Appendix C

Field Data Sheet and Chain of Custody Form

Gresham UIC Monitoring Plan

Date: _______________

Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, Oregon 97203-4552
Sample Custodian: (503) 823-5696
General Lab: (503) 823-5681

City of Portland Chain-of-Custody

Bureau of Environmental Services

Work Order #:

Collected By: ____________________

Client Name: City of Gresham

Matrix: Stormwater

Project Name: **City of Gresham UIC**

Requested Analyses

Special Instructions:
FY 12/13

Lab Number	**Location ID**	**Sample Date**	**Sample Time**	**Sample Type**	**BOD**	**TSS**	**E. coli**	**Ammonia-Nitrogen**	**Nitrate-Nitrogen**	**Total Phosphorus**	**Orth-Phosphate Phosphorus**	**TKN**	**PAHs + phthalates**	**Hardness**	**Total Metals** (Sb, Cu, Pb, Zn) + Hg	**Dissolved Metals** (Cu, Pb, Zn)	**Herbicides** (EPA 8321) PAL	**Trifluralin** (EPA 8081B) PAL							**# of Containers**	**Remarks**
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
				G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								
	Field Duplicate			G	●	●	●	●	●	●	●	●	●	●	●	●	●	●								Field Duplicate

Relinquished By: **Signature:** **Date:**	**Received By:** **Signature:** **Date:**	**Relinquished By:** **Signature:** **Date:**	**Received By:** **Signature:** **Date:**
Printed Name: **Time:**	**Printed Name:** **Time:**	**Printed Name:** **Time:**	**Printed Name:** **Time:**

Appendix D

Pesticide Assessment

Gresham UIC Monitoring Plan

Pesticide Assessment for Stormwater Monitoring

Prepared by the Cities of Gresham and Fairview
Submitted to Oregon Department of Environmental Quality
November 1, 2011

Background

The NPDES MS4 permit issued to the City of Gresham and City of Fairview by the Oregon Department of Environmental Quality (DEQ) on December 30, 2010 required the co-permittees to begin monitoring pesticides as part of the environmental monitoring program. In the Stormwater Monitoring-Storm Event requirement of Table B-1, DEQ specified monitoring for 2,4-D (the most widely used herbicide) and pentachlorophenol (a fungicide used to treat utility poles) in stormwater during the 5-year permit term. DEQ also added the following special condition in Table B-1:

Additional pesticide pollutant parameters that must be considered for purposes of stormwater monitoring – storm event include any pesticide currently used by the co-permittees within their jurisdictional areas and the following: Insecticides: Bifenthrin, Cypermethrin or Permethrin, Imidacloprid, Fipronil, Malathion, Carbaryl; Herbicides: Triclopyr, 2,4-D, Glyphosate & degradate (AMPA), Trifluralin, Pendamthalin; and, Fungicides: Chlorothananil, Propiconazole, Myclobutanil.

The co-permittees have been collecting information on pesticides; this report contains the current status of this assessment, which will be adaptively managed as additional information is considered.

Method

The first step in conducting the pesticide evaluation was developing a list of pesticides to consider. The sources of information considered for developing the list of pesticides included:

- List of pesticides (20 total) used by Gresham and Fairview public works/operations crews (including facilities, parks, stormwater, wastewater, water and transportation);
- The list of 15 pesticides DEQ included in the 2010 NPDES MS4 permit;
- Pesticides included on Oregon's 2009 Public Use Reporting System (PURS) list that were indicated as having a residential or urban use (12 pesticides);
- Pesticides available in pet, home, and garden stores in the Portland Metro area collected during a Metro shelf survey conducted in 2008 (122 pesticides);
- Pesticides identified by the Oregon Water Quality Pesticide Management Team (WQPMT 2011) as being either a Pesticide of Interest (POI), an Oregon Pesticide of Interest (POI-OR), a DEQ Priority Persistent Pollutant (P3), or on the DEQ Priority Toxic List (PTL) (74 pesticides)

The lists above have many pesticides in common and therefore the total number evaluated from all lists was 115.

Evaluation of pesticides was based on multiple criteria, including:

- Mobility (movement from soil to water),
- Persistence (based on half life in soil),
- Toxicity to humans,
- Toxicity to aquatic life,
- Use by the Co-permittees
- Availability for purchase in the permit area,
- Known widespread use by residents or businesses

- Of interest to Water Quality Pesticide Management Team (WQPMT) and labeled for non-agricultural use, and
- Whether or not DEQ has detected the pesticide in Oregon streams

The criteria used to evaluate pesticides fell into two broad categories – one related to environmental characteristics and the other related to introduction into the environment. The characteristics that determine how a pesticide moves through the environment and the risk posed to human or aquatic life are important, but these criteria only become important if the pesticide is available for use within the permit area. To this end, both categories were assumed to be equally important and the potential maximum score available for environmental characteristics was set equal to those related to availability and use.

Environmental Characteristics – Mobility, Toxicity and Persistence

Information on mobility, toxicity and persistence was obtained primarily from a literature review. The references section lists the sources of information used to obtain a rating for each pesticide.

In order to convert mobility, toxicity and persistence information to a value that could be evaluated for ranking, the ratings were converted using the following: Very Low (1), Low (2), Low to Moderate (3), Moderate (4), Moderate to High (5), High (6), Very High (7). Once converted to numeric scores, the weighting factor each of these parameters was: Mobility * 2, Persistence * 1.5, Human Toxicity *1, Aquatic Life Toxicity * 1.5. Since toxicity was considered separately for human and aquatic life, the maximum weighted score for toxicity is 17.5, the maximum for mobility is 14, and the maximum for persistence is 10.5. The maximum score a pesticide could receive for environmental characteristics is 42.

The logic behind the environmental characteristic weightings is as follows: Toxicity is key since the goal is to protect beneficial uses, and the other factors become less important if the pesticide isn't very toxic. Within the toxicity criteria, aquatic life toxicity was judged more important than human toxicity because human exposure to pesticides via water is typically through ingestion, and treatment of drinking water is presumed, unless the source of the water is groundwater—in which case soil provides some filtration/adsorption. Mobility was judged the next most significant criterion because pesticides need to leave the soil and enter water in order to cause water quality problems. Persistence was given the next highest weight because the half-life determines how far the pesticide moves before attenuating below levels of concern.

Use and Availability

The inventory of pesticides used by the City of Gresham was compiled from those reported for the annual NPDES MS4 report. An inventory of pesticides used by the City of Fairview during 2011 was obtained from the City of Fairview. Because DEQ specifically requested consideration of *any pesticide currently used by the co-permittees within their jurisdictional areas,* all pesticides used by either Co-Permittee were given a score of 15.

Pesticides available for purchase by residents in the permit area were identified by obtaining study data collected by Metro in 2008 assessing pesticides available on the shelf of local box retail locations, home and garden centers, and veterinary supply stores. The shelf survey contained brand names, as well as the active ingredients, in products available for use on pets, around the home, or in the garden. Because the frequency data for some products was skewed based on the variety available (e.g. pet shampoos containing the same active ingredient were available in multiple scents and container sizes), the data were sorted so that active ingredients in products available for pet and home use were given a value of 1, ingredients available in products for use in the garden or outdoors were given a score of 5, and ingredients available in both were given a score of 6. More weight was given to products used in the garden or

outdoors, since the exposure to precipitation and potential for runoff to groundwater or surface water is greater than for products designed for pet or indoor use.

In addition to availability data accessible through Metro, a "known widely used" pesticide criteria was also used in the assessment. Based on feedback from Gresham outreach staff conducting outreach visits with homeowners related to lawn care, the two most highly used pesticides (2,4-D and Glyphosate) were identified and scored a 10 for this criteria. Based on data from the City of Portland's UIC monitoring program, Pentachlorophenol was identified as widely used based on the density of treated utility poles within the urban environment.

The criterion associated with Oregon's Water Quality Pesticide Management Team (WQPMT) is a composite of two measures (or sub-criteria): number of lists, and urban use. The WQPMT created four lists (POI, POI-OR, P3, PTL); a pesticide received one point for each list upon which it appeared, for a maximum potential score of four points. The WQPMT also evaluated uses for each pesticide, identifying eight non-agricultural uses (lawns, turf, etc.). A pesticide was given one point for each of the eight uses the WQPMT associated with that pesticide, and a weighting factor of 0.5 was then applied to the total. A maximum score of 4 was therefore possible for a pesticide used in all 8 non-agricultural uses identified by the WQPMT. Considering both the number of lists and urban use sub-criteria, a pesticide could accrue up to 8 points total for the WQPMT criterion.

DEQ provided a list of pesticides detected in Oregon streams; however, the stream samples were located primarily in agricultural areas. Pesticides which have been detected in statewide stream sampling conducted by DEQ between 2007-2010 were given a score of 3. Pesticides which have either not been detected or not evaluated received a zero (0) for this criteria. The overall score for this criterion was lower than for other criteria in the use/availability category since little to none of the data was collected from streams with an urban stormwater influence.

Other than the weighting factor used within the WQPMT criterion, all use and availability criteria were given the same weight with respect to one another. Implicit weighting was achieved through the potential amount of points that could be awarded for each criterion.

Possible score

Based on the criteria descried in the methods section, the lowest and highest possible scores are listed in Table 1.

Table 1. Minimum and maximum scores for criteria used to assess pesticides

	Environmental Characteristics			Use and Availability						
	Mobil-ity	Toxic-ity	Persis-tence	Use by permit-tees	Avail-ability - Metro	Widely Used	WQPMT		DEQ in-stream	Total
							Lists	Non-ag Use		
Max Score	14	17.5	10.5	15	6	10	4	4	3	84
Min Score	2	2.5	1.5	0	0	0	0	0	0	6

As previously explained, environmental characteristics and availability and use characteristics each had equal potential to influence the total rating for a given pesticide, since a maximum of 42 points is possible for each category.

Results

Of the 115 pesticides assessed, the highest ranked pesticide was the herbicide 2,4-D, which scored 57 out of 84. In addition to 2,4-D, three other pesticides scored >50 points. Table 2 shows the top 10 pesticides from the assessment. Table 3 contains the ranked scores and complete set of criteria considered for the 155 pesticides considered in this assessment.

Table 2: Top 10 pesticides identified in assessment

Pesticide	Type	Mobility (*2)	Toxicity (human; *1)	Toxicity (aquatic life, *1.5)	Persistence (* 1.5)	Use by co-permittees (*15)	Availability (Metro)	Widely Used	WQPMT Lists	WQPMT non-ag uses	Detected in-stream by DEQ (*3)	Total
2,4-D *	**Herbicide**	**10**	**2**	**4.5**	**4.5**	**15**	**5**	**10**	**2**	**4**	**0**	**57**
Trifluralin *	Herbicide	4	2	12	7.5	15	5	0	1	4	3	53.5
Triclopyr *	Herbicide	12	2	6	6	15	5	0	1	4	0	51
Dicamba *	**Herbicide**	**14**	**2**	**3**	**6**	**15**	**5**	**0**	**1**	**4**	**0**	**50**
Dichlorbenil *	Herbicide	12	2	4.5	9	15	5	0	0	0	0	47.5
Glyphosate	**Herbicide**	**2**	**2**	**3**	**4.5**	**15**	**5**	**10**	**1**	**4**	**0**	**46.5**
Mecoprop (MCPP) *	Herbicide	12	2	3	6	15	5	0	0	0	0	43
Pentachloro-phenol *	**Fungicide**	**10**	**4**	**9**	**6**	**0**	**0**	**10**	**1**	**0**	**0**	**40**
Imidacloprid *	Insecticide	8	4	6	7.5	0	6	0	1	3.5	3	39
Isoxaben *	Herbicide	8	2	7.5	6	15	0	0	0	0	0	38.5

Pesticides highlighted in gray are those DEQ listed in Schedule B of the NPDES MS4 permit.
Pesticides in bold are those the co-permittees plan to monitor during the permit term.
* Pesticides with an asterisk are included in Pacific Agricultural Laboratory's Multi-residue screen.
Primary data used to assign points is provided in the attached spreadsheet, labeled Table 3: Pesticide Assessment

Conclusions

Based on widespread use, mobility and other environmental characteristics, the co-permittees plan to collect wet weather stormwater samples for the two pesticides (2,4-D and Pentachlorophenol) listed in Table B-1 of the NPDES MS4 permit during the permit term.[1] Environmentally relevant[2] results (e.g. method known to produce measurable results; MRL lower than EPA or other benchmark; MRL lower than values expected based on DEQ in-stream testing) for these two pesticides can be obtained through Test America's analysis using the chlorinated acid herbicide method (EPA 515.3). In addition to 2,4-D and pentachlorophenol, the chlorinated acid herbicide panel includes: 2,4,5-T, 2,4,5-TP (Silvex), 2,4-DB, 3,5-Dichlorobenzoic acid, Aciflurofen, Bentazon, Dicamba, Dichloprop, Dinoseb, and Picloram.

Because Glyphosate is included in the draft of the WPCF permit, the Co-Permittees anticipate that this pesticide will be monitored during at least one year of the permit term. The draft WPCF permit also includes Diazinon, which the Co-Permittees will likely ask to have replaced with one of the pesticides identified in this assessment. Because Diazinon is a restricted use pesticide not used by the Co-Permittees or available for purchase or use by residents, it is not anticipated to be present at detectable levels. Monitoring for Trifluralin or Triclopyr would be a more effective use of limited monitoring resources.

Additional monitoring beyond that required for NPDES MS4 or WPCF permit compliance requires a large amount of resources subject to the maximum expent practicable (MEP) standard. Most analyses cost between $100-200 per sample. The cost of additional information on presence of pesticides competes with the same finite pool of resources used to provide educational programs targeted at reducing use or other BMPs that prevent or reduce the amount of pesticides or other pollutants entering our local waterways.

During the permit term, the Co-Permittees will evaluate the cost, feasibility, and relevance of data obtained through monitoring some or all of the pesticides listed in Table 2. Pacific Agricultural Laboratory (PAL)[3] in Portland, OR offers a multi-residue screen (MRS) that includes many of the pesticides contained in Table 2 (asterisks next to all of the pesticides contained within this screen). While the broad nature of PAL's MRS is appealing, an evaluation of the method reporting limits (MRLs) available for each pesticide in the MRS versus the maximum value detected in-stream by DEQ determined that most of the pesticides would yield no detectable result, as the majority of MRLs were higher than the maximum value DEQ had detected in the environment. Based on verbal communication with Steve Thun at PAL, their analytical capabilities are improving, so the co-permittees will check with PAL to see if lower detection limits that would be environmentally relevant could be attained for some or all of the highest rated pesticides identified in this assessment.

[1] Explanation of the decision to analyze for these two pesticides is provided in the monitoring plans for the NPDES and UIC-related WPCF permits, respectively.

[2] "Environmentally relevant" as used here means that the method reporting limit for a pesticide is low enough to detect its presence in stormwater, groundwater, or surface waters. Pollutant levels expected to occur in these waters are based on sampling results from studies conducted within Oregon.

[3] The co-permittees have most water quality samples analyzed by the City of Portland's Water Pollution Control Laboratory, except that Portland outsources specialty constituents to outside contract labs. Test America is often used, although Pacific Agricultural Laboratory (PAL) is a local lab that specializes in pesticide analysis and is capable of achieving low level analyses. Test America contracts with PAL for some low level pesticide analyses.

The co-permittees will report any additional pesticide testing performed to DEQ in the annual report that follows a decision to add analytes.

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Table 3: Pesticide Assessment

Pesticide	Type	Products	Screen	NPDES MS4 permit (2010)	PUAS (2009)	Gresham (2011)	Fairview (2011)	Wide Use	Resident use ranking (Metro)	Metro (6 for all, 5 for garden only, 1 for P&H	WQPMT Lists (2011)	Non-ag label categories (WQPMT 2011)	Detectable in water column (WQPMT)	Mobility (soil to water)	Mobility score	Persistence (in soil). Half-life in parenthesis	Persistence score	Toxicity (Human)	Toxicity (Human) score	Toxicity (aquatic life)	Toxicity (ad) score	EPA Risk-based conc or Benchmark	EPA Risk-based water concentration (ug/L)	EPA MCL (ug/L)	Acute fish EPA Benchmark (ug/L)	Acute invert EPA benchmark (ug/L)	DEQ Detected in 2007-10 ambient monitoring	DEQ Detected over standard or benchmark	DEQ Detection Freq (% instream Clackamas)	DEQ Detection Max (ug/L)	Part of PAL MR Screen	Lab Reporting Limit, PAL MRS (ug/L)		Mobility (*2)	Toxicity (humans *1)	Toxicity (aq life *1.5)	Persistence (* 1.5)	Use in Gresham/ Fairview (*15)	Availability (Metro)	Widely Used	OR WQPMT Lists	WQPMT non-ag uses	Detected instream by DEQ (*3)	**Total**
2,4-D	Herbicide	Crossbow, Tordon	Chlorinated Acid	1	1	1	1	1	50	5	2	8	Y	(5) Moderate to Hig	5	(3) Low-Mod (1-14	3	(2) Low	2	(3) Low to Moderat	3	X	365	70	101000		NM	N			X	0.08		10	2	4.5	4.5	15	5	10	2	4	0	57
Trifluralin	Herbicide	Snapshot	Halogenated	1		1	1		20	5	1	8	Y	(2) Low	2	(5) Moderate to Hig	5	(2) Low	2	(8) Very High	8	X	8.73		20.5	280	Y	N			X	0.12		4	2	12	7.5	15	5	0	1	4	3	53.5
Triclopyr	Herbicide	Crossbow, Garlon	Chlorinated Acid	1		1	1		30	5	1	8	Y	(6) High	6	(4) Moderate (1-90	4	(2) Low	2	(4) Low to High	4				180	850	N	N			X	0.08		12	2	6	6	15	5	0	1	4	0	51
Dicamba	Herbicide		Chlorinated Acid		1	1			40	5	1	8	Y	(7) Very High	7	(4) Moderate (4-55	4	(2) Low	2	(2) Low	2	X	1100		14000	17300	NM	NM			X	0.08		14	2	3	6	15	5	0	1	4	0	50
Dichlorbenil	Herbicide	Casoron 4G, Root	Halogenated			1	1		15	5				(6) High	6	(6) High	6	(2) Low	2	(3) Low to Moderat	3						NM	NM			X	0.12		12	2	4.5	9	15	5	0	0	0	0	47.5
Glyphosate	Herbicide	Roundup, Rodeo,	Ranger Pro, Cleanup	1	1	1		1	45	5	1	8	Y	(1) Extremely Low	1	(3) Low-Med (2-197	3	(2) Low	2	(2) Low	2	X	3650	700	21500	26600	NM	NM						2	2	3	4.5	15	5	10	1	4	0	46.5
Mecoprop (MCPP)	Herbicide	MCPP	Chlorinated Acid			1			15	5				(6) High	6	(4) Moderate (2 mo	4	(2) Low	2	(2) Low	2	X	36.5				NM	NM			X	0.08		12	2	3	6	15	5	0	0	0	0	43
Pentachlorophenol	Fungicide		Chlorinated Acid					1			1	0	Y	(5) Moderate to Hig	5	(4) Moderate (45 d	4	(4) Moderate	4	(6) High	6	X	0.168				NM	NM			X	0.08		10	4	9	6	0	0	10	1	0	0	40
Imidacloprid	Insecticide		Organonitrogen	1			1		182	6	1	7	Y	(4) Moderate	4	(5) Mod-High (48-1	5	(4) Moderate	4	(4) Low to High	4				41500	35	Y	N	7	0.048	X	0.3		8	4	6	7.5	0	6	0	1	3.5	3	39
Isoxaben	Herbicide	Gallery, Snapshot	Organonitrogen			1	1		0					(4) Moderate	4	(4) Moderate (205	4	(2) Low	2	(5) Moderate to Hig	5	X	1830				NM	NM			X	0.12		8	2	7.5	6	15	0	0	0	0	0	38.5
Malathion	Insecticide		Organophosphorus	1					5	5	2	4	Y	(6) High	6	(2) Low (1-17 days)	2	(2) Low	2	(6) High	6	X	730		16.4	0.3	Y	Y	15	0.22	X	0.3		12	2	9	3	0	5	0	2	2	3	38
Chlorsulfuron	Herbicide	Telar XP				1								High	6	Moderate	4	Low	2	Low	2												12	2	3	6	15	0	0	0	0	0	38
Imazapyr	Herbicide								5	5	1	4	Y	High	6	High (60-436 days))	6	Low	2	Low	2				50000	50000	Y	N						12	2	3	9	0	5	0	1	2	3	37
Metaldehyde	Molluscicide	Deadline				1			40	5				(4) Moderate	4	(2) Low (several day	2	(3) Low to Moderat	3	(2) Low	2					NM	NM						8	3	3	3	15	5	0	0	0	0	37
Bifenthrin	Insecticide		Halogenated	1	1				77	6	2	8	Sed	(2) Low	2	(4) Low to High (7 d	4	(4) Moderate	4	(7) High to Very Hig	7	X	548		0.075	0.8	NM	NM			X	0.12		4	4	10.5	6	0	6	0	2	4	0	36.5
Pelargonic acid	Herbicide	Scythe				1			5	5				(4) Moderate	4	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM						8	2	3	3	15	5	0	0	0	0	36
Chlorpyrifos	Insecticide		Organophosphorus						2	1	3	5	Y	Low	2	Moderate	4	Moderate	4	Very High	8				0.083	0.05	Y	Y	7	0.98	X	0.3		4	4	12	6	0	1	0	3	2.5	3	35.5
Copper sulfate	Fungicide										1	3	Y	Low to High	4	Very High	8	Low to High	4	High	6				14.55	1.8	NM	NM						8	4	9	12	0	0	0	1	1.5	0	35.5
Disulfoton	Insecticide		Organophosphorus						5	5				Moderate	4	Low to Moderate	3	Very High	8	High	6						NM	NM			X	0.3		8	8	9	4.5	0	5	0	0	0	0	34.5
Oryzalin	Herbicide	Surflan	Organonitrogen		1	1			0					(2) Low	2	(3) Low to Moderat	3	(2) Low	2	(6) High	6	X	1830				NM	NM			X	0.3		4	2	9	4.5	15	0	0	0	0	0	34.5
Chlorothalanil	Fungicide		Halogenated	1	1				5	5	2	6	Y	(2) Low	2	(4) Moderate (1 to	4	(2) Low	2	(6) High	6	X	21.7		5.25	1.8	Y	N			X	0.12		4	2	9	6	0	5	0	2	3	3	34
Diazinon	Insecticide		Organophosphorus								3	0	Y	Moderate	4	Moderate	4	Low	2	Very High	8				45	0.11	Y	Y			X	0.3		8	2	12	6	0	0	0	3	0	3	34
Diuron	Herbicide		Phenylurea		1						2	3	Y	(4) Moderate	4	(5) Moderate to Hig	5	(4) Moderate	4	(5) Moderate to Hig	5	X	73		200	80	Y	Y	63	0.26	X	0.12		8	4	7.5	7.5	0	0	0	2	1.5	3	33.5
Lindane	Insecticide										2	0	Y	Moderate	4	High (15 mos)	6	Moderate	4	High to Very High	7				0.85	0.5	N	N						8	4	10.5	9	0	0	0	2	0	0	33.5
Acetochlor	Herbicide		Halogenated								1	0	Y	Low	2	High	8	High	6	Moderate to High	7				190	4100	NM	NM			X	0.3		4	6	10.5	12	0	0	0	1	0	0	33.5
Mefluidide	Plant growth	Embark 2S				1			0					(5) Moderate to Hig	5	(2) Low (2 days)	2	(2) Low	2	(2) Low	2						NM	NM						10	2	3	3	15	0	0	0	0	0	33
Aldicarb	Insecticide		Carbamate								1	0	Y	High	6	Moderate	4	Very High	8	Moderate	4						NM	NM			X	0.12		12	8	6	6	0	0	0	1	0	0	33
Carbofuran	Insecticide		Carbamate								1	0	Sed	High	6	Moderate (30-120 d	4	Moderate to High	5	High	6				44	1.12	NM	NM			X	0.12		12	5	9	6	0	0	0	1	0	0	33
Atrazine	Herbicide		Organonitrogen								2	8	Y	Moderate	4	High	6	Moderate	4	Low	2				2650	360	Y	N	6	0.01	X	0.3		8	4	3	9	0	0	0	2	4	3	33
Permethrin	Insecticide		Halogenated	1					420	6	2	8	Sed	(2) Low	2	(3) Low to Moderat	3	(3) Low to Moderat	3	(6) High	6	X	1830		0.395	0.01	N	N			X	1.2		4	3	9	4.5	0	6	0	2	4	0	32.5
Sodium metaborate	Herbicide	Bare Spot				1			0	6				Low-Mod	3	Very Low	1	Very Low	1	Low	2						NM	NM						6	1	3	1.5	15	6	0	0	0	0	32.5
Myclobutanil	Fungicide		Organonitrogen	1					20	5	1	1	Y	(6) High	6	(6) High (198-224 d	6	(2) Low	2	(2) Low	2				1200	5500	NM	NM			X	0.6		12	2	3	9	0	5	0	1	0.5	0	32.5
Endosulfan II	Insecticide		Halogenated								1	0	Y	Low	2	Moderate High (15(	5	Mod to High	5	Very High	8				0.05	0.3	Y	N			X	0.12		4	5	12	7.5	0	0	0	1	0	3	32.5
Methoprene	Insecticide								203	6				(6) High	6	(2) Low	2	(2) Low	2	(6) High	6						NM	NM						12	2	9	3	0	6	0	0	0	0	32
Allethrin	Insecticide								98	6				Low	2	High	6	Low	2	High	7						NM	NM						4	2	10.5	9	0	6	0	0	0	0	31.5
Carbaryl	Insecticide	Sevin	Carbamate	1					15	5	2	7	Y	(2) Low	2	(2) Low (4-72 days,	2	(2) Low	2	(6) High	6	X	3650		110	0.85	Y	N			X	0.12		4	2	9	3	0	5	0	2	3.5	3	31.5
Dichlorvos	Insecticide		Organophosphorus						2	1				High	6	Low (7 days)	2	High	6	High	6						NM	NM			X	0.3		12	6	9	3	0	1	0	0	0	0	31
Zinc sulfate	Herbicide								10	5				(6) High	6	(4) Moderate	4	(2) Low	2	(4) Moderate	4						NM	NM						12	2	6	6	0	5	0	0	0	0	31
Aminopyralid	Herbicide	Milestone VM				1			0					(4) Moderate	4	(2) Low (20-32 days	2	(2) Low	2	(2) Low	2						NM	NM						8	2	3	3	15	0	0	0	0	0	31
Sodium chlorate	Herbicide	Bare Spot				1			0					N/A	0	(6) High	6	(4) Moderate	4	(2) Low	2						NM	NM						0	4	3	9	15	0	0	0	0	0	31
Endosulfan I	Insecticide		Halogenated								1	0	Y	Low	2	Moderate (35 days)	4	Mod to High	5	Very High	8				0.05	0.3	Y	N			X	0.12		4	5	12	6	0	0	0	1	0	3	31
Dithiopyr	Herbicide	Dimension	Halogenated											(6) High (Koc>1000	6	(6) High (871 days)	6	(2) Low	2	(5) Moderate to Hig	5						NM	NM			X	0.12		12	2	7.5	9	0	0	0	0	0	0	30.5
Pendimethalin	Herbicide	Pendulum	Organonitrogen	1	1						3	7	Y	(2) Low	2	(4) Moderate (40 d	4	(2) Low	2	(6) High	6	X	1460		69	140	Y	N	13	0.103	X	0.12		4	2	9	6	0	0	0	3	3.5	3	30.5
Fipronil	Insecticide		Organonitrogen	1					20	1	2	2	Sed	(2) Low	2	(5) Mod-High (122-	5	(4) Moderate	4	(7) High to Very Hig	7				41.5	0.11	NM	NM			X	0.6		4	4	10.5	7.5	0	1	0	2	1	0	30
Dichlorprop (2,4-DP)	Herbicide		Chlorinated Acid						5	5				(5) Mod-High	5	(2) Low	2	(3) Low to Moderat	3	(6) High	6	X	292				NM	NM			X	0.08		10	3	9	3	0	5	0	0	0	0	30
Propiconazole	Fungicide		Halogenated	1							1	5	Y	(4) Moderate	4	(6) High	6	(2) Low	2	(3) Low to Moderat	3	X	475		425	2400	Y	N	2	4.04	X	0.3		8	2	4.5	9	0	0	0	1	2.5	3	30
Tralkoxydim	Herbicide										1	0	Y	Very High	8	Moderate (1-35 day	4	Moderate	4	Low	2				3750	87000	NM	NM						16	4	3	6	0	0	0	1	0	0	30
Terbacil	Herbicide		Halogenated								1	0	Y	High	6	High (50-180 days)	6	Low	2	Low	2				23100	32500	Y	N			X	0.12		12	2	3	9	0	0	0	1	0	3	30
Sulfometuron-methyl	Herbicide	Oust				1			0		1	0	Y	(2) Low	2	(3) Low to Moderat	3	(2) Low	2	(2) Low	2						NM	NM						4	2	3	4.5	15	0	0	1	0	0	29.5
Esfenvalerate	Insecticide		Halogenated								2	3	Sed	Low	2	Moder (15d to 3mo	4	Moderate	4	Very High	8				0.035	0.025	NM	NM			X	0.12		4	4	12	6	0	0	0	2	1.5	0	29.5
Azinphos-methyl	Insecticide		Organophosphorus								1	0	Y	Low	2	Moderate	4	Mod-High	5	Mod to Very High	7				0.18	0.08	Y	Y			X	0.3		4	5	10.5	6	0	0	0	1	0	3	29.5
MSMA	Herbicide										1	5	Y	Low	2	Very High	8	Moderate	4	Moderate	4						NM	NM						4	4	6	12	0	0	0	1	2.5	0	29.5
Acephate	Insecticide	Orthene							20	5				(6) High	6	(2) Low (3-6 days)	2	(4) Moderate	4	(3) Low to Moderat	3	X	7.73				NM	NM						12	4	4.5	3	0	5	0	0	0	0	28.5
Hexazinone	Herbicide		Organonitrogen								1	3	Y	High	6	Moderate (30-180)	4	Low	2	Low	2				137000	75800	Y	N	7	0.099	X	0.3		12	2	3	6	0	0	0	1	1.5	3	28.5
Prometon	Herbicide		Organonitrogen								1	5	Y	Moderate	4	High (500 days)	6	Low	2	Low	2				6000	12850	Y	N			X	0.6		8	2	3	9	0	0	0	1	2.5	3	28.5
Lambda-cyhalothrin	Insecticide								20	1	2	7	Sed	Low	2	Low	2	Moderate	4	High	7				0.105	0.0035	NM	NM						4	4	10.5	3	0	1	0	2	3.5	0	28
Dinoseb	Herbicide		Chlorinated Acid											(5) Mod to High	5	(2) Low (5-31 days)	2	(6) High	6	(6) High	6	X	36.5	7			NM	NM			X	0.08		10	6	9	3	0	0	0	0	0	0	28
Tebuthiuron	Herbicide		Organonitrogen								1	0	Y	High	6	High (12-15 months	6	Low to Moderate	3	Low	2				53000	148500	NM	NM			X	0.6		12	3	3	9	0	0	0	1	0	0	28
Clopyralid	Herbicide		Chlorinated Acid								1	5	Y	High	6	Mod-High	5	Low	2	Low	2				984000		NM	NM			X	0.08		12	2	3	7.5	0	0	0	1	2.5	0	28
Bromacil	Herbicide		Organonitrogen								1	3	Y	Mod-High	5	Mod-High	5	Low	2	Low	2				18000	60500	Y	N			X	0.3		10	2	3	7.5	0	0	0	1	1.5	3	28
Isoxaflutole	Herbicide										1		Y	Low to high	4	Moderate to High	5	Moderate to High	5	Moderate	4						NM	NM						8	5	6	7.5	0	0	0	1	0	0	27.5
Dikegulac sodium	Plant growth	Atrinal				1			0					(2) Low	2	(2) Low (15 days)	2	(2) Low	2	(2) Low	2						NM	NM						4	2	3	3	15	0	0	0	0	0	27
Thiamethoxam	Insecticide										1	4	Y	Moderate	4	Low	2	Moderate	4	High	6						NM	NM						8	4	9	3	0	0	0	1	2	0	27
Pyraclostrobin	Fungicide		Organonitrogen								1	3		Very low	1	Moderate to High	5	Low to Moderate	3	Very High	8						NM	NM			X	0.12		2	3	12	7.5	0	0	0	1	1.5	0	27
Benefin	Herbicide								10	5				Low	2	Moderate	4	Very Low	1	High	7						NM	NM						4	1	10.5	6	0	5	0	0	0	0	26.5
Picloram	Herbicide	Tordon RTU	Chlorinated Acid								1	3	Y	(5) Moderate to Hig	5	(5) Moderate to Hig	5	(2) Low	2	(3) Low to Moderat	3	X	2560	500	6500	34150	NM	NM			X	0.08		10	2	4.5	7.5	0	0	0	1	1.5	0	26.5
Fenbutatin oxide	Insecticide										1	0	Y	Low	2	Moderate to high	5	Low	2	Very High	8				0.85	15.5	NM	NM						4	2	12	7.5	0	0	0	1	0	0	26.5
Oxyfluorfen	Herbicide		Halogenated								2	2	Y	Very Low	1	Moderate (30-40 d	4	Low	2	High	7				102	40	Y	N			X	0.12		2	2	10.5	6	0	0	0	2	1	3	26.5
Avermectin	Insecticide								8	1				(2) Low	2	(2) Low	2	(6) High	6	Extremely High	8						NM	NM						4	6	12	3	0	1	0	0	0	0	26
Pentachloronitrobenzene	Fungicide				1									(3) Low to Moderat	3	(6) High (213 - 699	6	(2) Low	2	(6) High	6	X	0.259				NM	NM						6	2	9	9	0	0	0	0	0	0	26
Dimethenamid	Herbicide		Organonitrogen								1	0	Y	High	6	Moderate (31 days)	4	Moderate	4	Low	2				3150	6000	NM	NM			X	0.3		12	4	3	6	0	0	0	1	0	0	26
Ethoprop	Insecticide		Organophosphorus								1	0	Y	Low	2	Low to mod (10-40	3	High	6	Mod to High	5				150	22	Y	N			X	0.3		4	6	7.5	4.5	0	0	0	1	0	3	26
Simazine	Herbicide	Clean Crop	Organonitrogen								1	5	Y	(4) Moderate	4	(4) Moderate (28-1	4	(2) Low	2	(2) Low	2	X	0.56	4	3200	500	Y	N	57	0.08	X	0.6		8	2	3	6	0	0	0	1	2.5	3	25.5
Metalaxyl	Fungicide		Organonitrogen								1	3	Y	High	6	Moderate (7 to 170	4	Low	2	Low	2				65000	14000	NM	NM			X	0.3		12	2	3	6	0	0	0	1	1.5	0	25.5
DEET	Insecticide								259	6			Y	Moderate	4	Moderate	4	Low	2	Low	2						NM	NM	4	0.0096				8	2	3	6	0	6	0	0	0	0	25
Bentazon	Herbicide		Chlorinated Acid								1	0	Y	High	8	Low (<2 weeks)	2	Low	2	Low	2				50000	50000	NM	NM			X	0.08		16	2	3	3	0	0	0	1	0	0	25
Metribuzin	Herbicide		Organonitrogen								1	0	Y	Moderate to High	5	Moderate (30-60 d	4	Low	2	Low	2				21000	2100	Y	N			X	0.6		10	2	3	6	0	0	0	1	0	3	25
Deltamethrin	Insecticide		Halogenated								2	3	Sed	Low	2	Moderate (1-2 wee	4	Moderate	4	Mod to High	5				0.29	0.055	NM	NM			X	1.2		4	4	7.5	6	0	0	0	2	1.5	0	25
Cypermethrin	Insecticide		Halogenated	1					16	1	1		Y	(1) Extremely Low	1	(4) Moderate (30 d	4	(4) Moderate	4	(7) High to Very Hig	7	X	365				NM	NM	0.195	0.21	X	1.2		2	4	10.5	6	0	1	0	1	0	0	24.5
Aliphatic petroleum hydrocarl	Insecticide				1				122	5				(2) Low	2	(6) High	6	(2) Low	2	(3) Low to Moderat	3					NM	NM						4	2	4.5	9	0	5	0	0	0	0	24.5
Norflurazon	Herbicide		Halogenated								1	0	Y	Moderate	4	Moderate (90 days)	4	Low	2	Low to moderate	3				4050	7500	Y	N			X	0.12		8	2	4.5	6	0	0	0	1	0	3	24.5
Propargite	Insecticide		Organophosphorus								1	0	Y	Low	2	Moderate to High	5	Low to Moderate	3	High	6				59	37	NM	NM			X	0.6		4	3	9	7.5	0	0	0	1	0	0	24.5

