UNIVERSAL WASTE AND TRANSIT INC.

CONSTRUCTION PERMIT APPLICATION

LOCATED AT

7208 - 9th Avenue
Tampa, Florida

VOLUME 3

Waste Analysis Plan
Quality Assurance Program

UNIVERSAL WASTE & TRANSIT

WASTE ANALYSIS PLAN

FOR

STORAGE & TREATMENT FACILITY

AT

7208 - 9TH AVENUE

TAMPA, FLORIDA

General Waste Analysis

Waste Analysis Rationale

Before any waste material is accepted at the Universal Waste & Transit facility a detailed chemical and physical analysis on a representative sample of the waste must be available for review by facility personnel. At a minimum this information must be in sufficient detail so as to allow the generator to complete the attached Universal Waste & Transit Request For Disposal form. **The responsibility for obtaining this analytical information rests with the generator of the waste.**

The information requested on the UW&T Request For Disposal form is sufficient for facility personnel to determine the following:

- whether the facility is permitted to handle the waste
- if the waste is potentially amenable to solidification
- where the waste must be stored to insure compatability
- if the wastes require special handling
- whether sufficient storage space is available

If the generator does not supply the information required on the UW&T Request For Disposal form and the waste is inadvertently accepted into the facility the following steps will be taken:

- immediately contact the generator
- determine if the analytical data is available
- if it is not the waste will be rejected

  or

- samples will be obtained and analyzed by a contract laboratory at the generators cost

Any required sampling will be performed as specified within the "Sampling Techniques" section of this document.

All required analyses will be performed in accordance with the Quality Assurance Plan as appended to this document.

Frequency Of Analyses

The generator of the waste will be required to update the UW&T Request For Disposal form on the following basis:

- when the process generating the waste has changed
- when plant operations have sufficiently changed to warrant concern over changing waste characteristics
- when on-site quality control (QC) samples indicate a substantial variation between the data obtained and waste identified on the manifest
- if none of the above occur the waste shall be re-analyzed at least on an annual basis

Generator Requirements

Universal Waste & Transit will require all generators who intend to use this facility to submit at least the following:

- a completed UW&T Request For Disposal form
- a one quart (minimum) sample of any bulk waste (samples are not required for lab packs)
- all required Certification Statements as specified by the RCRA Reauthorization Act (land ban restrictions)

In lieu of the analytical data required on the UW&T Request For Disposal form the generator may submit a Material Safety Data Sheet(s) or analytical data obtained on a representative sample of the waste. The analytical data must be obtained from a DER or HRS certified laboratory. The laboratory must employ approved sampling and analytical techniques (as specified in 40 CFR Part 261, Appendix I. II & III).

On-Site Waste Inspection

When a waste shipment arrives at the UW&T facility the following steps are taken to insure its acceptability at the site:

1. the manifest is reviewed for completeness (Recordkeeping & Reporting section of this document)

2. the shipment is then visibly inspected for the following:
   - number & type of containers
   - properly labeled and marked
   - irregularities (leaks; damaged drums etc)
   - any restricted wastes present

3. After the shipment passes the initial visual inspection it is identified as being ready for quality control (QC) check samples. The subsequent steps and procedures are identified in the section entitled "Waste Sampling & Analysis".

Waste Sampling & Analysis

All shipments of waste into the UW&T facility will have some portion of the shipment sampled and analyzed to ensure its consistency with the accompanying manifest or shipping document.

The intent of the quality control program is not to completely reanalyze the waste but to determine, through indicator parameters, its conformance with the manifest and the UW&T Request For Disposal form.

The parameters employed on the QC samples will be:

- Flash Point (closed cup)
- pH
- Oxidation/Reduction Potential
- Color
- Total Solids
- Density

These parameters allow us the ability to ascertain a great deal of information in a short time period. Each parameter is discussed below.

Flash Point:
This determination will identify flammable & combustible materials so that appropriate storage and handling can be accomodated.

pH:
The pH value of the waste will allow us to identify the appropriate storage area for that material so that no comingling of incompatible wastes will result. It is also a good indicator parameter for assessing container compatability.

Oxidation/Reduction Potential:
The ORP test will determine the oxidizing or reducing capacity of the waste. This will help identify any reactive wastes which may arrive at the site.

Color:
The color of the waste is the easiest parameter to assess. This parameter allows us to quickly determine if the waste is consistent with the original sample and waste data submission.

Total Solids:
The solids content of the waste is a simple method to initially screen those incoming containers to determine their potential for solidification.

Density:
As with the color test, the density of a liquid waste should not change dramatically between the time of initial data submission and receipt of the waste at the facility. This parameter allows us the ability to rapidly screen incoming wastes.

All analyses will be performed in accordance with the methods specified in "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods" (SW-846). All specific methodology is included within the Quality Assurance Program which is appended to this plan.

The sampling procedure employed for the QC samples is dependent upon two criteria. Those criteria are:

- containment vessel (drum, tanker, lagoon etc)
- type of waste (liquid, viscous, fly ash etc)

A list of recommended samplers is included as Table 1; recommended sampling points as Table 2 and recommended number of samples to be collected as Table 3.

A list of representative sampling methods as specified in 40 CFR is attached as Table 4. This table will be employed when determining what sampling method and equipment to employ.

Universal Waste & Transit anticipates that most, if not all, of the waste entering the facility will be in 55 gallon drums or smaller containers. UW&T will employ the method of random numbers for the selection of containers to be sampled. The number of drums to be sampled is based upon the American Society for Testing and Materials (ASTM) cube root equation for barrels. A random number generator will be available at the facility.

All personnel involved in the sampling of hazardous waste will be outfitted in the proper protective clothing as specified in the "General" and "Training Program" portions of this application.

Internal Quality Control

Universal Waste & Transit will purchase commercially prepared analytical standards for the pH , ORP, and specific gravity procedures. An ASTM certified thermometer will be employed for the flash point determination. No standards are available for the solids and color determination.

USEPA quality control standards will be used for internal accuracy and precision assessments.

Any detailed chemical analyses will be performed on a contract basis with certified analytical laboratories such as Pace Laboratories in Tampa.

Universal Waste & Transit will develop an acceptable sample label, sample seal and chain-of-custody form prior to submission of the Operating Permit Application.

TABLE 1 SAMPLERS RECOMMENDED FOR VARIOUS TYPES OF WASTE

Waste type	Recommended sampler	Limitations
Liquids, sludges, and slurries in drums, vacuum trucks, barrels, and similar containers	Coliwasa	Not for containers 1.5 m(5 ft) deep.
	a) Plastic	Not for wastes containing ketones, nitrobenzene, dimethylformamide, mesityl oxide, or tetrahydrofuran[3,4].
	b) Glass	Not for wastes containing hydrofluoric acid and concentrated alkali solutions.
Liquids and sludges in ponds, pits, or lagoons	Pond	Cannot be used to collect samples beyond 3.5 m(11.5 ft). Dip and retrieve sampler slowly to avoid bending the tubular aluminum handle.
Powdered or granular solids in bags, drums, barrels, and similar containers	a) Grain sampler	Limited application for sampling moist and sticky solids with a diameter 0.6 cm(¼ in.).
	b) Sampling trier	May incur difficulty in retaining core sample of very dry granular materials during sampling.
Dry wastes in shallow containers and surface soil	Trowel or scoop	Not applicable to sampling deeper than 8 cm(3 in.). Difficult to obtain reproducible mass of samples.
Waste piles	Waste pile sampler	Not applicable to sampling solid wastes with dimensions greater than half the diameter of the sampling tube.
Soil deeper than 8 cm(3 in.)	a) Soil auger	Does not collect undisturbed core sample.
	b) Veihmeyer sampler	Difficult to use on stony, rocky, or very wet soil.
Wastes in storage tanks	Weighted bottle sampler	May be difficult to use on very viscous liquids.

TABLE 2 SAMPLING POINTS RECOMMENDED FOR MOST WASTE CONTAINERS

Container type	Sampling point
Drum, bung on one end	Withdraw sample through the bung opening.
Drum, bung on side	Lay drum on side with bung up. Withdraw sample through the bung opening.
Barrel, fiberdrum, buckets, sacks, bags	Withdraw samples through the top of barrels, fiberdrums, buckets, and similar containers. Withdraw samples through fill openings of bags and sacks. Withdraw samples through the center of the containers and to different points diagonally opposite the point of entry.
Vacuum truck and similar containers	Withdraw sample through open hatch. Sample all other hatches.
Pond, pit, lagoons	Divide surface area into an imaginary grid.[a] Take three samples, if possible: one sample near the surface, one sample at mid-depth or at center, and one sample at the bottom. Repeat the sampling at each grid over the entire pond or site.
Waste pile	Withdraw samples through at least three different points near the top of pile to points diagonally opposite the point of entry.
Storage tank	Sample from the top through the sampling hole.
Soil	Divide the surface area into an imaginary grid.[a] Sample each grid.

[a]The number of grid is determined by the desired number of samples to be collected, which when combined should give a representative sample of the wastes.

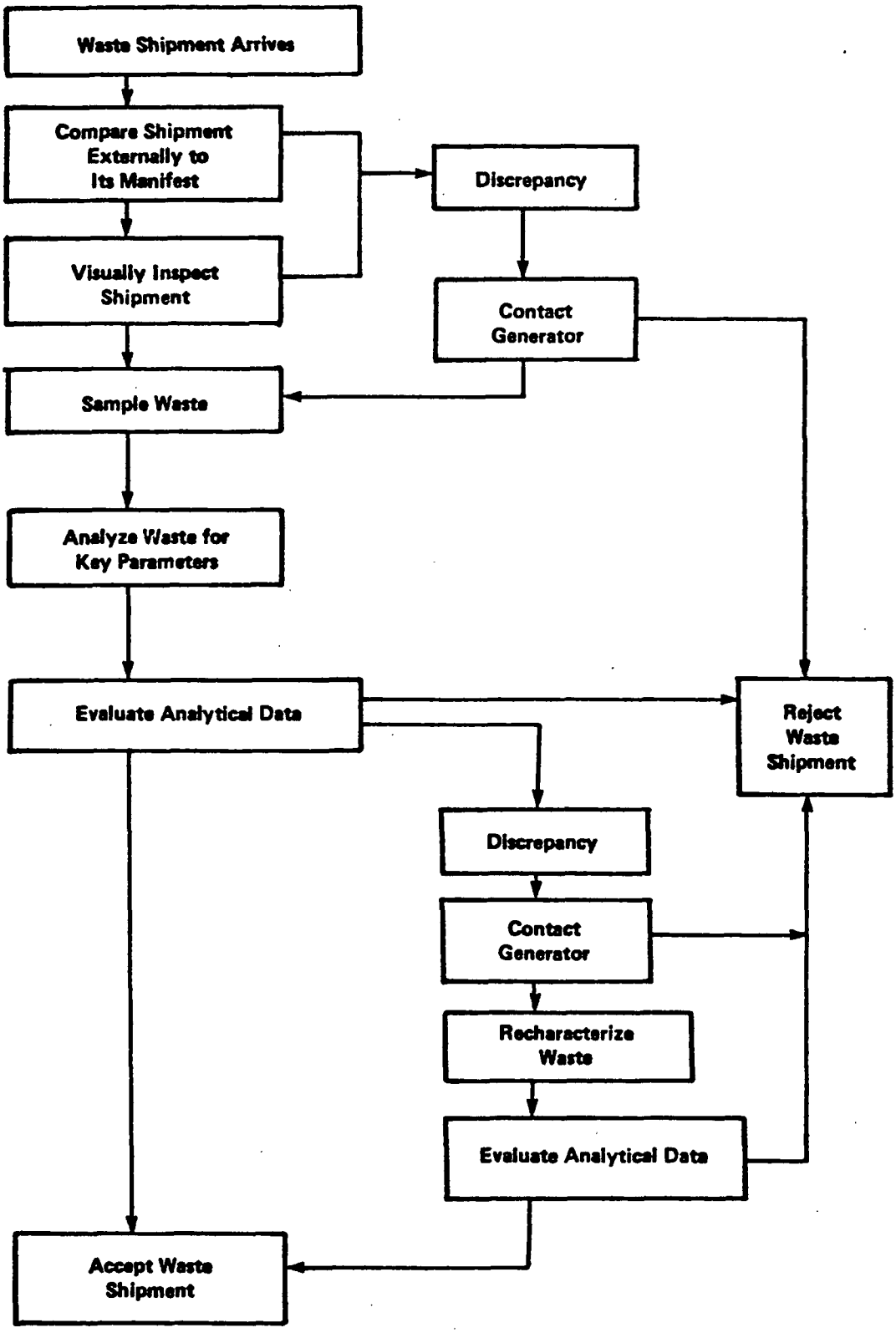
TABLE 3 NUMBER OF SAMPLES TO BE COLLECTED

Case No.	Information desired	Waste type	Container type	Number of samples to be collected
1	Average concentration	Liquid	Drum, vacuum truck, and similar containers	1 Collected with Coliwasa
2	Average concentration	Liquid	Pond, pit, lagoon	1 Composite sample of several samples collected at different sampling points or levels
3	Average concentration	Solid (powder or granular)	Bag, drum, bin sack	Same as Case #2
4	Average concentration	Waste pile	--	Same as Case #2
5	Average concentration	Soil	--	1 Composite sample of several samples collected at different sampling areas
6	Concentration range	Liquid	Drum, vacuum truck, storage tank	3 to 10 separate samples, each from a different depth of the liquid
7	Concentration range	Liquid	Ponds, pit, lagoon	3 to 20 separate samples from different sampling points and depths
8	Concentration range	Solid (powder or granular)	Bag, drum, bin	3 to 5 samples from different sampling points
9	Concentration range	Waste pile	--	Same as Case #8
10	Concentration range	Soil	--	3 to 20 separate samples from different sampling areas
11	Average concentration for legal evidence	All types	All containers	3 Identical samples or 1 composite sample divided into 3 identical samples if homogeneous
12	Average concentration	Liquid	Storage tank	Same as Case #2
13	Average concentration	Liquid	Storage tank	Same as Case #6

Table 4

PROPOSED SAMPLING METHODS

Extremely Viscous Liquids	ASTM D140-70
Crushed or Powdered Material	ASTM D346-75
Soil or Rock-Like Material	ASTM D420-69
Soil-Like Material	ASTM D1452-65
Fly Ash-Like Material	ASTM D2234-76
Containerized Liquid Waste	SW-846 Section 1.4.1
Liquids in Tanks	SW-846 Section 1.4.2



Shipment screening procedures.

WS# ___ — ___ — ___

REQUEST FOR DISPOSAL

GENERAL INFORMATION

US EPA GENERATOR ID NUMBER ___ ___-___-___

GENERATOR NAME

GENERATING FACILITY ADDRESS

CITY STATE ZIP CODE -

COUNTY

STATE EPA GENERATOR ID NUMBER

ADMINISTRATIVE CONTACT

TELEPHONE A/C - - Ext.

GENERATOR TECHNICAL CONTACT

TELEPHONE A/C - - Ext.

WASTE HAULER

ADDRESS

WASTE STREAM NAME

PROCESS GENERATING WASTE

CUSTOMER #

DATE RECEIVED / /

SAMPLING INFORMATION

DATE SAMPLE TAKEN ___/___/___

PERSON SAMPLING _____

TITLE _____

TELEPHONE A/C ___ - ___ - ____ Ext. ____

SAMPLE TYPE:

- ☐ (1) GRAB
- ☐ (2) COMPOSITE OF MORE THAN ONE SAMPLE
- ☐ (3) 24-HOUR COMPOSITE
- ☐ (4) IN-DEPTH SAMPLE
- ☐ (5) SPLIT SAMPLE
- ☐ (6) DUPLICATE SAMPLE
- ☐ (7) OTHER _____

COMMENTS _____

_____

_____

LAB NAME _____ DATE OF ANALYSIS ___/___/___

EPA HAZARDOUS WASTE CODES

(40 CFR 261.30-261.33)

☐ Check if waste is **not** hazardous per RCRA

☐ Check if additional EPA hazardous waste numbers are attached

___ - ___ - ___

WASTE DESCRIPTION

WASTE COMPOSITION

Check the **one** box that best describes the waste stream.

- ☐ (1) ORGANIC
- ☐ (2) INORGANIC
- ☐ (3) BOTH ORGANIC & INORGANIC

APPEARANCE

Check the **one** box **and** indicate the number of layers (phases) that best describes the waste stream.

- ☐ (1) FREE FLOWING LIQUID
- ☐ (2) RESINOUS LIQUID
- ☐ (3) OILY LIQUID
- ☐ (4) VISCOUS LIQUID
- ☐ (5) SLUDGE
- ☐ (6) POWDERY
- ☐ (7) GRANULAR
- ☐ (8) SOLID

Number of layers _____

COLOR

Check the **one** box that best describes the waste stream.

- ☐ (1) RED
- ☐ (2) BLUE
- ☐ (3) YELLOW
- ☐ (4) GREEN
- ☐ (5) BLACK
- ☐ (6) CLEAR
- ☐ (7) BROWN
- ☐ (8) MILKY WHITE
- ☐ (9) PURPLE
- ☐ (10) ORANGE

ODOR

Check the **one** box that best describes the waste stream.

- ☐ (1) SWEET
- ☐ (2) SOUR
- ☐ (3) PUNGENT
- ☐ (4) BACTERIALOGICAL
- ☐ (5) ETHER-LIKE
- ☐ (6) ALCOHOL-LIKE
- ☐ (7) AROMATIC
- ☐ (8) SOLVENT-LIKE
- ☐ (9) NONE

	SAMPLE	RANGE LOW	RANGE HIGH
PERCENT LIQUID	___ %	___ %	___ %
VISCOSITY (Centipoise)	___	___	___
BOILING POINT	___ °F	___	___ °F
DENSITY Numerical Value ☐ (1) lbs/gallon (LIQUIDS) Mandatory ☐ (2) lbs/cu. ft. (SOLIDS)	___	___	___

WASTE PROPERTIES

IGNITABILITY (40 CFR 261.21)

	SAMPLE	RANGE LOW	RANGE HIGH
FLASHPOINT	___ °F	___	___ °F

ANALYTICAL TECHNIQUE _____

Does Material Ignite When Exposed To:

AIR? ☐ (1) Yes ☐ (2) No WATER? ☐ (1) Yes ☐ (2) No FRICTION? ☐ (1) Yes ☐ (2) No

If yes, explain _____

REACTIVITY (40 CFR 261.23)

	SAMPLE	RANGE LOW	RANGE HIGH
CYANIDE AS CN^- TOTAL % BY WEIGHT			
SULFIDE AS $S^=$ TOTAL % BY WEIGHT			

ANALYTICAL TECHNIQUE _____

Does the waste contain any of the following?

1. A solid form of nitrate/nitrite ☐ (1) Yes ☐ (2) No
2. A precipitate of nitrate/nitrite ☐ (1) Yes ☐ (2) No

Is waste reactive with water to cause splattering or gas release? ☐ (1) Yes ☐ (2) No

If yes, describe reaction _____

CORROSIVITY (40 CFR 261.22)

Complete either pH for inorganics, or the corrosion rate test for organics. For solids, use the 1% solution test described in the instructions.

	SAMPLE	RANGE LOW	RANGE HIGH
pH			

Alkalinity (for pH greater than 9) _____ mg/l as calcium carbonate

Acidity (for pH less than 5) _____ mg/l as calcium carbonate

	SAMPLE	mm/yr	RANGE LOW	RANGE HIGH
CORROSION RATE TEST				

TOXICITY (40 CFR 261.24)

	LEACHATE – mg/l		LEACHATE – mg/l		LEACHATE – mg/l
LEAD		CHROMIUM		ENDRIN	
MERCURY		ARSENIC		LINDANE	
CYANIDE		SELENIUM		METHOXYCHLOR	
BARIUM		SILVER		TOXAPHENE	
		CADMIUM		2, 4-D	
				2, 4, 5-TP SILVEX	

COMPONENTS

Specific chemical names of components are required. **DO NOT** use generic names. **Account for 100% of the components.**

	PERCENT		
		RANGE	
	SAMPLE	LOW	HIGH
			–
			–
			–
			–
			–
			–

☐ CHECK IF ADDITIONAL COMPONENT DESCRIPTIONS ARE ATTACHED

ANALYTICAL TECHNIQUE _____

Does this waste stream contain biologic materials, pathogens, or etiological agents:

☐ (1) Yes ☐ (2) No

SHIPPING INFORMATION

ANTICIPATED **ANNUAL** VOLUME

☐ (1) GALLONS (LIQUIDS)

☐ (2) CU. FT. (SOLIDS)

Anticipated Transport Frequency

- ☐ 1. DAILY
- ☐ 2. WEEKLY
- ☐ 3. BI-WEEKLY
- ☐ 4. MONTHLY
- ☐ 5. QUARTERLY
- ☐ 6. SEMI-ANNUALLY
- ☐ 7. ANNUALLY
- ☐ 8. ONE TIME

DOT HAZARD CLASSES APPLICABLE

☐ 01	COMBUSTIBLE	☐ 08	FLAMMABLE SOLID	☐ 15	POISON B
☐ 02	CORROSIVE	☐ 09	IRRITATING AGENT	☐ 16	RADIOACTIVE
☐ 03	ETIOLOGIC AGENT	☐ 10	NONFLAMMABLE GAS	☐ 17	ORM-A
☐ 04	EXPLOSIVE A	☐ 11	ORGANIC PEROXIDE	☐ 18	ORM-B
☐ 05	EXPLOSIVE B	☐ 12	ORM-E	☐ 19	ORM-C
☐ 06	FLAMMABLE GAS	☐ 13	OXIDIZER	☐ 20	ORM-D
☐ 07	FLAMMABLE LIQUID	☐ 14	POISON A	☐ 99	NONE

Will packages contain a reportable quantity of a hazardous substance? ☐ (1) Yes ☐ (2) No

PROPOSED SHIPPING METHOD

The disposal site must be notified prior to shipping if packaging other than indicated here is to be used.

