap water

c. Rinse with distilled/deionized water

d. Rinse with 10% nitric acid*

e. Rinse with distilled/deionized water*

f. Rinse with acetone**

*If samples are to be analyzed for metals.
**If samples are to be analyzed for organics.

g. Air dry

h. Final rinse with distilled/dionized water.

i. Containerize all rinse water for proper disposal.

4.5.3 Quality Assurance/Quality Control

1. QC Samples - the use of QC samples will indicate the reliability of the data generated, as well as helping to pinpoint areas where faulty data might have arisen. Where possible, as in field blanks, the samples will be labeled as routine project samples. The QC samples were chosen following the guidance provided in Chapters 1 and 9, volume 2, 3rd edition SW-846. A description of the types of QC samples which will be used follows:

   a. Lab or Method Blanks - a portion of analyte free water taken through the entire preparation and analysis procedure in the laboratory. Analyte free water will also be used as blanks for soil samples.

   b. Field Blanks - will consist of two sets of containers, one full of analyte-free water, the other empty. At the site, the water from one container will be poured through decontaminated sampling equipment into an empty container. These samples will be collected at the rate of one per matrix per day, and will be analyzed for the same parameters as samples collected that day. Analyte-free water will be used as blanks for soil samples.

c. Trip blanks - will consist of containers of analyte free water filled in the laboratory, taken to the field and returned to the laboratory unopened. These will be analyzed for volatiles only, at a rate of one per two day sampling event or per sample shipment, whichever is shorter.

The clock governing holding times for trip blanks begins at the laboratory's verified time of sample receipt, as documented on the laboratory's chain of custody. Holding times for individual parameters are dictated by the analytical methods.

Field and trip blank samples must arrive on-site within one (1) day of their preparation in the laboratory, may be held for no longer than two (2) calendar days, and must arrive back in the lab within one (1) day of shipment from the field (four (4) days total). Blanks and all samples must be maintained at 4°C while on-site and during shipment.

d. One duplicate sample will be taken.

2. <u>Laboratory QA/QC</u>

a. The samples will be analyzed by QC Inc., an independent testing laboratory. QC's address and phone number are:

1205 Industrial Highway
P.O. Box 514
Southampton, PA 18966

(215) 355-3900

QC is certified by the State of New Jersey (certificate number 77166).

QC's quality assurance manual is included in this plan as Appendix A.

b. Only EPA approved methods will be used as shown in Table 1.

c. Chain-of-custody procedures outlined in Chapter 9, Volume 2 of SW846 will be in place and followed to ensure that the samples obtained in the field will be monitored as they are transported to the laboratory, stored in the laboratory, transported from storage to individual analysis areas and back to storage.

d. Data results will either be reported according to the latest version of US EPA CLP-Tier I format or according to the deliverables format requirements as specified in the 3rd edition, SW846.

4.5.4 Packaging and Shipment

The samples will be transported to the analytical laboratory in an expeditious manner, avoiding changes in samples caused by excess heat or excess time in transit. The samples will be placed in thermal chests where the temperature will be maintained at 4°C by ice. The thermal chests and their associated chain-of-custody forms will either be driven directly to the laboratory or delivered to the laboratory the next day. Laboratory personnel will acknowledge receipt of the samples the time of their arrival through signature on the chain-of-custody forms. Table 1 lists the sample

containers to be used as well as holding times and conditions for each sample.

4.5.5 Chain-of-Custody Procedures

Procedures outlined in Chapter 9, Volume 2 of SW-846 will be in place and followed to ensure that the samples obtained in the field will be monitored as they are transported to the laboratory, stored in the laboratory, transported from storage to individual analysis areas and back to storage. This will ensure the integrity of the samples. A sample chain of custody form is included as Figure 4.

Collected samples will be under lock and key or under visual control at all times, from the point of collection through transport to the laboratory and throughout their residence in the laboratory.

5.0 HEALTH AND SAFETY PLAN

Contingency Planning

The purpose of this Health and Safety Plan is to protect members of the sampling team during sampling at the east side of the C14 building at Naval Weapons Station Earle at Colts Neck, New Jersey.

This plan describes specific procedures for minimizing hazards, and will be implemented in accordance with all applicable standards and codes - Federal, State and Local. In addition the plan will be revised, if needed, based on additional site information and changes in field conditions and activities.

QC Inc

CHAIN OF CUSTODY RECORD

Customer _____ # _____

Address _____

_____ State _____ Zip _____

PSID # _____

LAB ID#	# OF CONTAINERS	DESCRIPTION OF SAMPLES

PERSON ASSUMING RESPONSIBILITY FOR SAMPLE	TIME	DATE

	SAMPLE NUMBER	RELINQUISHED BY:	RECEIVED BY:	TIME	DATE	REASON FOR CHANGE OF CUSTODY

FIGURE 4

No sampling will be performed in any area where the work cannot be performed safely. Work will be stopped immediately if any unsafe conditions are encountered. Work will not resume until safety has been assured.

Duties of the Sampling team leader include:

1. Supervision of field execution of this Health and Safety Plan.

2. Establishment and maintenance of liaison with station safety personnel.

3. Monitoring to ensure proper decontamination.

4. Indoctrination of employees with respect to safety protocols.

5. Maintenance of records of all field operations.

6. Investigation of accidents and reporting of findings to the station Safety Officer.

7. Issuance of safety instructions.

5.1 Health and Safety Procedures and Elements

This plan describes specific procedures for minimizing hazards. In particular, this plan addresses two major areas:

1. Field safety procedures

2. Emergency response

The plan also addresses training requirements, personnel responsibilities, and site specific precautions. This plan will be implemented

in accordance with all applicable standards and codes - Federal, State and Local as well as Station requirements. In addition, the plan will be revised, if needed, based on additional site information and changes in field conditions and activities.

5.1.1 Major Incident

A major incident is that situation that may require rescue, police, fire or security support from within or outside the station. In the case of a major incident, the sampling team leader will be responsible to notify the proper individuals from the station. THE NOTIFICATION LIST IS SHOWN IN SECTION 1.0 OF THE EMERGENCY SUMMARY IMMEDIATELY FOLLOWING SECTION 5.5.

5.1.2 Minor Incident

A minor incident is that situation that can be handled without direct support of station or other outside services.

5.2 Protective Equipment and Clothing

The sampling team leader will furnish his/her personnel with protective equipment and clothing required to safely conduct the required work.

Level D Protection will be worn by all personnel at the sampling locations unless conditions warrant a higher level of protection.

Level D Protection includes:

Coveralls

Gloves

Boots/shoes, leather or chemical resistant

Disposable boots (optional)

Safety glasses or chemical splash goggles

Hard hat and face shield (optional)

Escape mask (optional)

5.3 Site Air Monitoring

Air monitoring on-site will be performed during sampling. The instrument used to monitor the air will be one of the following organic vapor ionizers: Foxboro OVA Flame ionization detector, or Hnu photoionization detector.

5.4 Communications and Reporting

A daily Safety Log (Figure 5) will be filled out by the sampling team leader at the end of each working day. In the event of personal injury or exposure, an incident report (Figure 6) will be filled out by the team leader. In case of an emergency, the senior team member present will notify the proper station personnel.

5.5 Visitors and Observers

Unauthorized visitors and observers will not be permitted at the sampling sites. Any request shall be routed through the Earle Public Works Department.

5.6 Registration

Each member of the sampling team shall be processed at the Security Office prior to admittance to the station. Identification badges or temporary passes will be issued to all members of the sampling team for the

Figure 5

DAILY SAFETY LOG

Project Name: _____

Date: _____

Location: _____

Staff present: _____

Other personnel present: _____

Area of work: _____

Equipment used: _____

_____

Summary of work performed: _____

_____

Protective clothing worn: _____

Conditions encountered: _____

_____

Safety violations: _____

Accidents/exposure incidents (itemize below; give detailed account of incident on separate form): _____

_____

Emergency Procedures initiated: _____

_____

Instruments Used: _____

Prepared by: _____

Title: _____

Figure 6

INCIDENT REPORT

Project _____ Health & Safety Mgr. _____

Site Location _____ Project Mgr. _____

Incident Summary _____

_____

_____

Date and Time of Incident _____

Exposed Individuals _____

_____

_____

Exposed to _____

_____

Actions Taken:

First Aid Administered

Doctor Examination

Other _____

_____

duration of the sampling project. The sampling team leader will obtain numbered vehicle passes for each vehicle required for the work.

EMERGENCY SUMMARY

ES 1.0 Emergency Contacts

Contact	Station Extension	Commercial (area code 201)
Environmental Coordinator - Mr. William Matthaey	2146	577-2146
Security	2291	577-2291
Dispensary/First Aid	2300	577-2300
Safety	2311	577-2311
Base Fire Department	2260	577-2260
Riverview Medical Center		741-2700

ES 2.0 Emergency Notification Procedure

In case of any emergency, the sampling team leader will notify NWS Earle personnel listed above to coordinate any additional aid required. If medical attention beyond the capability of station first aid is needed, the injured person will be taken to Riverview Medical Center.

ES 3.0 General Site Requirements

In order to comply with NWS Earle Security Standard Operating Procedures, everyone in the sampling team shall comply with the following general regulations:

1. No smoking, matches or sparking devices will be permitted on Earle property.

2. No cameras will be permitted on Earle Property.

3. All personnel will obtain temporary identification badges from station security prior to entering the station.

4. All personnel are prohibited from entering any building on the station unless prior approval has been obtained.

5. Fire extinguishers will be carried in all vehicles at all times when on station property.

6. All sampling personnel are required to comply with the "Safety Requirements for Construction and Contractor Operations", included as Appendix B, as well as any safety directions given by station personnel.

7. Any station vehicle displaying headlights and/or flashing lights shall be yielded to, by pulling to the edge of the road and stopping completely.

Appendix A

QC, Incorporated

Quality Assurance Manual

QC, Incorporated
Quality Assurance Manual

Executive Summary

1. Data reduction
   1.1 All raw data is entered, in pen, in individual laboratory notebooks to include:

   a) Date of analysis at top of page.
   b) Name or type of analysis being performed.
   c) Raw data obtained for all samples tested.
   d) Calculations for each sample. One complete set of calculations must be presented if multiple samples are tested.
   e) Comments, notes or observations made during the testing.

2. Data validation
   2.1 Raw data is entered in bound notebooks, as described above. Data is initialed by the analysts indicating that it has been reviewed to prevent transcription errors. Notebook data is then transcribed onto daily test parameter worksheets and is initialed and presents the data to his/her supervisor for review.
   2.2 Data is reviewed on a regular basis by the QA Director who communicates with the Shift Supervisors and Vice president concerning any discrepancies observed in the data.
   2.3 After management review and final approval, daily sample work sheets are sent to the computer department for data entry. The Vice President reviews the final reports prior to issuance to the client and/or governmental agencies.

3. Quality Control
   3.1 Limited chemistry - standard curves
      3.1.1 One reagent blank and 5 standards will be used to generate a calibration curve.
      3.1.2 Absorbance values are based on the average of 3 readings for each standard.
      3.1.3 All data used in preparing the curve shall be indicated on the hard copy of the curve.
      3.1.4 The calibration curve shall be verified on a daily basis, or whenever analysis is performed.

   3.2 Calibration curve verification - limited chemistry
      3.2.1 Record of verification containing date and results of verification and name of the analyst shall be maintained in chart form.
      3.2.2 EMSL QC check sample is tested for curve verification after curve is prepared. Verification shall be deemed satisfactory if the result is +/- 10% of the theoretical value from the original curve.
      3.2.3 Verification analyses shall be at a 5% frequency rate and shall be deemed satisfactory if the results are +/- 10% of the th oretical value.

3.3 Atomic spectroscopy - standard curves

3.3.1 One reagent blank and 4 standards shall be used to generate a standard curve.

3.3.2 A new calibration curve shall be prepared with <u>every</u> analytical run.

3.4 Calibration curve verification - atomic spectroscopy

3.4.1 Reagent blanks are included in the beginning, middle and at the end of the run to monitor for sample cup contamination.

3.4.2 EMSL are included in <u>every</u> run.

3.4.3 Duplicates are analyzed at a 10% sample frequency.

3.4.4 Spikes are analyzed at a 10% sample frequency for direct aspiration, using the metal of interest.

3.4.5 For GFAA runs, spikes are at 1/2 the value of the highest standard.

3.5 Gas chromatography - standard curves

3.5.1 Reagent blank and 3 calibration levels shall be used to generate a standard curve.

3.5.2 New calibration curve shall be prepared each time a new standard mix is opened, a new GC column is installed or instrumental conditions are changed in any way.

3.5.3 Daily calibration curve verification is made by running one calibration level - +/- 10% of actual values permits data collection.

3.6 Calibration curve verification - gas chromatography

3.6.1 Solvent and method blanks are run at 10% sample frequency.

3.6.2 Standard mixes are run after every 10 samples, together with the solvent and method blanks.

3.6.3 EMSL QC check samples are tested at a 10% sample frequency.

3.6.4 Data is graphed on control charts with control limits set at +/- 2 standard deviations from mean value.

3.7 GC/MS - standard curves

3.7.1 Method blank and five (5) calibration levels shall be used to generate a standard curve.

3.7.2 New 5-point calibration curve shall be prepared whenever calibration check standard produces a non-linear response.

3.7.3 Three level standard curve and blank is run daily. If obtained values are +/- 10% of the actual values in the calibration curve, data collection may begin.

3.7.4 Internal standards are used for both the volatile and BNA methods as an aid to quantitation.

3.8 Calibration curve verification - GC/MS

3.8.1 Solvent and method blanks are run at a 10% sample frequency.

3.8.2 EMSL QC check samples and spikes are t sted at a 5% frequency.

6.8.4 Percent recoveries and standard deviations shall be calculated and limits for acceptable ranges developed and updated after every 5 samples spiked. Control limits ar devel ped equal to +/- 2 standard deviations from mean value.

T.M. Cinnorn

QUALITY ASSURANCE MANUAL

for

QC, Incorporated
1205 Industrial Highway
Southampton, PA 18966

This document contains a series of quality control procedures that have been implemented in the laboratory. The object of the Plan is to provide a summary of the quality control measures that the laboratory can utilize and also provide the means to ensure the these quality control procedures are followed. The Plan shall ensure that every check than can b made will be made so that data produced by QC, Incorporated will be accurate, precise and defensible. This Manual is divided into two parts. Part I outlines the quality control measures for Chemical Analysis. Part II outlines the quality control measures for Microbiological Analysis.

Revision 3
February 1, 1988

President: _____
Allen D. Schopbach

Vice President: _____
Thomas J. Hines

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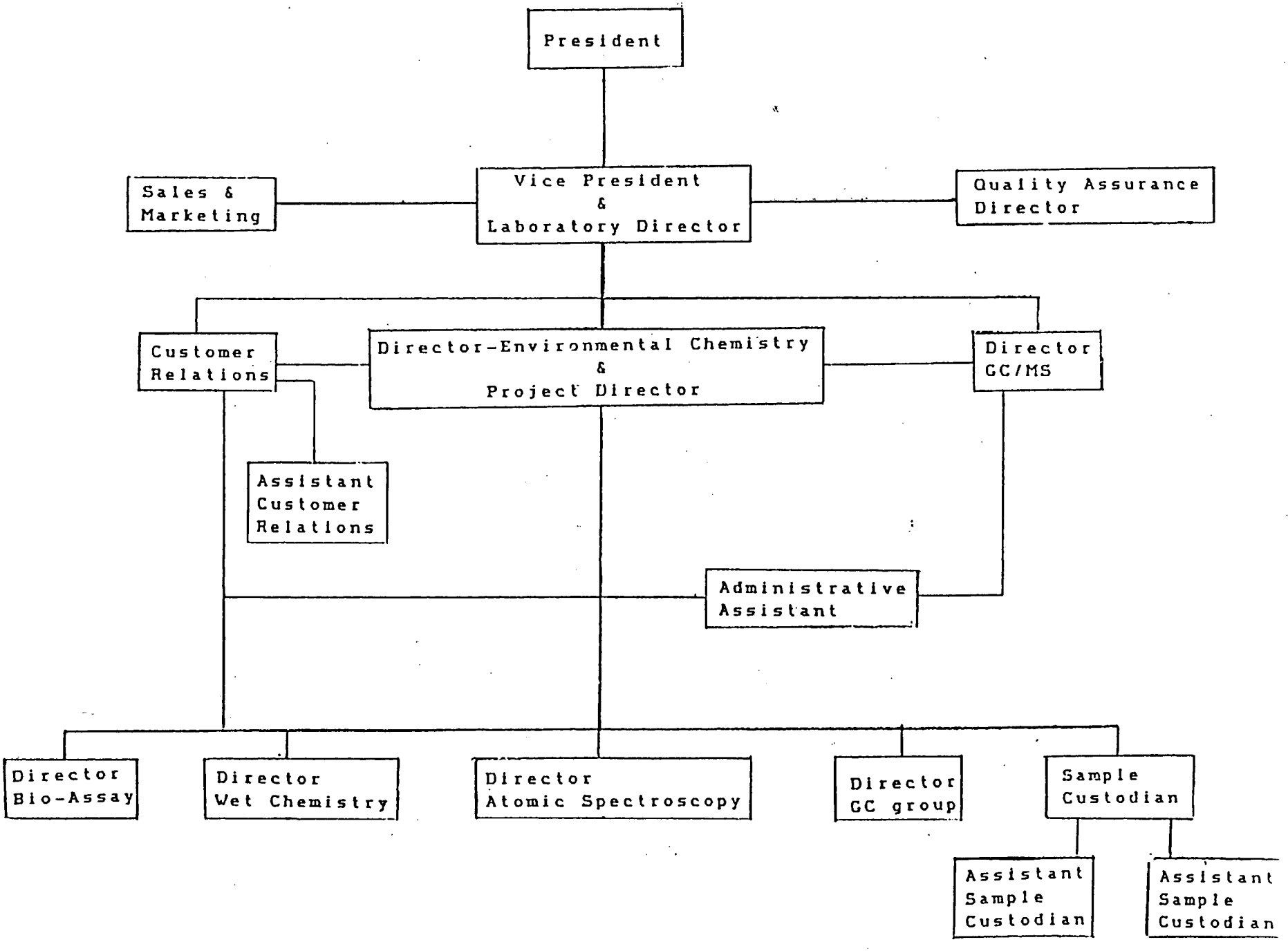
Introduction

QC, Incorporated has the corporate philosophy that there shall be no compr mises made in the level of effort taken to provide analytical data that is of the highest caliber. To ensure that this goal is attained, a Quality Assurance Program has been developed which exceeds all regulatory quality assurance requirements for sampling and analysis. QC, Incorporated follows rigorous data review and evaluati n pr toc ls to assure the correctness of the final data. These procedures may be summarized, as follows:

* Rigorous sample and standard preparation
* Calibration and/or standardization
* Analyses including QA/QC samples
* Analysis calculations
* QA/QC checks, including internal, external, and standard reference material (SRM) spiking procedures
* Calculation and notebook review by shift supervisor and/or Laboratory Director
* Report review by Laboratory Director and/or Quality Assurance Director
* Laboratory Director review
* Corrections made
* Management review - verify internal consistency, and all interpretations and/or conclusions for correctness
* Preparation of final report

The implementation of these procedures both reduces the occurrence of inaccuracies as well as provides the means for identifying and correcting any problems as they occur. This decision making process is illustrated in Section 9 of this manual.