Table 3: Pesticide Assessment

D-limonene	Cleaner/degr	Propower II Red							49	6				(2) Low	2	(6) High	6	(2) Low	2	(2) Low	2						NM	NM						4	2	3	9	0	6	0	0	0	0	24
Prometryn	Herbicide		Organonitrogen								1	0	Y	Low to Moderate	3	Moderate (60 days	4	Low to Moderate	3	Low to moderate	3				1450	9295	Y	N			X	0.3		6	3	4.5	6	0	0	0	1	0	3	23.5
Methyl anthranilate	Bird deterrer	Goose Blocker												(6) High	6	(2) Low	2	(2) Low	2	(4) Moderate	4						NM	NM						12	2	6	3	0	0	0	0	0	0	23
Alachlor	Herbicide		Halogenated								1	0	Y	Moderate	4	Low (8 days)	2	Low	2	Moderate	4				900	1250	Y	N			X	0.3		8	2	6	3	0	0	0	1	0	3	23
Ethalfluralin	Herbicide		Halogenated								2	0	Y	Low	2	Low	2	Low	2	Very High	8				16	30	NM	NM			X	0.12		4	2	12	3	0	0	0	2	0	0	23
Metolachlor	Herbicide		Halogenated								1	2	Y	Low	2	Moderate (15-70 da	4	Low	2	Moderate	4				1600	550	Y	N	35	0.275	X	0.3		4	2	6	6	0	0	0	1	1	3	23
Phosmet	Insecticide		Organophosphorus								1	0	Y	Low	2	Low (4 to 20 days)	2	Moderate	4	High to Very High	7				35	1	N	N			X	0.3		4	4	10.5	3	0	0	0	1	0	0	22.5
MCPA	Herbicide		Chlorinated Acid						10	5				(4) Low to High	4	(2) Low (5-6 days)	2	(3) Low to Moderat	3	(2) Low	2	X	18.3				NM	NM			X	0.08		8	3	3	3	0	5	0	0	0	0	22
Linuron	Herbicide		Phenylurea								2	0	Y	Low-Mod	3	Moderate (30-150 d	4	Low	2	Low	2				1500	60	Y	N			X	0.3		6	2	3	6	0	0	0	2	0	3	22
Triallate	Herbicide		Thiocarbamate								1	0	Y	Low	2	Moderate (80 days	4	Low	2	High	6				600		NM	NM						4	2	9	6	0	0	0	1	0	0	22
Dicofol			Halogenated								1	2	Y	Very Low	1	Moderate (60 days	4	Low to Moderate	3	High	6				26.5	70	NM	NM			X	0.3		2	3	9	6	0	0	0	1	1	0	22
Clethodim	Herbicide	Envoy												(5) Mod-High	5	(2) Low (3 days)	2	(4) Moderate	4	(3) Low-Mod	3						NM	NM						10	4	4.5	3	0	0	0	0	0	0	21.5
Dacthal	Herbicide	DCPA	Halogenated								1	0	Y	Low	2	Mod-High	5	Low to mod	3	Low	2				15000	13500	Y	N			X	0.12		4	3	3	7.5	0	0	0	1	0	3	21.5
Propazine	Herbicide		Organonitrogen								1	0	Y	Low to Moderate	3	High (35 to 231 day	6	Low	2	Low	2						N	N			X	0.3		6	2	3	9	0	0	0	1	0	0	21
Triadimefon	Fungicide		Organonitrogen								1	0	Y	Moderate	4	Low to Moderate (1	3	Moderate	4	Low	2						NM	NM			X	0.6		8	4	3	4.5	0	0	0	1	0	0	20.5
Napropamide	Herbicide		Amide								1	0	Y	Low	2	Moderate (56 to 84	4	Very Low to Low	2	Low to Moderate	3				3200	7150	Y	N						4	2	4.5	6	0	0	0	1	0	3	20.5
Amitrole	Herbicide	Amitrol T												(6) High	6	(2) Low (14 days)	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Monoethanolamine	Fungicide	Monterey Super 7												(6) High	6	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Proprionic acid	Fungicide/He	Monterey Super 7, LI 700												(6) High	6	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Metham sodium	Fumigant	Sanafoam Vaporooter												(2) Low	2	(2) Low	2	(4) Moderate	4	(6) High	6						NM	NM						4	4	9	3	0	0	0	0	0	0	20
Folpet	Fungicide		Halogenated								1	0	Y	Very Low	1	Low (2.5 days)	2	Low to Moderate	3	High to Very High	7						NM	NM			X	0.3		2	3	10.5	3	0	0	0	1	0	0	19.5
Cyfluthrin	Insecticide		Halogenated		1				63		1	0	Sed	(1) Very Low	1	(2) Low (48-72 hour	2	(4) Moderate	4	(6) High	6				0.034	0.013	NM	NM			X	0.6		2	4	9	3	0	0	0	1	0	0	19
Imazamethabenz	Herbicide	Assert									1	0	Y	Moderate	4	Low to Mod (25-36	3	Low	2	Low	2						NM	NM						8	2	3	4.5	0	0	0	1	0	0	18.5
Mesotrione	Herbicide										1	0	Y	Moderate	4	Low	2	Low	2	Low	2						NM	NM						8	2	3	3	0	0	0	1	0	0	17
Benfluralin	Herbicide		Halogenated								1	0	Y	Low	2	Moderate (22-79 days)		Low to Moderate	3	High	6				15.9	1090	NM	NM			X	0.12		4	3	9	0	0	0	0	1	0	0	17
Amitraz	Insecticide		Organonitrogen						2	1				Low to Moderate	3	Very Low (<1 day)	1	Low	2	Moderate	4						NM	NM			X	0.6		6	2	6	1.5	0	1	0	0	0	0	16.5
Boric acid	Insecticide				1				4	1				(5) Moderate to Hig	5	(2) Low	2	(1) Very Low	1	(1) Very Low	1						NM	NM						10	1	1.5	3	0	1	0	0	0	0	16.5
Alkylarylpolyoxykene ether	Surfactant	Chemsurf 90				1			0																									0	0	0	0	15	0	0	0	0	0	15
Azoxystrobin	Fungicide		Organonitrogen								1	4	Y	Low	2	Low (<2 weeks)	2	Low	2	Low	2				235	130	NM	NM			X	0.12		4	2	3	3	0	0	0	1	2	0	15
Flumetsulam	Herbicide	Torpedo									1	0	Y	Very Low	1	Moderate (2 weeks	4	Low	2	Low	2				150000	125000	NM	NM						2	2	3	6	0	0	0	1	0	0	14
Metsulfuron methyl	Herbicide	Headline									1	6	Y	Very Low	1	Low to Moderate (3	3	Very Low	1	Very Low	1						NM	NM						2	1	1.5	4.5	0	0	0	1	3	0	13
AMPA	Herbicide	Glyphosate break-down product		1										(1) Extremely Low	1	(3) Low-Med (2-197	3	(2) Low	2	(2) Low	2						NM	NM						2	2	3	4.5	0	0	0	0	0	0	11.5
Hydroprene	Insecticide	Raid Max Sterilizer							2	1						Very Low (few days	1	Low	2	Low	2													0	2	3	1.5	0	1	0	0	0	0	7.5

Appendix E

Intergovernmental Agreement with City of Portland for Laboratory Services

Gresham UIC Monitoring Plan

INTERGOVERNMENTAL AGREEMENT BETWEEN THE CITY OF PORTLAND AND THE CITY OF GRESHAM REGARDING LABORATORY ANALYTICAL SERVICES

This agreement is entered into on July 1, 2007 by and between the City of Gresham, Oregon (Gresham) and the City of Portland, Oregon (Portland).

RECITALS

WHEREAS, the goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland and;

WHEREAS, the City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) discharge permit. The NPDES permit requires the implementation of a stormwater management plan, monitoring requirements, and submittal of an annual report;

WHEREAS, the City of Gresham has been identified by Oregon Department of Environmental Quality (DEQ) as a designated management agency (DMA) and is required to comply with the Total Maximum Daily Load (TMDL) requirements for discharges to the Columbia Slough and Johnson Creek.

WHEREAS, the Columbia Slough, Fairview Creek, and Johnson Creek have been placed on the DEQ 1994/1996 and 1996/1998 303(d) list of water quality limited, impaired waterbody list for multiple parameters; and

WHEREAS, the City of Gresham is implementing a storm and surface water monitoring program to assess: instream baseline conditions, identification of pollutants and their sources, illicit connections and illegal dumping, long-term trends, and pollutant reduction effectiveness.

WHEREAS, the City of Gresham has submitted a request for both rule authorization and a Water Pollution Control Facility (WPCF) permit to comply with Underground Injection Control (UIC) rules. The UIC rules require implementation of a stormwater management plan and monitoring requirements.

WHEREAS, this intergovernmental agreement (IGA) is in conformance with the Columbia Slough monitoring IGA.

WHEREAS, this IGA is in conformance with a Memorandum of Agreement (MOA), which outlines an agreement with jurisdictions throughout the Johnson Creek watershed for cooperation, coordination, and support.

WHEREAS, the purpose of this Agreement is to detail the responsibilities, compensation and services to be provided by each party.

NOW 'HEREFORE, the parties agree to the following

SCOPE OF PORTLAND'S SERVICES

A. Portland shall be responsible for providing laboratory analytical services (including methods and rates) to Gresham as shown in the attached fee schedule (Exhibit A).

B Portland shall provide Gresham with all necessary sample bottles, ice-chests, and chain-of-custody documents.

C Portland shall provide a 14-day turn-a-round time on all sample analyses results, except in the event of delay caused by conditions beyond Portland's reasonable control. In the event of delay, Portland shall promptly notify Gresham of the delay and provide an estimated time for turn-a-round of the delayed sample analyses.

D. Portland shall provide data reports listing the analyses results, detection limits, methods used and routine quality assurance/quality control documentation as requested.

E Portland shall notify Gresham of changes in the attached fee schedule (Exhibit A) in writing no less than two months before implementation.

F Portland shall annually provide Gresham with the lab analytical cost sheet for the upcoming fiscal year.

2 SCOPE OF GRESHAM'S SERVICES

A. Gresham shall be responsible for review and acceptance of all products prepared by Portland.

B. Gresham shall annually review the lab analytical cost sheet for the upcoming fiscal year supplied by Portland.

3 COMPENSATION

Gresham shall reimburse Portland promptly for costs incurred in accordance with Section 4 INVOICE AND PAYMENT PROCEDURE. Gresham shall pay Portland within 30 days of being invoiced. Gresham shall pay Portland for laboratory services incurred as shown in the attached schedule of rates (Exhibit A) which may be amended by Portland pursuant to section 1.E above.

4 INVOICE AND PAYMENT PROCEDURE

Portland's invoice and Gresham's payment procedures shall be as set out below

Quarterly, Portland's project manager, shall submit to Gresham's project manager, a detailed statement describing analyses performed for approval. The invoice shall include all approved analytical costs related to this IGA. Portland will furnish Gresham such statements of expenditures as may be needed to satisfy fiscal requirements.

Payment of the amounts set out in paragraph 3 above shall be made to City of Portland, no later than 30 days of being invoiced, and shall be sent to:

City of Portland
Accounting Division, Office of Finance and Administration
Accounts Receivable
1120 SW Fifth Avenue, Room 1250
Portland, OR 97204

5. EFFECTIVE DATE

This agreement shall be effective as of July 1, 2007.

6. AMENDMENT OR TERMINATION OF AGREEMENT

A. Portland and Gresham, by mutual written agreement, may modify, amend, or terminate this Agreement at any time.

B. Either Portland or Gresham may terminate this Agreement in the event of a breach of the Agreement by the other. Prior to such termination, however, the party seeking the termination shall give to the other party written notice of the breach and of the party's intent to terminate. If the party has not cured the breach within thirty (30) days of the notice, then the party giving the notice may terminate the Agreement at any time thereafter by giving a written notice of termination.

C. Either Portland or Gresham may terminate this Agreement in the event of Portland's Water Pollution Control Laboratory is rendered inoperable by an Act of God.

D. Either Portland or Gresham may terminate this Agreement for convenience on 60 days prior written notice of intent to terminate

7. INDEMNIFICATION

To the extent permitted by the Oregon Tort Claims Act, Portland agrees to indemnify, defend, and hold harmless Gresham from any and all claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Portland and its officers, employees, and agents in performance of this intergovernmental agreement. To the extent permitted by the Oregon Tort Claims Act, Gresham agrees to indemnify, defend, and hold harmless Portland from any claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Gresham and its officers, employees, and agents in performance of this intergovernmental agreement.

8. FUNDS

Portland and Gresham certify that sufficient funds have been requested for the 2007-2008 fiscal year and when approved both Portland and Gresham are authorized to spend funds to cover the costs associated with this agreement for that fiscal year. Both Portland and

Gresham will use their best efforts to urge appropriation of funds to cover the costs of this agreement in the ensuing fiscal years.

9 NON-APPROPRIATION CLAUSE

This Agreement is subject to future appropriations by the Portland or Gresham City Councils.

Executed in five (5) copies by the duly authorized representatives of the parties.

CITY OF PORTLAND

By: _____
Sam Adams, Commissioner of Public Affairs

Date: 7/24/07

By: _____
Dean Marriott, Bureau Director

Date: 7/13/07

By: _____
Gary Blackmer, Auditor

Date: 7/26/07

CITY OF GRESHAM

By: _____
Mayor Shane Bemis

Date: 5/2/07

By: _____
Erik Kvarsten, City Manager

Date _____

APPROVED as to form

Portland City Attorney,
for City of Portland, Oregon

By: _____

Gresham City Attorney
for City of Gresham, Oregon

By: _____

ORDINANCE No. 181035

Authorize an Intergovernmental Agreement with the City of Gresham to provide Laboratory Analytical Services (Ordinance)

Section 1. The Council finds:

1. The City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit. The NPDES permit requires implementation of a stormwater-monitoring program. The City of Gresham uses the services of contract laboratories as needed to comply with requirements of the stormwater monitoring program;

2. The goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland, and;

3. The purpose of this agreement is to detail the responsibilities, compensation, and services to be provided by each party.

NOW, THEREFORE, the Council directs:

a. The Director of the Bureau of Environmental Services is authorized to execute an intergovernmental agreement with the City of Gresham for the purpose described in Section 1

b. The Mayor and Auditor are hereby authorized to accept approximately $60,000 per year for revenues in the Bureau of Environmental Services Sewer Operating Fund, centercode 14713030, from the City of Gresham for the City of Portland providing laboratory analytical services.

Passed by the Council, JUN 13 2007
Sam Adams
Commissioner of Public Utilities

Gary Blackmer
Auditor of the City of Portland
By Susan Parsons
Deputy

[Duane Linnertz]
[5-23-07]

INTERGOVERNMENTAL AGREEMENT BETWEEN THE CITY OF PORTLAND AND THE CITY OF GRESHAM REGARDING LABORATORY ANALYTICAL SERVICES

This agreement is entered into on July 1, 2007 by and between the City of Gresham, Oregon (Gresham) and the City of Portland, Oregon (Portland).

RECITALS

WHEREAS, the goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland and;

WHEREAS, the City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) discharge permit. The NPDES permit requires the implementation of a stormwater management plan, monitoring requirements, and submittal of an annual report;

WHEREAS, the City of Gresham has been identified by Oregon Department of Environmental Quality (DEQ) as a designated management agency (DMA) and is required to comply with the Total Maximum Daily Load (TMDL) requirements for discharges to the Columbia Slough and Johnson Creek.

WHEREAS, the Columbia Slough, Fairview Creek, and Johnson Creek have been placed on the DEQ 1994/1996 and 1996/1998 303(d) list of water quality limited, impaired waterbody list for multiple parameters; and

WHEREAS, the City of Gresham is implementing a storm and surface water monitoring program to assess: instream baseline conditions, identification of pollutants and their sources, illicit connections and illegal dumping, long-term trends, and pollutant reduction effectiveness.

WHEREAS, the City of Gresham has submitted a request for both rule authorization and a Water Pollution Control Facility (WPCF) permit to comply with Underground Injection Control (UIC) rules. The UIC rules require implementation of a stormwater management plan and monitoring requirements.

WHEREAS, this intergovernmental agreement (IGA) is in conformance with the Columbia Slough monitoring IGA.

WHEREAS, this IGA is in conformance with a Memorandum of Agreement (MOA), which outlines an agreement with jurisdictions throughout the Johnson Creek watershed for cooperation, coordination, and support.

WHEREAS, the purpose of this Agreement is to detail the responsibilities, compensation and services to be provided by each party.

NOW 'HEREFORE, the parties agree to the following

SCOPE OF PORTLAND'S SERVICES

A. Portland shall be responsible for providing laboratory analytical services (including methods and rates) to Gresham as shown in the attached fee schedule (Exhibit A).

B Portland shall provide Gresham with all necessary sample bottles, ice-chests, and chain-of-custody documents.

C Portland shall provide a 14-day turn-a-round time on all sample analyses results, except in the event of delay caused by conditions beyond Portland's reasonable control. In the event of delay, Portland shall promptly notify Gresham of the delay and provide an estimated time for turn-a-round of the delayed sample analyses.

D. Portland shall provide data reports listing the analyses results, detection limits, methods used and routine quality assurance/quality control documentation as requested.

E Portland shall notify Gresham of changes in the attached fee schedule (Exhibit A) in writing no less than two months before implementation.

F Portland shall annually provide Gresham with the lab analytical cost sheet for the upcoming fiscal year.

2 SCOPE OF GRESHAM'S SERVICES

A. Gresham shall be responsible for review and acceptance of all products prepared by Portland.

B. Gresham shall annually review the lab analytical cost sheet for the upcoming fiscal year supplied by Portland.

3 COMPENSATION

Gresham shall reimburse Portland promptly for costs incurred in accordance with Section 4 INVOICE AND PAYMENT PROCEDURE. Gresham shall pay Portland within 30 days of being invoiced. Gresham shall pay Portland for laboratory services incurred as shown in the attached schedule of rates (Exhibit A) which may be amended by Portland pursuant to section 1.E above.

4 INVOICE AND PAYMENT PROCEDURE

Portland's invoice and Gresham's payment procedures shall be as set out below

Quarterly, Portland's project manager, shall submit to Gresham's project manager, a detailed statement describing analyses performed for approval. The invoice shall include all approved analytical costs related to this IGA. Portland will furnish Gresham such statements of expenditures as may be needed to satisfy fiscal requirements.

Payment of the amounts set out in paragraph 3 above shall be made to City of Portland, no later than 30 days of being invoiced, and shall be sent to:

City of Portland
Accounting Division, Office of Finance and Administration
Accounts Receivable
1120 SW Fifth Avenue, Room 1250
Portland, OR 97204

5. EFFECTIVE DATE

This agreement shall be effective as of July 1, 2007.

6. AMENDMENT OR TERMINATION OF AGREEMENT

A. Portland and Gresham, by mutual written agreement, may modify, amend, or terminate this Agreement at any time.

B. Either Portland or Gresham may terminate this Agreement in the event of a breach of the Agreement by the other. Prior to such termination, however, the party seeking the termination shall give to the other party written notice of the breach and of the party's intent to terminate. If the party has not cured the breach within thirty (30) days of the notice, then the party giving the notice may terminate the Agreement at any time thereafter by giving a written notice of termination.

C. Either Portland or Gresham may terminate this Agreement in the event of Portland's Water Pollution Control Laboratory is rendered inoperable by an Act of God.

D. Either Portland or Gresham may terminate this Agreement for convenience on 60 days prior written notice of intent to terminate

7. INDEMNIFICATION

To the extent permitted by the Oregon Tort Claims Act, Portland agrees to indemnify, defend, and hold harmless Gresham from any and all claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Portland and its officers, employees, and agents in performance of this intergovernmental agreement. To the extent permitted by the Oregon Tort Claims Act, Gresham agrees to indemnify, defend, and hold harmless Portland from any claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Gresham and its officers, employees, and agents in performance of this intergovernmental agreement.

8. FUNDS

Portland and Gresham certify that sufficient funds have been requested for the 2007-2008 fiscal year and when approved both Portland and Gresham are authorized to spend funds to cover the costs associated with this agreement for that fiscal year. Both Portland and

Gresham will use their best efforts to urge appropriation of funds to cover the costs of this agreement in the ensuing fiscal years.

9 NON-APPROPRIATION CLAUSE

This Agreement is subject to future appropriations by the Portland or Gresham City Councils.

Executed in five (5) copies by the duly authorized representatives of the parties.

CITY OF PORTLAND

By: _____
Sam Adams, Commissioner of Public Affairs

Date: 7/24/07

By: _____
Dean Marriott, Bureau Director

Date: 7/13/07

By: _____
Gary Blackmer, Auditor

Date: 7/26/07

CITY OF GRESHAM

By: _____
Mayor Shane Bemis

Date: 5/2/07

By: _____
Erik Kvarsten, City Manager

Date _____

APPROVED as to form

Portland City Attorney,
for City of Portland, Oregon

By: _____

Gresham City Attorney
for City of Gresham, Oregon

By: _____

ORDINANCE No. 181035

Authorize an Intergovernmental Agreement with the City of Gresham to provide Laboratory Analytical Services (Ordinance)

Section 1. The Council finds:

1. The City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit. The NPDES permit requires implementation of a stormwater-monitoring program. The City of Gresham uses the services of contract laboratories as needed to comply with requirements of the stormwater monitoring program;

2. The goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland, and;

3. The purpose of this agreement is to detail the responsibilities, compensation, and services to be provided by each party.

NOW, THEREFORE, the Council directs:

a. The Director of the Bureau of Environmental Services is authorized to execute an intergovernmental agreement with the City of Gresham for the purpose described in Section 1

b. The Mayor and Auditor are hereby authorized to accept approximately $60,000 per year for revenues in the Bureau of Environmental Services Sewer Operating Fund, centercode 14713030, from the City of Gresham for the City of Portland providing laboratory analytical services.

Passed by the Council, JUN 13 2007
Sam Adams
Commissioner of Public Utilities

Gary Blackmer
Auditor of the City of Portland
By Susan Parsons
Deputy

[Duane Linnertz]
[5-23-07]

Appendix F

Portland Water Pollution Control Laboratory
Quality Assurance Project Plan

Gresham UIC Monitoring Plan

CITY OF PORTLAND
ENVIRONMENTAL SERVICES

Water Pollution Control Laboratory
6543 North Burlington Avenue, Portland, Oregon 97203-5452 Dean Marriott, Director Dan Saltzman, Commissioner

QUALITY MANUAL

Revision 6
April 1, 2005

Water Pollution Control Laboratory
6543 N. Burlington Avenue
Portland, Oregon 97203

Charles R. Lytle, Laboratory Manager
503-823-5568

Renee Chauvin, QA/QC Chemist
503-823-5612

Jennifer Shackelford
Jennifer Shackelford, Production Specialist
503-823-5614

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Subject	Page

QUALITY MANUAL

1. INTRODUCTION

The Water Pollution Control Laboratory (WPCL, or the Laboratory) is a work section within the municipal government of the City of Portland, Oregon (the City). The Laboratory provides analytical services in support of several City functions:

- process control and NPDES monitoring for two wastewater treatment plants
- industrial source control monitoring program
- stormwater program
- surface water and groundwater monitoring programs
- site assessments for City-sponsored construction projects
- spill response program
- other projects related to City environmental programs

In addition, WPCL provides analytical services to several other municipalities and agencies for NPDES monitoring, wastewater treatment process control, stormwater programs, surface water monitoring, and other projects.

Much of the data produced by the laboratory is used to monitor compliance with federal, state and local regulations and may provide the basis for legal enforcement actions. In addition, data are used by a wide array of clients to make decisions regarding environmental clean-up, restoration, and the most prudent use of public funding.

This document describes the protocols by which the quality of analytical data is controlled, in order to ensure its validity and usability. These protocols comprise the Quality Assurance Program for WPCL. All members of the Laboratory staff are required to read this Quality Manual and sign a concurrence page indicating the document has been read and understood.

A number of industry-specific abbreviations and technical terms are used in this document and the Laboratory SOPs. They are defined in Appendix A (Key to Abbreviations) and Appendix B (Glossary).

2. QA POLICIES

2.1 QA Policy Statement

The objective of the Quality Assurance Program is to provide a foundation for production of accurate and impartial analytical data, consistency in analytical performance, permanent documentation of procedures for data generation, and opportunities to detect errors prior to circulation of the data. The QA Program is based on EPA guidelines for analytical laboratories, with particular emphasis on NELAP guidelines. The QA Program covers all activities and documentation related to laboratory analysis and sample handling protocols.

QA procedures are an integral part of activities in the Laboratory. Every staff member is responsible for implementation of the established QA procedures applicable to their work,

both analytical QC and the documentation and monitoring protocols. The QA Program is endorsed by Laboratory Management as a fundamental element of data production. The Laboratory Manager has ultimate responsibility for data quality. Day-to-day QA activities are delegated to the QA/QC Chemist.

2.2 Ethics

The purpose of the ethics policy is to delineate activities and limitations related to data integrity. The Laboratory's ethics policy is based on the City's Code of Ethics and extends the general code to laboratory-specific expectations related to the production and documentation of analytical data. The basic principles are:

- Every employee is expected to follow established laboratory protocols, as described in SOPs and this Quality Manual, with the goal of producing and reporting valid and reliable data.
- Any intentional falsification of data, improper manipulation of a sample, or misrepresentation of data is not acceptable.
- Laboratory Management must provide a working atmosphere that is free from undue pressures and supports the production of unbiased data.

The full text of the ethics policy and a concurrence page are provided in Appendix C. Employees are required to follow the Laboratory's ethics policy. The policy is reviewed with the staff every year in a Staff Meeting. If absent from the meeting, an individual is asked to re-read the Policy and ask questions if necessary. Each staff member must sign the concurrence page each year.

2.3 Confidentiality

As part of a public agency, the Laboratory does not maintain confidentiality of sample information or analytical data. The data are downloaded from the Laboratory LIMS to a database that can be accessed by personnel in other Divisions and other Bureaus of the City. Potentially, private sector individuals may be invited to view the data on-line, or to access the entire database via certain Bureau computer interfaces. Furthermore, the public may obtain data through a formal request process based on federal public access laws.

2.4 Mechanisms for Evaluation of New Work

Evaluation of new work encompasses two factors. First is whether the Laboratory will receive and process the samples. Second is whether the Laboratory will perform the analysis or send it to another laboratory.

2.4.1 New Projects

The Laboratory receives new project requests from the Investigations and Monitoring Services (IMS) section. Work orders prepared by IMS indicate the analytical requirements for impending projects. New work that is within the general scope of an environmental laboratory is accepted.

2.4.2 Large Projects

If a project will require processing a large number of samples, the capability to successfully analyze all the samples is determined prior to acceptance. The main considerations are analytical holding times and availability of analytical staff. Staffing assignments may be changed in order to complete a large project, but all training requirements must still be met before an individual is certified to do an analysis (see Section 7). If samples cannot be analyzed within method holding times, all or some of them may be contracted to another qualified laboratory.

2.4.3 Sub-contracting Work

If a required analysis is not performed at this Laboratory, an appropriate sample aliquot is sent to a qualified contract laboratory to perform that analysis. Requests from non-city customers are treated similarly, though for some projects the customer may be advised to do business directly with a laboratory that specializes in an analysis.

2.4.4 New Analysis

The decision to bring up a new analysis is based on project planning, with information provided by IMS. The main factors are anticipated quantity, frequency, and duration of sampling; availability of qualified staff and equipment; existence of an established analytical method; and value to the customer. The Laboratory Manager, Production Specialist, QA/QC Chemist, and other key staff may participate in the decision-making process. Technical start-up procedures are delineated in Section 9.5 of this document.

