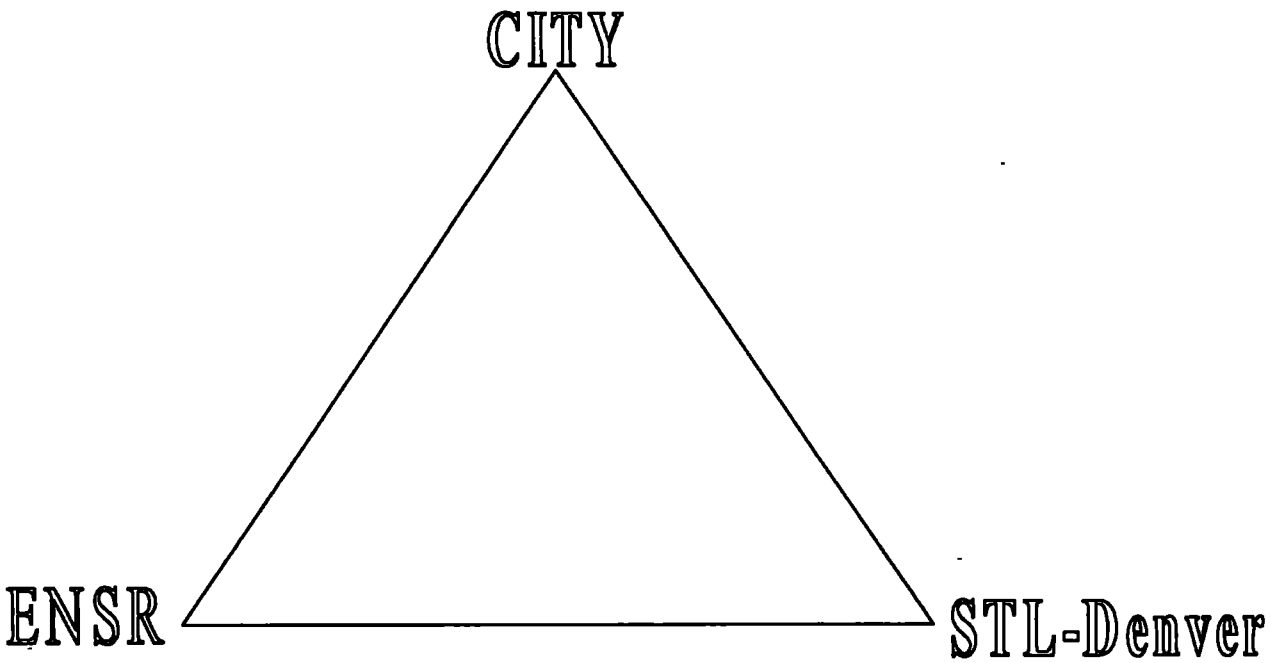
ANNUAL PERFORMANCE REPORT
GRANULAR ACTIVATED
CARBON TREATMENT SYSTEM
FOR 2000

REILLY TAR & CHEMICAL CORP.
N.P.L. SITE
ST. LOUIS PARK, MINNESOTA

SUBMITTED MARCH 15, 2001



CITY OF ST. LOUIS PARK

UTILITY OPERATIONS

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 15, 2001

Regional Administrator
United States Environmental
Protection Agency, Region 5
ATTN: Darryl Owens
Mail Code HSR-6J
77 West Jackson Boulevard
Chicago, Illinois 60604

Director, Groundwater and Solid
Waste Division
Minnesota Pollution Control Agency
ATTN: Site Response Section
520 Lafayette Road North
St. Paul, MN 55155

President
Reilly Industries, Inc.
300 N. Meridian #1500
Indianapolis, Indiana 46204

Commissioner
Minnesota Department of Health
121 E. Seventh Place
P. O. Box 64975
St. Paul, MN 55164-0975

RE: United States of America, et al. vs. Reilly Tar & Chemical Corporation, et al.
File No. Civ. 4-80-469
CD-RAP 4.3.5

Gentlemen:

Enclosed is the 2000 annual performance report of the Granular Activated Carbon treatment system submitted pursuant to Section 4.3.5. of the Consent Decree Remedial Action Plan in the above captioned matter. This report is issued by the City in accordance with Section 2(a) of the Reilly/St. Louis Park Agreement (Exhibit B to the Consent Decree).

Sincerely,

Scott E. Anderson
Superintendent of Utilities

SEA/bah
Enclosure

cc: William Gregg (w/enclosures)
Tom Scott (w/o enclosures)
Reilly File

3752 Wooddale Avenue St. Louis Park, Minnesota 55416-5127
Phone: 952-924-2558 Fax: 952-924-2570
Website: www.stlouispark.org

ANNUAL PERFORMANCE REPORT
FOR
GRANULAR ACTIVATED CARBON
TREATMENT SYSTEM 2000

Operation:

The City operated the Granular Activated Carbon (GAC) treatment system in substantial compliance with Section 4.2 of the Remedial Action Plan (RAP) during 2000, treating 247.224 million gallons of water pumped from SLP 10. This equates to an average of 20.6 million gallons per month.

The operational history of the GAC facilities indicates the average breakthrough of the GAC has been about one year after change-out. Although the 1st quarter sample results were low the City scheduled a change-out for May (The 1999 change-out was May 17) to insure the best possible water quality. The GAC was changed out on May 2, 2000.

The normal operation was disrupted due to required maintenance of the well pump and motor. The maintenance work was completed during the month of January. No pumpage of SLP 10 was conducted during January 2000. An attempt to pump the alternate well, SLP 15, failed due to malfunctioning controls. Therefore, the required 10 million gallons per month was not possible in January, due to the circumstances described above. Despite the January problems, the average pumpage per month for the year was 20.6 million gallons.

Monitoring:

The 2000 monitoring was jointly conducted by the City and Severn Trent Laboratories - Denver (STL-Denver) previously Quanterra Environmental Services. The City collected all samples and STL-Denver was responsible for the analytical services. Laboratory analyses were conducted at the STL-Denver laboratory in Arvada, Colorado.

The 2000 monitoring schedule (Table 2), as established in the 2000 Sampling Plan developed in accordance with the requirements of Section 3.3 of the RAP, provided for quarterly monitoring of the treatment system effluent (Table 3, page 1), and annual monitoring of the treatment system feed water (Table 3, page 2), acid fraction analysis(Section 4.3.4) and extended PAH compounds. However, the City opted to use the extended compound list for all PAH analysis, therefore no designated sample for extended compounds was taken. All samples were collected an analyzed in compliance with the CD-RAP.

The 3rd quarter sample results for Total Other PAH's for GAC 1 were well within compliance levels at 3.6 nanograms per liter (ng/l) Total Other PAH. GAC 4 sample was used as the quality control sample which includes a sample and a duplicate sample that is taken simultaneously with the sample. The duplicate sample is literally the same water as the sample. The result of the sample was a Total Other PAH of 206 which exceeds the Drinking Water Advisory level of 175. The result of the duplicate sample was a Total Other PAH of 13.3. This inconsistency indicates a laboratory error may have occurred. The City conservatively uses the higher of the sample results for reporting and decision making, therefore; the City collected verification samples as required in Section 12.1.1 of the RAP. The second sample was analyzed within the 21-day turnaround required by Section 12.1.3. The second sample result was 19.6 ng/1 Total Other PAH's. As directed by the RAP a third sample was taken and analyzed within the parameters of the RAP. The result of 10.8 ng/1 Total Other PAH's was consistent with the second sample. The City has reverted back to the normal schedule as directed by the RAP. Since the verification samples were taken in the 4th quarter they are representative of the 4th quarter sample required by the sample schedule.

Additional Information:

The CD-RAP provides the operational criteria for the GAC facility located adjacent to Water Treatment Plant No. 1, located at 2936 Idaho Avenue that treats water produced by SLP 10 or 15. The City constructed an additional GAC facility in 1994 located at 4701 West 41st Street (GAC-4) which treats water produced by SLP4. This GAC facility is not referenced in the RAP. The City operates the GAC-4 facility within the Drinking Water Criteria established in Section 2.2. The facility is operated on a continuous pumping schedule as directed by the Unites States Environmental Protection Agency and the Minnesota Pollution Control Agency. The system is operated in a series of GAC vessels. An operational sample is taken at the effluent of the lead vessel (SLP4TLE). The PAH analysis may reflect a level of Total Other PAH may indicate the first GAC in the lead vessels is spent, at which time the GAC is be scheduled for replacement. All SLP4TLE sample results were below the Drinking Water Advisory Levels.

The GAC4 facility treated 465.300 million gallons produced by SLP4. The monthly production is recorded in Table 4 of this report. The results of the facility effluent (GAC- SLP4T) are recorded in Table 3 of this report.

CITY ST. LOUIS PARK
GRANULAR ACTIVATED CARBON
TREATMENT PLANT GAC 1

2000 PRODUCTION

	MILLION GALLONS	
January	0.000	+
February	15.672	
March	20.398	
April	23.404	
May	26.995	++
June	27.781	
July	33.236	
August	36.406	
September	21.100	
October	21.539	
November	10.400	
December	10.293	
TOTAL	**247.224 MG**	
MONTHLY AVERAGE	**20.602 MG**	

\+ Well Maintenance

++ GAC Change-out

TABLE 1

2000 SAMPLING PLAN
GAC TREATMENT SYSTEM MONITORING SCHEDULE

RAP Section	Sampling Point	Start of Monitoring	Sample Frequency	Analysis
4.3.1(C)	Treated Water (TRTD	Date of plan approval	Quarterly	PAH (ppt)
4.3.3(D)	Feed Water (FEED)	Date of plan approval	Annually	PAH (ppt)
4.3.4	*Treated Water*	*Date of plan approval*	*Annually*	*PAH (ppt) Extended List*
4.3.4	Treated or Feed Water	Date of plan approval	Annually	Acid Fraction EPA Method 625

All PAH sample analysis includes the extended list. No seperate extended sample is taken.

GAC Treatment System
Analytical Results 2000

		1ST QUARTER		2ND QUARTER		3RD QUARTER		4TH QUARTER	
		SLP4TD	SLP10T	SLP4T	SLP10T	SLP4T	SLP10	SLP4TD	SLP10
		7-Mar	7-Mar	6-Jun	6-Jun	5-Sep	5-Sep	31-Oct	
2,3-Benzofuran		0	0	0					
2,3-Dihydroindene		0	1.9	3.9		3.7		2.8	
1H-Indene		0	0	0					
Naphthalene		0	0	0		7.1		3	
Benzo (b) Thiophene		0	0	0					
Quinoline*	C	0	0	0					
1H-Indole		0	0	0					
2-Methylnaphthalene		0	0	0		8.3		2.1	
1-Methylnaphthalene		0	0	0		3.6			
Biphenyl		0	0	0		2.1			
Acenaphthylene		0	0	0		1.7			
Acenaphthene		0	0	0		14			
Dibenzofuran		0	0	0		6.1			
Fluorene		0	0	0	2.1	8.3			
Dibenzothiophene		0	0	0		4.2			
Phenanthrene		0	1.7	5.5	14	87	3.6	6.2	
Anthracene		0	0	0					
Acridine		0	0	0					
Carbazole		0	0	0					
Fluoranthene		0	1.6	2.9	4	40		3.5	
Pyrene		7.4	0	0	1.8	20		2	
Benzo (a) Anthracene	C	0	0	0					
Chrysene	C	0	0	0		3	2	2.5	
Benzo (b) Fluoranthene	C	0	0	0					
Benzo (k) Fluoranthene	C	0	0	0					
Benzo (e) Pyrene		0	0	0					
Benzo (a) Pyrene	C	0	0	0					
Perylene		0	0	0					
Indino (1,2,3-cd) Pyrene	C	0	0	0					
Dibenz (a,h) Anthracene	C	0	0	0				2.7	
Benzo (g,h,i) Perylene	C	0	0	0				2.8	
TOTAL OTHER PAH		7.4	5.2	12.3	21.9	206.1	3.6	19.6	
BENZO(a)PYRENE + DIBENZO(A,H)		0	0	0	0	0	0	2.7	
TOTAL CARCINOGEN		0	0	0	0	3	2	8	

Not Available

If quinoline is the only carcinogenic PAH detected, then its value is

GAC Treatment System
Analytical Results 2000

		GAC FEED			VERIFICATION
		SLP4F	SLP10F		SLP4TD
		5-Sep	5-Sep		14-Nov
2,3-Benzofuran					
2,3-Dihydroindene		140			3.3
1H-Indene		31	3.3		
Naphthalene	C		85	C	
Benzo (b) Thiophene		13	9.6		
Quinoline*					
1H-Indole					
2-Methylnaphthalene			7.7		
1-Methylnaphthalene			13		
Biphenyl			5		
Acenaphthylene			18		
Acenaphthene		140	130		2.1
Dibenzofuran			12		
Fluorene			40		
Dibenzothiophene			7.4		
Phenanthrene		3.9	9.1		3.5
Anthracene		1.5	3.6		
Acridine					
Carbazole		23	3.8		
Fluoranthene	C	14	22	C	1.9
Pyrene	C	17		C	
Benzo (a) Anthracene	C		1.9	C	
Chrysene	C	2	2.3	C	
Benzo (b) Fluoranthene					
Benzo (k) Fluoranthene					
Benzo (e) Pyrene	C			C	
Benzo (a) Pyrene					
Perylene					
Indino (1,2,3-cd) Pyrene	C			C	
Dibenz (a,h) Anthracene	C			C	
Benzo (g,h,l) Perylene	C			C	
TOTAL OTHER PAH		383.4	369.5		10.8
BENZO(a)PYRENE + DIBENZO(A,H)		0	0		0
TOTAL CARCINOGEN		2	4.2		0

CITY ST. LOUIS PARK
GRANULAR ACTIVATED CARBON
TREATMENT PLANT GAC 4

2000 PRODUCTION

	MILLION GALLONS	
January	42.050	
February	41.731	
March	44.235	
April	42.732	
May	42.344	++
June	42.832	
July	42.911	
August	43.741	
September	17.217	
October	19.846	
November	41.396	
December	44.265	
TOTAL	**465.300 MG**	
MONTHLY AVERAGE	**38.775 MG**	

++ GAC Change-out

TABLE 4

SECTION 4.3.1 (C)

FIRST QUARTER

PAH ANALYSIS

Advanced Analytical Services

Quanterra Incorporated
4955 Yarrow Street
Arvada, Colorado 80002

303 421-6611 Telephone
303 467-9136 Fax

CASE NARRATIVE

FOR

City of St. Louis Park

March 21, 2000

Severn Trent Laboratories, Denver, CO

Project Lot Number D0C080151

Introduction

Seven aqueous samples (including matrix QC) were received at Severn Trent's, Denver Laboratory on March 8, 2000. The samples were logged in under Quanterra Denver's project lot number D0C080151. A cross reference associating Quanterra Denver's laboratory sample numbers to the actual field sample number is included. The samples were analyzed for part per trillion (ppt) PAHs .

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP for completeness, precision, accuracy, representativeness and defensibility of the data. Unless otherwise stated below, no quality control problems or technical difficulties were encountered which would impact the interpretation or use of data in this report.

The spike compound indene was recovered above the reporting limit in the method blank. Indene was not reported above the reporting limit in any of the samples associated with this method blank

The relative percent difference (RPD) for the spike compound indene in the duplicate control samples was reported at 60% which is above the acceptance limits.

The RPD for the compounds 2-methylnaphthalene, indene and naphthalene are reported above the acceptance limits for the matrix spike / matrix spike duplicate samples.

Except for the above, this data package is in compliance with the terms and conditions of the October 1999 QAPP both technically and for completeness.

Reported By: _____ **Date:** _____

Kurt C. Ill
Program Manager, AASG

EXECUTIVE SUMMARY - Detection Highlights

D0C080151

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4T-030700 03/07/00 001				
Fluoranthene	2.0 J	3.1	ng/L	SW846 8270A SIM
Phenanthrene	2.4	1.3	ng/L	SW846 8270A SIM
GAC-SLP4TD-030700 03/07/00 002				
Pyrene	7.4	1.4	ng/L	SW846 8270A SIM
GAC-SLP4TFB-030700 03/07/00 003				
Fluoranthene	1.9 J	3.1	ng/L	SW846 8270A SIM
GAC-SLP4TFBD-030700 03/07/00 004				
Fluoranthene	1.6 J	3.1	ng/L	SW846 8270A SIM
GAC-SLP10T-030700 03/07/00 005				
Fluoranthene	1.6 J	3.1	ng/L	SW846 8270A SIM
Phenanthrene	1.7	1.3	ng/L	SW846 8270A SIM
2,3-Dihydroindene	1.9 J	5.0	ng/L	SW846 8270A SIM

METHOD / ANALYST SUMMARY

D0C080151

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270A SIM	Monica R. Edwards	001685

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

D0C080151

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
D9D46	001	GAC-SLP4T-030700	03/07/00	
D9D4C	002	GAC-SLP4TD-030700	03/07/00	
D9D4D	003	GAC-SLP4TFB-030700	03/07/00	
D9D4F	004	GAC-SLP4TFBD-030700	03/07/00	
D9D4J	005	GAC-SLP10T-030700	03/07/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced, except in full, without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4T-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080151-001 Work Order #...: D9D46101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/14/00
Prep Batch #...: 0068322 Analysis Time..: 18:55
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	1.3	ng/L
Acenaphthylene	ND	1.4	ng/L
Anthracene	ND	2.7	ng/L
Benzo(a)anthracene	ND	2.5	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Biphenyl	ND	4.3	ng/L
Chrysene	ND	2.8	ng/L
Dibenz(a,h)anthracene	ND	1.6	ng/L
Dibenzofuran	ND	1.0	ng/L
Fluoranthene	**2.0 J**	**3.1**	**ng/L**
Fluorene	ND	1.0	ng/L
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
2-Methylnaphthalene	ND	3.9	ng/L
Naphthalene	ND	6.5	ng/L
Phenanthrene	**2.4**	**1.3**	**ng/L**
Pyrene	ND	1.4	ng/L
Carbazole	ND	1.9	ng/L
1-Methylnaphthalene	ND	2.8	ng/L
Indene	ND	0.90	ng/L
Quinoline	ND	6.9	ng/L
2,3-Benzofuran	ND	5.1	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Benzo(b)thiophene	ND	0.90	ng/L
Indole	ND	2.5	ng/L
Acridine	ND	6.1	ng/L
Perylene	ND	2.5	ng/L
Dibenzothiophene	ND	1.1	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	55	(10 - 118)
Fluorene d-10	66	(41 - 162)
Naphthalene-d8	73	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TD-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080151-002 Work Order #...: D9D4C101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/14/00
Prep Batch #...: 0068322 Analysis Time..: 20:21
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	1.3	ng/L
Acenaphthylene	ND	1.4	ng/L
Anthracene	ND	2.7	ng/L
Benzo(a)anthracene	ND	2.5	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Biphenyl	ND	4.3	ng/L
Chrysene	ND	2.8	ng/L
Dibenz(a,h)anthracene	ND	1.6	ng/L
Dibenzofuran	ND	1.0	ng/L
Fluoranthene	ND	3.1	ng/L
Fluorene	ND	1.0	ng/L
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
2-Methylnaphthalene	ND	3.9	ng/L
Naphthalene	ND	6.5	ng/L
Phenanthrene	ND	1.3	ng/L
Pyrene	**7.4**	**1.4**	**ng/L**
Carbazole	ND	1.9	ng/L
1-Methylnaphthalene	ND	2.8	ng/L
Indene	ND	0.90	ng/L
Quinoline	ND	6.9	ng/L
2,3-Benzofuran	ND	5.1	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Benzo(b)thiophene	ND	0.90	ng/L
Indole	ND	2.5	ng/L
Acridine	ND	6.1	ng/L
Perylene	ND	2.5	ng/L
Dibenzothiophene	ND	1.1	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	48	(10 - 118)
Fluorene d-10	45	(41 - 162)
Naphthalene-d8	50	(21 - 108)

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFB-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080151-003 Work Order #...: D9D4D101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/14/00
Prep Batch #...: 0068322 Analysis Time..: 20:50
Dilution Factor: 1

Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	1.3	ng/L
Acenaphthylene	ND	1.4	ng/L
Anthracene	ND	2.7	ng/L
Benzo(a)anthracene	ND	2.5	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Biphenyl	ND	4.3	ng/L
Chrysene	ND	2.8	ng/L
Dibenz(a,h)anthracene	ND	1.6	ng/L
Dibenzofuran	ND	1.0	ng/L
Fluoranthene	**1.9 J**	**3.1**	**ng/L**
Fluorene	ND	1.0	ng/L
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
2-Methylnaphthalene	ND	3.9	ng/L
Naphthalene	ND	6.5	ng/L
Phenanthrene	ND	1.3	ng/L
Pyrene	ND	1.4	ng/L
Carbazole	ND	1.9	ng/L
1-Methylnaphthalene	ND	2.8	ng/L
Indene	ND	0.90	ng/L
Quinoline	ND	6.9	ng/L
2,3-Benzofuran	ND	5.1	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Benzo(b)thiophene	ND	0.90	ng/L
Indole	ND	2.5	ng/L
Acridine	ND	6.1	ng/L
Perylene	ND	2.5	ng/L
Dibenzothiophene	ND	1.1	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	82	(10 - 118)
Fluorene d-10	56	(41 - 162)
Naphthalene-d8	62	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFBD-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080151-004 Work Order #...: D9D4F102 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/14/00
Prep Batch #...: 0068322 Analysis Time..: 21:19
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.1	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	0.90	ng/L
Naphthalene	ND	6.5	ng/L
Benzo(b)thiophene	ND	0.90	ng/L
Quinoline	ND	6.9	ng/L
Indole	ND	2.5	ng/L
2-Methylnaphthalene	ND	3.9	ng/L
1-Methylnaphthalene	ND	2.8	ng/L
Biphenyl	ND	4.3	ng/L
Acenaphthylene	ND	1.4	ng/L
Acenaphthene	ND	1.3	ng/L
Dibenzofuran	ND	1.0	ng/L
Fluorene	ND	1.0	ng/L
Dibenzothiophene	ND	1.1	ng/L
Phenanthrene	ND	1.3	ng/L
Anthracene	ND	2.7	ng/L
Acridine	ND	6.1	ng/L
Carbazole	ND	1.9	ng/L
Fluoranthene	**1.6 J**	**3.1**	**ng/L**
Pyrene	ND	1.4	ng/L
Benzo(a)anthracene	ND	2.5	ng/L
Chrysene	ND	2.8	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Perylene	ND	2.5	ng/L
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	67	(10 - 118)
Fluorene d-10	59	(41 - 162)
Naphthalene-d8	66	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP10T-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080151-005 **Work Order #...:** D9D4J101 **Matrix.....:** WATER
Date Sampled...: 03/07/00 **Date Received..:** 03/08/00
Prep Date.....: 03/08/00 **Analysis Date..:** 03/14/00
Prep Batch #...: 0068322 **Analysis Time..:** 21:48
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	1.3	ng/L
Acenaphthylene	ND	1.4	ng/L
Anthracene	ND	2.7	ng/L
Benzo(a)anthracene	ND	2.5	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L
Chrysene	ND	2.8	ng/L
Dibenz(a,h)anthracene	ND	1.6	ng/L
Dibenzofuran	ND	1.0	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Biphenyl	ND	4.3	ng/L
Fluoranthene	**1.6 J**	**3.1**	**ng/L**
Fluorene	ND	1.0	ng/L
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
2-Methylnaphthalene	ND	3.9	ng/L
Naphthalene	ND	6.5	ng/L
Phenanthrene	**1.7**	**1.3**	**ng/L**
Pyrene	ND	1.4	ng/L
Carbazole	ND	1.9	ng/L
1-Methylnaphthalene	ND	2.8	ng/L
Indene	ND	0.90	ng/L
Quinoline	ND	6.9	ng/L
2,3-Benzofuran	ND	5.1	ng/L
2,3-Dihydroindene	**1.9 J**	**5.0**	**ng/L**
Benzo(b)thiophene	ND	0.90	ng/L
Perylene	ND	2.5	ng/L
Dibenzothiophene	ND	1.1	ng/L
Indole	ND	2.5	ng/L
Acridine	ND	6.1	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	176 *	(10 - 118)
Fluorene d-10	58	(41 - 162)
Naphthalene-d8	64	(21 - 108)

NOTE(S):

* Surrogate recovery is outside stated control limits

J Estimated result. Result is less than RL

QC DATA ASSOCIATION SUMMARY

D0C080151

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	SW846 8270A SIM		0068322	0068154
002	WATER	SW846 8270A SIM		0068322	0068154
003	WATER	SW846 8270A SIM		0068322	0068154
004	WATER	SW846 8270A SIM		0068322	0068154
005	WATER	SW846 8270A SIM		0068322	0068154

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080151 **Work Order #...:** D9DV2101 **Matrix.....:** WATER
MB Lot-Sample #: D0C080000-322

Prep Date.....: 03/08/00 **Analysis Time..:** 17:31
Analysis Date..: 03/14/00 **Prep Batch #...:** 0068322
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	1.3	ng/L	SW846 8270A SIM
Acenaphthylene	ND	1.4	ng/L	SW846 8270A SIM
Anthracene	ND	2.7	ng/L	SW846 8270A SIM
Benzo(a)anthracene	ND	2.5	ng/L	SW846 8270A SIM
Benzo(b)fluoranthene	ND	2.5	ng/L	SW846 8270A SIM
Benzo(k)fluoranthene	ND	2.3	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	ND	2.8	ng/L	SW846 8270A SIM
Benzo(a)pyrene	ND	2.3	ng/L	SW846 8270A SIM
Benzo(e)pyrene	ND	1.9	ng/L	SW846 8270A SIM
Biphenyl	ND	4.3	ng/L	SW846 8270A SIM
Chrysene	ND	2.8	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	ND	1.6	ng/L	SW846 8270A SIM
Dibenzofuran	ND	1.0	ng/L	SW846 8270A SIM
Fluoranthene	ND	3.1	ng/L	SW846 8270A SIM
Fluorene	ND	1.0	ng/L	SW846 8270A SIM
Phenanthrene	ND	1.3	ng/L	SW846 8270A SIM
Pyrene	ND	1.4	ng/L	SW846 8270A SIM
Carbazole	ND	1.9	ng/L	SW846 8270A SIM
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L	SW846 8270A SIM
2-Methylnaphthalene	ND	3.9	ng/L	SW846 8270A SIM
Naphthalene	ND	6.5	ng/L	SW846 8270A SIM
1-Methylnaphthalene	ND	2.8	ng/L	SW846 8270A SIM
Indene	**3.1**	**0.90**	**ng/L**	**SW846 8270A SIM**
Quinoline	ND	6.9	ng/L	SW846 8270A SIM
2,3-Benzofuran	ND	5.1	ng/L	SW846 8270A SIM
2,3-Dihydroindene	ND	5.0	ng/L	SW846 8270A SIM
Benzo(b)thiophene	ND	0.90	ng/L	SW846 8270A SIM
Indole	ND	2.5	ng/L	SW846 8270A SIM
Acridine	ND	6.1	ng/L	SW846 8270A SIM
Perylene	ND	2.5	ng/L	SW846 8270A SIM
Dibenzothiophene	ND	1.1	ng/L	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	77	(10 - 118)
Fluorene d-10	61	(41 - 162)
Naphthalene-d8	65	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080151 **Work Order #...:** D9DV2102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: D0C080000-322 D9DV2103-LCSD
Prep Date.....: 03/08/00 **Analysis Date..:** 03/14/00
Prep Batch #...: 0068322 **Analysis Time..:** 17:59
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	**10.0**	**6.42**	**ng/L**	**64**		**SW846 8270A SIM**
	10.0	**7.30**	**ng/L**	**73**	**13**	**SW846 8270A SIM**
Benzo(e)pyrene	**10.0**	**7.17**	**ng/L**	**72**		**SW846 8270A SIM**
	10.0	**7.91**	**ng/L**	**79**	**9.8**	**SW846 8270A SIM**
Chrysene	**10.0**	**7.22**	**ng/L**	**72**		**SW846 8270A SIM**
	10.0	**7.72**	**ng/L**	**77**	**6.6**	**SW846 8270A SIM**
Fluorene	**10.0**	**6.95**	**ng/L**	**70**		**SW846 8270A SIM**
	10.0	**7.32**	**ng/L**	**73**	**5.2**	**SW846 8270A SIM**
Indene	**10.0**	**5.83**	**ng/L**	**58**		**SW846 8270A SIM**
	10.0	**10.8 p**	**ng/L**	**108**	**60**	**SW846 8270A SIM**
Naphthalene	**10.0**	**6.72**	**ng/L**	**67**		**SW846 8270A SIM**
	10.0	**7.70**	**ng/L**	**77**	**14**	**SW846 8270A SIM**
Quinoline	**10.0**	**6.20**	**ng/L**	**62**		**SW846 8270A SIM**
	10.0	**7.52**	**ng/L**	**75**	**19**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	72	(10 - 118)
	75	(10 - 118)
Fluorene d-10	59	(41 - 162)
	60	(41 - 162)
Naphthalene-d8	61	(21 - 108)
	66	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080151 **Work Order #...:** D9DV2102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: D0C080000-322 D9DV2103-LCSD
Prep Date.....: 03/08/00 **Analysis Date..:** 03/14/00
Prep Batch #...: 0068322 **Analysis Time..:** 17:59
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	**64**	**(20 - 150)**			**SW846 8270A SIM**
	73	**(20 - 150)**	**13**	**(0-20)**	**SW846 8270A SIM**
Benzo(e)pyrene	**72**	**(20 - 150)**			**SW846 8270A SIM**
	79	**(20 - 150)**	**9.8**	**(0-20)**	**SW846 8270A SIM**
Chrysene	**72**	**(20 - 132)**			**SW846 8270A SIM**
	77	**(20 - 132)**	**6.6**	**(0-20)**	**SW846 8270A SIM**
Fluorene	**70**	**(69 - 118)**			**SW846 8270A SIM**
	73	**(69 - 118)**	**5.2**	**(0-20)**	**SW846 8270A SIM**
Indene	**58**	**(20 - 150)**			**SW846 8270A SIM**
	108 p	**(20 - 150)**	**60**	**(0-20)**	**SW846 8270A SIM**
Naphthalene	**67**	**(20 - 150)**			**SW846 8270A SIM**
	77	**(20 - 150)**	**14**	**(0-20)**	**SW846 8270A SIM**
Quinoline	**62**	**(20 - 150)**			**SW846 8270A SIM**
	75	**(20 - 150)**	**19**	**(0-20)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	72	(10 - 118)
	75	(10 - 118)
Fluorene d-10	59	(41 - 162)
	60	(41 - 162)
Naphthalene-d8	61	(21 - 108)
	66	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080151 **Work Order #...:** D9D46102-MS **Matrix.....:** WATER
MS Lot-Sample #: D0C080151-001 D9D46103-MSD
Date Sampled...: 03/07/00 **Date Received..:** 03/08/00
Prep Date.....: 03/08/00 **Analysis Date..:** 03/14/00
Prep Batch #...: 0068322 **Analysis Time..:** 19:24
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	ND	10.1	5.79	ng/L	57		SW846 8270A SIM
	ND	10.1	7.38	ng/L	73 p	24	SW846 8270A SIM
Benzo(e)pyrene	ND	10.1	4.09	ng/L	40		SW846 8270A SIM
	ND	10.1	3.78	ng/L	37	8.0	SW846 8270A SIM
Chrysene	ND	10.1	5.89	ng/L	58		SW846 8270A SIM
	ND	10.1	5.50	ng/L	54	7.0	SW846 8270A SIM
Fluorene	ND	10.1	6.04	ng/L	60 a		SW846 8270A SIM
	ND	10.1	7.38	ng/L	73	20	SW846 8270A SIM
Indene	ND	10.1	5.13	ng/L	51		SW846 8270A SIM
	ND	10.1	6.31	ng/L	62 p	21	SW846 8270A SIM
Naphthalene	ND	10.1	6.12	ng/L	61		SW846 8270A SIM
	ND	10.1	7.98	ng/L	79 p	26	SW846 8270A SIM
Quinoline	ND	10.1	6.29	ng/L	62		SW846 8270A SIM
	ND	10.1	7.61	ng/L	75	19	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	53	(10 - 118)
	52	(10 - 118)
Fluorene d-10	50	(41 - 162)
	63	(41 - 162)
Naphthalene-d8	51	(21 - 108)
	68	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

a Spiked analyte recovery is outside stated control limits

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080151 **Work Order #...:** D9D46102-MS **Matrix.....:** WATER
MS Lot-Sample #: D0C080151-001 D9D46103-MSD
Date Sampled...: 03/07/00 **Date Received..:** 03/08/00
Prep Date.....: 03/08/00 **Analysis Date..:** 03/14/00
Prep Batch #...: 0068322 **Analysis Time..:** 19:24
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	57	(20 - 150)			SW846 8270A SIM
	73 p	(20 - 150)	24	(0-20)	SW846 8270A SIM
Benzo(e)pyrene	40	(20 - 150)			SW846 8270A SIM
	37	(20 - 150)	8.0	(0-20)	SW846 8270A SIM
Chrysene	58	(20 - 132)			SW846 8270A SIM
	54	(20 - 132)	7.0	(0-20)	SW846 8270A SIM
Fluorene	60 a	(69 - 118)			SW846 8270A SIM
	73	(69 - 118)	20	(0-20)	SW846 8270A SIM
Indene	51	(20 - 150)			SW846 8270A SIM
	62 p	(20 - 150)	21	(0-20)	SW846 8270A SIM
Naphthalene	61	(20 - 150)			SW846 8270A SIM
	79 p	(20 - 150)	26	(0-20)	SW846 8270A SIM
Quinoline	62	(20 - 150)			SW846 8270A SIM
	75	(20 - 150)	19	(0-20)	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	53	(10 - 118)
	52	(10 - 118)
Fluorene d-10	50	(41 - 162)
	63	(41 - 162)
Naphthalene-d8	51	(21 - 108)
	68	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

a Spiked analyte recovery is outside stated control limits

SECOND QUARTER

PAH ANALYSIS

2ND QTR

STL Denver
4955 Yarrow Street
Arvada, CO 80002-4517

Tel 303 736 0100
Fax 303 431 7171
www stl-inc com

CASE NARRATIVE FOR

City of St. Louis Park

June 30, 2000

STL AASG Lot Number R0F070125

Introduction

Five aqueous samples (plus additional QC) were received at Severn Trent's Denver Laboratory on June 7, 2000 The samples were logged in under STL AASG's project lot number R0F070125. A cross reference associating STL's laboratory sample numbers to the actual field sample number is included The samples were analyzed for part per trillion (ppt) PAHs

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP for completeness, precision, accuracy, representativeness and defensibility of the data Unless otherwise stated below, no quality control problems or technical difficulties were encountered which would impact the interpretation or use of data in this report

Phenanthrene and fluoranthene were detected above the reporting limit in the method blank. There were no other analytes detected above the reporting limit in the method blank

The relative percent difference (RPD) between the laboratory control sample (LCS) and the LCS duplicate sample and between the matrix spike and matrix spike duplicate was outside control limits for indene Indene was not detected above the reporting limit in any of the associated samples.

This data package has been reviewed for compliance with the terms and conditions of the October 1999 QAPP. Based on this review, this data package meets those requirements both technically and for completeness

Reported By: _____ **Date:** 1/20/00

Mark J. Mensik
Project Manager, AASG

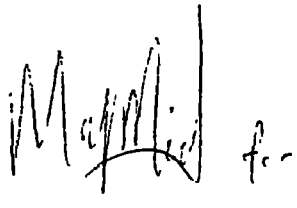
ANALYTICAL REPORT

Reilly Tar and Chemical Site

Mr. Scott Anderson

City of St. Louis Park

SEVERN TRENT LABORATORIES, INC.



Kurt C. Ill
Project Manager

June 30, 2000

EXECUTIVE SUMMARY - Detection Highlights

R0F070125

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4T-060600 06/06/00 001				
2,3-Dihydroindene	3.2 J	5.0	ng/L	SW846 8270A SIM
Indene	2.0 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	1.6 J	4.6	ng/L	SW846 8270A SIM
GAC-SLP4TD-060600 06/06/00 002				
2,3-Dihydroindene	3.9 J	5.0	ng/L	SW846 8270A SIM
Phenanthrene	5.5	4.7	ng/L	SW846 8270A SIM
Fluoranthene	2.9 J	4.6	ng/L	SW846 8270A SIM
GAC-SLP4TFB-060600 06/06/00 003				
Phenanthrene	2.9 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	2.4 J	4.6	ng/L	SW846 8270A SIM
GAC-SLP4TFBD-060600 06/06/00 004				
Phenanthrene	7.5	4.7	ng/L	SW846 8270A SIM
Fluoranthene	3.8 J	4.6	ng/L	SW846 8270A SIM
Pyrene	1.7 J	4.2	ng/L	SW846 8270A SIM
GAC-SLP10T-060600 06/06/00 005				
Fluorene	2.1 J	4.1	ng/L	SW846 8270A SIM
Phenanthrene	14	4.7	ng/L	SW846 8270A SIM
Fluoranthene	4.0 J	4.6	ng/L	SW846 8270A SIM
Pyrene	1.8 J	4.2	ng/L	SW846 8270A SIM

ANALYTICAL METHODS SUMMARY

R0F070125

PARAMETER	ANALYTICAL METHOD
Base/Neutrals and Acids	SW846 8270A SIM

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

R0F070125

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270A SIM	Monica R. Edwards	001685

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

R0F070125

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
DE9DH	001	GAC-SLP4T-060600	06/06/00	
DE9DJ	002	GAC-SLP4TD-060600	06/06/00	
DE9DK	003	GAC-SLP4TFB-060600	06/06/00	
DE9DL	004	GAC-SLP4TFBD-060600	06/06/00	
DE9DM	005	GAC-SLP10T-060600	06/06/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced, except in full without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity, pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4T-060600

GC/MS Semivolatiles

Lot-Sample #...: R0F070125-001 **Work Order #...:** DE9DH101 **Matrix.....:** WATER
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444 **Method.....:** SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**3.2 J**	**5.0**	**ng/L**
Indene	**2.0 J**	**4.7**	**ng/L**
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	ND	4.7	ng/L
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.6 J**	**4.6**	**ng/L**
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	54	(10 - 118)
Fluorene d-10	46	(41 - 162)
Naphthalene-d8	68	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TD-060600

GC/MS Semivolatiles

Lot-Sample #...: R0F070125-002 **Work Order #...:** DE9DJ101 **Matrix.....:** WATER
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444 **Method.....:** SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**3.9 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**5.5**	**4.7**	**ng/L**
Fluoranthene	**2.9 J**	**4.6**	**ng/L**
Pyrene	ND	4.2	ng/L
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	63	(10 - 118)
Fluorene d-10	54	(41 - 162)
Naphthalene-d8	85	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL.

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFB-060600

GC/MS Semivolatiles

Lot-Sample #...: R0F070125-003 **Work Order #...:** DE9DK101 **Matrix.....:** WATER
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444 **Method.....:** SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**2.9 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Fluoranthene	**2.4 J**	**4.6**	**ng/L**
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	70	(10 - 118)
Fluorene d-10	46	(41 - 162)
Naphthalene-d8	70	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFBD-060600

GC/MS Semivolatiles

Lot-Sample #...: R0F070125-004 **Work Order #...:** DE9DL101 **Matrix.....:** WATER
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444 **Method.....:** SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**7.5**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**3.8 J**	**4.6**	**ng/L**
Pyrene	**1.7 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	80	(10 - 115)
Fluorene d-10	63	(41 - 162)
Naphthalene-d8	86	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP10T-060600

GC/MS Semivolatiles

Lot-Sample #...: R0F070125-005 **Work Order #...:** DE9DM101 **Matrix.....:** WATER
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444 **Method.....:** SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	**2.1 J**	**4.1**	**ng/L**
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**14**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**4.0 J**	**4.6**	**ng/L**
Pyrene	**1.8 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	68	(10 - 118)
Fluorene d-10	60	(41 - 162)
Naphthalene-d8	88	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

QC DATA ASSOCIATION SUMMARY

R0F070125

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	SW846 8270A SIM		0160444	0160200
002	WATER	SW846 8270A SIM		0160444	0160200
003	WATER	SW846 8270A SIM		0160444	0160200
004	WATER	SW846 8270A SIM		0160444	0160200
005	WATER	SW846 8270A SIM		0160444	0160200

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: R0F070125 **Work Order #...:** DEE9L101 **Matrix.....:** WATER
MB Lot-Sample #: R0F080000-444

Prep Date.....: 06/08/00
Analysis Date..: 06/14/00 **Prep Batch #...:** 0160444

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	5.7	ng/L	SW846 8270A SIM
Acenaphthylene	ND	4.8	ng/L	SW846 8270A SIM
Anthracene	ND	3.4	ng/L	SW846 8270A SIM
Benzo(a)anthracene	ND	4.3	ng/L	SW846 8270A SIM
Benzo(b)fluoranthene	ND	4.7	ng/L	SW846 8270A SIM
Benzo(k)fluoranthene	ND	3.9	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	ND	6.2	ng/L	SW846 8270A SIM
Benzo(a)pyrene	ND	2.5	ng/L	SW846 8270A SIM
Benzo(e)pyrene	ND	4.3	ng/L	SW846 8270A SIM
Biphenyl	ND	5.6	ng/L	SW846 8270A SIM
Chrysene	ND	5.6	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	ND	5.9	ng/L	SW846 8270A SIM
Dibenzofuran	ND	5.7	ng/L	SW846 8270A SIM
Fluoranthene	**4.8**	**4.6**	**ng/L**	**SW846 8270A SIM**
Fluorene	ND	4.1	ng/L	SW846 8270A SIM
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L	SW846 8270A SIM
2-Methylnaphthalene	ND	5.9	ng/L	SW846 8270A SIM
Napnthalene	ND	8.6	ng/L	SW846 8270A SIM
Phenanthrene	**6.4**	**4.7**	**ng/L**	**SW846 8270A SIM**
Pyrene	**2.2 J**	**4.2**	**ng/L**	**SW846 8270A SIM**
Carbazole	ND	3.8	ng/L	SW846 8270A SIM
1-Methylnaphthalene	ND	5.6	ng/L	SW846 8270A SIM
Indene	ND	4.7	ng/L	SW846 8270A SIM
Quinoline	ND	9.0	ng/L	SW846 8270A SIM
2,3-Benzofuran	ND	5.4	ng/L	SW846 8270A SIM
2,3-Dihydroindene	ND	5 0	ng/L	SW846 8270A SIM
Benzo(b)thiophene	ND	5.2	ng/L	SW846 8270A SIM
Indole	ND	4.7	ng/L	SW846 8270A SIM
Acridine	ND	6.2	ng/L	SW846 8270A SIM
Perylene	ND	3.3	ng/L	SW846 8270A SIM
Dibenzothiophene	ND	4.1	ng/L	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	76	(10 - 118)
Fluorene d-10	55	(41 - 162)
Naphthalene-d8	81	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result Result is less than RL

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0F070125 **Work Order #...:** DEE9L102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: R0F080000-444 DEE9L103-LCSD
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Chrysene	**10.0**	**6.17**	**ng/L**	**62**		**SW846 8270A SIM**
	10.0	**5.96**	**ng/L**	**60**	**3.5**	**SW846 8270A SIM**
Fluorene	**10.0**	**7.39**	**ng/L**	**74**		**SW846 8270A SIM**
	10.0	**6.93**	**ng/L**	**69**	**6.4**	**SW846 8270A SIM**
Indene	**10.0**	**7.53**	**ng/L**	**75**		**SW846 8270A SIM**
	10.0	**10.4 p**	**ng/L**	**104**	**33**	**SW846 8270A SIM**
2-Methylnaphthalene	**10.0**	**8.53**	**ng/L**	**85**		**SW846 8270A SIM**
	10.0	**7.59**	**ng/L**	**76**	**12**	**SW846 8270A SIM**
Naphthalene	**10.0**	**8.70**	**ng/L**	**87**		**SW846 8270A SIM**
	10.0	**7.76**	**ng/L**	**78**	**11**	**SW846 8270A SIM**
Quinoline	**10.0**	**5.92**	**ng/L**	**59**		**SW846 8270A SIM**
	10.0	**6.13**	**ng/L**	**61**	**3.5**	**SW846 8270A SIM**
Benzo(e)pyrene	**10.0**	**7.93**	**ng/L**	**79**		**SW846 8270A SIM**
	10.0	**8.15**	**ng/L**	**81**	**2.6**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	97	(10 - 118)
	84	(10 - 118)
Fluorene d-10	59	(41 - 162)
	57	(41 - 162)
Naphthalene-d8	88	(21 - 108)
	88	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0F070125 **Work Order #...:** DEE9L102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: R0F080000-444 DEE9L103-LCSD
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Chrysene	**62**	**(20 - 132)**			**SW846 8270A SIM**
	60	**(20 - 132)**	**3.5**	**(0-20)**	**SW846 8270A SIM**
Fluorene	**74**	**(20 - 132)**			**SW846 8270A SIM**
	69	**(20 - 132)**	**6.4**	**(0-20)**	**SW846 8270A SIM**
Indene	**75**	**(20 - 150)**			**SW846 8270A SIM**
	104 p	**(20 - 150)**	**33**	**(0-20)**	**SW846 8270A SIM**
2-Methylnaphthalene	**85**	**(20 - 150)**			**SW846 8270A SIM**
	76	**(20 - 150)**	**12**	**(0-20)**	**SW846 8270A SIM**
Naphthalene	**87**	**(20 - 150)**			**SW846 8270A SIM**
	78	**(20 - 150)**	**11**	**(0-20)**	**SW846 8270A SIM**
Quinoline	**59**	**(20 - 150)**			**SW846 8270A SIM**
	61	**(20 - 150)**	**3.5**	**(0-20)**	**SW846 8270A SIM**
Benzo(e)pyrene	**79**	**(20 - 150)**			**SW846 8270A SIM**
	81	**(20 - 150)**	**2.6**	**(0-20)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	97	(10 - 118)
	84	(10 - 118)
Fluorene d-10	59	(41 - 162)
	57	(41 - 162)
Naphthalene-d8	88	(21 - 108)
	88	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0F070125 **Work Order #...:** DE9DH102-MS **Matrix.....:** WATER
MS Lot-Sample #: R0F070125-001 DE9DH103-MSD
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	**ND**	**10.2**	**9.13**	**ng/L**	**89**		**SW846 8270A SIM**
	ND	**10.0**	**9.19**	**ng/L**	**92**	**2.7**	**SW846 8270A SIM**
Chrysene	**ND**	**10.2**	**4.58**	**ng/L**	**45**		**SW846 8270A SIM**
	ND	**10.0**	**5.24**	**ng/L**	**52**	**15**	**SW846 8270A SIM**
Fluorene	**ND**	**10.2**	**7.54**	**ng/L**	**74**		**SW846 8270A SIM**
	ND	**10.0**	**7.31**	**ng/L**	**73**	**0.95**	**SW846 8270A SIM**
Indene	**2.0**	**10.2**	**14.9**	**ng/L**	**126**		**SW846 8270A SIM**
	2.0	**10.0**	**8.03**	**ng/L**	**60 p**	**58**	**SW846 8270A SIM**
Naphthalene	**ND**	**10.2**	**9.65**	**ng/L**	**94**		**SW846 8270A SIM**
	ND	**10.0**	**9.64**	**ng/L**	**96**	**1.9**	**SW846 8270A SIM**
Quinoline	**ND**	**10.2**	**7.03**	**ng/L**	**69**		**SW846 8270A SIM**
	ND	**10.0**	**6.51**	**ng/L**	**65**	**5.6**	**SW846 8270A SIM**
Benzo(e)pyrene	**ND**	**10.2**	**3.59**	**ng/L**	**35**		**SW846 8270A SIM**
	ND	**10.0**	**4.12**	**ng/L**	**41**	**16**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	60	(10 - 118)
	77	(10 - 118)
Fluorene d-10	56	(41 - 162)
	61	(41 - 162)
Naphthalene-d8	82	(21 - 108)
	93	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0F070125 **Work Order #...:** DE9DH102-MS **Matrix.....:** WATER
MS Lot-Sample #: R0F070125-001 DE9DH103-MSD
Date Sampled...: 06/06/00 **Date Received..:** 06/07/00
Prep Date.....: 06/08/00 **Analysis Date..:** 06/15/00
Prep Batch #...: 0160444

