Anatek Labs, Inc.

Quality Assurance Plan
Tables, Figures & Appendices

Items below are linked – click on a heading to proceed to that section

Tables

Tables 1a & 1b

Instrument Inventory

Table 1a

Anatek Moscow Equipment List

Type	Manufacturer	Model	Description
API 4000	APPLIED BIOSYSTEMS	API 4000	HPLC/MS/MS
API 4000	SHIMADZU	LC-20AD	LC
API 4000	SHIMADZU	LC-20AD	LC
API-3000	PE SCIEX	API-3000	TRIPLE QUAD MS/MS
ECD1	HP	HP6890	GC SYSTEM
ECD2	HP	HP6890	GC SYSTEM
FIA	OI ANALYTICAL	FS 3000	ANALYZER
FID1	HP	6890	GC SYSTEM
FID2	AGILENT	6890N	GC SYSTEM
GCMSMS	AGILENT	7890B	GC SYSTEM
GFPC	PROTEAN	MPC 9604	GAS FLOW PROPORTIONAL COUNTER
HPLC #2	SHIMADZU	RF20A	FLUORESCENCE DETECTOR
ICP	VARIAN	720-ES	ICP-OES
ICP-MS	AGILENT	G3281A	ICP-MS 7700X
IONS	METROHM	761	COMPACT IC
IONS	METROOHM	882	COMPACT IC PLUS
Mercury Analyzer	CETAC	M8000	Hg Analyzer
MSD2	AGILENT	6890N	GC SYSTEM
MSD3	AGILENT	7890B	GC SYSTEM
OIL & GREASE	HORIZON	3000XL	EXTRACTOR
RAD MONITOR	PYLON ELECTRONICS	AB6A	PORTABLE RAD MONITOR
SATURN 2100	Varian	2100T	GC/MS
TOC ANALYZER	SHIMADZU	TOC-Vcsh	TOC ANALYZER
VARIAN 1200	VARIAN	1200	QUADRUPOLE MS/MS
VARIAN 4000	VARIAN	4000	GC SYSTEM
VOC1	Agilent	6890N	GC

Table 1b

Anatek Spokane Equipment List

Type	Manufacturer	Model	Description
Autoclave	Market Forge Sterilmatic	STM-EL	
BOD	Hach	HQ40d	LBOD 101 Probe
BTU	Parr	1341EB	Oxygen Bomb Calorimeter
Chlorine	Hach	58700-00	Colorimeter
COD	HACH		Digestor
Coliform	IDEXX Quanti-tray 2X	89-10894-00	
Conductivity	Hach	HQ40d	Meter
FIA	Lachet	QUIKCHEM 8500	Analyzer
	Lachet	BD-46	TKN Digestor Block
	Lachet	65454	Cyanide Distillation System
FOG	CPI Instruments		
GC/ECD	Hewlett Packard	5890 SERIES II	GC
GC/FID	Hewlett Packard	5890 SERIES II	GC
GC/FID	Hewlett Packard	6890 SERIES II	GC
GC/MS	Encon	ENCON EV	Purge and Trap
	Centurion	CENT272011509	Autosampler
	Hewlett Packard	5890 SERIES II PLUS	GC
			MS
GC/MS	TEKMAR	3000	Purge and Trap
	Varian Archon		Autosampler
	Hewlett Packard	5890 SERIES II PLUS	GC
			MS
GC/PID/FID	Hewlett Packard	4430	Concentrator Purge and Trap
Gross a and ß counter	Protean Instrument	IPC650	Gas Flow Proportional Counter
HPLC	Agilent Technology	G1329B	Autosampler
	Agilent Technology	G1314B	UV
IC	Thermo Fisher	2100	ICS-2100
ICPMS	Agilent	7500cx	ICPMS
Mercury Analyzer	Cetac	M-7600	Analyzer
pH meter	Denver Instruments	225	
pH	Hach	HQ40d	
Salmonella	SEWARD STOMACHER	400	
Spectrophotometer	HACH	DR/3000	Analyzer
TOC	DOHRMANN PHOENIX	8000	
TOX	MICROCOULOMETER		Analyzer
Turbidimeter	HACH	2100AN	
	WTW	TURB355IR	

Table 2

Summary of Analytical Parameters, Method, Sample Containers, Preservation Methods, and Holding Times

Test Type	Parameter	Method	Container	Preservative	Holding Time
Organics - Drinking Water					
COMPOST	Herbicide/ Pesticide Residue in Soil/Compost		4 oz glass	n/a	14 days
DBP	Haloacetic Acids	SM 6251B	2 x 40 mL amber vial no headspace	4 mg Ammonium Chloride	28 days
DBP	Total Trihalomethane Potentials (THMP)	EPA 524.3	3 x 40 mL amber vial no headspace	Ambient Temperature	ASAP
DBP	Total Trihalomethanes (TTHM)	EPA 524.3	2 x 40 mL amber vial no headspace	25 mg ascorbic acid, 200 mg maleic acid	14 days
DIOXIN	Dioxin				
DIQUAT	Diquat	EPA 549	500 mL HDPE	10 mg Sodium Thiosulfate	7 days
EDB	EDB/DBCP	EPA 504.1	2 x 40 mL amber vial	3 mg Sodium Thiosulfate	14 days
ENDOTHALL	Endothall	EPA 548.1	250 mL amber glass	20 mg Sodium Thiosulfate	14 days
GAS	Petroleum in Soil-HCID WA TPH-HCID	NWTPH-Gx/EPA 8015	4 oz glass	n/a	14 days
GLYPHOSATE	Glyphosate	EPA 547	40 mL amber vial	3 mg Sodium Thiosulfate	14 days
HERB1	Herbicides Regulated & Unregulated	EPA 515.4	250 mL amber glass	20 mg Sodium Thiosulfate	14 days
HERB2	Private Herbicide	EPA 515.4	250 mL amber glass	Sodium Thiosulfate	14 days
HERB2	Private Herbicide	EPA 515.4	1 L amber glass	Sodium Thiosulfate	14 days
CARB	Carbamates Regulated & Unregulated	EPA 531.2	40 mL amber vial	6mg Sodium Thiosulfate / 560mg Potassium Dihydrate Citrate	28 days
NWTPH-HCID	Petroleum	NWTPH-HCID	1L amber bottle	HCl pH<2, Cool to <4°C	7 days
PERCHLORATE	Perchlorate	EPA 331.0/6850	125 mL HDPE	Cool to <4°C	14 days
PEST1	Chlorinated Pesticides/PCBs	EPA 505	2 x 40 mL amber vial	3 mg Sodium Thiosulfate	14 days
SOC	(SOC) Haloacetic Acids	SM 6251B	2 x 40 mL amber vial	4 mg NH4CL	14 days
SOC	Full SOC	Multiple methods			14 days
SOC	Synthetic Organic (SOC) Screen - Washington	Multiple methods	1 L amber glass and 1 x 40 mL amber vial	50 mg Sodium Sulfite 4 mg Sodium Thiosulfate	14 days
SOC	Synthetic Organic (SOC) Screen	Multiple methods	1 L amber glass	50 mg Sodium Sulfite	14 days
SOC	WA Short SOCs	Multiple methods			14 days
SOC Phase II	(Phase II SOC) Carbanates Regulated & Unregulated	EPA 531.2	40 mL amber vial	6mg Sodium Thiosulfate / 560mg Potassium Dihydrate Citrate	28 days
SOC Phase II	(Phase II SOC) Chlorinated Pesticides/PCBs	EPA 505	2 x 40mL amber vial	50 mg Sodium Thiosulfate	14 days
SOC Phase II	(Phase II SOC) EDB/DBCP	EPA 504.1	2 x 40 mL amber vial	3 mg Sodium Thiosulfate	14 days
SOC Phase II	(Phase II SOC) Herbicides Regulated & Unregulated	EPA 515.4	250 mL amber glass	20 mg Sodium Thiosulfate	14 days
SOC Phase II	(Phase II SOC) Semivolatiles	EPA 525.2	1 L amber glass	50 mg Sodium Sulfite	14 days
SOC Phase V	(Phase V SOC) Diquat	EPA 549.2	500mL HDPE	Sodium Thiosulfate	21 days
SOC Phase V	(Phase V SOC) Endothall	EPA 548.1	250 mL amber glass	Sodium Thiosulfate	14 days
SOC Phase V	(Phase V SOC) Glyphosate	EPA 547	2 x 40 mL amber vial	Sodium Thiosulfate	14 days
TOC	Total Organic Carbon (TOC)	SM 5310B	2 x 40 mL amber vial	H2SO4 or HCl pH<2	14 days
VOC	(VOC) Regulated & Unregulated Full List	EPA 524.3	3 x 40 mL amber vial	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC	(VOC) Single Volatile Compound (e.g. TCE or MTBE)	EPA 524.3	3 x 40 mL amber vial	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC	(VOC) Total Trihalomethanes (Total THM)	EPA 524.3	3 x 40 mL amber vial	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC	(VOC) Trihalomethanes (THMP)	EPA 524.3	3 x 40 mL amber vial	n/a	14 days
VOC1 Chlorinated	Regulated & Unregulated Full List	EPA 524.3	3 x 40 mL amber vial no headspace	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC1 Not chlorinated	Regulated & Unregulated Full List	EPA 524.3	3 x 40 mL amber vial no headspace	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC2	Private Volatiles (VOC)	EPA 524.3	3 x 40 mL amber vial no headspace	25 mg ascorbic acid, 200 mg maleic acid	14 days
VOC2	Single Volatile Compound (i.e. TCE or MtBE)	EPA 524.3/624/8270	3 x 40 mL amber vial no headspace	25 mg ascorbic acid, 200 mg maleic acid	14 days

Test Type	Parameter	Method	Container	Preservative	Holding Time
Inorganics - Drinking Water					
ASBESTOS	Asbestos in Insulation or Tile		100 grams, Ziploc bag (no vermiculite)	Cool to <4°C	6 months
ASBESTOS	Asbestos in Insulation or Tile		100 grams, Ziploc bag (no vermiculite)	n/a	6 months
FLUORIDE	Fluoride	EPA 300.0	125 mL HDPE	n/a	7 days
ID IOC Package	Arsenic & Sodium	EPA 200.8 / 200.7	125 mL HDPE	n/a	6 months
ID IOC Package	Fluoride	EPA 300.0	125 mL HDPE	n/a	28 days
ID IOC Package	Idaho Primary IOC package with cyanide waiver	Multiple methods	1 L HDPE	n/a	28 days
ID IOC Package	Idaho Secondary/Optional IOC package	Multiple methods	1 L HDPE	n/a	ASAP
ID IOC Package	Nitrate	EPA 300.0	125 mL HDPE	n/a	48 hours
ID IOC Package	Nitrate/Nitrite	EPA 300.0	125 mL HDPE	n/a	48 hours
ID IOC Package	Phase II IOC metals	EPA 200.7/200.8	500 mL HDPE	n/a	28 days
ID IOC Package	Phase V IOC	Multiple methods	500 mL HDPE	n/a	6 months
IOC	Alkalinity	SM 2320B	125 mL HDPE	n/a	14 days
IOC	Ammonia	SM 4500 NH3-G	125 mL HDPE	H2SO4 pH<2	28 days
IOC	Anionic Surfactants	SM 5540C	250 mL HDPE	n/a	48 hours
IOC	Anions: (Cl, F or SO4)	EPA 300.0	125 mL HDPE	n/a	28 days
IOC	Anions: (NO2, NO3 or PO4)	EPA 300.0	125 mL HDPE	n/a	48 hours
IOC	Chlorine - Total Residual	SM 4500 Cl-G	2 x 40mL clear vial no headspace	n/a	15 minutes
IOC	Color	SM 2120B	125 mL HDPE	n/a	48 hours
IOC	Conductivity	SM 2510B	125 mL HDPE	n/a	28 days
IOC	Corrosivity - Langlier		1 L HDPE	n/a	ASAP
IOC	Cyanide	EPA 335.4/SM 4500-CNE	250mL HDPE	NaOH pH > 12	14 days
IOC	Hardness	EPA 200.7 / SM 2340B	125 mL HDPE	HNO# pH <2	6 months
IOC	Hydrogen Sulfide		1 L HDPE	1 Tablet NaOH/L + Zn Acetate, pH>9	7 days
IOC	Iron	EPA 200.7	125 mL HDPE	HNO3 pH < 2	6 months
IOC	Lead & Copper (Pb/Cu) Rule	EPA 200.8	1 L HDPE	HNO3 Lab Preserves	6 months
IOC	Mercury by CVAFS	EPA 245.7/EPA 1631E	I L glass or 250 mL fluorinated plastic	HCl pH < 2	6 months
IOC	Metals (single metals)	EPA 200.7/200.8/6010/6020	125 mL HDPE	HNO3 pH < 2	6 months
IOC	Odor		1 L HDPE	n/a	ASAP
IOC	pH	SM 4500 H+B	125 mL HDPE	n/a	15 minutes
IOC	Phenolics	EPA 420.1	1L amber bottle	H2SO4 pH<2	28 days
IOC	Silica/Silicon - Dissolved Only	EPA 200.7	125 mL HDPE	n/a	6 months
IOC	Surfactants	SM 5540C	1 L amber glass	n/a	48 hours
IOC	TDS	SM 2540C	1 L HDPE	n/a	7 days
IOC	TSS	SM 2540D	1 L HDPE	n/a	7 days
IOC	Turbidity	EPA 180.1	125 mL HDPE	n/a	48 hours
IOC	Washington Complete IOC	Multiple methods	2 x 1 L HDPE	NaOH for CN in 1L	48 hours
IOC	Idaho Complete IOC	Multiple methods	1 L HDPE	n/a	48 hours
LEAD	Lead in Paint	EPA 6020	10 grams, Ziploc bag	Cool to <4°C	6 months
NITRATE	Nitrate	EPA 300.0	125 mL HDPE	n/a	48 hours
Spokane Co. Test Package	Coliform Bacteria, Nitrate	EPA 9223B/EPA 300.0	125 mL HDPE and Sterile 125 mL bottle	Sodium Thiosulfate (in Sterile bottle only)	30 hours
Tri-County Area Test Package	Coliform Bacteria, Nitrate, Lead, Arsenic	Multiple methods	1 Sterile 125 mL HDPE and 1 125 mL HDPE	Sodium Thiosulfate (in Sterile 125 mL HDPE only)	30 hours

Test Type	Parameter	Method	Container	Preservative	Holding Time
Private Well - Drinking Water					
PRIVATE WELL	Private Well List (with bacteria)	Multiple methods	125 mL HDPE and Sterile 125 mL bottle	Cool to <4°C	30 hours
PRIVATE WELL	Private Well List (without bacteria)	Multiple methods	125 mL HDPE	Cool to <4°C	48 hours
Microbiology - Drinking Water					
Bacteriological	Coliform P/A as Count	SM 9223B	Sterile 125 mL bottle	Sodium Thiosulfate	30 hours
Bacteriological	Heterotrophic Plate Counts (HPC)	SM 9215B	Sterile 125 mL bottle	Sodium Thiosulfate	30 hours
Bacteriological	Iron Bacteria		125 mL HDPE	n/a	30 hours
Bacteriological	Coliform Presence/Absence	SM 9223B	Sterile 125 mL bottle	Sodium Thiosulfate	30 hours
Bacteriological	Coliform Bacteria	SM 9223B	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours
Bacteriological	Coliform Bacteria - Waste Water	SM 9223B	Sterile 125 mL HDPE	Sodium Thiosulfate	6 hours
BOD	BOD	SM 5210B	1 L plastic	n/a	2 days

Microbiology - Waste Water

Test	Method	Container	Preservative	Holding Time
COLIFORM MPN	SM9223B	Plastic	Na2S2O3	6 Hours
E COLI	SM9221F	Plastic	Na2S2O3	8 Hours
E COLI MPN	SM9223B	Plastic	Na2S2O3	6 Hours
FECAL COLIFORMS	SM9221E	Plastic	Na2S2O3	8 Hours
HETEROTROPIC PLATE COUNT	SM9215B	Plastic	Na2S2O3	8 Hours
TOTAL COLIFORMS	SM9221B	Plastic	Na2S2O3	6 Hours
TOTAL/ECOLI COLILERT	SM9223B	Plastic	Na2S2O3	24 Hours

