ANALYTICAL LABORATORY METHODS
METHOD DETECTION LIMITS
REPORTING LIMITS

SANTA SUSANA FIELD LABORATORY
SURFACE WATER SAMPLING PROGRAM
LABORATORY MDLs, REPORTING LIMITS, STATE MINIMUM LEVELS, AND PERMIT LIMITS COMPARISON
NPDES PERMIT CA0001309
Order No. R4-2007-0055

Analyte	Laboratory 2008 MDL	Laboratory 2008 RL	SWRCB ML	Laboratory vs ML(1)	Monthly Ave. Limits 001 Benchmark -- 011 Compliance -- 019 Compliance	Daily Max Limits 001 Benchmark 002 Benchmark 011 Compliance 018 Compliance 019 Compliance	Daily Max Limits 003-007 Compliance 008 Benchmark 009 Benchmark 010 Compliance	Daily Max Limits 012-014 Benchmark	Receiving Water Limits 003-007 Compliance 009 Compliance 010 Compliance
624 - Low-level	**8260/624**	**8260/624**	**SWRCB**						
	MDL	**RL**	**Attach B**						
	ug/L	**ug/L**	**GCMS ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,1,1-Trichloroethane	0.30	0.5	2	--					
1,1,2,2-Tetrachloroethane	0.30	0.5	1	--					
1,1,2-Trichloroethane	0.30	0.5	2	--					
1,1-Dichloroethane	0.40	0.5	1	--					
1,1-Dichloroethene	0.42	0.5	2	--	3.2	6.0			
1,2-Dichlorobenzene	0.32	0.5	2	--					
1,2-Dichloroethane	0.40	0.5	2	--					
1,2-Dichloropropane	0.35	0.5	1	--					
1,3-Dichlorobenzene	0.35	0.5	2	--					
1,3-Dichloropropene (reported as cis & trans)	0.32	0.5	2	--					
1,4-Dichlorobenzene	0.37	0.5	2	--					
Benzene	0.28	0.5	2	--					
Bromodichloromethane	0.30	0.5	2	--					
Bromoform	0.40	0.5	2	--					
Bromomethane	0.34	1.0	2	--					
Carbon tetrachloride	0.28	0.5	2	--					
Chlorobenzene	0.36	0.5	2	--					
Chloroethane	0.40	1.0	2	--					
Chloroform	0.33	0.5	2	--					
Chloromethane	0.40	0.5	2	--					
Dibromochloromethane	0.40	0.5	2	--					
Ethylbenzene	0.25	0.5	2	--					
Methylene chloride	0.95	1.0	2	--					
Tetrachloroethene	0.32	0.5	2	--					
Toluene	0.36	0.5	2	--					
trans-1,2-Dichloroethene	0.30	0.5	1	--					
Trichloroethene	0.26	0.5	2	--		5.0			
Vinyl chloride	0.40	0.5	2	--					
1,2,3-Trichloropropane	0.85	1.0	na	--					
1,2-Dibromoethane (EDB)	0.32	1.0	na	--				50	
m,p-Xylenes	0.52	1.0	na	--					
Naphthalene	0.33	1.0	na	--				21	
o-Xylene	0.24	1.0	na	--					
Trichlorofluoromethane	0.34	0.5	na	--					
VOC - Add-ons	**8260/624**	**8260/624**	**SWRCB**						
	MDL	**RL**	**Attach B**						
	ug/L	**ug/L**	**GCMS ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,1,2-Trichloro-1,2,2-Trifluoromethane (Freon 113)	0.5	5	na	--					
1,2-Dichloro-1,1,2-Trichloroethane (Freon 123a)	TBS	TBS	na	--					
Cyclohexane (TIC)	na	na	na	--					

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Oxygenates	**8260/624**	**8260/624**	**SWRCB**						
	MDL	**RL**	**Attach B**						
	ug/L	**ug/L**	**GCMS ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Di-isopropyl Ether (DIPE)	0.25	2.0	na	--					
Ethyl tert-Butyl Ether (ETBE)	0.28	2.0	na	--					
Methyl-tert-butyl Ether (MTBE)	0.32	1.0	na	--					
tert-Amyl Methyl Ether (TAME)	0.33	2.0	na	--					
tert-Butanol (TBA)	3.1	10	na	--				12	
	8260/624	**8260/624**	**SWRCB**						
	MDL	**RL**	**ML**						
624/8260B A-A+2CVE LOW	**ug/L**	**ug/L**	**GCMS (ug/L)**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Acrolein	4	5	5	--					
Acrylonitrile	0.7	2	2	--					
2-Chloroethylvinylether	1.8	5	1	ML< MDL					
	ug/L	**ug/L**	**GCMS ML**						
			SWRCB						
625+NDMA+Hydrazine -Standard	**MDL**	**RL**	**Attach B**						
1,2,4-Trichlorobenzene	2.5	10	5	MDL<ML<RL					
1,2-Dichlorobenzene	2.7	10	2	ML< MDL					
1,2-Diphenylhydrazine/Azobenzene	3.9	20	10	MDL<ML<RL					
1,3-Dichlorobenzene	2.5	10	1	ML< MDL					
1,4-Dichlorobenzene	2.2	10	1	ML< MDL					
2,4,6-Trichlorophenol	3.4	20	10	MDL<ML<RL	6.5	13.0			
2,4-Dichlorophenol	3.5	10	5	MDL<ML<RL					
2,4-Dimethylphenol	2.7	20	2	ML< MDL					
2,4-Dinitrophenol	2.2	20	5	MDL<ML<RL					
2,4-Dinitrotoluene	3.2	10	5	MDL<ML<RL	9.1	18.3			
2,6-Dinitrotoluene	3.7	10	5	MDL<ML<RL					
2-Chloronaphthalene	2.5	10	10	--					
2-Chlorophenol	3.1	10	5	MDL<ML<RL					
2-Nitrophenol	3.3	10	10	--					
3,3-Dichlorobenzidine	5.6	20	5	ML< MDL					
4,6-Dinitro-2-methylphenol	2.3	20	5	MDL<ML<RL					
4-Bromophenyl phenyl ether	4.5	10	5	MDL<ML<RL					
4-Chloro-3-methylphenol	2.9	20	1	ML< MDL					
4-Chlorophenyl phenyl ether	3.8	10	5	MDL<ML<RL					
4-Nitrophenol	1.6	20	10	MDL<ML<RL					
Acenaphthene	3.1	10	1	ML< MDL					
Acenaphthylene	3.0	10	10	--					
Anthracene	3.3	10	10	--					
Benzidine	14	20	5	ML< MDL					
Benzo(a)anthracene	2.5	10	5	MDL<ML<RL					
Benzo(a)pyrene	2.0	10	10	--					