A chart of management structure is illustrated on the following page. It is important to note that the Quality Assurance Director reports directly to the Vice President, thus allowing for a greater degree of independence.


President
Sales & Marketing
Vice President & Laboratory Director
Quality Assurance Director
Customer Relations
Director-Environmental Chemistry & Project Director
Director GC/MS
Assistant Customer Relations
Administrative Assistant
Director Bio-Assay
Director Wet Chemistry
Director Atomic Spectroscopy
Director GC group
Sample Custodian
Assistant Sample Custodian
Assistant Sample Custodian

QC, Incorporated

Quality Assurance Manual

1. Sampling, Sample Handling and Storage

1.1 Sampling - general

1.1.1 All sampling is conducted in accordance with EPA protocols as outlined in the "Manual for the Certification of Laboratories Analyzing Drinking Water" (EPA-570/9-82-002).

1.1.2 When a QC Incorporated field representative collects a sample, he/she initiates a Q.C. sample report (See Appendix A, Figure 1). This report includes the f l-lowing:

a) Date and time of sample collection.
b) Sample source including name, location, and sample type.
c) Preservative used, if applicable.
d) Analyses required.
e) Name or initials of the sample collector.
f) Any pertinent field data (pH, D.O., residual chlorine, etc.)

1.1.4 All QC Incorporated field representatives are thoroughly trained in correct sampling procedures. No field representative is authorized to collect samples until he/she has received training from the Manager of Field Services. All sampling procedures used shall be in accordance with US EPA approved methods. The specific sampling procedures will be dictated by the analyses to be performed. The type of sample container, the required preservation for each organic and inorganic parameter, and maximum holding times are listed in Table I. See also Appendix A, Figure 2 for QC sampling instructions.

1.1.4 Sample bottles will be provided by QC, Incorporated. The bottles are new in order to avoid potential contamination problems. The acids that are used as preservatives are of trace metal grade. All other reagents used as preservatives are either trace or ACS quality.

1.1.5 A waterproof tag, complete with the required information, is securely fastened to the sample container (S e Appendix A, Figure 3). Samples submitted for chemical analysis are cooled to 4 C, by using ice in transit and are refrigerated at 4 C. during storage at the laboratory.

Table I

Sampling and Preservation Recommendations

Test Parameter	Vol. Req'd. (ml)	Container (1)	Preservative (2)	Holding Time (3)
Acidity	100	P,G	Cool, 4 C	14 Days
Alkalinity	100	P,G	Cool, 4 C	14 Days
BOD	1000	P,G	Cool, 4 C	48 Hrs.
Bromide	100	P,G	None req'd.	28 Days
Chloride	50	P,G	None req'd.	28 Days
Chlorine - residual	200	P,G	None req'd.	A I (4)
Chromium (+6)	200	P,G	Cool, 4 C	24 Hrs.
COD	50	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Color	50	P,G	Cool, 4 C	48 Hrs.
Conductance	100	P,G	Cool, 4 C	28 Days
Cyanides	500	P,G	Cool, 4 C; NaOH - pH>12 0.6g ascorbic acid (5)	14 Days
Dissolved oxygen - probe	300	G bottle & top	None req'd.	A I
Dissolved oxygen - Winkler	300	G bottle & top	Fix on site; store in dark	A I
Fluorides	300	P only	None req'd.	28 Days
Hardness	100	P,G	HNO_3 - pH<2;H_2SO_4 - pH<2	6 Mos.
MBAS	250	P,G	Cool, 4 C	48 Hrs.
Mercury - dissolved	100	P,G	Filter on site; HNO_3 - pH<2	28 Days
Mercury - total	100	P,G	HNO_3 - pH<2	28 Days
Metals - dissolved	200	P,G	Filter on site; HNO_3 - pH<2	6 Mos.
Metals - suspended	200	P,G	Filter on site	6 Mos.
Metals - total	100	P,G	HNO_3 - pH<2	6 Mos.
Nitrogen - ammonia	400	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Nitrogen - nitrate	100	P,G	Cool, 4 C	48 Hrs.
Nitrogen - nitrate/nitrite	100	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days

Table I

Sampling and Preservation Recommendations
(continued)

Test Parameter	Vol. Req'd. (ml)	Container (1)	Preservative (2)	Holding Time (3)
Nitrogen - nitrite	50	P,G	Cool, 4 C	48 Hrs.
Nitrogen - Total Kjeldahl	500	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Odor	200	G only	Cool, 4 C	24 Hrs.
Oil & grease	1000	G only	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Organic carbon	25	P,G	Cool, 4 C; H_2SO_4 or HCl pH < 2	28 Days
pH	25	P,G	None req'd.	A I
Phenols	500	G only	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Phosphorus				
O-phosphate, dissolved	50	P,G	Filter on site; cool 4 C	48 Hrs.
Hydrolyzable	50	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Total	50	P,G	Cool, 4 C; H_2SO_4 - pH<2	28 Days
Total, dissolved	50	P,G	Filter on site; cool 4 C H_2SO_4 - pH<2	24 Hrs.
Residue				
Filterable	100	P,G	Cool, 4 C	48 Hrs.
Non-filterable	100	P,G	Cool, 4 C	7 Days
Total	100	P,G	Cool, 4 C	7 Days
Volatile	100	P,G	Cool, 4 C	7 Days
Settleable matter	1000	P,G	Cool, 4 C	48 Hrs.
Silica	50	P only	Cool, 4 C	28 Days
Sulfate	100	P,G	Cool, 4 C	28 Days
Sulfide	500	P,G	Cool, 4 C; 2 ml $Zn(OAc)_2$ + NaOH - pH>9	7 Days
Sulfite	50	P,G	None req'd.	A I
Temperature	1000	P,G	None req'd.	A I
Turbidity	100	P,G	Cool, 4 C	48 Hrs.

Footnotes to Table I:

1. P,G - Plastic or Glass

2. Preservatives are added to sample containers by the lab ratory PRIOR to sampling. Thus, when containers are filled, the preservatives are present at the proper concentrations.

3. Holding times begin when samples are actually taken and iced down in the field. Samples are refrigerated at 4 C at the laboratory during the testing period and until final sample disposal.

4. AI - Analyze immediately - no holding time.

5. The addition of ascorbic acid is required only for samples taken from chlorinated sources.

1.2 Sampling instructions - micr biological

1.2.1 The sample tap must be free of aerators, strainers, hose attachments, and other water purification devices. The water is allowed to flow 3-5 minutes to clear the service line. Samples are then collected in specially prepared, sterilized bottles (120 ml or 4 oz.) and are filled only 3/4 full to allow room for mixing before the sample is tested. The bottles are prepared to contain sodium thiosulfate which reduces any residual chlorine which may be present. A chlorine residual test is conducted at this point and the result recorded on the QC sample report.

1.2.2 If the faucet is constructed of plastic or contains plastic parts, then the field representative shall not use the flame treatment. All sampling is conducted in an aseptic manner. If there is any doubt as to sample integrity, the field representative is obligated to discard the sample and resample. At this point, a sample report and sample tag are completed to contain all relevant data. The tag is then attached to the sample container which is iced and transported to the laboratory for analysis.

1.2.3 If a client conducts his or her own sampling, a copy of "Directions for Taking a Water Sample" (Appendix A, Figure 4) is forwarded to him/her together with the appropriate sample containers.

1.3 Sampling instructions - chemical

1.3.1 All sampling for chemical analysis can follow the microbiological sampling without any additional preparation. If sampling for chemical analyses is the only requirement, then the microbiological sampling procedure is followed without flame treatment. Bottles containing preservatives shall be filled to within 1 inch from the top so the sample contains the pr per ratio of sample to preservative. Sample containers with preservatives shall <u>NOT</u> be prerinsed before filling with sample. Prerinse only those sample containers without preservatives.

NOTE:
Samples for volatile organic analyses must be taken in special sample vials. These vials have a 40 ml capacity and have a silicone/Teflon-backed septum and a black plastic screw closure. The vials are specially prepared in the laboratory to contain sodium thiosulfate (0.008%). Each vial shall be filled to overflowing <u>WITHOUT</u> sampl prerinsing. The septum is then slid over the top of the vial, Teflon surface down. The plastic screw closure is then carefully screwed down on the vial to complete the seal. The bottle should be inverted to ch ck for air bubbles, which, if present, will require the sample to be discarded and a new vial used for the sample.

1.4 Chain of Custody

Appendix A, Figures 3 and 5, illustrate respectively, the ID tags and chain of custody forms used by QC, Incorporated. Records of field operations, which include sampling activity logs, important observations, as well as all tracking forms, shall be written in waterproof black ink in a bound log-book.

Items to be recorded in accordance with strict Chain of Custody protocols include:

a) Date of collection.
b) Time of collection.
c) Sample source, including name, number, location and type.
d) Preservative used.
e) Analyses required.
f) Name or initials of sample collector and witness(es).
g) Field data (pH, temperature, etc.).
h) Date and time of custody transfer.
i) Custodian's name or initials.
j) Date and time analysis begins.
k) Analyst's name or initials.

Chain of Custody forms or tags are shipped with the samples. A custodian has been designated to receive the samples at the laboratory and take full responsibility for ensuring sample integrity thereafter.

The custodian or the alternate will receive all samples. The custodian shall verify integrity of the seals if used and shall accept responsibility for the samples by signing or initialing the Chain of Custody forms and recording the date and time of the transfer. Chain of Custody forms are returned to the client, with the laboratory retaining a copy for its records. The sample custodian is also responsible for initiating the sample log at the laboratory by means of the computer data base. The custodian will record all pertinent information to include the following: a unique computer assigned sample number, the person (or service delivering the sample), the date sample was taken, how sample was transported to laboratory, and condition of the sample (whether sample seal was intact, etc.) An illustration of the laboratory sample tracking tag is illustrated in Appendix A, Figure 3. The QC Incorporated sample tag will remain attached to the sample until it is destroyed.

Each sample is entered on the laboratory report form (Appendix A, Figure 1) which is used for recording the field analytical results and sample identification data, which is entered into the analytical database and is used for final results printout. This will also serve as a written record of who removed the sample from the custody area, when it was removed, when it was returned. All laboratory personnel who use the sample shall initial this form showing that a transfer of custody took place. These persons are responsible for preserving sample integrity while the sample is in their possession.

The sample custody area in the laboratory is a l ckable walk-in type refrigerat r. All sample distribution from this area is done only by the custodian or the alternate. Samples that are completed and that are to be destroyed are done so nly by the custodian or alternate. The tags are removed at time of sample disposal and are catalogued for future reference.

2. Instrument Calibration and Operation

2.1 Analytical balances

QC, Incorporated has 6 analytical balances in use. The reader is directed to the individual balance operations manual for detailed information. These manuals are kept in close proximity to each balance.

2.1.1 Quality assurance requirements for all analytical balances are itemized as follows:

a) The balances must have a sensitivity of 0.1 mg.
b) The balances must be mounted on a secure table.
c) The balances are checked and adjusted annually by an authorized service person and the date recorded in a bound log-book.
d) The balances are checked monthly using at least 2 "Class S" weights. These weights must be accurate to the nearest 0.1 mg. The dates on which the checks were made, the name of the analyst and other pertinent information is recorded in a bound log-book.
e) All balances shall be kept clean at all times.
f) The balance level and zero shall be checked before each use.
g) The accuracy of the balances is checked twice-yearly using a 100 mg. weight under a 100 g load.

2.2 Pan balances

QC, Incorporated has 3 pan balances. The reader is directed to the individual balance operations manual for detailed information. These manuals are kept in close proximity to each balance.

2.2.1 Quality assurance requirements for all pan balances are itemized as follows:

a) Balances are checked monthly using at least two "Class S" weights. These weights must be accurate to the nearest 0.01 grams. The date on which the checks were performed, the name of the analyst performing the checks and other pertinent information must be recorded in a bound log-book.
b) Balances are checked and adjusted annually by an authorized service person and the date recorded in a bound log-book.
c) The balance accuracy is checked monthly using a 100 mg weight under a 100 g load.

2.3 Thermometers

Each thermometer in use at QC, Incorporated is verified for accuracy by comparison with an NBS certified thermometer. The verification is performed yearly and the following information is recorded in a bound log-book:

a) Each thermometer is given a unique identification number that is recorded along with the identificati n number of the NBS thermometer.
b) Deviations from the NBS thermometer are recorded.
c) The date that the verifications are performed.
d) The initials of the analyst performing the verification are recorded.

2.4 pH meters

QC, Incorporated has 4 pH meters. The reader is directed to the individual meter operations manuals for detailed information. These manuals are kept in close proximity to each pH meter.

2.4.1 Each pH meter utilized meets the following criteria:

a) The accuracy of the pH meter is +/-0.05 pH units.
b) The readability of the pH meter is +/-0.1 pH units.

2.4.2 The general protocol for operating the pH meters is listed below:

a) The electrodes shall be rinsed well with DI water after each reading.
b) The electrodes shall be dipped several times into the next sample before readings are taken.
c) All samples shall be stirred during measurement, using a magnetic stirrer and a Teflon-coated stir bar.
d) The electrodes shall be stored in DI water when not in use.
e) The pH meter shall not be used or stored on a metal surface.
f) Commercial buffers shall be dated when received. A discard date is noted on the label as well.
g) The pH meter shall be checked quarterly with EPA known standards (EMSL) and/or ERA Associates known standards. The data is recorded in a bound log-book.

2.4.3 The pH meter is calibrated daily before use with two buffer solutions bracketing the values to be measured; i.e., 4.0 and 7.0 buffers.

a) Place electrodes first in a pH 7.0 buffer solution and stir gently.
b) When meter has stabilized, adjust the reading to read 7.0 using the calibrate knob.
c) Remove probe from the buffer and rinse with DI water. Carefully dab the probe dry with a tissue and place probe into pH 4.0 buffer solution.
d) Stir gently until constant reading is obtained.
e) Adjust meter to pH 4.0 by means of the slope adjust.

NOTE TO ANALYST: If an adjustment of more than 0.2 pH units is made, there may be a problem with the pH probe and/or the met r. If an

adjustment is made to the meter or the probe is renewed, and if calibrati n is unacceptable, then the meter is taken out of service and the supervisor notified.

2.4.4 A daily check of the meter/electrode system is made after this calibration has taken place, as follows:

a) A pH 7.0 buffer is used. The probe and meter are adjusted to this buffer.
b) Without further adjustment, pH 4.0 and pH 10.0 buffers are measured with the obtained values recorded in a bound log book.

2.5 pH meter - Radiometer ION-85

The Radiometer pH meter is standardized using the same basic procedure as outlined above, in that the same buffer solutions are used, but the operation of the meter, however, is dramatically different. The Radiometer pH meter is an automated instrument; i.e., it is programmed to calibrate at the press of a button. The procedure is outlined in the following steps:

a) Place the pH probe in pH buffer 7.0.
b) Press calibrate pH button to initiate the calibrate mode function.
c) After stirring and stabilization of the reading, press the calibrate pH button again. This sets the pH meter to the value of pH 7.0.
d) The pH meter prompt indicates that the pH probe be placed in a second pH buffer solution. Choose a buffer that will will bracket the samples being measured.
e) When the meter is stable, press the calibrate butt n again. This sets the meter to the value of the buffer.
f) Press the button labeled pH to enter the read mode.
g) Place pH probe into a sample, stir, and when reading is stable, record that value.
h) Always rinse between samples with either DI water r next sample to be tested.
i) All pH meters must be checked monthly using EPA and/or ERA Associates known check samples and the results rec rded in a bound log-book.

2.6 Conductivity meter - Radiometer

2.6.1 Maintenance

2.6.1.1 The conductivity probe is rinsed with DI water.

2.6.1.2 Conductivity is checked with 0.001 M KCl standard daily. Results may not deviate more than 10% of the true value of 141 umhos at 25 C.

2.6.2 Measurement

2.6.2.1 The conductivity probe must be rinsed with the sample to be tested three times before a reading is taken.

2.6.2.2 Place sample in appropriate c ntainer with a

Tefl n coated stir bar, start magnetic stirrer and place probe into sample.

2.6.2.3 Samples are automatically temperature compensated.

2.6.2.4 Once meter reading has stabilized, it may be taken as the actual value to be recorded.

2.6.2.5 The meter is checked monthly with EPA and/or ERA known reference standards. These results are recorded in a bound log-book.

2.7 Refrigerators - walk-in and domestic types

2.7.1 QC, Incorporated has 4 walk-in type refrigerators and 3 domestic refrigerators. The walk-in refrigerators are used for sample storage and the the domestic type are used for sample and reagent storage. All refrigerators maintain an internal temperature of 1-4 C. A thermom - ter with at least 1 C increments is placed inside each refrigerator. The bulb of the thermometer is kept submerged in a flask of water. Each refrigerator has two temperature positions that are monitored; i.e., a high and a low position.

2.7.2 QC Incorporated has an upright, explosion-proof refrigerator used to store flammable reagents. This refrigerator maintains the same 1-4 C internal temperature as in the other refrigerators and is monitored in the same manner.

2.7.3 Quality assurance for all refrigerators consists of daily monitoring of the internal temperatures with the results recorded in a bound log-book. If the temperature of any refrigerator is found outside the allowable limits, the analyst shall report this immediately to his Supervisor. The Supervisor will investigate the discrepancy and if the problem is not correctable, he/she shall report the condition to the Q.A. Supervisor. The Q.A. Supervisor will take whatever acti n is necessary to correct the problem.