2.5 Use of Established Methods, SOPs, and Training

In general, EPA-sanctioned methods are used as reference protocols whenever available. *Standard Methods for the Examination of Water and Wastewater* is a key reference book for sample handling and chemistry guidance. For samples analyzed for regulatory purposes, the required program-specific methods are used. These include the wastewater methods listed in 40 CFR Part 136 for NPDES samples, EPA SW846 methods for solids and sludges, and Oregon/Washington NWTPH methods for soils from fuel-related cleanup sites. Method modifications and procedural details are documented in the Laboratory SOPs.

To insure consistency in results, laboratory personnel follow standard protocols and SOPs for all procedures. Written SOPs are maintained for analytical methods and other laboratory protocols. The format of the method SOPs is standardized, while other written protocols may use modified formats more appropriate to the task. Refer to SOP QA/QC-03, Preparation, Implementation, and Control of SOPs.

A formal training protocol is followed and documented for analytical training. The analyst must demonstrate accuracy and precision prior to reporting sample results. Refer to Section 7 and Appendix D of this document for further information on training.

This policy does not preclude the use of non-standard protocols for estimated results or information if requested by a customer. For example, screening analysis using an incomplete extraction or digestion procedure is acceptable if results are flagged as

screening estimates and the customer is made fully aware of the limitations in data usability.

2.6 Source Documentation Policy

Original data serves as the official Laboratory analytical and QA documentation. Sources of official documentation include original chain-of-custody forms, laboratory notebooks with manual entries, computer print-outs of raw or adjusted data, certificates of analysis for purchased standards and reagents, and any other original documents that contribute to the generation of sample results and conclusions. Whenever a result is in doubt, review of the original data is the most important step in resolving the question. While the Laboratory Information Management System (LIMS) serves as a general resource for other Bureau personnel who use Laboratory data, sample results found in the LIMS are unofficial unless validated by the QA/QC Chemist or other qualified laboratory representative.

2.7 Document Review/Revision Policies

Quality assurance documents include the Quality Manual, written SOPs, and the Ethics Policy. These documents are reviewed periodically for continuing relevance. When updates are made, a revision number is assigned and official copies of the old version are replaced with the new. Laboratory staff must read, at a minimum, the revised sections of these documents (SOPs as relevant to their work assignment) and sign a concurrence page. A copy of each outdated document is archived as documentation of past procedures. Note: this policy also applies to the Chemical Hygiene Plan.

2.8 Ongoing QA Program Development

As the work of the Laboratory grows and changes, specific policy statements are prepared as needed. They typically describe a new or modified protocol, summarize or formalize a complex protocol, or clarify appropriate actions for specific situations. Policy statements may be prepared by the QA/QC Chemist, Production Specialist, or Laboratory Manager depending on the topic, and each of these individuals reviews and initials each policy statement. Policies are distributed to the laboratory staff, usually by e-mail, and may be discussed in a staff meeting if considered necessary. Appendix E is a compilation of the QA policy statements.

3. LABORATORY ORGANIZATION

3.1 Laboratory Function

The Laboratory provides analytical services for the City of Portland for sewage treatment process wastewater, biosolids, industrial wastewater, stormwater, surface water, groundwater, soils, and sediments. The scope of analytical capabilities includes classic wet chemistry, N/P nutrients, microbiology, trace metals, and organic pollutants.

3.2 Position in the City

The Laboratory is a work section within the municipal government of the City of Portland, Oregon. Its position within the City structure is:

City of Portland
Bureau of Environmental Sciences
Pollution Prevention Group
Environmental Investigations Division
Water Pollution Control Laboratory

Appendix F is an organizational chart that shows the position of the Environmental Investigations Division within the Bureau and Group. Appendix G shows the Laboratory within the structure of the Pollution Prevention Group.

Because the Laboratory is part of a government agency, other sections and divisions impact laboratory function. The Investigations and Monitoring Services (IMS) section provides project management, serving as liaison between customers and the Laboratory. The Field Operations section (FO) collects a large portion of the environmental samples submitted for analysis. The Laboratory supports the functioning of other sections and divisions by providing analytical data used in compliance monitoring, enforcement actions, and environmental clean-ups and restorations.

3.3 Laboratory Staff Structure

Personnel structure in the Laboratory has four levels:

Laboratory Manager (1)
Production Specialist (1)
Chemists/Microbiologist (several)
Analysts (several)

All staff report to the Laboratory Manager for personnel issues such as leave time and overtime. For technical issues, Analysts report directly to the Production Specialist. Chemists and the Microbiologist report directly to the Laboratory Manager. The laboratory has several distinct analytical areas, plus a sample control area. Cross-trained Chemists and Analysts may work in multiple areas.

3.4. Job Descriptions

The City's official job descriptions for laboratory personnel are presented in Appendix H. Individual resumes that include current duties are compiled as Appendix I.

3.5 Relationships Among Management, Production, Quality, and Support

The Laboratory Manager holds the administrative, technical, and QA/QC authority in the Laboratory. The Production Specialist schedules and directs the work of the Analysts. The QA/QC Chemist works closely with the Production Specialist and the Chemists to resolve routine concerns and questions about data quality and reportability. The QA/QC Chemist has decision authority for routine QA issues, and authority to stop work for data quality

reasons. The QA/QC Chemist also flags data in the LIMS as needed, generates the analytical reports, and maintains laboratory documents. There is no support staff.

3.6 Signatories

3.6.1 Laboratory Documents

The Laboratory Manager, Production Specialist, and QA/QC Chemist are the approved signatories on laboratory technical documents. If a document is written by another staff member, as for many SOPs, that individual also signs the document.

3.6.2 Laboratory Reports

Routine laboratory analytical reports are generally initialed by the QA/QC Chemist. The Production Specialist has backup authority.

3.6.3 Signatures/Initials

Signatures and initials for all lab staff are shown in Appendix J.

3.7 ORELAP-Accredited Methods

< pending >

4. FACILITY

4.1 Laboratory Facility Description

The Laboratory occupies approximately 12,000 square feet in the City of Portland WPCL building at 6543 North Burlington Avenue, Portland, Oregon. The building, built in 1996, is a steel and masonry structure of approximately 39,000 square feet that houses the Laboratory and a two-story office area. The Laboratory is equipped with a computer-controlled HVAC system for temperature, humidity, and ventilation control. Numerous built-in safety features include fume hoods, safety showers, and eye washes.

The laboratory design is open modular, with each area being dedicated to a particular type of analysis: metals, semi-volatile organics, volatile organics, microbiology, nutrients, general chemistry, process control, and sample receiving. The modules are open to a common corridor, which improves ventilation control and facilitates communication and sharing of resources.

4.2 Security / Internal Chain-of-Custody

Both physical security and sample chain-of-custody are maximized by limiting access to the building and further limiting access to the Laboratory by means of a computerized card lock system. The main entrance to the building is unlocked during normal business hours, and a receptionist is stationed at the front desk. A card key is required to enter the building at other entrances, or to enter at the main entrance after business hours. The card key electronically identifies the person to whom the card was issued, the date and time of use,

and the door opened. Cards are assigned and controlled by a building security access control manager. Each card gives the user specific entry privileges, and only certain cards can open doors to the Laboratory. Access to the Laboratory is limited to Laboratory staff and certain other Bureau staff who need to enter for communication, sample delivery, or safety-related reasons.

5. EQUIPMENT AND SUPPLIES

Instruments, equipment, supplies, and chemicals are purchased from reliable, established vendors.

5.1 Laboratory Instruments and Other Equipment

Prior to use in sample analysis, instruments and other analytical equipment are tested for performance and sensitivity based on vendor-specified capabilities and method requirements. Appendix K is a list of analytical instruments and other major equipment used in the Laboratory. Refer to Section 6 for calibration and maintenance procedures.

5.2 Glassware and Supplies

Glassware and supplies must meet applicable guidelines for the procedure for which they are used. Volumetric glassware is purchased with a certificate of accuracy. Consumables such as filter membranes, autosampler tubes, and GC septa are inspected at the time of use for cleanliness and consistency. If a new brand of consumable supply is purchased, its performance is compared to the old brand if applicable.

5.3 Reagents and Standards

Reagents and standards are stored according to manufacturers' recommendations to minimize degradation, and discarded when the expiration date is past. Standard solutions traceable to NIST reference standards are purchased when available. Each purchased standard is accompanied by a certificate of analysis which is retained in the QA record files. Reagents, including compressed gases, meet or exceed the grade requirements specified in the reference method.

The Laboratory generates purified deionized water, referred to as Nanopure water. Nanopure water meets the reagent water requirements for use in method blanks and for dilution of standards and samples. Refer to SOP QA/QC-11 for details on the deionized water system and Nanopure systems.

6. EQUIPMENT CALIBRATION, VERIFICATION, AND MAINTENANCE

All laboratory equipment and instruments are maintained in good working order to the extent possible. Replacement parts are kept on hand in the laboratory for routine in-house maintenance (e.g., DO probe membrane caps, GC septa, a spare set of ICP/MS cones, etc.). After maintenance or repair of equipment, re-calibration or verification of calibration is required prior to analysis of samples. For each major instrument there is a bound Maintenance Notebook in which all maintenance, service visits, and repairs are documented.

6.1 Major Analytical Instruments

Major instruments include ICP, ICP/MS, GC, GC/MS, IC, and Autoanalyzers.

6.1.1 Initial Calibration

Analytical instruments are calibrated according to manufacturer and method protocols. Prior to use, a new instrument must be validated as capable of attaining and maintaining calibration appropriate for its intended use. The initial start-up data and calibration of a new instrument are appropriately documented (see Section 9.5).

6.1.2 Routine Calibration and Ongoing Verification

Once in service, the instrument is routinely calibrated according to method requirements (refer to specific method SOPs). Some methods require full calibration at the beginning of each analytical batch, with a second-source Initial Calibration Verification (ICV) standard tested immediately after calibration to verify the accuracy of the calibration curve. Then, to verify instrument stability throughout the run, Continuing Calibration Verification (CCV) standards are analyzed after every 10 samples and at the end of the run. Calibration, ICV, and CCV results are documented and reported along with sample results.

Other methods require less frequent calibration, but ICVs and/or CCVs are required at the beginning, during, and at the end of each analytical batch to verify that instrument response has not changed, within defined limits for the method.

Usually, an ICV result should be within +/-5% of the expected value, and a CCV result should be within +/-10% of the expected value. These requirements may vary according to the method (refer to specific SOPs). If the ICV fails to meet the recovery acceptance criteria, the entire run is considered not reportable. If a CCV fails, the samples analyzed after the last acceptable CCV are not reportable. An exception to this rule is as follows: in a long run with multiple CCVs, samples toward the end of the run that are bracketed by two successful CCVs are reportable even if a mid-run CCV fails, if the reason for the failure can be determined.

6.1.3 General Maintenance

Routine maintenance and minor repairs are usually performed by a staff member who uses the instrument. The need for routine maintenance is based on performance of the instrument and/or established preventative maintenance periods.

6.1.4 Service and Repair

Major repairs are performed by a manufacturer service technician or a contract service engineer recommended by the manufacturer. Most repairs are conducted on site; in some cases an instrument or part of an instrument may be shipped to a manufacturer's repair facility. Some instruments are covered by annual maintenance contracts with the manufacturers. These include: ICP, ICP/MS, GC, and GC/MS systems. The contracts

include regularly scheduled maintenance visits, software upgrades when available, and accelerated response times for non-routine service requests.

6.2 Balances and Weights

The Laboratory has numerous electronic analytical balances (to 0.0001g) and top-loading balances (to 0.01g or 0.001g), two sets of ASTM Class 1 weights, and two individual Class 1 weights of 500g and 300g. The balances are used both for gravimetric analyses and for reagent and standard preparations.

6.2.1 Calibration

Balances are calibrated annually *in situ* by a local metrology service. The weights used for daily calibration verification are also calibrated annually by the metrology service. The service company is A2LA-accredited and certifies the calibration as traceable to NIST standards. Calibration certificates are maintained in the QA record files.

6.2.2 Ongoing Verification and Internal Calibration

Calibration of each balance is verified daily (when used) using ASTM Class 1 weights. The calibration checks are reflective of the range of measurements to be made and are documented in a bound notebook for each balance. For analytical balances, weights <10.0000 g must measure to within +/- 0.5 mg, and weights ≥10.0000 g must measure within +/- 1.0 mg. For top-loading balances, the requirements are +/- 0.05 g for weights <10.00 g, and +/- 0.1 g for weights ≥10.00 g.

If a balance fails to meet the calibration check criteria, an internal electronic calibration is performed (by pressing the “cal” button). After this internal calibration, the balance is checked again with the series of weights. If the internal electronic process cannot establish acceptable calibration, professional service is needed (see Section 6.2.4).

6.2.3 General Maintenance

Balances are treated with care to avoid damaging the sensitive weighing mechanisms, particularly the analytical balances. The doors of the analytical balances are kept closed when not in use, to minimize dust accumulation and to protect from sudden changes in air flow. General upkeep for all balances consists mainly of cleaning up the weighing pan after every use, if needed. Weights are stored in their original containers with the lid closed, and handled only with plastic forceps.

6.2.4 Service and Repair

Balances and weights are repaired and/or re-certified by the local metrology service that provides the annual calibration service. The need is based upon inaccurate response compared to other balances or weights in the Laboratory. Service certificates are maintained in the QA records files.

6.3 Spectrophotometers

Spectrophotometers are cleaned, serviced, and calibrated annually by a local A2LA-accredited metrology service. Calibration certificates are maintained in the QA records files. The same company performs repairs if needed. Calibration is verified with each use by means of one or more standards, depending on the analysis.

6.4 Turbidity, Conductivity, Dissolved Oxygen, and pH Meters

The turbidity, conductivity, DO, and pH meters are calibrated by the analyst prior to each use. At the end of an analytical batch for turbidity, pH, or conductivity, the calibration is checked again and documented. The meters require little maintenance. Probes/electrodes are maintained by laboratory staff or replaced when analytical results indicate a malfunction.

6.5 Microwave Digesters/Extractors

Microwave ovens used for metals digestion and organic extraction are serviced annually. They are checked or calibrated for power settings (watts) and temperature readings (if needed). Calibration certificates are maintained in binders in the analytical areas.

6.6 Automatic Pipettes

Electronic pipettes are sent to the manufacturer for service and calibration annually, or if imprecision becomes evident. Both the base pipette and the various heads are serviced. Certificates of calibration are maintained in the QA records files.

6.7 Sterilization Equipment

Dilution bottles, equipment, and media used for microbiological analysis are sterilized by autoclave. The autoclave is cleaned and serviced quarterly by a professional service vendor, including calibration for temperature, pressure, and timing. The Microbiologist or backup staff performs routine maintenance and QA that include weekly cleaning, drain checks, temperature checks, timer calibration checks, and sterilization verification with a spore indicator sample. Sterilization tape is used on every item for every autoclave batch. The temperature is monitored using a recording device, which is verified for accuracy once per week using a maximum thermometer. All these measures are documented in the section QA notebooks.

A small table-top autoclave serves as a backup. When in use, the temperature, pressure, and timer accuracy are verified, and a spore indicator sample is used to verify sterilization efficiency.

6.8 Thermometers

Glass thermometers are used in numerous types of temperature-controlled equipment including refrigerators, ovens, furnaces, incubators, block digesters, and water baths. All purchased thermometers are certified as calibrated to NIST-traceable standards. The Laboratory has two electronic thermometers that are calibrated annually by a local metrology service.

6.9 Refrigerators, Ovens, and Incubators

The temperatures of laboratory refrigerators, ovens, and incubators are documented daily when in use. Completed temperature control logs are maintained in the QA record files.

6.10 Deionized Water System / Nanopure Units

SOP QA/QC-11 details the maintenance of the DI water system.

The basic deionized water system is serviced on contract by a professional service company that provides the resin tanks and other equipment. The system is monitored weekly for a significant drop in pressure that would indicate system degradation. Service is requested if water quality appears to be degrading prior to the routine scheduled maintenance. Additionally, the system is sterilized if a bacterial plate count indicates the presence of microorganisms.

The Nanopure units that further purify the deionized water have in-line digital resistivity meters that are visually monitored with each use. When a unit displays a resistivity less than 17.8 Mohm-cm, the resin cartridges are replaced by a knowledgeable staff member.

7. TRAINING

7.1 Introduction to Policies, Methods, and QA

New employees are introduced to the Laboratory's QA program immediately. In the first week of work, the new employee is asked to read numerous QA and Safety policy documents and learn the requirements of the training program. The Production Specialist and QA/QC Chemist are responsible for setting the tone for the employee's integration into WPCL's QA culture.

7.2 Training Protocol

The written Training Protocol is attached as Appendix D. This protocol is followed both for new employees and for tenured staff learning a new method. It is provided as a guideline for all method training, though different methods require different timelines. The goal of the training program is to ensure that the trainee fully understands an analytical procedure and has ample opportunity to practice the method using standards and matrix samples. An analyst must demonstrate accuracy and precision prior to reporting results for an analysis.

For complex methods, sample preparation and analysis are commonly taught as two separate protocols, though this is not mandatory. Likewise, analysis of the same analyte in two different matrices often takes two separate training processes.

7.3 Demonstration of Capability

When the trainer and trainee agree that training is complete, the final step is the 4-replicate demonstration of capability (DOC). The trainee must independently analyze four aliquots of a reference sample with acceptable precision and accuracy for the method. To the extent

possible, the reference material is a purchased standard or a laboratory-prepared LCS. In cases where standards are not available, a sample previously analyzed by a qualified analyst is used for the DOC.

7.4 Training Documentation

Completion of appropriate training documentation is mandatory. A training form is used to document and date the steps in the training process (observation, practice, DOC, etc.), and copies of DOC data are attached to the form. The QA/QC Chemist has final approval authority and does not sign the documentation until the demonstration of competency is complete. A training file is maintained for each analyst in the QA record files.

8. SAMPLE HANDLING

Procedures for sample handling and log-in are detailed in the relevant SOPs. Following are summaries of the QA requirements.

8.1 Sample Receiving

The key QA requirements for sample receiving are to verify accurate sample documentation on the chain-of-custody form and to accept custody of the samples by signing and dating the form. If samples are not relinquished in person, a note must be written on the chain-of-custody form to account for the location of the samples between the times relinquished and received.

The Sample Custodian receives most samples, but any member of the Laboratory staff may accept custody. If the samples cannot be preserved and distributed immediately, they are temporarily stored in the Sample Receiving refrigerator.

8.2 Sample Preservation, Distribution, and Storage

Protocols for sample handling and preservation are documented both in formal SOPs and in other guidance documents such as lists, tables, summaries, and policy statements. These documents are posted or otherwise immediately available in the sample receiving area. EPA guidelines for sample preservation and storage are used.

Each sample is assigned a unique laboratory sample identification number (see Section 15.1 of this document), and a number label is affixed to each sample bottle. After the samples are preserved and labeled, they are placed in a holding refrigerator for retrieval by the analysts who transfer them to refrigerators in the analytical areas. For analyses with holding times of 48 hours or less, special handling procedures ensure that the analysts are notified and receive the samples as soon as possible.

8.3 Compositing

Some samples require compositing by laboratory personnel. If a sample is to be analyzed for trace contaminants such as low-level metals or pesticides, the compositing container is processed through a “decon” procedure to ensure it is clean. This is a standard procedure

that employs dilute nitric acid and copious quantities of Nanopure water. If organic analytes are requested, solvent rinses are also incorporated.

8.4 Internal Custody

The building card lock system provides a custody barrier for samples that have been relinquished to the laboratory. Samples stay inside the locked Laboratory unless relinquished to another laboratory or, on occasion, brought outside the Laboratory but kept in sight of a staff member.

8.5 Sample Log-in

All samples are logged into the LIMS. While each sample is assigned a laboratory sample number for identification and tracking, the LIMS program designates an internal sample number that cannot be modified by the LIMS user. Samples are logged in by project code. Other sample information entered into the LIMS includes sampling date and time, sampler, received date and time, receiver, analyses requested, and other detailed information. This information is checked for accuracy after the electronic log-in. Modifications to the initial log-in are automatically documented in the computer and are tracked in a readily accessible audit trail file.

9. ANALYTICAL QA/QC

The goal of the Laboratory is to produce high-quality data that meet predetermined criteria for accuracy, precision, representativeness, comparability, completeness, and sensitivity. To that end, the quality assurance factors associated with every analytical procedure include proper sample manipulation, use of a valid and sensitive method, and analysis of QC samples and standards alongside the field samples.

9.1 Sample Handling in the Laboratory

Proper sample handling by the analyst contributes to maintaining sample integrity and accurate volumes. Samples are stored in refrigerators within the analytical areas, segregated by analysis if necessary to prevent cross contamination. The individual analysts are responsible for meeting the method-required analytical holding times. Samples are warmed to room temperature and mixed well before measuring analytical aliquots. Extracts and digestates are capped tightly and are stored as required by the method.

9.2 Sample Analysis

Samples are analyzed only by fully trained analysts who have demonstrated an ability to produce accurate and precise data. To ensure data comparability, analyses are based on standardized protocols that are documented in written SOPs. Whenever possible, the method SOPs are based on published methods. For regulated analytical requirements such as NPDES monitoring, use of EPA-specified methods is required.

9.3 MDLs and MRLs

The sensitivity and precision of an analytical method are determined before the method is used. Statistical MDLs are established according to the EPA procedure at 40 CFR Part 136 Appendix B. This type of MDL study is performed for complex instrumental analyses and for bench methods where applicable.

The laboratory sets Method Reporting Limits (MRLs) based on the established MDLs and estimates of recoverability and precision at concentrations near the MDL. In most instances, the MRL is three to five times the MDL, rounded to one significant figure or a multiple of 10. In some cases, the MRL is less than three times the MDL in order to meet customer requests for lower level data. Conversely, an MRL may be set more than five times above the MDL to account for possible matrix variability. Because the MRLs provide a wide buffer for sensitivity, they are raised for reporting purposes only if the sample aliquot is significantly different than the standard method aliquot due to volume adjustment or low percent dry weight for solid samples, or if sample dilution is required due to the matrix.

For metals analysis, Instrument Detection Limits (IDLs) are established as part of the instrument start-up protocols prior to establishing the MDLs. If the reference method requires it, the linear dynamic range is also established for each element.

9.4 Analytical QC Samples

Every analytical batch incorporates certain QC samples, depending on the analysis, to provide ongoing verification of accuracy and precision. System QC protocols serve to verify that the analytical system is functional, clean, and calibrated. Matrix QC samples are used to evaluate potential effects from the sample matrix. The distinction is emphasized because failed System QC may require formal corrective action and re-analysis of the sample batch. Failed Matrix QC, if verified as attributable to the sample matrix, allows for reporting the sample data with qualifying flags.

9.4.1 System QC

The basic QC samples used for each sample batch are the Method Blank (MB) and Laboratory Control Sample (LCS). The LCS may be referred to by other terms such as LFB, Blank Spike, or Check Standard. The MB and LCS are carried through the entire preparation and analysis alongside the samples, at a frequency of one MB and one LCS per preparation batch. System QC for instrumental analysis also includes periodic CCVs throughout an analytical batch, and may include method-specific requirements for instrument response parameters. These specific system requirements are delineated in the method SOPs.

9.4.1.1 Method Blank (MB)

The MB demonstrates that the analytical system is free of contamination that affect the sample results. If a target analyte is detected in the MB at or above the MRL, sample results must be flagged unless they are more than 10 times the amount in the MB. If unexplained contamination is found in the MB a second consecutive time, corrective action must be taken to determine the source.

9.4.1.2 Laboratory Control Sample (LCS)

The LCS is the key verification for accuracy for most analyses. It measures the recovery of target analytes apart from possible matrix interference. The LCS generally consists of a clean matrix such as Nanopure water spiked with a known amount of target analyte. The LCS concentration is typically near the midpoint of the analytical range. More than one LCS may be used to verify accuracy at different points in the working range of the method. For regulatory samples, the spike may be at the violation limit concentration. Successful recovery verifies that the analytical system, including the analyst's performance, is in control. An LCS recovery that falls outside the acceptance limits indicates a system nonconformance. The cause must be determined and the associated samples re-analyzed. If the unacceptable LCS recovery is determined to be due to problems in the preparatory step, the associated samples must be re-prepared before re-analysis. (Also, see note in Section 9.4.2.2.)

9.4.1.3 Method-Specific System QC

Complex instrumental analyses often require method-specific QC standards and samples. CCVs are used to verify that instrument response has not changed significantly over the course of an analytical batch. A CCV at the mid-point concentration of the calibration curve is analyzed after every 10 samples and at the end of a run. If a CCV result falls outside the acceptance limits, the samples analyzed since the last successful CCV must be re-analyzed. In a long analytical batch, each sample must be bracketed by a successful calibration verification before and after it is analyzed. In metals analysis, each CCV is followed by a CCB to monitor for system contamination or carryover.

In some cases, analysts may incorporate system QC samples that are beyond the method requirements. Common examples are low-level LCSs and Low Calibration Verification standards (LCVs), which increase confidence in results near the reporting limit. Low-level LCS and LCV recoveries may have wider acceptance ranges than for the required mid-range concentrations.

9.4.2 Matrix QC

Sample Duplicates and Matrix Spike (MS) samples are used to determine whether a sample matrix introduces analytical bias. Duplicate and MS samples are carried through the entire analytical procedure alongside the samples, with the MS having a known amount of target analyte(s) added to the aliquot prior to preparation. Duplicate and MS analysis are performed for at least one sample per batch or per matrix type within a batch, with a minimum of one per 10 samples.

9.4.2.1 Duplicates

For analytes that commonly are detected above the MRL, duplicate sample analysis is the key means of evaluating precision for the matrix, by calculating the Relative Percent Difference (RPD) of the two results. For analytes that usually are not detected in samples, duplicate MS samples should be used to evaluate precision. If the RPD is above the acceptance limit, the data should be examined

to determine whether that is due to the matrix specifically. For unfamiliar samples, re-analysis is used to determine if the poor precision was due to analytical problems or matrix problems. For samples known to have a non-homogeneous matrix, results may simply be flagged as estimates due to the matrix. The use of routine triplicate analysis may be applied for samples and methods that are known to produce inconsistent results due to matrix interferences.

The RPD limit is not applicable for concentrations less than 5 times the reporting limit for the analyte.

9.4.2.2 Matrix Spikes

MS samples are spiked with a known amount of target analyte, typically at a concentration near the midpoint of the analytical range. For regulatory samples, the spike concentration may be at the violation limit concentration. Recovery is calculated after subtracting out the concentration of analyte contributed by the native sample (the initial result, if run in duplicate). Recovery within the MS acceptance limits indicates that the matrix is not significantly impacting the analytical system. If the MS recovery is outside the acceptance limits, the data should be examined to determine whether that is due to the matrix specifically. For unfamiliar samples, re-analysis is used to determine if the unacceptable recovery was due to analytical problems or matrix problems. For samples known to have a non-homogeneous matrix, results may simply be flagged as estimates due to the matrix.

MS recovery acceptance limits are not applicable if the native concentration in the sample is more than 4 times the amount spiked.

NOTE: If the batch LCS fails for an identifiable reason that does not affect the samples, the MS can serve as the LCS if the MS recovery data meet the LCS acceptance limits and all other batch QC parameters pass.

9.4.2.3 Surrogates

System Monitoring Compounds (SMCs), or Surrogates, are used in most organic instrumental methods to evaluate extraction recovery efficiency for each sample. The SMCs are spiked into each sample at the start of the preparative procedure. Surrogate recoveries outside the established acceptance ranges require that the sample results be flagged as estimates due to matrix interference.

9.5 New Method / New Instrument Start-up

For bringing up a new method, procedures similar to the training protocol are followed. The individual starting the method learns the basic protocol, usually self-taught using the reference method, then analyzes standards, LCSs, blanks, practice samples, spiked matrices, etc. If the method is for a new analyte or analyte group, split-sample comparison with another laboratory is arranged if reasonable. If the new method is intended to replace an old method, in-house comparison analysis is done. Method MDLs must be established and the initial demonstration of capability (DOC) must be documented.

Replacing an instrument also requires that the new equipment be validated before sample results are reported. Analysis of standards, LCSs, blanks, and spikes are used to optimize instrument run conditions. If possible, parallel analysis of samples is used to verify similar results on the old and new systems. MDLs must be established, and a DOC is required for each analyst.

It is incumbent upon the QA/QC Chemist to fully review all start-up data and verify that the quantity and quality of the data supports validation of the method. Written documentation of a new method or new instrument start-up is sent to the Laboratory Manager, and a copy is placed in the QA record files.

10. DATA REPORTING AND VALIDATION

10.1 Reporting Analytical Results

The analyst prepares the final results that will be reported, including rounding to the correct significant figures. For analyses that use calibration curves, data reduction employs a linear (first-order) curve whenever required by the reference method. In other cases, a linear curve is preferable but a second-order curve may be used. For soils, sediments, and sludges, results are calculated to a dry-weight basis unless the customer requests otherwise.

For most bench methods, including microbiological procedures, the data are documented in a laboratory notebook designed for the analysis, and final results are entered in that notebook. The notebook is submitted for data review (see Section 10.2) and subsequent data entry in the LIMS.

The instrumental methods commonly employ computer spreadsheets for preparation of final results and calculation of QC parameters. The instrumental data are exported to a spreadsheet program and then refined using cell formulas and macros. Results for standards and QC samples, including calculated QC statistics, are reported along with the sample results. Analyst comments regarding analytical observations or difficulties are included in the analytical report, and must be transcribed into the LIMS when the accuracy of sample results may be affected (see Section 10.4). When the final results have been generated, all relevant data and information used to produce the final results are appended to a hardcopy of the spreadsheet, and the entire packet is submitted for data review (Section 10.2).

10.2 Data Review

All laboratory results are reviewed before being reported to the customer. The primary review may be performed by the Production Specialist, QA/QC Chemist, or any qualified member of the laboratory staff (based on knowledge of the analysis and associated calculations). Primary review is a thorough examination of the raw data, QC results, and final calculations to produce each result.

Analytical reports from contract laboratories are reviewed by the QA/QC Chemist to verify acceptable QC results. If results are flagged or otherwise qualified, that information is transferred to the LIMS as flags and comments for the affected samples (see Section 10.4).

10.3 Data Entry Review

Most data are manually entered into the LIMS. When data are entered, a hardcopy is printed and attached to the data source report (laboratory notebook or spreadsheet). The hardcopy is checked, usually by another person, to verify accuracy of data entry.

10.4 Flagged Data and Comments

When a sample result does not meet the quality criteria detailed in this Quality Manual, the data user (customer) is notified on the final report. Due to limitations in the LIMS system, any result that requires qualification is flagged with “EST”, meaning “estimate”, and the reason for the flag is explained in the “Comments” section of the report. The goal of flagging and comments is to provide all pertinent information to the data user. Results do not require a flag if data quality issues are resolved by re-analysis.

Most reasons that prompt a flag can be categorized as related to sample integrity, matrix effect, or analytical error. Some quality problems are beyond the control of the laboratory, and these are flagged as well. Some examples of failed data quality criteria that prompt a flag and comment are:

- holding time exceeded, whether due to lab error or late delivery of sample
- wrong sample bottle used, or insufficient preservation
- low spike or surrogate recovery due to matrix interference
- poor precision due to non-homogeneous matrix
- loss of sample due to broken sample bottle or laboratory glassware
- failed QC in an analysis where re-analysis is not possible

Comments may also be added if reporting limits are raised due to matrix interference, when Tentatively Identified Compounds (TICs) are found in GC/MS methods, when unusual results prompt verification and require explanation, or any other time the data user may benefit from discussion of the data.

10.5 Reports to Customers / Final Validation

When all data for a sample have been reviewed, entered into the LIMS, flagged as needed, and checked for data entry accuracy, the sample is ready for report generation. Hardcopy reports are not generated for process control samples for the treatment plants, but all other samples are reported on paper.

The QA/QC Chemist generates hardcopy reports for customers and performs a final validation review of the report as a whole. (The Production Specialist may serve as substitute.) The validation review includes a “sensibility” check and verification that necessary flags and comments are included. The sensibility check means looking for obvious errors and comparing related results. For example: a pH result of 64 is a typographical error; a result for o-phosphate should be less than or equal to total phosphorus; the ratio between conductivity and dissolved solids should be within a certain range.