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	89	(20 - 150)			SW846 8270A SIM
	92	(20 - 150)	2.7	(0-20)	SW846 8270A SIM
Chrysene	45	(20 - 132)			SW846 8270A SIM
	52	(20 - 132)	15	(0-20)	SW846 8270A SIM
Fluorene	74	(20 - 132)			SW846 8270A SIM
	73	(20 - 132)	0.95	(0-20)	SW846 8270A SIM
Indene	126	(20 - 150)			SW846 8270A SIM
	60 p	(20 - 150)	58	(0-20)	SW846 8270A SIM
Naphthalene	94	(20 - 150)			SW846 8270A SIM
	96	(20 - 150)	1.9	(0-20)	SW846 8270A SIM
Quinoline	69	(20 - 150)			SW846 8270A SIM
	65	(20 - 150)	5.6	(0-20)	SW846 8270A SIM
Benzo(e)pyrene	35	(20 - 150)			SW846 8270A SIM
	41	(20 - 150)	16	(0-20)	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	60	(10 - 118)
	77	(10 - 118)
Fluorene d-10	56	(41 - 162)
	61	(41 - 162)
Naphthalene-d8	82	(21 - 108)
	93	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

THIRD QUARTER

PAH ANALYSIS

3rd GTM

SAMPLE SUMMARY

ROI060133

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
DJX9E	001	GAC-SLP4T-090500	09/05/00	
DJX9P	002	GAC-SLP4TD-090500	09/05/00	
DJXA8	003	GAC-SLP4TFB-090500	09/05/00	
DJXA9	004	GAC-SLP4TFBD-090500	09/05/00	
DJXAA	005	GAC-SLP4FEED-090500	09/05/00	
DJXAC	006	GAC-SLP10FEED-090500	09/05/00	
DJXAE	007	GAC-SLP10T-090500	09/05/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced, except in full without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis color corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test pH, porosity pressure, reactivity redox potential specific gravity spot tests solids, solubility, temperature, viscosity, and weight

METHOD / ANALYST SUMMARY

R0I060133

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270A SIM	Mark Dymerski	004626

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4T-090500

GC/MS Semivolatiles

Lot-Sample #...:	R0I060133-001	Work Order #...:	DJX9E101
Date Sampled...:	09/05/00	Date Received..:	09/06/00
Prep Date.....:	09/07/00	Analysis Date..:	09/13/00
Prep Batch #...:	0256212	Analysis Time..:	16:34
Dilution Factor:	1		
		Method.....:	SW846 8270A SIM

Matrix.....: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**3.7 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	**7.1 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	**8.3**	**5.9**	**ng/L**
1-Methylnaphthalene	**3.6 J**	**5.6**	**ng/L**
Biphenyl	**2.1 J**	**5.6**	**ng/L**
Acenaphthylene	**1.7 J**	**4.8**	**ng/L**
Acenaphthene	**14**	**5.7**	**ng/L**
Dibenzofuran	**6.1**	**5.7**	**ng/L**
Fluorene	**8.3**	**4.1**	**ng/L**
Dibenzothiophene	**4.2**	**4.1**	**ng/L**
Phenanthrene	**87**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**40**	**4.6**	**ng/L**
Pyrene	**20**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**3.0 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	65	(10 - 118)
Fluorene d-10	61	(41 - 162)
Naphthalene-d8	51	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TD-090500

GC/MS Semivolatiles

Lot-Sample #...: R0I060133-002	**Work Order #...:** DJX9P101	**Matrix.....:** WATER	
Date Sampled...: 09/05/00	**Date Received..:** 09/06/00		
Prep Date.....: 09/07/00	**Analysis Date..:** 09/13/00		
Prep Batch #...: 0256212	**Analysis Time..:** 18:31		
Dilution Factor: 1			
	Method.....: SW846 8270A SIM		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**4.6 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	**4.9 J**	**5.7**	**ng/L**
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**2.1 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.7 J**	**4.6**	**ng/L**
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.2 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**2.2 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	67	(10 - 118)
Fluorene d-10	55	(41 - 162)
Naphthalene-d8	62	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFB-090500

GC/MS Semivolatiles

Lot-Sample #...: R0I060133-003 Work Order #...: DJXA8101 Matrix.....: WATER
Date Sampled...: 09/05/00 Date Received..: 09/06/00
Prep Date.....: 09/07/00 Analysis Date..: 09/13/00
Prep Batch #...: 0256212 Analysis Time..: 19:10
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**2.2 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	ND	4.6	ng/L
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.4 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**3.1 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**2.7 J**	**5.9**	**ng/L**
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	84	(10 - 118)
Fluorene d-10	64	(41 - 162)
Naphthalene-d8	75	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFBD-090500

GC/MS Semivolatiles

Lot-Sample #...:	R0I060133-004	**Work Order #...:**	DJXA9101	**Matrix.....:**	WATER
Date Sampled...:	09/05/00	**Date Received..:**	09/06/00		
Prep Date.....:	09/07/00	**Analysis Date..:**	09/13/00		
Prep Batch #...:	0256212	**Analysis Time..:**	19:49		
Dilution Factor:	1				
		Method.....:	SW846 8270A SIM		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**3.5 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**2.8 J**	**5.9**	**ng/L**
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.8 J**	**5.6**	**ng/L**
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**6.6 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	**2.5 J**	**5.7**	**ng/L**
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**2.6 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.7 J**	**4.6**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	82	(10 - 118)
Fluorene d-10	73	(41 - 162)
Naphthalene-d8	72	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4FEED-090500

GC/MS Semivolatiles

Lot-Sample #...: R0I060133-005 Work Order #...: DJXAA101 Matrix.....: WATER
Date Sampled...: 09/05/00 Date Received..: 09/06/00
Prep Date.....: 09/07/00 Analysis Date..: 09/13/00
Prep Batch #...: 0256212 Analysis Time..: 20:27
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Anthracene	**1.5 J**	**3.4**	**ng/L**
Benzo(ghi)perylene	ND	6.2	ng/L
Acridine	ND	6.2	ng/L
Carbazole	**23**	**3.8**	**ng/L**
Fluoranthene	**14**	**4.6**	**ng/L**
Pyrene	**17**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.0 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**140**	**5.0**	**ng/L**
Indene	**31**	**4.7**	**ng/L**
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	**13**	**5.2**	**ng/L**
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	**140**	**5.7**	**ng/L**
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.9 J**	**4.7**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	72	(10 - 118)
Fluorene d-10	59	(41 - 162)
Naphthalene-d8	63	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP10FEED-090500

GC/MS Semivolatiles

Lot-Sample #...: R0I060133-006 Work Order #...: DJXAC101 Matrix.....: WATER
Date Sampled...: 09/05/00 Date Received..: 09/06/00
Prep Date.....: 09/07/00 Analysis Date..: 09/19/00
Prep Batch #...: 0256212 Analysis Time..: 11:20
Dilution Factor: 2
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Naphthalene	**85**	**17**	**ng/L**
Benzo(b)thiophene	**9.6 J**	**10**	**ng/L**
Quinoline	ND	18	ng/L
Indole	ND	9.4	ng/L
2-Methylnaphthalene	**7.7 J**	**12**	**ng/L**
2,3-Benzofuran	ND	11	ng/L
2,3-Dihydroindene	**22**	**10**	**ng/L**
Indene	**3.3 J**	**9.4**	**ng/L**
1-Methylnaphthalene	**13**	**11**	**ng/L**
Biphenyl	**5.0 J**	**11**	**ng/L**
Acenaphthylene	**18**	**9.6**	**ng/L**
Acenaphthene	**130**	**11**	**ng/L**
Dibenzofuran	**12**	**11**	**ng/L**
Fluorene	**40**	**8.2**	**ng/L**
Dibenzothiophene	**7.4 J**	**8.2**	**ng/L**
Phenanthrene	**9.1 J**	**9.4**	**ng/L**
Anthracene	**3.6 J**	**6.8**	**ng/L**
Acridine	ND	12	ng/L
Carbazole	**3.8 J**	**7.6**	**ng/L**
Fluoranthene	**22**	**9.2**	**ng/L**
Pyrene	**42**	**8.4**	**ng/L**
Benzo(a)anthracene	**1.9 J**	**8.6**	**ng/L**
Chrysene	**2.3 J**	**11**	**ng/L**
Benzo(b)fluoranthene	ND	9.4	ng/L
Benzo(k)fluoranthene	ND	7.8	ng/L
Benzo(e)pyrene	ND	8.6	ng/L
Benzo(a)pyrene	ND	5.0	ng/L
Perylene	ND	6.6	ng/L
Indeno(1,2,3-cd)pyrene	ND	11	ng/L
Benzo(ghi)perylene	ND	12	ng/L
Dibenz(a,h)anthracene	ND	12	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	47	(10 - 118)
Fluorene d-10	85	(41 - 162)
Naphthalene-d8	66	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP10T-090500

GC/MS Semivolatiles

Lot-Sample #...: R0I060133-007 Work Order #...: DJXAE101 Matrix.....: WATER
Date Sampled...: 09/05/00 Date Received..: 09/06/00
Prep Date.....: 09/07/00 Analysis Date..: 09/13/00
Prep Batch #...: 0256212 Analysis Time..: 21:44
Dilution Factor: 1

Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.6 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	ND	4.6	ng/L
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.0 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	58	(10 - 118)
Fluorene d-10	66	(41 - 162)
Naphthalene-d8	74	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

EXECUTIVE SUMMARY - Detection Highlights

R0I060133

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4T-090500 09/05/00 001				
2,3-Dihydroindene	3.7 J	5.0	ng/L	SW846 8270A SIM
Naphthalene	7.1 J	8.6	ng/L	SW846 8270A SIM
2-Methylnaphthalene	8.3	5.9	ng/L	SW846 8270A SIM
1-Methylnaphthalene	3.6 J	5.6	ng/L	SW846 8270A SIM
Biphenyl	2.1 J	5.6	ng/L	SW846 8270A SIM
Acenaphthylene	1.7 J	4.8	ng/L	SW846 8270A SIM
Acenaphthene	14	5.7	ng/L	SW846 8270A SIM
Dibenzofuran	6.1	5.7	ng/L	SW846 8270A SIM
Fluorene	8.3	4.1	ng/L	SW846 8270A SIM
Dibenzothiophene	4.2	4.1	ng/L	SW846 8270A SIM
Phenanthrene	87	4.7	ng/L	SW846 8270A SIM
Fluoranthene	40	4.6	ng/L	SW846 8270A SIM
Pyrene	20	4.2	ng/L	SW846 8270A SIM
Chrysene	3.0 J	5.6	ng/L	SW846 8270A SIM
GAC-SLP4TD-090500 09/05/00 002				
2,3-Dihydroindene	4.6 J	5.0	ng/L	SW846 8270A SIM
Acenaphthene	4.9 J	5.7	ng/L	SW846 8270A SIM
Phenanthrene	2.1 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	1.7 J	4.6	ng/L	SW846 8270A SIM
Chrysene	2.2 J	5.6	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	2.2 J	6.2	ng/L	SW846 8270A SIM
GAC-SLP4TFB-090500 09/05/00 003				
Phenanthrene	2.2 J	4.7	ng/L	SW846 8270A SIM
Chrysene	2.4 J	5.6	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	3.1 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	2.7 J	5.9	ng/L	SW846 8270A SIM
GAC-SLP4TFBD-090500 09/05/00 004				
Benzo(ghi)perylene	3.5 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	2.8 J	5.9	ng/L	SW846 8270A SIM
Chrysene	2.8 J	5.6	ng/L	SW846 8270A SIM
Naphthalene	6.6 J	8.6	ng/L	SW846 8270A SIM
Acenaphthene	2.5 J	5.7	ng/L	SW846 8270A SIM
Phenanthrene	2.6 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	1.7 J	4.6	ng/L	SW846 8270A SIM

(Continued on next page)

EXECUTIVE SUMMARY - Detection Highlights

R0I060133

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4FEED-090500 09/05/00 005				
Anthracene	1.5 J	3.4	ng/L	SW846 8270A SIM
Carbazole	23	3.8	ng/L	SW846 8270A SIM
Fluoranthene	14	4.6	ng/L	SW846 8270A SIM
Pyrene	17	4.2	ng/L	SW846 8270A SIM
Chrysene	2.0 J	5.6	ng/L	SW846 8270A SIM
2,3-Dihydroindene	140	5.0	ng/L	SW846 8270A SIM
Indene	31	4.7	ng/L	SW846 8270A SIM
Benzo(b)thiophene	13	5.2	ng/L	SW846 8270A SIM
Acenaphthene	140	5.7	ng/L	SW846 8270A SIM
Phenanthrene	3.9 J	4.7	ng/L	SW846 8270A SIM
GAC-SLP10FEED-090500 09/05/00 006				
Naphthalene	85	17	ng/L	SW846 8270A SIM
Benzo(b)thiophene	9.6 J	10	ng/L	SW846 8270A SIM
2-Methylnaphthalene	7.7 J	12	ng/L	SW846 8270A SIM
2,3-Dihydroindene	22	10	ng/L	SW846 8270A SIM
Indene	3.3 J	9.4	ng/L	SW846 8270A SIM
1-Methylnaphthalene	13	11	ng/L	SW846 8270A SIM
Biphenyl	5.0 J	11	ng/L	SW846 8270A SIM
Acenaphthylene	18	9.6	ng/L	SW846 8270A SIM
Acenaphthene	130	11	ng/L	SW846 8270A SIM
Dibenzofuran	12	11	ng/L	SW846 8270A SIM
Fluorene	40	8.2	ng/L	SW846 8270A SIM
Dibenzothiophene	7.4 J	8.2	ng/L	SW846 8270A SIM
Phenanthrene	9.1 J	9.4	ng/L	SW846 8270A SIM
Anthracene	3.6 J	6.8	ng/L	SW846 8270A SIM
Carbazole	3.8 J	7.6	ng/L	SW846 8270A SIM
Fluoranthene	22	9.2	ng/L	SW846 8270A SIM
Pyrene	42	8.4	ng/L	SW846 8270A SIM
Benzo(a)anthracene	1.9 J	8.6	ng/L	SW846 8270A SIM
Chrysene	2.3 J	11	ng/L	SW846 8270A SIM
GAC-SLP10T-090500 09/05/00 007				
Phenanthrene	3.6 J	4.7	ng/L	SW846 8270A SIM
Chrysene	2.0 J	5.6	ng/L	SW846 8270A SIM

METHODS SUMMARY

R0I060133

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Base/Neutrals and Acids	SW846 8270A SIM	

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

FOURTH QUARTER

PAH ANALYSIS

STL Denver
4955 Yarrow Street
Arvada, CO 80002-4517

Tel 303 736 0100
Fax 303 431 7171
www stl-inc com

November 10, 2000

Mr Scott Anderson
City of St Louis Park
3752 Wooddale Avenue
St Louis Park, MN 55416

SEVERN TRENT LABORATORIES LOT NUMBER R0K010223

Dear Mr Anderson

Enclosed is the analytical report for the water samples received by Severn Trent Laboratory's Advanced Analytical Services Group on November 10, 2000. Included with the report is a Case Narrative This letter authorizes the release of the analytical results and is considered an integral part of this report

Please refer to the lot number referenced above to expedite any future discussions We will be happy to answer any questions or concerns that you may have

Sincerely,

Mark J Mensik
Project Manager
Advanced Analytical Services Group

CC Bill Gregg, ENSR Corporation

STL Denver

CASE NARRATIVE FOR

City of St Louis Park

November 10, 2000

STL AASG Lot Number R0K010223

Introduction

Five aqueous samples were received at STL Denver on November 1, 2000 The samples were logged in under the STL lot number R0K010223 A cross-reference associating STL's laboratory sample numbers to the actual field sample number is included The samples were analyzed for part per trillion (ppt5) PAHs

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP There were no quality control problems or technical difficulties encountered which would impact the interpretation or use of data in this report

Reported By: _____ **Date:** 11/10/00

Mark J Mensik
Project Manager
Advanced Analytical Services Group

Chain of Custody Record

Quanterra

QUA-4124 0797

Client	**Project Manager**	**Date**	**Chain of Custody Number**
CITY OF ST. LOUIS PARK UTILITY DIVISION 3752 WOODDALE AVENUE ST LOUIS PARK, MN 55416	[illegible]	10-31-00	39918
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page ____ of ____**
	924-2557; 953) 924-2570		
City	**Site Contact**	**Lab Contact**	
	[illegible]		
Project Name	**Carrier/Waybill Number**		
[illegible]	FED EX 808846316286		
Contract/Purchase Order/Quote No			

Sample I D No and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed	Soil	Containers & Preservatives: Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis (Attach list if more space is needed): PCP 604	Special Instructions/ Conditions of Receipt
GAC-SLP-[illegible]	004 10-31-00		X			X						6	X	NOT 5
GAC-SLP-[illegible]			X			X						6	X	NOT 5
GAC-SLPATMS-[illegible]	010		X			X						6	X	PPT 5
GAC-SLPATMSD-[illegible]			X			X						6	X	PPT 5
GAC-SLPATB-[illegible]	001		X			X						6	X	PPT 5
GAC-SLPATBAB-[illegible]			X			X						6	X	PPT 5
GAC-SLP-LEAD-[illegible]	005 10-31-00		X			X						6	X	PPT 5

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify)

	Date	Time		Date	Time
1 Relinquished By [illegible]	10-31-00	1400	1. Received By		
2 Relinquished By			2 Received By		
3 Relinquished By			3 Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample, CANARY - Returned to Client with Report, PINK - Field Copy

ANALYTICAL REPORT

Reilly Tar and Chemical Site

Lot #: R0K010223

Mr. Scott Anderson

City of St. Louis Park

SEVERN TRENT LABORATORIES, INC.

Mark Mensik
Project Manager

November 10, 2000

EXECUTIVE SUMMARY - Detection Highlights

R0K010223

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4T-103100 10/31/00 001				
2,3-Dihydroindene	2.1 J	5.0	ng/L	SW846 8270A SIM
Phenanthrene	4.6 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	2.8 J	4.6	ng/L	SW846 8270A SIM
Pyrene	2.0 J	4.2	ng/L	SW846 8270A SIM
Chrysene	2.4 J	5.6	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	2.6 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	2.1 J	5.9	ng/L	SW846 8270A SIM
GAC-SLP4TD-103100 10/31/00 002				
2,3-Dihydroindene	2.8 J	5.0	ng/L	SW846 8270A SIM
Naphthalene	3.0 J	8.6	ng/L	SW846 8270A SIM
2-Methylnaphthalene	2.1 J	5.9	ng/L	SW846 8270A SIM
Phenanthrene	6.2	4.7	ng/L	SW846 8270A SIM
Fluoranthene	3.5 J	4.6	ng/L	SW846 8270A SIM
Pyrene	2.0 J	4.2	ng/L	SW846 8270A SIM
Chrysene	2.5 J	5.6	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	2.8 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	2.7 J	5.9	ng/L	SW846 8270A SIM
GAC-SLP4TFB-103100 10/31/00 003				
Naphthalene	4.8 J	8.6	ng/L	SW846 8270A SIM
2-Methylnaphthalene	2.5 J	5.9	ng/L	SW846 8270A SIM
Phenanthrene	7.0	4.7	ng/L	SW846 8270A SIM
Fluoranthene	4.3 J	4.6	ng/L	SW846 8270A SIM
Pyrene	2.5 J	4.2	ng/L	SW846 8270A SIM
Chrysene	2.3 J	5.6	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	3.7 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	3.3 J	5.9	ng/L	SW846 8270A SIM
GAC-SLP4TFBD-103100 10/31/00 004				
Naphthalene	4.6 J	8.6	ng/L	SW846 8270A SIM
2-Methylnaphthalene	2.3 J	5.9	ng/L	SW846 8270A SIM
Phenanthrene	7.0	4.7	ng/L	SW846 8270A SIM
Fluoranthene	3.8 J	4.6	ng/L	SW846 8270A SIM
Pyrene	2.3 J	4.2	ng/L	SW846 8270A SIM
Chrysene	5.2 J	5.6	ng/L	SW846 8270A SIM
Benzo(e)pyrene	3.8 J	4.3	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	3.6 J	6.2	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	3.2 J	5.9	ng/L	SW846 8270A SIM

(Continued on next page)

EXECUTIVE SUMMARY - Detection Highlights

R0K010223

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4TLEAD-103100 10/31/00 005				
2,3-Dihydroindene	2.4 J	5.0	ng/L	SW846 8270A SIM
Naphthalene	4.0 J	8.6	ng/L	SW846 8270A SIM
2-Methylnaphthalene	2.6 J	5.9	ng/L	SW846 8270A SIM
Phenanthrene	7.6	4.7	ng/L	SW846 8270A SIM
Fluoranthene	4.2 J	4.6	ng/L	SW846 8270A SIM
Pyrene	2.6 J	4.2	ng/L	SW846 8270A SIM
Chrysene	4.0 J	5.6	ng/L	SW846 8270A SIM
Benzo(e)pyrene	3.1 J	4.3	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	2.1 J	6.2	ng/L	SW846 8270A SIM

METHODS SUMMARY

R0K010223

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Base/Neutrals and Acids	SW846 8270A SIM	

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

R0K010223

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270A SIM	Mark Dymerski	004626

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

R0K010223

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
DN62Q	001	GAC-SLP4T-103100	10/31/00	
DN62W	002	GAC-SLP4TD-103100	10/31/00	
DN62X	003	GAC-SLP4TFB-103100	10/31/00	
DN620	004	GAC-SLP4TFBD-103100	10/31/00	
DN622	005	GAC-SLP4TLEAD-103100	10/31/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as 'ND' were not detected at or above the stated limit
- This report must not be reproduced except in full, without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure reactivity, redox potential, specific gravity spot tests, solids, solubility, temperature, viscosity, and weight

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4T-103100

GC/MS Semivolatiles

Lot-Sample #...: R0K010223-001 Work Order #...: DN62Q1AA Matrix.....: WG
Date Sampled...: 10/31/00 Date Received..: 11/01/00
Prep Date.....: 11/02/00 Analysis Date..: 11/08/00
Prep Batch #...: 0309202 Analysis Time..: 13:27
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**2.1 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**4.6 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**2.8 J**	**4.6**	**ng/L**
Pyrene	**2.0 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.4 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**2.6 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**2.1 J**	**5.9**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	77	(10 - 118)
Fluorene d-10	65	(41 - 162)
Naphthalene-d8	64	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TD-103100

GC/MS Semivolatiles

Lot-Sample #...: R0K010223-002 Work Order #...: DN62W1AA Matrix.....: WG
Date Sampled...: 10/31/00 Date Received..: 11/01/00
Prep Date.....: 11/02/00 Analysis Date..: 11/08/00
Prep Batch #...: 0309202 Analysis Time..: 15:24
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**2.8 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	**3.0 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	**2.1 J**	**5.9**	**ng/L**
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**6.2**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**3.5 J**	**4.6**	**ng/L**
Pyrene	**2.0 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.5 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**2.8 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**2.7 J**	**5.9**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	77	(10 - 118)
Fluorene d-10	66	(41 - 162)
Naphthalene-d8	73	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFB-103100

GC/MS Semivolatiles

Lot-Sample #...: R0K010223-003 Work Order #...: DN62X1AA Matrix.....: WG
Date Sampled...: 10/31/00 Date Received..: 11/01/00
Prep Date.....: 11/02/00 Analysis Date..: 11/08/00
Prep Batch #...: 0309202 Analysis Time..: 16:03
Dilution Factor: 1

Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**4.8 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	**2.5 J**	**5.9**	**ng/L**
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**7.0**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**4.3 J**	**4.6**	**ng/L**
Pyrene	**2.5 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**2.3 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**3.7 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**3.3 J**	**5.9**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	72	(10 - 118)
Fluorene d-10	61	(41 - 162)
Naphthalene-d8	76	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TFBD-103100

GC/MS Semivolatiles

Lot-Sample #...: R0K010223-004 Work Order #...: DN6201AA Matrix.....: WG
Date Sampled...: 10/31/00 Date Received..: 11/01/00
Prep Date.....: 11/02/00 Analysis Date..: 11/08/00
Prep Batch #...: 0309202 Analysis Time..: 16:42
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**4.6 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	**2.3 J**	**5.9**	**ng/L**
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**7.0**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**3.8 J**	**4.6**	**ng/L**
Pyrene	**2.3 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**5.2 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	**3.8 J**	**4.3**	**ng/L**
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**3.6 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	**3.2 J**	**5.9**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	105	(10 - 118)
Fluorene d-10	65	(41 - 162)
Naphthalene-d8	74	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TLEAD-103100

GC/MS Semivolatiles

Lot-Sample #...: R0K010223-005 Work Order #...: DN6221AA Matrix.....: WG
Date Sampled...: 10/31/00 Date Received..: 11/01/00
Prep Date.....: 11/02/00 Analysis Date..: 11/08/00
Prep Batch #...: 0309202 Analysis Time..: 17:20
Dilution Factor: 1

Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**2.4 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	**4.0 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	**2.6 J**	**5.9**	**ng/L**
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**7.6**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**4.2 J**	**4.6**	**ng/L**
Pyrene	**2.6 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	**4.0 J**	**5.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	**3.1 J**	**4.3**	**ng/L**
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	**2.1 J**	**6.2**	**ng/L**
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	76	(10 - 118)
Fluorene d-10	53	(41 - 162)
Naphthalene-d8	62	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

QC DATA ASSOCIATION SUMMARY

R0K010223

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WG	SW846 8270A SIM		0309202	0309081
002	WG	SW846 8270A SIM		0309202	0309081
003	WG	SW846 8270A SIM		0309202	0309081
004	WG	SW846 8270A SIM		0309202	0309081
005	WG	SW846 8270A SIM		0309202	0309081

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: R0K010223 **Work Order #...:** DPD3K1AA **Matrix.....:** WATER
MB Lot-Sample #: R0K040000-202
Prep Date.....: 11/02/00 **Analysis Time..:** 10:11
Analysis Date..: 11/08/00 **Prep Batch #...:** 0309202
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	5.7	ng/L	SW846 8270A SIM
Acenaphthylene	ND	4.8	ng/L	SW846 8270A SIM
Anthracene	ND	3.4	ng/L	SW846 8270A SIM
Benzo(a)anthracene	ND	4.3	ng/L	SW846 8270A SIM
Benzo(b)fluoranthene	ND	4.7	ng/L	SW846 8270A SIM
Benzo(k)fluoranthene	ND	3.9	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	**2.8 J**	**6.2**	**ng/L**	**SW846 8270A SIM**
Benzo(a)pyrene	ND	2.5	ng/L	SW846 8270A SIM
Benzo(e)pyrene	**1.9 J**	**4.3**	**ng/L**	**SW846 8270A SIM**
Biphenyl	ND	5.6	ng/L	SW846 8270A SIM
Chrysene	**3.2 J**	**5.6**	**ng/L**	**SW846 8270A SIM**
Dibenz(a,h)anthracene	**2.4 J**	**5.9**	**ng/L**	**SW846 8270A SIM**
Dibenzofuran	ND	5.7	ng/L	SW846 8270A SIM
Fluoranthene	**2.4 J**	**4.6**	**ng/L**	**SW846 8270A SIM**
Fluorene	ND	4.1	ng/L	SW846 8270A SIM
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L	SW846 8270A SIM
2-Methylnaphthalene	ND	5.9	ng/L	SW846 8270A SIM
Naphthalene	ND	8.6	ng/L	SW846 8270A SIM
Phenanthrene	**4.0 J**	**4.7**	**ng/L**	**SW846 8270A SIM**
Pyrene	**1.5 J**	**4.2**	**ng/L**	**SW846 8270A SIM**
Carbazole	ND	3.8	ng/L	SW846 8270A SIM
1-Methylnaphthalene	ND	5.6	ng/L	SW846 8270A SIM
Indene	ND	4.7	ng/L	SW846 8270A SIM
Quinoline	ND	9.0	ng/L	SW846 8270A SIM
2,3-Benzofuran	ND	5.4	ng/L	SW846 8270A SIM
2,3-Dihydroindene	ND	5.0	ng/L	SW846 8270A SIM
Benzo(b)thiophene	ND	5.2	ng/L	SW846 8270A SIM
Indole	ND	4.7	ng/L	SW846 8270A SIM
Acridine	ND	6.2	ng/L	SW846 8270A SIM
Perylene	ND	3.3	ng/L	SW846 8270A SIM
Dibenzothiophene	ND	4.1	ng/L	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	49	(10 - 118)
Fluorene d-10	50	(41 - 162)
Naphthalene-d8	84	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result Result is less than RL

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0K010223 **Work Order #...:** DPD3K1AC-LCS **Matrix.....:** WATER
LCS Lot-Sample#: R0K040000-202 DPD3K1AD-LCSD
Prep Date.....: 11/02/00 **Analysis Date..:** 11/08/00
Prep Batch #...: 0309202 **Analysis Time..:** 12:09
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	10.0	7.10	ng/L	71		SW846 8270A SIM
	10.0	7.01	ng/L	70	1.3	SW846 8270A SIM
Chrysene	10.0	9.29	ng/L	93		SW846 8270A SIM
	10.0	9.08	ng/L	91	2.3	SW846 8270A SIM
Fluorene	10.0	5.91	ng/L	59		SW846 8270A SIM
	10.0	6.70	ng/L	67	13	SW846 8270A SIM
Indene	10.0	6.14	ng/L	61		SW846 8270A SIM
	10.0	6.45	ng/L	64	5.0	SW846 8270A SIM
Naphthalene	10.0	9.04	ng/L	90		SW846 8270A SIM
	10.0	7.72	ng/L	77	16	SW846 8270A SIM
Quinoline	10.0	4.41	ng/L	44		SW846 8270A SIM
	10.0	4.20	ng/L	42	4.7	SW846 8270A SIM
Benzo(e)pyrene	10.0	6.09	ng/L	61		SW846 8270A SIM
	10.0	6.93	ng/L	69	13	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	80	(10 - 118)
	69	(10 - 118)
Fluorene d-10	56	(41 - 162)
	57	(41 - 162)
Naphthalene-d8	60	(21 - 108)
	57	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0K010223 **Work Order #...:** DPD3K1AC-LCS **Matrix.....:** WATER
LCS Lot-Sample#: R0K040000-202 DPD3K1AD-LCSD
Prep Date.....: 11/02/00 **Analysis Date..:** 11/08/00
Prep Batch #...: 0309202 **Analysis Time..:** 12:09
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	**71**	**(20 - 150)**			**SW846 8270A SIM**
	70	**(20 - 150)**	**1.3**	**(0-20)**	**SW846 8270A SIM**
Chrysene	**93**	**(20 - 132)**			**SW846 8270A SIM**
	91	**(20 - 132)**	**2.3**	**(0-20)**	**SW846 8270A SIM**
Fluorene	**59**	**(20 - 132)**			**SW846 8270A SIM**
	67	**(20 - 132)**	**13**	**(0-20)**	**SW846 8270A SIM**
Indene	**61**	**(20 - 150)**			**SW846 8270A SIM**
	64	**(20 - 150)**	**5.0**	**(0-20)**	**SW846 8270A SIM**
Naphthalene	**90**	**(20 - 150)**			**SW846 8270A SIM**
	77	**(20 - 150)**	**16**	**(0-20)**	**SW846 8270A SIM**
Quinoline	**44**	**(20 - 150)**			**SW846 8270A SIM**
	42	**(20 - 150)**	**4.7**	**(0-20)**	**SW846 8270A SIM**
Benzo(e)pyrene	**61**	**(20 - 150)**			**SW846 8270A SIM**
	69	**(20 - 150)**	**13**	**(0-20)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	80	(10 - 118)
	69	(10 - 118)
Fluorene d-10	56	(41 - 162)
	57	(41 - 162)
Naphthalene-d8	60	(21 - 108)
	57	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0K010223 **Work Order #...:** DN62Q1AC-MS **Matrix.....:** WG
MS Lot-Sample #: R0K010223-001 DN62Q1AD-MSD
Date Sampled...: 10/31/00 **Date Received..:** 11/01/00
Prep Date.....: 11/02/00 **Analysis Date..:** 11/08/00
Prep Batch #...: 0309202 **Analysis Time..:** 14:06
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	**ND**	**10.1**	**8.10**	**ng/L**	**81**		**SW846 8270A SIM**
	ND	**10.0**	**7.55**	**ng/L**	**75**	**7.0**	**SW846 8270A SIM**
Chrysene	**2.4**	**10.1**	**8.36**	**ng/L**	**60**		**SW846 8270A SIM**
	2.4	**10.0**	**7.97**	**ng/L**	**56**	**4.8**	**SW846 8270A SIM**
Fluorene	**ND**	**10.1**	**6.81**	**ng/L**	**68**		**SW846 8270A SIM**
	ND	**10.0**	**5.99**	**ng/L**	**60**	**13**	**SW846 8270A SIM**
Indene	**ND**	**10.1**	**7.11**	**ng/L**	**71**		**SW846 8270A SIM**
	ND	**10.0**	**6.44**	**ng/L**	**64**	**9.8**	**SW846 8270A SIM**
Naphthalene	**ND**	**10.1**	**9.25**	**ng/L**	**92**		**SW846 8270A SIM**
	ND	**10.0**	**8.83**	**ng/L**	**88**	**4.6**	**SW846 8270A SIM**
Quinoline	**ND**	**10.1**	**4.56**	**ng/L**	**45**		**SW846 8270A SIM**
	ND	**10.0**	**4.31**	**ng/L**	**43**	**5.7**	**SW846 8270A SIM**
Benzo(e)pyrene	**ND**	**10.1**	**5.07**	**ng/L**	**50**		**SW846 8270A SIM**
	ND	**10.0**	**4.37**	**ng/L**	**43**	**15**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	73	(10 - 118)
	74	(10 - 118)
Fluorene d-10	64	(41 - 162)
	63	(41 - 162)
Naphthalene-d8	75	(21 - 108)
	70	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0K010223 **Work Order #...:** DN62Q1AC-MS **Matrix.....:** WG
MS Lot-Sample #: R0K010223-001 DN62Q1AD-MSD
Date Sampled...: 10/31/00 **Date Received..:** 11/01/00
Prep Date.....: 11/02/00 **Analysis Date..:** 11/08/00
Prep Batch #...: 0309202 **Analysis Time..:** 14:06
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	**81**	**(20 - 150)**			**SW846 8270A SIM**
	75	**(20 - 150)**	**7.0**	**(0-20)**	**SW846 8270A SIM**
Chrysene	**60**	**(20 - 132)**			**SW846 8270A SIM**
	56	**(20 - 132)**	**4.8**	**(0-20)**	**SW846 8270A SIM**
Fluorene	**68**	**(20 - 132)**			**SW846 8270A SIM**
	60	**(20 - 132)**	**13**	**(0-20)**	**SW846 8270A SIM**
Indene	**71**	**(20 - 150)**			**SW846 8270A SIM**
	64	**(20 - 150)**	**9.8**	**(0-20)**	**SW846 8270A SIM**
Naphthalene	**92**	**(20 - 150)**			**SW846 8270A SIM**
	88	**(20 - 150)**	**4.6**	**(0-20)**	**SW846 8270A SIM**
Quinoline	**45**	**(20 - 150)**			**SW846 8270A SIM**
	43	**(20 - 150)**	**5.7**	**(0-20)**	**SW846 8270A SIM**
Benzo(e)pyrene	**50**	**(20 - 150)**			**SW846 8270A SIM**
	43	**(20 - 150)**	**15**	**(0-20)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	73	(10 - 118)
	74	(10 - 118)
Fluorene d-10	64	(41 - 162)
	63	(41 - 162)
Naphthalene-d8	75	(21 - 108)
	70	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

Special Verification

PAH ANALYSIS

SEVERN TRENT SERVICES

STL Denver
4955 Yarrow Street
Arvada CO 80002-4517

Tel 303 736 0100
Fax 303 431 7171
www stl-inc com

December 20, 2000

Mr Scott Anderson
City of St Louis Park
3752 Wooddale Avenue
St Louis Park, MN 55416

SEVERN TRENT LABORATORIES LOT NUMBER R0K150283

Dear Mr Anderson

Enclosed is the analytical report for the water samples received by Severn Trent Laboratory's Advanced Analytical Services Group on November 15, 2000. Included with the report is a Case Narrative This letter authorizes the release of the analytical results and is considered an integral part of this report

Please refer to the lot number referenced above to expedite any future discussions We will be happy to answer any questions or concerns that you may have

Sincerely,

Mark J Mensik
Project Manager
Advanced Analytical Services Group

CC Bill Gregg, ENSR Corporation

ANALYTICAL REPORT

Reilly Tar and Chemical Site

Lot #: R0K150283

Mr. Scott Anderson

City of St. Louis Park

SEVERN TRENT LABORATORIES, INC.

Mark Mensik
Project Manager

December 19, 2000

Table Of Contents

Standard Deliverables with Supporting Documentation

Report Contents	Number of Pages
Standard Deliverables *(The Cover Letter and the Report Cover page are considered integral parts of this Standard Deliverable package This report is incomplete unless all pages indicated in this Table of Contents are included)*	20
• **Table of Contents**	
• **Case Narrative**	
• **Executive Summary – Detection Highlights**	
• **Methods Summary**	
• **Method/Analyst Summary**	
• **Lot Sample Summary**	
• **Analytical Results**	
• **QC Data Association Summary**	
• **Chain-of-Custody**	

Supporting Documentation *(Note: A one-page "Description of Supporting Documentation" is provided at the beginning of this section.)*	**Check below when supporting documentation is present.**
• **Volatile GC/MS**	
• **Semivolatile GC/MS**	X
• **Volatile GC**	
• **Semivolatile GC**	
• **LC/MS or HPLC**	
• **Metals**	
• **General Chemistry**	
• **Subcontracted Data**	

STL Denver

CASE NARRATIVE FOR

City of St Louis Park

December 19, 2000

STL Lot Number R0K150283

Introduction

Four aqueous samples were received at STL Denver on November 15, 2000 The samples were logged in under the STL lot number R0K150283 A cross-reference associating STL's laboratory sample numbers to the actual field sample number is included The samples were analyzed for part per trillion (ppt5) PAHs

Data Quality Assessment

The matrix spike (MS) associated with these samples was extracted on 11/20/00, although the report indicates that the MS was extracted on 11/17/00 This discrepancy is due to limitations of the laboratory information management system employed at the laboratory A method blank (MB), a laboratory control sample (LCS) and a LCSD (duplicate) were also extracted with the MS on 11/20/00 The reports for the MB and LCS indicate the correct extraction date of 11/20/00 All target analytes and surrogates were in control for the MB, MS, LCS, and LCSD

The LCS data report for the extraction date of 11/20/00 only includes the LCS data Refer to the Batch QC section of the enclosed raw data for the LCSD results The relative percent difference (RPD) for 2-methylnaphthalene and naphthalene were above the upper control limit

There is no MSD (duplicate) associated with these samples due to an extraction error

The LCS and LCSD extracted with the samples on 11/17/00 exhibited out of control results for the RPD for chrysene, indene, naphthalene, quinoline, and benzo(e)pyrene All analytes in the LCS and LCSD were within the control limits for percent recovery The primary reason for the RPD failure is due to the low concentration of the spike (10 ng/L) relative to the method reporting limits (RL) When spiking at levels near the RL, some precision is sacrificed, however, confidence in the RL is gained, and the incidence of false negatives is minimized

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP. There were no quality control problems or technical difficulties encountered which would impact the interpretation or use of data in this report

Reported By: _____ **Date:** 12/19/00

Mark J Mensik
Project Manager
Advanced Analytical Services Group

EXECUTIVE SUMMARY - Detection Highlights

R0K150283

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
GAC-SLP4T 11/14/00 001				
2,3-Dihydroindene	3.2 J	5.0	ng/L	SW846 8270A SIM
Acenaphthene	2.1 J	5.7	ng/L	SW846 8270A SIM
Phenanthrene	2.6 J	4.7	ng/L	SW846 8270A SIM
GAC-SLP4TD 11/14/00 002				
2,3-Dihydroindene	3.3 J	5.0	ng/L	SW846 8270A SIM
Acenaphthene	2.1 J	5.7	ng/L	SW846 8270A SIM
Phenanthrene	3.5 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	1.9 J	4.6	ng/L	SW846 8270A SIM
GAC-SLP4FB 11/14/00 003				
Naphthalene	4.0 J	8.6	ng/L	SW846 8270A SIM
Phenanthrene	3.7 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	2.7 J	4.6	ng/L	SW846 8270A SIM
Pyrene	1.8 J	4.2	ng/L	SW846 8270A SIM
GAC-SLP4FBD 11/14/00 004				
Acenaphthylene	2.9 J	4.8	ng/L	SW846 8270A SIM
Phenanthrene	3.2 J	4.7	ng/L	SW846 8270A SIM
Fluoranthene	2.1 J	4.6	ng/L	SW846 8270A SIM
Pyrene	1.5 J	4.2	ng/L	SW846 8270A SIM
Perylene	1.2 J	3.3	ng/L	SW846 8270A SIM

METHODS SUMMARY

R0K150283

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Base/Neutrals and Acids	SW846 8270A SIM	

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

R0K150283

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270A SIM	Patti Roach	003518

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

R0K150283

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
DPXH8	001	GAC-SLP4T	11/14/00	
DPXJD	002	GAC-SLP4TD	11/14/00	
DPXJH	003	GAC-SLP4FB	11/14/00	
DPXJL	004	GAC-SLP4FBD	11/14/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced except in full without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis color corrosivity, density, flashpoint, ignitability layers odor paint filter test pH porosity pressure reactivity redox potential specific gravity spot tests, solids, solubility, temperature, viscosity and weight

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4T

GC/MS Semivolatiles

Lot-Sample #...: R0K150283-001 Work Order #...: DPXH81AA Matrix.....: WG
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 06:46
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**3.2 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	**2.1 J**	**5.7**	**ng/L**
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**2.6 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	ND	4.6	ng/L
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	47	(10 - 118)
Fluorene d-10	74	(41 - 162)
Naphthalene-d8	68	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4TD

GC/MS Semivolatiles

Lot-Sample #...: R0K150283-002 Work Order #...: DPXJD1AA Matrix.....: WG
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 08:38
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	**3.3 J**	**5.0**	**ng/L**
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	**2.1 J**	**5.7**	**ng/L**
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.5 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.9 J**	**4.6**	**ng/L**
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	56	(10 - 118)
Fluorene d-10	76	(41 - 162)
Naphthalene-d8	68	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4FB

GC/MS Semivolatiles

Lot-Sample #...: R0K150283-003 Work Order #...: DPXJH1AA Matrix.....: WG
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 09:15
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**4.0 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.7 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**2.7 J**	**4.6**	**ng/L**
Pyrene	**1.8 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	79	(10 - 118)
Fluorene d-10	72	(41 - 162)
Naphthalene-d8	63	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4FBD

GC/MS Semivolatiles

Lot-Sample #...: R0K150283-004 Work Order #...: DPXJL1AA Matrix.....: WG
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 09:53
Dilution Factor: 1
Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	**2.9 J**	**4.8**	**ng/L**
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.2 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**2.1 J**	**4.6**	**ng/L**
Pyrene	**1.5 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	**1.2 J**	**3.3**	**ng/L**
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	90	(10 - 118)
Fluorene d-10	70	(41 - 162)
Napnthalene-d8	62	(21 - 108)

NOTE(S):

Estimated result. Result is less than RL

QC DATA ASSOCIATION SUMMARY

R0K150283

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WG	SW846 8270A SIM		0322466	0325170
002	WG	SW846 8270A SIM		0322466	0325170
003	WG	SW846 8270A SIM		0322466	0325170
004	WG	SW846 8270A SIM		0322466	0325170

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AA Matrix.....: WATER
MB Lot-Sample #: R0K170000-466

Prep Date.....: 11/17/00 Analysis Time..: 14.50
Analysis Date..: 11/30/00 Prep Batch #...: 0322466
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	5.7	ng/L	SW846 8270A SIM
Acenaphthylene	ND	4.8	ng/L	SW846 8270A SIM
Anthracene	ND	3.4	ng/L	SW846 8270A SIM
Benzo(a)anthracene	ND	4.3	ng/L	SW846 8270A SIM
Benzo(b)fluoranthene	ND	4.7	ng/L	SW846 8270A SIM
Benzo(k)fluoranthene	ND	3.9	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	ND	6.2	ng/L	SW846 8270A SIM
Benzo(a)pyrene	ND	2.5	ng/L	SW846 8270A SIM
Naphthalene	ND	8.6	ng/L	SW846 8270A SIM
Benzo(e)pyrene	**1.6 J**	**4.3**	**ng/L**	**SW846 8270A SIM**
Phenanthrene	**3.1 J**	**4.7**	**ng/L**	**SW846 8270A SIM**
Biphenyl	ND	5.6	ng/L	SW846 8270A SIM
Pyrene	ND	4.2	ng/L	SW846 8270A SIM
Chrysene	ND	5.6	ng/L	SW846 8270A SIM
Carbazole	ND	3.8	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	ND	5.9	ng/L	SW846 8270A SIM
1-Methylnaphthalene	ND	5.6	ng/L	SW846 8270A SIM
Dibenzofuran	ND	5.7	ng/L	SW846 8270A SIM
Indene	ND	4.7	ng/L	SW846 8270A SIM
Fluoranthene	ND	4.6	ng/L	SW846 8270A SIM
Fluorene	ND	4.1	ng/L	SW846 8270A SIM
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L	SW846 8270A SIM
2-Methylnaphthalene	ND	5.9	ng/L	SW846 8270A SIM
Quinoline	ND	9.0	ng/L	SW846 8270A SIM
2,3-Benzofuran	ND	5.4	ng/L	SW846 8270A SIM
2,3-Dihydroindene	ND	5.0	ng/L	SW846 8270A SIM
Benzo(b)thiophene	ND	5.2	ng/L	SW846 8270A SIM
Indole	ND	4.7	ng/L	SW846 8270A SIM
Acridine	ND	6.2	ng/L	SW846 8270A SIM
Perylene	ND	3.3	ng/L	SW846 8270A SIM
Dibenzothiophene	ND	4.1	ng/L	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	83	(10 - 118)
Fluorene d-10	83	(41 - 162)
Naphthalene-d8	82	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result. Result is less than RL

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AE Matrix.....: WATER
MB Lot-Sample #: R0K170000-466

Prep Date.....: 11/20/00 Analysis Time..: 15:30
Analysis Date..: 11/30/00 Prep Batch #...: 0322466
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	5.7	ng/L	SW846 8270A SIM
Acenaphthylene	ND	4.8	ng/L	SW846 8270A SIM
Anthracene	ND	3.4	ng/L	SW846 8270A SIM
Benzo(a)anthracene	ND	4.3	ng/L	SW846 8270A SIM
Benzo(b)fluoranthene	ND	4.7	ng/L	SW846 8270A SIM
Benzo(k)fluoranthene	ND	3.9	ng/L	SW846 8270A SIM
Benzo(ghi)perylene	ND	6.2	ng/L	SW846 8270A SIM
Benzo(a)pyrene	ND	2.5	ng/L	SW846 8270A SIM
Benzo(e)pyrene	ND	4.3	ng/L	SW846 8270A SIM
Biphenyl	ND	5.6	ng/L	SW846 8270A SIM
Chrysene	ND	5.6	ng/L	SW846 8270A SIM
Dibenz(a,h)anthracene	ND	5.9	ng/L	SW846 8270A SIM
Dibenzofuran	ND	5.7	ng/L	SW846 8270A SIM
Fluoranthene	ND	4.6	ng/L	SW846 8270A SIM
Fluorene	ND	4.1	ng/L	SW846 8270A SIM
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L	SW846 8270A SIM
2-Methylnaphthalene	ND	5.9	ng/L	SW846 8270A SIM
Naphthalene	ND	8.6	ng/L	SW846 8270A SIM
Phenanthrene	**2.0 J**	**4.7**	**ng/L**	**SW846 8270A SIM**
Pyrene	ND	4.2	ng/L	SW846 8270A SIM
Carbazole	ND	3.8	ng/L	SW846 8270A SIM
1-Methylnaphthalene	ND	5.6	ng/L	SW846 8270A SIM
Indene	ND	4.7	ng/L	SW846 8270A SIM
Quinoline	ND	9.0	ng/L	SW846 8270A SIM
2,3-Benzofuran	ND	5.4	ng/L	SW846 8270A SIM
2,3-Dihydroindene	ND	5.0	ng/L	SW846 8270A SIM
Benzo(b)thiophene	ND	5.2	ng/L	SW846 8270A SIM
Dibenzothiophene	ND	4.1	ng/L	SW846 8270A SIM
Indole	ND	4.7	ng/L	SW846 8270A SIM
Acridine	ND	6.2	ng/L	SW846 8270A SIM
Perylene	ND	3.3	ng/L	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	68	(10 - 118)
Fluorene d-10	91	(41 - 162)
Naphthalene-d8	91	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result Result is less than RL