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Benzo(b)fluoranthene	2.7	10	10	--					
Benzo(g,h,i)perylene	6.2	10	5	ML< MDL					
Benzo(k)fluoranthene	3.1	10	10	--					
Bis(2-chloroethoxy)methane	4.8	10	5	MDL<ML<RL					
Bis(2-chloroethyl)ether	2.6	10	1	ML< MDL					
Bis(2-chloroisopropyl)ether	4.3	10	2	ML< MDL					
Bis(2-ethylhexyl)phthalate	11	50	5	ML< MDL	--	4.0			
Butyl benzyl phthalate	3.7	20	10	MDL<ML<RL					
Chrysene	2.4	10	10	--					
Dibenz(a,h)anthracene	5.1	20	10	MDL<ML<RL					
Diethyl phthalate	3.7	10	2	ML< MDL					
Dimethyl phthalate	3.5	10	2	ML< MDL					
Di-n-butyl phthalate	3.1	20	10	MDL<ML<RL					
Di-n-octyl phthalate	3.9	20	10	MDL<ML<RL					
Fluoranthene	6.9	10	1	ML< MDL					
Fluorene	3.3	10	10	--					
Hexachlorobenzene	4.2	10	1	ML< MDL					
Hexachlorobutadiene	2.3	10	1	ML< MDL					
Hexachlorocyclopentadiene	4.9	20	5	MDL<ML<RL					
Hexachloroethane	2.3	10	1	ML< MDL					
Indeno(1,2,3-cd)pyrene	4.8	20	10	MDL<ML<RL					
Isophorone	3.7	10	1	ML< MDL					
Naphthalene	2.2	10	1	ML< MDL					
Nitrobenzene	3.2	20	1	ML< MDL					
n-Nitrosodimethylamine	2.4	20	5	ML< MDL	8.1	16.3			
n-Nitroso-di-n-propylamine	4.4	10	5	MDL<ML<RL					
n-Nitrosodiphenylamine	3.5	10	1	ML< MDL					
Pentachlorophenol	2.0	20	5	MDL<ML<RL	8.2	16.5			
Phenanthrene	3.5	10	5	MDL<ML<RL					
Phenol	4.1	10	1	ML< MDL					
2,4,5-Trichlorophenol	3.4	20	na	--					
Pyrene	5.3	10	10	--					
2-Methylnaphthalene	2.9	10	na	--					
2-Methylphenol	3.1	10	na	--					
2-Nitroaniline	2.9	20	na	--					
3-Nitroaniline	2.8	20	na	--					
4-Chloroaniline	2.3	10	na	--					
4-Methylphenol	3.3	10	na	--					
4-Nitroaniline	4.3	20	na	--					
Aniline	2.6	10	na	--					
Benzoic acid	1.0	20	na	--					
Benzyl alcohol	3.1	20	na	--					
Dibenzofuran	3.4	10	na	--					
			SWRCB						

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625+NDMA+Hydrazine -Low-level	**MDL**	**RL**	**ML**						
	ug/L	**ug/L**	**GC/MS (ug/L)**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,2,4-Trichlorobenzene	0.1	1	5	--					
1,2-Dichlorobenzene	0.1	0.5	2	--					
1,2-Diphenylhydrazine/Azobenzene	0.1	1	1	--					
1,3-Dichlorobenzene	0.1	0.5	1	--					
1,4-Dichlorobenzene	0.2	0.5	1	--					
2,4,6-Trichlorophenol	0.1	1	10	--	6.5	13.0			
2,4-Dichlorophenol	0.2	2	5	--					
2,4-Dimethylphenol	0.3	2	2	--					
2,4-Dinitrophenol	0.9	5	5	--					
2,4-Dinitrotoluene	0.2	5	5	--	9.1	18.3			
2,6-Dinitrotoluene	0.1	5	5	--					
2-Chloronaphthalene	0.1	0.5	10	--					
2-Chlorophenol	0.2	1	5	--					
2-Nitrophenol	0.1	2	10	--					
3,3-Dichlorobenzidine	0.93	5	5	--					
4,6-Dinitro-2-methylphenol	0.2	5	5	--					
4-Bromophenyl phenyl ether	0.1	1	5	--					
4-Chloro-3-methylphenol	0.2	2	1	MDL<ML<RL					
4-Chlorophenyl phenyl ether	0.1	0.5	5	--					
4-Nitrophenol	2.5	5	10	--					
Acenaphthene	0.1	0.5	1	--					
Acenaphthylene	0.1	0.5	10	--					
Anthracene	0.1	0.5	10	--					
Benzidine	2.4	5	5	--					
Benzo(a)anthracene	0.1	5	5	--					
Benzo(a)pyrene	0.1	2	10	--					
Benzo(b)fluoranthene	0.1	2	10	--					
Benzo(g,h,i)perylene	0.1	5	5	--					
Benzo(k)fluoranthene	0.1	0.5	10	--					
Bis(2-chloroethoxy)methane	0.1	0.5	5	--					
Bis(2-chloroethyl)ether	0.1	0.5	1	--					
Bis(2-chloroisopropyl)ether	0.1	0.5	2	--					
Bis(2-ethylhexyl)phthalate	1.7	5	5	PL < ML&RL		4.0			
Butyl benzyl phthalate	0.7	5	10	--					
Chrysene	0.1	0.5	10	--					
Dibenz(a,h)anthracene	0.1	0.5	10	--					
Diethyl phthalate	0.1	1	2	--					
Dimethyl phthalate	0.1	0.5	2	--					
Di-n-butyl phthalate	0.2	2	10	--					
Di-n-octyl phthalate	0.1	5	10	--					
Fluoranthene	0.1	0.5	1	--					
Fluorene	0.1	0.5	10	--					
Hexachlorobenzene	0.1	1	1	--					

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Hexachlorobutadiene	0.2	2	1	MDL<ML<RL					
Hexachlorocyclopentadiene	0.1	5	5	--					
Hexachloroethane	0.2	3	1	MDL<ML<RL					
Indeno(1,2,3-cd)pyrene	0.1	2	10	--					
Isophorone	0.1	1	1	--					
Naphthalene	0.1	1	1	--					
Nitrobenzene	0.1	1	1	--					
n-Nitrosodimethylamine	0.1	2	5	--	8.1	16.3			
n-Nitroso-di-n-propylamine	0.1	2	5	--					
n-Nitrosodiphenylamine	0.1	1	1	--					
Pentachlorophenol	0.1	2	5	--	8.2	16.5			
Phenanthrene	0.1	0.5	5	--					
Phenol	0.3	1	1	--					
2,4,5-Trichlorophenol	0.2	20	na	--					
Pyrene	0.1	0.5	10	--					
			SWRCB						
PCB, LL in Water (EPA 608)	**MDL**	**RL**	**ML**						
	ug/L	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Aroclor 1016	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1221	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1232	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1242	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1248	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1254	0.25	0.5	0.5	PL < ML&RL					0.0003
Aroclor 1260	0.25	0.5	0.5	PL < ML&RL					0.0003
			SWRCB						
Pesticides in Water, Low Level (EPA 608)	**MDL**	**RL**	**ML**						
	ug/L	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Aldrin	0.0015	0.005	0.005	--					
alpha-BHC	0.0025	0.01	0.01	--	0.01	0.03			
beta-BHC	0.004	0.01	0.005	MDL<ML<RL					
delta-BHC	0.004	0.005	0.005	--					
gamma-BHC (Lindane)	0.003	0.01	0.02	--					
Chlordane	0.040	0.1	0.1	PL < ML&RL					0.001
4,4'-DDD	0.002	0.005	0.05	PL < ML&RL					0.0014
4,4'-DDE	0.003	0.005	0.05	PL < ML&RL					0.001
4,4'-DDT	0.003	0.01	0.01	PL < ML&RL					0.001
Dieldrin	0.002	0.005	0.01	PL < ML&RL					0.0002
Endosulfan I	0.002	0.005	0.02	--					
Endosulfan II	0.003	0.005	0.01	--					
Endosulfan sulfate	0.003	0.01	0.05	--					
Endrin	0.002	0.005	0.01	--					
Endrin aldehyde	0.002	0.01	0.01	--					

