WORK PLAN
INTERIM REMEDIAL MEASURES COMPLETION
VOLUME II - APPENDICES

Pfohl Brothers Landfill
Cheektowaga, New York

PRINTED ON
APR 21 1993

RECEIVED

APR 22 1993

N.Y.S. DEPT. OF
ENVIRONMENTAL CONSERVATION
DIV. ENVIRONMENTAL ENFORCEMENT
BUFFALO FIELD UNIT

WORK PLAN
INTERIM REMEDIAL MEASURES COMPLETION
VOLUME II - APPENDICES

Pfohl Brothers Landfill
Cheektowaga, New York

APRIL 1993

REF. NO. 1979 (6)
This report printed on recycled paper

CONESTOGA-ROVERS & ASSOCIATES

APPENDIX A

INTERIM REMEDIAL MEASURES COMPLETION HEALTH AND SAFETY PLAN FOR PFOHL BROTHERS LANDFILL CHEEKTOWAGA, NEW YORK

LIST OF ATTACHMENTS

ATTACHMENT A	HEALTH AND SAFETY PLAN CERTIFICATION
ATTACHMENT B	CONFINED SPACE ENTRY PROCEDURE PERMIT
ATTACHMENT C	HIGH PRESSURE WASHER (LASER) SAFETY
ATTACHMENT D	JOB SAFETY ANALYSIS FOR TASKS NOT PREVIOUSLY COVERED IN THIS HSP
ATTACHMENT E	EXCAVATION SAFETY
ATTACHMENT F	HOT WORK PERMIT
ATTACHMENT G	VAPOR EMISSION RESPONSE PLAN
ATTACHMENT H	**MATERIAL SAFETY DATA SHEETS (ON-SITE COPY OF HSP ONLY)**
ATTACHMENT I	**NIOSH METHODS (ON-SITE COPY OF HSP ONLY)**

1.2 SCOPE OF WORK

The objectives of the IRM Completion are described in Section 2.0 of the IRM Completion Work Plan. The work required for the IRM Completion may include:

- Mobilization and Site preparation, including:
  - Construction of the support zone
  - Construction of the decontamination pads
  - Construction of the temporary waste storage pads
  - Installation of the truck scale
  - Construction of the access roads
  - Installation of the meteorological station
  - Installation of the storm water management controls.
- Consolidation of currently staged excavated drums and visibly impacted soils for off-Site disposal.
- Crushing or shredding and on-Site placement of RCRA empty drums.
- Test trenching along the existing berm between test pits TP-19 and TP-23 **(completed)** and other areas.
- Excavation, removal, staging, and segregation of drums and visibly impacted soil around TP-19 in the Area C marsh **(completed except for removal of visibly impacted soil from small area in southwest corner)**.
- Investigation **(completed)** and excavation of tars in Area C in the general location identified in Figure A.1.3 and subsequent off-Site disposal.

- Excavation and consolidation of remaining drums and visibly impacted soil in Areas B and C for off-Site disposal.
- Retrieval, sampling, staging and characterization of drums found within 100 year flood plain.
- Sampling and analysis of drums and visibly impacted soil.
- Transportation and disposal of waste and radioactive material to approved off-site disposal facility(ies).
- Removal and disposal of drums from the bottom of Aero Creek **(completed)**.
- Excavation and off-Site disposal of the white granular radioactive material on the ground surface within the 100-year floodplain.
- Site demobilization.

3.0 PROJECT HAZARDS

The general categories of hazards that may be present at the Site are described in this section. The main divisions of health hazards at the Site are chemical, physical, and environmental. The pathways for hazardous substance dispersion at this project are (in order of most likely to least likely): air/vapor dispersion, groundwater, personnel, and equipment tracking.

3.1 CHEMICAL HAZARDS

Preventing exposure to toxic chemicals is a primary concern at hazardous material projects. Most sites contain a variety of chemical substances in gaseous, liquid, or solid form. These substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage to the point of contact or can act systematically, causing a toxic effect at a part of the body distant from the point of initial contact. A list of the chemical hazards expected at this project is presented below. Materials Safety Data Sheets (MSDS) for these compounds **will be included as Attachment H to the on-Site copy of the HSP and** will be available on Site during IRM Completion activities and will be reviewed prior to personnel participating in such activities.

- Outer gloves will be cleaned and removed, and depending on condition, will be discarded (if damaged or uncleanable).

- Disconnect and remove supplied air breathing apparatus. The initial five phases of decontamination should eliminate the airborne hazard at this point.

- Splash gear will be removed, cleaned and hung up to dry (if worn).

- Tyvek or Saran suits will be removed and disposed **with the consolidated** ~~in the solid~~ ~~w~~**W**aste ~~stream~~.

- Vinyl booties will be removed and disposed **with the consolidated** ~~in the solid~~ ~~w~~**W**aste ~~stream~~.

- Sample gloves will be removed and disposed **with the consolidated** ~~in the solid~~ ~~w~~**W**aste ~~stream~~.

- Personnel will then wash their hands, arms, neck and face.

6.2 PERSONNEL DECONTAMINATION PROCEDURES - LEVEL C

- Deposit any Site-used equipment in a segregated area prior to entering the CRZ. This segregation reduces the possibility of cross contamination.

- At the perimeter of the EZ, rain gear or splash protection (if worn) will be damp-wiped or wet sprayed to remove any adhered particulates or corrosive liquids. The effort will eliminate any exposure to support personnel and workers themselves during the PPE doffing process.

- Robar/Tingley boots will be scrubbed with a detergent-water solution. The boots will then be removed and placed on a rack for drying.

- Hard hats will be removed and hung up. On a daily basis, these will be scrubbed with detergent-water solution.

- Outer gloves will be cleaned and removed, and depending on condition, will be disposed in the solid waste stream (if damaged or uncleanable).

- Splash gear will be removed, cleaned and hung up to dry (if worn).

- Tyvek or Saran suits will be removed and disposed ~~in~~ **with** the ~~solid~~ **consolidated W**~~w~~aste~~stream~~.

- Respirators will be removed and prepared for reuse or decontaminated.

- Vinyl booties will be removed and disposed ~~in~~ **with** the ~~solid~~ **consolidated W**~~w~~aste~~stream~~.

- Sample gloves will be removed and disposed ~~in~~ **with** the ~~solid~~ **consolidated W**~~w~~aste~~stream~~.

6.6 OTHER DECONTAMINATION PROCEDURES

6.6.1 General

All liquids ~~and disposable clothing~~ will be treated as contaminated waste and disposed of properly. **All disposable clothing will be consolidated with the excavated Waste.** Personnel handling contaminated waste will wear Level C protection. Equipment must be cleaned prior to demobilization. Washwaters and residues must be collected for treatment and/or proper disposal.

6.6.2 Diaphragm Pumps

- Don appropriate personal protective equipment.
- Drain Pump.
- Pump decontamination solution through pump (water, penetone, citrikleen, bleach, kerosene, etc.)
- Wash outside of pump.
- Disassemble pump and wipe down internal surfaces.
- Soak all pump components (including hardware) in decontamination solution.
- Rinse and dry.
- Reassemble as needed.

7.0 AIR MONITORING

Air monitoring will be conducted on this project to ensure the safety of personnel **and of the surrounding community**. The measurements obtained by these instruments are intended to indicate when the use of protective clothing and equipment is required, to validate the use of air-purifying respirators, determine when or if supplied air respirators are required, alert personnel of potentially explosive conditions, and ensure sufficient oxygen for work. Air monitoring for this project will have a two-fold approach utilizing both direct reading real time and integrated sampling instrumentation.

7.1 HNU-PID (PHOTOIONIZATION DETECTOR)

An HNU-PID equipped with a 10.2 eV lamp will be used in all areas of site operation to determine real time concentrations of total volatile organics. Total volatile organics will be checked for on a daily basis prior to the start of operations in the EZ, at the site perimeter and perimeter of each EZ when operations are conducted pertaining to excavation, staging and removal, and in the immediate area of excavations in progress.

7.2 COMBUSTIBLE GAS INDICATOR/OXYGEN (CGI/O_2) METER

When required, a $CGI/0_2$ meter may be used to monitor explosive or oxygen-deficient atmospheres. If any area shows airborne Lower

background. A radiation survey meter will be used in these areas to monitor for levels of radiation. In the event that a radiation trifoil or other symbol of radioactivity is detected, a radiation dose rate survey meter will also be utilized. It will be used continuously if radioactivity is detected. A radiation dose rate survey will be performed in each excavation area.

7.4 COLORIMETRIC DETECTOR TUBES

Colorimetric detector tubes may be used to determine the concentration of known chemicals and other contaminants present on the Site.

7.5 TOTAL RESPIRABLE PARTICULATE MONITORING

Real time monitoring for total respirable particulates will be conducted daily at the site perimeter of areas B & C and perimeter of each exclusion zone utilizing a Mini Aerosol Monitor (Mini-Ram) or performance equivalent. There will be one upwind and three downwind locations at the site perimeter and one upwind and one downwind locations for each active EZ. In addition, integrated sampling for total nuisance dust at the site perimeters of areas B & C will be conducted weekly when excavation, staging, removal, and new operations within the respective EZ's are taking place. Total nuisance dust will be collected using a PVC collection filter and personnel sampling pump and analyzed gravimetrically according to NIOSH Method 0500. **After reviewing the results of each weekly total nuisance dust**

sampling event, the SSO may increase the frequency of this monitoring to 2 days per 5 working days if the monitoring results reveal a concern.

Sampling station locations will be determined by the SSO in coordination with the NYSDEC field representative. Sampling locations for integrated sampling will be 6' above ground level. The NYSDEC Technical and Administrative Guidance Memorandum entitled, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites", will be used as a guide for air monitoring under this section.

7.6 PERSONAL AIR MONITORING

OSHA standards require that personal air monitoring be performed (for specific contaminants) on personnel who are working in Levels C and D protection that have the highest potential for exposure to hazardous substances and health hazards above permissible exposure limits.

Personal samples to measure for total organics, semi-volatiles, total nuisance dust and PCB's, using NIOSH methods 1500, 5517, 0500 and 5503, will be collected initially from a worker having the highest potential for exposure to hazardous substances. Samples will be collected during startup of those activities which present the highest level of potential exposure to Site chemicals. Subsequent personal sampling will be determined after a review of the results from the initial sampling or any additional sampling.

monitored for using a **photoionization detector and total nuisance dust will be monitored for using a** Mini-Aaerosol monitor.

7.11 ORGANIC VAPOR MONITORING

Whenever field activities occur at the Site, real-time air monitoring will be conducted continuously for total volatile organic compounds (VOCs) at the perimeter of areas B and C and each EZ in each excavation area. If organic vapor concentrations at the downwind perimeter of the EZ exceeds 10 ppm, work must cease and corrective measures will be implemented to control the source of the release and the vapor emissions response plan implemented (see Attachment G). If efforts to abate the emission source are unsuccessful, then the Site-specific emergency response and contingency plan (under separate cover) must be placed into effect, whereby emergency officials and the surrounding community are notified.

Due to the possibility of semi-volatile organics being present and released during the drum removal, semi-volatiles will be monitored by using NIOSH Method 5517. Documentation air monitoring will be conducted weekly at each EZ perimeter based on conditions encountered (i.e. damaged or leaking drums, discolored soil, etc.) as directed by the SSO. **After reviewing the results of each weekly semi-volatile monitoring event, the SSO may increase the frequency of this monitoring to 2 days per 5 working days if the monitoring results reveal a concern.**

8.3 EMERGENCY EVACUATION FROM EXCLUSION AND CONTAMINATION- REDUCTION ZONES

Any personnel requiring emergency medical attention will be evacuated immediately from EZ and CRZ. Personnel will not enter the area to attempt a rescue if their own lives would be threatened. The SS and SSO decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of the injury and the nature of the contaminant.

If decontamination cannot be performed because it may aggravate the injury or delay life-saving treatment, the emergency response personnel will:

- Wrap the victim in blankets or plastic to reduce contamination of other personnel and emergency vehicles.

- Alert emergency and medical personnel to potential contamination; instruct them about specific decontamination procedures.

- Send site personnel familiar with the incident **and chemical safety information e.g. MSDS** to the hospital with the victim.

- Obtain paramedic services or ambulance transport to local hospital. The hospital route is shown on Figure A.8.1. This procedure will be followed even if there is not visible injury and will be coordinated by the SSO.

The hospital routes are:

<u>Millard Fillmore Suburban Hospital</u>

- **West on Aero Drive to Youngs Road;**
- **North (right) onto Youngs Road to Maple Road; and**
- **turn west (left) onto Maple Road to the hospital entrance.**

<u>St. Joseph's Intercommunity Hospital</u>

- **West on Aero Drive to Holtz Road;**
- **turn south (left) onto Holtz Road; to Genessee Street (Route 33);**
- **turn west (right) onto Genessee Street to Expressway (Route 33);**
- **Expressway to Harlem Road exit (Route 240); and**
- **turn south (left) onto Harlem Road to hospital entrance.**

- Other personnel in the work area will be evacuated to a safe distance until the SS determines that it is safe for work to resume. If there is any doubt regarding the condition of the area, work will not commence until all hazard-control issues are resolved.

- Notify State of incident.

figure A.1.3

AREAS OF CONCERN
INTERIM REMEDIAL MEASURES
Pfohl Brothers Landfill, Cheektowaga, New York

1979(6) APR.12/93 REV.1

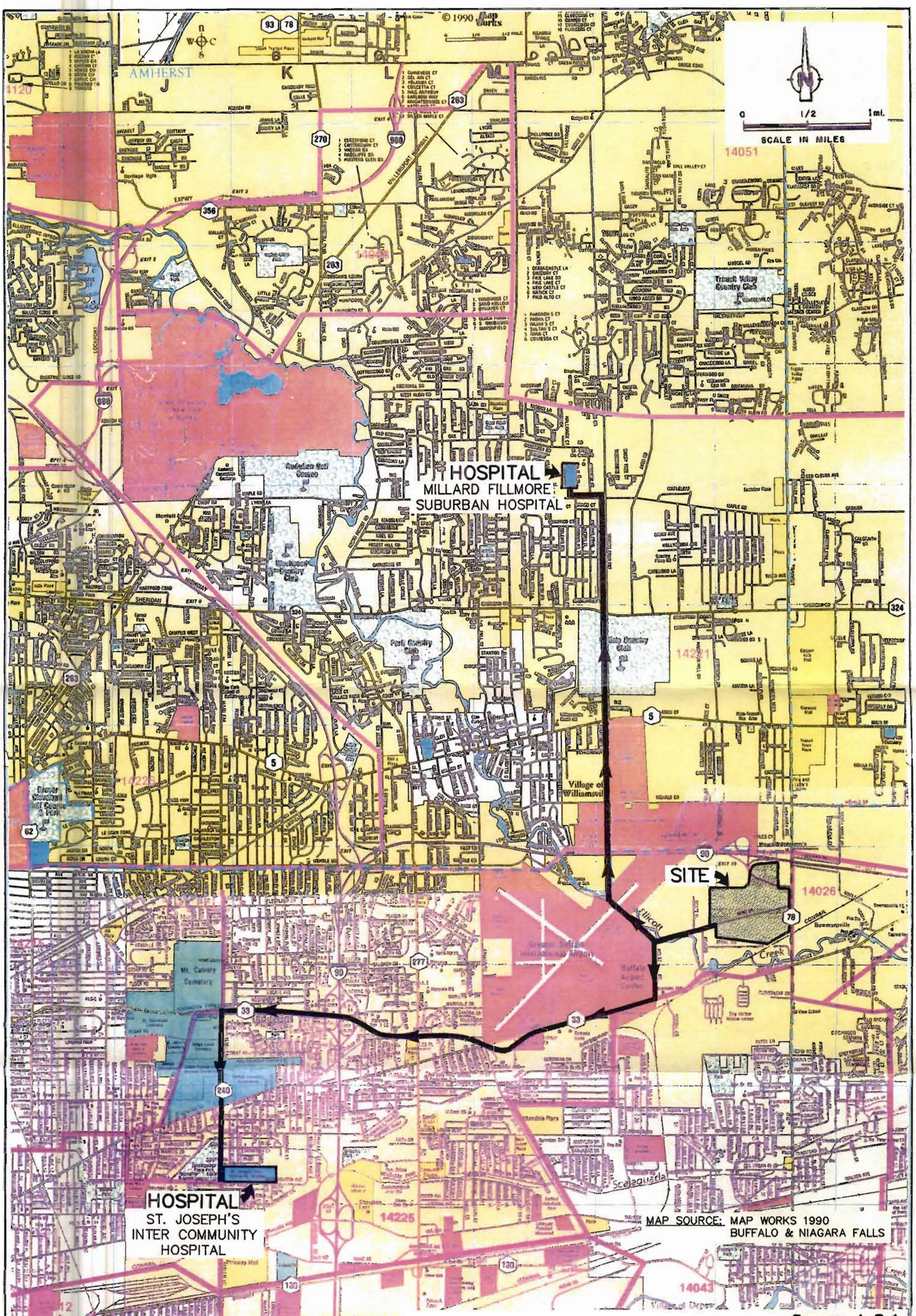


figure A.8.1

EMERGENCY HOSPITAL ROUTE
INTERIM REMEDIAL MEASURE
Pfohl Brothers Landfill, Cheektowaga, New York

CRA

ATTACHMENT I

NIOSH METHODS

(ON-SITE COPY OF HSP ONLY)

ATTACHMENT H

MATERIAL SAFETY DATA SHEETS

(ON-SITE COPY OF HSP ONLY)

APPENDIX B

TABLE OF CONTENTS

WESTON LABORATORY QA/QC PLAN

RECRA LABORATORY QA/QC PLAN

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1993
ISSUED April 1, 1992
REVISED May 21, 1992

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10026

Director: MR. ROBERT WYETH
Lab Name: RECRA ENVIRONMENTAL INC
Address : 10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228

is hereby APPROVED as an Environmental Laboratory for the category

CONTRACT LABORATORY PROTOCOL (CLP)

All approved subcategories and/or analytes are listed below:

CLP Inorganics | CLP PCB/Pesticides | CLP Semi-Volatile Organics (ALL) | CLP Volatile Organics (ALL)

Serial No.: 11180

Lawrence S. Sturman

Lawrence S. Sturman, M.D., Ph.D., Acting Director
[redacted]
Wadsworth Center for Laboratories and Research

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1993
ISSUED April 1, 1992
REVISED May 21, 1992

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10026

Director: MR. ROBERT WYETH
Lab Name: RECRA ENVIRONMENTAL INC
Address : 10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/SOLID AND HAZARDOUS WASTE

All approved subcategories and/or analytes are listed below:

Characteristic Testing :
- Corrosivity
- Ignitability
- Reactivity
- TCLP
- Toxicity

Miscellaneous :
- Cyanide, Total
- Hydrogen Ion (pH)
- Sulfide (as S)

Polynuclear Arom. Hydrocarbon (ALL)
Priority Pollutant Phenols (ALL)
Acrolein and Acrylonitrile (ALL)
Chlor. Hydrocarbon Pesticides (ALL)
Haloethers (ALL)
Metals II (ALL)
Polychlorinated Biphenyls (ALL)
Purgeable Aromatics (ALL)
Chlorophenoxy Acid Pesticides (ALL)
Chlorinated Hydrocarbons (ALL)
Metals I (ALL)
Nitroaromatics Isophorone (ALL)
Phthalate Esters (ALL)
Purgeable Halocarbons (ALL)

Serial No.: 11179

Lawrence S. Sturman, M.D., Ph.D., Acting Director
~~Robert W. Lackerman, M.D., Ph.D., Director~~
Wadsworth Center for Laboratories and Research

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1993
ISSUED April 23, 1992
REVISED May 21, 1992

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10026

Director: MR. ROBERT WYETH
Lab Name: RECRA ENVIRONMENTAL INC
Address : 10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/AIR AND EMISSIONS

All approved subcategories and/or analytes are listed below:

Miscellaneous Air :
Formaldehyde
Particulates
Sulfur Dioxide

Chlorophenoxy Acid Pesticides (ALL)
Metals I (ALL)
Polynuclear Aromatics (ALL)
Purgeable Aromatics (ALL)

Chlor. Hydrocarbon Pesticides (ALL)
Metals II (ALL)
Polychlorinated Biphenyls (ALL)
Purgeable Halocarbons (ALL)

Chlorinated Hydrocarbons (ALL)
Mineral (ALL)
Priority Pollutant Phenols (ALL)

Serial No.: 11178

Lawrence S. Sturman, M.D., Ph.D., Acting Director
~~Robert W. Dickerman, M.D., Ph.D., Director~~
Wadsworth Center for Laboratories and Research

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1993
ISSUED April 1, 1992
REVISED May 21, 1992

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10026

Director: MR. ROBERT WYETH
Lab Name: RECRA ENVIRONMENTAL INC
Address : 10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER

All approved subcategories and/or analytes are listed below:

Chlor. Hydrocarbon Pesticides :
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- alpha-BHC
- Aldrin
- beta-BHC
- Chlordane Total
- delta-BHC
- Dieldrin
- Endrin aldehyde
- Endrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Heptachlor
- Heptachlor epoxide
- Lindane
- Mirex
- Methorychlor
- Toxaphene

Wastewater Miscellaneous :
- Bromide
- Boron, Total
- Cyanide, Total
- Color
- Phenols
- Oil & Grease Total Recoverable
- Hydrogen Ion (pH)
- Specific Conductance
- Sulfide (as S)
- Surfactant (MBAS)
- Temperature
- Organic Carbon, Total

Purgeable Aromatics (ALL)
TCLP Additional Compounds (ALL)

Wastewater Metals III :
- Cobalt, Total
- Molybdenum, Total
- Tin, Total
- Titanium, Total
- Thallium, Total

Chlorophenoxy Acid Pesticides (ALL)
Demand (ALL)
Wastewater Metals I (ALL)
Mineral (ALL)
Nitrosoamines (ALL)
Polynuclear Aromatics (ALL)
Phthalate Esters (ALL)
Purgeable Halocarbons (ALL)