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AC-LCS Matrix.....: WATER
LCS Lot-Sample#: R0K170000-466 DP4XT1AD-LCSD
Prep Date.....: 11/17/00 Analysis Date..: 11/30/00
Prep Batch #...: 0322466 Analysis Time..: 16:10
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
2-Methylnaphthalene	10.0	9.19	ng/L	92		SW846 8270A SIM
	10.0	7.78	ng/L	78	17	SW846 8270A SIM
Chrysene	10.0	7.77	ng/L	78		SW846 8270A SIM
	10.0	6.03 p	ng/L	60	25	SW846 8270A SIM
Fluorene	10.0	8.54	ng/L	85		SW846 8270A SIM
	10.0	7.94	ng/L	79	7.3	SW846 8270A SIM
Indene	10.0	9.11	ng/L	91		SW846 8270A SIM
	10.0	7.00 p	ng/L	70	26	SW846 8270A SIM
Naphthalene	10.0	9.78	ng/L	98		SW846 8270A SIM
	10.0	7.86 p	ng/L	79	22	SW846 8270A SIM
Quinoline	10.0	5.30	ng/L	53		SW846 8270A SIM
	10.0	6.63 p	ng/L	66	22	SW846 8270A SIM
Benzo(e)pyrene	10.0	9.17	ng/L	92		SW846 8270A SIM
	10.0	7.09 p	ng/L	71	26	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	74	(10 - 118)
	58	(10 - 118)
Fluorene d-10	90	(41 - 162)
	90	(41 - 162)
Naphthalene-d8	96	(21 - 108)
	80	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AC-LCS Matrix.....: WATER
LCS Lot-Sample#: R0K170000-466 DP4XT1AD-LCSD
Prep Date.....: 11/17/00 Analysis Date..: 11/30/00
Prep Batch #...: 0322466 Analysis Time..: 16:10
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
2-Methylnaphthalene	92	(20 - 150)			SW846 8270A SIM
	78	(20 - 150)	17	(0-20)	SW846 8270A SIM
Chrysene	78	(20 - 132)			SW846 8270A SIM
	60 p	(20 - 132)	25	(0-20)	SW846 8270A SIM
Fluorene	85	(20 - 132)			SW846 8270A SIM
	79	(20 - 132)	7.3	(0-20)	SW846 8270A SIM
Indene	91	(20 - 150)			SW846 8270A SIM
	70 p	(20 - 150)	26	(0-20)	SW846 8270A SIM
Naphthalene	98	(20 - 150)			SW846 8270A SIM
	79 p	(20 - 150)	22	(0-20)	SW846 8270A SIM
Quinoline	53	(20 - 150)			SW846 8270A SIM
	66 p	(20 - 150)	22	(0-20)	SW846 8270A SIM
Benzo(e)pyrene	92	(20 - 150)			SW846 8270A SIM
	71 p	(20 - 150)	26	(0-20)	SW846 8270A SIM

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	74	(10 - 118)
	58	(10 - 118)
Fluorene d-10	90	(41 - 162)
	90	(41 - 162)
Naphthalene-d8	96	(21 - 108)
	80	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AF Matrix.....: WATER
LCS Lot-Sample#: R0K170000-466
Prep Date.....: 11/20/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 05:31
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
2-Methylnaphthalene	**10.0**	**7.55**	**ng/L**	**75**	**SW846 8270A S**
Chrysene	**10.0**	**7.39**	**ng/L**	**74**	**SW846 8270A S**
Fluorene	**10.0**	**7.16**	**ng/L**	**72**	**SW846 8270A S**
Indene	**10.0**	**6.83**	**ng/L**	**68**	**SW846 8270A S**
Naphthalene	**10.0**	**9.08**	**ng/L**	**91**	**SW846 8270A S**
Quinoline	**10.0**	**4.52**	**ng/L**	**45**	**SW846 8270A S**
Benzo(e)pyrene	**10.0**	**7.88**	**ng/L**	**79**	**SW846 8270A S**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	76	(10 - 118)
Fluorene d-10	67	(41 - 162)
Naphthalene-d8	65	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: R0K150283 Work Order #...: DP4XT1AF Matrix.....: WATER
LCS Lot-Sample#: R0K170000-466
Prep Date.....: 11/20/00 Analysis Date..: 12/02/00
Prep Batch #...: 0322466 Analysis Time..: 05:31
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
2-Methylnaphthalene	**75**	**(20 - 150)**	**SW846 8270A SIM**
Chrysene	**74**	**(20 - 132)**	**SW846 8270A SIM**
Fluorene	**72**	**(20 - 132)**	**SW846 8270A SIM**
Indene	**68**	**(20 - 150)**	**SW846 8270A SIM**
Naphthalene	**91**	**(20 - 150)**	**SW846 8270A SIM**
Quinoline	**45**	**(20 - 150)**	**SW846 8270A SIM**
Benzo(e)pyrene	**79**	**(20 - 150)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	76	(10 - 118)
Fluorene d-10	67	(41 - 162)
Naphthalene-d8	65	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Lot-Sample #...: R0K150283 Work Order #...: DPXH81AC Matrix.....: WG
MS Lot-Sample #: R0K150283-001
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/04/00
Prep Batch #...: 0322466
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	METHOD
2-Methylnaphthalene	**ND**	**10.0**	**6.17**	**ng/L**	**62**	**SW846 8270A SIM**
Chrysene	**ND**	**10.0**	**6.38**	**ng/L**	**64**	**SW846 8270A SIM**
Fluorene	**ND**	**10.0**	**5.56**	**ng/L**	**56**	**SW846 8270A SIM**
Indene	**ND**	**10.0**	**5.52**	**ng/L**	**55**	**SW846 8270A SIM**
Naphthalene	**ND**	**10.0**	**7.21**	**ng/L**	**72**	**SW846 8270A SIM**
Quinoline	**ND**	**10.0**	**4.71**	**ng/L**	**47**	**SW846 8270A SIM**
Benzo(e)pyrene	**ND**	**10.0**	**5.02**	**ng/L**	**50**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	67	(10 - 118)
Fluorene d-10	62	(41 - 162)
Naphthalene-d8	63	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Lot-Sample #...: R0K150283 Work Order #...: DPXH81AC Matrix.....: WG
MS Lot-Sample #: R0K150283-001
Date Sampled...: 11/14/00 Date Received..: 11/15/00
Prep Date.....: 11/17/00 Analysis Date..: 12/04/00
Prep Batch #...: 0322466
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
2-Methylnaphthalene	**62**	**(20 - 150)**	**SW846 8270A SIM**
Chrysene	**64**	**(20 - 132)**	**SW846 8270A SIM**
Fluorene	**56**	**(20 - 132)**	**SW846 8270A SIM**
Indene	**55**	**(20 - 150)**	**SW846 8270A SIM**
Naphthalene	**72**	**(20 - 150)**	**SW846 8270A SIM**
Quinoline	**47**	**(20 - 150)**	**SW846 8270A SIM**
Benzo(e)pyrene	**50**	**(20 - 150)**	**SW846 8270A SIM**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	67	(10 - 118)
Fluorene d-10	62	(41 - 162)
Naphthalene-d8	63	(21 - 108)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

SECTION 4.3.3 (D)

SEVERN TRENT SERVICES

STL Denver

CASE NARRATIVE

FOR

City of St. Louis Park

June 28, 2000

Severn Trent Laboratories, Denver, CO

Project Lot Number R0E310123

Introduction

Eleven aqueous samples (including QC) were received at Severn Trent's, Denver Laboratory on May 31, 2000 The samples were logged in under STL AASG's project lot number R0E310123. A cross reference associating STL's laboratory sample numbers to the actual field sample number is included. The samples were analyzed for part per trillion (ppt) PAHs.

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP for completeness, precision, accuracy, representativeness and defensibility of the data Unless otherwise stated below, no quality control problems or technical difficulties were encountered which would impact the interpretation or use of data in this report.

Client samples with laboratory Id's R0E310123-001, -002 were analyzed at a dilution for the SIM PAH analysis due to target analytes exceeding the linear range of the instrument The reporting limits were raised accordingly.

The method blank for this lot was below reporting limits for all target analytes. One of the surrogates was recovered high, naphthalene-d8 at 200%, with no visible contamination present. The other two surrogates are within limits for this blank

Two spike compounds in the LCS/LCSD, (indene and naphthalene), exceed the RPD limit. The accuracy limits were met in both of the QC samples for these analytes

STL Denver

Except for the above, this data package is in compliance with the terms and conditions of the October 1999 QAPP both technically and for completeness

Reported By: Mark Dymerski **Date:** 6/28/00

Mark Dymerski
Quality Assurance Manager, AASG

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP4-053000

GC/MS Semivolatiles

Lot-Sample #...: R0E310123-001 Work Order #...: DE002101 Matrix.....: WATER
Date Sampled...: 05/30/00 Date Received..: 05/31/00
Prep Date.....: 06/01/00 Analysis Date..: 06/16/00
Prep Batch #...: 0154268
Dilution Factor: 2 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	11	ng/L
2,3-Dihydroindene	**170**	**10**	**ng/L**
Indene	**38**	**9.4**	**ng/L**
Naphthalene	ND	17	ng/L
Benzo(b)thiophene	**18**	**10**	**ng/L**
Quinoline	ND	18	ng/L
Indole	ND	9.4	ng/L
2-Methylnaphthalene	ND	12	ng/L
1-Methylnaphthalene	ND	11	ng/L
Biphenyl	ND	11	ng/L
Acenaphthylene	ND	9.6	ng/L
Acenaphthene	**150**	**11**	**ng/L**
Dibenzofuran	ND	11	ng/L
Fluorene	ND	8.2	ng/L
Dibenzothiophene	ND	8.2	ng/L
Phenanthrene	ND	9.4	ng/L
Anthracene	**3.2 J**	**6.8**	**ng/L**
Acridine	ND	12	ng/L
Carbazole	**17**	**7.6**	**ng/L**
Fluoranthene	**11**	**9.2**	**ng/L**
Pyrene	**14**	**8.4**	**ng/L**
Benzo(a)anthracene	ND	8.6	ng/L
Chrysene	ND	11	ng/L
Benzo(b)fluoranthene	ND	9.4	ng/L
Benzo(k)fluoranthene	ND	7.8	ng/L
Benzo(e)pyrene	ND	8.6	ng/L
Benzo(a)pyrene	ND	5.0	ng/L
Perylene	ND	6.6	ng/L
Indeno(1,2,3-cd)pyrene	ND	11	ng/L
Benzo(ghi)perylene	ND	12	ng/L
Dibenz(a,h)anthracene	ND	12	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	54	(10 - 118)
Fluorene d-10	68	(41 - 162)
Naphthalene-d8	74	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP4D-053000

GC/MS Semivolatiles

Lot-Sample #...: R0E310123-002 Work Order #...: DE003101 Matrix.....: WATER
Date Sampled...: 05/30/00 Date Received..: 05/31/00
Prep Date.....: 06/01/00 Analysis Date..: 06/16/00
Prep Batch #...: 0154268
Dilution Factor: 2 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	11	ng/L
2,3-Dihydroindene	**190**	**10**	**ng/L**
Indene	**42**	**9.4**	**ng/L**
Naphthalene	**6.1 J**	**17**	**ng/L**
Benzo(b)thiophene	**19**	**10**	**ng/L**
Quinoline	ND	18	ng/L
Indole	ND	9.4	ng/L
2-Methylnaphthalene	ND	12	ng/L
1-Methylnaphthalene	ND	11	ng/L
Biphenyl	ND	11	ng/L
Acenaphthylene	ND	9.6	ng/L
Acenaphthene	**160**	**11**	**ng/L**
Dibenzofuran	ND	11	ng/L
Fluorene	ND	8.2	ng/L
Dibenzothiophene	ND	8.2	ng/L
Phenanthrene	ND	9.4	ng/L
Anthracene	**2.8 J**	**6.8**	**ng/L**
Pyrene	**15**	**8.4**	**ng/L**
Benzo(a)anthracene	ND	8.6	ng/L
Chrysene	ND	11	ng/L
Acridine	ND	12	ng/L
Carbazole	**18**	**7.6**	**ng/L**
Fluoranthene	**12**	**9.2**	**ng/L**
Benzo(b)fluoranthene	ND	9.4	ng/L
Benzo(k)fluoranthene	ND	7.8	ng/L
Benzo(e)pyrene	ND	8.6	ng/L
Benzo(a)pyrene	ND	5.0	ng/L
Perylene	ND	6.6	ng/L
Indeno(1,2,3-cd)pyrene	ND	11	ng/L
Benzo(ghi)perylene	ND	12	ng/L
Dibenz(a,h)anthracene	ND	12	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	58	(10 - 118)
Fluorene d-10	67	(41 - 162)
Naphthalene-d8	75	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL.

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP4FB-053000

GC/MS Semivolatiles

Lot-Sample #...: R0E310123-003	**Work Order #...:** DE005101	**Matrix.....:** WATER	
Date Sampled...: 05/30/00	**Date Received..:** 05/31/00		
Prep Date.....: 06/01/00	**Analysis Date..:** 06/14/00		
Prep Batch #...: 0154268			
Dilution Factor: 1	**Method.....:** SW846 8270A SIM		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	ND	4.7	ng/L
Anthracene	**1.3 J**	**3.4**	**ng/L**
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	ND	4.6	ng/L
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	80	(10 - 118)
Fluorene d-10	49	(41 - 162)
Naphthalene-d8	66	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP4FBD-053000

GC/MS Semivolatiles

Lot-Sample #...: R0E310123-004 Work Order #...: DE006101 Matrix.....: WATER
Date Sampled...: 05/30/00 Date Received..: 05/31/00
Prep Date.....: 06/01/00 Analysis Date..: 06/14/00
Prep Batch #...: 0154268
Dilution Factor: 1 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**3.6 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	**1.5 J**	**4.1**	**ng/L**
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**1.9 J**	**4.7**	**ng/L**
Anthracene	ND	3.4	ng/L
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.6 J**	**4.6**	**ng/L**
Pyrene	**1.5 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	77	(10 - 118)
Fluorene d-10	65	(41 - 162)
Naphthalene-d8	85	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

SEVERN TRENT SERVICES

STL Denver

CASE NARRATIVE

FOR

City of St. Louis Park

June 28, 2000

Severn Trent Laboratories, Denver, CO

Project Lot Number R0E250178

Introduction

Nine aqueous samples (including QC) were received at Severn Trent's, Denver Laboratory on May 25, 2000 The samples were logged in under STL AASG's project lot number R0E250178 A cross reference associating STL's laboratory sample numbers to the actual field sample number is included. The samples were analyzed for part per trillion (ppt) PAHs.

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP for completeness, precision, accuracy, representativeness and defensibility of the data. Unless otherwise stated below, no quality control problems or technical difficulties were encountered which would impact the interpretation or use of data in this report.

Client samples with laboratory Id's R0E250178-001, -002 , -010 were analyzed at a dilution for the SIM PAH analysis due to target analytes exceeding the linear range of the instrument The reporting limits were raised accordingly. As a result of the dilution, the surrogate compounds associated with these samples were not detected and are reported as "NC".

Three spike compounds in the LCS/LCSD, (indene, naphthalene and 2-methylnaphthalene), exceed the RPD limit The accuracy limits were met in both of the QC samples for these analytes The surrogate results in the samples contained in this lot indicate that the samples were not affected by the error that is observed in the LCS sample.

STL Denver

Except for the above, this data package is in compliance with the terms and conditions of the October 1999 QAPP both technically and for completeness.

Reported By: _____ **Date:** 6/28/00

Mark Dymerski
Quality Assurance Manager, AASG

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP10-052400

GC/MS Semivolatiles

Lot-Sample #...: R0E250178-001 Work Order #...: DDP13101 Matrix.....: WATER
Date Sampled...: 05/24/00 Date Received..: 05/25/00
Prep Date.....: 05/30/00 Analysis Date..: 06/15/00
Prep Batch #...: 0151561
Dilution Factor: 10 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	54	ng/L
2,3-Dihydroindene	**340**	**50**	**ng/L**
Indene	**37 J**	**47**	**ng/L**
Naphthalene	ND	86	ng/L
Benzo(b)thiophene	**47 J**	**52**	**ng/L**
Quinoline	ND	90	ng/L
Indole	ND	47	ng/L
2-Methylnaphthalene	ND	59	ng/L
1-Methylnaphthalene	**66**	**56**	**ng/L**
Biphenyl	ND	56	ng/L
Acenaphthylene	**100**	**48**	**ng/L**
Acenaphthene	**660**	**57**	**ng/L**
Dibenzofuran	**37 J**	**57**	**ng/L**
Fluorene	**200**	**41**	**ng/L**
Dibenzothiophene	**43**	**41**	**ng/L**
Phenanthrene	**530**	**47**	**ng/L**
Anthracene	**56**	**34**	**ng/L**
Acridine	ND	62	ng/L
Carbazole	**19 J**	**38**	**ng/L**
Fluoranthene	**190**	**46**	**ng/L**
Pyrene	**170**	**42**	**ng/L**
Benzo(b)fluoranthene	ND	47	ng/L
Benzo(k)fluoranthene	ND	39	ng/L
Benzo(e)pyrene	ND	43	ng/L
Benzo(a)anthracene	ND	43	ng/L
Chrysene	ND	56	ng/L
Benzo(a)pyrene	ND	25	ng/L
Perylene	ND	33	ng/L
Indeno(1,2,3-cd)pyrene	ND	54	ng/L
Benzo(ghi)perylene	ND	62	ng/L
Dibenz(a,h)anthracene	ND	59	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	NC	(10 - 118)
Fluorene d-10	NC	(41 - 162)
Naphthalene-d8	NC	(21 - 108)

NOTE(S):

NC The recovery and/or RPD were not calculated

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP10D-052400

GC/MS Semivolatiles

Lot-Sample #...: R0E250178-002 Work Order #...: DDP16101 Matrix.....: WATER
Date Sampled...: 05/24/00 Date Received..: 05/25/00
Prep Date.....: 05/30/00 Analysis Date..: 06/15/00
Prep Batch #...: 0151561
Dilution Factor: 10 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	54	ng/L
2,3-Dihydroindene	**430**	**50**	**ng/L**
Indene	**48**	**47**	**ng/L**
Naphthalene	ND	86	ng/L
Benzo(b)thiophene	**60**	**52**	**ng/L**
Quinoline	ND	90	ng/L
Indole	ND	47	ng/L
2-Methylnaphthalene	ND	59	ng/L
1-Methylnaphthalene	**84**	**56**	**ng/L**
Biphenyl	**20 J**	**56**	**ng/L**
Acenaphthylene	**130**	**48**	**ng/L**
Acenaphthene	**840**	**57**	**ng/L**
Dibenzofuran	**43 J**	**57**	**ng/L**
Fluorene	**240**	**41**	**ng/L**
Dibenzothiophene	**48**	**41**	**ng/L**
Phenanthrene	**520**	**47**	**ng/L**
Anthracene	**73**	**34**	**ng/L**
Acridine	ND	62	ng/L
Carbazole	**21 J**	**38**	**ng/L**
Fluoranthene	**200**	**46**	**ng/L**
Pyrene	**180**	**42**	**ng/L**
Benzo(a)anthracene	ND	43	ng/L
Chrysene	ND	56	ng/L
Benzo(b)fluoranthene	ND	47	ng/L
Benzo(k)fluoranthene	ND	39	ng/L
Benzo(e)pyrene	ND	43	ng/L
Benzo(a)pyrene	ND	25	ng/L
Perylene	ND	33	ng/L
Indeno(1,2,3-cd)pyrene	ND	54	ng/L
Benzo(ghi)perylene	ND	62	ng/L
Dibenz(a,h)anthracene	ND	59	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	NC	(10 - 118)
Fluorene d-10	NC	(41 - 162)
Naphthalene-d8	NC	(21 - 108)

NOTE(S):

NC The recovery and/or RPD were not calculated

J Estimated result Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP10FB-052400

GC/MS Semivolatiles

Lot-Sample #...: R0E250178-003 Work Order #...: DDP18101 Matrix.....: WATER
Date Sampled...: 05/24/00 Date Received..: 05/25/00
Prep Date.....: 05/30/00 Analysis Date..: 06/13/00
Prep Batch #...: 0151561
Dilution Factor: 1 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	ND	8.6	ng/L
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	ND	4.7	ng/L
Anthracene	**1.4 J**	**3.4**	**ng/L**
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**1.7 J**	**4.6**	**ng/L**
Pyrene	ND	4.2	ng/L
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L
Dibenz(a,h)anthracene	ND	5.9	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	70	(10 - 118)
Fluorene d-10	53	(41 - 162)
Naphthalene-d8	70	(21 - 108)

NOTE(S):

J Estimated result. Result is less than RL

CITY OF ST. LOUIS PARK

Client Sample ID: PCJ-SLP10FBD-052400

GC/MS Semivolatiles

Lot-Sample #...: R0E250178-004 Work Order #...: DDP19101 Matrix.....: WATER
Date Sampled...: 05/24/00 Date Received..: 05/25/00
Prep Date.....: 05/30/00 Analysis Date..: 06/13/00
Prep Batch #...: 0151561
Dilution Factor: 1 Method.....: SW846 8270A SIM

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,3-Benzofuran	ND	5.4	ng/L
2,3-Dihydroindene	ND	5.0	ng/L
Indene	ND	4.7	ng/L
Naphthalene	**3.3 J**	**8.6**	**ng/L**
Benzo(b)thiophene	ND	5.2	ng/L
Quinoline	ND	9.0	ng/L
Indole	ND	4.7	ng/L
2-Methylnaphthalene	ND	5.9	ng/L
1-Methylnaphthalene	ND	5.6	ng/L
Biphenyl	ND	5.6	ng/L
Acenaphthylene	ND	4.8	ng/L
Acenaphthene	ND	5.7	ng/L
Dibenzofuran	ND	5.7	ng/L
Fluorene	ND	4.1	ng/L
Dibenzothiophene	ND	4.1	ng/L
Phenanthrene	**3.9 J**	**4.7**	**ng/L**
Anthracene	**1.5 J**	**3.4**	**ng/L**
Acridine	ND	6.2	ng/L
Carbazole	ND	3.8	ng/L
Fluoranthene	**2.6 J**	**4.6**	**ng/L**
Pyrene	**1.7 J**	**4.2**	**ng/L**
Benzo(a)anthracene	ND	4.3	ng/L
Chrysene	ND	5.6	ng/L
Benzo(b)fluoranthene	ND	4.7	ng/L
Benzo(k)fluoranthene	ND	3.9	ng/L
Benzo(e)pyrene	ND	4.3	ng/L
Benzo(a)pyrene	ND	2.5	ng/L
Perylene	ND	3.3	ng/L
Indeno(1,2,3-cd)pyrene	ND	5.4	ng/L
Benzo(ghi)perylene	ND	6.2	ng/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	90	(10 - 118)
Fluorene d-10	61	(41 - 162)
Naphthalene-d8	81	(21 - 108)

NOTE(S):

J Estimated result Result is less than RL

SECTION 4.3.4

Advanced Analytical Services

Quanterra Incorporated
4955 Yarrow Street
Arvada, Colorado 80002

303 421-6611 Telephone
303 467-9136 Fax

CASE NARRATIVE

FOR

City of St. Louis Park

March 29, 2000

Severn Trent Laboratories, Denver, CO

Project Lot Number D0C080146

Introduction

Seven aqueous samples (including matrix QC) were received at Severn Trent's, Denver Laboratory on March 8, 2000. The samples were logged in under STL Denver's project lot number D0C080146. A cross reference associating Quanterra Denver's laboratory sample numbers to the actual field sample number is included. The samples were analyzed for Base/Neutral/Acid – acid fraction only organics.

Data Quality Assessment

The results contained in this report were reviewed relative to data acceptance criteria as specified in the October 1999 QAPP for completeness, precision, accuracy, representativeness and defensibility of the data. Unless otherwise stated below, no quality control problems or technical difficulties were encountered which would impact the interpretation or use of data in this report.

The surrogate compound 2-fluorophenol in client samples with laboratory Id's D0C080146-002, -002MSD and -004 had recoveries of 16%, 8.8% and 2.3% which is below the 21% to 110% acceptance limits. 2-fluorophenol was recovered within acceptance limits in the method blank and duplicate control samples. A matrix effect is indicated.

The relative percent difference (RPD) for the spike compounds phenol and e-chlorophenol are repoted above the control limits in the matrix spike / matrix spike duplicate samples. The RPD for these compounds was within the acceptance limits in the duplicate control samples. A matrix effect is indicated.

The spike compound 2-chlorophenol was recovered at 17% in the matrix spike duplicate sample. This is below the 27% to 123% acceptance limits. 2-chlorophenol was recovered within acceptance limits in the duplicate control samples A matrix effect is indicated.

Except for the above, this data package is in compliance with the terms and conditions of the October 1999 QAPP both technically and for completeness.

Reported By: _____ **Date:** _____

Kurt C. Ill
Program Manager, AASG

EXECUTIVE SUMMARY - Detection Highlights

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
NO DETECTABLE PARAMETERS				

ANALYTICAL METHODS SUMMARY

D0C080146

PARAMETER	ANALYTICAL METHOD
Semivolatile Organic Compounds by GC/MS	SW846 8270C

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

D0C080146

ANALYTICAL METHOD	ANALYST	ANALYST ID
SW846 8270C	Tim O'Donnell	000443

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

D0C080146

WO #	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
D9D2Q	001	GAC-SLP10AF-030700	03/07/00	
D9D3A	002	GAC-SLP4AF-030700	03/07/00	
D9D3C	003	GAC-SLP4AFD-030700	03/07/00	
D9D3F	004	GAC-SLP4AFFB-030700	03/07/00	
D9D3H	005	GAC-SLP4AFFBD-030700	03/07/00	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages
- All calculations are performed before rounding to avoid round-off errors in calculated results
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced, except in full, without the written approval of the laboratory
- Results for the following parameters are never reported on a dry weight basis color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP10AF-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080146-001 Work Order #...: D9D2Q101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/24/00
Prep Batch #...: 0068354 Analysis Time..: 12:23
Dilution Factor: 1
Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Phenol	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
2,4-Dimethylphenol	ND	10	ug/L
2,4-Dichlorophenol	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2,4,6-Trichlorophenol	ND	10	ug/L
2,4,5-Trichlorophenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
4-Nitrophenol	ND	50	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
Pentachlorophenol	ND	50	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	68	(21 - 110)
2,4,6-Tribromophenol	73	(10 - 123)
Phenol-d5	75	(10 - 110)

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4AF-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080146-002 Work Order #...: D9D3A101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/24/00
Prep Batch #...: 0068354 Analysis Time..: 12:55
Dilution Factor: 1
Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Phenol	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
2,4-Dimethylphenol	ND	10	ug/L
2,4-Dichlorophenol	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2,4,6-Trichlorophenol	ND	10	ug/L
2,4,5-Trichlorophenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
4-Nitrophenol	ND	50	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
Pentachlorophenol	ND	50	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	16 *	(21 - 110)
2,4,6-Tribromophenol	71	(10 - 123)
Phenol-d5	36	(10 - 110)

NOTE(S):

* Surrogate recovery is outside stated control limits

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4AFD-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080146-003 Work Order #...: D9D3C101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/24/00
Prep Batch #...: 0068354 Analysis Time..: 14:33
Dilution Factor: 1
Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Phenol	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
2,4-Dimethylphenol	ND	10	ug/L
2,4-Dichlorophenol	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2,4,6-Trichlorophenol	ND	10	ug/L
2,4,5-Trichlorophenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
4-Nitrophenol	ND	50	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
Pentachlorophenol	ND	50	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	72	(21 - 110)
2,4,6-Tribromophenol	74	(10 - 123)
Phenol-d5	84	(10 - 110)

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4AFFB-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080146-004 Work Order #...: D9D3F101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/24/00
Prep Batch #...: 0068354 Analysis Time..: 15:06
Dilution Factor: 1
Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Phenol	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
2,4-Dimethylphenol	ND	10	ug/L
2,4-Dichlorophenol	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2,4,6-Trichlorophenol	ND	10	ug/L
2,4,5-Trichlorophenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
4-Nitrophenol	ND	50	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
Pentachlorophenol	ND	50	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	2.3 *	(21 - 110)
2,4,6-Tribromophenol	61	(10 - 123)
Phenol-d5	10	(10 - 110)

NOTE(S):

* Surrogate recovery is outside stated control limits

CITY OF ST. LOUIS PARK

Client Sample ID: GAC-SLP4AFFBD-030700

GC/MS Semivolatiles

Lot-Sample #...: D0C080146-005 Work Order #...: D9D3H101 Matrix.....: WATER
Date Sampled...: 03/07/00 Date Received..: 03/08/00
Prep Date.....: 03/08/00 Analysis Date..: 03/24/00
Prep Batch #...: 0068354 Analysis Time..: 15:38
Dilution Factor: 1
Method.....: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Phenol	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
2,4-Dimethylphenol	ND	10	ug/L
2,4-Dichlorophenol	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2,4,6-Trichlorophenol	ND	10	ug/L
2,4,5-Trichlorophenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
4-Nitrophenol	ND	50	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
Pentachlorophenol	ND	50	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	66	(21 - 110)
2,4,6-Tribromophenol	66	(10 - 123)
Phenol-d5	73	(10 - 110)

QC DATA ASSOCIATION SUMMARY

D0C080146

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	SW846 8270C		0068354	0068171
002	WATER	SW846 8270C		0068354	0068171
003	WATER	SW846 8270C		0068354	0068171
004	WATER	SW846 8270C		0068354	0068171
005	WATER	SW846 8270C		0068354	0068171

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080146 **Work Order #...:** D9E1F101 **Matrix.....:** WATER
MB Lot-Sample #: D0C080000-354

Prep Date.....: 03/08/00 **Analysis Time..:** 10:45
Analysis Date..: 03/24/00 **Prep Batch #...:** 0068354
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Phenol	ND	10	ug/L	SW846 8270C
2-Methylphenol	ND	10	ug/L	SW846 8270C
4-Methylphenol	ND	10	ug/L	SW846 8270C
2-Chlorophenol	ND	10	ug/L	SW846 8270C
2-Nitrophenol	ND	10	ug/L	SW846 8270C
2,4-Dimethylphenol	ND	10	ug/L	SW846 8270C
2,4-Dichlorophenol	ND	10	ug/L	SW846 8270C
4-Chloro-3-methylphenol	ND	10	ug/L	SW846 8270C
2,4,6-Trichlorophenol	ND	10	ug/L	SW846 8270C
2,4,5-Trichlorophenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrophenol	ND	50	ug/L	SW846 8270C
4-Nitrophenol	ND	50	ug/L	SW846 8270C
4,6-Dinitro-2-methylphenol	ND	50	ug/L	SW846 8270C
Pentachlorophenol	ND	50	ug/L	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	64	(21 - 110)
2,4,6-Tribromophenol	67	(10 - 123)
Phenol-d5	70	(10 - 110)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080146 **Work Order #...:** D9E1F102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: D0C080000-354 D9E1F103-LCSD
Prep Date.....: 03/08/00 **Analysis Date..:** 03/24/00
Prep Batch #...: 0068354 **Analysis Time..:** 11:18
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Phenol	**150**	**114**	**ug/L**	**76**		**SW846 8270C**
	150	**107**	**ug/L**	**71**	**6.1**	**SW846 8270C**
2-Chlorophenol	**150**	**114**	**ug/L**	**76**		**SW846 8270C**
	150	**110**	**ug/L**	**73**	**4.0**	**SW846 8270C**
4-Chloro-3-methylphenol	**150**	**117**	**ug/L**	**78**		**SW846 8270C**
	150	**116**	**ug/L**	**77**	**0.93**	**SW846 8270C**
4-Nitrophenol	**150**	**113**	**ug/L**	**76**		**SW846 8270C**
	150	**109**	**ug/L**	**72**	**4.2**	**SW846 8270C**
Pentachlorophenol	**150**	**98.7**	**ug/L**	**66**		**SW846 8270C**
	150	**91.4**	**ug/L**	**61**	**7.6**	**SW846 8270C**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	64	(21 - 110)
	70	(21 - 110)
2,4,6-Tribromophenol	78	(10 - 123)
	77	(10 - 123)
Phenol-d5	72	(10 - 110)
	77	(10 - 110)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080146 **Work Order #...:** D9E1F102-LCS **Matrix.....:** WATER
LCS Lot-Sample#: D0C080000-354 D9E1F103-LCSD
Prep Date.....: 03/08/00 **Analysis Date..:** 03/24/00
Prep Batch #...: 0068354 **Analysis Time..:** 11:18
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Phenol	76	(12 - 110)			SW846 8270C
	71	(12 - 110)	6.1	(0-42)	SW846 8270C
2-Chlorophenol	76	(27 - 123)			SW846 8270C
	73	(27 - 123)	4.0	(0-40)	SW846 8270C
4-Chloro-3-methylphenol	78	(23 - 97)			SW846 8270C
	77	(23 - 97)	0.93	(0-42)	SW846 8270C
4-Nitrophenol	76	(10 - 80)			SW846 8270C
	72	(10 - 80)	4.2	(0-50)	SW846 8270C
Pentachlorophenol	66	(9.0- 103)			SW846 8270C
	61	(9.0- 103)	7.6	(0-50)	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	64	(21 - 110)
	70	(21 - 110)
2,4,6-Tribromophenol	78	(10 - 123)
	77	(10 - 123)
Phenol-d5	72	(10 - 110)
	77	(10 - 110)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080146 **Work Order #...:** D9D3A102-MS **Matrix.....:** WATER
MS Lot-Sample #: D0C080146-002 D9D3A103-MSD
Date Sampled...: 03/07/00 **Date Received..:** 03/08/00
Prep Date.....: 03/08/00 **Analysis Date..:** 03/24/00
Prep Batch #...: 0068354 **Analysis Time..:** 13:28
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Phenol	**ND**	**152**	**79.7**	**ug/L**	**52**		**SW846 8270C**
	ND	**152**	**39.1**	**ug/L**	**26 p**	**68**	**SW846 8270C**
2-Chlorophenol	**ND**	**152**	**79.1**	**ug/L**	**52**		**SW846 8270C**
	ND	**152**	**25.9**	**ug/L**	**17 a,p**	**101**	**SW846 8270C**
4-Chloro-3-methylphenol	**ND**	**152**	**91.4**	**ug/L**	**60**		**SW846 8270C**
	ND	**152**	**102**	**ug/L**	**68**	**12**	**SW846 8270C**
4-Nitrophenol	**ND**	**152**	**84.5**	**ug/L**	**56**		**SW846 8270C**
	ND	**152**	**109**	**ug/L**	**72**	**26**	**SW846 8270C**
Pentachlorophenol	**ND**	**152**	**70.0**	**ug/L**	**46**		**SW846 8270C**
	ND	**152**	**91.1**	**ug/L**	**60**	**26**	**SW846 8270C**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	47	(21 - 110)
	8.8 *	(21 - 110)
2,4,6-Tribromophenol	63	(10 - 123)
	73	(10 - 123)
Phenol-d5	55	(10 - 110)
	26	(10 - 110)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

* Surrogate recovery is outside stated control limits

a Spiked analyte recovery is outside stated control limits

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D0C080146 **Work Order #...:** D9D3A102-MS **Matrix.....:** WATER
MS Lot-Sample #: D0C080146-002 D9D3A103-MSD
Date Sampled...: 03/07/00 **Date Received..:** 03/08/00
Prep Date.....: 03/08/00 **Analysis Date..:** 03/24/00
Prep Batch #...: 0068354 **Analysis Time..:** 13:28
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Phenol	**52**	**(12 - 110)**			**SW846 8270C**
	26 p	**(12 - 110)**	**68**	**(0-42)**	**SW846 8270C**
2-Chlorophenol	**52**	**(27 - 123)**			**SW846 8270C**
	17 a,p	**(27 - 123)**	**101**	**(0-40)**	**SW846 8270C**
4-Chloro-3-methylphenol	**60**	**(23 - 97)**			**SW846 8270C**
	68	**(23 - 97)**	**12**	**(0-42)**	**SW846 8270C**
4-Nitrophenol	**56**	**(10 - 80)**			**SW846 8270C**
	72	**(10 - 80)**	**26**	**(0-50)**	**SW846 8270C**
Pentachlorophenol	**46**	**(9.0- 103)**			**SW846 8270C**
	60	**(9.0- 103)**	**26**	**(0-50)**	**SW846 8270C**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	47	(21 - 110)
	8.8 *	(21 - 110)
2,4,6-Tribromophenol	63	(10 - 123)
	73	(10 - 123)
Phenol-d5	55	(10 - 110)
	26	(10 - 110)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

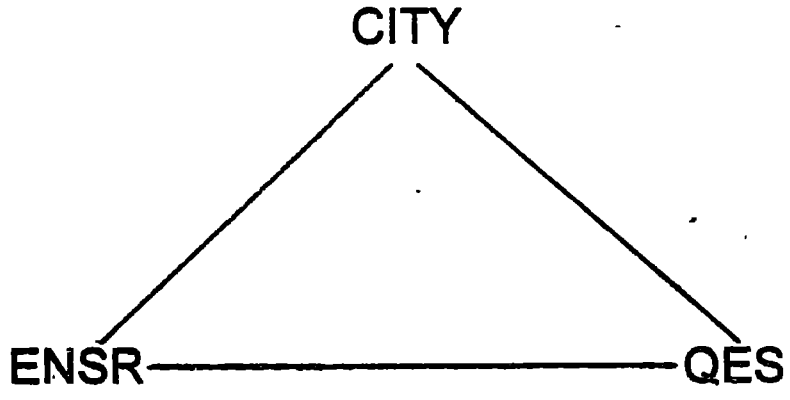
Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

* Surrogate recovery is outside stated control limits

a Spiked analyte recovery is outside stated control limits

1997 SAMPLING PLAN
REILLY TAR & CHEMICAL CORP.
N. P. L. SITE
ST. LOUIS PARK, MINNESOTA



ENSR Consulting
and Engineering
4500 Park Glen Road
Suite 210
St. Louis Park, MN 55416
(612) 924-0117
FAX (612) 924-0317

October 31, 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Regional Administrator
United States Environmental
Protection Agency, Region 5
ATTN: Darryl Owens
Mail Code SR-6J
77 West Jackson
Chicago, Illinois 60604

Director, Solid and Hazardous
Waste Division
Minnesota Pollution Control Agency
ATTN: Site Response Section
520 Lafayette Road North
St. Paul, Minnesota 55155

President
Reilly Industries, Inc.
300 N. Meridian St., Suite 1500
Indianapolis, Indiana 46204-1763

Re: United States of America, et al. vs. Reilly Tar & Chemical Corporation, et al.
File No. Civ. 4-80-469
CD-RAP Section 3.3

Gentlemen:

In accordance with Section 3.3 of the Remedial Action Plan for the referenced case, the City of St. Louis Park hereby submits the 1997 Sampling Plan.

This year's Sampling Plan incorporates comments received from the Minnesota Pollution Control Agency in a letter dated March 4, 1996.

Any comments regarding this submittal may be directed to this office.

Sincerely,
William M. Gregg
William M. Gregg
Project Leader for the
City of St. Louis Park

cc: Mike Rardin
Scott Anderson

r:\ensr\1620-013\l26

October 1996

REILLY TAR AND CHEMICAL CORPORATION

N.P.L. SITE

ST. LOUIS PARK, MINNESOTA

SITE MANAGEMENT PLAN

INTRODUCTION

Ground water in the City of St. Louis Park, Minnesota, has been found to contain polynuclear aromatic hydrocarbons (PAH) and phenolics as a result of activities at a coal-tar distillation and wood preserving plant (Site) operated from 1917 to 1972. Numerous previous studies have identified PAHs in various aquifers beneath St. Louis Park and adjacent communities.

The United States Environmental Protection Agency (EPA), the Minnesota Pollution Control Agency (MPCA), the Minnesota Department of Health (MDH), the City of St. Louis Park (City), and Reilly Industries, Inc. (formerly Reilly Tar & Chemical Corporation - Reilly) have agreed to acceptable water quality criteria for PAH. These criteria, as incorporated into a Consent Decree, include the following concentration levels:

	Advisory Level	**Drinking Water Criteria**
Sum of benzo(a)pyrene and dibenz(a,h) anthracene	3.0 ng/l*	5.6 ng/l
Carcinogenic PAH	15 ng/l	28 ng/l
Other PAH	175 ng/l	280 ng/l

*** or the lowest concentration that can be quantified, whichever is greater**

In conjunction with the implementation of remedial measures to limit the spread of PAH and phenolics, granular activated carbon (GAC) treatment systems have been installed to treat water from City wells (identified - SLP) 4, 10 and 15. Further provisions of a Remedial Action Plan (RAP) call for long-term monitoring of the influent and effluent of the GAC treatment systems and the major aquifers underlying the region. The general objective of the monitoring program is to identify the distribution of PAH and/or phenolics in the ground water. The analytical data will be used to evaluate water quality by comparing the levels of PAH and/or phenolics found in the various samples with historical water quality data and with water quality criteria established in the Consent Decree-RAP. The specific objectives of the monitoring program, and therefore, the intended end use of the data vary slightly for the different aquifers being monitored in accordance with the Consent Decree-RAP.

The objective of the GAC treatment system monitoring is to assess and evaluate the performance of the treatment systems. Analytical results for influent and effluent samples will be compared to the drinking water criteria for PAH as established in the Consent Decree-RAP. Based on these comparisons, decisions will be made on: 1) system operations (e.g., when the carbon should be replaced), and 2) cessation of the treatment systems, if desired, when sufficiently low concentrations of PAH in influent samples are demonstrated.

The objective of monitoring the four existing Mt. Simon-Hinckley Aquifer municipal drinking water wells and any new Mt. Simon-Hinckley Aquifer municipal drinking water wells installed within one mile of well W23, and analyzing for PAH, is to assure the continued protection of these wells from PAH resulting from activities of Reilly at the Site. The analytical data will be used to make comparisons between the levels of PAH found in the Mt. Simon-Hinckley Aquifer, and the drinking water criteria established in the Consent Decree-RAP.

If any new Ironton-Galesville Aquifer drinking water wells are installed within one mile of well W23, then those wells will be sampled and analyzed for PAH to meet the objective of assuring protection of the wells from PAH resulting from the activities of Reilly at the Site. The analytical data will be used to compare the levels of PAH found in potential Ironton-Galesville Aquifer drinking water wells to the drinking water criteria established in the Consent Decree-RAP.

The objectives of monitoring the many Prairie du Chien-Jordan Aquifer wells, including municipal drinking wells, private or industrial wells, and monitoring wells are to: 1) monitor the distribution of PAH in the aquifer, thus evaluating the source and gradient control systems, and 2) assure the continued protection of drinking water wells from PAH resulting from the activities of Reilly at the Site. The analytical data will be used to compare the levels of PAH in the Prairie du Chien-Jordan Aquifer to historical PAH data and to various criteria established in the Consent Decree-RAP (e.g., drinking water criteria for drinking water wells, and a cessation criterion of 10 micrograms per liter of total PAH for source control well W23). Water level data will be used to evaluate ground water flow patterns in the Prairie du Chien-Jordan Aquifer.

The objectives of monitoring St. Peter Aquifer wells are to: 1) monitor the distribution of PAH in the aquifer, thus evaluating a gradient control system installed at W410 in 1990, and 2) assure the continued protection of drinking water wells from PAH resulting from the activities of Reilly at the Site. The analytical data will be used to compare the levels of PAH in the St. Peter Aquifer to historical PAH data, to drinking water cessation criteria for well W410, and to drinking water criteria established in the Consent Decree-RAP. Water level data will be used to evaluate ground water patterns in the St. Peter Aquifer.

The objective of monitoring the Drift-Platteville Aquifer wells is to monitor the distribution of PAH and phenolics in the aquifer, thus evaluating the source and gradient control systems. Ground water analytical data will be used to compare levels of PAH and phenolics in the Drift-Platteville Aquifer with historical water quality data for the aquifer and with various criteria established in the Consent Decree-RAP for PAH and phenolics. Water level data will be used to evaluate ground water flow patterns in the Drift-Platteville Aquifer.

The Site Management Plan (Plan) outlines the scope of work to be performed in order to monitor the ground water in the St. Louis Park, Minnesota, area in accordance with the Consent Decree-RAP related to the Reilly N.P.L. Site. Included in this Plan are: 1) the identity of wells to be monitored, 2) the schedule for ground water monitoring, and 3) a description of the procedures that will be used for sample collection, water level measurement, sample handling, sample analysis, and reporting. Although a GAC treatment system has been constructed to treat water from wells W23, W105, and the Drift-Platteville Aquifer source control wells prior to its discharge to surface water receivers, monitoring of the effluent is not within the scope of work to be

performed under this Plan, as the activity is not embodied in the Consent Decree-RAP. Similarly, a GAC treatment system has been constructed to treat water from well SLP4 prior to discharge to the municipal water supply system; however, monitoring of the effluent is not within the scope of work to be performed under this Plan, as the activity is not embodied in the Consent Decree-RAP.

The time period covered by this Plan is from January 1, 1997, or the date of its acceptance and approval by the Agencies whichever is later, to December 31, 1997. The next subsequent Sampling Plan (RAP Section 3.3) will be submitted by October 31, 1997 covering the 1998 calendar year.

This Plan incorporates the requirements of RAP Sections 3.2, 3.3, 4.3, 5.1, 7.3, 8.1.3, 9.1.3, 9.2.3, 9.3.3, and 9.6. Some of the monitoring required under these RAP Sections has already taken place in accordance with previous Sampling Plans.

MONITORING SCHEDULE

The monitoring schedule outlined in this Plan indicates the starting criteria and the frequencies of monitoring as outlined in the RAP to determine when the GAC treatment system and wells are monitored (Tables 1 and 2). In general, the monitoring schedule will allow economies of scale in the field and in the laboratory by grouping the various monitoring events described by the RAP as much as possible. Samples will be collected within the time periods indicated on Tables 1 and 2, and all parties will be given at least 48 hours notice in advance of routine sampling.

Tables 1 and 2 summarize the GAC system/ground water monitoring schedule for the period through December 1997, and represent the minimum monitoring program that is likely to occur during the year. However, additional monitoring will take place if treated water from the GAC treatment system or ground water from active municipal drinking water wells exceeds the drinking water criteria established in the Consent Decree-RAP. This additional monitoring is described in Sections 4 and 12 of the RAP, and are reproduced in Appendix A of this Plan.

The duration of field sampling events will depend on the number and type of wells to be monitored. For estimating purposes, Drift and Platteville Aquifer monitoring wells typically are monitored at a rate of five to 10 wells per day, St. Peter Aquifer monitoring wells typically are monitored at a rate of five wells per day, and Prairie du Chien Aquifer monitoring wells typically require two to four hours or more per well to monitor.