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Endrin ketone	0.003	0.01	na	--					
Heptachlor	0.003	0.01	0.01	--					
Heptachlor epoxide	0.003	0.005	0.01	--					
Methoxychlor	0.004	0.005	na	--					
Toxaphene	0.070	0.5	0.5	PL < ML&RL					0.0003
Chlorpyrifos	0.070	0.1	0.5	PL < ML					0.02 / 0.74
Diazinon	0.070	0.1	0.5	PL < ML					0.16 / 0.91
			SWRCB						
	MDL	**RL**	**ML**						
ICP/MS 200.8	**ug/L**	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Antimony	0.20	2	0.5	MDL<ML<RL	--	6.0	6.0		
Arsenic	0.70	1	2	--	--	10			
Beryllium	0.200	0.5	0.5	--	--	4.0			
Cadmium (Low Level test code)	0.110	0.2	0.25	--	2.0	3.1/4.0	3.1 (outfall 008) / 4.0	3.1	
Chromium	0.70	2	0.5	MDL<ML<RL	see Cr VI	see Cr VI			
Copper	0.75	2	0.5	MDL<ML<RL	7.1	14.0	14.0	13.5	
Lead	0.30	1	0.5	MDL<ML<RL	2.6	5.2	5.2	5.2	
Manganese	0.75	1	n/a	--		50			
Nickel	0.90	1	1	--	35	96	100		
Selenium	0.30	2	2	--	4.1	8.2/5	5 (outfall 008)	5	
Silver	0.30	1	0.25	MDL=ML<RL	2.0	4.1			
Thallium	0.20	1	1	--	--	2.0	2.0		
Zinc	2.5	5	1	ML=MDL	54	119	159 (outfall 008)	159	
			SWRCB						
	MDL	**RL**	**ML**						
ICP 200.7	**ug/L**	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Antimony	7	10.0	50	PL < ML&RL	--	6.0	6.0		
Arsenic	7	10	10	--	--	10			
Beryllium	0.9	2	2	--	--	4.0			
Cadmium	2	5.0	10	PL < ML&RL	2.0	3.1/4.0	3.1 (outfall 008) / 4.0	3.1	
Chromium	2	5	10	--	see Cr VI	see Cr VI			
Copper	3	10.0	10	PL < ML&RL	7.1	14.0	14.0	13.5	
Lead	3	5.0	5	PL < ML&RL	2.6	5.2	5.2	5.2	
Manganese	7.00	20	n/a	--		50			
Nickel	2	10	20	--	35	96	100		
Selenium	8	10.0	10	PL < ML&RL	4.1	8.2/5	5 (outfall 008)	5	
Silver	3	10.0	10	PL < ML&RL	2.0	4.1			
Thallium	7	10.0	10	PL < ML&RL	--	2.0	2.0		
Zinc	6	20	20	--	54	119	159 (outfall 008)	159	

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			SWRCB						
	MDL	**RL**	**ML**						
ICP 200.7	**mg/L**	**mg/L**	**mg/L**		**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Boron	0.020	0.05	na	--			1	1	
Iron	0.015	0.4	na	--		0.3			
Barium	0.006	0.01	na	--		1.0			
			SWRCB						
	MDL	**RL**	**ML**						
Mercury (Weck Lab)	**ug/L**	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
245.1	0.0039	0.05	0.2	PL < ML&RL	0.05	0.1	0.13	0.1	
			SWRCB						
	MDL	**RL**	**ML**						
Chromium VI	**ug/L**	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
218.6/7199	0.25	1	10	--	8.1	16.3			
			SWRCB						
	MDL	**RL**	**Attach B**						
	ug/L	**ug/L**	**ML**						
Chromium III (calc)	0.7	2	na	--					
			SWRCB						
	MDL	**RL**	**ML**						
	ug/L	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Cyanide by EPA 335.2	2.2	5.0	5	PL < ML&RL	4.3	8.5			
			SWRCB						
	MDL	**RL**	**ML**						
	MFL	**MFL**	**MFL**		**MFL**	**MFL**	**MFL**	**MFL**	**MFL**
Asbestos by EPA 100.1 (TEM)			na						
			SWRCB						
	MDL	**RL**	**Attach B**						
8260B-Mod	**ug/L**	**ug/L**	**ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,4-Dioxane	1.0	2	na	--				3	
			SWRCB						
	MDL	**RL**	**Attach B**						
8015-Mod	**ug/L**	**ug/L**	**ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Volatile Fuel Hydrocarbons	30	50	na	--				100	

SANTA SUSANA FIELD LABORATORY
SURFACE WATER SAMPLING PROGRAM
LABORATORY MDLs, REPORTING LIMITS, STATE MINIMUM LEVELS, AND PERMIT LIMITS COMPARISON
NPDES PERMIT CA0001309
Order No. R4-2007-0055

Analyte	Laboratory 2008 MDL	Laboratory 2008 RL	SWRCB ML	Laboratory vs ML(1)	Monthly Ave. Limits 001 Benchmark -- 011 Compliance -- 019 Compliance	Daily Max Limits 001 Benchmark 002 Benchmark 011 Compliance 018 Compliance 019 Compliance	Daily Max Limits 003-007 Compliance 008 Benchmark 009 Benchmark 010 Compliance	Daily Max Limits 012-014 Benchmark	Receiving Water Limits 003-007 Compliance 009 Compliance 010 Compliance
			SWRCB						
	MDL	**RL**	**Attach B**						
8015-Mod	**ug/L**	**ug/L**	**ML**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Extractable Fuel Hydrocarbons	45	500	na	PL < RL				100	
Extractable Fuel Hydrocarbons (low-Level)	50	100	na	--				100	
			SWRCB						
	MDL	**RL**	**Attach B**						
	ug/L	**ug/L**	**ML (ug/L)**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Perchlorate by EPA 314.0	0.9	4	na	--		6.0	6.0	6.0	
			SWRCB						
			Attach B						
	ug/L	**ug/L**	**ML (ug/L)**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
2,3,7,8, TCDD (Vista Lab)	8.40E-13	5.00E-12	na	--	1.40E-08	2.80E-08	2.80E-08	2.80E-08	
			SWRCB						
	MDL	**RL**	**Attach B**						
General Chemistry	**mg/L**	**mg/L**			**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Suspended Soilids (TSS)	10	10	na	--	15	45		45	
BOD	0.5	2	na	--	20	30			
Conductivity (umhos/cm)	1	1	na	--					
Settleable Solids (ml/L)	0.1	0.1	na	--	0.1	0.3		0.3	
Oil & Grease (1664-HEM)	1.4	5	na	--	10	15	15	15	
Ammonia-N	0.5	0.5	na	--	1.96	10.1	10.1 (outfall 008)	10.1	
Turbidity (NTU)	0.04	1	na	--					
Total Residual Chlorine	0.1	0.1	na	--		0.1			
Total Organic Carbon	0.5	1	na	--					
Total Dissolved Solids	10	10	na	--		950	850 / 950 (outfall 008)	950	
Chloride	0.25	0.5	na	--		150	150	150	
Sulfate	0.2	0.5	na	--		300	250 / 300 (outfall 008)	300	
Detergents (MBAS)	0.025	0.1	na	--		0.5			
Nitrate + Nitrite-N	0.15	0.26	na	--		8	8 (outfall 008) / 10	8	
Nitrate-N	0.06	0.15	na	--		8	8 (outfall 008)	8	
Nitrite-N	0.09	0.15	na	--		1	1 (outfall 008)	1	
Fluoride	0.02	0.1	na	--		1.6	1.6	1.6	