Organophosphate Pesticides :
- Demeton-S
- Parathion ethyl
- Parathion methyl

Acrolein and Acrylonitrile (ALL)
Benzidines (ALL)
Chlorinated Hydrocarbons (ALL)
Haloethers (ALL)
Wastewater Metals II (ALL)
Nitroaromatics and Isophorone (ALL)
Nutrient (ALL)
Polychlorinated Biphenyls (ALL)
Priority Pollutant Phenols (ALL)
Residue (ALL)

Serial No.: 11176

Lawrence S. Sturman, M.D., Ph.D., Acting Director
[illegible], Director
Wadsworth Center for Laboratories and Research

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

NEW YORK STATE DEPARTMENT OF HEALTH

DAVID AXELROD, M. D. *COMMISSIONER*

Expires 12:01 AM April 1, 1993
ISSUED April 1, 1992
REVISED September 1, 1992

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10026

Director: MR. ROBERT WYETH
Lab Name: RECRA ENVIRONMENTAL INC
Address : 10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/ POTABLE WATER

All approved subcategories and/or analytes are listed below:

Drinking Water Non-Metals :
- Alkalinity
- Calcium Hardness
- Chloride
- Color
- Fluoride, Total
- Nitrate (as N)
- Hydrogen Ion (pH)
- Solids, Total Dissolved
- Sulfate (as SO4)

D.W. Organohalide Pesticides :
- Endrin
- Lindane
- Methoxychlor
- Toraphene

D.W. Chlorinated Acids :
- 2,4-D
- 2,4,5-TP (Silvex)

Drinking Water Metals I (ALL)
Volatile Aromatics (ALL)
Volatile Halocarbons (ALL)

Lawrence S. Sturman, M.D., Ph.D., Acting Director
Herbert W. Dickerman, M.D., Ph.D., Director
Wadsworth Center for Laboratories and Research

Serial No.: 13361

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (11/90)

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Demand						
Biochemical Oxygen Demand	8101	49.200	52.7000	34.000 - 64.500	29.200 - 69.300	4
Biochemical Oxygen Demand	8102	81.300	94.2000	58.100 - 104.000	50.900 - 112.000	4
Chemical Oxygen Demand	8101	74.600	67.4000	63.400 - 85.800	59.900 - 89.300	4
Chemical Oxygen Demand	8102	122.000	109.0000	107.000 - 138.000	102.000 - 143.000	4
Organic Carbon, Total	8101	30.200	31.1000	26.600 - 33.800	25.500 - 34.900	4
Organic Carbon, Total	8102	49.700	57.4000	43.800 - 55.600	41.900 - 57.500	3
Residue						
Solids, Total	8103	425.000	418.0000	398.000 - 451.000	390.000 - 459.000	4
Solids, Total	8104	225.000	233.0000	201.000 - 249.000	193.000 - 257.000	4
Solids, Total Dissolved	8103	397.000	393.0000	367.000 - 427.000	358.000 - 437.000	4
Solids, Total Dissolved	8104	151.000	161.0000	127.000 - 174.000	120.000 - 182.000	4
Solids, Total Suspended	8103	23.800	22.8000	20.100 - 27.500	18.900 - 28.600	4
Solids, Total Suspended	8104	72.900	72.3000	67.800 - 78.100	66.100 - 79.800	4
WW Hydrogen Ion (pH)						
Hydrogen Ion (pH)	8105	8.950	8.9700	8.840 - 9.070	8.800 - 9.100	4
Hydrogen Ion (pH)	8106	3.010	3.0200	2.910 - 3.110	2.880 - 3.140	4
Organic Nutrients						
Kjeldahl Nitrogen, Total	8107	3.330	3.2100	2.690 - 3.970	2.490 - 4.180	4
Kjeldahl Nitrogen, Total	8108	4.780	4.4800	3.850 - 5.710	3.560 - 6.010	4
Phosphorus, Total	8107	6.480	5.9200	5.770 - 7.190	5.550 - 7.410	4
Phosphorus, Total	8108	8.120	7.5000	7.230 - 9.010	6.950 - 9.290	4

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC
TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Total Alkalinity						
Alkalinity	8109	97.700	95.7000	91.600 - 104.000	89.700 - 106.000	4
Alkalinity	8110	272.000	268.0000	256.000 - 288.000	252.000 - 293.000	4
Inorganic Nutrients						
Ammonia (as N)	8111	2.960	3.2600	2.540 - 3.370	2.410 - 3.500	4
Ammonia (as N)	8112	3.630	3.9700	3.130 - 4.120	2.980 - 4.280	4
Nitrate (as N)	8111	4.960	5.2500	4.420 - 5.490	4.250 - 5.660	4
Nitrate (as N)	8112	2.970	3.3000	2.580 - 3.360	2.460 - 3.480	4
Orthophosphate (as P)	8111	2.740	2.8600	2.460 - 3.020	2.380 - 3.110	4
Orthophosphate (as P)	8112	3.130	3.2200	2.820 - 3.440	2.720 - 3.540	4
NW Minerals						
Chloride	8113	45.400	45.6000	41.900 - 49.000	40.800 - 50.100	4
Chloride	8114	161.000	172.0000	151.000 - 171.000	148.000 - 174.000	3
Fluoride, Total	8113	5.320	5.6200	4.750 - 5.890	4.570 - 6.060	4
Fluoride, Total	8114	2.260	2.2900	1.950 - 2.580	1.850 - 2.680	4
Sulfate (as SO4)	8113	136.000	142.0000	120.000 - 151.000	115.000 - 156.000	4
Sulfate (as SO4)	8114	54.100	56.6000	47.000 - 61.200	44.700 - 63.500	4
Phenols						
Phenols	8115	0.246	0.2370	0.207 - 0.285	0.195 - 0.298	4
Phenols	8116	0.043	0.0462	0.027 - 0.059	0.022 - 0.064	4
Oil and Grease						
Oil & Grease Total Recove	8117	44.000	45.3000	37.400 - 50.500	35.300 - 52.600	4
Oil & Grease Total Recove	8118	72.500	74.3000	62.000 - 82.900	58.800 - 86.200	4

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

TEST NUMBER: 81
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Wastewater Metals I and II						
Aluminum, Total	8119	308.000	299.0000	242.000 - 373.000	221.000 - 394.000	4
Aluminum, Total	8120	504.000	490.0000	434.000 - 573.000	413.000 - 594.000	4
Antimony, Total	8119	586.000	700.0000	494.000 - 678.000	465.000 - 707.000	3
Antimony, Total	8120	196.000	220.0000	152.000 - 240.000	138.000 - 253.000	4
Arsenic, Total	8119	98.600	98.0000	82.900 - 114.000	78.000 - 119.000	4
Arsenic, Total	8120	294.000	300.0000	250.000 - 338.000	236.000 - 352.000	4
Barium, Total	8119	251.000	250.0000	227.000 - 275.000	219.000 - 282.000	4
Barium, Total	8120	988.000	982.0000	903.000 - 1070.000	877.000 - 1100.000	4
Beryllium, Total	8119	24.900	26.4000	21.500 - 28.200	20.400 - 29.300	4
Beryllium, Total	8120	119.000	122.0000	106.000 - 131.000	103.000 - 134.000	4
Cadmium, Total	8119	15.200	16.6000	11.900 - 18.400	10.900 - 19.400	4
Cadmium, Total	8120	50.200	49.1000	44.500 - 55.900	42.800 - 57.600	4
Calcium, Total	8119	39900.000	41000.0000	36300.000 -43600.000	35100.000 -44700.000	4
Calcium, Total	8120	15200.000	15200.0000	13800.000 -16600.000	13300.000 -17000.000	4
Chromium, Total	8119	88.500	88.0000	71.900 - 105.000	66.700 - 110.000	4
Chromium, Total	8120	397.000	390.0000	352.000 - 442.000	338.000 - 456.000	4
Cobalt, Total	8119	599.000	591.0000	534.000 - 664.000	514.000 - 684.000	4
Cobalt, Total	8120	300.000	295.0000	270.000 - 330.000	260.000 - 339.000	4
Copper, Total	8119	150.000	152.0000	136.000 - 164.000	132.000 - 168.000	4
Copper, Total	8120	399.000	396.0000	369.000 - 429.000	359.000 - 439.000	4
Iron, Total	8119	199.000	320.0000	172.000 - 227.000	164.000 - 235.000	0
Iron, Total	8120	298.000	319.0000	264.000 - 333.000	253.000 - 344.000	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

TEST NUMBER: 81
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Lead, Total	8119	250.000	330.0000	215.000 - 284.000	204.000 - 295.000	0
Lead, Total	8120	350.000	400.0000	306.000 - 394.000	292.000 - 408.000	3
Magnesium, Total	8119	12900.000	12900.0000	11700.000 -14100.000	11400.000 -14500.000	4
Magnesium, Total	8120	7940.000	7940.0000	7200.000 - 8670.000	6970.000 - 8910.000	4
Manganese, Total	8119	248.000	242.0000	226.000 - 270.000	219.000 - 277.000	4
Manganese, Total	8120	149.000	146.0000	136.000 - 162.000	132.000 - 166.000	4
Nickel, Total	8119	148.000	158.0000	131.000 - 166.000	126.000 - 171.000	4
Nickel, Total	8120	346.000	344.0000	312.000 - 379.000	302.000 - 389.000	4
Potassium, Total	8119	15500.000	15300.0000	14100.000 -16900.000	13600.000 -17300.000	4
Potassium, Total	8120	5020.000	5070.0000	4440.000 - 5610.000	4250.000 - 5790.000	4
Selenium, Total	8119	155.000	165.0000	126.000 - 185.000	117.000 - 194.000	4
Selenium, Total	8120	88.400	82.0000	71.200 - 106.000	65.300 - 111.000	4
Silver, Total	8119	78.500	139.0000	68.300 - 88.700	65.100 - 91.900	0
Silver, Total	8120	149.000	190.0000	130.000 - 167.000	125.000 - 173.000	0
Sodium, Total	8119	6940.000	7640.0000	6270.000 - 7600.000	6060.000 - 7810.000	3
Sodium, Total	8120	24700.000	25800.0000	22700.000 -26700.000	22000.000 -27400.000	4
Thallium, Total	8119	308.000	340.0000	256.000 - 361.000	239.000 - 377.000	4
Thallium, Total	8120	715.000	690.0000	592.000 - 839.000	553.000 - 877.000	4
Vanadium, Total	8119	402.000	390.0000	356.000 - 449.000	341.000 - 463.000	4
Vanadium, Total	8120	250.000	238.0000	222.000 - 278.000	213.000 - 286.000	4
Zinc, Total	8119	786.000	749.0000	716.000 - 856.000	694.000 - 878.000	4
Zinc, Total	8120	2460.000	2300.0000	2240.000 - 2690.000	2170.000 - 2760.000	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
WW Mercury						
Mercury, Total	8119	9.670	9.9000	7.730 - 11.600	7.120 - 12.200	4
Mercury, Total	8120	5.020	4.8000	4.070 - 5.970	3.770 - 6.270	4
Total Cyanide						
Cyanide, Total	8119	2.000	1.2900	1.590 - 2.420	1.460 - 2.550	0
Cyanide, Total	8120	1.270	1.3000	1.050 - 1.490	0.980 - 1.560	4
Wastewater Metals III						
Molybdenum, Total	8119	623.000	628.0000	555.000 - 690.000	534.000 - 711.000	4
Molybdenum, Total	8120	249.000	260.0000	219.000 - 279.000	209.000 - 289.000	4
Titanium, Total	8119	371.000	366.0000	337.000 - 405.000	326.000 - 415.000	4
Titanium, Total	8120	494.000	486.0000	444.000 - 544.000	428.000 - 560.000	4
Purgeable Aromatics						
Benzene	8121	23.400	25.0000	18.700 - 28.100	17.300 - 29.600	4
Benzene	8122	37.100	36.0000	29.100 - 45.200	26.600 - 47.700	4
Chlorobenzene	8121	30.000	32.0000	23.900 - 36.100	21.900 - 38.000	4
Chlorobenzene	8122	47.500	48.0000	38.000 - 57.100	35.000 - 60.100	4
Ethyl benzene	8121	35.800	37.0000	28.500 - 43.100	26.200 - 45.400	4
Ethyl benzene	8122	26.900	26.0000	21.100 - 32.700	19.300 - 34.500	4
Total Xylenes	8121	33.800	32.0000	24.100 - 43.500	21.000 - 46.500	4
Total Xylenes	8122	25.400	23.0000	18.300 - 32.500	16.100 - 34.800	4
Purgeable Halocarbons						
Bromodichloromethane	8121	54.600	59.0000	42.600 - 66.600	38.900 - 70.300	4
Bromodichloromethane	8122	87.300	91.0000	69.000 - 106.000	63.200 - 111.000	4

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Chloroform	8121	59.000	66.0000	44.500 - 73.400	40.000 - 78.000	4
Chloroform	8122	44.500	46.0000	35.100 - 54.000	32.200 - 56.900	4
1,2-Dichloroethane	8121	51.600	55.0000	40.400 - 62.900	36.900 - 66.400	4
1,2-Dichloroethane	8122	38.900	39.0000	30.100 - 47.700	27.300 - 50.400	4
Tetrachloroethene	8121	51.000	55.0000	37.900 - 64.100	33.800 - 68.200	4
Tetrachloroethene	8122	84.000	90.0000	60.800 - 107.000	53.500 - 115.000	4
1,1,1-Trichloroethane	8121	42.900	45.0000	32.300 - 53.000	29.600 - 56.100	4
1,1,1-Trichloroethane	8122	70.400	70.0000	52.900 - 87.900	47.400 - 93.400	4
Trichloroethene	8121	61.700	69.0000	47.200 - 76.300	42.600 - 80.900	4
Trichloroethene	8122	46.000	48.0000	35.600 - 56.300	32.400 - 59.600	4
Chlorinated Hydrocarbons						
Hexachlorobenzene	8123	68.700	64.0000	44.400 - 93.000	36.700 - 101.000	4
Hexachlorobenzene	8124	55.800	45.0000	38.000 - 73.700	32.400 - 79.300	4
Hexachloroethane	8123	55.100	54.0000	19.900 - 90.300	8.810 - 101.000	4
Hexachloroethane	8124	66.100	66.0000	25.900 - 106.000	13.400 - 119.000	4
Hexachlorocyclopentadiene	8123	84.200	68.0000	28.100 - 153.000	10.500 - 174.000	4
Hexachlorocyclopentadiene	8124	32.200	22.0000	10.700 - 62.600	4.020 - 72.100	4
1,2,4-Trichlorobenzene	8123	55.000	51.0000	23.900 - 86.100	14.100 - 95.900	4
1,2,4-Trichlorobenzene	8124	88.500	67.0000	41.700 - 135.000	27.000 - 150.000	4
Polynuclear Aromatic Hydrocarbons						
Anthracene	8123	57.800	28.0000	39.600 - 76.000	33.900 - 81.700	0
Anthracene	8124	46.800	20.0000	33.400 - 60.300	29.200 - 64.500	0

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Acenaphthylene	8123	39.700	28.0000	25.100 - 54.300	20.600 - 58.900	4
Acenaphthylene	8124	32.200	22.0000	19.800 - 44.600	15.900 - 48.500	4
Benzo(ghi)perylene	8123	25.900	17.0000	8.900 - 43.000	3.560 - 48.300	4
Benzo(ghi)perylene	8124	34.000	21.0000	11.700 - 56.300	4.760 - 63.300	4
Chrysene	8123	43.300	39.0000	28.300 - 58.300	23.600 - 63.000	4
Chrysene	8124	53.700	44.0000	33.200 - 74.100	26.800 - 80.500	4
Haloethers						
Bis(2-chloroethoxy)methan	8123	63.100	56.0000	41.400 - 84.700	34.600 - 91.500	4
Bis(2-chloroethoxy)methan	8124	26.800	22.0000	16.500 - 37.100	13.300 - 40.300	4
4-Bromophenylphenyl ether	8123	58.700	54.0000	40.800 - 76.500	35.200 - 82.100	4
4-Bromophenylphenyl ether	8124	95.100	73.0000	65.000 - 125.000	55.600 - 135.000	4
Priority Pollutant Phenols						
2,4-Dichlorophenol	8123	87.500	78.0000	54.700 - 120.000	44.400 - 131.000	4
2,4-Dichlorophenol	8124	70.900	57.0000	43.800 - 98.000	35.300 - 107.000	4
2-Methyl-4,6-dinitropheno	8123	78.400	77.0000	36.900 - 120.000	23.900 - 133.000	4
2-Methyl-4,6-dinitropheno	8124	60.900	57.0000	28.000 - 93.900	17.600 - 104.000	4
4-Nitrophenol	8123	50.100	76.0000	16.700 - 100.000	6.260 - 116.000	4
4-Nitrophenol	8124	63.100	64.0000	21.100 - 126.000	7.890 - 146.000	4
Pentachlorophenol	8123	64.800	68.0000	32.400 - 97.300	22.200 - 107.000	4
Pentachlorophenol	8124	80.800	55.0000	38.200 - 123.000	24.800 - 137.000	4
Phthalate Esters						
Benzyl butyl phthalate	8123	68.300	68.0000	22.800 - 118.000	8.540 - 134.000	4
Benzyl butyl phthalate	8124	29.800	31.0000	9.950 - 52.500	3.730 - 59.600	4

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME. : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Di-n-butyl phthalate	8123	69.300	60.0000	38.600 - 99.900	28.900 - 110.000	4
Di-n-butyl phthalate	8124	30.800	24.0000	14.400 - 47.300	9.270 - 52.400	4
Diethyl phthalate	8123	46.100	42.0000	15.400 - 77.400	5.760 - 87.300	4
Diethyl phthalate	8124	74.300	66.0000	27.400 - 121.000	12.600 - 136.000	4
Di-n-octyl phthalate	8123	41.000	35.0000	19.700 - 62.400	13.000 - 69.100	4
Di-n-octyl phthalate	8124	66.500	56.0000	27.000 - 186.000	14.600 - 118.000	4
Polychlorinated Biphenyls						
PCB-1016	8125	0.977	0.7600	0.556 - 1.400	0.423 - 1.530	4
PCB-1016	8126	1.540	1.2000	0.899 - 2.190	0.697 - 2.390	4
PCB-1260	8125	1.180	0.9100	0.668 - 1.690	0.509 - 1.850	4
PCB-1260	8126	1.750	1.3000	0.995 - 2.500	0.760 - 2.730	4
Chlorinated Hydrocarbon Pesticides						
Lindane	8125	104.000	120.0000	52.500 - 155.000	36.400 - 171.000	4
Lindane	8126	28.500	30.0000	15.200 - 41.700	11.000 - 45.900	4
4,4'-DDT	8125	62.200	58.0000	25.100 - 99.300	13.500 - 111.000	4
4,4'-DDT	8126	34.400	37.0000	17.300 - 51.500	12.000 - 56.900	4
Dieldrin	8125	48.400	53.0000	27.700 - 69.100	21.200 - 75.600	4
Dieldrin	8126	60.000	66.0000	34.900 - 85.200	27.000 - 93.100	4
Endosulfan II	8125	26.000	24.0000	12.400 - 39.600	8.090 - 43.800	4
Endosulfan II	8126	48.900	50.0000	24.400 - 73.500	16.600 - 81.200	4
Endrin	8125	28.700	32.0000	17.100 - 40.400	13.400 - 44.100	4
Endrin	8126	42.700	48.0000	24.900 - 60.500	19.300 - 66.100	4

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 81
TEST DATE: 6-Jul-1992

Analyte		Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
SW Polynuclear Aromatic Hydrocarbons							
Acenaphthene	(SW)	8129	89.100	68.0000	31.600 - 147.000	13.500 - 165.000	4
Benzo(b)fluoranthe	(SW)	8129	75.100	41.0000	28.400 - 122.000	13.700 - 136.000	4
Chrysene	(SW)	8129	75.600	60.0000	35.600 - 116.000	23.100 - 128.000	4
Fluoranthene	(SW)	8129	88.700	63.0000	35.000 - 143.000	18.100 - 159.000	4
Phenanthrene	(SW)	8129	97.000	73.0000	32.400 - 162.000	12.100 - 183.000	4
Pyrene	(SW)	8129	107.000	82.0000	35.800 - 180.000	13.400 - 203.000	4
SW Metals							
Antimony, Total	(SW)	8130	51.700	50.1000	26.800 - 76.700	18.900 - 84.600	4
Arsenic, Total	(SW)	8130	47.200	48.0000	32.000 - 62.400	27.300 - 67.200	4
Barium, Total	(SW)	8130	509.000	541.0000	369.000 - 649.000	325.000 - 693.000	4
Cadmium, Total	(SW)	8130	19.600	16.5000	13.900 - 25.200	12.200 - 26.900	4
Chromium, Total	(SW)	8130	83.400	63.9000	27.300 - 192.000	10.400 - 226.000	4
Lead, Total	(SW)	8130	173.000	177.0000	124.000 - 221.000	109.000 - 236.000	4
Nickel, Total	(SW)	8130	210.000	211.0000	140.000 - 280.000	118.000 - 302.000	4
Selenium, Total	(SW)	8130	21.300	11.0000	9.470 - 33.200	5.740 - 36.900	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

NON-POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

TEST NUMBER: 81
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 6-Jul-1992

Analyte		Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Silver, Total	(SW)	8130	73.900	98.6000	31.800 - 116.000	18.500 - 129.000	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

TEST NUMBER: 75
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
al Alkalinity						
Alkalinity	7501	47.400	46.2000	44.400 - 50.400	43.400 - 51.400	4
Alkalinity	7502	147.000	143.0000	139.000 - 155.000	136.000 - 157.000	4
. Minerals						
Chloride	7503	25.200	24.2000	22.800 - 27.600	22.100 - 28.400	4
Chloride	7504	99.800	96.2000	93.800 - 106.000	91.900 - 108.000	4
Fluoride, Total	7503	2.520	2.4800	2.270 - 2.760	2.190 - 2.840	4
Fluoride, Total	7504	4.530	4.5200	4.140 - 4.910	4.020 - 5.040	4
Nitrate (as N)	7503	0.510	0.6520	0.424 - 0.596	0.397 - 0.623	0
Nitrate (as N)	7504	6.500	7.9400	5.680 - 7.320	5.420 - 7.580	0
Sulfate (as SO4)	7503	110.000	116.0000	98.400 - 121.000	94.800 - 125.000	4
Sulfate (as SO4)	7504	35.300	34.9000	31.900 - 38.800	30.800 - 39.900	4
Solids, Total Dissolved	7503	213.000	211.0000	190.000 - 236.000	183.000 - 243.000	4
Solids, Total Dissolved	7504	272.000	282.0000	248.000 - 296.000	240.000 - 304.000	4
lcium Hardness						
Calcium Hardness	7505	150.000	149.0000	140.000 - 160.000	137.000 - 163.000	4
Calcium Hardness	7506	25.200	22.3000	22.200 - 28.300	21.300 - 29.200	4
drogen Ion						
Hydrogen Ion (pH)	7507	8.430	8.4200	8.340 - 8.530	8.310 - 8.560	4
Hydrogen Ion (pH)	7508	4.000	3.9800	3.920 - 4.070	3.900 - 4.090	4
inking Water Metals						
Barium, Total	7509	797.000	811.0000	744.000 - 851.000	727.000 - 868.000	4
Barium, Total	7510	499.000	507.0000	456.000 - 542.000	443.000 - 555.000	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