TABLE 1

Sampling Plan GAC Treatment System Monitoring Schedule[a]

RAP Section	Sampling Points	Start of Monitoring	Sampling Frequency	Analyses[b]
4.3.1(C)	Treated water (TRTD)	Date of plan approval	Quarterly	PAH(ppt)[c]
4.3.3(D)	Feed water (FEED)	Date of plan approval	Annually	PAH(ppt)
4.3.4	Treated water	Date of plan approval	Annually	Extended PAH(ppt)
4.3.4	Treated or Feed water	Date of plan approval	Annually	Acid fraction compounds in EPA Test Method 625

a This schedule does not include certain contingencies (e.g. exceedance monitoring) and, therefore, represents the minimum program that is likely to occur between the date this Plan is approved and December 31, 1996. Sections 4 and 12 of the RAP outline the additional monitoring that will be conducted if PAH criteria are exceeded. The first samples will be collected during the period indicated by the monitoring frequency following the date of the start of monitoring. The location of the GAC treatment system is shown in Figure 1.

b Lists of parameters and methods for analysis of PAH, extended PAH, and acid fraction compounds in EPA Test Method 625 are provided in the QAPP. Field blanks will be collected and analyzed at a frequency of one every ten samples or fewer. Treated water will be duplicated at a rate of 100 percent. Feed water duplicate samples will be collected and analyzed at a frequency of one per ten samples.

c ppt = parts per trillion. This signifies analysis using selected ion monitoring gas chromatography mass spectrometry.

TABLE 2

Sampling Plan Ground Water Monitoring Schedule[a]

Source of Water	RAP Section	Sampling[b] Points	Start of Monitoring	Sampling Frequency	Analyses[c]
Mt. Simon-Hinckley Aquifer	5.1	SLP11, SLP12, SLP13, SLP 17	Date of plan approval	Annually	PAH(ppt)[d]
	5.3.2	New municipal wells within one mile of well W23	At the time of installation	Annually	PAH(ppt)
Ironton-Galesville Aquifer	6.2.1	New municipal wells within one mile of well W23	At the time of installation	Annually	PAH(ppt)
Prairie du Chien-Jordan Aquifer	7.3(A)	SLP4	Start of pumping	Semi-annually	PAH(ppt) phenolics
	7.3(B)	W23	Date of plan approval	Semi-annually	PAH(ppb)[e]
	7.3(C)	SLP6, SLP7 or SLP9	Date of plan approval	Annually	PAH(ppt)
	7.3(D)	W405 or W406[f], H3, SLP10 or SLP15, SLP14, SLP16, W402 W403, W119	Date of plan approval	Annually	PAH(ppt)
	7.3(E)	SLP5, H6, E3, MTK6, W29, W40, W70	Date of plan approval	Annually	PAH(ppt)
	7.3(F)[g]	W32, SLP8, SLP10, E4	Date of plan approval	Semi-annually	No chemical analyses[g]
	7.4.1[h]	W48, W401, E2, E7, E13, E15	Date of plan approval	Semi-annually	PAH(ppt)
St. Peter Aquifer	8.1.3[i]	SLP3, W24, W33, W122, W129, W133, W408, W409, W410, W411, W412, P116	Date of plan approval	Semi-annually	PAH(ppt)

TABLE 2

Sampling Plan Ground Water Monitoring Schedule[a]

Source of Water	RAP Section	Sampling[b] Points	Start of Monitoring	Sampling Frequency	Analyses[c]
Drift-Platteville Aquifer	9.1.3 and 9.2.3	W420, W421, W422, W439	Date of plan approval	Quarterly	PAH(ppb) and total phenols
	9.5	W1, W18, W19, W20, W22, W27, W101, W120, W121, W124, W130, W131, W143, W424, W426, W428, W431, W432, W433, W434, W440[d]	Date of plan approval	Semi-annually	PAH(ppt)

TABLE 2

Sampling Plan Ground Water Monitoring Schedule[a]

Source of Water	RAP Section	Sampling[b] Points	Start of Monitoring	Sampling Frequency	Analyses[c]

a This schedule does not include certain contingencies (e.g. exceedance monitoring) and, therefore, represents the minimum program that is likely to occur between the date this Plan is approved and December 31, 1996. Section 12 of the RAP outlines the additional sampling that will be conducted if the drinking water criteria are exceeded in samples from water supply wells. The first samples will be collected during the period indicated by the monitoring frequency following the date of the start of monitoring. Field blanks will be collected at a frequency of one for every ten samples or fewer, and one duplicate sample will be collected for every ten samples.

b Sampling points are located on the maps shown in Figures 1 through 5. Letter prefixes to well codes are defined as follows:

W	4-inch monitoring well
P	monitoring piezometer
SLP	St. Louis Park supply well
E	Edina supply well
H	Hopkins supply well
MTK	Minnetonka supply well

c Lists of parameters and descriptions of the methods for analysis of PAH, phenolics, and expanded analyses are provided in the QAPP. Water levels will be measured each time samples are collected for analyses, except for those wells which prove to be inaccessible for such measurements.

d ppt = parts per trillion. This signifies analysis using selected ion monitoring gas chromatography mass spectrometry.

e ppb = parts per billion. This signifies analysis by the Non-Criteria Method. If analytical results for individual wells are below 20 micrograms per liter (20 ppb) using this method, then the Low-Level Method will be used on subsequent monitoring rounds.

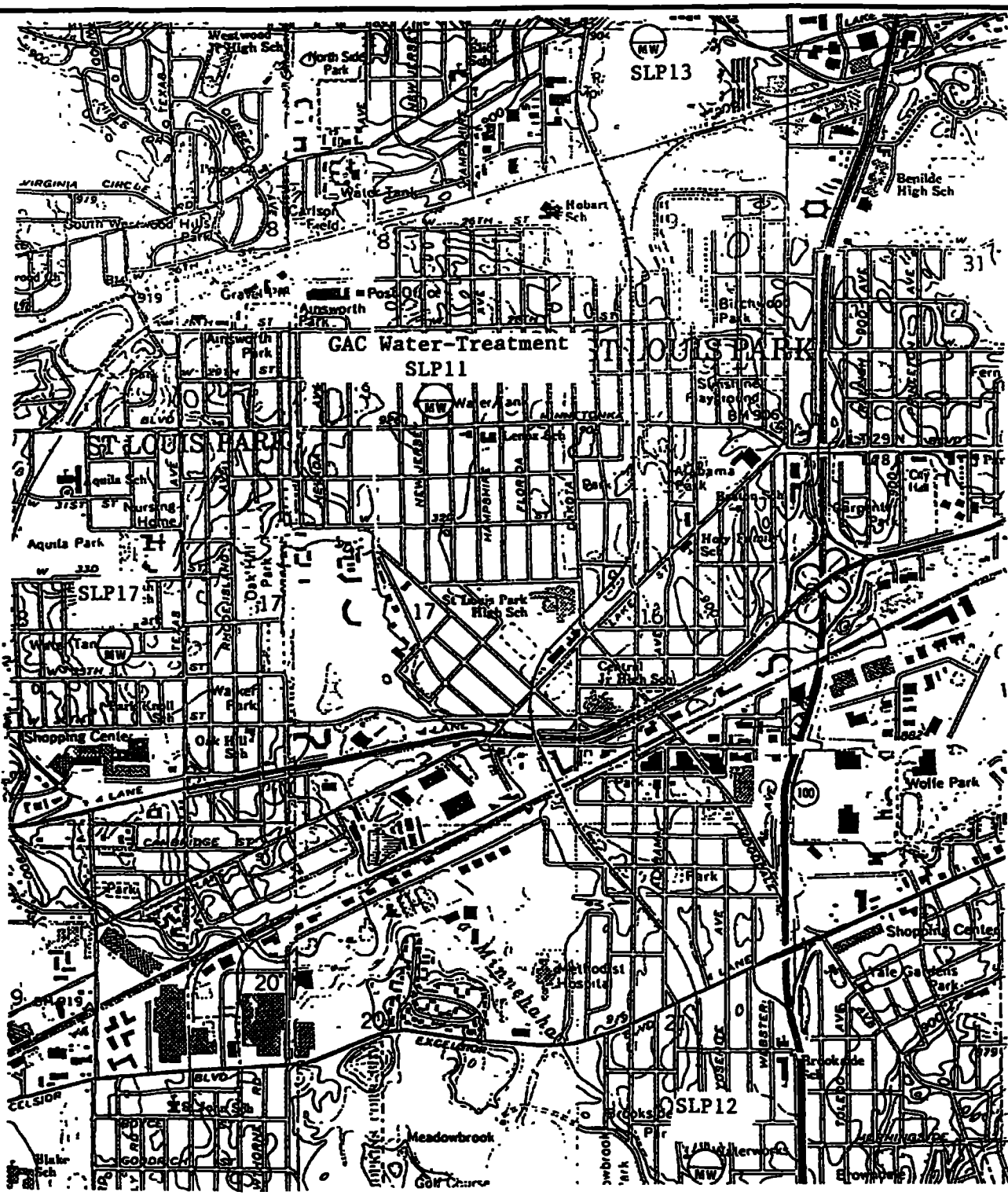
f W405 = American Hardware Mutual, W406 = Minikahda Golf Course.

g Water levels will be measured semi-annually at these wells, except for those wells which prove to be inaccessible for such measurements.

h In accordance with the Gradient Control Modification System, these wells are now sampled semi-annually as opposed to annually.

i Section 8.1.3 of the Consent Decree-RAP originally specified St. Peter Aquifer monitoring requirements. Monitoring requirements for 1994, and subsequent years are now specified in the St. Peter Aquifer Record of Decision (ROD).

j These wells were requested to be sampled semi-annually in accordance with the ROD for the Northern Area of the Platteville Aquifer. However, three of the wells, W420, W421, and W422, are required to be sampled quarterly per Section 9.1.3 and 9.2.3 and will continue to be sampled quarterly and SLP3 is already required to be sampled semi-annually per Section 8.1.3 and will continue to be sampled twice per year.



SOURCE: USGS 7½ Minute Topographic Quadrangle, Minneapolis South, Minnesota, photorevised 1993

SCALE

0 1/4 1/2 1 MILE

N

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FIGURE 1

LOCATIONS OF MT. SIMON HINKLEY MONITOR WELLS AND ST. LOUIS PARK GAC WATER TREATMENT PLANT

St. Louis Park, Minnesota

DRAWN. JJO	DATE October 27, 1995	PROJECT NO.:	REV:
FILE NO.:	CHECKED: WMG	1620-013	

QUADRANGLE LOCATION

HOPKINS, MINNEAPOLIS SOUTH, MINN.

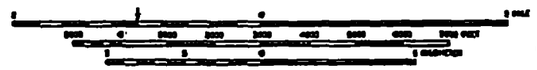

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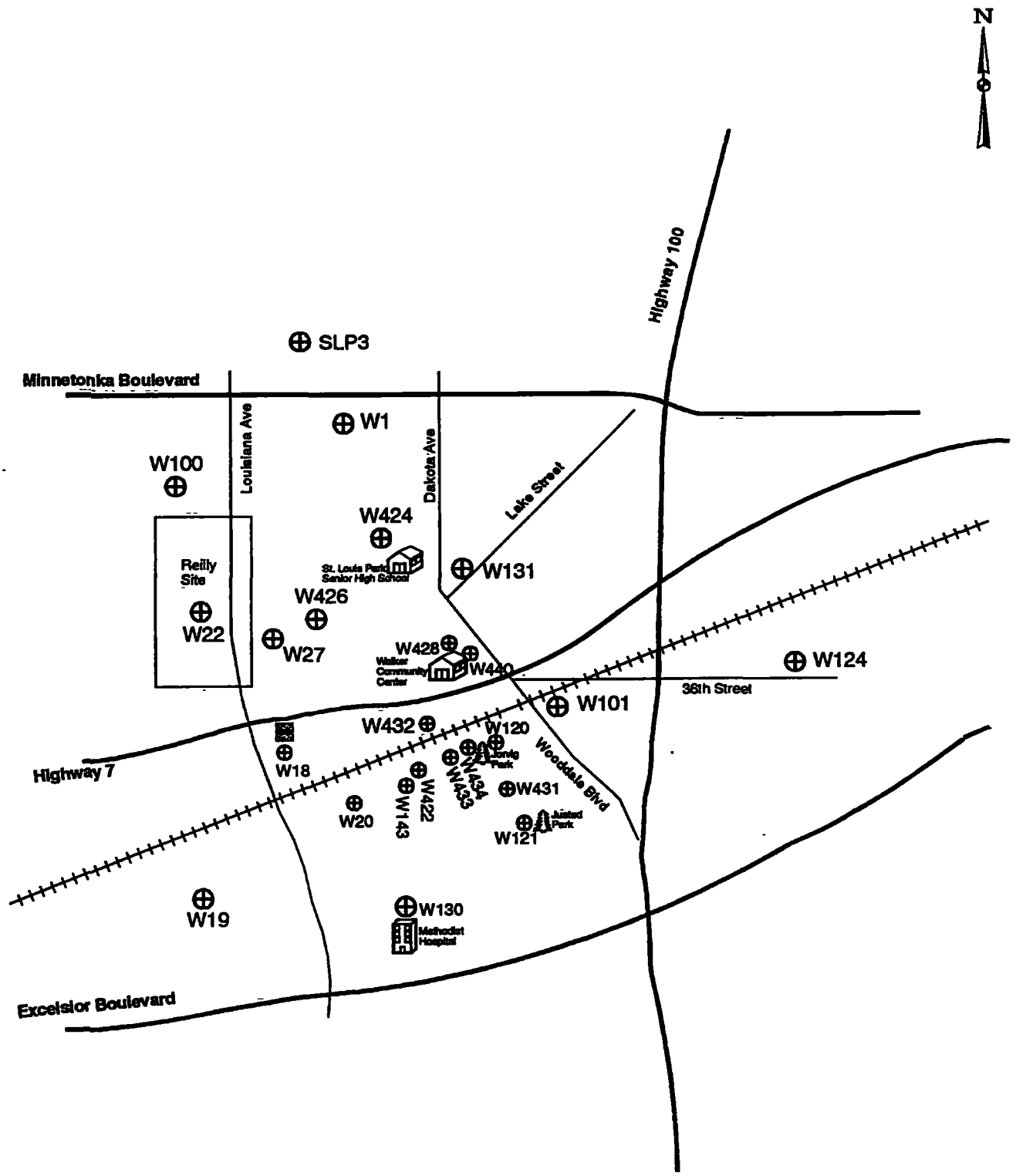
FIGURE 2
LOCATIONS OF PRAIRIE DU CHIEN-JORDAN AQUIFER WELLS
St. Louis Park, Minnesota

DRAWN: JJO	DATE: October 27, 1995	PROJECT NO.: 1820-013	REV
FILE NO.:	CHECKED: WMG		



Scale 1000 0 1000 2000 Feet

EXPLANATION

⊕ W121 Sampling Well

W420/W421 Pumphouse

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FIGURE 3

LOCATIONS OF DRIFT/PLATTEVILLE AQUIFER MONITOR WELLS

St. Louis Park, Minnesota

DRAWN: JJO	DATE. October 27, 1995	PROJECT NO..	REV.
FILE NO:	CHECKED: WMG	1620-013	

SOURCE: USGS 7½ Minute Topographic Quadrangle, Minneapolis South, Minnesota, photorevised 1993

SCALE

0 1/4 1/2 1 MILE

N

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FIGURE 4

LOCATIONS OF ST. PETER AQUIFER MONITOR WELLS

St. Louis Park, Minnesota

DRAWN JJO	DATE: October 27, 1995	PROJECT NO.:	REV.
FILE NO..	CHECKED WMG	1620-013	

GROUND WATER SAMPLING PROCEDURES

An important distinction is made between the sampling procedures for active pumping wells (e.g. municipal wells) and for non-pumping monitoring wells. Active pumping wells are used on a regular basis, have dedicated pumps and associated plumbing, and have sample taps for collecting samples. Non-pumping monitoring wells may be new, or may have not been pumped for several years, and most require pumping and associated equipment for sampling. Another distinction is that the active pumping wells are typically located inside buildings whereas non-pumping monitoring wells are not.

With these considerations in mind, this Plan has been developed so that the ground water monitoring program in each aquifer meets the requirements and intent of the RAP. Ground water monitoring will be conducted in accordance with the procedures given in the Quality Assurance Project Plan (QAPP), and with Minnesota Pollution Control Agency guidelines entitled "Development of Sampling Plans, Protocols and Reports", January 1995.

Water Level Measurements

Water level measurements will be made using electric tapes or weighted steel tapes. Water level measurements using steel tapes will be made by suspending a known length of tape in the well so that the bottom end of the tape is below the water level. The lower portion of tape will be coated with blue chalk that exhibits a noticeable color change when wetted. The water level measurement will be obtained by subtracting the length of wetted tape from the total length of tape suspended below the measuring point of each well.

Using the electric tape, the probe at the end of the tape will be lowered slowly in the well until contact with the water is made. Because of surface tension, readings of the water level made when the probe enters the water will differ from readings made when the probe leaves the water, thus breaking surface tension. To standardize these measurements, the second reading will always be used (i.e. the reading made when the probe leaves the water).

Water level measurement made for the purpose of defining ground water flow patterns in a particular aquifer may be performed independently from ground water sampling, as a discrete event so as not to last more than two days. The wells will be revisited for sampling, and measurements to determine the volume of water in the well will be made at that time.

Sample Collection at Active Pumping Wells

At active pumping wells, the sampling team will first determine that the wells have actually been pumping during the period preceding sampling. This information may be derived from inspecting flow recorders or from interviewing knowledgeable persons regarding the wells (water department employees, well owners, etc.). The information will be documented in the field notes of the sampling team.

Water level measurements will then be made, if practical. The normal operation of the well will not be interrupted for the purpose of measuring water levels. An electric tape will be used to measure water levels in pumping wells. Sampling will proceed by filling the required containers with water from the sampling tap as near to the well head as possible, and before any holding tanks or treatment is encountered. The only exception to this is the GAC treatment system monitoring under RAP Section 4.3 which includes treated water monitoring.

If it cannot be determined that a well has been pumping at some time during the 24 hour period preceding sampling, or if it is known the well was not pumping, then the well shall be purged until field measurements of temperature, pH, and specific conductance have stabilized after at least three well volumes have been removed from the well. These measurements, water levels, and the amount of water pumped will be recorded in the field notes.

Sample Collection at Monitoring Wells and Piezometers

Because unanticipated or changed conditions may cause difficulty in the purging and sampling of the monitoring wells and piezometers, flexibility in the approach to sample retrieval is necessary. This Plan proposes that the sampling team be given latitude in the selection of purge/sample equipment and procedures necessary to compete the monitoring task.

Table 2 specifies the monitoring of Prairie du Chien-Jordan Aquifer monitor well W70 which is equipped with an operable dedicated submersible pump. Well purging and sample retrieval tasks will be completed with the aid of the pump in conformance with parameter monitoring established herein.

Monitoring wells and piezometers not equipped with dedicated submersible pumps will be purged using a non-dedicated submersible pump, suction pump or bailer. During the purging of each well, temperature, pH, and specific conductance of the purge water will be monitored using a Hydrolab water quality monitor (or equivalent). Readings will be taken once per well volume. Stabilization of these readings will indicate that purging is complete and sampling may commence. Upon completion of well purging, samples will be collected from each well using a stainless steel or teflon bailer and a new length of nylon or polyester rope.

Samples will be collected by filling each of the appropriate sample containers in rapid succession, without pre-rinsing the containers with sample. The bottle will be held under the sample stream without allowing the mouth of the bottle to come in contact with the bailer and filled completely, and the cap securely tightened. All sample labels will be checked for completeness, sample custody forms completed and a description of the sampling event recorded in the field notebook.

The discharge from purging monitoring wells will be handled in accordance with the Contingency Plan (Appendix B). In general, if a visible sheen can be seen on the water surface, the discharge will be routed to the sanitary sewer. Otherwise, the storm sewer or surface water discharge will be used. Non-dedicated ground water sampling or monitoring equipment that comes in contact with the ground water will be decontaminated between uses, as described in the QAPP.

ANALYTICAL PROGRAM

Tables 1 and 2 show the ground water monitoring summary as prescribed in the RAP. Indicated on the tables are the analyses required. Details of all analytical methodology can be found in the QAPP and its appendices. All analyses will be performed at Quanterra Incorporated's Arvada, Colorado, analytic facility. Quanterra has agreed to provide a turnaround time of 30 working days from the receipt of samples to the submittal of analytical reports. The laboratory will notify the City if it cannot meet this turnaround time.

Ground water monitoring will include two methods of PAH analyses depending upon the anticipated PAH concentration levels. Low-Level (nanograms per liter or part per trillion) PAH analyses will be performed utilizing selected ion monitoring (SIM) gas chromatography mass spectrometry (GC/MS). This method will be used to analyze samples from drinking water wells and from other wells for which the RAP requires drinking water criteria to be enforced (e.g. St. Peter Aquifer monitoring wells). This method is designed to analyze samples containing up to 600 nanograms per liter of an individual PAH. With dilution of the sample extract, the effective range of the method can be extended into the microgram per liter range. Specific details of this methodology can be found in Appendix B of the QAPP.

Non-criteria level (micrograms per liter or part per billion) PAH analyses, using the Scanning GC/MS Method, will be performed on samples from wells that have historically contained elevated PAH concentrations (e.g. part per million levels in well W23), and on wells that are not subject to the RAP's requirements for meeting drinking water criteria (e.g. Drift-Platteville Aquifer monitoring wells).

Two methods are required for PAH analyses because the Low-Level part per trillion SIM method is not appropriate for samples containing more than approximately 20 micrograms per liter of total PAH. Analysis of samples containing total PAH concentrations over 20 micrograms per liter, if performed with the Low-Level method, requires multiple dilutions and increases the risk of cross-contamination of the samples. This decreases the reliability of the data. Not only will multiple dilutions increase the variability of measurements, but critical quality control information (e.g., surrogate recoveries) is lost. Therefore, for samples containing greater than 20 micrograms per liter of total PAH, the analytical method that will be used is Scanning GC/MS Method as described in the QAPP.

The Scanning GC/MS Method analysis will be performed on 1-liter samples, and will have detection limits of 10 micrograms per liter. For wells that are tested with this Non-Criteria method, if the analytical results of historical monitoring indicate total PAH concentrations less than 20 micrograms per liter, the Low-Level method will be used to analyze samples in 1994. This procedure will allow an evaluation of long-term PAH concentrations around the fringe PAH contamination in the Drift-Platteville Aquifer.

Depending on the circumstances and the actual PAH level, previous analytical results using the Low-Level that exceed 20,000 nanograms per liter of total PAH will indicate a switch to the Scanning GC/MS Method for 1994 sampling rounds.

REPORTING

The analytical reporting requirements of the Consent Decree and RAP are identified in Part K of the Consent Decree, and Sections 3.4, 4.3.5, 12.1.1, and 12.1.2 of the RAP. Park K requires Reilly to submit an annual progress report on March 15, 1994. This report will contain analytical reports as specified in Section 5.0 of the QAPP for this Plan, all water level measurements and chemical analyses that have not been presented in previous reports, and interpretive maps and tables, as specified in RAP Section 3.4(B) and (C). Also, the effectiveness of the source and gradient control well systems in the Drift-Platteville and St. Peter Aquifers will be discussed in the annual report.

The reporting requirement for each aquifer, and for the GAC treatment system, are described below.

GAC Treatment System

RAP Section 4.3.5 requires the City to submit an annual report that presents the results of all monitoring of the GAC treatment system. Analytical results for wellhead water, feed water, and treated water will be included in this report. The report will also describe briefly the operating performance of the GAC treatment system during the previous calendar year. The GAC treatment system annual reports are due each March 15.

Mt. Simon-Hinckley Aquifer

The monitoring data for the Mt. Simon-Hinckley Aquifer will be included in the annual report. In addition to the results of all water level measurements and chemical analyses, the report will contain a map showing each well sampled with the concentrations of Other PAH, Carcinogenic PAH, and the sum of benzo(a)pyrene and dibenz(a,h) anthracene labelled by the location of each well in accordance with RAP Section 3.4(C). Since the Mt. Simon-Hinckley Aquifer wells are monitored on an annual basis, there will be only one sampling event to report.

Ironton-Galesville Aquifer

The monitoring data for the Ironton-Galesville Aquifer will be included in the Annual Report, if any new Ironton-Galesville Aquifer drinking water wells are installed within one mile of well W23.

Prairie du Chien-Jordan Aquifer

The monitoring data for the Prairie du Chien-Jordan Aquifer will be included in the annual report. The results of all water level measurements and chemical analyses will be included. For each of the water level measuring periods, a water level contour map will be prepared with elevations labelled at each well. For each sampling event, a map showing each well sampled with the concentrations of Other PAH, Carcinogenic PAH, and the sum of benzo(a)pyrene and dibenz(a,h) anthracene labelled by the location of each well will be prepared in accordance with

RAP Section 3.4(C), and a map of the area indicating the extent of PAH above drinking water criteria shall be provided.

St. Peter Aquifer

The monitoring data for the St. Peter Aquifer will be included in the annual report. The results of chemical analyses will be reported and a map showing each well sampled with the concentrations of Other PAH, Carcinogenic PAH, and the sum of benzo(a)pyrene and dibenz(a,h) anthracene labelled by the location of each well will be prepared in accordance with RAP Section 3.4(C). Likewise, the results of water level measurements will be provided and a water level contour map will be prepared with elevations labelled at each well in accordance with RAP Section 3.4(B). In addition, a map of the area indicating the extent of PAH above drinking water criteria shall be provided.

Drift-Platteville Aquifer

The monitoring data for the Drift-Platteville Aquifer including the results of all water level measurements and chemical analyses, will be presented in the Annual Progress Report. A map showing each well sampled with the concentrations of Other PAH, Carcinogenic PAH, and the sum of benzo(a)pyrene and dibenz(a,h) anthracene labelled by the location of each well, and a map with phenolics concentrations labelled by the location of each well will be prepared in accordance with RAP Section 3.4. The Drift-Platteville Aquifer monitoring data will be included in the annual report to support a discussion of the results with respect to the effectiveness of the source and gradient control well systems.

APPENDIX A

ADDITIONAL MONITORING REQUIREMENTS

Level or Drinking Water Criterion is exceeded during the first year of operation of the system, Reilly shall immediately notify the Regional Administrator, the Director, and the Commissioner, and shall undertake such additional Monitoring as is required by Section 4.3.2.

(D) Routine Monitoring after two carbon changes shall be quarterly, unless the Regional Administrator, the Director, and the Commissioner determine that the observed service life of the carbon is too short to permit this frequency, in which case the Regional Administrator, the Director and the Commissioner shall notify Reilly of the required Monitoring frequency in accordance with Part G or H of the Consent Decree.

4.3.2. Carbon Replacement Monitoring

(A) If the analytical results from any treated water sample obtained pursuant to Section 4.3.1. exceed the Drinking Water Criterion for Other PAH or exceed the Advisory Level for either Carcinogenic PAH or the sum of benzo(a)pyrene and dibenz(a,h)anthracene, then Reilly shall collect two additional treated water samples at least 2 Days apart within one week of receiving the results of the exceedance sample. If the

analytical results from either one or both of the two additional samples also exceed the Drinking Water Criterion for Other PAH or the Advisory Level for either Carcinogenic PAH or the sum of benzo(a)pyrene and dibenz(a,h)anthracene, and neither of the conditions specified in (C)(1) and (2) below are met, then the carbon shall be replaced within 21 Days of receiving the additional sample results.

(B) If the analytical results from any treated water sample obtained pursuant to Section 4.3.1. exceed the Advisory Level for Other PAH, then Monitoring of treated water shall be conducted immediately according to Section 12.1. If the results of any two samples required by Section 12.1. exceed the Drinking Water Criterion for Other PAH, and neither of the conditions specified in (C)(1) and (2) below are met, then the carbon shall be replaced within 21 Days of receiving the additional sample results.

(C) If any analytical result from the additional samples taken as required by (A) or (B) above exceeds the Drinking Water Criterion for Other PAH, or the Advisory Level for either Carcinogenic PAH or the sum of benzo(a)pyrene and dibenz(a,h)anthracene during either

(1) within one year after the carbon treatment system is placed into service or

(2) within one year after the first carbon change if carbon was changed in the first year of operation of the carbon treatment system,

then Reilly shall conduct the Monitoring program specified in Section 4.6. Reilly shall report the results of the Section 4.6. Monitoring program to the Regional Administrator, the Director and the Commissioner within 7 Days of receiving the analytical data. If the treated water from the carbon treatment system is determined pursuant to Section 4.6. to exceed the Drinking Water Criterion for Other PAH or the Advisory Levels for Carcinogenic PAH or the sum of benzo(a)pyrene and dibenz(a,h)anthracene, then Reilly shall replace the carbon within 14 Days of making this determination. If the treated water is determined pursuant to Section 4.6. to meet the Drinking Water Criterion for Other PAH and the Advisory Levels for Carcinogenic PAH and the sum of benzo(a)pyrene and dibenz(a,h)anthracene, then normal GAC system operation and Monitoring in accordance with Sections 4.3.1.(B) and

(C) After the first month of operation, Monitoring of feed water shall be performed quarterly until the carbon has been changed twice. If the Regional Administrator, the Director and the Commissioner determine pursuant to Section 4.3.1.(B) that the GAC system is not operating properly, Reilly may, upon receipt of such determination, be required to resume biweekly Monitoring of feed water.

(D) After two carbon changes in the GAC system, feed water shall be Monitored annually.

4.3.4. Extended Monitoring

Treated water from the GAC system shall be sampled and analyzed annually for the extended list of PAH in Part A.2. of Appendix A, using gas chromatography/mass spectroscopy (GC/MS), or other methods approved by the Regional Administrator and the Director. During this extended analysis, any compounds listed in Part A.2. of Appendix A, or any other compounds which are detected with significant peak heights that are not routinely Monitored, shall be identified and, if possible, quantified, using a mass spectral library which contains extensive spectra of PAH compounds, such as the National Bureau of Standards mass spectral library. Reilly shall analyze a sample of treated or feed water once a year for the acid fraction compounds determined by EPA Test Method 625 or by other methods approved by the Regional Administrator and the Director.

CONTINGENT ACTIONS FOR MUNICIPAL DRINKING WATER SUPPLY WELLS

12.1. Contingent Monitoring

12.1.1. Exceedance of Advisory Levels

If the analytical result of any sample taken from an active municipal drinking water well under the Monitoring requirements of Sections 3., 4.3., 5.1., 6.2.1., 7.3., or 8.4. above exceeds an Advisory Level, Reilly shall take another sample within seven Days of receiving the analytical results and analyze this sample. If the results of the second sample are below all of the Advisory Levels, a third sample shall be taken by Reilly within seven Days of receiving the results of the second sample. If the third sample is below all of the Advisory Levels, Monitoring of the affected well shall revert to its normal schedule. If the analytical result of the second or third sample exceeds an Advisory Level but is less than all. Drinking Water Criteria, the Regional Administrator, the Director, and the Commissioner shall be notified by Reilly immediately and subsequent samples shall be taken by Reilly monthly until such time as either:

(A) three consecutive samples yield results less than all of the Advisory Levels, in which case the sampling interval shall revert to the level specified for the affected well in Sections 3., 4.3., 5.1., 6.2.1., 7.3., or 8.4. above; or

(B) a sample yields results greater than a Drinking Water Criterion, in which case the requirements of Section 12.1.2., below, apply.

12.1.2. Exceedance of Drinking Water Criteria

(A) If the analytical result of any sample taken from an active municipal drinking water well pursuant to Section 12.1.1 exceeds the Drinking Water Criterion for Carcinogenic PAH, the sum of benzo(a)pyrene and dibenz(a,h)anthracene, or Other PAH, the Regional Administrator, the Director and the Commissioner shall be immediately notified by Reilly, and another sample shall be taken by Reilly within three Days of receiving the results of the first sample and analyzed. If the analytical result of the second sample is less than all of the Drinking Water Criteria but greater than any Advisory Level, a third sample shall be taken by Reilly within seven Days of receiving the results of the second sample and analyzed. If the results of this third sample are less than all of the Drinking Water Criteria, but greater than any Advisory Level, Reilly shall comply with the monthly sampling frequency specified in Section 12.1.1. above.

(B) If the analytical result of the second or third sample taken pursuant to Section 12.1.2.(A) above is greater than the Drinking Water Criterion for Carcinogenic PAH, the sum of benzo(a)pyrene and dibenz(a,h)anthracene, or Other PAH, Reilly shall Monitor the well weekly until such time as either: (1) three consecutive samples yield results below all of the Drinking Water Criteria, in which case Monitoring of the well shall revert to the normal schedule (including Advisory Level Monitoring as specified by Section 12.1.1. above if applicable); or, (2) three consecutive samples yield results above any Drinking Water Criterion, in which case Reilly shall immediately notify the Regional Administrator, the Director and the Commissioner. The Commissioner may then require the affected well to be taken out of service, in which case Reilly shall undertake the contingent actions specified in Section 12.2. below.

12.1.3. Analytical Turn-around Time

All Monitoring conducted pursuant to Section 12.1. shall be on a 21-Day turn-around time basis in accordance with Section 2.8.

APPENDIX B

CONTINGENCY PLAN

Contingent Actions for Contaminated Water

It is possible that groundwater contaminated with coal tar materials will be encountered during the sample retrieval operations. Groundwater generated during sample retrieval operations will be classified as contaminated if the water exhibits a discernible oil sheen or oil phase. Contaminated water will be pumped to the sanitary sewer if it contains less than ten percent organic material. Estimates of flow rate, disposal volume and water quality will be established and the Metropolitan Waste Control Commission (MWCC) will be informed before the discharge to the sanitary sewer if the estimated flow exceeds 150 gallons per workday from any individual site. Contaminated liquids containing more than ten percent organic material or failing to receive MWCC approval for discharge will be disposed of in accordance with all applicable local, state and federal rules and regulations and Part T of the Consent Decree. Uncontaminated water will be disposed of in the storm sewer or by other means acceptable to the City of St. Louis Park.

The City will be responsible for keeping the Environmental Protection Agency, Minnesota Pollution Control Agency and Reilly Tar & Chemical Corporation informed of all significant actions involving the generation of contaminated groundwater. All actions, decisions and communications by the City, Environmental Protection Agency, Minnesota Pollution Control Agency, and Reilly in dealing with contaminated soils will be in accordance with and subject to the provisions of Parts I, J, and O of the Consent Decree in the Reilly settlement.

QUALITY ASSURANCE PROJECT PLAN FOR SAMPLING AND ANALYSIS - GROUND WATER AND GAC TREATMENT SYSTEM MONITORING

for the
Reilly Tar & Chemical Corporation
N.P.L. Site
St. Louis Park, Minnesota

Prepared by

The City of St. Louis Park
St. Louis Park, Minnesota 55416

Approved by: Larry Penfold Date: 10-30-96
Larry Penfold, Quality Assurance
Director, Quanterra Environmental Services
Denver Laboratory

Approved by: William M. Gregg Date: 10-31-96
William Gregg, Project Manager
City of St. Louis Park, MN

Approved by: _____ Date: _____
Quality Assurance Officer
U.S. EPA Region V

Approved by: _____ Date: _____
Remedial Project Manager
U.S. EPA Region V

Approved by: _____ Date: _____
Project Manager
Minnesota Pollution Control Agency

CONTENTS

LIST OF TABLES

LIST OF FIGURES

3.0 PROJECT DESCRIPTION

3.1 Background

Ground water in the City of St. Louis Park (City), Minnesota, has been found to contain polynuclear aromatic hydrocarbons (PAH) and phenolics as a result of activities at a coal-tar distillation and wood preserving plant (Site) operated from 1917 to 1972. Numerous previous studies have identified PAHs in various aquifers beneath St. Louis Park and adjacent communities. Accordingly, the site of the plant operations was placed on the National Priorities List and the federal and state governments sought remediation of environmental contamination via United States District Court Case No. Civil 4-80-469. A more detailed explanation of site background is contained on Pages 3 through 9 of the Consent Decree. The City's consulting company is ENSR. ENSR works with the City to address issues concerning the Consent Decree - Remedial Action Plan (CD-RAP) which includes work plan development and implementation for various tasks, ground water sampling, and compliance to the CD-RAP.

A summary of the aquifers which underlie the former wood preserving plant site, their approximate location below the surface level, the general use of the aquifers, and the relative maximum historical PAH and phenolics concentrations measured in each unit (as indicated by historical records and the federal government's Record of Decision in Case No. Civil 4-80-469) are as follows:

Aquifer	Approximate Depth (ft.)	Use	Approximate Upper Concentration of Total PAHs	Phenolics
Drift-Platteville	0 - 90	Private/Industrial/Monitor wells	1000 µg/ℓ off site	10,000 µg/ℓ off site
St. Peter	90 - 200	Municipal/Private drinking water wells	10 ng/ℓ off site	16 µg/ℓ off site
Praine du Chien-Jordan	250-500	Municipal drinking water wells	10 µg/ℓ off site	10 µg/ℓ off site
Ironton-Galesville	700 - 750	Industrial	1.4 µg/ℓ on site	5 µg/ℓ off site
Mt. Simon-Hinckley	800 - 1100	Municipal drinking water wells	16 ng/ℓ off site	Not detected

More extensive information relative to the identified level of PAHs in the various aquifers is provided in the following reports:

- Annual Monitoring Reports for 1988 through 1995
- St. Peter Aquifer Remedial Investigation Report (March 30, 1989)
- Drift-Platteville Aquifer (Northern Area) Remedial Investigation Report (March 30, 1989)

The United States Environmental Protection Agency (EPA), the Minnesota Pollution Control Authority (MPCA), the Minnesota Department of Health (MDH), the City, and Reilly Industries, Inc. (formerly Reilly Tar & Chemical Corporation - Reilly) have agreed to acceptable water quality criteria for PAH. These criteria, as incorporated into the CD- RAP, in the case referenced above, include the following concentration levels:

	Advisory Level	Drinking Water Criteria
Sum of benzo(a)pyrene and dibenz(a,h)anthracene	3.0 ng/ℓ*	5.6 ng/ℓ
Carcinogenic PAH	15 ng/ℓ	28 ng/ℓ
Other PAH	175 ng/ℓ	280 ng/ℓ

* or the lowest concentration that can be quantified, whichever is greater

Table 3-1 lists the nominal reporting limits for the target compounds listed in the CD-RAP. Currently, only Quanterra Environmental Services (QES) has conducted laboratory analyses of ground water samples.

In conjunction with the implementation of remedial measures to limit the spread of contaminants, a granular activated carbon (GAC) treatment system has been installed to treat water from City wells (identified - SLP) 10 and 15. Further provisions of the RAP call for long-term monitoring of the influent and effluent of the GAC treatment system and the major aquifers underlying the region. The general objective of the monitoring program is to identify the distribution of PAH and/or phenolics in the ground water and compare the analytical data with water quality criteria established in the CD-RAP. Currently, both the City and ENSR are collecting the ground water samples. Typically, the City collects water samples from pumping wells (i.e. City owned wells) and ENSR collects water samples from non-pumping wells (i.e. monitoring wells). The specific objectives of the sampling and analysis program, and therefore, the intended end use of the data

TABLE 3-1

Table of Reporting Limits for Tested Parameters

CAS Number	Compound	Reporting Limit ng/L (PPT)	Reporting Limit ug/L (PPB)
271-89-6	2,3-Benzofuran	5.1	10
496-11-7	2,3-Dihydroindene	5.0	10
95-13-6	1H-Indene	0.9	10
91-20-3	Naphthalene	6.5	10
4565-32-6	Benzo(b)thiophene	0.9	10
91-22-5	Quinoline	6.9	10
120-72-9	1H-Indole	2.5	10
91-57-6	2-Methylnaphthalene	3.9	10
90-12-0	1-Methylnaphthalene	2.8	10
92-52-4	Biphenyl	4.3	10
208-96-8	Acenaphthylene	1.4	10
83-32-9	Acenaphthene	1.3	10
132-64-9	Dibenzofuran	1.0	10
86-73-7	Fluorene	1.0	10
132-65-0	Dibenzothiophene	1.1	10
85-01-8	Phenanthrene	1.3	10
120-12-7	Anthracene	2.7	10
260-94-6	Acridine	6.1	10
86-74-8	Carbazole	1.9	10
206-44-0	Fluoranthene	3.1	10
129-00-0	Pyrene	1.4	10
56-55-3	Benzo(a)anthracene	2.5	10
218-01-9	Chrysene	2.8	10

TABLE 3-1

Table of Reporting Limits for Tested Parameters

CAS Number	Compound	Reporting Limit ng/L (PPT)	Reporting Limit ug/L (PPB)
205-99-2	Benzo(b)fluoranthene	2.5	10
207-08-9	Benzo(k)fluoranthene	2.3	10
192-97-2	Benzo(e)pyrene	1.9	10
50-32-8	Benzo(a)pyrene	2.3	10
198-55-0	Perylene	2.5	10
193-39-5	Indeno(1,2,3-cd)pyrene	2.1	10
53-70-3	Dibenz(a,h)anthracene[1]	1.6	10
191-24-2	Benzo(g,h,i)perylene	2.8	10
205-82-3	Benzo(j)fluoranthene[2]	-	-
195-19-7	Benzo(c)phenanthrene[3]	-	-
215-58-7	Dibenz(a,c)anthracene[1]	1.6	-
192-65-4	Dibenzo(a,e)pyrene[3]	-	-
189-64-0	Dibenzo(a,h)pyrene[3]	-	-
189-55-9	Dibenzo(a,i)pyrene[3]	-	-
57-97-6	7,12-Dimethylbenz(a)anthracene	2.8	-
56-49-5	3-Methylcholanthrene	3.5	-
108-95-2	Phenol	-	10
95-48-7	2-Methylphenol	-	10
106-44-5	4-Methylphenol	-	10
95-57-8	2-Chlorophenol	-	10
88-75-5	2-Nitrophenol	-	10
105-67-9	2,4-Dimethylphenol	-	10
120-83-2	2,4-Dichlorophenol	-	10

TABLE 3-1

Table of Reporting Limits for Tested Parameters

CAS Number	Compound	Reporting Limit ng/L (PPT)	Reporting Limit ug/L (PPB)
59-50-7	4-Chloro-3-methylphenol	-	10
88-06-2	2,4,6-Trichlorophenol	-	10
95-95-4	2,4,5-Trichlorophenol	-	50
51-28-5	2,4-Dinitrophenol	-	50
100-02-7	4-Nitrophenol	-	50
534-52-1	4,6-Dinitro-2-methylphenol	-	50
87-86-5	Pentachlorophenol	-	50
	Total Phenolics	-	5

1 Dibenz(a,h)anthracene and Dibenz(a,c)anthracene coelute.

2 Laboratory studies have shown that Benzo(j)fluoranthene will coelute with either benzo(b)fluoranthene or benzo(k)fluoranthene depending on the relative concentration of these two compounds in solution. Benzo(j)fluoranthene cannot be consistently separated by this method. Therefore, if present, it will be detected and reported as benzo(b) and/or benzo(k)fluoranthene.

3. Analytical standards not consistently available. It has not been demonstrated that this component can be routinely detected by this method.

varies slightly for the different aquifers (Mt. Simon-Hinckley, Ironton-Galesville, Prairie du Chien-Jordan, St. Peter, and Drift-Platteville) being monitored in accordance with the CD-RAP.

The overall sampling program is summarized in Tables 3-2, 3-3, and 3-4, and Figures 3-1 through 3-4.

3.2 Objectives and Intended Data Usage

Analytical levels for this project incorporate aspects of levels IV, and V, as defined by "Data Quality Objectives for Remedial Response Activities" (U.S. EPA, 1987). Contents of reports and data packages provided by the analytical laboratory will be based on those specified in Contract Laboratory Program (CLP) Statement of Work (SOW) Document OLM01.8, August 1991, (the deliverables are discussed in Section 10.3 in this QAPP). Data validation criteria are derived from "National Functional Guidelines for Organic Data Review" (U.S. EPA, December 1994). The details for quality control data acceptance criteria are discussed in Section 11 and Appendix B (Analytical Standard Operating Procedures (SOPs)). Data use categories include monitoring during implementation, site characterization, and risk assessment. It is the level of concern for low part per trillion concentrations of PAH that specifies a level V analytical level for this project. Level V includes non-conventional parameters, method-specific detection limits, and the modification of existing analytical methods. Rigorous Quality Assurance/Quality Control (QA/QC) to produce data of known quality are part of this program.

The objective of the GAC treatment system monitoring (CD-RAP Section 4.3) is to assess and evaluate the performance of the treatment system. Analytical results for influent and effluent samples will be compared to the drinking water criteria for PAH as established in the CD-RAP. Based on these comparisons, decisions will be made on: 1) system operations (e.g., when the carbon should be replaced), and 2) cessation of the treatment system, if desired, when sufficiently low concentrations of PAH in influent samples are demonstrated.

The objective of monitoring the four existing Mt. Simon-Hinckley Aquifer municipal drinking water wells and any new Mt. Simon-Hinckley Aquifer municipal drinking water wells installed within one mile of well W23, and analyzing for PAH (CD-RAP Section 5.1), is to assure the continued protection of these wells from PAH resulting from activities of Reilly at the Site. The analytical data will be used to make comparisons between the levels of PAH found in the Mt. Simon-Hinckley Aquifer, and the drinking water criteria established in the CD-RAP.

If any new Ironton-Galesville Aquifer drinking water wells are installed within one mile of well W23 (CD-RAP Section 6.2.1), then those wells will be sampled and analyzed for PAH to meet the objective of assuring protection of the wells from PAH resulting from the activities of Reilly at the

TABLE 3-2

Summary of Sampling and Analytical Program

Sample Matrix	Field Parameter	Number of Samples	Laboratory Parameters	Number of Samples	Field Blanks	Field Duplicates	Matrix Spike[1]	Matrix Spike Duplicate[1]	Matrix Total
GAC Treated Water	X	X	PAH (ppt)	4	4	4	4	4	20
			Acid Fraction compounds[2]	1	X	1	1	1	4
GAC Feed Water	X	X	PAH (ppt)	1	X	1	1	1	4
Ground Water	pH	79	PAH (ppt)	103	18	18	18	18	175
	temperature		PAH (ppb)	14	4	4	4	4	30
	Specific Conductance		Total Phenols	14	4	4	4	4	30

1. Matrix spike sample/matrix spike duplicate sample shall consist of the same matrix being analyzed. Triple the normal volume when related matrix spike/matrix spike duplicate samples are to be retrieved.

2. Analysis of samples for acid fraction compounds listed in EPA Method 625 shall be in accordance with Contract Laboratory Program Statement of Work Document OLM01.0, or most recent version.

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TABLE 3-3

Sampling Plan GAC Treatment System Monitoring Schedule[a]

RAP Section	Sampling Points	Start of Monitoring	Sampling Frequency	Analyses[b]
4.3.1(C)	Treated water (TRTD)	Date of plan approval	Quarterly	PAH(ppt)[c]
4.3.3(D)	Feed water (FEED)	Date of plan approval	Annually	PAH(ppt)
4.3.4	Treated water	Date of plan approval	Annually	Extended PAH(ppt)
4.3.4	Treated or Feed water	Date of plan approval	Annually	Acid fraction compounds in EPA Test Method 625

a This schedule does not include certain contingencies (e.g. exceedance monitoring) and, therefore, represents the minimum program that is likely to occur between the date this Plan is approved and December 13, 1995. Sections 4 and 12 of the RAP outline the additional monitoring that will be conducted if PAH criteria are exceeded. The first samples will be collected during the period indicated by the monitoring frequency following the date of the start of monitoring. The location of the GAC treatment system is shown in Figure 1.

b Lists of parameters and methods for analysis of PAH, extended PAH, and acid fraction compounds in EPA Test Method 625 are provided in the QAPP. Field blanks will be collected and analyzed at a frequency of one every ten samples or fewer. Treated water will be duplicated at a rate of 100 percent. Feed water duplicate samples will be collected and analyzed at a frequency of one per ten samples.

c ppt = parts per trillion. This signifies analysis using selected ion monitoring gas chromatography mass spectrometry.