	CONTAINER TYPE	SIZE
☐ (1) DOT APPROVED DRUM		
☐ (2) BULK LIQUID		
☐ (3) BULK SOLID		
☐ (4) OTHER		

I certify and warrant that the above waste stream identification for the materials offered for disposal as appears on this form, and any attachments or supplements, is true and correct. I further certify and warrant that the identification is the result of an analysis of a representative sample obtained and analyzed in accordance with procedures specified by the U.S. Environmental Protection Agency.

Authorized Signature _____

Name _____

Date _____ Title _____

7.0 Calculations

7.1 External Standard Calibration

The concentration of each analyte in the sample is determined by calculating the amount of standard purged or injected, from the peak response, using the calibration curve or the calibration factor determined in paragraph 4.1.1. The concentration of a specific analyte may also be calculated as follows:

Aqueous samples

$$\text{Concentration (ug/l)} = [(A_x)(A)(V_t)(D)]/[(A_s)(V_i)(V_s)]$$

where:

A_x = Response for the analyte in the sample, units are in either area counts or peak height.

A = Amount of standard injected or purged (ng)

A_s = Response for the external standard, units the same as for A_x.

V_i = volume of extract injected, uL. For purge and trap analysis, V_i is not applicable and = 1

D = Dilution factor, if dilution was made on the sample prior to analysis. If no dilution was made, D=1 and is dimensionless

V_t = Volume of total extract, uL. For purge and trap analysis, V_t is not applicable and is = 1

V_s = Volume of sample extracted or purged, mL.

Nonaqueous samples

$$\text{Concentration (ng/g)} = [(A_x)(A)(V_t)(D)]/[(A_s)(V_i)(W)]$$

where:

W = weight of sample extracted or purged, g. The wet weight or dry may be used, depending upon the specific applications of the data.

A_x, A_s, A, V_t, D, and V_i have the same definition as for aqueous samples.

7.2 Internal Standard Calibration

For each analyte of interest, the concentration of that analyte in the sample is calculated as follows:

Aqueous samples:

$$\text{Concentration (ug/L)} = [(A_x)(C_{is})(D)]/[(A_{is})(RF)(V_s)]$$

where:

A_x = Response fo the analyte being measured, units are either area counts or peak height.

C_{is} = Amount of internal standard added to extract or volume purged, ng.

D = Dilution factor, if a dilution was made on the sample prior to analysis. If no dilution was made then D=1 and is dimensionless.

A_{is} = Response of the internal standard, units same as A_x.

RF = Response factor fro analyte, as determined in paragraph 4.3.2.

V_s = Volume of water extracted or purged, mL.

Nonaqueous samples:

$$\text{Concentration (ug/kg)} = [(A_s)(C_{is})(D)]/[(A_{is})(RF)(W_s)]$$

where:

W_s = Weight of sample extracted, g. Either a dry weight or wet weight may be used, depending upon the specific application of the data.

A_s, C_{is}, D, A_{is}, and RF have the same definition as for aqueous samples.

8.Ø Instrument QC

8.1 QC Check Samples

To establish the abilily to generate acceptable accuracy and precision, the following operations are performed.

The quality (QC) check sample concentrate is prepared containing the analytes of interest. The QC check sample concentration varies dependent upon the analytes being investigated. The QC check samples are prepared from stock standards independent from those used for calibration.

8.1.1 Preparation and Analysis

Reagent water is spiked with a known amount of the QC check sample concentrate. Four aliquots of the spiked water are analyzed by the same procedures used to analyze the actual samples. For volatile organics, the preparation/analysis process is purge and trap GC. For semivolatile organics, the QC check samples undergo solvent extraction.

8.1.2 Calculations

The average percent recovery in ug/l, and the standard deviation of the recovery in ug/l, for each analyte of interest are calculated. For each analyte the percent recovery and standard deviation are compared to the corresponding QC acceptance criteria for each of the methods. If the percent recovery and standard deviation for all the analytes of interest meet the acceptance criteria, the system performance is acceptable and the analysis of actual samples can begin. If any analyte fails to meet the criteria, then the test must be repeated. Repeated failure, however will confirm a system problem and must be corrected before any analysis of actual samples begins.

$$\% \text{ recovery} = C_a/C_t * 1ØØ$$

where:

C_a = concentration of analyte obtained from analyis.

C_t = true concentration value for analyte spiked.

$$\text{Std. Dev.} = [\text{sum}(x - m)^2/N]^{1/2}$$

where:

x = individual recovery values

m = mean recovery value

N = number of recovery values

8.2 Spiked Samples

On an ongoing basis, at least one sample per analytical batch (maximum of 20 samples per analytical batch) to assess accuracy is performed. The concentration of the spike is determined as follows:

8.2.1 Compliance Monitoring

If, as in compliance, the concentration level of a specific analyte in the sample is being checked against a regulatory limit, the spike is at that limit or 1 to 5 times the background limit, whichever is larger.

8.2.2 Non-Limit Specific

If the concentration of a specific in the sample is not being checked against a limit specific to that analyte, then the spike concentration is the same as the QC check sample or 1 to 5 times greater than background concentration, whichever concentration is greater.

8.3 Background Concentrations

One unspiked and one spiked sample are analyzed to determine the percent recovery of the spiked compounds. The percent recovery for each analyte is compared to the corresponding acceptance criteria for each method. If the percent recovery falls outside the designated range a check standard is analyzed to assess the system performance.

8.4 Matrix Spikes

As part of the QC program, method accuracy for each matrix studied is assessed. After analysis of five spiked samples of the same matrix type, the percent recovery and standard deviation are calculated for each analyte of interest. Accuracy is assessed as a percent recovery interval from (+2 * std. dev.) to (-2 * std. dev.). The accuracy assessment for each analyte is updated on a regular basis.

8.5 Surrogate Spikes

The accuracy and precision limits for surrogate standards are obtained in the following manner:

For each sample analyzed, the percent recovery of each surrogate is calculated. Once a minimum of thirty samples of the same matrix have been analyzed, the average percent recovery and standard deviation of the percent recovery for each surrogate are calculated. The control limits for the surrogates are done in the following manner:

Upper Control Limit (UCL) = P + 3s
Lower Control Limit (LCL) = P - 3s

where:

p = percent recovery for each surrogate

s = standard deviation of the percent recovery for each surrogate

If the recoveries do not fall into the limits established the following is done:

Calculations, internal standards, and surrogate solutions are checked for errors. Reanalysis of the extract is done. Also reextraction and reanalysis are performed. If none of these options fail to rectify the problem, instrument performance is checked. (Section 8.1) At a minimum, the surrogate recovery limits on a matrix by matrix basis are updated annually.

8.6 Percent Completeness

To insure the quality of the data that is produced by the laboratory, the quantity of acceptable quality control data is maintained.

% completeness = I / T * 100

where:

I = the total number of quality control data that falls within limits (includes QC check samples, spike samples, and surrogate spikes)

T = Total number of QC samples attempted

The laboratory maintains that greater than 85% completeness produces acceptable data.

9.0 Documentation

9.1 Forms

1. Form I Analytical Results - Organic Analysis Data Sheet

Retention times, retention time windows, and calibration factors.

11. Form XI - Pesticide/PCB Identification

    Sample Identification, primary analytical column, retention time and windows, confirmation column, and GC/MS confirmation.

12. Form XII - GC/MS Tuning and Mass Calibration (DFTPP)

    Spectra of standards generated from authentic standards, spectra for analytes from actual analysis., and Spectrometer identifier.

13. Form XIII - GC/MS Tuning and Mass Calibration (BFB)

    Spectra of standards generated from authentic standards, spectra for analytes from actual analysis, and Spectrometer indentifier.

14. Chromatograms

    All chromatograms for reported results labeled with sample identification, method identification, and identification of retention time of analyte on chromatograms.

Analyte concentration, Sample weight, Percent water Final volume of extract or diluted samples, date extracted, and detection limits.

2. Form II - Initial Calibration Data - Volatile Compounds

   Response factors, calibration check compounds, system performance check compounds, and standard deviation of calibration data.

3. Form III - Initial Calibration Data - Semivolatile Compounds

   Response factors, Calibration check compounds, system performance check compounds, and standard deviation of calibration data.

4. Form IV - Continue Calibration Check - Volatile Compounds

   Response factors, Calibration check compounds, system performance check compounds, and percent difference.

5. Form V - Continue Calibration Check - Semivolatile Compounds

   Response factors, Calibration check compounds, system performance check compounds, and percent difference.

6 Form VI - Surrogates
   - Water surrogate percent recovery
   - Soil surrogate percent recovery

   Amount of surrogate spiked, and percent recovery of each surrogate.

7. Form VII - Matrix/Duplicate Spikes
   - Watermatrixspike/matrixspikeduplicate recovery
   - Soil matrix spike/matrix spike duplicate recovery

   Amount spiked, percent recovery, and relative percent difference for each compound in the spiked samples for the analytical batch.

8. Form VIII - Method Blank Summary

   Identity and amount of each constituent.

9. Form IX - Pesticide Evaluation Standards Summary

   Calibration factors, percent breakdown (compounds 4,4' - DDT and Endrin), and percent difference of calibration factors.

10. Form X - Pesticide/PCB Standards Summary

DRAFT

CONFIDENTIAL

Generic Quality Assurance Plan

Prepared For:
State of Florida
The Department of Environmental Regulation

Prepared By:

PACE Laboratories, Inc.
Tampa, FL 55422

June 1987

Consultant Manager Laboratory Director	Date
Consultant QA Officer	Date
DER QA Officer	Date

II. TABLE OF CONTENTS

A. INTRODUCTION

The Generic Quality Assurance (QA) Plan was written in compliance with the Florida Department of Environmental Regulation (FDER) with "Guidelines for Preparing Quality Assurance Plans" (DER-QA-001/85 January 30, 1986). This document contains the seventeen (17) required elements of a Quality Assurance Plan and is prepared in such a way that entire sections can be referenced in subsequent project plans.

B. LIST OF TABLES

C. LIST OF FIGURES

D. APPENDICES

III. STATEMENT OF POLICY

PACE Laboratories, Inc. is committed to the policy of providing the highest quality product to its clients. The validity and reliability of the information generated is maximized by the adherence to documented quality control procedures and quality assurance protocols. PACE emphasizes the application of sound quality assurance/quality control principles beginning with the initial planning of the project, through all the field and laboratory activities and ultimately to the generation of the final report. The principles of data quality objectives, representativeness, completeness, comparability, precision and accuracy are applied.

PACE is committed to providing the resources, including facilities, equipment and personnel, to ensure the adherence to rigorous QA/QC protocols. Individual Quality Assurance Project Plans are developed for monitoring analytical projects to conform with the established QA/QC protocols.

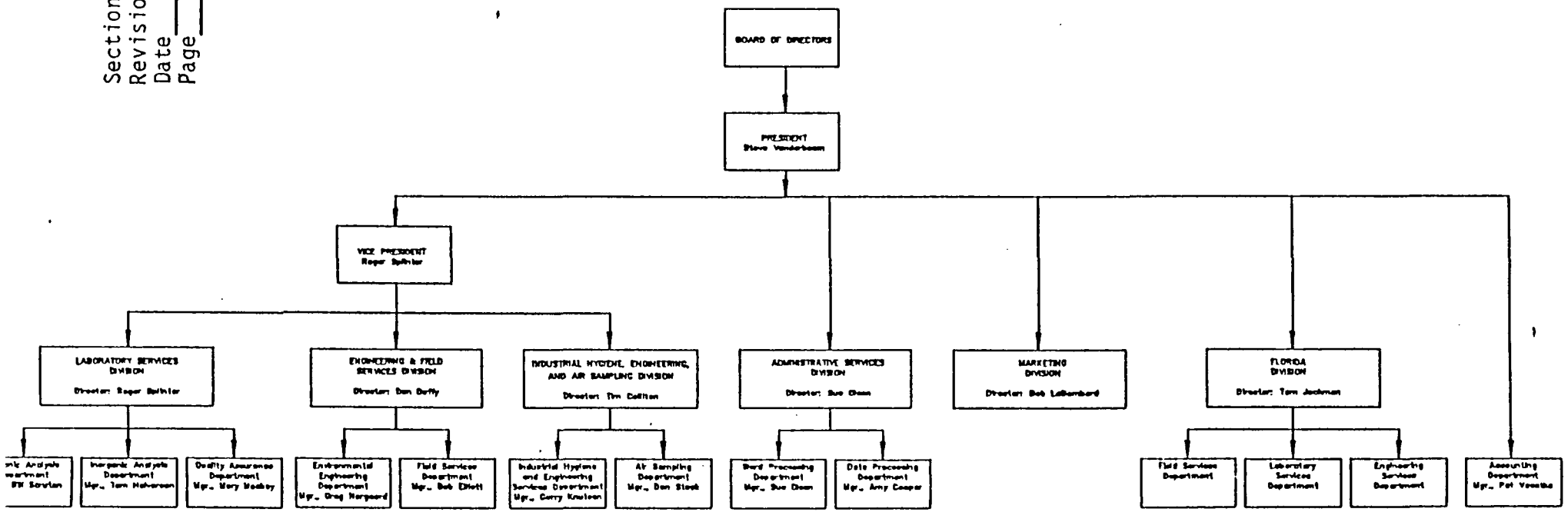
IV. PROJECT ORGANIZATION AND RESPONSIBILITY

The organizational structures for PACE Laboratories, Inc. and the Laboratory Division of PACE (Tampa) are provided in Figures IV-1 and IV-2. Resumes which give qualifications, specific duties and experience summaries for each of the professionals in the organization are provided in Section XVII.

Figure IV-1

PACE Laboratories, Inc.

ORGANIZATIONAL STRUCTURE



June 1987

Figure IV-2

PACE LABORATORIES, INC.
FLORIDA DIVISION

Organizational Structure

Thomas A Jackman, Ph.D.
Director

Laboratory Services

Inorganic

Timothy M O'Dell	Supervisor
Kathy L. Harris	Chemist, Quality Assurance Officer
Michael F. Valder	Chemist
Michael C. Jackman	Technician
Ron Brock	Lab Aide

Organic

Michael W. Palmer	Chemist
R. Niles Bashaw	Chemist

Field Services

James E. Franklin	Environmental Technician
John T. Stimus	Environmental Technician

Engineering

Curt W. Lessl	Ch.E., E.I.T.

Administration

Sandra G. Bell	Secretary
Cheryl Kochansky	Receptionist/Typist

V. QUALITY ASSURANCE/OBJECTIVES

A. INTRODUCTION

The purpose of the Quality Assurance/Quality Control (QA/QC) program outlined here is to define procedures for the evaluation and documentation of sampling, analytical methodologies and the reduction validation and reporting of data. The objective is to provide a uniform basis for sampling, sample handling, instrument condition, methods control, performance evaluation and analytical data generation and reporting.

The Quality Assurance program is designed to monitor all phases of a project including: pre-survey planning, sample collection, preservation, transportation and storage, sample log-in and tracking, laboratory analysis, and data validation and reporting of results.

The scope of the program includes those audit procedures used to evaluate the application of the procedures defined within this QA/QC program.

B. SAMPLE COLLECTION

1. Duplicate Samples

One out of every 10 samples will be collected in duplicate and analyzed separately.

2. Travel Blanks

A travel blank will be prepared using organic free deionized

water each day of sample collection. The environmental technician will prepare the appropriate sample bottles which will travel to the job site and return without being opened. The travel blanks will be analyzed only if contaminants are found in the field blanks.

3. Field Blanks

Field blank samples will be collected at each monitoring well. Field blanks may be analyzed upon review of the raw data or at the request of the client.

4. Ground Water Sample Collection

Ground water sample collection will be performed as described in Section VI using standard operating procedures from the PACE "Groundwater Monitoring Field Quality Assurance Manual".

C. LABORATORY QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

1. Objectives

The primary objective of the analytical QA/QC plan is to insure validity and reliability of analytical results. To this end, all samples collected during the project will be analyzed following EPA or other approved methods, and other QA/QC requirements detailed in this plan.

Specific objectives for the completeness of QA effort are accuracy, precision, representativeness, documentation, and comparability. These are summarized in Table V-1.

2. Completeness of QA Effort

Travel blanks, method blanks, and field blanks will be provided for each set of water samples collected. A method blank will also be run with each day's analysis. A minimum of 10 percent duplicate spiked samples will be analyzed or 1 per group of samples collected. Surrogates will be added to each sample for organic analysis to monitor adequate system performance. Prior to the monitoring program, PACE Laboratories, Inc. will validate their analytical methodology consistent with EPA Methods. Independently prepared external reference samples shall be analyzed quarterly at a minimum.

3. Accuracy Goals

For sample spikes, reagent water spikes, and performance check evaluations at concentrations of 10 ug/l or greater, recoveries should range from 80-120 percent at the 95 percent confidence level or +/- 2 standard deviations from the mean recovery. Reference sample results should be within +/- 20% of the true values.

4. Precision Goals

The relative percent difference (RPD) for all duplicate analysis will be calculated and reported. The RPD should range within the control limits specified for that analyses. These control limits are summarized in Table V-2.

5. Detection Limits Goals

Method detection limits are established in Section IX for

all analyses. The detection levels listed in Section IX will be utilized unless the sample matrix dictates otherwise. Laboratory method blanks should have concentrations below the method detection levels for the compounds of interest. Method detection limit for soil samples will be established appropriately based on the nature of the sample matrix.

6. Completeness Goals

The completeness goal will be greater than or equal to 90 percent.

7. Documentation

The documentation system includes the following elements: calibration procedures, analytical procedures, computational procedures, quality control procedure, bench data, operating procedures, lab notebook policy.

8. Comparability Goals

Comparability between data generated in the laboratory is matrix dependent. Every effort is made to compare sample results of similar matrices analyzed by equivalent methods.

9. Representativeness Goals

The samples collected will be representative of the environment that is being assessed.