2.8 Incubators

2.8.1 QC, Incorporated has 2 low temperature incubators for BOD analysis. The incubators are maintained at 20 C.

2.8.2 Quality assurance for the incubators consists of daily monitoring of internal temperatures with the results recorded in a bound log-book. If the temperature of any incubator is found outside the allowable limits, the analyst shall report this immediately t his Supervisor. The Supervisor will investigate the discrepancy and if the problem is not correctable, h /she shall report the condition to the Q.A. Supervisor. The Q.A. Supervisor will take whatever acti n is necessary to correct the problem.

2.9 Magnetic stirrers

2.9.1 QC, Incorporated has numerous magnetic stirrers, all purchased from different manufacturers. All magnetic stirrers are variable speed and all stirring bars are coated with Teflon.

2.10 Hot plates

2.10.1 QC, Incorporated has numerous hot plates of different manufacture. All hot plates have variable temperature controls.

2.11 Drying ovens

2.11.1 QC, Incorporated has 5 mechanical convection ovens. Each oven has variable temperature control from r m temperature to 180 C. The ovens are predominantly used at one set temperature; i.e., one is set at 105 C, one is set at 130 C, and one is set at 180 C.

2.11.2 Quality assurance for all drying ovens requires that the temperatures are monitored with NBS-traceable thermometers. The thermometers used must be graduated in at least 1 C increments, and are used with their bulbs submerged in a beaker of sand. The temperatures of the ovens are checked daily and are recorded in a bound log-book.

2.12 Centrifuges

2.12.1 QC, Incorporated has 3 centrifuges all capable of holding centrifuge tubes of at least 15 ml capacity. One of the centrifuges can hold tubes of 150 ml capacity.

2.13 Desiccators

2.13.1 QC, Incorporated has several portable desiccators as well as two stationary desiccators. All desiccators contain a moisture absorbing material (desiccant). The type of desiccant used is dependent on the particular test procedure being performed. See the QC Methods Manual for the particular test procedure and the specified desiccant.

2.14 Spectrophotometer - Milton Roy

2.14.1 QC, Incorporated uses a Milton Roy Spectronic 601 spectrophotometer for specific inorganic procedures. This unit has a usable wavelength range of 195-999 nm. It has a maximum spectral band width of <= 5 nm and a wavelength accuracy of +/- 1.0 nm. The instrument can accommodate cells with path lengths of 1-5 cm. A 1 cm path l ngth is normally used. All cells are kept clean and free from scratch s, fingerprints,

smudges, and evaporated film residues.

2.14.2 The spectrophotometer is checked monthly for proper operation. QC, Incorporated uses Oxford Spectro-Check solutions for monitoring. Two solutions are utilized and readings are taken at 400, 450, 510, 550, and 600 nm. Results are evaluated in accordance with the following guidelines:

a) The wavelength of 510 nm is the peak absorbance for this reference solution. A change of 0.03 nm or more would indicate a change in bandwidth.
b) The absorbance of Solution II should be half that of Solution I. If not, the instrument is not linear.
c) At wavelengths 450 and 550 nm, a shift in opposite directions will indicate a shift in wavelengths.

2.14.3 Stray light is checked by using a solution of potassium chromate (0.169g qs 1 liter with 0.05 N NaOH) and is measured at 374 nm (ideal <2% T).

2.14.4 Instrument wavelength calibration shall be checked monthly by using a holmium oxide filter standardized at 536.9 nm. The pertinent data shall be recorded in a bound log-book.

2.14.5 All spectrophotometer cuvettes and cells are checked for absorbance uniformity every six months.

2.15 Spectrophotometer - Turner

2.15.1 QC, Incorporated uses a Turner Associates Model 350 spectrophotometer for specific inorganic procedures. This unit is capable of measurements in the wavelength range 400-700 nm. It has a spectral band width of <20 nm and a wavelength accuracy of +/- 2.5 nm. The instrument can accommodate cells with path lengths of 1-5 cm. A 1 cm path length is normally used. All cells are kept clean and free from scratches, fingerprints, smudges, and evaporated film residues.

2.15.2 The spectrophotometer is checked monthly for proper operation. QC, Incorporated uses Oxford Spectro-Ch ck solutions for monitoring. Two solutions are utilized and readings are taken at 400, 450, 510, 550, and 600 nm. Results are evaluated in accordance with the following guidelines:

a) The wavelength of 510 nm is the peak absorbance for this reference solution. A change of 0.03 nm or more would indicate a change in bandwidth.
b) The absorbance of Solution II should be half that of Solution I. If not, the instrument is not linear.
c) At wavelengths 450 and 550 nm, a shift in opposite directions will indicate a shift in wavelengths.

2.15.3 Stray light is checked by using a s luti n of potassium chromate (0.169g qs 1 lit r with 0.05 N NaOH) and is measured at 374 nm (ideal (2% T).

2.15.4 Instrument wavelength calibration shall be checked monthly by using a holmium oxide filter standardized at 536.9 nm. The pertinent data shall be recorded in a bound log-book.

2.15.5 All spectrophotometer cuvettes and cells are checked for absorbance uniformity every six months.

2.16 Specific ion meter - Radiometer/Copenhagen Ion 85

2.16.1 QC, Incorporated has an ION 85 specific ion meter manufactured by Radiometer/Copenhagen. The meter is readable and accurate to +/-0.1 mV. Many specific ion probes are used with this meter; eg., nitrates, fluoride, chloride, iodide, silver-sulfide, ammonia, and their associated reference electrodes. The probes, are left in the appropriate 10 ppm working standard when in use. If there is to be an extended period of time between sample measurements, the manufacturer recommends that the probe be stored with the protective cover in place over the sensing surface of the probe.

2.16.2 Quality assurance for the specific ion meter and the probes requires that at least a 10X concentration range of the standard curve is measured for each group of analyses. The standard curve is run before each set of samples. For the meter and probe to be operating correctly, a 57-59 mV change must occur for each decade change in standard concentration. If this condition is not met, the standard curve must be redone. The probe, meanwhile, is left in a beaker of DI water to equilibrate. The curve is rerun; if the results are no better or even worse than before, the analyst shall report the condition to his/her Supervisor. The Supervisor shall replace or regenerate the probe, as required. If the problem cannot be corrected by the Shift Supervisor, he/she shall inform the Quality Assurance Director. The Quality Assurance Director shall expedite a solution to the pr blem. A possible temporary solution to the problem might be to set up an alternate approved method until the specific ion meter and/or probe malfunction can be corrected.

2.17 Muffle furnace

2.17.1 QC, Incorporated has several muffle furnaces in use, all being capable of reaching at least 850 C. Th accuracy of the ashing provided by the muffle furnaces is checked by running control samples with the actual

samples. The results f sample spike recoveries are monitored for each test parameter utilizing the muffle. If the results are lower than expected, the muffle furnace could be the cause. An investigation would then be made to determine if the muffle is heating too hot. If no other reason can be determined for low recoveries, the Quality Assurance Director is notified, who will initiate a service call or, if need be, have the unit replaced.

2.18 Turbidimeter

2.18.1 QC, Incorporated uses a Hach Model 2100A turbidimeter for the determination of turbid or cloudy samples in water chemistry.

2.18.2 Meter calibration

Set range control to 100 and pour 25 ml of 40 NTU standard into a clean glass cell. Wipe outer surface clean with a tissue, place the cell in the cell holder and cover the top with the light shield. Adjust meter to read 40. Empty cell, rinse and pour 25 ml of 4. NTU standard into the cell. Switch the range control to the 10 scale and insert the cell and cover top with light shield. Adjust meter to read 4.0. Turn range control to 100 - the reading should be approximately 4.0 on this scale as well. If not, check reading on the 10 scale again. When these readings agree, sample analysis may begin.

2.19 Total organic carbon analyzer - O.I. Corporation Model 700

2.19.1 The TOC analyzer may be used to test for total organic carbon (TOC), total inorganic carbon (TIC), and purgable organic carbon (POC) The analysis range for these parameters is 4 ppb to 10,000 ppm.

2.19.2 The Model 700 incorporates an infrared detector that responds to carbon dioxide. TIC is determined by measuring carbon dioxide after sample acidification. TOC is determined, after subtracting TIC, by measuring carbon dioxide released during chemical oxidation of the sample.

2.19.3 Potassium acid phthalate is used to calibrate the instrument. A 1000 ppm C solution (KHP) is prepared monthly and kept refrigerated when not in use. Standards are prepared daily from this stock. Although the Model 700 accepts only a one point calibration (selected at the mid-range of expected TOC values), two additional standards are tested to verify response linearity over the expected analysis range. Dilutions are made for all samples exceeding 110% of the highest daily standard.

A series of five (5) KHP standards is tested monthly to check the infrared detector. The d tector millivolt response is plotted against the standard concentrations. This plot is used to determine any deviation in response from linearity to carbon dioxide The infrared detector is cleaned if linearity is not observed.

2.19.4 Duplicates are tested at 10% intervals. The relative percent difference (RPD) is calculated and must be <20%. If the RPD is >20%, the instrument is checked for proper operation and recalibrated, as required.

Spikes are tested at 10% intervals. Samples are spiked with KHP at a level not exceeding 50% of the sample result. Percent recoveries are calculated. Quality control spike recovery limits are 85-115%.

The millivolt response from reagents, nitrogen purge gas and tubing is frequently determined. This "base-line" response is subtracted from the sample response before the TOC is calculated. Baseline millivolt response is determined each time fresh reagents are prepared, a new gas cylinder is put into service, and when any tubing or component is replaced.

2.19.5 A log-book is kept to record actual instrument run-time for the Model 700. This is used to schedule maintenance for the instrument.

2.20 Total organic halogen analyzer - Mitsubishi Chemical Industries, Ltd Model TOX-10

2.20.1 The TOX analyzer may be used to determine organic halogens by absorbing TOX onto activated carbon. The activated carbon-TOX is combusted in a stream of oxygen and the halogens converted to their respective hydrogen halides (HX). HX is then titrated with silver ions in a coulometric cell according to Faraday's Law.

The Model TOX-10 has an operating range of 0.2-40ug Cl +/- 5%.

2.20.2 Using EPA Method 450.1 (1980), trichlorophenol is used for instrument calibration prior to each use. A 1000 ppm stock solution is prepared every 6 weeks and stored at 4 C. Each daily calibration uses a 100 ppb Cl standard. The 100 ppb standard is processed as a sample and a readout of 100+/-5 ppb is expected.

Blanks of activated carbon are run to determine ug Cl in the carbon. These blanks should be <0.4 ug TOX per 40 mg carbon. The carbon blank TOX is subtracted from both standard and sample results.

2.20.3 Duplicat s are tested at 10% intervals. The relative percent difference (RPD) is calculated and should be <20%. If the RPD is >20%, the sample is tested a third time and a new RPD calculated. An unsatisfactory RPD is addressed by checking the instrument and running additional standards.

Spikes are run at 10% intervals. A 2,4,6-trichlorophenol spike is used, not to exceed the sample value. Spike recoveries are calculated and should be in the 70-125% range.

2.20.4 A log-book is kept to record actual instrument run-time for the Model TOX-10. This log is used to schedule maintenance for the equipment.

2.21 Infrared spectrophotometer

2.21.1 QC, Incorporated has a Perkin Elmer Model 467 grating infrared spectrophotometer for use as an organic fingerprint screening instrument and to determine petroleum hydrocarbons by EPA Method 418.1. This IR instrument is a double beam, optical null, programmable slit width, linear transmittance vs wavenumber instrument (4000-250 cm-1).

2.21.2 Quality control checks shall be performed monthly to ensure proper performance of the instrument. All charts will be saved, and evaluation date, notes and analyst name shall be kept in a bound log-book.

a) Wavelength check: A 0.05 mm polystyrene film is used for an adequate check of instrument performance throughout its spectral range. The test film is placed in the sample holder, the SCAN-MODE switch set to slow (S) and the SLIT PROGRAM selector set to the N position. The start button is pressed to begin the scan (4000-250 cm-1). The test spectrogram is compared to reference spectra in respect to wavenumber accuracy, resolution and noise (Appendix B, Figure 1).

b) Io determination: The pen is placed at approximately 90%T and the double beam Io line traced. The M SCAN-MODE switch position is recommended. The start button is pressed to begin the scan and the test Io spectrogram is c mpared to the reference Io spectrogram (Appendix B, Figure 2).

c) Stay-light check: The stray-light test is conducted by using either sodium chloride or potassium bromide as a standard. Either standard is placed in the sample compartment and scanned from 600-250 cm-1. The test stray-light spectrogram is c mpared with the reference stray-light spectrogram.

2.21.3 Instrument repeatablity is v rified by making two consecutiv scans on the same sample under identical conditions. and n the same chart pap r. After completing the first scan, the chart is rewound. Make certain that the control engages and that the chart and the wavenumber indicator are synchronized and rescan.

2.22 Atomic absorption spectrophotometers

2.22.1 QC, Incorporated has 4 atomic absorption spectrophot - meters, 3 of which have graphite furnace capabilities. All QC, Incorporated AA instruments meet or exceed EPA requirements; i.e., single channel, single or d uble beam with a grating monochrometer and a photomultiplier detector, adjustable slits, and a usable wavelength range of 190-800nm.

All elements of interest are tested using single or multi-element hollow cathode lamps and/or EDLs (electrodeless discharge lamps). Graphite furnaces are capable of reaching the method specific atomization temperatures. Burner heads for flame analyses are approved types only - air/acetylene or nitrous oxide/acetylene. All instruments are equipped with Deuterium background correction. Atomic absorption grade acetylene is used throughout. Compressed air supplies the air for the air/acetylene flame, nitrous oxide cylinders (commercial grade) supply the nitrous oxide for the N2O/acetylene flame. Argon is of 99.999% pure.

2.22.2 All EPA atomic spectroscopy accessory requirements are met by QC, Incorporated, as follows:

a) Pipet tips (manual pipetting) are free from metal contamination.

b) A 17.5 cm quartz absorption cell with end windows is used for cold vapor mercury analyses. A peristaltic air pump is used with a regulated flow of 1 liter/minute. Nitrogen or argon is used as a carrier gas. Stannous chloride is used as the reducing agent.

2.22.3 Calibration for all atomic absorption instrum nts is performed daily. A blank and 4 standards are run with every sample group. If the obtained results are not within the limits for the EPA EMSL QC check samples, the standard curve is redone.

2.22.4 Each analyte requires a known to be run at the beginning and end of the analysis. Duplicates are run at a 5% sample frequency, matrix spikes at 10% fr quency and calibration (using reslope) at a 10% sample frequency.

NOTE: Every matrix is spiked (GFAAS) at a 10% sample frequency.

2.22.5 Many sample matrix modifiers are used in GFAAS to help with the different interference problems that may be encountered (chemical, ionization and physical). A bound log-book is maintained to record the different types of modifiers used with various matrices.

2.22.6 Every precaution is taken to avoid matrix interferences. When interferences are suspected, samples are analyzed by the method of standard additions.

2.22.7 A log-book is kept to record instrument maintenance for each atomic absorption spectrophotometer. This log is used to schedule factory maintenance for the equipment.

2.23 Inductively Coupled Plasma Atomic Spectrophotometer

2.23.1 QC, Incorporated has a Perkin Elmer Model 6500 ICP atomic spectrophotometer with a flame AA accessory. The AA section meets or exceeds the EPA criteria for AA spectrophotometers, as described in Section 2.21.1, above. The ICP operates via a 27.5 MHz RF generator, computer control, and has background correction for each element file.

2.23.2 Each ICP method may contain one or more elements. For each element, a standard curve consisting of 2 points and a reagent blank is prepared. An EPA known control sample (EMSL) and an interference check are included in each run. Reagent blanks are run every 10% of the samples; duplicates at 20% frequency and sample spikes at 10% frequency. Samples are spiked at a level equal to or less than the MCL.

2.23.3 A log book is kept to record instrument maintenance for the ICP instrument and is used to schedule fact ry maintenance for the equipment.

2.24 Technicon Autoanalyzer

2.24.1 QC, Incorporated has a Technicon TRAACS-800 autoanalyzer system with a BD-40 block digester for sample preparation. The system is controlled by an IBM PC/XT operating under PC-DOS 3.1.

2.24.2 The TRAACS-800 system is currently utilized only for EPA or EPA-approved methodologies. Specifically, the system is used for:

a) Kjeldahl nitrogen
b) Nitrate.nitrites
c) Nitrites
d) Phosphorus - all forms

Other methods may be added from time to time but nly with the written approval f the Quality Assurance Director.

2.24.3 Instrument specifications meet or exceed EPA criteria for automated analyzer equipment; i.e., abs rbance range is 0.05-3.0 AU, photometric linearity is 0.015 AU up to 1.0 AU, filter band widths are 12.5-20 nm at 400-550 nm and 15-21nm at 550-880 nm.

2.24.4 Quality control checks include:

a) Baseline setting using appropriate reagents and DI water. This is checked for drift at the end of the run.
b) A minimum of 5 standards are used to generate a calibration curve.
c) A new calibration curve is prepared for each run.
d) A marking standard is included with every 20 samples.
e) The calibration curve is checked at the end of each run with a high and low standard and the data recorded.

2.25 Gas chromatographs

2.25.1 QC, Incorporated has eight gas chromatographs, each designated to perform only specific standard methodologies, such as:

EPA Methods 601/602/603 - volatiles
EPA Method 606 - phthalate esters
EPA Method 608 - pesticides & PCBs
EPA Method - chlorophenoxy herbicides
EPA Method 502.1 - trihalomethanes

2.25.2 Quality control for pesticides, PCBs, phthalate esters and chlorophenoxy herbicides is as follows:

a) A laboratory method blank shall be analyzed on each day that any of the above mentioned analyses are conducted.
b) A minimum of three (3) calibration levels for each parameter of interest is used when preparing a calibration curve. One concentration shall be at or near the "MCL" for each analyte and the other levels should corresp nd to the expected range of concentrations in the samples to be tested.
c) Once the three standard calibration curve has been prepared, at least one standard is run on a daily basis as a response check (+/- 15% of the previous calibration).
d) Dibutylchloroendate, "DBC", is used as an internal in all environmental pesticide and PCB applications. DBC recoveries are monitored as well as are shifts in retention time.
e) Duplicates, spikes and spike duplicates are tested at a 10% frequency with the precision and accuracy data calculated from these results.
f) Precision and accuracy data are tabulated in bound logbooks and are plotted on control charts. The limits us d to evaluate the data are +/- 2 standard deviations from

the mean value. At no time will data exceed performance data listed in the specific method.

g) MDLs shall be developed for all parameters and can be calculated by analyzing seven replicates at a concentration 5X the baseline noise. The standard deviation of the seven replicates is determined and is multiplied by the Student T value for the seven replicates (3.143). This number represents the MDL.

h) An EMSL QC check sample shall be tested at a 10% frequency of all the samples analyzed.