TEST NUMBER: 75
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Cadmium, Total	7509	10.200	10.3000	8.810 - 11.500	8.390 - 11.900	4
Cadmium, Total	7510	4.160	4.0200	3.440 - 4.870	3.210 - 5.100	4
Copper, Total	7509	607.000	621.0000	559.000 - 655.000	544.000 - 670.000	4
Copper, Total	7510	202.000	206.0000	183.000 - 221.000	177.000 - 227.000	4
Lead, Total	7509	32.600	31.2000	28.500 - 36.800	27.200 - 38.100	4
Lead, Total	7510	16.700	16.9000	13.600 - 19.800	12.600 - 20.800	4
Manganese, Total	7509	40.000	40.0000	36.100 - 43.900	34.900 - 45.200	4
Manganese, Total	7510	10.100	10.0000	8.760 - 11.500	8.330 - 11.900	4
Silver, Total	7509	20.300	19.8000	17.400 - 23.200	16.500 - 24.100	4
Silver, Total	7510	39.800	40.5000	36.000 - 43.500	34.900 - 44.700	4
Zinc, Total	7509	599.000	614.0000	548.000 - 650.000	532.000 - 666.000	4
Zinc, Total	7510	991.000	1020.0000	909.000 - 1070.000	883.000 - 1100.000	4
Arsenic, Total	7509	20.000	21.2000	17.200 - 22.800	16.300 - 23.700	4
Arsenic, Total	7510	39.900	40.2000	34.600 - 45.100	33.000 - 46.800	4
Chromium, Total	7509	20.100	20.9000	17.200 - 23.100	16.300 - 24.000	4
Chromium, Total	7510	14.300	15.1000	12.500 - 17.200	11.700 - 18.000	4
Iron, Total	7509	304.000	312.0000	275.000 - 333.000	266.000 - 342.000	4
Iron, Total	7510	102.000	103.0000	89.300 - 114.000	85.500 - 118.000	4
Mercury, Total	7509	1.060	1.0000	0.749 - 1.370	0.652 - 1.470	4
Mercury, Total	7510	0.824	0.9000	0.563 - 1.090	0.482 - 1.170	4
Selenium, Total	7509	4.030	4.0000	3.000 - 5.050	2.670 - 5.330	4
Selenium, Total	7510	6.060	5.5000	4.780 - 7.340	4.370 - 7.740	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

POTABLE WATER CHEMISTRY PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 75
TEST DATE: 13-Apr-1992

Analyte	Sample	Mean	Result	Satisfactory Limits	Marginal Limits	Score
Sodium, Total	7509	1030.000	1140.0000	907.000 - 1150.000	869.000 - 1190.000	4
Sodium, Total	7510	327.000	470.0000	259.000 - 396.000	237.000 - 417.000	0
ed Pesticides						
Endrin	7511	0.079	0.0710	0.048 - 0.110	0.038 - 0.120	4
Endrin	7512	0.193	0.1950	0.105 - 0.281	0.077 - 0.309	4
Lindane	7511	0.503	0.4700	0.323 - 0.683	0.266 - 0.740	4
Lindane	7512	1.970	2.0500	1.280 - 2.660	1.060 - 2.880	4
Methoxychlor	7511	4.650	4.4100	2.690 - 6.620	2.070 - 7.240	4
Methoxychlor	7512	18.200	19.5000	11.500 - 24.800	9.370 - 26.900	4
aphene						
Toxaphene	7513	2.080	2.1900	0.920 - 3.250	0.554 - 3.610	4
Toxaphene	7514	5.040	4.6500	2.940 - 7.140	2.280 - 7.800	4
ed Herbicides						
2,4-D	7515	6.740	5.6800	2.250 - 12.600	0.843 - 14.400	4
2,4-D	7516	4.330	3.2700	1.450 - 7.910	0.541 - 9.040	4
2,4,5-TP (Silvex)	7515	7.300	7.0600	2.440 - 12.400	0.912 - 14.000	4
2,4,5-TP (Silvex)	7516	2.570	2.3900	0.932 - 4.200	0.420 - 4.710	4

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

VOLATILE ORGANIC CHEMICALS PROFICIENCY TEST REPORT

TEST NUMBER: 76
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Target	Result	Satisfactory Limits	Score
Volatile Halocarbons					
Bromochloromethane	7601	17.100	14.7000	13.700 - 20.500	4
Bromochloromethane	7602	7.600	6.9500	4.560 - 10.600	4
Bromomethane	7601	blank	< 0.5000	D.L. - < 0.5	4
Bromomethane	7602	blank	< 0.5000	D.L. - < 0.5	4
Carbon tetrachloride	7601	9.430	9.4100	5.660 - 13.200	4
Carbon tetrachloride	7602	23.600	25.0000	18.900 - 28.300	4
Chloroethane	7601	blank	< 0.5000	D.L. - < 0.5	4
Chloroethane	7602	blank	< 0.5000	D.L. - < 0.5	4
Chloromethane	7601	blank	< 0.5000	D.L. - < 0.5	4
Chloromethane	7602	blank	< 0.5000	D.L. - < 0.5	4
Dibromomethane	7601	24.700	22.5900	19.800 - 29.600	4
Dibromomethane	7602	4.930	4.5900	2.960 - 6.900	4
Dichlorodifluoromethane	7601	6.630	4.4000	3.980 - 9.280	4
Dichlorodifluoromethane	7602	22.100	14.1000	17.700 - 26.500	0
1,1-Dichloroethane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,1-Dichloroethane	7602	blank	< 0.5900	D.L. - < 0.5	4
1,2-Dichloroethane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,2-Dichloroethane	7602	blank	< 0.5900	D.L. - < 0.5	4
1,1-Dichloroethene	7601	5.950	5.8300	3.570 - 8.330	4
1,1-Dichloroethene	7602	17.900	17.1000	14.300 - 21.500	4

D.L. = Detection Limit greater than zero.

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
NEW YORK STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL LABORATORY APPROVAL PROGRAM

VOLATILE ORGANIC CHEMICALS PROFICIENCY TEST REPORT

TEST NUMBER 79
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Target	Result	Satisfactory Limits	Score
cis-1,2-Dichloroethene	7601	blank	< 0.5000	D.L. - < 0.5	4
cis-1,2-Dichloroethene	7602	blank	< 0.5000	D.L. - < 0.5	4
trans-1,2-Dichloroethene	7601	blank	< 0.5000	D.L. - < 0.5	4
trans-1,2-Dichloroethene	7602	blank	< 0.5000	D.L. - < 0.5	4
1,2-Dichloropropane	7601	22.700	22.0000	18.200 - 27.200	4
1,2-Dichloropropane	7602	6.809	6.4200	4.080 - 9.520	4
1,3-Dichloropropane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,3-Dichloropropane	7602	blank	< 0.5000	D.L. - < 0.5	4
2,2-Dichloropropane	7601	blank	< 0.5000	D.L. - < 0.5	4
2,2-Dichloropropane	7602	blank	< 0.5000	D.L. - < 0.5	4
1,1-Dichloropropene	7601	blank	< 0.5000	D.L. - < 0.5	4
1,1-Dichloropropene	7602	blank	< 0.5000	D.L. - < 0.5	4
cis-1,3-Dichloropropene	7601	blank	< 0.5000	D.L. - < 0.5	4
cis-1,3-Dichloropropene	7602	blank	< 0.5000	D.L. - < 0.5	4
trans-1,3-Dichloropropene	7601	blank	< 0.5000	D.L. - < 0.5	4
trans-1,3-Dichloropropene	7602	blank	< 0.5000	D.L. - < 0.5	4
Methylene chloride	7601	blank	< 0.5000	D.L. - < 0.5	4
Methylene chloride	7602	blank	< 0.5000	D.L. - < 0.5	4
1,1,1,2-Tetrachloroethane	7601	7.590	7.6100	4.550 - 10.600	4
1,1,1,2-Tetrachloroethane	7602	15.200	16.2000	12.200 - 18.200	4
1,1,2,2-Tetrachloroethane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,1,2,2-Tetrachloroethane	7602	blank	< 0.5000	D.L. - < 0.5	4

D.L. = Detection Limit greater than zero

VOLATILE ORGANIC CHEMICALS PROFICIENCY TEST REPORT

TEST NUMBER: 7S
LAB ID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Target	Result	Satisfactory Limits	Score
Tetrachloroethene	7601	blank	< 0.5000	D.L. - < 0.5	4
Tetrachloroethene	7602	blank	< 0.5000	D.L. - < 0.5	4
1,1,1-Trichloroethane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,1,1-Trichloroethane	7602	blank	< 0.5000	D.L. - < 0.5	4
1,1,2-Trichloroethane	7601	13.900	13.6000	11.100 - 16.700	4
1,1,2-Trichloroethane	7602	5.560	5.8200	3.340 - 7.780	4
Trichloroethene	7601	4.470	4.3900	2.680 - 6.260	4
Trichloroethene	7602	22.400	22.4000	17.900 - 26.900	4
Trichlorofluoromethane	7601	8.010	7.6900	4.810 - 11.200	4
Trichlorofluoromethane	7602	16.000	14.4000	12.800 - 19.200	4
1,2,3-Trichloropropane	7601	blank	< 0.5000	D.L. - < 0.5	4
1,2,3-Trichloropropane	7602	blank	< 0.5000	D.L. - < 0.5	4
Vinyl chloride	7601	blank	< 0.5000	D.L. - < 0.5	4
Vinyl chloride	7602	blank	< 0.5000	D.L. - < 0.5	4
Volatile Aromatics					
Benzene	7603	9.700	8.5100	5.220 - 12.200	4
Benzene	7604	17.400	17.3000	13.900 - 20.900	4
Bromobenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
Bromobenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
n-Butylbenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
n-Butylbenzene	7604	blank	< 0.5000	D.L. - < 0.5	4

D.L. = Detection Limit greater than zero.

VOLATILE ORGANIC CHEMICALS PROFICIENCY TEST REPORT

LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC

TEST NUMBER: 75
TEST DATE: 13-Apr-1992

Analyte	Sample	Target	Result	Satisfactory Limits	Score
sec-Butylbenzene	7603	16.800	17.8000	13.400 - 20.200	4
sec-Butylbenzene	7604	6.710	6.7100	4.030 - 9.390	4
tert-Butylbenzene	7603	5.110	4.5500	3.070 - 7.150	4
tert-Butylbenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
Chlorobenzene	7603	19.800	20.1000	15.800 - 23.800	4
Chlorobenzene	7604	8.790	8.7900	5.270 - 12.300	4
2-Chlorotoluene	7603	blank	< 0.5000	D.L. - < 0.5	4
2-Chlorotoluene	7604	blank	< 0.5000	D.L. - < 0.5	4
4-Chlorotoluene	7603	blank	< 0.5000	D.L. - < 0.5	4
4-Chlorotoluene	7604	21.100	24.4000	16.900 - 25.300	4
1,2-Dichlorobenzene	7603	7.810	8.1700	4.690 - 10.900	4
1,2-Dichlorobenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
1,3-Dichlorobenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
1,3-Dichlorobenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
1,4-Dichlorobenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
1,4-Dichlorobenzene	7604	16.300	16.7000	13.000 - 19.600	4
Ethyl benzene	7603	15.600	17.1000	12.500 - 18.700	4
Ethyl benzene	7604	8.660	9.4100	5.200 - 12.100	4
Hexachlorobutadiene	7603	blank	< 0.5000	D.L. - < 0.5	4
Hexachlorobutadiene	7604	blank	< 0.5000	D.L. - < 0.5	4
Isopropylbenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
Isopropylbenzene	7604	blank	< 0.5000	D.L. - < 0.5	4

D.L. = Detection Limit greater than zero.

VOLATILE ORGANIC CHEMICALS PROFICIENCY TEST REPORT

TEST NUMBER: 76
LABID : 10026 LAB NAME : RECRA ENVIRONMENTAL INC TEST DATE: 13-Apr-1992

Analyte	Sample	Target	Result	Satisfactory Limits	Score
p-Isopropyltoluene (P-Cym	7603	13.200	13.6000	10.600 - 16.000	4
p-Isopropyltoluene (P-Cym	7604	6.640	6.6300	3.980 - 9.300	4
n-Propylbenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
n-Propylbenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
Styrene	7603	blank	< 0.5000	D.L. - < 0.5	4
Styrene	7604	blank	< 0.5000	D.L. - < 0.5	4
Toluene	7603	8.470	7.8700	5.080 - 11.900	4
Toluene	7604	16.900	16.1000	13.500 - 20.300	4
1,2,3-Trichlorobenzene	7603	14.000	12.3000	11.200 - 16.800	4
1,2,3-Trichlorobenzene	7604	7.990	6.9800	4.790 - 11.200	4
1,2,4-Trichlorobenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
1,2,4-Trichlorobenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
1,2,4-Trimethylbenzene	7603	blank	< 0.5000	D.L. - < 0.5	4
1,2,4-Trimethylbenzene	7604	blank	< 0.5000	D.L. - < 0.5	4
1,3,5-Trimethylbenzene	7603	25.600	27.4000	20.500 - 30.700	4
1,3,5-Trimethylbenzene	7604	5.110	5.2700	3.070 - 7.150	4
m-Xylene	7603	blank	< 0.5000	D.L. - < 0.5	4
m-Xylene	7604	blank	< 0.5000	D.L. - < 0.5	4
o-Xylene	7603	blank	< 0.5000	D.L. - < 0.5	4
o-Xylene	7604	blank	< 0.5000	D.L. - < 0.5	4
p-Xylene	7603	blank	< 0.5000	D.L. - < 0.5	4
p-Xylene	7604	blank	< 0.5000	D.L. - < 0.5	4

D.L. = Detection Limit greater than zero

REGION 2
ORGANIC PERFORMANCE EVALUATION SAMPLE
INDIVIDUAL LABORATORY SUMMARY REPORT
FOR 08 4 FY 92

LABORATORY: RECRA Env. (NY)
PERFORMANCE: ACCEPTABLE - No Response Required
RANK: Above = 0 Same = 13 Below = 30

% SCORE: 100
REPORT DATE: 09/20/92
MATRIX: WATER

COMPOUND	TOLERANCE INTERVALS WARNING LOWER	WARNING UPPER	ACTION LOWER	ACTION UPPER	LABORATORY DATA CONC	Q	#LABS MIS-ONT	PROGRAM #LABS NOT-ID	DATA #LABS ID-CPD	TOTAL #LABS
TCL VOLATILE										
BROMOMETHANE	22	36	20	44	33		3	0	60	60
CHLOROFORM	10	12	10	13	11		2	0	60	60
CARBON TETRACHLORIDE	57	72	55	74	62		4	0	60	60
BROMODICHLOROMETHANE	74	91	71	94	83		6	0	60	60
DIBROMOCHLOROMETHANE	49	62	47	64	53		4	0	60	60
BROMOFORM	11	16	10	17	13		2	0	60	60
1,1,2,2-TETRACHLOROETHANE	58	78	55	81	74		2	0	60	60
STYRENE	88	110	85	120	110		2	0	60	60
TCL SEMIVOLATILE										
PHENOL	15	23	14	24	21		4	1	59	60
2-METHYLPHENOL	32	49	29	58	47		6	0	60	60
HEXACHLOROETHANE	10	16	10	20	15		2	0	60	60
ISOPHORONE	26	38	24	44	32		4	0	60	60
2,4-DIMETHYLPHENOL	10	17	10	21	7		2	1	59	60
BIS(2-CHLOROETHOXY)METHANE	12	18	10	19	15		1	1	59	60
1,2,4-TRICHLOROBENZENE	10	15	10	17	14		1	0	60	60
NAPHTHALENE	23	34	21	40	31		6	0	60	60
HEXACHLOROCYCLOPENTADIENE	NU	NU	NU	NU	10	U	0	27	33	60
2,4,6-TRICHLOROPHENOL	12	17	12	18	15		8	0	60	60
2,4-DINITROTOLUENE	30	45	27	54	42		3	0	60	60
4-CHLOROPHENYL PHENYL ETHER	14	21	13	22	18		9	0	60	60
ANTHRACENE	NU	NU	NU	NU	3		0	5	55	60
PYRENE	64	140	53	190	110		1	0	60	60
DI-N-OCTYL PHTHALATE	24	44	21	47	35		8	1	59	60
BENZO(A)PYRENE	11	15	10	18	15		1	1	59	60
TCL PESTICIDES										
ALPHA-BHC	0.1	0.16	0.096	0.16	0.14		5	0	60	60
HEPTACHLOR	0.17	0.28	0.16	0.3	0.23		5	0	60	60
ENDOSULFAN II	0.59	0.88	0.55	0.92	0.72		5	0	60	60
ENDOSULFAN SULFATE	0.3	0.45	0.27	0.47	0.34		4	0	60	60
ENDRIN KETONE	0.19	0.28	0.18	0.29	0.22		6	0	60	60
ENDRIN ALDEHYDE	0.44	0.87	0.38	0.93	0.67		7	2	58	60
AROCLOR-1248	1.4	2.1	1.3	2.2	1.6		12	3	57	60
NON-TCL VOLATILE										
BENZENE,N-PROPYL-					71			4	56	60
VINYL ACETATE					0	NR		60	0	60
NON-TCL SEMIVOLATILE										
BETA-BHC					0	NR		44	16	60
TCL VOLATILE (Contaminants)										
2-BUTANONE					7			27	33	60

REGION 2
ORGANIC PERFORMANCE EVALUATION SAMPLE
INDIVIDUAL LABORATORY SUMMARY REPORT
FOR QB 4 FY 92

LABORATORY: RECRA Env. (NY)
PERFORMANCE: ACCEPTABLE - No Response Required
RANK: Above = 0 Same = 13 Below = 30

% SCORE: 100
REPORT DATE: 09/20/
MATRIX: WATER

COMPOUND	TOLERANCE INTERVALS WARNING LOWER	TOLERANCE INTERVALS WARNING UPPER	TOLERANCE INTERVALS ACTION LOWER	TOLERANCE INTERVALS ACTION UPPER	LABORATORY DATA CONC	LABORATORY DATA Q	#LABS MIS-QNT	PROGRAM DATA #LABS NOT-ID	PROGRAM DATA #LABS ID-CPD	TOTAL #LABS
TRICHLOROETHENE					1			52	8	60
NON-TCL VOLATILE (Contaminants)										
UNKNOWN					31			46	14	60
UNKNOWN					8			58	2	60
METHYL ACETATE					10			57	3	60
NON-TCL SEMIVOLATILE (Contaminants)										
2-CYCLOHEXEN-1-ONE					3			59	1	60
CYCLOHEXANE,HEXACHLORO- ISOME					43			58	2	60
OXYGENATED COMPOUND					11			59	1	60
UNKNOWN					2			42	18	60
ETHANOL,2,2'-OXYBIS-					13			59	1	60
CYCLOHEXANE,HEXACHLORO- ISOME					38			59	1	60

OF TCL COMPOUNDS NOT-IDENTIFIED: 0
OF TCL COMPOUNDS MIS-QUANTIFIED: 0
OF TCL CONTAMINANTS: 0

OF NON-TCL COMPOUNDS NOT-IDENTIFIED: 0
OF NON-TCL CONTAMINANTS: 0

World University Games Buffalo '93
GRAND PATRON
HELPING TO BRING THE WORLD TO BUFFALO

257

RECRA ENVIRONMENTAL, INC.
QUALITY ASSURANCE/
QUALITY CONTROL PLAN

April, 1991

Version 3.1
Revision 0

PREPARED BY

Recra Environmental, Inc.
Corporate Office

10 Hazelwood Drive
Amherst, New York 14228-2298

R a Stadelmaier

Robert A. Stadelmaier
President
Chief Executive Officer

Robt K Wyeth

Robert K. Wyeth
Executive Vice President
Corporate QA Officer

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Recra Environmental, Inc. (Recra) is in the business of providing chemical and environmental analysis services. These services are provided to industrial and commercial concerns, governmental agencies, public utilities, engineering firms, law firms and waste services companies. Recra's laboratories participate in the U.S. Environmental Protection Agency Contract Laboratory Program (CLP) and are certified or approved by various federal and state agencies across the country.

Recra Environmental, Inc.'s corporate mission, simply stated, is:

> "To deliver high quality chemical and environmental analysis services on a timely basis to our customers in a manner that achieves nationally recognized professional and business excellence".

2. QUALITY ASSURANCE/QUALITY CONTROL POLICY

In order to achieve our corporate mission, Recra has established a corporate policy for quality assurance which combines good laboratory practices, method compliance and quantitative criteria for data acceptability. Compliance with the QA plan presented herein provides the foundation for technically sound analytical results of known and documentable quality. The program presented herein defines Recra's QA/QC objectives, operating and support procedures, and specific criteria which provide the focus for an effective on-going program. Recra's philosophy is to build quality into our products and services at every step of their production. Every employee at Recra has a role in quality control and every employee is responsible and accountable for the quality of their work.

Standard Quality Assurance Procedures are documented and available upon request of the Corporate or Facility Quality Assurance Officer.

3. PURPOSE, SCOPE AND FORMAT OF THE QUALITY ASSURANCE PLAN

This Quality Assurance (QA) plan presents the essential elements of Recra's QA/QC program. This plan is modeled after numerous documents including, most notably, the following two U.S. Environmental Protection Agency guidance documents:

1) "Interim Guidelines and Specifications for Preparing Quality Assurance Program Plans", QAMS-004/80, December 29, 1980 and

2) "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", QAMS-005/80, February, 1989.