TABLE V-1
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Acidity	Water	0	0	NA	
Alkalinity	Water	3	8	100	2
Bacteria					
Total Coliform	Water	NA		NA	
Fecal Coliform	Water	NA		NA	
Fecal Coliform	Water	NA		NA	
Total Plate	Water	NA		NA	
Biochemical Oxygen Demand	Water	NA		95	6
Boron	Water	9	6	96	12
Chemical Oxygen Demand, - High	Water	427	664	104	10
Chemical Oxygen Demand - Low	Water	0.8	0.6	101	12
Chloride	Water	0.6	0.6	100	5
Chlorine, Residual	Water	ID		ID	
Cyanide, Total	Water	0.1	0.2	88	11
Chromium, Hexavalent	Water	0.02	0.05	99	4
Cyanide, Chlorine Amenable	Water	ID		ID	
Fluoride, Total	Water	0.5	0.12	97	13
Fluoride, Dissolved	Water	ID		ID	
Hardness, Total	Water	7.8	8.8	NA	
Hardness, Calcium	Water	NA		NA	

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Nitrate Nitrogen	Water	3.6	4.4	96	8
Total Kjeldahl Nitrogen	Water	0.8	0.7	103	9
Nitrite Nitrogen	Water	ID		ID	
Organic Nitrogen	Water	ID		ID	
Oil & Grease Soxhlet	Water	NA		97	10
Oil & Grease Gravimetric	Water	NA		97	10
Dissolved Oxygen Electrode	Water	NA		NA	
pH	Water	0	0	100	0.4
Phenol	Water	0.004	0.004	91	10
Total Phosphorus	Water	0.7	1.1	101	8
Ortho Phosphorus	Water	ID		91	26
Silica, Reactive	Water	ID		NA	
Total Solids	Water	23	26	100	7
Total Volatile Solids	Water	ID		95	17
Total Suspended Solids	Water	66	77	100	8
Total Volatile Suspended Solids	Water	ID		ID	

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Total Dissolved Solids	Water	23	26	94	6
Specific Conductivity	Water	1.3	3.5	100	2
Sulfate	Water	28	34	102	8
Sulfide	Water	ID		ID	
Sulfite	Water	ID		ID	
Surfactants	Water	ID		ID	
Turbidity	Water	0.84	1.9	95	10
% Asn	HW or Oil	0.9	1.4	NA	
% Chlorine	HW or Oil	0.4	0.5	NA	
Density	HW or Oil	NA		NA	
Flash Point	HW or Oil	ID		ID	
Free Liquids	HW or Oil	NA		NA	
% Sulfur	HW or Oil	0.32	0.32	NA	
% Water	HW or Oil	ID		NA	
Cyanide, Total	HW or Oil	ID		75	0
Cyanide, Amenable	HW or Oil	ID		ID	
Cyanide, Reactive	HW or Oil	ID		ID	
Sulfide					
Total	HW or Oil	ID		ID	
Reactive	HW or Oil	ID		ID	
pH	HW or Oil	0	0	NA	

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Specific Conductivity	HW or Oil	1.3	3.5	100	2
Specific Gravity	HW or Oil	0.7	2.6	NA	
Formaldehyde	Water	NA		78	18

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Aluminum-U	Water	ID		120	39
Aluminum-A	Water	ID		106	13
Aluminum-A	Soil	ID		103	10
Antimony-U	Water	ID		100	16
Antimony-A	Water	ID		101	16
Antimony-A	Soil	ID		96	0
Arsenic-U	Water	1	2	99	19
Arsenic-U	Soil	ID		NA	
Barium-U	Water	ID		106	16
Barium-A	Water	0.19	0.29	104	11
Barium-A	Soil	36	75	101	8
Beryllium-U	Water	ID		104	12
Beryllium-A	Water	ID		9	1
Beryllium-A	Soil	ID		92	1
Cadmium-U	Water	ID		99	8
Cadmium-A	Water	0.04	0.05	9	3
Cadmium-A	Soil	0.10	0.12	100	5
Calcium-A	Water	3.9	4.8	103	4
Chromium-U	Water	0.3	0.5	82	10
Chromium-A	Water	0.55	0.92	103	5
Chromium-A	Soil	0.7	0.7	94	8

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Cobalt-U	Water	ID		108	9
Cobalt-A	Water	ID		96	9
Copper-U	Water	ID		90	8
Copper-A	Water	0.29	0.39	100	1
Copper-A	Soil	0.4	0.5	100	0
Iron-A	Water	0.29	0.76	99	3
Lead-U	Water	4.4	3.6	103	8
Lead-A	Water	2.8	2.0	102	7
Lead-A	Soil	9.8	12		
Magnesium-A	Water	2.3	2.5	100	2
Manganese-A	Water	0.03	0.04	99	3
Mercury	Water	0.3	0.9	95	12
Mercury	Soil	ID		ID	
Molybdenum-U	Water	ID		NA	
Molybdenum-A	Water	ID		98	14
Molybdenum-A	Soil	ID		ID	
Nickel-U	Water	1.6	2.6	99	5
Nickel-A	Water	0.2	0.7	99	5
Nickel-A	Soil	2.4	2.4	102	6
Potassium-A	Water	0.3	0.5	99	3
Potassium-A	Soil	ID		100	0

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Selenium-U	Water	ID		86	16
Selenium-H	Water	0.8	0.8	102	22
Silver-U	Water	ID		90	21
Silver-A	Water	0.4	0.5	98	10
Silver-A	Soil	ID		ID	
Sodium	Water	6.5	8.5	101	3
Strontium	Water	0.03	0.04	91	10
Thallium-U	Water	ID		100	3
Thallium-A	Water	ID		100	0
Thallium-A	Soil	ID		92	0
Tin-U	Water	ID		130	0
Tin-A	Water	ID		107	8
Tin-A	Soil	ID		100	0
Titanium-A	Water	ID		108	13
Vanadium-U	Water	ID		78	0
Vanadium-A	Water	ID		105	17
Vanadium-A	Soil	ID		92	5
Zinc-U	Water	ID		100	18
Zinc-A	Water	0.7	1.1	100	1
Zinc-A	Soil	2.6	2.7	100	3

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
Chloromethane	Water	10	8.7	82	31
Bromomethane	Water	6.8	5.3	97	15
Vinyl Chloride	Water	6.9	5.4	93	20
Chloroethane	Water	7.6	7.7	94	17
Methylene Chloride	Water	5.1	5.6	96	13
1,1-Dichloroethylene	Water	7.6	1.1	94	15
1,1-Dichloroethane	Water	4.7	4.7	92	14
Chloroform	Water	6.7	5.5	96	15
Carbon Tetrachloride	Water	10	6.5	93	13
1,2-Dichloropropane	Water	7.2	6.0	93	10
1,1,2-Trichloro-ethylene	Water	11	7.5	91	11
Dibromochloromethane	Water	9.0	7.7	97	19
1,1,2-Trichloroethane	Water	9.0	7.7	97	19
Chloroethylvinyl Ether	Water		ID	94	20
1,1,2,2-Tetrachloro-ethylene	Water	12	8.6	88	12
Chlorobenzene	Water	8.3	4.5	86	14
1,3-Dichlorobenzene	Water	9.3	6.3	80	19
1,4-Dichlorobenzene	Water	11	6.9	83	21
Dichlorodifluoro methane	Water	11	11	106	26
Trichlorofluoromethane	Water	7.1	6.9	104	11

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]		Accuracy (%R, Sd)[1]	
1,2-Dibromoethane	Water	ID		ID	
Methyl-t-butyl ether	Water	ID		ID	
Dichlorofluoromethane	Water	7.3	4.7	104	12
Trans-1,2-Dichloroethylene	Water	6.7	5.4	98	10
1,2-Dichloroethane	Water	4.1	4.1	100	12
1,1,1-Trichloroethane	Water	5.3	4.5	97	12
Bromodichloromethane	water	4.6	3.4	100	10
2,3-Dichloropropene	Water	3.9	3.3	99	12
Trans-1,3-Dichloropropene	Water	5.1	5.3	90	19
Cis-1,3-Dichloropropene	Water	5.6	4.5	100	13
1,2-Dibromomethane	Water	5.0	4.8	101	17
Bromoform	Water	6.9	6.3	96	14
1,1,2,2-Tetrachloroethane	Water	7.9	10	99	13
1,2-Dichlorobenzene	Water	9.0	8.3	92	13
Benzene	Water	8.0	10	99	15
Toluene	Water	11	9.6	95	9.9
Ethylbenzene	Water	8.2	8.3	98	11
m-Xylene	Water	7.7	9.0	9.0	13
o-Xylene	Water	7.8	9.4	9.1	15
Benzene	Water	ID		ID	
Bromodichloromethane	Water	ID		ID	
Bromoform	Water	ID		ID	

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]	Accuracy (%R, Sd)[1]
Bromomethane	Water	ID	ID
Carbon Tetrachloride	Water	ID	ID
Chlorobenzene	Water	ID	ID
Chloroethane	Water	ID	ID
2-Chloroethylvinyl Ether	Water	ID	ID
Chloroform	Water	ID	ID
Chloromethane	Water	ID	ID
Dibromochloromethane	Water	ID	ID
1,2-Dichlorobenzene	Water	ID	ID
1,3-Dichlorobenzene	Water	ID	ID
1,4-Dichlorobenzene	Water	ID	ID
1,1-Dichloroethane	Water	ID	ID
1,2-Dichloroethane	Water	ID	ID
1,1-Dichloroethene	Water	ID	ID
trans-1,2-Dichloroethene	Water	ID	ID
1,2-Dichloropropane	Water	ID	ID
cis-1,3-Dichloropropene	Water	ID	ID
trans-1,3-Dichloropropene	Water	ID	ID
Ethyl Benzene	Water	ID	ID
Methylene Chloride	Water	ID	ID
1,1,2,2-Tetrachloroethane	Water	ID	ID
Tetrachloroethene	Water	ID	ID

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]	Accuracy (%R, Sd)[1]
Toluene	Water	ID	ID
1,1,1-Trichloroethane	Water	ID	ID
1,1,2-Trichloroethane	Water	ID	ID
Trichloroethene	Water	ID	ID
Trichlorofluoromethane	Water	ID	ID
Vinyl Chloride	Water	ID	ID
Acenapthene	Water	ID	ID
Acenapthylene	Water	ID	ID
Aldrin	Water	ID	ID
Anthracene	Water	ID	ID
Benzo(a)anthracene	Water	ID	ID
Benzo(b)fluoranthene	Water	ID	ID
Benzo(k)fluoranthene	Water	ID	ID
Benzo(a)pyrene	Water	ID	ID
Benzo(g,h,i)perylene	Water	ID	ID
Benzyl butyl phthalate	Water	ID	ID
B-BHC	Water	ID	ID
B-BHC	Water	ID	ID
Bis(2-Chloroethyl)ether	Water	ID	ID
Bis(2-Chloroethoxy)methane	Water	ID	ID
Bis(2-Chloroisopropyl)ether	Water	ID	ID

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]	Accuracy (%R, Sd)[1]
Bis(2-ethylhexyl)phthalate	Water	ID	ID
4-Bromophenyl phenyl ether	Water	ID	ID
2-Chloronapthalene	Water	ID	ID
4-Chlorophenyl phenyl ether	Water	ID	ID
Chrysene	Water	ID	ID
4,4'-DDD	Water	ID	ID
4,4'-DDE	Water	ID	ID
4,4'-DDT	Water	ID	ID
Dibenzo(a,h)anthracene	Water	ID	ID
Di-n-butyl phthalate	Water	ID	ID
1,2-Dichlorobenzene	Water	ID	ID
1,3-Dichlorobenzene	Water	ID	ID
1,4-Dichlorobenzene	Water	ID	ID
3,3'-Dichlorobenzene	Water	ID	ID
Dieldrin	Water	ID	ID
Diethyl phthalate	Water	ID	ID
Dimethyl phthalate	Water	ID	ID
2,4-Dinitrotoluene	Water	ID	ID
2,6-Dinitrotoluene	Water	ID	ID
Di-n-octyl phthalate	Water	ID	ID
Endosulfan sulfate	Water	ID	ID
Endrin aldehyde	Water	ID	ID

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\bar{X}$, Sd)[1]	Accuracy (%R, Sd)[1]
Fluoranthene	Water	ID	ID
Fluorene	Water	ID	ID
Heptachlor	Water	ID	ID
Heptachlor epoxide	Water	ID	ID
Hexachlorobenzene	Water	ID	ID
Hexachloro butadiene	Water	ID	ID
Hexachloroethane	Water	ID	ID
Indeno(1,2,3-cd)pyrene	Water	ID	ID
Isophorone	Water	ID	ID
Naphthalene	Water	ID	ID
Nitrobenzene	Water	ID	ID
N-Nitrosodi-n-propylomine	Water	ID	ID
PCB-1260	Water	ID	ID
Phenanthrene	Water	ID	ID
Pyrene	Water	ID	ID
1,2,4-Trichlorobenzene	Water	ID	ID
4-Chloro-3-methylphenol	Water	ID	ID
2-Chlorophenol	Water	ID	ID
2,4-Dichlorophenol	Water	ID	ID
2,4-Dimethylphenol	Water	ID	ID
1-Methyl Napthalene	Water	ID	ID
2-Methyl Napthalene	Water	ID	ID

TABLE V-1 (Continued)
QUALITY ASSURANCE OBJECTIVES

Measurement Parameter	Experimental Matrix	Precision ($\overline{X}$, Sd)[1]	Accuracy (%R, Sd)[1]
2,4-Dinitrophenol	Water	ID	ID
2-methyl-4,6-dinitrophenol	Water	ID	ID
2-Nitrophenol	Water	ID	ID
4-Nitrophenol	Water	ID	ID
Pentachlorophenol	Water	ID	ID
Phenol	Water	ID	ID
2,4,6-Trichlorophenol	Water	ID	ID
PCB,			
Aracnlor-1016	Water	ID	ID
Arachlor-1221	Water	ID	ID
Arachlor-1232	Water	ID	ID
Aracnlor-1242	Water	ID	ID
Aracnlor-1248	Water	ID	ID
Arachlor-1254	Water	ID	ID
Arachlor-1260	Water	ID	ID

1) $\overline{X}$ = Average Range Between Duplicate Analysis
%R = Average Percent Recovery Of Spikes
Sd = Standard Deviation
NA = Not Applicable
ID = Insufficient Data
U = Furnace Atomic Absorption
A = Flame Direct Aspiration
H = Hydride

Accuracy and precision control limits have not been internally generated for all parameters and matrices. Control values (Table V-1) and EPA specified quality control objectives are used as guidelines when internally generated statistics are insufficient.

TABLE V-2
PRECISION GOALS*

Duplicate Analysis	Maximum Relative Percent Difference
Volatiles	30%
Semi-Volatiles	30%
Metals	20%

* These limits are for advisory purposes and are not meant to be used as a criteria for re-analysis of samples.

VI. SAMPLING PROCEDURES

A. SAMPLING PROCEDURES FOR GROUND WATER AND SURFACE WATER

Ground and surface water sampling techniques employed by PACE are in accordance with the EPA Region IV Standard Operating Procedures and Quality Assurance Manual, and FDER's Supplement "A" - Standard Operating Procedures and Quality Assurance Manual.

Trained field sampling crews will be sent to the site for sample collection and delivery of samples to the laboratory.

Samples from monitoring wells will be taken with a precleaned stainless steel bailer. Bailers are precleaned by washing first with detergent then rinsed with tap water and finally triple rinsed with deionized water.

Prior to sampling, the water level in the well is determined with an electronic water level meter and recorded on the field log data sheet, along with all the other pertinent information. (See Appendix A, page 74). The volume of water in the casing is calculated and three to five times that volume is purged from the well. In all cases the well is purged until the conductivity, temperature, and pH has stabilized.

All samples collected for metals analysis will be filtered with a disposable 0.45 micron filter immediately after collection and preserved with nitric acid.

The bailer to be used for sampling is used for purging two inch diameter wells and a gas driven centrifugal pump is used when larger volumes of water need to be removed, (static water level

less than 25 feet). Wells with static water levels greater than twenty-five feet and casing diameters greater than 3 inches are purged with a submersible pump.

See Appendix A for detailed sampling and prepumping standard operating procedures.

For surface water sampling, see Appendix A pg 48.

Table VI-1 lists the containers used for sampling, preservatives, holding times and conditions for ground and surface water samples. New bottles are used for sample collection. Detailed bottle preparation procedures are listed in Appendix A for the specific parameters of concern.

B. SAMPLING PROCEDURES FOR SOILS AND SEDIMENTS

Soil and sediments will be collected according to procedures in Test Methods for Evaluating Solid Waste EPA-SW-846.

There are numerous methods that can be used when taking soil samples, ranging from a power auger to a sample spade.

Soil sampling is used to determine the depth and range of contamination from spillage or the leaching effect of rain on material stored above ground. The depth and placement of the borings should be determined by the project manager and the client, using the suspected range of contamination as a guide. A background boring is usually collected to analyze the conditions of the soil.

Step 1. Meeting with project manager to discuss analysis to be

run and placement and depth of borings and also the various depths at which samples are to be collected.

Step 2. Prepare and clean auger and sample bottles. (For PCB samples all bottles must be hexane rinsed.)

Step 3. Contact client once on site to gain access to site area.

Step 4. Collect a surface sample in the first boring location, if desired. (Fill out a soil boring data sheet as you go along.)

Step 5. Begin boring. If a total composite is desired, place the soil in a large jar. If samples are desired at only certain depths the unwanted soil can be discarded in a pile next to the boring.

Step 6. Continue augering until the desired depth is reached. Then fill the sample bottles from the bottom of the auger.

Step 7. Usually the auger will have to be cleaned with D.I. water or hexane between samples.

Step 8. Repeat Step 6 until you have collected all the samples desired.

Step 9. Refill the hole with the soil augered out and place a stake in the hole to mark the location.

TABLE VI-1
SAMPLE PRESERVATION TECHNIQUES AND
RECOMMENDED HOLDING TIMES

Parameter	Vol. Req. (ml)	Container[a]	Preservative	Recommended Holding Time	EPA Proposed Holding Time
A. Non Metals					
Acidity	100	P, G	Cool, 4°C	24 Hours	14 Days
Alkalinity	100	P, G	Cool, 4°C	24 Hours	14 Days
Bacteria	250	Whirlpak,	Cool, 4°C	6 Hours - polluted waters	6 Hours - polluted waters
		Sterilized Glass	(2 ml 0.1 N Thiosulfate for chlorinated waters)	48 Hours - potable waters	48 Hours - potable waters
Biochemical Oxygen Demand	100	P, G	Cool, 4°C	6 Hours	48 Hours
Boron	100	P	Cool, 4°C	7 Days	-
Chemical Oxygen Demand	100	P, G	H_2SO_4 (pH <2)	7 Days	28 Days
Chloride	50	P, G	None Required	7 Days	28 Days
Chlorine Residual	500	P, G	Det. on Site	No Holding	2 Hours
Color	100	P, G	Cool, 4°C	24 Hours	48 Hours
Cyanides	500	P, G	4°C, NaOH (pH >11) 0.6 g. ascorbic acid	24 Hours	14 Days
Fluoride	300	P, G	Cool, 4°C	7 Days	28 Days
Hardness	100	P, G	4°C, HNO_3 (pH <2)	7 Days	6 Months

TABLE VI-1
SAMPLE PRESERVATION TECHNIQUES AND
RECOMMENDED HOLDING TIMES (Cont'd)

Parameter	Vol. Req. (ml)	Container[a]	Preservative	Recommended Holding Time	EPA Proposed Holding Time
Nitrogen,					
Ammonia	500	P, G	4°C, H_2SO_4 (pH <2)	24 Hours	28 Days
Kjeldahl	500	P, G	4°C, H_2SO_4 (ph <2)	7 Days	28 Days
Nitrate	50	P, G	Cool, 4°C	24 Hours	48 Hours
Nitrite	50	P, G	Cool, 4°C	48 Hours	48 Hours
Nitrate-nitrite	50	P, G	4°C, H_2SO_4 (pH <2)		28 Days
Grease & Oil	1000	G	4°C, H_2SO_4 (pH <2)	24 Hours	28 Days
Oxygen, Dissolved					
Probe	300	G	Det. on Site	No Holding	1 Hour
Winkler	300	G	Fix on Site	4-8 Hours	8 Hours
pH	25	P, G	Cool, 4°C	6 Hours	2 Hours
Phenols	500	G only	Cool, 4°C, H_2SO_4 (pH <2)	24 Hours	28 Days
Phosphorus,					
Total	100	P, G	4°C, H_2SO_4 (pH <2)	7 Days	28 Days
Ortho	100	P, G	4°C, H_2SO_4 (ph <2)	24 Hours	48 Hours
Silica	100	P only	Cool, 4°C	7 Days	28 Days

TABLE VI-1
SAMPLE PRESERVATION TECHNIQUES AND
RECOMMENDED HOLDING TIMES (Cont'd)

Parameter	Vol. Req. (ml)	Container(a)	Preservative	Recommended Holding Time	EPA Proposed Holding Time
Solids,					
Total	100	P, G	Cool, 4°C	7 Days	7 Days
Suspended	100	P, G	Cool, 4°C	7 Days	7 Days
Volatile	100	P, G	Cool, 4°C	7 Days	7 Days
Dissolved	100	P, G	Cool, 4°C	7 Days	48 Hours
Settleable	100	P, G	None Required	24 Hours	48 Hours
Specific					
Conductance	100	P, G	Cool, 4°C	24 Hours	28 Days
Sulfate	100	P, G	Cool, 4°C	7 Days	28 Days
Sulfide	500	P, G	2 ml Zinc Acetate	24 Hours	7 Days
Sulfite	100	P, G	Det. on Site	No Holding	48 Hours
Surfactants	250	P, G	Cool, 4°C	24 Hours	48 Hours
Turbidity	100	P, G	Cool, 4°C	7 Days	48 Hours
B. Metals					
Total	100	P	HNO_3 (pH < 2)	6 Months	
Dissolved	200	P	Filter on Site HNO_3 (pH < 2)	6 Months	
C. Hazardous Waste & Oil Analysis					
% Ash	50 ml	P, G	None Required	-	-
% Chlorine (bomb)	1 g	P, G	None Required	-	-
Density	50 g	P, G	None Required	-	-

TABLE VI-1
SAMPLE PRESERVATION TECHNIQUES AND
RECOMMENDED HOLDING TIMES (Cont'd)

Parameter	Vol. Req. (ml)	Container(a)	Preservative	Recommended Holding Time	EPA Proposed Holding Time
Flash Point	25 ml	P, G	None Required	-	-
Heat of Combustion	1 g	P, G	None Required	-	-
% Sulfur (Bomb)	1 g	P, G	None Required	-	-
Viscosity	25	P, G	None Required	-	-
% Water					
D. Gas Chromatography					
Herbicide	500	G, Foil or Teflon Cap	Cool, 4°C	7 Days (Pre-extraction) 40 Days (Completion)	
Phenol	1000	G. Teflon Cap Teflon Cap	Cool, 4°C, H_2SO_4 pH < 2, Sodium Thiosulfate	7 Days (Pre-extraction) 40 Days (Completion)	
PCB, Water	1500	G, Foil or Teflon Cap	Cool, 4°C	7 Days (Pre-extraction) 40 Days (Completion)	
Soxhlet	50 g	G, Foil or Teflon Cap	Cool, 4°C	7 Days (Pre-extraction) 40 Days (Completion)	
Sludge	10 g	G, Foil or	Cool, 4°C	7 Days (Pre-extraction) 40 Days (Completion)	

TABLE VI-1
SAMPLE PRESERVATION TECHNIQUES AND
RECOMMENDED HOLDING TIMES (Cont'd)

Parameter	Vol. Req. (ml)	Container(a)	Preservative	Recommended Holding Time	EPA Proposed Holding Time
Oil	5 g	G, Foil or Teflon Cap	Cool, 4°C		
Purge & Trap					
Water	40	Vial, Teflon Septum	Cool, 4°C	14 Days	
Solid	5 g	Vial, Teflon Septum	Cool, 4°C	14 Days	
Solvent Characterization					
Liquid	1	G, M	None Required		-
Solid	2 g	G, M	None Required		-

a - P = Plastic
G = Glass

Reference - F.R., Vol. 49, No. 209, U.S. EPA, 1984.