The hardcopy report is initialed on every page by the QA/QC Chemist. This is the official analytical report. A photocopy of the initialed report is retained in the Laboratory records and the original is submitted to the customer either directly or via the IMS section. Other personnel in the Bureau have access to the LIMS and may generate unofficial copies of reports. IMS may use the reporting feature of LIMS to generate electronic copies of the reports. For non-validated samples, the report format includes notations indicating that the report is preliminary and the results have not been validated. For fully validated samples, the electronic version of the report states that the QA signature is on file.

11. TRACEABILITY OF MEASUREMENTS

Analytical measurements are traced via documented activities and certificates of analysis. Standards, reagents, and measurement equipment are purchased based on the grade or quality level required. To the extent possible, standards are traceable to NIST, reagents are ACS reagent grade or better (as needed) and equipment is chosen based on the vendor's published accuracy and precision specifications.

11.1 Purchased Standards and Reagents

Purchased standard and reagent solutions are received with certificates of analysis. The date of receipt is noted on the certificate. Each certificate is retained as laboratory documentation, either in the QA records file room or in the analytical area where the solution is used. For bulk reagents (acids, neat chemicals, and microbiological media), the reagent grade or purity is certified on the container. The date the container is opened is noted on the container by the analyst.

Standards, solutions, and bulk reagents are stored appropriately to minimize degradation and contamination, as recommended by the reference methods, vendors, or according to general chemistry knowledge, as applicable. Expiration dates on the certificates and/or containers are respected, and solutions prepared from purchased stock are assigned and labeled with expiration dates as appropriate to the solution.

11.2 Equipment and Instruments

Certain types of measurement equipment (automatic pipettes, balances, autoclaves, spectrophotometers, etc.) are periodically calibrated by professional service companies, and calibration is routinely verified in the course of analytical activities. Refer to Section 6 of this QM for specific schedules and documentation procedures.

NIST-traceable thermometers are used to monitor temperatures in refrigerators, ovens, and incubators. The certificates of traceability are retained in the QA record files.

11.3 Internal Laboratory Activities

Analytical instruments are calibrated as required by the methods. Refer to Section 6.1 of this QM. The source standards used for initial and ongoing calibration are of documented quality (see Sections 5.3 and 11.1). Initial calibration and startup data are retained, and ongoing calibration records are filed as part of the documentation for each analytical batch.

Quantitative reagents and standards are prepared using calibrated measurement equipment (see Sections 6 and 11.2). Preparation is documented in the appropriate laboratory notebook associated with the method. The solutions are stored appropriately to minimize degradation and contamination, and the containers are labeled with expiration dates appropriate to the solution.

The Laboratory participates in external and internal proficiency testing and interlaboratory comparisons in order to verify that results are comparable with other environmental laboratories. The QA/QC Chemist maintains copies of the PT and interlaboratory results. (Refer to Section 13.)

12. DOCUMENTATION AND RECORDKEEPING

12.1 General Rules of Documentation

Laboratory activities related to sample receiving, analysis, instrument maintenance, and QA/QC protocols must be documented. Laboratory records must identify the personnel involved (by initials) and the date of the activity. The QA/QC Chemist maintains a list of the laboratory staff and other Bureau personnel who handle samples, with their signatures and initials.

Manual documentation and notations must be recorded legibly in permanent ink.

Corrections are made using a single line marked through the error, and the individual making the correction must initial and date it. This applies to both manual entries and instrument printouts. If the correction is made because of information provided by another individual, a parenthetical notation identifying that individual should be added. Errors may not be obliterated or concealed (e.g., with “white-out” or a black marker).

12.2 Sample Chain-of-Custody Records

Each sample accepted by the Laboratory is recorded on a chain-of-custody form or in a logbook that serves as the chain-of-custody record. These forms and logbooks are retained as the official documentation of sample receipt and identification.

The chain-of-custody record must contain sample identifying information including the date collected, sample collector, type of sample (grab/composite), and the analyses requested. If this information has not been provided by the customer, it must be requested. The samples must be relinquished by signing and dating on the chain-of-custody record. The sample receiver also signs and dates it, then adds laboratory identification numbers.

12.3 Analytical Data

The official records of analysis are analytical notebooks, original instrument printouts, and electronically archived instrument data. Laboratory notebooks are numbered, tracked, and archived by the QA/QC Chemist. Instrument hardcopy printouts are retained as official data, along with a copy of the final calculated results (see Section 10.1). Electronic storage media are kept as data backup when available.

Analytical data recorded in laboratory notebooks, such as sample preparations and bench chemistry analyses, must be entered promptly and directly into the notebook. All analytical notations must clearly indicate the analyst and date.

12.4 Hardcopy Reports

A copy of each printed analytical report (see Section 10.5) is attached to the chain-of-custody form for storage and archive. For samples that are documented in a logbook rather than a chain-of-custody form, the report copy is filed without attachment. Reports from contract laboratories are retained in labeled storage boxes as part of the QA record files.

12.5 Document Control

The Quality Manual and SOPs are maintained as controlled documents. They are assigned revision numbers when modified. Copies are tracked, and copies of old versions are recalled, if possible, when a new revision is distributed. The QA/QC Chemist maintains the original signed copy of each SOP and QM revision. The old versions are archived with notations indicating the period of time in effect.

For each controlled document, a revision page is maintained to document the history of revisions. A concurrence page is also maintained for the QM, to verify that each staff member reads the QM and annually reviews, at a minimum, the revised sections.

12.6 Records Retention

When data and records are no longer needed in the Laboratory work area, they are filed in a locked file room in the WPCL building that houses the QA records. Laboratory notebooks, instrument print-outs, chain-of-custody forms, hardcopy reports, and QA documentation are generally stored in file cabinets in the file room for two years or more. The information is then transferred to labeled storage boxes and stored in designated areas of the building where space permits. Laboratory records are considered permanent City records. They are stored on-site at the Laboratory for at least 10 years and then may be transferred to the City's central archive.

13. AUDITS AND QA REPORTS

13.1 Proficiency Testing

Proficiency testing is performed routinely, serving as performance audits to verify the general accuracy of the Laboratory's data. If a PT sample fails to meet the acceptance criteria, a corrective action process is implemented to determine the cause of the failure. At a minimum, the analyst and QA/QC Chemist are involved in the corrective action(s). Successful analysis of a PT sample may serve as an analyst's annual continuing demonstration of capability in a method.

13.1.1 Regulatory PTs

The Laboratory participates in the annual EPA DMR-QA Study. The DMR-QA PT samples are tested for analytes required in the City's NPDES permits for the wastewater treatment plants.

13.1.2 Internal PTs

The QA/QC Chemist administers blind QC samples approximately four times per year, purchased from a NVLAP-accredited PT provider. The purpose is to test the performance of individual analysts. These quarterly blind QCs include samples for most of the analyses performed in the laboratory, and every analyst participates in the program at least twice per year. The analysts are aware that the samples are for QA/QC purposes, but do not know the certified values. When analyses are complete, the results are summarized in a table and made available to customers interested in the Laboratory's performance.

13.1.3 Double Blind PTs

Occasionally a customer submits a QC sample as an unknown. This is done independent of the Laboratory, usually by a customer within the Bureau. If certified values are made available to the Laboratory, the data is retained in the QA record files.

13.2 Laboratory Audits

13.2.1 Internal QA Audits

The QA/QC Chemist performs formal and informal audits of analytical data and the associated documentation. Informal audits are frequent, performed in conjunction with or as a check on primary data review, to verify that all analytical and QA/QC protocols have been applied for an analytical batch. Formal audits are performed by the QA/QC Chemist on randomly chosen data packets, approximately once per quarter, and are signed by the QA/QC Chemist when complete. Training data, new method start-up data, annual DOCs, MDL studies, and other required QA documentation also receive QA review and signature.

13.2.2 Annual Regulatory Audit

In connection with the analytical services provided to the City's sewage treatment plants, the State of Oregon Department of Environmental Quality (DEQ) performs an annual audit at WPCL for E.coli, BOD, and TSS analysis. The audit consists of a laboratory walk-through, review of analytical documentation, and the analysis of split samples for the three parameters. Because WPCL is considered an in-house laboratory for the treatment plants, records of these audits are maintained by management at the Columbia Boulevard plant.

13.2.3 System Audits

Full system audits are performed by external organizations when deemed necessary by the Bureau management. The purpose is to provide the Bureau with an unbiased evaluation of the Laboratory's functioning compared to general industry standards.

13.3 Interlaboratory Programs

13.3.1 Formal Interlaboratory Programs

The Laboratory participates in one formal interlaboratory split sampling program, administered by a regional watershed management agency. Nitrogen- and phosphorus-containing nutrients are targeted. This program is especially relevant because WPCL routinely analyzes the same target nutrients in surface water and stormwater runoff for a number of Bureau monitoring projects.

13.3.2 Informal Split Sampling and Comparisons

Certain samples collected by Bureau personnel or consultants are collected as split samples. Industrial wastewater samples are split with the industry if requested. Some environmental projects have sampling plans that include up to 10% split sampling. The Laboratory often does not receive the comparison results, but may receive a general acknowledgement that the results are comparable.

When the results of specific samples or matrices come into question, the Laboratory may arrange for split sample testing with another laboratory. Records of these events are maintained by the QA/QC Chemist. WPCL also maintains ongoing relationships with other laboratories that include occasional analytical comparisons to help resolve questions or improve methodology.

13.4 Reports to Management

QA reports to management are informal. The Laboratory Manager, Production Specialist, and QA/QC Chemist meet weekly to discuss production and QA issues. The QA/QC Chemist and Production Specialist are responsible for overseeing the protocols outlined in this Quality Manual and resolving data quality problems as they arise.

14. NON-CONFORMANCES / CORRECTIVE ACTIONS

14.1 Analytical Non-Conformances

When an analytical procedure is not producing the expected QC results, corrective action is initiated to identify and correct the problem. If the corrective action is routine, such as re-analysis of a Method Blank that exhibits contamination due to carryover, it is documented in the analytical data packet. If the inconsistency is systematic, cannot immediately be explained or resolved, or if previously reported results must be modified, a more formal corrective action procedure must be implemented. Any non-conformance that affects data quality is noted on the final report to the customer. However, non-conformances that are resolved internally through re-analysis or other evaluation are not reported to the customer.

When a non-conformance requires investigation and/or a procedural adjustment, a Corrective Action Report (CAR) is used to document the resolution of the problem. Usually the analyst is responsible for finding the source of the problem and correcting it. The QA/QC Chemist reviews all CARs. Each completed CAR becomes part of the laboratory QA records and is referenced to help resolve the problem if it happens again.

Not every analytical problem requires a CAR, but any non-conformance that affects a sample result must, at a minimum, be noted when the result is reported. Refer to section 10.4 for examples of when flags and comments are required. The analyst is responsible for including necessary comments and conclusions on data reports. The analyst must not delete data that fails QC criteria. Rather, any problems and the successful follow-ups must be documented.

14.2 QA Non-Conformances

QA non-conformances are evaluated much like analytical non-conformances. Examples of QA non-conformances are: failure to monitor the temperature of a sample refrigerator, and reporting results before the data is reviewed. A one-time failure is documented and the customer is notified if data quality is affected. If a systematic error is noted, the corrective action protocol is implemented. A key goal is always to prevent a recurrence.

14.3 Excepted Departures From Policy

The two basic requirements regarding exceptions to policy are documentation and notification. The QA/QC Chemist is responsible for evaluating the effects of an exception and ensuring that it is documented, including the reason for the violation of protocol. Corrective action is taken immediately upon recognition of a QA exception. The Laboratory's policy is to inform customers of anything that may affect data quality or validity.

In some cases departures from policy are requested, such as using a non-validated method for estimated results. There must be a reasonable expectation that the customer understands the potential effect on data quality, and the final report must include a comment qualifying the result(s).

14.4 Handling Complaints

14.4.1 Analytical Results Questioned

Except for process control data for the City's wastewater treatment plants, the QA/QC Chemist addresses questions of data accuracy. The Production Specialist oversees the process control data. Questions may be received via telephone, e-mail, or person-to-person. The data sources (laboratory notebooks, computer printouts, etc.) are checked for accuracy of calculations, reporting, and for analyst comments. If the complaint is based on the historical trend for a routine sample, that trending is also examined. If the sample is still available, it may be re-analyzed.

Any changes resulting from a complaint are fully documented in the data. Revised customer reports are marked as such.

14.4.2 Other Complaints

Complaints about turn-around time are directed to the Production Specialist. Complaints about reporting limits, reporting format, QC failures, error frequency, and most other data-related problems are handled by the QA/QC Chemist. Every effort is made to improve laboratory processes, particularly when more than one complaint is noted on a topic. The Laboratory Manager may be included in the resolution of a complaint that relates to the Laboratory as a whole.

15. LIMS

The LIMS in use at WPCL is Labworks ES (PerkinElmer, Inc.). The basis of the database search ability is the individual sample, each of which is electronically stamped with a unique system identification number when logged into the LIMS. This number is different from the laboratory identification number assigned at the time of sample reception.

Sample information and results are entered manually into the LIMS. Every effort is made to maintain accurate data in the LIMS because it serves as the database for generating reports for clients. It also provides tracking information for samples that are in progress, and can be used to observe trends in analytical results. For most analyses, QC results are entered into the LIMS, with the QC tests attached to one sample of a batch.

15.1 Coding and Sample Numbering Conventions

Conventions are used when creating project codes and laboratory sample identification numbers. These conventions facilitate sample login procedures and provide sorting mechanisms for sample tracking and reporting.

Each sample source (e.g., an industry, a sample point at the WWTP, an outside customer) is assigned a project name by another Bureau work section. The Laboratory abbreviates these names to location codes in Labworks. Each code is set up in Labworks like a project account, automatically registering key identifying information for each sample logged in under the code.

Each laboratory sample number is comprised of a 2- or 3- letter prefix, the year designation, and a 4-digit number. The prefix provides information about the source or matrix of the sample, and each project/industry code has a designated prefix.

15.2 Sample Tracking and Information Via LIMS

The LIMS is used to track sample status, view pending analyses (the backlog), view special information such as rush requests, and generate hardcopy reports. The information entered into the LIMS is reviewed for accuracy. The sample login information is reviewed within a day of login, usually by the QA/QC Chemist. As results are entered for each analysis, hardcopies of the entered data are printed and submitted for data entry review.

Each sample goes through a series of status steps. The status is “analysis pending” until results have been entered for all logged-in analyses. When all results are complete, the status changes to “validation queue”. Only the QA/QC Chemist, Production Specialist, and

Laboratory Manager have privileges to electronically validate samples. Validation changes the status to “report queue”. Generating a report then automatically changes the status to “inactive”, meaning the sample is complete and reported. The sample status can change back to a previous status in the series. For example, if a customer requests an additional analysis after the sample has been validated and reported, logging in the new analysis sets the status back to “analysis pending”. Also, any change to sample information or results after a sample has been validated sets the status back to “validation queue” and requires electronic re-validation and reporting to move it to “inactive” status again. These status changes are automatic in the LIMS software. They cannot be manually forced.

15.3 Privileges and Responsibilities

Through a password-protected System Manager account, individual LIMS user accounts are assigned privileges appropriate to the user’s function. Knowledge of the System Manager password is limited to the Laboratory Manager, Production Specialist, QA/QC Chemist, and computer specialists who assist with database issues.

Privileges to enter or modify data are limited to personnel responsible for sample login, data entry, or QA review of those tasks. These privileges are also allowed to the Laboratory Manager, computer specialists, and a Labworks service technician. Labworks has an audit trail function that tracks modifications to sample information and results, with an automatic electronic stamp that indicates the user, date, and time, and a feature to designate the reason for the modification.

Privileges to validate samples are limited to the Laboratory Manager, Production Specialist, QA/QC Chemist, and computer specialists who assist with database issues (the latter for testing purposes only).

15.4 QC Data in LIMS

The LIMS is programmed to calculate QC statistics from entered results, but the LIMS calculations are based on rounded figures. The QC data in the LIMS are usable for general tracking purposes and for generating approximate control charts to look for trends. Official QC results are determined from the source data and are filed with the analytical results.

15.5 LIMS Data Back-up

As part of the Bureau computer network, the LIMS database is backed up on tape nightly by Information Technology personnel. The tapes are saved for three weeks. Additionally, the transaction log is backed up every 2 hours from 6: 00 AM to 6:00 PM on working days, and saved for three weeks.

16. SUB-CONTRACTING

WPCL retains a formal contract with one environmental testing laboratory, resulting from a competitive bid process. Additional informal agreements are made with specialty laboratories to perform non-routine analyses. In some instances, a customer may require specialty analysis by a laboratory that does not have a formal quality assurance program. In such cases, the QA/QC

Chemist is responsible for informing the customer that the data may not be considered valid by EPA or other quality standards.

16.1 QA Requirements of Contract Laboratories

The formally contracted laboratory must have a quality assurance program based on EPA guidelines, and must provide a copy of their Quality Manual for review. For regulatory samples (e.g., NPDES), the laboratory must use EPA-mandated methods. Laboratory reports must include basic QC data including method blanks, LCSs, matrix QC, and appropriate flags and comments to acknowledge non-conformances, as needed.

16.2 Evaluation of QA Program and Results

The QA/QC Chemist is responsible for evaluating a contract laboratory's QA Program. This is done mainly by review of the Quality Manual and by on-going review of the QC data provided with sample results. Each report from a contract laboratory is reviewed to verify that correct analyses were performed and the QC data is acceptable. If results are flagged or otherwise qualified, that information is reported on the WPCL hardcopy report.

16.3 Reporting Data from Sub-Contracted Laboratories

The Bureau requires that all data be entered into the WPCL LIMS. Although the contract data are reported to customers from the LIMS, signed hardcopy reports from the contract laboratory are retained as the official source documentation for the data.

KEY TO ABBREVIATIONS

ATP: Alternative Test Procedure

BES: Bureau of Environmental Services of the City of Portland, Oregon

BOD: Biochemical Oxygen Demand

BS: Blank Spike

CCB: Continuing Calibration Blank

CCV: Continuing Calibration Verification

CFR: Code of Federal Regulations

CHP: Chemical Hygiene Plan

CoC: Chain of Custody

COD: Chemical Oxygen Demand

DI: Deionized, refers to deionized reagent water

DO: Dissolved Oxygen

DOC: Demonstration of Capability

EPA: United States Environmental Protection Agency

GC: Gas Chromatograph

GC/MS: Gas Chromatograph / Mass Spectrometer

IC: Ion Chromatograph

ICP-AES: Inductively Coupled Plasma - Atomic Emission Spectrometry

ICP/MS: Inductively Coupled Plasma / Mass Spectrometer

ICV: Initial Calibration Verification

INELA: Institute for Environmental Laboratory Accreditation

IS: Internal Standard

LCS: Laboratory Control Sample

LCV: Low Calibration Verification

LFB: Laboratory Fortified Blank

LIMS: Laboratory Information Management System

MB: Method Blank

MDL: Method Detection Limit

MRL: Method Reporting Limit

MS: Matrix Spike

MSD: Matrix Spike Duplicate

NELAC: National Environmental Laboratory Accreditation Conference

NELAP: National Environmental Laboratory Accreditation Program

NIST: National Institute of Standards and Technology

NPDES: National Pollutant Discharge Elimination System

ORELAP: (State of) Oregon Environmental Laboratory Accreditation Program

PB: Preparation Blank

PBMS: Performance Based Measurement System

PDS: Post Digestion Spike

PT: Proficiency Testing

QA: Quality Assurance

QC: Quality Control

QM: Quality Manual

RB: Reagent Blank

RPD: Relative Percent Difference

RSD: Relative Standard Deviation

SAP: Sampling and Analysis Plan

SM: refers to *Standard Methods for the Examination of Water and Wastewater*

SMC: System Monitoring Compound

SOP: Standard Operating Procedure

SRM: Standard Reference Material

TCLP: Toxicity Characteristic Leaching Procedure

TIC: Tentatively Identified Compound

TKN: Total Kjeldahl Nitrogen

WPCL: Water Pollution Control Laboratory of the City of Portland, Oregon

GLOSSARY

The following definitions are applicable to the terms used in the WPCL Quality Manual and Laboratory SOPs.

Acceptance Limits: The minimum and/or maximum values for a QC result that meet established requirements for precision, accuracy, or other QC parameter. Also called Control Limits.

Accuracy: The degree of agreement between a measured value and the true or expected value. Accuracy is generally determined from spiked (fortified) samples and is expressed in terms of percent recovery (%R).

Analyst: An individual who performs analytical methods and related protocols and who is responsible for applying the associated quality control requirements for the methods and protocols. If capitalized, the term refers to a member of the Laboratory staff who holds the specific rank of Analyst.

Analytical System: The sum of the components required to effect sample analysis, including preparative steps. The analytical system includes instrumentation, equipment, glassware, reagents, standards, sample containers, and the analyst.

Batch: A group of samples that are prepared and/or analyzed together by the same personnel and using the same lot(s) of reagents. A **preparation batch** is a specified number of samples (often 10 or 20) of the same matrix which are processed together, along with certain QC samples processed at the same time. An **analytical batch** is a set of prepared samples and associated QC samples that are analyzed as a group. The samples in an analytical batch may differ in matrix, and may exceed 20 in number.

Bias: The systematic deviation of a measured value from the true value. Bias is inherent in a method or in the measurement system, or caused by matrix effects. Matrix spike results are a key indicator of matrix bias. At WPCL, sample results are not bias-corrected.

Blank: See **Method Blank** and **Reagent Blank**.

Blank Spike: Another name for Laboratory Control Sample. The term **Blank Spike** is commonly used in organics and nutrients analysis.

Blind QC Sample: A sample with an established concentration of target analyte that is known to the submitter but not known to the analyst. The analyst may or may be aware that the sample is a QC sample. A blind QC sample is used to test the analyst's analytical proficiency.

Calibration: A procedure that establishes the relationship between analyte concentration and analytical response. The term is most commonly used in reference to instrument response to standard solutions of known concentrations (calibration standards).

Calibration Blank: A zero standard, used in metals analysis. The Cal Blank is prepared using the same matrix of acidified water as for Calibration Standards, except no target elements are added.

Calibration Standards: Solutions of known concentrations which are used to standardize the measurement procedure. Calibration standards are used to establish the relationship between analyte concentration and analytical response.

Calibration Curve: A graphical plot of the concentrations of the calibration standards *versus* analytical response (e.g., peak area, counts, absorbance). The curve must meet certain correlative criteria in order for the calibration to be considered acceptable.

Chain-of-Custody Form: A paper record that documents the collection and possession of samples. It generally also includes the requested analyses.

Check Standard: Another name for Laboratory Control Sample. The term **Check Standard** is commonly used in wet chemistry methods.

Certification: A documented statement that an analyst is fully trained to perform an analytical method. Certification requires a Demonstration of Capability, and agreement among the trainee, the trainer, and QA/QC Chemist that the trainee understands the method and is capable of performing it accurately and precisely.

Certified Reference Material (CRM): A reference standard traceable to NIST, and documented as traceable in an accompanying certificate.

Comparability: The degree to which one data set can be compared to another. Comparability is achieved by use of consistent analytical methods and by traceability of standards to a reliable source.

Confirmation: Qualitative verification of an analyte by use of an alternative analytical practice. Examples include a second chromatographic column, an alternative wavelength or detector, or an alternative analytical procedure.

Continuing Calibration Blank (CCB): A zero standard (matrix-matched blank) run periodically throughout an analytical batch in metals analysis, usually directly after each CCV. If target elements are detected in the CCB above the reporting limit, the run must be stopped and evaluated for contamination.

Continuing Calibration Verification (CCV): A single standard, usually at the mid-point concentration of the calibration range, used to verify calibration throughout an analytical batch and/or quantify drift in instrument response. The CCV solution may be one of the same solutions used for the calibration curve. CCV analysis is generally required after every 10 samples in the analytical batch. The typical response requirement is ±10% of the true value.

Control Chart: A graphical representation of accuracy or precision data, allowing for visual detection of trends and biases. The chart includes statistical evaluations of the data, marking upper and lower control limits (see Warning Limit and Control Limit) that are based on the standard deviation of responses or statistics.

Control Limits: Acceptance limits determined on a control chart, usually ±3s distant from the mean value. When a result falls outside the control limits, steps must be taken to identify the source of the problem.

Corrective Action: The action taken to eliminate the cause of a nonconformance and prevent its recurrence. Corrective actions are usually taken in response to failed quality control results. They sometimes require a significant investigation and should be documented using a Corrective Action Report (CAR) form.

Data Audit: A review of the documentation and procedures associated with an analysis to verify that they comply with the stated protocols and the QC results meet the specified acceptance criteria.

Demonstration of Capability (DOC): A procedure to establish the ability of an analyst to generate data of acceptable accuracy and precision. The DOC usually consists of analysis of four replicates of an LCS containing all target analytes for the method, with acceptable accuracy and precision.

Detection Limit: See Method Detection Limit

Deionized (DI) Water: Water that has been treated in a specific way in order to remove impurities to a level that no positive or negative interferences are detectable when subjected to defined analytical procedures for target analytes. At WPCL, tap water is deionized by passing it through a series of resin beds, charcoal, and filters; then further purified through Barnstead Nanopure systems that consist of more resin beds which vary depending on the intended use of the DI water (organic or inorganic analysis). Nanopure DI water serves as reagent water for all analytical tests performed.

Duplicate: A separate aliquot of sample, treated and analyzed identically to the original aliquot. Comparison of duplicate results is the basis for precision measurement. Laboratory duplicates (or replicates) are aliquots taken from the same sample bottle. Field duplicates are from the same sample source but are labeled, stored, and analyzed as discrete samples.

Holding Time: The maximum time that a sample may be held prior to analysis and still be considered not compromised. WPCL uses EPA-established holding times. The holding time is based on the assumption of proper sample preservation, if applicable.

Initial Calibration Verification (ICV): A standard prepared independently of the calibration standards, used to verify the accuracy of the calibration before any samples are analyzed. The ICV concentration is different from any of the calibration standards but within the calibration range. The typical response requirement is ±5% of the true value.

Interference: A substance in a sample (or added during sample analysis) that produces a bias in the analytical result. Interferences are often referred to as Matrix Effect.

Internal Standard (IS): An analyte added to a prepared sample which is used as a basis for quantification. Target analytes are quantified based on their analytical response relative to the Internal Standard response.

Laboratory Control Sample (LCS): A clean matrix spiked with a known amount of analyte, or a material containing a known, verified amount of an analyte. **LCS** is the general term for a sample prepared and analyzed identically to other samples in order to evaluate analytical accuracy (as % Recovery) without consideration of matrix interference. Other commonly used terms that represent QC samples with the same purpose are **Blank Spike, Check Standard,** and **LFB.**

Laboratory Fortified Blank (LFB): Another name for Laboratory Control Sample. The term **LFB** is commonly used in metals analysis.

Laboratory Information Management System (LIMS): A computer database used to track samples and store the associated data. Sample information such as collection date and time, collector, project association, matrix, and analysis request are logged into the LIMS at the time of sample reception. Results are manually entered as they are available. At WPCL, every effort is made to assure the accuracy of data in the LIMS; however, the original chain-of-custody forms, laboratory notebooks, and instrument-generated analytical data are the official sources of sample information and data.

Low Calibration Verification (LCV): A standard near the reporting limit, used to verify adequate response and calibration at low concentrations. The LCV is similar to a CCV but is prepared at a lower concentration, has wider acceptance limits (in %R), and may be analyzed only once during an analytical batch.

Matrix: The component or substrate (e.g., wastewater, surface water, sludge, soil) which is to be analyzed for target analytes.

Matrix Spike (MS): An aliquot of sample which has been spiked (fortified) with a known concentration of target analyte prior to sample preparation. Treatment and analysis of matrix spikes is identical to samples in all respects. The percent recovery of the spiked analytes is a measure of analytical accuracy for the matrix, and is used to document the bias of the method in the given sample matrix.

Method Blank (MB): A sample of a matrix similar to the batch of associated samples, that is free of the target analytes. The method blank is processed and analyzed simultaneously and identically to the samples in all respects, and the results are evaluated for possible contamination or interferences resulting from the analytical process.

Method Detection Limit (MDL): A statistically-determined concentration that estimates the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is matrix-specific.

Method Detection Limit Study (MDL Study): An MDL determination. A standard MDL study involves the analysis of 7 replicates of a low-level spike in the matrix.

Method Reporting Limit (MRL): The concentration that is the minimum reportable amount of target analyte, based on precision at low concentrations in the given matrix. If detected below the MRL, the analyte is not reported as being present in the sample unless flagged as an estimate. The MRL is generally 3 to 5 times the MDL. The MRL is a laboratory-estimated limit of quantitation.

Nanopure Water: Reagent water processed first through a standard resin-based deionization system and then further purified using a Barnstead Nanopure system of multiple polishing resin beds. Specific resin beds are chosen depending on the intended use of the final water. Nanopure water contains no detectable target analytes or interferents.

Nonconformance: An event that does not meet the applicable QA/QC requirements. Examples include low recovery on an LCS, failure to analyze a sample within the holding time, a contaminated Method Blank.

Percent Recovery (%R): A measured concentration value converted to a percent of the true or accepted value.

The calculation for %R for a standard or blank spike is:

$$\%R = \frac{X}{T} \times 100$$

where X = concentration determined for standard or blank spike
T = true or expected value, in concentration units

The general calculation for %R for a matrix spike sample is:

$$\%R = \frac{A - B}{T} \times 100$$

where A = concentration determined for the spiked sample
B = concentration determined for the non-spiked sample
T = true or expected value, in concentration units

Post-Digestion Spike (PDS): A known amount of target analyte added to a prepared sample digestate. The purpose is to determine the amount recoverable by the analysis procedure independent of sample preparation. This protocol is used mainly in metals analysis to verify that low recovery is due to sample matrix or loss during preparation, and not due to instrument problems.

Precision: The degree of agreement among a set of measurements, independent of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses of a sample (native or spiked) containing the target analyte at a concentration above the MRL. Precision is expressed in terms of Relative Percent Difference (RPD) for 2 values, or as Relative Standard Deviation (RSD) for 3 or more values.

Preparation Blank (PB): Synonymous with **Method Blank**, this term is commonly used in metals analysis.

Preservation: A means of maintaining the chemical or biological integrity of a sample prior to analysis. The most common types of preservation are refrigeration and the addition of reagents that change the pH or prevent chemical changes to the target analytes.

Proficiency Testing and PT Samples: Proficiency Testing is a means of evaluating analytical performance by the analysis of unknown samples provided by an external source. PT Samples are single-blind QC samples of matrix and concentration similar to everyday samples.

Quality Assurance Program: A system of activities and protocols designed to integrate planning, quality control, quality assessment, documentation, and quality improvement, with the purpose of defining and implementing standards of data quality and validity that meet the needs of data users.

Quality Control (QC): A system of technical laboratory activities designed to evaluate and control data quality through the use of known concentration samples.

Quality Control Sample: A sample that is analyzed for purposes of evaluating data quality based on a particular QA/QC parameter such as accuracy or precision. A routine QC sample is one that is prepared by the analyst in the course of analyzing a batch of samples. A blind QC sample is one for which the true concentration of the target analyte is not known by the analyst. A double blind QC is one that is submitted for analysis without informing the analyst of its identity as a QC sample.

Quality Manual: A document that describes the laboratory quality program.

Quality System: See **Quality Assurance Program**.

Raw Data: Any original documented information from analytical activity, including manual written entries and computer-generated values, that contributes to the construction of a result or conclusion.

Reagent Blank (RB): A sample consisting of reagents, without the sample matrix or target analyte(s). A reagent blank is used to determine the contribution of the reagents to the analytical results.

Reagent Water: A purified water in which no target analytes or analytical interferents are detectable. Different purification processes are required for different types of analytes. At WPCL, **Nanopure** deionized water is used as reagent water.

Recovery: See **Percent Recovery**.

Relative Percent Difference (RPD): The difference between two determined concentration values, converted to percentage of the average value of the two determinations. RPD is used as a standard representation of precision. The calculation for RPD is:

$$RPD = \frac{|A1 - A2|}{(A1+A2)/2} \times 100$$

where A1 = first determined concentration
A2 = second determined concentration

Relative Standard Deviation (RSD or %RSD): The standard deviation of three or more determined values, converted to percentage of the mean of the multiple determinations. RSD is used as a representation of precision, or as a measure of agreement among the response factors for points on a calibration curve. The calculation for RSD is:

$$RSD = \frac{s}{A} \times 100$$

where s = standard deviation of multiple determined concentrations or response factors
A = mean of multiple determined concentrations

Replicate: A separate aliquot of sample, taken from the same sample container as the original aliquot, and treated and analyzed identically to the original aliquot. (See more at Duplicate.)