Both of these documents were published by the U.S. Environmental Protection Agency's Office of Monitoring Systems and Quality Assurance. All of the elements of these reference documents, as well as items and issues specific to the operation of Recra's laboratories, are described in this plan.

The purpose of Recra's QA plan is to control and monitor the quality and acceptability of laboratory data relative to standard laboratory practices, standard methods employed, and contractual obligations between Recra and our clients.

It is also a purpose of this plan to eliminate, to the extent possible, systematic and random errors, which affect data quality.

A good QA/QC program, coupled with sound professional judgement, will result in analytical data of acceptable, known, and documentable quality. Attainment of this type of data is the goal of this plan.

At Recra, the overall quality program is divided into two parts;

Quality Assurance, and
Quality Control

Quality Assurance generally relates to laboratory qualifications and capabilities. Quality Assurance activities are generally more system related and include the following components:

- Organization
- Facility(s)
- Equipment
- Preventive Maintenance
- Staff Competency
- Laboratory Certifications
- Sample Custody Procedures
- Protocol/Contract Compliance
- Report Preparation Procedures
- Audits

Quality Control on the other hand, is performance related and is generally based on established quantitative acceptance criteria as defined by methodology or past results. Quality Control activities include:

- Adherence to Methodology
- Calibration Procedures and Frequency
- Analytical Precision
- Analytical Accuracy
- Standard Reference Materials
- Use of Laboratory and Field Blanks
- Detection and Quantification Limits
- Data Reduction and Validation
- Data Completeness
- Corrective Action(s)

The quality control program in effect at Recra Environmental Laboratories is based upon recommendations contained in the EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories (March 1979), 600/4-79-019 and U.S. EPA Good Laboratory Practice Standards (August 17, 1989), 40 CFR Parts 160 and 792.

4. CORPORATE AND DIVISIONAL ORGANIZATION

Recra Environmental, Inc. operates four facilities located in, Amherst, New York; Columbia, Maryland; Cleveland, Ohio; and Farmington Hills, Michigan. Table 4-1 illustrates the different facilities operated by Recra.

Implementation of the QA Program is the responsibility of the Corporate QA Officer. Assisting the Corporate QA Officer with this responsibility are facility QA Officers (QAO). The responsibilities of the facility QAO is to implement and audit the compliance with QA policy and monitor adherence to QC procedures at all levels of the laboratory operation. Facility QAOs report to the Corporate QAO who in turn reports to the president and CEO.

The corporate organizational structure is presented in Figure 4-1. Figure 4-2 presents a representative organizational structure for Recra's testing operations.

Both management and staff understand their responsibility and authority in achieving the stated quality objectives. Personnel work together to monitor all QA/QC activities and to assure that these activities are performed according to authorized policies and procedures. Standard operating procedures practiced by Recra's laboratory staff to achieve this goal include but are not necessarily limited to the following:

- Extensive sample security, tracking and documentation.
- Certified and documented traceability of standards, reagents, and gases
- Strict calibration procedures, criteria and frequency
- Analysis of spikes, surrogates, internal standards, and control samples
- Duplicates and various blanks
- Statistical assessment of internal Quality Control
- Documented preventive maintenance of equipment
- Thorough review, validation and data quality assessment
- Corrective action reports
- Internal record keeping and document control
- Performance and systems audits
- Comprehensive Standard Operating Procedures (SOPs)

Based upon staff understanding of their assigned responsibilities and their knowledge of the contents of this plan through on-going QAP training, the proper number of duplicates, spikes, and blanks, is maintained throughout the laboratory operation and is not left to the analyst's discretion. In addition to performing the proper amount of quality control, the analyst is responsible for the initial review and assessment of the data generated. If data is outside of warning limits or out of control, the source of the problem will be identified with the aid of the appropriate supervisor or manager. Supervisors are ultimately responsible for all data generated from their section, and all data in an analytical report must first be approved by the appropriate supervisor. Following the supervisors review and acceptance of the data, the results are submitted through the department manager to the data processing and/or report writing group. Upon preparation of the report, the review process continues through the QA department and ultimately the Laboratory Director.

All analytical reports (including all quality control data) are reviewed for purposes of maintaining the highest standards of QA/QC. More specific details on how data quality is reviewed, assessed, and either approved or rejected is presented in latter sections of this document.

In the operation of Recra's laboratories, the Corporate QA/QC Officer is responsible for the performance of all staff personnel relative to the overall quality of the data. Administrative functions including financial control, contractual issues, and various other business concerns are directly under the control of the Chief Executive Officer. Day to day technical management resides with the facility specific Laboratory Operations Manager. Data assessment relative to completeness, comparability and quality as well as final data/report review are completed under the direction and control of the Laboratory Director and the facility QA Officer.

Individual analysts, under the direction of the supervisors, are responsible for the performance of instrument calibration and sample analysis, along with the performance of associated quality control analyses; i.e., blanks, spikes, duplicates, etc. All data are entered into individually bound laboratory notebooks specific to each instrument and analysis. These are reviewed by supervisors and managers and are signed or witnessed as specified periodically.

Supervisors are charged with maintaining instrumentation in proper operating order according to manufacturers' specifications. Scheduling of routine servicing as well as reacting to instrument problems are also the duty of the supervisor. All major instrumentation is maintained under service agreement with the manufacturer. Logs and files of service requirements and visits are also maintained.

A3076

TABLE 4-1

RECRA ENVIRONMENTAL, INC.
FACILITIES

CORPORATE HEADQUARTERS

Audubon Business Centre
10 Hazelwood Drive
Amherst, NY 14228-2298
(716) 691-2600

New York Testing Laboratories

111 Wales Avenue
Tonawanda, NY 14150
(716) 692-2801

505 Fillmore Avenue
Tonawanda, NY 14150
(716) 692-2833

10 Hazelwood Drive
Amherst, NY 14228-2298
(716) 691-2600

Maryland Testing Laboratory

8320 Guilford Road
Columbia, MD 21046
(301) 381-2288

Ohio Testing Laboratory

8001 Sweet Valley Drive
Cleveland, OH 44125
(216) 328-9510

Michigan Testing Laboratory

23963 Research Drive
Farmington Hills, MI 48024
(313) 442-0450

Figure 4-1
RECRA ENVIRONMENTAL, INC.
ORGANIZATIONAL CHART

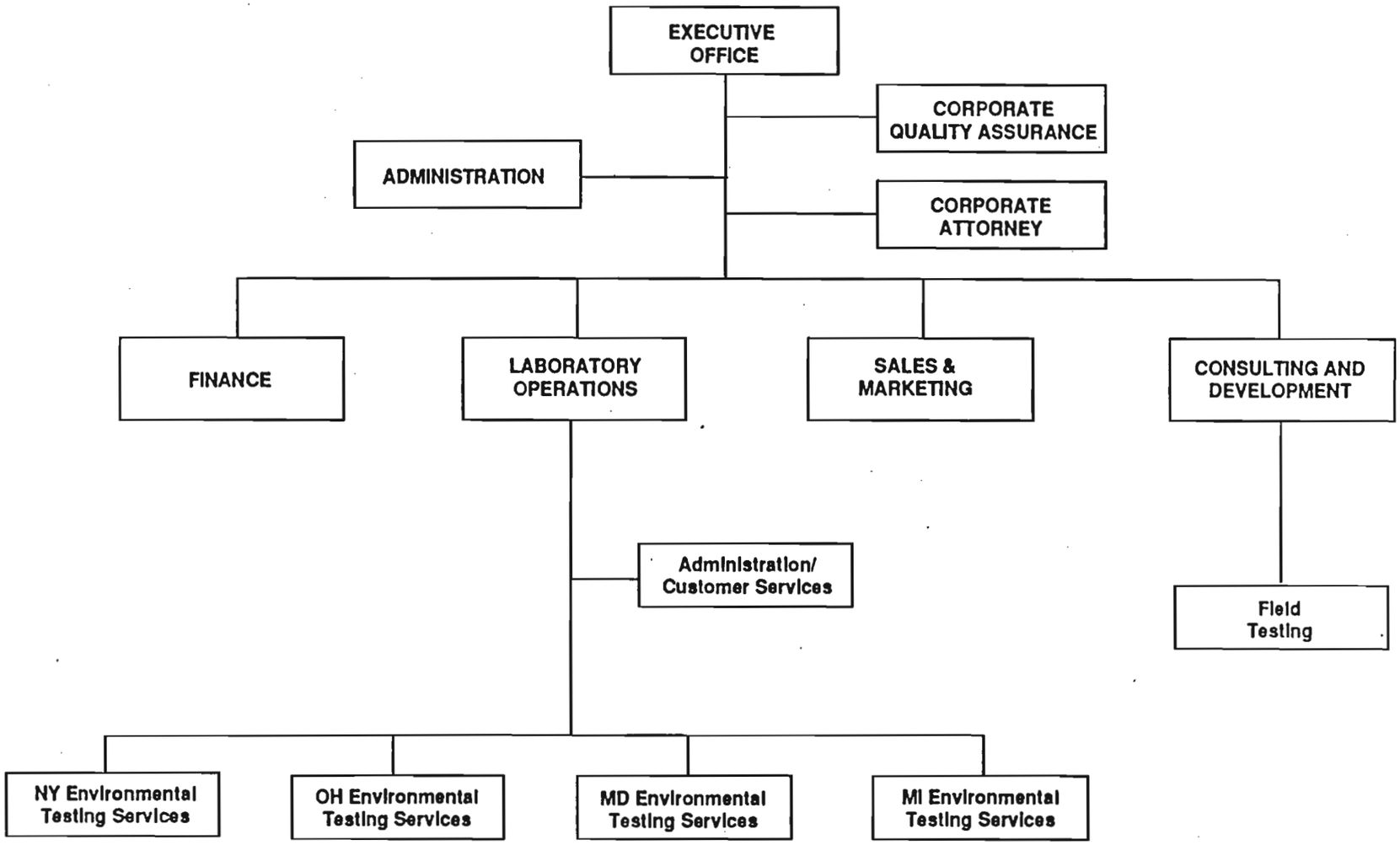
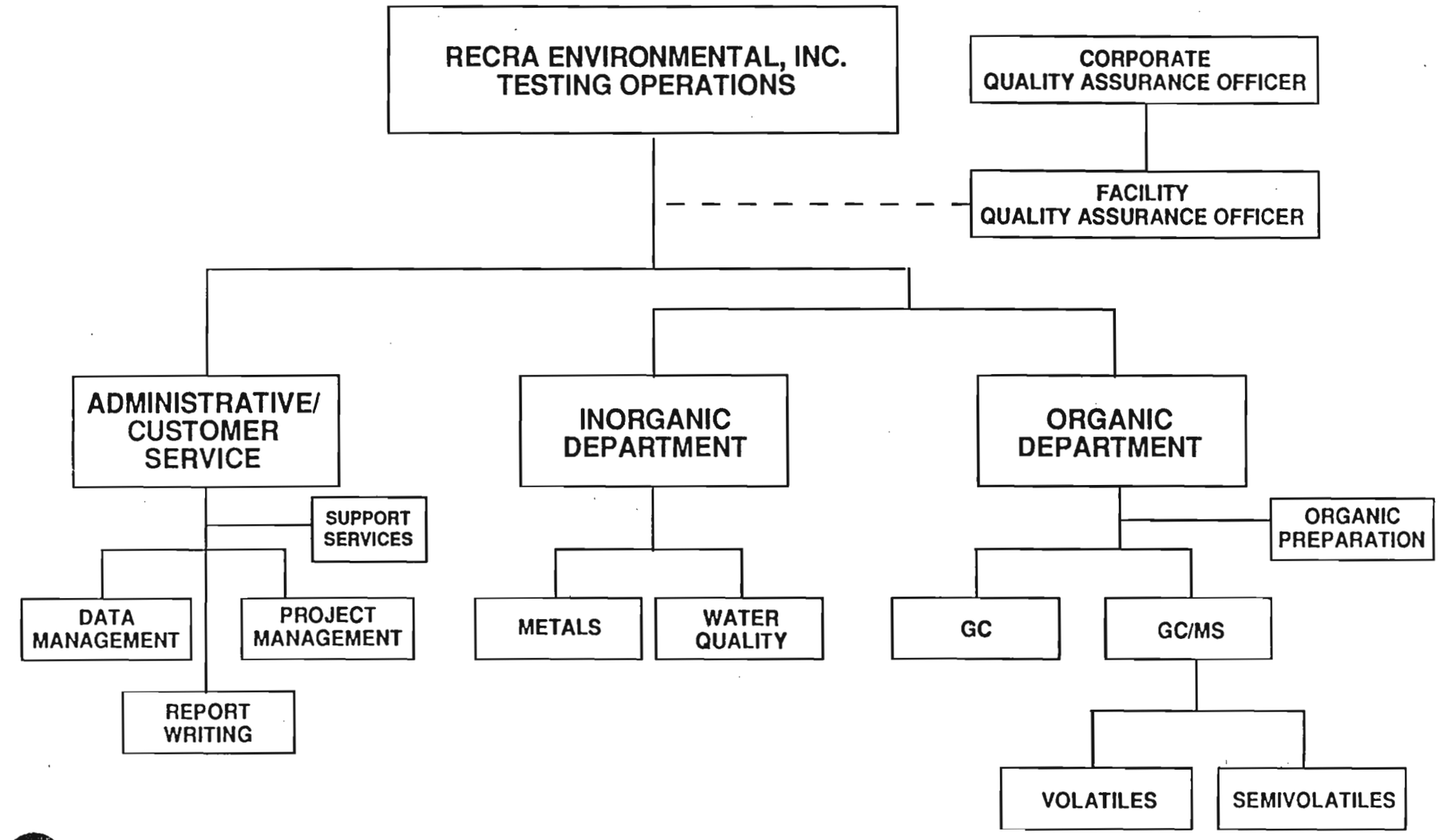


Figure 4-2

Recra Environmental, Inc.
Generalized Laboratory Organization



5. DATA QUALITY OBJECTIVES

Data quality objectives with regard to Recra's environmental testing services are described in terms of accuracy, precision, completeness, representativeness, and comparability. General definitions of these terms follow:

- **Accuracy** - the degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, usually expressed as the absolute value of the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100 (1X-T1)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system.

  For purposes of the Recra QA Plan, the determination will be made as percent (%) recovery of known constituent additions (spikes).

- **Precision** - a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is expressed in terms of standard deviation. Various measures of precision exist, depending upon the "prescribed similar conditions".

For purposes of the Recra QA Plan, the coefficient of variation (a measure of standard deviation) can also be used as a measure of precision. Relative percent difference is also used for compliance with certain methodologies. Experience has shown that, based upon the wide range of concentrations found in laboratory samples, the "normalization" of precision data by use of the coefficient of variation can accommodate data review activities.

- **Completeness** - a measure of the amount of valid data obtained from a measurement system, compared to the amount that was expected to be obtained under correct normal conditions.

  Generally, the established criteria at Recra for completeness is minimally 90%. In specific cases or investigations however, where matrices include soils and leachates, completeness criteria on a project specific basis as presented in project specific quality assurance plan or quality assurance project plan (QAPjP) of less than 90% are being utilized.

Representativeness - expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Comparability - expresses the confidence with which one data set can be compared to another.

Comparability of data sets is a function of numerous variables. These variables include laboratory errors and biases, and the representativeness of the samples, and the inherent "population variance" within the data set of which the samples are a part. Comparability, in a general sense, is valuable but is difficult to apply with any certainty, confidence or specificity. Representativeness of data is a function of both field and laboratory variance. The field variance is often greater than 80% of the overall variance between results. The remaining 20% or less of the variance in the data is attributable to both systematic and random laboratory error which, to the extent possible, is controlled by the QA/QC activities illustrated within (and measured by) the precision and the accuracy of the analysis.

6. SAMPLING PROCEDURES

The quality of data can be greatly effected by sample collection activities. If the integrity of collected samples is for some reason in question, the data will also be in question regardless of its analytical quality. Recra operates a separate field testing department, which under its own standard operating procedures, is responsible for the collection of samples representative of the matrix being investigated. If the reader is interested in these standard operating procedures and what measures Recra takes to insure sample integrity, a copy of those procedures is available upon request.

From an analytical perspective, the following procedures are followed to insure the integrity of the samples:

- Upon collection, samples are placed in the proper containers. In general, samples collected for organic analysis are placed in pre-cleaned, glass containers, and samples collected for inorganic analysis are placed in precleaned plastic (polyethylene) bottles.
- Samples are properly and appropriately preserved in order to minimize loss of the constituent(s) of interest due to physical, chemical or biological mechanisms.

- Appropriate volumes must be collected to insure that method or contract required detection limits (or quantification limits) can be successfully obtained and that the required level of quality control relative to both precision and accuracy can be completed.
- Samples must be shipped in a timely fashion so that holding-times and/or analysis times as prescribed by the methodology can be met. Samples must also be shipped in containers which will preserve the refrigeration temperature for those parameters for which such refrigeration is required in the defined preservation protocols.

Table 6-1 lists the volume requirements, preservation protocols, container types and holding-times applicable to common analyses. It must be pointed out that the information presented in this table may vary dependent upon the requirements of given programs, matrices, special methods, clients, or governmental agency protocols. Recra personnel can provide consultation and assistance in this regard, should such assistance be required.

Table 6.1 (page 1 of 4)
Recra Environmental, Inc.
Recommended Sample Preservation/Storage and Holding Times

PARAMETER DESCRIPTION	MINIMUM SAMPLE VOLUME SOLID/LIQUID		CONTAINER TYPE SOLID/LIQUID		PRESERVATIVE LIQUID SAMPLES	HOLDING TIME
Acidity		100 mls		250 ml HDPE	Cool 4°C	14 days
Alkalinity		100 mls		250 ml HDPE	Cool 4°C	14 days
Ammonia		500 mls		1 L HDPE	Cool 4°C, H_2SO_4 <2	28 days
Biochemical Oxygen Demand		1 L		2 L HDPE	Cool 4°C	48 hours
Bromide		100 mls		250 ml HDPE	None Required	28 days
Chemical Oxygen Demand		50 mls		125 ml HDPE	Cool 4°C, H_2SO_4 <2	28 days
Chloride		50 mls		125 ml HDPE	None Required	28 days
Chlorine, Total Residual		200 mls		500 ml HDPE	None Required	Analyze Immediately
Color		50 mls		125 ml HDPE	Cool 4°C	48 hours
Cyanide, Total and Amenable	10 gms	500 mls	1 L BR	1 L HDPE	0.6 gms ascorbic acid NaOH to pH 12	14 days
Fluoride		300 mls		500 ml HDPE	None Required	28 days
Hardness		100 mls		250 ml HDPE	HNO_3 or H_2SO_4 <2	6 months
Hydrogen Ion (pH)	100 gms	25 mls	4 oz GWM	60 ml HDPE	None Required	Analyze Immediately
Kjeldahl and Organic Nitrogen		500 mls		1 L HDPE	Cool 4°C, H_2SO_4 <2	28 days
Chromium VI	10 gms	100 mls	8 oz GWM	250 ml HDPE	Cool 4°C	24 hours
Mercury	10 gms	100 mls	8 oz GWM	250 ml HDPE	HNO_3 <2	28 days
Metals (except Mercury and Chrome VI)	10 gms	200 mls	16 oz BR	500 ml HDPE	HNO_3 <2	6 months
Nitrate		100 mls		250 ml HDPE	Cool 4°C	48 hours
Nitrate + Nitrite		100 mls		250 ml HDPE	Cool 4°C, H_2SO_4 <2	28 days
Nitrite		50 mls		125 ml HDPE	Cool 4°C	48 hours
Oil and Grease	10 gms	1 L	8 oz GWM	2 L GWM	Cool 4°C, H_2SO_4 <2	28 days
Organic Carbon	10 gms	25 mls	8 oz GWM	125 ml HDPE	Cool 4°C, H_2SO_4 <2	28 days
Orthophosphate		50 mls		125 ml HDPE	Cool 4°C, Filter immed.	48 hours
Oxygen, Dissolved		300 mls		500 ml glass	Store in dark	8 hours

Recra Environmental, Inc.

