PRISM LABORATORIES QUALITY ASSURANCE PLAN

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1.0 STATEMENT OF POLICY

Prism Laboratories, Inc. has created this Quality Assurance Plan in order to document its commitment to providing data of known, discernible, and verifiable quality. This plan is intended to meet the requirements for Quality Assurance Plans as required in various state and federal environmental programs.

Prism Laboratories assumes the responsibility to implement and perform the procedures as defined in this plan, in order to assure that the precision and accuracy of its data are known and documented, and that the methods used to generate the data are appropriate and in compliance with governing regulations.

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 CAPABILITIES

Prism Laboratories, Inc. is a privately owned, full-service environmental sampling and testing company, capable of performing an array of environmental services to commercial and industrial clients. Prism provides a variety of sampling services through its Environmental Services Division, as well as a wide variety of testing methods for water, soil, sludges, hazardous waste, and air. A description of Prism's job responsibilities follows, as well as an organizational chart defining the individuals currently holding these assignments.

2.2 CORPORATE OFFICERS

Prism Laboratories has been in operation since the spring of 1992. There are four owners of the company, who share equally in responsibility for the actions and direction of the corporation, as a whole. The partners in this operation have defined their roles as follows:

2.2.1 PRESIDENT

The president is responsible for an array of administrative duties, including financials, human resources, and report preparation, as well as general oversight of company operations.

2.2.2 LABORATORY DIRECTOR

The laboratory director oversees all laboratory operations, including sample and personnel management, data validation and reporting, and all activities concerning the generation and reporting of data from the laboratory. The laboratory director acts as the primary individual, who is ultimately responsible for the quality and integrity of the analytical work performed by the laboratory.

2.2.3 VICE-PRESIDENT OF ENVIRONMENTAL SERVICES

The vice-president of environmental services oversees all sampling services provided by the laboratory. This individual is responsible for coordinating and managing the sampling programs for a variety of commercial and industrial clients. Several laboratory personnel perform sampling duties under the direction of this individual.

2.2.4 VICE-PRESIDENT OF MARKETING AND PROJECT MANAGEMENT

This individual oversees the sales and marketing functions for the company, as well as general project management.

2.3 LABORATORY AND TECHNICAL SUPPORT

2.3.1 QUALITY ASSURANCE MANAGER

The QA manager oversees the Quality Assurance/Quality Control Program, which is outlined in this document, and as such, is responsible for the writing and maintenance of this plan. Primary QA/QC responsibilities include auditing the laboratory and field operations for regulatory and QA program compliance, defining data quality objectives, reviewing and validating outgoing data, initiating corrective actions, and overseeing various performance evaluation studies.

2.3.2 INORGANICS DEPARTMENT SUPERVISOR

This individual supervises the daily operations of the wet chemistry (classical chemistry) and metals analytical areas. Examples of analyses in this area would be pH, biochemical oxygen demand, nitrate, lead, flashpoint, and cyanide. This position oversees wet chem technicians, metals analysts, and metals prep technicians.

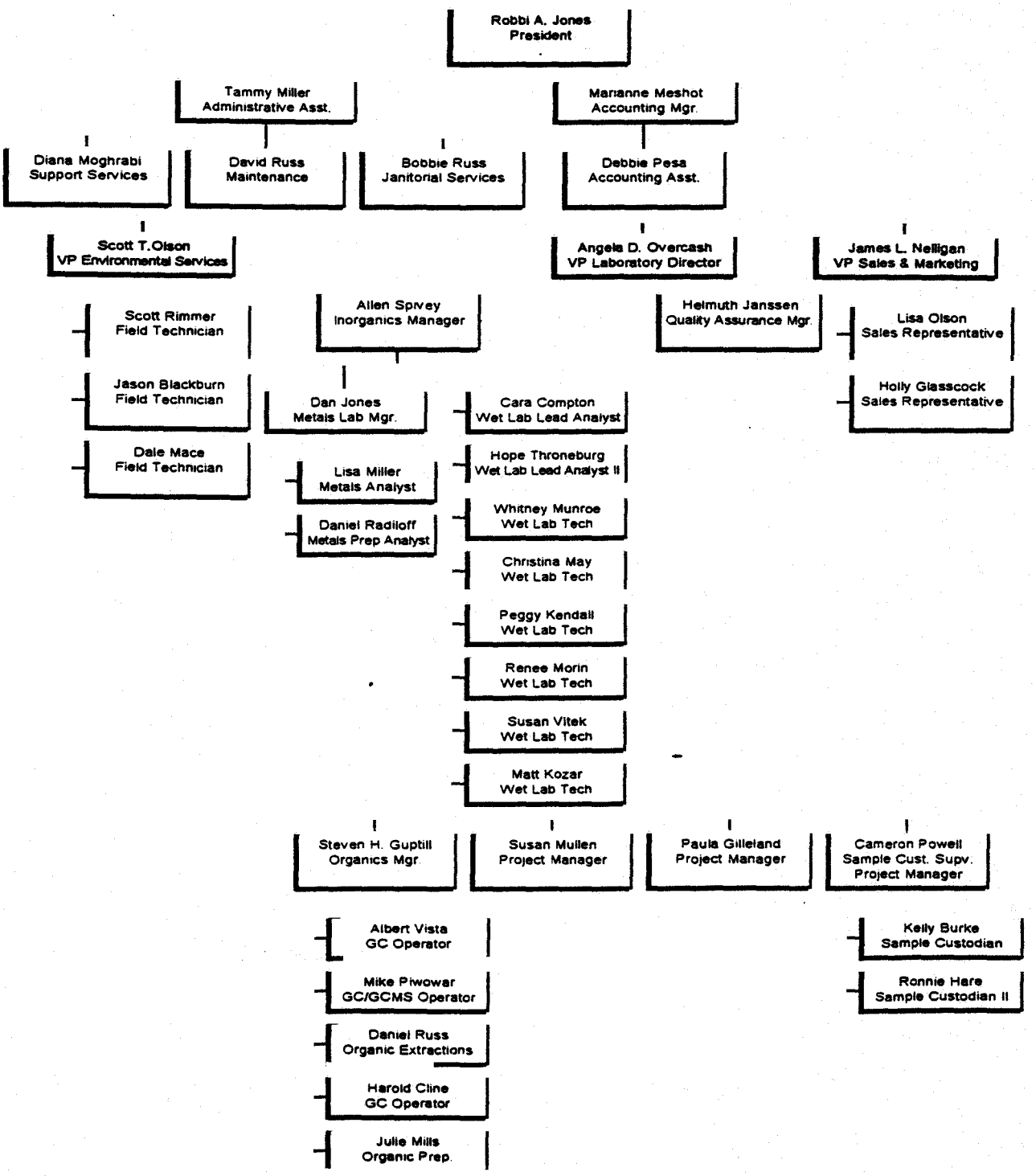
2.3.3 GC/MS DEPARTMENT SUPERVISOR

The GC/MS supervisor is responsible for the daily operations of the gas chromatography/mass spectrometry analytical area. Examples of analyses in this area would be volatile and semivolatile organics by GC/MS (624, 8240, 8260, 625, 8270). This position oversees GC/MS extractions technicians.

2.3.4 GC DEPARTMENT SUPERVISOR

The GC supervisor is responsible for the daily operations of the gas chromatography analytical area. Examples of analyses in this area would be Total Petroleum Hydrocarbons-Gas Range Organics (TPH-GRO), volatiles by GC (601, 602, 8010, 8020, 8021), and semivolatiles by GC (608, 610, etc.). This position oversees GC extractions technicians and GC analysts.

Prism Laboratories, Inc.



3.0 DATA OUALITY OBJECTIVES

Table 3.1 presents the Data Quality Objectives for the analyses as performed by Prism Laboratories. The PQLs reported here are based on MDL studies using the EPA method for determination of MDLs (40CFR, Part 136, Appx.B, rev 1.11; see section 9.6 of this QAP for more information regarding MDLs and PQLs).

The parameters listed in Table 3.1 were available at the time of revision of this document— other methods may have become available since the time of this publication.

All methods presented here are EPA methods, unless specified otherwise:

"SM" methods are from *Standard Methods*, 17th ed.
"ASTM" methods are from the *American Society for Testing Materials*.

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Non Metals

Parameter	*Method*	*POL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Acidity, Total	EPA 305.1 SM 2310 B	1	9.0	88	108
Alkalinity, Total	EPA 310.1 SM2320 B	5	3.6	88	114
Biological Oxygen Demand					
BOD - 05	SM 5210 EPA 405.1	1	31	84	114
BOD - 05, Carbonaceous	SM 5210 B	1	31	84	114
Chemical Oxygen Demand	SM 5220B HACH 8000	50	7.8	81	118
Chloride	SM 4500Cl-C EPA 325.3 SW846-9252	1	19	62	144
Chromium, Hexavalent	SW 846-7196 SM 3500-Cr D	0.01	12	82	124
Cyanide, Total	EPA 335.2 SM 4500-CN C & SM 4500-CN-E SW 846-9010	0.002	36	36	159
Cyanide, Amenable to Chlorination,	EPA 335.1 SM 4500-CN G	0.002	62	28	142
Fluoride, Dissolved (ISE) Total (ISE)	EPA 340.2 SM 4500-F-C EPA 340.2	0.1	21	75	119
Hardness, Total	SM 2340 C EPA 130.2	5	12	79	119
Nitrogen					
Ammonia	SM 4500-NH3-E EPA 350.2	0.1	2.8	85	110
Ammonia	SM 4500-NH3-F EPA 350.3	0.1	12	76	128
Nitrate	SM 4500-NO3-E less SM 4500-NO2-B EPA 353.3 less EPA 354.1	0.01	23	64	127

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Non Metals

Parameter	Method	PQL (mg/L)	Precision (RPD)	Accuracy Range (%R)	
Nitrate+Nitrite	SM 4500-NO3-E/ EPA 353.3	0.01	23	64	127
Nitrite	SM 4500-N02-B EPA 354.1	0.01	4.2	89	118
Total Kjeldahl Nitrogen	EPA 351.3 SM 4500-NORG-B	0.5	23	64	127
Organic Nitrogen	EPA 351.3 - EPA 350.3 SM 4500-NORG-B - SM 4500-NH3-F	0.5	32	62	112
Oil & Grease, Gravimetric	SW846-9070 SM 5520B	10	34	65	116
Petroleum Hydrocarbons, Gravimetric	SM 5520F	10	32	59	132
Oil & Grease, Gravimetric- Hexane Extraction (HEM)	EPA 1664	5*	18*	79*	114*
SGT-HEM	EPA 1664	5*	24*	66*	114*
pH	SM 4500-H+ B EPA 150.1 SW 846-9040	0.1 units	1.2	92	106
Phenol, Total	EPA 420.1 SW 846-9065	0.1	20	82	122
Phenol, Total Low Level	EPA 420.1 SM 5530 C	0.01	20	70	129
Phosphorus					
Ortho-	EPA 365.2 SM 4500-P-E	0.05	37	55	131
Total	EPA 365.2 SM 4500-P-E	0.05	21	69	143
Solids,					
Dissolved	2540 C EPA 160.1	50	35	70	148
Percent	2540 B EPA 160.3	0.1 %	22	80	122
Suspended	SM 2540 D EPA 160.2	1	17	73	129
Total	SM2540 B EPA 160.3	50	4.7	83	116

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Non Metals

Parameter	*Method*	*POL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Specific Conductivity	SM 2510 B EPA 120.1 SW 846-9050	10 uMhos/cm	27	82	118
Sulfate	SM 4500-SO4 E EPA 375.4	5	34	67	127
Sulfide	EPA 376.1 SW 846-9030	1	8	82	126
Surfactants	SM 5540 C	0.05	32	62	128
Turbidity	SM 2130 B EPA 180.1	1.0 NTU	12	69	109

* - Oil & Grease by EPA 1664 - CIs from Section 17, Table 1, Method 1664: N-Hexane Extractable Material and Silica Gel Treated N-Hexane Extractable Material By Extraction and Gravimetry, EPA-821B-94-004b, April 1995.

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Metals by GFAA

Parameter	*Method*	*PQL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Antimony	EPA 200.9 SW 846-7041	0.005	28	82	122
Arsenic	EPA 200.9 SW 846-7060A	0.002	32	78	122
Beryllium	EPA 200.9 SW 846-7091	0.005	38	62	142
Cadmium	EPA 200.9 SW 846-7131A	0.005	28	70	118
Chromium	EPA 200.9 SW 846-7191	0.005	32	66	138
Lead	EPA 200.9 SW 846-7421	0.002	36	62	129
Molybdenum	EPA 200.9 SW 846-7481	0.002	28	69	112
Selenium	EPA 200.9 SW 846-7740	0.002	39	52	119
Silver	EPA 200.9 SW 846-7761	0.005	48	42	132
Thallium	EPA 200.9 SW 846-7841	0.002	36	52	139
Vanadium	EPA 200.9 SW 846-7911	0.002	28	72	137

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Metals by ICP

Parameter	*Method*	*POL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aluminum	EPA 200.7 SW 846-6010B	0.005	29	66	128
Antimony	EPA 200.7 SW 846-6010B	0.002	28	62	128
Arsenic	EPA 200.7 SW 846-6010B	0.005	13	65	114
Barium	EPA 200.7 W 846-6010B	0.01	10	66	111
Beryllium	EPA 200.7 SW 846-6010B	0.005	22	69	112
Boron	EPA 200.7	0.1	28	83	118
Cadmium	EPA 200.7 SW 846-6010B	0.005	22	62	108
Calcium	EPA 200.7 SW 846-6010B	0.01	38	42	140
Chromium	EPA 200.7 SW 846-6010B	0.005	10	73	113
Cobalt	EPA 200.7 SW 846-6010B	0.005	26	72	118
Copper	EPA 200.7 SW 846-6010B	0.005	21	81	120
Iron	EPA 200.7 SW 846-6010B	0.001	33	70	121
Lead	EPA 200.7 SW 846-6010B	0.002	10	72	107
Magnesium	EPA 200.7 SW 846-6010B	0.005	38	64	140
Manganese	EPA 200.7 SW 846-6010B	0.001	19	65	125
Molybdenum	EPA 200.7 SW 846-6010B	0.0006	8.2	73	109
Nickel	EPA 200.7 SW 846-6010B	0.001	7.9	73	109
Potassium	EPA 200.7 SW 846-6010B	0.02	20	70	112
Selenium	EPA 200.7 SW 846-6010B	0.001	30	57	108
Silicon	EPA 200.7	0.01	42	54	156

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Metals by ICP

Parameter	*Method*	*POL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Silver	EPA 200.7 SW 846-6010B	0.001	31	D	131
Sodium	EPA 200.7 SW 846-6010B	0.01	36	75	128
Tin	EPA 200.7	0.01	42	44	130
Thallium	EPA 200.7 SW 846-6010B	0.004	20	78	116
Vanadium	EPA 200.7 SW 846-6010B	0.001	20	72	112
Zinc	EPA 200.7 SW 846-6010B	0.001	29	77	107

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Metals by Cold Vapor

Parameter	*Method*	*POL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Mercury	EPA 245.1 SW 846-7470A	0.0002	32	66	132

QUALITY ASSURANCE OBJECTIVES FOR GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1A Inorganics in Waters

Metals by FAA *

Parameter	*Method*	*PQL (mg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aluminum	EPA202.1 SW 846-7020	0.01	20	78	132
Antimony	EPA 204.1 SW 846-7040	0.01	12	65	115
Barium	EPA 208.1 W 846-7080A	1.0	34	76	113
Beryllium	EPA 210.1 SW 846-7090	0.01	21	66	128
Cadmium	EPA 213.1 SW 846-7130	0.01	21	59	114
Calcium	SW 846-7140 EPA 215.1	0.05	52	38	129
Chromium	SW 846-7190 EPA 218.1	0.02	48	35	125
Cobalt	SW 846-7200 EPA 219.1	0.05	48	43	110
Copper	SW 846-7210 EPA 220.1	0.01	54	49	127
Iron	SW 846-7380 EPA 236.1	0.01	23	60	119
Lead	SW 846-7420 EPA 239.1	0.1	22	D	144
Magnesium	SW 846-7450 EPA 242.1	0.01	23	76	118
Manganese	SW 846-7460 EPA 243.1	0.01	23	66	123
Molybdenum	SW 846-7480 EPA 246.1	0.05	14	63	115
Nickel	SW 846-7520 EPA 249.1	0.01	12	54	113
Potassium	SW 846-7610 EPA 258.1	0.1	18	54	107
Silver	SW 846-7760A EPA 272.1	0.05	48	D	121
Sodium	SW 846-7770 EPA 273.1	0.1	32	42	124
Vanadium	SW 846-7910 EPA 286.1	0.05	14	78	114
Zinc	SW 846-7950 EPA289.1	0.02	26	44	118

*** - Very few samples processed by FAA; most work performed by ICP.**

Annotations for Table 3.1A
All acceptance data generated from actual sample spikes at a mid-level concentration range, unless otherwise noted.