Organics - Waste Water

Test	Method	Container	Preservative	Holding Time
624 VOLATILES IN WW	EPA 624	40mL Amber Vial	HCl	14 Days
AMINOPYRALID	HPLC/MS/MS		n/a	10 Days
BTEX	EPA 624/8260	40mL Amber Vial	HCL	14 Days
CLOPYRALID	GC/MS/MS	Plastic or glass	n/a	14 Days
DIESEL	NWTPHD/EPA 8015D	1L Amber Glass	HCl	14 Days
EPA 8141A	EPA 8141A	1L Amber Glass	n/a	7 Days
EPH - WA DOE	WTPHEPH	G	n/a	7 Days
EXPLOSIVES GC	EPA 8095	1L Amber Glass	n/a	7 Days
EXPLOSIVES HPLC	EPA 8330	1L Amber Glass	n/a	7 Days
GASOLINE	NWTPH-G/EPA 8015D	40mL Amber Vial	HCl	14 Days
Glyphosate-LC/MS	EPA 8321A	250mL Amber Glass	n/a	14 Days
HERBICIDES	EPA 8151A	1L Amber Glass	n/a	14 Days
KEROSENE MOSC	EPA 8015D	1L Amber Glass	HCl	14 Days
METHAMPHETAMINE	HPLC/MS/MS			28 Days
OC PEST 8081A	EPA 8081A	G	n/a	7 Days
OP PESTS	EPA 8270Dm	1L Amber Glass	n/a	7 Days
PAH 8270D MOSC	EPA 8270D	1L Amber Glass	n/a	7 Days
PCB 8082	EPA 8082	G	n/a	7 Days
PERCHLORATE 331.0	EPA 331.0	125mL HDPE	n/a	28 Days
PEST SCREEN 8270D	EPA 8270D	1L Amber Glass	n/a	7 Days
SEMIVOLATILES 625	EPA 625	1L Amber Glass	n/a	7 Days
SVOC 8270D	EPA 8270D	1L Amber Glass	n/a	7 Days
TCLP HERBICIDES	EPA 8151A	1L Amber Glass	n/a	7 Days
TCLP PESTICIDES	EPA 8081A		n/a	14 Days
TCLP SVOC	EPA 8270D	1L Amber Glass	n/a	14 Days
TCLP VOLATILES	EPA 8260B	40mL Amber Vial	HCl	14 Days
TOC/DOC	SM 5310B	40mL Clear Vial	HCl	28 Days
VOLATILE ACIDS GC	EPA 8015D	40mL HCL Vial	HCl	14 Days
VOLATILES 8260	EPA 8260B	40mL HCL Vial	HCl	14 Days
VOLATILES MISC GC/MS	EPA 8260B	40mL HCL Vial	HCl	14 Days
Volatiles Priority Pollutant	EPA 624	40mL HCL Vial	HCl	14 Days
WA Fertilizer Metals	N/A			14 Days

Radiochemistry - Waste Water

Test	Method	Container	Preservative	Holding Time
GROSS ALPHA	EPA 900.0	1L HDPE	HNO3	180 Days
GROSS BETA	EPA 900.0	1L HDPE	HNO3	180 Days
RADIUM-226	EPA 903.0	1L HDPE	HNO3	180 Days
RADIUM-228	EPA 904.0	1L HDPE	HNO3	180 Days

Inorganics - Waste Water

Test	Method	Container	Preservative	Holding Time
ALKALINITY	SM2320B	125mL HDPE	n/a	48 Hours
AMMONIA-NITROGEN	SM4500NH3G	125mL HDPE	H2SO4	28 Days
CARBONATE	SM2320B	125mL HDPE	n/a	48 Hours
CHLORIDE	EPA 300.0	125mL HDPE	n/a	28 Days
CHROMIUM VI (HEXAVALENT)	SM3500CR	1 L Plastic	n/a	28 Days
CN AMENABLE TO CHLORINATION	SM4500CNG	Plastic or glass	NaOH	14 Days
COLOR	SM 2120B	125mL HDPE	n/a	7 Days
CONDUCTIVITY	SM2510B	Plastic or glass	n/a	7 Days
CYANIDE FREE SM 4500 CN-E	SM4500CNE	250mL HDPE	NaOH	14 Days
CYANIDE REACTIVE	SW846 CH7	250mL HDPE	NaOH	14 Days
CYANIDE TOTAL EPA	EPA 335.4	250mL HDPE	NaOH	14 Days
CYANIDE WAD	SM4500CNI	250mL HDPE	NaOH	14 Days
DISSOLVED MERCURY-CVAFS	EPA 245.7		HNO3	28 Days
DISSOLVED MERCURY-TRACE	EPA 1631e	PTFE/Glass	HCl / BrCl	180 Days
DISSOLVED METALS - ICP	EPA 200.7/6010B	Plastic or glass	HNO3	28 Days
DISSOLVED METALS ICP-MS	EPA 200.8/6020a	Plastic or glass	HNO3	28 Days
DISSOLVED NITRATE	EPA 300.0		n/a	48 Hours
DISSOLVED NITRATE + NITRITE AS N	EPA 300.0		n/a	48 Hours
DISSOLVED NITRITE	EPA 300.0		n/a	48 Hours
DISSOLVED PHOSPHATE/P FIA	SM4500PF	Plastic or glass	H2SO4	28 Days
DISSOLVED SULFATE	EPA 300.0		n/a	28 Days
DISSOLVED TOTAL P FIA	SM4500PF	Plastic or glass	H2SO4	28 Days
DOC - MOSC	SM 5310B	40mL Clear Vial	HCl	28 Days
FLUORIDE	EPA 300.0	125mL HDPE	n/a	28 Days
FOG - HEM	EPA 1664A	1L Amber Glass	H2SO4 or HCl	28 Days
FOG - NON POLAR	EPA 1664	1L Amber Glass	H2SO4 or HCl	28 Days
GLYCOLS - EG & PG	EPA 8015	G	n/a	14 Days
HARDNESS	EPA 200.7	125mL HDPE	HNO3	180 Days
MERCURY-CV-7471A	EPA 7471A			28 Days
MERCURY-CVAFS	EPA 245.7	40mL Amber Vial	HCl	28 Days
MERCURY-ICPMS	EPA 200.8	125mL HDPE	HNO3	180 Days
MERCURY-TRACE	EPA 1631e	PTFE/Glass	HCl / BrCl	180 Days
METALS ICP	EPA 200.7/6010B	Plastic or glass	HNO3	180 Days
METALS ICP-MS	EPA 200.8	Plastic or glass	HNO3	180 Days
NITRATE/NITRITE FIA	SM 4500 NO3F/EPA 353.2	125mL HDPE	H2SO4	48 Hours
NITRATE/NITRITE	EPA 300.0	125mL HDPE	n/a	48 Hours
NITRITE - TOTAL N+N FIA	SM 4500 NO3F	125mL HDPE	H2SO4	28 Days
pH	SM 4500pH-B	Plastic or glass	n/a	15 Minutes
PHENOLICS TOTAL	EPA 420.1	1L Amber Glass	H2SO4	28 Days
PHOSPHATE - SRP	SM4500PF	Plastic or glass		28 Days
PHOSPHATE/P	EPA 300.0	Plastic or glass	n/a	48 Hours
PHOSPHATE/P FIA	SM4500PF	Plastic or glass	H2SO4	28 Days
SOLIDS - TDS/TSS/TS/TVS/VSS	SM 2540C	Plastic or glass	n/a	7 Days
SOLIDS - FDS	EPA 160.4	1L HDPE	n/a	7 Days
SULFATE	EPA 300.0	Plastic or glass	n/a	28 Days
SULFIDE REACTIVE	SW846 CH7	250ml HDPE	NaOH / ZnAc	7 Days
SURFACTANTS	SM5540C	Plastic or glass	H2SO4	48 Hours
TANNIN & LIGNIN	SM5550B	Plastic or glass	n/a	28 Days
TCLP MERCURY BY 245.7	EPA 245.7			28 Days
TCLP Metals	EPA 6020A	Plastic or glass		14 Days
TCLP METALS	EPA 6020A		n/a	14 Days
TCLP Metals ICP	EPA 6020A	Plastic or glass		14 Days
TKN	SM4500NORGC	125mL HDPE	H2SO4	28 Days
TOTAL 4	N/A	Plastic or glass	HNO3	14 Days
TOTAL P FIA	SM4500PF	125mL HDPE	H2SO4	28 Days
TOTAL VOLATILE ACIDS	SM5560C	Plastic or glass	n/a	14 Days
TURBIDITY	EPA 180.1	Plastic or glass	n/a	48 Hours

Microbiology - Soils/Solids

Test	Method	Container	Preservative	Holding Time
E COLI	SM9221F	Plastic	n/a	24 Hours
FECAL COLIFORMS	SM9221E	Plastic	n/a	24 Hours
HETEROTROPIC PLATE COUNT	SM9215B	Plastic	n/a	24 Hours
TOTAL COLIFORMS	SM9221B	Plastic	n/a	24 Hours

Organics - Soil/Solids

Test	Method	Container	Preservative	Holding Time
ACROLEIN	EPA 8260B	Glass	Cool to 4°C	14 Days
AMINOPYRALID	HPLC/MS/MS	Plastic or glass	Cool to 4°C	10 Days
BTEX 8260	EPA 8260B	Glass	Cool to 4°C	14 Days
CARBAMATE PESTICIDES	EPA 8318	Glass	Cool to 4°C	28 Days
CLOPYRALID	GC/MS/MS	Plastic or glass	Cool to 4°C	28 Days
DIESEL	NWTPH-DX/EPA 8015D	Glass	Cool to 4°C	14 Days
EPA 6850 perchlorate	EPA 331.0	4oz glass jar	Cool to 4°C	14 Days
EPA 8141A	EPA 8141A		Cool to 4°C	7 Days
EPH - WA DOE	WTPHEPH	Glass	Cool to 4°C	14 Days
EXPLOSIVES GC	EPA 8096	Glass	Cool to 4°C	14 Days
EXPLOSIVES HPLC	EPA 8330	Glass	Cool to 4°C	14 Days
GASOLINE	NWTPH-GX/EPA 8015D	Glass	Cool to 4°C	14 Days
GLYPHOSATE IN SOIL	HPLC/MS/MS	Glass	Cool to 4°C	28 Days
HERBICIDES	EPA 8151A	Glass	Cool to 4°C	14 Days
KEROSENE	EPA 8015D		Cool to 4°C	14 Days
METHAMPHETAMINE	HPLC/MS/MS		Cool to 4°C	28 Days
OC PEST 8081A	EPA 8081A	Glass	Cool to 4°C	14 Days
OP PESTS	EPA 8270Dm/EPA 8141	Glass	Cool to 4°C	14 Days
PAH 8270D MOSC	EPA 8270D	1L Amber Glass	Cool to 4°C	7 Days
PCB 8082	EPA 8082	Glass	Cool to 4°C	14 Days
PERCHLORATE 6850	EPA 6850	8 OZ JAR	Cool to 4°C	14 Days
SEMIVOLATILES 625	EPA 625	Glass	Cool to 4°C	7 Days
SEMIVOLATILES MISC GC/FID	GC/FID		Cool to 4°C	7 Days
SEMIVOLATILES MISC GC/MS	EPA 8270CMOD		Cool to 4°C	14 Days
SEMIVOLATILES MISC GC/MS/MS	EPA 8270CMOD		Cool to 4°C	7 Days
SEMIVOLATILES MISC HPLC	HPLC		Cool to 4°C	14 Days
SEMIVOLATILES MISC LC/MS/MS	EPA 8321A		Cool to 4°C	14 Days
SPLP TPHDx	EPA 8015D		Cool to 4°C	14 Days
SVOC 8270D MOSC	EPA 8270D	1L Amber Glass	Cool to 4°C	7 Days
TCLP HERBICIDES	EPA 8151A		Cool to 4°C	14 Days
TCLP PCB	EPA 8082		Cool to 4°C	14 Days
TCLP PESTICIDES	EPA 8081A		Cool to 4°C	14 Days
TCLP SVOC	EPA 8270D		Cool to 4°C	14 Days
TCLP VOLATILES	EPA 8260B		Cool to 4°C	14 Days
VOLATILES 8260	EPA 8260B	Glass	Cool to 4°C	14 Days

Inorganics - Soil/Solids

Test	Method	Container	Preservative	Holding Time
ALKALINITY	SM2320B	Plastic or glass	Cool to 4°C	48 Hours
AMMONIA-NITROGEN	SM4500NH3G	Plastic or glass	Cool to 4°C	28 Days
CATION EXCHANGE CAPACITY	EPA 9081	Plastic or glass	Cool to 4°C	28 Days
CHLORIDE	EPA 300.0	Plastic or glass	Cool to 4°C	28 Days
CN AMENABLE TO CHLORINATION	SM4500CNG	Plastic or glass	Cool to 4°C	14 Days
CONDUCTIVITY	ASTM G57A		Cool to 4°C	7 Days
CYANIDE REACTIVE	SW846 CH7	Plastic or glass	Cool to 4°C	14 Days
CYANIDE TOTAL	EPA 335.4/EPA 9012B	Plastic or glass	Cool to 4°C	14 Days
CYANIDE TOTAL EPA 9012B	EPA 9012B		Cool to 4°C	14 Days
CYANIDE TOTAL SM	SM4500CNE	Plastic or glass	Cool to 4°C	14 Days
CYANIDE WAD	SM4500CNI	Plastic or glass	Cool to 4°C	14 Days
FLUORIDE	EPA 300.0	Plastic	Cool to 4°C	28 Days
FOG - HEM	EPA 1664A	Glass	Cool to 4°C	28 Days
FOG - NON POLAR	EPA 1664	Glass	Cool to 4°C	28 Days
GLYCOLS - EG & PG	EPA 8015	Glass	Cool to 4°C	14 Days
HEX CHROM - SOIL	SM3500 CrD		Cool to 4°C	Days
MERCURY-CV-7471A	EPA 7471A		Cool to 4°C	28 Days
MERCURY-ICPMS	EPA 6020A	Plastic or glass	Cool to 4°C	180 Days
METALS ICP	EPA 200.7/6010B		Cool to 4°C	180 Days
METALS ICP-MS	EPA 6020A	Plastic or glass	Cool to 4°C	180 Days
NITRATE FIA	SM 4500 NO3F	Plastic or glass	Cool to 4°C	48 Hours
NITRATE/N	EPA 300.0	Plastic or glass	Cool to 4°C	48 Hours
NITRATE+ NITRITE AS N	EPA 300.0	Plastic or glass	Cool to 4°C	28 Days
NITRATE+NITRITE FIA	SM 4500 NO3F	Plastic or glass	Cool to 4°C	28 Days
NITRITE FIA	SM 4500 NO3F	Plastic or glass	Cool to 4°C	48 Hours
NITRITE/N	EPA 300.0	Plastic or glass	Cool to 4°C	48 Hours
pH 1:5	EPA 9045	Plastic or glass	Cool to 4°C	14 Days
PHENOLICS TOTAL	EPA9065	Glass	Cool to 4°C	28 Days
PHOSPHATE/P	EPA 300.0	Plastic or glass	Cool to 4°C	48 Hours
PHOSPHATE/P FIA	SM4500PF	Plastic or glass	Cool to 4°C	48 Hours
SOLIDS - TSS/TVS	SM2540D	Plastic or glass	Cool to 4°C	7 Days
SPLP MERCURY BY 245.7	EPA 245.7		Cool to 4°C	28 Days
SPLP Metals	EPA 6020A	Plastic or glass	Cool to 4°C	14 Days
SULFATE	EPA 300.0	Plastic or glass	Cool to 4°C	28 Days
SULFIDE - EXTRACTABLE	EPA 9031		Cool to 4°C	Days
SULFIDE REACTIVE	SW846 CH7		Cool to 4°C	Days
SURFACTANTS	SM5540C	Plastic or glass	Cool to 4°C	48 Hours
SURFACTANTS	SM5540C	Plastic or glass	Cool to 4°C	48 Hours
TCLP 8 METALS	N/A		Cool to 4°C	14 Days
TCLP MERCURY BY 245.7	EPA 245.7		Cool to 4°C	14 Days
TCLP MERCURY BY 6010B	EPA 6010B		Cool to 4°C	180 Days
TCLP Metals	EPA 6020A	Plastic or glass	Cool to 4°C	14 Days
TCLP Metals ICP	EPA 6010B		Cool to 4°C	180 Days
TKN	SM4500NORGC	Plastic or glass	Cool to 4°C	28 Days
TOTAL 4/8	N/A		Cool to 4°C	14 Days
TOTAL P FIA	SM4500PF	Plastic or glass	Cool to 4°C	28 Days
TOTAL SOLIDS	SM2540G		Cool to 4°C	28 Days