Recommended Sample Preservation/Storage and Holding Times

PARAMETER DESCRIPTION	MINIMUM SAMPLE VOLUME SOLID/LIQUID		CONTAINER TYPE SOLID/LIQUID		PRESERVATIVE LIQUID SAMPLES	HOLDING TIME
Phenols, Total		500 mls		1 L BR	Cool 4°C, H2SO4 <2	28 days
Phosphorus, Total		50 mls		125 ml HDPE	Cool 4°C, H2SO4 <2	28 days
Residue, Total		100 mls		250 ml HDPE	Cool 4°C	7 days
Residue, Filterable		100 mls		250 ml HDPE	Cool 4°C	7 days
Residue, Non-filterable		100 mls		250 ml HDPE	Cool 4°C	7 days
Residue, Settleable		1 L		2 L glass	Cool 4°C	48 hours
Residue, Volatile		100 mls		250 ml HDPE	Cool 4°C	7 days
Silica		50 mls		125 ml HDPE	Cool 4°C	28 days
Specific Conductance	100 gms	100 mls	8 oz GM	250 ml HDPE	Cool 4°C	28 days
Sulfate		50 mls		125 ml HDPE	Cool 4°C	28 days
Sulfide	100 gms	500 mls	8 oz GM	1 L HDPE	NaOH to pH 9, Zn Acetate	7 days
Sulfite		50 mls		125 ml HDPE	None Required	Analyze Immediately
Surfactants		250 mls		500 ml HDPE	Cool 4°C	48 hours
Temperature		1 L		2 L HDPE	None Required	Analyze Immediately
Turbidity		100 mls		250 ml HDPE	Cool 4°C	48 hours
Purgeable Halocarbons	5 gms	40 mls	4 oz GM	40 ml GV	Cool 4°C, .008% Na2S2O3	14 days
Purgeable Aromatic Hydrocarbons	5 gms	40 mls	4 oz GM	40 ml GV	HCl 2 Cool 4°C, .008% Na2S2O3	14 days
Acrolein and Acrylonitrile	5 gms	40 mls	4 oz GM	40 ml GV	pH 4-5 Cool 4°C, .008% Na2S2O3	14 days
Phenols	10 gms	1 L	8 oz GM	2.5 L AGJ	Cool 4°C. .008% Na2S2O3	7 days until extraction 40 days until analysis
Benzidines	10 gms	1 L	8 oz GM	2.5 L AGJ	Cool 4°C, .008% Na2S2O3	7 days until extraction 40 days until analysis
Phthalate Esters	10 gms	1 L	8 oz GM	2.5 L AGJ	Cool 4°C	7 days until extraction 40 days until analysis
Nitrosamines	10 gms	1 L	8 oz GM	2.5 L AGJ	Cool 4°C, .008% Na2 S2O3	7 days until extraction 40 days until analysis
PCBs	10 gms	1 L	8 oz GM	2.5 L AGJ	Cool 4°C	7 days until extraction 40 days until analysis
Nitroaromatics and Isophorone	10 gms	1 L	8 oz GM	2.5 L AGJ	.008% Na2 S2O3 Store in dark, Cool 4°C	7 days until extraction 40 days until analysis

Table 6.1 (page 3 of 4)
Recra Environmental, Inc.
Recommended Sample Preservation/Storage and Holding Times

PARAMETER DESCRIPTION	MINIMUM SAMPLE VOLUME SOLID/LIQUID		CONTAINER TYPE SOLID/LIQUID		PRESERVATIVE LIQUID SAMPLES	HOLDING TIME
Polynuclear Aromatic Hydrocarbons	10 gms	1 L	8 oz CWM	2.5 L AGJ	.008% $Na_2S_2O_3$ Store in dark 4°C	7 days until extraction 40 days until analysis
Haloethers	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C, .008% $Na_2S_2O_3$	7 days until extraction 40 days until analysis
Chlorinated Hydrocarbons	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C	7 days until extraction 40 days until analysis
Chlorinated Herbicides	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C	7 days until extraction 40 days until analysis
Dioxins and Furans	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C, .008% $Na_2S_2O_3$	7 days until extraction 40 days until analysis
TOX	10 gms	250 mls	4 oz CWM	1 L BR	Cool 4°C, H_2SO_4 (2	7 days until extraction 40 days until analysis
Pesticides, Chlorinated	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C, pH 5.9	7 days until extraction 40 days until analysis
Nonhalogenated Volatiles	5 gms	40 mls	4 oz CWM	40 ml GV	Cool 4°C	14 days
Volatile Organics	5 gms	40 mls	4 oz CWM	40 ml GV	Cool 4°C	14 days
Semi-volatile Organics	10 gms	1 L	8 oz CWM	2.5 L AGJ	Cool 4°C	7 days until extraction 40 days until analysis
EP TOX Extraction	100 gms		32 oz AWM		None	7 days until extraction 40 days until analysis
TCLP Extraction	100 gms		32 oz AWM		None	14 days

Storage Containers:

AGJ	Amber Glass Jug
AWM	Amber Wide Mouth
BR	Boston Round
CWM	Clear Glass Wide Mouth
GV	Glass Vial
HDPE	High Density Polyethylene

It should be noted that this table is to be used only as a guideline, and that the requirements for preservation, storage and holding times may vary per protocol, individual method and/or regulatory requirements.

7. SAMPLE CUSTODY PROCEDURES

Recra's chain-of-custody procedures are based upon the National Environmental Information Center (NEIC) policies and procedures (EPA-330/9-78-001-R). A full-time sample custodian is assigned the responsibility of sample control for the laboratory. It is the responsibility of the sample custodian to receive all incoming samples at the laboratory. Once received, the custodian insures that all samples are received in good condition (i.e., unbroken, cooled, etc.), that the associated paperwork, such as chain-of-custody sheets are completed and signs the chain-of-custody forms (Figure 7-1). The custodian will also insure that the samples are appropriately subsampled and preserved properly for the specific parameters of interest, consistent with the applicable program or protocols if such splitting and preservation procedures were not previously accomplished. Documentation is maintained for all inter- and intra-laboratory sample tracking by the laboratory sample custodian. If samples are received after the custodian has finished his work shift, designated second or third shift personnel will inspect and take possession of samples, and sign the chain-of-custody forms.

The sample custodian will then place the samples into secure, limited access storage (refrigerated storage if required).

Consistent with the analyses requested on the chain-of-custody form or other documentation, analyses by laboratory analysts will begin in accordance with the appropriate methodologies. Samples are removed from storage only after internal chain-of-custody sign-out procedures are followed.

All remaining sample (and empty sample bottles when the available volume is consumed by the analysis) are returned to secure and limited access storage. Upon completion of the entire analytical work effort, samples are ultimately disposed of by the sample custodian. The length of time that samples are held is thirty (30) days after reports are submitted to the client, or a period of time consistent with specific contract terms and conditions. Whenever possible, samples of a hazardous nature or the remaining sample(s) are returned to the client or the clients designee.

Sample or sample bottle disposal only occurs upon approval of the Laboratory Director. All empty sample bottles are disposed of as non-hazardous solid waste consistent with sample exclusion and empty container provisions of RCRA. All liquid and solid samples requiring disposal are reviewed prior to authorization for disposal. If the samples are hazardous by characteristic (reactive, corrosive, ignitable or toxic) or are a TSCA/PCB waste, appropriate controlled disposal is accomplished. Recra is a permitted generator of hazardous wastes and has disposal contracts with all necessary types of subtitle-C TSDF facilities. Full documentation of each step of the disposal process, consistent with the requirements of RCRA, are monitored by Recra's Environmental Health and Safety Officer.

For other non-characteristically hazardous or non-TSCA materials, Recra will review the available analytical results for the samples in question and dependent on the presence of and concentration of hazardous constituents will either dispose of materials as hazardous wastes, or exercise its options to dispose of the materials as non-hazardous waste based upon the laboratory sample exclusion provisions of RCRA.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO	SITE NAME	NO OF CONTAINERS							REMARKS
SAMPLERS (SIGNATURE)									
STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION				

RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE TIME	REMARKS	

Distribution: Original accompanies shipment, copy to coordinator field files

8. CALIBRATION PROCEDURES AND FREQUENCY

Paramount to successful analysis of environmental samples is standardization, in one form or another, of all of the materials and equipment used in completion of the analysis.

Critical to the standardization process is the use of materials of known purity and quality, and the traceability of standard solutions and reagents used in the testing procedures and protocols. Recra carefully monitors the use of all laboratory materials including solutions, standards and reagents through well-documented procedures.

All solid chemicals and acids/bases used by Recra are reagent grade or better. All gases are high purity or better. All standards or standard solutions are obtained from the U.S. Environmental Protection Agency or from reliable commercial sources. All Standard Reference Materials or Performance Evaluation Materials are obtained from the National Institution of Standards and Technology (formerly National Bureau of Standards) or reliable commercial sources.

All materials including standards or standard solutions are logged upon receipt, and are identified by material name, lot number, purity and/or concentration, supplier, receipt/preparation date, recipient/preparers name, expiration date and all other pertinent information. All primary standards are traceable to their source of generation and to certification of purity and solution concentrations provided by the manufacturer.

Standards or standard solutions are validated prior to use. This validation may take the form of supplier certifications. This validation may also be restandardization for acids or bases, response factor comparison, standard curve response, or comparison to other standards made at a different time or by a different analyst. All standards and standard materials are routinely checked for signs of deterioration including unusual volume changes (solvent loss), discoloration, formation of precipitates, changes in analyte response or simply age. All standards and standard solutions are properly stored and handled, and are labelled with all appropriate information including compound/solution name, concentration, solvent, expiration date, preparation date and initials of preparer.

All solvent materials or materials used as a part of a given procedure are also checked. Each new lot of solvent is analyzed to insure the absence of interfering constituents. Reagent and method blanks are routinely analyzed to protect against laboratory based contamination of the samples.

Analytical instrumentation available at Recra's facilities includes a wide variety of equipment. Table 8-1 illustrates some of the primary instrumentation and equipment at the Recra facilities.

Each laboratory employs computer software for the generation of analytical data. Our GC/MS systems use Finnigan Formaster to reduce the data and for the generation of report forms. The GC instrumentation also utilizes the Formaster software plus Nelson Turbochrome. Ward software has been installed for the metals department, and water quality data requires manual entry into a data base system.

Instruments are calibrated in order to assure that they are operating correctly and that method required criteria can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the method being performed. System responses for midpoint standards are recorded in a standards response log. To a large extent, calibration considerations such as frequency of calibration or re-calibration, linear ranges, minimum concentrations, and use of specific selected constituents are determined by the manufacturer, the analytical method, or by contractual requirements.

Since calibration procedures and frequencies vary by type of instrumentation system, (GC/MS, GC, atomic absorption spectrophotometer, and inductively coupled plasma spectrometer), each are addressed individually in the following paragraphs.

Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS)

The mass spectrometer (MS) is tuned prior to each analytical event and verified after twelve hours of continuous operation, or consistent with the method being performed. The tuning is accomplished using DFTPP or BFB (as appropriate) according to EPA procedures. The tuning and mass calibration/ion abundance criteria are maintained on file.

Initial standard curves consist of at least five levels within the dynamic range of the analytical system. Recalibration of initial standard curves are completed when method criteria is not compliant or at a minimum, monthly. All compounds of interest will have $\leq$25% Relative Standard Deviation (RSD) of the response factors of the initial standard curve or a Pearson (R) correlation coefficient of $\leq$0.995 or criteria consistent with the method being performed, before analysis can begin. After initial calibration and ten sample analyses or after twelve hours, a mid-point standard must be analyzed to verify continued calibration. For analysis to continue, the response for every analyte of interest must not vary by more than the method defined criteria or $\pm$20%. In the event calibration criteria are not met, a new calibration curve must be prepared for that compound(s).

For volatile organics, surrogates are used to verify recovery of the constituents of interest from purge and trap GC/MS systems. Quantitation is accomplished via internal standardization techniques.

For semi-volatile organics, numerous surrogates characteristic of the constituents of interest are added to the sample prior to extraction to assess the accuracy of the procedure. Internal standards are also added to all extracts and calibration solutions immediately before analysis for purposes of quantification.

Various blanks are analyzed with each group of samples to assess potential contamination or interferences.

The surrogates and internal standards that are added to all samples and standards and their responses are monitored with each analysis as well as being reported, in summary form, on a daily basis. When all GC/MS analyses are completed, the extracted ion currents of the characteristic ions of the recovery and internal quantitation standards are profiled.

Gas Chromatographs

After determination of acceptable chromatograph resolution, detector sensitivity and chromatographic performance, calibration curves are generated from the analysis of pure compounds at known concentrations covering the dynamic range within each analysis group. Recalibration of initial standard curves are completed when method criteria is not compliant or monthly. All compounds of interest will have $\leq$20% Relative Standard Deviation (RSD) of the response factors of the initial standard curve, a Pearson (R) correlation coefficient of $\geq$0.995 or criteria consistent with the method being performed, before analysis can begin. At the beginning of each new run and/or ten sample analyses, a mid-point standard must be analyzed to verify continued calibration. For analysis to continue, the response for every analyte of interest must not vary by more than the method defined criteria or $\pm$15%. In the event calibration criteria are not met, a new calibration curve must be prepared for that compound(s).

The laboratory must calculate retention time windows for each standard on each GC column and whenever a new GC column is installed as outlined below. This data is documented and retained on file at each applicable facility.

Three injections of all single component standard mixtures and multi-response components are injected throughout the course of a 72-hour period. The standard deviation of the three absolute retention times for each single component standard is calculated. After selection of one major peak for the multi-response compounds, the standard deviation of the three retention times for that peak is calculated. The acceptable retention time window is defined as plus or minus three times the standard deviation of the absolute retention times for each standard. In those cases where the standard deviation for a compound is zero, the laboratory must substitute the standard deviation of a close eluting, similar compound to develop a valid retention time window.

The establishment of daily retention time windows is accomplished by using the absolute retention time of each analyte from the daily standard as the midpoint of the window for that day. The daily retention time window equals the midpoint plus or minus three times the previously determined standard deviation.

If any of the continuing calibration standards fall outside this daily retention time window, the system is out of control. The cause of the problem must be determined and corrected.

Various blanks are analyzed with each group of samples to assess potential contamination or interferences.

Surrogates are added to all samples and standards and their responses are monitored with each analysis as well as being reported, in summary form, on a daily basis.

Atomic Absorption Spectrophotometer/Plasma Spectrometer

Prior to the determination and the concentration of a particular metal in a sample, the instrument must be calibrated. This is first accomplished by a minimum of two (furnace) or three (flame) instrument manufacturer standards. The ICP calibration consists of a standard and a blank.

The instrument calibration is then verified with an initial calibration verification (ICV) standard which cannot vary by more than $\pm$ 10% from its' true value.

The flame and furnace analyses incorporate five levels of standards that encompass the expected sample concentrations. Acceptable criteria includes a Pearson Correlation coefficient of $\geq$ 0.995.

To ensure calibration is within acceptable criteria throughout the analysis, a continuing calibration verification (CCV) standard must be analyzed at a frequency of 10% and after the last analytical sample. The results of the CCVs cannot vary by more than $\pm$ 10%.

If the results of the ICV or CCV deviate from the control limits, the analysis must be stopped, the problem corrected, the instrument recalibrated, the calibration verified; reanalysis of the preceding ten analytical samples or all samples analyzed since the last acceptable calibration verification must then occur.

Spectrometer/Colorimeter

Initial calibration consists of a daily five point curve that encompasses the expected range of the analytical samples or the dynamic range of the instrument. The correlation coefficient of this curve must be $\geq$0.995 and the Y intercept must be less than the method detection limit in order for analysis to begin. A calibration verification sample (CVS) is to be analyzed after each curve to verify calibration and must be within $\pm$10% of its true value or within the manufacturers confidence limits. A continuing calibration verification (CCV) standard, must be analyzed after every ten sample analyses and at the end of the analytical run. The CCV must be within $\pm$ 10% of its true value or the analysis is stopped, problem investigated and resolved, and affected sample re-analyzed.

Gravimetric

Calibration of the analytical balance is annually performed by the manufacturer or his authorized representative. Continuing calibration is achieved with daily use of a minimum of three certified "S" weights in the dynamic range of the samples being analyzed or as specified by the method.

Titrimetric

Calibration is accomplished by the standardization of solutions as maintained in the solution log and/or method log books. A calibration verification sample (CVS) is then analyzed to verify calibration and must be within ±10% of its true value or within the manufacturers confidence limits. A continuing calibration verification (CCV) standard, must be analyzed after every ten analyses and at the end of the analytical run. CCV must be within 10% of its true value or the analysis is stopped, problem investigated and resolved, and affected samples re-analyzed.

pH

The pH meter is subject to daily calibration which starts with a 4 or 10 and a 7 pH standard. Next, all 3 calibration standards are read and recorded. The standards must read ± 0.05 of its true value. A calibration verification sample (CVS) is then analyzed to verify calibration and must also be within ±0.05 of the true value or within the manufacturers confidence limits. A continuing calibration verification (CCV) standard, must be analyzed after every ten sample analyses and at the end of the analytical run. CCV must be within 10% of its true value or the analysis is stopped, problem investigated and resolved, and affected samples re-analyzed.

TOC, TOX, TRPH

To insure the instrumentation is in calibration, a five point curve is generated containing concentrations that bracket expected sample values. The correlation coefficient must be ≥ 0.995 and the Y intercept less than the method detection limit before sample analysis may begin.

After the curve criteria is in compliance, a calibration verification sample (CVS) is then analyzed to verify calibration and must be within ±10% of the true value or within the manufacturers confidence limits. A continuing calibration verification (CCV) standard, must be analyzed every ten sample analyses and at the end of the analytical run. CCV must be within 10% of its true value or the analysis is stopped, problem investigated and resolved, and affected samples re-analyzed.

Calibration for other water quality analyses are performed following protocols in the "Methods for Chemical Analysis of Water and Wastes" EPA - 600/4-79-020. A calibration verification sample (CVS) is then analyzed after curve criteria is met to verify calibration and must be within ±10% of the true value or within the manufacturers confidence limits. A continuing calibration verification (CCV) standard, must be analyzed every ten sample analyses and at the end of the analytical run. CCV must be within 10% of its true value or the analysis is stopped, problem investigated and resolved, and affected samples re-analyzed.

TABLE 8-1

RECRA ENVIRONMENTAL, INC.
MAJOR LABORATORY EQUIPMENT
Page 1 of 3

Gas Chromatograph/Mass Spectrometer (GC/MS)

Finnigan Model 5100 SP	3 units
Finnigan Model 3200	1 unit
Finnigan Model INCOS 50	7 units
Hewlett Packard Model 5993B	1 unit
Hewlett Packard Model 5993C	1 unit
Hewlett Packard Model 5970B	6 units

Gas Chromatograph (GC)

Hewlett Packard Model 5840A Electron Capture/Flame Ionization Detectors	1 unit
Hewlett Packard Model 5880 Electron Capture/Flame Ionization Detectors	1 unit
Hewlett Packard Model 5880 Electron Capture Detectors	2 units
Hewlett Packard Model 5890 Electron Capture Detectors	9 units
Hewlett Packard Model 5890 Flame Ionization Detector	2 units
Hewlett Packard Model 5790 Electron Capture Detector	1 unit
Hewlett Packard Model 5890 Series II Electron Capture/Nitrogen Phosphorous Detectors	1 unit
Hewlett Packard Model 5890 Series II Dual Electron Capture Detectors	1 unit
Perkin-Elmer Model 8500 Hall/Photoionization Detectors	2 units
Perkin-Elmer Model Sigma 1 Flame Ionization/Nitrogen Phosphorous Detectors	1 unit
Perkin-Elmer Model Sigma 3 Electrolytic Conductivity Detector	1 unit
Gow-Mac Model 550 Thermal Conductivity Detector	1 unit

TABLE 8-1 (continued)

RECRA ENVIRONMENTAL, INC.
MAJOR LABORATORY EQUIPMENT
Page 2 of 3

Perkin-Elmer Sigma 2000 Hall/Photoionization Detectors	1 unit
Perkin-Elmer Sigma 2000 Electron Capture/Flame Ionization Detectors HS6 Head Space Analyzer	1 unit
Dynatech PTA-30 Auto Samplers	3 units
Tekmar LSC-2 Purge & Trap Sampler	5 units
Tekmar LCS2000 Purge and Trap Sampler	6 units
Tekmar ALS2016 Autosampler	6 units
Tekmar ALS Autosampler	4 units
ABC Industries Gel Permeation Chromotograph UV Detector	2 units
Atomic Absorption Spectrophotometer (AA) Perkin-Elmer Model 5000 - Graphite Furnace	1 unit
Zeeman Furnace Atomic Absorption Spectrophotometer Perkin-Elmer Model 5100	3 units
Atomic Absorption Spectophotometer (AA) Perkin-Elmer Model 3100 - Flame	2 units
Inductively Coupled Argon Plasma Spectrometer (ICP) Sequential Perkin-Elmer Plasma 40	1 unit
Inductively Coupled Argon Plasma Spectrometer (ICP) Simultaneous ARL Model 3560	1 unit
Mercury Analyzer System/Cold Vapor Coleman Model MAS-50B	2 units
Shimadzu Total Organic Carbon Analyzer Model AS1-502	1 unit
Shimadzu Total Organic Carbon Analyzer Model 500	2 units

TABLE 8-1 (continued)

RECRA ENVIRONMENTAL, INC.
MAJOR LABORATORY EQUIPMENT
Page 3 of 3

Beckman Carbon Analyzer Model 915A	1 unit
Beckman UV-VIS Spectrometer Model DU-62	1 unit
Shimadzu UV-VIS Spectrometer Model UV-120-02	2 units
Perkin-Elmer UV-VIS Spectrometer Model 200	1 unit
Milton Roy UV-VIS Spectrometer Spectronic 1201	1 unit
Bausch & Lomb Spectrometer Model 20	1 unit
Coleman Spectrometer Model 35	1 unit
Perkin-Elmer IR Spectrometer Model 567	1 unit
Dohrmann Total Organic Halides Analyzer Model DX-20A	1 unit

9. ANALYTICAL PROCEDURES

Most analytical programs performed by Recra's environmental laboratories testing services result from state or federal regulatory or enforcement requirements. Methods most frequently used by Recra therefore originate within these agencies, most notably the U.S. Environmental Protection Agency.

Recra's laboratories participate in the U.S. Environmental Protection Agency CLP Program, have been deemed technically acceptable by the U.S. Army Corps of Engineers, the New York State Department of Environmental Conservation, the New Jersey Department of Environmental Protection, the NY Department of Transportation and are certified by numerous state health or environmental departments as well as those by various industrial concerns.

Consistent with these certification or approval programs, Recra performs a wide variety of test procedures in addition to U.S. Environmental Protection Agency protocols. Some of these methods are distinctly different from EPA procedures while others are merely modifications of EPA methodologies. The following list of referenced analytical methods illustrates those procedures most commonly employed within our laboratories. Recra's capabilities are not limited to this list of methods, however.

- Current U.S. Environmental Protection Agency Contract Laboratory Program (CLP) protocols for analysis of organic (target compound list) and inorganic (target analyte list) hazardous constituents.

- "Test Methods for Evaluating Solid Waste" SW-846, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response
  - (a) 2nd Edition (revised), Update I (1984), Update II (1985)
  - (b) 3rd Edition, with appropriate updates.
- "Guidelines Establishing Test Procedures for the Analysis of Pollutants", 40 CFR 136 (Federal Water Pollution Control Act Amendments of 1972 as amended by the Clean Water Act of 1977), as most recently amended
- "Methods of Chemical Analysis of Water and Wastes", U.S. Environmental Protection Agency, Office of Environmental Monitoring and Support Laboratory, EPA-600/4-79-020, Revised, March 1983.
- "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", U.S. Environmental Protection Agency, Office of Environmental Monitoring and Support Laboratory, EPA-600/4-82-057, July 1982.
- "Methods for the Determination of Organic Compounds in Drinking Waters", U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring Systems Laboratory, EPA-600/4-88/039, December 1988.
- Standard Methods for the Examination of Water and Wastewater, 17th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington, DC, 1989.