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 32.1B Organics in Waters

Halogenated Volatile Organics by SW846 8021B/EPA 601

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Chloromethane	0.9	32	20	138
Bromomethane	0.8	26	39	150
Dichlorodifluoromethane(Freon 12)	0.9	27	18	150
Vinyl Chloride	1.3	20	34	140
Chloroethane	0.8	31	51	125
Methylene Chloride	0.7	20	62	171
Trichlorofluoromethane(Freon 11)	1.0	20	62	130
1,1-Dichloroethene	1.0	15	71	127
1,1-Dichloroethane	0.9	15	70	132
trans 1,2-Dichloroethene	0.8	14	65	128
Chloroform	0.7	13	84	131
1,2-Dichloroethane	0.5	15	69	125
1,1,1-Trichloroethane	0.8	15	76	133
Carbon Tetrachloride	1.0	15	82	133
Bromodichloromethane	0.6	15	69	139
EDB	0.4	14	64	114
1,2-Dichloropropane	0.7	15	72	129
Trans 1,3-Dichloropropene	0.2	32	42	125
Trichloroethene	0.5	15	74	125
Dibromochloromethane	0.5	15	74	128
1,1,2-Trichloroethane	0.5	15	76	130
cis-1,3-Dichloropropene	0.6	32	58	124
Bromoform	0.4	21	61	132
1,1,2,2-Tetrachloroethane	0.5	19	49	174
Tetrachloroethene	0.5	15	81	137
1,2 Dichlorobenzene	1.7	15	68	142
1,3 Dichlorobenzene	0.4	15	67	122
1,4 Dichlorobenzene	0.4	15	64	128
Chlorobenzene	0.4	15	60	133

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) by Microextraction and Gas Chromatography, SW846-8011 & 504

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Ethylene Dibromide(EDB)	0. 014	28	74	121
1,2-Dibromo-3-Chloropropane	0. 017	30	73	121

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Purgeable Aromatics by SW846 - 8021B/EPA 602

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Methyl tert-Butyl Ether	1.8	18	84	123
Benzene	0.3	14	67	128
Toluene	0.5	15	71	123
Ethylbenzene	0.5	15	75	138
m & p- Xylenes	0.8	16	85	134
o-Xylene	0.5	28	77	148
Isopropyl ether	0.5	16	82	123

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Organochlorine Pesticides and PCBs by SW846-8081, 8082/ EPA 608

Parameter	*MDL (ug/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aldrin	0.05	42	35	121
a-BHC	0.05	50	52	160
b-BHC	0.05	53	49	155
d-BHC	0.05	50	46	171
g-BHC (Lindane)	0.05	48	57	139
Heptachlor	0.05	40	51	131
Heptachlor epoxide	0.05	41	44	128
Endosulfan I	0.05	25	57	116
Endosulfan II	0.05	22	53	107
Endosulfan sulfate	0.05	40	29	130
Dieldrin	0.05	34	46	130
Endrin	0.05	40	49	162
Endrin aldehyde	0.10	22	48	117
Methoxychlor	0.10	50	43	173
Chlordane	0.50	40	25	176
Toxaphene	0.60	48	41	126
4,4-DDD	0.10	40	25	176
4,4-DDE	0.10	24	55	112
4,4-DDT	0.10	43	55	121
PCB-1016	0.2	30	41	107
PCB-1221	0.4	28	38	168
PCB-1232	0.7	23	32	165
PCB-1242	0.4	26	49	105
PCB-1248	0.9	28	38	142
PCB-1254	0.3	16	29	128
PCB-1260	0.5	32	28	127
PCB-1262	0.3	27	32	138
PCB-1268	0.4	24	48	142

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Volatile Organics by GC/MS SW846-8260B/EPA 624

Parameter	*MDL (ug/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
1,1-Dichloroethane	1.9	20	68	138
1,1-Dichloroethene	2.3	22	65	130
1,1,1-Trichloroethane	2.0	20	83	120
1,1,1,2- Tetrachloroethane	2.3	35	60	121
1,1,2-Trichloroethane	2.6	35	68	141
1,1,2,2-Tetrachloroethane	2.8	28	63	120
1,1-Dichloropropene	2.1	35	65	139
1,2-Dibromoethane (EDB)	1.2	33	69	125
Dibromomethane	2.2	35	62	130
1,2-Dichlorobenzene	0.9	34	80	115
1,2-Dichloroethane	2.3	20	81	147
1,2-Dichloropropane	1.7	20	80	140
1,2,3-Trichlorobenzene	1.7	46	62	156
1,2,3-Trichloropropane	2.7	40	70	186
1,2,4-Trichlorobenzene	1.7	35	63	153
1,2,4-Trimethylbenzene	1.1	46	59	139
1,2-Dibromo-3-Chloropropane (DBCP)	3.2	37	62	122
1,3-Dichlorobenzene	1.0	32	71	131
1,3,5-Trimethylbenzene	1.9	33	58	126
1,3-Dichloropropane	1.9	37	70	128
1,4-Dichlorobenzene	0.9	34	74	139
2-Butanone (MEK)	5.9	22	65	161
2-Chloroethylvinyl ether	1.9	38	50	113
2,2-Dichloropropane	3.8	29	74	125
2-Chlorotoluene	1.0	34	75	122
2-Hexanone	3.0	26	59	141
4-Chlorotoluene	2.2	35	61	131
Acetone	3.2	37	51	150
Acetonitrile	17	52	50	189
Acrolein	12	35	28	112
Acrylonitrile	7.9	42	23	138
Allyl Chloride	12	30	50	150
Benzene	0.9	20	80	125
Bromobenzene	1.1	36	60	134
Bromochloromethane	1.8	25	68	126
Bromodichloromethane	1.5	20	80	132
Bromoform	0.8	39	74	128
Bromomethane	2.0	31	63	135
Butylbenzene	2.6	37	64	124

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Volatile Organics by GC/MS SW846-8260B/EPA 624

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Carbon Disulfide	1.6	33	50	150
Carbon tetrachloride	1.6	20	80	122
Chlorobenzene	0.9	20	80	120
Chloroethane	2.0	36	71	129
Chloroform	1.2	23	73	132
Chloromethane	0.7	23	38	146
Chloroprene	3.1	30	70	150
cis-1,2-Dichloroethene	0.6	45	81	119
cis-1,3-Dichloropropene	2.2	34	48	152
Dibromochloromethane	1.3	38	71	127
Dichlorodifluoromethane	3.6	41	55	143
Ethyl Benzene	1.1	15	84	119
Ethyl Methacrylate	4.8	30	50	150
Hexachlorobutadiene	3.9	35	66	134
Isobutyl alcohol	8.4	35	50	150
Isopropylbenzene	1.8	33	70	134
Isopropyltoluene	2.2	60	48	178
m & p-Xylenes	1.3	15	80	120
Methacrylonitrile	8.3	35	50	150
Methyl Iodide	3.3	32	65	128
Methyl Methacrylate	4.2	35	50	150
Methylene chloride	0.6	32	65	186
Naphthalene	3.0	35	62	134
o-Xylene	0.6	25	80	140
Pentachloroethane	4.1	35	50	150
Propionitrile	6.0	35	50	150
n-Propylbenzene	1.8	30	66	132
sec-Butylbenzene	2.5	31	74	146
Styrene	0.5	39	51	145
tert-Butylbenzene	2.6	38	85	134
Tetrachloroethene	2.4	20	74	120
Toluene	0.6	20	80	122
trans-1,2-Dichloroethene	0.9	20	71	131
trans-1,3-Dichloropropene	1.9	34	48	117
trans-1,4-Dichlorobutene	2.6	34	50	150
Trichloroethene	0.8	20	86	120
Trichlorofluoromethane	0.8	42	53	125
Vinyl Acetate	1.1	30	61	123
Vinyl Chloride	1.2	20	37	141

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Semi-Volatile Organics by GC/MS SW846-8270C/EPA 625

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
1,2,4-Trichlorobenzene	5.5	33	48	126
1,2-Dichlorobenzene	7.1	38	43	129
1,3-Dichlorobenzene	7.9	38	47	117
1,4-Dichlorobenzene	7.6	38	47	120
2-Chloronaphthalene	4.1	28	62	123
2-Methyl 4,6-Dinitrophenol	8.1	30	29	139
2-Methylnaphthalene	3.0	36	10	154
2-Methylphenol	6.8	35	10	142
2-Nitroaniline	3.2	42	13	154
2-Nitrophenol	6.5	36	36	182
2,4-Dichlorophenol	8.7	32	37	118
2,4-Dimethylphenol	5.2	28	32	118
2,4-Dinitrophenol	5.3	53	10	105
2,4-Dinitrotoluene	2.4	24	45	136
2,4,5-Trichlorophenol	8.9	30	45	142
2,4,6-Trichlorophenol	10	19	51	132
2,6-Dinitrotoluene	1.4	26	61	158
2-Chlorophenol	9.1	36	40	110
3- & 4-Methylphenol	6.5	38	40	152
3,3-Dichlorobenzidine	2.7	47	16	159
3-Nitroaniline	2.7	38	13	156
4-Bromophenyl phenyl ether	1.9	30	55	121
4-Chloro-3-methylphenol	5.3	25	45	120
4-Chloroaniline	5.2	36	10	139
4-Chlorophenyl phenyl ether	2.2	20	55	122
4-Nitroaniline	2.8	32	52	139
4-Nitrophenol	3.7	44	10	105
4,6-Dinitro-2-methylphenol	8.1	56	10	152
Acenaphthene	3.0	21	58	120
Acenaphthylene	3.8	20	69	120
Aniline	4.5	30	50	150
Anthracene	2.7	20	73	124
AminoAzobenzene	2.7	46	44	164
Benzidine	7.2	43	10	124
Benzo(a)anthracene	4.3	50	33	131
Benzo(a)pyrene	2.2	20	63	125
Benzo(b)fluoranthene	3.2	30	31	143
Benzo(g,h.i)perylene	3.2	28	28	147
Benzo(k)fluoranthene	5.4	33	74	118

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN GROUNDWATER, SURFACE WATER, AND WASTEWATER

Table 3.1B Organics in Waters

Semi-Volatile Organics by GC/MS SW846-8270C/EPA 625

Parameter	*MDL (µg/L)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Benzyl Alcohol	5.8	44	25	124
Bis(2-chloroethoxy) methane	5.1	36	38	121
Bis(2-chloroethyl)ether	8.5	44	36	113
Bis(2-chloroisopropyl) ether	4.9	49	33	117
Bis(2-ethylhexyl) phthalate	6.1	25	69	119
Butyl benzyl phthalate	5.2	22	65	117
Chrysene	4.4	42	36	134
Di-n-butyl phthalate	8.5	20	77	123
Di-n-octyl phthalate	3.2	24	63	123
Dibenzo(a,h)anthracene	4.3	24	65	125
Dibenzofuran	3.0	26	67	124
Diethyl phthalate	9.1	24	67	119
Dimethyl phthalate	6.7	20	63	113
Fluoranthene	3.9	23	65	125
Fluorene	2.0	20	67	115
Hexachlorobenzene	1.2	20	60	139
Hexachlorobutadiene	5.6	36	49	129
Hexachlorocyclopentadiene	7.1	36	24	217
Hexachloroethane	9.0	44	50	122
Indeno(1,2,3-c,d)-pyrene	2.9	28	20	154
Isophorone	3.5	27	43	164
N-Nitrosodi-n-propylamine	4.1	39	35	123
N-Nitrosodimethylamine	0.7	47	18	130
N-Nitrosodiphenylamine	2.4	20	58	133
Naphthalene	3.5	33	52	121
Nitrobenzene	3.7	46	41	121
Pentachlorophenol	7.3	31	28	126
Phenanthrene	1.6	27	75	117
Phenol	5.2	45	13	62
Pyrene	2.7	27	67	127
Pyridine	3.9	44	48	142

QUALITY ASSURANCE OBJECTIVES FOR INORGANICS IN SOLIDS

Table 3.1C Inorganics in Solids

Non Metals

Parameter	*Method*	*PQL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Chloride*	SW 846-9253	10	15*	78*	121*
Chromium, Hexavalent	SW 846-7196A	0.1	20*	75*	125*
Cyanide, Total	SW 846-9010B	0.04	32	65	135
Flash Point/Ignitability	SW 846-1010	70°F	16	86	112
Fluoride	SW 846-9214	1.0	25	75	125
Nitrogen, Ammonia	SM 4500-NH3 E	22	23	61	135
Nitrogen, Nitrate &Nitrite	EPA 350.3	0.2	28	61	132
Kjeldahl Nitrogen, Total	SM 4500-NORG-B	1.0	22	65	126
Oil & Grease	SW 846-9071A	5	12	73	124
Paint Filter Test	SW 846-9095	0.1	13	NA	NA
pH	SW846-9040B SW 846-9045C	0.1 units	13	92	112
Phenol, Total*	SW 846-9065	0.1	25	75	125
Phosphorus, Total	EPA 365.2	0.5	21	63	128
Solids, Percent Total	EPA 160.3	0.1%	18	NA	NA
Sulfate, Total*	SW 846-9038	10	20	80	120
Sulfide, Total*	SW 846-9034	10	20*	80*	120*

* - Target limits, until sufficient data points are collected to generate statistical confidence intervals.

QUALITY ASSURANCE OBJECTIVES FOR INORGANICS IN SOLIDS

Table 3.1C Inorganics in Solids

Metals by ICP

Parameter	*Method*	*MDL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aluminum	SW 846-6010B	0.06	18	58	163
Antimony	SW 846-6010B	0.03	16	78	165
Arsenic	SW 846-6010B	0.04	17	40	91
Barium	SW 846-6010B	0.01	16	65	135
Beryllium	SW 846-6010B	0.01	16	72	122
Boron	SW 846-6010B	0.05	17	72	128
Cadmium	SW 846-6010B	0.01	23	72	115
Calcium	SW 846-6010B	0.10	29	17	192
Chromium	SW 846-6010B	0.01	15	79	139
Cobalt*	SW 846-6010B	0.01	25	75	125
Copper	SW 846-6010B	0.10	24	70	175
Iron	SW 846-6010B	0.03	18	64	137
Lead	SW 846-6010B	0.03	21	61	145
Magnesium	SW 846-6010B	0.03	15	72	150
Manganese	SW 846-6010B	0.01	22	67	131
Molybdenum	SW 846-6010B	0.04	21	79	141
Nickel	SW 846-6010B	0.01	9	73	119
Potassium	SW 846-6010B	0.30	35	47	158
Selenium	SW 846-6010B	0.05	16	68	117
Silver	SW 846-6010B	0.04	21	D	115
Sodium	SW 846-6010B	0.10	32	54	197
Strontium*	SW 846-6010B	0.1	25	75	125
Thallium	SW 846-6010B	0.06	27	59	159
Tin*	SW 846-6010B	0.05	25	75	125
Vanadium	SW 846-6010B	0.02	23	67	122
Zinc	SW 846-6010B	0.05	28	60	146

QUALITY ASSURANCE OBJECTIVES FOR INORGANICS IN SOLIDS

Table 3.1C Inorganics in Solids

Mercury by Cold Vapor

Parameter	*Method*	*MDL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Mercury	SW 846-7471A	0.005	36	49	128

QUALITY ASSURANCE OBJECTIVES FOR INORGANICS IN SOLIDS

Table 3.1C Inorganics in Solids

Metals by GFAA

Parameter	*Method*	*MDL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Antimony*	SW 846-7041	0.03	25	75	125
Arsenic	SW 846-7060A	0.04	36	42	129
Beryllium*	SW 846-7091	0.01	25	75	125
Lead	SW 846-7421	0.03	28	28	112
Selenium*	SW 846-7740	0.05	25	75	125
Thallium*	SW 846-7841	0.06	25	75	125
Vanadium*	SW 846-7911	0.02	25	75	125

QUALITY ASSURANCE OBJECTIVES FOR INORGANICS IN SOLIDS

Table 3.1C Inorganics in Solids

Metals by FLAA

Parameter	*Method*	*MDL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aluminum	SW 846-7020	0.5	28	64	115
Barium	SW 846-7080A	2.0	36	58	135
Cadmium	SW 846-7130	0.2	23	78	123
Calcium	SW 846-7140	1.0	32	36	158
Chromium	SW 846-7190	0.5	33	48	132
Iron	SW 846-7380	1.4	18	46	128
Lead	SW 846-7420	1.5	30	28	168
Magnesium	SW 846-7450	1.1	24	67	144
Nickel	SW 846-7520	2.0	37	55	141
Potassium	SW 846-7610	5	28	47	138
Silver	SW 846-7760A	1.1	42	D	117
Sodium	SW 846-7770	5	27	68	124
Zinc	SW 846-7950	0.8	28	62	123

Annotations for Table 3.1C

* - Target Acceptance Criteria. Insufficient data points to date to generate acceptance ranges.