VII. SAMPLE CUSTODY

A. CHAIN OF CUSTODY

Chain of Custody will be initiated in the field according to Appendix A pg 50.

B. CONTROL OF INCOMING SAMPLES

PACE has a designated sample custodian whose primary responsibility is to document receipt of samples, initiate the appropriate log-in procedures described below, assure proper documentation and prompt analyses of the samples. The sample custodian also maintains proper custody of samples and analytical data to verify the integrity of reports submitted to our clients.

When samples are received at the laboratory accompanied by a chain of custody form (Figure VII-1), the sample custodian will initiate the following steps:

1. Verify that each sample was in the packing container as recorded on the Chain of Custody record.
2. Document on the Chain of Custody form any breaking of seal of sample bottles which may have occurred during transport to the laboratory.
3. Sign and date the "received at laboratory by" box. The exact number of sample containers received by the laboratory is recorded for each sample.

4. Next, a sample and analysis data entry form is filled out (see Figure VII-2). This sheet contains all pertinent

information about the client, sample collection, sample matrix, analyses to be performed and number of bottles received.

All samples received by PACE are identified and labeled showing the name of the client, sample location or code, date received and the preservative added to the bottle. Samples are entered into the log book which contains the following:

1. A number assigned to each sample. Numbers begin with 1 on the first day of the year.
2. Identification of the client name.
3. Date the sample was received at the laboratory.
4. Number of bottles received for each sample.
5. Initials of person who checked in samples.

To complete the sample and analysis data entry procedure, all the information from the sample receiving form is entered into a computer noted as the Lab Data Management System (LDMS). A copy of what was checked into the LDMS is attached to the original check-in sheet and kept with any other information about the project. Before samples are stored, they are rechecked to make sure they are in the correct container and are properly preserved.

C. MAINTENANCE OF CUSTODY AND SAMPLE STORAGE

PACE has implemented standard operating procedures to assure the integrity of both samples and data so that they are not degraded or disclosed to unauthorized personnel. In order to insure that this policy is maintained, the laboratory facilities are under controlled access. Only employees of PACE Laboratories, Inc.

are allowed access to the laboratory facilities. Visitors must register at the front desk. Visitors are accompanied at all times when in the laboratory by an employee of PACE. The building is locked and secured at the end of each working day. Keys to the building are issued only to select personnel.

Samples are stored either in refridgerators at 4^{o} C, at room temperature, or in a ventilated hazardous waste room. All sample storage areas have locks and are secured at the end of each working day by the sample custodian.

Samples are removed from their proper storage location by the analyst and are returned to the storage area immediately after the required sample volume has been taken. This minimizes unnecessary time spent searching for samples and helps prevent matrix degradation from prolonged exposure to room temperature.

Most samples are retained in storage in their original locations for approximately two months. Preserved metals samples and hazardous waste type samples are stored for up to six months. After the final report is sent and clients are allowed adequate time to review the results, the samples are properly discarded or returned to the client.

PACE normally will complete the sample analysis within ten working days after receipt, except for those parameters whose holding time requires otherwise. Those parameters with holding times less than 24 hours are given top priority for immediate analysis.

Additional and more rigorous chain of custody protocols for samples and data can be implemented by client request. For

samples involving a high degree of confidentiality or potential litigation, PACE Laboratories, Inc. has developed more extensive sample and data handling protocols to assure the scientific and legal defensibility of the report submitted.

ace
Laboratories, Inc.

CHAIN-OF-CUSTODY RECORD

NO. 6491

Douglas ... polis, MN 55422 612 544 5543

PROJ

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Date 06/30/87
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NAME OF CLIENT | PROJECT TELEPHONE NO. | PROJECT NUMBER

M	SAMPLE NO			IS	GENERAL	METALS	NITROGEN	CYANIDE	VOLATILES			SAMPLE DESCRIPTION	TRANSFER NO. & CHECK 1	2	3	4	5	6	7
5																			
6																			1
7																			
8																			

FIGURE VII-1

ISON RESPONSIBLE FOR SAMPLE COLLECTION | AFFILIATION

ATE | TIME

URPOSE OF ANALYSIS (use back of front sheet if needed)

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	ACCEPTED BY	DATE	TIME
1					
2					
3					
4					
5					
6					
7					

ORIGINAL

pace laboratories, inc.

Client Name: _____ Contact: _____ Phone # : _____

Address: _____ Project Name: _____

Client # : _____ Project # : _____ Collected By: _____ Date: _____

Lab Rec'd Date: _____ By: _____ Check-In By: _____ Due Date: _____ Priority: _____

Special Instructions: _____ PACE Contact: _____

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SAMI LYSIS
D/)RM

SAMPLE #	SAMPLE DESCRIPTION (30 Characters)	MATRIX	BOTTLE TYPES (30 Characters)	COMMENTS
	ANALYSIS:			
	ANALYSIS:			
	ANALYSIS:			
	ANALYSIS:			
	ANALYSIS:			
	ANALYSIS:			

FIGURE VII-2

BOTTLE TYPES:

Cyanide	CN	Oil & Grease	OG	Whirlpak	WK	Filter Cassette	HF
General	GN	Phenol	PH	GC VOA	GV	Impinger	HI
Metals Not Filtered	MD	Radiological	RA	GC C-Amber	GL	Sorbent Tube	HT
Metals Filtered	MU	Sulfide	SU	GC Misc. Refrig	GM	Diffusion Mon	HM
[illegible]	NT	[illegible]	[illegible]	GC Unrefrig	GO	Bulk Sample	HB

Freon Wash [illegible] Wet [illegible]

VIII. CALIBRATION PROCEDURES AND FREQUENCY

A. LABORATORY OBJECTIVES

Standardized calibration of the equipment used is necessary to obtain valid data. Standard procedures for the preparation of standard solutions is also necessary to generate valid data. Detailed procedures for calibrations are provided as follows for each piece of lab equipment or can be found in the corresponding analytical methods manual.

1. Metals Analysis Calibration Procedures

a. Stock Solution Preparation

1. Reagents and standard solutions for EPA Atomic Absorption (AA) methods are purchased from American Scientific Products.

2. Stock reagents and working standards are prepared and stored according to EPA methods.

3. All standards prepared for use throughout the laboratory are entered in the Standard Notebook with all information regarding source of the standard, the preparation of that standard, i.e., date, analyst, name of each compound and amount used and final volume. All standard and stock reagent containers are labeled with the standard's or reagent name, date and analysts' initials.

for every analyte by the analysis of EPA Quality Control Solutions. When measurements for the certified components exceed the specified control limits, the analysis must be terminated, the problem corrected, the instrument recalibrated and the calibration reverified.

3. The values for the initial and subsequent continuing calibration verifications shall be recorded for AA and cyanide analyses, as indicated.

4. The instrument detection limits are documented within 30 days of the start of the analyses and at least quarterly (every 3 months), and must meet the levels specified. The instrument detection limits (IDL) are 3 times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration 3-5 times the IDL on three (3) nonconsecutive days with 7 consecutive measurements per day. These instrument detection limits will be lower than or equal to the required detection limit.

5. A calibration blank is analyzed each time the instrument is calibrated, at the end of the run, and at a frequency of 10% during the run. The results for the calibration blank solution shall be recorded for AA analysis, as indicated. Blanks are to be reported as "less than (numeric value)" when the concentration is less than the required detection limit, not as "N.D." or " D.L.". If this blank result is greater than the (RDL), terminate analysis, correct the

4. For Atomic Absorption and cyanide systems, calibration standards are prepared by diluting the stock solution at the time of analysis. Low calibation standards are prepared fresh each time an analysis is to be made and discarded after use. A blank and at least three calibration standards in graduated amounts in the appropriate range is prepared. The calibration standards are prepared using the same type of acid or combination of acids and at the same concentration as will result in the samples following sample preparation.

b. Calibration of Atomic Absorption

1. The Atomic Absorption system is set up according to EPA and manufacturer's instruction. Beginnning with the blank and working towards the highest concentration each standard is aspirated and the absorbance readings are recorded. Readings for the highest standard are compared with previous data and the suggested manufacturers guidelines for optimum instrument performance. The system is calibrated daily or each time an analysis is performed. The instrument response obtained for each compound in a newly prepared standard is compared to the response obtained from the previous standard which was verified by EPA QA Standard. The two standards must agree within 15% or the new standard may not be used until the discrepancy has been resolved.

2. After the AA system has been calibrated, the accuracy of the initial calibration is verfied and documented

problem and recalibrate.

6. Continuing Calibration Verification

To assure calibration accuracy during each analysis run, one of the standards is analyzed for each analyte at a frequency of 10% during an analysis run, and after the last analytical sample. The analyte concentrations in the continuing calibration standard must be at or near the mid-range levels of the calibraton curve.

The same continuing calibration standard is used throughout the analysis runs for a case of samples received.

If the deviation of the continuing calibration verification is greater than the Control Limit specified, the instrument is recalibrated and the preceding 10 samples reanalyzed for the analytes affected. Information regarding the continuing verification of calibration for AA is recorded.

B. FIELD INSTRUMENTATION

Calibration procedures and frequency of calibration for field equipment is an integral component of each instrument's Standard Operating Procedure (SOP) detailed in PACE Laboratories, Inc. Field Manual (See Appendix A). The instruments used will be routinely calibrated in conformance with manufacturer's specification, at a minimum. The Log Sheet for each piece of equipment will contain the following items where appropriate:

1. Date of calibration,

2. All data pertaining to the calibration and/or maintenance procedure (not contained in specific equipment worksheets),

3. Next due date of calibration and/or maintenance,

4. Initials of person performing the calibration and/or maintenance,

5. Adjustments made and the accuracy of the equipment prior to and following calibration (where applicable),

6. A record of equipment failure or inability to meet specifications (where applicable).

Tables VIII-1 and VIII-2 provide calibration procedures for the field pH meter and conductivity meter.

TABLE VIII-1
STANDARD PROCEDURE FOR CALIBRATION OF pH METERS

STEP 1: Choose appropriate pH buffers depending upon expected pH of the sample (Acidic use four and seven, Basic use seven and ten).

STEP 2: Turn selector dial to zero and the meter to warm up for the ten minutes.

STEP 3: Adjust temperature dial to the temperature of the buffers.

STEP 4: Rinse the probe with D.I. water and place it in the seven buffer. Turn the selector dial to the pH position.

STEP 5: While gently stirring the buffer with the probe turn the calibration knob until the meter is reading seven.

STEP 6: Turn the selector dial back to zero. Rinse the probe with D.I. water and place it in either the four or ten buffer.

STEP 7: Turn the selector dial to pH. The meter should read four or ten depending upon the buffer being used. If it does not, split the difference by turning the calibration knob.

STEP 8: Turn the selector dial to zero, rinse the probe with D.I water and place it in the seven buffer.

STEP 9: Turn the selector dial to pH. If the meter reads seven it is now ready to be used. The probe should be rinsed and the temperature dial adjusted between samples.

STEP 10: Turn the selector dial to zero and record what the meter reads. As long as the zero remains the same it is not necessary to recalibrate until the next day.

TABLE VIII-2
STANDARD PROCEDURE FOR CALIBRATION OF CONDUCTIVITY METERS

STEP 1: Check batteries by turning the switch on and the range dial to TEST. The meter must read above the test line or new batteries are needed.

STEP 2: Using a thermometer take the temperature of the 717 umho/cm standard and adjust the temperature dial accordingly.

STEP 3: Rinse probe with D.I. water and place in the 717 umho/cm standard.

STEP 4: Turn the range dial to 0-1,000 and switch the meter on, use a gentle up and down motion with the probe to thoroughly mix the standard.

STEP 5: Turn the Stp screw until the meter is reading 720. Turn the switch off and rinse the probe using D.I. water.

STEP 6: Take temperatures of the 1413 umho/cm and adjust the temperature dial.

STEP 7: Turn the range dial to 0-10,000, place the probe in the standard and turn meter on. The meter should read 1400. The meter is now ready for use. The temperature of every sample must be taken and the probe rinsed between samples.

IX. ANALYTICAL PROCEDURES

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	ASTM
A. Non-Metals					
Acidity	Potentiometric Titration	1 mg/l	402		D1067-70
Alkalinity	Potentiometric Titration	1 mg/l	403	310.1	D1067
	Automated Methyl Orange	10 mg/l		310.2	
Bacteria,					
Total Coliform	Membrane Filter	-	909C		
Fecal Coliform	Membrane Filter	-	980C		
Fecal Strept.	Membrane Filter	-	910A		
Total Plate	Agar Medium	-	907		
Biochemical Oxygen Demand, 5-day	Winkler	1 mg/l	507	405.1	
	Electrode	6 mg/l	507		
Boron	Curcumin 405-A	0.2 mg/l	404A	212.3	
Chemical Oxygen Demand	Dichromate Reflux High	50 mg/l	508A	410.1	D1252-78
	Dichromate Reflux Low	5 mg/l	508A		
Chloride	Mercuric Nitrate	1 mg/l	407B	325.3	D512-67
	Automated Ferricyanide	1 mg/l		325.2	
Chlorine, Residual	Amperometric Titration	0.01 mg/l	408C	330.1	D1253-76
Color	Visual Comparison	1 Unit	204A		
Cyanide, Total	Pyridine-Barbitutic Acid, Colorimetric	0.01 mg/l	412D	335.2	D2036-75
Amendable	Chlorination-colorimetric	0.02 mg/l	412F	335.1	D2036-75
Flouride, Total	Distillation-Electrode	0.1 mg/l	413A		D1179-72
Fluoride, Diss.	Electrode	0.1 mg/l	413B	340.2	

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	ASTM
Hardness, Total	EDTA Titration	1 mg/l as $CaCO_3$	314B	130.2	D1126-67
Hardness, Calcium	EDTA Titration	1 mg/l as $CaCO_3$		242.1	
Nitrogen,					
Ammonia	Distillation-Titration	0.1 mg/l as N	417D	350.2	
Kjeldahl	Digestion-Distillation-	0.1 mg/l as N	420B	351.3	D3590-77
Nitrate	Automated Cadmium	0.1 mg/l as N	418F	353.2	D3967-79
Nitrite	Automated Cadmium	0.1 mg/l as N	418F	353.2	D3867-79
Organic	Kjeldahl-NH_3	0.1 mg/l as N	420A	-	
Oil & Grease	Soxhlet	1 mg/l	503C		
	Partition-Gravimetric	1 mg/l	503A	413.1	
Oxygen, Dissolved	Winkler	0.1 mg/l	421B	360.2	D1589-60
	Electrode	0.1 mg/l	421F	360.1	
pH	Electrode	0.1 Unit	423	150.1	D1293-78
Phenol	Distillation-Extraction Colorimetric	0.005 mg/l	420.1		D1783-70
Phosphorus, Total	Persulfate Digestion- Ascorbic Acid Reduction	0.02 mg/l as P	424F	365.2	D515-78
Ortho	Ascorbic Acid Reduction	0.02 mg/l as P	424F		
Silica, Reactive	Molybdosilicate	0.02 mg/l	425C	370.1	D859-65
Solids,					
Total	Gravimetric	1 mg/l	209A	160.3	
Total Volatile	Gravimetric	1 mg/l	209E	160.4	
Suspended	Gravimetric	1 mg/l	209D	160.2	
Suspended Volatile	Gravimetric	1 mg/l	209A		
Total Dissolved	Gravimetric	1 mg/l	209B	160.1	
Settleable	Gravimetric	1 mg/l	209F	160.5	
Specific Conductance	Meter	1 umho	205	120.1	D1125-77

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	ASTM
Sulfate	Turbimetric	1 mg/l	426C	375.4	D516-68
	Automated Methyl Thymol Blue	3mg/l	-	375.2	
Sulfide	Colorimetric	0.1 mg/l as S	427C	376.2	
	Titration	0.2 mg/l as S	427D	376.1	
Sulfite	Titration	0.2 mg/l as S	428F	377.1	D1339-78
Surfactants (MBAS)	Methylene Blue	0.05 mg/l	512A	425.1	D2330-68
Turbidity	Meter	0.1 NTU	214A	180.1	D1889-71

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	SW 846
B. Metals					
Aluminum	AA-Direct Aspiration	0.4 mg/l	303C	202.1	
	AA-Furnace	7 ug/l	304	202.2	
Antimony	AA-Direct Aspiration	0.8 mg/l	303A	204.1	7040
	AA-Furnace	3 ug/l	304	204.2	7041
Arsenic	AA-Gaseous Hydride	1 ug/l	303E	206.3	7061
	AA-Furnace	4 ug/l	304	206.2	7060
Barium	AA-Direct Aspiration	0.2 mg/l	303C	208.1	7080
	AA-Furnace	3 ug/l	304	208.2	7081
Beryllium	AA-Direct Aspiration	0.02 mg/l	303C	210.1	7090
	AA-Furnace	0.2 ug/l	304	210.2	7091
Cadmium	AA-Direct Aspiration	0.01 mg/l	303A	213.1	7130
	AA-Furnace	0.1 ug/l	304	213.2	7131
Calcium	AA-Direct Aspiration	0.4 mg/l	303A	215.1	
	EDTA Titration	1 mg/l	311C	215.2	

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	SW 846
Chromium, Total	AA-Direct Aspiration	0.05 mg/l	303A	218.1	7190
	AA-Furnace	1 ug/l	304-	218.2	7191
Hexavalent	Colorimetric	0.02 mg/l	312B		7196
Cobalt	AA-Direct Aspiration	0.05 mg/l	303A	219.1	
	AA-Furnace	1 ug/l	304	219.2	
Copper	AA-Direct Aspiration	0.05 mg/l	303A	220.1	721.0
	AA-Furnace	4 ug/l	304	220.2	721.1
Iron	AA-Direct Aspiration	0.05 mg/l	303B	236.1	
	AA-Furnace	1 ug/l	304	236.2	
Lead	AA-Direct Aspiration	0.1 mg/l	303A	239.1	7420
	AA-Furnace	1 ug/l	304	239.2	7421
Lithium	AA-Direct Aspiration	0.02 mg/l	317B		
Magnesium	AA-Direct Aspiration	0.4 mg/l	303A	242.1	
Manganese	AA-Direct Aspiration	0.03 mg/l	303A	243.1	
	AA-Furnace	1 ug/l	304	243.2	
Mercury	AA-Cold Vapor	0.2 ug/l	303F	245.1 7471	7470 or
Molybdenum	AA-Direct Aspiration	0.3 mg/l	303C	246.1	
	AA-Furnace	5 ug/l	304	246.2	
Nickel	AA-Direct Aspiration	0.05 mg/l	303A	249.1	7520
	AA-Furnace	2 ug/l	304	249.2	7521
Potassium	AA-Direct Aspiration	0.01 mg/l	303A	258.1	
Selenium	AA-Gaseous Hydride	1 ug/l	303E	270.3	7740
	AA-Furnace	5 ug/l	304	270.2	7741
Silver	AA-Direct Aspiration	0.04 mg/l	303A	272.1	7760
	AA-Furnace	0.2 ug/l	304	272.2	7761

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	SW 846
Sodium	AA-Direct Aspiration	0.1 mg/l	303A	273.1	
Strontium	AA-Direct Aspiration	0.05 mg/l	303A		
Thallium	AA-Direct Aspiration AA-Furnace	0.4 mg/l 3 ug/l	303A 304	279.1 279.2	7840 7841
Tin	AA-Direct Aspiration AA-Furnace	2 mg/l 5 ug/l	303A 304	282.1 282	
Titanium	AA-Direct Aspiration AA-Furnace	1.0 mg/l 1 ug/l	303C 304	283.1 283.2	
Vanadium	AA-Direct Aspiration AA-Furnace	1 mg/l 5 ug/l	303C 304	286.1 286.2	7910 7911
Zinc	AA-Direct Aspiration AA-Furnace	0.1 mg/l 1 ug/l	303A 304	289.1 289.2	7950 7951
C. Hazardous Wastes & Oil Analyses					
% Ash	Gravimetric	0.01%	209E		
% Chlorine	Bomb Calorimeter	0.01%		8808-63	
Density	Gravimetric	0.01	213E		
Flash Point Closed Cup	Pensky-Martin	1°F		D93-73	1010
Free Liquids	Paint Filter	1 ml			9095
Heat of Combustion	Bomb Calorimeter	100 BTU		D240-64	
Leach Test, EP Toxicity	Extraction	-			1310
ASTM Water	Extraction			D3987	

TABLE IX-1
ANALYTICAL METHODS

Parameter	Method	Minimum Detection Limit	Standard Methods 15th Ed.	EPA Methods 1979	SW 846
% Sulfur	Bomb Calorimeter	0.01%		D129-64	
Viscosity	Saybolt	0.1 S	-	D88-56	
% Water	Distillation	0.1%		D95-74	
Cyanide, Total	Pyridine-Barbitutic Acid Colorimetric				9010
Amenable	Chlorination-Colorimetric				9010
Reactive	Pyridine-Barbitutic Acid Colorimetric				261.23
Sulfide, Total	Titration				9030
Reactive	Titration				261.23
pH	Electrode				9040
Specific Conductance	Meter				9050
Specific Gravity	Mass Displacement		213E		

Parameter	Method	EPA 600-4-82-067 July 1982	MDH*	SW 846
D. Organic Analytical Method				
Purgeable Halocarbons (includes trihalomethanes)	Gas Chromatography	601		8010
				8020
Purgeable Aromatics	Gas Chromatography	602		8020
Acrolein & Acrylonitrile	Gas Chromatography	603		8030
Phenols	Gas Chromatography	604		8040
Phthalate Esters	Gas Chromatography	606		8060

TABLE III
ANALYTICAL METHODS

Parameter	Method	EPA 600-4-82-067 July 1982	MDH*	SW 846
Pesticides & PCB's	Gas Chromatography	608		8080
Nitroaromatics & Isophorone	Gas Chromatography	609		8090
Polynuclear Aromatic Hydrocarbons	Gas Chromatography	610		8100
Haloethers	Gas Chromatography	611		
Purgeables	Gas Chromatography Mass Spectrophotometer	624		8240
Base/Neutral Acids	Gas Chromatography Mass Spectrophotometer	625		8250 8270
Purgeables (includes 601, 602)	Gas Chromatography		465B	8015
1,2-Dibromoethane	Gas Chromatography	601**		
* Minnesota Health Department Method		504.1		

** ECD detector used in place of Hall detector

==========

The following parameters are analyzed at PACE Laboratories, Inc in Minneapolis, Minnesota and are not currently analyzed in the Tampa:

Parameter	Method	
Purgeables	EPA 624	Gas Chromatograph-Mass Spectrometer
Base/Neutral	EPA 625	Gas Chromatograph-Mass Spectrometer

X. DATA REDUCTION VALIDATION AND REPORTING

Upon receiving samples for a project, all background information pertaining to that project is entered via the LDMS as described in Control of Incoming Samples (Section VII).