SANTA SUSANA FIELD LABORATORY
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Analyte	Laboratory 2008 MDL	Laboratory 2008 RL	SWRCB ML	Laboratory vs ML(1)	Monthly Ave. Limits 001 Benchmark -- 011 Compliance -- 019 Compliance	Daily Max Limits 001 Benchmark 002 Benchmark 011 Compliance 018 Compliance 019 Compliance	Daily Max Limits 003-007 Compliance 008 Benchmark 009 Benchmark 010 Compliance	Daily Max Limits 012-014 Benchmark	Receiving Water Limits 003-007 Compliance 009 Compliance 010 Compliance
			SWRCB						
	MDL	**RL**	**Attach B**						
Radiochemistry (Eberline & TA-Irvine)	**pCi/L**	**pCi/L**	**ML**		**pCi/L**	**pCi/L**	**pCi/L**	**pCi/L**	**pCi/L**
Gross Alpha**	na	3	na	--		15	15		
Gross Beta**	na	4	na	--		50	50		
Radium 226 + 228**	na	1	na	--		5	5		
Tritium**	na	400	na	--		20000	20000		
Strontium 90**	na	2	na	--		8	8		
Uranium**	na	1	na	--		20	20		
Potassium-40**	na	40	na	--					
Cesium-137**	na	10	na	--					
			SWRCB						
	MDL	**RL**	**Attach B**						
8315M (Truesdail Lab)	**ug/L**	**ug/L**	**ML (ug/L)**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Monomethyl hydrazine**	0.561	5	na	--					
Dimethyl hydrazine	0.315	1	na						
Hydrazine	0.15	1	na						
			SWRCB						
	MDL	**RL**	**Attach B**						
Toxicity (Aquatic Lab)	**% Survival**	**% Survival**	**ML**		**% Survival**	**% Survival**	**% Survival**	**% Survival**	**% Survival**
Acute Toxicity**	na	na	na	--		70	70	70	
	TUc	**TUc**	**TUc**		**TUc**	**TUc**	**TUc**	**TUc**	**TUc**
Chronic Toxicity**	na	na	na	--		1.0	1.0	1.0	
			SWRCB						
	MDL	**RL**	**Attach B**						
Biological	**MPN**	**MPN**	**ML**		**MPN**	**MPN**	**MPN**	**MPN**	**MPN**
Total Coliform**	na	na	na	--					
Fecal Coliform**	na	na	na	--					

SWRCB = State Water Resources Control Board

** The SWRCB does not have MLs established for these analyses. As required In the NPDES Permit, a full list of MDL/RL's will be supplied to the RWQCB on an annual basis.

Columns are used to compare laboratory's reporting limits (RLs) and method detection limits (MDLs) to the SWRCB MLs and the permit limits

(1) This column indicates the status of analytical capabilities if the ML is < the laboratory RL or MDL.

If nothing is displayed in the cell, the RL meets the ML and the Permit Limit.

The following designations which are in the table, summarize the comparison of RLs, MDLs, MLs, and permit limits:

--	Laboratory RL meets ML and permit limit requirements
ML< MDL	The laboratory MDL does not meet the ML
MDL<ML<RL	The ML is less than RL, but greater than the MDL
Permit<ML	The established permit limit is less than the ML (the permit limit is in parentheses)
RL>permit	RL is greater than the permit limit

QA/QC LABORATORY PROCEDURES

QUALITY ASSURANCE PROGRAM PLAN

Prepared by:

AQUATIC TESTING LABORATORIES
4350 Transport St., Unit 107
Ventura, CA 93003
(805) 650-0546

Revision 3.0
January 2008

Approval:

3-12-08

Joseph A. LeMay
Laboratory Director

Table of Contents

1. INTRODUCTION

Aquatic Testing Laboratories (ATL) is dedicated to providing quality aquatic toxicity testing to its clients. This document describes ATL's Quality Assurance policies and procedures as they relate to biological monitoring for environmental pollutants.

Purpose of Document

This Quality Assurance Program Plan (QAPP) is intended to ensure that precision, accuracy, completeness, comparability, and representativeness of data are known and documented.

The QAPP presents an overview of the essential elements of ATL's QA program. This plan has been modeled along EPA guidelines as outlined in "Interim Guideline and Specifications for Preparing Quality Assurance Program Plans," QAMS-004/80, December 29,1980; "Interim Guideline and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, February 1983; "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," EPA/600/4-89/001; and "Manual for the Evaluation of Laboratories Performing Aquatic Toxicity Tests," EPA/600/4-90/031. All of these documents have been issued by the Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. Environmental Protection Agency (U.S. EPA). Primary guidance was obtained from "Enseco Incorporate Quality Assurance Program Plan for Environmental Biology," Revision 3.1, July, 1988, written by Enseco Inc. with additional guidance provided from the Environmental Laboratory Accreditation Program, (State of California Department of Health Services and Department of Fish and Game).

QA Objectives

This QA Program Plan is designed to control and monitor the quality of data generated at ATL. The described QA program is geared toward generating data that comply with federal regulatory requirements specified under the National Pollutant Discharge Elimination System (NPDES) as well as the State of California Department of Health Services Environmental Laboratory Accreditation Program (DOHS ELAP) and other state equivalents. Although the QC requirements of these various programs are not completely consistent, each of the programs base data quality judgments on two types of information:

* Data that indicate the overall qualifications of the laboratory to perform environmental analyses;

* Data that measure the laboratory's daily performance using a specific method.

The operational elements that are involved in making each of these assessments are described in TABLE 1 along with the pertinent section number from this document in which each is discussed.

TABLE 1
DATA QUALITY ASSESSMENT

Evaluation Criteria	Operational Elements	Section of QA Plan
LABORATORY QUALIFICATIONS	Facilities/Equipment/Staff	SOQ*
	Written SOP's for all laboratory procedures	15
	Sample custody	5
	Calibration procedures	6
	Testing procedures	7
	Data validation	8
	Documented QA program	1-15
	Laboratory certifications	10
LABORATORY PERFORMANCE	Calibration data	6
	Check samples	10
	Reference toxicant data	9
	Control charts	9

* SOQ (Statement Of Qualifications) described in a separate document.

2. DEFINITIONS

Definition of Terms

Protocol: the actual plan for scientific testing. A protocol may refer to several SOP's to complete the plan.

Quality Assurance (QA): the total integrated program for assuring the reliability of data generated in the laboratory.

Quality Assurance Program Plan (QAPP): an assemblage of management policies, objectives, principles, and general procedures outlining the techniques by which the laboratory produces data of known and accepted quality.

Quality Assurance Project Plan (QAPjP): an assemblage of detailed SOP's describing how the laboratory will generate data that meet the data quality objective of a specific project.

Quality Control (QC): the routine application of specific, well documented procedures to ensure the generation of data of known and accepted quality, thus fulfilling the objectives of the QA program.

Quality Control Manual: an assemblage of detailed SOP's describing the laboratory implementation of the QAPP.

Standard Operating Procedure (SOP): a detailed, written description of a procedure designed to systematize and standardize the performance of the procedure.

3. ORGANIZATION, RESPONSIBILITIES AND AUTHORITIES

Executing an effective QA program demands the commitment and attention of both management and staff. The QA effort at ATL is managed by the Laboratory Director who serves as the QA Officer and as such, has the responsibility of overseeing and regulating all laboratory functions. The QA program operates independently of all areas, generating analytical data to ensure complete objectivity in the evaluation of laboratory operations.

QA Officer Responsibilities

The QA officer is responsible for:

* Developing and implementing a QA program that ensures that all data generated are scientifically sound, legally defensible, and of known precision and accuracy;

* Monitoring the QA Plan to ensure compliance with QA objectives;

* Ensuring that all employees are complying with the QA Plan;

* Developing and implementing new QA procedures to improve data quality;

* Conducting in-house audits and inspections of all laboratories on a regular basis and applying corrective actions as needed to ensure compliance with the QA Plan;

* Maintaining copies of all SOP'S;

* Assist in the writing of SOP's;

* Distributing current SOP's to the laboratory staff;

* Monitoring laboratory performance in the areas of holding times, turn-around times, and meeting contractual obligations;

* Performing statistical analyses of QC data and establishing data bases that accurately reflect the performance of the laboratory;

* Maintaining reference toxicant control charts on all testing done at ATL;

* Maintain records and archives of all QA/QC data, PE results, audit comments, and client inquiries concerning data quality;

* Conducting seminars on QA issues for both clients and laboratory staff; and

* Promoting sound QA practices within the environmental regulatory and analytical communities.

QA Officer Authority

The QA officer has the final authority on all issues dealing with data quality and has the authority to require that procedures be amended or discontinued, or analyses suspended or repeated. He also has the authority to suspend or terminate employees on the grounds of dishonesty, incompetence, or repeated non-compliance with QA procedures.