All acceptance data are generated from sample spikes at a mid-level concentration range, unless otherwise noted.

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Halogenated Volatile Organics by SW846-8021B

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Chloromethane	2.8	53	10	182
Bromomethane	0.8	52	10	173
Dichlorodifluoromethane(Freon 12)	1.0	46	26	152
Vinyl Chloride	1.0	54	10	166
Chloroethane	1.0	37	52	129
Methylene Chloride	5.2	51	10	228
Trichlorofluoromethane(Freon 11)	1.5	47	33	138
1,1-Dichloroethene	1.0	30	50	138
1,1-Dichloroethane	1.0	35	55	126
trans 1,2-Dichloroethene	0.6	23	40	144
Chloroform	1.0	27	60	137
1,2-Dichloroethane	1.5	22	51	144
1,1,1-Trichloroethane	1.2	34	52	136
Carbon Tetrachloride	0.8	34	55	130
Bromodichloromethane	1.2	21	55	124
1,2-Dichloropropane	1.0	17	55	130
Trans 1,3-Dichloropropene	1.2	38	44	137
Trichloroethene	1.1	25	29	149
Dibromomethane	0.8	38	54	135
Dibromochloromethane	1.0	43	51	123
1,1,2-Trichloroethane	2.0	47	39	133
cis-1,3-Dichloropropene	1.2	36	49	131
Bromoform	0.7	50	37	139
1,1,2,2-Tetrachloroethane	0.7	44	48	130
Tetrachloroethene	1.0	30	45	143

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Purgeable Aromatics by SW846-8021

Parameter	*MDL (ug/Kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Benzene	0.3	25	45	136
Toluene	0.4	26	33	148
Ethylbenzene	0.3	18	38	156
m/p-Xylene	0.4	18	55	140
Total Xylenes	0.6	45	33	160

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Organochlorine Pesticides and PCBs by SW846-8081/8082

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aldrin	2	19	42	122
a-BHC	2	23	37	134
b-BHC	2	17	17	147
d-BHC	2	27	19	140
g-BHC (Lindane)	2	25	32	127
Heptachlor	2	22	34	109
Heptachlor epoxide	2	21	46	142
Endosulfan I	4	22	46	152
Endosulfan II	4	47	D	200
Endosulfan sulfate	2	24	36	143
Dieldrin	2	25	40	146
Endrin	2	27	31	147
Chlordane	10	18	46	127
Toxaphene	10	20	41	120
4,4-DDD	4	20	45	119
4,4-DDE	4	27	31	141
4,4-DDT	4	29	25	160
PCB-1016	50	15	50	114
PCB-1221	50	35	15	178
PCB-1232	50	32	10	215
PCB-1242	50	21	39	150
PCB-1248	50	25	38	158
PCB-1254	50	18	29	131
PCB-1260	50	17	8	127

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Volatile Organics by GC/MS SW846-8260B

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Benzene	5	18	63	133
Bromobenzene	5	14	58	142
n-Butylbenzene	5	20	40	160
sec-Butylbenzene	5	20	40	160
tert-Butylbenzene	5	19	45	159
Bromochloromethane	5	17	39	144
Bromodichloromethane	5	23	68	128
Bromoform	5	28	45	153
Bromomethane	5	21	32	158
Carbon tetrachloride	5	27	76	141
Chlorobenzene	5	18	74	120
Chloroethane	5	23	20	158
Chloroform	5	24	69	129
Chloromethane	5	23	24	162
Dibromomethane	5	15	55	145
1,2-Dibromoethane (EDB)	5	10	72	132
Dichlorodifluoromethane	5	20	30	150
Dibromochloromethane	5	22	68	126
1,2-Dichlorobenzene	5	19	68	124
1,3-Dichlorobenzene	5	17	70	119
1,4-Dichlorobenzene	5	19	75	113
1,1-Dichloroethene	5	21	81	150
1,1-Dibromoethane	5	15	55	145
1,2-Dichloroethane	5	25	51	143
Cis-1,2-Dichloroethene	5	17	50	152
trans-1,2-Dichloroethene	5	19	76	152
1,2-Dichloropropane	5	15	39	147
1,3-Dichloropropane	5	16	48	144
2,2-Dichloropropane	5	44	D	218
1,2-Dibromo-3-Chloropropane	5	52	D	239
1,1-Dichloropropene	5	23	29	167
Ethyl Benzene	5	21	53	162
Hexachlorobutadiene	5	18	46	154
Isopropylbenzene	5	20	41	161
n-Propylbenzene	5	15	55	149
Methylene chloride	5	18	13	170
Naphthalene	5	21	41	167
1,1,1,2-Tetrachloroethane	5	18	36	144

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Volatile Organics by GC/MS SW846-8260B

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
1,1,2,2-Tetrachloroethane	5	16	29	155
Styrene	5	19	45	159
Tetrachloroethene	5	22	51	151
Toluene	5	18	75	124
2-Chlorotoluene	5	16	42	138
4-Chlorotoluene	5	21	78	120
p-Isopropyltoluene	5	17	48	150
1,1,1-Trichloroethane	5	24	75	140
1,1,2-Trichloroethane	5	26	49	148
Trichloroethylene	5	19	73	121
Trichlorofluoromethane	5	21	26	152
1,2,3-Trichloropropane	5	37	D	219
1,2,3-Trichlorobenzene	5	22	43	175
1,2,4-Trichlorobenzene	5	22	42	174
1,2,4-Trimethylbenzene	5	21	36	162
1,3,5-Trimethylbenzene	5	19	35	149
Vinyl Chloride	5	50	42	164
o-Xylene	5	21	70	123
m/p-Xylene	5	21	77	135

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Acid and Base Neutral Extractable Semivolatiles by SW846-8270C

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Acenaphthene	330	28	47	145
Acenaphthylene	330	40	33	145
Anthracene	330	32	27	133
Benzo(a)anthracene	330	28	33	143
Benzo(a)pyrene	330	39	17	163
Benzo(b)fluoranthene	330	39	24	159
Benzo(k)fluoranthene	330	32	17	163
Benzo(g,h.i)perylene	330	59	D	195
Bis(2-chloroethoxy)methane	330	35	33	184
Bis(2-chloroethyl)ether	330	38	25	82
Bis(2-chloroisopropyl) ether	330	48	15	84
Bis(2-ethyl hexyl)phthalate	330	46	36	166
4-Bromophenyl phenyl ether	330	23	53	127
Butyl benzyl phthalate	330	23	D	152
2-Chloronaphthalene	330	13	60	118
4-Chlorophenyl phenyl ether	330	33	25	158
Chrysene	330	48	17	168
Dibenzo(a,h)anthracene	330	70	D	227
1,2-Dichlorobenzene	330	31	32	129
1,3-Dichlorobenzene	330	42	D	172
1,4-Dichlorobenzene	330	32	20	124
1,2,4-Trichlorobenzene	330	28	44	122
3,3-Dichloro-benzidine	330	71	D	262
Diethyl phthalate	330	27	D	114
Dimethyl phthalate	330	23	D	112
Di-n-butyl phthalate	330	17	1	118
Di-n-octyl phthalate	330	31	4	146
2,4-Dinitrotoluene	330	22	39	139
2,6-Dinitrotoluene	330	30	50	158
Fluoranthene	330	33	26	137
Fluorene	330	21	19	121
Hexachlorobenzene	330	25	D	152
Hexachloroethane	330	25	40	113
Hexachlorocyclopentadiene	330	46	D	107
Hexachlorobutadiene	330	26	24	116
4-Chloroanaline	330	47	D	102
Indeno(1,2,3-c,d)-pyrene	330	45	D	171
Isophorone	330	63	21	196
2-Nitrophenol	330	35	29	182

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Acid and Base Neutral Extractable Semivolatiles by SW846-8270C

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
4-Nitrophenol	330	47	D	132
Pentachlorophenol	330	49	14	176
Phenol	330	23	5	112
2,4,6-Trichlorophenol	330	32	37	144
2-Methyl- 4,6-Dinitrophenol	330	93	D	181
Pentachlorophenol	330	49	14	176
2-Chloronapthalene	330	13	60	118
4-Chloro-3-methyphenol	330	37	22	147
2-Chlorophenol	330	56	2	144
2,4-Dichlorophenol	330	26	39	135
2,4-Dimethylphenol	330	26	32	119
2,4-Dinitrophenol	330	50	D	191
2-Methyl-4,6-Dinitrophenol	330	93	D	181
Phenanthrene	330	21	54	120
Naphthalene	330	30	21	133
Nitrobenzene	330	39	35	180
N-Nitrosodi-n-propylamine	330	55	D	230
N-Nitrosodi-phenylamine	330	45	12	143
Phenanthrene	330	21	54	120
Pyrene	330	25	52	115
1,2,4-Trichlorobenzene	330	28	44	142

QUALITY ASSURANCE OBJECTIVES FOR ORGANICS IN SOLIDS

Table 3.1D Organics in Solids

Pesticides and PCBS by GC/MS SW846-8270C

Parameter	*MDL (ug/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
Aldrin	660	39	D	166
b-BHC	660	32	24	149
g-BHC (Lindane)	660	22	D	110
4,4'-DDD	660	31	D	145
4,4'-DDE	660	32	4	136
4,4'-DDT	660	62	D	227
Dieldrin	660	31	29	136
Endosulfan sulfate	660	17	D	107
Endrin aldehyde	660	33	D	209
Heptachlor	660	37	D	192
Heptachlor epoxide	660	55	26	155
PCB-1016	1650	15	51	111
PCB-1221	1650	35	63	130
PCB-1232	1650	32	21	165
PCB-1242	1650	21	45	142
PCB-1248	1650	25	38	156
PCB-1254	1650	18	64	110
PCB-1260	1650	17	36	160

QUALITY ASSURANCE OBJECTIVES FOR PCBs in Oils

Table 3.1D Organics in Solids

PCBS by SW846-8081

Parameter	*MDL (mg/kg)*	*Precision (RPD)*	*Accuracy Range (%R)*	
PCB-1016	1	22	41	141
PCB-1221	5	28	15	167
PCB-1232	1	29	18	162
PCB-1242	1	29	40	111
PCB-1248	1	13	38	142
PCB-1254	1	22	29	128
PCB-1260	1	17	28	127

TABLE 3.2 SAMPLE PREPARATION METHODS

Method	Component	Matrix	Preparation For
Metals Preparation			
3005A	Total Recoverable Metals	W	Al, Sb, As, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn
SW846 - 3010A	Total Metals	W	Al, As, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn
SW846 - 3020A	Total Metals by GFAA	W	Be, Cd, Cr, Co, Pb, Mo, Tl,
SW846 - 3031	Digestion of Oils	O	Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Ag, Tl, V, Zn
SW846 - 3040	Dissolution Procedure	O	Sb, Be, Cd, Cr, Cu, Fe, Mn, Ni, V
SW846 - 3050A	Acid Digestion of Solids	S	Al, As, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Os, K, Se, Ag, Na, Tl, V, Zn
SW846 - 3060A	Alkaline Digestion	W,S	Hexavalent Chromium
SW846 - 7470A	Mercury in Waters	W	Mercury
SW846 - 7041A	Mercury in Solids	S, O	Mercury
Inorganic Sample Preparation			
SM4500-NH3 B	Ammonia &TKN Distillation	W, S	Ammonia, TKN
SM 4500-CN- B & C	Cyanides	W	Cyanides, Total & Amenable
SW 846-9013	Cyanide Distillation for Solids and Oils	S, O	Cyanide, Total
SM 4500-P B	Phosphorus	W	Phosphorus, Total
SM 5530 B	Phenols	W	Phenols, Total - O&G and Tar Removal, and Distillation
SW 846-9030B	Distillation for Sulfides	W, S	Sulfides, Total
SW 846-9031	Extractable Sulfides	S	Sulfides, Extractable
SW 846-Vol IC, Ch 7, Sec 7.3.3.2, Rev 3 12/96	Hydrogen Cyanide Release	W, S	Hydrogen Cyanide Release
SW 846-Vol IC, Ch 7, Sec 7.3.3.2, Rev 3 12/96	Hydrogen Sulfide Release	W, S	Hydrogen Sulfide Release
SW 846-9214	Distillation Procedure for Fluoride	W, S(modified)	Fluorides
SW 846-3580A	Extraction/Dilution of Solids for Water Soluble Analytes	S	Alkalinity, Chloride, Sulfate, Nitrate, Nitrite

TABLE 3.2 SAMPLE PREPARATION METHODS

Method	Component	Matrix	Preparation For
Organic Preparation			
SW846 - 3500B	*Organic Extraction*		
SW846 - 3510C	Liquid/Liquid Extraction	W	SW846 - 8270C, 8081, 8082, 9070
SW846 - 3520C	Liquid/Liquid Extraction	W	SW846 - 8270C, 8081, 8082
SW846 - 3540C	Soxhlet Extraction	S	SW846 - 9071A
SW846 - 3550B	Ultrasonic Extraction	S	SW846 - 8270C, 8081, 8082
SW846 - 3580A	Waste Dilution	S, O	SW846 - 8270C, 8082
SW846 - 5030B	Purge and Trap	W, S, O	SW846 - 8015B, 8021B, 8260B
Organic Clean-up Procedures			
SW846 - 3600A	*Clean-up*		
SW846 - 3620A	Florisil Clean-up	W,S	SW846 - 8082
SW846 - 3630A	Silica Gel Clean-up	W,S,O	SW846 - 8100, 8270C
SW846 - 3650A	Acid-Base/Neutal Partion	W,S,O	SW846 - 8270C
SW846 - 3660A	Sulfur Clean-up	W,S,O	SW846 - 8082, 8270C
TCLP			
1311*	TCLP	W,S,O	TCLP Extractions

Matricies:
W = Waters
S = Solids, Soils, Sludges
O = Oils, Greases, Petroleums, Waxes

4.0 SAMPLING PROCEDURES

Prism Laboratories provides an array of sampling services as outlined in this section. Prism utilizes two primary documents for guidance in sampling procedures: EPA Region IV's "Standard Operating Procedures and Quality Assurance Manual" (2/91) and the Florida Department of Environmental Protection's "Standard Operating Procedures for Laboratory Operations and Sample Collection Activities" (9/92). The rules and regulations of the state in which sampling occurs will be followed for individual sampling projects. Prism's sampling capabilities and equipment are listed in the following sections.