All information is then gathered and organized by the LDMS and is displayed in a series of reports. These reports show the progress of the analytical workload which is reviewed and assessed by the appropriate laboratory manager. These reports are reviewed before the beginning of each week and a work schedule are made for performing the analytical tasks needed to complete each project. Each technician then uses this schedule and a daily updated report to perform analyses in guiding them in completing each analytical task. The data are then appropriately recorded on parameter specific raw data sheets, which are signed and dated by the technician. These raw data sheets are reviewed and approved by signature of the laboratory manager. The data are then entered into the computer by the LDMS operator and when the last piece of data is entered for a particular project a draft report is formulated for that project. The raw data sheets go to the Quality Assurance Department (QAD) to be reviewed for calculation errors, precision and accuracy. QC data are recorded and plotted on QC charts, any data point, which exceeds the calculated control limit is investigated and corrective action taken when necessary. If there are any changes in the data, the QAD will notify the laboratory manager and the LDMS operator before the final report is generated. All changes in original data are crossed out with a straight line and the corrected number is written in, initialed by the technician, and dated. These raw data are then filed and stored in the QAD where the access is restricted to authorized personnel only. When the laboratory manager is satisfied that the draft report results are valid and correct, a final report

is produced, which is reviewed and signed by the Laboratory Manager and the Director of Laboratory Services. The project is invoiced and mailed to the client. A copy of the report is retained for PACE's files.

When needed, additional footnotes are attached describing problems, interferences, analytical procedures, quality control or other information necessary for accurate data interpretation by the client.

XI. INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

A. INTERNAL QUALITY ASSURANCE CHECKS

Internal quality assurance procedures are designed to assure the consistency and continuity of data. If required, external quality assurance procedures (interlaboratory checks) are carried out to assess the accuracy of the data generated. Internal quality assurance procedures include:

1. Instrument performance checks;

2. Instrument calibration;

3. Documentation on the traceability of instrument standards, samples, and data;

4. Documentation on analytical methodology and QC methodology (QC methodology includes spiked samples, duplicate samples, and split sample use of reference blanks and check standards for method accuracy and precision); and

5. Documentation on sample preservation and transport.

B. TYPES OF QUALITY CONTROL CHECKS INCLUDE BUT ARE NOT LIMITED TO:

1. Method Blank Analysis

   A method blank is a volume of deionized-distilled laboratory water carried through the entire analytical scheme. The method blank volume must be approximately equal to the sample volumes being processed.

2. Surrogate Spike Analysis

Surrogate spikes are routinely added to samples, standards, and blanks to monitor the performance of analytical methods and equipment. The surrogate spiking compounds should behave in a similar fashion to analytical compounds, but should not be found naturally occurring in samples.

3. Duplicate Analysis

At selected stations on a random time frame, duplicate samples are collected from two sets of field equipment installed at the site, or duplicate grab samples are collected, or samples are randomly split in the laboratory and analyzed separately. This provides a check of sampling, techniques, and analytical methods for precision.

4. Matrix Spike/Matrix Spike Duplicate Analysis

Known amounts of a particular constituent are added to an actual sample at concentrations at which the accuracy of the test method is satisfactory. The amount added is coordinated with the laboratory. This method provides a proficiency check for the accuracy of the analytical procedures.

The spiked samples can also be run in duplicate as indicated in an analytical procedure (ie., Volatile Organic Analysis U.S. EPA Method 601). This provides a check of analytical procedures for precision.

5. Control Charts

Control Charts are used to monitor variations in the precision and accuracy of routine analysis and detect trends in these variations. QC control charts are

constructed from data representing performance of the complete analytical method. The construction of a control chart requires initial data to establish the mean and range of measurements. Control charts are used to monitor both accuracy and precision.

C. FREQUENCY OF QUALITY CONTROL CHECKS

With each lot of samples analyzed at a particular time, at least one matrix spike, and one matrix spike duplicate sample are run. The total number of laboratory matrix spike duplicates and matrix spikes analyzed over the course of a project are at least 10% of the total number of samples. Surrogate spike compounds are added to each analysis run where called for in the respective method.

At least one method blank is analyzed with each batch of analyses. Internal standards, as recommended in the pertinent methods, are added to several samples as a check on accuracy of the external standard.

XIII. PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

A. INSTRUMENTATION MAINTENANCE

PACE is dependent on sophisticated instrumentation. The end result of any test performed on an instrument depends on the inherent accuracy and proper operation, use and function of the instrument itself.

It is essential that the instruments in the laboratory operate under optimum conditions at all times. Local service personnel are available on an on-call basis. Formalized preventive maintenance contracts have been executed with outside vendors. Much of the preventive maintenance is done on a day-to-day basis, in-house. The laboratory staff at PACE is familiar with the manufacturer's operating manual on each instrument and routinely performs various service checks.

Each instrument, prior to use, is calibrated according to the manufacturer's instructions. Next to the instrument, for the analyst's use, is a set of operating instructions. Daily checks of the instrument performance are made by the analyst assigned responsibility for that instrument.

B. EQUIPMENT LOG RECORD

An inventory control system including all equipment and instrumentation is maintained by the equipment manager as the basis for maintenance and calibration control. The inventory control documentation includes for each item:

1. Description of item.

2. Manufacturer, model number, and serial number.

3. Name, address, and telephone number of company which services item.

4. Type of service policy.

5. Timing and frequency of routine maintenance, servicing, and calibration.

C. ROUTINE MAINTENANCE AND TROUBLESHOOTING

Preventive maintenance that is routinely performed does not correct for all problems associated with the VOA analyses. Samples with very high concentrations and equipment malfuctions can cause a variety of problems that are difficult to diagnose. It may be necessary to disconnect portions of the analytical system to identify the problem. (For example the purge and trap system can be eliminated by directly injecting onto the column.) A troubleshooting guide for an individual method is only a guideline; each problem may require a combination of corrective actions before acceptable data may be generated.

XIV. SPECIFIC ROUTINE PROCEDURES TO BE USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS OF SPECIFIC MEASUREMENT PARAMETERS INVOLVED

A. OVERVIEW

The Quality Assurance Program provides a measure of the credibility of the data produced in the laboratory on a day to day basis. The program is designed to ensure that the laboratory continues to generate valid results through current quality control assessment procedures as well as preventive and corrective measures.

The following sections describe in detail the Quality Control measures used at PACE Laboratories, Inc. These practices are critical in assuring the consistent production of reliable data. However, the experience, knowledge, professional pride and motivation of the analyst are human qualities which are difficult to measure. Yet these subjective factors are crucial in assuring optimum performance. Therefore, the Quality Assurance Program at PACE is intended to help each analyst evaluate his performance in a valuable manner. The program is not a critic of poor results, but a constructive tool for the assurance of the high level of performance maintained by PACE Laboratories, Inc.

This section documents the system used at PACE to verify - on a daily basis - that procedures pertaining to laboratory methods, glassware, solvents, reagents and gases are in control.

The reliability and credibility of analytical laboratory results can be established by the inclusion of a program of randomly-

scheduled replicate analyses, analysis of standard or spiked samples, and the cooperative analysis of split samples by several laboratories. These external quality control checks should be an integral part of any sampling and analytical plan.

Regularly scheduled analysis of known duplicates, standards, and spiked samples are a routine aspect of data reduction validation and reporting procedures (see Section X). The specific procedures used to calculate these values follow.

B. QUALITY CONTROL PROCEDURES FOR ANALYTICAL PERFORMANCE

The system used at PACE involves the use of precision and accuracy data to determine the acceptability of analytical results. Precision refers to the reproductibility of the results and accuracy measures the degree of difference between observed and true values. Approximately, one of every ten analyses performed at PACE is run in duplicate (precision). Also, every tenth to fifteenth sample is spiked with a synthetic standard to check the accuracy of the method. Once 15 to 18 sets of precision or accuracy data have been obtained, a quality control chart is prepared. The Shewart technique[4] is the statistical method used to construct the charts. These quality control charts provide a quick, visual means for monitoring the daily performance of the laboratory. Figures XIV-1 and XIV-2 contain examples of accuracy and precision charts along with their corresponding data sheets.

1. Precision

The precision, or ability to reproduce results, of each method is monitored by the construction of statistically

meaningful charts. Samples representing the entire range of concentrations and interferences are analyzed in duplicate. Since the range between duplicates varies with concentration, all precision data is separated into concentration ranges. Two factors are considered when assigning ranges to a particular parameter. First, each concentration range must contain a "significant" number of data pairs to allow calculation of statistically sound precision values. Therefore, considering the relatively small number of samples analyzed, the fewest number of concentration ranges is desired. Yet, as the second consideration, the ranges must be small enough so that variation in true concentration values does not negatively affect the average range and standard deviation. In most cases, concentrations separated by a factor of ten provide the simplest consideration of the data. However, these are arbitrary designations and are subject to change depending upon the test, number of data sets, and the distribution of the data sets within a range.

After 15 to 18 duplicate results have been obtained for a concentration range, a Shewart Quality Control Chart is calculated. The ranges between each set of duplicates are entered into the computer program for precision. The program calculates the average range (R) and multiplies it by the factor 3.27 to produce the upper control limit (UCL). The chart for the concentration range will graphically display the average range (R) and the upper control limit (UCL). The range values for successive duplicate analyses are plotted on the chart and any value that exceeds the upper control limit is considered out of

control. If such an out of control situation exists, the test is shut down until the problem is identified, corrected and documented. The charts are periodically updated with the accumulation of 15 to 18 additional data pairs.

Precision data can also be reviewed through the calculation of the Relative Percent Difference (RPD) for a matrix spike duplicate analysis using the following equation

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

where:

RPD = Relative percent Difference
D_1 = First Sample Value
D_2 = Second Sample Value

This method of calculating precision is used for volatile organic analysis or other analysis as specified in a particular project plan.

2. Accuracy

In addition to the guarantee of precise results, one must also be assured of the accuracy of those results. This is accomplished by spiking one of every ten to fifteen samples analyzed with a synthetic standard for the parameter. The sample is analyzed and the recovery(P_i) of the spike is

determined. When 15 to 18 spike results have been obtained, the computer program for accuracy will calculate the mean percent recovery (P), the standard deviation (Sp), and the upper and lower control limits, (UCL, LCL). A test is considered in control if the percent recovery (P_i) is between the upper and lower control limits. These limits are determined to be plus or minus two standard deviations from the mean percent recovery (P + 2Sp), or plus or minus ten percent from the mean percent recovery (P + 10%). Successive data points are plotted on the accuracy chart which graphically displays the UCL, LCL and P. With the accumulation of 15 to 18 additional data sets, a new chart is prepared.

The Quality Control Charts for accuracy and precision are kept in separate three ring notebooks where they can be easily reviewed for QC interpretation. The analysts themselves are encouraged to use them as a constructive measure of the test's integrity and their own professional performance.

3. Other Quality Control Procedures

a. Method Blank Analysis

A method blank is a volume of deionized, distilled laboratory water carried through the entire analytical scheme. The method blank volume must be approximately equal to the sample volumes being processed.

1. Method blank analysis must be performed at the

following frequency:

A method blank analysis must be performed every twelve hours, once per lot or with every twenty (20) samples of similar concentration and/or sample matrix, whichever is more frequent.

It is the laboratory's responsibility to ensure that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in gas chromatograms be minimized.

2. For the purpose of this protocol, an acceptable laboratory method blank should meet the following criteria:

A method blank for volatile analysis should contain no greater than two times (2X) the Detection Limit of common laboratory solvents (common laboratory solvents are: methylene chloride, acetone, benzene, methyl ethyl ketone and toluene). The method blank must not contain greater than five times (5X) the Detection Limit of those compounds previously listed.

b. Analytical Standards

All analyses require that standard samples, samples that the analyst has prepared from pure materials and distilled water or purchased from certified materials

(traceable to the National Bureau of Standards) be analyzed concurrently with the samples. In general, the range covered by the standards should comprise the useful parameters concentration range and sensitivity of the analytical method.

The data generated from analysis of these standards are documented and reviewed in the same manner as the matrix spike analysis for accuracy.

c. Sample Analysis

Samples can be analyzed upon successful completion of the initial QC activities. Any major system maintenance may necessitate a recalibration. Minor maintenance should necessitate only the calibration verification.

C. DOCUMENTATION

As discussed earlier, if a test result for quality control exceeds the control limits, the test is stopped until the source of error is identified and corrected. Great care is taken to promptly document the situation in the Laboratory Out-of-Control Situation (LOCS) Notebook. This documentation provides a valuable review of the laboratory's performance. It also helps to resolve current problems that may have occured previously under similar circumstances. Any situation that requires documentation is assigned an identifying "LOCS" number which describes the page in the LOCS notebook and the situation. For example, "LOCS #12.7" indicates an out-of-control situation is documented on page 12 of the notebook and is the seventh entry

of the page. This identification number is entered in the comment section on the raw data sheet so that either the analyst or supervisory personnel can quickly review the situation.

D. WEEKLY QC REVIEW

The Quality Control staff meets with the laboratory personnel, supervisor, manager, and director at least once a week at a predetermined time. Out-of-control situations from the previous week are reviewed to determine the progress made in resolving the problem.

New situations of concern are discussed and corrective measures are instituted. This meeting also serves to cultivate new ideas on how the laboratory may perform more efficiently. The open, informal discussion reduces the occurrence of problems due to lack of communication. The results of these weekly reviews and the subsequent actions taken are recorded in the Weekly QC Review Notebook.

E. COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

For most remedial activities these 3 terms are quality characteristics which should be considered during study planning. Data completeness can be quantified during data assessment. It is expected that laboratories should provide data, meeting QC acceptance criteria, for 90% or more of the requested determinations. It is incumbent for planners to identify any sample types, such as control or background locations, which require 100% completeness. Representativeness is most often thought of in terms of collection of

representative samples that can accurately assess the environment being evaluated (compositing sub-aliquots if appropriate) or selection of representative sample aliquots during laboratory analysis. Comparability is a consideration during planning to avoid noncomparability between different organizations' data or between different analytical methods or sample matrices.

REFERENCES

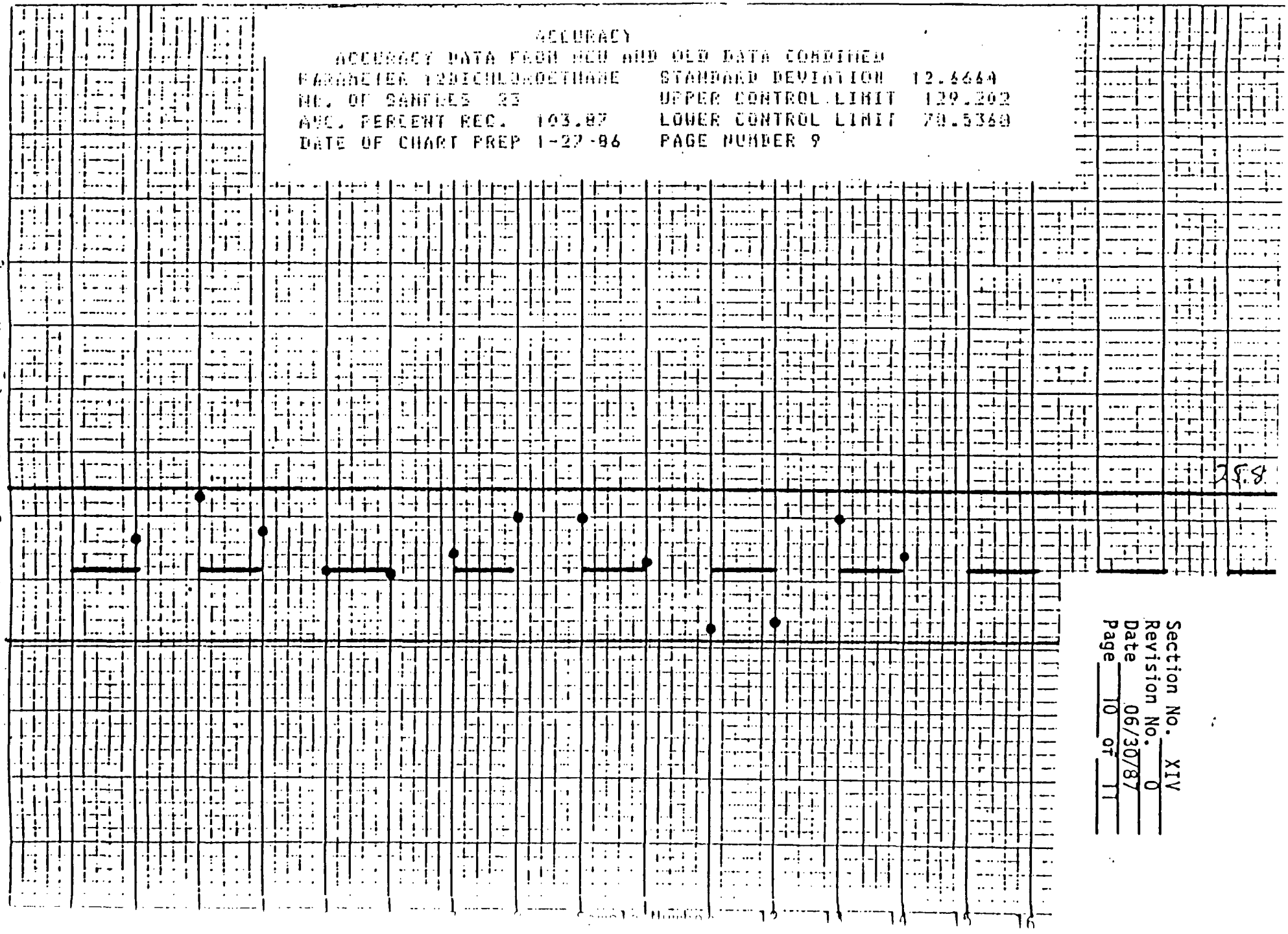
1. U.S. EPA, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, NERC 1972.