Representativeness: The degree to which data accurately and precisely represent the condition which is being measured. Sampling design and sub-sampling for analytical aliquots are key factors in establishing representativeness.

Sensitivity: The degree to which an analytical system can discriminate between measured values or detect low concentrations of an analyte. Sensitivity is often used as a relative term rather than a quantified parameter.

Spike: A known amount of target analyte added to a blank or sample aliquot. The purpose is to determine the amount of analyte recoverable by the analytical procedure.

Standard: A solution of known concentration, used to calibrate or verify calibration of an analytical system.

Standard Operating Procedure (SOP): A detailed written description of a procedure, designed to systematize (standardize) the performance of that procedure. The purpose of laboratory method SOPs is to ensure a consistent methodology among different analysts.

Standard Reference Material (SRM): A certified reference material produced by NIST, characterized for absolute content of target analyte(s) independent of analytical methodology.

Surrogate Compound: See **System Monitoring Compound**.

System Monitoring Compound (SMC or Surrogate): A compound that is similar in chemical composition and analytical behavior to target analytes, but which is not normally found in environmental samples. SMCs are added to a sample before preparation and analysis begin, and %R is calculated for each compound. SMC recoveries provide a measure of bias for each individual sample analyzed, much like a matrix spike. SMCs are used mainly for trace organics analyses. They are also called Surrogate Compounds.

Target Analyte: A compound, element, or aggregate property (e.g., COD, solids, alkalinity) for which a sample is analyzed.

Tentatively Identified Compound (TIC): In GC/MS analysis, a sample contaminant that is not on the target analyte list but is tentatively identified by comparison of the mass spectrum to those in a mass spectral library.

Traceability: The ability to relate a measurement to a standard reference material through an unbroken chain of comparisons.

Trip Blank: A sample of laboratory reagent water used to monitor for contamination during the transportation of samples, used when samples will be tested for volatile organic compounds. A trip blank is typically reagent water collected into an appropriate sample container, which then accompanies the containers used for field samples, both before and after sample collection.

Validation: Evaluation of available data and other information to confirm that results meet the quality requirements for their intended use.

Warning Limits: Statistical limits determined on a control chart, usually $\pm 2s$ distant from the mean value. When results fall outside the warning limits too frequently, steps must be taken to identify the source of the problem. A single value outside the warning limits does not require action but should prompt attention as a possible problem.

Work Cell: A group of analysts (2 or more) who work together to perform an analysis. A member of a work cell may perform only part of the method, and training certification relates to the entire work cell.

CITY OF PORTLAND
WATER POLLUTION CONTROL LABORATORY
CODE OF ETHICS

CITY OF PORTLAND CODE OF ETHICS

Introduction. All employees of the City of Portland are subject to the City Code of Ethics at Section 1.03 and including paragraphs 1.03.010 through 1.03.050. This new section was added by Ordinance on May 4, 1994. The City Code of Ethics addresses trust, objectivity, accountability, and leadership and applies to elected officials, employees, appointees to boards and commissions, and citizen volunteers authorized to act on behalf of the City (collectively referred to as "officials" in the text of the Code).

Section 1.03.020, Trust. All nine items in this section are of particular importance for laboratory workers:

A. The City's powers and resources are used for the benefit of the public rather than any official's personal benefit.

B. City officials promote public respect by avoiding even the appearance of impropriety.

C. Policy makers place long-term benefit to the public as a whole above all other considerations, including the concerns of important individuals and special interests. However, the public interest includes protecting the rights of under-represented minorities.

D. Administrators implement policies in good faith as equitably and economically as possible, regardless of their personal views.

E. Whistle-blowing is appropriate on unlawful or improper actions.

F. Citizens have a fair and equal opportunity to express their views to City officials.

G. City officials do not give the appearance of impropriety or personal gain by accepting personal gifts.

H. City officials devote City resources, including paid time, working supplies, and capital assets to benefit the public.

I. Political campaigns are not conducted on City time or property.

Section 1.03.050, Leadership. The first four items in this section are of particular importance for laboratory workers:

A. City officials obey all laws and regulations.

B. City officials do not exploit loopholes.

C. Leadership facilitates, rather than blocks, open discussion.

D. Officials avoid discreditable personal conduct and are personally honest.

WPCL employees must be familiar with and follow all the items in the City of Portland Code of Ethics.

LABORATORY CODE OF ETHICS

Introduction. The production of analytical data requires more detailed and focused ethics guidelines in addition to the broad, over-arching items found in the City Code of Ethics. By signing the concurrence page of the WPCL Code of Ethics, laboratory employees agree to follow all of the ethical guidelines and prohibitions enumerated in this Laboratory Code of Ethics. Noncompliance with this ethics policy is considered to be contrary to personnel regulations. Any laboratory employee who does not comply with this ethics policy may be subject to the City's disciplinary process, up to and including termination. This policy does not apply to unintentional human errors that may occur from time to time.

General Ethics. All WPCL employees are charged with meeting the City's and Laboratory's standard of ethical conduct in the performance of their duties and are further charged to report data, test results, and conclusions that are accurate to the best of their knowledge and that are obtained using sound laboratory practices. All WPCL employees are expected to follow established, written protocols as detailed in the laboratory standard operating procedures and quality manual. Adherence to the WPCL ethics policy is fundamental to maintaining data integrity.

Duty To Report. All WPCL employees must immediately report any accidental or intentional reporting of inauthentic data. Such reporting may be done to the QA Chemist, Production Specialist, Laboratory Manager, or Group Manager. If any WPCL employee is asked by another to engage in an activity that compromises data integrity, that employee has the duty and the right to refuse any such request and to immediately appeal the request to the QA Chemist, Production Specialist, Laboratory Manager, or Group Manager.

Management Coercion/Retaliation Prohibited. The Laboratory Manager or laboratory employee with oversight responsibility may not instruct, direct, or request any other laboratory employee to perform a practice that would violate the City or WPCL Codes of Ethics. In addition, they may not discourage, intimidate, or inhibit a laboratory employee who refuses to follow an order to engage in unethical conduct and may not retaliate against the employee.

Specific Unethical Laboratory Practices. The following behaviors are prohibited and are considered improper and unethical, and in certain instances, illegal:

A. Falsification of data by reporting results other than those obtained by analysis.

B. Falsification of data by reporting results for a sample that was not analyzed (dry labbing).

C. Falsification of quality control results.

D. Intentional contamination of samples bottles or omission of preservative.

E. Intentional improper manipulation of a sample during sample handling procedures.

F. Intentional improper manipulation of a sample or QC sample during analysis.

G. Improper manipulation of data to produce a more desirable result.

H. Intentional deviation from established protocols or regulatory requirements.

I. Non-reporting of an error or deviation from protocol that affects the analysis result.

J. The carrying-out of any action intended to misrepresent, distort, or conceal analysis results.

K. Reporting of dates and times of analyses different from the actual dates and times at which the analyses were performed.

L. Intentional reporting of another's work as one's own or vice versa.

M. Attesting to the review of laboratory notebooks or final analysis results (via initialing and dating) without actually performing the appropriate data checking protocols.

CITY OF PORTLAND
WATER POLLUTION CONTROL LABORATORY
CODE OF ETHICS CONCURRENCE PAGE

The following, by their signatures: (1) attest to having read and understood the WPCL Code of Ethics; (2) agree to follow all the precepts and prohibitions in both the WPCL and City of Portland Codes of Ethics.

Name	Title	Signature	Date

TRAINING PROTOCOL

1. Introduction

The purpose of this document is to establish a protocol for training laboratory employees in analytical procedures. The goals of training are 1) to provide information and practice to the trainee under supervision of a skilled trainer, and 2) to verify and document the analyst's skill in the procedure through analysis of known samples and a demonstration of capability (DOC).

Use checklists to document completion of the steps in the training protocol, initialed and dated by the trainer and the trainee. The completed checklist is stored in the analyst's training folder, which is maintained by the QA/QC Chemist.

This document applies to routine training of analytical personnel by another qualified analyst. Implementation protocols for new method start-up are described in the WPCL Quality Manual.

2. Trainer Qualifications

The trainer must be a person qualified to do the analysis and should have at least three months experience performing the procedure. Because method details change over time, the trainer should be currently active in performing the analysis. Whenever possible, the laboratory employee most experienced with the procedure will train the new analyst.

3. Training Opportunities and Trainee Qualifications

Training opportunities are based on the principle of progressive advancement. An analyst must be successful at simpler tasks before training on complex methods. Being successful means consistently performing an analysis with good results.

An analyst must demonstrate a thorough understanding of assigned bench methods before progressing to instrumentation, and must master the simpler instruments before advancing to complex instrument systems. Evaluation of progressive advancement includes verified experience at another laboratory. Other factors that affect cross-training assignments include the analyst's interest in learning the method, proven aptitude for the type of task, ability to meet the time requirements of the task, and the cross-training needs of the laboratory. The Laboratory Production Specialist and QA/QC Chemist are responsible for training assignments.

Note that the idea of progressive advancement does not require that every analyst take the same route of analytical experience. Quality of work is the most important factor in evaluating analytical success. Reliability and thoroughness indicate an ability to move on to other tasks. Solving analytical problems is an indication of understanding and

mastery of an analysis. Taking the initiative to fix a problem, improve a procedure, or work on a new method demonstrates independent motivation to do higher level work.

4. General Training Protocol

Training for a specific analysis or laboratory protocol is the same for a new employee or an established analyst learning a new method (cross-training). However, for new analysts with little or no experience, refer to Section 6 for an outline of basic training topics that must be covered before focusing on a particular analysis. During cross-training, it is important not to make assumptions about the trainee's abilities. While the trainee may be an experienced co-worker, she/he does not know the specific requirements of the new analysis. All the training steps should be followed for cross-training, including discussion of the specific safety precautions.

The following steps for training serve as a guideline. They are generally applicable for bench methods and for initial training phases of instrumental analyses. Emphasize hands-on experience for the trainee, but it is also important to explain the chemical basis of the analysis and the reason for each step in the procedure. Depending on the method, more or less time may be spent on certain steps, extra practice may be required, or the training steps may be ordered differently.

4.1 The trainee observes the trainer perform the procedure. The trainer should explain each step as it is done. Point out any special techniques that produce the best results, discuss the QC requirements for the method, and point out safety concerns throughout the procedure. The trainee should take written notes.

4.2 The trainee reads the reference method, the laboratory SOP, and the MSDS sheets for the reagents. If the method has changed since the SOP was last updated, the trainer should discuss the details of the procedure as currently performed. The trainee should also have access to equipment/instrument manuals and other resources that explain the theory and applications of the method.

4.3 Depending on the complexity of the analysis, the trainee may need to observe the procedure again, with further discussion of theory and equipment.

4.4 The trainee performs the procedure on a known sample while the trainer observes. It is important that the trainer watch every detail of this first attempt, correct any errors or technique deficiencies, and answer questions as they come up.

4.5 When the trainee feels comfortable with the method, he/she performs the procedure on one or more additional batches of practice samples, including method blanks and other standard QC samples. The trainer compares these practice results to the expected values. The cause of any poor results must be determined and corrected.

4.6 When the trainee has independently performed the analysis on practice and QC samples with correct results, the formal demonstration of capability (DOC) can be done. The DOC requires analysis of 4 replicates of a known sample. The DOC sample is usually a laboratory control sample (blank spike) prepared by the trainer, with the true concentration unknown to the trainee. If a blank spike or other reference material is not available, a real sample that was previously analyzed by a qualified analyst may be used. The Production Specialist and/or QA/QC Chemist should be consulted in deciding when the trainee is ready to try the 4-replicate DOC.

4.7 If the DOC results meet the method acceptance criteria for accuracy (%R) and precision (RPD), the training data and checklist are submitted to the QA/QC chemist. When the trainer, trainee, Production Specialist, and QA/QC Chemist are all confident that the trainee understands the analysis and can produce valid results, the trainee will be considered qualified to analyze real samples.

4.8 If the DOC results do not meet the acceptance criteria, more practice samples must be analyzed, with the trainer closely evaluating the trainee's analytical technique. The trainee may not analyze and report results for real samples until proficiency has been demonstrated through a successful 4-replicate DOC.

4.9 Even after the trainee is considered proficient in the procedure, the trainer or another qualified analyst should still be available to answer questions. Any difficult or unusual samples should be discussed with another qualified analyst or the Production Specialist, until the trainee's experience is adequate to allow independent resolution of analytical problems.

4.10 At some time during the training process, key method-related procedures must be explained and demonstrated. These include preparation and storage of reagents and standards, method-specific glassware cleaning procedures, instrument maintenance, etc., as applicable. The trainer should closely supervise the trainee during the initial performance of these procedures.

5. Training Considerations for Instrumental Methods

The general training steps used for bench methods -- observation, reading, practice, discussion, and a DOC -- are also applicable for instrumental analysis. Training for a complex instrumental analysis is usually a multi-phase process, partitioned into phases including sample preparation, routine calibration and analysis, data interpretation, reporting, maintenance, troubleshooting, and handling non-routine samples and data. An analyst may become certified in sample preparation only. An analyst may be considered qualified to analyze routine samples if proficient in sample preparation, calibration and analysis, routine data interpretation, and reporting. For chemist-level

certification, it is necessary to demonstrate skills in troubleshooting, instrument maintenance, non-routine analysis, and advanced data interpretation.

It may take several months before an analyst can independently generate results on a complex instrument system. A common approach to training for a complex analysis is for the trainee to first learn sample preparation. Then the trainer and trainee can work together on the instrument until the trainee understands all aspects of the analysis. The trainee should refer to the instrument manual, reference method, SOP, and other resources throughout the training process. It is important that the trainee fully understand the instrument and the data system, as well as the chemical/physical principles of both sample preparation and analysis. Close supervision during the training process is essential for the trainee to learn how to successfully analyze real samples. The trainer can use his/her judgment to determine when the trainee is ready to do certain steps such as instrument set-up, entering the sample queue, preparing standards, etc. The trainee may not process samples independently until proficiency has been demonstrated in sample preparation, calibration and analysis, and data interpretation.

6. Preliminary Training for Entry-Level Analysts

A trainer must be aware of the educational background and experience of the trainee. A person with no lab experience will be lacking in some knowledge and technique skills that are fundamental to good analysis. These skills should be taught to the trainee, independent of a particular analytical method. That is, teach the trainee how to use laboratory equipment before teaching the analysis that requires the equipment. The trainer should ask a trainee, “Have you used this equipment before?” If no, then training and practice are necessary. If the answer is yes, the trainee should demonstrate correct usage to the trainer. The following types of laboratory equipment require specific training and time to develop skill in their use.

6.1 Graduated glassware -- discuss the meniscus, how to estimate the final digit, TD vs. TC glassware

6.2 Transfer techniques -- use of pipette bulbs, automatic pipettors, how to avoid contaminating reagents, quantitative transfer of samples

6.3 Volumetric flasks -- how to fill to the meniscus, not to heat in oven or on hotplate, liquid should be at room temperature for final measurement

6.4 Volumetric pipettes -- touching the tip to inside surface of container, reading the meniscus, care not to break tip, volumetrics are TD (do not blow out)

6.5 Burettes -- removing air bubbles, managing the last drip on tip, the “quick-flip” to release minimal volume at endpoint, removing the stopcock to clean, pre-rinsing with titrant

6.6 Filtering -- pre-wet filter paper in funnel, use of appropriate type of filter paper, how the vacuum works and how to release it

6.7 Glassware -- fitting ground-glass joints, cleaning, never heat or scratch volumetrics

6.8 Probes -- rinsing, appropriate storage conditions

6.9 Top-loading balances -- how to use, taring to zero, cleanup, limits of sensitivity

6.10 Analytical balance -- calibration checks, frequent zeroing, doors closed for weighing, the effects of fingerprints, absorbed moisture and drafts, sensitivity. Anyone using an analytical balance should have full knowledge of its functions and the care required to maintain its precision.

In addition to laboratory skills, a new technician must learn a number of concepts that are essential to the production of good laboratory data. Knowledge of the following procedures is required.

6.11 Basic Analytical Chemistry

6.11.1 Solutions -- normality vs. molarity, standardization, handling exothermic reactions

6.11.2 Titrations -- use of indicators, determining the endpoint, $N_1V_1 = N_2V_2$

6.11.3 Instrumentation -- all instrumental conditions must be maintained throughout an analytical batch, instrument warm-up/stabilization period, calibration checks

6.12 Documentation

6.12.1 Analytical documentation -- recording all data in permanent laboratory notebooks or appropriate log sheets, making written comments about unusual sample matrix or analytical response, filing of instrument and computer print-outs as permanent records, use of specific units for final reporting, documenting preparation of reagents and standards

6.12.2 Use of standard methodology -- SOPs based on published analytical methods must be used whenever possible, methods must be referenced with the data

6.12.3 Chain-of-custody -- understanding of the sample chain-of-custody procedures and the purpose of limited access to the laboratory / sample handling area

6.13 Math

6.13.1 Units -- metric units, conversions, equivalencies (μg/mL = mg/L, mg/Kg = ppm, etc.), fundamental relationships for water (1L = 1Kg, 1g = 1mL)

6.13.2 Calculations -- use of calculation formulas, canceling out units to final reporting units, dilution factors, QC calculations (%R, RPD, etc.)

6.13.3 Significant figures -- standard rules for determining significant figures and rounding-off, number of significant figures to report for specific analyses

6.13.4 Standard curves and linearity -- standard curve coefficients of linearity, expected linear ranges for specific analyses, determining required dilutions

6.14 Quality control in analytical chemistry

6.14.1 Consistency -- the importance of a consistent analytical procedure and technique to ensure valid and reproducible results

6.14.2 QA/QC measures -- system calibration, analysis of calibration checks, control samples, blanks, duplicates, and spikes to support the validity of sample results

6.14.3 Sample preservation -- use of the proper sample bottle with correct preservation for a specific analysis, performing analysis within method-prescribed holding time

6.14.4 Aliquots -- must attain a representative sample, shake liquids before each aliquot is taken, mix solids well

6.14.5 Reagents and standards -- the importance of fresh reagents and standards, documentation of reagents and standards preparation, use of proper bottles and storage, periodic re-standardization of acids and bases, use of second-source QC checks to verify working standards

6.15 Safety in the laboratory

6.15.1 Habitual use of routine safety equipment such as safety glasses, gloves, and fume hoods; understanding conditions which require additional protection such as goggles, rubber apron, etc.

6.15.2 Knowledge of the locations of emergency equipment, including eyewash station, fire blanket, emergency showers, spill kits

6.15.3 Knowledge of all lab safety rules

6.15.4 Knowledge of emergency escape routes and thorough familiarity with the building Fire and Life Safety Plan

6.15.5 Thorough familiarity with the Chemical Hygiene Plan, MSDS sheets, spill response for lab chemicals, waste disposal

WPCL POLICY STATEMENT

TITLE ANALYTICAL SYSTEM QC

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE April 1998

POLICY

As part of the WPCL Quality Assurance Program, every analysis requires QC measures to verify accuracy and precision. QC analyses are of two types: analytical system QC and matrix QC. Analytical system QC is not sample-specific but rather reflective of the entire analytical apparatus and reagents. Matrix QC applies to a specific sample or set of samples of the same matrix. This document serves as a QA policy statement on analytical system QC. Matrix QC requirements were described in a separate QA memorandum (10/97).

Analytical system QC results verify that the analytical system is in control. Being "in control" means that the system is stable and accurate. The analytical system encompasses all reagents and apparatus associated with the analysis, including solutions, standards, deionized water, glassware, instrumentation, measuring devices, and any other equipment used during the analysis. Unacceptable system QC results could be due to a problem in any of the reagents or equipment. Some examples include: an expired reagent, contaminated deionized water, a degraded standard solution, contaminated glassware, inaccurate pipette, degraded or contaminated electrode, cracked GC inlet, mis-aligned ICP plasma torch, degraded tubing, a poor seal on fitted glassware. For an analytical system to work well, everything must be just right. System QC procedures are meant to alert the analyst to a possible failure in some part of the system. The knowledgeable analyst must then determine the source of the problem. Samples may not be analyzed until all system QC results indicate that the system is in control.

System QC protocol for most methods includes calibration standards (curve), ICV, CCVs, method blank, and blank spikes. Some analyses require other QC samples that are specific to the analysis. The term "blank spike" is a general term that applies to a number of differently named QC samples that are analyzed in this laboratory. Different names may be used, but they are basically the same thing for every analysis. For example, the same purpose is served by the following QC samples: Laboratory Fortified Blank (metals), Check Standard (oil & grease, numerous others), Glucose/Glutamic Acid Check (BOD), and the Positive Control (fecal coliform). They are all essentially blank spikes -- blank water or buffer that is spiked with the analyte(s) of interest and then treated like a sample. Another term for this type of sample is Laboratory Control Sample (LCS), the name used in many EPA methods. LCS is a useful name because the words suggest that 1) it is created in the lab, 2) it is used to verify that the system is in control, and 3) it is treated like any other sample.

Calibration

Calibration standards are used to determine the response of an analytical system, based on concentration of the analyte. The calibration range also defines the range of measurement for sample concentrations. If the sample concentration is greater than the calibration range, the sample must be diluted and re-analyzed. The calibration of an instrument should be consistent from day to

WPCL POLICY STATEMENT (CONTINUED)

day. An unexplained change in response usually indicates a system problem, even if the calibration is linear.

Most instrumental analyses require an ICV (Initial Calibration Verification) after the calibration curve has been established. An ICV standard is prepared from a different source of reference material than the calibration standards. The purpose of the ICV is to verify the accuracy of the calibration curve. A calibration may meet the criteria for linearity, but could still be inaccurate if a common bias exists in all of the calibration standards. The ICV provides an independent verification of accuracy. The ICV acceptance range is generally ±5 - 10% of the expected value, depending on the method. The concentration of the ICV should be at the mid-range of the calibration curve or lower.

Analysis of a CCV (Continuing Calibration Verification) is required periodically during an analytical batch. The CCV is usually one of the calibration standards. The purpose of the CCVs is to verify that system response does not change throughout the batch run. The CCV acceptance range is generally ± 10% of the expected value. The concentration of the CCV should be at the mid-range of the calibration curve or lower. The frequency of CCVs is usually one per ten samples.

Blanks

Method blanks are standard procedure for every analysis. The purpose of the method blank is to verify that if a sample is free of the targeted analyte(s) there will not be a false positive result. It is essential that the blank be carried through the entire analytical process as if it were a sample. Anything done to any sample must also be done to the method blank. For most analyses, the method blank must be free of target analytes (at the detection limit) before sample analysis can proceed. Blank subtraction is not allowed.

For water samples, a method blank consists of pure reagent water that is treated exactly like any other sample. This should include the addition of any preservative that was added to the samples.

For solid samples, it is ideal to use purified sand or soil. In some cases, such as for metals, reagent water may be appropriate. In other cases, it may be possible to prepare a blank using only the reagents and equipment as used for the real samples, but without sample. It is necessary to calculate blank concentrations in the same units as the samples are reported, using the target sample weight in the formula.

There are other types of blanks besides method blanks. Metals analysis employs a calibration blank which is used as a point in the calibration curve. For GC analysis, a system blank is run each day to verify that the instrumental system is clean. The types of blanks used depend on the analysis.

Blank Spikes

Blank spike results are key indicators of the ability to generate accurate results. The purpose of the blank spike is to verify that if a sample contains the targeted analyte(s) above the detection limit, it will be detected. It is essential that the blank spike be carried through the entire analytical process as if it were a sample. Anything done to any sample must also be done to the blank spike. A blank spike should be prepared in the same way as the method blank, but with the addition of a known amount of target analyte(s).

The spike concentration is dependent on the purpose of the analysis. For regulatory purposes such as industry monitoring samples, the spike may be at the regulatory concentration (violation limit). Successful spike recovery at this concentration provides confidence in the data at the regulatory level. Another guideline offered by EPA is to spike at 1 to 5 times the amount expected in the samples. This is based on the fact that the blank spike and matrix spike should be at the same

WPCL POLICY STATEMENT (CONTINUED)

concentration, and it ensures a measurable difference between the sample concentration and the spiked sample concentration. Another common spike level is at the midpoint of the calibration curve, or one step lower than the midpoint. This is a good guideline to use for samples that are commonly non-detects or have very low concentrations of the target analyte(s).

Summary

System QC provides the first line of evidence that the analytical system is (or is not) in control. It is necessary that the calibration standards, calibration verifications, blanks, and blank spikes have acceptable results in order for sample data to be valid. Any unacceptable system QC result, or variation from "normal" system response, requires investigation and resolution.

BACKGROUND

As WPCL expands and improves its QA program, guidance is provided to the staff in order to define and distinguish among the types of analytical QC protocols. This policy is defines the QC measures used to verify that an analytical system is in control, independent of sample matrix effects. A separate policy statement on Matrix QC has been prepared.

WPCL POLICY STATEMENT

TITLE ARCHIVE ROOM ACCESS

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE April 8, 2002

POLICY

The two doors to the archive room are to be always locked.

If anyone other than laboratory staff needs access to the archive room, it must be coordinated with the laboratory QA/QC Coordinator. In the absence of the QA/QC Coordinator, authority is delegated to the Laboratory Manager.

BACKGROUND

Access to the laboratory archive room (behind the first floor coffee nook) must be strictly controlled at all times as part of the lab's mandate to maintain data security.

WPCL POLICY STATEMENT

TITLE BOD SAMPLE pH ADJUSTMENT AND SEEDING

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE February 1999

POLICY

All industry samples to be analyzed for BOD must be checked for pH and adjusted to neutral (6.5-7.5) as needed. All industry samples must be seeded, whether or not the pH was adjusted. Other BOD samples must also be checked for pH unless field data verifies neutral pH. Any sample that requires pH adjustment must be seeded because the non-neutral pH may have killed or debilitated the naturally present bacteria.

Seeding all industrial wastewater samples will ensure that plenty of living anaerobic bacteria are present, and may also improve the consistency of BOD readings among the different dilutions for a given sample. The BOD reference method requires that samples be pH-neutral and that they be seeded with bacteria if the pH required adjustment. For further information, refer to the analytical method, SM 5210B.

BACKGROUND

Over the past year, a number of industry samples have had non-reportable or conflicting results for BOD. Sometimes the BOD results for two dilutions of the same sample would not agree with each other. Sometimes the COD would be more than 10 times higher than the BOD. Such a high COD/BOD ratio is uncommon and has sometimes happened for samples with an expected COD/BOD ratio of 2 or 3. These problem results are apparently related to a lack of active bacteria in the samples. In some cases, the pH is too high or low for bugs to live and grow. In other cases, an industry's process water and sewerage are separate, so there are few or no bugs in the process discharge. If there are no living bugs, there will be no oxygen depletion in the BOD bottles.

In the last few months, Jennifer ran a number of industry samples for BOD in duplicate, seeding one set and not seeding the other. Samples with high or low pH were adjusted before aliquotting to the BOD bottles. In many cases, the seeded set had a higher BOD reading than the non-seeded. For the seeded samples, there was better consistency among the different dilutions and the COD/BOD ratios were more reasonable. The data clearly demonstrate that neutral pH and sufficient bacterial population are necessary to produce accurate BOD results. If you would like to review the experimental data, it is in the BOD Notebook #349.

WPCL POLICY STATEMENT

TITLE BOD SEED PROCEDURE

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC ____ Production
DATE January 2004

POLICY

This policy is a summary and update of the procedure for BOD seed preparation and usage.

Background

Columbia primary effluent is used for BOD seed. When the primary effluent has an elevated BOD value, the seed value approaches 2-3 mg/L BOD for 2 mL seed. The consistency of the seed from day to day and sample bottle to sample bottle may also be variable.

The desired seed value is 0.6-1 mg/L BOD per seed aliquot. It is also desirable to improve the seed homogeneity. Dissolved BOD is more consistent. After investigation, filtered Columbia primary effluent has been determined to be an appropriate seed.

To avoid any confusion over judging the quality of the seed (to filter or not to filter), the following procedure will be implemented as part of the daily routine.

Procedure

Filter Columbia primary effluent through a 4.7 cm glass fiber filter (TSS filter) in a volume sufficient for the anticipated needs of the day (approximately 100-200 mL). Use 4-mL aliquots to seed samples.

Set up a BOD on the filtered sample for seed value determination. Due to the lower concentration of dissolved BOD, a combination of dilutions of 10, 15, 20, and/or 30 (i.e. 30, 20, 15, and/or 10 mL of sample) should yield usable results for seed value determination. Record the filtered BOD set-up data in the Treatment Plant BOD analysis notebook.

If the daily filtered seed is used up and more samples require seed, filter more primary effluent. This second batch of filtered primary effluent must be treated in the same manner as the first. Set up a BOD on the second batch for seed value determination. Note which samples are seeded with the second batch. Additional seed is most likely to be used on “general” BOD samples and the BOD data may be recorded in the General BOD analysis notebook.

This procedure will be incorporated in the laboratory BOD Standard Operating Procedure.

WPCL POLICY STATEMENT

TITLE CALCULATION OF SPIKE RECOVERY

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE June 2001

POLICY

Throughout the laboratory, the formula for calculating matrix spike recovery commonly uses the average of the duplicate results. The average is subtracted from the spiked sample result, and the remainder is divided by the spike amount. Effective immediately, please change the procedure for calculating matrix spike recoveries. Use the initial result, not the average of the duplicates. This change is based on the standard EPA procedure. Here is the new formula:

$$\frac{S_R - X_I}{S_A} \times 100 = \%\text{Recovery}$$

where S_R = spike result
S_A = spike amount
X_I = initial sample result

BACKGROUND

In the past, the average of duplicate analyses was subtracted from the spike result before dividing by the spike amount. This new formula is based on EPA CLP protocol.

WPCL POLICY STATEMENT

TITLE CHAIN OF CUSTODY PROCEDURES FOR INDIRECTLY RELINQUISHED SAMPLES

TYPE _X_ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES _X_ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC _____ Production
DATE March 2004

POLICY

Some samples are relinquished to the laboratory when no person is physically present to receive them. Upon physical receipt, chain-of-custody forms should be signed with the date and time that a laboratory staff member actually receives the samples*. Any time the "relinquished" date/time and the "received by" date/time differ, there must be a note added to explain where the samples were stored during the intervening period.

The receipt date/time used for sample log-in depends on the circumstance, as follows.

If samples are placed in the laboratory's Sample Receiving refrigerator, they are considered to be in the custody of the laboratory. Therefore, they should be logged-in as being received at the date and time they were relinquished to the refrigerator. For example, if Field Ops personnel bring samples into the lab late at night on June 7, a lab person signing the chain-of-custody the next morning should date it June 8, and note that the samples were stored in the Sample Receiving refrigerator overnight. The samples would be logged in as being received on June 7.

If the samples are held somewhere other than inside the laboratory, they are not considered to be in the custody of the laboratory. One example would be samples collected by a CBWTP operator late on December 26, signed as relinquished on Dec 26, and taken from the CBWTP refrigerator by lab personnel at 08:15 on Dec 27. The chain-of-custody and log-in would indicate receipt at 08:15 on Dec 27. A comment would state that the samples were retrieved from the CBWTP refrigerator. Another example would be samples delivered by courier, relinquished at 11:30 on June 5 and received at 14:55 on June 5. The chain-of-custody should indicate receipt at 14:55, with a comment noting delivery by a courier, and log-in would also indicate receipt at 14:55.

*For samples received during normal working hours, a slight delay in signing to receive samples should not result in a different time than the "relinquished" time indicated by the sample collector.

BACKGROUND

Occasionally, samples are received by laboratory personnel on the day after they have been relinquished by the sample collector. Two common examples are samples collected at the CBWTP during night shift or very early in the morning, and samples delivered by Field Operations staff after regular laboratory hours. The purpose of this policy is to clarify what time and date should be documented by laboratory personnel who first encounter these samples.

WPCL POLICY STATEMENT

TITLE COMPROMISED SAMPLES

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE March 2002

POLICY

A "compromised sample" is one in which there has occurred an anomaly in sampling, storage, preservation, or transport.