4.1 SAMPLING CAPABILITIES

Parameter Group	Sample Source
Extractable organics	Drinking water, surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), soils, and air
Volatile organics	Drinking water, surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), soils, and air
Metals	Drinking water, surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), and soils
Inorganic Anions	Drinking water, surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), and soils
Organics (BOD, Oil & Grease)	Drinking water, surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), and soils
Physical Properties	Drinking water, surface water, groundwater, wastewater (sediments, domestic sludges, haz waste [liquid and sludges], and soils, where applicable)
Cyanide	Surface water, groundwater, wastewater, sediments, domestic sludges, haz waste (liquid and sludges), and soils

4.2 SAMPLING EQUIPMENT

Matrix	Equipment	Construction	Use	Parameter Groups
Groundwater	Bailer	Stainless Steel, Teflon	Purging & Sampling	All param. groups
	Submersible Pump	Stainless Steel, Teflon	Purging Sampling	All param. groups All param. groups, except VOCs
	1.0 µm Filtration Units	N/A	Filtering dissolved constituents	Metals
	0.45 µm Filtration Units	N/A	Filtering dissolved constituents	Demands, Nutrients
Surface water	Sample bottle	Glass Plastic	Grab sampling Grab sampling	All param. groups Inorganic parameters
	Bailer	Stainless Steel, Teflon	Grab sampling	All param. groups
	0.45 µm Filtration Units	N/A	Filtering dissolved constituents	All dissolved parameters
Wastewater	ISCO autosamplers	Stainless Steel, Teflon, glass	Grab & Composite sampling	All param. groups (with some restrictions on params. for compositing)
	Sample bottle	Glass Plastic	Grab sampling Grab sampling	All param. groups Inorganic parameters
	0.45 µm Filtration Units	N/A	Filtering dissolved constituents	All dissolved parameters
Drinking Water	Sample bottle	Glass Plastic	Grab sampling Grab sampling	All param. groups Inorganic parameters
Sediments/soils	Scoop, spoon	Stainless Steel	Sampling & Compositing	All param. groups; VOCs may not be taken from composite samples
	Mixing tray	Stainless Steel	Compositing & Homogenizing	All param. groups; VOCs may not be taken from composite samples
	Hand auger, shovel	Stainless Steel	Sampling	All param. groups
	Shelby tube	Stainless Steel	Sampling	All param. groups
Sludges & Hazardous Waste	Drum Thief	Glass	Sampling	All param. groups
	Coliwasa tube	Glass	Sampling	All param. groups
	Sludge Judge	Plastic	Sampling	All inorganic parameters
	Sludge sampler	Stainless Steel	Sampling	All param. groups
Air	Air Pump	Plastic	Sampling	Organics (volatile and semivolatile)
	Carbon tubes	Charcoal/Glass	Sampling	Organics (volatile and semivolatile)

4.2 SAMPLING EQUIPMENT (continued)

	Equipment	Use
Misc. Equipment	Cooler with wet ice and insulation	Sample transportation and preservation
	Tape measures, water level indicator, monofilament, latex gloves, glasses, protective jacket/smock	Miscellaneous, expendable and protective gear
	Documents Kit: COCs, analysis request forms, sampler's log, indelible markers	Documentation
	Preservatives Kit: Reagent grade $Na_2S_2O_3$, H_2SO_4, NaOH, HCl, and HNO_3 in glass bottles, disposable glass pipettes, narrow range pH paper	Sample preservation
	Decon Kit: Pesticide grade isopropanol in glass or teflon container, lab water in HDPE carboy, plastic wash buckets, Alconox® premixed in HDPE carboy, Liquinox®, lab brushes	Decontamination
	Waste Kit: Heavy-duty plastic garbage bag, reinforced cardboard box, solvent waste bottle, purge waste containers	Waste disposal, containment, and transportation
	pH meter	Measuring pH
	pH standards	Calibrating meter
	Thermometer	Measuring temperature
	Conductivity meter	Measuring conductivity
	Conductivity standards	Calibrating meter
	DO meter	Measuring dissolved oxygen
	OVA	Organic Vapor Analyzer; rented as needed
	OVA standards	Calibrating OVA

4.3 SAMPLE CONTAINER CLEANING PROCEDURES

Prism Laboratories provides precleaned sample containers which are certified by the manufacturer as being cleaned to EPA requirements for the parameters for which they will be used.

4.4 SAMPLE PRESERVATION. HOLDING TIMES AND CONTAINER TYPE

Sample preservation, holding times, and container types are provided in accordance with federal and state regulations (40CFR Parts 136 and 141, as well as EPA-SW-846).

4.5 SAMPLE DISPATCH

Sample kits are prepared by the laboratory, with sample containers prepreserved (unless requested otherwise). Sample containers are packed to reduce the chance of bottle breakage and further cross-contamination concerns. Kits may be sent to the client via standard ground or air express carriers, or held for customer pick-up. A system is in place to help expedite the kit preparation procedure and to help reduce errors in taking customer requests. See Section 5.2 for further information concerning kit preparation and other sample custody considerations.

4.6 FIELD REAGENT STORAGE AND WASTE DISPOSAL

Laboratory reagent storage and waste disposal is discussed in Section 6 of this QAP. Protocols for field reagent storage and transportation are followed per the EPA and Florida DEP SOP guidelines.

5.0 SAMPLE CUSTODY AND DOCUMENTATION

Sample custody is maintained if a sample is found to be in any of the following states:

- It is in a sampler's or transferee's physical possession.
- It is in a sampler's or transferee's view, after being in his/her physical possession.
- It has been secured by the sampler or transferee to prevent tampering.
- It has been placed in a secured area, with access limited to certain individuals.

5.1 CHAIN-OF-CUSTODY

Chain-of-Custody is a system of procedures and documentation utilized to track the possession of a sample and to help ensure its integrity. This system incorporates certain procedures, such as the signing for and securing of sample containers as they arrive into the laboratory. For purposes of this discussion, there are two basic levels of Chain-of-Custody provided by this laboratory: ***Routine or Simple*** *Chain-of-Custody*, and ***Legal or Evidentiary*** *Chain-of-Custody*. Prism Laboratories operates under routine chain-of-custody protocols, as discussed below. If legal chain-of-custody procedures are required for a project, Prism is equipped to provide this service; however, arrangements must be made with the laboratory prior to kit preparation and sampling.

5.1.1 ROUTINE CHAIN-OF-CUSTODY

For the majority of environmental sampling plans, routine chain-of-custody, as defined in this section, should be adequate for the tracking and assessment of sample custody and disposition from the initial sampling through the reporting of analytical results. The primary instrument used by Prism for documenting a sample's custody is the Chain-of-Custody Form, or COC. Routine chain-of-custody procedures generally begin at time of sample collection. Once sampling has been completed, the sampling crew should sign the COC (as relinquishing samples), re-pack the kit, and return the cooler to the laboratory.

Upon receipt by the laboratory, the kit is opened and checked for sample integrity, the COC is signed (as being received by the laboratory), and a copy of the COC is given to the client as a record for receipt of the samples by the lab.

Once the requested analyses are completed, the final sample report is prepared, and sent to the client with another copy of the COC.

5.1.1 ROUTINE CHAIN-OF-CUSTODY (continued)

Other documents used to assess a sample's custody are the sample bottle label, the sample log-in logbook and worksheet, the analytical and instrument logbooks, and any raw data printouts. All of these documents are used to assess the chain-of-custody under routine laboratory operation.

Examples of chain-of-custody documentation are presented at the end of this section as follows:

Figure 5.1 - Prism Chain-of-Custody
Figure 5.2 - Sample Log-In Logbook
Figure 5.3 - Sample Log-In Worksheet
Figure 5.4 - Example of Analytical Logbook

5.1.2 LEGAL CHAIN-OF-CUSTODY

Legal chain-of-custody, as defined here, is a system of procedures and documentation utilized to record and track the possession of a sample, in order to provide legally defensible evidence in a court-of-law. All individuals physically possessing the sample must as such by recording the date and time of possession and signing the chain-of-custody. The primary concern in legal custody issues is the matter of identifying opportunities for which the raw sample may be tampered with or altered. The key difference between *routine* and *legal* sample chain-of-custody is the requirement that **all** individuals must document possession for legal chain-of-custody, including every employee in the laboratory. It can be argued that a sample, which is physically located at the laboratory facility, is secured and maintained by capable hands, and that opportunities for tampering with it (presumably by individuals outside of the facility), would be held to an extreme minimum. Tampering by individuals within the company, for all practical purposes, may be possible under either chain-of-custody protocol. For these reasons, routine chain-of-custody procedures, as practiced by Prism Laboratories, should be sufficient for standard sample tracking and quality assurance purposes.

5.2 LABORATORY CUSTODY PROCEDURES

Sample custody procedures can be better understood by observing a sample's path through the laboratory (see Figure 5.5, Workflow Diagram). Several key individuals are responsible for the integrity and security of clients' samples. Following are some of these individuals, who play vital roles in helping assure that samples are properly identified, analyzed, and maintained:

- Sample Custodian - This individual is the primary person responsible for the receipt, log-in, and storage of samples. This person also may identify problems incurred during the sampling, preservation, and shipment of samples. Subsequently, the sample custodian may notify the client or alert other laboratory personnel as to these problems.

5.2 LABORATORY CUSTODY PROCEDURES (continued)

- Departmental Supervisors - These individuals check to ensure that every project is logged in to the Laboratory Information Management System (LIMS) correctly. Any problems encountered are discussed with the appropriate personnel, and the information in the LIMS is corrected by the supervisor or the sample custodian. Supervisors are also responsible for helping with the implementation and oversight of chain-of-custody procedures within their individual departments.

- Laboratory Analysts and Technicians - Each analyst and technician is responsible for maintaining sample integrity during the course of the sample's route through the laboratory system. Each analyst and technician is instructed in the techniques necessary for proper sample handling and storage.

- Quality Assurance Manager - This individual is responsible for defining, documenting, implementing, and auditing the procedures used by the laboratory in order to maintain proper chain-of-custody.

- Laboratory Director - This individual is ultimately responsible for the implementation and oversight of the entire laboratory system, helping assure that the proper procedures are in place and effectively monitored, in order to maintain sample and data integrity.

5.2.1 SAMPLE KIT PREPARATION

When a client requests sample bottles from the laboratory, the employee taking the request is instructed to identify and record the necessary information for sample kit preparation. The information can be recorded on a Sample Kit Prep/Pick-up Request form (see Figure 5.6). This form is then sent to the Kit Preparation area, where the kit is prepared accordingly. The sample containers are assembled, along with a blank Chain-of-Custody Form, and the entire kit is prepared for shipment or customer pick-up. In most cases, bottles are pre-preserved by our facility, during the sample kitting procedure. In the event that preservation may need to be performed in the field (for example, when sampling chlorinated supplies), a preservatives kit is supplied, along with instructions for proper sample collection and preservation.

5.2.2 SAMPLE RECEIPT

The samples are unpacked and the Chain-of-Custody is signed by the person receiving the samples for the laboratory. A log-in worksheet is completed, where integrity information and special instructions are recorded. If discrepancies are observed, the samples are stored, and appropriate laboratory personnel (supervisors, QA manager, lab director) are notified. The laboratory then notifies the client as to the discrepancies and awaits the client's instructions. Further action is entirely at the discretion of the client and will be noted on the final data report.

5.2.3 SAMPLE LOG-IN

If samples are intact and no apparent discrepancies are noted, the samples are then logged into the Laboratory Information Management System (LIMS) as a login group. A *login group* is defined as the set of samples received in a single, distinct group, which generally coincides with a single project for a single client (which is usually further identified by separate COCs).

At the time of computer entry, a record is also maintained in the login logbook, in order to maintain appropriate tracking documentation, in the event that the computer system goes down. Once the samples have been logged into the LIMS, the sample custodian prints out a summary of the login group (referred to by the LIMS as a "Backlog Report"), which enumerates the analyses requested for each sample, as they have been entered into the LIMS. The backlog, COC, and Sample Log-In Worksheet are attached to each other and submitted to the appropriate laboratory supervisors for their approval. If no errors have been identified in the logging-in of their department's samples, the Log-In Worksheet is initialed by the supervisors and returned to a project folder, which is maintained for each individual login group.

Once samples have been logged into the LIMS, sample bottle labels are printed and affixed to the appropriate sample bottles.

5.2.4 SAMPLE STORAGE

Sample containers are held temporarily in the Log-In Cooler, until they are moved to their appropriate final storage space.

All non-volatile samples are stored on a designated shelf of the walk-in cooler. Samples for volatile analyses are stored in an isolated refrigerator.

A specific area is designated for legal chain-of-custody samples, for which limited access is available.

5.2.5 SAMPLE DISTRIBUTION AND TRACKING

Backlogs are generated for each department of the laboratory. These backlogs indicate which analyses are required for the individual samples, as well as other pertinent information, such as sample receipt date, login group number, and sample storage location. The analyst uses the backlogs to schedule daily activities and prioritize short-hold time and rush analyses.

The LIMS assigns a unique, sequential ID to each sample. The numbering scheme is a code of two uppercase letters, followed by five numbers in the form of: AA#####. The system starts at AA00001, continues through AA99999, then rolls over to AB00000, and so on. This scheme allows for 6,759,999 uniquely designated samples.

5.2.5 SAMPLE DISTRIBUTION AND TRACKING (continued)

To help track a group of samples that arrives at the laboratory together, a login group number is also assigned and linked to all the individual samples in that group. As an example, a client may submit four samples for Volatiles by GC (EPA 601/602) analysis. The LIMS will generate four unique, sequential ID numbers, such as AA31202, AA31203, AA31204, and AA31205. Subsequently, the person logging in the samples will further assign a login group number, in the form of ####A# (e.g., 6543A4). The first five characters are assigned sequentially. Any designation after the letter indicates how many samples are in the login group. The system starts at 0001A# through 9999A#, then rolls over to 0000B#. This scheme allows for 259,999 uniquely designated login groups.

The assignment of login group helps track the entire group of samples through the laboratory together. Most of the computer-generated forms, including the final sample report, are created by using this link. The LIMS also offers other tracking features, such as cross-reference searching of virtually all the data recorded in the LIMS, such as date received, date sampled, analysis requested, and client name.

Once the analyst has completed a specific analysis, results are checked by a supervisor (or a peer in the event that a supervisor performed the analysis), entered into the data entry portion of the LIMS, and the analyst makes a photocopy of the raw data to be included in the project file. From the data entry step, the sample's results are forwarded to the data validation portion of the LIMS. Here, the laboratory director checks all LIMS-recorded results against the raw data included in the project folder. Once the director is finished reviewing the data, the results are forwarded to the report generation module, then the invoicing module. See Figure 5.5 for an overview of a sample's path through the laboratory.

5.2.6 INTERLABORATORY CUSTODY

All samples sent to other laboratories are sent with interlaboratory chain-of-custody forms. Sample information supplied by our client is transferred to this interlab COC, with the exception of client name, address, project, or sample site ID. In place of this confidential information, we supply our Login Sample Number to the subcontracted laboratory. At no time will confidential client information be supplied to anyone other than a designated representative of that client.

5.3 ELECTRONIC DATA RECORDS

Various areas of the laboratory generate electronic data, including the sample login and organics instrumentation areas. The most vital records for each area are also printed to hardcopy. All GC and GC/MS electronic data are archived to a tape backup system. Archived tapes are held for a minimum of three years. The LIMS is archived each night, with the previous day's tape held off-site each night. Occasionally, the LIMS is archived to reduce the number of active records in the system (in order to increase system performance). These are archived to computer disks, filed chronologically by sample ID number, and stored in a fireproof cabinet.

Figure 5.1 - Prism Chain-of-Custody

PRISM LABORATORIES, INC.

Full Service Analytical & Environmental Solutions

CHAIN OF CUSTODY RECORD

449 Springbrook Road ▲ Charlotte, NC 28217
P.O. Box 240543 ▲ Charlotte, NC 28224-0543
Phone: 704/529-6364 ▲ Fax: 704/525-0409

PRESS DOWN FIRMLY - 3 COPIES

Client
Address
Phone

Report To
Bill To
P.O.#/Billing Reference
Project Name

Lab Location Requested for Certified Analysis NC ___ SC ___ Other ___
Water Chlorinated Yes ___ No ___ NA ___
Sample Iced Upon Collection Yes ___ No ___
Requested Due Date

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW*	NO.	SIZE	PRESERVATIVES	ANALYSES REQUESTED						REMARKS	SUB LAB CERT. ID NO.	PRISM LAB ID NO.