Laboratory Personnel Responsibilities

All laboratory personnel involved in the generation and reporting of data have a responsibility to understand and follow the ATL QA Plan. Laboratory personnel are responsible for:

* Have a working knowledge of the ATL QA Plan;

* Ensuring that all work is generated in compliance with the QA Plan;

* Performing all work according to written SOP's;

* Ensuring that all documentation related to their work is complete and accurate; and

* Providing management with immediate notification of quality problems.

Laboratory Personnel Authority

Laboratory personnel have the authority to accept or reject data based on compliance with well-defined QC acceptance criteria. The acceptance of data that fall outside QC criteria must be approved by laboratory management. The authority of the laboratory personnel flows from the Laboratory Director.

4. SAMPLING PROCEDURES

The generation of quality data begins with the collection of the effluent, water or sediment sample. Therefore the integrity of the sample collection process is of concern to the laboratory. Samples must be collected in such a way that no foreign material is introduced into the sample and no material of interest escapes from the sample prior to analysis. To ensure sample integrity, the following must be considered:

* Samples must be collected in appropriate containers. In general, glass containers are used for soils and solids, while plastic "cubitainers" are used for effluents and surface waters;

* The sample containers must be properly cleaned to ensure that the sample is not contaminated during the collection process;

* Appropriate volumes of sample must be collected to ensure that the required testing may completed and QC samples may be analyzed;

* Samples must be cooled to the appropriate holding temperature (4°C) prior to shipping;

* Samples must be properly shipped to the laboratory, in the appropriate time frame, to ensure that holding times can be met.

ATL can assist in the sample collection process by providing consultation and assistance to clients designing sampling programs and also by making available to the client a set of appropriate sample containers that are properly cleaned for use in sample collection.

The maximum holding times recommended by ATL, appropriate containers, and minimum sample volumes required for routine testing are given in Appendix I. These holding times are in general agreement with EPA and the State of California recommended holding times, as stated in the National Pollutant Discharge Elimination System (NPDES) and the California Environmental Laboratory Accreditation Program (ELAP) programs. Other holding times can be honored if special arrangements are made with the laboratory.

5. SAMPLE CUSTODY

Upon receipt by ATL, samples proceed through an orderly processing sequence specifically designed to ensure continuous integrity of both the sample and its documentation.

All samples are received by ATL's sample control personnel and are carefully checked for label identification, and completed, accurate chain-of-custody records. Photographs may be used to document the condition of samples. Each sample is then assigned an unique laboratory identification number. The date received, the condition upon receipt, the temperature upon receipt, the new laboratory identification number, as well as the client and the client's sample identification are recorded in the sample control log book. A sample file is then generated in which all documentation, including testing results, are kept. The sample itself is labeled with the laboratory identification number and stored in a secured refrigerated storage facility with temperature maintained at 4°C until analysis. The total residual chlorine (TRC) of effluent samples is measured and recorded. Any unused sample is returned to refrigerated storage with little headspace as possible, until all analyses are complete. Samples are then either returned to the client, properly disposed of, or at the request of the client, stored for an extended length of time.

6. CALIBRATION PROCEDURES AND FREQUENCY

Standard/Reagent Preparation

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical and/or biological operations. ATL continually monitors the quality of reagents and standard solutions through a series of well-documented procedures.

To ensure the highest purity possible, all primary reference standards and standard solutions are obtained from the EPA laboratory in Cincinnati, Ohio, or other reliable commercial sources. All standards and standard solutions are recorded into a log book that identifies the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and all other pertinent information.

Care is exercised in the proper storage and handling of standard solutions, and all containers are labeled as to compound, concentration, solvent, expiration date, and preparation data (initials of preparer/date of preparation).

Instrument Calibration and Tuning

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity. Instruments used for routine measurements of chemical and physical parameters such as pH, DO, temperature, conductivity, salinity, alkalinity, and hardness, must be calibrated and standardized according to the instrument manufacturer's procedures prior to any uninterrupted use. The light meter is certified calibrated biannually per manufacturer's recommendation. Analytical balances are calibrated annually by a certified technician and verified monthly by laboratory personnel.

Dissolved oxygen probes are calibrated daily by use of the moist air technique, however, comparison to the Winkler titrimetric method may be performed as needed.

Wet chemical methods used to measure hardness and alkalinity must be standardized according to EPA Methods 130.2 and 310.1.

7. TESTING PROCEDURES

Test Organisms

The fish and invertebrates used in toxicity testing should appear healthy, behave normally, feed well, and have low mortality in cultures, holding tanks, and test controls. Test organisms should be disease-free and should be positively identified to species.

The sensitivity (quality) of test organisms obtained from an outside of the laboratory source is to be tested by conducting a reference toxicant test on organisms from each batch received by the laboratory or at a minimum on a monthly basis when more than one batch of organisms are received during the month from the same provider provided that the organisms have preformed satisfactory in the previous five monthly reference toxicant tests (value not well outside the expected range). The sensitivity of test organisms obtained from an in-lab breeding culture is to be tested by conducting a reference toxicant test on the cultured organisms on a monthly basis. Reference toxicant tests may be performed concurrently with an effluent toxicity test.

Facilities, Equipment, and Test Chambers

Laboratory and bioassay temperature control equipment must be adequate to maintain recommended test water temperatures. Surfaces that come in contact with the sample, such as test chambers, must be made of recommended materials. See individual testing SOP's and protocols for recommended materials and testing regimes.

Dilution Water

The dilution water used in toxicity tests will depend on the objectives of the study and client requirements. Hazardous waste testing utilize synthetic, soft (hardness: 40-48 mg/l $CaCO_3$) water. EPA NPDES toxicity test utilizes synthetic, moderately hard water or 20% diluted mineral water (DMW). Some tests will require the use of client-supplied dilution water.

The dilution water used for internal quality assurance tests with organisms, food, and reference toxicants should be water routinely used with success in the laboratory.

Testing Conditions

Water temperature must be maintained within the limits specified for each test. Dissolved

oxygen (DO) concentration and pH in fish and invertebrate test chambers should be checked daily throughout the test period, as described in the test SOP.

Food Quality

The quality of the food for fish and invertebrates is an important factor in toxicity tests. Suitable fish food flakes, brine shrimp cysts, and other foods must be obtained as described in the test SOP's and protocols. The suitability of each new supply of food should be determined in a side-by-side test, using two treatments with four replicates per treatment. In this test, the response of control test organisms fed with the new food is compared with the response of organisms fed a reference food or a previously used, satisfactory food.

Test Methods

Most tests performed by ATL are driven by regulatory concerns. Therefore, methods used at ATL predominately originate from regulatory agencies. Generally the methods used are those specified by the U.S. EPA and other federal agencies, state agencies, and professional organizations, as provided in the following references:

* California Department of Health Services. 1988. Static Acute Bioassay Procedures for Hazardous Waste Samples. Prepared by J.M. Polisini and R.G. Miller. California Department of Fish and Game Water Pollution Control Laboratory.

* California State Water Resources Control Board (CSWRCB). 1996. Procedures Manual for Conducting Toxicity Tests Developed by the Marine Bioassay Project. CSWRCB, Sacramento, CA. 96-1WQ

* U.S.EPA. 1993. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. 4th ed. EPA/600/4-90/027F.

* U.S.EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. 3rd ed.EPA600-4-91-002.

* U.S.EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. 2nd ed. EPA-600-4-91-003.

* U.S.EPA. 1995. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms. EPA/600/R-95R/136.

* U.S.EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. 5th ed. EPA-821-R-02-012.

* U.S.EPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. 4th ed. EPA-821-R-02-013.

* U.S.EPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. 3rd ed. EPA-821-R-02-014.