Parameter:
Upper & Lower Control Limit (UCL-LCL):
# of Samples Considered:

Average % Recovery:
Standard Deviation:
Date of Chart Preparation:

QUALITY CONTROL
SHEWHART CONTROL CHART FOR PRECISION

Page #:



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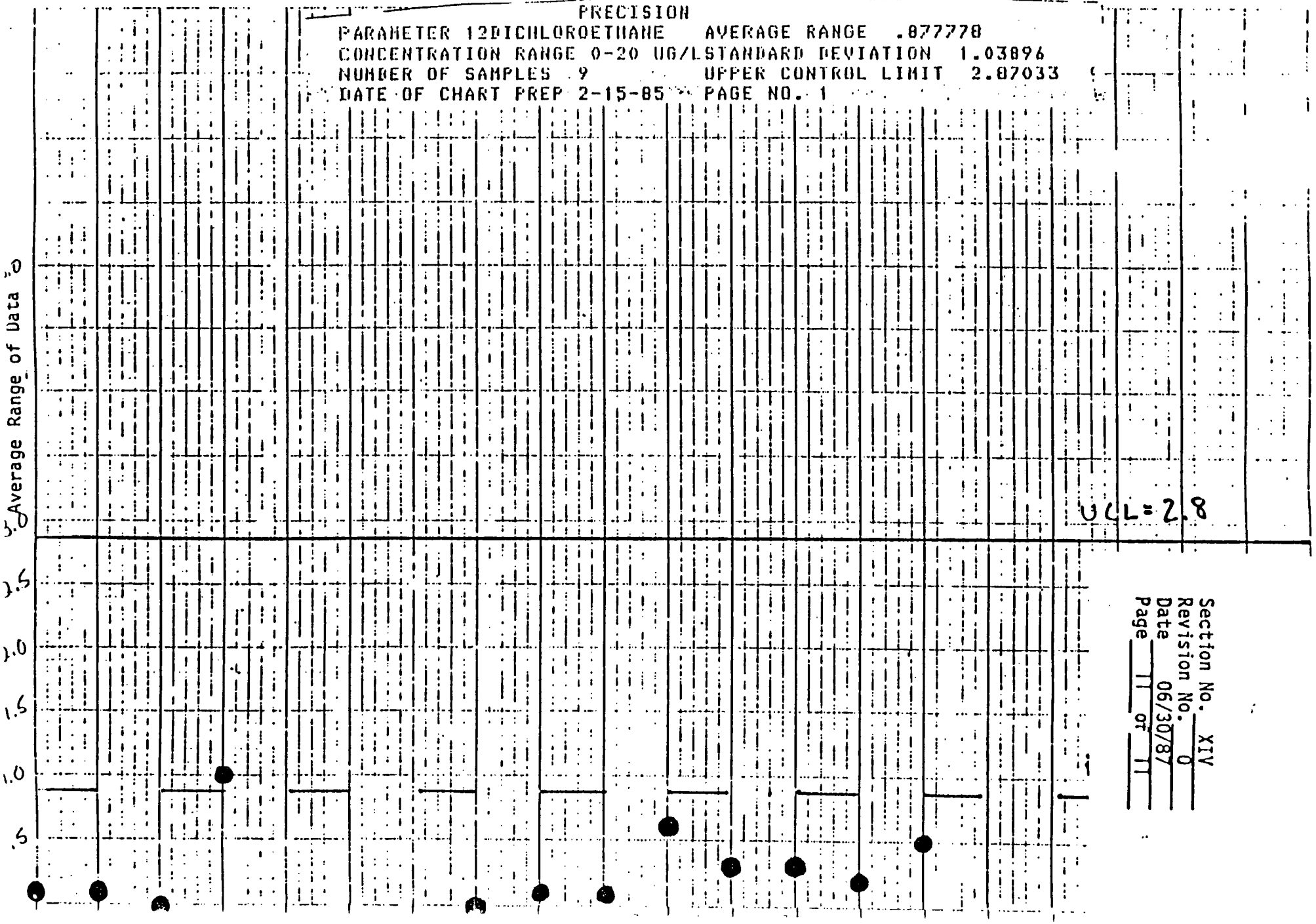
Parameter:
Concentration Range:
Upper Control Limit (UCL):
# of Samples Considered:

Average Range of Data:
Standard Deviation:
Date of Chart Preparation:

Page #:

QUALITY CONTROL
SHEWHART CONTROL CHART FOR PRECISION



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CV. CORRECTIVE ACTIONS

When, as a result of audits or QC sample analysis, sampling or analysis systems are shown to be unsatisfactory, a corrective action shall be implemented. The Project Manager, Laboratory Director, Quality Assurance Manager, and analyst may be involved in the corrective action. If previously reported data is affected by the situation requiring correction or if the corrective action will impact the project budget or schedule, the action should directly involve the Project Manager and the Quality Assurance Manager. Corrective actions are of two kinds:

A. Immediate, to correct or repair nonconforming equipment and systems. The need for such an action will most frequently be identified by the analyst as a result of calibration checks and QC sample analyses.

B. Long term, to eliminate causes of nonconformance. The need for such actions will probably be identified by audits. Examples of this type of action include:

1. Staff training in technical skills or in implementing the QA Program;

2. Rescheduling of laboratory routine to ensure analysis within allowed holding times;

3. Identifying vendors to supply reagents of sufficient purity; and

4. Revision of QA system or replacement of personnel.

submittal as verification that the problem has been eliminated.

XVI. QUALITY ASSURANCE REPORTS TO MANAGEMENT

A. OBJECTIVE

This section describes the methods used by PACE to store and retrieve quality assurance records and issue the appropriate reports.

B. REQUIREMENTS

Comprehensive records shall be maintained to provide evidence of the quality assurance activities. All points which indicate an out-of-control situation must be evaluated and explained. Any corrective actions and re-analysis of samples must be fully explained and documented.

C. IMPLEMENTATION

Procedures for recording all aspects of the quality assurance program will be written and placed on file. Appropriate personnel will be trained in the use of these procedures.

D. DISCUSSION

The proper maintenance of quality assurance records is essential to document validity and reliability and to provide support in evidentiary proceedings as needed.

The original quality assurance records will be kept in the Program Quality Assurance Department.

All information received from outside sources will be retained

by the group using the data.

Access to working files will be restricted to only project personnel.

Access to all files containing quality assurance records will be restricted to listed personnel.

Upon termination of an individual task or work assignment, working files will be processed for storage as quality assurance records.

E. RESPONSIBILITIES

The Project Manager shall be responsible for ensuring that quality assurance records are being properly stored and that they can be retrieved.

The Quality Assurance Department shall be responsible for maintaining the records, which will include quality assurance record files and a quality assurance records index.

The Quality Assurance Department shall be responsible for identifying the documents to be designated as quality assurance records. These shall be responsble for identifying the documents to be designated as quality assurance records.

F. REPORTS TO MANAGEMENT

Quarterly reports are provided by the Quality Assurance Department to the President, Vice President and Director of Laboratory Services of PACE. This report addresses the

quarterly Quality Assurance Activities including details of corrective actions implemented, audit results, and Q.C. summary information.

THOMAS A. JACKMAN, Ph.D.
Director, Florida Division
PACE Laboratories, Inc.

EDUCATION

Ph.D. Chemistry	University of South Florida, Tampa, Florida, 1976.
B. A. Chemistry	University of South Florida, Tampa, Florida, 1971.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Sigma XI
American Association for the Advancement of Science
Association of Official Analytical Chemists

PROFESSIONAL EXPERIENCE

Experienced in the acquisition and interpretation of data from various types of analytical instrumentation. Representative instrumentation includes:

Gas Chromatography (FID, ECD, NPFID, FPD, HALL, DID)
Gas Chromatography/Mass Spectrometry
Atomic Absorption Spectrophotometry
Ion Chromatography
Infrared, Visible, Ultraviolet Spectroscopy
Nuclear Magnetic Resonance
Electron Paramagnetic Resonance

Specialized expertise in the use of chemical analytical instrumentation for the detection of trace quantities of chemical compounds in various matrices. This includes:

Analysis of industrial atmospheres to determine worker exposure to hazardous materials. Working knowledge of NIOSH sampling and analytical procedures.

Analysis of fire debris to determine the presence of absence of potential accelerants. Qualified as an expert witness in state and federal courts in Florida and Louisiana.

Analysis of water, wastewater, and hazardous waste in accordance with USEPA Protocol. Working knowledge of the 500 and 600 series protocol, SW-846, ASTM, AOAC, and Standard Methods.

Experienced in the generation and detection of trace organic chemicals in the air. Actively participating in a research project which involves the generation and validation of low concentrations of organosulfur and organophosphorus compounds. The analytical protocol requires the use of gas chromatographic separation with flame photometric detection.

Provide technical support and consulting to clients regarding the determination of regulatory compliance in the following areas:

Hazardous Waste: Permitting, agency liaison, and interpretation of RCRA and HSWA regulatory requirements.

Superfund: Project Manager for Remedial Investigation at a site included ont he National Priorities List. Provide technical expertise in all aspects of the investigation and remedy selection and participate in negotiations with the Environmental Protection AGency. Working knowledge of the provisions of the CERCLA and SARA regulations.

Air Emissions: Air Emissions testing (EPA Methods 1-5, 6,7,8,9,12,13), permitting, and regulatory liaison.

WORK EXPERIENCE

1987 - Present PACE Laboratories, Inc.
Director, Florida Division

Responsible for operations and management of organization specializing in environmental consulting and laboratory analysis.

1977 - 1987	Interscience, Inc. Vice President, Senior Chemist Responsible for all aspects pertaining to the operation of an analytical chemical laboratory. Also responsible for environmental monitoring programs and consulting services.
1976 - 1977	Department of Chemistry Wright State University Dayton, Ohio Postdoctoral Fellow
1976	Hillsborough Community College Tampa, Florida Instructor
1972 - 1976	Department of Chemistry University of South Florida Tampa, Florida

KATHY L. HARRIS
Chemist
Quality Assurance Officer
PACE Laboratories, Inc.

EDUCATION

B. S. Chemistry — University of Florida, Gainesville, Florida, 1981.
Computer Courses — Eastern Mennonite College
Waters HPLC Short Course
IL - AA Course, Flame and Furnace

EXPERIENCE

June 1987 - Present — PACE Laboratories, Inc.
Chemist
Quality Assurance Officer

Analytical and quantitative testing using AA, flame and furnace, GC, IC, UV-Vis, TLC, titrametric and gravimetric assays, Kjeldahl nitrogen, COD, BOD, and IR.

Responsible for quality control, data interpretation, equipment maintenance and repair, and technical consulting.

July 1985 - June 1987 — Interscience, Inc.
Chemist

Analytical and quantitative testing, quality control, data interpretation, equipment maintenance and repair, and technical consulting.

Proficient in analytical techniques: AA, flame and furnace, LC, GC, IC, UV-Vis, TLC, titrametric and gravimetric assays, sterile preparticulate matter, Kjeldahl nitrogen, COD, BOD, and IR, with exposure to NMR.

Dec. 1984 - Mar. 1985 — Merck & Company, Inc.
Chemist

Developed HPLC method which was 50% faster than the assay currently in use in Q.C. Participated in strain improvement program by establishing analytical support for the program with HPLC and Technicon auto analyzer.

June 1982 - Dec. 1987 — Merck & Company, Inc.
Quality Control Technician

Responsible for maintaining quality throughout the processes of pharmaceutical manufacturing.

Sept. 1981 - Apr. 1982 — University of Florida
Department of Biochemistry
Chemist I

Pioneered only lab in the Southeast for sequencing and analysis of synthesized amino acids. Developed an HPLC method for quantitation of amino acids.

June 1979 - Apr. 1982 — Shands Teaching Hospital, Inc.
Medical Laboratory Technician

Analyzed blood serum using automated instrumentation and flame AA.

MEMBERSHIPS

Florida Society of Environmental Analysts

CURT W. LESSL
Chemical Engineer
PACE Laboratories, Inc.

EDUCATION

1979	St. Louis Community College, St. Louis, Missouri, Associate Degree in General Education.
1985	University of South Florida, Tampa, Florida, B. S. Chemical Engineering

EXPERIENCE

1987 - Present	PACE Laboratories, Inc. Chemical Engineer

RCRA compliance; air emissions testing and permitting; POTW discharge permitting; hazardous waste manifest preparation, documentation, shipment, and disposal; waste treatment process development and design; bench scale and pilot plant studies; classification of chemical waste for lab pack disposal; economic analysis; personnel training; SARA/Community Right to Know; Environmental Auditing.

1986 - 1987	Interscience, Inc. Chemical Engineer

MEMBERSHIPS

American Institute of Chemical Engineers

Engineer in Training

MICHAEL F. VALDER
Chemist
PACE Laboratories, Inc.

EDUCATION

B. S. Chemistry — University of South Florida, Tampa, Florida, 1986.

EXPERIENCE

1987 - Present — PACE Laboratories, Inc.
Chemist

Responsibilities include general wet chemistry, ion chromatography, and low level chloride in concrete analysis. Certified Visible Emissions observer with client contact in areas concerning visible emissions.

1986 - 1987 — Interscience, Inc.
Chemist

Major responsibilities include general wet chemistry, ion chromatography, and low level chloride in concrete analysis.

MEMBERSHIPS

Florida Society of Environmental Analysts

R. NILES BASHAW
Chemist
PACE Laboratories, Inc.

EDUCATION

B. S. Chemistry — Florida State University, Tallahassee, Florida, 1957.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Florida Advisory Committee on Arson Prevention (FACAP)
International Association of Arson Investigators (IAAI)
International Association for Fire Safety Science
Florida Chapter of IAAI
Pinellas Arson Co-Op of Florida (PARCO)

EXPERIENCE

1987 - Present — PACE Laboratories, Inc.
Chemist

Fire and explosion cause and origin determinations for residential, commercial and industrial losses. Fire and materials chemistry analyses. Participation in laboratory and full scale burn testing. Gas chromatography, Infrared and Mass Specoscopy analyses, Forensic chemistry analysis.

1985 - 1987 — Interscience, Inc.
Chemist

Fire and explosion cause and origin determinations for residential, commercial and industrial losses. Fire and materials chemistry analyses. Participation in laboratory and full scale burn testing. Gas chromatography, Infrared and Mass Specoscopy analyses, Forensic chemistry analysis.

1982 - 1985 Selin Company
President

A marketing firm representing several manufacturers selling to the gift and stationery market in Florida.

1973 - 1982 Iminac, Inc.
Subsidiary of The Dow Chemical Company
Sales Manager and Technology Manager

Responsible for marketing and the research and development. Iminac was purchased by the major managers.

1957 - 1973 Dow Chemical Company
Advanced from Chemist to Research Specialist

Conducted individual and group research in fire chemistry, polymer chemistry, radiation chemistry, free radical chemistry and chemical synthesis.

1954 - 1957 Florida State University

Individual research in radiation chemistry and teaching assistant.

MICHAEL WAYNE PALMER
Chemist
PACE Laboratories, Inc.

EDUCATION

1984 University of Tampa, Tampa, Florida, Bachelor of Science, Majors: Chemistry, Biology, Marine Science, December 1984.

EXPERIENCE

1987 - Present
PACE Laboratories, Inc.
Chemist

Analysis of pesticides, herbicides, poly aromatic hydrocarbons, volatile organics and PCB's, in drinking water, waste water, soil and oil by gas chromatography. Experienced with FID, Hall, ECD, PID, TCD gas chromatographs equipped with FID, Hall, PID, ECD and TCD detection. Experienced with EPA Methods including 601, 602, 608, 610, 504.2

1986 - 1987
ENVIROPACT, Inc.
Analytical Chemist

Analysis of pesticides, herbicides, poly aromatic hydrocarbons, volatile organics and PCB's, in drinking water, waste water, soil and oil by gas chromatography using Shimadzu Mini G.C. and a Varian 3700 with a Tracor Hall Detector.

1985 - 1986
State Department of HRS
Chemist II

Analysis of pesticides, herbicides, EDB and hydrocarbons in water and food by gas chromatography and method development using Hewlett Packard, Perkin Elmer, and Tracor gas chromatographs on line with a Hewlett Packard Data System.

JOHN T. STIMUS
Environmental Technician
PACE Laboratories, Inc.

EDUCATION

1985 University of Tampa, Tampa, Florida, Bachelor of Science, April, 1985.

EXPERIENCE

1987 - Present
PACE Laboratories, Inc.
Environmental Technician

Experienced in the collection of air, groundwater, wastewater and hazardous waste samples. Completed 40 hours training for work on hazardous waste sites.

1986 - 1987
ENVIROPACT, Inc.
Remedial Technician/Field Supervisor

Chemist, Wet Lab Supervisor

1985 - 1986
University of Tampa
Admissions Representative

1985 - 1985
Hillsborough County Schools
Substitute Teacher

JAMES E. FRANKLIN
Environmental Technician
PACE Laboratories, Inc.

EDUCATION

University of Minnesota, Bachelor of Arts, Biology

Vermilion Community College, Ely, Minnesota, EAT Program

EXPERIENCE

1986 - Present

PACE Laboratories, Inc.
Environmental Technician

Transferred to Florida in June, 1987. Responsible for supervising the Field Services Department.

Ground water sample collection for analysis of trace level contaminants at sanitary landfills, Super Fund sites, hazardous waste sites, accidental spills and leaking underground storage tanks.

Waste water sample collection at a wide variety of manufacturing and industrial facilities for NPDES permitting, process control, and compliance testing.

Flow monitoring involving the construction and installation of weirs, other primary devices, and the set up and maintenance of ISCO 2500 systems.

Soil sampling for PCB's, organics, and conventional parameters. One project involved sampling a grid covering over 3 square kilometers.

Hazardous waste sampling, labelling, and recontainerization involving a wide range of wastes and materials. Experienced in SCBA (self-contained breathing apparatus) and air-line work.

Completed a 16 hour course on hazardous waste safety for EPA Level B.

Co-author of PACE's Hazardous Waste QC Manual.

Air stack sampling of industrial emissions to test for compliance and process efficiency.

Sample custody involving sample check-in, chain of custody, and Contract Lab Protocol.

Prior to joining PACE, Mr. Franklin's experience included:

Field Services for the MN Department of Health.

Portage Crew with the U. S. Forest Service in Ely, Minnesota.

Laboratory technician with the University of MN, Minneapolis.

MEMBERSHIPS

National Water Well Association

RONALD ERWIN BROCK
Lab Aide
PACE Laboratories, Inc.

EDUCATION

James Sprunt Institute, Kennansville, N.C., Radio & Television Repair, 1977-1979.

Wallace-Rosehill High School, Wallace, N.C., 1977.

EXPERIENCE

1987 - Present
PACE Laboratories, Inc.
Lab Aide

Responsibilities include preparation of equipment for use in field sampling and in laboratory analyses.

1982 - 1987
Rhone-Poulenc Inc.
Research Triangle Park, N.C.
Research Assistant

Analyzed crop samples and environmental samples for Aldicarb.

Data entry and quarterly reports.

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C

MSDS#

CAS = Chemical Abstract Services
CAS # XXXXXX-XX-X (ACS format)

Note: Some older Genium Sheets have CAS numbers in an XXX XXX XXX format. The ACS format is preferred and is the current practice.

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D

E

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F

G

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H

MSDS#

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J

MSDS#

K

L

M

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Union Carbide Corp.
Ethylene Oxide Derivatives Div.
- Ethylamine 540

Union Carbide Corp.
Linde Div.
- Acetylene 403
- Argon 64
- Carbon Monoxide 35
- Dichlorotetrafluorethane 572
- Helium 98
- Hydrogen Gas 65
- Hydrogen Sulfide 52
- Methane 440
- Nitrogen 61
- Oxygen 62
- Phosgene 66
- Phosphine 63

Union Carbide Corporation
Solvents & Intermediates
- Acetic Anhydride 434
- N-Aminoethyl Piperazine 408
- BAKELITE ERL-4221 386
- Butanol 337
- Butyl Acetate 338
- Butyl CARBITOL 322
- Butyl CARBITOL Acetate 368
- 4-t-Butylphenol 422
- CARBOWAX 3350, 4600, 8000 364
- CELLOSIZE HEC, Types WP and QP 401
- CELLOSOLVE Acetate 321
- CELLOSOLVE Solvent 319
- Cumene 395
- Dibutyl Phthalate 429
- Diethanolamine 426
- Diethylene Glycol Monoethyl Ether 460
- Diethyl Ketone 478
- 1,4-Dioxane 412
- Ethyl Acetate 437
- Ethyl Butyl Ketone 306
- Ethylenediamine 325
- 2-Ethylhexyl Acrylate 345
- Ethyl Silicate 446
- Formic Acid 416
- Isopropyl Acetate 496
- Methyl CELLOSOLVE 352
- Methyl Methacrylate (Monomer) 441
- Monoethanolamine 418
- Proprietary Solvent (Federal Formula #1) 1242
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- SYNASOL PM 3224 & PM 509 1073
- SYNASOL Solvent 190, PM41 1242
- Triethanolamine 427
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Union Carbide Corporation
Specialty Chemicals & Plastics Div.
Acrolein 573
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Union Oil Company of California
Union Chemical Div.
AMSCO Rubber Solvent 371
AMSCO Solv 5391 496
AMSCO Solv 5470 353
AMSCO Special Naptholite 391
Amyl Acetate, Primary
(Mixed Isomers) 486

US Borax & Chemical Co.
Boron Oxide 143
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US Steel Corp.
USS Chemicals Div.
Aniline 407
Di(2-Ethylhexyl)Phthalate 414

United Mineral & Chemical Corp.
Zinc Sulfate 96

Urethane Tooling and Eng'g Corp.
UT-100 Adhesive 1172

USI Chemical
Vinyl Acetate, Monomer,
Inhibited 509

Ventron Corp.
ALFA Div.
Silver Nitrate 81

Vesicol Chemical Corporation
Benzoic Acid 402
Chlorendic Anhydride 339

Virginia Chemicals, Inc.
Diethylamine 453
Isopropyl Amine 483
Sulfur Dioxide, Anhydrous 50

Vulcan Materials Company
Stannous Chloride 67
Stannous Sulfate 14

Warner Company
Industrial Minerals Div.
Calcium Hydroxide 39
(Bell Mine Chemical Hydrate)

WD-40 Company
WD-40 1030

Weld-Aid Products, Inc.
NOZZLE KLEEN 1164

S.S. White Industrial Products
AIRBRASIVE POWDER No. 1 1000
No. 3 1197

White Chemical Corporation
Acetyl Chloride 452

Whitford Corp.
XYLAN 1010 1143

Whittaker Corporation
Ram Chemicals Division
RAM MOLD RELEASE 225 (Aerosol) 1046
RAM MOLD RELEASE 225 1046A

Witco Chemical Corp.
U.S. Peroxygen Div.
MEK Peroxide Solution
(9 wt% max "active oxygen") 329A

Woodhill Chemical Sales Corporation
SUPERGLUE 3 1065

Woodmont Products, Inc.
THOXENE TA-12 A&B 1027A
(No longer commercially available)

Xerox Corporation
XEROX DUPLICATING TONERS 1028
Part Numbers: 6R5, 6R20, 6R60, 6R61, 6R148, 6R152, 6R157
TRADE NAMES: 720/813/914/970/1000/1824/1860/LDX Toner
XEROX DUPLICATING TONER (Dry Imager) 1028A
Part Numbers: 6R87, 6R40, 6R41, 6R64, 6R65, 6R62, 6R63, 6R207, 6R208
TRADE NAMES: 1200 Toner (Dry Imager)/970; TC 200/600 MEP Toner (Dry Imager); 2400/3600/7000/840 EPS Toner (Dry Imager)

LATEST ISSUE LIST

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NUMBERS: GENIUM assigns Data Sheet numbers to materials arbitrarily. The numbers have no other significance than merely the organization of this Collection.