Sampler's Signature ___ Sampled By (Print Name) ___ Affiliation ___

Relinquished By: (Signature) ___ Received By: (Signature) ___ Date ___ Military Hours ___ Additional Comments:

Relinquished By: (Signature) ___ Received By: (Signature) ___ Date ___

Relinquished By: (Signature) ___ Received For Prism Laboratories By: ___ Date ___

Method of Shipment: ___ Date ___

NPDES: NC ___ SC ___ OTHER ___ UST: NC ___ SC ___ OTHER ___ GROUNDWATER: NC ___ SC ___ OTHER ___ DRINKING WATER: NC ___ SC ___ OTHER ___ SOLID WASTE: NC ___ SC ___ OTHER ___ OTHER: NC ___ SC ___ OTHER ___

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

ORIGINAL

Figure 5.2 - Sample Log-In Logbook

PRISM

Sample Login Logbook

Group #	Customer Name	Prism ID #	Cust. Project ID	Date Rec'd	Initials	Inv. Date	Inv. #	Comments

Logbook # Q003

Figure 5.3 - Sample Log-In Worksheet

PRISM

Sample Log-In Worksheet

Client Name: LIMS Sample ID#:

Date Sample(s) Received:

Date Samples(s) Collectbd: Log-In Group #:

✓✓✓ LOGIN REVIEW ✓✓✓

Inorganics	Date	GC	Date	GC/MS	Date
Log-in	Date	Field	Date	QA	Date

Please check log-in computer report against chain-of-custody for accuracy prior to initialing.
If sample integrity is suspect, please contact client and document the conversation below.

SAMPLE RECEIPT CHECKLIST

				COMMENTS
Samples PROPERLY PRESERVED?	Y	N	n/a	
Samples INTACT upon arrival?	Y	N	n/a	
Samples received ON WET ICE?	Y	N	n/a	
VOLATILES rec'd WITHOUT HEADSPACE?	Y	N	n/a	
Samples received WITHIN HOLDING TIME?	Y	N	n/a	
Samples received with CUSTODY SEALS INTACT?	Y	N	n/a	

SPECIAL COMMENTS OR INSTRUCTIONS

SUBCONTRACTED ANALYSES

Analysis	Subcontractor	Date Sent	Initial

Figure 5.4 - Example of Analytical Logbook

Lead, Pb

PRISM

Date: Instrument: Analyst:

Batch ID(s): Wavelength: Checked by:

Method: FL: 239.1/7420; GF: 239.2/7421 Slit: Reported by:

Sample	Time	Abs. or Conc.	Final mL	Initial mL or g	Dilutions	% Solids	µg/L or µg/kg	mg/L or mg/kg	Reported Value

	A spike conc. (ppm)	B amt. spiked (mL)	C mL or g of sample used	D % solids (xx%)	E SPK result (ppb)	F ORIG result (ppb)	%R	%R Limits	RPD	RPD Limit
MS								-		
MSD								-		
BS								-		

Logbook # M036

Figure 5.5 - Sample/Data Workflow

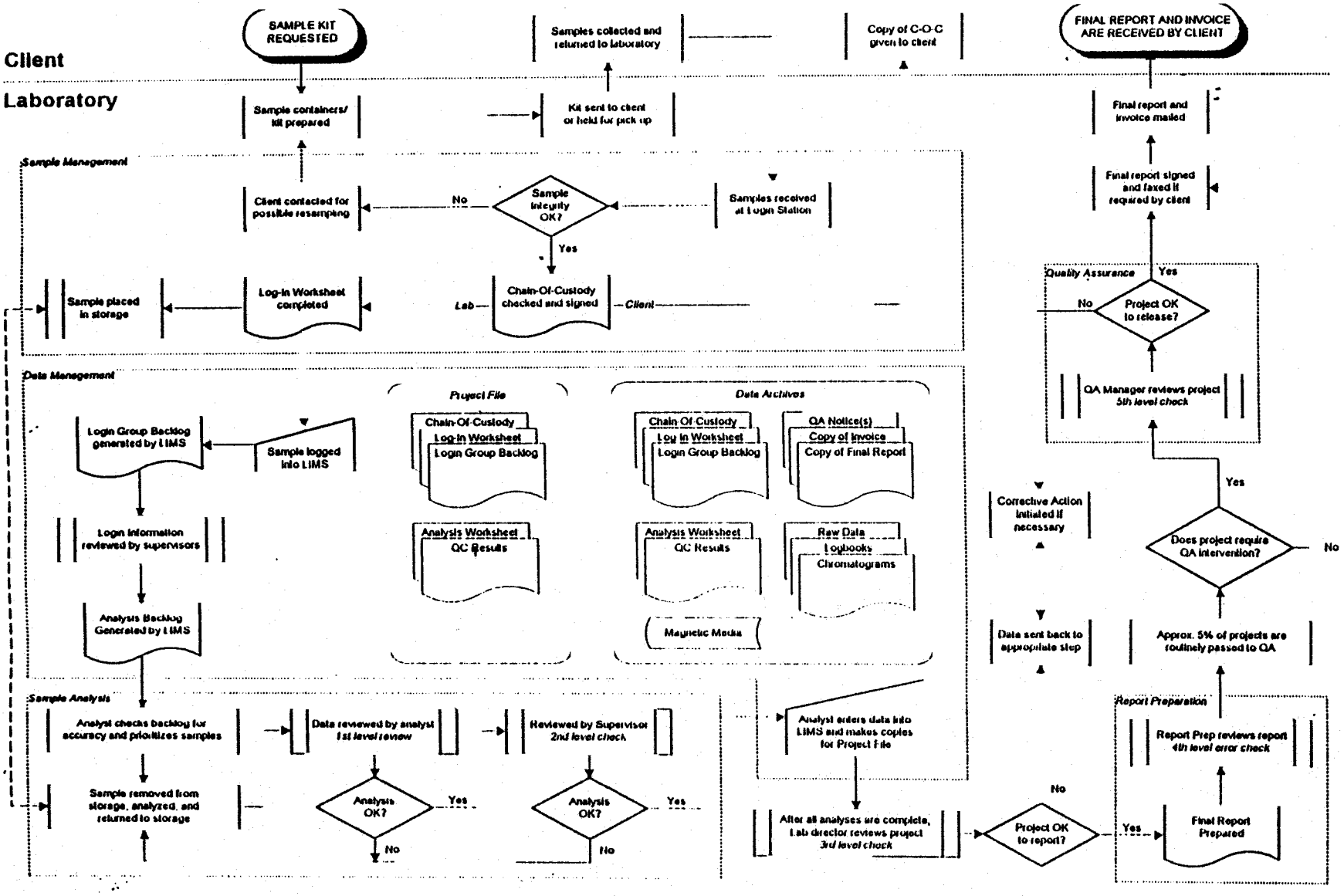


Figure 5.6 - Sample Kit Prep/Pick-Up Request Form

PRISM LABORATORIES, INC.

Sample Kit Prep/Pick-Up Request

Today's Date: | Your Initials:

Person Requesting the Kit or Pick-Up:

Their Company:

Their Project Name or Number:

To be completed at time of kit preparation

Number of Samples	Analyses Requested	Sample Matrix	Chlorinated?*	Bottles Supplied (quantity & type)	Preservatives
		water soil		1-L 32-oz. Amber-G 16-oz. 9-oz. Clear-G 8-oz. 4-oz. Plastic 40-mL VOA Collect	HNO_3 HCl H_2SO_4 NaCH $Na_2S_2O_3$ *none*
		water soil		1-L 32-oz. Amber-G 16-oz. 9-oz. Clear-G 8-oz. 4-oz. Plastic 40-mL VOA Collect	HNO_3 HCl H_2SO_4 NaCH $Na_2S_2O_3$ *none*
		water soil		1-L 32-oz. Amber-G 16-oz. 9-oz. Clear-G 8-oz. 4-oz. Plastic 40-mL VOA Collect	HNO_3 HCl H_2SO_4 NaCH $Na_2S_2O_3$ *none*
		water soil		1-L 32-oz. Amber-G 16-oz. 9-oz. Clear-G 8-oz. 4-oz. Plastic 40-mL VOA Collect	HNO_3 HCl H_2SO_4 NaCH $Na_2S_2O_3$ *none*

* - check this column if aqueous sample is from a chlorinated source. Sample may require sodium thiosulfate ($Na_2S_2O_3$) preservation.

When do they need the kit or pick-up?

☐ They need bailers

TRANSPORTATION | hold for pick-up: | ship UPS ( ) | we'll deliver

Special Instructions/Extra Equipment Requested/Comments:

Kit prepared by (Init&Date):

6.0 ANALYTICAL PROCEDURES

6.1 ANALYTICAL METHODS

Refer to the tables in Section 3 for analytical method used in this laboratory.

6.2 GLASSWARE CLEANING PROCEDURES

6.2.1 VOLATILE ORGANICS DEPARTMENT

All glassware associated with volatile organic analysis are soaked in detergent (Alconox®), scrubbed, rinsed with tap water, rinsed with deionized water, and baked dry in an isolated oven separated from other glassware which have been in contact with solvents. A methanol rinse after use and prior to soaking may also be necessary.

6.2.2 SEMIVOLATILE ORGANICS DEPARTMENT

All glassware associated with extractable organic analyses are soaked in detergent, scrubbed, rinsed with tap water, rinsed with deionized water, rinsed with acetone, and baked dry. Following drying, all glassware are capped with aluminum foil and stored. All extractable glassware are rinsed with the solvent to be used in the extraction prior to introducing the sample. Solvent rinsing prior to soaking is appropriate if necessary.

6.2.3 METALS DEPARTMENT

All metals glassware are rinsed with tap water and soaked in detergent (Alconox®), scrubbed, rinsed with tap water, rinsed with deionized water, and soaked in a solution of 1:1 nitric acid. The glassware are then rinsed with distilled water and stored in a cabinet designated for metals glassware.

6.2.4 WET CHEMISTRY DEPARTMENT

Wet chemistry glassware are rinsed with tap water, soaked in detergent, rinsed with tap water, and rinsed with deionized water. Care is taken to isolate the nutrient glassware from nitric acid exposure. The glassware are then stored in drawers and cabinets located in the wet chemistry department.

Note: All Class-A volumetric glassware are air dried— never baked in an oven.

6.3 LAB REAGENT STORAGE

All reagents and standards are dated upon receipt. When opened, the containers are initialed and dated by the analyst. (See Table 6.1 for Storage Information.)

6.4 WASTE DISPOSAL

The following protocols are observed when disposing of hazardous waste from the laboratory:

I. Summary:	Prism Labs has completed the requirements of laboratory in-house hazardous and non-hazardous waste management per EPA guidelines. This includes furnishing materials, safety equipment, and expertise necessary for the classification and manifesting for the removal of waste from the facility.
II. Waste Preparation:	All wastes are prepared to meet EPA guidelines for containment of laboratory wastes for disposal.
III. Packaging:	Hazardous wastes are packaged in containers meeting EPA and DOT specifications for storage and shipment.
IV. Labeling:	Before containers are used, they are labeled to assure proper use of the container. Once a container is full, it is securely closed and proper shipment labels are applied to each container.
V. Characterization:	Once a container is full, the contents are analyzed according to disposal requirements of the transportation company and the disposal site.
VI. Manifesting:	For all hazardous waste shipped by the facility, a manifest is prepared according to EPA, DOT, and transporter requirements.
VII. Non-hazardous Waste:	Non-hazardous wastes are disposed into the sanitary sewer according to local regulations and restrictions.

TABLE 6.1 CHEMICAL INVENTORY & STORAGE LOCATION

Chemical Name	Storage Location
Acenaphthene	Wet Lab Storage Shelf
Acenaphthylene	Wet Lab Reagent Shelf
Acetic Acid	Vented Hood
Acetone	Vented Flammables Cabinet
Alizarin Yellow R, 0.5% pH Indicator	Wet Lab Reagent Shelf
Alumina, Activated	Wet Lab Reagent Shelf
Aluminum Oxide	Wet Lab Reagent Shelf
Aluminum Sulfate	Wet Lab Reagent Shelf
Aminoantipyrine	Wet Lab Reagent Shelf
Ammonium Chloride	Wet Lab Reagent Shelf
Ammonium Citrate	Wet Lab Reagent Shelf
Ammonium Hydroxide	Vented Hood
Ammonium Oxalate	Wet Lab Reagent Shelf
Ammonium Phosphate	Wet Lab Reagent Shelf
Ammonium Sulfate	Wet Lab Reagent Shelf
Amylose	Wet Lab Reagent Shelf
Anthracene	Wet Lab Reagent Shelf
Ascorbic Acid	Wet Lab Reagent Shelf
Barbituric Acid	Wet Lab Reagent Shelf
Barium Chloride Dihydrate	Wet Lab Reagent Shelf
Barium Hydroxide	Wet Lab Reagent Shelf
Benzene	Vented Flammables Cabinet
Bismuth (III) Nitrate	Wet Lab Reagent Shelf
Boron Trifluoride	Vented Flammables Cabinet
Bromophenol Blue	Wet Lab Reagent Shelf
Cadmium Acetate	Wet Lab Reagent Shelf
Cadmium Nitrate Tetrahydrate	Wet Lab Reagent Shelf
Calcium Carbonate	Wet Lab Reagent Shelf
Calcium Chloride Dihydrate	Wet Lab Reagent Shelf
Calcium Hypochlorite	Wet Lab Reagent Shelf
Calcium Oxide	Wet Lab Reagent Shelf
Calmagite, Indicator Grade	Wet Lab Reagent Shelf
Cellosolve Solvent	Vented Flammables Cabinet
Cesium Chloride	Wet Lab Reagent Shelf
Chloramine-T	Wet Lab Reagent Shelf
Chlorobenzene	Vented Flammables Cabinet
Chromium Trioxide	Vented Flammables Cabinet
Clear Bath	Wet Lab Reagent Shelf
Copper Metal	Wet Lab Reagent Shelf
Copper Metal (shot)	Wet Lab Reagent Shelf
Cupric Sulfate	Wet Lab Reagent Shelf
Cyclohexane	Vented Flammables Cabinet
Dichloromethane	Vented Flammables Cabinet
Diphenylcarbazone Reagent	Wet Lab Reagent Shelf

TABLE 6.1 CHEMICAL INVENTORY & STORAGE LOCATION (continued)

Chemical Name	Storage Location
Ethyl Acetate	Vented Flammables Cabinet
Ethyl Alcohol	Vented Flammables Cabinet
Ethyl Ether	Vented Flammables Cabinet
Ethylbenzene	Vented Flammables Cabinet
Ethylenediaminetetra Acetic Acid	Wet Lab Reagent Shelf
Ferrous Ammonium Sulfate (Solid)	Wet Lab Reagent Shelf
Ferrous Ammonium Sulfate (Liquid)	Wet Lab Reagent Shelf
Fluoranthene	Wet Lab Reagent Shelf
Fluorene, 98%	Wet Lab Reagent Shelf
Formaldehyde	Vented Flammables Cabinet
Glycerol	Wet Lab Reagent Shelf
Hexadecane	Vented Flammables Cabinet
Hexane	Vented Flammables Cabinet
Hydrochloric Acid	Vented Hood
Hydrogen Sulfide Water	Wet Lab Reagent Shelf
Hydroquinone	Wet Lab Reagent Shelf
Hydroxylamine Hydrochloride	Wet Lab Reagent Shelf
Iodine	Wet Lab Reagent Shelf
Kaliumhydrogenphthalat	Wet Lab Reagent Shelf
Lead Acetate Crystal	Wet Lab Reagent Shelf
Magnesium Chloride Hexahydrate	Wet Lab Reagent Shelf
Magnesium Nitrate Hexahydrate	Wet Lab Reagent Shelf
Mercury	Vented Flammables Cabinet
Mercury (III) Nitrate Monohydrate	Wet Lab Reagent Shelf
Methyl Ethyl Ketone	Vented Flammables Cabinet
Methyl Red	Wet Lab Reagent Shelf
n-Pentane	Vented Flammables Cabinet
Naphthalene	Wet Lab Reagent Shelf
Nickel Nitrate Hexahydrate	Wet Lab Reagent Shelf
Nitric Acid	Vented Hood
o-Dichlorobenzene	Vented Flammables Cabinet
Orange IV	Wet Lab Reagent Shelf
p-Dichlorobenzene	Vented Flammables Cabinet
Petroleum Ether	Vented Flammables Cabinet
Phenanthrene	Wet Lab Reagent Shelf
Phenolphthalein	Wet Lab Reagent Shelf
Phenylarsine Oxide	Wet Lab Reagent Shelf
Phenylazoformic Acid 2-phenylhydrazide	Wet Lab Reagent Shelf
Phosphoric Acid	Vented Hood
Potassium Chloride	Wet Lab Reagent Shelf
Potassium Chromate	Wet Lab Reagent Shelf
Potassium Cyanide	Wet Lab Reagent Shelf
Potassium Dichromate	Wet Lab Reagent Shelf
Potassium Ferricyanide	Wet Lab Reagent Shelf
Potassium Fluoride	Wet Lab Reagent Shelf
Potassium Fluoride	Wet Lab Reagent Shelf
Potassium Hydroxide	Wet Lab Reagent Shelf