Figures

Anatek Labs, Inc. Organizational Chart

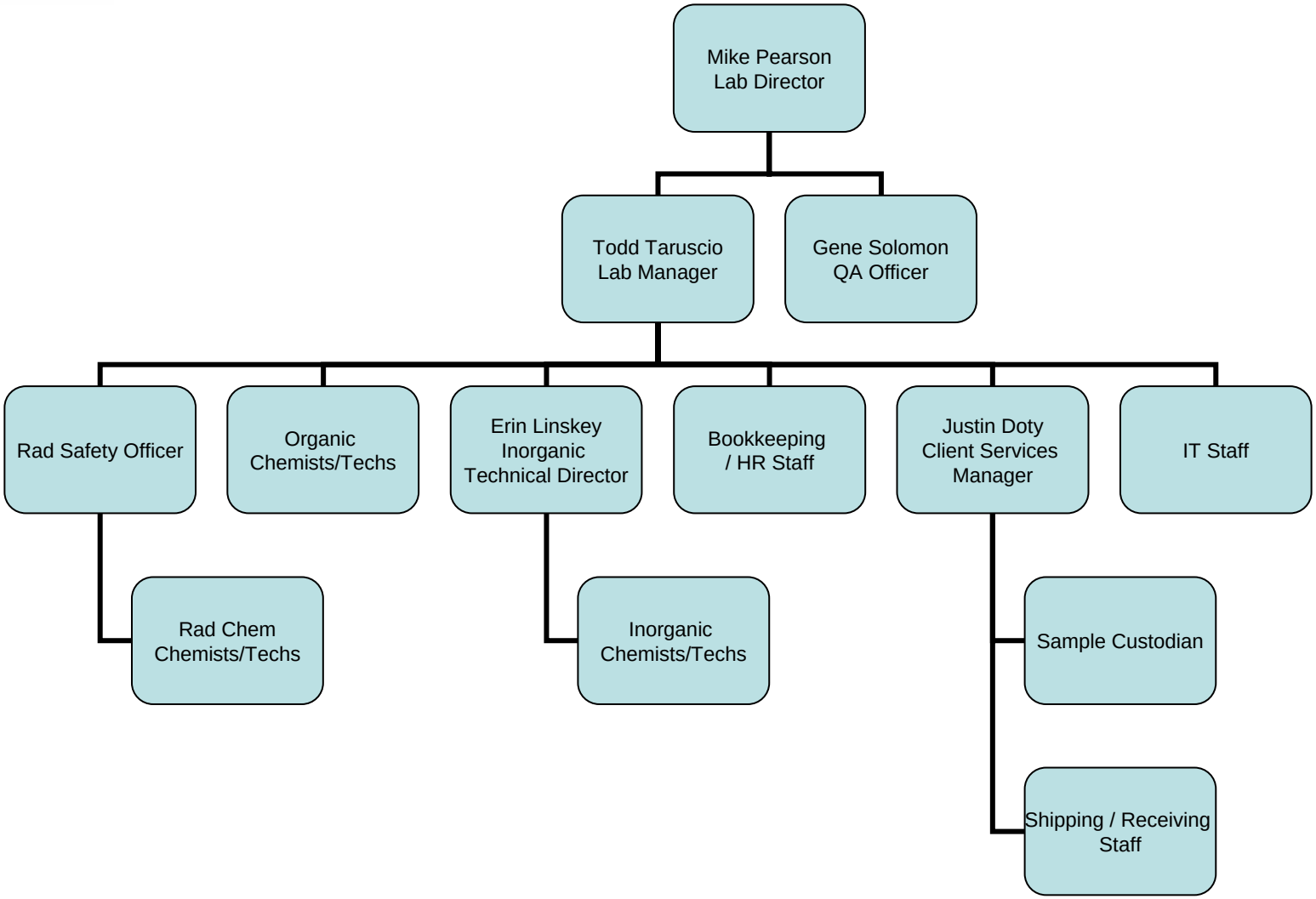
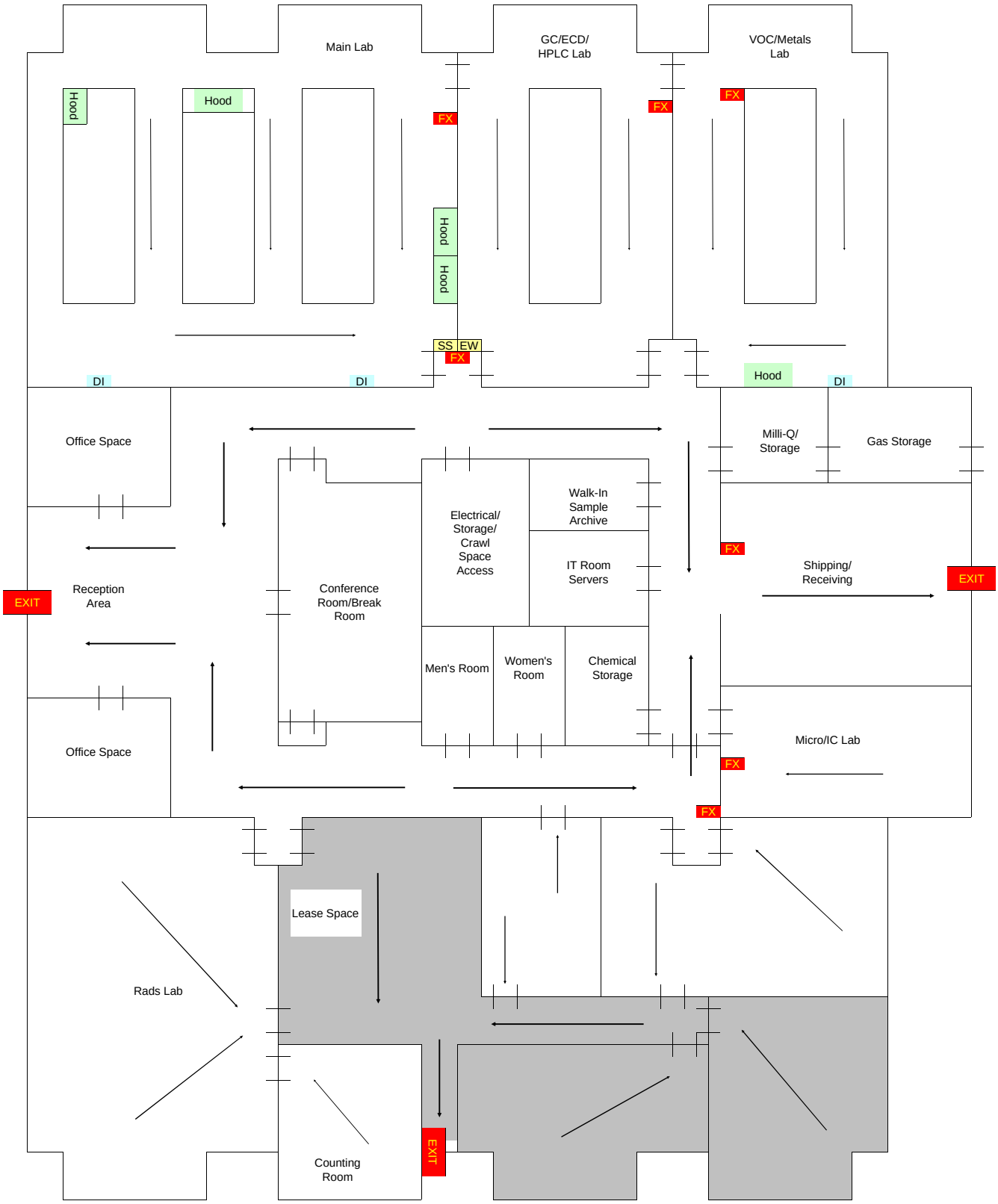


Figure 2

Anatek Labs, Moscow Personnel

Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S Elec. Eng.
Laboratory Manager	Todd Taruscio	Ph.D. Zoophysiology
Technical Director - Inorganics Supervisor	Erin Linskey	B.S. Biology
Technical Director - Rads Supervisor	John Ingram	M.S. Chemistry/MBA
Chemist III	Stuart Tolman	M.S. Food Science
Chemist II	Mark Havrilla	B.S. Chemistry
Chemist II	Helen Westbrook	M.S. Chemistry/B.S. Biochemistry
Chemist I	Brandon McGovern	B.S. Science Microbiology
Chemist I	Mark Ritari	B.S. Chemistry
Lab Tech	Kelly Cavanaugh	B.S. Microbiology/Molecular Biology
Lab Tech	Staniela Nikolova	B.S. Molecular Biology/Biotech
QA Officer	Gene Solomon	B.A. Economics
Client Services/Project Manager	Justin Doty	
Sample Custodian	Travis Keane	
Shipping/Receiving Asst.	Justin Korn	
IT Manager	Terrill Settles	
Bookkeeper	Cheri Price	
Bookkeeper	Kerri Renner	


Main Lab
GC/ECD/
HPLC Lab
VOC/Metals
Lab
Hood
Hood
Hood
Hood
Hood
FX
FX
FX
FX
SS
EW
DI
DI
DI
Hood
Office Space
Milli-Q/
Storage
Gas Storage
Electrical/
Storage/
Crawl
Space
Access
Walk-In
Sample
Archive
IT Room
Servers
Shipping/
Receiving
EXIT
EXIT
Reception
Area
Conference
Room/Break
Room
Men's Room
Women's
Room
Chemical
Storage
Office Space
Micro/IC Lab
Lease Space
Rads Lab
Counting
Room
EXIT

Anatek Labs, Inc.

Anatek Labs Organizational Chart - Spokane, Inc.