2.25.3 Quality control for VOCs and THMs

a) Laboratory method blank shall be analyzed on each day that the above mentioned analyses are conducted. Blanks showing contamination greater than 0.4 ppb of any of the individual THMs shall be cause for data rejection.

b) A minimum of three (3) calibration levels for each parameter of interest is used when preparing a calibration curve. One concentration shall be at or near the "MCL" for each analyte and the other levels should correspond to the expected range of concentration in the samples to be tested.

c) A 2 ppb QC check sample is tested daily before samples are tested. Instrument status checks and lower detection limits at 5X instrument noise level are determined from this data.

d) The daily 2 ppb QC check sample is prepared by dosing laboratory DI water with a QC check concentrate (US EPA EMSL or commercially prepared) containing all of the analytes of interest. Recoveries from the QC check sample are compares to established control limits.

e) Data for QC check samples must be within acceptable limits for all sample data for that day to be valid.

f) Duplicate samples, QC checks, matrix spikes and matrix spike duplicates are all tested at 10% frequency intervals. Precision and accuracy data are calculated from these results.

g) Control charts are plotted from the precision and accuracy data to be found in the bound log-books. Control limits ate +/- 2 standard deviations from mean values and shall be used to evaluate data.

h) US EPA EMSL QC check samples are tested quarterly to determine method accuracy. Results shall not vary by m re than the confidence interval given for each parameter. Results shall be recorded in the bound log-book.

2.26 Gas chromatograph/mass spectrometers

2.26.1 GC/MS equipment must be tuned daily and calibration ch cked.

2.26.2 QA requirements - volatiles

a) Instrument is tuned with 50 ng f brom fluorobenzene (BFB) every 12 hours. A successful tune meets the foll wing mass criteria:

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	Base peak, 100% relative abundance
173	5-9% of mass 95
174	<2% of mass 174
175	>50% of mass 95
176	>95% but <101% of mass 174
177	5-9% of mass 176

b) After tune criteria are met, a calibration check standard is run and is compared to the most recent 5-point calibration for linear response. When the calibration check standard produces unacceptable data (out of linear response), a new 5-point calibration shall be run.

c) When successful calibration has been achieved, a blank analysis is run once every 12 hours. The method blank may have no analyte above the Quantitation Limit found.

NOTE: Exceptions to this are methylene chloride, acetone and 2-butanone, all common volatile laboratory contaminants, in which 5 times the Quantitation Limit is permissible.

d) Once blank criteria are met, sample analyses may begin. Sample analysis requires the addition of three surrogate standards to the samples with percent recovery calculated for each surrogate.

Volatile Surrogates	Allowable % Recovery
Toluene-d8 (50 ug)	88-110
4-Bromoflurorbenzene (50 ug)	86-115
1,2-Dichloroethane-d4 (50 ug)	76-114

e) Matrix spike analyses are run at a 5% sample frequency.

2.27.3 QA requirements - base/neutral and acid extractables

a) The instrument is tuned with 50 ng of DFTPP at least once every 12 hours. A successful tune meets the following EPA mass criteria:

Mass	Ion Abundance Criteria
51	30-6-% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	40-60% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative abundanc
199	5-9% of mass 198
275	10-30% of mass 198
365	>1% of mass 198
441	Present but < mass 443
442	>40% of mass 198

Mass	Ion Abundance Criteria
443	17-23% of mass 442

b) After tune criteria are met, a calibration check standard is run and is compared to the most recent 5-point calibration for linear response. When the calibration check standard produces unacceptable data (out of linear response), a new 5-point calibration shall be run.

c) Once a successful calibration has been achieved, a blank analysis is run once every 12 hours. The method blank may have no analyte above the Quantitation Limit found.

d) When blank criteria are met, sample analyses may begin. Sample analysis requires the addition of three surrogate standards to the samples from each fraction, with percent recovery calculated for each surrogate.

BNA Surrogates	Allowable % Recovery
Nitrobenzene-d5 (50 ug)	35-114
2-Fluorobiphenyl (50 ug)	43-116
p-Terphenyl-d14 (50 ug)	33-141
Phenol-d5 (100 ug)	10-94
2-Fluorophenol (100 ug)	21-100
2,4,6-Tribromophenol (100 ug)	10-123

e) Blank and matrix spike analyses are run at a 5% sample frequency.

2.27 Reagents, chemicals and standards

2.27.1 QC, Incorporated shall purchase only the finest quality reagents and chemicals that are available, as required by a particular test procedure. Analysts are instructed to follow the test procedures in detail. Analysts shall use the grade of reagents required f r a given analysis.

2.27.2 Quality assurance may be summarized, as follows:

a) Stock and working standard solutions shall be checked regularly for signs of deterioration including, but not limited to, discoloration, formation of precipitates, and changes in concentration due to evaporation.

b) All solutions shall be properly labeled with the identification of the solution, concentration or titer, solvent, date prepared, and analyst initials.

c) All AA standards shall be ultra-high purity.

d) All chemicals, solutions, and standards shall be dated when received by the laboratory.

e) Special purity standards for organic analysis shall be purchased. Reagents that are heat or light sensitive and require refrigeration shall be stored in an explosion-proof refrigerator at 1-4 C.

2.28 Laboratory water

2.28.1 QC, Incorporated uses a custom designed water purification system to produce water of the required quality. The system incorporates a carbon filter, mixed bed, a cationic bed, an anionic bed, a final mixed bed polisher, and a UV filter. The system is equipped with an indicator light to alert personnel when a deionizer cartridge is spent. Two cartridges are kept in series so that at no time will the water quality be affected.

2.28.2 The DI water system is checked daily and conductivity readings from the in-line conductivity bridge recorded in a bound log-book.

2.28.3 The water quality meets or exceeds EPA requirements; i.e., 0.5 megohms resistivity or 2.0 micromhos conductivity. Reagent water blanks are run with every analysis as a quality assurance check on the DI water.

Table II is a summary of the analytical instrumentation in use in the laboratories at QC, Incorporated.

Table II

Analytical Equipment List

1. Analytical balances
   Mettler Model P1200N
   Mettler Model AE100
   Mettler Model A30
   Mettler Model AE160 - 2 each
   Mettler H5

2. Pan balances
   Mettler Grammatic balance
   Ohaus Brainweigh B300
   Fisher Scientific Model 7215A

3. pH meters
   Corning Model 125
   Fisher Scientific Accumet 815MP
   Fisher Scientific Accumet 830
   Radiometer/Copenhagen ION-85

4. Conductivity meter
   Radiometer/Copenhagen CDM-83

5. Magnetic stirrers
   Thermix Model 220T - 4 each
   Thermix Model 120M
   Thermix Model 120MR

6. Hot plates
   Corning Model PC-100 - 4 each
   Corning Model PC-35 - 3 each

7. Drying ovens
   GCA Precision mechanical convection oven - 2 each
   Fisher IsoTemp 200 Model 215G
   Lab Line Model 3511
   Fisher IsoTemp 300 Model 338P

8. Centrifuges
   IEC Model K, Size 2
   Damon/IEC Model HN-SII

9. Spectrophotometers
   Milton Roy Spectronic 601
   Bausch & Lomb Spectronic 21
   Bausch & Lomb Spectronic 20
   Turner Model 350

10. Muffle furnaces
    Lindburgh Model 51828 box furnace
    Fisher Scientific IsoTemp Model 184A

Table II
Analytical Equipment List
(Continued)

11. Turbidimeter
    Hach Model 2100A

12. Total organic carbon analyzer
    OI Corporation Model 700 - with TIC, TOC and POC capabilities

13. Total organic halogen analyzers
    Mitsubishi Model TOX-10
    Dohrmann-Xertex Model DX-20

14. Infrared spectrophotometer
    Perkin Elmer Model 467

15. Atomic absorption spectrophotometers
    Varian SpectAA 40 with
        GTA graphite tube atomizer
        DS-15 data station

    Varian Model 975 with
        Model 55 programmable sample changer
        VGA 76 vapor generation accessory

    Perkin Elmer Model 603 with
        HGA-2100 hollow graphite atomizer

    Perkin Elmer Model 2380

15. Inductively coupled plasma atomic spectrophotometer
    Perkin Elmer Model 6500 with
        PE-7300 computer and ICP software
        PR-210 printer

16. Autoanalyzer
    Technicon TRAACS-800 with
        IBM PC/XT
        BD-40 block digestor

17. Gas chromatographs
    H wlett-Packard Model 5380 with
        FID detector
        Electron capture detector
        Model 7671A autosampler
        Model 18850A GC terminal

    Varian Model 3700 with
        Electron capture detector
        Nelson Analytical Model 960 interface
        Varian 8000 autosampler

Table II
Analytical Equipment List
(Continued)

Varian Model 3700 with
- Electron capture detector
- Thermionic specific detector
- Nelson Analytical Model 760 interface
- Varian Model 8000 autosampler

Tracor Model 540 with
- Electron capture detector
- Dynatech Precision Sampling autosampler
- Nelson Analytical Model 760 interface

Tracor Model 540 with
- Flame ionization detector
- Electron capture detector
- Nelson Analytical Model 760 interface

IBM PC/XT (640 Kb; 10 Mb hard drive) operating on PC-DOS 3.1 and
- Nelson Analytical GC Software Model 2600 V4.1 with Epson FX-85

Varian Model 3700 with
- Tracor Model 700A Hall detector
- Tracor Model 703A photoionization detector
- Tekmar LSC-2 liquid sample concentrator
- Tekmar ALS automatic laboratory sampler
- Varian Model 4270 integrator

Varian Model 3700 with
- Tracor Model 700A Hall detector
- HNU photoionization detector
- Tekmar LSC-2 liquid sample concentrator
- Tekamr ALs automatic laboratory sampler
- Varian Model 4270 integrator

Tracor Model 540 with
- Model 700A Hall detector
- Model 703A photoionization detector
- Tekmar Model 4000 dynamic headspace concentrator
- Varian Model 4290 integrator

18. Gas chromatograph/mass spectrometers

Finnigan MAT Model 1020 automated GC/MS - for volatiles
- Perkin-Elmer Sigma 3B gas chroamtograph
- 32 Mb CMD disk drive
- Tekmar LSC-2 liquid sample concentrator
- Tekmar ALS automatic liquid sampler

Finnigan MAT Model 5100 automated GC/MS - for BNAs
- Finnigan 9600 gas chromatograph
- 32 Mb CMD disk drive
- Nova 4C computer
- Super INCOS and Aut Quan software

Table II
Analytical Equipment List
(Continued)

Varian 8000 autosampler
9-track magnetic tape drive
QA Formaster C/P data reporting software

3. Laboratory Glassware

Q C, Incorporated uses only borosilicat glass for its glassware. This type of glassware is resistant to damage, chemicals and repeated use. All volumetric glassware is Class A. Graduated cylinders, beakers and flasks are accurate to +/- 5% of the specified volume. Seriological or Mohr type pipets are not volumetric pipets and shall not be used in tests or analyses that require quantitative sample transfer and measurement. Bottles for storage of reagents and standard solutions may be of borosilicate glass or p lyethylene.

3.1 Glassware cleaning procedure - general

The cleaning procedure will vary depending on the specific glassware use. The general applications glassware is first cleaned with detergent; Fisherbrand "Sparkleen" or equivalent is satisfactory. Glassware is then rinsed several times with tap water, followed by several DI water rinses.

3.2 Glassware cleaning procedure - procedure - general purpose organics

Particular care must be taken with glassware such as Kuderna-Danish flasks, evaporative concentrator tubes, or any other glassware coming in contact with an extract that will be concentrated to a smaller volume. The process of concentrating a pesticide in this operation may similarly concentrate the contaminating substance, yielding extraneous chromatographic peaks.

All glassware used in pesticide and herbicide analyses shall be cleaned and stored as outlined in section 13A of "The Manual of Analytical Methods for the Analysis of Pesticide Residues in Human and Environmental Samples, US EPA.

NOTE: Certain detergents, even in trace quantities, may c ntain rganics that will contribute significant background contamination in electron capture gas chromatography. For this reason, any detergent selected should be carefully checked to ensure that no such contamination is present.

Soak glassware in an oxidizing agent to destroy traces of organic materials. The most effective and commonly used is the traditional chromic acid/sulfuric acid. For maximum efficiency, the soak solution should be hot (40-50 C).

3.3 Glassware cleaning procedure - special purpose - trace metals

This glassware should first undergo cleaning as described in 3.1, above. This is then followed by rinses of 1+1 HNO_3, tap water, 1+1 HCl and finally, DI water.

4. Analytical Procedures

4.1 QC, Incorporated uses only EPA and/or EPA approved meth dologies. Strict adherence to all details of each method shall be maintained. Due to constant advances in technologies and new EPA approvals for methodologies, QC, Incorporated reserves the right to utilize the most appropriate, approved method.

All changes in methodology shall be made only at the discretion of the Quality Assurance Director with final approval coming from the President or Vice President of QC, Incorporated. Documentation of all changes shall be made and kept on file by the Quality Assurance Director.

Because of the complexity of each test procedure, they will not be presented here but rather, each method will be presented by reference. Please refer to the cited references and the QC, Incorporated Laboratory Methods Manual for additional information.

4.2 QC, Incorporated uses only those test procedures specified in 40 CFR 141 and NJ and PA SDA regulations in the analysis of drinking water parameters.

4.3 QC, Incorporated uses only those test procedures specified in 40 CFR 136 for the analysis of NPDES and NJPDES compliance monitoring parameters.

4.4 Tables III, IV and V list the analytical methodologies currently being used by QC, Incorporated.

4.5 Tables VIA, VIIA and VIIIA summarize the method detection limits for the various analytical methodologies currently used by QC, Incorporated.

Table III

Analytical Methodology - Metals

Metal	Methodology	EPA (1)	EPA - ICP (1)
Aluminum	Atomic absorption; furnace	204.2	---
Antimony	Atomic absorption; furnace	206.2	---
Arsenic	Atomic absorption; gaseous hydride	206.2	---
Barium	Atomic absorption; furnace	208.2	200.7
Beryllium	Atomic absorption; furnace	210.2	---
Boron	Atomic absorption; direct aspiration	---	200.7
Cadmium	Atomic absorption; furnace	213.2	200.7
Chromium (total)	Atomic absorption; furnace	218.2	200.7
Cobalt	Atomic absorption; direct aspiration	219.1	---
Copper	Atomic absorption; furnace	220.1	---
Iron	Atomic absorption; direct aspiration	236.1	200.7
Lead	Atomic absorption; furnace	239.2	200.7
Magnesium	Atomic absorption; direct aspiration	242.1	---
Manganese	Atomic absorption; direct aspiration	243.1	200.7
Mercury	Atomic absorption; manual cold vapor	245.1	---
Molybdenum	Atomic absorption; furnace	246.2	---
Nickel	Atomic absorption; furnace	249.2	200.7
Potassium	Atomic absorption; direct aspiration	258.1	---
Selenium	Atomic absorption; gaseous hydride	270.1	---
Silver	Atomic absorption; furnace	272.2	---
Sodium	Atomic absorption; direct aspiration	273.1	---
Thallium	Atomic absorption; furnace	279.2	---
Tin	Atomic absorption; furnace	282.2	---
Titanium	Atomic absorption; furnace	283.2	---
Zinc	Atomic absorption; direct aspiration	289.1	---

Table IV

Analytical Methodology
Inorganics, metals

Test Parameter	Methodology	EPA (1)	Std Meth (2)
Acidity	Titrimetric	305.1	----
Alkalinity	Titrimetric	310.1	----
Ammonia	Ion selective electrode	350.3	----
BOD	5 day; 20 C	405.1	----
Bromides	Titrimetric	320.1	----
Calcium	Titrimetric; EDTA	215.2	----
Chlorides	Titrimetric; argentometric	----	407A
	Titrimetric; mercuric nitrate	----	407B
Chromium (hexavalent)	Colorimetric; diphenylcarbazide	----	312B
COD (high level)	Dichromate reflux; titrimetric	410.1	----
COD (low level)	Dichromate reflux; colorimetric	----	508C
Color	Colorimetric; platinum - cobalt	110.2	----
Conductivity	Specific conductance	120.1	----
Cyanides (total)	Distillation; ion selective electrode	----	412C/412E
Detergents	MBAS	----	512B
Dissolved oxygen	Modified Winkler	360.2	421B
Fluorides	Ion selective electrode	340.2	----
Hardness (total)	Titrimetric; EDTA	130.2	314B
Nitrate	Colorimetric; cadmium reduction	353.3	418C
Nitrate/nitrite	Colorimetric; automated	353.1	----
Nitrite	Colorimetric	354.1	----
Odor	Threshold odor	140.1	----
Oil & grease	Soxhlet extraction	----	503A
Petroleum hydrocarbons	Partition; infrared	418.1	----
pH	Electrometric	150.1	----

Table IV

Analytical Methodology
Inorganics, metals
(continued)

Test Parameter	Methodology	EPA (1)	Std Meth (2)
Phenols	Distillation; 4-AAP	420.1	----
Phosphorus (all forms)	Colorimetric; automated; ascorbic acid	365.1	----
Residue - filterable	Gravimetric; 180 C	160.1	----
Residue - nonfilterable	Gravimetric; 103-105 C	160.2	----
Residue - total	Gravimetric; 103-105 C	160.3	----
Residue - volatile	Gravimetric; 550 C	160.4	----
Settlable solids	Volumetric, Imhoff Cone	160.5	----
Sulfates	Turbidimetric	375.4	----
Sulfides	Titrimetric, iodine	376.1	----
Sulfites	Titrimetric, iodine	377.1	----
Total Kjeldahl Nitrogen	Colorimetric; semiautomated	351.2	----
Turbidity	Nephelometric	180.1	----
E/P extraction	Extraction; acetic acid	(3)	----