If a sample is known to be compromised, the QA/QC Coordinator must be notified immediately. The QA/QC Coordinator will contact the client or the appropriate person in Field Ops or IMS to discuss the sample and gather information, such as details about the sampling event, nature of the analysis requested, etc.

After consulting with the appropriate parties, the QA/QC Coordinator will determine whether or not to proceed with the analysis. If the analysis is done, the QA/QC Coordinator will prepare a cautionary statement appropriate to the situation. This statement will be placed in the LIMS comment field for that sample and MUST be included in any report sent to the client.

There is no automatic delegation of this authority during a short-term absence of the QA/QC Coordinator. Authority is delegated to the Laboratory Manager ONLY if the QA/QC Coordinator is expected to be absent for an extended period of time (more than a day or two).

BACKGROUND

Sampling and sample handling prior to acceptance of samples by the laboratory are integral parts of the overall analysis effort. Compromised samples have a high potential to generate non-representative results.

The decision authority on analysis and the preparation of any cautionary statement are vested in the QA/QC Coordinator by the Laboratory QA Management Plan.

WPCL POLICY STATEMENT

TITLE Corrective Action Reports

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC _____ Production
DATE 9/23/04

POLICY

Corrective action is taken to identify and correct a non-conformance. In the laboratory, this refers to an analytical problem or a non-conformance to a QA/QC protocol. A Corrective Action Report (CAR) is used to document the problem and the corrective action. Each completed CAR becomes part of the laboratory QA records as evidence that non-conformances are investigated and corrected. A CAR also serves as information to help solve a problem if it happens again. In some cases it can lead to an improved procedure.

Corrective action must be taken when a procedure is not producing the expected results. This may be based on a QC failure, observed bias on a control chart, or after-the-fact realization of non-conformance to a QA protocol. A CAR is needed when the problem is systematic, cannot immediately be explained or resolved, or the reported results must be modified. One way to think about whether a CAR is required is to ask this question: In resolving the problem, did I learn something that would be helpful for another analyst to know? In general, a single QC failure does not warrant a CAR if the problem is immediately resolved or the cause was a simple mistake. For example, if an ammonia ICV fails at 50% recovery, then is re-prepared and passes, it is likely that the first one was simply prepared incorrectly, and a CAR is not required.

Here are examples of when a CAR is needed:

Method Blank is contaminated twice or more. Contamination in Method Blanks must be corrected immediately. Commonly, the analyst can guess at the likely source and prepare/analyze another blank to verify that the system is back in control. If the initial effort is not successful, corrective action must be taken to determine the source of contamination before other samples are analyzed.

Lapse in documentation. If the temperature of a sample storage refrigerator is not monitored for two weeks because the usual person is on vacation, a CAR must be implemented. In a case like this, the corrective action may be at the management level, to establish a new policy on vacation coverage.

Bias in QC results. If CCV or LCS recoveries are consistently above or consistently below 100% and approaching the acceptance limit, the cause of the bias must be investigated. Corrective action is needed even if the individual recoveries are considered acceptable, because a bias is evident.

A PT sample result is not within the acceptance range. PT samples serve as a form of performance audit because they come from an outside source and are of certified concentration. An unsuccessful PT suggests a systematic analytical error. The problem should be resolved before more samples are analyzed. (Quarterly blind QC samples are one type of PT sample.)

NOTE: Not every analytical problem requires a CAR, but any non-conformance that affects a sample result must, at a minimum, be noted when the result is reported. Refer to the Quality Manual for examples of when results require flags and comments. The analyst is responsible for making necessary comments on data reports. The analyst should not delete data that does not pass the QC criteria. Rather, any problems and the successful follow-ups must be documented.

WPCL POLICY STATEMENT

TITLE DATA ENTRY -- OUTSIDE LAB PQLs VS. MDLs

TYPE _X_ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES _X_ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC _____ Production
DATE April 2004

POLICY

(see definitions of acronyms below)

This policy establishes a protocol for data entry when results from an outside laboratory include both MDLs and either PQLs or MRLs. When two sets of limits are provided, use the PQL / MRL when entering data in the WPCL LIMS.

This policy is consistent with WPCL's data reporting protocol using MRLs, not MDLs. In Labworks the field is labeled "MDL", but on final reports for customers the field is labeled "MRL" .

Generally, laboratories that report both MDLs and other reporting limits use the EPA convention of the J-flag for results that are above the MDL but below the PQL / MRL. If a result is J-flagged, report it as an estimate (we use "EST" before the numerical result). A comment is then added in the Sample Comments field to explain the flag, for example: Pesticide results flagged as estimates were detected at concentrations below the Practical Quantitation Limits.

BACKGROUND

Data reports from other laboratories sometimes include two sets of minimum limits: statistical MDLs and reporting limits labeled as either PQLs or MRLs. In such cases, sample results that are above the MDL but below the PQL/MRL are J-flagged. This is a standard EPA flag indicating that the result should be considered an estimate because the target analyte was positively detected but the concentration value is too low to meet all QC precision criteria.

MDL = Method Detection Limit (a statistically derived value)
PQL = Practical Quantitation Limit (usually 5x to 10x the MDL, a value that indicates the lower level at which an accurate and precise value can be reported)
MRL = Method Reporting Limit (usually 3x to5x the MDL, an informal designation representing the lowest concentration that the analyst can report with confidence that the result is numerically meaningful)

WPCL POLICY STATEMENT

TITLE DOCUMENTATION FOR REAGENTS, STANDARDS, & MAINTENANCE

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE April 1999

POLICY

Following are documentation guidelines for 1) purchased reagents and standards, 2) in-house preparation or dilution of reagents and standards, and 3) equipment maintenance.

Documentation for each purchased reagent or standard:

Name of reagent or standard
Purity or concentration
Vendor
Date received
Lot number
Expiration date
Analyst's initials

The vendor's certificate of analysis may be used as documentation. These can be kept in 3-ring binders. If any of the above-listed information is not on the certificate, the analyst must write it on and initial the certificate. Often the expiration date is not on the certificate but is on the bottle. Always check to see that the lot number on the bottle and the certificate of analysis are the same.

If a certificate of analysis is not included with a reagent or standard, the information listed above must be entered in a reagent logbook.

On any purchased reagent or standard bottle, the person receiving it for the lab must write the date received on the bottle and initial it. The person who first opens the bottle must write the date opened on the bottle and initial it.

Documentation for preparation of a reagent or standard solution:

Preparation of all reagents and standard solutions must be documented in bound laboratory notebooks. Both the intermediate dilutions and final working solutions must be documented. At a minimum, the following information must be recorded for each preparation event.

Name of reagent or standard
Analysis
Date prepared
Analyst's initials
Expiration date
Stock source information =
    Purity or concentration
    Lot number

WPCL POLICY STATEMENT (CONTINUED)

Vendor
Final concentration in prepared solution
Recipe =
Solvent or grade of water used to dilute
Initial weight or volume of stock used
Final volume of prepared solution
Type of glassware/equipment used for preparation procedure
Procedural details, as needed (e.g., warmed to dissolve, mixed overnight)

The expiration date of a solution is determined either from the reference method, another technical source such as Standard Methods, or from the experience of the analyst.

Every preparation event must be individually documented. For commonly prepared solutions, it is not necessary to write the recipe details in the logbook every time. The recipe may be written in the logbook once and then the page number may be referenced. Each time the solution is prepared, make a new entry in the logbook that includes all of the items listed above except for the recipe. If the recipe changes in any way, write the new procedure on a new reference page. If a new notebook is started, be sure to write the procedure in the new notebook.

If the solution being made is a standard with multiple analytes, the analyte list may be referenced in the same way as for the recipe. List the analytes and their concentrations in the logbook once, then reference the page number each time a fresh solution is prepared. If the list changes or any analyte concentrations change, re-enter the revised list on a new page.

NOTE: If a recipe or analyte list is changed in any way, the new recipe or list must be written in the logbook on a new page. It is NOT acceptable to simply note the change on the original page.

Any solution that will be saved for more than 48 hours must be transferred to a labeled bottle for storage. Mark the bottle with the following information. (In the near future, appropriate bottle labels will be provided.)

Contents
Analysis used for
Preparation reference (notebook number and page)
Preparer's initials
Date prepared
Expiration date

Modern QA protocol for analytical laboratories requires a numbering system for reagents and standards. The numbering system provides a unique identification number for each solution that is purchased or prepared, so that the use of each solution can be tracked in association with analytical batches. This idea will not be immediately implemented at WPCL, but is a future QA goal.

Documentation for equipment maintenance:

A maintenance logbook must be kept for each major piece of laboratory equipment. This includes analytical instruments, sample preparation equipment such as hotblock and microwave digesters, and autoclaves. All preventative maintenance, cleaning, and repairs must be documented in this logbook, whether performed by the analyst or by the vendor or other outside technician. If a service company provides a detailed report of the service performed, this report may be maintained as documentation. However, the event must also be noted in the maintenance notebook, with reference made to the detailed report on file.

WPCL POLICY STATEMENT (CONTINUED)

The following information is needed for each maintenance entry:

Date
Analyst initials
Who provided the service, if done by vendor or service company
What was done, in reasonable detail
What parts were replaced, including part numbers if applicable

If the maintenance was needed because of poor equipment performance, the entry should begin with a description of the problem. Then include a step-by-step description of what was done to correct the poor performance, and evidence of proper performance after the maintenance.

For analytical instruments, it is important to document all physical changes including routine replacements of tubing, septa, filters, etc. Routine cleaning procedures must also be documented. Changes of compressed gas cylinders or dewars should be documented, either in the associated instrument maintenance logbook or in a separate log kept for gas sources.

The maintenance logbook is a good place to document QA events such as the periodic check of microwave power, the quarterly check of the autoclave timer, and temperature calibration of block digesters. The logbook may be used to record any instrument-specific information used to verify good performance.

BACKGROUND

A laboratory audit in late 1998 produced a number of recommendations regarding laboratory documentation procedures. While some reagents, standards, and equipment maintenance procedures were documented, there was no systematic or standard means of doing so. Each laboratory section now has bound notebooks to document these procedures.

WPCL POLICY STATEMENT

TITLE LABORATORY TOURS

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE March 20, 2002

POLICY

All tours of groups larger than four persons are limited to viewing laboratory operations from the hallway parallel to the west side of the lab. Tour groups of four persons or less MAY be allowed inside the laboratory at the discretion of the Laboratory Manager. In the absence of the Laboratory Manager, decision authority is delegated to the QA/QC Coordinator.

An exception may be made if the group is comprised of either laboratory/technical personnel or persons whose business requires access (for example, outside contractors who must make a detailed examination of laboratory physical plant). The decision to grant an exception is the responsibility of the Laboratory Manager. In the absence of the Laboratory Manager, decision authority is delegated to the QA/QC Coordinator.

All tours INSIDE the laboratory must be escorted. The primary escort shall be the Laboratory Manager. In the absence of the Laboratory Manager, the escort may be the QA/QC Coordinator or any other chemist, at the discretion of the QA/QC Coordinator.

BACKGROUND

Lab access must be limited and tours escorted because of the QA/QC requirement for the laboratory to demonstrate internal chain-of-custody AT ALL TIMES in the handling of samples and sample extracts. Without this strict access limitation, the laboratory would have to maintain paper chain-of-custody forms that would have to be filled out each time samples were placed in a refrigerator, moved from a refrigerator, and returned to a refrigerator. A chain-of-custody form would also have to be maintained for all sample extracts as they similarly move about the laboratory.

WPCL POLICY STATEMENT

TITLE MATRIX QC

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE October 1997

POLICY

This is a QA/QC policy statement to clarify the definition and purpose of matrix QC. Matrix QC consists of duplicates and spikes of actual samples. The purpose of matrix QC is to determine whether the sample matrix has an effect on the reproducibility of results or on the recovery of target analytes. In contrast, analytical system QC refers to method blanks, standards, fortified blanks, check standards, and other samples that verify acceptable method performance. (A separate memorandum will address the specifics of analytical system QC.)

Virtually all of the analyses performed in this laboratory require matrix duplicates at a rate of 10% of the samples. That is, for every 10 samples analyzed, at least one sample should be analyzed in duplicate. Matrix spikes are required for most analyses, also usually at a rate of 10%. Matrix spikes are not practical for some methods (solids, pH, alkalinity, etc.). Refer to the method SOP for specific matrix QC requirements.

Matrix QC must be performed on actual field samples. Duplicates and spikes of rinsate blanks, trip blanks, or filter blanks do not serve as matrix QC. These are field QC samples, and are essentially just deionized water. Do not use these for matrix QC analysis because they do not represent the sample matrix. Field QC samples are generally distinguishable from the real samples because they are usually clean and clear. If you cannot tell which samples are actual samples and which is a field QC sample, ask the sample custodian or the QA/QC chemist to determine this from the sampling paperwork.

The value of matrix QC is that it reveals matrix effects. If the analytical system QC indicates acceptable method performance, then poor matrix QC results are probably attributable to the matrix. However, the matrix effect must be proven. If a matrix QC sample does not meet acceptance criteria, every step of the analysis should be reviewed for possible errors. Correct any procedural errors and re-analyze the affected samples. The entire sample batch may require re-analysis. If no errors are apparent, the QC sample should be re-analyzed, including re-preparation. If the re-analysis gives similar results, then the unacceptable QC may be attributed to matrix effect.

The cause of unacceptable QC must be determined and corrected before any sample results are reported. If matrix effect is the cause, add a comment to the data report for the affected samples indicating that the results are estimates due to matrix interference. In instances where re-analysis is not possible, the associated sample result(s) may be flagged as an estimate or may be considered “not reportable”, depending on the analysis and how the data will be used.

BACKGROUND

As WPCL expands and improves its QA program, guidance is provided to the staff in order to define and distinguish among the types of analytical QC protocols. This policy is defines the QC measures used to determine whether a sample matrix may be affecting the accuracy or precision of the analysis. A separate policy statement on Analytical System QC has been prepared.

WPCL POLICY STATEMENT

TITLE METHOD APPROPRIATENESS

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE August 13, 2003

POLICY

The decision as to whether a particular method is appropriate for a requested analysis will be the responsibility of the QA/QC Coordinator, in consultation with the appropriate Section Chemist, IMS project manager, client (inside or outside), and the Laboratory Manager. This authority includes both analyses done in-house and analyses that are sent out to the WPCL contract laboratory. An example situation might be the client specifying a particular organic method and then requesting the analysis of a specific compound not normally quantitated by that method.

If the QA/QC Coordinator determines that the request is technically sound and allowed by the controlling regulations, the analysis is allowed to proceed, either by WPCL or by the outside contract laboratory. If the decision is made either that the request is not technically sound or that the appropriate regulations do not allow the analysis, the QA/QC Coordinator communicates the decision and the rationale to the IMS Project Manager. The IMS Project Manager contacts the client to explain the situation.

BACKGROUND

Such requests are often the result of the client not possessing the in-depth knowledge necessary to understand a method's applications and limitations. An example might be the requesting of an analysis for NPDES permitting that is not listed at 40 CFR 136 and is not specifically allowed by letter from the appropriate controlling agency. WPCL will try to assist the client in a search for a more appropriate way to provide the analytical answers they seek.

See also the WPCL Policy Statement "Requests For New/Unusual Analyses."

WPCL POLICY STATEMENT

TITLE REQUESTS FOR NEW/UNUSUAL ANALYSES

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE July 3, 2002

POLICY

Requests for new analyses must be made in writing to the laboratory QA/QC Coordinator using the attached form. Because the process can take a significant amount of time, the laboratory asks:

(1) communicate with the QA/QC Coordinator first to scope the degree of difficulty or expense that might be anticipated
(2) submit the request as soon as practically possible
(3) do not use the formal request process for casual information gathering.

ATTACHMENT

The attachment title is Request For New Analysis and is located on the S-Drive at Lab/Forms.

BACKGROUND

Use of the form ensures that all necessary information is at hand before the process begins, thus saving a significant amount of time. The form provides essential information to answer the following questions:

(1) Is the new analysis something WPCL could gear up to do?
(2) Will the new analysis have to be subcontracted?
(3) What outside lab is doing the analysis now?
(4) What outside lab would be willing to gear up to do the analysis?
(5) How much will the analysis cost?

WPCL POLICY STATEMENT

TITLE RECORDS RETENTION

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE January 2, 2002

POLICY

Lab-generated paper records will be retained for ten years, as stated in the Laboratory QA Management Plan. Older records will be destroyed unless the pertinent client wants them retained. In the latter case, the records will be physically transferred to the client under chain-of-custody and will be stored away from any laboratory storage location.

Laboratory Information Management System data entry printouts will be retained for two years.

Oversight of the retention and destruction of laboratory records is the responsibility of the Laboratory QA/QC Coordinator.

ATTACHMENTS

Oregon Administrative Rules: OAR 166-200-0120, Public Works, Wastewater Treatment Records.

BACKGROUND

Records retention for laboratory data is covered in the Oregon Administrative Rules for wastewater treatment plant operations and permits. In general, the retention is permanent for reports and any addenda and/or modifications and is five years for “other records.” The Laboratory QA Management Plan specifies ten years for ALL laboratory generated reports. This policy adheres to the latter, more conservative time scale.

WPCL POLICY STATEMENT

TITLE SAMPLE DILUTION

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE July 1998

POLICY

This a QA policy statement on sample dilution factors and the dilution process. There are two main reasons that a sample may require dilution. First, the analyte concentration is greater than the calibration range. Second, the sample matrix must be diluted to prevent degradation of the analytical system. The reason for dilution is key to determining the dilution factor. The dilution process must be accurate.

Concentration exceeds the calibration range

Most dilutions are needed because the analyte concentration is outside the calibration range. In this case, dilution must bring the concentration down to within the calibration range, but not too low. The most accurate quantitation occurs when the sample concentration is between the mid-point and high point of the calibration range.

A good dilution factor can be estimated using the high end and mid-range values of the calibration range. For example, an undiluted sample reads 342 ppm and the analysis is calibrated up to 100* ppm, making the mid-range of the calibration 50* ppm. Do the following calculations:

$$\frac{342}{100^*} = 3.4$$

$$\frac{342}{50^*} = 6.8$$

To attain a concentration within the upper end of the calibration range, try a dilution factor between 3.4 and 6.8. In this case, a good choice would be 5.

If an un-diluted sample result is far above the calibration range, it may be a poor estimate of the true concentration. If the concentration is very high, the analytical system may become overloaded. The analyst must be aware of the limits of the procedure, both for sample preparation and the analysis. For high-level samples, multiple dilution attempts may be needed to produce a result within the upper end of the calibration range. For example, an undiluted sample reads 1650 ppm and the analysis is calibrated up to 50 ppm, making the mid-range of the calibration 25 ppm. Do the following calculations:

$$\frac{1650}{50} = 33$$

$$\frac{1650}{25} = 66$$

WPCL POLICY STATEMENT (CONTINUED)

The apparent choice for dilution factor would be 50 (between 33 and 66). But because the sample concentration is far greater than the calibration range, the sample may require a higher dilution. It would be best to do at least 2 dilutions: one at 50, another at 100. If there is any indication of system overload, even higher factors may be needed.

The result for a diluted sample must be evaluated to insure that the dilution factor was appropriate. If the diluted sample response is still greater than the highest standard, re-analyze using a higher dilution factor. If the diluted sample response is less than the mid-point calibration standard, re-analyze using a lower dilution factor.

For some instrumental analyses, the dilution factor can be programmed into the computer for automatic calculation of the final result. If this automatic process is used, the result for the diluted sample must be evaluated with the dilution factor in mind. This can be done either of two ways. The direct way is to evaluate instrument response. The raw counts for the diluted sample must be no greater than the raw counts for the highest calibration standard. The indirect way is to divide the final calculated result by the dilution factor. Verify that this value is no greater than the concentration of the highest standard.

Sample matrix requires dilution

Sometimes a sample is diluted based on its appearance rather than a high concentration of a target analyte. The decision to dilute a difficult matrix should balance the following considerations.

Dilution of a difficult matrix can reduce interferences. This simplifies the analysis and reduces QC failures. That is, the higher the dilution factor, the easier the analysis. Dilution also protects the analytical equipment. It can prevent instrument carryover and cross-contamination of samples. In some cases, a bad matrix can contaminate an instrument to the point that the system must be taken down and cleaned. For these reasons, matrix dilution is a useful approach to handling difficult matrices.

The counter-consideration is that target analytes may be diluted out to non-detectable levels. The analytes' reporting limits are increased by a factor equal to the dilution factor. So if a sample is diluted by 10, an analyte that has a usual reporting limit of 2.0 ppm now has a reporting limit of 20 ppm. This can be a problem if the increased reporting limit is above a monitoring level or violation limit. Because of this consideration, dilution factors based on matrix should be kept as small as possible. A common tendency is to over-dilute. Sometimes a dilution factor of 2 is sufficient to reduce matrix interference, while raising the reporting limit by a factor of only 2.

Dilution Procedure

For samples that exceed the calibration range, samples are usually diluted after the preparation procedure. The dilution matrix should match that of the other samples and standards. If the reason for dilution is to reduce matrix interference, dilution is generally done before sample preparation. This approach may also be used for samples that are known to contain the analyte(s) of interest at high concentration. For example, a sample with greater than 0.1 mg/L silver must be diluted prior to sample digestion because silver at higher concentration can precipitate during the procedure. Additional post-digestion dilution may also be required.

Ideally all dilution procedures should utilize volumetric glassware. An automatic pipettor is not equivalent to volumetric glassware, but is often used for convenience. A pipettor must be used properly in order to get the best results. Select a volume range attachment based on the volume needed. Always work in the upper half of the range, for increased accuracy. For example, to pipet

WPCL POLICY STATEMENT (CONTINUED)

750 μL use an attachment with a range no greater than 100 μL. If you use the 250 μL attachment to pipet 50 μL, you are working at the lower end of the range, and this decreases accuracy in the measurement. Always observe the pipet tip carefully during the pipetting process. If there are air bubbles or drips, the tip has not been properly attached or is not sealed. Discard that tip and try again. There should be a smooth flow of liquid into the pipet tip and the liquid should stay in the tip without dripping.

If a dilution factor of more than 100 is required, make serial dilutions rather than a single dilution. For example, if the required dilution is 500, first dilute the sample 1:10, then dilute that solution 1:50. Alternatively, use 1:20 and 1:25. Make the smaller dilution first. This two-step procedure is more accurate than a single 1:500 dilution.

When the diluted sample has been analyzed, think about whether the result makes sense. Except for very high-level samples, the final calculated result for the dilution should be similar to the non-diluted result. If not, look for possible errors in the dilution process.

Always write down the volumes used for dilution. That is, do not simply write “diluted 1 to 50”. Rather, write the specific volumes, such as “diluted 500 μL to 25 mL”. This allows you to review the details of the procedure if there is any question about the results.

Summary

Samples that are diluted because of high concentration should be targeted to the upper half of the calibration range. Samples diluted to reduce matrix interference should be diluted as little as necessary. Sample dilution is a manipulation of the sample. It should be done with maximum care and precision because an error in the dilution process will cause inaccurate sample results. Compare dilution results with the original analysis to verify sensibility.

BACKGROUND

The degree to which a sample is diluted for analysis affects the final result and reporting limit. Excessive dilution lowers the precision of a result for a detected analyte, and may raise the reporting limit for a non-detected analyte beyond an acceptable level. This policy provides guidance on how to determine an appropriate dilution factor.

WPCL POLICY STATEMENT

TITLE SAMPLE RECEIVING

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE January 2002

POLICY

The Sample Custodian must be notified when samples are delivered to the laboratory. This is especially important when samples are delivered to the front desk in the building lobby. If the Sample Custodian is absent, the following may be contacted, in descending order:

Sample Custodian Designated Alternate
QA/QC Coordinator
Laboratory Manager
Any other member of the laboratory staff

The Sample Custodian is charged with the responsibility for day-to-day sample receipt and log-in. The Sample Custodian also serves as the point person if there are questions about samples, chain-of-custody, hold times, preservation, etc. The Sample Custodian has the responsibility for notifying the QA/QC Coordinator for corrective action guidance.

BACKGROUND

In the past, non-laboratory personnel were taking samples in the lab, opening coolers, and filling out chain-of-custody forms. This is a violation of the Laboratory QA Management Plan. Adherence to the notification hierarchy listed above will maintain sample receiving QA compliance, remove confusion and uncertainty, and will avoid the situation in which key, need-to-know lab staff are unintentionally left out of the loop.

WPCL POLICY STATEMENT

TITLE SIGNIFICANT FIGURES AND ROUNDING OFF

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE November 2002

POLICY

This policy is a summary and update of rules for significant figures and rounding off.

Significant figures

The standard laboratory criterion is used for assigning significant figures: The measurement with the least number of significant figures determines the significant figures in the final reported result. With that stated, there are still questions about the precision of some measurements, and sample matrix can affect the precision of measurements applied to the sample. When matrix effects are apparent, fewer significant figures should be reported.

The number of significant figures reported for a given analysis also depends upon how close the result is to the reporting limit. Lower results commonly have fewer significant figures reported because the significance of digits that are lower than the reporting limit is questionable. Sample results are generally reported to no more than one decimal place past the reporting limit places, and may be limited to the same number of places as in the reporting limit.

Following are the established usages of significant figures for the analyses performed at WPCL.

Analysis	Significant Figures Reported
Alkalinity	3 generally, but 2 for results <10.0
Ammonia	3 generally, but 2 for results <1.00
Anions (F, Cl, NO_3, Br, SO_4)	2
BOD	up to 3, whole numbers only
COD	2
Color	up to 2, to the nearest 5 CU
Conductivity	3
Cyanide	3 generally, but 2 for results <1.00
Flashpoint	up to 3, whole numbers only
Hardness (by ICP)	3
MBAS Surfactants	2
Metals by ICP	3, down to 0.001 ppm
Metals by ICP-MS, water	3, down to 0.001 ppb
Metals by ICP-MS, soil	3, down to 0.01 ppm
NWTPH-Dx (soil)	up to 3, whole numbers only
Nitrite	3 generally, but 2 for results <1.00
Oil & Grease	up to 3, depending on sig.figs. in the weight of residue
ortho-Phosphate	3 generally, but 2 for results <1.00

WPCL POLICY STATEMENT (CONTINUED)

PCBs	up to 3, whole numbers only (ppb)
pH	report to the tenths place
Phosphorus, Total	3 generally, but 2 for results <1.00
Residual chlorine	3 generally, but 2 for results <1.00
Semivolatile Organics	3 generally, but 2 for results <10 ppb
Sulfide	2
TKN	3 generally, but 2 for results <1.00
TDS	up to 2, whole numbers only
TS	up to 3, depending on sig.figs. in the weight of residue
TSS	up to 3, depending on sig.figs. in the weight of residue
Turbidity	whole numbers only, depends on the range of NTU:

Turbidity Range	Report to the nearest NTU
5-40	1
41-100	5
101-400	10
401-1000	50
>1000	100

Volatile Organics	3 generally, but 2 for results <10 ppb

Rounding off

The basic protocol for rounding off is well known by now: above 5 rounds up, below 5 rounds down, and 5 rounds to the nearest even number. Thus, 8850 rounds to 8800. There are at least two specific points that need clarification. The first is what to do when there are digits other than zero following a 5 which is to be rounded. For example, if you want to round the number 8851 to two significant figures, do you consider only the "5", and round to 8800, or do you consider that "51" is greater than 50, and therefore round up to 8900. According to the book *Quality Assurance of Chemical Measurements* (J.K. Taylor, 1987), you do consider figures that come after the 5, so the number 8851 would round up to 8900.

The second common question concerns *when* to do the rounding. Always use more significant figures in the calculations than will be used for the final reported result. If, for example, a sample is diluted for analysis, applying the dilution factor too early will affect the final result:

Analysis result = 156	Rounded analysis result = 160
Dilution factor = 2	Dilution factor = 2
Final result = 312, rounded to **310**	**Final result = 320**

When calculating QC statistics, very different values may be attained when working at the high or low end the result range. For spike recoveries, if the sample result is above the spike amount, the calculated spike recovery can be significantly affected by rounding:

Sample result = 116 mg/L	Rounded sample result = 120
Spike amount = 50 mg/L	Spike amount = 50 mg/L
Spike result = 164	Rounded spike result = 160
Spike recovery = 96%	**Spike recovery = 80%**

For duplicate RPD, the effect is especially evident at the low end of the reporting range when fewer significant figures are reported at the low end:

TSS Result 1 = 7.6	Rounded result 1 = 8
TSS Result 2 = 6.4	Rounded result 2 = 6
RPD = 17	**RPD = 29**

WPCL POLICY STATEMENT (CONTINUED)

These two QC examples both show situations that favor the analyst by not rounding too early. There are other situations where rounding would bring unacceptable QC results into range, but it is not allowable to use rounding to make the data look better. The WPCL policy is to always use at least one extra significant figure in calculations, leaving the rounding until the end.

BACKGROUND

The number of significant figures reported for a sample result depends on the precision of the measurement system. Different analyses have different levels of precision. This policy states the determined number of significant figures to be reported for the various analyses performed at WPCL, and also clarifies aspects of the protocol for rounding off to significant figures for final reporting and QC calculations.

WPCL POLICY STATEMENT

TITLE SUMMARY OF KEY QUALITY ASSURANCE PROCEDURES

TYPE ___ QA/QC ___ Internal Lab Operations ___ Outside Relations
ATTACHMENT AS PART OF POLICY ___ YES ___ NO
CONCURRENCES _____ Laboratory Manager _____ QA/QC Coordinator
DATE April 1998

POLICY

As customers become more aware of analytical issues for their monitoring projects, there is increasing expectation that WPCL will perform at the same quality level as is required of the commercial environmental laboratories. In general, it is EPA QA/QC guidelines that set the standard for laboratory performance. Following is a list of quality assurance protocols that are applicable to environmental laboratories.

- Everyone is responsible for quality assurance. QA is not a set of rules for the QA chemist to follow. It consists of procedures that are followed everyday by everyone in the lab.

- The lab must used established methods of analysis and must reference the specific methods used. Modifications must be documented and proven equivalent to the standard method. If an established method does not exist, a written procedure must be prepared, including QC data to support the validity of the procedure.

- The lab must employ standard analytical practices that maximize data quality. Examples of such practices include:

    - the use of reagent-grade (or better) chemicals
    - use of Class A glassware for preparation of standards and quantitative reagents
    - appropriate glassware cleaning procedures
    - aseptic technique for microbiological testing
    - periodic calibration of measuring devices (balances, pipettors, pipettes, burets, thermometers, etc.)
    - serial dilution technique for preparation of low-level standards and reagents

- Documentation is a key factor in QA. Adequate documentation is necessary for future understanding of data that is produced today.

    - Every step of an analysis must be documented. Details such as volumes, weights, temperature, wavelength, and reagent concentrations must be documented. Sample preparation must be documented in a lab notebook, even if the analysis is documented by a computer print-out. This includes preparation of QC samples. Observations about samples should also be noted in the lab notebook.
    - The preparation of standards and spiking solutions must be documented in a lab notebook.
    - The preparation of reagents must be documented in a lab notebook.
    - Temperatures of sample storage refrigerators, incubators, water baths, etc., must be documented daily on temperature log sheets.
    - Raw data from analytical instruments must be archived in electronic format.

WPCL POLICY STATEMENT (CONTINUED)

- Corrections to written documentation must be lined-out, initialed, and dated; do not scribble out mistakes.

- Sample chain-of-custody is essential to the validity of lab data. Any sample received in the laboratory must be documented on a chain-of-custody form and logged into the LIMS.

- SOPs should be updated any time there is a change in procedure. For example, if a block digester replaces heating mantles, or if a new instrument is put into use.

- QA documents (QA Plan, SOPs) and laboratory notebooks need to be "controlled". This is NOT to limit access in any way. The main purposes of document control are 1) to provide evidence of up-to-date QA documents in place during a given time period, 2) to ensure that everyone is working from the same revision of a particular document, and 3) to provide a tracking mechanism for data.

- Samples must be properly collected, preserved, and stored prior to analysis. Results for samples that are improperly collected, preserved, or stored are not valid.

- Training must be documented, and the trainee must demonstrate proficiency. Further, an analyst must regularly perform an analysis in order to maintain proficiency.

- Non-conformances and subsequent corrective actions must be documented by the analyst. Routine corrective actions may be documented in laboratory notebooks such as instrument maintenance logs and standard preparation notebooks.