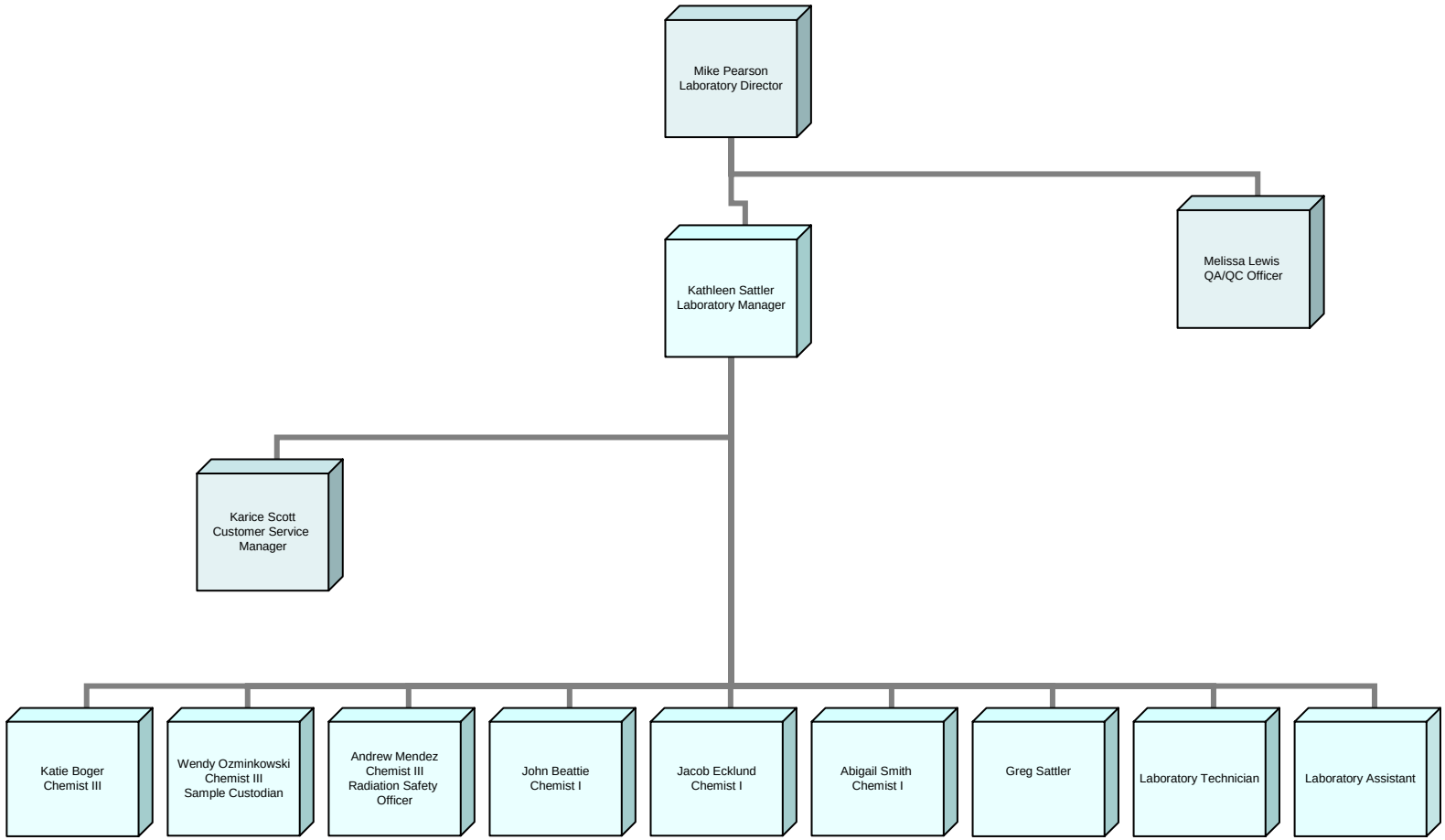


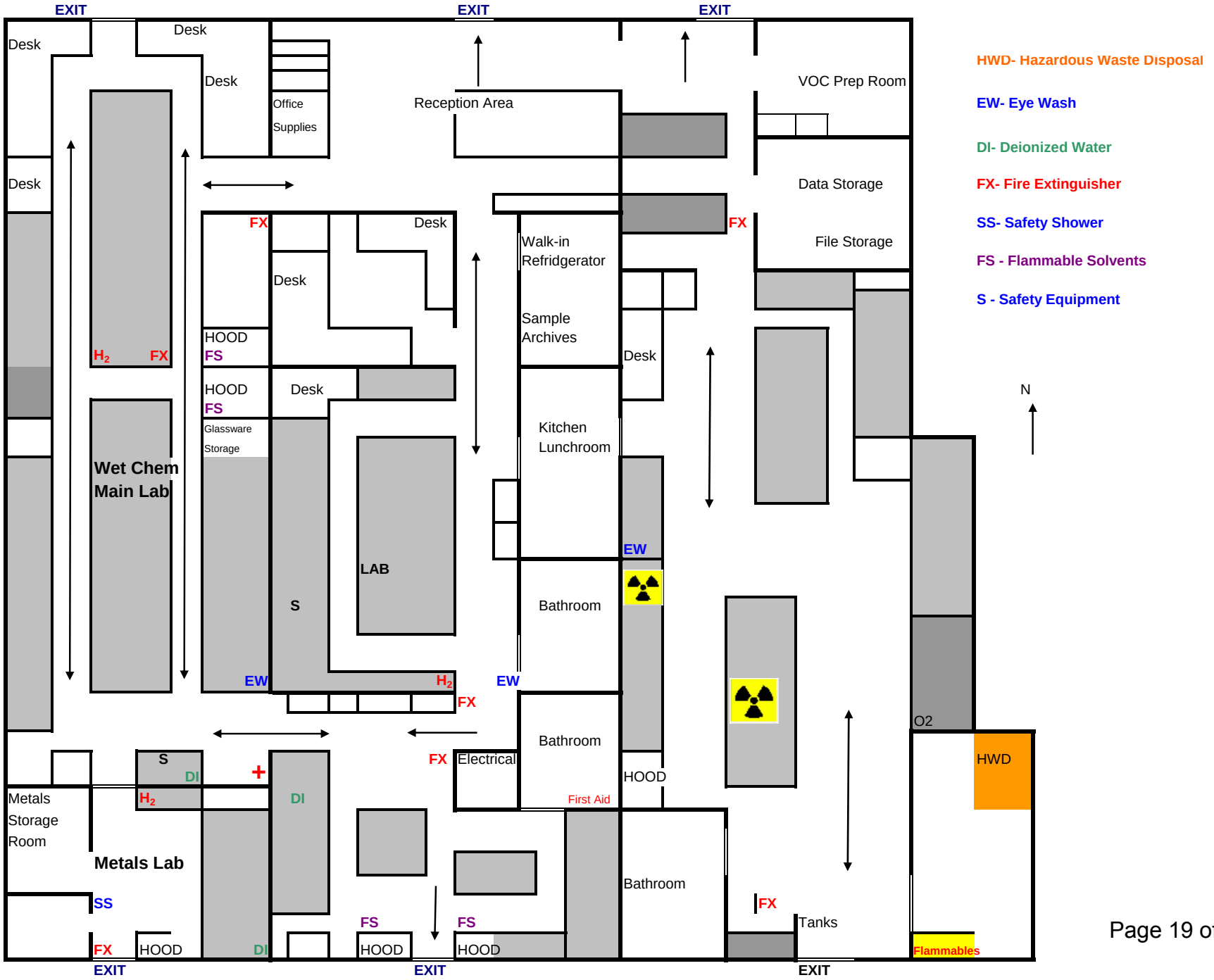
Figure 5

Anatek Labs, Spokane
Personnel

Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S. Electrical Engineering
Laboratory Manager	Kathleen Sattler	B.S. Microbiology
QA Officer	Melissa Lewis	B.S. General Studies/Natural Sciences
Chemist III	Wendy Ozminkowski	B.S. Chemistry
Chemist II	Katie Boger	B.S. Chemistry and Biochemistry
Chemist II/RSO	Andrew Mendez	B.A. Chemistry
Chemist I	Jacob Ecklund	B.S. Biochemistry
Chemist I	Abigail Smith	
Chemist I	Greg Sattler	B.S. Microbiology
Chemist I	John Beattie	B.A. Environmental Studies
Customer Service Manager	Karice Scott	

Anatek Labs, Spokane Floor Plan and Safety Plan

Figure 6



HWD- Hazardous Waste Disposal

EW- Eye Wash

DI- Deionized Water

FX- Fire Extinguisher

SS- Safety Shower

FS - Flammable Solvents

S - Safety Equipment

Anatek Labs, Inc.

Appendices

Appendix A

Index of Standard Operating Procedures

Moscow Index is followed by Spokane Index

Anatek Labs, Inc.
Standard Operating Procedures

Laboratory Director:
Mike Pearson

17 July 2017

The SOP's contained herein are for the use of Anatek Labs Employees and are not to be removed from the premises without the prior approval of the Lab Director or Lab Manager. Original signed copies are maintained by the QA Officer. Any changes should be submitted to the QA Officer for implementation.

SOP Number	Effective Date	SOP Name
General		
ALI-01.05:	23 Feb 2015	Preparing and Maintaining Standard Operating Procedures
ALI-02.05:	23 Jan 2017	Sample Login, Handling and Custody
ALI-03.02:	12 Feb 2010	Glassware Cleaning
ALI-04.07:	16 Feb 2015	Waste Disposal
ALI-05.04:	11 Jan 2016	Data Entry
ALI-06.03:	14 Jan 2013	Complaints
ALI-07.07:	17 Mar 2017	Corrective Action Reports and Non-Conformance Forms
ALI-08.08:	1 Feb 2017	Standards and Reagents – Labeling, Logging, Storage, and Expiration Dates
ALI-09.10:	11 Jan 2016	Instrument Maintenance and Calibration
ALI-10.09:	1 Feb 2017	Laboratory Safety
ALI-11.05:	01 Feb 2015	Data Handling
ALI-12.03:	01 Feb 2015	Laboratory Blind Samples
ALI-13.03:	14 Jan 2013	Personnel Training Records
ALI-14.10:	28 Mar 2016	Data Archiving
ALI-15.02:	14 Jan 2013	Instrument Activities Logbooks & Laboratory Notebooks
ALI-16.06:	14 Sep 2015	Internal Inspections and Reporting
ALI-17.04:	23 Feb 2015	Procedure for QA Audits of Instrument Activity Logs, IDC's & MDL's
ALI-18.14:	23 Jan 2017	Sample Receiving
ALI-19.09:	23 Jan 2017	Temperature Monitoring and Thermometer Calibrations
ALI-20:		No longer in use
ALI-21.04:	01 Mar 2016	Customer & Regulator Notification
ALI-22.03:	01 Feb 2015	Training
ALI-23:		No longer in use

ALI-24.03:	23 Feb 2015	Performing Records Inspections
ALI-25.05:	16 Feb 2015	Performance of IDCs, MDLs, and PQLs
ALI-26.03:	21 Nov 2012	Data Reporting
ALI-27.03:	28 Mar 2016	IT Systems Documentation
ALI-28.00:	01 Sep 2012	QC Acceptance Ranges
ALI-29.03:	17 Jan 2017	PT Reporting
ALI-30.02:	13 Jan 2017	Authorized Signatures
ALI-31.00:	01 Aug 2015	Master List of Quality Systems Documents
ALI-32.00:	13 Mar 2017	Preventive Action Reports
Office Manual		
ALI-OM-01.02:	13 Jan 2010	Customer Service
ALI-OM-02.02:	13 Jan 2010	Custodial Services
ALI-OM-03:		No longer in use
ALI-OM-04.02:	13 Jan 2010	Telephone Systems Procedures
ALI-OM-05.02:	13 Jan 2010	Mail Handling
ALI-OM-06.03:	09 Jan 2015	Purchasing
ALI-OM-07.07:	09 Jan 2015	Shipping
ALI-OM-08.03:	14 Jan 2013	Office Equipment
ALI-OM-09.05:	24 Jan 2011	Accounting
ALI-OM-10.03:	28 Jan 2013	Credit Accounts
ALI-OM-11.04:	19 Jan 2015	Employees
ALI-OM-12.00:	01 Jun 2014	Website Maintenance
Radiochemistry – General (00)		
ALI-R-01.05:	16 Dec 2016	Radiation Safety Plan
ALI-R-02.01:	6 Mar 2017	Disposal by Sanitary Sewerage
ALI-R-03.00:	1 Sept 2015	Radiochemical Method Validation
Analytical		
Drinking Water (100)		
ALI-A-101.12:	12 Oct 2015	EDB/DBCP/1,2,3-TCP Analysis by EPA Method 504.1
ALI-A-102.17:	12 Oct 2015	Haloacetic Acids Analysis by SM 6251B
ALI-A-103.14:	20 Oct 2014	Organochlorine Pesticides and PCB's by EPA Method 505
ALI-A-104.15:	3 Oct 2016	Herbicides Analysis by EPA Method 515.4
ALI-A-105.08:	29 Mar 2013	Volatile Organic Analysis by EPA Method 524.2
ALI-A-106.17:	13 Feb 2017	Semi-volatiles Analysis by EPA Method 525.2
ALI-A-107.13:	5 Feb 2017	Carbamates Analysis by EPA Method 531.2
ALI-A-108.10:	5 Feb 2017	Glyphosate Analysis by EPA Method 547
ALI-A-109.10:	6 Mar 2017	Endothall Analysis by EPA Method 548.1
ALI-A-110.09:	10 Oct 2016	Diquat/Paraquat Analysis by EPA Method 549.2
ALI-A-111:	Not in use	Explosives by GC/MS – EPA Method 529
ALI-A-112:	Not in use	Pesticides and Flame Retardants by GC/MS – EPA Method 527

ALI-A-113:	Not in use	Acetanilide Degradates by LC/MS/MS – EPA Method 535
ALI-A-114:	Not in use	Nitrosamines by GC/MS/MS - EPA Method 521
ALI-A-115:	Not in use	Semi-volatiles Analysis by EPA Method 525.2 – UCMR2 List
ALI-A-116.02:	16 Feb 2015	Volatile Organic Analysis by EPA Method 524.3
ALI-A-117.00:	20 Jan 2012	1,4-Dioxane by EPA Method 522
ALI-A-118.00:	12 Mar 2012	Perfluorinated Alkyl Acids by EPA Method 537
ALI-A-119.00:	12 Mar 2012	Hormones Analysis by EPA Method 539
Non Drinking Water Organic (200)		
ALI-A-201.05:	13 Feb 2017	Pressurized Fluid Extraction By EPA Method 3545
ALI-A-202:		No longer used
ALI-A-203.11:	08 Nov 2014	Pesticides/PCB's by EPA Method 608/608.2
ALI-A-204.02:	21 Feb 2011	Carbamates/Urea Pesticide Analysis by HPLC-UV by EPA Method 8321B & EPA Method 632
ALI-A-205.12:	6 Feb 2016	Herbicides by EPA Method 8151A/615
ALI-A-206.15:	13 Feb 2017	Semivolatile Organic Compounds Analysis by GC/MS by EPA Method 625/8270D
ALI-A-207.08:	1 Apr 2017	Volatile Organic Analysis by EPA Method 8260C
ALI-A-208.08:	1 Apr 2017	Volatile Organic Analysis by EPA Method 624
ALI-A-209.03:	30 Mar 2016	Explosives and Explosive By-products by EPA Method 8330B
ALI-A-210:		No longer used
ALI-A-211.10:	13 Feb 2017	Organophosphorus Pesticide Analysis by GC/MS by EPA Method 8141B Modified/614/614.1
ALI-A-212.11:	15 Jan 2016	Pesticides/PCB's by EPA Method 8081B/8082A
ALI-A-213.06:	02 Mar 2015	Soil Herbicides by EPA Method 8151A Modified
ALI-A-214:		No longer used
ALI-A-215:		See SOP ALI-A-340
ALI-A-216.02:	26 Mar 2012	Volatile Organic Analysis by EPA Method 8260B
ALI-A-217.03:	13 Feb 2017	Semivolatile Organic Compounds Analysis by EPA Method 8270C
ALI-A-218.02:	05 Oct 2015	Triclopyr and 2,4-D by HPLC/MS/MS by EPA Method 8321A
ALI-A-219.00:	18 Nov 2013	Closed Purge-and-Trap Extraction for VOCs by EPA Method 5035A
ALI-A-220.02:	5 Feb 2017	Continuous Liquid-Liquid Extraction by EPA Method 3520C
ALI-A-221.00:	16 Feb 2016	PCBs in Oil and Soil by EPA Method 8082A
Inorganic and Wet Chemistry (300)		
ALI-A-301.07:	22 May 2017	Orthophosphate/Total Phosphorus (SM4500P-F/EPA 365.4) Flow Injection Analysis
ALI-A-302:		No longer in use
ALI-A-303.08:	6 Mar 2017	Phenolics by Manual Colorimetry by EPA Method 420.1/SM5530C/EPA 9065
ALI-A-304.07:	22 May 2017	Ammonia Nitrogen (SM4500NH3-G/EPA 350.1) and TKN (SM4500NorgC) by Flow Injection

		Analysis
ALI-A-305.02:	06 Apr 2012	Cation Exchange Capacity of Soils by EPA Method 9081
ALI-A-306.02:	01 Sep 2014	Residual Chlorine by SM 4500Cl-G
ALI-A-307:		No longer in use
ALI-A-308.06:	8 Apr 2016	Cyanide (Total, Amenable, and Weak Acid Dissociable) by Semi-Automated Colorimetry SM 4500-CN-E-G-I
ALI-A-309.10:	20 Apr 2015	Total Cyanide by Semi-Automated Colorimetry by EPA Method 335.4/9012B
ALI-A-310.07:	05 Dec 2011	pH by EPA Method 150.1 & EPA Method 9045C & SM4500 H+B
ALI-A-311.07:	13 Apr 2017	Alkalinity by EPA Method 310.1/SM 2320B
ALI-A-312.08:	9 Jun 2017	Conductivity by EPA Method SM 2510B (and Resistivity by ASTM G57a)
ALI-A-313.03:	24 Jan 2014	Hardness by SM 2340B
ALI-A-314.12:	17 Jul 2017	Trace Metal Analysis by EPA Method 200.8
ALI-A-315.11:	1 Dec 2016	Trace Metal Analysis by EPA Method 6020B
ALI-A-316.02:	Not in use	Ultra Trace Metal Analysis by EPA Method 1638
ALI-A-317:		No longer in use
ALI-A-318.11:	1 Feb 2016	Trace Mercury Analysis by EPA Method 1631/245.7/7471A
ALI-A-319.07:	22 May 2017	Nitrate/N and Nitrite/N (SM4500NO3-F & EPA 353.2) Flow Injection Analysis
ALI-A-320.12:	22 May 2017	Ions (Nitrate, Nitrite, Chloride, Sulfate, Fluoride, Phosphate) By EPA Method 300.0
ALI-A-321.03:	04 Feb 2013	Chlorate Analysis by EPA Method 300.1
ALI-A-322.07:	7 Jun 2017	Turbidity by EPA Method 180.1
ALI-A-323.10:	17 Mar 2017	TSS by SM 2540-D and TDS by SM 2540-C
ALI-A-324.02:	18 Feb 2013	Color (Platinum-Cobalt Method) by SM 2120B
ALI-A-325.04:	02 Nov 2015	Total Volatile Solids by EPA Method 160.4/SM 2540E & Total Fixed Solids (%Ash) by EPA Method 1684 and Total Solids
ALI-A-326.02:	01 Mar 2012	Total Volatile Acids by SM 5560 C
ALI-A-327.03:	11 Apr 2016	Anionic Surfactants by Method 5540 C
ALI-A-328.05:	1 Mar 2017	Tannin and Lignin by SM 5550 B
ALI-A-329:		No longer in use
ALI-A-330.06:	11 Jan 2016	Toxicity Characteristic Leaching Procedure by SW 846 Method 1311
ALI-A-331:		No longer in use
ALI-A-332.05:	02 Nov 2015	Sulfide (SM4500-S2 F) Iodometric Titration
ALI-A-333:	Not in use	Ammonia Nitrogen by SM4500 NH3-G (Discrete Analyzer)
ALI-A-334:	Not in use	Low Level Orthophosphate/Total P by SM4500P-F (Discrete Analyzer)
ALI-A-335:	Not in use	Mid Range Orthophosphate/Total P by SM4500P-F (Discrete Analyzer)
ALI-A-336:	Not in use	TKN by SM4500NorgC (Discrete Analyzer)