DATES: The Sheets are dated when originally written and revised. Sheets marked with "R" indicate the sheet was reviewed and found not to need revision. "R" dates remain the issue date in the Latest Issue List; the date of the review is noted only on the MSDS Sheet itself.

VOLUME I - INORGANIC MATERIALS (1 to 299)

MSDS#		DATED(a)
1	Anhydrous Ammonia	8/85
1A	Ammonium Hydroxide (28-30%)	5/80
2	Potassium Hydroxide	2/84
3	Sodium Hydroxide	8/85
3A	Sodium Hydroxide, 50% Liquid	8/85
4	Boric Acid	3/83
5	Chromic Acid, Solid	8/85
6	Hydrofluoric Acid (Anhydrous)	5/81
6A	Hydrofluoric Acid (47-70%)	5/81
7	Nitric Acid	10/80
8	Phosphoric Acid	3/83
9	Sulfuric Acid	2/86
9A	Oleum	2/86
10	Hydrazine Monohydrobromide	7/79
11	Mono-Aluminum Phosphate	10/77
12	Cuprous Cyanide	5/84
13	Potassium Cyanide	5/80
14	Stannous Sulfate	9/84
15	Asbestos Tape	11/79
15A	Chrysotile Asbestos	11/79
15B	Asbestos-Rubber Sheet & Gaskets	10/82
16	Sodium-Potassium Alloy	2/84
17	Zirconium Metal/Powder	9/80
18	Zinc Chloride Soldering Flux	5/84
19	Ferric Chloride Solution	2/84
20	Nickel Nitrate	5/84
21	Ammonium Chloride	8/85
22	Calcium Oxide	9/78
23	Cadmium Metal	12/80
24	Mica Powder (Muscovite)	9/77
25	Phosphorus (Yellow)	9/77

VOLUME I - INORGANIC MATERIALS 1 to 299

MSDS #		Dated (a)
26	Mercury	9/81
27	Sulfur Hexafluoride	6/81
28	Antimony Trioxide	10/85
29	Copper Sulfate	5/84
30	Hydrogen Chloride (Anhydrous)	6/84
30A	Hydrochloric Acid	6/84
31	Disodium Hexafluorosilicate	7/79
32	Cu/Co/Be Alloy	5/80
33	Ammonium Persulfate	1/78
34	Ozone	2/82
35	Carbon Monoxide	1/86
36	Nickel Chloride	2/86
37	Nickel Sulfate	2/86
38	Lead Monoxide	2/86
39	Calcium Hydroxide	10/84
40	Barium Octahydrate	2/86
41	Ag/Cd/Zn/Cu Brazing Alloy	7/84
42	Talc	11/78
43	Trisodium Phosphate Dodecahydrate	11/78
(44)	None issued	--
44A	Hydrogen Peroxide (60%)	12/78
44B	Hydrogen Peroxide (27-52%)	12/78
45	Zinc Oxide	2/86
46	Fibrous Glass	12/78
47	Nitrogen Dioxide	R-12/78
48	Sodium Carbonate, Anhydrous	11/84
49	Ammonium Bifluoride	2/86
51	Carbon Black	8/85
52	Hydrogen Sulfide	7/79
53	Chlorine	7/79
54	Carbon Dioxide	7/79
55	Wallastonite	7/79
56	Sulfur	10/79
57	Ferrous Sulfate Heptahydrate	4/80
58	Sodium Cyanide	4/80
59	Beryllium Metal/Powder	4/80
60	Bismuth Metal/Powder	4/80
61	Nitrogen	4/80
62	Oxygen	4/80
63	Phosphine	5/80
64	Argon	10/84
65	Hydrogen Gas	5/80
66	Phosgene	5/80
67	Stannous Chloride	7/80
68	Calcium Hypochlorite	7/80
69	Diatomaceous Earth (Natural)	R-9/80
70	Antimony Metal/Powder	9/80
71	Quartz	9/80
72	Sulfamic Acid	9/80
73	Zinc Metal/Powder	9/80
74	Tin Metal/Powder	9/80
75	Titanium Metal/Powder	10/80
76	Thorium Metal/Powder	11/80
77	Bromine	7/80
78	Calcium Carbide	4/81
79	Ammonium Nitrate	7/81
80	Thallium Metal/Powder	12/80
81	Silver Nitrate	12/80
82	Cobalt Metal/Powder	3/81
83	Chromium Metal/Powder	3/81
84	Molybdenum Metal/Powder	3/81
85	Sodium Meta Silicate	10/81
86	Thionyl Chloride	7/81
87	Sodium Bisulfide	5/81
88	Vanadium Pentoxide	6/81
89	Hydrofluosilicic Acid	6/81

VOLUME I - INORGANIC MATERIALS

MSDS #	1 to 299	Dated (a)
90	Sulfuryl Chloride	7/81
91	Boron Trifluoride	10/81
92	Aluminum Sulfate, Liquid	10/81
93	Sodium Borohydride	10/81
94	Magnesium Oxide	10/81
95	Potassium Permanganate	10/81
96	Zinc Sulfate	10/81
97	Magnesium Carbonate	11/81
98	Helium	3/82
99	Sodium Silicate Solution	5/82
100	Aluminum Metal/Powder	5/84
101	Sodium Nitrate	4/82
102	Perchloric Acid (70-72%)	10/85
103	Diborane	3/82
104	Decaborane	10/82
105	Lithium Fluoride	10/82
106	Silicon Tetrachloride	9/82
107	Silane	11/82
108	Tellurium Metal/Powder	10/82
109	Nitrous Oxide	10/82
110	Phosphorus Trichloride	10/82
111	Ammonium Fluoride	10/82
112	Borax Pentahydrate	11/82
113	Boron Nitride Powder	11/82
114	Iodine	12/82
115	Sodium Hypochorite Aqueous Solution (5-12%)	2/83
116	Sodium Nitrite	7/83
117	Phosphorus Oxychloride	7/83
118	Titanium Dioxide	10/83
119	Barium Carbonate	10/83
120	Strontium Carbonate	10/83
121	Cupric Chloride	10/83
122	Manganese Dioxide	10/83
123	Tungsten Carbide Powder	10/83
124	Vanadium Metal/Powder	10/83
125	Chlorine Trifluoride	12/83
126	Hydrazine, Anhydrous	6/84
127	Hydrazine, Aqueous	6/84
128	Nickel Fluoborate	4/85
129	Ammonium Dichromate	12/85
130	Ammonium Metavanadate	4/85
131	Barium Fluoride	4/85
132	Barium Chloride	4/85
133	Cadmium Oxide	5/85
134	Yitrium Oxide	6/85
135	Manganese Carbonate	6/85
136	Selenium	6/85
137	Tricalcium Phosphate	7/85
138	Sodium Fluoride	8/85
139	Ammonium Acetate	8/85
140	Potassium Ferricyanide	9/85
141	Calcium Chloride, Anhydrous	8/85
142	Ferric Nitrate	8/85
143	Boron Oxide	8/85
144	Cadmium Chloride, Anhydrous	8/85
145	Lanthanum Oxide	8/85
146	Mercuric Chloride	8/85
147	Rhodium Metal/Powder	8/85
148	Manganese Metal/Powder	9/85
149	Lithium Bromide	9/85
150	Lead Chloride	9/85
151	Manganese Sulfate	9/85
152	Selenium Dioxide	10/85
153	Sodium Dichromate	10/85
154	Cadmium Metal Powder	10/85
155	Bottom Ash	11/85

VOLUME I - INORGANIC MATERIALS

MSDS #	1 TO 299	Dated (a)
156	Pond Sludge	11/85
157	Copper I Oxide	12/85
158	Copper II Oxide	12/85
159	Strontium Nitrate	12/85
160	Lithium Hydride	12/85
161	Carbon Steel (Scrap)	12/85
162	Copper (Scrap)	12/85
163	Stainless Steel-Cobalt Base	12/85
164	Stainless Steel-Nickel Base	12/85
165	Beryllium-Copper Alloy (Scrap)	12/85
166	Titanium-Based Alloy	12/85
167	Tantalum Powder	1/86
168	Potassium Dichromate	1/86
169	Mercury (II) Nitrate	1/86
170	Mercury (II) Oxide	1/86
171	Cadmium Nitrate Tetrahydrate	1/86
172	Bromine Pentafluoride	2/86
173	Barium Nitrate	2/86
174	Copper (II) Nitrate, Trihydrate	2/86
175	Iron (III) Oxide	2/86
176	Zinc Metal Powder	3/86
177	Tungsten Carbide	3/86
178	Arsine	3/86

MSDS #'s 179 to 299 are reserved for future use.

VOLUME I - ORGANIC MATERIALS

MSDS#	(300 to 999)	DATED
300	Acetone	9/85
301	Cyclohexanone	8/79
302	Methyl n-Amyl Ketone	9/79
303	Methyl Ethyl Ketone	9/79
304	Methyl Isobutyl Ketone	9/79
305	Methyl n-Propyl Ketone	9/79
306	Ethyl n-Butyl Ketone	9/79
307	Chlorodifluoromethane	2/86
308	Dichlorodifluoromethane	2/86
309	Fluorotrichloromethane	2/86
310	Methylene Chloride	9/85
311	1,1,1-Trichloroethane	8/83
312	Trichloroethylene	7/79
313	Perchloroethylene	11/78
314	Trichlorotrifluoroethane	2/86
315	Chloroform	8/79
316	Benzene	11/78
317	Toluene	8/79
318	Xylene	10/80
318A	o-XYLENE	11/80
318B	m-XYLENE	11/80
318C	p-XYLENE	11/80
319	2-Ethoxyethanol	R-10/79
320	2-Butoxyethanol	9/85
321	2-Ethoxyethyl Acetate	R-11/79
322	Diethylene Glycol Monobutyl Ether	9/78
323	Ethylene Glycol	11/80
324	Isopropyl Alcohol	9/85
325	Ethylenediamine	5/84
326	Benzyldimethylamine	2/84
327	Acetic Acid, Glacial	12/80
327A	Acetic Acid, 28%	10/80
328	Oxalic Acid	2/81
329	MEK Peroxide Solution	R-4/80
329A	MEK Peroxide Solution, 9% Max	11/80

MSDS #	VOLUME I - ORGANIC MATERIALS 300 TO 999	Dated (a)
330	Trimellitic Anhydride	12/79
331	Toluene-2,4-Diisocyanate	R-11/78
332	Tricresyl Phosphate	11/77
333	Triphenyl Phosphate	11/82
334	Mineral Spirits, Type I	7/84
334A	Mineral Spirits, Type II	7/84
334B	Stoddard Solvent, Type III	11/77
335	Epoxy Resin, Solid (Unmodified)	1/82
(335A)	None issued	--
335B	Epoxy Resin, Liquid (Unmodified)	1/82
336	Vinyltoluene	7/79
337	n-Butyl Alcohol	6/84
338	n-Butyl Acetate	5/84
339	Chlorendic Anhydride	10/81
340	Dicyclopentadiene	2/84
341	Isoprene	11/77
342	Dimethyl Ether	4/83
343	Diethyl Ether	8/79
344	Dimethyl Sulfate	11/77
345	2-Ethylhexyl Acrylate	2/84
346	Methylenedianiline	10/78
347	N,N-Dimethylaniline	11/77
348	N,N-Diethylaniline	12/79
349	Dimethyl Silicone Fluid	R-12/76
350	Carbon Disulfide	9/82
351	Styrene Monomer	8/79
352	2-Methoxyethanol	R-7/81
353	Diacetone Alcohol	12/83
354	Methyl Alcohol	9/85
355	Phenol	9/85
356	Morpholine	3/81
357	Isophorone	7/79
358	o-Dichlorobenzene	2/84
359	1,2-Dichloroethane	11/78
360	Formalin	3/81
361	Ethyl Alcohol	10/81
362	1,3-Butanediol	10/77
363	Cobalt (6%) Naphthenate Solution	8/83
364	Polyethylene Glycol	3/82
365	Trichlorobenzene, Dielectric Grade	12/79
366	Chlorobenzene	11/82
367	2-Ethylhexanol	2/84
368	Diethylene Glycol Monobutyl Ether Acetate	11/77
369	Bisphenol A	9/85
370	White Shellac Solution	1/78
371	Rubber Solvent	1/78
372	4,4'-Methylene Bis(2-chloroaniline)	7/79
373	Methyl Chloride	8/78
374	Allyl Chloride	8/78
375	Turpentine	10/84
376	Wood Dust	7/79
377	Rosin (Gum, Wood or Tall Oil)	10/84
378	Tris(dimethylaminomethyl) Phenol	8/78
379	Tetrahydrofuran	9/85
380	Liquefied Propane	10/84
381	Acrylonitrile Monomer	8/78
382	Vinyl Chloride Monomer	R-8/78
383	"Isooctane"	8/78
384	Lead Naphthenate Solution (24% Lead)	8/78
385	Ethyl Benzene	8/78
386	Cycloaliphatic Epoxy Resin	8/83
387	Kerosene Solvent	12/82
388	Polytrifluorochloroethylene, Liquid	10/78
389	Cyclohexane	3/84
390	Formamide	9/78
391	VM&P Naphtha (Rule 66 Exempt)	9/78
392	Triethylamine	9/78
393	Electrical Insulating Oil	R-9/78
394	Reactive Polyamide Liquid Resins	R-9/78
395	Cumene	9/78
396	Isobutyl Acetate	10/78
397	n-Hexane	8/83
397A	Hexane Isomers	8/83
398	Isobutyl Alcohol	8/85
399	Polyvinyl Formal Resins	10/78
400	Adipic Acid	12/79
401	Hydroxyethyl Cellulose	10/78
402	Benzoic Acid	11/78
403	Acetylene	7/84
404	Dimethyl Terephthalate	12/78
405	Pyridine	12/78
406	t-Butyl Perbenzoate	12/78
407	Aniline	10/84
408	N-Aminoethyl Piperazine	12/78
409	Cresol	12/78
409A	Cresylic Acid	12/79
410	Carbon Tetrachloride	12/80
411	Triphenyl Phosphite	11/84
412	1,4-Dioxane	R-12/78
413	Furfural	9/81
414	Di(2-Ethylhexyl)Phthalate	11/84
415	Stearic Acid	6/79
416	Formic Acid	6/79
417	Phthalic Anhydride	R-6/79
418	Monoethanolamine	6/79
419	Tetramethylguanidine	6/79
420	Acetone Solvent Blend	7/79
421	4-t-Butylcatechol	8/79
422	4-t-Butylphenol	8/79
423	Ethylene Thiourea	10/79
424	Dimethylformamide	3/82
425	Methyl-n-Butyl Ketone	10/79
426	Diethanolamine	10/79
427	Triethanolamine	4/80
428	Dimethyl Sulfoxide	4/80
429	Dibutyl Phthalate	5/80
430	Dimethyl Phthalate	5/80
431	N-Methyl-2-pyrrolidone	7/80
432	Methyl Formate	5/80
433	Ethylene Oxide	5/80
434	Acetic Anhydride	5/80
435	Diethyl Phthalate	7/80
436	Nitroethane	5/85
437	Ethyl Acetate	R-7/80
438	Maleic Anhydride	R-7/80
439	Nitrobenzene	7/80
440	Methane	7/80
441	Methyl Methacrylate	7/80
442	2-Butanol	2/86
443	Terephthalic Acid	9/80
444	Zinc Stearate	9/80
445	Calcium Stearate	9/80
446	Ethyl Silicate	5/81
447	Propylene Carbonate	2/81
448	2-Nitropropane	5/85
449	Acrylic Acid	3/81
450	Cresyl Diphenyl Phosphate	3/81
451	Biphenyl	4/81
452	Acetyl Chloride	9/81
453	Diethylamine	5/81
454	Mesityl Oxide	5/81
455	4-Methoxyphenol	6/81
456	2,6-Di-t-Butyl-p-Cresol	8/81

MSDS #	VOLUME I - ORGANIC MATERIALS 300 TO 999	Dated (a)
457	Ethylene	11/81
458	N,N-Dimethyl Acetamide	7/81
459	Benzoyl Chloride	6/81
460	Diethylene Glycol Monoethyl Ether	6/81
461	Diphenylamine	9/81
462	Paraformaldehyde	9/81
463	1,3-Butadiene	9/81
464	n-Heptane	9/81
465	Methyl Mercaptan	10/81
466	Methyl Isopropyl Ketone	10/81
467	Automotive Gasoline, Lead-free	10/81
468	Fuel Oil #1	3/82
469	Fuel Oil #2	10/81
470	Diesel Fuel Oil #2-D	10/81
471	Coconut Shell Charcoal	12/81
472	Starch (Corn)	2/82
473	Fuel Oil #5	10/81
474	Fuel Oil #6	10/81
475	Potassium Biphathalate	10/81
476	Linseed Oil	11/81
477	Soya Oil	11/81
478	Diethyl Ketone	3/82
479	Furfuryl Alcohol	7/82
480	Ethyl Amyl Ketone	4/80
481	Liquefied Butane	3/82
482	Hexahydrophthalic Anhydride	6/82
483	Isopropyl Amine	8/82
484	Pine Oil	8/82
485	1,4-Butanediol	9/85
486	Amyl Acetate Primary (Mixed Isomers)	3/82
487	n-Amyl Acetate	3/82
488	Kerosine Burner Fuel	11/82
489	Cyclohexanol	9/82
490	Ammonium Lauryl Ether Sulfate	5/82
491	Bituminous Coal Dust	5/82
492	Ethylene Dibromide	9/82
493	Terpineol	9/82
494	n-Propyl Alcohol	9/82
495	Tall Fatty Acids	9/82
496	Isopropyl Acetate	10/82
497	t-Butanol	2/86
498	Pyrrolidine	10/82
499	Acetonitrile	10/82
500	Benzoyl Peroxide	10/82
501	Diisobutyl Ketone	10/82
502	Ethyl Formate	7/85
503	Methyl Acetate	12/82
504	Butyl Mercaptan	12/82
505	Allyl Alcohol	2/86
506	n-Amyl Alcohol	12/82
507	Cellulose Flock from Wood	4/82
508	Nitromethane	5/85
509	Vinyl Acetate, Monomer, Inhibited	2/83
510	Ethyl Mercaptan	2/83
511	Chlorendic Acid	2/83
512	Lard Oil	3/83
513	Hexamethyldisilazane	7/83
514	p-Dichlorobenzene	10/83
515	n-Propyl Acetate	10/83
516	Cyclohexene	10/83
517	Pentachlorophenol	10/83
518	Petroleum "Ether"	10/83
519	sec-Butyl Acetate	10/83
520	Tetrahydrofurfuryl Alcohol	10/83
521	Tributyl Phosphate	10/83
522	Propylene Glycol Monomethyl Ether	10/83

MSDS #	VOLUME I - ORGANIC MATERIALS 300 TO 999	Dated (a)
523	n-Pentane	10/83
524	Trichloroacetic Acid	12/83
525	Mineral Oil	11/85
526	2-Methoxyethyl Acetate	2/84
527	Diallyl Phthalate Monomer	2/84
528	Urea	2/84
529	Cyclopropane	5/84
530	Petroleum "Ether," High Boiling	5/84
531	Camphor	5/84
532	Cellulose Acetate, Lacquer Grade	10/84
533	Citric Acid	4/85
534	Picric Acid	4/85
535	Acetaldehyde	5/85
536	Benzyl Alcohol	5/85
537	Cyclohexylamine	5/85
538	Ethyl Chloride	5/85
539	Polyvinyl Alcohol	7/85
540	Ethylamine	5/85
541	Isopropyl Ether	5/85
542	N-Butyraldehyde	5/85
543	Salicylic Acid	7/85
544	Chlorosulfonic Acid	7/85
545	Fumaric Acid	7/85
546	Lactic Acid	7/85
547	Butyl Acrylate	7/85
548	Glutaraldehyde	7/85
549	Adiponitrile	7/85
550	Zinc Acetate	8/85
551	Methyl Acrylate	8/85
552	Methyl Hydrazine	8/85
553	Ethyl Acetoacetate	8/85
554	n-Butyl Methacrylate	8/85
555	Aminoethylethanolamine	8/85
556	2,4-Pentanedione	8/85
557	p-Cymene	8/85
558	Epoxy Resins (Liquid) Generic	11/85
559	Epoxy Resins (Curing Agents) Generic	11/85
560	o-Cresol	11/85
561	2,6-Xylenol	11/85
562	Acetylene Tetrabromide	12/85
563	Decahydronapthalene	12/85
564	Bromobenzene	12/85
565	Diethyl Carbitol	12/85
566	Dimethylamino Ethanol	12/85
567	Acetophenone	1/86
568	Aminopyridine	1/86
569	Butylamine	1/86
570	Cyclopentanone	1/86
571	Dichloroethyl Ether	1/86
572	Dichlorotetrafluoroethane	12/85
573	Acrolein	2/86
574	Thioglycolic Acid	2/86
575	Isopentyl Nitrite	2/86
576	Allyl Glycidyl Ether	2/86
577	Acrylamide	2/86
578	Crotonaldehyde	2/86
579	SD No. 3A Alcohol	2/86
580	Caprolactam	2/86
581	Mesitol	2/86
582	Diamyl Amine	2/86

MSDS #'s 583 to 999 are reserved for future use.