Table V
Analytical Methodology
Organics

Method 601 - Volatiles by purge & trap GC (4)

2V	Bromodichloromethane	16V	1,2-Dichloroethane
3V	Bromoform	17V	1,1-Dichloroethene
4V	Bromomethane	18V	t-1,2-Dichloroethene
5V	Carbon tetrachloride	19V	1,2-Dichloropropane
6V	Chlorobenzene	20V	c-1,3-Dichloropropene
7V	Chloroethane	21V	t-1,3-Dichloropropene
8V	2-Chlorovinyl ether	23V	Methylene chloride
9V	Chloroform	24V	1,1,2,2-Tetrachloroethane
10V	Chloromethane	25V	Tetrachloroethene
11V	Dibromochloromethane	27V	1,1,1-Trichloroethane
12V	1,2-Dichlorobenzene	28V	1,1,2-Trichloroethane
13V	1,3-Dichlorobenzene	29V	Trichloroethene
14V	1,4-Dichlorobenzene	30V	Trichlorofluoromethane
	Dichlorodifluoromethane	31V	Vinyl chloride
15V	1,1-Dichloroethane		

Method 602 - Aromatic volatiles by purge & trap GC (4)

1V	Benzene
7V	Chlorobenzene
12V	1,2-Dichlorobenzene
13V	1,3-Dichlorobenzene
14V	1,4-Dichlorobenzene
22V	Ethyl benzene
26V	Toluene

Method 603 - Volatiles by purge & trap GC (4)

1	Acrolein
2	Acrylonitrile

Method 608 - Pesticides & PCBs by GC (4)

1P	Aldrin	14P	Endrin
2P	a-BHC	15P	Endrin aldehyde
3P	b-BHC	16P	Heptachlor
4P	g-BHC	17P	Heptachlor epoxide
5P	d-BHC	18P	Toxaphene
6P	Chlordane	19P	PCB-1016
7P	4,4'-DDD	20P	PCB-1221
8P	4,4'-DDE	21P	PCB-1232
9P	4,4'-DDT	22P	PCB-1242
10P	Dieldrin	23P	PCB-1248
11P	Endosulfan I	24P	PCB-1254
12P	Endosulfan II	25P	PCB-1260
13P	Endosulfan sulfate		

Table V

Analytical Methodology
Organics
(continued)

Method 624 - Volatiles by GC/MS (4)

1V	Benzene	18V	t-1,2-Dichloroethene
2V	Bromodichloromethane	19V	1,2-Dichloropropane
3V	Bromoform	20V	c-1,3-Dichloropropene
4V	Bromomethane	21V	t-1,3-Dichloropropene
5V	Carbon tetrachloride	22V	Ethyl benzene
6V	Chlorobenzene	23V	Methylene chloride
7V	Chloroethane	24V	1,1,2,2-Tetrachloroethane
8V	2-Chlorovinyl ether	25V	Tetrachloroethene
9V	Chloroform	26V	Toluene
10V	Chloromethane	27V	1,1,1-Trichloroethane
11V	Dibromochloromethane	28V	1,1,2-Trichloroethane
12V	1,2-Dichlorobenzene	29V	Trichloroethene
13V	1,3-Dichlorobenzene	30V	Trichlorofluoromethane
14V	1,4-Dichlorobenzene	31V	Vinyl chloride
15V	1,1-Dichloroethane	32	Acrolein (5)
16V	1,2-Dichloroethane	33	Acrylonitrile (5)
17V	1,1-Dichloroethene		

Method 625 - Acid extractables by GC/MS (4)

1A	2-Chlorophenol	7A	4-Chloro-3-methylphenol
2A	2-Nitrophenol	8A	2,4-Dinitrophenol
3A	Phenol	9A	2-Methyl-4,6-dinitrophenol
4A	2,4-Dimethylphenol	10A	Pentachlorophenol
5A	2,4-Dichlorophenol	11A	4-Nitrophenol
6A	2,4,6-Trichlorophenol		

Table V

Analytical Methodology
Organics
(continued)

Method 625 - Base neutrals by GC/MS (4)

1B	1,3-Dichlorobenzene	36B	Heptachlor epoxide
2B	1,4-Dichlorobenzene	37B	Endosulfan I
3B	Hexachloroethane	38B	Fluoranthene
4B	Bis(2-chloroethyl)ether	39B	Dieldrin
5B	1,2-Dichlorobenzene	40B	4,4'-DDE
6B	Bis(2-chloroisopropyl)ether	41B	Pyrene
7B	N-Nitroscdi-N-propylamine	42B	Endrin
8B	Nitrobenzene	43B	Endosulfan II
9B	Hexachlorobutadiene	44B	4,4'-DDD
10B	1,2,4-Trichlorobenzene	45B	Benzidine
11B	Isophorone	46B	4,4'-DDT
12B	Naphthalene	47B	Endosulfan sulfate
13B	Bis(2-chloroethoxy)methane	48B	Endrin aldehyde
14B	Hexachlorocyclopentadiene	49B	Butylbenzyl phthalate
15B	2-Chloronaphthalene	50B	Bis(2-ethylhexyl) phthalate
16B	Acenaphthalene	51B	Crysene
17B	Acenaphthene	52B	Benzo(a)pyrene
18B	Dimethyl phthalate	53B	3,3'-Dichlorobenzidine
19B	2,6-Dinitrotoluene	54B	Di-n-octyl phthalate
20B	Fluorene	55B	Benzo(b)fluoranthene
21B	4-Chlorophenyl ether	56B	Benzo(k)fluoranthene
22B	2,4-Dinitrotoluene	57B	Benzo(a)pyrene
23B	Diethyl phthalate	58B	Indeno(1,2,3-c,d)pyrene
24B	N-Nitrosodiphenylamine	59B	Dibenzo(a,h)anthracene
25B	Hexachlorobenzene	60B	Benzo(g,h,i)perylene
26B	b-BHC	61B	N-Nitrosodimethylamine
27B	4-Bromophenyl phenyl ether	62B	Chlordane
28B	g-BHC (Lindane)	63B	Toxaphene
29B	Phenanthrene	64B	PCB-1016
30B	Anthracene	65B	PCB-1221
31B	b-BHC	66B	PCB-1232
32B	Heptachlor	67B	PCB-1242
33B	a-BHC	68B	PCB-1248
34B	Aldrin	69B	PCB-1254
35B	Dibutyl phthalate	70B	PCB-1260

Table VIA
Method Detection Limits
Water & Waste water

Metal	Methodology	AA (mg/l)	ICP (mg/l)
Aluminum	Atomic absorption; furnace	0.01	---
Antimony	Atomic absorption; furnace	0.001	---
Arsenic	Atomic absorption; gaseous hydride	0.001	---
Barium	Atomic absorption; furnace	0.002	0.005
Beryllium	Atomic absorption; furnace	0.002	---
Boron	Atomic absorption; ICP only	---	0.5
Cadmium	Atomic absorption; furnace	0.0001	0.005
Chromium (total)	Atomic absorption; furnace	0.001	0.005
Cobalt	Atomic absorption; direct aspiration	0.05	---
Copper	Atomic absorption; furnace	0.01	---
Iron	Atomic absorption; direct aspiration	0.01	0.05
Lead	Atomic absorption; furnace	0.001	0.005
Magnesium	Atomic absorption; direct aspiration	0.1	---
Manganese	Atomic absorption; direct aspiration	0.05	0.05
Mercury	Atomic absorption; manual cold vapor	0.0002	---
Molybdenum	Atomic absorption; furnace	0.01	---
Nickel	Atomic absorption; furnace	0.01	0.05
Potassium	Atomic absorption; direct aspiration	0.1	---
Selenium	Atomic absorption; gaseous hydride	0.002	---
Silver	Atomic absorption; furnace	0.0002	---
Sodium	Atomic absorption; direct aspiration	0.1	---
Thallium	Atomic absorption; furnace	0.005	---
Tin	Atomic absorption; furnace	0.5	---
Titanium	Atomic absorption; furnace	0.1	---
Zinc	Atomic absorption; direct aspiration	0.05	---

Table VIIA
Method Detection Limits
Inorganics, metals
Water & waste water

Test Parameter	Methodology	MDL - mg/l
Acidity	Titrimetric	2.
Alkalinity	Titrimetric	2.
Ammonia	Ion selective electrode	0.1
BOD	5 day; 20 C	2.
Bromides	Titrimetric	0.1
Calcium	Titrimetric; EDTA	2.
Chlorides	Titrimetric; argentometric	2.
	Titrimetric; mercuric nitrate	2.
Chromium (hexavalent)	Colorimetric; diphenylcarbazide	0.01
COD (high level)	Dichromate reflux; titrimetric	2.
COD (low level)	Dichromate reflux; colorimetric	0.5
Color	Colorimetric; platinum - cobalt	5.
Conductivity	Specific conductance	N/A
Cyanides (total)	Distillation; ion selective electrode	0.05
Detergents	MBAS	0.05
Dissolved oxygen	Modified Winkler	0.1
Fluorides	Ion selective electrode	0.1
Hardness (total)	Titrimetric; EDTA	2.
Nitrate	Colorimetric; cadmium reduction	0.5
Nitrate/nitrite	Colorimetric; automated	0.1
Nitrite	Colorimetric	0.02
Odor	Threshold odor	N/A
Oil & grease	Soxhlet extraction	2.
Petroleum hydrocarbons	Partition; infrared	0.5
pH	Electrometric	0.01 units

Table VIIA
Method Detection Limits
Inorganics, metals
Water & waste water
(continued)

Test Parameter	Methodology	MDL - mg/l
Phenols	Distillation; 4-AAP	0.001
Phosphorus (all forms)	Colorimetric; automated; ascorbic acid	0.05
Residue - filterable	Gravimetric; 180 C	2.
Residue - nonfilterable	Gravimetric; 103-105 C	2.
Residue - total	Gravimetric; 103-105 C	2.
Residue - volatile	Gravimetric; 550 C	2.
Settlable solids	Volumetric, Imhoff Cone	0.5 ml/l
Sulfates	Turbidimetric	2.
Sulfides	Titrimetric, iodine	0.5
Sulfites	Titrimetric, iodine	2.
Total Kjeldahl Nitrogen	Colorimetric; semiautomated	1.
Turbidity	Nephelometric	0.1 NTU
E/P extraction	Extraction; acetic acid	N/A

Table VIIIA
Method Detection Limits
Organics
Water & waste water

Method 601 - Volatiles by purge & trap GC

		MDL - ug/l			MDL - ug/l
2V	Bromodichloromethane	0.5	16V	1,2-Dichloroethane	0.5
3V	Bromoform	0.5	17V	1,1-Dichloroethene	0.5
4V	Bromomethane	0.5	18V	t-1,2-Dichloroethene	0.5
5V	Carbon tetrachloride	0.27	19V	1,2-Dichloropropane	0.5
6V	Chlorobenzene	0.5	20V	c-1,3-Dichloropropene	0.5
7V	Chloroethane	0.5	21V	t-1,3-Dichloropropene	0.5
8V	2-Chlorovinyl ether	0.5	23V	Methylene chloride	0.5
9V	Chloroform	0.5	24V	1,1,2,2-Tetrachloroethane	0.5
10V	Chloromethane	0.5	25V	Tetrachloroethene	0.5
11V	Dibromochloromethane	0.5	27V	1,1,1-Trichloroethane	0.5
12V	1,2-Dichlorobenzene	0.5	28V	1,1,2-Trichloroethane	0.5
13V	1,3-Dichlorobenzene	0.5	29V	Trichloroethene	0.5
14V	1,4-Dichlorobenzene	0.5	30V	Trichlorofluoromethane	0.5
	Dichlorodifluoromethane	0.5	31V	Vinyl chloride	0.15
15V	1,1-Dichloroethane	0.5			

Method 602 - Aromatic volatiles by purge & trap GC

		MDL - ug/l
1V	Benzene	0.5
7V	Chlorobenzene	0.5
12V	1,2-Dichlorobenzene	0.5
13V	1,3-Dichlorobenzene	0.5
14V	1,4-Dichlorobenzene	0.5
22V	Ethyl benzene	0.5
26V	Toluene	0.5

Method 603 - Volatiles by purge & trap GC

		MDL - ug/l
1	Acrolein	5.
2	Acrylonitrile	5.

Method 608 - Pesticides & PCBs by GC

		MDL - ug/l			MDL - ug/l
1P	Aldrin	0.05	14P	Endrin	0.1
2P	a-BHC	0.05	15P	Endrin aldehyde	0.1
3P	b-BHC	0.05	16P	Heptachlor	0.05
4P	g-BHC	0.05	17P	Heptachlor epoxide	0.05
5P	d-BHC	0.05	18P	Toxaphene	1.
6P	Chlordane	0.5	19P	PCB-1016	0.05
7P	4,4'-DDD	0.1	20P	PCB-1221	0.05
8P	4,4'-DDE	0.1	21P	PCB-1232	0.05
9P	4,4'-DDT	0.1	22P	PCB-1242	0.05
10P	Dieldrin	0.1	23P	PCB-1248	0.05
11P	Ensosulfan I	0.05	24P	PCB-1254	1.
12P	Ensosulfan II	0.1	25P	PCB-1260	1.
13P	Ensosulfan sulfate	0.1			

Table VIIIA
Method Detection Limits
Organics
Water & waste water
(continued)

Method 624 - Volatiles by GC/MS

		MDL - ug/l			MDL - ug/l
1V	Benzene	5.	18V	t-1,2-Dichloroethene	5.
2V	Bromodichloromethane	5.	19V	1,2-Dichloropropane	5.
3V	Bromoform	5.	20V	c-1,3-Dichloropropene	5.
4V	Bromomethane	10.	21V	t-1,3-Dichloropropene	5.
5V	Carbon tetrachloride	5.	22V	Ethyl benzene	5.
6V	Chlorobenzene	5.	23V	Methylene chloride	5.
7V	Chloroethane	10.	24V	1,1,2,2-Tetrachloroethane	5.
8V	2-Chlorovinylether	10.	25V	Tetrachloroethene	5.
9V	Chloroform	5.	26V	Toluene	5.
10V	Chloromethane	10.	27V	1,1,1-Trichloroethane	5.
11V	Dibromochloromethane	5.	28V	1,1,2-Trichloroethane	5.
12V	1,2-Dichlorobenzene	5.	29V	Trichloroethene	5.
13V	1,3-Dichlorobenzene	5.	30V	Trichlorofluoromethane	5.
14V	1,4-Dichlorobenzene	5.	31V	Vinyl chloride	10.
15V	1,1-Dichloroethane	5.	32	Acrolein	
16V	1,2-Dichloroethane	5.	33	Acrylonitrile	
17V	1,1-Dichloroethene	5.			

Method 625 - Acid extractables by GC/MS

		MDL - ug/l			MDL - ug/l
1A	2-Chlorophenol	10.	7A	4-Chloro-3-methylphenol	10.
2A	2-Nitrophenol	10.	8A	2,4-Dinitrophenol	50.
3A	Phenol	10.	9A	2-Methyl-4,6-dinitrophenol	50.
4A	2,4-Dimethylphenol	10.	10A	Pentachlorophenol	50.
5A	2,4-Dichlorophenol	10.	11A	4-Nitrophenol	50.
6A	2,4,6-Trichlorophenol	10.			

Table VIIIA
Method Detection Limits
Organics
Water & Waste water
(continued)

Method 625 - Base neutrals by GC/MS

		MDL-ug/l			MDL-ug/l
1B	1,3-Dichlorobenzene	10.	36B	Heptachlor epoxide	10.
2B	1,4-Dichlorobenzene	10.	37B	Endosulfan I	10.
3B	Hexachloroethane	10.	38B	Fluoranthene	10.
4B	Bis(2-chloroethyl)ether	10.	39B	Dieldrin	10.
5B	1,2-Dichlorobenzene	10.	40B	4,4'-DDE	10.
6B	Bis(2-chloroisopropyl)ether	10.	41B	Pyrene	10.
7B	N-Nitrosodi-N-propylamine	10.	42B	Endrin	10.
8B	Nitrobenzene	10.	43B	Endosulfan II	10.
9B	Hexachlorobutadiene	10.	44B	4,4'-DDD	10.
10B	1,2,4-Trichlorobenzene	10.	45B	Benzidine	10.
11B	Isophorone	10.	46B	4,4'-DDT	10.
12B	Naphthalene	10.	47B	Endosulfan sulfate	10.
13B	Bis(2-chloroethoxy)methane	10.	48B	Endrin aldehyde	10.
14B	Hexachlorocyclopentadiene	10.	49B	Butylbenzyl phthalate	10.
15B	2-Chloronaphthalene	10.	50B	Bis(2-ethylhexyl) phthalate	10.
16B	Acenaphthalene	10.	51B	Crysene	10.
17B	Acenaphthene	10.	52B	Benzo(a)pyrene	10.
18B	Dimethyl phthalate	10.	53B	3,3'-Dichlorobenzidine	20.
19B	2,6-Dinitrotoluene	10.	54B	Di-n-octyl phthalate	10.
20B	Fluorene	10.	55B	Benzo(b)fluoranthene	10.
21B	4-Chlorophenyl ether	10.	56B	Benzo(k)fluoranthene	10.
22B	2,4-Dinitrotoluene	10.	57B	Benzo(a)pyrene	10.
23B	Diethyl phthalate	10.	58B	Indeno(1,2,3-c,d)pyrene	10.
24B	N-Nitrosodiphenylamine	10.	59B	Dibenzo(a,h)anthracene	10.
25B	Hexachlorobenzene	10.	60B	Benzo(g,h,i)perylene	10.
26B	b-BHC	10.	61B	N-Nitrosodimethylamine	10.
27B	4-Bromophenyl phenyl ether	10.	62B	Chlordane	10.
28B	g-BHC (Lindane)	10.	63B	Toxaphene	10.
29B	Phenanthrene	10.	64B	PCB-1016	10.
30B	Anthracene	10.	65B	PCB-1221	10.
31B	b-BHC	10.	66B	PCB-1232	10.
32B	Heptachlor	10.	67B	PCB-1242	10.
33B	a-BHC	10.	68B	PCB-1248	10.
34B	Aldrin	10.	69B	PCB-1254	10.
35B	Dibutyl phthalate	10.	70B	PCB-1260	10.