- Official Methods of Analysis, 14th Edition, Association of Official Analytical Chemists (AOAC), Arlington, VA, 1984 (or most recent edition)
- Annual Book of ASTM Standards, Section 11, Volumes 11.01, 11.02, 11.03, 11.04, American Society for Testing and Materials (ASTM), Philadelphia, PA, 1988 (or most recent edition).
- "Techniques of Water Resources Investigation of the United States Geological Society", Book 5, Laboratory Analyses, USGC, Washington, DC, 1979.
- "NIOSH Manual of Analytical Methods", 3rd Edition, U.S. Department of Health and Human Services, National Institutes for Occupational Safety and Health, August, 1987.
- "Interim Methods for the Sampling and Analysis of Priority Pollutants in Sediments and Fish Tissue", U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, August 1977, revised 1980.

The selection of analytical methods or protocols is generally a programmatic decision outside of the scope of this document. In general, however, factors such as program objectives, data quality objectives, type of sample matrices, qualitative certainty, quantification sensitivity, precision and accuracy all need to be considered. Methods are routinely documented in standard operating procedures (SOP's) which are available within the laboratory.

Recra's laboratories also have the capabilities to develop new analytical procedures (or modify existing protocols) to meet specific client needs.

10. DATA REDUCTION VALIDATION AND REPORTING

All analytical results generated by Recra's laboratories are reviewed for accuracy, precision and completeness, as well as compliance with other specific contract or method requirements.

The analyst has prime responsibility and accountability for the correctness and completion of his/her data. Each laboratory analyst has responsibility for QA/QC functions at their level and within their assigned tasks. The reduction of data, its validation and the ultimate reporting of results is aided greatly by automated data management systems throughout the laboratories. Figure 10-1 illustrates schematically the organic and inorganic data routines and generalizes the report writing activities. More specifically, the QA/QC function is schematically provided in Figure 10-2. Initial review by the analyst and supervisor is completed in relation to compliance with methodology and acceptability of precision and accuracy results. Review at the supervisor/manager level includes these elements as well as a review of data acceptability based upon internal QC criteria.

Tertiary review occurs within the Analytical Program Office where pertinent information pertaining to each specific analysis (i.e., GC/MS, GC, metals, and water quality) is compiled. The data generated from the GC/MS, GC and metals department through various computer programs, is transferred to the Analytical Program Office. Analytical data forms are then processed and data validation is accomplished. Water quality data is written in log books, verified and manually entered onto data forms. This review activity is accomplished relative to quality of data from each department which is contributing to the overall efforts for the program or job.

After report preparation, the laboratory director and the facility QA officer provide the final review of the data submitted to the client.

Generally, for any and all measurement systems at Recra, the following chronological steps are adhered to at one or more levels of the review process:

- sample receipt;
- sample logging, inventory, chain-of-custody;
- sample splitting and preservation (if required);
- sample storage;
- sample preparation (extraction and/or digestion);
- sample analysis (standard, QC and samples);
- data calculation;
- re-analysis (if and when required) and assessment;
- data review/QC logging;
- report preparation;
- report review/final QC review;
- report issuance/central file maintenance;
- data storage on magnetic tape
- sample archival and/or disposal.

All chromatograms, standards information, QA/QC results, analytical results, appropriate copies of separations or digestion logbooks, injection log book pages, linear regression/graphs, and any other project specific information is maintained in the job/case file and is used for data calculation and final report preparation.

Any one or all of Recra's four specific analytical groups may be involved in the testing activities specific to a given project. The specific means by which each group processes this data is in general agreement with the above steps but is more specifically outlined below.

WATER QUALITY

This group is responsible for the analysis of samples for pH, specific conductance, chloride, total organic carbon, etc. Each of these test procedures utilizes a separate bound data notebook which contains appropriate information such as:

- instrument I.D.
- method utilized
- analysis date
- analyst
- job number
- sample I.D.
- initial volume or weight of sample
- dry weight (for solids only)
- volume distilled
- volume extracted
- sample absorbance from UV-VIS spectrophotometer at the appropriate analytical wavelength
- all appropriate blank information
- all appropriate calibration information
- results of replicate sample analyses
- spike (recovery) determinations
- SRM recovery

- final sample concentrations
- reagent/standard solution ID

With the above information and calculations performed in accordance with the published methods, results are generated and verified. Data and associated QA/QC from the logbook is reviewed by all appropriate levels of laboratory operations and upon approval is sent to the Analytical Program Office for purposes of report preparation.

METALS

In a similar fashion, the metals department enters the following information into separate bound notebooks or into computer systems:

- methodology (analysis and digestion)
- analysis date
- instrument I.D.
- analyst
- job number
- sample I.D.
- initial volume or weight of sample
- final volume after digestion (if required)
- background absorbance or emission readings from the AA or ICP respectively for each sample per metal
- absorbance or emission readings from the AA or ICP for each sample per metal
- all required blank information
- all appropriate calibration information
- absorbance/concentration readings for all replicate samples

- absorbance/concentration readings for all pre-spike/post-spike samples
- absorbance/concentration readings for all standard reference material
- solutions/reagents I.D.

With the above information and calculations performed in accordance with the published methods, results are generated and verified. Data and associated QA/QC from the logbook(s) is reviewed by all appropriate levels of laboratory operations and upon approval is sent to the Analytical Program Office for purposes of report preparation.

GAS CHROMATOGRAPHY (including separations laboratory)

The sample processing begins in the separations laboratory where a bound notebook is maintained for the purpose of recording all pertinent information regarding the extraction and clean-up (if required) for the samples. This logbook contains the following data:

- analyst
- methodology (extraction)
- extraction date
- surrogate additions
- job number
- sample blank/I.D.
- extracted volume or weight of sample
- final concentration volume
- extraction/concentration holding time compliance with protocol
- vial number (for extracts produced)
- analysis type (BN, AP, Pest.)

- glassware set where appropriate
- I.D. of QC samples with MS/MSD/SRM, etc.
- cleanup
- solvent/reagent I.D.

The above information is required for either GC or GC/MS analyses. The addition of "glassware sets", where appropriate, has proved useful. Within a laboratory such as Recra's, which is involved in the analysis of waste samples or contaminated aqueous samples, the glassware set information allows for identification of one specific area in which potential quality control problems may be found.

After samples have been prepared for analysis by the separations group, the GC department uses a series of logs, reporting forms and computer software to maintain the necessary data. The first is the bound injection log which contains the following:

- analyst
- instrument I.D.
- injection date
- job number
- sample I.D./vial number
- instrument run number
- method number (specific column and instrument conditions for the particular analyses)
- detector used

With the above information and calculations performed in accordance with the published methods, results are generated and verified. Data and associated QA/QC from the logbook(s) is reviewed by all appropriate levels of laboratory operations and upon approval is sent

to the Analytical Program Office for purposes of report preparation.

GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

Regarding the analysis of base neutral, acid-phenolic, volatile priority pollutant, HSL compounds and pesticide/PCB confirmation (by CLP or non-CLP methods) separate bound injection logs are again employed.

A bound injection log is maintained for each of Recra's GC/MS units and contains the following information:

- method
- instrument I.D.
- analysis date/time
- analyst
- computer file number
- sample I.D. and extract vial number
- job number/case number
- injected volume
- appropriate separations laboratory information
- dilution factors
- column I.D.
- internal standard retention time and % recoveries
- surrogate recoveries

With the above information and calculations performed in accordance with the published methods, results are generated and verified. Data and associated QA/QC from the logbook is reviewed by all appropriate levels of laboratory operations and upon approval is sent to the Analytical Program Office for purposes of report preparation.

FIGURE 10-1

AUTOMATED ANALYTICAL
REPORT WRITING

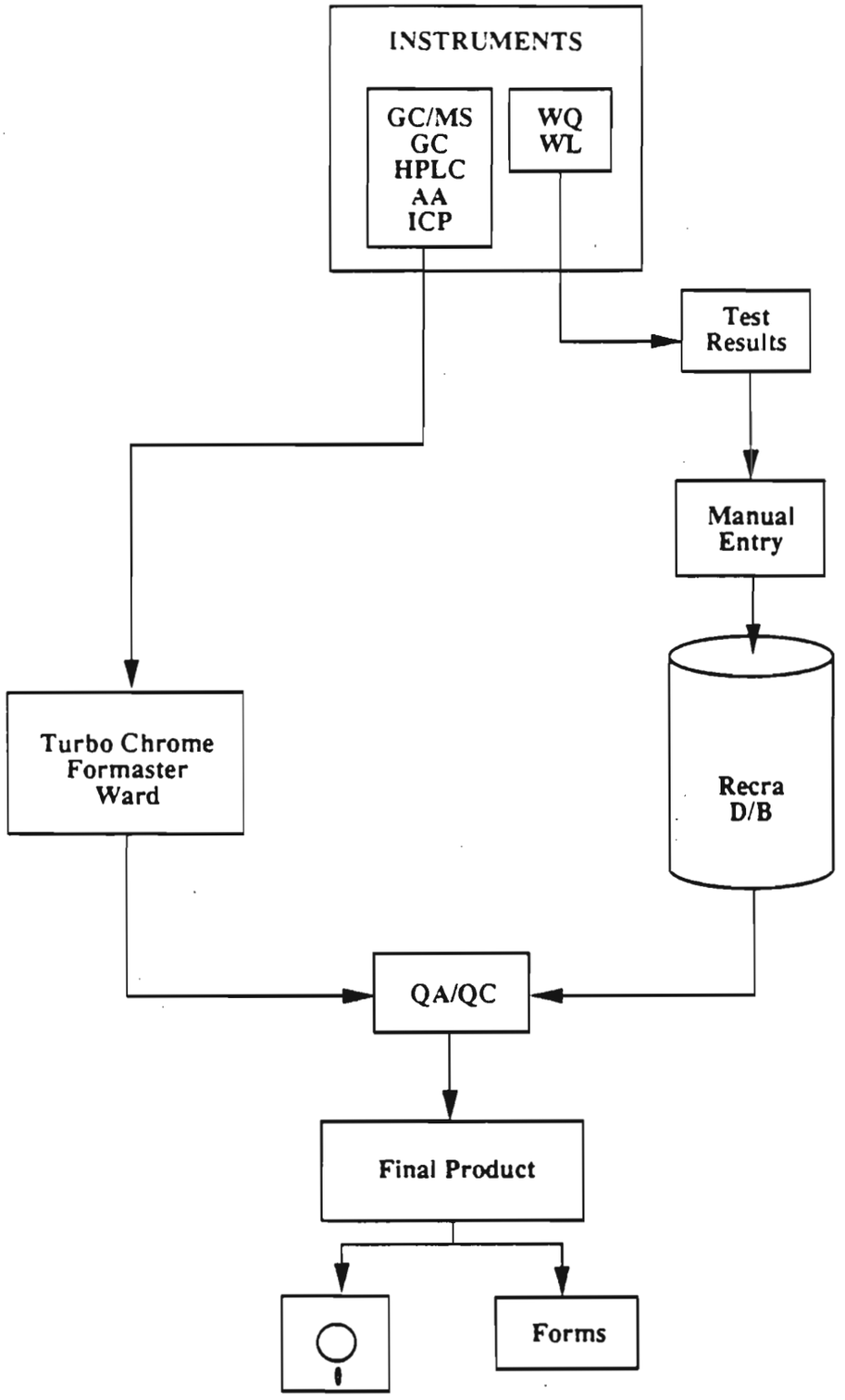
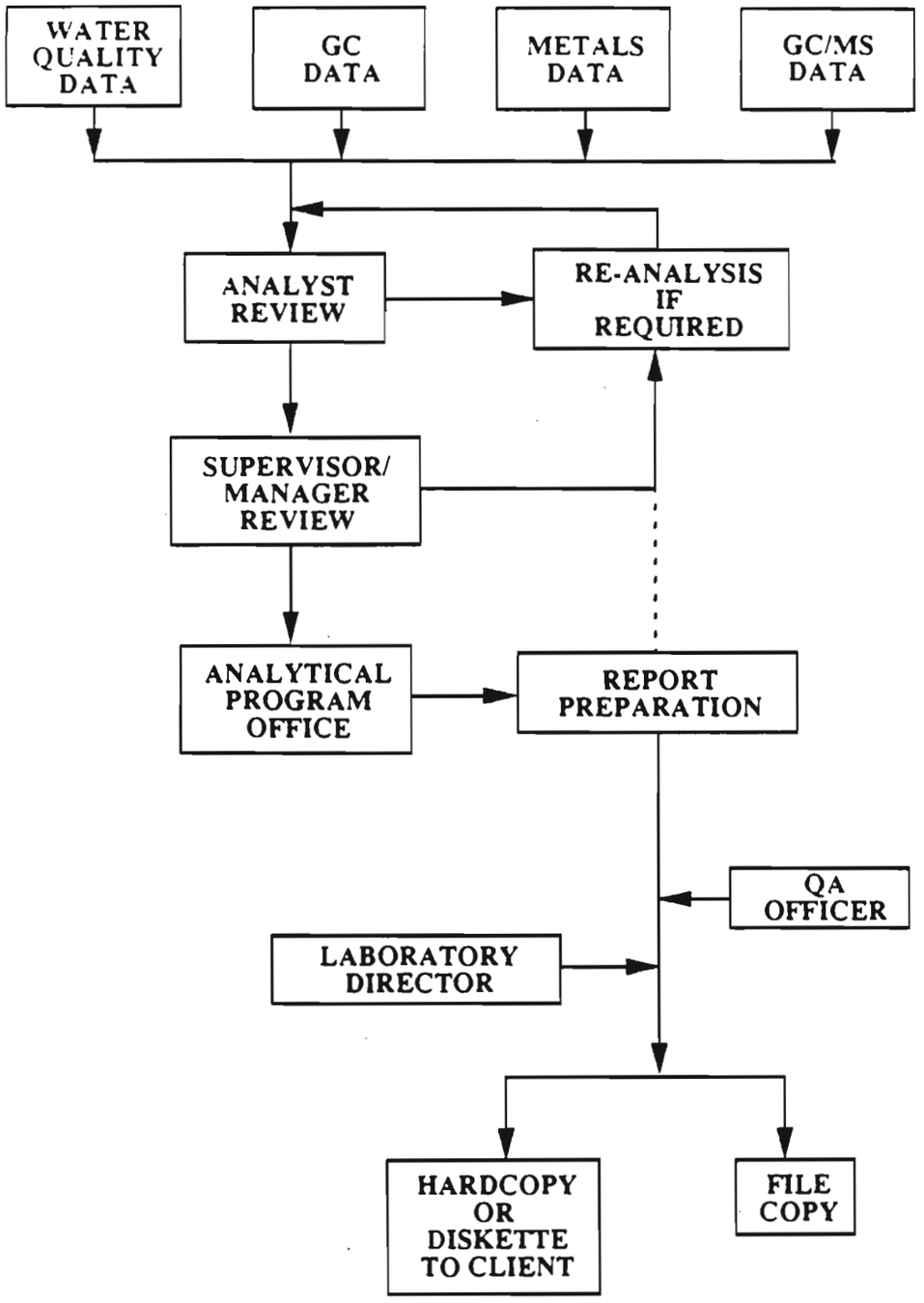


FIGURE 10-2

QA/QC PROCESS



11. INTERNAL QUALITY CONTROL CHECKS

As previously described steps are taken by Recra to insure the quality of our analytical results, including measures such as proper sampling techniques, appropriately cleaned sample and reagent bottles (either cleaned by the laboratory or purchased as "certified clean"), proper sample identification and logging, applicable sample preservation and storage. Additionally the use of controlled materials, standards reagents or solvents all contribute to maintenance of overall laboratory control.

One control issue not yet discussed is the use of laboratory glassware. Organic glassware is cleaned according to the following procedure:

1. rinsed with final solvent immediately after use,
2. hot detergent wash,
3. hot tap water rinsed (3 times),
4. DI water rinsed (3 times),
5. rinsed with reagent grade acetone, and
6. rinsed with pesticide grade hexane or methylene chloride, depending upon methodology, just prior to use

Glassware used for metals analysis is cleaned according to the following procedure:

1. hot detergent wash,
2. hot tap water rinse (3 times),
3. DI water rinse (3 times),
4. 1:1 nitric acid-water mixture rinse, and
5. final rinsing is accomplished with copious quantities of deionized water

Water Quality/Wet Chemistry Glassware is cleaned according to the following procedures:

1. hot detergent wash,
2. hot tap water rinse (3 times), and
3. DI water rinse (3 times)

Additional cleaning with appropriate agents including, but not necessarily limited to, chromic, nitric or hydrochloric acid may be necessary for extremely dirty glassware.

Internal quality control checks include analysis of method or preparation blanks to monitor the potential introduction of contaminants into the preparation or analytical process. The frequency of these blanks for both organic and inorganic analysis is one per sample set or five percent.

Additional blanks which monitor a variety of processes include trip blanks (VOA only), field blanks, holding blanks (VOA only) and solvent/reagent blanks. The field (rinse) and trip blanks are considered by the lab to be samples and will be analyzed as received. Trip blanks only pertain to volatile organics. Holding blanks also pertain to volatile organics only and will be analyzed one per SDG or five percent. Organic solvent/reagent blanks are analyzed once per lot whereas inorganic solvent/reagent blanks are run once per sample set.

As per the requirements of select methods, initial calibration blanks (ICB) and continuing calibration blanks (CCB) must be completed to insure compliance with protocols.

Organic and inorganic blanks must contain less than the MDL or CRDL of all analytes of interest unless otherwise dictated by protocol or as stated in Section 16 of this manual.

Accuracy and precision are two criteria used to evaluate the quality of generated data.

Accuracy is a measure of the ability of a laboratory to determine the true concentration of a constituent in a sample and the correctness of data. Three means used to insure accuracy are recovery surrogates, matrix spikes/matrix spike duplicates (MS/MSD), and standard reference materials (SRMs); each being measured, documented and maintained separately.

The second criterion is precision. Precision is a measure of the reproducibility of the data. MS/MSD and/or sample and sample duplicate are used to establish precision.

In order to assess the quality of the data, both criteria must be defined. Precision and accuracy charts are maintained for specific parameters as described in the EPA handbook or NYS ELAP manual. Actual criteria is defined by method protocol or method performance.

Organic analysis of drinking water require ten percent matrix spikes (MS) and ten percent matrix duplicates (MD). The ten percent spiking requirement should be met with an equivalent number of matrix spike duplicates (MSD). If there are less than ten samples analyzed, the laboratory must analyze a MS, MSD, and a MD once per set or once per month. All other protocols require one MS and MSD per analytical batch or five percent. The CLP defined spiking solution is used. Additionally, a monthly matrix spike containing all analytes of interest for the 600 and 500 series methods are analyzed.

Inorganic CLP samples require a MS and MD at a frequency of ten percent each. All other protocols (SW-846, 40 CFR 136), will incorporate a MS and MSD or MD at a frequency of one per batch or five percent each. Post spikes will be analyzed when pre spikes fail criteria, or consistent with specific protocols. Pre-spikes will be charted and post-spikes tabulated when analyzed.

Accuracy, as measured by percent recovery for matrix spikes/matrix spike duplicates as well as surrogates, internal standards and standard reference materials, is charted. The percent recovery is the amount of the compound recovered from the sample compared to the amount added. The percent recovery of an analyte is an indication of the accuracy of an analysis and is expressed on an accuracy chart.

The accuracy chart presented in Figure 11-1 was developed by determining the mean percent recovery of Fluoride in a series of typical water samples. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Spiked Sample Concentration} - \text{Background Concentration}}{\text{Known Spike Concentration}} \times 100$$

The standard deviation of percent recoveries is calculated and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Alternate criteria for acceptable accuracy can be defined by specific protocols or methods.

Acceptable data is realized when results fall between the lower and upper warning limits. If the quality control value falls between the control limit and warning limit (UCL and UWL or LCL and LWL), the analysis should be scrutinized as possibly out-of-control. The sample results however, are still acceptable at this point.

Organic analyses employing the GCMS and GC requires that all samples contain method surrogates. Internal standards are required for all GCMS analyses and must be added to all standards and samples. Acceptable criteria for the recovery of surrogates and internal standards are defined by methods or past laboratory performance. Control charts for internal standards and method surrogates are illustrated in Figures 11-2 and 11-3, respectively.

Standard Recra QA/QC policy also includes the analysis of Standard Reference Materials (SRMs) or matrix spike blanks (MSB). SRMs are independently supplied samples with known concentrations of selected parameters. They are often accompanied not only with a known value, but an acceptable range for analytical results. Recra Environmental, maintains a supply of SRMs. In cases where an SRM is not available, one can be prepared by the laboratory staff with materials other than the various calibration solutions. These laboratory prepared solutions are referred to as matrix spike blanks. The frequency of SRMs or MSBs employed for organic analyses is one per method batch or five percent; CLP spiking solution compounds are utilized where applicable. Inorganic analyses also require one SRM or MSB per batch or five percent.

The precision chart presented in Figure 11-4 is typical of charts used to monitor laboratory precision and is based upon information presented in Section 6 of the EPA Handbook of Analytical Quality Control in Water and Wastewater Laboratories (March 1979), 600/5-79-019.

The Upper Control Limit (UCL) used in charting the precision for inorganic analyses, through duplicates, is calculated as follows:

$$UCL = D4R$$
$$= 3.27\ (0.006)$$
$$= 0.0196$$

Where:

D4 = Stewart factor for ranges based upon duplicate analyses.
R = The mean range of multiple replicate determinations.

The critical R value (R_c) is the upper control limit rounded off to an operationally feasible number; i.e., the $R_c = 0.020$. This R_c or critical R value is the maximum allowable difference between replicate determinations on a single sample in the 0-0.5 mg/l concentration range. The R value is plotted every day analyses are performed and the points are reviewed for trends. If an R value exceeds the R_c value, the data are invalid and the cause for such performance is investigated and corrected before analyses are resumed.

For organic constituents, the upper control limit is based upon the standard deviation of previous MS/MSD replicate pairs or consistent with protocol. The relative percent difference (RPD) for an MS/MSD pair is calculated according to the following formula;

$$\frac{(MS - MSD)}{1/2\ (MS + MSD)} \times 100 = RPD$$

Using the last 20 MS/MSD pairs, the standard deviation of the RPDs is determined and the upper control limit is established at the mean RPD plus three times the standard deviation of the RPD. Each MS/MSD RPD is plotted against the upper control limit as illustrated in Figure 11-5. Control limits are reviewed at least semi-annually or as necessary, based upon standard principles of quality control.