TABLE 3-4

Sampling Plan Ground Water Monitoring Schedule[a]

Source of Water	RAP Section	Sampling[b] Points	Start of Monitoring	Sampling Frequency	Analyses[c]
Mt. Simon-Hinckley Aquifer	5.1	SLP11, SLP12, SLP13, SLP 17	Date of plan approval	Annually	PAH(ppt)[d]
	5.3.2	New municipal wells within one mile of well W23	At the time of installation	Annually	PAH(ppt)
Ironton-Galesville Aquifer	6.2.1	New municipal wells within one mile of well W23	At the time of installation	Annually	PAH(ppt)
Prairie du Chien-Jordan Aquifer	7.3(A)	SLP4	Start of pumping	Semi-annually	PAH(ppt) phenolics
	7.3(B)	W23	Date of plan approval	Semi-annually	PAH(ppb)[e]
	7.3(C)	SLP6, SLP7 or SLP9	Date of plan approval	Annually	PAH(ppt)
	7.3(D)	W405 or W406[f], H3, SLP10 or SLP15, SLP14, SLP16, W402 W403, W119	Date of plan approval	Annually	PAH(ppt)
	7.3(E)	SLP5, H6, E3, MTK6, W29, W40, W70	Date of plan approval	Annually	PAH(ppt)
	7.3(F)[g]	W32, SLP8, SLP10, E4	Date of plan approval	Semi-annually	No chemical analyses[g]
	7.4.1[h]	W48, W401, E2, E7, E13, E15	Date of plan approval	Semi-annually	PAH(ppt)
St. Peter Aquifer	8.1.3[i]	SLP3, W14, W24, W33, W122, W129, W133, W408, W409, W410, W411, W412, P116	Date of plan approval	Semi-annually	PAH(ppt)
Drift-Platteville Aquifer	9.1.3 and 9.2.3	W420, W421, W422	Date of plan approval	Quarterly	PAH(ppb) and total phenols
	9.5	W1, W18, W19, W20, W22, W27, W101, W120, W121, W124, W130, W131, W143, W424, W426, W428, W431, W432, W433, W434, W440[j]	Date of plan approval	Semi-annually	PAH(ppt)

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TABLE 3-4

Sampling Plan Ground Water Monitoring Schedule[a]

[a] This schedule does not include certain contingencies (e.g. exceedance monitoring) and, therefore, represents the minimum program that is likely to occur between the date this Plan is approved and December 31, 1996. Section 12 of the RAP outlines the additional sampling that will be conducted if the drinking water criteria are exceeded in samples from water supply wells. The first samples will be collected during the period indicated by the monitoring frequency following the date of the start of monitoring. Field blanks will be collected at a frequency of one for every ten samples or fewer, and one duplicate sample will be collected for every ten samples.

[b] Sampling points are located on the maps shown in Figures 3-1 through 3-4. Letter prefixes to well codes are defined as follows:

W	4-inch monitoring well
P	monitoring piezometer
SLP	St. Louis Park supply well
E	Edina supply well
H	Hopkins supply well
MTK	Minnetonka supply well

[c] Lists of parameters and descriptions of the methods for analysis of PAH, phenolics, and expanded analyses are provided in the QAPP. Water levels will be measured each time samples are collected for analyses, except for those wells which prove to be inaccessible for such measurements.

[d] ppt = parts per trillion. This signifies analysis using selected ion monitoring gas chromatography mass spectrometry.

[e] ppb = parts per billion. This signifies analysis by the Non-Criteria Method.' If analytical results for individual wells are below 20 micrograms per liter (20 ppb) using this method, then the Low-Level Method will be used on subsequent monitoring rounds.

[f] W405 = American Hardware Mutual, W406 = Minikahda Golf Course.

[g] Water levels will be measured semi-annually at these wells, except for those wells which prove to be inaccessible for such measurements.

[h] In accordance with the Gradient Control Modification System, these wells are now sampled semi-annually as opposed to annually.

[i] Section 6.1.3 of the Consent Decree-RAP originally specified St. Peter Aquifer monitoring requirements. Monitoring requirements for 1994, and subsequent years are now specified in the St. Peter Aquifer Record of Decision (ROD).

[j] These wells were requested to be sampled semi-annually in accordance with the ROD for the Northern Area of the Platteville Aquifer. However, three of the wells, W430, W431, and W432, are required to be sampled quarterly per Section 6.1.3 and 6.2.3 and will continue to be sampled quarterly and SLP3 is already required to be sampled semi-annually per Section 6.1.3 and will continue to be sample quarterly.

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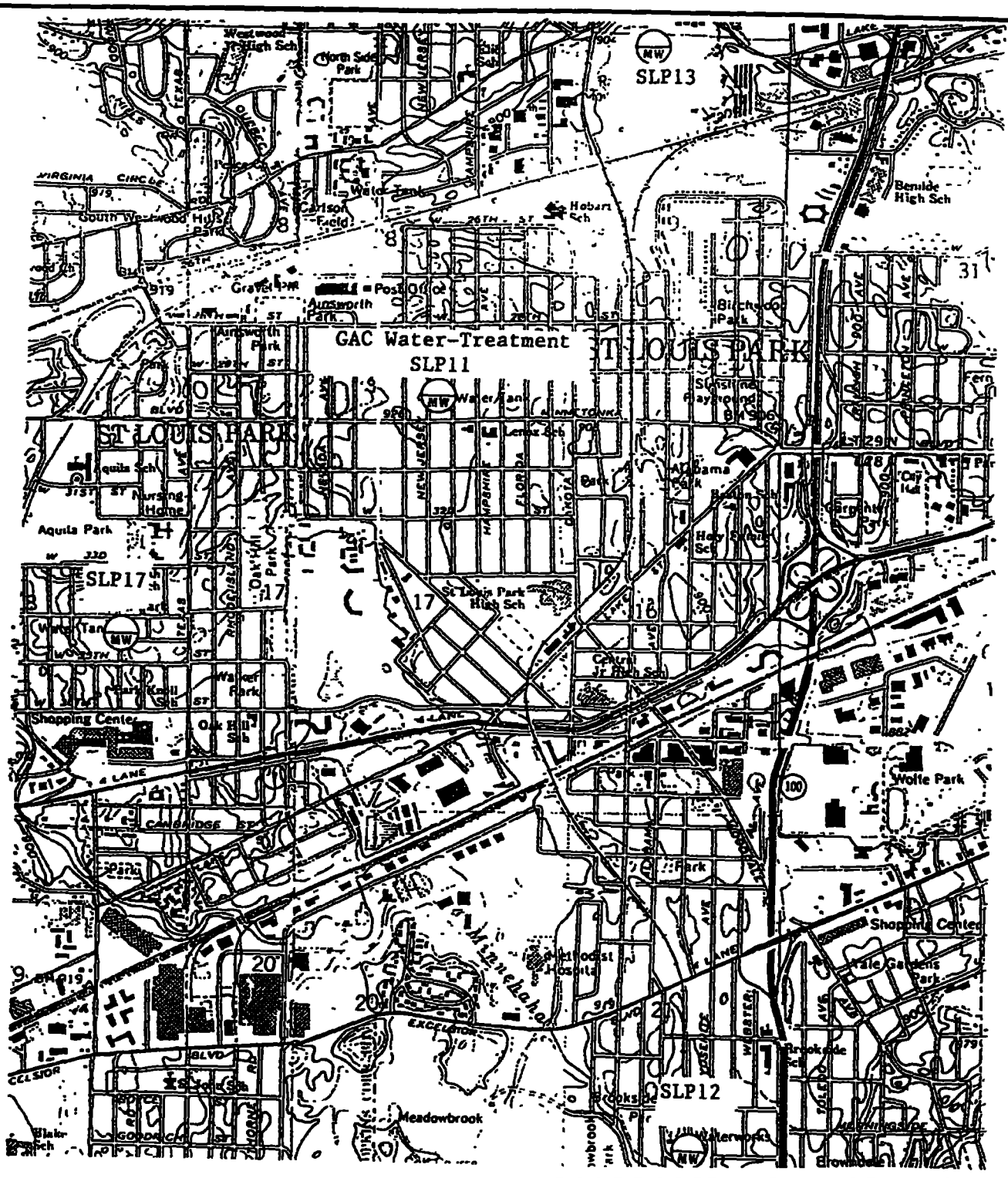

SOURCE: USGS 7½ Minute Topographic Quadrangle, Minneapolis South, Minnesota, photorevised 1993

SCALE

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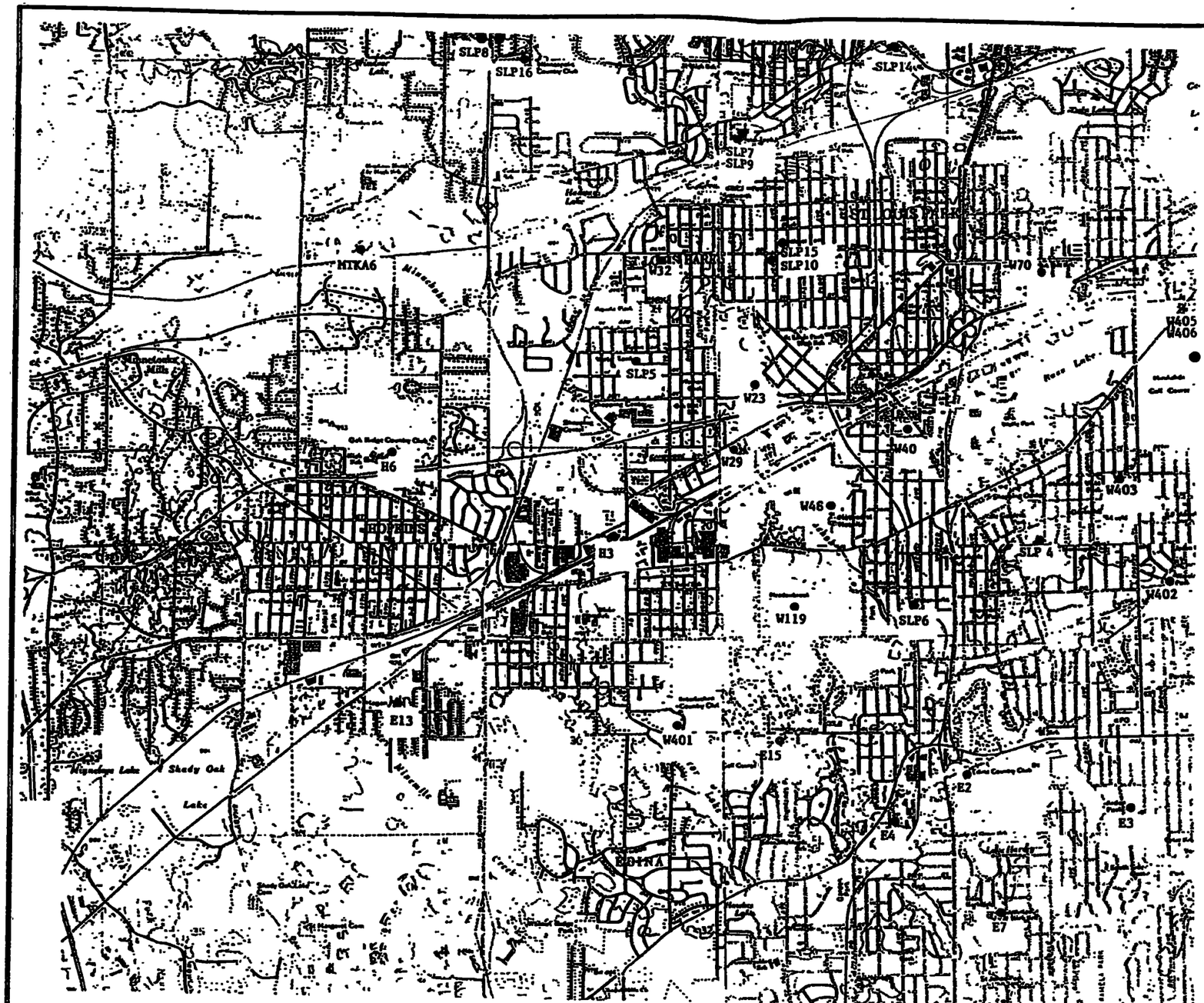
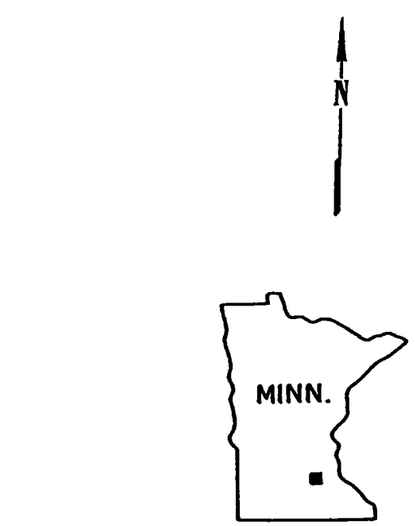
FIGURE 3-1

LOCATIONS OF MT. SIMON HINKLEY MONITOR WELLS AND ST. LOUIS PARK GAC WATER TREATMENT PLANT

St. Louis Park, Minnesota

DRAWN JJO	DATE. October 27, 1995	PROJECT NO.: 1620-013	REV:
FILE NO	CHECKED: WMG		





QUADRANGLE LOCATION

HOPKINS, MINNEAPOLIS SOUTH, MINN.

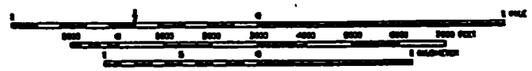


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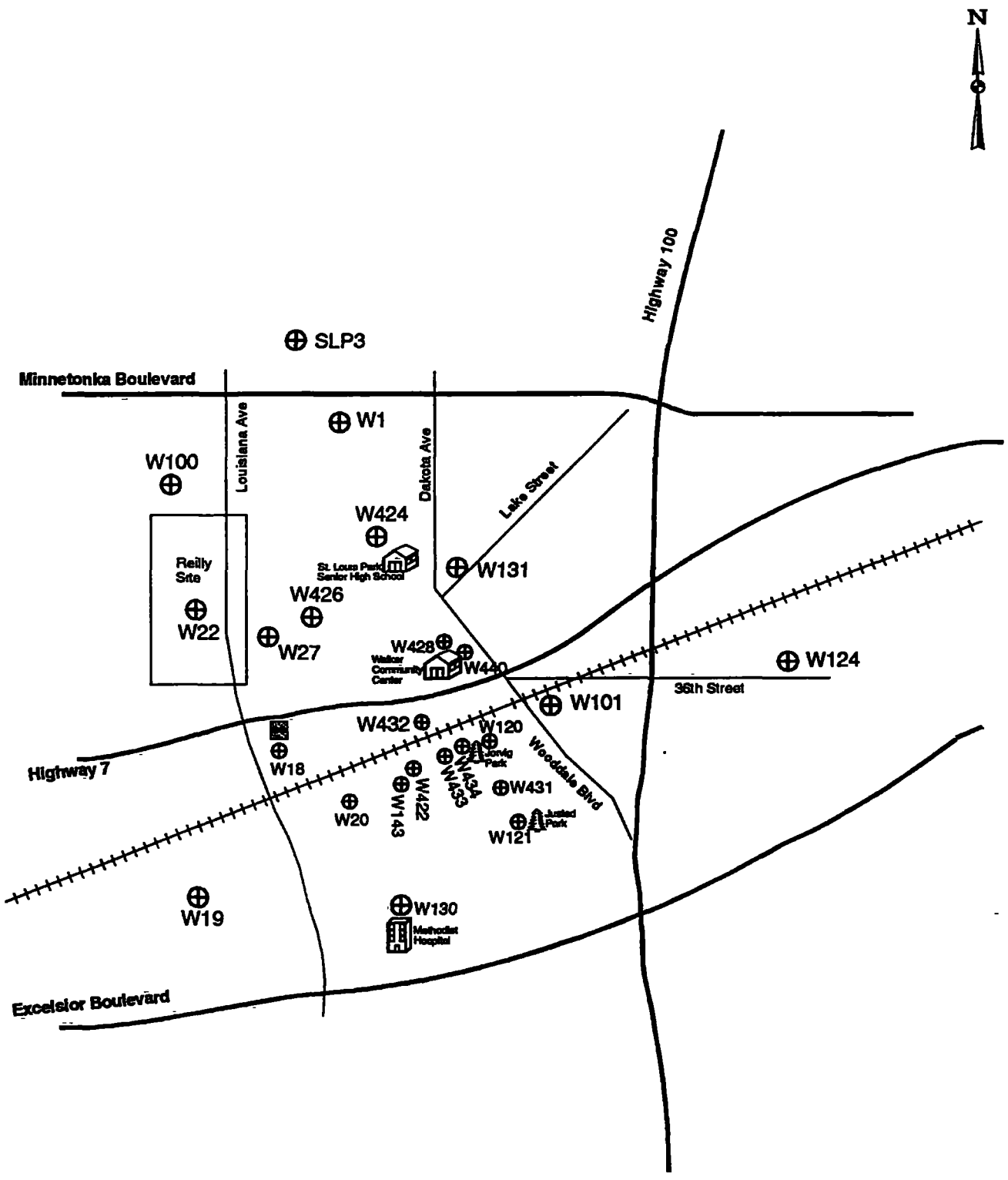
FIGURE 3-2
LOCATIONS OF PRAIRIE DU CHIEN-JORDAN AQUIFER WELLS
St. Louis Park, Minnesota

DRAWN: JJO	DATE: October 27, 1995	PROJECT NO.: 1620-013	REV:
FILE NO.:	CHECKED: WMG		



Scale 1000 0 1000 2000 Feet

EXPLANATION

⊕ W121 Sampling Well

W420/W421 Pumphouse

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FIGURE 3-3

LOCATIONS OF DRIFT/PLATTEVILLE AQUIFER MONITOR WELLS

St. Louis Park, Minnesota

DRAWN: JJO	DATE: October 27, 1995	PROJECT NO.: 1620-013	REV:
FILE NO.:	CHECKED: WMG		

SOURCE: USGS 7½ Minute Topographic Quadrangle, Minneapolis South, Minnesota, photorevised 1993

SCALE

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ENSR Consulting and Engineering

FIGURE 3-4

LOCATIONS OF ST. PETER AQUIFER MONITOR WELLS

St. Louis Park, Minnesota

DRAWN JJO	DATE October 27, 1995	PROJECT NO.: 1620-013	REV:
FILE NO.	CHECKED WMG		

Site. The analytical data would be used to compare the levels of PAH found in potential Ironton-Galesville Aquifer drinking water wells to the drinking water criteria established in the CD-RAP.

The objectives of monitoring the many Prairie du Chien-Jordan Aquifer wells, including municipal drinking water wells, private or industrial wells, and monitoring wells are to (CD-RAP Section 7.3): 1) monitor the distribution of PAH in the aquifer, thus evaluating the source and gradient control system, and 2) assure the continued protection of drinking water wells from PAH resulting from the activities of Reilly at the Site. The analytical data will be used to compare the levels of PAH in the Prairie du Chien-Jordan Aquifer to historical PAH data and to various criteria established in the CD-RAP (e.g., drinking water criteria for drinking water wells, and a cessation criterion of 10 micrograms per liter of total PAH for source control well W23).

In addition to water quality data generation, water level data will be used for the purpose of determining ground water flow patterns in the Prairie du Chien- Jordan Aquifer.

The objectives of monitoring St. Peter Aquifer wells are to (CD-RAP Section 8.1.3): 1) monitor the distribution of PAH in the aquifer, thus evaluating a gradient control system installed at W410 in 1990, and 2) assure the continued protection of drinking water wells from PAH resulting from the activities of Reilly at the Site.

Upon its receipt, analytical data will be used to compare the levels of PAH in the St. Peter Aquifer to historical PAH data, to drinking water cessation criteria for well W410, and to drinking water criteria established in the CD-RAP. Water level data will be used to evaluate ground water patterns in the St. Peter Aquifer.

The objective of monitoring the Drift-Platteville Aquifer wells (CD-RAP Section 9.6) is to monitor the distribution of PAH and phenolics in the aquifer, thus evaluating the source and gradient control systems. Ground water analytical data will be used to compare levels of PAH and phenolics in the Drift-Platteville Aquifer with historical water quality data for the aquifer and with various criteria established in the CD-RAP for PAH and phenolics. Water level data will be used to evaluate ground water flow patterns in the Drift-Platteville Aquifer.

In addition to the objectives for laboratory analytical data described above, field measurement data will be collected to aid in the ground water sampling procedure. In accordance with MPCA Guidelines (January 1995) field measurements of temperature, pH, and specific conductance will be made for the purpose of determining that a sufficient volume of water has been purged from the well prior to sampling. The objective of those field measurements is to determine when three successive well volumes exhibiting equivalent temperature pH, and specific conductance have been purged from each monitoring well, so that representative samples may be collected.

The Site Management Plan outlines the scope of work to be performed in order to monitor the ground water in the St. Louis Park, Minnesota, area in accordance with the CD-RAP related to the Reilly N.P.L. Site. Included in this Plan are: 1) the identity of wells to be monitored, 2) the schedule for ground water monitoring, and 3) a description of the procedures that will be used for sample collection, water level measurement, sample handling, sample analysis, and reporting. Although a GAC treatment system has been constructed to treat water from well W23 and the Drift-Platteville Aquifer source control wells prior to its discharge to surface water receivers, monitoring of the effluent is not within the scope of work to be performed under this Plan, as the activity is not embodied in the CD-RAP. Similarly, a GAC treatment system has been constructed to treat water from well SLP4 prior to discharge to the municipal water supply system; however, monitoring of the effluent is not within the scope of work to be performed under this Plan, as the activity is not embodied in the CD-RAP.

The time period covered by this Plan is from January 1, 1997, or the date of its acceptance and approval by the Agencies, whichever is later, to December 31, 1997. The next subsequent Sampling Plan (RAP Section 3.3) will be submitted by October 31, 1997, covering the 1998 calendar year.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This project is being conducted in accordance with the CD-RAP for the Reilly Tar & Chemical Corporation N.P.L Site in St. Louis Park, Minnesota. The parties to the Consent Decree include Reilly, the City, EPA, MPCA, and MDH. The project organization shown in Figure 4-1 indicates the involvement of the parties to the Consent Decree, as appropriate. The responsibility for the overall QA/QC on the project is ENSR. Both the City and ENSR are responsible for the completion of the monitoring tasks described in this Plan and project QA/QC. The City is assisted in the retrieval and laboratory analysis of water samples by ENSR and QES, respectively. ENSR is responsible for the field sampling QA/QC and will be performing the biannual audit of QES.

ENSR will be responsible for the coordination of all field sample retrieval and Quanterra Environmental Services (QES), with analytical facilities in Arvada, Colorado, will be responsible for the coordination and completion of all laboratory analyses. Responsibilities of the key positions in the organization of QES are described below:

- Laboratory Project Manager: The Laboratory Project Manager is ultimately responsible for all laboratory analyses and is the primary point of contact for issues surrounding this Quality Assurance Project Plan (QAPP), resolving technical problems, modifications to SOPs, etc. The Laboratory Project Manager is responsible for the coordination of routine day-to-day project activities including project initiative, status tracking, data review and requests, inquiries and general communication related to the project.

- Operations Manager: The Operations Manager is responsible for oversight of preparation and analysis of PAH samples to ensure that project objectives, requirements and QA/QC criteria are met.

- Laboratory Supervisor: The Laboratory Supervisor shall be responsible for daily supervision of technicians and analysts for PAH and total phenolics analyses, including sample extraction and preparation.

- Analyst: The Analyst is responsible for the analysis of water samples for the requested parameters utilizing the methods prescribed by the QAPP.

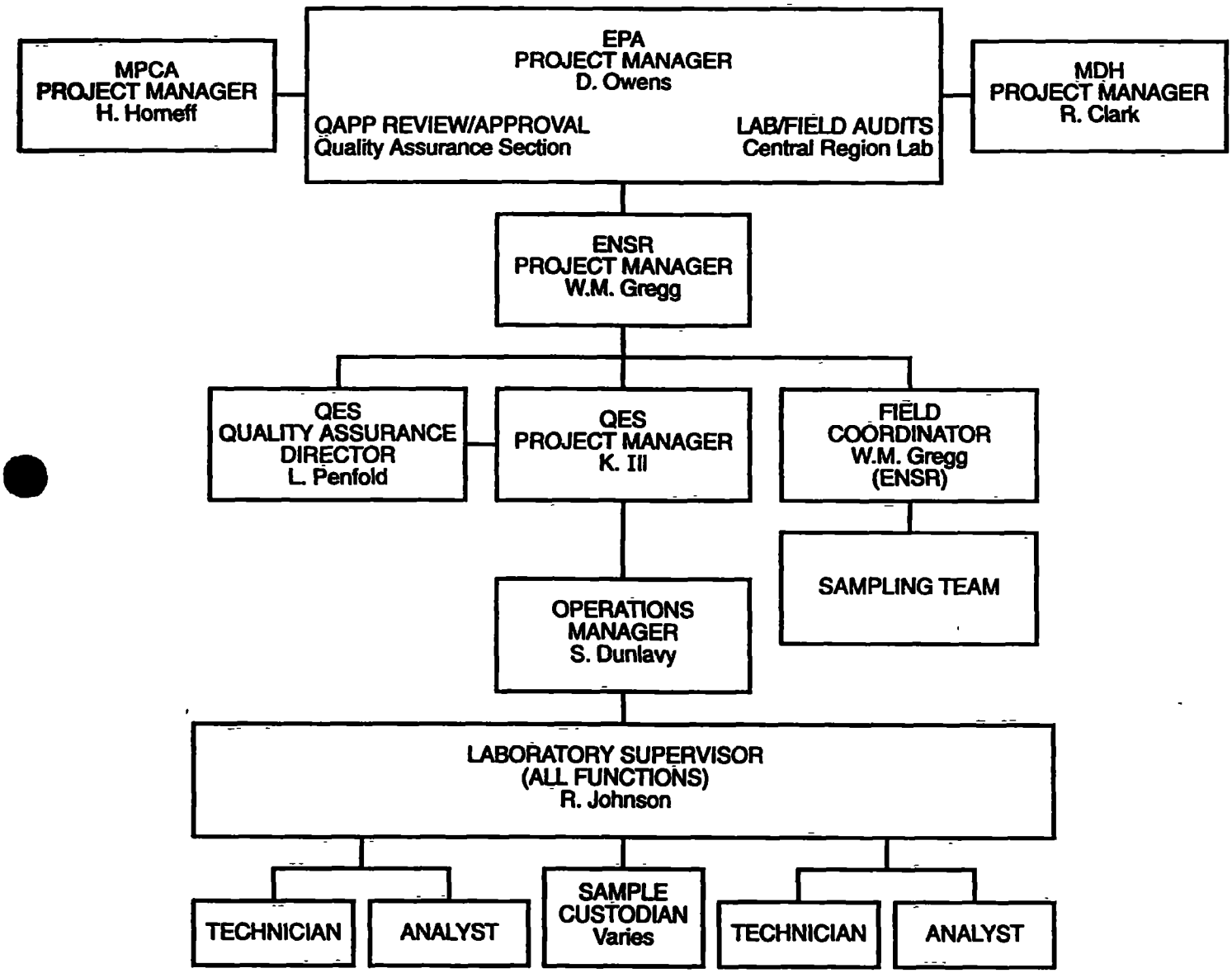


FIGURE 4-1 Program Organization

- Technician: The Technician is responsible for sample extraction. This requires practical experience and knowledge in the techniques of liquid - liquid solvent extraction, Kuderna - Danish evaporation, and the quantitative preparation of sample extracts for analysis.

- Quality Assurance Director: The Quality Assurance Director is responsible for overall quality control oversight, including internal audits. The Quality Assurance Director supervises an independent QA/QC department and reports directly to the Division Director and Corporate Vice President for Quality Assurance.

- Data Assessment: The evaluation of data, as it is compiled and organized in accordance with the requirements of the QAPP, is the responsibility of the Operations Manager. Additional review, evaluation, and assessment of the data is performed by the Laboratory Manager, thereby providing additional assurance that the requirements of the QAPP are met.

  The City's Project Manager shall be responsible to assess the data relative to the objectives and intended data usage identified in Section 3.2. of this QAPP.

The Sampling Team shall consist of employees of the City and ENSR. The team shall be responsible for sample collection, conducting field measurements (i.e. water level), and maintaining proper decontamination procedures stated in the QAPP.

The EPA and MPCA are responsible for review and approval of the Sampling Plan, including the QAPP. In addition, laboratory and field audits may be completed by appropriate EPA representatives. The MPCA is responsible for review of field procedures practiced by the Sampling Team. Responsibilities of the key positions in the EPA and MPCA are described below:

- EPA Project Manager: The EPA Project Manager, EPA Region 5, is responsible for the review and approval of the QAPP on behalf of the EPA.

- EPA Quality Assurance Officer: The EPA Quality Assurance Officer, EPA Region 5, is responsible for the review and approval of the QAPP on behalf of the EPA.

- EPA Central Regional Laboratory: The EPA Central Regional Laboratory, EPA Region 5, shall be responsible for audits of both field activities and laboratory analyses.

- MPCA Project Manager: The MPCA Project Manager shall be responsible for review and approval of the Sampling Plan, and review of field procedures practiced by the Sampling Team.

5.0 QUALITY ASSURANCE OBJECTIVES

The principal objectives of the QAPP pertain to the collection of data that are sufficient to monitor the effectiveness of the GAC treatment system and to detect changes in ground water quality. Therefore, the quality of the data gathered in this project can be defined in terms of the following elements:

- Completeness - a sufficient number of successful (valid) measurements to characterize the concentrations of PAH in the influent and effluent of the treatment system and in the aquifers of interest over a period of time. For this project, the completeness objective is that 95 percent of the laboratory analyses and 95% of the field measurements will produce valid data. Field data will be supplemented by resampling if necessary to ensure completeness.

- Representativeness - the extent to which reported analytical results truly depict the PAH and phenolics concentrations in the sampled environment. Representativeness is optimized through proper selection of sampling sites, times and procedures, through proper sample preservation, and through prompt extraction and analysis.

- Accuracy and Precision - Accurate and precise data will be achieved through the use of sampling and analytical procedures that minimize biases, through the use of standard procedures, through the meticulous calibration of analytical equipment and by implementing corrective action whenever measured accuracy and precision exceed pre-established limits. Accuracy and precision will be measured by the analysis of method spikes and duplicate samples.

  It is essential that representative ground water samples be retrieved for laboratory analyses. Accuracy and precision in the measurement of parameters used to monitor ground water as it is purged from monitor wells and piezometers will be achieved through the use of standard monitoring procedures carried out continuously during the sample retrieval task. Field measurement equipment will be calibrated in accordance with the manufacturer's recommendations, as outlined in Table 6-6, and appropriate corrective action will be initiated whenever measured accuracy and precision do not meet pre- established limits. Precision and accuracy of field measurement devices will be tested by taking duplicate samples and calculating the relative percent difference using the formula

presented in Section 14. Duplicate field readings will be completed at a ten percent frequency.

- Sensitivity - Determination of instrument sensitivity is accomplished by calibration using multiple concentrations of the analytes of interest. Once instrument sensitivity is demonstrated, analysis of replicate spiked samples of deionized reagent water at a concentration of one to five times the instrument sensitivity, is used to determine method sensitivity (i.e. method detection limit).

- Comparability - the extent to which comparisons among separate measurements will yield valid conclusions. Comparability among measurements in the monitoring program will be achieved through the use of rigorous standard sampling and analytical procedures.

- Traceability - the extent to which results can be substantiated by hard-copy documentation. Traceability documentation exists in two forms: that which links final numerical results to authoritative measurement standards, and that which explicitly describes the history of each sample from collection to analysis.

The fundamental mechanisms that will be employed to achieve these quality goals can be categorized as prevention, assessment and correction, as follows:

1. Prevention of defects in the quality through planning and design, documented instructions and procedures, and careful selection and training of skilled, qualified personnel

2. Quality assessment through a program of regular audits and inspections to supplement continual informal review (refer to Section 12 of this QAPP)

3. Permanent correction of conditions adverse to quality through a closed-loop corrective action system

The City sampling program QAPP has been prepared in direct response to these goals. The QAPP describes the quality assurance program to be implemented and the quality control procedures to be followed by QES during the course of laboratory analyses in support of the various site investigation studies for the City Site. The Quality Assurance objectives will include field blanks, method blanks, field duplicates, surrogate spikes, matrix spikes and matrix spike duplicates. Precision, accuracy and completeness criteria are established for each parameter of

interest. The specific criteria for each analysis and parameter are set forth in detail in the following sections:

Objective	Frequency (%)	Sections Discussing Criteria
Field Duplicates	10	6.8, 11.1.4
Field Blanks	10	6.5.2
Method Blanks	5	11.1.1, 15.1.3
Surrogate Spikes	100 of GC/MS analyses	11.1.2, 15.1.1
Matrix Spikes/Duplicates	5*	11.1.3, 15.1.2

* One per group of 20 or fewer investigative samples.

6.0 SAMPLING PROCEDURES

Samples will be collected by ENSR and City personnel in accordance with MPCA guidelines (MPCA, 1995). The overall sampling program was summarized in Tables 3-2, 3-3, and 3-4, and Figures 3-1 through 3-4. This section discusses general QAPP provisions relevant to sample collection, containerization, packaging and shipping activities (SOPs 7130 and 7510; Appendix A).

6.1 Training

All ENSR and City personnel working on the project will be properly trained, qualified individuals. Prior to commencement of work, personnel will be given instruction specific to this project, covering the following areas:

- Organization and lines of communication and authority
- Overview of the Site Management Plan and QAPP
- Documentation requirements
- Decontamination requirements
- Health and Safety considerations

Training of field personnel will be provided by the Field Coordinator or a qualified designee.

The analysts performing chemical analyses of samples will be trained in and will have exhibited proficiency in the analytical methods to be employed.

6.2 Document Control

Document Control for the Sampling Plan serves a two-fold purpose. It is a formal system of activities that ensures that:

1. All participants in the project are promptly informed of revisions of the QAPP

2. All documents generated during the course of the program are accounted for during, and at the end of the project

This QAPP and all Standard Operating Procedure documents have the following information on each page:

- Document Number
- Page Number
- Total number of pages in document
- Revision number
- Revision date

When any of these documents are revised, the affected pages are reissued to all personnel listed as document holders with updated revision numbers and dates. Issuance of revisions is accompanied by explicit instructions as to which documents or portions of documents have become obsolete.

Control of, and accounting for documents generated during the course of the project is achieved by assigning the responsibility for document issuance and archiving. Table 6-1 lists the key documentation media for the project and corresponding responsible parties for issuance, execution and archiving.

6.3 Sample Control Procedures and Chain of Custody

In addition to proper sample collection, preservation, storage and handling, appropriate sample identification procedures and chain of custody are necessary to help insure the validity of the data.

6.3.1 Sample Identification

Sample labels shall be completed for each sample using waterproof ink. The information recorded on the sample label includes:

Sample Number - Unique coded sample identification number as described below.

Time - A 4-digit number indicating the military time of collection.

Sampler - Signature of person collecting the sample.

Remarks - Any pertinent observations or further sample description. The sample number includes three parts (source code, sampling point code, and date code) in the following sequence:

XXX-YYYYY-ZZZZZZ

TABLE 6-1

Document Control

Item	Issued By	Issued To	Archived By
Field Notebooks	Field Coordinator	Sampling Team	Field Coordinator
Field Equipment Calibration Forms	Field Coordinator	Sampling Team	Field Coordinator
Sample Logs	Field Coordinator	Sampling Team	Field Coordinator
Chain-of-Custody Forms	Lab Sample Custodian	Field Coordinator	Lab Sample Custodian
Sample Labels	Field Coordinator	Sampling Team	Lab Sample Custodian

XXX	=	Source Code	
		GAC Treatment System	= GAC
		Mt. Simon-Hinckley Aquifer	= MSH
		Ironton-Galesville Aquifer	= IGV
		Prairie du Chien-Jordan Aquifer	= PCJ
		St. Peter Aquifer	= STP
		Drift-Platteville Aquifer	= DPV
YYYYY	=	Sampling Point Code	
ZZZZZZ	=	Date Code Month, day, year	

Those samples which will be taken in accordance with this QAPP for quality control purposes will be identified by appending to the sampling point codes the following:

Field blank = FB
Field duplicate = D
Matrix spike = MS
Matrix spike duplicate = MSD

As an example, a field blank sample taken for the Mt. Simon-Hinckley Aquifer, sampling point SLP11 on January 1, 1991, would be identified as follows:

MSH-SLP11FB-010191

During the sampling event, one sample will be taken per sampling point unless it is duplicated. Duplicate samples will be collected as specified in Table 3-2 (Page 13 of 95). Those samples collected for matrix spike analysis will be selected at the time of sampling and labelled in the field.

After collection, identification, and preservation, the sample will be maintained under chain-of-custody procedures discussed below.

6.3.2 Field Forms

In addition to sample labels and chain-of-custody forms, a bound field notebook will be maintained by the sample team leader to provide a daily record of significant events. Information to be documented in the notebook will be ground water sample collection records, calibration records, list of samples collected and any other pertinent information such as weather conditions, site visitors, ease/difficulty of retrieving samples, etc. All entries will be signed and dated. All members of the sampling team will use this notebook. The notebook will be kept as a permanent record.

6.4 Sampling Procedures - GAC Treatment System

Chain-of-custody forms will be completed and all samples shipped to QES' laboratory by overnight delivery on the same day they are collected.

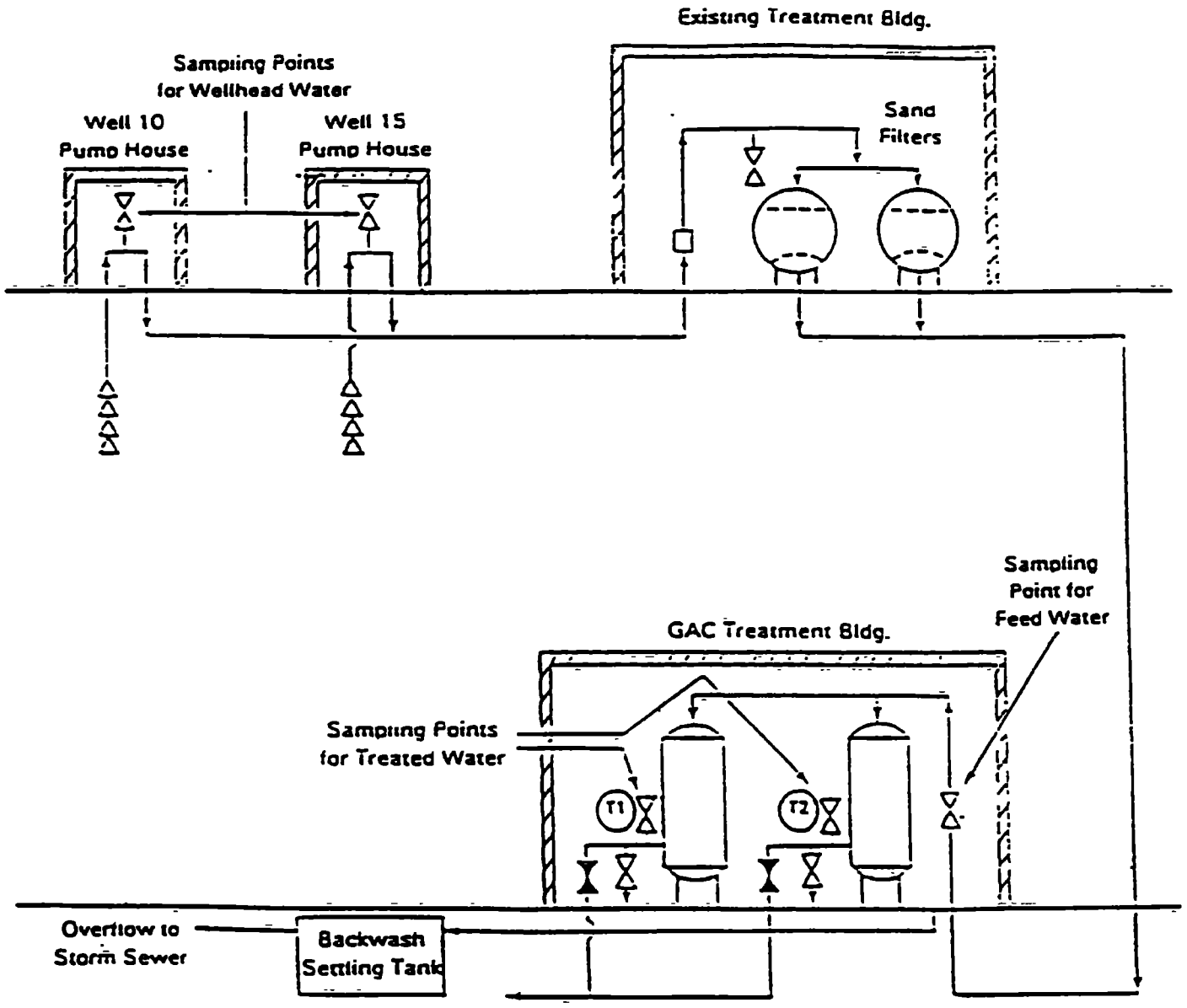
Sampling points will be flushed for at least five minutes before collecting a sample. Each PAH sample and matrix spike sample will be collected in six 1-liter amber glass bottles, which should be filled and capped in succession. PAH sample bottles will not be rinsed before being filled.

The GAC treated water samples will have to be collected from two sample taps, one for each column (see Figure 6-1). This will be done by filling three 1-liter bottles from the first column sample tap and then three more bottles from the second (six from each for duplicate samples). No notations distinguishing the two taps will be made on the labels. Only four PAH bottles will be extracted and the extracts composited for analysis.

Field blank samples will be prepared by transferring contaminant-free deionized water provided by QES into sample bottles in a fashion as closely similar to actual sample collection as possible. Field blank sample bottles will be filled and capped in succession with individual bottles open to the atmosphere for an equal time as for actual process samples. Field blanks will be prepared in the area in which GAC treated water samples are collected.

Field duplicate and matrix spike duplicate samples will be obtained by filling 12 one-liter bottles at the sampling point by the procedure described above, splitting these into two groups of six bottles, and assigning a different sample number to each of the resulting six bottle samples. All samples will be packed, cooled to a temperature less than 4°C, and shipped on the day they are collected.

The sampling team must recognize that great care is required to collect samples for part per trillion level PAH analyses that are free from outside contamination. PAH compounds are



Sampling Locations

Figure 6-1

present in cigarette smoke, engine exhaust and many petroleum derived oils, among other sources. There will be no smoking anywhere in the GAC treatment building for at least 72 hours prior to the day on which PAH samples are to be collected. Similarly, no vehicles will enter the GAC treatment building and the large access door will stay closed for at least 72 hours prior to the sampling day. Disposable gloves will be worn when collecting, handling and packaging samples. Sample bottles will remain in closed shipping coolers until they are needed, and will be packaged and sealed for shipment as soon as possible after sampling.

6.5 Ground Water Sampling and Water Level Measurements

Ground water samples will be collected and water levels measured in accordance with the procedures outlined in this QAPP. The wells involved in the monitoring program include municipal and commercial wells, piezometers and ground water monitoring wells (Table 3-4, Page 15 of 95). Sampling procedures to accommodate the dimensions and configuration of each type of well are described below. Further details on well dimensions, water level measurements and sample acquisition strategies are given in the Site Management Plan.

The importance of proper sampling of wells cannot be over emphasized. Even though the well being sampled may be correctly located and constructed, special precautions must be taken to ensure that the sample taken from that well is representative of the ground water at that location and that the sample is neither altered nor contaminated by the sampling and handling procedure. Sample collection will always proceed from the less contaminated sampling points to the monitoring points containing progressively higher concentrations of PAH or phenolics.

6.5.1 Decontamination

The field decontamination procedure to be used on sampling equipment which comes into contact with ground water samples is as follows:

- Disassemble equipment, if applicable
- High pressure, hot water steam clean, using potable water

The laboratory decontamination procedure to be used on sampling equipment which comes into contact with ground water samples is as follows:

- Disassemble equipment
- Rinse with methanol
- Scrub with hot soapy water
- Rinse three times with hot deionized water

- Set on aluminum foil, dull side up, air dry
- Bake for one hour at 200°C
- Wrap with aluminum foil, dull side in

6.5.2 Field Blanks

Field blank samples will be prepared by transferring contaminant-free deionized water, provided by QES, into sample bottles in a fashion as closely similar to actual sample collection as possible. This will involve collecting samples through any non-dedicated sample equipment that is decontaminated between samples. Field blank sample bottles will be filled and capped in succession with individual bottles open to the atmosphere for an equal time as for actual process samples. Field blanks will be prepared in the area where samples are being collected at a rate of one per day or where more than ten samples are collected in a day at a rate of one field blank per ten samples.

6.5.3 Sample Containers

For PAH and phenolics, 1-liter amber glass bottles will be used (Table 6-2). Caps will be fitted with pre-cleaned teflon liners. Six bottles are required for each Low-Level PAH sample collected and two bottles for each Non-Criteria PAH and Extended Analysis sample collected. One 16-ounce glass bottle with two milliliters of 50 percent sulfuric acid is required for total phenolics. An independent commercial firm shall provide precleaned bottles to QES for use on this project.

In the event QES is required to prepare bottles for sampling, the bottles will be prepared as follows:

1. Wash bottles with hot detergent water.

2. Rinse thoroughly with tap water followed by three or more rinses with organic-free water.

3. Rinse with Burdick & Jackson quality redistilled acetone, followed by equivalent quality methylene chloride.

4. Allow to air dry in a contaminant-free area.

5. Caps and liners must be washed and rinsed also. Bottles should be stored and shipped with the Teflon-lined caps securely fastened.

TABLE 6-2
SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND
MAXIMUM HOLDING TIMES

Parameter	Containers[1]	Preservation[2]	Maximum Holding Time[3]
Water:			
PAH (PPT)	Six 1-liter amber glass bottles, Teflon-lined caps	cool, to 4°C; protect from light	5 days (until extraction), 40 days after extraction
PAH (PPB)	Two 1-liter amber glass bottle, Teflon-lined caps	cool, to 4°C, protect from light	5 days (until extraction), 40 days after extraction.
Phenolics, (Acid Fraction)	Two 1-liter amber glass bottle,	cool, to 4°C	5 days (until extraction), 40 days after extraction
Phenolics (Total	Two 16 oz. clear glass bottle	cool, to 4°C 2 ml 50% H_2SO_4	28 days

Ref: Federal Register Guidelines/Vol.49, No.209/Friday, October 26, 1984/p. 43260.

1 Matrix spike samples shall consist of the same matrix being analyzed, therefore triple the normal volume when a related matrix spike sample and matrix spike duplicate are to be retrieved.

2 Sample preservation will be performed immediately upon sample collection.

3 Samples will be analyzed as soon as possible after validated time of sample receipt (VTSR). The times listed are the maximum times that samples may be held before analysis and still be considered valid.

6.5.4 Sample Collection - Monitoring Wells and Piezometers

Because unanticipated or changed conditions may cause difficulty in purging the monitoring wells and piezometers, flexibility in the approach to the method of well purging is necessary. This QAPP proposes that the sampling team be given latitude in the selection of purge equipment necessary to complete the task (various pumping equipment and procedures that may be used for purging monitoring wells are described in SOP 7130 and MPCA's 1995 Guidelines). In all cases where no dedicated pump exists, samples will be retrieved using laboratory-cleaned, stainless steel or teflon bailers as described below.

Table 3-4 (Page 15 of 95) specifies that Prairie du Chien-Jordan Aquifer monitor well W70, and St. Peter Aquifer monitor wells W24 and W33 be monitored. Each well is equipped with a dedicated submersible pump and it will be the responsibility of the sampling team to determine if the pump is operable. In the event the dedicated pump within any individual well is operable, well purging and sample retrieval tasks will be completed with the aid of the pump in conformance with monitoring parameters established herein. In the event the dedicated pump within any individual well is inoperable, the pump will be removed and purging/sampling procedures will be as established below.

Monitoring wells and piezometers not equipped with dedicated submersible pumps will be purged using a non-dedicated submersible pump, suction pump or bailer. During the purging of each well, temperature, pH and specific conductance of the purge water will be monitored using a Hydrolab water quality monitor (or equivalent). Readings will be taken once per well volume. Stabilization of these readings will indicate that purging is complete and sampling may commence. Upon completion of well purging, samples will be collected from each well using a stainless steel or teflon bailer and a new length of nylon or polyester rope. All non-dedicated purging and sampling equipment will be decontaminated before use and between sampling points as described in Section 6.5.1 (Page 36 of 95). An equipment blank will be collected at the frequency of one for each ten samples collected from wells that have non-dedicated sampling equipment.