- QC samples are necessary for every analysis, for every batch analyzed. Typical QC samples are method blanks, sample duplicates, blank spikes, matrix spikes, etc.

- Instruments must be calibrated prior to sample analysis. For some methods, verification of a previous calibration is adequate. An instrument must always be re-calibrated after significant instrument maintenance.

- Method detection limits must be established and documented for all analyses. Method detection limits must be verified after significant instrument maintenance.

- All analytical data must be reviewed by a peer or supervisor.

- Sample results must be flagged as estimates on the report if QC requirements were not met for the analytical batch.

- Periodic performance audits are necessary to provide evidence of acceptable lab performance. External performance evaluations, such as EPA-DMR studies, represent this lab compared to other similar labs. Internal blind QC samples allow the individual analyst to compare his/her results to known values, with the main goals of learning and improving analytical processes.

BACKGROUND

In order to serve customers' needs, WPCL must increase its conformance with EPA standards for quality assurance in the laboratory. This document provides the staff with a summary of expectations for QA/QC in everyday lab functions.

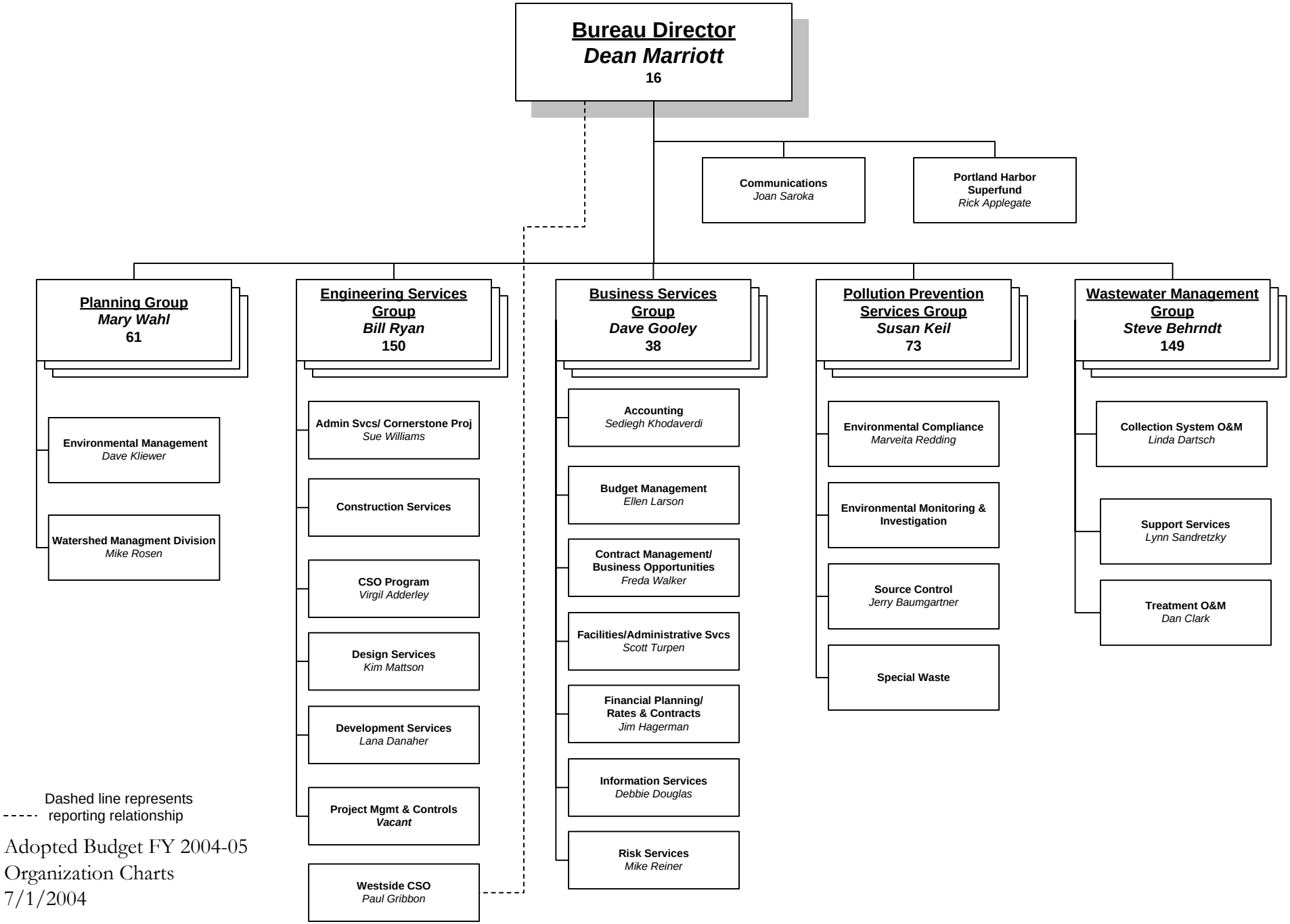
Appendix F
Organizational Chart

Division within Bureau and Group

BUREAU OF ENVIRONMENTAL SERVICES -- CITY OF PORTLAND

FY 2004-05

487 FTEs



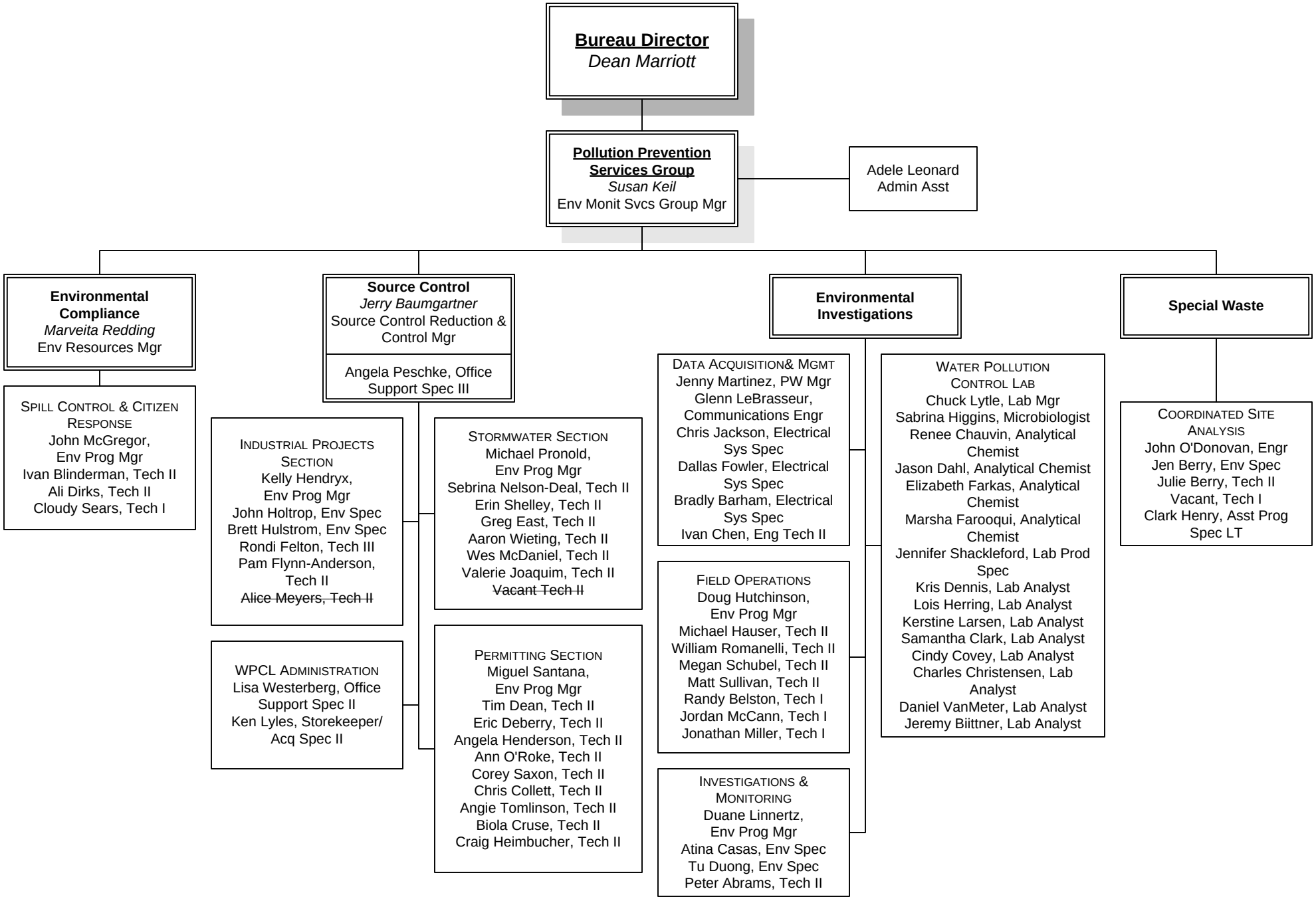
Dashed line represents reporting relationship

Adopted Budget FY 2004-05
Organization Charts
7/1/2004

Appendix G
Organizational Chart

Laboratory within Group and Division

Pollution Prevention Services Group



Appendix H
City Job Descriptions

CLASS SPECIFICATION
Laboratory Manager

FLSA Status: Exempt
Union Representation: Nonrepresented

GENERAL PURPOSE

Under general direction, plans, organizes and directs the performance of complex chemical, bacteriological and physical analyses of water and wastewater, using sophisticated laboratory instrumentation and technology in the operation of a water quality laboratory; reviews, comments and makes recommendations regarding treatment processes to ensure compliance with federal and state laws and regulations; and performs related duties as assigned.

DISTINGUISHING CHARACTERISTICS

Positions in this class are responsible for planning, coordinating and managing all activities and personnel at a large water quality-testing laboratory in either the Water Bureau or Environmental Services Bureau. The work of this class is complex and involves significant accountability for ensuring the assigned bureau's operations are carried out in compliance with federal and state laws and regulations.

ESSENTIAL DUTIES AND RESPONSIBILITIES

Any one position in this class may not perform all the duties listed below, nor do the listed examples of duties include all similar and related duties that may be assigned to this class.

1. Plans, organizes, controls, integrates and evaluates the work of the assigned laboratory operations division; with subordinates, develops, implements and monitors work plans to achieve division mission, goals and performance measures; directs the development of and monitors performance against the biennial laboratory budget; manages and directs the development, implementation and evaluation of work programs, plans, processes, systems and procedures to achieve City and bureau goals, objectives and performance measures consistent with the City's quality and citizen service expectations.

2. Plans, organizes, directs and evaluates the performance of assigned staff; establishes performance requirements and personal development targets; regularly monitors performance and provides coaching for performance improvement and development; provides compensation and other rewards to recognize performance; recommends disciplinary action, up to and including termination, to address performance deficiencies, in accordance with City Charter, Code, human resources policies and labor contract agreements, subject to director and City management concurrence.

3. Provides leadership and works with staff to develop and retain highly competent, service-oriented staff through selection, compensation, training and day-to-day management practices that support the City's and bureau's mission, objectives and service expectations; provides leadership and participates in programs and activities that promote workplace diversity and a positive employee relations environment.

4. Advises management on water quality-related issues and makes recommendations on water quality regulatory impacts and the resolution of water quality problems.
5. Ensures the laboratory meets all federal and state certification requirements.
6. Reviews and coordinates with appropriate personnel the implementation of local, state and federal laws and regulations pertaining to water quality, water quality analysis and testing.
7. Prepares special or recurring reports and technical studies; develops recommendations to improve water quality; coordinates work with various divisions and others in making system modifications.
8. Directs laboratory staff in performing quality assurance and quality control programs as mandated by federal and state regulation.
9. Reviews proposed regulations for impacts on the City's water or wastewater operations; recommends changes in programs, processes and operations to comply with new regulatory requirements; provides advice and technical assistance to bureau management regarding water and wastewater treatment processes.
10. Drafts monthly, quarterly, semi-annual and annual reports; provides assistance to consultants and state regulatory agents during on-site inspections and sampling.
11. Oversees the preparation and standardization of laboratory reagents; approves requisitions and directs maintenance of an inventory of laboratory chemicals and supplies; drafts bid specifications for the purchase of laboratory equipment; drafts Requests for Proposals and contract requirements for the conduct of special water quality studies.
12. Communicates directly with bureau customers; works with the public in matters of water quality; recognizes customer complaints and deals with difficult and sensitive issues in a professional and diplomatic manner in order to enhance customer relations.
13. Reviews and ensures accuracy of charges for laboratory services prior to customer billing

MINIMUM QUALIFICATIONS

Knowledge of:

1. Federal and state regulations applicable to the operations of wastewater treatment plants and potable water systems.
2. Theory, principles, practices and methods used in complex chemical, bacteriological and physical analysis and testing of water.
3. Methods and processes used in water and wastewater treatment.
4. Applicable analytical chemistry, organic chemistry, inorganic chemistry and bacteriological analysis, and chronic and acute toxicity testing.
5. Safe laboratory practices and procedures.
6. Budgeting and purchasing practices and procedures.

7. Principles and practices of effective management and supervision.

Ability to:

1. Analyze, evaluate, interpret, explain and apply complex federal and state environmental law and regulations.
2. Use complex laboratory equipment in the analyses of samples.
3. Repair and maintain laboratory equipment.
4. Communicate clearly, accurately and concisely, orally and in writing.
5. Organize, set priorities and exercise sound independent judgment within areas of responsibility.
6. Prepare clear, accurate and concise technical reports on complex water quality issues.
7. Maintain records and files on testing, analysis, quality assurance and control in conformance with regulatory requirements.
8. Establish and maintain effective working relationships with staff and others encountered in the course of work.

Training and Experience:

A typical way of obtaining the knowledge, skills and abilities outlined above is graduation from a college or university with a major in analytical chemistry, organic chemistry, biology or a closely related field; and five years of increasingly responsible chemical or biological laboratory experience involving chemical, bacteriological, physical analyses and chronic and acute toxicity testing typically performed in a water quality laboratory; or an equivalent combination of training and experience.

Licenses; Certificates; Special Requirements:

A valid state driver's license.

Appropriate state-required certification.

OSHA 1910.120 Hazardous Materials Handling & Response Certification.

PHYSICAL AND MENTAL DEMANDS

Persons with disabilities may be able to perform the essential duties of this class with reasonable accommodation. Reasonable accommodation will be evaluated on an individual basis and depends, in part, on the specific requirements for the job, the limitations related to disability and the ability of the hiring bureau to accommodate the limitation.

Class History:

Adopted: 07-01-02

Revised:

Class created as a result of Nonrepresented Classification & Compensation Study, 2000-2002. This class is composed of positions from the following class(es):

2034 LABORATORY MANAGER. Adopted: 02-21-78; Revised: 07-01-90, 07-01-92, 01-17-01

City of Portland **3280-3288**

Laboratory Analyst Series

FLSA Status: Covered
Bargaining Unit: District Council of Trade Unions (DCTU)

FLSA Status: Exempt
Bargaining Unit: District Council of Trade Unions (DCTU)

General Summary

Positions in this broad class collect and conduct laboratory analyses of field samples for public health and protection of the environment.

Laboratory Analyst - 3280

Distinguishing Characteristics

The journey level of this class typically performs sampling and testing work subject to quality control protocols and program direction from a Chemist or Microbiologist.

Typical Duties/Examples of Work

1. Collects samples of potable water, ground water, surface water, waste materials, soils, sludges, sediments, and/or composted materials as required for analysis.

2. Conducts laboratory analyses of samples to produce relevant data.

3. Follows quality assurance methods to maintain standards for procedures and data collection.

4. Takes appropriate action when needed in response to technical and operational problems.

5. Performs related duties as assigned.

Required Knowledge, Skills and Abilities

Knowledge of: laboratory and sample collection practices and methodologies; chemistry and/or microbiology; mathematics used in statistics

Ability to: adhere to rules and regulations regarding sample collection and analysis; communicate effectively, orally and in writing; establish and maintain effective working relationships with co-workers; work constructively in a team; diagnose and correct problems with laboratory equipment and/ or procedures.

Skill in: sample collection; utilizing laboratory equipment and computers to conduct sample and data analyses

Special Requirements

Valid state driver's license. Requires course work in laboratory sciences, laboratory experience, related field or equivalent.

Classification History:
Adopted: 2-03-99:
Class created as a result of DCTU Classification and Compensation Study 1998-99.
This class is composed of the following classes:
3280 Water Lab Tech

Microbiologist - 3284

Distinguishing Characteristics

The senior level of this class (as is the Chemist) typically has program responsibility and performs statistical analyses for quality assurance. It is distinguished from the Laboratory Analyst by its lead, program and quality assurance responsibilities. It is distinguished from the Chemist by its professional focus.

Typical Duties/Examples of Work

1. Collects samples and conducts laboratory work with a focus on microbiological analysis and related equipment.

2. Provides scientific quality control and assurance; oversees quality assurance and quality control program for assigned area.

3. Reviews and/or takes corrective action when needed in response to technical and operational problems.

4. Performs statistical analysis for quality assurance; carries out data and process analysis.

5. Plans, schedules and coordinates work; determines resource needs of work group; directs work of assigned work group; reviews the work of and provides training and guidance to assigned staff.

6. Performs related duties as assigned.

Required Knowledge, Skills and Abilities

Knowledge of: microbiology; laboratory equipment used in microbiological analysis; advanced mathematics; statistical analysis, process control and quality assurance techniques

Ability to: schedule and assign the work of others; lead, coach, monitor, and motivate staff

Skill in: interpreting, following and applying rules and regulations regarding sample collection and analysis. Planning and defining sample collection; utilizing laboratory equipment and computers to conduct sample and data analyses. Oral and written communication and communicating technical concepts; diagnosing and correcting problems with laboratory equipment and/ or procedures; ensuring quality assurance and process control. Instructing and overseeing others in safe and effective microbiological sample collection and use of analytical equipment. Providing lead direction to staff, including assigning and reviewing work; demonstrating techniques to others; providing training to others

Special Requirements

Valid state driver's license. Requires degree in microbiology and laboratory experience, or equivalent.

Classification History:
Adopted: 2-03-99:
Class created as a result of DCTU Classification and Compensation Study 1998-99.
This class is composed of the following classes:
3284 Water microbiologist

Chemist - 3285

Distinguishing Characteristics

The senior level of this class (as is the Microbiologist) typically has program responsibility and performs statistical analyses for quality assurance. It is distinguished from the Laboratory Analyst by its lead, program, and quality assurance responsibilities. It is distinguished from the Microbiologist by its professional focus.

Typical Duties/Examples of Work

1. Collect samples and conducts laboratory work with a focus on chemical analysis and related equipment.

2. Provides scientific quality control and assurance; oversees quality assurance and quality control program for assigned area.

3. Reviews and/ or takes corrective action when needed in response to technical and operational problems.

4. Performs statistical analysis for quality assurance; carries out data and process analysis.

5. Plans, schedules and coordinates work; determines resource needs of work group; directs work of assigned work group; reviews the work of and provides training and guidance to assigned staff.

6. Performs related duties as assigned.

Required Knowledge, Skills and Abilities

Knowledge of: chemistry; laboratory equipment used in chemical analysis; advanced mathematics; statistical analysis, process control and quality assurance techniques

Ability to: schedule and assign the work of others; lead, coach, monitor, and motivate staff

Skill in: interpreting, following and applying rules and regulations regarding sample collection and analysis; planning and defining sample collection; utilizing laboratory equipment and computers to conduct sample and data analyses; oral and written communication and communicating technical concepts; diagnosing and correcting problems with laboratory equipment, procedures and analytical process; ensuring quality assurance and process control; instructing and overseeing others in safe and effective chemical sample collection and use of analytical equipment; providing lead direction to staff, including assigning and reviewing work; demonstrating techniques to others; providing training to others

Special Requirements

Valid state driver's license. Requires degree in chemistry and laboratory experience, or equivalent.

Classification History:
Adopted: 2-03-99:
Class created as a result of DCTU Classification and Compensation Study 1998-99.
This class is composed of the following classes:
3285 Water Analytical Chemist

Sr. Laboratory Analyst - 3287

Distinguishing Characteristics

The advanced level of this class typically has program responsibility for both Chemistry and Microbiology and is the designated Quality Assurance Officer for the lab. It is distinguished from the Laboratory Analyst by its lead, program, and quality assurance responsibilities. It is distinguished from the Microbiologist & Chemist by quality control responsibility for the entire lab, including work in both disciplines.

Typical Duties/Examples of Work

1. Provides scientific quality control and assurance for chemistry and microbiology lab work; insures that quality checks were performed and that analytical methods are followed; verifies that quality control criteria are met; verifies accuracy and completeness of data; performs statistical analysis for quality assurance; validates data generated by lab analysts; takes corrective action when needed; performs quality and maintenance checks on lab instruments.

2. Serves as focal point for quality assurance/quality control (QA/QC) issues and activities and oversees the quality program for the lab; develops or reviews new protocols and implements them once approved; updates and maintains quality manuals and documentation of Standard Operating Procedures (SOP); performs reviews of the lab's quality system; facilitates on-site accreditation assessments and prepares written responses to findings; coordinates proficiency testing; initiates corrective action and write corrective action reports; maintains quality control data records and archives; trains lab analysts and others on the content and use of the Quality Manual and SOPs; assists lab manager with keeping current on regulations and insuring that they are addressed.

3. Conducts laboratory work and analysis at an advanced level.

4. Plans, schedules and coordinates work; determines resource needs of work groups; directs work of assigned work groups; reviews the work of and provides training and guidance to assigned staff.

5. Performs related duties as assigned.

Required Knowledge, Skills and Abilities

Knowledge of: chemistry; microbiology; laboratory equipment used in chemical and microbiological analysis; organic and inorganic analytical instrumentation techniques; good laboratory procedures, including quality assurance and quality control; standard computer programs and software used to perform data analysis; advanced mathematics; statistical analysis; process control and quality assurance techniques; laboratory accreditation standards

Ability to: design, implement and monitor technical procedures and policies; perform QA/QC activities objectively and without outside influence; schedule and assign the work of others; lead, coach, monitor, and motivate staff

Skill in: identifying need for new practices or policies; interpreting, following and applying rules and regulations regarding sample collection and analysis and lab accreditation; planning and defining sample collection; utilizing laboratory equipment and computers to conduct sample and data analyses; oral and written communication and communicating technical concepts; diagnosing and correcting problems with laboratory equipment, procedures and analytical processes; ensuring objective quality assurance and process control; making verbal and written presentations; instructing

and overseeing others in safe and effective sample collection and use of analytical equipment; providing lead direction to staff, including assigning and reviewing work; demonstrating techniques to others; providing training to others

Special Requirements
Valid state driver's license. Requires degree in chemistry and laboratory experience, or equivalent. Requires demonstrated experience or training in microbiology.

Classification History:
Adopted: 7-11-03

Laboratory Production Specialist - 3288

Distinguishing Characteristics

This level in the series schedules and oversees all bench level work for a large laboratory with fluctuating workloads, and performs sampling and testing work. It is distinguished from the Microbiologist & Chemist by having laboratory-wide responsibility for scheduling and overseeing workflow. It is distinguished from the Sr. Laboratory Analyst by working in a large laboratory with fluctuating workload of significant variety.

Typical Duties/Examples of Work

1. Schedules Laboratory Analysts' daily work for the entire laboratory; meets with analysts daily to review laboratory workload and discuss assignments; utilizes knowledge of employees' training, experience and method certifications to make assignments; coordinates with Chemists and Microbiologists.

2. Works directly with field operations and other work groups on a daily basis to determine the amount and nature of incoming work and schedules staff in anticipation of workload variances; provides feedback to field operations regarding scheduling of sampling work as related to laboratory workload.

3. Tracks the progress of sample work through the laboratory, including fast turnaround and non-routine analyses; expedites the steps between sample receipt and data reporting by maintaining close contact with the laboratory staff; ensures that analyses are completed within holding times and within turnaround expectations.

4. Conducts laboratory analyses of samples to produce relevant data.

5. Contributes to evaluation of laboratory employees' work; assists with development of work plans.

6. Performs related duties as assigned.

Required Knowledge, Skills and Abilities

Knowledge of: Flow of work in an environmental lab, including sample collection, receiving, documentation, preparation and analysis, data validation and data reporting; regulatory programs and related sampling and analysis requirements, and analytical procedures; chemistry or microbiology; laboratory equipment used in chemical or microbiological analysis; advanced mathematics; statistical analysis; process control and quality assurance techniques.

Ability to: schedule and oversee work of professional and technical staff; understand needs of diverse client base, including engineers, planners, and scientists, and interact effectively with them; communicate effectively in verbal and written form; organize work, set priorities and exercise sound judgment; maintain records in conformance with regulatory requirements.

Skill in: collecting samples; utilizing laboratory equipment and computers to analyze samples and data.

Special Requirements
Valid state driver's license. Requires a degree in chemistry or microbiology and chemical or biological laboratory experience, or equivalent.

Classification History:
Adopted: 5-5-04

Working Conditions

Work in this class is typically performed in both a laboratory environment and a field environment. Incumbent is typically required to negotiate rough terrain; to lift up to 50 pounds; to work outdoors in all weather conditions; to wear protective gear; to potentially be exposed to hazardous materials.

Jeremy D. Biittner

Analyst

Summary of Experience:

Eight years of experience in environmental chemistry and microbiology using Standard Methods and EPA methods, including associated QC protocols. Bench methods include BOD, solids, alkalinity, pH, residual chlorine, volatile acids, and oil & grease. Instrumental experience with spectrophotometers, flow analyzers, IC and TOC. Microbiological testing for *E.coli*and fecal coliforms at WPCL, and previous experience with hydrocarbon degrading bacteria and enterococci. Additional experience in sampling using composite samplers (ISCO and Sigma).

Current Duties:

- Wet Chemistry – pH, Volatile acids, alkalinity, BOD5, solids, residual chlorine
- Microbiology – E.coli and Fecal Coliform MPN
- Oil and Grease analysis by solid phase extraction - gravimetric
- ortho-Phosphate ans Nitrite by flow injection analysis
- Collection of samples from treatment plant composite samplers at WWTP

Education and Training:

BS in Biology/Chemistry minor - University of Wisconsin at LaCrosse, 1997

Career Chronology:

October 2002 to present	Analyst, City of Portland, Water Pollution Control Laboratory
July 1998 to October 2002	Lab Analyst, North Creek Analytical
June to September 1997	Field Biology Intern, National Park Service, Montrose, CO
Jan 1995 to May 1996	Lab analyst, Davy Environmental Laboratory

Key Projects and Experience:

Studied BOD blank and seed depletion problems. Discovered solutions to current issues that were eventually implemented by management. (2004).

Helped the microbiology department organize its QC information and rewrite SOPs in an effort towards NELAC certification (2003-2005).

Performed MDL study and linearity study for Chlorophyll-*a* analysis (2005).

Renee Chauvin

QA/QC Chemist

Summary of Experience:

Environmental analysis, technical program management, QA/QC management, data validation, hiring and training, customer service, safety management.

Current Duties:

Technical QA/QC oversight; review of laboratory protocols, SOPs, and logbooks; oversight of implementation of corrective actions; supervision of chain-of-custody and evidentiary procedures; ensuring that program and project-specific DQOs are met; oversight of data management tasks including LIMS data entry and report production; oversight of laboratory training program; primary interface with clients in questions of data quality.

Education and Training:

M.S., Zoology, Louisiana State University, 1985
B.S., Zoology, Louisiana State University, 1976
Technical training GC/MS analysis

Career Chronology:

1997 - present	QA/QC Chemist City of Portland, Water Pollution Control Laboratory, Portland, Oregon
1996 - 1997	QA Officer, QA Chemist U.S. Army Corps of Engineers, Troutdale, Oregon
1993 - 1994	Technical Director Hughes Analytical Laboratory, Gresham, Oregon
1985 - 1992	Technical Director, Organic Section Manager, Chemist Coffey Laboratories, Inc., Portland, Oregon

Key Projects and Experience:

Upgraded laboratory QA/QC program to meet basic EPA requirements under CWA and RCRA for analytical QC, training, documentation, and reporting protocols (City of Portland WPCL, 1997-99).

Managed the process to attain laboratory accreditation by State of Washington Department of Ecology environmental laboratory accreditation program (Hughes Analytical Laboratory, 1994).

Established laboratory-wide data review and validation requirements, and formal training program (Coffey Laboratories, Inc., 1990-91).

Established GC/MS analytical programs to meet EPA requirements under CWA and RCRA (Coffey Laboratories, Inc., 1986; Hughes Analytical Laboratory, 1994).

Presentations on laboratory topics for wastewater professionals (1998 - 2004) and for drinking water operators (1987, 1988, 1990).

Participation with the Oregon State Health Division, Clandestine Drug Lab Committee, and panel member for round-table discussion for the public (1987-1988).

Charles K Christensen

Analyst

Summary of Experience:

Five years of diverse environmental analytical experience in both the private and public sectors. Have performed work as general lab analyst, sample custodian, field sampling technician, microbiologist and GC chemist on all types of matrices including drinking water, wastewater, soil and food products.

Current Duties:

Serve as Sample Custodian. Responsible for receiving samples, preserving and distributing samples to appropriate lab areas. Log all samples into LIMS and log analyst data into LIMS. Work one day a week in Process Control area, analyzing wastewater treatment plant samples for BOD, TSS, TS, volatile acids, pH and alkalinity.

Education and Training:

B.S., Chemistry, Pacific Lutheran University, 1999

Career Chronology:

2004 - present	Laboratory Analyst, City of Portland WPCL, OR
2002 - 2004	Laboratory Technician, City of Salem, OR
1999 - 2001	Sample Custodian, GC Chemist, Microbiologist, Laucks Testing Labs, Seattle, WA

Key Projects and Experience:

Experience as drinking water distribution system daily sample collector, including both routine sampling as well as customer complaints. Also included routine maintenance of chlorine analyzers at system reservoirs and pump stations.

Experience performing all analytical and project management duties within microbiology department at commercial lab. Duties included phone customer service, reporting, ordering of supplies, media preparation and all types of analytical testing.

Experience operating and troubleshooting multiple HP GC-FID systems in the analysis of extractable hydrocarbons using EPA SW-846, NWTPH, California LUFT and Alaska state methods on both water and soil samples. Preparation of CLP-like data packages for the above analyses.

Samantha E. Clark

Chemist

Summary of Experience:

Over four years experience in environmental analytical chemistry, including volatile and semivolatile extractions for trace organic analytes, volatile and semivolatile GC analysis for trace organic analytes by FID, PID, and ECD detectors, digestions for trace metals and mercury, and wet chemistry methods such as pH, solids, BOD, COD and TOC for natural waters, industrial waters, and sewage treatment plant solids and waters.

Current Duties:

In the Organics department responsible for the analysis of soil and water samples for Hydrocarbon Identification (HCID) screens, Diesel (Dx) by the NorthWest Total Petroleum Hydrocarbon method, and soil samples for PolyChloroBiphenyls (PCBs) as Aroclors by EPA 3456modified extraction and 8082 analysis, following all protocols of the above methods including calibration, batch and instrumental QC, recording and compilation of data, trouble shooting, implementation of corrective actions and instrument maintenance. Also serve as backup for the analysis of alkalinity, pH, residual chlorine, TS, TSS, volatile acids, metals filtration and E. coli in process control and microbiology.

Education and Training:

B. S., Chemistry, University of New Hampshire, 1998

Completion of Agilent Technologies 3 day hands on GC Maintenance class

Career Chronology:

August 2003-Present	Chemist, City of Portland WPCL
October 2000 – July 2003	Analyst, City of Portland WPCL
April 2000 – October 2000	Chemist, Environmental Services Laboratory, Tualatin, OR
1998 – 2000	Travel within the Ecotourism Industry

Key Projects and Experience:

Three years GC experience including the use of Flame Ionization Detector (FID), Photo Ionization Detector (PID) and Electron Capture Detector (ECD) to perform analysis by SW-846 and NorthWest Total Petroleum Hydrocarbon methods.

Method development for Total Organic Carbon (TOC), Northwest Total Petroleum Hydrocarbon Diesel (NWTPH-Dx) and Polychlorinated Biphenyls (PCBs) under SW-846, 40CFR136, and NorthWest Total Petroleum Hydrocarbons guidelines.

Senior thesis investigating the degradation of methyl-t-butyl ether (MTBE) in aqueous solution using Advanced Oxidation Processes.