The choice of method is dependent on the objectives of the study in terms of qualitative certainty, quantitative sensitivity, precision and accuracy, and the type of matrix to be analyzed. Each method used routinely is documented in the form of an SOP. The SOP contains detailed instructions concerning both the use and the expected performance of the method. Any deviations from the published methodology are documented and explained in the SOP. A complete description of the contents of laboratory SOP's is given in Section 15.

Before any methods are routinely used to generate analytical and/or biological data, the method is validated. Validation criteria consists of:

* Method selection by a senior staff member;

* Documentation of the method in a SOP. This includes a summary of the method, detailed description of the procedure, calculations, reporting formats, safety concerns, and special remarks;

* Testing of the method to verify detection limits and linear range and establish precision and accuracy criteria; and

* Establishment of data acceptance criteria that must be approved by a senior staff member and the QA Officer.

8. DATA REDUCTION, VALIDATION, AND REPORTING

All data generated by ATL are extensively checked for accuracy and completeness. The data validation process consists of data generation, reduction, and two levels of review, as described below.

The analyst who generates the data has the prime responsibility for the correctness and completeness of the data. All data are generated and reduced following methods specified in laboratory SOP's. Each analyst reviews the quality of his work based on an established set of guidelines. The analyst reviews the data package to ensure that:

* The protocol has been followed exactly; if not, any deviations are properly noted;

* Sample preparation information is correct and complete;

* Analyst information is correct and complete;

* The appropriate SOP's have been followed;

* Analytical/biological results are correct and complete;

* QC (reference toxicant) results are within established control limits;

* Special sample preparation and analytical requirements have been met; and

* Documentation is complete.

The data reduction and validation steps are documented signed and dated by the analyst. This initial review step, performed by the analyst, is designated as Level 1 review. The analyst then passes the data package to the QA Officer, who performs a Level 2 review.

Level 2 review is conducted to an established set of guidelines and is structured to ensure that:

* Calibration data are scientifically sound, appropriate to the method, and completely documented;

* QC samples (reference toxicants) are within established guidelines;

* Qualitative identification of sample components is correct;

* Quantitative results are correct;

* Documentation is complete and accurate;

* The data are ready for incorporation into the final report; and

* The data package is complete and ready for data archive.

Level 2 review is structured so that all calibration and QC data are reviewed and all of the analytical and biological results are checked back to the bench sheet. The review is complete when the data package has been reviewed in its entirety.

An important element of Level 2 review is the documentation of any errors that have been identified and corrected during the review process. Errors that are found are documented and transmitted to the appropriate supervisor. The cause of the errors is then addressed with additional training or clarification of procedures to ensure that quality data will be generated at the bench.

Data Reduction

Many toxicity tests require the calculation of an LC50, EC50, NOEC, LOEC, or percent survival calculations. ATL primarily utilizes the computer statistical program TOXCALC to calculate these values. Other statistical packages may be utilized to evaluate the data when appropriate. Proper statistical procedures, such as examining homogeneity of variance prior to ANOVA analyses, or data transformations when required, are conducted according to the method being tested. Proper statistical analyses are outlined in each test method SOP.

Data that do not appear to be in conformance with the substantial majority are often referred to as "outliers", and may be due to random variation, clerical errors, or experimental errors. Statistical outlier detection procedures are screening procedures that indicate whether a value is extreme enough to be considered not due just to random variation and thereby excluded from statistical analysis of the remaining testing data. When outliers are not known to be erroneous values, data analyses are performed with and without the questionable values in order to assess their importance.

Data Reporting

A final report will be generated after successful completion of Level 1 and 2 reviews. The report will include, but not be limited to, the following items:

* Summary, which includes: client name, client sample description, title and description of test, laboratory identification number, test dates, a description of the test organism, water, a definition of the effect criteria, and calculated endpoints.

* Material and Methods, which include: protocol, test dates, laboratory personnel, raw data and/or bench sheets, a description of the test methods and any deviation from the protocol, identification and source of test organisms, description of holding conditions, description and chemical/physical characterization of diluent water, description of analytical methods, counting procedures and statistical techniques.

* Results, which include: all observations, and endpoint determinations.

* References.

* Appendices, where appropriate:

    A. Raw data, including all biological observations and analytical results.

    B. Certification of good laboratory practices signed by all personnel involved in the study and the QA Officer. The certification will include the location and the period for data archiving.

* Client Services: Special services including data interpretation, special consultation, and raw data packages, when requested are included in the final report.

9. INTERNAL QC CHECKS

The QA/QC program monitors data quality with internal QC checks which are used to determine if all laboratory operations are "in control," (i.e., operating within acceptable QC guidelines), during data generation.

Responsibility for internal QC checks rests with the QA Officer and with the individual

analyst. These QC checks include instrument calibration checks, chemical monitoring of dilution waters, specific test validity requirements, and a reference toxicant monitoring program which includes the generation of test control charts.

Instrument QC Checks

All analytical instruments will be calibrated prior to use as set forth in ATL SOP's. Whenever calibration cannot be achieved or measurement of a calibration standard is not within specified limits, the instrument will be considered malfunctioning and will be reported to the Laboratory Director. Any malfunctioning instrument will not be used until appropriate maintenance or repairs are performed and documented.

Chemical Monitoring Of Dilution Waters

In order to establish and continuously monitor the acceptability of the dilution waters utilized in toxicity tests, the dilution waters will be monitored continuously, for deionized water, or at least twice per year for field collected seawater. Dilution waters are to be analyzed to the parameters listed in the appropriate SOP. Results of such analyses are to be maintained in appropriate dilution log books.

Test Validity Requirements

Due to the wide range of test guidelines utilized in toxicity testing, the requirements to determine the validity of any test conducted will be stated in the appropriate SOP. Generally, all acute toxicity tests will be required to meet the following criteria for acceptability:

* No more than a total of 10 percent of the control organisms may appear to be diseased, stressed, or die in a test.

* Appropriate testing conditions, (i.e., temperature, light/dark cycles), are maintained during the course of testing.

Reference Toxicant Monitoring Program

The QA Officer will obtain reference toxicants from the EPA Environmental Monitoring and Support Laboratory in Cincinnati, Ohio, (Telephone No.: (513) 569-7325), or from another reputable commercial supplier. Generally, sodium dodecylsulfate (SDS) will be the reference toxicant of choice, however, in some instances or for certain species other reference toxicants may be utilized.

Reference toxicant tests will be performed on each new batch of test organisms received at the laboratory or on a monthly basis for organisms cultured in-house. Appropriate reference toxicant testing will be conducted concurrently with sample testing when required by test methodology or by the client.

Control Charts

Control charts are to be established and continuously maintained for each organism and test conducted at ATL. Control charts should monitor appropriate test endpoints such as LC50 and NOEC values obtained from the reference toxicant testing program. The control chart is used to evaluate the cumulative trend of the statistics from a series of tests. For point estimation techniques, the mean and upper and lower control limits (+/- 2 times the mean toxicity value standard deviation) are re-calculated with each successive point, until the statistics stabilize. Outliers, which are values which fall outside the upper and lower control limits, and trends of increasing or decreasing sensitivity are readily identified. Note: at the 0.05 probability level, one in 20 tests would be expected to fall outside of the control limits by chance alone. For hypothesis testing results, the same concentrations of reference toxicants are used for each toxicity test. The NOEC from each successive test is entered on the control chart, and the values should fall within one concentration interval above or below the central tendency.

Control charts are to be established based on five successfully completed reference toxicant tests with control limits recalculated with each successive valid reference toxicant test data endpoint. Control charts are used to monitor test organism sensitivity for both commercially obtained and in-house cultured test organisms. If a control chart data point falls outside the established control limits, corrective action must be taken to determine the cause of the discrepancy.

Laboratory Performance QC Program

Laboratory Performance QC is provided as a standard part of every analysis. The main elements of Laboratory Performance QC are:

* Organism survival and reproduction;

* The analysis of reference toxicants

* The generation of daily calibration data.