VOLUME II - TRADENAME LISTINGS

MSDS#	(1000-2000)	DATED
Tradename Index		7/85
1000	AIRBRASIVE POWDER #1	7/79
(1001)	None issued	--
1001A	VERSILOK 528	R-10/78
1001B	LORD ACCELERATOR #4	R-10/78
1002	ISONEL 31-66 (XV 503)	7/79
1003	SCOTCHKOTE RESINS (K2006, K2008)	9/78
(1003 No longer commercially available)		
(1004)	None issued	--
1004A	Conthane CE-1155, Part A	10/84
1004B	Conthane CE-1155, Part B	9/84
1005	IMIDEX E, GE 73156	7/79
1006	RTV-577	7/79
1007	RTV-9811	7/79
1008	SS-4004	8/83
1009	LAMINAC 4146	7/79
1010	TEFLON FEP	7/79
(1011)	None issued	--
1011A	HYSOL EA 934, Part A	7/79
1011B	HYSOL EA 934, Part B	7/79
1012	RISTON II STRIPPER 1000X (Concentrate)	8/79
1013	RISTON II DEVELOPER 2000 (Concentrate)	8/79
1013A	RISTON II DEVELOPER 2000 (Use Conc.)	7/79
1014	AZ-111 PHOTO RESIST	8/79

See Volume I for sheet #'s below 1000.

1015	AZ-1112A REMOVER	8/79
1016	STRYPP NF	R-10/75
1017	RACK STRIP C SOLUTION	10/79
1017A	RACK STRIP C	10/79
1018	LACO M-A Flux	R-11/75
1019	PEX SPRAY 66	9/84
1020	DIFFERENTIATED KLARIFIANT	R-10/75
1021	NOVACITE	R-11/76
1022	KESTER 197 RESIN FLUX	R-10/76
1023	KESTER 108 THINNER	R-10/76
1024	PERMAFIL 73517	R-10/76
1025	GE MU-124	R-10/76
1026	GE 74023	10/78
(1027)	None issued	--
1027A	THOXENE TA-12B	R-1/77
(1027A No longer commercially available)		
1027B	EPON CURING AGENT D	R-1/77
1028	XEROX DUPLICATING TONER	11/82
1028A	XEROX DUPLICATING TONER (Dry Imager)	11/82
1029	ASTRO SPECIAL 3044	R-12/76
(1029 No longer manufactured)		
1030	WD-40	9/84
1031	SKC-NF SPOTCHECK CLEANER (Formula B)	11/78
1032	OAKITE 160	R-11/76
1033	ECCOSTRIP 93	12/78
1034	HYSOL H2-3416 DETA	12/79
1035	HYSOL H2-3404 TETA	12/79
1036	EPORAL	12/79
1037	TRITHERM 981 WIRE ENAMEL	1/81
1038	PARAPLEX P-49	12/76
(1038 No longer commercially available)		
1039	KODAFLEX TXIB	4/80
1040	GE 73039 WIRE ENAMEL	12/79
1041	HAVILAND ND 68G ETCH	2/82
1042	OAKITE STRIPPER ANP	11/78
1043	CORAL NO-TARN	12/79
1044	PROTECTO-O-METAL No. 2	9/84
1045	KWIK KASE, PARK KASE 5C	9/81

VOLUME II - TRADENAME MATERIALS

MSDS #	1000 AND UP	Dated (a)
1046	RAM MOLD RELEASE 225 (Aerosol)	6/80
1046A	RAM MOLD RELEASE 225	6/80
1047	RESIN-NT (Formerly THEIC)	11/78
1048	ZYGLO PENETRANT, ZL-22A and B	10/80
(1049)	None issued	--
1049A	Quantor IR-75, First Developer (Part 1)	12/76
1049B	Quantor IR-75, First Rinse (Part 2)	12/76
1049C	Quantor IR-75, Bleach (Part 3)	12/76
1049D	Quantor IR-75, Cleaning Bath (Part 4)	12/76
1049E	Quantor IR-75, Second Developer (Part 5)	12/76
1049F	Quantor IR-75, Second Rinse (Part 6)	12/76
1050	KANO KROIL	R-1/77
1051	DIELEKTROL I	12/80
1052	DIELEKTROL II	12/80
1053	PENESOLVE 5	3/84
1054	PENETONE 2389	2/84
1055	PENETONE TYPE S	2/84
1056	STEAM KLEEN	2/84
1057	NAVEE 42	3/84
1058	TRIM TAP HEAVY	R-1/77
1059	KRYLON CRYSTAL CLEAR SPRAY COATINGS	R-1/77
1060	LECTON ACRYLIC RK6323 & RK6327	10/78
(1060 No longer manufactured)		
1061	EXXON AROMATIC 100	5/80
1061A	EXXON AROMATIC 150	5/80
1062	NADIC METHYL ANHYDRIDE	10/80
1063	BLANKROLA SOLVENT	R-1/77
1064	CAB-O-SIL	R-1/81
1065	SUPERGLUE 3	8/80
1066	HYSOL PC 18	8/80
1067	FACTOQUENCH 74	8/80
1068	SANTICIZER 9	9/80
1069	MAGNU-SPRAY 105	8/80
1070	GE MATERIAL A50A206B	10/77
1071	SKD-NF SPOTCHECK DEVELOPER (Formula B)	12/78
(1072)	None issued	---
1072A	ASTRO 3069, Part A	10/77
1072B	ASTRO 3069, Part B	10/77
1073	PROPRIETARY SOLVENT (Fed. Formula #3)	9/80
1074	EPI-CURE 856	10/83
1075	GE A50A262, EPOXY VARNISH	10/83
1076	DOWTHERM A	10/80
1077	ALPHA 413-F THINNER	5/84
1078	ALPHA 810 THINNER	5/84
1079	ALPHA 815 FLUX	10/80
1080	ALPHA MELROSE 611 FLUX	11/78
1081	PHOSFLEX 112	10/77
(1081 No longer manufactured)		
1082	PROTEXULATE	10/77
1083	RODINE 92A	5/81
1084	WELDWOOD CONTACT CEMENT	2/81
1085	ISOMID "B"	2/81
1086	HYCAR 4031-50	10/77
(1086 No longer commercially available)		
1087	PEG Hand Solution	R-10/77
1088	GE 2PV-4, HAND CLEANER	10/77
1089	GE 2PV-32, EPOXY RESIN	10/77
1090	CIM CLEAN 30	3/82
(1091)	None issued	--
1091A	BIWAX 142-R (Part A)	3/82
1091B	BIWAX 142-C (Part B)	3/82
1092	B&B 3100	10/77
1093	IMMUNOL S-6	4/83
1094	POLY-TERGENT SURFACTANTS	2/84
1095	SHELL PD680 CLEANING COMPOUND	10/77

VOLUME II - TRADENAME MATERIALS

MSDS #	1000 AND UP	Dated (a)
1096	INDUSTRIAL CLEANER 68-A	3/82
1097	EVANS 7050 HOT MELT	10/77
(1097 No longer commercially available)		
1098	STEELGARD #1505B	2/83
1099	GALAXY THREAD CUTTING OILS	10/77

See Volume I for sheet #'s below 1000.

1100	SIKAFLEX 1A	4/83
1101	EPOCAST 2226B	6/84
(1102)	None issued	--
1102A	FLEXISEAL (Part One)	10/77
(1102A No longer commercially available)		
1102B	FLEXISEAL (Part Two)	10/77
(1102B No longer commercially available)		
1103	DURITE LD-5102	10/80
1104	VAMAC B-124	4/83
1105	MONDUR-M	7/80
1106	SARTOMER SR-297	3/83
1107	VITON E-60, E60C	2/84
1108	MAGNUS 26-N	8/83
1109	MAGNUS 92-S	3/83
1110	MAGNUS SC-100	10/83
1111	MAGNUS 215D	10/83
1112	MAGNUS WATER WASH 402	4/83
1113	MAGNUS 614	4/83
1114	MAGNUS 617	R-11/77
1115	URETHANE ENAMEL ACCELERATOR 189-S	10/83
1116	POLYISOCYANATE ACTIVATOR 192-S	10/83
1117	IMRON M, M, ENAMEL WHITE (817 U)	2/84
1118	RANEY NICKEL CATALYST #28	11/77
1119	KURIFLOCK PN-147 (Cancelled)	11/77
1119A	KURIFLOCK PN-161	10/82
1120	PYRE-ML WIRE ENAMEL, RC 5863	10/83
1121	PYRE-ML WIRE ENAMEL, Type I (RC5877)	10/83
1122	MAKON NF-5	8/83
1123	WHITE STAR BODY FILLER	5/84
1124	Y-469-D PIGMENT, YELLOW MED.	11/77
1125	PEDIGREE #357, TERASOD Wire Enamel	9/84
(1126)	None issued	--
1126A	BR-123 PRIMER	4/80
1126B	FM-123-5 ADHESIVE FILM	1/78
1127	PR-420	1/78
1128	EPON RESIN 829	1/78
1129	PEDIGREE #946 Wire Enamel	9/84
1130	J-1345, Basic Zinc Chromate	1/78
1131	REZ-N-BOND #1	12/78
1132	TEXACO SOLUBLE OIL "C"	1/78
(1133)	None issued	--
1133A	ARMSTRONG 520 ADHESIVE	12/83
1133B	ARMAFLEX PIPE INSULATION	1/78
1134	FREUND 6060 GLUE	10/84
1135	CM-154-XTX, Alkaline Soak Cleaner	1/78
1136	MOLD RELEASE #210-SS	9/84
1137	TEXACO 2234 CLEARTEX 140X	1/78
1138	COMPOUNDERS WAX IE-367	1/78
(1138 No longer commercially available 5/85)		
1139	PR-1527	1/78
1140	MOBIL VACTRA #2	4/82
1140A	MOBIL VACTRA #4	4/82
1141	MOBIL MIST LUBE 27	4/83
1142	GE RTV Silicone Rubber, Acetoxy-cure	R-3/82
1143	XYLAN 1010	8/78
1144	HANDY FLUX	8/78

VOLUME II - TRADENAME MATERIALS

MSDS #	1000 AND UP	Dated (a)
1145	ENSTRIP A	5/84
1146	SYNTHITE EB-41	12/83
1147	DOLPH CW-340-1	8/78
1148	DOLPH T-200X	8/78
1149	CHLOROWAX, LIQUID	8/78
1149A	CHLOROWAX RESIN	6/79
1150	VERSILOK 505	R-9/78
1151	SS-4155 PRIMER	5/84
1152	MARKEM 320 CLEANER	9/84
1153	DYKEM REMOVER AND THINNER	9/78
1154	DYKEM LAYOUT FLUIDS	9/78
1155	ELECTRO-BRITE Z-200	10/84
1156	NEU-TRI SOLVENT	9/78
(1157)	None issued	--
1157A	SCOTCHWELD STRUCTURAL ADHESIVE 2216, A	2/84
1157B	SCOTCHWELD STRUCTURAL ADHESIVE 2216, B	12/83
1158	BRULIN 815 MX	9/84
1159	BRULIN 815 QR	9/84
1160	BLUE GOLD	1/82
1161	TEXACO 1557, TRANSULTEX F	9/84
1162	TEXACO 2228, CLEARTEX B	9/84
1163	ALKANEX INSULATING VARNISH (GE 9522 and GE 9637)	9/78
1164	NOZZLE KLEEN	9/78
1165	CLEAR VARNISH 2609	9/78
1166	ELECTRO-BRITE NAZ-32	9/78
1167	OAKITE 67	10/78
1168	BORDEN FM 203W CATALYST POWDER	10/78
1169	DOW CORNING 1090 VARNISH	11/78
1170	TUN-O-WASH CLEANER	10/78
1171	DOW CORNING GP-77 VARNISH	10/78
1072	UT-100 ADHESIVE (Parts A & B)	10/78
1173	GLYPTAL 1500 THINNER	11/84
1174	JDM F2A2 GREEN ALKYD RESIN ENAMEL (Exempt Solvent)	11/78
1175	FRYQUEL 550	6/84
1176	MAGNUS 763-NF	12/78
1177	BARCO BOND MB-100X & MV-12	12/78
(1178)	No sheet issued, See 1178A and 1178B	--
1178A	HYSOL PC 29 PART A	2/81
1178B	HYSOL PC 29 PART B	2/81
1179	HYSOL DK0295	12/78
1180	3M BRAND TYPE R DEVELOPER	12/78
1181	SCOTCHCAST RESIN #8 (Parts A & B)	12/83
1182	OAKITE STRIPPER 156	7/79
1183	OAKITE 98	8/79
1184	HI-THERM BC-350	8/79
1185	WYANDOTTE B.N.	9/79
1186	WYANDOTTE EXPRAY-541	9/79
1187	CHEMGLAZE Z004	R-10/79
1188	PERMABOND QUICK FILLER/SETTER	10/79
1189	FIREX RX-2373 (Parts A & B)	10/79
1190	ASTRO SPECIAL 4017 (A & B)	10/79
1191	STERLING U-300-20 THERMOPOXY COMPOUND	9/84
1192	GLYPTAL C.E. 514	10/79
1193	GLYPTAL 7815	10/79
1194	GLYPTAL C-1103	10/79
1195	Q-CLEAN SE-67	11/79
1196	ROLFITE 404	11/79
1197	AIRBRASIVE POWDER NO. 3	12/79
1198	SPRITS MOLD RELEASE	12/79
1199	SK-4 COLD STRIPPER	4/80
1200	AROCLOR 1254	5/80
1201	KODAK METAL ETCH RESIST THINNER	7/80
(1202)	None issued	--
1202A	IPS TR 250 (Component A)	7/80
1202B	IPS TR 250 (Component B)	7/80

MSDS #	VOLUME II - TRADENAME MATERIALS 1000 AND UP	Dated (a)
1203	KODAK PHOTO RESIST DEVELOPER	7/80
1204	KODAK METAL ETCH RESIST (KMER) DEVELOPER	8/80
1205	AZ 119 THINNER	9/80
1205A	AZ 119S	9/80
1206	ALKALUME 1744	8/80
1207	RELIASOLV NO. 1001	8/80
1208	ETHYL ANTIOXIDANT 701	8/80
1209	NYLATRON GS-63	12/80
1210	AGITENE	1/81
1211	FREON TMS	12/80
1212	FREON TMC	12/80
1213	FREON TE & FREON TES	12/80
1214	OAKITE 32	2/81
1215	DOWTHERM G	R-1/81
1216	DIELEKTROL III	12/80
1217	KODAK PHOTO RESIST THINNER, Type 4	12/80
1218	VINYLOID 160 REDUCER	1/81
1219	EASTMAN 910 ADHESIVE	12/80
1220	ZINC-PLATE 162 REDUCER	1/81
1221	EPOLON 22 BLACK MASTIC (A & B)	1/81
1222	HUMISEAL 1A20	2/81
1223	ZINC-PLATE 49 ORGANIC PRIMER	5/81
1224	OAKITE 56	4/81
1225	FEL PRO C-102	2/81
1226	OAKITE 90	2/81
1227	CUPOSIT CATALYST 9F	3/81
1228	OAKITE 94	7/81
1229	TECTYL 890	6/81
1230	ENDOX 114	6/81
(1231)	[FREON 116 (deleted 12/85, see MSDS # G 572)]	
1232	CUPOSIT Y	9/81
1233	CUPOSIT 802M	9/81
1233A	CUPOSIT 802A	9/81
1233B	CUPOSIT 802B and 802B-2	9/81
1233C	CUPOSIT 802R REPLENISHER	9/81
1234	CUPOSIT CP-74A	10/81
1235	CUPOSIT Z	10/81
1236	CUPOSIT CP-74B	10/81
1237	CUPOSIT CP-74H	10/81
1238	CUPOSIT CP-74M	11/81
1239	CUPOSIT CP-74Q	10/81
1240	CUPOSIT CP-74R	11/81
1241	CHEMLOK 250	R-6/82
1242	PROPRIETARY SOLVENT (Fed. Formula #1)	10/81
1243	DAG 154	10/81
1244	OAKITE CRYSCOAT 247	9/81
1245	CHLOROCLEAN	9/81
1246	CIMCOOL FIVE STAR 30	6/82
1247	OAKITE DEOXIDIZER 34	5/82
1248	RODINE 85	6/82
1249	RELIASOLV 564	1/82
1250	ALPHA 811 FLUX	2/82
1251	SE-75 DEGREASING SOLVENT	2/82
1252	ALPHA 812 THINNER	2/82
1253	HI-SIL 233	2/82
1254	PHENOLIC MOLDING COMPOUND, MINERAL FILLED	R-3/82
1254A	PHENOLIC MOLDING COMPOUND, CELLULOSE FILLED	R-3/82
(1255)	[Cancelled 3/83. Replaced by MSDS #507]	--
1255A	HYSOL PC17, Part A	2/83
1255B	HYSOL PC17, Part B	2/83
1256	SUN WAY OIL 90	4/82
1257	VARSOL 1	5/82

MSDS #	VOLUME II - TRADENAME MATERIALS 1000 AND UP	Dated (a)
1258	VARSOL 18	5/82
1259	ISOPAR L	5/82
1260	ISOPAR M	9/82
1261	PENNWALT CLEANER K-2	9/82
1262	DOWTHERM J	10/82
1263	WAYCOAT SC RESIST 100/180/900	11/82
1264	PARAFFINIC MINERAL OIL LUBRICANT	5/84
1265	ACRYLIC TOUCH-UP LACQUER, AEROSOL	2/83
1266	MOBIL VAPROTEC LIGHT	3/83
1267	MOBIL VAPROTEC CONCENTRATE	3/83
1268	NUODEX COBALT NAPTHTHENATE SOLUTION, 6% Co	7/83
1269	EPI-CURE 855	10/83
1270	SHELL OMALA OILS	10/83
1271	SHELL TURBO OILS	10/83
1272	SHELL TELLUS OILS	10/83
1273	Triple Carbonate Coating Media	10/83
1274	TEXSOLVE B (GETTYSOLVE B)	7/84
1275	TEXSOLVE C (GETTYSOLVE C)	7/84
1276	STYROPOR (BR Grades)	12/83
1277	Kodak Photo Resist, KPR	12/83
1278	Kodak Photo Resist Developer	12/83
1279	GLASKYD 1901	2/84
1280	TEXSOLVE F (GETTYSOLVE F)	7/84
1281	SS-4044 Primer	5/84
1282	FRYQUEL 150 R&O	6/84
1283	TECTYL Rust Preventatives	7/84

See Volume I for sheet #'s below 1000.

1284	SUNVIS 916 (32)	9/84
1285	V-Lube Pump Oil F	9/84
1286	Aromatic A-150	7/84
1287	Armstrong D-253	9/84
1288	Silastic RTV Adhesive/Sealant (Acetoxy-cure)	9/84
1289	DOW CORNING 994 VARNISH	7/85
1290	DOW CORNING 997 VARNISH	7/85
1291	TRITON X-100 SURFACTANT	7/85

#'s 1292-2000 are reserved for future use.