References - analytical methodologies

1. EPA-600/4-79-020, Methods of Chemical Analysis for Water and Wast - water, US EPA, 1979 and subsequent revisions.

2. Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Association, 1985.

3. SW-846, 3rd ed., Test Methods for Evaluating Solid Wastes, Physical and Chemical Methods, US EPA, 1986.

4. 40 CFR 136, Appendix A.

5. Screening only, confirmation by EPA Method 603 (GC-FID).

5. Data Reduction and Validation

5.1 Raw data acquisition - general

Routine computations to obtain the parameter in the units designated by sample instructions will be performed by the analyst assigned the sample. Analysts shall enter all raw data into their bound notebooks. All entries shall be made in ink. Work shall be neat and organized. The minimum information requirements to be written for a typical analysis is the following:

a) The analyst shall the date of analysis at the top of the notebook page.
b) The name of the analysis shall be recorded; eg., Nitrate - Cadmium reduction.
c) The raw data shall then be recorded.
d) Calculations shall then be noted; if there are any multiple calculations for a given analysis, at least <u>one</u> complete calculation <u>must</u> be recorded. Abbreviated calculations for the remaining samples is permitted and shall then be recorded.
e) Any comments or notes shall then be recorded.

NOTES:

1. Each analyst keeps his/her own notebook and, therefore, he/she need not record his/her initials on each page. However, each analyst shall record his/her own name on the front cover of the notebook along with the date that the notebook was started.

2. Mistakes in a laboratory notebook are to be negated by a single diagonal pen stroke along with the analyst's initials and date. Erasures shall not be permitted. Notebooks shall be kept available for review by Shift Supervisors and the Quality Assurance Supervisor.

5.2 Calculations for trace metals and inorganic analyses

5.2.1 Calibration curves are prepared to read directly in mg/l or ug/l so it is only necessary to correct for dilution. Solid sample concentrations are reported in mg/kg, based on dry weight or net weight of the wet solid.

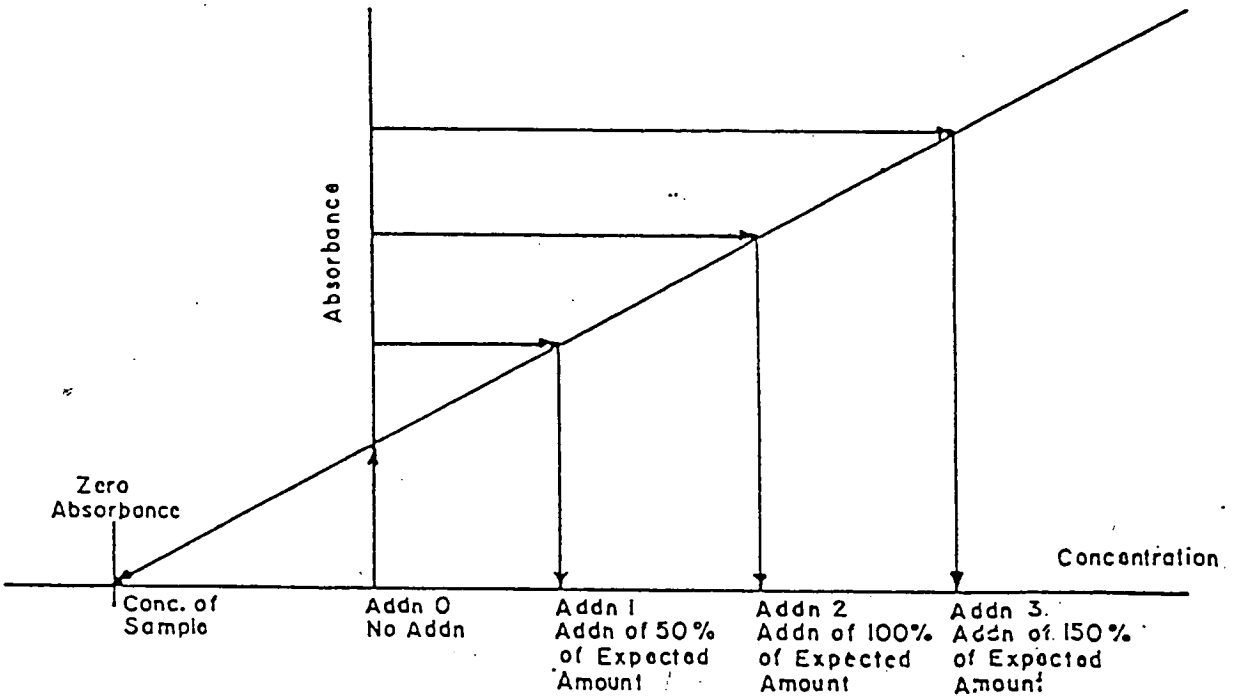
Dry solid: metal, mg/kg =

$$\frac{\text{mg metal (from curve) X sample volume, in ml}}{\text{dry weight, in grams}} \times \frac{1\text{L}}{1000\text{ ml}} \times \frac{1000\text{g}}{\text{kg}}$$

Wet solid: metal, mg/kg =

$$\frac{\text{mg metal (from curve) X sample volume, in ml}}{\text{dry weight, in grams X \% solids/100}} \times \frac{1\text{L}}{1000\text{ ml}} \times \frac{1000\text{g}}{\text{kg}}$$

5.2.2 The Method of Standard Additions is often used. QC, Incorporated instrumentation is, for the most part, computer controlled to calculate standard additions by means of linear regression. Manual determinations are performed using the following scheme:



5.3 Calculations for GC and GC/MS analyses

5.3.1 Calibration curves are prepared for each analytical method utilized. GC/MS results are calculated by the dedicated instrument computer, whereas much of the GC data is reduced manually to the final analytical results.

5.3.2 Internal standard calculations are used whenever possible. In this method, a compound with a retention time close to but not equal to the parameter in question is added to standards and samples. This method corrects for variations in injection size and technique.

Calculation:

$$\text{Sample conc.} = \frac{\text{Sample area (or pk ht)}}{\text{Int. std. area (or pk ht)}} \times \text{Conc. of std.}$$

5.3.3 External standard calculations are used when internal standard calculations are not practical; i.e., environmental samples that have peaks of similar retention times to those internal standards typically used.

Calculation:

$$\text{Sample conc.} = \frac{\text{Sample area (or pk ht)}}{\text{Std. area (or pk ht)}} \times \text{Conc. of std.}$$

5.3.4 All gas chr matograms shall have the following information recorded on the hard copies:

a) The date and initials of the analyst.
b) The type of the analysis.
c) Indentification for all peaks, where possible.
d) Standard concentration for comparison.
e) Name of column packing and column identification.
f) GC model used in analysis.
g) Calculations and final results.

5.4 Validation

Raw data is transcribed into bound workbooks by the analyst. Analysts initial sign these additions indicating that they checked the entries to prevent transcription errors. The data is then transcribed from the analyst's note book to the daily test parameter worksheet. He/she initials signs and dates the worksheet and passes it on to his/her supervisor for review.

The Quality Assurance Director reviews data periodically from all departments. The QA Director communicates with the Shift Supervisors and the Vice President about any discrepancies that are found.

After management review and final approval, sample work sheets are sent on to the computer department for data entry of the results. Completed reports are sent back to the Vice President for final review before they are issued to the clients and/or governmental agencies.

6. Quality Control

6.1 Limited chemistry - standard curves

6.1.1 A minimum of one reagent blank and 5 standards will be used to generate a curve.

6.1.2 Absorbance or transmittance values are based on the average of 3 readings for each standard.

6.1.3 A new curve shall be prepared quarterly, or when a new reagent is prepared, whichever is more frequent.

6.1.4 All data used in preparing the curve shall be indicated on the hard copy of the curve.

6.1.5 The curve shall be verified on a daily basis, or whenever analysis is performed.

6.2 Calibration curve verification - limited chemistry

6.2.1 Record of verification containing date and results of verification and the name of the analyst shall be maintained in chart form.

6.2.2 An EMSL QC check sample is run for curve verification after the curve is prepared. Verification shall be considered satisfactory if, and only if, the result is within 10% of the theoretical value from the riginal curve.

6.2.3 If 20 or more samples are analyzed per day, the working standard curve shall be verified by running an additional standard at or near the MCL or at the concentration normally encountered in such analyses. The frequency of such analyses shall be one verification analysis per each set of 20 samples. Such checks shall be determined as satisfactory only if the results are within 10% of the theoretical value according to the original curve.

6.3 Atomic spectroscopy - standard curves

6.3.1 A minimum of one reagent blank and 4 standards shall be used to generate a standard curve.

6.3.2 A new calibration curve shall be prepared with <u>every</u> analytical run.

6.4 Calibration curve verification - atomic spectroscopy

6.4.1 Reagent blanks are included in each sample run at the beginning, middle and at the end of the run to monitor for sample cup contamination.

6.4.2 EPA known control sampl s (EMSL) are included in <u>every</u> run as a QC check.

6.4.3 Duplicates are analyzed at a 10% sample frequency.

6.4.4 Spikes are analyzed at a 10% sample frequency for direct aspiration, using the metal of interest.

6.4.5 For GFAA runs, every sample is spiked at 1/2 the value of the highest standard, a value equal to or less than the MCL for each element.

6.4.6 Data is recorded in a permanently bound log-book and graphed on control charts. Control limits are +/- 2 standard deviations from the mean value.

6.5 Gas chromatography - standard curves

6.5.1 A minimum of one reagent blank and 3 calibration levels shall be used to generate a standard curve.

6.5.2 A new calibration curve shall be prepared each time a new standard mix is opened, a new GC column is installed or instrumental conditions are changed in any way.

6.5.3 A calibration curve shall be verified on a daily basis by running one concentration level. If values obtained are within +/- 10% of the actual values, data collection may begin. If values are outside the 10% range, the calibration curve shall be rerun.

6.6 Calibration curve verification - gas chromatography

6.6.1 Solvent and method blanks are included in each sample run at 10% sample frequency. Further, These are also included in the middle of the sample run.

6.6.2 Standard mixes are run after every 10 samples, t gether with the solvent and method blanks.

6.6.3 US EPA EMSL QC check samples are tested at a 10% sample frequency with all data recorded in a bound log-book.

6.6.4 Data is graphed on control charts with control limits set at +/- 2 standard deviations from the mean value.

6.7 GC/MS - standard Curves

6.7.1 A minimum of one method blank and five (5) calibration levels shall be used to generate a standard curve.

6.7.2 A new 5-point calibration curve shall be prepared whenever the calibration check standard produces a non-linear response.

6.7.3 A 3 level standard curve and blank (and blank) is run daily. If btained values are +/- 10% of the actual values in the calibration curve, data collecti n may begin.

6.7.4 Internal standards are used for both the volatile and BNA methods as an aid to quantitation, as follow:

Volatiles	BNA
Bromochloromethane	Acenaphthene-d10
1,4-Dichlorobutane	Chrysene-d12
2-Bromo-1-chloropropane	1,4-Dichlorobenzene-d4
	Naphthalene-d8
	Perylene-d12
	Phenanthrene-d10

6.8 Calibration curve verification

6.8.1 Solvent and method blanks are included in each sample run at a 10% sample frequency.

6.8.2 US EPA EMSL QC check samples are tested at a 5% frequency. If data for a specific parameter is unacceptable (recoveries outside allowable range), then that parameter must be rechecked using a QC check sample containing only that parameter.

6.8.3 Spikes will be analyzed at a 5% sample frequency.

6.8.4 Percent recoveries and standard deviations shall be calculated and limits for acceptable ranges developed and updated after every 5 samples spiked. Control limits are developed equal to +/- 2 standard deviati ns from the mean value.

6.9 Accuracy and precision - general requirements

6.9.1 Spiked sample analyses shall be conducted wherever possible to verify accuracy of methods for the applicable parameters in the Limited Chemistry and Atomic Spectroscopy categories. Such verifications shall be performed at one of the following frequencies:

a) If 20 or more samples of any one parameter are analyzed per month, the precision of the analysis shall be verified on at least 5% of the samples analyzed. The result, the date of verification, the method of verification, and the analyst performing the verification shall be documented.

b) If less than 20 samples of any one parameter are analyzed per month, the precision of the analysis shall be verified monthly. The result, the date of verificati n, the method of verification, and the analyst performing the verification shall be documented.

6.9.2 Replicate sample analyses shall be conducted wherever possible to verify the precision of methods for the applicable parameters in the Limited Chemistry and Atomic Spectroscopy categories. Such verifications shall be performed at one of the following frequencies:

a) If 20 or more samples of any one parameter are analyzed per month, the precision of the analysis shall be verified on at least 5% of the samples analyzed. The result, the date of verification, the method of verification, and the analyst performing the verification shall be documented.

b) If less than 20 samples of any one parameter are analyzed per month, the precision of the analysis shall be verifi d monthly. The result, the date of verification, the method of verification, and the analyst performing the verification shall be documented.

6.9.3 Standard deviations shall be calculated and documented for all applicable measurements conducted in the Limited Chemistry and Atomic Absorption categories. Such calculations and documentation shall be performed in accordance with the following criteria and procedures:

a) Standard deviations shall be calculated for control samples which have been prepared at the MCL for the appropriate drinking water parameters, or at the concentration level normally encountered in the analysis for all other parameters.

b) A control sample shall be analyzed once the standard curve has been prepared or verified.

c) The standard deviation shall be calculated after 20 such determinations, using one control sample per run.

d) Standard deviations shall be calculated by computer software for all test parameters.

e) The theoretical value, mean value, and the range of acceptable values derived from two standard deviations shall be recorded. Control charts shall be generated by computer, using this data.

f) Standard deviations shall be documented in either tabular form or on control charts.

6.10 Accuracy monitoring

6.10.1 Accuracy is a measure of how well an experimental result c mpares with a true value. Accuracy shall be measured in terms f the percent recovery of known amounts of pure r ag nts (spikes) that are added to

either real samples or DI water.

$$\% \text{ Recovery} = \frac{CT - CS(a)}{CSP} \times 100$$

where:

CT = total concentration of spiked sample.
CS(a) = average concentration in sample before spike addn.
CSP = theoretical conc. of spike added.

After 20 percent-recovery calculations are made, the mean percent recovery and standard deviation are calculated.

6.10.2 X quality control charts shall be prepared to monitor accuracy. The spread of percent recovery around the mean percent is calculated as the absolute value, both positive and negative deviations recorded. This will produce upper and lower warning limits as well as upper and lower control limits.

Daily recovery values are then plotted on the Accuracy Control Chart as a function of time (date). Accuracy control and warning levels are recalculated upon generation of a new control chart.

6.11 Precision Monitoring

6.11.1 Precision is a measure of repeatability of a given method. Precision shall be monitored by means of control samples, duplicates and standards.

After 20 determinations have been completed, the standard deviation and mean value shall be calculated, as follows:

$$\text{Mean value} = \overline{X} = \sum_{i=1}^{n} X_i / n$$

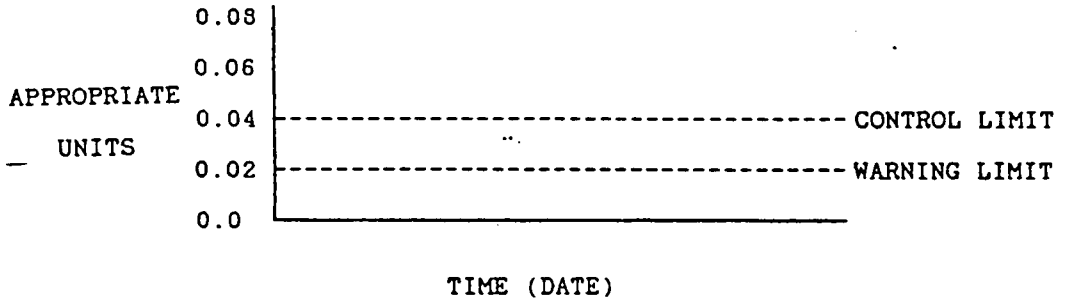
$$\text{Standard deviation} = S = \sqrt{\frac{\sum_{n=1}^{n} X_i^2 - \left(\frac{1}{n}\right)\left(\sum_{n=1}^{n} X_i\right)}{n-1}}$$

or simplified:

$$\text{Standard deviation} = S = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n-1}}$$

6.11.2 Shewhart Quality Control Charts shall be prepared to monitor precision. The control charts are based on normal distribution of precision values. The charts

will start fr m a "zer deviation" baseline and will c ntain a warning limit and a control limit. The value corresponding to one standard deviation shall be used to establish the warning limit. The value corresponding to two standard deviations shall be used to establish the control limit.



Once the charts are prepared, daily control, duplicate or standard values are plotted as a function of time (date) on the x-axis. Precision control and warning limits are recalculated upon generation of a new control chart.

6.11.3 Precision monitoring of duplicates
Precision shall be measured as the absolute range of two duplicate sample results, as follows:

Precision (for single determination) = R = R1 - R2

After 20 determinations have been made, the mean precision and standard deviation are calculated.

Mean Precision $= \overline{R} = \sum_{n=1}^{n} R_i / n$

Standard Deviation $= S = \sqrt{\Sigma R^2 / 2n}$

where:
R = difference between duplicate results or ranges.
n = number of samples run in duplicate.

NOTE: S, when calculated in this manner, is the standard deviation associated with a single determination.

6.11.4 R quality control charts shall be prepared to monitor precision. The value corresponding to 2.456 R (th 95% limit), shall be used as the warning limit. The value corresponding to 3.27 R (the 99% limit), shall

be used as the control limit.

Once charts have been prepared, daily duplicates shall be plotted as a function of time (date) on the x-axis.

Duplicate data may be interpreted further by means of the following table:

Difference	%
Less then R	57.5
Between R and 1.5R	19.4
Between 1.5R and 2.0R	12.1
Between 2.0R and 2.5R	6.4
Greater than 2.5R	4.6

7. Preventive Maintenance

7.1 Detailed descriptions of the preventive maintenance schedules and procedures may be found in the QC, Incorporated SOP and the individual instrument operations manuals.

7.2 Critical spare parts are kept in inventory. Backup lamps are maintained for each metal analyzed by atomic absorption, together with spare graphite rings, tubes and platforms, and compressed gas cylinders. In general, the policy for stocking spares is to recognize the service volume, critical nature of the analysis, and the general availability of the item.