Satisfactory laboratory performance is demonstrated by performing at least one acceptable reference toxicant test per month for each of the toxicity test methods commonly used in the laboratory. Reference toxicant tests are to be conducted concurrently with less frequently performed tests. If the toxicity value from a given test with the reference toxicant does not fall in the expected range for the test organisms when using the standard dilution water, the sensitivity of the organisms and the overall credibility of the test system are suspect. In this case, the test procedure should be examined for defects and should be repeated with a different batch of test organisms.

Please refer to section 6 of this manual for a discussion of calibration procedures.

10. PERFORMANCE AND SYSTEM AUDITS

ATL participates in a variety of federal and state certification programs, (i.e., EPA's DMR study and California's ELAP program), that subject the laboratory to stringent system and performance audits on a regular basis. A system audit is a review of laboratory operations conducted to verify that the laboratory has the necessary facilities, equipment, staff and procedures in place to generate acceptable data. A performance audit verifies the ability of the laboratory to correctly identify toxicity in blind check samples submitted by the auditing agency. The purpose of these audits is to identify those laboratories that are capable of generating scientifically sound data. A list of current ATL certifications is available upon request.

In addition to external audits conducted by certifying agencies or by clients, the QA Officer periodically conducts system and performance audits of the laboratory to verify that only quality, scientifically sound, data are being generated.

11. PREVENTIVE MAINTENANCE

To minimize downtime and interruption of analytical and/or biological work, preventive maintenance is routinely performed. Designated laboratory personnel are trained in routine maintenance procedures for all major equipment. When repairs are necessary, they are performed by either trained staff or trained service engineers employed by the manufacturer or qualified service company personnel.

Detailed SOP's are on file that describes preventive maintenance procedures. The laboratory also maintains a detailed logbook documenting the preventive maintenance and repairs performed on each analytical instrument or piece of equipment.

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA QUALITY

The effectiveness of a QA program is measured by the quality of data generated by the laboratory. Data quality is judged in terms of its precision, accuracy, representativeness, completeness and comparability. These terms are described as follows:

Precision

Precision is the degree to which the measurement is reproducible. Precision can be assessed by replicate measurements of reference toxicants or environmental samples. The standard deviation of replicate measurements of a single sample is commonly used in estimating precision. The sample coefficient of variation or CV, (also known as the relative standard deviation), expresses the standard deviation as a percentage of the mean, where CV = 100(std. dev./mean).

In the case of duplicates, the relative percent difference (RPD) between two samples may be used to estimate precision. $RPD = [|X_1 - X_2| / ((X_1 + X_2)/2)]*100$

The ability of the laboratory personnel to obtain consistent, precise results must be demonstrated with reference toxicants before they attempt to measure effluent toxicity. The single laboratory precision of each type of test to be used in a laboratory should be determined by performing at least five or more toxicity tests with a reference toxicant. In cases where the test data are used to obtain point estimates, such as LCs, ECs, or ICs, precision can be described by the mean, standard deviation, and relative standard deviation (percent coefficient of variation, or CV) of the calculated endpoints from the replicated tests. However, in cases where the results are reported in terms of the NOEC and LOEC, precision can only be described by listing the NOEC-LOEC interval for each test. In this case, it is not possible to express precision in terms of a commonly used statistic. For instance, when all tests of the same toxicant yield the same NOEC-LOEC interval, maximum precision has been attained. However, the "true" no effect concentration could fall anywhere within the interval, NOEC +/- (NOEC-LOEC).

The dilution factor selected for a test determines the width of the NOEC-LOEC interval and the inherent maximum precision of the test. As the absolute value of the dilution factor decreases, the width of the NOEC-LOEC interval increases, and the inherent maximum precision of the test decreases. Other factors which can affect test precision include test organism age, condition, and sensitivity, and temperature control and feeding.

Replication and Test Sensitivity

The sensitivity of the tests will depend in part on the number of replicates, the probability level selected, and the type of statistical analysis. The minimum recommended number of replicates varies with the test and statistical method used. If the variability remains constant, the sensitivity of the test will increase as the number of replicates is increased. See individual test SOP's and protocols for additional information on replication.

Accuracy

Accuracy is a determination of how close the measurement is to the true value. Accuracy can be assessed by comparing testing data to standard reference materials of a known toxicity or value.

Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Analytical and/or biological data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix.

Completeness

Completeness is a measurement of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions. To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the data base is sufficient.

Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured through the use of established and approved analytical/biological methods, consistency in the basis of analysis (wet weight, volume, etc.), and consistency in reporting units (ppm, ppb, etc.).

13. CORRECTIVE ACTION

When errors, deficiencies, or out-of-control situations exist, the QA program provides systematic procedures, called "corrective actions," to resolve problems and restore proper functioning to the analytical and/or biological system.

Laboratory personnel are alerted that corrective actions may be necessary if:

* QC data are outside the warning or acceptable limits for precision and accuracy;

* Deficiencies are detected during QA internal or external audits or from the results of performance check samples.

* Inquiries concerning data quality are received from clients.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation procedure for possible errors, checks the instrument calibration, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, director or QA Officer for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA Officer and recorded in the corrective action log book.

14. QUALITY ASSURANCE REPORTS

The reporting system is a valuable tool for measuring the overall effectiveness of the QA program. It serves as an instrument for evaluating the program design, identifying problems and trends, and planning for future needs. The QA Officer periodically prepares QA reports which include:

* The results of system audits including corrective actions taken;
* Performance evaluation scores and commentaries;
* Results of site visits and audits by regulatory agencies and clients;
* Performance on major contracts;
* Problems encountered and corrective actions taken;
* Holding time violations; and
* Comments and recommendations.

QA Reports are submitted to the Laboratory Director for review and action if necessary.

15. LABORATORY DOCUMENTATION

Complete and accurate documentation of analytical, biological and procedural information is an important part of the QA program. Bound notebooks should be used to maintain detailed records of the test organisms such as species, source, age, date of receipt, and other pertinent information relating to their history and health, and information on the calibration of equipment and instruments, test conditions employed, and test results. Annotations should be made on a real-time basis to prevent loss of information. The following describes different types of documentation used at ATL.

Standard Operating Procedures (SOP's)

Details of analytical, biological and QC protocols are contained in SOP's. SOP's are documents that contain detailed information on the requirements for the correct performance of a laboratory procedure. ATL has five categories of laboratory SOP's:

* Performance of an Analytical Testing Method
* Performance of a Biological Testing Method
* Preparation of Standards and Reagents
* Equipment Operation, Calibration, and Maintenance; and
* General Laboratory Procedures.

Formats for these SOP's are shown in Appendix II.

All SOP's are approved by the QA Officer before being implemented. The distribution of current SOP's and archiving of outdated ones is controlled by the QA Officer who also serves as the Document Custodian.

Laboratory Bench Sheets

Laboratory bench sheets are used to document information from routine laboratory operations, including sample preparation and analysis. Bench sheets are used to ensure that the information is recorded in a complete and organized manner and that the analysis can be reconstructed, if necessary.

Laboratory Notebooks

Laboratory notebooks are used to document information that cannot easily be recorded on bench sheets such as methods development information. Each data entry in a laboratory notebook in initialed and dated by the analyst as the data is being entered.

Control Charts

Control charts are used to visually track precision and accuracy data. These control charts are used to identify trends in the analyses which may indicate a problem with the analytical procedure. When an adverse trend or data point is detected corrective action is performed.

Project Files

The project file consists of a project summary and raw data records. The project summary records includes correspondence from the client, (letters, phone logs, contracts, project plans), copies of preliminary and final reports, chain of custody records, air bills, photographs of samples, QA review checklists when applicable, and the summary file inventory check list. Raw data records include original sample raw data, QC data, bench sheets, and instrument logbook pages pertinent to the project. Contracts, project plans, calibration data and QC data may be stored separately from the project record. All project records must contain cross-references to this information. When a project is complete, all records are passed to the Document Custodian who inventories the file, checks for completeness, and puts the file into document archive.