ALI-A-337.04:	24 Feb 2014	Synthetic Precipitation Leaching Procedure by SW-846 Method 1312
ALI-A-338.08:	1 Dec 2016	Trace Metals Analysis by EPA Method 200.7
ALI-A-339.05:	1 Dec 2016	Trace Metals Analysis by EPA Method 6010B
ALI-A-340.04:	27 Feb 2015	Perchlorate by EPA Method 331.0 (HPLC/ESI/MS)
ALI-A-341.03:	12 Mar 2012	Perchlorate by EPA Method 6850
ALI-A-342.02:	18 Aug 2014	TOC/DOC by SM5310B
ALI-A-343.06:	04 Dec 2014	Trace Metals Analysis by EPA Method 200.8 – UCMR3 Analysis
ALI-A-344.02:	6 Jan 2016	Acid Digestion of Sediments, Sludges, and Soils by EPA Method 3050B
ALI-A-345.00:	26 Jun 2013	Odor by SM 2150B
UST Petroleum Methods (400)		
ALI-A-401:		No longer used
ALI-A-402:		No longer used
ALI-A-403:		No longer used
ALI-A-404.08:	1 Dec 2016	Gasoline Analysis by NWTPHG(x)/EPA Method 8260C/EPA Method 8015 (Modified)/NW TPHG(X)
ALI-A-405.13:	13 Mar 2017	TPH-D & HCID-NW TPH-D & NW TPH-HCID – EPA 8015D
ALI-A-406:		No longer used
ALI-A-407.06:	24 Feb 2017	Hexane Extractable Material (FOG) by EPA Method 1664B
ALI-A-408.05:	11 Mar 2013	Extractable Petroleum Hydrocarbons (EPH) Massachusetts Method) and Diesel Range Organics (DRO)
ALI-A-409:		No longer used
ALI-A-410:		No longer used
ALI-A-411.02:	20 Apr 2012	Flashpoint by EPA Method 1010
ALI-A-412:	Not in use	C10-C32 Hydrocarbons in Soil by 8015AZ
ALI-A-413.03:	26 Jan 2015	Glycols by EPA 8015D
Coliform and Bacteria (500)		
ALI-A-501.06:	16 Mar 2016	SM 9223B-MPN (Quanti-tray) Procedure
ALI-A-502.10:	27 Feb 2017	SM 9223B-PA Procedure
ALI-A-503.04:	1 Mar 2017	Heterotrophic Plate Count by Method 9215 B
ALI-A-504:		No longer used
ALI-A-505.04:	19 Apr 2016	SM 9223E-MPN Fecal Coliform and E. coli Count by Multiple Tube Fermentation
ALI-A-506.05:	19 Apr 2016	SM9221B-E-F-MPN Total Coliform, Fecal Coliform, and E. coli Count by Multiple Tube Fermentation
ALI-A-507.00	1 Jan 2017	BOD, CBOD, and Dissolved Oxygen by SM 5210B
Special (600)		
ALI-A-601.06:	02 Mar 2015	Quantitation of Clopyralid in Finished Compost

ALI-A-602.05:	25 Mar 2016	Determination of Methamphetamine from Wipe Samples and Other Matrices
ALI-A-603.00:	26 Nov 2012	Glyphosate and AMPA in Soil & Solids
Radiochemistry - Analytical (700)		
ALI-A-701.06:	10 Mar 2017	Gross Alpha-Beta Radioactivity by EPA Method 900.0
ALI-A-702.05:	4 Jan 2017	Radium-226 by EPA Method 903.1
ALI-A-703.06:	10 Mar 2017	Radium-228 by EPA Method 904.0
ALI-A-704.01:	6 Mar 2017	Wipe Testing for Gross Alpha-Beta Radioactivity
ALI-A-705.04:	20 Mar 2017	ICP Barium Recovery
ALI-A-706.05:	10 Mar 2017	Radium 226 by EPA Method 903.0

Anatek Labs, Inc.
Standard Operating Procedures

Office Manual and General SOP's

Laboratory Director: Mike Pearson
Laboratory Manager: Kathy Sattler

Revised 1 March 2015

The SOP's contained herein are for the use of Anatek Labs employees and are not to be removed from the premises without the prior approval of the Lab Director or Lab Manager. Original signed copies are maintained by the QA Officer. Any changes should be submitted to the QA Officer for implementation.

Office Manual (00)

ALI-OM-01	Customer Service
ALI-OM-02	Custodial Services
ALI-OM-03	Sample Handling Procedures
ALI-OM-04	Telephone Systems Procedures
ALI-OM-05	Mail Handling
ALI-OM-06	Purchasing
ALI-OM-07	Shipping
ALI-OM-08	Office Equipment
ALI-OM-09	Accounting
ALI-OM-10	Credit Accounts
ALI-OM-11	Employees

General (00)

ALI-01	Preparing and Maintaining Standard Operating Procedures
ALI-02	Sample Login, Handling, and Custody
ALI-03	Glassware Cleaning
ALI-04	Waste Disposal
ALI-05	Data Entry
ALI-06	Complaints

General (00) cont.

ALI-07	Corrective Action Reports
ALI-08	Standards and Reagents - Labeling, Logging, Storage, and Expiration Dates
ALI-09	Instrument Maintenance and Calibrations
ALI-10	Chemical Hygiene Plan
ALI-11	Data Handling
ALI-12	Laboratory Blind Sample
ALI-13	Personnel Training Records
ALI-14	Data Archiving
ALI-15	Instrument Activities Logbooks
ALI-16	Internal Inspections and Reporting
ALI-17	Procedure for QA Audits of Instrument Activity Logs, IDC's and MDL's
ALI-18	Sample Receiving
ALI-19	Calibration and Monitoring of Thermometers
ALI-20	IDEXX Bottle Volume and Sterility Test
ALI-21	Customer Notification
ALI-22	Training
ALI-23	Shipping and Receiving
ALI-24	Performing Records Inspections
ALI-25	Performance of IDCs, MDLs, and PQLs
ALI-26	Data Reporting
ALI-27	IT Systems Documentation
ALI-28	Control Charting
ALI-29	PT Reporting
ALI-30	Authorized Signatures
ALI-31	Fume Hood Performance Testing
ALI-32	Vendor Qualifications and Purchasing
ALI-33	Regulatory Inspections
ALI-34	Law Enforcement, Cannabis and Anatek Labs
ALI-35	Security System

Analytical (000)

Organics (100)

ALI-S-101	Volatile Organic Analysis by EPA Method 524.2
ALI-S-102	Volatile Organic Analysis by EPA Method 624.4
ALI-S-103	Volatile Organic Analysis by EPA Method 8260B - retired
ALI-S-104	Total Organic Carbon by SM 5310C
ALI-S-105	Total Organic Halides by EPA Method 9020B
ALI-S-106	Extractable Organic Halides by EPA Method 9023
ALI-S-107	Haloacetic Acids by SM 6251B
ALI-S-108	Volatile Organic Analysis by EPA Method 8260C

Inorganic and Wet Chemistry (200)

ALI-S-201 Total Phosphorus by SM4500-PF
ALI-S-202 Total Residual Chloride by SM4500Cl-G
ALI-S-203 Total Cyanide by SM 4500CN-F
ALI-S-204 pH by EPA Method 150.1
ALI-S-205 Alkalinity (Carbonate & Bicarbonate) by SM 2320 B/EPA 310.1
ALI-S-206 Conductivity by SM 2510 B
ALI-S-207 Hardness by SM 2340 B
ALI-S-208 Anions (NO_3, NO_2, SO_4, Cl, F, PO_4, Br) by EPA Method 300.0
ALI-S-209 Ions (Bromate, Chlorate, Chlorite) by EPA Method 300.1 Part B
ALI-S-210 Turbidity by EPA Method 180.1
ALI-S-211 TSS (Total Suspended Solids) by EPA Method 160.2/SM 2540 D
ALI-S-212 TDS (Total Dissolved Solids) by EPA Method 160.1/SM 2540 C
ALI-S-213 TS (Total Solids) by EPA Method 160.3
ALI-S-214 BOD/DO/CBOD by SM 5210 B
ALI-S-215 COD by EPA Method 410.4
ALI-S-216 Percent Solids
ALI-S-217 pH (non-aqueous) by EPA Method 9045D
ALI-S-218 Color by SM 2120 B
ALI-S-219 Ammonia Nitrogen by SM 4500 NH3-G
ALI-S-220 Ortho-phosphate by SM 4500-PF
ALI-S-221 Sulfide by SM4500-S^{2-}F
ALI-S-222 Acidity by EPA 310.1 / SM2310-B
ALI-S-223 Sulfite by SM4500-SO_3^{2-}B
ALI-S-224 pH (in Soil and Waste) by EPA Method 9040C
ALI-S-225 Resistivity by ASTMG57A
ALI-S-226 Metals by EPA 200.8
ALI-S-227 Metals by EPA 6020A
ALI-S-228 TKN by SM 4500N_{ORG} C
ALI-S-229 Specific Gravity/Density by
ALI-S-230 Chlorine Demand by SM
ALI-S-231 MBAS by SM 5540C
ALI-S-232 Carbon Dioxide
ALI-S-233 Sulfide by SM4500-S^{2-}D
ALI-S-234 CN in DW by SM 4500 CN F / EPA 335.4
ALI-S-235 Total CN by SM 4500 CN N / EPA 335.4
ALI-S-236 Nitrate + Nitrite by SM 4500
ALI-S-237 Hexane Extractable Material by EPA 1664A/B
ALI-S-238 Sharps, Inerts and Foreign Matter by TMECC 03.06
ALI-S-239 Mercury Analysis by EPA 245.1
ALI-S-240 Trace Mercury Analysis by EPA 245.7/1631/7471A
ALI-S-241 Toxicity Characteristic Leaching Procedure by SW 846 Method 1311
ALI-S-242 Cation Exchange Capacity of Soils by EPA Method 9081
ALI-S-243 TVS, VSS, FDS by SM 2540
ALI-S-244 Acid Digestion of Sediments, Sludges, and Soils by EPA 3050B

Hazardous Waste/Waste Oil (300)

ALI-S-301 PCB's by EPA Method 8082
ALI-S-302 BTU – Heat of Combustion
ALI-S-303 Total Chlorine by EPA Method 9076

UST Petroleum Methods (400)

ALI-S-401 Gasoline Analysis by NW TPHG(x)
ALI-S-402 BTEX by EPA Method 8021 (Modified)
ALI-S-403 VPH by MADEP-VPH-98-1
ALI-S-404 VPH by WA VPH Method
ALI-S-405 Oxyfuel Analysis by ASTM D 4815
ALI-S-406 Diesel and Lube Oil Analysis by NW-TPHDx & HCID
ALI-S-407 Gasoline Range Organics (GRO) by EPA Method 8015B

Microbiology (500)

ALI-S-501 Total and E. coli by SM 9223B-PA Quanti-Tray
ALI-S-502 Total and E. coli by SM 9223B-PA
ALI-S-503 Archived
ALI-S-504 Multi-tube MPN Total and Fecal coliform SM 9221 B
ALI-S-505 Multi-tube MPN Fecal and E.coli SM 9221 E
ALI-S-506 Multi-tube MPN Fecal and E.coli in soil SM 9221 E
ALI-S-507 Heterotrophic Plate Count by SM 9215 B
ALI-S-508 HPC by SimPlate (unit dose) SM 9221 B
ALI-S-509 HPC by SimPlate (unit dose) SM 9221 B
ALI-S-510 Fecal Coliform Membrane Filtration by SM 9222D
ALI-S-511 Fecal in Biosolids by EPA 1680
ALI-S-512 Salmonella in Biosolids by EPA 1682
ALI-S-513 Fecal Streptococcus and Enterococcus by Multi-Tube Fermentation SM 9230 B

Radionuclides (600)

ALI-S-601 Gross Alpha and Gross Beta by EPA 900.0
ALI-S-602 Wipe Testing for Gross Alpha-Beta Radioactivity
ALI-S-603 Radium 226 by EPA 903.0

Cannabis (700)

ALI-S-701 THC Analysis by HPLC with UV/VIS Detector
ALI-S-702 Cannabis Microbial Testing Panel
ALI-S-703 Residual Solvent by GC/MS

Appendix B

Example of Sample Submission Form

Anatek Labs, Inc.

Chain of Custody Record

1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433

Anatek
Log-In #

Company Name:	Project Manager:
Address:	Project Name & # :
City: State: Zip:	Email Address :
Phone:	Purchase Order #:
Fax:	Sampler Name & phone:

Turn Around Time & Reporting

Please refer to our normal turn around times at:
http://www.anateklabs.com/services/guidelines/reporting.asp

__Normal
__Next Day*
__2nd Day*
__Other*_____

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
__Email

Provide Sample Description / **List Analyses Requested** / **Note Special Instructions/Comments**

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Preservative:									

Inspection Checklist

Received Intact?	Y	N
Labels & Chain Agree?	Y	N
Containers Sealed?	Y	N
VOC Head Space?	Y	N

Temperature (C): _____

Preservative: _____

Inspected By: _____

Date & Time:

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Appendix C

Quick Reference for Chemical Safety

ACIDS	Hazards	First Aid (Skin)	Fire-Fighting	Spillage
Acetic Acid (CH_3COOH)	Flammable, corrosive	Water spray	CO_2, Powder	Neutralize with weak base
Hydrochloric acid (HCl) (concentrated)	Not combustible, corrosive	Rinse with plenty of water	Any extinguishing agent	Report to supervisor
Hydrochloric acid (HCl) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Hydrofluoric Acid (HF) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Report to supervisor
Hydrofluoric Acid (HF) (diluted 30%<)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Neutralize with weak base
Nitric Acid (HNO_3) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Report to supervisor
Nitric Acid (HNO_3) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Neutralize with weak base
Phosphoric Acid (H_3PO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Sulfuric Acid (H_2SO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Powder, CO_2, NO WATER	Neutralize with weak base
BASES				
Ammonium Hydroxide (NH_4OH)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid

(diluted)				
Potassium Hydroxide (KOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
Sodium Hydroxide (NaOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
SOLVENTS	**Hazards**	**First Aid (Skin)**	**Fire-Fighting**	**Spillage**
Acetone	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
Acetonitrile	Flammable	Rinse with plenty of water	CO_2, Powder	Ventilate, Collect in container
Carbon Disulfide	Highly flammable	Rinse with plenty of water	CO_2, Powder	Evacuate, report to supervisor
Chloroform	Drowsiness, not combustible	Rinse with plenty of water	Any extinguishing agent	Evacuate, Collect in container
Diethyl Ether	Extremely flammable, drowsiness	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Collect in container
Ethyl Acetate	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethylene Glycol	Combustible	Rinse with water	CO_2, Powder	Collect in container
Hexane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
Hydrogen Peroxide	Corrosive, not combustible	Rinse with plenty of water	Water	Ventilate, wash with plenty of water
Isooctane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container

Methanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Evacuate, Collect in container
Methylene Chloride	Drowsiness, combustible	Rinse with water	Any extinguishing agent	Ventilate, Collect in container
MTBE	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
THF	Highly flammable	Rinse with water	CO_2, Powder, Water	Ventilate, Collect in container
Toluene	Highly flammable	Rinse with water	CO_2, Powder	Collect in container

Appendix D

Laboratory Management and Staff
CVs/Qualifications

ANATEK LABS, INC.

MIKE PEARSON

MIKE@ANATEKLABS.COM

EXPERIENCE

08/00– Present **Laboratory Manager**, Alturas Analytics, Inc, Moscow, ID
Manages and initiates experiments in the laboratory including:
Develops and directs employees in the development of HPLC/MS/MS methods,
Maintains analytical equipment, supervise scientific employees, perform HPLC/MS/MS quantitation of drugs and other compounds from various matrices, develops HPLC/MS/MS methods

03/92- Present **Laboratory Director**, Anatek Labs, Inc., Moscow, ID
Directs all aspects of the laboratory including:
Supervise scientific and administrative personnel, develop business plan and marketing strategy, prepare and analyze budgets, bid contracts

09/87-03/92 **Instrumentation Specialist**, Precision Analytics, Pullman, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Ion Chromatography and Flow Injection Analysis
- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Method development and analysis of small molecule organic and inorganic compounds using the above techniques
- Extractions and wet chemistry including solid and liquid phase extraction techniques

EDUCATION

BS in Electrical Engineering, University of Idaho, Moscow, ID, 1987

ANATEK LABS, INC.
TODD TARUSCIO
TODDT@ANATEKLABS.COM

EXPERIENCE

2016 – Present	**Laboratory Manager**, Anatek Labs, Inc, Moscow, ID Responsible for all aspects of day-to-day operation of a full service analytical laboratory, including customer relations, preparation of bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines.
2006– 2016	Technical Director, Anatek Labs, Inc, Moscow, ID Manage and coordinate activities of laboratory departments, assuring objectives of the QA Plan are met. Provide technical support to laboratory staff, and investigate new methods and technologies. Responsible for non-routine instrument maintenance. Write reports and work with customers as necessary.
1999 – 2006	Organic Group Leader/Manager, Analytical Sciences Laboratory, Dept. of Food Science and Toxicology, University of Idaho, Moscow, ID General & direct supervision of scientists & technicians performing organic analysis, including pesticides, herbicides, and other compounds in biological and environmental samples. Also responsible for QA/QC oversight and Good Laboratory Practice compliance.
1994-1999	Laboratory Manager, Anatek Labs, Inc., Moscow, ID Managed full service environmental laboratory, including inorganic and organic analyses of water and soil samples.
1989-1994	Teaching Assistant, Dept. of Zoology, Washington State University, Pullman Organized, supervised, and lectured in physiology courses, including human, mammalian, and cell physiology.