Samples will be collected by filling each of the appropriate sample containers in rapid succession, without pre-rinsing the containers with sample. The bottle will be held under the sample stream without allowing the mouth of the bottle to come in contact with the bailer and filled completely, and the cap securely tightened. All sample labels will be checked for completeness, sample custody forms completed and a description of the sampling event recorded in the field notebook.

6.5.5 Sample Collection - Pumping Wells

At active pumping wells, the sampling team will first determine that the wells have actually been pumping during the period preceding sampling. This information may be derived from inspecting flow recorders or from interviewing knowledgeable persons regarding the wells (water department employees, well owners, etc.). The information will be documented in the field notes of the sampling team.

Water level measurements will then be made, if practical. The normal operation of the well will not be interrupted for the purpose of measuring water levels. A clean electric tape will be used to measure water levels in pumping wells. Sampling will proceed by filling the required containers with water from the sampling tap as near to the well head as possible, and before any holding tanks or treatment is encountered.

If it cannot be determined that a well has been pumping at some time during the 24 hour period preceding sampling, or if it is known the well was not pumping, then the well shall be purged until field measurements of temperature, pH, and specific conductance have stabilized after at least three well volumes have been removed from the well. These measurements, water levels, and the amount of water pumped will be recorded in the field notes.

6.6 Sample Preservation, Shipment and Storage

Packaging and shipment of samples shall be in accordance with SOP 7510 (Appendix A). The samples will be iced or refrigerated at 4°C from the time of collection until extraction. PAHs are known to be light sensitive; therefore, samples will be stored in amber bottles and kept away from prolonged exposure to light. All samples for gas chromatography mass spectrometry (GC/MS) analysis will be extracted within five days of validated time of sample receipt as per CLP SOW Document OLM01.8, or most recent version. The analysis will be completed within 40 days following extraction. The holding time for total phenolics is 28 days from sample collection to analysis.

Samples will be protected from breakage and shipped in coolers at a temperature of 4°C ± 2°C. An overnight carrier will be selected to insure delivery at the laboratory within 24-36 hours after collection.

Samples received at the laboratory will be checked for leakage and a notation made regarding sample temperature at time of receipt. All samples should be stored in an organic-free refrigerator at 4°C ± 2°C.

6.7 Field Measurement Equipment

All field measurement equipment will be controlled to ensure that measurements obtained are accurate and defensible. Table 6-3 summarizes the parameters to be monitored, the instruments to be used for each measurement,procedures including calibration and frequency, and quality control criteria (also refer to Appendix A, SOP 7320, Calibration and Operation of Hydrolab Water Quality Monitor).

In addition, these measurement devices will be issued through a formal equipment tracking system and operated by trained personnel.

6.8 Duplicate Samples

Duplicate samples will be collected by alternately filling sample bottles from the source being sampled. For six liter sample collection, one bottle will be filled for the sample, then one bottle for the duplicate, then a second bottle for the sample and then a second bottle for the duplicate, etc. Duplicates will be taken for each analysis type and each sample type, at a rate of one duplicate sample being collected for each ten samples, with a minimum of one duplicate for any sample batch. There are two sample types for this program: GAC treatment system water and ground water.

For purposes of fulfilling the ten percent duplicate requirement, all the sampling points shown on Table 3-4 (Page 15 of 95) are the same sample type and have been chosen to maximize the frequency of sample duplication from pumping wells and monitor wells where experience indicates sampling is easiest, thereby insuring consistency of results.

TABLE 6-3
FIELD MEASUREMENT EQUIPMENT QUALITY CONTROL

Device	Calibration	Routine Check Method	Routine Check Frequency	Control Limits
pH Meter (Hydrolab)	Standardize in three or more standard buffer solutions	Calibration check-analyze standard buffer solution	1/10 samples	±0.1 pH units
		Analyze duplicates	1/10 samples	±0.1 pH units
Conductivity Meter (Hydrolab)	Standardize using two or more KCL solutions	Calibration check-analyze standard KCL solution	1/10 samples	±1% of range being used
		Analyze duplicates	1/10 samples	±1% of range being used
NBS* Thermometer	Factory calibrated	Not required	Not required	±0.1° C
Water Level Measurement Device (Electric)	Factory calibrated	Not required	Not required	±0.01 Ft.

* NBS - National Bureau of Standards

Samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate custody record accompanying each shipment. Shipping containers will be sealed for shipment to the laboratory. The method of shipment, courier name(s) and other pertinent information are entered in the "Remarks" box. Then tear off the last copy of the form and place the original and remaining copies in the container. After the container is closed, place the custody seals on the container.

Whenever samples are split with another laboratory, it is noted in the "Remarks" section. The note indicates with whom the samples are being split and is signed by both the sampler and recipient. If either party refuses a split sample, this will be noted and signed by both parties. The person relinquishing the samples to the facility or agency should request the signature of a representative of the appropriate party, acknowledging receipt of the samples. If a representative is unavailable or refuses to sign, this is noted in the "Remarks" space. When appropriate, as in the case where the representative is unavailable, the custody record should contain a statement that the samples were delivered to the designated location at the designated time.

7.2 Security and Recordkeeping

Samples entering the QES analytical facilities located in Arvada, Colorado, proceed through an orderly chain-of-custody sequence specifically designed to insure continuous integrity of both the sample and documentation.

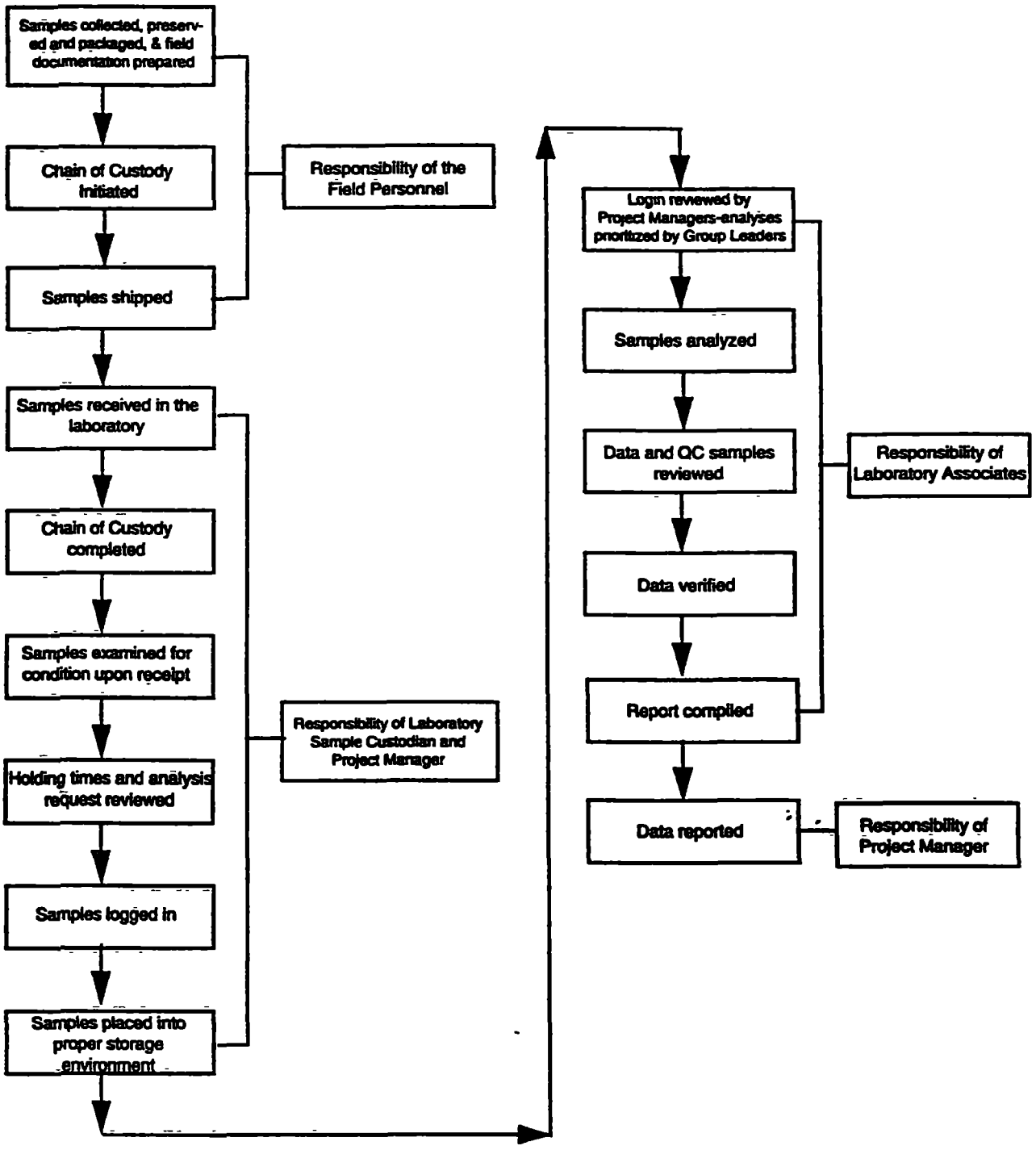
Appendix A contains Standard Operating Procedures (SOPs) which address the following aspects of facility security and sample custody. Figure 7-1 shows the data collection process flow chart.

- Building Security - SOP No. LP-RMA-0001
- Sample Log-in - LP-RMA-0003
- Sample Receipt and Chain of Custody - SOP No. LP-RMA-0005

7.3 Final Evidence File

The final evidence (or data) files will be maintained for the period specified in the RAP. Evidence files will consist of all data necessary to completely reconstruct the analysis, and will consist of (at a minimum): all field documents, logs, project reports raw data, continuing calibration checks, decafluorotriphenyl phosphine (DFTPP) tune, detection limits, chain-of-custody

FIGURE 7-1
Data Collection Process Flow Chart



documentation, quality control data for blanks and matrix spikes, results forms, and a file custodian. In addition, the analytical report, which contains a brief discussion of the method and a more detailed narrative of any analytical issues is included in the package. The City will maintain these files in a secure, limited access area, under the custody of the Project Manager. QES maintains all GC/MS raw data files on tapes or other magnetic media for an indefinite period. This data will be available upon request.

8.0 CALIBRATION PROCEDURES

Calibration is required to ensure that field and laboratory analytical systems are operating correctly and functioning at the proper sensitivity to meet established detection limits. For this project, calibration is required for field measurements of temperature, pH, and specific conductance. Appendix A contains SOP 7320 that describes calibration procedures for field measurement instruments. This project also requires calibration for the four laboratory analyses (Low-Level, Non-Criteria, Extended, and Phenolics). These four analyses are defined in Section 9 of this QAPP.

The laboratory is required to maintain logbooks that contain instrument usage, preventive maintenance, repairs, corrective actions, initial calibrations, daily calibration verifications and calibration standards used.

The specific calibration requirements for each of these analyses are summarized in the subsections below.

8.1 Low-Level (ppt) Analysis

The calibration requirements are described in detail in the SOP for ppt PAH analyses (Appendix B). The discussion below highlights the key aspects of the calibration requirements.

Prior to use of the method for Low-Level analysis of PAH, a five-point response factor calibration curve must be established showing the linear range of the analysis.

A midpoint calibration standard is analyzed at the start of each 12-hour calibration sequence and the area of the primary characteristic ion is tabulated against concentration for each compound. The response factor (RF) for each compound listed in Table 8-1 is calculated.

These daily response factors for each compound must be compared to the initial calibration curve. If the daily response factors are within $\pm$35 percent of the corresponding calibration curve value, the analysis may proceed. If, for any analyte, the daily response factor is not within $\pm$35 percent of the corresponding calibration curve value, the system is out of control and corrective action must be performed.

The quantitation mass ion, which represents the 100 percent abundance ion, is selected for quantitation and for the daily response factor measurement. The second ion, or confirmation ion, is used for confirmation of the identification. The daily response factor for the quantitation

TABLE 8-1 TARGET COMPOUNDS AND KEY IONS
FOR LOW LEVEL PAH ANALYSES

CAS NO.	COMPOUND	QUANTITATION MASS ION	CONFIRMATION ION (% ABUNDANCE)
271-89-6	2,3-Benzofuran	118	90 (52)
496-11-7	2,3-Dihydroindene	117	118 (57)
95-13-6	1H-Indene	116	115 (108)
91-20-3	Naphthalene	128	102 (7)
4565-32-6	Benzo(B)Thiophene	134	89 (8)
91-22-5	Quinoline*	129	102 (20)
120-72-9	1H-Indole	117	90 (31)
91-57-6	2-Methylnaphthalene	141	115 (31)
90-12-0	1-Methylnaphthalene	141	115 (28)
92-52-4	Biphenyl	154	153 (35)
208-96-8	Acenaphthylene	152	151 (17)
83-32-9	Acenaphthene	154	153 (93)
132-64-9	Dibenzofuran	168	139 (40)
86-73-7	Fluorene	166	165 (90)
132-65-0	Dibenzothiophene	184	139 (19)
85-01-8	Phenanthrene	178	176 (19)
120-12-7	Anthracene	178	176 (19)
260-94-6	Acridine	179	178 (26)
86-74-8	Carbazole	167	166 (28)
206-44-0	Fluoranthene	202	200 (17)
129-00-0	Pyrene	202	200 (18)
56-55-3	Benzo(A)Anthracene*	228	226 (22)
218-01-9	Chrysene*	228	226 (26)
205-99-2	Benzo(B)Fluoranthene*	252	250 (22)
207-08-9	Benzo(K)Fluoranthene	252	250 (22)
192-97-2	Benzo(E)Pyrene	252	250 (35)
50-32-8	Benzo(A)Pyrene*	252	250 (26)
198-55-0	Perylene	252	250 (24)
193-39-5	Indeno (1,2,3-CD)Pyrene*	276	274 (25)
53-70-3	Dibenz(A,H)Anthracene*	278	279 (20)
191-24-2	Benzo(G,H,I)Perylene*	276	274 (25)
205-82-3	Benzo(J)Fluoranthene*	252	250 (22)

NOTE: The % abundance for the confirmation ion is a typical value. Although these ratios will vary, the relative intensities of confirmation ions must agree within plus or minus 20% between the calibration standard for any given day and the samples run on that day.

* Carcinogenic PAH as defined in Appendix A of the RAP.

mass ion is compared to the initial calibration curve. During the analysis of the daily calibration standard, the percent abundance of the confirmation ion is obtained. This percent abundance is used for identification purposes for samples analyzed during that day. The percent abundance values shown in Table 8-1 are typical values.

Mass tuning will be performed using the mass calibration compound FC43. Tuning will be performed to maximize the sensitivity of the mass spectrometer for the mass range of compounds being analyzed. In the FC43 spectra, the ion abundance of masses 131 and 219 are adjusted to a ratio of 1:1. These two ions are then maximized to be approximately 50 to 70 percent of the ion abundance of the base mass 69. This procedure maximizes the sensitivity of the instrument in the mass region of interest for the PAH analysis.

The requirements above will be employed for all compounds in Table 8-1 with the exception of benzo(j)fluoranthene. Laboratory studies have shown that Benzo(j)fluoranthene will coelute with either Benzo(b)fluoranthene or Benzo(k)fluoranthene depending on the relative concentration of these two compounds in solution. Benzo(j)fluoranthene cannot be consistently separated by this method. Therefore, if present, it will be detected and reported as Benzo(b) and/or Benzo(k)fluoranthene.

8.2 Non-Criteria Analysis

All Non-Criteria analyses will follow the calibration requirements described in CLP Document OLM01.8, or most recent version. In summary, the SOW requires an initial verification that the mass spectrometer is tuned properly using DFTPP. The SOW also requires an initial five-point calibration be performed for all compounds and that this calibration be verified by the analysis of a daily calibration standard.

The calibration requirements in the SOW are based on the determination of a diverse list of semivolatile organics. Calibration is verified on a daily basis by comparing the responses of a few select compounds, termed calibration check compounds (CCC). Only one of these compounds (acenaphthene) is a target PAH for this project. The response of another group of compounds, termed system performance check compounds (SPCC), are used to verify the analytical system is working properly. None of the SPCCs are target PAH for this project. Finally, the target PAH for this project contain compounds not measured under CLP protocols.

Accordingly, the procedures in the SOW for calibration have been modified to accommodate the differences in the monitoring lists. A calibration standard containing all of the analytes shown in Table 8-1 is used for both initial and continuing calibration in place of the CLP standard. The daily calibration is verified by comparing the response of all 32 compounds to the response from

the initial calibrations. For the initial calibration, the relative standard deviation (RSD) for each compound must be less than 30 percent or the system is out of control and corrective action must be performed. For continuing calibration, the percent difference for each compound must be less than 30 percent.

The control limit for the daily calibration is based on the accuracy and precision objectives of this project and experience with this group of analytes. The limits in the CLP SOW, which is slightly more stringent, is based on a select group of compounds with extensive method performance data.

8.3 Extended Analysis

In addition to the compounds listed in Table 8-1, the compounds shown in Table 8-2 are required to be determined in the extended monitoring program. This extended list of compounds include phenols and other PAHs specified for this project.

Analyses for the extended list of compounds will be performed on the semivolatiles extract prepared as described in CLP SOW Document OLM01.8, or most recent version.

Since most of the compounds on the extended monitoring list are also target compounds in the CLP protocol, the CLP calibration protocol will be followed.

The system is tuned with DFTPP and calibrated with the semivolatile compounds as specified in the CLP SOW. The compounds used to assess system performance and to verify the continuing calibration (SPCCs and CCCs) are used to verify that the system is in control. The control limits in the SOW are used. The presence of the PAH compounds listed in Table 8-2 is determined by evaluating the library search results generated for the CLP analysis of the sample.

Example retention times, quantitation ions and the internal standards determined at the laboratory for 7,12-dimethylbenz(a)anthracene and 3-methylcholanthrene are listed in Table 8-3.

8.4 Phenolics

The calibration requirements are described in detail in the SOP for the total recoverable phenolics analyses (Appendix B). The discussion below highlights the key aspects of the calibration requirements.

TABLE 8-2

TARGET COMPOUNDS FOR EXTENDED ANALYSES

CAS NO.	A. OTHER CARCINOGENIC PAH	REPORTING LIMIT ng/L
195-19-7	Benzo(c)phenanthrene[1]	-
215-58-7	Dibenz(a,c)anthracene[2]	1.06
192-65-4	Dibenzo(a,e)pyrene[1]	-
189-64-0	Dibenzo(a,h)pyrene[1]	-
189-55-9	Dibenzo(a,i)pyrene[1]	-
57-97-6	7,12-Dimethylbenz(a)anthracene	1.29
56-49-5	3-Methylcholanthrene	2.49

1 No analytical standards are available.
2. Coelutes with dibenz(a,h)anthracene. If these isomers are detected, they will be reported as a total value.

CAS NO.	B. ACIDIC COMPOUNDS LISTED IN EPA METHOD 625	REPORTING LIMIT ug/L
108-95-2	Phenol	10
95-48-7	2-Methylphenol	10
106-44-5	4-Methylphenol	10
95-57-8	2-Chlorophenol	10
88-75-5	2-Nitrophenol	10
105-67-9	2,4-Dimethylphenol	10
120-83-2	2,4-Dichlorophenol	10
59-50-7	4-Chloro-3-methylphenol	10
88-06-2	2,4,6-Trichlorophenol	10
95-95-4	2,4,5-Trichlorophenol	50
51-28-5	2,4-Dinitrophenol	50
100-02-7	4-Nitrophenol	50
534-52-1	4,6-Dinitro-2-methylphenol	50
87-86-5	Pentachlorophenol	50

TABLE 8-3

RETENTION TIMES, QUANTITATION IONS AND INTERNAL STANDARDS FOR EXTENDED PAH LIST

Compound	Absolute Retention Time	Relative Retention Time	Quantitation Ions	Internal Standard
7,12-dimethylbenz(a) anthracene	30:51:00 minutes	0.890 minutes	M/Z 256	D_{12}-B(A)P[1] M/Z 264
3-methylcholanthrene	32:48:50 minutes	1.085 minutes	M/Z 268	D_{12}-B(A)P[1] M/Z 264

[1] Benzo(A)Pyrene

9.0 ANALYTICAL PROCEDURES

9.1 Low-Level Analysis

As specified in the Consent Decree, four types of analyses are to be performed as part of the RAP for this project. These four analyses are defined below, and the details of the specific analytical procedures are presented in subsequent subsections.

- Low-Level: Refers to the determination of a specific list of 21 polynuclear aromatic hydrocarbons using GC/MS with operation in the selected ion monitoring (SIM) mode. The list of target PAH contains carcinogenic and non-carcinogenic compounds and is shown in Table 8-1 of the QAPP. The list includes 14 compounds which are not on EPA's priority pollutant, Appendix IX or Superfund target compound list. The analytical methodology is based on well known principles of GC/MS technology. Although there is no EPA method that embodies this technique for this class of compounds, methods developed for the measurement of polychlorinated dibenzodioxins (e.g., Methods 613 and 8280) are based on selected ion monitoring technology.

- Non-Criteria: The Low-Level PAH method is designed to measure PAH at the sub-ppb level. At higher concentrations, the compounds can be measured under scanning GC/MS conditions. Since scanning GC/MS provides more reliable qualitative data, this method, termed "Non- Criteria PAH" is preferred for samples containing ppb concentrations of PAH. The method is based on the Contract Laboratory Program (CLP) protocol for semivolatile organics with the appropriate modifications to address the differences in the monitoring lists.

- Extended: Some samples are analyzed for the specific list of compounds shown in Table 8-2 of the QAPP using scanning GC/MS. This list, termed "Extended" analyses, includes additional PAH, specific acid (phenolic) compounds and a provision for "identifying" unknown compounds. Unknown compounds will be identified and reported from the analysis of the acid fraction only. As in the Non-Criteria analyses, analyses are performed using CLP protocols with the appropriate modifications.

- Phenolics: Refers to the determination of "total phenols" using a colorimetric procedure.

9.4 Phenolics

Total phenolics will be determined by RMAL SOP No. 1112 which references Methods 420.1 and 420.2 as published in the "Methods for Chemical Analysis for Water and Waste, EPA 600/4-79-020" (refer to Appendix B).

The data packages for total phenolics shall as closely follow CLP deliverables for inorganic analysis as possible. Reports shall contain all applicable CLP forms as well as the associated raw analytical data. The package includes Forms I - III, V and VI (results, initial and continuing calibration verification, blanks, matrix spike and duplicate). The report shall be organized as described in CLP Inorganic SOW 7/88.

QES has determined the method detection limits for the ppt PAH analysis of water samples, utilizing GC/MS selected ion monitoring, according to the method described in Appendix B to Part 136 of the Friday, October 26, 1984, Federal Register, Vol. 49, No. 209 - Definition and Procedure for the Determination of the Method Detection - Revision 11.1. Table 10-1 lists the compounds, the observed concentrations of seven replicates spiked at five ppt, the standard deviations and the method detection limits.

QES has also determined the method detection limits for part per billion Phenolics according to Method 420.2 as published in the "Methods for Chemical Analysis for Water and Waste, EPA 600/4-79-020":

TABLE 10-2

METHOD DETECTION LIMIT STUDY - TOTAL PHENOLICS

Sample #	Concentration Detected (mg/L)
1	0.0315
2	0.0340
3	0.0291
4	0.0315
5	0.0291
6	0.0291
7	0.0315

Calculated Standard Deviation	**= 0.0018**
Calculated Method Detection Limit	**= 0.00579 mg/L** **= 5.8 ug/L**

These calculated method detection limits will be used in sample reporting as follows:

- Analytes detected at concentrations greater than or equal to the calculated method detection limits will be reported with no qualifiers

Quanterra Environmental Services, Denver
METHOD DETECTION LIMIT STUDY (Aqueous)

DATE COMPLETED:	10/3/96	PROG/PROJECT:	
METHOD NUMBER:	8270 SIM	PROJECT NUMBER:	48051
METHOD DESCRIPTION:	PAHs using Select Ion Monitoring	ANALYST:	D. Spence
PREP METHOD:	3520 (4-Liter extraction)	QUALITY ASSURANCE:	W. Sullivan

ANALYTE	SPIKE CONC ng/L	REPLICATE MEASUREMENT 1	2	3	4	5	6	7	AVG ng/L	Recovery of Spike %	PREC. ng/L	MDL ng/L
2,3-Benzofuran	5	4.41	4.88	4.73	4.20	5.03	4.35	4.59	4.60	91.96%	0.30	0.94
2,3-Dihydroindene	5	6.63	4.82	5.06	4.05	4.76	4.75	4.48	4.94	98.70%	0.81	2.56
1H-Indene	5	5.16	4.65	4.98	4.70	4.96	4.69	4.53	4.81	96.21%	0.23	0.71
Naphthalene	5	6.28	6.27	8.37	5.22	5.98	7.18	6.11	6.49	129.78%	1.01	3.17
Benzo(b)thiophene	5	4.26	4.69	4.46	4.07	4.64	4.26	4.33	4.39	87.76%	0.22	0.70
Quinoline	5	5.75	3.06	4.61	2.68	3.55	3.41	4.81	3.97	79.35%	1.12	3.52
1H-Indole	5	3.41	4.46	3.92	3.45	3.66	3.56	4.12	3.80	75.94%	0.39	1.22
2-Methylnaphthalene	5	5.74	6.29	7.08	5.11	6.00	6.18	5.48	5.98	119.69%	0.63	1.99
1-Methylnaphthalene	5	4.93	5.85	5.50	4.41	5.34	5.12	5.00	5.16	103.28%	0.46	1.44
Biphenyl	5	4.83	5.19	5.40	4.61	5.24	4.84	4.79	4.98	99.69%	0.29	0.91
Acenaphthylene	5	4.55	4.81	4.34	4.24	4.43	4.35	4.36	4.44	88.82%	0.19	0.60
Acenaphthene	5	4.68	4.97	4.39	4.30	4.77	4.61	4.63	4.62	92.42%	0.23	0.71
Dibenzofuran	5	4.92	5.34	4.74	4.55	4.96	4.85	4.74	4.87	97.43%	0.25	0.79
Fluorene	5	5.04	5.14	4.99	4.47	4.71	4.83	4.78	4.85	96.95%	0.23	0.72
Dibenzothiophene	5	4.73	4.84	4.74	4.52	4.92	4.49	5.20	4.78	95.57%	0.24	0.76
Phenanthrene	5	7.41	7.02	6.86	6.52	6.94	6.60	7.76	7.02	140.30%	0.44	1.38
Anthracene	5	4.73	4.23	4.19	3.55	4.14	3.54	4.44	4.12	82.36%	0.44	1.38
Acridine	5	4.66	2.71	3.17	1.85	2.19	2.23	3.71	2.93	58.62%	0.99	3.12

PAHSIM4L.XLS

Quanterra Environmental Services, Denver
METHOD DETECTION LIMIT STUDY (Aqueous)

DATE COMPLETED:	10/3/96	PROG/PROJECT:	
METHOD NUMBER:	8270 SIM	PROJECT NUMBER:	48051
METHOD DESCRIPTION:	PAHs using Select Ion Monitoring	ANALYST:	D. Spence
PREP METHOD:	3520 (4-Liter extraction)	QUALITY ASSURANCE:	W. Sullivan

ANALYTE	SPIKE CONC ng/L	REPLICATE MEASUREMENT 1	2	3	4	5	6	7	AVG ng/L	Recovery of Spike %	PREC. ng/L	MDL ng/L
Carbazole	5	5.89	4.55	4.44	4.30	4.76	4.38	5.30	4.80	96.05%	0.58	1.84
Fluoranthene	5	6.96	5.72	5.78	5.67	5.77	5.54	6.32	5.97	119.35%	0.50	1.58
Pyrene	5	6.18	5.38	5.30	5.13	5.24	5.16	5.88	5.47	109.35%	0.40	1.27
Benzo(a)anthracene	5	4.33	4.01	4.12	4.04	4.10	4.61	4.03	4.18	83.53%	0.22	0.68
Chrysene	5	4.19	4.32	4.67	5.45	4.37	5.15	4.66	4.69	93.78%	0.46	1.46
7,12-Dimethylbenz(a)anthracene	5	4.06	3.06	3.45	2.84	3.02	3.19	3.55	3.31	66.19%	0.41	1.29
Benzo(e)pyrene	5	4.23	4.46	4.48	4.56	4.35	4.87	4.63	4.51	90.12%	0.21	0.65
Benzo(a)pyrene	5	4.39	3.68	3.84	3.92	3.43	3.56	3.88	3.81	76.25%	0.31	0.98
Perylene *	5	3.97	3.59	3.67	3.76	3.83	3.79	3.55	3.73	74.70%	0.15	0.50
Indeno(1,2,3-cd)pyrene	5	4.06	4.89	4.57	4.18	4.36	4.79	4.13	4.43	88.53%	0.33	1.04
Dibenzo(a,h)anthracene	5	3.94	4.79	4.50	4.08	4.31	4.32	3.81	4.25	85.01%	0.34	1.06
Benzo(g,h,i)perylene	5	4.46	5.15	5.05	4.48	4.72	5.06	4.81	4.96	99.25%	0.55	1.73
3-Methylcholanthrene	5	3.27	1.66	1.27	1.28	1.94	0.86	2.17	1.78	35.56%	0.79	2.49
Benzo(b)fluoranthene	5	4.12	4.47	4.14	3.96	3.97	4.31	3.87	4.12	82.43%	0.21	0.67
Benzo(k)fluoranthene	5	4.21	4.17	4.70	5.06	4.58	4.97	4.59	4.61	92.19%	0.34	1.07

Parameter	Advisory Level	Drinking Water Criterion
Sum of Benzo(a)pyrene and Dibenz(a,h)anthracene[1]	3.0 ng/L[1]	5.6 ng/L
Total Carcinogenic PAH[2]	15 ng/L[3]	28 ng/L[3]
Total Other PAH	175 ng/L	280 ng/L

1 Or the detection limit, whichever is largest
2 See Table 10-3
3 Different concentrations for additional carcinogenic PAH may be established in accordance with the procedure specified in Part D.1 of the Consent Decree

Reporting requirements for methods blanks are discussed in Section 11.1.1.

10.5 Final Evidence Files

The final evidence (or data) files will be maintained for the period specified in the RAP. Evidence files will consist of all data necessary to completely reconstruct the analysis, and will consist of (at a minimum): all field documents, logs, project reports, raw data, continuing calibration checks, DFTPP tune, detection limits, chain-of-custody documentation, quality control data for blanks and matrix spikes, results forms, and a file custodian. In addition, the analytical report, which contains a brief discussion of the method and a more detailed narrative of any analytical issues, is included in the package. The City will maintain these files in a secure, limited access area under the custody of the Project Manager. QES maintains all GC/MS raw data files on tapes or other magnetic media for an indefinite period. This data will be available upon request.

TABLE 10-3

CARCINOGENIC PAH[a]

benz(a)anthracene
benzo(b)fluoranthene
benzo(j)fluoranthene
benzo(ghi)perylene
benzo(a)pyrene[b]
chrysene
dibenz(a,h)anthracene[b]
indeno(1,2,3-c,d)pyrene
quinoline

(a) The total maximum levels of carcinogenic PAH established in the Consent Decree-RAP are:

Advisory Level - 15 ng/l

Drinking Water Criterion - 28 ng/l

(b) The total maximum levels of the sum of benzo(a)pyrene and debenz(a,h) anthracene are:

Advisory Level - 3.0 ng/l (or the lowest concentration that can be quantified, whichever is greater)

Drinking Water Criterion - 5.6 ng/l

11.0 INTERNAL QUALITY CONTROL

The internal quality control checks will include field blanks, method blanks, surrogate spikes, duplicate analyses, monitoring of internal standard area, and matrix spike analyses. Each quality control check has a specific level of performance which will be reevaluated in an ongoing basis and amended as appropriate through mutual agreement of the EPA, MPCA, and City. The specific details are presented below.

11.1 Low-Level and Non-Criteria PAH Analyses

Internal quality control checks for the Low-Level and Non-Criteria PAH analyses will consist of method blanks analysis, surrogate compound analysis, matrix spike analysis, analysis of duplicate samples, and monitoring of internal standard areas.

11.1.1 Method Blank Analysis

A method blank consists of deionized, distilled laboratory water carried through the entire analytical scheme (extraction, concentration, and analysis). The method blank volume must be approximately equal to the sample volumes being processed.

Method blank analyses are performed at the rate of one per case[1], each 14 calendar day period during which samples in a case are received, with every 20 samples of similar concentration and/or sample matrix, or whenever samples are extracted by the same procedure, whichever is most frequent.

Different control limits have been established relative to method blanks for the Low-Level and Non-Criteria analyses since the target compounds in Table 8-1 are present as "laboratory contaminants" in method blanks at the ppt concentration level.

For the Low-Level analyses, an acceptable method blank analysis must not contain any carcinogenic PAH in Table 8-1 at concentrations greater than or equal to the Method Detection Limits (MDL) in Figure 10-1 or any non-carcinogenic PAH at a concentration greater than five times the MDL. For the Non-Criteria analyses, an acceptable method blank does not contain any PAH in Table 8-1 above ten micrograms per liter. If the method blanks do not meet these criteria, the analytical system is out of control and the source of the contamination must be

[1] A case is a group or a set of samples collected from a particular site over a given period of time.

investigated and corrective measures taken and documented before further sample analysis proceeds.

11.1.2 Surrogate Compound Analysis

As detailed in the QES SOP (Appendix B), the laboratory will spike all samples and quality control samples with deuterated PAH surrogate compounds. The surrogate compound will be spiked into the sample prior to extraction to measure individual sample matrix effects associated with sample preparation and analysis.

QES will take corrective action whenever the surrogate recovery is outside the acceptance criteria shown below. The corrective action is described in Section 15 of this QAPP.

In addition, if the recovery of any surrogate is less than 30 percent, the narrative will list the sample together with a comment concerning a possible low bias to the sample result.

	Acceptance Criteria %	
Surrogate	**Low-Level**	**Non-Criteria**
Naphthalene-d8	21 - 108	37 - 107
Fluorene-d10	41 - 162	36 - 127
Chrysene-d12	10 - 118	25 - 160

11.1.3 Matrix Spike/Matrix Spike Duplicate Analysis

Low-Level PAH matrix spike and matrix spike duplicate samples will be analyzed as outlined in the QES SOP (Appendix B). Non-Criteria PAH matrix spike and matrix spike duplicate samples will be analyzed pursuant to applicable criteria of CLP SOW Document OLM01.8, or most recent version.

The laboratory will spike and analyze 5 percent matrix spike and matrix spike duplicate samples. QES will spike seven representative compounds into water. These compounds and the spiking levels are listed below:

	Low-Level (ng/L)	Non-Criteria (µg/L)
Naphthalene	10	50
Fluorene	10	50
Chrysene	10	50
Indene	10	50
Quinoline	10	50
Benzo(e)pyrene	10	50
2-methylnaphthalene	10	50

The matrix spike criteria for data validity are as follows:

- The Matrix Spike - Matrix Spike Duplicate average for each spike compound must fall between the established acceptable limits.

Matrix Spike Limits

Compound	Low-Level	Non-Criteria
Naphthalene	20 - 150	43 - 128
Fluorene	69 - 118	51 - 120
Chrysene	20 - 132	43 - 124
IH-Indene	20 - 150	49 - 108
Quinoline	20 - 150	40 - 126
Benzo(e)pyrene	20 - 150	20 - 150
2-methylnaphthalene	20 - 150	47 - 138

- Only one compound can be below its required minimum percent recovery. These minimum percent recoveries are:

  1. 10 percent for chrysene and benzo(e)pyrene
  2. 20 percent for all other compounds

Corrective action will be performed if these criteria are not achieved as described in Section 15.

11.3.2 Laboratory Check Standard

The initial calibration is verified by the analysis of an ICV check standard. A continuing calibration verification (CCV) check standard is analyzed at a frequency of one per ten samples. The measured value for the ICV and CCVs must be within 90 to 110 percent of the true value (these limits are from EPA's Method 420.4, August 1993) for the analytical run to be accepted. If a CCV fails, all the samples analyzed after the last successful CCV must be reanalyzed.

The laboratory uses a phenol standard obtained from a different source than the calibration check standards for the laboratory check standard (LCS). A minimum of one LCS must be analyzed with each batch of prepared samples. The LCS is processed with the samples through all steps of the procedure. The control limits for the LCS are 72 to 115 percent (these limits are statistically based on the laboratory's past performance on the method). If these limits are not met, the associated samples must be reanalyzed.

Quality control charts are used by analysts when trouble-shooting method problems and by the QA office as part of the annual update of historical control limits. The quality control charts are maintained in the QA office.

If the measured values from the check standards are not within control limits, the system is out of control and corrective action must be performed.

11.3.3 Matrix Spikes/Matrix Spike Duplicates

As for the other tests, matrix spikes and matrix spike duplicates will be performed at a frequency of five percent. The spike level is 50 micrograms per liter. The recovery of the matrix spike must be between 75 percent and 125 percent. Corrective action is performed if these criteria are not achieved.

11.3.4 Duplicates

Field duplicate analyses are performed at a frequency of ten percent. Corrective action is performed if the relative difference from the duplicate analysis is greater than 70 percent.

12.0 PERFORMANCE AND SYSTEM AUDITS

The ability of the Sampling Team to successfully monitor pumping wells and monitor wells, and the ability of the laboratory to successfully analyze ground water samples will be confirmed by a series of audits conducted in conjunction with the implementation of the ground water monitoring program established in the CD-RAP.

12.1 Field Audits

EPA Region 5 Central Regional Laboratory (CRL) and the Central District Office (CDO) are responsible for the external audits of field activities, including field sampling and measurements, for compliance of requirements specified for this project. The Quality Assurance Manager and/or Field Team Leader of ENSR will be responsible for internal audits to see if field sampling and measurements are properly followed. Currently, no field audit has been scheduled. Results of any field audit will be forwarded to the EPA and MPCA in accordance with Section 16.

12.2 Laboratory Audits

QES participates in a variety of federal and state certification programs, (including the EPA CLP), that subject the laboratory to stringent systems and performance audits on a regular basis. A system audit is a review of laboratory operations conducted to verify that the laboratory has the necessary facilities, equipment, staff and procedures in place to generate acceptable data. A performance audit verifies the ability of the laboratory to correctly identify and quantitate compounds in blind check samples submitted by the auditing agency. The purpose of these audits is to identify those laboratories that are capable of generating scientifically sound data. Section 15.2.4 discusses audits in more detail. A laboratory audit has been tentatively scheduled for winter of 1996. Results of the audit will be forwarded to EPA and MPCA in accordance with Section 16.

12.2.1 External Audits

QES will be subjected to EPA performance and system audits for approval/ disapproval specific to the requirements of this program. The Laboratory Scientific Support Section (LSSS) of EPA Region 5 CRL is responsible for the audits.

12.2.2 Internal Audits

In addition to external audits conducted by EPA Region 5 CRL, the City and/or Northwest Regional Quality Assurance Manager of ENSR (office in Fort Collins, Colorado), will be responsible for at least biennial auditing of the QES laboratory. Audit procedures will include both system audits and performance audits as necessary to satisfy the City that QES is capable of rendering satisfactory laboratory services under this QAPP (see Figure 12-1 for the City of St. Louis Park Audit Checklist). Also, ENSR performs its own audit for file completeness and content.

CITY OF ST. LOUIS PARK AUDIT CHECKLIST

Sample Receiving	YES	NO
Are refrigerator/cold storage area temperatures recorded daily and are records properly maintained? Comments:		
Are sample chain-of-custody forms completed properly? Comments:		
Are the temperatures of the coolers being checked and recorded? Comments:		
Are volatile samples stored separately? Comments:		
Is access to sample storage area restricted? Comments:		
Data Review		
Are all calculations checked by the analyst for accuracy and completeness? Comments:		
Are anomalies documented and reported? Comments:		
What corrective actions are taken when the analytical results fail to meet QC criteria? Comments:		
Standard Preparation		
Are Class S weights used to check the balances? Comments:		
Are non-EPA and non-NBS neat materials compared to EPA or NBS whenever possible? Comments:		
Have expired standards and reagents been discarded? Comments:		
Inorganics		
Is the conductivity of the Milli-Q water system checked daily and recorded? Comments:		
Is linearity verified (correlation coefficient of at least 0.995) before sample analysis?		

Figure 12-1 City of St. Louis Park Audit Checklist

Figure 12-1 (continued)

YES NO

If the CCV does not meet acceptance criteria, is the system recalibrated and are all affected samples reanalyzed?
Comments:

Organic Extraction

Are all reagents and solvents screened for potential contamination?
Comments:

What is the source of reagent water?
Comments:

Are spiking solutions and standards prepared from separate stocks?
Comments:

Is glassware cleaned appropriately?
Comments:

Are the hood airflows checked and how often are they checked?
Comments:

GC/MS Lab

Are current SOP's available for all personnel in the area?
Comments:

Is preventive maintenance performed on all instruments?
Comments:

Have MDL studies been performed on all methods?
Comments:

Are method blanks analyzed with every batch of samples?
Comments:
Are results of QC samples verified to determine if QC criteria has been met before sample analysis begins?
Comments:

Are QC results which are outside of acceptance limits checked for error?
Comments:

Are corrective actions taken as necessary and documented and samples reprepped/reanalyzed?
Comments:

Are logbooks reviewed periodically, as indicated by the signature/ date/comments of the reviewer?
Comments:

13.0 PREVENTIVE MAINTENANCE

Since instrumental methods of analysis require properly maintained and calibrated equipment, the operation and maintenance of modern analytical instrumentation is of primary importance in the production of acceptable data. In order to provide this data, QES subscribes to the following programs:

- Maintenance agreements/service contracts with instrument manufacturers
- Laboratory preventive maintenance program

13.1 Service Contracts

The gas chromatography/mass spectrometry equipment utilized by QES laboratory personnel for this project are covered by maintenance agreements with the instrument manufacturers. These manufacturers provide for both periodic "preventive" service calls as well as the non-routine or emergency calls.

13.2 Instrument Logbooks

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

Individual instrument logbooks are maintained for each piece of equipment and located near the instrument. General information contained in the logbooks include:

- Inventory information: Equipment name, model number, serial number, manufacturer, date of acquisition, original cost
- Service tasks and intervals: Cleaning, calibration, operation based on the manufacturer's recommended schedule, and previous laboratory experience
- Service record: Date of breakdown, date of return to service, downtime, problems, repairs, cost of repairs, who performed the repairs, parts required, etc.
- Calibration/performance checks
- Daily operational notes

Analysts are referred to manufacturers' operating manuals for specific procedures to be followed in the operation and/or maintenance of the individual instruments.

Within each laboratory, a Service Coordinator is assigned he responsibility for overseeing the instrument maintenance program. Group Leaders and analysts actually implement and document the maintenance program.

Each instrument or piece of equipment shall be uniquely identified. Each operating unit shall maintain the following:

- Instrument/equipment inventory list
- Instrument/equipment major spare parts list or inventory
- External service agreement documents (if applicable)
- Instrument-specific preventive maintenance logbook or file for each functional unit

The record of maintenance shall include at a minimum:

- Actions taken, including parts replaced
- Analyst initials and the date maintenance was performed whether by the analyst or a contracted service representative

QES documents and describes in detail instrument or equipment preventive maintenance in operation-specific SOPs. SOPs are specific to the type of instrument or equipment being used for sample analysis. Preventive maintenance schedules for instruments used at QES are shown in Tables 13-1 and 13-2.

13.3 Field Equipment

All field equipment shall be inspected daily for damaged or missing pieces, which will be replaced as needed.

13.3.1 Thermometer

The field worker will handle the thermometer with care to preserve its measurement integrity. After each use, the thermometer will be rinsed with de-ionized or potable water, wiped dry, and returned to its protective case.

TABLE 13-1
Instrument Maintenance Schedule
Gas Chromatograph[1]

Daily	As Needed	Quarterly/Semi-annually/Annually
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Replace front portion of column packing or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	Quarterly ECLD: change roughing resin, clean cell assembly.
Check temperatures of injectors and detectors. Verify temperature programs.	Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of capillary column is removed.	Semi-annually ECD: perform wipe test.
Check inlets, septa. When using HP7673 autosampler, change septa daily.	Replace septum (approximately every 100 injections).	Annually ELCD: change finishing resin, clean solvent filter.
Check baseline level.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).	
Check reactor temperature of electrolytic conductivity detector.	Replace or repair flow controller if constant gas flow cannot be maintained.	
	Replace fuse.	
	Reactivate external carrier gas dryers.	
	Detectors: clean when baseline indicates contamination or when response is low. FID: clean/replace jet, replace ignitor. NPD: clean/replace collector assembly. PID: clean lamp window, replace seals. ECLD: check solvent flow weekly, change reaction tube, replace solvent, change reaction gas, clean/replace Teflon transfer line.	
	Reactivate flow controller filter dryers when presence of moisture is suespected.	

TABLE 13-1
Instrument Maintenance Schedule
Gas Chromatograph[1]
(Continued)

Daily	As Needed	Quarterly/Semi-annually/Annually
(continued)	HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.	(continued)
	Purge & trap devices: periodic leak checks, replace/condition traps (when poor response or disappearance of reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), clean glassware.	
	Purge & trap autosamplers: leak check system, clean sample lines, valves. PTA-30 autosampler also requires cleaning the syringes, frits, valves, and probe needles, adjustment of micro switches, replacement of Teflon valve bleck, and lubrication of components.	

TABLE 13-2

Instrument Maintenance Schedule
Spectrophotometer[1]

As Needed	Daily	Monthly	Annually
Dust the lamp and front of the front lens.	Check the zero percent T adjustment.	Perform wavelength calibration at 530 mm.	Oil bearings.

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14.2 Internal Components

The results of quality control samples created in the laboratory represent estimates of analysis and precision for the preparation and analysis steps of sample handling. This section describes the quality control-type information provided by each of these analytical measurements. The frequency of each of these measurements is discussed in Sections 5 and/or 11.

- Surrogates - provide an estimate of bias based on recovery of similar compounds, but not the compounds analyzed, for each sample, preparation and analysis.

- Internal standard - an analyte that has the same characteristics as the surrogate, but is added to the sample extract just prior to analysis. It measures bias or change in instrument performance from sample to sample, incorporating matrix effects associated with the analysis process only.

- Matrix spikes/Matrix spike duplicates - the matrix spike is added prior to preparation and analysis. The analyte used is the same as that being analyzed and usually is added to a selected few samples in a batch of analyses. It incorporates matrix effects associated with the laboratory analysis.

- Method blanks - provide an estimate of bias based on contamination.

14.3 Calculation Techniques

The quality assessment procedures described above require calculations of relative percent difference (duplicate analyses) and percent recovery (matrix and surrogate spikes). The techniques for performing these calculations are described below.

- Precision - is the degree to which the measurement is reproducible. Precision is assessed by duplicate measurements by calculating the Relative Percent Difference (RPD) between duplicate measurements. The RPD is calculated as follows:

$$RPD = \frac{1D_1 - D_2 1}{(D_1 + D_2)/2} \times 100$$

where: RPD = relative percent difference
D_1 = first sample value
D_2 = second sample value (duplicate)

- Accuracy - is a determination of how close the measurement is to the true value.

  The determination of the accuracy of a measurement requires a knowledge of the true or accepted value for the signal being measured. Accuracy may be calculated in terms of percent recovery as follows:

  $$Percent\ Recovery = \frac{X}{T} \times 100$$

  where: X = the observed value of measurement
  T = "true" value

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

  To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the database is sufficient.

  When possible, the percent completeness for each set of samples is calculated as follows:

  $$Completeness = \frac{valid\ data\ obtained}{total\ data\ planned} \times 100\%$$

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

15.1 Low-Level and Extended PAH Analyses

15.1.1 Surrogates

As discussed in Section 11.1.2, corrective action will be performed whenever the surrogate recovery is outside the following acceptance criteria:

	Acceptance Criteria %	
Surrogate	**Low-Level**	**Non-Criteria**
Naphthalene-d8	21 - 108	37 - 107
Fluorene-d10	41 - 162	36 - 127
Chrysene-d12	10 - 118	25 - 160

The following corrective action will be taken when required as stated above:

1. Check calculations to assure there are no errors

2. Check internal standard and surrogate solutions for degradation, contamination, etc., and check instrument performance.