APPENDIX I

SAMPLE HOLDING TIMES AND COLLECTION INFORMATION

Sample Holding Times And Collection Information

TEST	Container	Volume	Holding Time
Hazardous Waste Tests			
CCR Title 22 (Calif. DOHS 1988)	glass	Screen: 25 gm Definitive: 55 gm	NA* "
NPDES Acute Tests			
Fathead Minnow, *Menidia*, Topsmelt, Mysid	plastic/cubitainer	% Survival: 1 gallon Full (LC50): 2.5 gallons	36 Hours "
Rainbow Trout	plastic/cubitainer	% Survival: 5 gallons Full (LC50): 10 gallons	36 Hours "
Ceriodaphnia, *Daphnia*	plastic/cubitainer	% Survival: 1 liter Full (LC50): 1 liter	36 Hours "
NPDES Chronic Tests			
Fathead Minnow	plastic/cubitainer	2.5 liters/day	36 Hours
Ceriodaphnia	" "	1 liter/day	"
Selenastrum	" "	1 liter	"
3 Species Freshwater Chronics	" "	2.5 gal./2 days	"
Red Abalone Larvae	plastic/cubitainer	1 liter	36 Hours
Giant Kelp	" "	1 liter	"
Topsmelt	" "	1 gal./day	"
Menidia	" "	1 gal./day	"
3 Species Marine Chronics	" "	2.5 gal./2 days	"

* No holding time specified in protocol.

Note: Static-renewal tests may require more than one sample. Chronic static-renewal tests may require multiple day sampling, ie. collecting samples on a Monday, Wednesday and Friday.

APPENDIX II

FORMATS FOR STANDARD OPERATING PROCEDURES (SOP's)

FORMAT FOR SOP - LABORATORY ANALYTICAL METHOD

Title (includes method number)

1.0 Scope and Application

- 1.1 Analytes
- 1.2 Detection limit (instrument and method)
- 1.3 Applicable matrices
- 1.4 Dynamic range
- 1.5 Approximate analytical time

2.0 Method Summary

Generic description of method and chemistry behind it.

3.0 Comments

- 3.1 Interferences
- 3.2 Helpful hints

4.0 Safety Issues

5.0 Sample Collection, Preservation, Containers, and Holding Times

6.0 Apparatus

7.0 Reagents and Standards

8.0 Procedure (detailed step-by-step)

- 8.1 Sample preparation
- 8.2 Calibration
- 8.3 Analysis

9.0 QA/QC Requirements

- 9.1 QC samples
- 9.2 Acceptance criteria (precision and accuracy)
- 9.3 Corrective action required (reference current QC manual)

10.0 Calculations

11.0 Reporting

- 11.1 Reporting units
- 11.2 Reporting limits
- 11.3 Significant figures

12.0 References

- 12.1 Method source
- 12.2 Deviations from source method and rationale

13.0 Appendices (optional)

Additional information may be placed in appendices. This may include supporting data (e.g. method validation information), tables, flow charts, etc.

FORMAT FOR SOP - LABORATORY BIOLOGICAL METHOD

Title (includes method number, if applicable)

1.0 Scope and Application

- 1.1 Organism(s)
  - 1.1.1 Source
  - 1.1.2 How identified
  - 1.1.3 Authority
- 1.2 Response
- 1.3 Analysis
- 1.4 Approximate analytical time

2.0 Method Summary

Generic description of method and chemistry behind it.

3.0 Comments

- 3.1 Definitions
- 3.2 Helpful hints
- 3.3 Comments

4.0 Safety Issues

5.0 Sample Collection, Preservation, Containers, and Holding Times

- 5.1 Toxicant
- 5.2 Preservation
- 5.3 Containers
- 5.4 Holding Time

6.0 Equipment

7.0 Reagents and Standards

- 7.1 Reagents
- 7.2 Standards

8.0 Procedure (detailed step-by-step)

- 8.1 Sample preparation
- 8.2 Organism preparation
- 8.3 Equipment and calibration of equipment
- 8.4 Analysis
- 8.5 Monitoring parameters
- 8.6 Organism disposal
- 8.7 Data analysis
  - 8.7.1 Statistics required
  - 8.7.2 Technique
  - 8.7.3 Reasoning and interpretation
- 8.9 Other

9.0 Record Keeping

- 9.1 Lab notebooks
- 9.2 Bench sheets
- 9.3 Other

10.0 Reporting

- 10.1 Reporting units
- 10.2 Reporting limits
- 10.3 Significance of values
- 10.4 Other

11.0 QA/QC Requirements

- 11.1 QC controls
- 11.2 Reference Toxicant
- 11.3 QC Acceptance criteria
  - 11.3.1 Precision and accuracy
  - 11.3.2 Water Quality parameters
  - 11.3.3 Other

11.4 Inspections
11.5 Audits
11.6 Special considerations (client requests)
11.7 Corrective action required (reference current QC manual)
11.8 Other

12.0 References

12.1 Method source
12.2 Deviations from source method and rationale

13.0 Responsibilities

14.0 Appendices (optional)

Additional information may be placed in appendices. This may include supporting data (e.g. method validation information), tables, flow charts, etc.

FORMAT FOR SOP - LABORATORY PROCEDURE

Title (includes method number)

1.0 Purpose

2.0 Policies

3.0 Safety Issues

4.0 Procedure (detailed step-by-step)

5.0 Responsibilities

6.0 Comments

7.0 Definitions

8.0 References

FORMAT FOR SOP - LABORATORY STANDARDS AND REAGENTS

Title

1.0 Reagent/standard name

2.0 Type

3.0 Constituents/concentration

4.0 Solvent

5.0 Safety Issues

6.0 Shelf life and storage

- 6.1 Neat material
- 6.2 Prepared solution
- 6.3 Other

7.0 Procedure (detailed step-by-step)

- 7.1 Preparation for use
- 7.2 Documentation
  - 7.2.1 Purchase date
  - 7.2.2 Source
  - 7.2.3 Purity
  - 7.2.4 Date opened
  - 7.2.5 Labeling
  - 7.2.6 Other
- 7.3 Verification
- 7.4 Usage

8.0 Responsibilities

9.0 Comments

10.0 Definitions

11.0 References

Quality Assurance Program Manual

Prepared by:
Richmond, CA Laboratory
Quality Assurance Department

☐ **Controlled** ☐ **Uncontrolled**
Copy No. _____ **Issue Date _____**

Issued to:

Eberline Analytical Corporation
Richmond, CA Laboratory
2030 Wright Avenue
Richmond, CA 94804
Tel (510) 235-2633
Fax (510) 235-0438
NELAP Cert No.
01120CA (California)

Rodney Melgard
Mr. Rodney Melgard
Laboratory Manager 08/19/08

Mr. Cesar S. Sangalang 8.19.08
Technical Director

Katsumi Yamamoto
Mr. Katsumi Yamamoto 08/19/08
Q.A. Manager

AUTHORIZATION AND APPROVAL (A&A) STATEMENT

This Eberline Analytical Corporation, Richmond, CA Laboratory, Quality Assurance Program Manual, with all revisions, is authorized and approved in its entirety by:

Katsumi Yamamoto 08/19/08

Katsumi Yamamoto
Q.A. Manager
Eberline Analytical Corporation
Richmond, CA Laboratory
2030 Wright Avenue
Richmond, CA 94804

Date

And Directed by:

Rodney Melgard 08/19/08

Rodney Melgard
Laboratory Manager
Eberline Analytical Corporation
Richmond, CA Laboratory
2030 Wright Avenue
Richmond, CA 94804

Date