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Ion Chromatography
- Residue analysis, method development and validation, technical report writing, personnel management
- Extractions and wet chemistry including solid and liquid phase extraction techniques

EDUCATION

Ph.D in Zoophysiology, Washington State University, Pullman, 1994

B.S. in Biochemistry, Washington State University, Pullman, 1989

ANATEK LABS, INC.

ERIN LINSKEY
ERIN@ANATEKLABS.COM

EXPERIENCE

7/02 – Present **Inorganic Supervisor, Chemist III**, Anatek Labs, Inc, Moscow, ID
Typical duties include training junior level staff, editing and improving analytical procedures and coordinating Inorganic department, troubleshooting methods and analytical instruments. Responsible for performing preparation and analysis of trace and ultra trace metal levels in samples.

9/98 – 7/02 **Analyst/Lab Technician**, Anatek Labs, Inc, Moscow, ID

9/97 – 5/98 **Lab Technician**, Stukenholtz Laboratory, Twin Falls, ID

SKILLS AND TECHNIQUES

- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Ion Chromatography IC
- Flow Injection Analysis FIA
- Wet Chemistry and Microbiology

EDUCATION

BS in Biology, Minor History, University of Idaho, Moscow, ID, 2000

AWARDS AND PROFESSIONAL AFFILIATIONS

National Dean's List, member, 2000 - present
American Red Cross, Certified First Responder, 1999 – present
Presidential Award for Academic Achievement, 1993

ANATEK LABS INC.
GENE M. SOLOMON
GENES@ANATEKLABS.COM

EXPERIENCE

8/04 – Present	**QA/QC Officer**, Anatek Labs, Inc., Moscow, ID Responsible for maintaining company QA Plan, SOPs, and training records. Responsible for ordering and organizing PE samples, performing internal audits and acting as liaison to the Quality departments of the various certifying agencies (IDOH, FLDOH, WADOE, etc.)
1/10 – 6/13	**QA Consultant**, Alturas Analytics, Inc., Moscow, ID
8/04 – 12/09	**QA Officer**, Alturas Analytics, Inc., Moscow, ID Responsible for performing internal audits of all GLP studies. Responsible for maintaining company SOPs and training records.
8/94 – Present	**GMP Software Consultant & Trainer**, self-employed, worldwide
1/95 – Present	**Technical Writer/Editor**, self-employed, various locations
1/92 – 8/94	**Customer Service Manager**, Blue Mountain Quality Resources, State College, PA

EDUCATION

B.A. in Economics with High Honors, University of Montana, Missoula, 1988

PROFESSIONAL DEVELOPMENT & TRAINING

Radiation Safety Officer Training, Radiation Safety Associates, September 2014
WordPress Design and Marketing, Nectar Consulting, January 2014
Internal Data Review Training – Organics & Inorganics, Advanced Systems, April 2010
Ethics Training for Environmental Labs, Advanced Systems, March 2010
Laboratory Controls in the GMP/GLP Environment, SQA, April 2009
Continual Quality Improvement, SQA, April 2009
PK/TK Training, Drug Safety Evaluation Consulting, January 2009
Analytical Instrument Qualification Seminar, SQA, January 2008
Bioanalytical Training, SQA, May 2007
Advanced Training: Good Laboratory Practices, SQA, April 2006
Basic & Advanced Training: Good Laboratory Practices, SQA, September 2005
Quality Responsibilities of Management, SQA, September 2005
GLP Facility Audit Training, Mary Kay Erickson, QA Consultant, January 2005
GLP Training, Alturas Analytics, August 2004
GMP-FDA Quality System Requirements-1996, Parts 1-3

PROFESSIONAL MEMBERSHIP

Member Pacific Regional Chapter of the Society of Quality Assurance, 2004 – 2010
Associate Member of the Society of Quality Assurance, 2004 – 2010

ANATEK LABS, INC.
JOHN M. INGRAM
JOHNI@ANATEKLABS.COM

EXPERIENCE

2014– Present	**Radiochemistry Technical Director/Radiation Safety Officer**, Anatek Labs, Inc, Moscow, ID Oversee radionuclide analysis lab, including standards, instrumentation, analysis, and safety. Also perform semivolatile GC-MS/MS and HPLC-MS/MS analyses, and concommitant extraction methods.
2011 – 2014	VP Science and Technology, Joi Scientific, Kennedy Space Center, FL
2009 – 2011	Uniformed Science Advisor, US Central Command, MacDill AFB, FL
2006 – 2009	Assistant Professor of Chemistry, US Military Academy, West Point, NY
2005 – 2006	Assistant Program Manager, Terminal High Altitude Air Defense Launcher Program, Redstone Arsenal, AL
2004 – 2005	Assistant Program Manager, Javelin Antitank Missile Program, Redstone Arsenal, AL
2003 – 2004	European Liaison Officer, Program Executive Office Tactical Missiles, V Corps, Heidelberg, Germany
1999 – 2002	Assistant Professor of Chemistry and Radiation Safety Officer, Photonics Research Center, US Military Academy, West Point, NY
1995 – 1997	Company Commander, Assistant Operations Officer, and Logistics Officer, 1st Battalion, 87th Infantry Regiment, 10th MTN Division, Fort Drum, NY
1990 – 1994	Platoon Leader, Asst. Operations Officer, Company Executive Officer, and Battalion Maintenance Officer, 5th Battalion, 502nd Infantry Regiment, Berlin, Germany

SKILLS AND TECHNIQUES

- Gas Flow Proportional Counting Systems (GFPC)
- Gas-Scintillation Counting
- Gas Chromatography/tandem mass spectrometry (GC/MS/MS)
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Hydrogen production methods
- Energy storage systems
- Camouflage design and spectral reflectance
- High-energy lasers
- Hyperspectral imaging
- Remote chemical detection
- Laser pyrolized polymers
- Lean Six Sigma Green Belt Training
- Ranger, Airborne, and Infantry Officer Training

EDUCATION

MBA, Webster University, St. Louis, 2003
M.S. Physical Chemistry, University of Idaho, Moscow, 1999
B.S. General Chemistry, University of Idaho, Moscow, 1989

PROFESSIONAL DEVELOPMENT & TRAINING

Radiation Safety Officer Training, Radiation Safety Associates, September 2014
Gas Flow Proportional Counting and Instrumentation, Protean Instruments, December 2014

ANATEK LABS INC.

KATHLEEN A. SATTLER
KATHY@ANATEKLABS.COM

EXPERIENCE

10/01 – Present **Laboratory Manager**, Anatek Labs, Inc., Spokane, WA
Responsible for all aspects of day-to-day operation of a full service analytical laboratory. Typical duties include training junior level staff, preparing bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines, and customer relations.

07/96 – 10/01 **Microbiology Supervisor**, Anatek Labs, Inc., Spokane, WA

10/96 – 02/97 **Laboratory Assistant**, Sacred Heart Medical Center, Spokane, WA

07/95 – 07/96 **Microbiologist I**, Bremerton-Kitsap County Health District, Bremerton, WA

SKILLS AND TECHNIQUES

- Bacteria cultures, isolation, identification
- Membrane filtration
- Multiple tube fermentation
- Heterotrophic plate count
- Bacteriological examination of water
- Proficient with aseptic technique
- Nutrient agar preparation
- Centrifugation and separation of blood for testing
- Spectrophotometry
- Dilutions, titrations
- Urine analysis
- Quality control and Quality analysis

EDUCATION

B.S. in Microbiology, Minor in Chemistry, University of Idaho, 1994

Professional Affiliations

American Water Works Association Member
AWWA Inland Empire Subsection Member

ANATEK LABS INC.

MELISSA J. LEWIS
MELISSA@ANATEKLABS.COM

EXPERIENCE

01/03 – Present	**QA/QC Officer**, Anatek Labs, Inc., Spokane, WA Responsible for the QA/QC plan, writing and reviewing SOP's, keeping the current SOP's in the system. Also responsible for the QC of data packages. Report the PT's to the correct agencies and order the PT studies. Keep track of pipet calibrations and thermometer checks.
01/02 – Present	**Laboratory Technician III**, Anatek Labs, Inc., Spokane, WA Responsible for HCID and TPH-D and TPH-Dx in all matrices on the GC/FID. Responsible for troubleshooting and maintenance of instruments. Responsible for Sulfide in water, Carbon Dioxide, Total Residual Chlorine and other miscellaneous testing. Write reports for customers and customer service.
05/00 – 09/01	**Scientific Aide**, University of Idaho, Moscow, ID
11/98 – 05/00	**Laboratory Assistant**, University of Idaho, Moscow, ID

SKILLS AND TECHNIQUES

- HPLC, GC-MS, ECD, NPD, IC, FID
- COD's
- Coliform MPN methods
- Nutrient agar preparation
- Heterotrophic plate count
- Spectrophotometry
- Dilutions, titrations
- Quality control and Quality analysis
- Wet chemistry: pH, Alkalinity, TDS, TSS, Conductivity, BOD, Turbidity, TRC, Sulfide
- Organic analysis: PCB's, HCID, TPH-D, TPH-Dx
- Liquid phase extractions and solid phase extractions
- Familiar with FDA GLP (Good Laboratory Practice) Regulations
- Veterinary toxicology – Aflitoxins, Ionophores, Strychnine, ACHE
- Instrument Maintenance

EDUCATION

B.S. in General Studies in Natural Sciences, Lewis Clark State College, 1996

ANATEK LABS INC.
WENDY OZMINKOWSKI
WENDYO@ANATEKLABS.COM

EXPERIENCE

2004 – Present	**Chemist III,** Anatek Labs, Inc., Spokane, WA Responsible for TOX's, G/BTEX, VOC's, VPH's, OxyFuels, Ion analysis and BTU's. Responsible for troubleshooting and repair of instruments and methods.
2002 – 2004	**Organic Chemistry Supervisor**, SVL Analytical, Inc., Kellogg, ID
1998 – 2002	**Organic Chemist I**, SVL Analytical, Inc., Kellogg, ID
1998	**Laboratory Technician,** Quality Coatings, Post Falls, ID
1993 – 1995	**Laboratory Technician**, North Idaho College, Coeur d'Alene, ID

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, ELCD, FID, PID detection
- Gas Chromatography/Mass spectrometry (GC/MS)
- Ion Chromatography (IC)
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- Dohrmann Phoenix 8000 NDIR
- TOX 10

EDUCATION

B.S. in Chemistry, University of Idaho, 1996

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society, 2000-2004

ANATEK LABS INC.

KARICE T. SCOTT
KARICES@ANATEKLABS.COM

EXPERIENCE

10/03 – Present **Sample Custodian**, Anatek Labs, Inc., Spokane, WA
Responsibilities include sample receipt/processing, customer service and general office.

09/95-05/03 **Social Activities Director**, The Spokane Club, Spokane, WA

SKILLS AND TECHNIQUES

- Microsoft Office applications
- Sample handling
- Database maintenance
- Customer relations
- Shipping and receiving

EDUCATION

Business Skills Certificate, Spokane Falls Community College, 1992

ANATEK LABS INC.

ANDREW P. MENDEZ
ANDREWM@ANATEKLABS.COM

EXPERIENCE

2/11 – Present **Radiation Safety Officer**, Anatek Labs, Inc., Spokane, WA
Responsibilities: Preparation/implementation of radiochemistry division
Overseeing safe use/transport of radioactive material
Radionuclide analysis of drinking water

10/09 - Present **Chemist I**, Anatek Labs, Inc., Spokane, WA
Responsibilities: Analysis of PCB's in all matrices on the GC/ECD.
Variety of Wet Chem. analyses
Troubleshooting and maintenance of instruments.
General lab maintenance

8/08-5/09 **Lab Assistant,** Carroll College, Helena, MT
Responsibilities: Setup, monitoring, and cleanup of routine experiments
Reagent preparation

SKILLS AND TECHNIQUES

- ICP-MS, GC-ECD, IPC
- Spectrophotometry
- Preparation/implementation of wide range of SOPs
- Dilutions, titrations
- Liquid phase extractions and solid phase extractions
- Wet chemistry: pH (in soil, drinking and wastewater and other matrices), Alkalinity, TDS, Hardness, Conductivity, Turbidity, Color
- Quality control and Quality analysis
- Instrument Maintenance
- Gas Proportional Counter

EDUCATION

B.A. in Chemistry and Spanish, Carroll College, 2009

ANATEK LABS INC.

KATIE BOGER
KATIEA@ANATEKLABS.COM

EXPERIENCE

1/12-Present	**Chemist II**, Anatek Labs, Inc., Spokane, WA Responsible for Metals on ICP-MS Responsible for Coliform MPN, P/A, Salmonella, Fecal, Membrane Filtration and other Microbiology
6/09 – 1/12	**Chemist I**, Anatek Labs, Inc., Spokane, WA Responsible for Resistivity, Hardness, Cyanide Responsible for Coliform MPN method, and Coliform Presence/Absence Method Responsible for Metals on ICP-MS
6/08-9/08	**Summer Intern**, Washington State Patrol Crime Lab, Marysville, WA

SKILLS AND TECHNIQUES

- pH Probe
- Turbidimeter
- Cyanide Probe
- Coliform MPN Method
- Coliform Presence/Absence Method
- Wet chemistry: Alkalinity, TSS, TDS, Acidity, Hardness, Cyanide, pH, Turbidity, Color, Resistivity, Conductivity
- Quality control and Quality analysis
- Dilutions and titrations
- Heterotrophic plate count
- ICP-MS
- IC
- Preparation of Media
- Salmonella in water and soil
- Fecal Biosolids
- ABI 300
- PCR Amplification
- Diamond Head FD-IR

EDUCATION

B.S. in Biochemistry – Forensic Sciences, Eastern Washington University, 2009

Appendix E

Current State Certifications
Anatek - Moscow

Florida Department of Health (NELAP # E87893)
(Primary Accrediting Authority for NELAP)
Idaho Department of Health (EPA ID00013)
Washington Department of Ecology (C595)
Oregon Department of Environmental Quality (ORELAP # ID200001)
Nevada Department of Conservation and Natural Resources (ID00013)
Montana Department of Public Health and Human Services (CERT0028)
New Mexico Environment Department, Drinking Water Bureau (ID00013)
Arizona Department of Health Services (AZ0701)
EPA Region 8/Wyoming (EPA ID00013)

Current State Certifications
Anatek - Spokane

Florida Department of Health (NELAP # E871099)
(Primary Accrediting Authority for NELAP)
Idaho Department of Health (EPA WA00169)
Washington Department of Ecology (C585)
Montana Department of Public Health and Human Services (CERT0095)
Washington State Liquor Control Board (Cert# 0010)

Current scopes of accreditation are available at
www.anateklabs.com/certifications

Anatek Labs, Inc.

Appendix F

Backup, Fault Tolerance, Disaster Recovery and Data Archive of Mission-critical Information Storage and Services

Terrill Settles
Information Systems Manager

Updated 8/12/2015

Introduction

Mission-critical information storage and services are those that a business cannot afford to lose. Loss of such data or interruption of such services will seriously impact the daily operations of the business and incur monetary loss.