TABLE 6.1 CHEMICAL INVENTORY & STORAGE LOCATION (continued)

Chemical Name	Storage Location
Potassium Iodate	Wet Lab Reagent Shelf
Potassium Permanganate	Wet Lab Reagent Shelf
Potassium Persulfate	Wet Lab Reagent Shelf
Propyl Alcohol	Vented Flammables Cabinet
Pyrene	Wet Lab Reagent Shelf
Pyridine	Vented Hood
Rhodamine B Base	Wet Lab Reagent Shelf
Silica Gel	Wet Lab Reagent Shelf
Silicon	Wet Lab Reagent Shelf
Silver Acetate	Wet Lab Reagent Shelf
Silver Nitrate	Wet Lab Reagent Shelf
Sodium Acetate	Wet Lab Reagent Shelf
Sodium Bicarbonate	Wet Lab Reagent Shelf
Sodium Borohydrate	Wet Lab Reagent Shelf
Sodium Borohydride	Wet Lab Reagent Shelf
Sodium Carbonate	Wet Lab Reagent Shelf
Sodium Chloride	Wet Lab Reagent Shelf
Sodium Fluoride	Wet Lab Reagent Shelf
Sodium Formate	Wet Lab Reagent Shelf
Sodium Hydroxide	Wet Lab Reagent Shelf
Sodium Molybdate Dihdrate	Wet Lab Reagent Shelf
Sodium Nitrate	Wet Lab Reagent Shelf
Sodium Phosphate Monobasic Monhydrate	Wet Lab Reagent Shelf
Sodium Salicylate	Wet Lab Reagent Shelf
Sodium Sulfide	Wet Lab Reagent Shelf
Sodium Thiosulfate	Wet Lab Reagent Shelf
Stannous Chloride	Wet Lab Reagent Shelf
Starch Indicator	Wet Lab Reagent Shelf
Sulfamic Acid	Wet Lab Reagent Shelf
Sulfanilamide	Wet Lab Reagent Shelf
Sulfuric Acid	Vented Hood
Tetrabutylammonium Hydrogen Sulfate	Wet Lab Reagent Shelf
Tin (II) Chloride Dihydrate	Wet Lab Reagent Shelf
Toluene	Vented Flammables Cabinet
Total Ionic Strength Adjustment Buffer	Wet Lab Reagent Shelf
Trichloroethylene	Vented Flammables Cabinet
Urea	Wet Lab Reagent Shelf
Xylene Cyanole	Wet Lab Reagent Shelf
Xylenes	Vented Flammables Cabinet
Zinc	Wet Lab Reagent Shelf
Zinc Acetate	Wet Lab Reagent Shelf
Zinc Sulfate	Wet Lab Reagent Shelf

TABLE 6.2 GENERAL REAGENT/SOLVENT STORAGE BY DEPARTMENT

Chemical	Method of Storage
ORGANICS DEPARTMENT -	
Methylene Chloride Trichlorofluoromethane	Solvent storage cabinet (non-flammables storage)
Acetone	(flammables storage)
Diethyl Ether	Freezer (-20 to -10 °C)
Standards	Freezer (-20 to -10 °C) (separate freezer for volatiles and semivolatiles)
Silica Gel	Oven (170 °C)
Sodium Sulfate	Oven (170 °C)
INORGANICS DEPARTMENT -	
Nitric Acid Sulfuric Acid Hydrochloric Acid Perchloric Acid	Acid Storage Cabinet
Standards	Isolated, air conditioned storage area
Hydrogen Peroxide	freezer (-20 to -10 °C)
WET CHEMISTRY DEPARTMENT -	
Acids	Acid Storage Cabinet
Standards	Refrigerator, 2 to 6 °C (if required)
Reagents (dry)	Chemical Storage shelves
Reagents (wet)	Refrigerator, 2 to 6 °C (if required)

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 EQUIPMENT LIST

A list of laboratory equipment, including instrumentation which requires calibration, can be found in Table 7.1. Field equipment is detailed in Section 4.2 of this plan.

7.2 STANDARD RECEIPT AND TRACEABILITY

Standards are received by the appropriate department supervisor and are initialed and dated at the time of receipt. All manufacturers' paperwork associated with each standard is filed in each area's Certificates of Analysis binder. All standards, when opened are initialed and dated by the analyst.

Whenever standards are prepared or diluted, they are logged into a Standards Prep logbook unique to each department. All standards are assigned a unique number which is listed on the container as well as in the logbook. Information contained in the Standards Prep logbook include manufacturer, lot number, initial concentration, date made, analyst, solvent used, initial and final volumes, calculations, how the standard was made, and expiration date.

All procedures associated with making the standard are recorded. Standards which are diluted from previously diluted, in-house standards are recorded as unique standards in the standards logbook.

7.3 STANDARD SOURCES AND PREPARATION

See Table 7.2 for standard sources and preparation.

7.4 INSTRUMENT CALIBRATION

Method calibration requirements will be followed if more stringent than those summarized in this Quality Assurance Plan.

7.4.1 ORGANICS DEPARTMENT INSTRUMENTATION CALIBRATION

GCs and GC/MSs are calibrated to meet or exceed method requirements. See Table 7.3 for an overview of the general techniques used.

7.4.2 INORGANICS DEPARTMENT INSTRUMENTATION CALIBRATION

See Table 7.3 for metals and wet chemistry instrumentation calibration techniques.

TABLE 7.1 - LABORATORY EQUIPMENT

Equipment	Manufacturer	Model
Gas Chromatograph	Hewlett-Packard	Series II, 5890
Sample Concentrator (P&T)	Tekmar	LSC-2000
Autosampler	Tekmar	ALS2016
Photoionization Detector (PID)	Hewlett-Packard	
Flame Ionization Detector (FID)	Hewlett-Packard	
Gas Chromatograph	Tracor	540
Autosampler	Tracor	
Electron Capture Detector (ECD)	Tracor	
Flame Ionization Detector (FID)	Tracor	
Data System (for the above two GC systems)	Scientific Software, Inc.	EZ Chrom
Gas Chromatograph	Hewlett-Packard	5890A
Sample Concentrator (P&T)	O. I. Corporation	4460A
Autosampler	O. I. Corporation	24 Position
Photoionization Detector (PID)	O. I. Corporation	4430
Electrolytic Conductivity Detector (ELCD/Hall)	O. I. Corporation	4420
Data System (for the above GC system)	Scientific Software, Inc.	EZ Chrom
Gas Chromatograph	Varian	Star 3400
Sample Concentrator (P&T)	Tekmar	LSC-2000
Autosampler	Tekmar	ALS2016
Photoionization Detector (PID)	Tremetrics	703
Flame Ionization Detector (FID)	Varian	
Electrolytic Conductivity Detector (ELCD/Hall)	Tremetrics	1000
Data System (for the above GC system)	Varian	Star v4.0
Mass Spectrometer (quadrupole)	Finnigan	5100
Gas Chromatograph	Finnigan	9611
Sample Concentrator	Tekmar	LSC-2
Autosampler	Tekmar	ALS 10-port
Mass Spectrometer (quadrupole)	Hewlett-Packard	5970B MSD
Gas Chromatograph	Hewlett-Packard	Series II, 5890
Autosampler	Hewlett-Packard	7673
Data System (for the above two GC/MS Systems)		
Data Acquisition and Hardware Coupling	Technivent	Envirolink
Software	Hewlett-Packard	Enviro Quant II
Mass Spectral Library	NIST	v4.0 (75,000)
Mass Spectrometer & Data System (ITD)	Varian	Saturn II
Gas Chromatograph	Varian	Star 3400
Autosampler	Varian	8200
Mass Spectral Library	NIST	1992 ver.
Flame Atomic Absorption Spectrophotometer & Data System	Perkin-Elmer	3030
Furnace Attachment	Perkin-Elmer	098617
Cold Vapor Generator	Buck Scientific	
Flame Atomic Absorption Spectrophotometer & Data System	Shimadzu	AA-6501F
Furnace Attachment	Shimadzu	GFA-6000
Autosampler	Shimadzu	ASC-6000
UV-VIS Spectrophotometer	Sequoia-Turner Corp.	390
Miscellaneous & Support Equipment		
Analytical Balance w/ data printer	Sartorius	BA1105
Analytical Balance	American Scientific Products	SP120
Top-Loader Balance	Ohaus	Galaxy 400
Refrigerators	GE, Amana, various	
Walk-in Refrigerator	Champe Manufacturing	

TABLE 7.1 - LABORATORY EQUIPMENT
(continued)

Equipment	Manufacturer	Model
Miscellaneous & Support Equipment (continued)		
Bomb Colorimeter	Parr	
pH meter	Orion	SA520
Turbidimeter	Hach	16800
Pensky-Martens Flashpoint Tester	Fisher	
Ion Analyzer w/ Fluoride and DO probes	Orion	EA920 (DO probe: 97-08-00)
Conductivity Meter	Fisher	09-326-2
NIST-traceable Thermometer 0-50°C	Fisher	15041A
NIST-traceable Thermometer 0-200°C	Fisher	15041D
Sonicator	Branson	450
Sonicator	Fisher	550
Incubator	Precision Scientific	31483
Incubator	Precision Scientific/GE	805
Drying Oven	Blue M	M25A-1A
Drying Oven	Blue M	OV-480A
Drying Oven	American Scientific Products	DX-38
Drying Oven	Despatch	LEB-1-27
Water Bath	Blue M	Magni Whirl MW-1120A-1
Water Bath	Fisher	
Muffle Furnace	Fisher	14
Autoclave w/dryer	NAPCO	8000-DSE
COD Reactor	Hach	45600
Desiccating Cabinet	Boekel	
Heating Manifolds/Hot Plates	Various	
TCLP Tumbling Device	Custom made	
TCLP Zero-Headspace Extraction Vessels	Assoc. Design & Manufact.	
TCLP Filtration Device	Assoc. Design & Manufact.	

TABLE 7.2 STANDARD SOURCES AND PREPARATION

Instrument Type	Sources	How Received	Primary Storage	Working Std. Preparation	Storage	Frequency
GC & GC/MS	Ultra Supelco ChemService Aldrich	various/ conc., neat	-20 to -10 °C 2 to 6 °C (as necessary)	Primary stocks prep'd from source stocks	-20 to -10 °C	semiannually
				Intermediate stocks prep'd from primary stocks	2 to 6 °C	monthly
				Working stocks prep'd from intermediate stocks	2 to 6 °C	as needed
AA	SPEX PlasmaChem	1000 ppm	room temp.	Primary stocks, 1-10 ppm are prepared from source stocks	pH<2,HNO_3	annually
				Intermediate stocks, 1 ppb-1 ppm	pH<2,HNO_3	semiannually
				Working stocks	pH<2,HNO_3	daily
pH meters	Fisher	neat	room temp.	used as received	room	daily
conductivity	Fisher	neat	room temp.	used as received	room	daily
TPH/ O&G	Wesson oil	neat	room temp.	working std. from stock	room	monthly
Turbidimeter	Fisher	formazin chk.	room temp.	serial dil. 8-400NTU	room	daily
Ion-specific electrode	Fisher	various	room/refrig.	serial dilutions	room	daily
Colorimetry	Fisher, Hach	various	room temp.	serial dilutions	room	semiannually
Nessler stds. (for color)	Aldrich	neat	room temp.	serial dilutions	room	annually

TABLE 7.3 LABORATORY INSTRUMENT CALIBRATION

Instrument	Calibration Type	# of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
Gas Chromatograph	initial	5	linear	per method	when cont. cal. fails
	continuing	1		per method	daily
GC/MS	DFTPP or BFB	1		method specific	per method
	initial	5	linear		when cont. cal fails
	continuing	1			1 per tune
Atomic Absorption	initial	4-5	linear	0.995 corr. coeff.	as needed
pH meter	initial	3		pH4, pH7, pH10	daily
Conductiv. Meter	initial	2		conc. w/i 5% of known value	daily
D.O. meter	initial	1 (air)		calibrate to 7.4 mg/L D.O.	daily
UV/Vis Spec	initial	3	linear	0.995 corr. coeff.	daily
Turbidimeter	daily	1 per range			monthly
Ion-specific electrode	daily	3	linear	0.995 corr. coeff.	daily
Analytical Balance	initial	per contract			semiannually
	daily	3	cal. check	0.010g ± 0.0005 g 1.0g ± 0.0005 g 10g ± 0.0005 g	daily
Analytical thermometers	annual	N/A	recalibration	Cal. against NIST-traceable therm.	annually

8.0 PREVENTATIVE MAINTENANCE

8.1 ROUTINE MAINTENANCE ACTIVITIES

See Table 8.1 for routine maintenance activities.

8.2 DOCUMENTATION

All instruments have a maintenance logbook. Any routine and non-routine repairs are recorded in the log.

Service contracts are in effect for GC/Mass Specs and laboratory balances. Back-up instrumentation and equipment are available for most analyses with limited holding times.

8.3 CONTINGENCY PLANS

In the event of major equipment failure, the following options are available:

1. Use alternative (back-up) instrument
2. Request a service call
3. Subcontract to another certified laboratory
4. Invalidate/reschedule the sampling event

At no time will holding times be compromised due to equipment failure. Relationships with other certified laboratories have been established and shall be used as needed.

TABLE 8.1 - PREVENTATIVE MAINTENANCE ACTIVITIES

Instrument	Activity	Frequency
GCs and GC/MSs	check septum	daily
	check gases	daily
	change gases	as needed
	change in-line filters	as needed
	clip cap. columns	as needed
	ELCD reservoir	fill daily
	polish PID lamp	quarterly
	change Ion Exchange resin	annually/as needed
	replace Ni tube (ELCD)	as needed
	clean detectors	quarterly
	Jet tip cleaning	bi-monthly
	bake-off columns/traps	as needed
	replace pump oil	semi-annually
	check autosampler syringe and tubing	daily
Atomic Absorption spectrophotometers	check gases	daily
	check DI reservoir	daily
	inspect microsyringe	daily
	inspect quartz window	daily
	clean furnace electrodes	daily
	inspect fuel inlet washers	daily
	clean burner heads	daily
	clean auto pipettor	daily
	clean hood with detergent	weekly
	inspect tubing on furnace	weekly
	change graphite tube	as needed
	change lamps	as needed
Meters/probes	check probe solution	daily
	replace probe filling solution	as needed
	check probe membrane	daily
	change membrane	as needed

TABLE 8.1 - PREVENTATIVE MAINTENANCE ACTIVITIES

Instrument	Activity	Frequency
Desiccator	change desiccant	as needed
Refrigerators/freezers/ ovens	check temperature	daily
	clean	as needed
Balances	clean pans	before and after use
	check alignment	before use
	Class S weight check	daily
	recalib. with NIST-traceable weight	semi-annually
Turbidimeter	clean	before and after use
TCLP apparatus	clean	before and after use
Thermometers	recalib. against NIST-traceable therm.	annually
	check for cracks and gaps in mercury	daily
Autoclave	gasket checked	weekly
	timer checked	semi-annually
	clean interior	monthly
	sterilization indicator tape	daily
UV/Vis Spectrophotometer	clean sample compartment before/after use	daily
	clean cuvettes after each use	daily
	windows cleaned	monthly
	check electronics	as indicated
Automatic samplers	check operation	prior to sampling
	check purge-pump-purge cycle	after installed, daily
	check flow pacer	prior to sampling
	check desiccant	daily
	check battery	daily
	check pumping rate	daily

9.0 QUALITY CONTROL PROCEDURES

9.1 QUALITY CONTROL CHECKS

The following quality control samples are utilized by the laboratory to assess method precision and accuracy. In most cases quality control samples are assigned to sample batches by the analyst performing the test. Prism is currently in the process of automating much of the QC sample batching and tracking through its LIMS.