3. If the upper control limit is exceeded for only one surrogate, and the instrument calibration, surrogate standard concentration, etc. are in control, it can be concluded that an interference specific to the surrogate was present that resulted in the high recovery and this interference would not affect the quantitation of other target compounds. (The presence of this type of interference can be confirmed by evaluating the chromatographic peak shapes and ion intensities of the surrogates.)

4. If the surrogate could not be measured because the sample required a dilution, no corrective action is required. The recovery of the surrogate is recorded as D with the note surrogate diluted out.

5. Reanalyze the sample or extract if the steps above fail to reveal a problem. If reanalysis of the extracts yields surrogate spike recoveries within the stated limits, then the reanalysis data will be used. Both the original and reanalysis data will be reported and documented in the narrative.

15.1.2 Matrix Spikes/Matrix Spike Duplicates

The matrix spike criteria for data validity are as follows:

- The Matrix Spike - Matrix Spike Duplicate average for each spiked compound must fall between the established acceptable limits (refer to Section 11.1.3 for limits).
- Only one compound can be below its required minimum percent recovery.

If the matrix spike criteria are not met, the matrix spike analysis will be repeated or a laboratory control sample (LCS) will be analyzed. If the subsequent matrix spike analysis or the LCS analysis meets the criteria, the data will be considered valid. Both matrix spike and surrogate spike recoveries will be used in assessing QA/QC for QES's analytical work.

TABLE 15-1

Summary of Historical Surrogate Control Recoveries

QC Category	Testcodes	QC Type	Components	Accuracy Limits	Precision Limits
PAHCSLP75A	PAH-CSLP-LL-75-A (Low Level 75)	DCS/LCS/MSSD	Indene	29-105	20
		DCS/LCS/MSSD	Naphthalene	49-123	20
		DCS/LCS/MSSD	Quinoline	29-139	20
		DCS/LCS/MSSD	2-Methylnaphthalene	52-108	20
		DCS/LCS/MSSD	Fluorene	53-105	20
		DCS/LCS/MSSD	Chrysene	32-101	20
			Benzo(e)pyrene	41-121	20
		SCS Blank	Naphthalene-d8	49-102	
		SCS Blank	Fluorene-d10	51-86	
		SCS Blank	Chrysene-d12	44-131	
		Sample Surrogates	Naphthalene-d8	24-108	
		Sample Surrogates	Fluorene-d10	21-103	
		Sample Surrogates	Chrysene-d12	1-137	

The values in Table 15-1 are the limits for the surrogate recoveries for the Laboratory Control Samples and Method Blanks. These values were calculated using historical data from prior analyses.

15.1.3 Blanks

If non-carcinogenic PAH are detected in any Low-Level QC method blanks above the MDL but less than five times the MDL, the corrective action will consist of flagging the data and investigating the source of the problem to implement a corrective action for future work. If the concentration of carcinogenic PAH in the method blank exceeds the MDL or the concentration of non-carcinogenic PAH in the method blank exceeds five times the MDL, additional corrective action, including but not limited to, reanalyses of the blank and reanalyses of the samples may be required.

If target compounds are detected in Non-Criteria method blanks above ten micrograms per liter, the corrective action will consist of flagging the data and investigating the source of the problem to implement a corrective action for future work.

The relative concentration of compounds in both the samples and the blank are assessed as part of this corrective action. The results of these activities are documented in the narrative.

15.2 Other Corrective Actions

These sections discuss corrective actions which will be taken in the event that a sample or sample extract is lost or destroyed during shipment, storage or analysis, or in performance and system audits.

15.2.1 Samples

In order to minimize the possibility of sample destruction during shipment, six 1-liter bottles will be taken for all Low-Level (ppt) samples. For all samples, field blanks and matrix spikes and duplicates, subsequent extraction and analysis will be conducted on four intact 1-liter bottles. All field blank duplicates will be extracted and held. In the event that the field blank is lost during analysis or invalidated, the duplicate field blank will be analyzed and reported. Additional sample matrix will be required for matrix spike analyses.

If less than four liters of a sample remains after shipment and storage for analysis, the Program Manager will be notified and another sample will be collected and shipped to the laboratory for analysis. The analysis report for the sample batch containing the affected sample will clearly note in the discussion section that a replacement sample was taken.

15.2.2 Samples Extracts

If a sample extract is broken or lost during analysis, the Program Manager will be notified and will be responsible for determining the need for replacing the lost sample. The analysis report for the sample batch containing the affected sample will clearly note in the discussion section the action taken.

15.2.3 Quality Control Samples

If a method blank, or matrix spike and its duplicate is lost or broken during analysis, a replacement QC sample will be sampled and analyzed. The analysis report will clearly note that a replacement QC sample was analyzed.

If a field blank is lost or broken during shipment, storage, or analysis, its duplicate will be analyzed. The analysis report for the sample batch associated with the field blank will clearly note the occurrence in the discussion section.

15.2.4 Audits

Audits of QES are performed to assess the degree of adherence to policies, procedures, and standards. These assessments are conducted internally by QES personnel and externally by clients and regulatory agencies. Audits can identify areas for improvement with regard to compliance with policies, procedures, and standards. Audits also provide a means for correction prior to system failure. The following types of audits and assessments are performed at QES.

- Performance Audits
- Systems Audits
- Data Audits
- Spot Assessments
- Compliance Audits

Internal audits are generally conducted by QA staff, although periodic self-audits may be conducted by the operational units. Audits and assessments are generally conducted through the use of checklists and appropriate reference documents. Systems and compliance audits are conducted with an opening meeting in which representatives from management, key operational staff, and QA staff participate. The opening meeting provides a review of the objectives of the audit and the schedule required to conduct the audit. At the completion of the audit, a debriefing is held to outline the findings, including identification of positive performance, to discuss requirements in areas of deficiencies, and to answer questions. Spot assessments are generally

more informal than systems or compliance audits, and may be conducted without prior scheduling.

The findings of all audits and assessments are documented as is the laboratory response and any corrective actions. Follow-up checks are performed and the status of implementation of corrective actions is documented for all categories of audits and assessments. This cycle continues until all issues are closed.

15.2.4.1 Performance Audits

Performance audits or performance evaluations are conducted to verify the ability of the laboratory to correctly identify and quantitate compounds in check samples. These samples may be supplied internally or externally as blind or double-blind samples. These samples demonstrate data quality through statistical analysis. The results of internal performance audits may be used to document the training level of the analyst performing the work or to assess the overall performance of the facility. Periodic double-blind performance audits are conducted by QES to assess all aspects of laboratory performance from project initiation through analysis and reporting. Each laboratory QA Manager is responsible for ensuring that performance audit sample(s) are analyzed quarterly (either external or internal).

The results of each performance audit shall be reported to laboratory management. All performance audit results which are identified as unacceptable must be investigated. It is recommended that any results which are flagged as exceeding the warning limits, but within the control limits for the study shall also be reviewed. The findings of the investigation and corrective action taken must be documented. This documentation for all external performance audits shall be provided to the agency or client supplying the audit, as well as being included in the QA monthly report to management.

15.2.4.2 Systems Audits

A systems audit assesses fulfillment of the QES Quality Assurance Management Plan (QAMP) and the state of the QES Quality Management System (QMS). Each laboratory undergoes numerous systems audits performed by external parties, including certifying agencies and clients.

15.2.4.2.1 Internal Systems Audits

An annual systems audit will be performed under the direction of the Corporate Director of QA. This audit is performed to assess each laboratory's adherence to the requirements of the QAMP and to assess the status of corrective actions from other audits at that facility.

The Corporate Director of QA shall appoint a lead auditor to conduct the systems audit. A corporate audit checklist shall be used. The lead auditor has the authority to lengthen the audit, revise the scope of the audit, stop work, or specify an accelerated schedule for re-audit. The lead auditor shall be responsible for preparing a report detailing the results of the audit. The report shall be submitted to the audited Laboratory Director and Laboratory QA Manager within four weeks of the audit. Copies of the report shall be distributed to the Regional QA Director, the Regional Operations Vice President, the Senior Vice President of Operations Services, and the President. The audited laboratory must respond in writing within four weeks of receiving the audit report.

The audit report shall have the following sections:

- Introduction
- Purpose
- Scope
- Summary
- Findings
- Comments

Findings are defined as those non-compliant practices which require corrective action. Comments are considered advice and do not require a corrective action response. It is the responsibility of the QA Manager at each facility to verify implementation of the corrective actions and close all internal audit findings. This process shall be documented and the report shall be provided to the recipients of the original audit report.

Internal audit reports shall be maintained according to the QES Record Retention Policy as confidential documents and shall not be released for use outside the laboratory. External auditors may view internal audit reports as part of their on-site audit.

15.2.4.2.2 External Systems Audits

Audits of QES are performed by external agencies and clients. All scheduled audits shall be placed on the facility's calendar with the knowledge of the Laboratory Director and the Laboratory QA Manager to assure no scheduling conflicts occur and that appropriate staff will be available to meet the agencies or client's objectives.

All deficiencies reported to the laboratory must be satisfactorily responded to in a timely manner. Corrective actions taken must also be documented. A copy of the external audit report and the laboratory's response, documenting corrective actions, must be provided to the Laboratory Director, the Regional Director of QA, the Corporate Directory of QA, and the Vice President and

General Manager of Laboratory Operations. It is the responsibility of the QA Manager to verify implementation of the corrective actions and close all findings from the audit.

15.2.4.3 Data Audits

Data audits will be routinely performed and documented to ensure that project records meet project requirements as described in method SOPs, project plans, or other documented requirements. The data audit is used to identify any lab errors that may have occurred. The laboratory QA Manager is responsible for performing data audits as specified in QA Policy No. QA-005.

15.2.4.4 Spot Assessments

Spot assessments are conducted to monitor or observe a process or activity in order to verify conformance to the specified requirements for that activity. These assessments are performed monthly, unless a systems audit or follow-up audit is performed by the QA Manager or Corporate QA office. The scope of the assessment is determined by the QA Manager and may be directed based on information obtained from client inquiries, trends in recorded non-conformances, performance audits, or other sources. A spot assessment may be used to assess a procedure performance relative to the documented SOP. This assessment identifies deviations from requirements that may not be detected in a detailed review of the data package alone. Such an assessment is conducted by observation of the associates performing the task compared with the documented SOP. In some cases, the assessment may be conducted through interviews with the associate when observation of a task is not possible. Review of relevant documentation for the completed procedure is included in such an assessment. A checklist may be used in conducting the assessment. The results of the assessment are documented, as are the corrective actions. All deficiencies noted as a result of a spot assessment must be corrected by the responsible staff in a timely manner.

15.2.4.5 Compliance Audits

Compliance audits may consist of any combination of the previously described audits. A compliance audit is conducted to ensure that the laboratory is performing according to explicit contract requirements. These requirements may be stated in a contract, QAPjP, Statement of Work, analytical methods, or some combination of these documents. In addition, a compliance audit may include assessment of the administrative requirements of the contract, such as small business subcontracting plans, invoices, and notifications. The technical aspects of the compliance audit are assessed by the QA staff while the administrative aspects are assessed by a representative of the Contract Compliance Officer. Compliance audits are initiated at the request of the Contract Compliance Officer.

15.2.5 Field Audits and Corrective Actions

ENSR oversees field sampling activities including field corrective actions. The only planned field corrective actions are replacement of bottles, bailers, or ground water pumping equipment if these items are damaged in the field. Other corrective actions may be necessary if field meters do not provide measurements within QA/QC limits. Recalibration and maintenance in accordance with manufacturer's specifications is performed, or the meter is replaced. Resampling has occurred in the past to replace samples lost or broken in shipment.

The location of the monitoring wells is convenient to City and ENSR offices and to stores/vendors where field support is available. Therefore, the sampling programs are always capable of successfully collecting the samples required for the sampling event in accordance with the Sampling Plan.

Data inconsistencies are potentially short-term problems that are addressed by ENSR and the City jointly. During the ten years of CD-RAP monitoring, only one municipal well has contained PAH above advisory levels and the specific course of action to resample that well, in accordance with the CD-RAP was followed. The data have been successfully used for the past ten years to identify "breakthrough" at the carbon treatment plants, and to plan the replacement of the carbon in accordance with the CD-RAP. Other than the resampling prescribed by the CD-RAP, data inconsistencies are not the basis for any field corrective actions. The long-term nature of the ground water containment remediation strategy allows any data inconsistencies to be put into the context of a large data set that defines water quality. The laboratory analytical method has evolved, and has been refined, over the years to avoid data inconsistencies that were apparent during the earlier years of this program. The City and ENSR will continue to evaluate the laboratory analytical procedures in an effort to understand any data inconsistencies and the potential need for corrective actions.

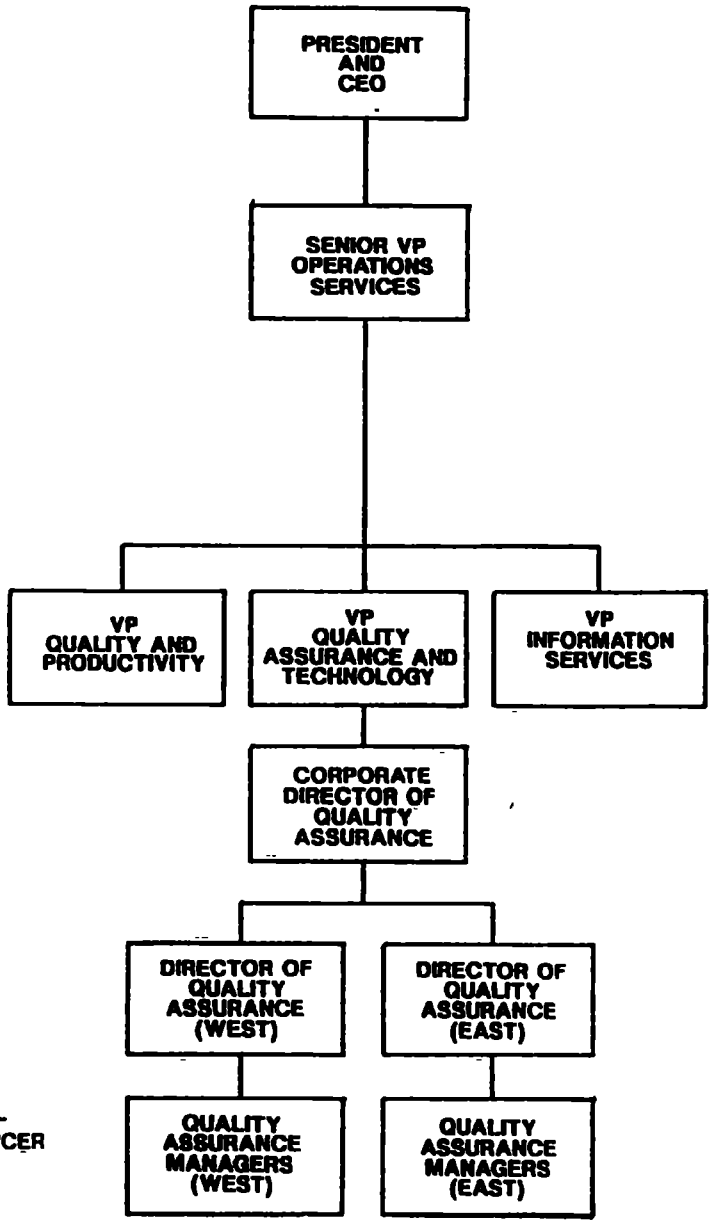


Figure 16-1 Quanterra Quality Assurance Group Organizational Chart

The reporting system is a valuable tool for measuring the overall effectiveness of the QA program. It serves as an instrument for evaluating the program design, identifying problems and trends, and planning for future needs. Regional QA Directors submit extensive monthly reports to the Vice President of QA and to the Vice President and General Manager of Laboratory Operations. These reports include:

- The results of all systems audits including any corrective actions taken
- Performance evaluation scores and commentaries
- Results of site visits and audits by regulatory agencies and clients;
- Problems encountered and corrective actions taken
- Holding time violations
- Comments and recommendations

The Regional QA Directors submit monthly reports to the Vice President and General Managers of Laboratory Operations. These reports summarize the information gathered through the laboratory reporting system and contain a thorough review and evaluation of laboratory operations throughout QES.

INDEX OF STANDARD OPERATING PROCEDURES

SOP NUMBER	SUBJECT	NO. OF PAGES
SOP 7130	Ground Water Sample Collection from Monitoring Wells	17
SOP 7320	Calibration and Operation of Hydrolab Water Quality Monitor	8
SOP 7510	Packaging and Shipment of Samples	5
LP-RMA-0001	Building Security	2
LP-RMA-0002	Laboratory Data Review	12
LP-RMA-0003	Sample Log-In	8
LP-RMA-0004	Use of Project Assignment Record	29
LP-RMA-0005	Sample Receipt and Chain of Custody	7

Title: Ground-Water Sample Collection from Monitoring Wells
(REFER TO QAPP SECTION 6.5.4.)

1.0 Applicability

This Standard Operating Procedure (SOP) is concerned with the collection of valid and representative samples from ground-water monitoring wells. The scope of this document is limited to field operations and protocols applicable during ground-water sample collection.

2.0 Responsibilities

The site coordinator or his delegate will have the responsibility to oversee and ensure that all ground-water sampling is performed in accordance with the project-specific sampling program and this SOP. In addition, the site coordinator must ensure that all field workers are fully apprised of this SOP. The field team is responsible for proper sample handling as specified in SOP 7510, Handling and Storage of Samples.

3.0 Supporting Materials

The list below identifies the types of equipment which may be used for a range of ground water-sampling applications. From this list, a project-specific equipment list will be selected based upon project objectives, the depth to ground-water, purge volumes, analytical parameters and well construction. The types of sampling equipment are as follows:

- Purging/Sample Collection

  Bailers
  Centrifugal Pump
  Submersible Pump
  Peristaltic Pump

- Sample Preparation/Field Measurement

  pH Meter
  Specific Conductance Meter
  Filtration Apparatus
  Water-Level Measurement Equipment

Additional equipment to support sample collection and provide baseline worker safety will be required to some extent for each sampling task. The additional materials are separated into two primary groups: general equipment which is reusable for several samplings, and materials which are expendable.

- General

  Project-specific sampling program
  Deionized-water dispenser bottle
  Methanol-dispenser bottle
  Site-specific Health & Safety equipment (gloves, respirators, goggles)
  Field data sheets and/or log book
  Preservation solutions
  Sample containers
  Buckets and intermediate containers
  Coolers
  First-Aid kit

- Expendable Materials

  Bailer Cord
  Respirator Cartridges
  Gloves
  Water Filters
  Chemical-free paper towels
  Plastic sheets

Equipment checklists have been developed to aid in field trip organization and should be used in preparation for each trip.

4.0 Water-Level Measurement

4.1 Introduction

Prior to obtaining a water-level measurement, cut a slit in one side of the plastic sheet and slip it over and around the well, creating a clean surface onto which the sampling equipment can be positioned. This clean working area should be a minimum of eight feet square. Care will be taken not to kick, transfer, drop, or in any way let soil or other materials fall onto this sheet unless it comes from inside the well. Do not place meters, tools, equipment, etc. on the sheet unless they have been cleaned first with a clean rag.

After unlocking and/or opening a monitoring well, the first task will be to obtain a water-level measurement. Water-level measurements will be made using an electronic or mechanical device. Electronic measurement devices will be used in all wells wherein a clearly audible sound cannot be produced with a mechanical device.

4.2 Well Security

Unlock and/or open the monitoring well. Enter a description of condition of the security system and protective casing on the Ground-Water Sample Collection Record shown in Figure 1.

4.3 Measuring Point

Check for the measuring point for the well. The measuring point location should be clearly marked on the outermost casing or identified in previous sample collection records. If no measuring point can be determined, a measuring point should be established. Typically the top (highest point) of the protective or outermost well casing will be used as the measuring point. The measuring point location should be described on the Ground-Water Sample Collection Record and should be the same point used for all subsequent sampling efforts.

4.4. Measurement

To obtain a water-level measurement lower a clean steel, fiberglass tape into the monitoring well. Care must be taken to assure that the water-level measurement device hangs freely in the monitoring well and is not adhering to the wall of the well casing. The water-level measuring tape will be lowered into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time the precise measurement should be determined (to hundredth of a foot) by repeatedly raising and lowering the tape to converge on the exact measurement. The water-level measurement should be entered on the Ground-Water Sample Collection Record. As well point of measurement should be indicated; i.e., top of protective casing, top of pueriser, ground level.

4.5 Decontamination

The measurement device shall be decontaminated immediately after use with a methanol soaked towel. Generally only that portion of the tape which enters the water table should be cleaned. It is important that the measuring tape is never placed directly on the ground surface.

5.0 Purge-Volume Computation

All monitoring wells to be purged prior to sample collection. Depending upon the ease of purging, 3 to 10 volumes of ground water to be determined by hydrogeologing prior to sampling present in a well

shall be withdrawn prior to sample collection or one volume if well can be purged dry. The volume of water present in each well shall be computed based on the length of water column and well casing diameter. The water volume shall be computed using Figure 2.

6.0 Well-Purging Methods

6.1 Introduction

Purging must be performed for all ground-water monitoring wells prior to sample collection in order to remove stagnant water from within the well casing and ensure that a representative sample is obtained. The following sections explain the proper procedures for purging and collecting water samples from monitoring wells.

Three general types of equipment are used for well purging: bailers, surface pumps, or down-well submersible pumps.

In all cases pH and/or specific conductance will be monitored during purging. Field parameter values will be entered on the Ground-Water Sample Collection Record along with the corresponding purge volume.

6.2 Bailing

In many cases bailing is the most convenient method for well purging. Bailers are constructed using a variety of materials; generally, PVC stainless steel, and Teflon®. Care must be taken to select a specific type of bailer that suits a study's particular needs. Teflon® bailers are generally most "inert" and are used most frequently. Keep in mind the diameter of each monitoring well so that the correct size bailers are taken to the site. It is preferable to use one bailer per well; however, field decontamination is a relatively simple task if required.

Bailing presents two potential problems with well purging. First, increased suspended solids may be present in samples as a result of the turbulence caused by raising and lowering the bailer through the water column. High solids concentrations may require that total suspended solids (TDS) and the chemical character of solids be evaluated during sample analyses. Second, bailing may not be feasible for wells which require that greater than twenty (20) gallons be removed during purging. Such bailing conditions mandate that long periods be spent during purging and sample collection or that centrifugal pumps be used. All ground-water collected from monitoring wells for subsequent volatile organic compound analyses shall be collected using bailers, regardless of the purge method.

6.3 Surface Pumping

Ground-water withdrawal using pumps located at the ground surface is commonly performed with centrifugal or peristaltic pumps.

All applications of surface pumping will be governed by the depth to the ground-water surface. Peristaltic and centrifugal pumps are limited to conditions where ground water need only be raised through approximately 20 feet of vertical distance. The lift potential of a surface pumping system will depend upon the net positive suction head of the pump and the friction losses associated with the particular suction line, as well as the relative percentage of suspended particulates.

Surface pumping can be used for many applications of well purging and ground-water sample collection. In all cases, pumping cannot be used for the collection of samples to be analyzed for volatile organic compounds (VOCs).

6.3.1 Peristaltic Pump

Peristaltic pumps provide a low rate of flow typically in the range of 0.02-0.2 gallons/min (75-750 ml/min). For this reason, peristaltic pumps are not particularly effective for well purging. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses. Peristaltic pumps are most often used in conjunction with field filtering of samples and therefore can be used to obtain water samples for direct filtration at the wellhead.

6.3.2 Centrifugal Pump

Centrifugal pumps are designed to provide a high rate of pumping, in the range of 10-40 gallons per minute (gpm), depending on pump capacity. Discharge rates can also be regulated somewhat provided the pump has an adjustable throttle.

When centrifugal pumps are used, samples should be obtained from the suction (influent) line during pumping by an entrapment scheme as shown in Figure 3. Construction of this sampling scheme is relatively simple and will not be explained as part of this SOP. It is suggested that if samples cannot be obtained before going through the pump, that samples be obtained by using a bailer once pumping has ceased. Collecting samples from the pump discharge is not recommended.

6.3.3 Submersible Pump

Submersible pumps provide an effective means for well purging and in some cases sample collection. Submersible pumps are particularly useful for situations where the depth to water table is greater than twenty (20-30) feet and the depth or diameter of the well requires that a large purge volume be removed during purging.

ERT uses the Johnson-Keck pump model SP-81 which has a 1.75 inch diameter pump unit. The pump diameter restricts use to monitoring wells which have inside diameters equal to or greater than two (2) inches. As with other pump-type purge/sample collection methods, submersible pumps will not be used for the collection of samples for analyses of volatile organic compounds. Submersible pumps should never be used for well development as this <u>will</u> seriously damage the pump.

7.0 Sample Collection Procedures

7.1 Bailing

Obtain a clean/decontaminated bailer and a spool of polypropylene rope or equivalent bailer cord. Using the rope at the end of the spool tie a bowline knot or equivalent through the bailer loop. Test the knot for security and the bailer itself to ensure that all parts are intact prior to inserting the bailer into the well.

Remove the protective foil wrapping from the bailer, and lower the bailer to the bottom of the monitoring well and cut the cord at a proper length. Boiler rope should never touch the ground surface at any time during the purge routine.

Raise the bailer by grasping a section of cord using each hand alternately in a "rocking" action. This method requires that the samplers' hands be kept approximately 2-3 feet apart and that the bailer rope is alternately looped onto or off each hand as the bailer is raised and lowered.

Bailed ground water is poured from the bailer into a graduated bucket to measure the purged water volume.

For slowly recharging wells, the bailer is generally lowered to the bottom of the monitoring well and withdrawn slowly through the entire water column. Rapidly recharging wells should be purged by varying the level of bailer insertion to ensure that all stagnant water is removed. The water column should be allowed to recover

to 70-90% of its static volume prior to collecting a sample. Water samples should be obtained from midpoint or lower within the water column.

Samples collected by bailing will be poured directly into sample containers from bailers which are full of fresh ground water. During sample collection, bailers will not be allowed to contact the sample containers.

7.2 Peristaltic Pump

Place a new suction and discharge line to the peristaltic pump. Silicon tubing must be used through the pump head. A second type of tubing may be attached to the silicon tubing to create the suction and discharge lines. Such connection is advantageous for the purpose of reducing tubing costs, but can only be done if airtight connections can be made. Tygon tubing will not be used when performing well purging or collecting samples for organic analysis. The suction line must be long enough to extend to the static ground-water surface and reach further should drawdown occur during pumping.

Measure the length of the suction line and lower it down the monitoring well until the end is in the upper 2-5 inches of the water column present in the well. Start the pump and direct the discharge into a graduated bucket.

Measure the pumping rate in gallons per minute by recording the time required to fill a selected volume of a bucket. Flow measurement shall be performed three times to obtain an average rate.

The pumping shall be monitored to assure continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record.

Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and Specific Conductance) have stabilized.

When the sample bottles are prepared, each shall be filled directly from the discharge line of the peristaltic pump. Care will be taken to keep the pump discharge line from contacting the

sample bottles. Ground-water samples requiring filtration prior to placement in sample containers, will be placed in intermediate containers for subsequent filtration or filtered directly using the peristatic pump.

At each monitoring point when use of the peristaltic pump is complete, all tubing including the suction line, pump head and discharge line must be disposed of. In some cases where sampling will be performed frequently at the same point, the peristaltic pump tubing may be retained between each use in a clean zip-lock plastic bag.

7.3 Centrifugal Pump

7.3.1 Direct Connection Method (Note: This method requires that the well casing be threaded at the top.)

Establish direct connection to the top of the monitoring well if possible using pipe connections, extensions, and elbows, with Teflon® tape wrapping on all threaded connections. If the centrifugal pump will subsequently be used for sample collection, a sample isolation chamber will be placed in the suction line configuration as shown in Figure 3.

Prime the pump by adding tap water to the pump housing until the housing begins to overflow.

Start the pump and direct the discharge into a graduated bucket or a bucket of known capacity (>2.5 gallons).

Start the pump and measure the pumping rate in gallons per minute by recording the time required to fill the graduated bucket. Flow measurement should be checked periodically to determine if pumping rates are continuous, fluctuating, or diminishing. If discharge stops, the pump will be throttled back to determine if pumping will restart at a lower rate. If pumping does not restart, the pump should be shut off to allow the well to recharge.

Measurements of pH and specific conductance will be made periodically during well purging. All readings will be entered on the Ground-Water Sample Collection Record. Samples will be collected after the required purge volume has been withdrawn and the field parameters (pH and Specific Conductance) have stabilized. Samples should be collected from an in-line discharge valve or with a bailer. The pump should be properly decontaminated between wells.

7.3.2 Down-Well Suction-Line Method

Lower a new suction line into the well. The suction line will have a total length great enough to extend to the water table and account for a minimum of five (5) feet of drawdown. Note should be made that drawdown may exceed the depth where pumping will terminate as a result of a limitation derived from suction-line conditions and the lift potential of the pump. All connections should be made using Teflon® ferrules and Teflon® thread wrapping tape. Run the pump as per Section 7.3.1.

At each monitoring well when use of a centrifugal pump is complete, all suction line tubing should be disposed of properly.

7.4 Submersible Pump

Prior to using a submersible pump, a check will be made of well diameter and alignment. A 1.75 inch diameter decontaminated cylindrical tube should be lowered to the bottom of each monitoring well to determine if the alignment or plumbness of a well is adequate to accommodate the submersible pump. All observations will be entered in the Ground-Water Sample Collection Record.

Slowly lower the submersible pump into the monitoring well taking notice of any roughness or restrictions within the riser.

Count the graduations on the pump discharge line and stop lowering when the stainless steel portion is below the uppermost section of the static water column within monitoring well. Secure the discharge line and power cord to the well casing.

Connect the power cord to the power source (i.e., rechargeable battery pack or auto battery monitor) and turn the pump on (forward mode). When running, the pump can usually be heard by listening near the well head.

Voltage and amperage meter readings on the pump discharge must be checked continuously. The voltage reading will decline slowly during the course of a field day representing the use of power from the battery. Amperage readings will vary depending upon the depth to water table. Amperage readings greater than 10 amps usually indicate a high solids content in the ground water which may cause pump clogging and serious damage. If a steady increase

in amperage is observed, the pump should be shut off, allowed to stop, switched to the reverse mode, stopped again and then placed in forward mode. If high amperage readings persist, the pump should be withdrawn and checked using the large upright cylinder and tap water. Ground-water conditions such as high solids may require that an alternate purge/sample method be used.

Drawdown must also be monitored continuously by remaining near the well at all times and listening to the pump. When drawdown occurs, a metallic rotary sound will be heard as the pump intake becomes exposed and ceases to discharge water, but continues to run. The pump should be lowered immediately to continue pumping water within the uppermost section of the static water column. NOTE: The submersible pump cannot be allowed to run while not pumping for more than five seconds or the pump motor will burn out.

If drawdown continues to the extent that the well is pumped dry, the pump should be shut off and the well allowed to recharge. This on/off cycle may need to be repeated several times in order to purge the well properly.

Measurements of the pumping rate, pH, and specific conductance should be made periodically during well purging. All readings and respective purge volumes should be entered on the Ground-Water Sample Collection Record.

While pumping is on-going and when sample bottles are prepared, bottles will be filled directly from the discharge line of the pump taking care not to touch sample bottles to the discharge line.

At each monitoring well when use of the submersible pump is complete, the pump, discharge line and power cord shall be decontaminated according to the procedures contained in the SOP for Decontamination.

8.0 Sample Preparation

8.1 Introduction

Prior to sample transport or shipment, ground-water samples may require filtration and/or preservation dependent on the specific type of analysis required.

Specific preservation techniques are described in the EPA document, Handbook for Sampling and Sample Preservation of Water and Wastewater (EPA-600/4-82-029). The EPA manual and laboratory manager should be consulted during the planning stage of the project. Project-specific sampling plans shall be assembled using the approved procedures obtained from the EPA manual.

8.2 Filtration

Ground-water samples collected for dissolved metals analyses will be filtered prior to being placed in sample containers. Ground-water filtration will be performed using a peristaltic pump and a 0.45 micron, water filter. Typically the water filters are 142 mm in diameter and are usually placed in 142 mm polycarbonate housings.

The filtration of ground-water samples shall be performed either directly from the monitoring well or from intermediate sample containers such as decontaminated buckets. In either case, well purging shall be performed first. Fresh ground water shall then be filtered and discharged from the filtration apparatus directly into sample containers. For most dissolved metal analyses, pH adjustment of the sample is also required and shall be performed after filling the sample bottles. This is generally accomplished using laboratory supplied compounds such as sulfuric or nitric acid and sodium hydroxide.

9.0 Documentation

A number of different documents must be completed and maintained as a part of ground-water sampling effort. The documents provide a summary of the sample-collection procedures and conditions, shipment method, the analyses requested and the custody history. The list of documents is:

- Ground-water sample collection record
- Sample labels
- Chain of custody forms and tape
- Shipping receipts

Sample labels shall be completed at the time each sample is collected and will include the information listed below. A sample label is shown in Figure 4.

- Client or project name
- Sample number
- Designation (i.e., identification of sample point no.)
- Analysis
- Preservative (e.g., filtration, acidified pH<2 HNO_3)
- Sample-collection date
- Sampler's name

Figure 5 displays the chain of custody record used by ERT. The chain of custody form is the record sample collection and transfer of custody. Information such as the sample collection date and time of collection, sample identification and origination, client or project name shall be entered on each chain of custody record. In accordance with 40 CFR 261.4(d) the following information must accompany all ground water samples which are known to be non-hazardous and to which U.S. Department of Transportation and U.S. Post Office regulations do not apply. Such information is:

- sample collector's name, mailing address and telephone number,
- analytical laboratory's name, mailing address and telephone number,
- quantity of each sample,
- date of shipment, and
- description of sample.

The chain of custody forms provide a location for entry of the above-listed information.

10.0 References

EPA, Handbook for Sampling and Sample Preservation of Water and Wastewater EPA-600/4-82-029, September 1982.

Geotrans, Inc. RCRA Permit Writer's Manual, Ground-Water Protection prepared for U.S. EPA. Contract No. 68-01-6464, October 1983.

Code of Federal Regulations, Chapter 40 (Section 261.4(d).

Figure 1

ENSR

Well No. _____

GROUND WATER SAMPLE COLLECTION RECORD

Job No. _____ Date: _____

Location: _____ Time: S _____

Weather Conds.: _____ F _____

1. WATER LEVEL DATA: (from ToC) ToC Elevation (from LS) _____

a. Total Well Length (= TC) _____ (known, meas.) Tape Corr. (TC) _____

b. Water Table Elev. (= TC) _____ Well Dia. _____

c. Length of Water Column _____ (a-b)

2. WELL PURGING DATA:

a. Purge Method _____

b. Required Purge Volume (@ ____ well volumes) _____

c. Field Testing: Equipment Used _____

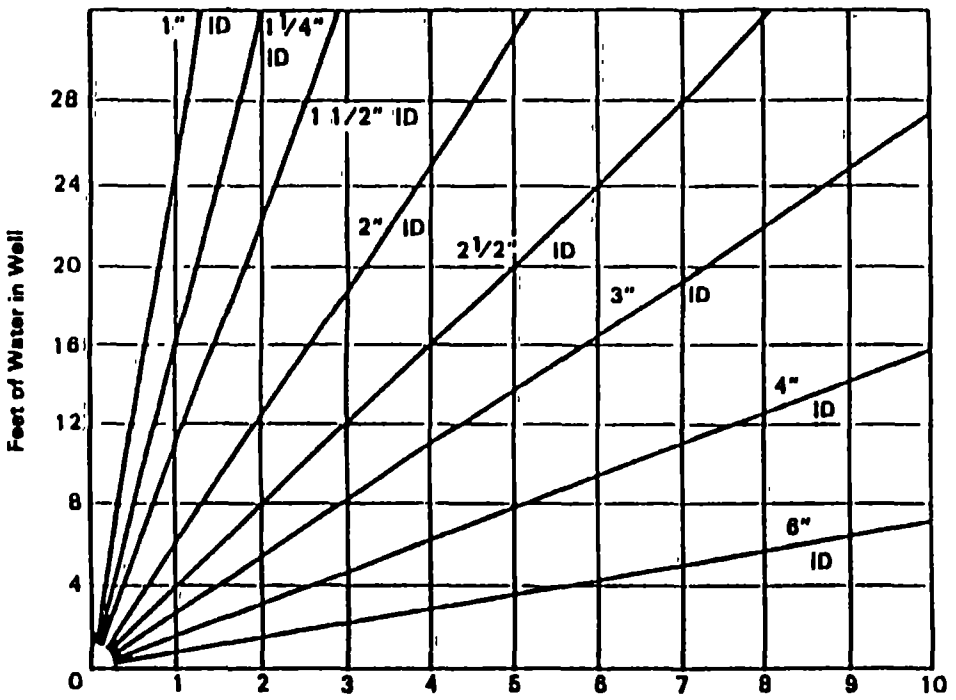
Volume Removed	T°	PH	Spec. Cond.	Color

3. Sample Collection: Method _____

Container Type	Preservation	Analyses Req.

Comments: _____

1995-12-84



(a) Graphical Explanation

Volume/Linear Ft. of Pipe		
ID(in)	Gal	Liter
1/4	0 003	0 010
3/8	0 006	0 022
1/2	0 010	0 039
3/4	0 023	0 087
1	0 041	0 164
2	0 163	0 618
3	0 367	1.39
4	0 653	2 47
6	1 47	5 56

(b) Volume Factors

Figure 2 Purge Volume Computation

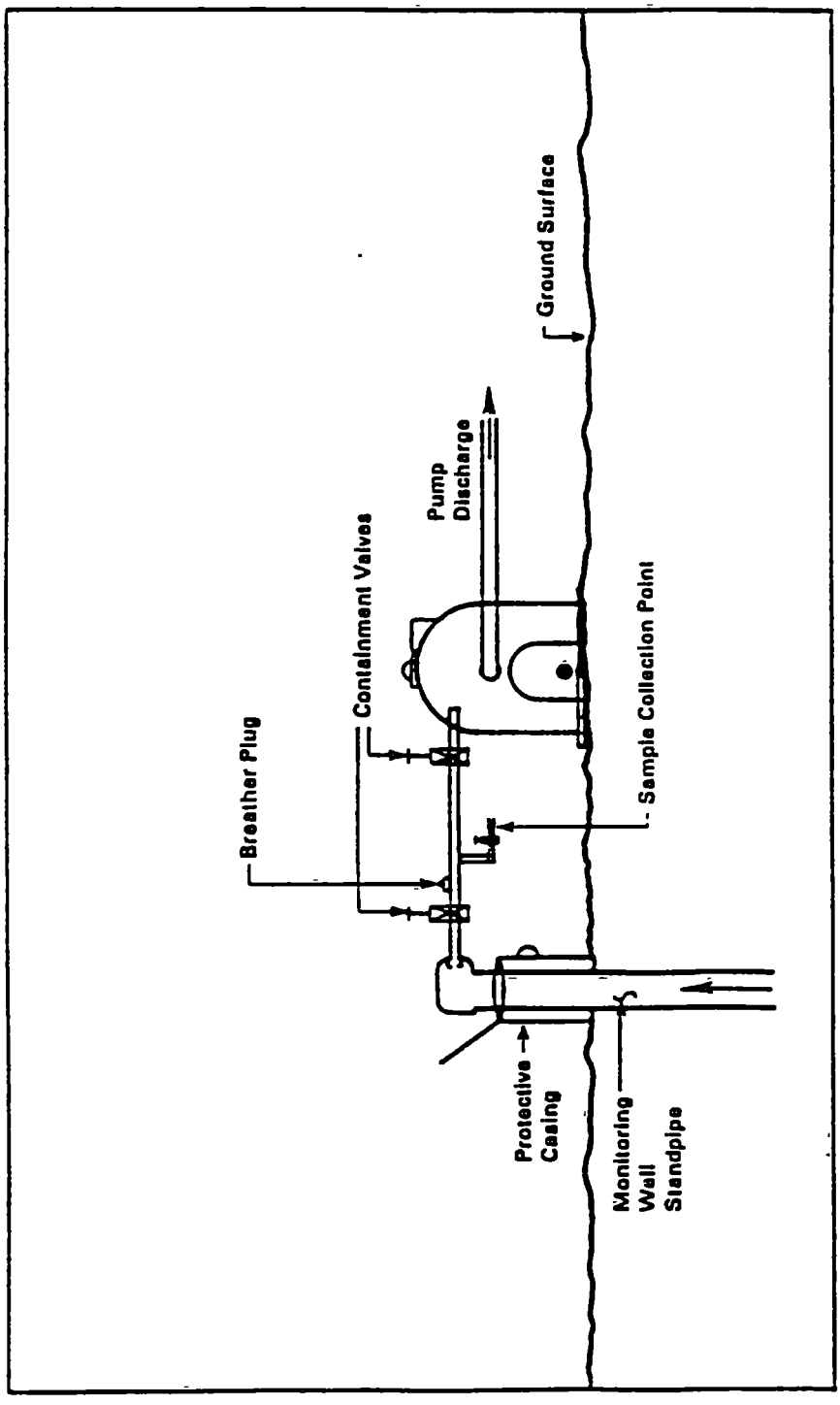


Figure 3 Down Well Suction Line Configuration

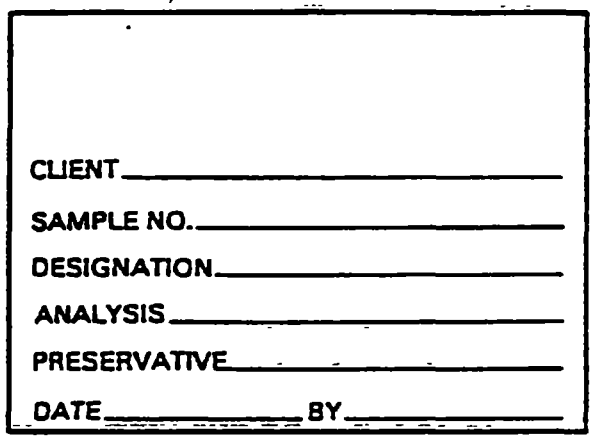


Figure 4 Sample Container Label

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location	ANALYSES
Project No	Field Logbook No.	
Sampler: (*Signature*)	Chain of Custody Tape No	

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample							REMARKS

Relinquished by: (*Signature*)	Date	Time	Received by (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received by (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received for Laboratory (*Signature*)	Date	Time
Sample Disposal Method.	Disposed of by: (*Signature*)			Date	Time

SAMPLE COLLECTOR	ANALYTICAL LABORATORY	
		No

1974 3 84

Figure 5 Sample Chain-of-Custody Record

STANDARD OPERATING PROCEDURE
(REFER TO QAPP SECTION 6.7)

Title: Calibration and Operation of Hydrolab Water Quality Monitor

Date: 1st Qtr 19
Number: SOP 7320
Revision: 1

1.0 Applicability

This Standard Operating Procedure (SOP) provides basic instructions to be employed for the field operation of Hydrolab digital multimeters (Model Nos. 4041 and 8000). Hydrolabs are used for field measurement of water-quality parameters.

2.0 Responsibilities

The field team is responsible for ensuring that the Hydrolab unit is in proper operating condition prior to use in the field. All system-calibration checks are the responsibility of the field team.

3.0 Materials

- Hydrolab Operation and Maintenance Instruction Manual
- Hydrolab Sonde unit, battery pack and surface unit
- Hydrolab calibration-cup
- Two Fisher-brand laboratory potassium chloride (KCl) standard solutions (known conductivity at 25°C)
- Two freshly prepared pH buffer solutions. Generally pH 7.0 and pH 4.0 or 10.0 are used.
- Distilled or de-ionized water (approximately two liters)
- Chemical-free paper towels
- Screwdrivers (as supplied in the Hydrolab Accessory Kit)

4.0 Procedures

The Hydrolab provides simultaneous measurement of four water quality parameters; 1) dissolved oxygen, in mg/l, 2) temperature, in °C; 3) pH, in standard units, and 4) conductivity, in umhos/cm (uS/cm). The panel switch on the front of the indicator unit controls which parameter is being measured and read-out.

The display is read in the following manner; temperature, pH and dissolved oxygen are read out directly. For example, a temperature of 21.8°C will be displayed as 21.8. A dissolved oxygen (D.O.) or pH reading of 8.1 will be displayed at 08.1. Conductivity is read out directly on the 2k scale. If the 20k scale is required to measure higher conductivity the number that is displayed will need to be

multiplied by 10. In the 200k scale the reading will be multiplied by 100. For example, suppose the sample being measured has a conductivity of 1527 uS/cm. Using the 2k scale, the display will show 1527 (direct read-out). Using the 20k scale the display will show 153 (153 x 10 = 1530 uS/cm). Using the 200k range the display will show 015 (015 x 100 = 1500 uS/cm). Only the Hydrolab model 4041 offers the three scale measurement. The Hydrolab model 8000 is restricted to measurement of conductivity within the range of 0-2000.

4.1 Hydrolab Calibration

A complete calibration check should be performed before going to and after returning from a field sampling/water quality measurement activity. The calibration procedures should be carried out in a controlled environment such as a laboratory, but a field office or closed-in shelter may also be used.

At least one hour prior to calibration, take the following preparatory steps:

1) Remove the "Storage-Cup" from the Sonde Unit.

2) Remove the protective guard from the dissolved oxygen sensor.

3) Install the "Calibration-Cup" on the Sonde Unit and fill to the brim with distilled water.

4) Seal the Calibration Cup with the soft plastic cap and store the sonde unit, calibration standards, and the distilled water at constant room temperature for at least one hour in order to bring the various sensors, temperature compensating elements, and the calibration solutions into thermal equlibrium (within a few degrees).

All of the calibration controls are located on the front panel of the Indicator Unit. Adjustments, if necessary, should be made in the following manner:

1) Remove the appropriate seal-screw for the parameter being adjusted.

2) Insert a small screwdriver through the access hole and adjust the calibration control in the direction which brings the reading into agreement with the value of the standard solution being employed.

3) Replace the seal-screw.

A RINSE STEP will be used several times during the calibration procedure. It is to be performed in the following manner: Fill the calibration cup halfway with de-ionized or distilled water. Snap on the soft plastic cap; shake the sonde unit for ten seconds and then pour out the water. Repeat twice more using fresh de-ionized or distilled water. Remove the cup and shake as much of the rinse water as possible from the electrodes.

4.1.1 Dissolved Oxygen Calibration

The Dissolved Oxygen system is the first to be calibrated since the water that has been stored in the calibration cup is used to maintain control of the temperature inside the cup. The calibration standard is either a water sample of a known D.O. concentration (determined in the laboratory by the Winkler or iodemtric method in accordance with Standard Methods for the Examination of Water and Wastewater, 15th Edition, APHA-AWWA-WPCF, 1980 or water-saturated air at the temperature inside the calibration cup. The following procedures are for the water-saturated air method for D.O. calibration.

Invert the Sonde Unit and remove the soft plastic cap. Pour off enough water to bring the level to just below the D.O. membrane- retainer O-ring. With a clean paper towel or tissue blot any moisture from the D.O membrane. Cover the calibration cup mouth with one of the hard plastic caps provided in the Accessory Kit. This will keep drafts from blowing on the membrane. Do not seal the cup with the plastic cap, because that could cause a partial-pressure change in the cup. Wait approximately 5 minutes, or until the reading is stable, then switch to the TEMPERATURE position and record the temperature reading. Refer to Table 1 for the correct oxygen concentration at this temperature. Since the table values refer to concentrations at Standard Pressure it will be necessary to correct the value for local barometric pressure. This should be done in the following manner:

Correct D.O. Setting = (Local Barometric Pressure/760mm) x (Table value at Cup Temperature)

EXAMPLE: If T = 28.5°C and Local Barometric Pressure = 800mm,

Correct D.O. Setting = (800mm/760mm) x (7.6 mg/l)
= 8.0 mg/l

If a barometer is not available, the equivalent pressure may be estimated from Table 2 which relates atmospheric pressure with elevation above mean sea level. Therefore, the approximate atmospheric pressure at an altitude of 2000 feet, for example, would be: Local Atmospheric Pressure = 705mm Hg.