Fault Tolerance

Fault tolerance in data storage involves redundant storage disks to tolerate certain faults in the hardware. For example, in RAID 5 implementation, in case of failure of one disk, the remaining disks in the array still maintain the data. But with the loss of a disk the array is in a critical state and its performance is greatly reduced until the failed disk is replaced and the array is rebuilt.

Fault tolerance only tolerates hardware faults. It does not cover human or application software faults. For example, accidental or intentional deletion by operators or file damage caused by misbehaving applications is not covered by fault tolerance. So fault tolerance does not replace backups and the archiving of the data.

Backup

Backup is the process of copying data to other media creating an extra copy. The media can be copied to hard disk drives, tape drives, USB drives, CD and DVD disks, and even to the internet "cloud." In case of loss of or damage to current files, if they were backed up, and the media is available, the data can be restored. Backup usually occurs during off-peak hours, normally nights and weekends.

Backups generally cannot copy certain open system files and database files such as SQL databases and Exchange Information Store. However, by using the built-in backup tools within these programs a backup can be created to a file or folder. After these backups have occurred this data can now be backed up to another media.

System Disaster Backup and Recovery

A system disaster is an incident that causes the loss of the server operating system and other data due to hardware or software failure. If set up correctly the downtime due to system disaster can be minimized due to a well-planned, and rehearsed, recovery model.

Normal data backup works well for regular data files but does not back up the system files. The system files are used by the server's operating system. In case of loss of the server system such as an operating system crash, the server cannot be restored the same as restoring normal data files. In a disaster recovery scenario the operating system will need to be installed, then any additional programs will need to be installed. Finally, any configurations and data files will need to be restored as well.

A disaster recovery plan involves recognizing and documenting what programs are installed on the system, backing up of the system files and other programs configuration files, and having available a recovery plan and the backups of the files.

A backup of the system has to be made during a downtime made available for system maintenance. There are different possibilities backing up of the system files. One could be an image of the server created while off-line. Backups can also be accomplished by backing up the system files using other manufacturers' offline backup programs.

Data Archiving

Infrequently used older data should be archived onto other media. Data archiving serves dual purposes. It frees online disk storage, and, if it is still necessary to put a copy online, the archive provides a backup.

Identification of mission-critical information storage and services

Analytical data and results acquired by the instruments:

The analytical data resides on a server with RAID 5 fault tolerance. Current and recent data files are in a share folder called "AnatekData." Archived data is copied to CD/DVD ROMs and is available in IT and in off-site storage. These files are backed up nightly Monday through Friday, and again on Sunday night.

SQL Server running on Windows server:

SQL server databases for LIMS and other miscellaneous databases: LIMS databases provide data entry, storage and reporting. Databases and their logs reside on RAID drives. Further, database files and log files reside on separate disk spindles for maximum recoverability in case of disk failure. SQL provides its own backup nightly -- the files are also backed up nightly Monday through Friday, and again on Sunday night.

Exchange Server running on Windows server:

Microsoft Exchange Provides e-mail, tasking, scheduling and other collaborating functions to the company. The Exchange data is located on a RAID drive. Exchange provides its own backup nightly – the files are also backed up nightly Monday through Friday, and again on Sunday night.

Windows Domain Controller Servers:

These servers provide Active Directory services which includes user authentication, security, and sharing functions for the domain. Active Directory services provide the platform on which SQL, Exchange, FTP, IIS, and other services reside.

Standard Windows File Server:

Provide general file service for user shares.

IIS on Windows Server:

Provides a web service for Internet, Intranet and Extranet.

QuickBooks files on Windows File Server:

Stores all accounting information of the company, including banking, purchasing, receivable, payable and payroll. These files are stored on the RAID disk of Windows file server.

Data security/integrity implementations

Fault Tolerance

Each Windows Server has been configured with RAID 5 or RAID 10 for storage of critical data files. All disks are hot swappable. The domain controllers have redundant power supplies.

Backup

The backup software currently in use is Macrium Reflect and the Windows NTbackup utility. Backup hardware is a removable hard disk drive for disk-to-disk backup. Macrium Reflect runs on server Treasure copying the following files: Analysis Data from server Treasure and other Instrument PCs; SQL and FTP backups from server Bobwhite; department and user personal files from Grouse; Quickbook and Payclock backup files from PC Moonstone; and Quickbook files from Magpie. Data backups on Friday run a full backup. Data backups Sunday through Thursday run incremental backups.

Exchange runs its own backup and places the backup files on server Bobwhite in folder "ExchangeBackup."

Quickbooks backups are copied from server Magpie in the folder "Quickbooks." PC Moonstone also runs a windows backup to copy the files every Sunday through Friday at 9AM.

SQL runs its own backups and they occur Sunday through Thursday at 1AM and are placed on server Bobwhite in folder "SQL2K8\Backup".

Disaster recovery

We have Symantec Ghost 7.5 as an imaging tool. The entire hard disks of the Windows servers and majority of workstations have been taken as a snapshot. The images of those disks were either burned onto DVD disks or storage on removable drives.

As imaging the servers requires taking them off-line, the imaging is not a regularly scheduled task. However, when major changes are made to servers, re-imaging should be done once the servers have been tested to be running satisfactorily.

Workstation imaging is updated when there is major configuration change in hardware or software.

Data archiving

The older data files on the analytical data storage server (older than 6 or 12 months, as dictated by data volume) are archived to CD/DVD at intervals of 6 or 12 months, or when deemed necessary, for permanent archival. The permanent archive has two copies, one kept on-site and another off-site. The DVD/CD disks, if properly stored, should have a lifetime of at least 50 years. A few randomly selected DVD/CD disks are checked for readability annually to ensure the availability of older data files.

A copy of the archived data files is kept available for read-only, as long as the storage server has enough space for them. When the space approaches depletion, the oldest files will be purged.

The shared location for the older data is secured so only system administrators can change them. All regular users have read-only permission.

Summary

We have hardware redundancy to protect against disk failure for the most important data. Our backup scheme is disk-to-disk technology and CD/DVD archival. The disk backups are on a four week off-site rotation. The servers and majority of workstations are imaged for quick disaster recovery. Data archiving is done on a regular basis and two permanent copies of archived data are kept.

Appendix G

Control Chart Information

Control Charting

Control charting is a useful way to determine accuracy and precision data for specific repeated recovery calculations (surrogates, LFBs, CCVs, etc.). It is most useful to calculate acceptance criteria from the most recent data, and allows comparison to written method requirements if they exist.

At minimum, control charts must be made for control standards. For methods that require the addition of surrogate compounds, control charts are also required for the surrogate recoveries.

Definitions: Let X_1, X_2, X_3, X_4,.....X_n ($n \geq 20$) represent the first n time ordered determinations for an analyte, and then define the following:

$$X = \text{average} = \frac{1}{n}\,(X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots + X_n)$$

$$S = \text{Standard Deviation of the Group} = \left[\frac{\Sigma (X_n - X)^2}{n-1}\right]^{\frac{1}{2}}$$

Based on the average and standard deviation information of this n number of trials a control chart can be plotted using the formulas outlined in Table 1. An example of a control chart is shown in Figure 1 with X = 99 % and S = 4 %. Such plot can then be used to determine if one or a set of trial is out of control.

Table 1: Control Chart Formula.

Parameter	**Symbol**	**Formula**
Centerline	CL	X
Upper Control Limit	UCL	X + 3S
Lower Control Limit	LCL	X – 3S
Upper Warning Limit	UWL	X + 2S
Lower Warning Limit	LWL	X – 2S

Criteria for an Out-of-Control Situation

A process is considered out of statistical control whenever one of the following conditions is demonstrated from control charting.

a. Any one point is outside of the control limits.

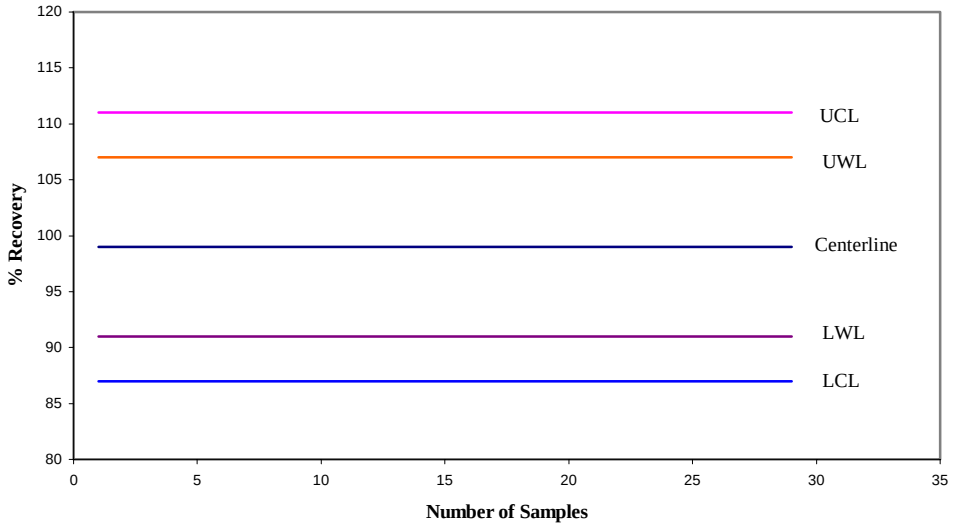
b. Any three consecutive points are outside the warning limits.

c. Any ten consecutive points are on the same side of the centerline.

d. Any six consecutive points are such that each deviation is greater than its predecessor.

e. Any obvious cyclic pattern is seen in the points.

Figure 1: A sample control chart.



Corrective Action

When a process is out of control as determined by control chart monitoring, an immediate solution must be found before processing more samples. An example might be the slow deterioration of the PID lamp, which might cause recoveries to slowly decrease. This problem may easily be remedied by more frequent cleaning or perhaps more frequent calibration.

Appendix H

Method Detection Limit

USEPA DEFINITION AND METHOD FOR MDL

From: 40 CFR (7–1–95 Edition) Part 136, Appendix B

APPENDIX B TO PART 136 — DEFINITION AND PROCEDURE FOR THE DETERMINATION OF THE METHOD DETECTION LIMIT — REVISION 1.11

Definition

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Scope and Application

This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete, specific, and well defined analytical method. It is essential that all sample processing steps of the analytical method be included in the determination of the method detection limit. The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample. The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device- or instrument-independent.

Procedure

1. Make an estimate of the detection limit using one of the following:
(a) The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5.

(b) The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

(c) That region of the standard curve where there is a significant change in sensitivity, i.e., a break in the slope of the standard curve. (d) Instrumental limitations. It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the initial estimate of the detection limit.

2. Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferent concentrations are not detected at the method detection limit of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferent). The

interferent concentration is presupposed to be normally distributed in representative samples of a given matrix.

3. (a) If the MDL is to be determined in reagent (blank) water, prepare a laboratory standard (analyte in reagent water) at a concentration which is at least equal to or in the same concentration range as the estimated method detection limit. (Recommend between 1 and 5 times the estimated method detection limit.) Proceed to Step 4.

(b) If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated detection limit, proceed to Step 4. If the measured level of analyte is less than the estimated detection limit, add a known amount of analyte to bring the level of analyte between one and five times the estimated detection limit. If the measured level of analyte is greater than five times the estimated detection limit, there are two options.

(1) Obtain another sample with a lower level of analyte in the same matrix if possible.

(2) The sample may be used as is for determining the method detection limit if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes as the analyte concentration increases from the MDL, hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

4. (a) Take a minimum of seven aliquots of the sample to be used to calculate the method detection limit and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

(b) It may be economically and technically desirable to evaluate the estimated method detection limit before proceeding with 4a. This will: (1) Prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an inflated MDL will be calculated from data obtained at many times the real MDL even though the level of analyte is less than five times the calculated method detection limit. To insure that the estimate of the method detection limit is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower method detection limit. Take two aliquots of the sample to be used to calculate the method detection limit and process each through the entire method, including blank measurements as described above in 4a. Evaluate these data: (1) If these measurements indicate the sample is in desirable range for determination of the MDL, take five additional aliquots and proceed. Use all seven measurements for calculation of the MDL. (2) If these measurements indicate the sample is not in correct range, reestimate the MDL, obtain new sample as in

3 and repeat either 4a or 4b.

5. Calculate the variance (S2) and standard deviation (S) of the replicate measurements, as follows:

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \left(\frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right)\right]$$

$$s = (s^2)^{1/2}$$

where: Xi; i = 1 to n, are the analytical results in the final method reporting units obtained from the n sample aliquots and
S refers to the sum of the X values from i = 1 to n.

6. (a) Compute the MDL as follows:

MDL = t(n-1, 1-alpha = 0.99) (S)

where: MDL = the method detection limit
t(n-1, 1-alpha = .99) = the students' t value appropriate for a 99% confidence level and alpha standard deviation estimate with n-1 degrees of freedom. See Table.
S = standard deviation of the replicate analyses.

(b) The 95% confidence interval estimates for the MDL derived in 6a are computed according to the following equations derived from percentiles of the chi square over degrees of freedom distribution (X^2/df).

LCL = 0.64 MDL
UCL = 2.20 MDL

where: LCL and UCL are the lower and upper 95% confidence limits respectively based on seven aliquots.

7. Optional iterative procedure to verify the reasonableness of the estimate of the MDL and subsequent MDL determinations.

(a) If this is the initial attempt to compute MDL based on the estimate of MDL formulated in Step 1, take the MDL as calculated in Step 6, spike the matrix at this calculated MDL and proceed through the procedure starting with Step 4.

(b) If this is the second or later iteration of the MDL calculation, use S^2 from the current MDL calculation and S^2 from the previous MDL calculation to compute the F-ratio. The F-ratio is calculated by substituting the larger S^2 into the numerator S^2_A and the other into

the denominator S^2_B. The computed F-ratio is then compared with the F-ratio found in the table which is 3.05 as follows: if $S^2_A / S^2_B < 3.05$, then compute the pooled standard deviation by the following equation:

$$S_{pooled} = [(6S^2_A = 6S^2_B) / 12]^{½}$$

if $S^2_A / S^2_B > 3.05$, respike at the most recent calculated MDL and process the samples through the procedure starting with Step 4. If the most recent calculated MDL does not permit qualitative identification when samples are spiked at that level, report the MDL as a concentration between the current and previous MDL which permits qualitative identification.

(c) Use the Spooled as calculated in 7b to compute the final MDL according to the following equation:

$$MDL = 2.681 (S_{pooled})$$

where 2.681 is equal to t(12, 1-alpha = .99).

(d) The 95% confidence limits for MDL derived in 7c are computed according to the following equations derived from percentiles of the chi squared over degrees of freedom distribution.

LCL = 0.72 MDL
UCL = 1.65 MDL

where LCL and UCL are the lower and upper 95% confidence limits respectively based on 14 aliquots.

TABLES OF STUDENTS' t VALUES AT THE 99 PERCENT CONFIDENCE LEVEL

Number of replicates	Degrees of freedom (n-1)	t(n-1, .99)
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
61	60	2.390
00	00	2.326

Reporting

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. If the analytical method permits options which affect the method detection limit, these conditions must be specified with the MDL value. The sample matrix used to determine the MDL must also be identified with MDL value. Re-port the mean analyte level with the MDL and indicate if the MDL procedure was iterated. If a laboratory standard or a sample that contained a known amount analyte was used for this determination, also report the mean recovery. If the level of analyte in the sample was below the determined MDL or exceeds 10 times the MDL of the analyte in reagent water, do not report a value for the MDL. [49 FR 43430, Oct. 26, 1984; 50 FR 694, 696, Jan. 4, 1985, as amended at 51 FR 23703, June 30, 1986]

Interpretation of Data Index
Pesticide National Synthesis Project Home Page
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URL: ***http://ca.water.usgs.gov/pnsp/rep/interpret/.html***
Last Modified: Thu Feb 17 2000

Appendix I

CALIBRATION METHODS AND EQUATIONS

This chapter provides an overview of calibration models and equations commonly used by methods performed at Anatek Labs, Inc. Calibration information is provided here as a reference, so that definitions and equations do not have to be provided in each individual analytical SOP. Review of this information shall be considered adequate on-going training in calibration models and equations.