9.1.1 GENERAL

- **Method Reagent Blanks** - A sample of appropriate analyte-free matrix is prepared (digested, extracted, etc.) and analyzed with a specified sample set at a rate of one per batch.

- **Matrix Spikes** - At least one sample per batch or 5-10% frequency (depending on method requirements) is prepared and analyzed with and without the addition of spike material. The unspiked sample is designated as the *original*. The spiked sample is identified as a *matrix spike*.

- **Duplicate Samples** - Duplicate samples are analyzed at a minimum of one per batch. There are basically two types of duplicates utilized by the laboratory: *sample duplicates* and *matrix spike duplicates*. In most instances, the laboratory utilizes matrix spike duplicates, which is simply a second matrix spike, analyzed along with the first. In some cases, where spiking is impossible or impractical (such as temperature or conductivity), sample duplicates are performed.

- **Quality Control Check Samples** - QC check samples are analyzed at least semi-annually. These samples are usually obtained from a commercial QC supplier as blind samples. Corrective actions are initiated when anomalies occur.

- **Blank Spikes** - Blank spikes, or laboratory control samples, are analyte-free water spiked with a known amount of analyte. These are used to help confirm matrix effects, which may cause problems with matrix spikes. Blank spikes are analyzed at a frequency of one per sample batch or 5% frequency, whichever is more frequent.

- **Calibration Verification Standards** - CVSs are analyzed at a rate of 5% of the samples in an analytical run, or may be substituted by an acceptable blank spike.

- **Reagent Purity Checks** - All new chemicals are analyzed with a reagent blank to determine their purity and performance in the analytical system.

9.1.2 FIELD QC

- **Equipment Blanks** - Equipment blanks are prepared by rinsing the sampling equipment with analyte-free water prior to the sampling event. Equipment blanks are collected at a rate appropriate to the sampling event or project plan.

- **Trip Blanks** - A trip blank is analyte-free water sealed in the appropriate sample container and travels with the sample kit from kit preparation through sample receipt. Typically, trip blanks are used only for volatile analyses and are provided by the lab per client request.

- **Field Duplicates** - Field duplicates are prepared by duplicating the entire sampling procedure for a single site. They are collected per client request.

- **Split Samples** - Split samples are two halves of a single sample divided into two containers and analyzed by separate laboratories, independent of each other. They should not be *duplicate* samples (which require sampling the same site twice), but rather *split* samples (which require sampling once and dividing the sample). Split samples are usually only taken by our clients.

9.1.3 ORGANIC ANALYSES

- **Surrogate Standards** - Surrogate standards are compounds which have similar characteristics to the compounds of interest, but do not affect the recovery of those compounds. They are added to the sample prior to extraction or purging. Surrogates are used to monitor the performance of the entire analytical procedure.

- **Internal Standards** - Internal standards are used to provide a set, known concentration from which each sample may be reliably quantified, minimizing the effects of fluctuations in instrument sensitivity between samples. Internals are added to samples just prior to analysis, but after sample extraction.

9.1.4 MICROBIOLOGY QC

- **Positive/Negative Controls** - Positive and negative control organisms are obtained from the American Type Culture Collection (ATCC) or the State of North Carolina's Drinking Water Laboratory. These controls are run once for every new lot of media.

9.2 ROUTINE METHODS USED TO ASSESS PRECISION AND ACCURACY

9.2.1 PRECISION

Precision is defined as the reproducibility of a method or technique. Samples are analyzed in duplicate (as sample duplicates or matrix spike duplicates) to determine reproducibility. The precision is calculated and reported in terms of the relative percent difference of the two values, or RPD.

The RPD is calculated as follows:

$$\text{RPD} = \frac{\text{absolute value of the difference of the two results}}{\text{average of the two results}} \times 100\%$$

9.2.2 ACCURACY

Accuracy is defined as the relative "closeness" of a result to the value that was expected. Blank and matrix spikes are the primary means used to assess accuracy on a routine basis. The calculation for accuracy is known as the percent recovery, or %R. Percent recovery on a spiked sample is defined as follows:

$$\%\text{R} = \frac{\text{conc. of spiked sample - conc. of unspiked sample}}{\text{conc. of spike added to sample}} \times 100\%$$

For some methods, however, it is impossible to spike a sample for that particular parameter. Temperature is one such analysis. For some of these methods, known samples are analyzed to check the analyst's ability to produce a similar result to that which was expected.

9.3 QUALITY CONTROL CHARTS

Quality control charts are used to monitor the ongoing QC analyses in the laboratory. On a regular basis, QC data are collected from the various analyses in order to generate QC limits to be used by the analysts. These limits are plotted on QC charts in order to give a visualization of trends in the QC data over time.

The first requirement for the establishment of a QC chart is to obtain a sample of results from the analysis of matrix spike pairs. When at least 20 spike pairs have been analyzed, the chart may be established using the following methods:

- The mean, $\overline{X}$, and the sample standard deviation, s, are calculated from the data set.
- The y-axis of the chart represents the %R (for accuracy) or RPD (for precision). The x-axis represents the spiking events.
- Horizontal lines are drawn representing the 95% and 99% confidence limits (2s and 3s). The lines corresponding to 99% confidence limits (3s) are called the upper and lower *control* limits, while the lines for the 95% confidence limits (2s) are called the upper and lower *warning* limits. Once the chart has been established, subsequent results obtained from sample spikes are plotted as they are generated. New charts are established approximately every 20 data points or, at a minimum, annually.

9.4 FORMULAS FOR CALCULATION OF CONTROL LIMITS

9.4.1 UPPER/LOWER CONTROL LIMITS -

$$UCL = \overline{X} + 3s \qquad LCL = \overline{X} - 3s$$

$\overline{X}$ = average
UCL = Upper Control Limit
LCL = Lower Control Limit
s = sample standard deviation

9.4.2 UPPER/LOWER WARNING LIMITS -

$$UWL = \overline{X} + 2s \qquad LWL = \overline{X} - 2s$$

$\overline{X}$ = average
UWL = Upper Warning Limit
LWL = Lower Warning Limit
s = sample standard deviation

9.5 SPIKE CONCENTRATION LEVELS

It is expected that the quality of analytical measurements will change with varying analyte concentration; therefore, precision and accuracy must be consistently assessed at similar analyte levels. Table 3.1 indicates the precision and accuracy limits for each parameter, along with the concentration range for which the limits are determined. These levels, noted as "Conc. Range" in the table are defined as follows:

L, Low Level - The low level is defined as a spike concentration equivalent to < 20% of the highest standard in the calibration curve.

M, Mid Level - The mid level is defined as a spike concentration equivalent to 20-80% of the highest standard in the calibration curve.

H, High Level - The high level is defined as a spike concentration equivalent to 80-100% of the highest standard in the calibration curve.

9.6 METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS

9.6.1 METHOD DETECTION LIMITS

The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the value is above zero. The MDL actually achieved in a given analysis will vary depending on instrumentation sensitivity and matrix effects. Since the vast majority of MDL data published by the EPA (and regulatory limits are often based upon these data) are determined using reagent water as the sample matrix, all MDLs for this laboratory have been determined with reagent water. Since it is arguably impossible to reliably spike a solid matrix (given the unlikely representativeness of any chosen matrix, such as sand, to all the various solid matrices actually analyzed and a further problem with inhomogeneity of a spiked solid), all MDLs for solid matrices are extrapolated from the aqueous study's data, using extraction factors.

Since MDLs are derived using the most pristine matrix available, it is surmised that the MDL is the lowest, reliable detectable level of measurement. Its applicability to real-world samples, with an infinite variety of complex matrices, is unjustifiable; therefore, a more reasonable limit, called the *PQL*, is used in the reporting of laboratory data. The discussion of PQLs follows this discussion of MDLs.

9.6.1 METHOD DETECTION LIMITS (continued)

The MDL determined per 40CFR, Part 136, Appendix B, which is summarized here:

1. Estimate the detection limit (via published information or empirical data).
2. Prepare a reagent blank that is as free of analytes as possible.
3. Spike this blank with the analyte to be determined at 3 to 5 times the estimated MDL.
4. Process at least 7 aliquots of this spiked blank through the entire analytical method.
5. Calculate the sample standard deviation (s) for the replicate measurements as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x-\overline{x})^2}{n-1}}$$

where:
x = individual aliquot's result
$\overline{x}$ = mean of the results for all the aliquots
n = total number of aliquots analyzed

6. Compute the MDL as follows:

$$MDL = s \times t_{(n-1,1-\alpha=0.99)}$$

where:
s = sample standard deviation derived above
$t_{(n-1,1-\alpha=0.99)}$ = student's t-value at a 99% confidence level with n-1 degrees of freedom

9.6.2 PRACTICAL QUANTITATION LIMITS

The practical quantitation limit is defined by our laboratory as a value, approximately 3 to 10 times the MDL, nominally chosen for ease of reporting. The PQL is considered to be the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Prism Laboratories uses the PQL to establish reporting limits that have a high degree of confidence, with less probability of reporting false negatives or false positives, which is incurred by reporting down to the MDL level. In certain cases where data must be reported down to the MDL level (such as when regulatory limits are set at or near the MDL), the data will be qualified as to the relatively higher degree of uncertainty of those values.

Method Detection Limits and Practical Quantitation Limits are determined during method development and whenever major alterations occur to the analytical system; e.g., new type of column, new instrument, or new analyst.

10.0 DATA REDUCTION, VALIDATION AND REPORTING

This section details the various processes used in data reduction, validation and final report generation for Prism Laboratories.

10.1 DATA REDUCTION

Data reduction is defined as the process of converting raw data (such as a computer printout, balance weight reading, or a thermometer reading) into reportable data. The methods employed in reducing raw data must be tightly controlled, standardized, and monitored. This process is shown as part of the Sample/Data Workflow Diagram at the end of Section 5 (figure 5.5).

Initial data reduction is the responsibility of the analyst or technician making the measurement. Once the raw data are recorded, the analyst may perform various calculations to convert the information into more meaningful, reportable results. Also involved in this process is the determination of quality control results, including spike recoveries, duplicate results, blank results, and calibration verification.

10.1.1 RECORDS

- **Logbooks and Benchsheets** - All analyses performed within the laboratory have an associated laboratory logbook or benchsheet file where all sample entries, calculations, notes and problems are recorded in ink. Any errors are crossed out with a single line, corrected near the original data, initialed by the person making the correction. Some analyses, particularly the wet chemistry techniques, use a benchsheet system, where individual benchsheets are completed and filed in a bound filer. The laboratory is currently moving toward a logbook system, where a single, bound logbook is available for each analysis. Each logbook is uniquely identified and each page sequentially numbered. These logs are issued and archived by the quality assurance manager. In addition to the data logbooks, each analyst is assigned a personal notebook for non-data notes, such as method notes, historical sample information, etc.

- **Computerized analytical data** - All computer generated data (e.g., raw chromatographic data, analysis data files) are assigned unique filenames by the computer data systems. An entry is made in the instrument run logbook indicating this filename. The instrument run log cross-references the sample ID numbers with the associated data file. All computerized data are archived to magnetic media. These archives are stored for a minimum of five years.

- **Hardcopies of data and final reports** - All chromatography results and final report copies are printed out and kept for a minimum of five years. A filing system has been implemented to help locate all associated data, such as quality control samples and calibration information.

10.1.1 RECORDS (continued)

- **Other computerized information** - The analytical data stored in the Laboratory Information Management System (LIMS) are entirely traceable to the original, manually recorded raw data. The LIMS operates on a Local Area Network, which is maintained by laboratory staff with expertise in computerized data management. Each night the entire network (and all LIMS data) is backed-up to magnetic media, providing for minimal downtime in the event of catastrophic computer failure. This, however, is only a security feature— formal archiving of LIMS data (for final storage) is conducted approximately every two months. Archiving is made to magnetic media, which are then stored for a minimum of five years.

10.1.2 METALS ANALYSES

A calibration curve is established at the start of all metals analyses. A mid-range external source standard is then analyzed to verify the calibration curve. Concentrations are then read directly as a function of absorbance. Some of the calculations used in the analysis of metals are as follows:

A. Dilutions - If the concentration of the analyte is such that dilution is required, the following calculation is used:

$$\text{mg/L of metal in sample} = \frac{A \times (B + C)}{C}$$

where: A = mg/L of metal in diluted sample from calibration curve
B = mL of acidified reagent water used for dilution
C = mL of original sample aliquot used for dilution

B. Solids - Solids are reported on a dry-weight basis (NCDEHNR requirement):

$$\text{mg/Kg of metal in sample (dry weight basis)} = \frac{C \times V \times D}{W \times S}$$

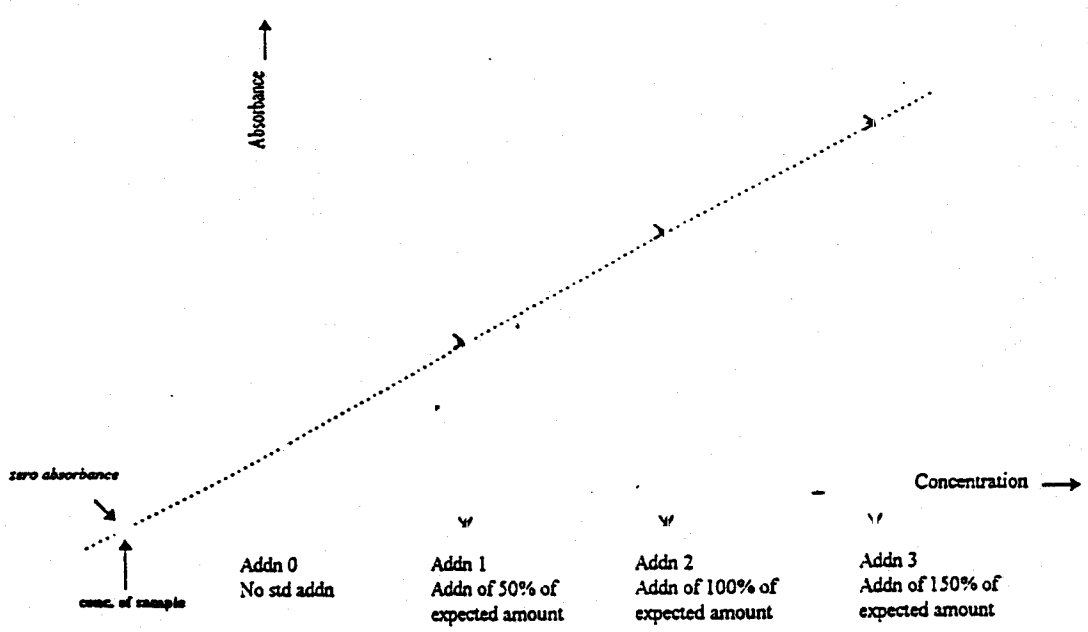
where: C = mg/L of metal of digested sample from calibration curve
V = final volume of the digested sample in mL
D = dilution factor, if digestate required dilution
W = wet weight of original solid in Kg
S = % Solids / 100

10.1.2 METALS ANALYSES (continued)

C. Method of Standard Additions -

When the sample matrix is complex and cannot be accurately matched, the method of standard additions is used. In this method, equal volumes of sample are added to a water blank and to three standards containing different known amounts of the test element. The absorbance of each solution is determined and then plotted on the vertical axis of a graph, with the concentrations of the known standards plotted on the horizontal axis. When the resulting line is extrapolated back to zero absorbance, the point of interception on the abscissa is the concentration of the unknown. The following is an example of an MSA plot:

FIGURE 10.1 Plot of Standard Additions



10.1.3 ORGANIC ANALYSES

Organic results are determined against a calibration curve of three to five points, depending on the method. The concentration in the original sample is then determined by the following:

A. Aqueous samples- External standard method

$$\text{Concentration } (\mu g/L) = \frac{(A_x) \times (A) \times (V_t) \times (D)}{(A_s) \times (V_i) \times (V_s)}$$

where:
- A_x = Area of analyte peak in sample analysis
- A = Amount of standard injected or purged (ng)
- V_t = Volume of total extract (µL); for purge-and-trap, Vt = 1
- D = Dilution, if performed on sample prior to analysis; if none, D = 1
- A_s = Area of analyte peak in standard analysis
- V_i = Volume of extract injected (µL); for purge-and-trap, V_i = 1
- V_s = Volume of sample extracted or purged (mL)