Cindy A. Covey

Analyst

Summary of Experience:

Trained in traditional analytical chemistry methods specifically related to environmental inorganic analysis of wastewater, drinking water, surface water, soils, and other types of liquids and solids as defined by the EPA and Standard Methods. Project management knowledge pertaining to stormwater permits, industrial permits, and environmental consulting projects and knowledge pertaining to higher-level QC data packets including up to Tier IV deliverables, such as CLP-like format.

Current Duties:

Analyst for the Nutrients, Process Control, General Chemistry, and Microbiology departments, as well as routine sampling at the Columbia Boulevard Treatment Plant. Specific analyses include BOD, TSS, TS (Waters & Soils), TVFS, Volatile Acids, pH, Alkalinity, COD, Ion Chromatography, ortho-Phosphate, Nitrite, Ammonia, Total Phosphorus, and TKN, TCLP Extraction for metals, E.coli by the Quanti-Tray Method. Other laboratory duties include date review, data entry, sample bottle decontamination, SOP writing and review, laboratory morale cheerleader, lab meeting secretary, bulletin board organizer.

Education and Training:

B.S., Chemistry, Linfield College

Career Chronology:

Oct. 2000 - Present	Analyst, Water Pollution Control Laboratory, City of Portland
Sept. 2000 - Oct. 2000	Analyst, North Creek Analytical Laboratories
Sept. 1998 - Sept. 2000	Laboratory Technician I, Oregon Analytical Laboratory
Sept. 1996 - Sept. 1998	Client Manager, Oregon Analytical Laboratory
July 1995 - Aug. 1996	Client Manager, Coffey Laboratories

Key Projects and Experience:

Performing inorganic analyses for various wastewater, surface water, stormwater, soils, and other matrices as an Analyst at the Water Pollution Control Laboratory for the City of Portland. Duties for all analyses include QC measures according to Standard Methods and EPA procedures, routine maintenance of instrumental equipment, and review of data.

Independently performed an air-borne ammonia contamination study for Nutrients department.

Participation in initial set up and verification of the new flow-injection autoanalyzers (O-I instruments) for total phosphorus, TKN, ortho-phosphorus, nitrite, and ammonia analysis.

Performed inorganic analyses for various wastewater, drinking water, surface water, soils, and other solid matrices as a Laboratory Technician at Oregon Analytical Laboratory. Main job duties included analysis and QC measures according to Standard Methods and EPA procedures, maintenance of inorganic equipment, data review, and creation of inorganic QC data packets.

Managed major accounts for Oregon Analytical Laboratory as Client Manager. Main job duties included account and project set up, maintaining and monitoring project results, and billing.

Managed accounts for Coffey Laboratories as Client Manager. Main job duties included: account and project set up, maintaining and monitoring project results, and log in of samples.

Jason Dahl

Chemist

Summary of Experience:

Over fifteen years in environmental analytical chemistry with focus on inorganic analysis. Experience includes ICP-MS low-level metals, ICP metals, nutrients by autoanalyzer, anions by IC, general bench methods (cyanide, COD, oil & grease, flashpoint), and WWTP process control analysis (solids, BOD, etc.). In-depth experience with method development, instrument maintenance, and troubleshooting. Knowledge of "clean" techniques for trace metals sampling and analysis.

Current Duties:

In the Metals section, as part of the two-person team, I am responsible for testing the local river & streams, stormwater, wastewater, soil, and other matrices for metals at concentrations ranging from parts per trillion (ppt) thru parts per million (ppm). Analyses are performed by both ICP-AES and ICP-MS, using EPA methods 3015A, 3051A, 200.7, 200.8, 6010, & 6020. Technical responsibilities encompass all section QA/QC protocols, troubleshooting, implementation of corrective actions, and oversight of instrument hardware maintenance. Additional analytical tasks include backup coverage for bench chemistry methods and process control analyses on Saturdays. I also serve as a technical resource for division project managers, and assist in training new analysts.

Education and Training:

B.S., Chemistry, Portland State University, 1990
Graduate classes in statistics and environmental science, Portland State University, 1990

Career Chronology:

1999 - present	Chemist, City of Portland WPCL
1996 - 1999	Analyst, City of Portland WPCL
1990 – 1996	Chemist, Braun Intertec NW

Key Projects and Experience:

Six years experience with ICP-MS using EPA methods 200.8, 6020, 3015A, & 3051A. Includes optimization of sample preparation techniques and instrument settings to achieve low detection limits and consistent recoveries.

Developed analysis of Mercury by ICP-MS, which lowered reporting levels from 200 ppt (via cold vapor AA) to 1 ppt for dissolved Mercury via the ICP-MS.

Streamlined the analysis of soil samples, which had required three digestions and three instrument runs, to a single digestion and single instrument run.

Part of two-member team to evaluate and select new ICP-MS capital equipment.

Ten years experience at the bench doing a variety of tests (BOD, COD, Cyanide, Oil & Grease, IC, Nutrients and Process Control).

Several presentations at technical conferences on ICP-MS techniques and other analytical protocols.

Kris Dennis
Analyst

Summary of Experience:

Thirteen plus years of laboratory environmental analytical chemistry. Primary experience in analysis of wastewater, surface water, groundwater and soils following analytical procedures established by EPA and *Standard Methods*. Served as sample custodian, responsible for all aspects of sample receiving, distribution, and log-in, for two years.

Two years experience as a Marine Science Technician conducting forensic oil analysis. Responsibilities included Fluorescence Spectrophotometry method officer, Thin Layer Chromatography method officer, Safety officer, and Hazardous Waste officer.

Temporary work as a wastewater chemist, MSDS coordinator and as a wastewater treatment operator.

Current Duties:

- Wet Chemistry – pH, Volatile acids, alkalinity, BOD5, solids, residual chlorine
- Microbiology – E.coli
- Oil and Grease analysis by solid phase extraction - gravimetric

Education and Training:

- Course work in chemistry and geology at Montana College of Mineral Science and Technology, 1984-1985.
- Certified as a Marine Science Technician in the United States Coast Guard, 1988.
- Hazardous waste management training, 1989.

Career Chronology:

1991 - present	Analyst, City of Portland WPCL
1990 - 1991	Kelly Technical Services, Portland, Oregon
1986 - 1990	United States Coast Guard,
	1986 - 1987 Okinawa, Japan
	1987 - 1988 Portland, Oregon
	1988 - 1990 Groton, Connecticut

Key Projects and Experience:

- Two deployments to the Exxon Valdez Oil Spill (Valdez, Alaska) 1989. Conducted analysis on spill areas covering the Gulf of Alaska and various plant and animal tissues affected (USCG Marine Safety Lab).
- Fluorescence Spectrophotometry method officer, Thin Layer Chromatography method officer, Safety officer, and hazardous waste officer (USCG Marine Safety Lab).
- One Year experience Loran “C” operations and watch (USCG LORAN Station Gesashi, Okinawa, Japan).
- Two years experience as the sample custodian, WPLC.
- Method development cyanide digestion analysis.

Elizabeth Farkas

Chemist

Summary of Experience:

Over ten years experience in environmental inorganic analysis, with primary experience in ICP/MS, ICP, ion chromatography, and flow autoanalyzers. In-depth experience in method development, QA/QC protocols for data validation, troubleshooting, and implementation of corrective actions. Additional analytical experience in bench chemistry methods for wastewater and sludges. Supervision of analysts and primary data review for nutrient and metals analysis. Previous professional experience in statistical process control, metal plating, rubber pressing, and plastic injection molding.

Current Duties:

Primary responsibilities are analysis and data review for metals: ICP/MS analysis for trace levels of elements including mercury in surface waters, stormwater, groundwater, wastewater, soils, and sludges; ICP analysis of wastewaters and sludges; primary review of metals data generated by other metals chemist. Also serves as a technical resource for nutrients section for autoanalyzer and IC analyses.

Education and Training:

B.S. Chemical Engineering (Organic Specialty), Polytechnic Institute of Timisoara, 1965

Additional class work in statistics, statistical process control, instrumental analysis; 1990 - 1994

Career Chronology:

1997 - present	Chemist, City of Portland WPCL
1994 - 1997	Laboratory Technician, City of Portland WPCL
1993 - 1994	Chemist for urine drug analysis, Task of Oregon
1992 - 1993	Engineering Technician, statistical process control, Blount IMMP
1989 - 1992	Operator, metal plating / plating bath analysis, Triquent Semiconductor
1968 - 1985	Production Manager, rubber press / plastic inj. molding, Prodcomplex
1965 - 1968	Laboratory Manager, bulk assays, Harghita Mining

Key Projects and Experience:

Initial ICP/MS method development at WPCL; trained analysts in ICP/MS operation; later assisted in further development and refinement of analytical protocols and elimination of ambient contamination for trace analysis (1997).

Served as nutrients section chemist from 1997 to 2002, responsible for data review, troubleshooting, and oversight of corrective actions. Had participated in initial method development for nutrients by flow autoanalyzer(1996).

Marsha Farooqui

Chemist

Summary of Experience:

Over 15 years experience in analytical chemistry with emphasis in organic chemistry. Includes ten years of GC/MS analysis of environmental and wastewater samples, with previous experience in trace drug analysis, explosives assays, and general bench chemistry.

Current Duties:

Schedule all day-to-day activities for GC/MS analysis: sample preparation, sample analysis, instrument maintenance, and ordering of supplies and equipment. Perform analysis of organic chemical constituents on water samples using accepted scientific methods found in Standard Methods and 40CFR Part 136. Review the results and certify their validity. Utilize knowledge and skill in the application of mathematics and interpretation of the data resulting from these analyses. Evaluate and initiate analytical techniques, procedures, and instrumentation for QC procedures and for greater efficiency. Troubleshoot and maintain equipment in Organics lab. Write technical bid specification for procurement of new equipment and contracts. Prepare QC standards and samples. Summarize results in the form of control charts and review statistical data to verify that the analysis is meeting stated QC objectives. Define, authorize and implement corrective actions for out of control procedures. Responsible for new method development for GC/MS tests. Provide technical advise and support for GC Chemist and perform QA review of GC data.

Education and Training:

B.S. Chemistry, University of Utah, Salt Lake City, Utah, 1989
Technical training in GC, LC, and GPC by Lee Scientific Inc., 1989
Technical training in GC/MS by Hewlett-Packard, 1989, 1995, 1996, 2002
Technical training in auto analyzers by Beckman Instruments, 1990
Technical training in Atomic Spectroscopy by Perkin Elmer, 1991
Technical training in GC/MS by Perkin Elmer, 1996, 1998, 1999, 2000, 2004
Technical training in GPC by ISCO Inc., 1993, 1996
Course work in computers, Portland Community College, 2000

Career Chronology:

1995 - present	Chemist, City of Portland WPCL
1993 - 1995	Laboratory Technician, City of Portland WPCL
1991 - 1993	Chemist, IRECO Inc., West Jordan, Utah
1989 - 1990	Chemist, BioTrace Laboratories, Salt Lake City, Utah
1988 - 1989	Applications Chemist, Lee Scientific Inc., Salt Lake City, Utah

Key Projects and Experience:

1988: Taught customer education classes on chromatography science and instrumentation.
1990: Helped prepare a drug-of-abuse laboratory for federal government NIDA certification.
1995: Combined extracts and analytes for method 625, decreasing analysis time by 50%.
1996: Developed method and analyzed samples for pesticides by GC/ECD.
1996: Purchased new instrument -- ISCO GPC system for extract clean-up.
1999: Developed HCID screen by NWTPH protocol.
2002: Researched and brought on line new extract concentration technology, TurboVap II, improving surrogate recoveries and decreasing sample preparation time.
2003: Developed EPA Method 8270 for analysis of Semi-volatiles by GC/MS.
2003: Developed SIM Method for 8270 for low-level analysis of PAHs and Pentachlorophenol. Also researched and implemented procedure to use a single extract for both 8270 and 8270SIM, reducing preparation time by 50%.
2004: Developed EPA Method 8260 for analysis on Volatile organics and combined analysis with 624 and BTEX.

Lois M. Herring

Analyst

Summary of Experience:

Twenty plus years experience in the preparation and analysis of wastewater, wastewater sludge, and environmental samples following EPA and Standard Methods. Includes experience operating flow injection autoanalyzers and ion chromatographs. Also includes microbiological analysis of waters and sludges, bench methods for wastewater analysis, and sample collection at WWTPs.

Current Duties:

Principal analyst for Nutrients Department at WPCL. Analyses include TKN, total phosphorus ammonia, ortho-phosphate, and nitrite by flow injection autoanalyzer, and anions by ion chromotography. Samples matrices include environmental, wastewater, sludges, and soils. Responsible for instrument calibration, QA/QC, data reduction, troubleshooting, corrective actions, and preventive maintenance of instruments. Also responsible for arranging for instrument repair service as needed, ordering supplies, and preparing and updating SOPs.

Education and Training:

BS in Biology, Portland State University, 1973.
BS in Medical Technology, University of Oregon (now Oregon Health Sciences U.), 1974.
Certified as Medical Technologist by American Society of Clinical Pathologists

Career Chronology:

1980 – present	Analyst / Water Laboratory Technician, City of Portland WPCL
1979 – 1980	Chemist I, State of Oregon DEQ Laboratory
1975 – 1979	Water Laboratory Technician, City of Portland WPCL

Key Projects and Experience:

Seven years recent experience operating Alpkem “flow injection” type autoanalyzers for analysis of TKN, total phosphorus, ortho-phosphate, ammonia-nitrogen, and nitrite-nitrogen.

Five years experience in anion chromatography by EPA Method 300.0 using Dionex ICs.

Wrote bid specifications (with minimal assistance from Laboratory Manager) for purchase of two new autoanalyzer systems. Performed initial testing and verification of systems. (2004)

Assisted Laboratory Manager in preparation of bid specifications for a new ion chromatograph and associated software. Performed initial testing and verification of system. (2003)

Developed electronic spreadsheets (Excel) for calculating and reporting nutrient concentrations and QC results for sludges and soils.

Did research and trial runs to check feasibility of eliminating use of mercury catalyst for TKN and total phosphorus analysis. (2002-2003)

Two years experience assisting Microbiologist with all phases of work in Microbiology Department. Duties included: analysis for fecal coliforms and E. coli by membrane filtration and MPN methods; preparation and sterilization of culture media and supplies; quality assurance testing and record keeping, including verification of positive colonies.

Sabrina I. Higgins
Microbiologist

Summary of Experience:

Twenty-five years of microbiology experience in food, water, drugs and cosmetics. Analyzed water and drinking water samples for Total Coliform, Fecal Coliform, Enterococcus and *E.coli*. Analyzed food and dairy products for pathogenic microorganisms and organisms of sanitary quality. Performed sterility testing on drugs and cosmetics and microbiological assays of antibiotics. Monitored equipment in food and dairy production plants for organisms of sanitary significance.

Fifteen years experience in various wet chemistry methods such as: TKN, Total Phosphorus, Ammonia, Nitrates, Total Solids, Conductivity, BOD, COD, Alkalinity, Volatile Acids, Turbidity, and Color. Also analyzed pharmaceutical products for raw material content and performed food assays on food and dairy products.

Current Duties:

Manage and supervise the microbiology laboratory. Responsible for all microbiological analyses of sewage plant effluents, natural waters, sewage plant biosolids and sediments. Also responsible for all quality control, troubleshooting, training, ordering stock and SOP writing in the microbiology department. Responsible for development and implementation of new methods in this department, as well as updates based on new technology.

Education and Training:

Associates Degree, Laboratory Technology, Guyana Technical Institute, South America, 1982
Additional class work in chemistry, biology, mathematics, statistics and literature, Portland Community College and Portland State University, 1988-1994
Training courses in Microbiological Assays on Antibiotics, Safety Evaluation on Drugs and Cosmetics, and MF Method for Testing Water; Ministry of Health in collaboration with PAHO/WHO South America; 1982

Career Chronology:

1998 - present	Microbiologist, City of Portland WPCL
1990 - 1998	Laboratory Technician, City of Portland WPCL
1988 - 1990	Laboratory Technician, Coffey Laboratories, Portland, OR
1986 - 1988	Moved to the United States
1983 - 1986	Laboratory Technician, Guyana Pharmaceutical Corporation
1979 - 1983	Laboratory Technician, Government Analyst Department, Guyana

Key Projects and Experience:

Twenty - five years of microbiology experience in food, water, drugs and cosmetics, including development and implementation of new methods to reduce cost and labor: *E.coli* by MF, MPN, and Quantitray; Fecal Coliforms by MPN; and Salmonella by MPN. Improved methods for optimum results and cost reduction, and implemented a QA/QC plan for microbiology.

Ten years experience in wet chemistry methods for environmental and treatment plant samples.

Two years experience in the preparation and analysis for food assays following AOAC methods.

Three years experience in the extraction and analysis of pharmaceutical products.

Kerstine Larsen

Analyst

Summary of Experience:

Thirteen years of laboratory environmental analytical chemistry. Primary experience in analysis of wastewater, surface water, soils, and drinking water, following analytical procedures established by EPA and *Standard Methods*. Includes four years of experience in microbiology, specifically related to drinking water and wastewater. Was the primary laboratory personnel in a drinking water certified laboratory in Colorado. One year of industrial sampling and field work. Part time experience in a bioassay laboratory.

Current Duties:

Analyst for the Nutrients, Process Control, Organics and Microbiology departments, including sampling from the wastewater treatment plant. Specific analyses include BOD, solids, volatile acids, pH, alkalinity, ion chromatography, ortho-Phosphate, Nitrite, Ammonia, Total Phosphorus, and TKN, NWTPH-HCID and -Dx, and E.coli by the Quanti-Tray Method. Other laboratory duties include data review, sample bottle decontamination, SOP writing and review, and general float person.

Education and Training:

B.S. in Natural Resource Management, minor in Fishery Biology; Colorado State University, 1990
Additional class work in Organic Chemistry, Clark College 2000-2001

Career Chronology:

1994 - present	Analyst, City of Portland WPCL
1992 - 1994	Laboratory Technician, N.E. Colorado Health Department
1990-1992	Laboratory Technician, ENSR (part time); and Certified Nursing Assistant, Good Samaritan Retirement Facility.

Key Projects and Experience:

Participated in the initial purchase and method development of Flow 3000 autoanalyzers for nutrient analysis. Served as laboratory liaison with the vendor (Perstorp). Recommended gas diffusion method instead of salicylate for TKN analysis. Did extensive troubleshooting on the instrument and digestion methods for TKN and Total Phosphorous.

Acting Microbiologist during August 2001. Handled a record high sample load for microbiology and received a “going above the line of duty” recognition for this event.

Primary operator of GC/FID including sample prep, instrument calibration, routine maintenance, reporting, and assisting in troubleshooting.

Designed and implemented Excel macros to create reports for the autoanalyzers.

Have performed field analysis and sampling for the City of Portland.

(CRL Page 1 of 2)

Charles R. Lytle

Laboratory Manager

Summary of Experience

Analytical chemistry; laboratory management; inorganic and organic analysis of environmental matrices; quality assurance/quality control; data management, validation, & assessment; analytical protocol development; program & project management; representation of clients to local, state, & federal regulatory agencies.

Current Duties

Overall management of the city of Portland's Water Pollution Control Laboratory; preparation and administration of direct expense budget; oversight of staff performance; lead for capital equipment procurement and staff hiring; principal interface with upper management.

Education and Training

Ph.D., Environmental Sciences & Resources/Analytical Chemistry, Portland State University
M.S., Analytical Chemistry, Purdue University
B.S., Chemistry, Juniata College
OSHA 1910.120: 40-hour basic, 8-hour refresher, 8-hour management

Career Chronology

2001 – present	Laboratory Manager, City of Portland Water Pollution Control Laboratory, Portland, OR
1989 - 2001	President; Vice President; Manager, Portland Operations NEA, Inc.; Keystone/NEA; Chester Env.; Chester LabNet, Portland, OR
1988 - 1989	Senior Scientist, Manager of Portland, Oregon Office PTI Environmental Services, Portland, OR
1987 - 1988	Research Environmental Scientist, Laboratory Manager MEI-Charlton, Portland, OR
1985 - 1987	Staff Scientist Tetra Tech, Bellevue, WA
1982 - 1985	Assistant Professor of Chemistry Pacific University, Forest Grove, OR
1977 - 1982	Graduate Studies Portland State University, Portland, OR

Key Projects and Experience

At WPCL — Initiated cost tracking and control mechanisms to facilitate operation as a quasi-profit center, allowing tighter control of internal billing rates and cost allocations.

Initiated centralized scheduling system for highly cross-trained Analysts to facilitate rapid response to changing analytical requirements.

Initiated an employee recognition program that improved staff morale and motivated staff in the quest for efficiency gains and cost savings.

Provided technical input to city of Portland Pollution Prevention, Planning, and Engineering Groups for the city's two NPDES permits and MS4 permit, Class V UIC draft permit, combined sewer overflow capital improvement projects, and Willamette River TMDL studies.

Prior To WPCL

Overall responsibility for the analytical division of an environmental company, including initial build-out of a 15,000 sq ft laboratory, instrument selection and installation, hiring and management of technical and support staff, training, establishment of standard operating procedures, third-party certifications, facility compliance with OSHA, RCRA, and SARA Title III regulations, public relations, sales and marketing, program and project management, servicing of in-house and external clients.

Managed analytical studies in support of the Grand Canyon Visibility Study involving the Navaho Generating Station for the Salt River Project. Project involved the analysis of over 20,000 samples and workloads requiring three-shift days and seven-days-per-week operation.

Managed all phases of analytical support for rapid-turnaround analysis of samples collected during CERCLA/SARA remediations for Fluor-Daniel (Laskin Poplar site), URS Consultants (Times Beach, MO site), Engineering Science (Big D Campground site), and Bechtel Environmental (FMC/Simplot, Idaho site).

Served as QA/QC Coordinator for three Superfund remedial investigation efforts; wrote laboratory protocols, field sampling plans, QA project plans; provided data oversight and assessment; represented clients in negotiations with state and federal regulatory agencies.

Managed sampling and analysis for municipal landfill closure, for the Portland (Oregon) Metropolitan Service District.

Conducted environmental monitoring and assessments for heavy industry siting and for major urban construction projects, for the Portland (Oregon) Development Commission.

Prepared analytical protocols for storm drain source evaluations, for the city of Tacoma, WA.

Prepared analytical protocols and analyzed samples by ICP, GFAA, and DFAA for stormwater impact studies on urban impoundments, for the Oregon Department of Environmental Quality.

Prepared reports on metals of concern, detection limits, and analytical protocols as part of the Dredged Disposal Analysis portion of the Puget Sound Estuary Program, for the Seattle District, U.S. Corps of Engineers.

Participated in multi-agency caucuses on the standardization of environmental protocols for environmental investigations throughout Puget Sound, WA. Complex and technical evaluations and negotiations included U.S. EPA, U.S. COE, US Geological Survey, NOAA, WA Dept. of Ecology, WA Dept. of Natural Resources, various port authorities and regional governments, and Native American tribes.

Served on the Laboratory Accreditation Advisory Committee for the Oregon Department of Environmental Quality. Duties included preparing regulatory language and supporting documentation and providing oral testimony before a legislative select committee.

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Jennifer S. Shackelford

Lab Production Specialist

Summary of Experience:

Over fifteen years experience in environmental analytical chemistry, including preparation and analysis methods for metals (ICP-AES, GFAA, CVAA-Hg), wet chemical methods such as cyanide and COD; analysis of environmental and industrial samples for anions and cations by ion chromatography and ISE electrode; analysis of natural and wastewater treatment plant samples for BOD, pH, solids, residual chlorine, alkalinity, and volatile acids.

Experience writing, reviewing, and initiating procedures and protocols; assessing workload and establishing and communicating priorities; assigning work duties and determining training needs; managing laboratory safety program.

Current Duties:

Daily scheduling of the lab analysts work duties according to existing and anticipated workload, and staff availability and training; keep up-to-date on new and existing project requirements and inform staff of new information; prioritize projects; serve as point person for tracking sample status; data package and bench sheet review; maintain chemical and MSDS inventories; maintain sampling schedule and provide technical support for two wastewater treatment plants; analytical support in the Process Control/General Section for BOD, pH, COD, TSS, volatile acids, residual chlorine, alkalinity, volatile acids, and cyanide following 40 CFR 136, Appendix A protocols, including calibration, batch and instrumental QC, recording and compilation of data, trouble shooting, implementation of corrective actions. Oversee and assist in training of analysts. Acting Chemical Hygiene Officer and BES safety committee member. Coordinate disposal and treatment of laboratory hazardous waste.

Education and Training:

B.S., Chemistry, Oregon State University, 1989

Career Chronology:

2003 – present	Lab Production Specialist, City of Portland WPCL
1996 – 2003	Process Control Chemist, City of Portland WPCL
1995 – 1996	Laboratory Technician, City of Portland WPCL
1989 – 1995	Bench Chemist, North Creek Analytical, Beaverton, OR

Key Projects and Experience:

Fifteen years experience in the preparation and analysis of environmental samples following EPA methods listed in Appendix A of 40 CFR 136.

Fifteen years experience in the writing of standard operating procedures and the application of QA/QC to instrumental and wet chemical environmental methods.

Fifteen years experience training analysts in instrumental and wet chemical environmental methods.

Fifteen years experience reviewing data for accuracy, completeness, and adherence to QA/QC protocols.

(JSS Page 2 of 2)

Ten years experience acting as liaison to wastewater treatment plant personnel regarding daily results, special sampling or projects, any anomalous results, and technical assistance.

Extensive knowledge of WPCL laboratory staff training, laboratory analysis capabilities, sample expectations and flow, quality control system, and documentation requirements.

Three years experience scheduling analyst work duties based on workload and priorities.

Three years experience consulting with Field Operations and Investigation Monitoring work groups to exchange information about new and existing projects, sampling timetables, and sample status.

Ten years experience as laboratory Chemical Hygiene Officer and safety committee member. Responsible for maintaining and revising Chemical Hygiene Plan.

Extensive knowledge of WPCL General/Process Control analytical methods and QA/QC requirements, and wastewater treatment plant NPDES permit discharge requirements.

Twelve years experience with treatment, disposal, and handling of laboratory hazardous waste.

Daniel Van Meter

Analyst

Summary of Experience:

Four years experience in environmental analysis testing wastewater, stormwater, and surface waters by EPA-approved methods. Previous professional experience includes three years of QA/QC inspection for manufacturing/industry, and four years of biology research assistantships.

Current Duties:

Bench chemistry for process control and general analysis. Proficiencies include cyanide, oil & grease, COD, BOD, pH, Volatile acids, alkalinity, solids, residual chlorine, and *E.coli* by Quantitray. Also collect routine samples at the WWTP for process control. Backup for Sample Custodian -- receiving and processing samples, logging in samples, and entering analytical data into the LIMS.

Education and Training:

B.S. Biology, University of Colorado, 1995
Additional studies at Colorado State University in Animal Science, 1995 - 1997

Career Chronology:

2001 - present	Analyst, City of Portland WPCL
2000 - 2001	QA/QC Inspector/Microbiologist backup, Longmont Foods
1997 – 1999	QA/QC Inspector, Oakley Tubing, Inc.
1992 – 1995	Research Assistant, Barbara Davis Center for Juvenile Diabetes

Key Projects and Experience:

Computer skills in a wide range of Microsoft applications.

Experience in biological laboratory techniques including preparation of buffers and reagents, sterilization, and cryopreservation.

Signatures/ Initials of Laboratory Staff

Name	Signature	Initials
Jeremy D. Biittner		
Renee J. Chauvin		RJC
Charles K. Christensen		CKC
Samantha E. Clark		
Cindy A. Covey		CAC
Jason R. Dahl		JRD
Kris Dennis		KD/KD
Elizabeth Farkas		EF
Marsha Farooqui		MF
Lois Herring		LH
Sabrina I. Higgins		SIH
Kerstine Larsen		KL
Charles R. Lytle		CRL
Jennifer S. Shackelford		JSS/JSS
Daniel K. Van Meter		DKVM

WPCL Instrumentation List 4/1/05

DESCRIPTION	MANUFACTUERER	MODEL #	SERIAL #
Metals Section			
ICP System	Fisons	ARL 3410	1199
Power Supply For ICP	Emerson	Micropower II	47577-2
UPS For ICP	Powerware	9-150	1030000046
Computer system	Digital	922WW	
ICP/MS System #1 (V.G. PQ-3)	Thermo V.G.	PQ-3	CR018
Main Chiller For PQ-3 ICP/MS	Neslab	M75	102344020
UPS For PQ-3 & X-7 ICP/MS	Powerware	9-170+	660C120
Small Chiller For PQ-3 ICP/MS	Lauda	WKL230	
Computer system	Dell		
ICP/MS System #2 (Thermo X-7)	Thermo V.G.	X-7	X0241
Chiller For X-7 ICP/MS	Neslab	M75	103031064
Autosampler For X-7 ICP/MS	CETAC	ASX-500	029714ASK
Computer system	Dell		
Microwave Sample Digestion System	CEM	Mars-5	DS6335
Organics Section			
GC-ECD System	Agilent	6890N	US10148038
GC-FID System	Perkin-Elmer	Autosystem XL	610N8102901
GC/MS System (for Semi-Volatiles)			
Gas Chromatograph	Agilent	6890N	US10224107
Mass Spectrometer	Agilent	5973	US21853222
Computer system	Hewlett-Packard		
UPS For Semi-Vol GC/MS	Powerware	Prestige 6000	TS273W0110
GC/MS System (for VOA)			
Gas Chromatograph	Perkin-Elmer	Autosystem XL	610N8071714
Mass Spectrometer	Perkin-Elmer	Turbomass	640E809143
Purge and Trap Autosampler For VOA GC/MS	Tekmar	Precept II	98303003
Sample Concentrator For VOA GC/MS	Tekmar	3000	98139003
Computer System	Dell	Optiplex GXa	
UPS For VOA GC/MS	Powerware	Prestige 6000	TS101W0411
Microwave Sample Digestion System	CEM	Mars-X	XM3056
Ultrasonic Horns (2)	Branson	Sonifier 450	
Nutrients Section			
Autoanalyzer System #1 (TKN & Total P)			
Flow Injection System	OI Analytical	FS-3000	4298-214-76
Autosampler For FIS System	Foss/OI	5027/A000989	429898469
Computer System	Dell	DHM	44FBY41
Autoanalyzer System #2 (NO2, NH3, o-PO4)			
Flow Injection System	OI Analytical	FS-3000	4278-212-55
Autosampler For FIS System	Foss/OI	5027/A000952	427898254
Computer system	Dell	DHM	7KJXV31
Non-Interruptable Power Supply (for both systems)	PowerWare	9	RV364A0060
Ion Chromatography System			
Ion Chromatograph	Dionex	ICS-2000	3080225
Autosampler for IC	Dionex	AS40	3080127
Computer system	Dell	DHM	1SGW831

WPCL Instrumentation List 4/1/05				
	DESCRIPTION	**MANUFACTUERER**	**MODEL #**	**SERIAL #**
General Chemistry				
	COD Reactor Blocks (2)	Hach	45600	950500012562
	DO Meters	various		
	Flash Point Tester	Boekel	152800	1031
	Muffle Furnace	Fisher		
	pH Meters	various		
	Spectrophotometers	various		
	Turbidimeter	Orbeco-Hellige	965-10	2383
Microbiology				
	Incubators (2)	VWR	1545	
	Water Baths (2)	Precision	253 / 270	
	QuantiTray Sealer Units (2)	IDEXX Labs	Quantitray-2X	
Laboratory				
	Balances, Analytical (to 0.0001g)	various		
	Balance, Top-loading (to 0.001g)	Ohaus	AR-3130	H0451202480311P
	Balances, Top-loading (to 0.01g)	various		
	DI Water Polishing Systems (5)	Barnstead	Nanopure	

Appendix G

Permittee Personnel Responsible for UIC Monitoring Plan

Appendix G: Key Personnel Responsible for UIC Stormwater Monitoring

Personnel, Position	Responsibility	Phone
Lynne Kennedy, Water Resources Program Manager, Watershed Division, Gresham Department of Environmental Services	UIC Program Manager	503-618-2634
Torrey Lindbo, Water Quality Specialist, Watershed Division, Gresham Department of Environmental Services	Monitoring Program Lead	503-618-2405