7.3 Below, for example, is a list for GC/MS maintenance:

a) Daily - change injector septum of GC.

b) Monthly - check air filter in card cage. Replace if necessary.

c) Quarterly - change oil in vacuum and turbomolecular pumps.

d) Semiannually - change air filter in disc drive.

e) Irregularly - clean MS source and quadrupoles.
- clean jet separator.

f) Spare parts in stock
- all filters and oils mentioned above.
- complete ion source.
- electron multiplier.
- glass jet separator.
- various fuses.
- extra filament assemblies.

7.4 A bound log book shall be kept for all maintenance and repairs made on all equipment. Each instrument has its own maintenance record log book.

8. Employee Training Program

8.1 All new analysts undergo a rigorous formal orientation/training program to familiarize themselves with the laboratory and the test procedures with which they will be working.

8.2 During the initial orientation phase, each new analyst is given a thorough tour of the laboratory facility. He/she is given an introduction to the safety equipment, their use and location, chemical reagents, glassware, and commonly used equipment such as the balances, pH meters, etc.

8.3 After this initial orientation phase has been completed, detailed instruction and discussion on the use of this equipment, glassware and reagent handling is conducted by the Training Supervisor. The Quality Assurance Director f rmally reviews the Quality Assurance manual and discusses the Quality Assurance program in detail.

8.4 The procedures and methods for which the analyst will be responsible will be reviewed and explained in detail. This will be followed by demonstrations of the various analyses.

8.5 The progress of new analysts is monitored carefully by the Training and Shift Supervisors. This close monitoring continues until each new analyst demonstrates proficiency in their assigned analytical techniques.

8.6 Periodic laboratory method and technique reviews are conducted by the Training and Shift Supervisors to ensure continued proficiency in the various analytical methodologies.

9. Monitoring the Quality Assurance Program

9.1 The Quality Assurance Program is carefully monitored to ensure compliance with corporate and regulatory agency policies.

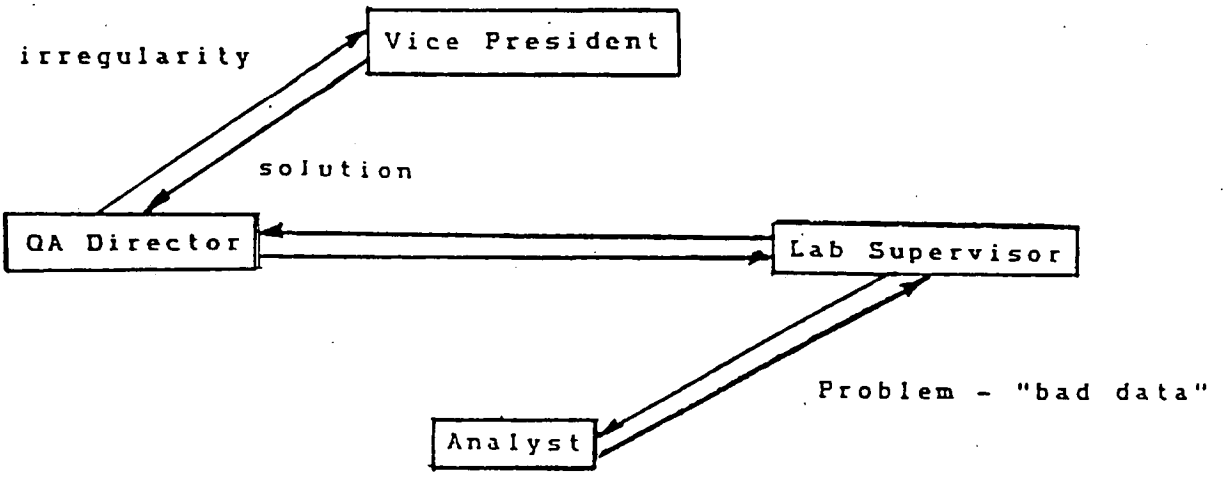
9.2 All quality assurance data is collected, processed and reviewed on a weekly basis.

9.3 The Quality Assurance Director shall conduct a full scale internal compliance audit of the program twice yearly, with more frequent audits conducted of the various departments on an individual basis. Results of all internal audits are reported in writing to the Vice President and to the appropriate department heads.

9.4 QC, Incorporated utilizes a "blind sample" program as a means of further evaluating the analytical system. Samples f known concentration are submitted as regular samples; i.e., they are logged in and are assigned unique laboratory identification numbers in the usual manner. The results of these blind samples are reviewed with the appropriate analyst(s) should any corrective action be required. These results are also plotted on control charts with the regular quality control data.

9.5 Irregularities in the analytical system are communicated by the Quality Assurance Director to the Vice President in writing with a copy maintained in the Q A files.

Below is a diagram of line reporting responsibility for an irregularity in the analytical system.



10. Corrective Action - contingency plan

10.1 Unacceptable instrumental or wet chemical data and/or internal control checks require notification of the Quality Assurance Director who shall immediately initiate an investigation as to the possible cause of the problem.

10.2 The first objective of this investigation is to determine if the discrepancy has affected client sample results.

10.3 If there is ANY question about the accuracy of the sample results, the testing is discontinued and questionable data discarded. If any data has been discarded, the samples will be scheduled for resampling and retesting. If any data previously reported is in question, the client and appr - priate regulatory agencies (if required) shall be notified.

10.4 The second objective of the investigation is to specifically determine what actually occurred, how to correct it, and to determine how to prevent the problem(s) in the future. The Quality Assurance Director shall report the incident to the Vice President. Once the problem has been corrected, and the analytical system is in control, sample testing may resume, but only with written approval from the Vice President.

10.5 The Quality Assurance Director shall prepare a written report detailing the event. The report will include as much information as is available on the incident, the date and time of the occurrence and the results of the investigation that followed. Further, the report will include all measures taken to get the analytical system back in control, as well as any new approaches to prevent the problem from recurring in the future. This report shall be forwarded to the Vice President and President for their review.

Appendix A
Figure 1
QC Sample Report

QC Inc

PICK SHEET - 1

CUSTOMER

CUST NO
ROUTE NO.
$ COLLECTION
P O NO

PHONE
ROUTE
SAMPLED BY _____

BOX TEMP. _____ °F

TEMP CONTROL _____ °F

	COLLECTED	RECEIVED	TESTED	COMPLETED
DATE				
TIME				
BY				
TEMP.	°F	°F	°F	APP

COMMENTS.

AUTHORIZED BY _____

QC, Incorporated
1205 Industrial Highway
P.O. Box 514
Southampton, PA 18966

Appendix A, Figure 2
QC Sampler Instructions

Preservation Requirements

If a customer is requesting a group of analyses, special sampling containers must be used from each group (unpreserved, acid, caustic, etc.). Please review the parameters requested and select the appropriate sample containers.

Example: A customer is requesting an analysis for pH, cadmium, and ammonia. Therefore, an unpreserved container and an acid container must be utilized.

Unpreserved (plastic)	Sulfuric acid pH < 2	Nitric acid pH < 2	Caustic pH > 12	Special Requirements
Acidity	COD	Aluminum	Cyanide	Unpreserved
Alkalinity	Kjeldahl nitrogen	Antimony	(add ascorbic	PCBs (2xqt amber glass)
BOD	Nitrate	Arsenic	acid 0.6g if	Pesticides (2xqt amber glass)
Bromide	Oil & grease	Barium	residual chlorine	Herbicides (2xqt amber glass)
Chloride	(separate container	Cadmium	is present)	
Chlorine	1/2 gal glass)	Calcium		
Chromium (hex)	Phenols	Chromium		40 ml Vial (preserved) - 2@
Color	TOC	Cobalt		THMs
Conductivity	Ammonia	Copper		TCE/PCE
Detergents (MBAS)	Total phosphorus	Iron		EPA 601/602
DO		Lead		VO - GC/MS
Fluoride		Magnesium		A280
Hardness		Manganese		
Nitrite		Mercury		
pH		Nickel		Preserved pH<2 - H_2SO_4
Phosphate - ortho		Potassium		Petroleum hydrocarbons
Residue - suspended		Selenium		(1/2 gal glass)
Residue - total		Silver		
Silica		Sodium		
Sulfate		Thallium		Preserved - $Zn(OAc)_2$ + NaOH
Turbidity		Tin		Sulfides to pH 9
		Zinc		

Note: All sample containers shall be cooled to 4 C and stored in ice while in transit to laboratory.

Note: Samples for tests in the same column may be removed from the same container except where noted

Appendix A
Figur 3
QC Sample Tag

QC Inc
1205 INDUSTRIAL HIGHWAY
P.O. BOX 514
SOUTHAMPTON, PA 18966
(215) 355-3900

LAB I.D. NUMBER

CLIENT: #

SAMPLE IDENTIFICATION:

SAMPLED BY: DATE: TIME:

ANALYSIS:

PRESERVATION: REFRIG. YES ☐ NO ☐

CLIENT:

CUSTODIAN: DATE: TIME:

DESCRIPTION:

SAMPLE I.D.	REL. BY.	REC'D. BY	TIME	DATE	REASON

Appendix A
Figure 4

QC Inc

1205 INDUSTRIAL HIGHWAY • P.O. BOX 514 • SOUTHAMPTON, PA 18966-0514 • (215) 355-3900

DIRECTIONS FOR TAKING A WATER SAMPLE

A water sample for bacteriological analysis must be taken in a laboratory sterilized bottle. Water samples for realty transactions, F H A or V A certifications, U S Public Health or E P A approval, and food and beverage service to the public must be taken by laboratory personnel or a health officer. Samples of streams, ponds sewage or industrials wastes also require special procedures and equipment, as well as professional observations.

Water to be tested for potability must be collected in a sterilized container. QC Inc. will supply you with the necessary containers. Sampling containers can be picked up at the main office at 1205 Industrial Highway or arrangements can be made to mail the containers to you.

Take the sample from a faucet that is in regular use, not from a hose or a seldom-used pipe. The tap must be free of aerators, strainers, hose attachments and other water purification devices. Flame the rim of the faucet with a torch or cigarette lighter for 15 seconds to destroy all external bacteria. Let the water run for five minutes, or several hours if there has been no recent use of the system. If the faucet is constructed of plastic, the sampler should eliminate the flame treatment step and only flush water system. A new or repaired well should be disinfected and flushed out before sampling.

Remove the cap from the bottle without touching the glass surfaces at the neck. Fill leaving a half-inch air space at the top. Replace the cap tightly and place the bottle in its jacket. Write identification on the jacket label or on the tag. Keep the sample refrigerated and deliver to the laboratory within 30 hours.

If a fecal strep analysis is requested it must be delivered to the laboratory within 6 hours. If the time constraints are not met, the sample will be rejected and a resample requested.

All laboratory sterilized bottles contain thiosulfate, which neutralizes any residual chlorine that may have been in the water supply. If a system has been hand chlorinated recently, it MUST be pumped out enough to eliminate all trace of chlorine otherwise the analysis would be meaningless. An ortho-tolidiné or DPD test should be made to check for residual chlorine.

If a supply is regularly treated by a mechanical chlorinator, there should be a residual chlorine reading of 0.3 to 0.6 parts per million at the time of taking the sample. The thiosulfate in the bottle will neutralize this chlorine upon contact, and bacteriological analysis will show the condition of the water at the time of sampling. If treated by an iodinator, there should be an iodine residual of 0.4 to 0.5. A special iodine test kit is needed to check for this condition.

A laboratory sterilized bottle contains enough water for all bacteriological analyses. A separate bottle must be provided if information on chemical qualities is desired, or if pollution is suspected. That bottle should be clean glass or plastic, not previously used as a container. It need not be sterile, but should be rinsed thoroughly with the water being sampled, and must never have been in contact with soaps or detergents.

App ndix A
Figure 4
(continued)

QC Inc
1205 INDUSTRIAL HIGHWAY • P.O. BOX 514 • SOUTHAMPTON, PA 18966-0514 • (215) 355-3900

INFORMATION TO ACCOMPANY A WATER SAMPLE

Write identification on the jacket label or on the tag. Fold this sheet and place it inside the jacket. See other side for directions in taking a sample, for volume of water required and for testing supplies that were chlorinated.

SEND REPORT TO: Name _____

Address _____

_____

Phone _____

WATER SAMPLE OF: Name _____

SEND COPIES TO: _____

Water sample taken by _____ Date taken _____

Taken at: source ____ pump discharge ____ pressure tank ____ faucet _____

Supply: drilled well ____ dug well ____ spring ____ pond ____ stream _____

If a drilled well: year drilled ____ feet of casing ____ type of pump _____

If a dug well: depth ____ type of pump ____ type of covering _____

Recent repairs or construction _____

Any: sediment ____ staining ____ discoloration after rain ____ taste, odor _____

Chemical treatment of sampled water: softener ____ neutralizer ____ filter _____

Purifying treatment of sampled water: chlorinator ____ iodinator ____ ultra-violet sterilizer _____

Treatment after point where sample was taken _____

Was the supply hand-chlorinated recently? ____ If so, was it thoroughly pumped out and tested to make certain there was no residual chlorine? _____

Type of analysis desired: bacteriological ____ domestic chemical _____

Other _____

(In the absence of specific instructions, the laboratory will provide analyses and recommendations relative to the background information provided above.)

QC Inc

CHAIN OF CUSTODY RECORD

Customer _____ # _____

Address _____

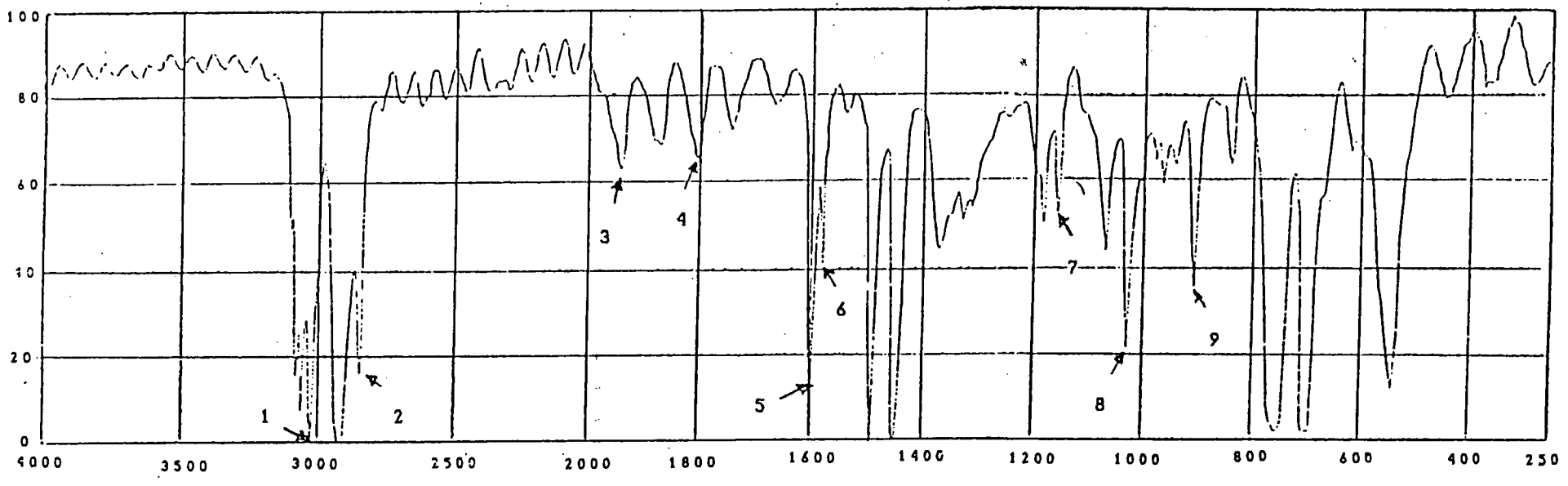
_____ State _____ Zip _____

PSID # _____

LAB ID#	# OF CONTAINERS	DESCRIPTION OF SAMPLES
Appendix A Figure 5		Page 64

PERSON ASSUMING RESPONSIBILITY FOR SAMPLE	TIME	DATE

	SAMPLE NUMBER	RELINQUISHED BY:	RECEIVED BY:	TIME	DATE	REASON FOR CHANGE OF CUSTODY



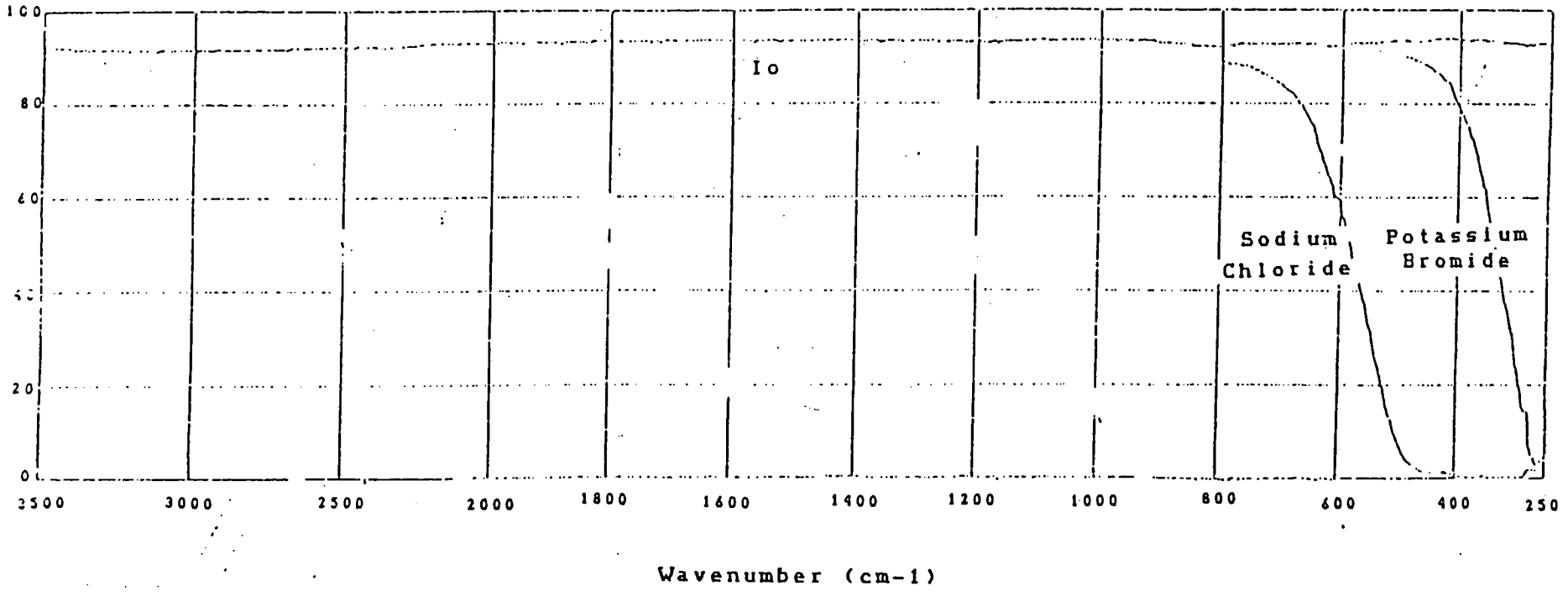
Wavenumber (cm-1)

	1	2	3	4	5	6	7	8	9
Wavenumber (cm-1)	3027.1	2850.7	1944.0	1801.6	1601.4	1583.1	1154.3	1028.0	906.7

Appendix B
Figure 1

Polystyrene Spectrum

Appendix B
Figure 2



Stray Light Runs and Io Line

Appendix B

Station Safety Requirements

for

Contractor Operations

STATION SAFETY REQUIREMENTS FOR CONTRACTOR OPERATIONS

1. Policy. Private contractors performing construction work, maintenance and repair, and utilities services on board the Station shall comply with all applicable safety regulations, OSHA standards, and the regulations contained herein. Additional safety requirements will be outlined by the Contracting Officer during the preconstruction conference.

a. The Occupational Safety and Health Act of 1970 (OSHA), Public Law 91-596, requires contractors to comply with safety standards promulgated by the Occupational Safety and Health (OSH) Administration. The OSH Administration has the authority and responsibility for enforcing the safety standards. Personnel involved in the administration, management or inspection of contracts do not have any authority or responsibility for enforcing contractor compliance with OSHA standards.

b. Under authority of the OSH Act, OSHA officials (commonly referred to as OSHA compliance officers), whether they be Federal (i.e., Department of Labor) or State, inspect and conduct investigations at contractor workplaces for the purpose of enforcing compliance with OSHA standards. Subject to allowing access by the Station Commanding Officer, these officials may visit without prior notice, work sites where the Navy has contract administration responsibility for safe working conditions. Such visits may be the result of a random selection of locations, in direct response to a complaint of a hazardous condition by a worker, or a serious accident.

c. This chapter will be issued to contractors at time of contract award.