B. Aqueous samples- Internal standard method

$$\text{Concentration } (\mu g/L) = \frac{(A_x) \times (C_{is}) \times (D)}{(A_{is}) \times (RF) \times (V_s)}$$

where:
- A_x = Area of analyte peak in sample analysis
- C_{is} = Amount of internal standard added to extract or volume purged (ng)
- D = Dilution, if performed on sample prior to analysis; if none, D = 1
- A_{is} = Area of analyte peak in standard analysis
- V_s = Volume of sample extract or volume purged (mL)
- RF = Response factor for analyte from standard, as described here:

$$RF = \frac{(A_s) \times (C_{is})}{(A_{is}) \times (C_s)}$$

where:
- A_s = Area of analyte peak in standard analysis
- C_{is} = Concentration of the internal standard (µg/L)
- A_{is} = Area of internal standard in standard analysis
- C_s = Concentration of the analyte in the standard analysis (µg/L)

10.1.3 ORGANIC ANALYSES (continued)

C. Non-aqueous samples- External standard method, as dry-weight

$$\text{Concentration } (\mu g / Kg) = \frac{(A_x) \times (A) \times (V_t) \times (D)}{(A_s) \times (V_i) \times (W)}$$

where:
- A_x = Area of analyte peak in sample analysis
- A = Amount of standard injected or purged (ng)
- V_t = Volume of total extract (µL); for purge-and-trap, Vt = 1
- D = Dilution, if performed on sample prior to analysis; if none, D = 1
- A_s = Area of analyte peak in standard analysis
- V_i = Volume of extract injected (µL); for purge-and-trap, V_i = amount of methanol added to reagent water
- W = Dry weight of sample extracted or purged (mg)

D. Non-aqueous samples- Internal standard method, as dry-weight

$$\text{Concentration } (\mu g / L) = \frac{(A_x) \times (C_{is}) \times (D)}{(A_{is}) \times (RF) \times (W)}$$

where:
- A_x = Area of analyte peak in sample analysis
- C_{is} = Amount of internal standard added to extract or volume purged (ng)
- D = Dilution, if performed on sample prior to analysis; if none, D = 1
- A_{is} = Area of analyte peak in standard analysis
- W = Dry weight of sample extracted or purged (mg)
- RF = Response factor for analyte from standard, as described here:

$$RF = \frac{(A_s) \times (C_{is})}{(A_{is}) \times (C_s)}$$

10.2 DATA VALIDATION

Data validation is the process of reviewing analytical results to assure that they are of a verifiable and acceptable quality. This process relies on the use and success of quality control samples, as well as the experience of the laboratory personnel in determining the integrity of the data generated. The ultimate responsibility for the data lies with the laboratory director, who performs the last validation of sample results; however, several other individuals are responsible for their parts of the validation process. These roles and the data validation process are defined in this section.

10.2.1 DATA INTEGRITY

Each level of data validation requires that an individual check the integrity of various activities and systems which directly affect the validity of the analytical measurement. These individuals and their responsibilities are outlined here:

- **Raw Data and Calculations** - All analysts are responsible for raw data and calculations. Department supervisors are responsible for assuring that members of their staff are well versed in data reduction and reporting. All raw data, calculations, and final results are reviewed by department supervisors, who are responsible for all activities and data generated within their respective departments.

- **Sample Prep Logs** - Sample Preparation personnel are responsible for maintaining a current log of all activities conducted within their area. The department supervisor is responsible for reviewing prep logs on a routine basis.

- **Instrument and Analytical Logs** - Any analyst involved in the operation of an instrument is responsible for maintaining a current log of all activities associated with an instrument. It is the responsibility of the appropriate department supervisor to review this log on a regular basis.

- **Calibration and QC Criteria** - Each analyst is responsible for meeting the calibration and QC criteria for their methods. Supervisors review these data before data are released.

- **Formal Chain-of-Custody** - In the event that formal, internal chain-of-custody procedures are required, the laboratory director is responsible for implementing and monitoring the sample custody process, including the procurement of analyst signatures at points of transfer.

- **Systems Review** - The Quality Assurance Manager is responsible for monitoring all of the above systems for completeness and effectiveness.

10.2.2 VALIDATION OF DATA

A. Responsibilities

- **Laboratory Analyst** - Responsible for actual analysis of samples and generation of results. Analysts are trained in raw data reduction, linear regression, and initial data review steps. Analysts check data for accuracy and completeness.

- **Department Supervisors** - Responsible for reviewing analyst data, QC results, logbooks, and login records.

- **Project Manager** - Several individuals in the laboratory act as a client's project manager. This individual is responsible for the tracking and timeliness of a particular project through the laboratory. In the event that a client request "verbals," the project manager may advise the client on the applicability and acceptability of such results. In most cases, the project manager is the primary individual responsible for helping a client interpret minor questions concerning the laboratory report and the validity of the reported data.

- **Quality Assurance Manager** - Responsible for conducting audits of logbooks, raw data, holding time violations, calibration records, etc. Also reviews a percentage of laboratory reports prior to reporting. May issue quality assurance notices, data qualifiers, or quality assurance narratives if necessary. Responsible for the overall implementation and review of the laboratory's quality systems.

- **Login Personnel and Department Supervisors** - Responsible for reviewing the chain-of-custody information submitted by the client against the LIMS login information.

- **Laboratory Director** - Ultimately responsible for all activities and data within the laboratory.

B. Laboratory Quality Control Checks -

- **Method Reagent Blanks** - Any contamination present in method reagent blanks warrants reanalysis of any samples which contain that analyte found in the blank. Some notable exceptions include common laboratory artifacts, such as methylene chloride and phthalates—in such cases, internal guidances have been established to monitor and reduce their presence; however, data will be qualified in the event that laboratory contamination is suspected.

- **Matrix Spikes** - Matrix spike recoveries which fall outside of the established control limits warrant that all samples analyzed within that batch of samples be reanalyzed and qualified, in the event that sample matrix interferences are suspected.

10.2.2 VALIDATION OF DATA (continued)

- **Blank Spikes** - Blank spikes, or laboratory control samples, must fall within the guidelines established in each method or within QC limits established by the laboratory, whichever is more stringent.

- **Quality Control Check Samples** - QC Check Samples are analyzed as blind samples at least semiannually. In the event that unacceptable performance is indicated, the analytical method is audited and corrective actions are implemented.

- **Duplicate Samples** - Any duplicate samples which fall outside of the allowable range shall be reanalyzed to determine if matrix problems are present. No additional data will be reported until the problems have been corrected.

- **Continuing Calibration Standards** - Continuing calibration standards which fall outside of the allowable range shall be reanalyzed. If the acceptance criteria is exceeded again, a new calibration verification standard shall be prepared and analyzed, or a new curve will be run.

- **Surrogate and Internal Recoveries/Responses** - Surrogates and internals are checked against method requirements or internally generated control limits, whichever are more stringent or appropriate.

10.3 FINAL PROJECT REVIEW

The laboratory director is responsible for final project review prior to issuance of the final report. A portion of all reports is also reviewed by the quality assurance manager. Key areas which are reviewed prior to submission to the client are:

- Field and laboratory raw data
    - Transcription errors
    - Calculation errors
    - Calibration data
    - Mass spectral interpretation
    - Times and dates of analysis
- Chain-of-Custody
- Holding Times
- Anomalies concerning interdepartmental data

10.4 DATA STORAGE

All vital data generated within the laboratory are placed on hardcopy. Raw instrument data are archived to magnetic backup. All archived information is maintained for a minimum of three years within the laboratory, unless a longer period is required. Archived data are generally stored chronologically; however, final reports are stored by client name, then chronologically (as well as by sample ID), to aid in data retrieval.

Examples of paper records archived include: final reports, sample log-in worksheets, field data sheets and notebooks, chain-of-custody records, and laboratory logbooks.

All such data are protected from environmental degradation and stored in a secure area.

11.0 CORRECTIVE ACTIONS

11.1 REQUIREMENTS FOR CORRECTIVE ACTIONS

The criteria for corrective action differ according to analytical department. Some typical corrective action responses are outlined in this section. Corrective actions are initiated whenever a regulator of client notifies the laboratory project manager, laboratory director, or quality assurance manager of a suspected anomaly.

11.1.1 ORGANICS DEPARTMENT

Some of the typical corrective actions outlined below:

- × Calibration has poor linearity or fails method requirements
  - ✓ ACTION: Recalibrate using fresh standards

- × Excessive chromatographic drift or noise
  - ✓ ACTION: Perform preventative maintenance

- × GC/MS tuning compound (DFTPP/BFB) fails tune criteria
  - ✓ ACTION: Manually retune instrument

- × Continuing calibration check falls outside control or method limits
  - ✓ ACTION: Recalibrate with fresh standards

- × Contamination is present in any equipment, field, or method blank
  - ✓ ACTION: Investigate to isolate/identify source of contamination

- × Spike recovery data are found not acceptable
  - ✓ ACTION: Re-extract batch/confirm matrix problems, if indicated

- × Regulator, client, supervisor, or QA manager finds any need for corrective action
  - ✓ ACTION: As recommended

11.1 REQUIREMENTS FOR CORRECTIVE ACTIONS (cont.)

11.1.2 METALS DEPARTMENT

Some of the typical corrective actions outlined below:

- Calibration verification standard falls outside of allowable limits
  - ✓ ACTION: Recalibrate with fresh standards

- Contamination of blanks is discovered/suspected
  - ✓ ACTION: Investigate source of contamination

- Results of quality control samples found unacceptable
  - ✓ ACTION: Investigate digestion and analysis; redigest if indicated

- An increasing or decreasing trend is noted in data points on the quality control charts
  - ✓ ACTION: Perform Preventative maintenance, purchase new spike concentrates

- Regulator, client, supervisor, or QA manager finds any need for corrective action
  - ✓ ACTION: As recommended

11.1.3 WET CHEMISTRY DEPARTMENT

Some of the typical corrective actions outlined below:

- Spike recoveries are outside of acceptable limits
  - ✓ ACTION: Reanalyze batch, prepare fresh spiking solution

- Contamination of blanks is discovered
  - ✓ ACTION: Investigate source of contamination

- Correlation coefficient of curve is less than 0.995
  - ✓ ACTION: Recalibrate using fresh standards

- Results of quality control check standards and samples are found unacceptable
  - ✓ ACTION: Investigate method

- Regulator, client, supervisor, or QA manager finds any need for corrective action
  - ✓ ACTION: As recommended

11.2 INITIATING CORRECTIVE ACTIONS

The following individuals are responsible for assessing each QC measure and initiating and/or approving corrective actions:

Laboratory Analysts - Analysts are versed in the methodology incorporated in the analysis and are required to adhere to all procedures as outlined in the EPA-approved methods. Any corrective actions required as indicated by control limit outliers are addressed at this level. If equipment failure is noted, the department supervisor is notified.

Department Supervisor - The department supervisor initiates corrective action when notified of a problem by the analyst, as a result of quality audits, or when requested by the laboratory director or quality assurance manager.

Laboratory Director - The laboratory director initiates corrective action according to requests by the department supervisors, clients, QA manager, or regulators. This would include all repairs and upgrades to laboratory instrumentation.

Quality Assurance Manager - The quality assurance manager will initiate corrective action according to results of performance evaluation samples, regulator and client system audits, and internal audits. When QC problems are indicated, the QA manager will initiate a corrective action in an attempt to resolve the problem.

11.3 NOTIFICATION OF CORRECTIVE ACTIONS

The laboratory director, department supervisors, QA manager, and company officers will be notified in writing of any major corrective action undertaken. Such corrective actions are maintained in the QA Corrective Action Log by the QA manager.

All corrective action related to analytical procedures will be documented in laboratory notebooks or other appropriate laboratory record (e.g., on chromatograms, data printouts). Corrective action entries will include:

- Identification of problem
- Corrective actions taken
- Analyst performing corrective action
- Date of corrective action
- Cause of corrective action
- Result of corrective action

12.0 PERFORMANCE AND SYSTEMS AUDITS

12.1 LABORATORY SYSTEMS AUDITS

Systems audits are performed on a periodic basis to ensure that the measurement systems, which include instrumentation, documentation, and other components necessary to generate acceptable and reliable data, are within the appropriate guidelines.

12.1.1 EXTERNAL SYSTEMS AUDITS

Regularly scheduled systems audits are performed by various regulatory agencies, including the North Carolina Department of Environment, Health, and Natural Resources. Prism Laboratories welcomes any potential client or regulating agency to perform on-site external system audits. We firmly believe that such audits play a vital and necessary role in monitoring and improving our data quality.

12.1.2 INTERNAL SYSTEMS AUDITS

The laboratory's quality assurance manager performs a thorough systems audit annually. A final report of results is submitted to the laboratory director and company officers for review and corrective action. On a regular basis, the quality assurance manager conducts "walk-through" audits to check the effectiveness of corrective action plans or as part of a corrective action, itself.

As part of these systems audits, the quality assurance manager audits the program to ensure compliance with standard operating procedures (SOPs), EPA-approved methodologies, and other regulatory requirements. A checklist system is utilized in order to effectively document adherence to these requirements (see Figure 12.1).

Some of the issues that are addressed in internal systems audits are:

- ✓ Laboratory Notebooks: How issued, where stored, when completed, how maintained (permanent ink, dated, initialed properly, etc.)
- ✓ Methods: Complete SOPs, pertinent to procedures
- ✓ Equipment Calibration: Method of calibration, documentation of calibration
- ✓ Equipment Maintenance: Necessary preventative maintenance, maintenance log
- ✓ Chemicals, solvents, reagents: Selection of reagents, proper labeling/dating
- ✓ Check of Standards, Spikes, and Duplicates: How often run, documentation of results
- ✓ Sample Handling: How samples are logged, identified, stored, and disposed

12.2 SYSTEMS AUDITS OF FIELD OPERATIONS

Systems audits of the company's field sampling operations are conducted in a similar fashion as the laboratory audits. Field operations are audited to check such practices as decontamination, meter and sampler calibration, documentation, and sample handling and custody.

The quality assurance manager is responsible for auditing the field operations and generating the appropriate corrective actions.

12.3 PERFORMANCE AUDITS

Performance audits are conducted on an ongoing basis as part of the operational procedure of the laboratory activities. These audits include periodic blind samples prepared by the QA manager, internal and external split samples, as well as regulator-supplied check samples.

12.3.1 INTERNAL PERFORMANCE AUDITS

At least one blind sample (usually a commercially available QC sample) is submitted by the QA manager for each analytical group at a minimum of once per year. The more common analyses are audited at least twice a year. The results of the audit are analyzed, documented, given to the lab director, supervisors, and company officers, and archived for future reference. Figure 12.2 is an example of the documentation used in the internal performance audit.

12.3.2 EXTERNAL PERFORMANCE AUDITS

EPA and State performance studies for certifiable parameters are analyzed semi-annually. All results from the EPA performance studies remain on file and are available for review. Two drinking water (WS) and two environmental (WP) performance audits are conducted annually by the EPA. North Carolina DEHNR also submits performance evaluation samples at least annually.

Figure 12.1 - Example of Laboratory Internal Systems Audit Form

LABORATORY EVALUATION CHECKLIST

I. Sample Receiving and Storage Area

	Question	YES	NO	Inadequate
1	Is a sample custodian designated?			
2	Have SOPs been written for sample receiving?			
3	Have SOPs been written for sample storage?			
4	Are the appropriate SOP sections at the receipt/storage area?			
5	Are the sample shipping containers stored in a manner which prevents lab contamination?			
6	Are samples requiring preservation stored in such a way as to maintain their preservation?			
7	Is the temperature of the cold storage recorded daily?			
8	Have the storage refrigerators been kept at 4° ± 2°C?			
9	Are the temperature and receipt/storage logs maintained in a manner consistent with GLP?			

Comments:

Figure 12.2 - Example of Internal Performance Audit Documentation

Date of audit:

Audit samples: WS / WP / NC / Internal, CLT

Audit performed by:

Department: Metals

Parameter	Method Used	Reported Result (mg/L)	Acceptance Range	Pass Fail	Comments
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Cadmium					
Calcium					
Chromium					
Copper					
Iron					
Lead					
Magnesium					
Manganese					
Mercury					
Molybdenu					
Nickel					
Potassium					
Selenium					
Silver					
Sodium					
Thallium					
Zinc					

Corrective Actions Indicated (sign & date):