FIGURE 11-1

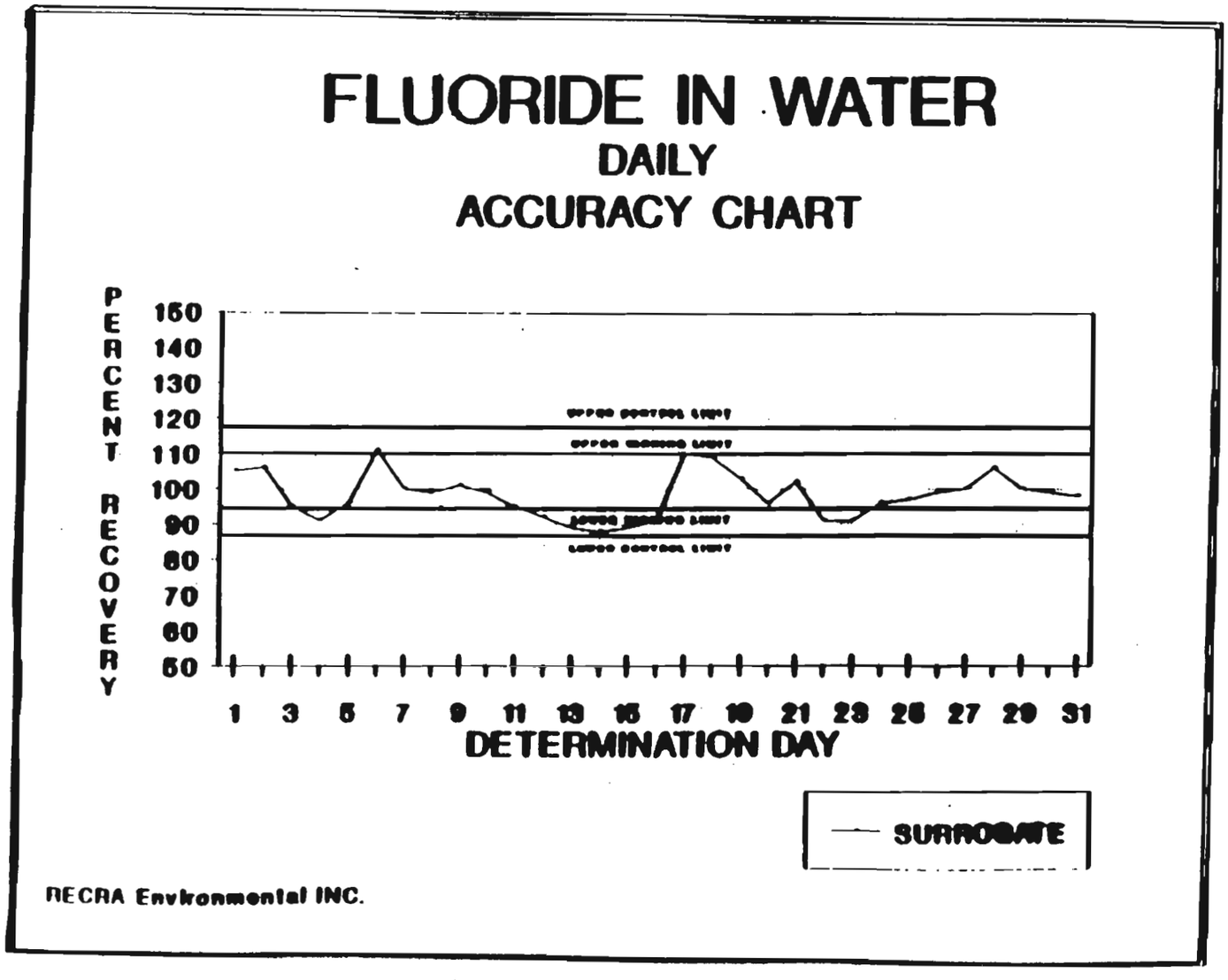

FLUORIDE IN WATER
DAILY
ACCURACY CHART
PERCENT RECOVERY
150
140
130
120
110
100
90
80
70
60
50
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
DETERMINATION DAY
SURROGATE
RECRA Environmental INC.

FIGURE 11-2

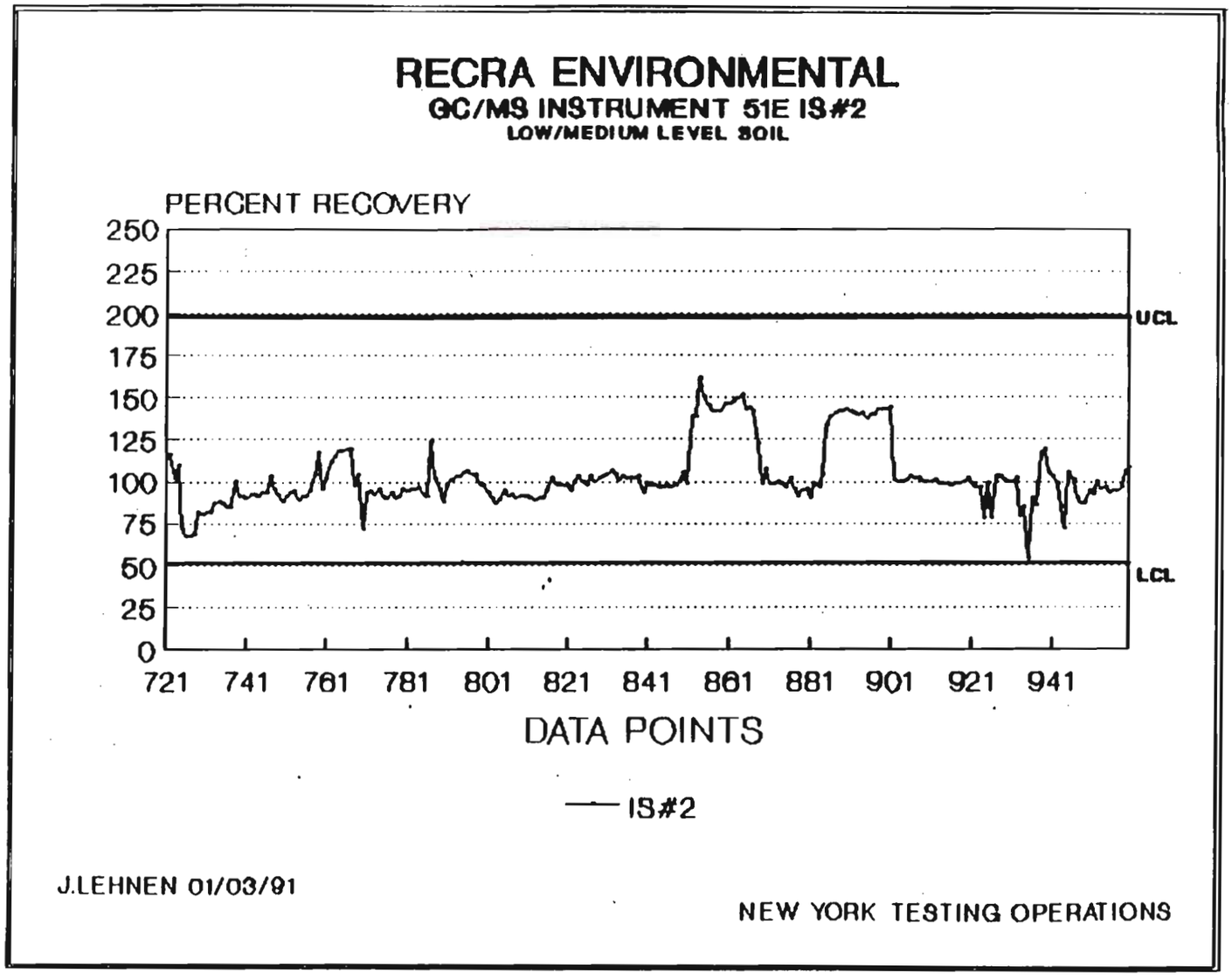

RECRA ENVIRONMENTAL
GC/MS INSTRUMENT 51E IS#2
LOW/MEDIUM LEVEL SOIL
PERCENT RECOVERY
250
225
200
175
150
125
100
75
50
25
0
UCL
LCL
721
741
761
781
801
821
841
861
881
901
921
941
DATA POINTS
IS#2
J.LEHNEN 01/03/91
NEW YORK TESTING OPERATIONS

FIGURE 11-3

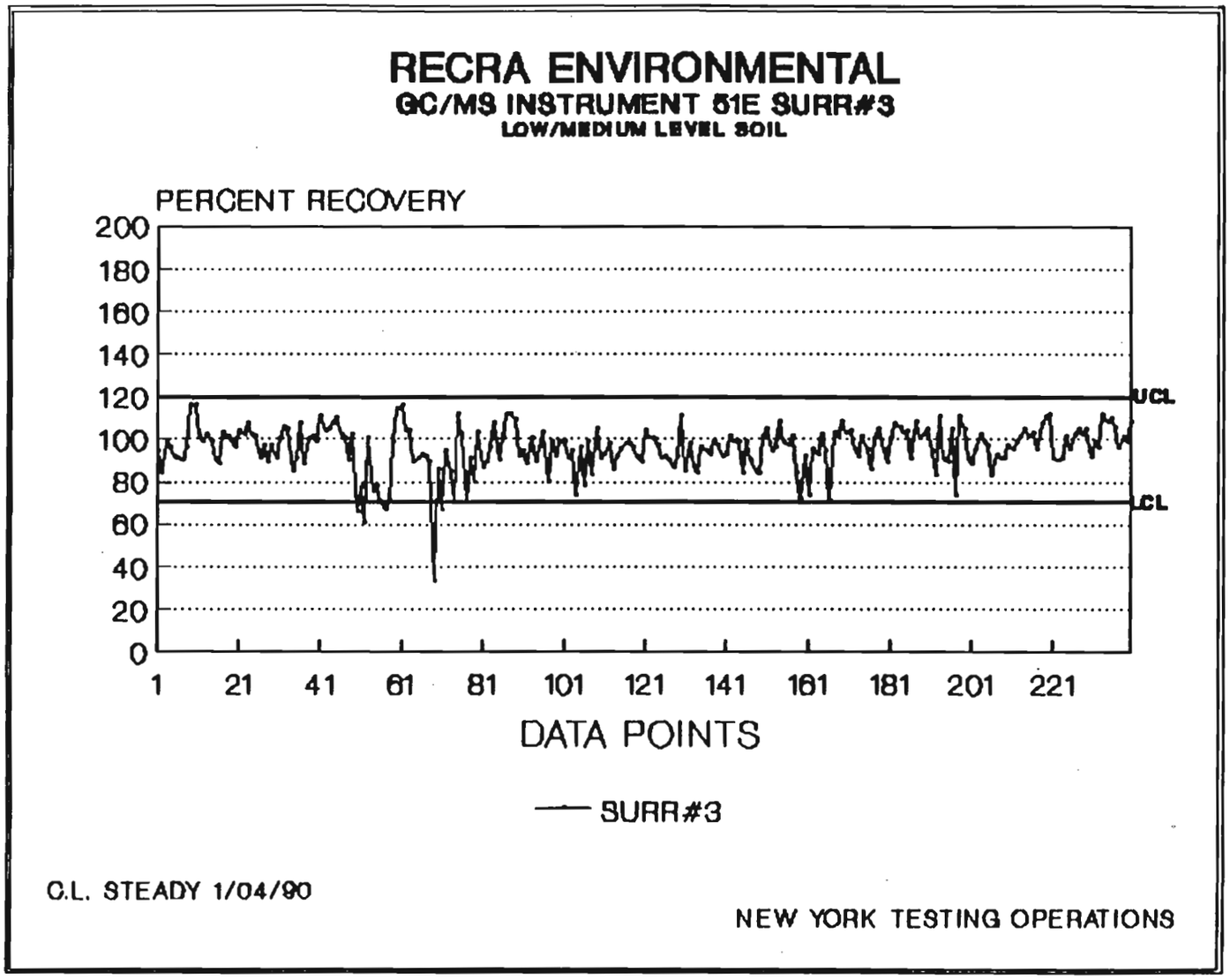

RECRA ENVIRONMENTAL
GC/MS INSTRUMENT 51E SURR#3
LOW/MEDIUM LEVEL SOIL
PERCENT RECOVERY
200
180
160
140
120
100
80
60
40
20
0
UCL
LCL
1
21
41
61
81
101
121
141
161
181
201
221
DATA POINTS
SURR#3
C.L. STEADY 1/04/90
NEW YORK TESTING OPERATIONS

FIGURE 11-4

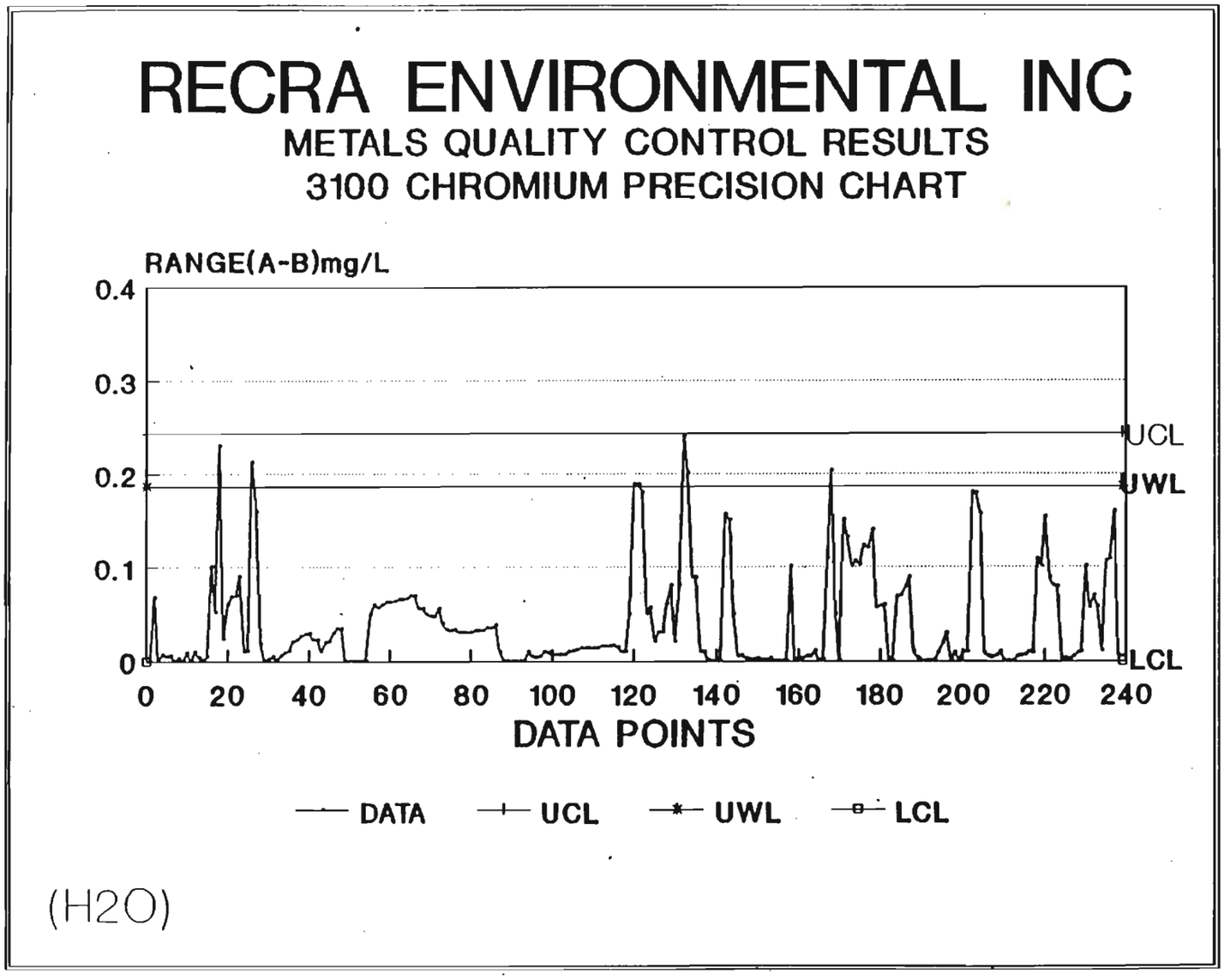
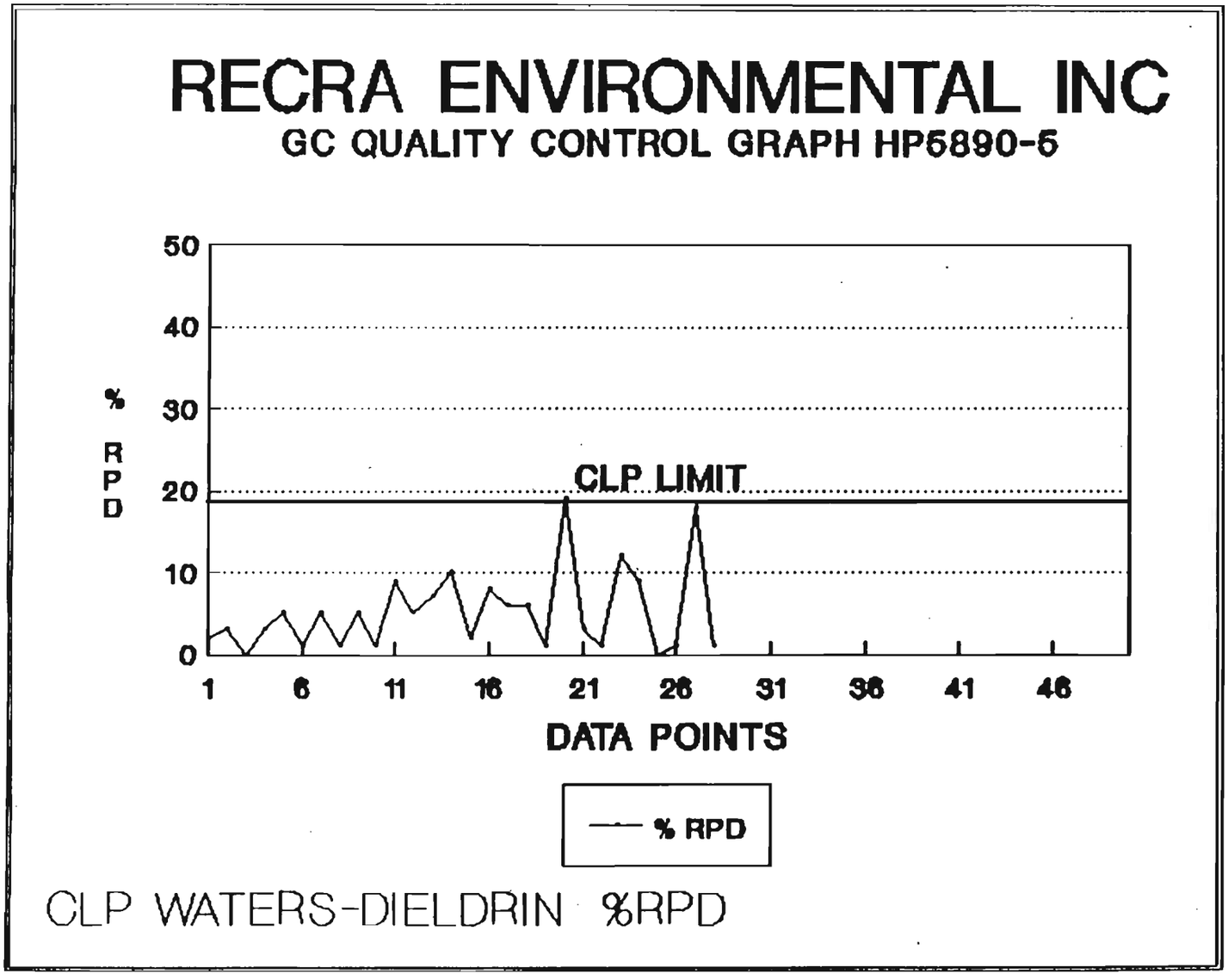

RECRA ENVIRONMENTAL INC
METALS QUALITY CONTROL RESULTS
3100 CHROMIUM PRECISION CHART
RANGE(A-B)mg/L
0.4
0.3
0.2
0.1
0
UCL
UWL
LCL
0 20 40 60 80 100 120 140 160 180 200 220 240
DATA POINTS
DATA
UCL
UWL
LCL
(H2O)

FIGURE 11-5


RECRA ENVIRONMENTAL INC
GC QUALITY CONTROL GRAPH HP5890-5
50
40
30
20
10
0
% RPD
CLP LIMIT
1
6
11
16
21
26
31
36
41
46
DATA POINTS
% RPD
CLP WATERS-DIELDRIN %RPD

12. INTERNAL RECORD KEEPING AND DOCUMENT CONTROL

Various record keeping and document control procedures are employed by Recra Environmental. All sample and analytical activities are documented, and maintained according to specific regulatory requirements and SOP.

Corrections or additions to documents, supporting documents and raw data are made by drawing a single line through the error and entering the corrected information. Corrections and additions to supporting documents and raw data are initialed and dated. No information is written over, obliterated or rendered unreadable. Unused portions of documents are "z'd" out, and appropriately dated and initialed.

Laboratory notebooks and logbooks are issued, inventoried and archived by the Facility Quality Assurance Officer. Each notebook and logbook is reviewed for completeness, legibility and compliance on at least a bi-weekly basis by the appropriate area supervisor. When completed or closed out, notebooks and logbooks are archived for an indefinite period of time.

Sample Tracking and Custody is maintained with both inter- and intra-company chain-of-custody and transfer procedures.

File organization, preparation, review and archival exists for each and every individual job. Job files begin at the time of sample receipt and contain all information specific to that particular job. Each job file is reviewed for QC requirements stipulated in other sections of this manual. Job files are maintained for a minimum of five (5) years.