2. Contracts and Federally-Aided Programs and Projects. In accordance with the provisions of Public Law 91-596 and the rules set by the Secretary of Labor in 29 CFR, employers are responsible for the safety of their employees. Therefore, in accordance with those rules, each contractor, grantee, or other entity conducting programs or projects which are funded in whole or in part by the Navy, bears the responsibility to provide safe and healthful places and conditions of employment for its employees as a condition under the terms of the contract or agreement. Under the standard safety clauses in each Federal contract or agreement, the Navy shall take action to ensure contractor compliance with those clauses whenever non-compliance is recognized by the contracting officer or his representative. The following paragraphs outline procedures to be followed in providing the control necessary to ensure the safe prosecution of contracts or Federally funded programs.

3. Stop Orders for Imminent Danger. Safety Manager, Contracting Officer or their representatives, shall issue a "Stop Order" when in their opinion a condition exists, during the term of the contract, which could reasonably be expected to cause death, serious physical harm, or substantial property damage immediately, or before such danger can be eliminated through corrective procedures. When such an order is issued, the contracting officer shall be notified by the most expedient means of such issuance. Examples of conditions which may warrant stop order action are (but are not limited to):

a. Personnel working in hazardous atmospheres without proper respiratory protection.

b. Personnel working in deep trenches, the sides of which are crumbling and unprotected by shoring or other means.

c. Work being conducted over an unprotected passageway, walkway, or workplace.

d. Unauthorized welding or cutting or working on unpurged containers (hot work permits must be approved by the Fire Department).

e. Personnel working under suspended loads.

f. Improper use or safeguarding of explosives.

g. Improper guarding of excavations.

h. Personnel working over or near water without USCG approved life jacket or buoyant work vests.

4. Additional Detail for Contract Administration

a. Specifications developed for contract projects shall be reviewed by the office of prime responsibility to ensure that specifications are not in conflict with applicable safety and occupational health standards published in 29 CFR and that specifications are included as necessary to provide protection as required by this Article.

b. Contracting officers shall ensure, by requiring certification or by other mechanism, that the review required above has been made prior to taking solicitation action.

c. Prior to the commencement of work the Contracting Officer shall review the contractor's written safety and occupational health plan to ensure that it is adequate. If, in the opinion of the Contracting Officer or the Station safety and health manager, a meeting with the contractor is necessary, the Contracting Officer, his field representative, the safety and health manager, and the contractor shall meet to review the contractor's written safety and occupational health plan. They shall modify and add to the plan all necessary details to ensure the safe prosecution of the work and to ensure that the rules are understood by all parties concerned.

d. Accident reports and statistical data on contractor accidents will be made available to properly identified OSHA (Federal or state) representatives upon request. However, accident report requirements levied on the contractor, as a provision of the contract, in no way change the reporting requirements of OSHA.

e. When work will impinge on the living or working conditions of Station employees, military personnel, their dependents, or the public, the contracting officer shall so advise the commanding officer and shall assist as requested in ensuring that affected personnel are aware of the project,

potential unsafe conditions, and the personnel to contact should they feel potentially dangerous conditions exist during the course of the contract.

5. Duties and Responsibilities

a. Commanding Officer, Naval Weapons Station Earle, is responsible for the safety and health of Station personnel under all conditions and circumstances and shall take timely action to safeguard all personnel and property under his command.

b. Contracting officers and their representatives shall take action to assure compliance with fire, safety and occupational health contract specifications.

c. Safety and health management personnel shall advise the command with regard to contract safety and occupational health matters and advise and assist contracting officers and their representatives in obtaining compliance with safety and occupational health specifications.

6. Occupational Safety and Health Administration (OSHA) Responsibilities. The Department of Labor has the responsibility for enforcing standards promulgated in 29 CFR. OSHA compliance personnel have a legal right to enter upon any Navy facility or vessel to observe contractor operations, consistent with security regulations. If considered necessary to assist the Navy in ensuring full contractor compliance with the safety and occupational health specifications of a contract, the Commanding Officer may invite OSHA representatives to inspect the contractor's worksite.

7. OSHA Compliance. Permission may be granted by the Commanding Officer or his designated representative for OSHA officials to enter the Station for the sole purpose of conducting safety and health inspections involving contractor workplaces. As a matter of interim guidance, a "contractor workplace" shall be considered to be any place where work is currently being, recently has been, or will be performed by contractor employees under a Department of Defense contract, including a reasonable access route to and from the workplace. The term "contractor workplace" does not include any area, structure, machine, apparatus, device equipment, or material therein, with which a contractor is not required or reasonably expected to have contact, nor does it include any work environment with respect to which OSHACT jurisdiction has been preempted.

8. OSHA Inspection Procedures

a. Upon presenting appropriate credentials and security clearance, the OSHA official, acting under the inspections and investigations' provisions of 29 CFR Section 657, will be provided with an escort to the contractor workplace, as defined herein, for inspection purposes and to conduct investigation of contractor workplaces based upon specific complaints from, or accidents involving contractor employees.

b. If photographs are required in support of an OSHA inspection, they shall be taken by a Station official photographer and will be tentatively classified CONFIDENTIAL. Photographs will not be delivered to OSHA officials until all film, negatives, and photographs have been sent to Commander, Naval

Sea Systems Command (SEA-00D2) and fully screened and censored, as appropriate, in the interest of national security. Any other documented data or design information, e.g., recordings of noise sound level profiles, etc., shall be forwarded to NAVSEA for screening as above prior to release.

c. Public Law 91-596 prohibits giving advance notice to employers of pending OSHA inspections under penalty of a fine up to $1,000 and/or imprisonment up to 1 year. It is therefore incumbent upon Station personnel to abide by this requirement and not notify a contractor of an impending inspection.

9. OSHA Inspection Responsibilities

a. Director, Administration/Security Department. When an OSHA official requests to visit a contractor workplace aboard this activity, the following procedure shall be followed:

(1) Upon presentation of appropriate credentials prepare a one-visit escort required pass. Security clearances will be mailed ahead of the initial visit and the clearance will be renewed annually. A hand-carried copy of a security clearance will not be accepted as proof of a security clearance status. Certification of security clearance must be on file with the cognizant DOD Regional Security Office and with the Station's Administration/Security Department. OSHA officials normally have no operational "need to know" and they should not be given access to classified information beyond what is necessary.

(2) Notify Head, Safety Department to provide an escort, and upon arrival of the escort, issue the Escort Required Pass to the OSHA visitor.

b. Director, Safety Department. When an OSHA official requests permission to visit a contractor workplace, as defined in this instruction, the following procedure shall be followed:

(1) When notified by the Administration/Security Department, provide an escort for the OSHA official for the purpose of conducting an inspection or investigation as defined herein.

(2) Notify the Commanding Officer and the Contracting Officer of the OSHA official's findings following the visit.

10. Contracts Involving Ammunition and Explosives

a. The primary mission of this activity is centered around unique military ammunition, explosives and weaponry. Therefore, special guidance is necessary. Contractors are required to comply with all applicable DOD/DON safety regulations regarding work in ammunition and explosives areas and facilities.

b. Public Works and Safety will:

(1) Provide safety clauses and technical safety data to be included in contracts for work in connection with ammunition and explosive areas and facilities.

(2) Ensure that adequate safety and fire criteria are included in the contract.

(3) Require pre-award safety surveys be conducted to determine that the contractor can meet at least the minimum requirements of applicable explosives safety regulations.

c. Contractor Responsibility. Provide a safety program to assure the safety of its employees, Station personnel and the general public and property. Designate a responsible individual as point of contact for safety matters.

d. Safety Office Responsibility

(1) Review for safety implications and specifications, including plans for modifying or changing, in any way, facilities or equipment.

(2) Inspect magazines and other explosives-related facilities prior to the commencement of work to determine that the facility is environmentally safe for welding/burning opertions, etc.

e. Waivers and Exemptions

(1) When compliance with mandatory safety requirements cannot be effected, a request for waiver or exemption will be forwarded by the Contracting Officer to the Station Safety Director.

(2) The Safety Director will evaluate the request and, if valid, forward recommendations to CNO/NAVSEA, as appropriate.

f. Use of Lasers. Every system using a laser must have prior approval of the Station Commanding Officer. Laser safety encompasses hazards to personnel, ordnance, fuel and all other material that can be irradiated by a laser. Laser safety and health standards are contained in NAVSEAINST 5101.1 (NAVSEA Laser Safety Program) and BUMEDINST 6470.14 (Laser Health Standards).

g. Use of Explosives and Explosive Devices

(1) Permission shall be obtained from the Commanding Officer before explosives are brought on the Station. Plans for the use of explosives or explosive devices shall be reviewed by the ROICC in consultation with the Station Safety Director prior to use of such explosives or explosive devices on the Station.

(2) Blasting materials or other explosives shall be stored in approved magazine storage when such materials must remain on the Station beyond regular working hours.

(3) Powder-actuated tools shall not be used in explosive facilities unless authorized by the Station Safety Director and the Ordnance Officer.

h. Portable Power Tools. Sparking portable electric tools shall not be introduced or used in magazines or in locations where exposed explosives are present.

NOTE: Reference (h) is the basic guide used for construction site safety.

11. Construction Sites

a. Walkways and Sidewalks

(1) All walkways and sidewalks bordering on or running through any construction site shall be provided with substantial guardrails or board fences. In addition, temporary footwalks beyond the curb shall be substantially constructed and provided with protection on both sides.

(2) Sidewalks and walkways shall be kept clean of excavated materials or other obstructions and no sidewalks shall be undermined unless shored to carry a live load of 125 pounds per square foot.

(3) If planks are used for a sidewalk they shall be butt ended and cleated underneath to prevent displacement. Planks shall be uniform in thickness and all exposed ends shall be beveled to prevent tripping.

(4) Raised walkways shall be provided with plank steps on strong stringers. Ramps used in place of steps shall be provided with cleats to insure safe walking.

b. Illumination. During the hours between sunset and sunrise, all sidewalks and walkways shall be adequately illuminated, and warning lights shall be placed about the property.

c. Overhead Protection. Pedestrian and vehicle traffic shall not be required or permitted to travel under loads handled by power shovels, derricks, or hoists, unless ample side barricades and overhead protection are provided.

d. Street and Road Work Projects

(1) Traffic flow must be maintained safe and with minimum of delay on Station street and roadway systems. Contractors performing any type of work on or near Station thoroughfares, or whose vehicle is disabled shall place adequate traffic warning devices (signs, flashers, barricades, etc.) on roadways at least 300 feet prior to work sites or vehicle on straightaways and 500 feet on curves (in both directions). Traffic controls and placement of traffic warning devices shall comply with Federal Standards for Uniform Traffic Control Devices for Streets and Roadways (ANSI Standard D6.1).

(2) When signs, signals, and barricades do not provide necessary protection on or adjacent to a roadway or street, flagmen or other appropriate traffic controls shall be provided.

(a) Flagmen shall be provided with and shall wear a red or orange warning garment while flagging. Warning garments worn at night shall be reflectorized material. Danger or warning signs shall be posted at all truck entrances and exits.

(3) Open trenches, manholes, overhead work on wires or trees, or other potential hazards to pedestrians or motor vehicles shall be adequately marked with warning devices and barricades.

12. Motor Vehicle Regulations

a. Motor vehicle operations on the Station must comply with New Jersey Traffic Laws (NJSA Title 39) and Station Security Regulations (WPNSTAEINST 5510.1 series).

b. Only personnel holding a valid driver's license issued by a state or government authority may operate a motor vehicle aboard this Station. Vehicles will not be allowed to enter the station without proof of registration and current insurance.

c. On entering or leaving the Station, a motor vehicle must be brought to a complete stop until the sentry directs it to proceed. At night, lights will be dimmed when approaching gates.

d. The following vehicles are classified as emergency vehicles at this Station: fire apparatus, ambulances, security (police) vehicles, and vehicles marked "ammunition" or "explosives." "Ammunition" or "explosive" vehicles in operation are placarded on all four sides, and have their head lights on and flashers in operation.

e. When approached by an emergency vehicle from any direction, a motor vehicle shall pull to the side of the road and stop until the emergency vehicle has passed.

f. A motor vehicle overtaking an emergency vehicle shall remain a safe distance behind and not pass the emergency vehicle.

g. Troops marching on the highway shall have the right of way, but may be passed at a safe clearance at no more than 5 mph.

h. No unauthorized vehicles are permitted in restricted areas of the Station.

i. Only one lane traffic is permitted on overpasses or underpasses on Normandy Road. Southbound (toward Main Base area) traffic shall, in constricted areas, yield right of way to northbound (toward Waterfront Area) traffic, except that emergency vehicles displaying their lights shall have right of way over all other vehicles.

j. All vehicles will be operated with due regard for the possibility of the sudden appearance of wildlife on the roadway.

k. Motor vehicles with catalytic converters shall not be operated within 100 feet of fuel storage areas and transfer operations, where lowlying accumulations of flammable vapors or hazardous ignition-combustible material sources are present. In addition, such vehicles will not be parked over any grassy area or unpaved surfaces which could be considered to be oil soaked.

l. All motor vehicle accidents must be reported to the Security Officer without delay.

m. Except for Station vehicles, CB radio transmission is not authorized on the Station because of the radio frequency (rf) interference of certain sensitive testing facilities and also because rf signals present potential dangerous situations when near certain buildings with rf activated explosive devices. All such equipment must be registered in accordance with WPNSTAEINST 2302.1 series and the Security Manual, WPNSTAEINST 5510.1. Any unauthorized radio transmission is cause for denying entry on the Station.

n. Smoking in vehicles is strictly prohibited while on the Station.

13. Accident/Incident Alarm

a. An Accident/Incident alert signifies that an emergency of grave significance exists. The Station signal for this condition is repeated blasts (10 or more) of the fire whistles.

b. When this signal is sounded, all personnel will take the following actions:

(1) All windows, doors, vents and air conditioners of offices and shops are to be secured.

(2) Personnel walking or working outdoors will take cover in the nearest building. (Contractor/utility supervisors will be responsible for knowing the location of an open building nearest this work site.)

(3) Vehicles are to be driven to the side of the road and parked. Occupants will remain inside. All windows, doors, air vents and air conditioners will be secured.

(4) Telephone and radio communications will be terminated leaving the telephone system and the airways clear for emergency requirements.

(5) There shall be no eating, drinking or smoking during the alert.

c. The all clear signal is two (2) blasts on the fire whistle at which time personnel may continue their normal activities.

d. Planned drills: When drills are planned in advance the Contracting Officer shall attempt to notify all contractors of the drill. For planned drills contractors may continue working but should refrain from operating motor vehicles on the station road until the all-clear signal.

14. General Industrial Safety Requirements. The following Navy safety standards must be adhered to. They are general in nature and do not include all conceivable operations and functions involved in the many Station activities. However, the lack of pertinent precautions is not to be interpreted as an indication of their non-existence or unimportance.

a. Industrial Housekeeping

(1) Areas within 50 feet of Station buildings shall not be used for storage of combustible materials. Combustible scrap and debris shall be removed at regular intervals. Containers shall be provided for collection and

separation of all refuse. Rubbish and trash shall be cleared from buildings at the end of each workday.

(2) Harmful substances, including flammable liquids, shall not be poured into sewers or drains, or on the ground. They shall be collected in steel drums or other designated covered containers and disposed of as directed by the Contracting Officer.

b. Hazardous Material - Hazardous Waste. Contractor shall be responsible for training their employees in the safe use, handling, storage, and disposal of hazardous substances. Disposal of unwanted materials shall be done in accordance with applicable regulations.

15. Safety Review of Plans. The Public Works Officer is required to submit plans for minor construction, renovation, or engineering changes to the Safety Office for review/approval prior to solicitation of any contract in order to determine if Navy or civilian personnel are likely to be exposed to any potential health hazard.