This chapter consists of the following sections:

- Definitions
- General Criteria for All Calibration Models
- External Standard Calibration
- Internal Standard Calibration
- Response/Calibration Factor Model
- Linear Calibration Using A Least Square Regression
- Weighted Least Squares Regression

DEFINITIONS

Calibration can be defined in several ways:

- **Reference standards with known values for selected points covering the chosen concentration range are measured with the instrument. A functional relationship is then established between the values of the standards and the corresponding measurements.**

- **Calibration: set of operations that establish, under specific conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.**

Instrument calibration is intended to eliminate or reduce bias in an instrument's readings over a range for all continuous values.

Precision is a measure of the degree of agreement among replicate analyses of a sample, usually expressed as a standard deviation.

Bias is consistent deviation of measured values from the true value, caused by systematic errors in a procedure.

Accuracy is the combination of bias and precision of an analytical procedure, which reflects the closeness of a measured value to a true value

An acceptable calibration assures that an instrument will produce results which meet or exceed some defined criteria with a specified degree of confidence.

GENERAL CRITERIA FOR ALL CALIBRATION MODELS

- **Mid-points cannot be dropped to meet criteria**
- **Points can be reanalyzed, original run must be discarded**
- **Analyzing additional standards and discarding some to achieve a better correlation coefficient value is prohibited**
- **Narrowing of curve on either end is allowed**

Initial Calibration

Perform initial calibration with a minimum of three concentrations of standards for linear curve, a minimum of five concentrations for nonlinear curves, or as specified by the method of choice.

At the beginning of each day that samples are to be analyzed, a calibration curve covering the sample concentration range and all target analytes should be generated according to the approved SOP. Depending on concentration ranges, the curve should be composed of three or more points. The reporting limit should be included in the calibration range.

Daily Verification Standard

Where the determinative time is extensive and the instrument is very stable, the calibration curve should be initially developed. Thereafter, each day analyses are performed, this curve should be verified by analysis of at least one standard for each of the target analytes at the expected concentration range. This verification should be done at both the beginning and end of the analyses.

Calibration Plot

A working curve is a plot of the instrument response as a function of analyte concentration. The concentration of an unknown sample is determined by correlating its response to the mathematical relationship of concentration to the instrument response established by the curve.

Response Factor/Calibration Factor

Both calibration factors and response factors are measures of the slope of the calibration relationship. Each calibration or response factor represents the slope of the line between the response for a given standard and the origin. Under ideal conditions, the factors will not vary with the concentration of the standard. In practice, some variation is to be expected.

If response factors or calibration factors are used, the calculated % RSD for each analyte of interest must be less than or equal the method-specified value. Refer to the applicable method for the calibration procedure and acceptance criteria on the response factors or calibration factors for each analyte.

Correlation Coefficient

The correlation coefficient is a measure of the degree with which the independent variable and its partner move either together or in opposition. A positive result indicates direct correlation and a negative result indicates an inverse correlation.

If linear regression is used, use the minimum correlation coefficient specified in the method. If the minimum correlation coefficient is not specified then a minimum value of 0.995 is recommended. The appropriate linear or nonlinear correlation coefficient for standard concentration to instrument response should be > 0.995.

It is not necessarily true that a relationship measured by r is meaningful. There must be a rational relationship of the two variables under investigation.

The sample on which the data is based must be large enough to ensure that the influence of chance causes of variation is minimized.

Coefficient of Determination

In a correlation analysis, r2 (occasionally called the “correlation index”) may be calculated most simply by squaring the correlation coefficient, r. It may be described as the amount of variability in one of the variables accounted for by correlating that variable with the second variable. As in regression analysis, r2 may be considered to be a measure of the strength of the straight-line relationship. In order for the linear regression model to be used for quantitative purposes, r, COD, or r2 must be greater than or equal to 0.99

EXTERNAL STANDARD CALIBRATION

For an external standard quantitation, known data from a calibration standard and unknown data from the sample are combined to generate a quantitative report.

It is called external standard because the standard or known material is separate or external to the unknown material. External standard calibration is one of the most common approaches to calibrations. It involves a simple comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards.

Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the detector response to the amount (mass) of analyte in the calibration standard is defined as the calibration factor (CF).

$$CF = (Ax)/(Cx)$$

Where: Ax = Area of the compound
Cx = Concentration of the compound

Advantages:

- The advantages of external standard calibration are that it is simple to perform this type of calibration and it can be applied to a wide variety of methods.

Disadvantages:

- The primary disadvantage is that it is greatly affected by the stability of the chromatographic detector system and the presence of chromatographic interferences in a sample or sample extract.

INTERNAL STANDARD CALIBRATION

Internal standard calibration involves the comparison of the instrument responses from the target compounds in the sample to the responses of reference standards added to the sample or sample extract before injection.

The response of the target compound is normalized to the response of the reference standard. This reference standard is called an *internal standard* because it is contained within the aliquot of the sample or sample extract that is actually injected into the instrumentation. A constant amount of the internal standard is added to all samples or extracts. That same amount of the internal standard is also included in each of the calibration standards.

The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard.

This ratio is termed the response factor (RF) or relative response factor (RRF), indicating that the target compound response is calculated relative to that of the internal standard.

$$\mathbf{RF = ((Ax)(Cis))/((Ais)(Cx))}$$

Where: **Ax = Area of the compound**
Cx = Concentration of the compound
Ais = Area of the internal standard
Cis = Concentration of the internal standard

Selection of Internal Standards

- Internal standards that are similar in analytical behavior to the compounds of interest, and not expected to be found in the samples
- The analyst needs to demonstrate that the measurement of the internal standard is not affected by target analytes, surrogates, or by matrix interferences
- This is not as useful for GC and HPLC methods with non-MS detectors, unless the internal standards could be separated from target compounds chromatographically.

Advantages:

- Accounts for routine variation in the response of the chromatographic system
- Accounts for the variations in the exact volume of sample or sample extract introduced into the chromatographic system
- The retention times of the target compound and the internal standard may be used to calculate the relative retention time (RRT) of the target compound and can then be used to compensate for small retention time shifts

Disadvantages:

- The principal disadvantage to internal standard calibration is that the internal standards must be compounds that are not found in the samples to be analyzed and they must produce an unambiguous response on the chromatographic detector system.

RESPONSE/CALIBRATION FACTOR MODEL

Calibration Factor: A measure of the chromatographic response of a target analyte relative to the mass injected.

Response Factor: A measure of the relative mass spectral response of an analyte compared to its internal standard.

Each calibration or response factor represents the slope of the line between the response for a given standard and the origin. The average calibration factor or response factor of the standards for each analyte is then used to calculate the concentration of the sample.

When the variation, measured as the relative standard deviation (RSD) of the factors, is less than or equal to 20%, then the slopes of the lines for each standard are sufficiently close to one another that the use of the linear model is generally appropriate over the range of standards that are analyzed. A relative standard deviation (RSD) of 25% or less is considered linear.

Response/Calibration Factor Equations

External Standard Equation

$$CF = (Ax)/(Cx)$$

or

Internal Standard Equation

$$RF = ((Ax)(Cis))/((Ais)(Cx))$$

Where: Ax = Area of the compound
Cx = Concentration of the compound
Ais = Area of the internal standard
Cis = Concentration of the internal standard

Response/Calibration Factor Statistical Equations

Average RF or CF: $RFAVE = (S\ RFi / n)$

Standard Deviation (s): $s = \sqrt{\{ [S (RFi - RFAVE)2] / (n-1) \}}$

Relative Standard Deviation (RSD): $RSD = s / RFAVE * 100$

Where: n = number of pairs of data
RFi = Response Factor for each level
RFAVE = Average of all the response factors
S = the sum of all the individual values

In the equations above RF can be replaced with CF

Response/Calibration Factor Equations for Concentration

External Standard Equation
$Cx = Ax/CFAVE$

or

Internal Standard Equation
$Cx = ((Ax)*(Cis)) / ((Ais)*(RFAVE))$

Advantages

- Assumes linearity through the origin, no negative calculated concentrations.
- Simple calculation

Disadvantages

- Linearity of the curve is required.
- May not reflect actual detector response curve.

LINEAR CALIBRATION USING A LEAST SQUARE REGRESSION

According to NIST Linear least squares regression is by far the most widely used modeling method. It is what most people mean when they say they have used "regression", "linear regression" or "least squares" to fit a model to their data.

Least square regression is a method of determining the curve that best describes the relationship between expected and observed sets of data by minimizing the sums of the squares of deviation between observed and expected values. The regression calculations attempt to minimize this sum of the squares, hence the name “least squares regression.”

A linear calibration model based on a least squares regression may be employed based on past experience or a prior knowledge of the instrument response and at the discretion of the analyst. This approach may be used for analytes that do meet the RSD Limits. The linear calibration model is most easily achieved by performing a linear least squares regression of the instrument response versus the mass of the analyte.

Correlation Coefficient Definition: A measure of the interdependence of two random variables that ranges in value from −1 to +1, indicating perfect negative correlation at −1, absence of correlation at zero, and perfect positive correlation at +1. Also called coefficient of correlation.

Linear Equation

$$y = mx + b$$

Where: y = Response Ax for External Standard
Or
Ax/Ais for Internal Standard

x = Concentration Cx for External Standard
or
Cx/Cis for Internal Standard
m = Slope
b = Intercept

Linear Regression Statistical Equations

Slope (m)

$$m = \frac{[(Swxiyi * Sw) - (Swxi * Swyi)]}{[(Sw * Swxi2) - (Swxi * Swxi)]}$$

Intercept (b)

$$b = yAVE - (m * (xAVE))$$

Correlation Coefficient (r)

$$r = \frac{[(Sw * Swxiyi) - (Swxi * Swyi)]}{\sqrt{\{[(Sw * Swxi2) - (Swx * Swxi)] * [(Sw * Swyi2) - (Swyi * Swyi)]\}}}$$

Coefficient of Determination (r2)

$$r2 = r * r$$

Where:
- n = number of x, y pairs
- xi = individual values for the independent variable
- yi = individual values for the dependent variable
- w = weighting factor, for equal or no weighting w = 1
- xAVE = average of the x values
- yAVE = average of the y values
- S = the sum of all the individual values

Equations for Concentration

External Standard Equation

$$Cx = \{Ax-b\} /m$$

or

Internal Standard Equation

$$Cx = [\{(Ax)/(Ais)\}-b] /m * Cis$$

Advantages

- This technique is the simplest and most commonly applied form of Linear Curve
- Computation of coefficients and standard deviations is easy

Disadvantages

- If least squares regression (linear and non-linear) is used for curve construction it is usually noticed that the lower levels of the calibration may fail the re-fit criteria (<20% D) even when the r/COD/r2 criteria have been met.

- Analysts that use least squares regression and rely only on the r/COD/r2 criteria for curve acceptance may not be aware of this potential problem at the lower calibration levels.

WEIGHTED LEAST SQUARE REGRESSION

Each term in the weighted least squares criterion includes an additional weight that determines how much each observation in the data set influences the final parameter estimates and it can be used with functions that are either linear or nonlinear in the parameters.

One of the common assumptions underlying most process modeling methods, including linear and nonlinear least squares regression, is that each data point provides equally precise information about the deterministic part of the total process variation. In other words, it is assumed that the standard deviation of the error term is constant over all values of the predictor or explanatory variables. This assumption clearly does not hold, even approximately, in every modeling application.

In a weighted fit, less weight is given to the less precise measurements and more weight to more precise measurements when estimating the unknown parameters in the model. Using weights that are inversely proportional to the variance at each level of the explanatory variables yields the most precise parameter estimates possible.

Method 8000C describes variance as the difference between the observed instrument response for the i^{th} calibration standard and the predicted or calculated response for the i^{th} calibration standard.

Weighting the sum of the squares of the differences may significantly improve the ability of the least square regression to fit the linear model to the data.

$$\sum w_i (y_i - y'_i)^2$$

where:

w_i = **Weighting factor for the i^{th} calibration standard (w=1 for unweighted least square regression)**

y_i = **Observed instrument response for the i^{th} calibration standard**

y'_I = **Predicted (or calculated) response for the i^{th} standard**

$\sum$ = **The sum of all individual values**

The mathematics used in unweighted least squares regression has a tendency to favor numbers of larger value over numbers of smaller value. Thus the regression curves that are generated will tend to fit points that are at the upper calibration levels better than those points at the lower calibration levels.

Examples of weighting factors which can place more emphasis on numbers of smaller value are:

$$w_i = 1/y_i \quad \text{or} \quad w_i = 1/y_i^2$$

where,

wi = weighting factor for the ith calibration standard (wi=1 for unweighted least squares regression).

y_i = observed instrument response (area or height) for the i^{th} calibration standard.

Different Types Of Weights

No Weights:	Default higher weighting of higher amounts or signal values
1/Amount:	Nearly cancels out the weighting of higher amounts
1/Amount^2 :	Causes over-proportional weighting of smaller amounts
1/Response:	Nearly cancels out the weighting of higher signal values
1/Response^2:	Causes over-proportional weighting of smaller signal values
1/RSD:	Weights signal values with small relative standard deviations more than those with large relative standard deviations
$1/RSD^2$:	Weights signal values with small relative standard deviations clearly more than those with large relative standard deviation.

Advantages

- Weighted least squares is an efficient method that makes good use of small data sets. It also shares the ability to provide different types of easily interpretable statistical intervals for estimation, prediction, calibration and optimization.

- The main advantage that weighted least squares enjoys over other methods is the ability to handle regression situations in which the data points are of varying quality.

Disadvantages

- The biggest disadvantage of weighted least squares is probably the fact that the theory behind this method is based on the assumption that the weights are known exactly. The exact weights are almost never known in real applications, so estimated weights must be used instead. The effect of using estimated weights is difficult to assess, but experience indicates that small variations in the weights due to estimation do not often affect a regression analysis or its interpretation.

- When the weights are estimated from small numbers of replicated observations, the results of an analysis can be very badly and unpredictably affected. This is especially likely to be the case when the weights for extreme values of the predictor or explanatory variables are estimated using only a few observations. It is important to remain aware of this potential problem, and to only use weighted least squares when the weights can be estimated precisely relative to one another.

- Weighted least squares regression is also sensitive to the effects of outliers. If potential outliers are not investigated and dealt with appropriately, they will likely have a negative impact on the parameter estimation and other aspects of a weighted least squares analysis.

- If a weighted least squares regression actually increases the influence of an outlier, the results of the analysis may be far inferior to an unweighted least squares analysis.

Authorized Signatures

The individuals listed below are authorized to sign/approve documents in the classes listed. See also SOP ALI-30.

Approval Signatures - Moscow

Quotes/Contracts/RFP Submissions

- Todd Taruscio, Lab Manager
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director
- Gene Solomon, QA Officer

Analytical Reports

- Todd Taruscio, Lab Manager
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director

SOPs

- Todd Taruscio, Lab Manager
- Gene Solomon, QA Officer
- Justin Doty, Customer Service Manager (for office procedures)
- Erin Linskey/Todd Taruscio, Technical Director (in Lab Manager's absence)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Corrective Action Reports

- Todd Taruscio, Lab Manager
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director
- Gene Solomon, QA Officer

Demonstrations of Capability (IDC/DOC)

- Todd Taruscio, Lab Manager
- Gene Solomon, QA Officer
- Erin Linskey, Technical Director (in Lab Manager's absence)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Approval Signatures - Spokane

Quotes/Contracts/RFP Submissions

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

Analytical Reports

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

SOPs

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director
- Karice Scott, Office Manager (for office procedures)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Corrective Action Reports

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

Demonstrations of Capability (IDC/DOC)

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director