SOPs may be generated, or revisions suggested, by any Recra employee. The proposed SOP is then reviewed and approved by the Facility Laboratory Director or Chief Laboratory Operations Officer, the Facility or Corporate Quality Assurance Officer and the Corporate Health and Safety Officer (when applicable). An approved SOP is issued, with old revisions retrieved and archived, to the appropriate personnel. SOPs are available to all laboratory personnel for their reference. SOPs are also available, upon request from the Facility Quality Assurance Officer, to clients for their review.

The revision process for technical or documentation procedures is accomplished as needed or according to updates and changes in regulatory requirements. A review committee including the Laboratory Director, The Chief Laboratory Officer and the Quality Assurance Officer exists for necessary approval of SOP modifications.

13. PERFORMANCE AND SYSTEM AUDITS

By NEIC definition, an audit is a systematic check to determine the quality of operation of some function or activity. Audits are further defined as being of two basic types; performance and system audits.

A performance audit is one in which quantitative or qualitative data are independently obtained for comparison with routinely obtained data from a measurement system. Performance audits are completed at Recra Environmental via a number of mechanisms, including the analyses of evaluation samples from various states, U.S. Environmental Protection Agency and industrial clients, as well as the analysis of commercially available check samples. Additionally, Recra's Corporate QA Officer submits blind or double blind performance evaluation samples to the laboratory on a semi-annual basis. The routine use of available and applicable SRMs or MSBs, although not blind samples, provides for continuous performance auditing.

System audits, as opposed to performance audits, are strictly qualitative and consist of an on-site review of a laboratory's quality assurance system and physical facilities for calibration and measurement. System audits are routinely performed by many of Recra's clients as an element of Recra's participation in their certification or contract programs. New York State, New Jersey, U.S. Corps of Engineers, and the U.S. Environmental Protection Agency all routinely audit Recra's facilities relative to analytical services contracts. Additionally, detailed internal audits are performed on a semi-annual basis by the Corporate and Facility Quality Assurance Officers.

At the conclusion of internal or external system audits, reports are made to Recra's operating divisions for appropriate comment and corrective actions where necessary. Written response to internal as well as external audits are required. Records of audits and corrective actions are maintained by the Corporate QA Officer.

Analytical services that Recra may choose to subcontract require a system audit by Recra's QA department of those subcontractors. During the audit, the subcontracted laboratory will supply to Recra amongst other information their past proficiency evaluation studies/results. At the conclusion of the system audit, a written report is issued to the subcontracted laboratory. A written response is required from the subcontractor and is kept on file at Recra Environmental, Inc.

14. PREVENTATIVE MAINTENANCE

All major analytical equipment at Recra is covered by some type of maintenance contract generally with the manufacturer of said equipment. The degree and extent of contracted routine or preventative maintenance assistance is a function of the complexity of the equipment, amount of equipment redundancy at Recra, and our in-house expertise relative to repair and maintenance of the particular piece of equipment. All maintenance activities are documented and maintained in permanent files and logbooks.

All analytical balances are under a service agreement with the manufacturer or their authorized representative to provide emergency service, preventative maintenance and calibration on an annual basis.

With regard to Recra's Atomic Absorption/Emission Spectrophotometers, and the Inductively Coupled Plasma Spectrophotometers, a manufacturers service plan covers all systems. The plans include replacement parts required during all service visits. Routine operator maintenance and cleaning is performed by an experienced analyst or chemist according to manufacturer's specifications.

Hewlett Packard GC/MS and Finnigan GC/MS systems are under service agreements covering all repair parts, extended parts, labor and travel. Our internal preventative maintenance service involves cleaning, adjusting, inspecting and performing testing procedures designed to reduce product failure and/or extend useful product life.

Gas chromatographic systems are under service agreements with Hewlett Packard and Perkin Elmer which cover all repair parts, extended parts, labor and travel. Our experienced analysts clean, adjust, inspect and perform test procedures designed to reduce product failure and/or extend useful product life according to manufacturer's specifications.

15. DATA QUALITY ASSESSMENT

The procedures employed by Recra Environmental, Inc. to assess the quality of data originated in our facilities includes, but is not limited to, the following:

- Identification of the sample matrices requiring analysis
- Identification of the analytical method used to acquire the data
- Determination of analytical precision - per method
- Determination of analytical accuracy - per method
- Determination of analytical completeness
- Determination of method detection limits

These procedures, for the most part, have been previously discussed in other sections of this manual. With regard to method detection limits (MDL), method specific requirements are verified during initial performance of the method and verified quarterly for all parameters. EPA procedures are used for determination of MDL's.

Data quality reviews by analysts, supervisors, managers, laboratory directors and QA personnel all contribute to the total process. Analytical project managers within the analytical program office interface with clients in order to insure that their needs are met and that information provided fulfills their requirements. Recra's staff also provide compliance screening activities on all CLP analysis prior to its delivery to any client requesting such testing services.

Data validation, data quality assessments or data usability determinations are also services available from Recra for our clients. These services are provided consistent with applicable state and or federal guidelines and applicable method based QA requirements. These services are provided for Recra generated data and data produced by other laboratories.

16. CORRECTIVE ACTION

Recra's evaluation of data quality and acceptability for methodologies such as CLP (where criteria are defined by the protocol), results of internal standard and surrogate recovery and MS and MSD analysis are evaluated consistent with the protocol or method. The following paragraphs define criteria which must be met to maintain Recra's high standards of data quality. Corrective action procedures and evaluation criteria, which are an integral part of the entire QA processes, are also presented.

GCMS

Internal Standards

Every standard, blank, analytical and QC sample contains internal standards (IS). These standards are used as the basis for the quantitation of the various compounds being analyzed. The extracted ion current profile (EICP) is monitored through the internal standards, and cannot vary by more than a factor of two (-50 to +100%) from the most recent calibration standard. If this occurs, the mass spectrometric system must be inspected for malfunction and the problem corrected. All samples must be re-analyzed. In the event that re-analysis continues to illustrate failure of IS recovery, matrix effects may be responsible for said non-compliance.

Method Blank

The method blank analysis must be performed with each sample batch or at a minimum every 20 samples and monitors contamination throughout the analytical process. For a volatile method blank to be acceptable it must not contain:

1. Concentrations greater than five times the detection limit of methylene chloride, acetone, toluene, or 2-butanone.

2. Concentrations greater than the detection limit of any analyte other than the above mentioned.

For a semi-volatile method blank to be acceptable, it must not contain:

1. Concentrations greater than five times the detection limit of phthalate esters.

2. Concentrations greater than the detection limit of any analyte other than the above mentioned.

Blanks for both volatile and semi-volatile organics should not contain TICs greater than 10% of the nearest internal standard.

If these criteria are not met, the problem is investigated with the guidance of the facility QAO and the situation is corrected. If necessary, all samples associated with the contaminated blank are re-analyzed or re-extracted and re-analyzed. This re-analysis should occur within defined holding times

Surrogates

Surrogates are added to every standard, blank, analytical and QC sample to monitor the preparation and analysis of these materials. If any one surrogate deviates from the volatile method specified criteria, the following actions must be taken:

1. Check for calculation errors, degradation or contamination of internal standards and surrogates and review instrument performance.

2. Re-analyze or re-extract and re-analyze the sample unless surrogate recovery can be resolved with consideration of MS/MSD.

3. If the sample is a method blank it must be re-analyzed.

The above actions also apply for semi-volatiles if any one surrogate compound in either fraction (base neutral or acid) is below 10% or the recoveries of 2 or more surrogate compounds in either or both fractions are outside method specified criteria. If method blanks for semi-volatile analysis are non-compliant, corrective actions should be taken under the direction of the facility QAO.

Matrix Spikes/Matrix Spike Duplicates/Matrix Spike Blanks

MS/MSD/MSB

These spikes and duplicates are used to evaluate matrix effects of the sample upon the analytical methodology being used. The recovery criteria for the MS/MSD are for advisory purposes only, however, results must be reported on a job/case basis. MS/MSD recoveries which suggest serious matrix affects must be brought to the immediate attention of the facility QAO, investigated, documented, and corrective action applied.

The MSB (SRM) recoveries are not for advisory purposes, they monitor the extraction and analytical processes. These recoveries must measure between 75 and 125% or method or manufacturer specified limits.

GC/VOA, PESTICIDES/PCB AND HERBICIDES

Method Blank

The method blank analysis must be performed with each sample batch or every 20 samples and contain less than the detection limit of any analyte. If this criterion is not met, the problem is investigated with the guidance of the facility QAO and the situation is corrected. If necessary, all samples associated with the contaminated blank must be re-analyzed or re-extracted and re-analyzed. This re-analysis should occur, when necessary, before defined holding times are expired.

Surrogates

All standards, blanks and samples must contain surrogate spiking compound(s). Recoveries should be within acceptable criteria, if not, results are checked for calculation errors, degradation or contamination of surrogates and instrument performance. Unless surrogate recovery can be resolved with consideration of the MS/MSD failure to produce acceptable surrogate recoveries generally require re-analysis or re-extraction and re-analysis of the affected sample(s). If a method blank is non-compliant, corrective actions should be taken under the directive of the facility QAO.

Matrix Spikes/Matrix Spike Duplicates/Matrix Spike Blanks

MS/MSD/MSB

These spikes and duplicates are used to evaluate matrix effect of the sample upon the analytical methodology being used. The recovery criteria for the MS/MSD are for advisory purposes only, however results must be reported on a job/case basis. MS/MSD recoveries which suggest serious matrix affects must be brought to the immediate attention of the facility QAO, investigated, documented, and corrective action applied.

The MSB (SRM) recoveries are not for advisory purposes, they monitor the extraction and analytical processes. These recoveries must measure between 75 and 125% or method or manufacturer specified limits.

PESTICIDES/PCB ONLY

Dibutylchlorendate (DBC) Retention Time Shift

The retention time shift for DBC should be less than 2.0 percent difference for packed columns, 1.5 percent for wide bore capillary columns, and 0.3 percent for narrow bore capillary columns. If this criteria is not met for a pesticide/PCB standard, the non-compliance is investigated, documented and necessary corrective action is taken. If a sample or a blank does not comply, attempts are made to identify the problem and correct and/or document this non-compliance.

Endrin/4,4'DDT Breakdown

At the beginning of each analytical sequence and after column resolution has been verified, evaluation standards containing Aldrin, Endrin, 4,4'-DDT and DBC must be analyzed. The percent breakdown for Endrin and/or 4,4'-DDT must not exceed 20% or corrective action(s) must be taken before further analysis.

METALS AA/ICP

Initial Calibration Blank (ICB)/Continuing Calibration Blank (CCB)

The ICB is analyzed immediately after the initial calibration verification standard for the ICP and after the analysis of the five standards on the AA. The CCB is analyzed after the continuing calibration standard at a frequency of 10% and at the end of the analytical sequence. The ICB and CCB monitor only the analytical system. All element concentrations must be below the instrument detection limit or analysis must be terminated, the problem corrected and the instrument recalibrated. In the event a calibration blank is non-compliant, all analytical samples must be re-analyzed since the analysis of the last compliant blank.

Method Blank

The method or preparation blank monitors the digestion process and should not exhibit results above the instrument detection limits. If this situation does occur, the analyst investigates the problem, and subsequently corrects and documents action(s) necessary for resolution. The requirement of re-analyses of any affected sample(s) will be based upon the degree of corrective action (if required) and/or as directed by the facility QAO.

Matrix Spikes/Matrix Spike Duplicates/Matrix Duplicate/Matrix Spike Blanks (MS/MSD/MD/MSB)

These spikes and duplicates are used to evaluate matrix effect of the sample upon the analytical methodology being used. The criteria for the MS/MSD/MD are for advisory purposes only, however, results must be reported on a job/case basis. A post-spike must be analyzed when pre-spike recoveries are not compliant. MS/MSD/MD results which suggest serious matrix affects must be brought to the immediate attention of the facility QAO, investigated, documented, and corrective action applied.

The MSB (LCS) recoveries are not for advisory purposes, they monitor the extraction and analytical processes. These recoveries must measure between 75 and 125% or method or manufacturer specified limits.

ICP ONLY

Interference Check Sample (ICS)

At the beginning of each analytical sequence, an ICS is to be performed to verify the interelement and background correction factors. The criteria of ± 20% of the true value has been established. If the ICS is not compliant, analysis is terminated, corrective action is taken and the instrument is recalibrated.

LIMITED CHEMISTRY

Method Blank

This method blank which monitors contamination throughout the analytical processes must contain less than the detection limit for any analyte being tested.

If this criteria is not met, the problem is investigated with the guidance of the facility QAO and appropriate corrective action is taken. If necessary, re-analysis of samples associated with the contaminated blank is completed. This re-analysis must occur before holding times have expired.

Matrix Spikes/Matrix Spike Duplicates/Matrix Duplicate/Matrix Spike Blanks (MS/MSD/MD/MSB)

These spikes and duplicates are used to evaluate matrix effect of the samples upon the analytical methodology being used. The criteria for the MS/MSD/MD is method specified or analytically derived and must be monitored daily or on a job/case basis. Any analyte outliers must be brought to the immediate attention of the facility QAO, investigated, documented, and corrective action applied.

The MSB (SRM) recoveries monitor the preparation and analytical processes. These recoveries must measure between 75 and 125% or method or manufacturer specified limits.

17. QUALITY ASSURANCE REPORTS TO MANAGEMENT

Critically important to the successful implementation of the QA Plan is the reporting system which provides the means by which the program can be reviewed, problems identified, and programmatic changes made to remediate or improve the plan.

Quality Assurance reports to management take a number of forms as follows:

- QA job/case summary
- Audit reports, internal and external audits with responses
- Performance evaluation sample results; internal and external sources
- Daily QA/QC summary reports
- QA charts (trend analyses)
- Corrective Action Notices

QA/QC summary reports are presented to laboratory management personnel so that performance criteria can be monitored on a daily basis for all analysis from each analytical department.

Additionally, monthly, quarterly and annual QA reports which include measures of productivity, compliance, data usability and instrument performance are produced to management. These reports also summarize both internal and external audit findings, contract performance issues and corrective action for the specified period of record.

A P P E N D I X

RECRA ENVIRONMENTAL, INC.

CORPORATE QUALITY ASSURANCE PLAN

GLOSSARY OF TERMS

GLOSSARY OF TERMS

The following is a list of terms and definitions used throughout the Quality Assurance Manual:

- AA Spectroscopy - Atomic absorption spectrometers which measure explicit wavelengths of metals by absorption.

- Absorbance - a measure of the decrease in incident light passing through a sample into the detector.

- Accuracy - The degree of agreement between the true or accepted reference value and the measured value.

- Analysis - The separation, identification and quantification of a compound into its constituent parts, the breaking down of a complex substance into simpler substances.

- Analyte - the element or ion an analysis seeks to determine; the element or compound of interest.

- Analytical Balance - A mechanical or electrical balance with a sensitivity of 0.1 milligram or less.

- Analytical Batch - Samples which are analyzed together with the same method sequence, the same lots of reagents and with the same manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (i.e., groundwater, sludge, etc.)

- Analytical Sample - Any solution or media introduced into an instrument or apparatus on which an analysis is performed excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification and continuing calibration blank. Note the following are all defined as analytical samples: undiluted and diluted samples, predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, interference check samples (ICS), CRDL standard for AA (CRA), CRDL standard for ICP (CRI), laboratory control sample (LCS), and method/preparation blank (MB/PB).

- BFB (4-Bromofluorobenzene) - The compound chosen to establish mass spectral instrument performance for volatile analyses.

- Blank - An artificial sample designed to monitor the introduction of artifacts into the analysis process. For aqueous samples, reagent water is used as a blank matrix. A common matrix does not exist for solid samples, therefore, reagent water, sodium sulfate, or reagent grade kaolin is used. There are several types of blanks which monitor a variety of processes: laboratory (method) blank, trip blank, holding blank and field blank.

- Calibration Verification - The periodic analysis of one or more standards independent of the calibration standards to verify the accuracy of the calibration standards as well as the calibration ratio.

- CVS - Calibration Verification Sample is a standard solution derived from a source different from your calibration standards. This standard is a check only on your calibration since it is not prepared or extracted similar to the analytical samples.

- Chain-of-Custody - A document designed to trace the custody of a sample(s) from the point of origin to final destination with the intent of legally proving that custody remained intact and that tampering or substitutions were precluded.

- Coefficient of Variation (CV) - the standard deviation as a percent of the arithmetic mean.

- Colorimetric - Analyses based on the measurement of color that develops during the test-specific reaction. This determination is made at a specific wavelength on a spectrometer.

- Completeness - A measure of the amount of valid data obtained from a measurement system relative to the amount of data that was expected to be obtained under correct, normal conditions.

- Concentration - The relative fraction of one substance in another, normally expressed in weight percent, volume percent or as a weight per volume ratio.

- Correlation Coefficient - a number (r) which indicates the degree of dependence between two variables (concentration - absorbance). The more dependent they are the closer the value (r) to unity (1.000); normally determined on the basis of the least squares analysis.

- Custody - Immediate charge, control or possession exercised by a person or competent authority.

- DFTPP (Decaflurortriphenylphosphine) - The compound chosen to establish mass spectral instrument performance for semi-volatile analysis.

- Duplicate - A second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

- Field Blank - An organic or aqueous solution that should be free of analytes. This solution is transferred from one vessel to another at the sampling site and preserved with the appropriate reagents. This blank served as a check on reagent and environmental contamination. Rinse or rinsate blank are often also considered to be field blanks.

- Gravimetric - Analyses based on the direct or indirect weighing of an analyte. This weighing usually requires at least a four decimal place analytical balance.

- Holding Time - The storage time allowed between sample collection, preparation and sample analysis when the proper preservation and storage techniques are used.

- Inductively Coupled Plasma (ICP) - A technique for the simultaneous or sequential multi-element determination of elements in solution. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique.

- Initial Calibration - The analysis of standards containing various amounts of analyte to establish the ratio of the measurement system response to analyte mass or concentration across the working range of the analytical technique.

- Instrument Detection Limit (IDL) - The smallest signal above background noise that an instrument can detect reliably.

- Internal Standards - Compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for VOAs), and sample extract (for semi-volatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds.

- Laboratory Control Sample (LCS) - a control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents, and analytical methods employed for any samples received.

- Matrix - The physical characteristics or state of a sample, i.e., water, soil, sludge, etc..

- Matrix Spike - Aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring spiked analyte recovery.

- Matrix Spike Duplicate - A second aliquot of the same matrix as the matrix spike (above) that is measured to determine the precision of the method.

- Method or Reagent Blank - An organic or aqueous solution(s) that should be free of analytes. The method (or preparation) blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. This blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

- Method Detection Limit (MDL) - The minimum concentration of a substance that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero.

- Percent Error - A measure of accuracy that is calculated as the absolute error relative to the true value, expressed as a percent.

- Performance Evaluation (PE) Sample - A sample of known composition provided by commercial source, state or federal agency for analysis; used to evaluate laboratory performance/capabilities.

- PQL - The practical quantitation limit is the lowest level that can be reliably achieved for actual specific samples within specified limits of precision and accuracy during routine laboratory operating conditions.

- Precision - The agreement of repeatability of a set of replicate results among themselves, usually expressed in terms of the deviation of a set of results from the arithmetic mean. Precision may be qualified in terms of possible sources of variability, replicatability, repeatability and reproducibility.

- Qualitative Analysis - A procedure which determines the presence or absence of a specific analyte.

- Quality Assurance - All those planned and systematic actions necessary to provide adequate confidence in a laboratory result(s).

- Quality Control - Those quality assurance actions that provide a means to control and measure the characteristics of measurement equipment and processes to meet established requirements.

- Quantitative Analysis - A procedure which measures or determines the amount of a specific analyte with precision and accuracy.

- Recovery - A determination of the accuracy of the analytical procedure made by comparing measured values for a fortified (spiked) sample against the known spike values. Recovery is determined by the following equation:

$$\% \text{ Recovery} = \frac{\text{measured value}}{\text{spiked value}} \times 100\%$$

- Relative Percent Difference (RPD) - A measure of precision that is calculated as the difference between two results, relative to their arithmetic mean, expressed as a percent.

- Relative Standard Deviation (RSD) - A measure of precision that is calculated as the standard deviation(s) of a set of values relative to their arithmetic mean, expressed as a percent.

- Reproducibility - The precision of repeated but independent measurements made on the same sample by the same analyst at essentially the same time under the same conditions; the precision of measurements of the same sample at different locations.

- Resolution - Also termed separation, the separation between peaks on a chromatogram.

- Rinsate Blank - The DI water used to rinse the sample collection equipment. This monitors the possible contaminants from the collection devices. Often times referred to as a field blank.

- Run - A continuous analytical sequence consisting of prepared samples and all associated quality assurance measurements.

- Sample Delivery Group (SDG) - a unit within a sample Case that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer samples within a Case, received over a period of up to 14 calendar days. Data from all samples in an SDG are due concurrently. A Sample Delivery Group is defined by one of the following, whichever occurs first:

    - Case; or
    - Each 20 samples within a Case; or
    - Each 14-day calendar period during which samples in a Case are received, beginning with receipt of the first sample in the Case or SDG.

Samples may be assigned to Sample Delivery Groups by matrix (i.e., all soils in one SDG, all waters in another), at the discretion of the laboratory.

- Sample Matrix - All of the chemical components and physical characteristics of a sample other than the parameter of interest.

- Semivolatile Compounds - Compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with Base/Neutral/Acid (BNA) compounds.

- Sensitivity - The ability of a measurement system to detect and accurately quantitate a parameter at a critical level within a specific sample matrix.

- Solution - The liquid mixture of two or more substances where one is dissolved in the other.

- Solvent - Liquid that is capable of dissolving another substance.

- Standard Deviation - The square root of the variance of a set of values.

- Surrogates (Surrogate Standard) - Compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, deuterated, fluorinated, or isotopically labelled compounds not expected to be detected in environmental media.

- Test Method - A defined technical procedure to determine one or more specific characteristics of a material or product.

- Trip Blank - An organic or aqueous solution that is free of analytes and is transported to the sampling site and returned to the laboratory without being opened. This serves as a check on sample contamination originating from sample transport, shipping and from the site conditions.

- Volatile Compounds - Compounds amenable to analysis such as purge and trap techniques. Used synonymously with purgeable compounds. Usually reflect solvent type materials and constituents with relatively low boiling points.

APPENDIX C

REAL ESTATE PLAN

(TO BE SUPPLIED)