Adjust the Dissolved Oxygen calibration control until the proper value (rounded to nearest tenth) is displayed. Pour out the water; and then follow with a RINSE STEP.

4.1.2 pH Calibration

Calibrating the pH system requires the use of two Fisher-brand pH laboratory buffer solutions. Depending upon the application, either pH 4.0 or pH 10.0 is used in addition to pH 7.0. Invert the sonde unit and fill the calibration cup with fresh pH 7.0 buffer solution. Switch to "pH", and wait approximately 5 minutes for thermal equilibrium. Then adjust the pH calibration control until 7.0 is displayed on the read-out.

Pour out the 7.0 buffer and repeat the RINSE STEP. Invert the sonde unit and screw on the calibration cup; fill with 10.0 or 4.0 buffer. After approximately 5 minutes, adjust the pH "Slope" control until either 10.0 or 4.0 (as appropriate for the buffer being used) is displayed on the read-out. Pour out the buffer and repeat the RINSE STEP <u>Two Times</u>

4.1.3 Conductivity Calibration

After the second RINSE STEP, take a clean paper towel or tissue, and blot most of the moisture in the electrode area so that the standard will not suffer dilution.

Install a clean calibration cup and invert the sonde unit. The conductivity system is calibrated using at least two prepared KCl standard solutions with a known conductivity at 25°C. From Table 3, select two standard solutions with values of approximately one-third and two-thirds of the range you are most likely to encounter in the field. For example, if you are going to be working in fresh water (0-2K scale) you would want to use a 0.01M standard and a 0.005M standard. Select the <u>more concentrated</u> of the two standards and pour it slowly down the side of the calibration cup until full. When the reading is stable, adjust the conductivity calibration control until the display matches

the value listed in Table 3. Empty the calibration cup and repeat the RINSE STEP Two Times. Pour in the second standard. Check the reading on the Display. It should be correct within ± 1% of the range being used. For example, if the 0-2K scale is used, the reading for the second standard should be correct within ± 20 uS/cm of the true value. Pour out the standard solution. Perform a RINSE STEP.

4.1.4 Temperature Calibration

The temperature system is factory calibrated and is accurate to ± 0.2°C. No calibration adjustment is provided. A periodic check of the temperature system against an NBS-traceable thermometer should be performed as a verification.

4.2 Final Preparation

Turn the system off and disconnect the system components. Replace all rubber dust caps. Remove the Calibration Cup from the Sonde Unit and replace the protective guard on the dissolved oxygen electrode. Fill the Storage Cup with tap water and install onto the Sonde Unit. The system is now calibrated and ready for field use.

4.3 Field Operation

Remove the Storage Cup from the calibrated sonde unit and install the guard or the optional sample circulator. Connect the system components. Lower the sonde unit into the water (sideways, if possible) and shake it to dislodge air bubbles trapped in the conductivity cell block. Release the sonde unit and lower it to sample depth. Wait until the readings stabilize (D.O. is the best indicator) and then record the value for each parameter. Repeat at new depths or locations.

When using for ground water sampling, pour/place a sample of ground water into the Storage Cup and attach it to the sonde so that all nodes are submerged.

Check the battery voltage occasionally; charge or change batteries if the level drops below 10.5 volts. DO NOT charge the battery routinely after each day's use. Doing so may shorten the life of the battery. Use the battery until the voltage level drops to between 10.5 and 11.0 volts. At this point put the battery on charge for 24 hours.

TABLE 1

DISSOLVED OXYGEN SATURATION VALUES IN

DISTILLED WATER AT 760 mm Hg

Temp. (°C)	DO (mg/l)	Temp (°C)	DO (mg/l)
0.0	14.6	15.5	9.9
0.5	14.4	16.0	9.8
1.0	14.2	16.5	9.7
1.5	14.0	17.0	9.6
2.0	13.9	17.5	9.5
2.5	13.7	18.0	9.4
3.0	13.5	18.5	9.3
3.5	13.3	19.0	9.2
4.0	13.1	19.5	9.1
4.5	13.0	20.0	9.0
5.0	12.8	20.5	8.9
5.5	12.6	21.0	8.8
6.0	12.5	21.5	8.8
6.5	12.3	22.0	8.7
7.0	12.1	22.5	8.6
7.5	12.0	23.0	8.5
8.0	11.8	23.5	8.4
8.5	11.7	24.0	8.3
9.0	11.6	24.5	8.2
9.5	11.4	25.0	8.2
10.0	11.3	25.5	8.1
10.5	11.1	26.0	8.0
11.0	11.0	26.5	8.0
11.5	10.9	27.0	7.9
12.0	10.8	27.5	7.8
12.5	10.6	28.8	7.7
13.0	10.5	28.5	7.6
13.5	10.4	29.0	7.6
14.0	10.3	29.5	7.5
14.5	10.2	30.0	7.4
15.0	10.0	30.5	7.4

TABLE 2

Site Elevation (Feet above mean sea level)	Approximate Mean Barometric Pressure (mm Hg)
1000	733
1500	720
2000	705
2500	694
3000	680
3500	669
4000	656
4500	644
5000	632
5500	620
6000	609
6500	598
7000	586
7500	575
8000	564
8500	554
9000	543
9500	533
10000	523

TABLE 3

CONDUCTIVITY CALIBRATION STANDARDS

Conducitivies of Potassium Chloride Solutions at 25°C M.W. = 74.555			Conductivity Reading on Hydrolab Display for Given Range Setting (uS/cm)		
Conc.	Grams KCl/L	uS/cm	(0-2K)	(0-20K)	(0-200K)
0.0005	0.03728	73.9		-	-
0.001	0.07456	147.0	147	-	-
0.002	0.1491	292.0	292	-	-
0.005	0.3728	717.8	718	-	-
0.01	0.7456	1.413K	1413	141	-
0.02	1.491	2.767K	—	277	-
0.05	3.728	6.668K	—	667	-
0.1	7.456	12.90K	—	1290	129
0.2	14.911	24.82K	—	—	248
0.5	37.278	58.64K	—	—	586
1.0	74.555	111.9K	—	—	1119

NOTES:

(1) Two conductivity standards are recommended for each range setting (boxed-in values). Calibration adjustments will be made first with the higher concentration and then with the lower concentration.

(2) Single dashes indicate ranges which are not recommended for calibration checks.

(3) The Hydrolab model 8000 is restricted to conductivity readings between 0-2000 µS/cm (0-2k) scale), therefore conductivity readings and thus calibration solutions within the 0-20k and 0-200k ranges will not apply.

Title: Packaging and Shipment of Samples
(REFER TO QAPP SECTION 6.6)

1.0 Applicability

This Standard Operating Procedure (SOP) is concerned with procedures associated with the packaging and shipment of samples. Two general categories of samples exist: environmental samples consisting of air, water and soil; and waste samples which include non-hazardous solid wastes and hazardous wastes as defined by 40 CFR Part 261.

2.0 Responsibilities

It is the responsibility of the project manager to assure that the proper packaging and shipping techniques are utilized for each project. The site operations manager shall be responsible for the enactment and completion of the packaging and shipping requirements outlined in the project specific sampling plan. The site operations manager shall be responsible to research, identify and follow all applicable U.S. Department of Transportation (DOT) regulations regarding shipment of materials classified as waste.

3.0 General Method

The objective of sample packaging and shipping protocol is to identify standard procedures which will minimize the potential for sample spillage or leakage and maintain field sampling program compliance with U.S. EPA and U.S. DOT regulations.

The extent and nature of sample containerization will be governed by the type of sample, and the most reasonable projection of the sample's hazardous nature and constituents. The EPA regulations (40 CFR Section 261.4(d)) specify that samples of solid waste, water, soil or air, collected for the sole purpose of testing, are exempt from regulation under the Resource Conservation and Recovery Act (RCRA) when all of the following conditions are applicable:

A. Samples are being transported to a laboratory for analysis;
B. Samples are being transported to the collector from the laboratory after analysis;
C. Samples are being stored (1) by the collector prior to shipment for analyses, (2) by the analytical laboratory prior to analyses, (3) by the analytical laboratory after testing but prior to return of sample to the collector or pending the conclusion of a court case.

Qualification for categories A and B above require that sample collectors comply with U.S. DOT and U.S. Postal Service (USPS) regulations or comply with the following items if U.S. DOT and USPS regulations are found not to apply:

The following information must accompany all samples and will be entered on a sample specific basis on chain of custody records:

- sample collector's name, mailing address and telephone number,
- analytical laboratory's name, mailing address and telephone number,
- quantity of sample,
- date of shipment,
- description of sample, and

in addition, all samples must be packaged so that they do not leak, spill or vaporize.

4.0 General Methods

4.1 Place plastic bubble wrap matting over the base and bottom corners of each cooler or shipping container as needed to manifest each sample.

4.2 Obtain a chain of custody record as shown in Figure 1 and enter all the appropriate information as discussed in Section 3.0 of this SOP. Chain of custody records will include complete information for each sample. One or more chain of custody records shall be completed for each cooler or shipping container as needed to manifest each sample.

4.3 Wrap each sample bottle individually and place standing upright on the base of the appropriate cooler, taking care to leave room for some packing material and ice or equivalent. Rubber bands or tape should be used to secure wrapping, completely around each sample bottle.

4.4 Place additional bubble wrap and/or styrofoam pellet packing material throughout the voids between sample containers within each cooler.

4.5 Place ice or cold packs in heavy duty zip-lock type plastic bags, close the bags, and distribute such packages over the top of the samples.

4.6 Add additional bubble wrap/styrofoam pellets or other packing materials to fill the balance of the cooler or container.

4.7 Obtain two pieces of chain of custody tape as shown in Figure 2 and enter the custody tape numbers in the appropriate place on the chain of custody form. Sign and date the chain of custody tape.

4.8 To complete the chain of custody form enter the type of analysis required for each sample, by container, under the "ANALYSES" section. Under the specific analysis enter the quantity/volume of sample collected for each corresponding analysis.

If shipping the samples where travel by air or other public transportation is to be undertaken, sign the chain of custody record thereby relinquishing custody of the samples. Relinquishing custody should only be performed when directly transmitting custody to a receiving party or when transmitting to a shipper for subsequent receipt by the analytical laboratory. Shippers should not be asked to sign chain of custody records.

4.9 Remove the last copy from the chain of custody record and retain with other field notes. Place the original and remaining copies in a zip-lock type plastic bag and place the bag on the top of the contents within the cooler or shipping container.

4.10 Close the top or lid of the cooler or shipping container and with another person rotate/shake the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.

When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening is simple. In these cases, chain of custody will be maintained by the person transporting the sample and chain of custody tape need not be used. If the cooler is to be left unattended, then chain of custody procedures should be enacted.

4.11 Place the chain of custody tape at two different locations on the cooler or container lid and overlap with transparent packaging tape. For coolers with hinged covers, if the hinges are attached with screws, chain of custody tape should also be used on the hinge side.

4.12 Packaging tape should be placed entirely around the sample shipment containers. A minimum of one to two full wraps of packaging tape will be placed at at least two places on the cooler. Shake the cooler again to verify that the sample containers are well packed.

4.13 If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipper.

4.14 If the samples are to travel as luggage, check with regular baggage.

4.15 Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain of custody form. The laboratory will verify that the chain of custody tape has not been broken previously and that the chain of custody tape number corresponds with the number on the chain of custody record. The analytical laboratory will then forward the back copy of the chain of custody record to the sample collector to indicate that sample transmittal is complete.

5.0 Documentation

As discussed in Section 4.0 the documentation for supporting the sample packaging and shipping will consist of chain of custody records and shipper's records. In addition a description of sample packaging procedures will be written in the field log book. All documentation will be retained in the project files following project completion.

0908J

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location	ANALYSES
Project No.	Field Logbook No	
Sampler: (*Signature*)	Chain of Custody Tape No	

Sample No / Identification	Date	Time	Lab Sample Number	Type of Sample							REMARKS

Relinquished by: (*Signature*)	Date	Time	Received by (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received by: (*Signature*)	Date	Time
Relinquished by: (*Signature*)	Date	Time	Received for Laboratory (*Signature*)	Date	Time
Sample Disposal Method	Disposed of by (*Signature*)			Date	Time

SAMPLE COLLECTOR

ERT - A Resource Engineering Company
696 Virginia Road
Concord, MA 01742
617-369-8910

ANALYTICAL LABORATORY

ENSR

No. 1663

1974 3 84

Figure 1

Enseco

STANDARD
OPERATING
PROCEDURE

Subject or Title:
BUILDING SECURITY - REFER TO QAPP SECTION 7

SOP No.:	Revision No.:	Effective Date:
LP-RMA-0001	Original	12/9/87

Supersedes:

1. Purpose:

The purpose of building security is to guarantee data security and confidentiality for the client as well as providing analytical data which is legally defensible.

2. Policies:

RMAL's security policy includes controlled access to the building, testing areas and data files, confidentially agreements with all personnel, identification badges for all personnel, electronic security and fire alarm systems, and a security guard. All visitors are also assigned visitor badges and are accompanied by RMAL staff during their stay in the facility.

3. Safety Issues: Not Applicable

4. Procedure:

Building Security

a. All exterior doors to the facility will remain locked at all times with the exception of the front entrance.
b. During the hours of 7:00 a.m. to 6:00 p.m., the front entrance or main reception area is controlled by the receptionist and secured by locked entries. The alarm system is not activated during this time period.
c. During the hours of 6:00 p.m. to 7:00 a.m., the front entrance is controlled by security guard. All persons entering or leaving the facility will be recorded by the security guard. The alarm system is activated during this time period to prevent all other exterior doors from being usable, including sample receiving and the patio doors.

Prepared by: Peter J. Thebeau Date:

Management Approval: Date: 12/10/87

QA Officer Approval: Robert C Hanisch Date: 12/9/87

d. Sample receiving during the hours of 6:00 p.m.to 7:00 a.m. is permitted only with the assistance of the security guard.

Personnel Identification

a. All employees and visitors are required to wear security badges at all times while on the premises of all ENSECO divisions.
b. The personnel administrator is responsible for issuing a picture I.D. badge to an employee on the employee's first day of employment. Each employee is responsible for his/her badge. Additionally, each employee will be required to sign a "Confidentiality Agreement" which is included in the employee's personnel file.
c. The receptionist is responsible for issuing a badge to each visitor to the facility. Visitors must request a badge from the front office of the division they visit, sign the visitor log and must be accompanied by an ENSECO employee before access to any building will be allowed.

Building Alarm System

a. While it is not anticipated that employees will have to set or disarm the alarm system, it is important that employees understand the procedure. Unless used correctly, the alarm will go off and the Arvada Police Department will be called.
b. The procedure is confidential information and can be obtained from the Personnel Department.

5. Responsibilities:

a. It is the responsibility of each employee to maintain confidentiality of all clients data.
b. The Personnel Department is responsible for issuing employee identification badges and having signed "Confidentiality Agreements" in each employee's personnel file.
c. The receptionist is responsible for issuing visitor badges and for visitor sign-in during normal business hours. The security guard is likewise responsible for visitor and employee comings and goings between the hours of 6:00 p.m. and 7:00 a.m.
d. Employees escorting visitors are responsible for ensuring that visitation procedures are followed and that data confidentiality has not been compromised.

6. Comments:

STANDARD
OPERATING
PROCEDURE

Subject or Title: Laboratory Data Review - REFER TO QAPP SECTION 10.1		Page 1 of 12
SOP No.: LP-RMA-0002	Revision No.: Original	Effective Date: 12/9/87
Supersedes: -		

1. Purpose

All laboratory data will be subjected to a rigorous data review process prior to its release to the client. The review process has been developed to minimize errors associated with sample processing, sample analysis and data reporting and to ensure that information pertaining to a given sample is well-documented. The process consists of a three-level review whereby results generated for a specific project are evaluated to ensure that

- o project is complete;
- o precision, accuracy and detection limits are met;
- o raw data interpretation is correct;
- o all calculations are correct;
- o contractual requirements are met; and,
- o all information is well documented for archival purposes.

Enseco/RMAL uses a computerized Laboratory Information Management System (LIMS), as well as a variety of custom software programs designed to perform calculations, check results, generate reports, and to ensure data integrity and security. Whenever possible, historical client-specific data may aid in the review process as an additional check on generated results.

2. Policies

All project data will be subjected to a three-tier review process including review by operations, the data review group for inorganics, GC/MS, and chromatography and the final review by the project or client managers. Data will not be released to the client until the review process is completed.

Prepared by: Allen J. Medine, Ph.D.	Date: December 9, 1987
Management Approval: Paul Webb	Date: 12/10/87
QA Officer Approval: Robert E. Hamisch	Date: 12/10/87

3. Safety Issues

There are no direct safety issues which are of concern for the data review process. As with other non-analytical activities, caution should always be exercised when performing data review functions in the laboratory. For example, discussing problems with analysts, examining original samples, checking preparation aliquots will require review personnel to be in the laboratory or in appropriate storage areas. A review of safety concerns for all of these areas shall be implemented.

4. Procedure

The data review framework is essentially the same for the metals, non-metals, GC/MS and chromatography groups. The differences between each groups procedure are due to analysis differences, data entry and data correction software developed for LIMS. The data review process consists of three levels (LEVEL 1, LEVEL 2 and LEVEL 3). The general framework for the laboratory review process is shown in Figure 1.

A. LEVEL 1 REVIEW

The LEVEL 1 REVIEW begins at the analytical (bench) stage where LEVEL 1 review is primarily a self-review of all information generated during the analysis. During the analytical test, the analysts have much information concerning the precision, accuracy and problems. The intent of the data review program is to take advantage of this condition by-review of all analytical details generated by the analyst and subsequent approval of the test results and QC by the analysts immediate supervisor. Specifically, the functions of the analyst and supervisor are as follows:

ANALYST:

1. Review Prep Lab Notes - Preparation lab notes are to be reviewed to determine if there were anomalies observed which may affect the analysis for certain parameters.

2. Review Special Instructions - For certain projects, the Client may have specified certain modifications to a standard test, analysis using a custom test, project specific QC, or special preparation of the sample.

3. Record All Necessary Information - While this may be considered more of an operations or analytical method concern, proper documentation of the analysis, in sufficient detail to allow re-creation of the analysis, is essential for an effective, efficient data review program and to permit development of a sound data archive program. An important part of data recording is to reveal whether

the test proceeded according to the Analytical Method SOP and that deviations from the method, anomalies during analysis, or that decisions concerning re-analysis are well-documented.

4. Check All Calculations - Errors frequently occur during calculations for standard curves, dilution factors, unit conversions, or extrapolations from instrument response to appropriate concentrations. The analysts will check ALL calculations, or verify data entry into software designed to perform calculations, examine results for agreement with expected results (i.e. order of magnitude or better) and indicate that calculations were reviewed on the LEVEL 1 REVIEW CHECKLIST.

5. Provide Data and QC Summary - Summaries of parameter concentrations and QC data generated are to be provided to the supervisor along with raw data (bench sheets, chromatograms, etc.) for supervisor approval of the analytical results.

6. Provide Out of Control/Anomally Sheet - Information regarding out of control situations or anomalies is necessary for review personnel to re-create the analysis when there are questions concerning the data which has been generated during the analysis. Holding time violations are to be clearly indicated along with the appropriate reasons for the violation.

7. LEVEL 1 REVIEW CHECKLIST - The function of the checklist is to indicate that the above items have been considered in the analysis. The LEVEL 1 REVIEW CHECKLIST is shown in Figure 2. There are more detailed items which are considered during the analysis and the review procedure by both analysts and the immediate supervisor in the GC/MS, GC, Metals and Inorganic Groups. Much of this information can be found on the LEVEL 2 CHECKLIST's. For example, in metals analysis using graphite furnace analysis, the analysts and supervisor will examine instrument standardization criteria (absorbance for standards,etc.), dilution factors, linear range compliance, detection limit adjustment and whether the Method of Standard Additions was required.

SUPERVISOR:

It is recognized that the analyst supervisors are not a part of the data review group. However, the supervisors are directly responsible for the analytical performance of the various analyst and, as such, are an integral part of the review process. The main functions of the supervisors are to review analysis as soon as possible and 1) accept analysis or 2) suggest re-analysis. As part of

the LEVEL 1 REVIEW process, supervisors will perform the following tasks:

1. Review analysis package for QC, reasonable results, holding tie violations and general acceptance of analysis. It is very important that re-analysis decisions be made at this level.

2. Signify approval on LEVEL 1 REVIEW CHECKLIST

3. Approval of data entry into data base management system

4. Schedule data entry (applicable to inorganics analysis at this time only).

It will be the responsibility of the supervisor to review and approve (or disapprove) the analysis on a daily basis. It will not be acceptable for supervisors to allow their review packages to stack up while other tasks are being performed. The review process depends on a continual flow of information through the the various levels. To meet turnaround times and other constraints of a commercial laboratory, it is essential for supervisors to provide a timely review of data generated by the analysts.

B. LEVEL 2 REVIEW: DATA REVIEW GROUPS

At the present time, separate data review groups exist in the inorganics division, the GC/MS division and the Chromatography division. A thorough review of the project data base takes place within the data review groups. There are numerous items which are common to each divisions review procedure. Each review group has developed a separate checklist to aid each reviewer in specifics related to the analytical tests. In addition, the reviewers in each group possess sufficient experience with the analyses conducted by the division to allow a comprehensive assessment of the precision and accuracy of the data generated.

The LEVEL 2 REVIEW is considered to be a peer review of the analytical data and review of project specific requirements. At this stage of the review, a complete check of the tests assigned to a project is made against the project data base to assess project completion. Additionally, the preparation lab notes, bench sheets, QC forms and anomally sheets are reviewed in detail to ensure that raw data has been interpreted correctly, that detection, precision and accuracy criteria are met, that the information is well documented for archival purposes, and that contractual requirements are also met.

Each data review group will evaluate the project data with respect to the LEVEL 2 REVIEW checklists. If any re-analysis is required at this stage, the decision is documented along with other project specific data. The LEVEL 2 REVIEW CHECKLISTS for each group are shown in Figures 3-5. The completion of the LEVEL 2 REVIEW is indicated on the checklists by the appropriate signature.

The reviewers will also provide information which is used by the report preparation personnel to prepare the final project report. Reviewers should provide comments on unusual or inconsistent results, anomalies, subcontractor data, and the extent of any necessary data qualification. Reviewers are to also assemble the complete package for report generation, including the above comments and raw data, when requested.

Following the completion of the review by the peer reviewers, the complete package will be examined by the data review supervisor. Supervisors will provide additional review of comments, anomalies, data qualification, and relationships between parameters, when appropriate. Approval of the LEVEL 2 REVIEW by the supervisor is also indicated on the LEVEL 2 REVIEW CHECKLIST.

The supervisors will also check the file for completeness, address comments from reviewers, and spot check results for reasonableness. The supervisors will also develop revisions to the data review SOP, provide training to data reviewers, assist development of computer knowledge-based review software and provide a continued evaluation of data review procedures.

At the completion of the review process for each division, the supervisor will change the project completion status in LIMS from status 4 to 7. Altering the project status in this way allows management to effectively move projects through the laboratory as rapidly as possible.

C: LEVEL 3 REVIEW: CLIENT MANAGERS

The last review of project data takes place at the client manager level. This review is directed at the results obtained, the clients needs, overall project results across analytical divisions, special instructions, analysis problems, the extent of data qualification. Client managers are not responsible for numerical errors, wrong analysis dates and other information which is the responsibility of LEVEL 1 and LEVEL 2 REVIEW.

5. Responsibilities

LEVEL 1 REVIEW

The operations supervisors are directly responsible for the approval of the analysis and the LEVEL 1 REVIEW CHECKLIST. The analysts are responsible for the analyst items on the checklist and being aware of what takes place during LEVEL 2 REVIEW.

LEVEL 2 REVIEW

The peer reviewers in each data review group (inorg., GC/MS and chromatography) are responsible for the detailed review of all project information as indicated on the LEVEL 2 REVIEW CHECKLIST. The data review supervisor is responsible for a brief examination of the project data and comments, additional comments appropriate for the final report, training reviewers, and developing review procedures to be used for the LEVEL 1 and LEVEL 2 REVIEW.

LEVEL 3 REVIEW

The client managers are responsible for ensuring that the client's needs have been met, that the data appears reasonable and that contractual requirements have been met.

6. Comments

For the review process to be effective in correcting problems and improving data generated in the laboratory, it is essential that reviewers inform operations supervisors and client managers on a regular basis of the problems which have been identified during the review process. Review checklists or written memos would be an effective means for alerting various personnel on problems which could be avoided or should be corrected.

LABORATORY DATA REVIEW FRAMEWORK

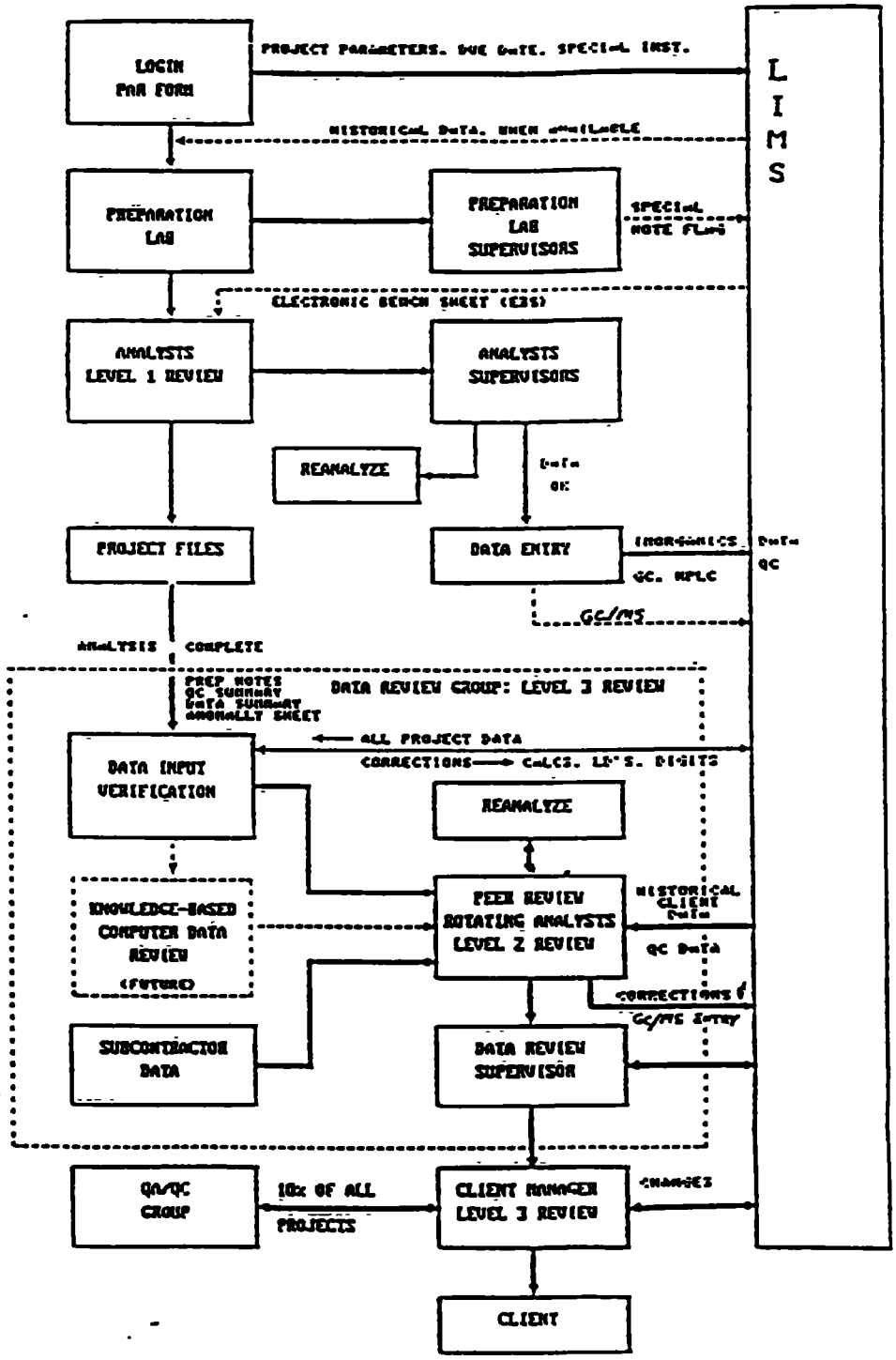


Figure 1 - Laboratory Data Review Framework Form

DATA REVIEW PROGRAM

LEVEL 1 REVIEW CHECKLIST PROJECT # _____

ANALYTICAL TEST_____

ANALYST ITEMS

Y N NA Preparation Lab Notes Reviewed

Y N NA Special Instructions Followed

Y N NA Samples Properly Preserved and in Proper Container

Y N NA Bench Sheets (Data Package Completed With All Information, Including Special Instructions

Y N NA Blank Correction Procedure Followed

Y N NA All Calculations Checked

Y N NA QC Within Limits

Y N NA Out of Control Form Filed

Y N NA Analysis Anomallies Noted

ANALYST COMMENTS:

ANALYSTS REVIEW_____ DATE _____

SUPERVISOR ITEMS

Y N NA Results Appear Reasonable

Y N NA Re-run Decision Documented

Y N NA Holding Time Violations Documented

SUPERVISOR COMMENTS:

SUPERVISOR APPROVAL_____ DATE _____

DATE DATA ENTERED _____BY WHOM_____

Figure 2 - Data Review Program Form

DATA REVIEW PROGRAM

LEVEL 2 REVIEW CHECKLIST PROJECT # _____

INORGANICS: METALS ____ NON-METALS ____

Y N NA Project Assignment Record (LIMS) vs. Actual Data

Y N NA Preparation Lab Notes Reviewed

Y N NA Special Instructions Followed, Check Item
- ____ Project Specific QC
- ____ Raw Data Requested
- ____ Limited Sample Volume
- ____ Special Preparation Needed
- ____ Custom Analytical Test
- ____ Special Holding Times
- ____ Other_____

Y N NA Bench Sheets (Analysis Package) Complete
Y N NA Special Instructions Noted
Y N NA Detection Limits Correct
Y N NA Blank Correction Procedure Followed
Y N NA Significant Digits Correct
Y N NA All Calculations Checked

Y N NA QC Checked and Acceptable
Y N NA QC Lot Assignment Correct
Y N NA Out of Control Form Filed

Y N NA Analysis Anomallies Noted

Y N NA Re-run Decision Documented

Y N NA Analysis Date Reflects Date of Accepted Data

Y N NA Holding Time Violations Documented

Y N NA Camera-Ready Report Cover Sheets Completed
Y N NA Prep sheet Attached
Y N NA Analysis Anomally Sheet Attached
Y N NA Raw Data Attached

LEVEL 2 REVIEW APPROVAL_____ DATE _____

CORRECTIONS ENTERED_____ DATE _____

SUPERVISOR APPROVAL_____ DATE _____

Figure 3 - Data Review Program Form

GC/MS DATA REVIEW CHECKLIST

- ☐ 1. Check LIMS Test vs SOP.
- ☐ 2. Check anomalies sheet and QC forms.
- ☐ 3. Check standard and see if it was updated.
- 4. Look at chromatogram for:
  - ☐ a. carry-over
  - ☐ b. truncating peaks
  - ☐ c. general chromatographic quality
  - ☐ d. very large unknown peaks
- ☐ 5. Recalculate run factors.
- ☐ 6. Check surrogates.
- 7. Check Quant list for:
  - ☐ a. linear ranges
  - ☐ b. co-eluting compounds
  - ☐ c. IS areas
  - ☐ d. carry-over
- ☐ 8. Check spectra for ID's and saturation.
- ☐ 9. Check if TID's are pulled if necessary.
- ☐ 10. Check chromatogram vs Quant list vs TID's.
- ☐ 11. Recalculate all target compounds and TID's.
- ☐ 12. Note any anomalies not on form already.
- ☐ 13. Over-all project review (compound types, ratios).

Figure 4 - GC/MS Data Review Checklist Form

DATA REVIEW PROGRAM

LEVEL 2 REVIEW CHECKLIST PROJECT # _____

CHROMATOGRAPHY

Y N NA Project Assignment Record (LIMS) vs. Actual Data

Y N NA Preparation Lab Notes Reviewed

Y N NA Special Instructions Followed. Check Item
____ Project Specific QC
____ Raw Data Requested
____ Limited Sample Volume
____ Special Preparation Needed
____ Custom Analytical Test
____ Special Holding Times
____ Other_____

Y N NA Bench Sheets (Analysis Package) Complete
Y N NA Special Instructions Noted
Y N NA Detection Limits Correct
Y N NA Blank Correction Procedure Followed
Y N NA Significant Digits Correct
Y N NA All Calculations Checked

Y N NA QC Checked and Acceptable
Y N NA QC Lot Assignment Correct
Y N NA Out of Control Form Filed

Y N NA Analysis Anomallies Noted

Y N NA Re-run Decision Documented

Y N NA Analysis Date Reflects Date of Accepted Data

Y N NA Holding Time Violations Documented

Y N NA Camera-Ready Report Cover Sheets Completed
Y N NA Prep sheet Attached
Y N NA Analysis Anomally Sheet Attached
Y N NA Raw Data Attached

LEVEL 2 REVIEW APPROVAL_____ DATE _____

CORRECTIONS ENTERED_____ DATE _____

SUPERVISOR APPROVAL_____ DATE _____

Figure 5 - Data Review Program Form

STANDARD
OPERATING
PROCEDURE

Subject or Title: SAMPLE LOG-IN		Page 1 of 3
SOP No.: LP-RMA-0003	Revision No.: 2.0	Effective Date: Jan. 04, 1993
Supersedes: 1.0		

ENSECO PROPRIETARY INFORMATION STATEMENT

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1. Purpose:

   To create analyses records in the laboratory computer for notification to lab analysts.

2. Policies:

   Log-in must be completed within 24 hours of authorization. Authorization occurs after all discrepancies are resolved or in some instances approved addendas are received.

Prepared by:		Date: January 04, 1993
Management Approval:		Date: 1/6/93
QA Officer Approval:		Date: 1/6/93

3. Safety:

Always wear gloves, safety glasses and lab coats when handling samples.

4. Procedure:

As log-in proceeds fill out the LOG-IN checklist (Figure 1) and address all the issues on this form.

4.1 Once all discrepancies (as described in the sample receipt SOP LP-RMA-0005) have been resolved as best possible, go to the second page of the project screen in LIMS. Make sure that the correct information regarding turn around time, due date, date of receipt are present. Accept the samples by using the sample delivery acceptance soft key. After each soft key, a "do" or saving key must be used to save the changes. Samples cannot be logged in unless this step is performed.

4.2 Determine group codes for each sample. Samples with the same analytical requests and same matrix type should be grouped together in one group code. Check with the project administrator regarding any special instructions for the samples.

4.3 In LIMS, go to "Group Code"by using the "Group Code" soft key. Add a group code by pressing the "Add Group Code" soft key. In the group code the LIMS sample numbers, matrix type and total sample number fields should be completed.

4.4 Next go to "Test List" using the "Test List" soft key. Use the "Add test list" soft key and add the test codes that are applicable to the client request for each sample as listed on the chain of custody and/or other supporting documentation.

4.5 Create group codes and add the requested tests for all samples with similar sample matrices and analytical requests.

4.6 Add any applicable special instructions for the corresponding groupcode in which the sample(s) is assigned. To input special instructions, the following sequence of soft keys must be used. If others are used, the special instructions will not appear. "Group Code", "Test List", "More Functions", "More Functions", "Group Instruc.", "Add Instruc." If special instructions are long, additional sequences may be necessary. Make sure a note that there are additional sequences is added.

RMAL Industrial Sample Checklist Revision 3.0 February 27, 1992

Project #:_____. Date/Time Received:_____

Company Name & Sampling Site:_____

*Cooler #(s):_____ _____ _____ _____ * Place copy of airbill inside all non-RMAL coolers. Describe here.

Temperatures:_____ _____ _____ _____

UNPACKING & LABELING CHECK POINTS:	Y	N	INITIALS
1. Radiation Checked; (record reading if > 15 mr):	___	___	_____
2. Cooler seals Intact:	___	___	_____
3. Chain of Custody Present:	___	___	_____
4. Bottles broken or leaking (comment if Y): -photograph broken bottles-	___	___	_____
5. Containers labeled (comment if N):	___	___	_____
6. pH of samples taken: -any discrepancies between pH and bottle type? (list below)_____	___	___	_____
7. Chain of Custody signed with date, time & lab:	___	___	_____
8. CoC agrees with bottle count (comment if N):	___	___	_____
9. CoC agrees with labels (comment if N):	___	___	_____
10. VOA samples filled completely (comment if N):	___	___	_____
11. VOA samples preserved:	___	___	_____
12. Sediment present in "D" bottles:	___	___	_____
13. Short holding times:	___	___	_____
14. Matrix QC verified:	___	___	_____
15. Multi phase samples present (comment if Y): -photograph multiphase samples-	___	___	_____
16. Clear picture taken & labeled:	___	___	_____

Comments: include action taken to resolve discrepancies/problems. Include a hard copy of VAX mail or extra paper if more space is needed.

_____

_____

_____

Sign and Date:_____

4.7 Go to the sample list by using the "Sample List" soft key. Add each sample, (use "Add Sample" soft key) filling out all pertinent information such as; sampling date and time, group code, bottle types received. Fill out all fields.

4.8 Print the sample list, and a group code report using a control"R" at the sample list screen and group code screen. The paper work should be placed in the project folder. A level 3 checklist (Figure 2) should already be in the the project folder. Abort from this data base and go into "Project reports". Go to acceptance letter and print the acceptance letter by using the appropriate soft key. By using the appropriate soft keys print the sample description and request list paper work. This paper work should also be place into the project folder.

4.9 Fill out a chain of custody (Figure 3) for subcontracted work if necessary. A purchase order (Figure 4) must also be filled out. For subcontracting to another Enseco facility fill out the Interlaboratory Analysis Request form (Figure 5).

4.10 Perform any compositing, filtering or splitting as necessary. Create any additional preserved bottles if necessary.

4.11 Put samples in the proper locations. Volatiles are placed in separate refrigerators. Waters for organic prep are placed in refrigerators near the Organic prep labs. All other samples are placed by team identification in the walk in refrigerator.

4.12 Place project folder in the appropriate location for the team.

5. Responsibilities:

Project Administrator is responsible for reviewing that the log in has been performed correctly based upon the client's requirements and that sample receiving personnel are notified of log in errors. The Project Administrator is responsible for confirming that errors have been corrected. Sample receiving personnel are responsible for transferring the information received with the samples to the laboratory LIMS system and ensuring that a hard copy of this information is placed into the project folder.

6. Definitions:

Special instructions - Typed instructions in LIMS to the teams and analysts that are necessary to complete the work and can not be indicated by using one of the test codes assigned to the samples.

FIGURE 1

RMAL Industrial Login Review Revision 3.0 February 27, 1992

Project #: _____ Dup'd from project #: _____

Set-up By: _____ Dup'd Group Codes: _____

Logged By: _____ Date: _____

SAMPLE CONTROL REVIEW

	Y	N	INITIALS
1. Chain of Custody filled out correctly:	___	___	_____
2. Short holding time worksheet correct:	___	___	_____
3. Sample bottle/type correct:	___	___	_____
4. Overflow sample storage in special instructions:	___	___	_____
5. All login paperwork included and correct: Sample list, group code report & acceptance letter	___	___	_____
6. Trip blanks, equipment blanks, and field blanks have correct aliquot designation:	___	___	_____
7. Sample disc., request list, and acceptance letter in folder:	___	___	_____

8. Comments: Include action taken to resolve discrepancies. Include hardcopy of VAX mail, or extra paper, if more space is needed. Sign and date.

_____

_____

PROJECT ADMINISTRATOR REVIEW:	Y	N	INITIALS	DATE
Report input sheet:	___	___	_____	_____
Invoice information:	___	___	_____	_____
All discrepancies resolved:	___	___	_____	_____
Sample and test matrices correct:	___	___	_____	_____
Sub paper work correct:	___	___	_____	_____
Clear picture of sub samples in folder	___	___	_____	_____
Special Instructions in LIMS:	___	___	_____	_____
Modified component lists checked:	___	___	_____	_____
Project due, TAT, received & collected dates OK:	___	___	_____	_____
Log released:	___	___	_____	_____

_____

_____

_____

FIGURE 1

LEVEL 3 CHECKLIST

(To be completed at level 3 review prior to reporting projects.)

CLIENT:_____ PROJECT #:_____

	YES	NO
1. Is the chain of custody complete and properly signed? (CHECK: client IDs, date/time collected, date/time received, sample matrix.)	____	____
2a. Have all requested parameters been reported for each sample, including sub-out work and raw data? (CHECK: tests requested and methods referenced.)	____	____
b. Have all miscellaneous items been checked? (CHECK: dry weight vs. wet weight, units, "J" values, "B" flags, reporting limits/dilutions, field parameters reported.)	____	____
c. Will reanalysis data be reported with original data (if requested)?	____	____
3. Are the following forms/checklists available and complete?:		
-industrial report writing checklists	____	____
-anomaly forms	____	____
-out-of-control forms	____	____
-holding time violation forms	____	____
4. Are ALL changes effecting project/program specifications documented and present in the project folder? (This includes phone logs pertinent to the project specifications and project anomalies, all change orders, HT violations, and changes in TAT.)	____	____
5. Is the report consistent with the specifications in the Program Assessment Checklist (PAC)? (This includes format, DQOs, etc.)	____	____
6. Are the project data consistent with related measurements and parameters, including sub-out work? (Does the data make sense from an historical or site specific perspective?)	____	____
7a. Have all non-analytical items and invoice text items been added to the invoice?	____	____
b. If the primary deliverable was late, or holding time violations occurred, have penalties been assessed and has the invoice been adjusted (if applicable)?	____	____

Comments:_____

_____

_____

PA Initials:_____ Date:_____

FIGURE 3

Enseco
A Corning Company

Rocky Mountain Analytical Laboratory
4955 Yarrow Street
Arvada, CO 80002
303/421-6611 FAX: 303/431-7171

CHAIN OF CUSTODY

ENSECO CLIENT	SAMPLE SAFE™ CONDITIONS PACKED BY	SEAL NUMBER
PROJECT	SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY	CONDITION OF CONTENTS
SAMPLING COMPANY	SEALED FOR SHIPPING BY	INITIAL CONTENTS TEMP °C
SAMPLING SITE	SEAL NUMBER	SAMPLING STATUS ☐ Done ☐ Continuing Until
TEAM LEADER	SEAL INTACT UPON RECEIPT BY LAB ☐ Yes ☐ No	CONTENTS TEMPERATURE UPON RECEIPT BY LAB °C

DATE	TIME	SAMPLE ID/DESCRIPTION	SAMPLE TYPE	# CONTAINERS	ANALYSIS PARAMETERS	REMARKS

CUSTODY TRANSFERS PRIOR TO SHIPPING

RELINQUISHED BY (SIGNED)	RECEIVED BY (SIGNED)	DATE	TIME

SHIPPING DETAILS

DELIVERED TO SHIPPER BY

METHOD OF SHIPMENT | AIRBILL NUMBER

RECEIVED FOR LAB | SIGNED | DATE/TIME

ENSECO PROJECT NUMBER

ENS—1133

White - CLIENT Pink - LAB

FIGURE 4

PURCHASE ORDER

NUMBER_____

Show this Purchase Order Number on all correspondence, invoices, shipping papers and packages.

Rocky Mountain Analytical Laboratory
4955 Yarrow Street, Arvada, CO 80002 (303) 421-6611

A DIVISION OF
ENSECO
INCORPORATED

Date

To _____ Contact _____

_____ Phone _____

_____ Date Required _____

Emp. No.	Dept.	Project	Quantity	Item#/Description	Price	Amount	Rec'd	Date

Acknowledge promptly if you are unable to ship complete order by date specified.
Invoice in triplicate.

Signed by _____

SS-012

INTERLABORATORY CHAIN OF CUSTODY

Enseco
A [illegible] Company

FIGURE 3

PAGE OF

SHIP TO:

ATTENTION:

ANALYTICAL REQUESTS

SEND RESULTS TO.

ATTENTION:

EXPORT ID							SAMPLE CONDITION UPON RECEIPT	COMMENTS
TEST PRICE							WRITTEN RESULTS REQUIRED BY (DATE)	VERBAL/FAC RESULTS REQUIRED BY (DATE) / P O No
SUBTOTAL							Q.C. ☐ STANDARD ENSECO ☐ CLP PROTOCOL ☐ PROJECT SPECIFIC _____	
DISCOUNT / SURCHARGE							SAMPLE DISPOSAL ☐ ENSECO ☐ RETURN TO CLIENT ☐ PHONE _____	
TOTAL							DETECTION LIMITS ☐ COMMON PRODUCTS ☐ OTHER*	

*SPECIAL INSTRUCTIONS

HOLDING TIMES ☐ ENSECO ☐ EPA-CLP ☐ TIER ☐ OTHER*

RAW DATA COPIES NEEDED ☐ YES ☐ NO

CUSTODY SEALS INTACT ☐ YES ☐ NO | ☐ WET WEIGHT ☐ DRY WEIGHT

RELINQUISHED DATE / TIME

RECEIVED DATE / TIME

ENS—1109

IMPORT COPY

Subject or Title: Page 1 of 29
USE OF PAR (Project Assignment Record) - Refer to QAPP Section 7.1

SOP No.:	Revision No.:	Effective Date:
LP-RMA-0004	Original	12/9/87

Supersedes:

1. Purpose:

To designate and authorize the tests required for each sample (or sample site) and the matrix of these samples in order for a sample receipt technician to assign these tests in the lab computer.

2. Policies:

PAR's are always filled out before the log-in process may take place. Changing a standard list of analytes for a test logged in must be approved by a senior level manager.

3. Procedure:

a. Choose one of the 4 types of PARs.

Long Form - for projects involving Mass spec., Chromatography, Inorganic and metal work. (Figure 1).
Inorganic - for only inorganic and metals work. (Figure 2)
Chromatography - for only chromatography work. (Figure 3)
Mass Spectrometry - for only Mass spec. work. (Figure 4)

b. Fill in the information at top. Group the samples by similar tests required for the same sample matrix. Indicate the proper sample matrix (Figure 5). Indicate the proper test matrix (see the choices on the PAR).

For tests 01 - water
20 - solid
40 - waste
16 - TCLP
13 - EP TOX

Prepared by:	Date: 12/10/87
Management Approval:	Date: 12/10/87
QA Officer Approval: Robert C. Hamisch	Date: 12/9/87

c. Mark the columns associated with each group of samples for the test desired (with an x). Some exceptions are:

S or Q are required for some tests to indicate single or quad analyses

T or D are required to indicate Total or Dissolved

C is required to indicate a change to a standard list. For any C marked there must be an explanation written on the PAR. For example some analytes might be deleted or added from a standard Priority Pollutant Semivolatile list.

d. New tests that are not on the PAR must be created by the Data Administrator following completion of the Request form (Figure 6). Generic tests are available as place holders while the test is being created.

5. Responsibilities:

Project managers are responsible for the accuracy of the PAR.

6. Comments:

TCLP preps must be assigned. They are not pulled with the job codes. Some tests are not to be changed or modified (ICPLIT). Not all created tests are on the PAR. Most of the tests that RMAL sends to subcontractors must be hand written on the PAR. (Figure 7)

7. Definitions:

Jobcode - groups of tests that will be automatically assigned by the computer by the use of a simple phrase; example RCRA01C assigns all RCRA tests.

LONG FORM pg 1. *Last Revision: 6/8/87 Current Revision: 9/15/87* |Job Code Y N

Project # |Proj Mgr: |Prepared By: |Date: / / |Spcl Inst: Y N

GROUP	Smpl Mtx	Test Mtx	Client Description	RMA Sample Numbers
A				
B				
C				
D				
E				

Hazard Label:

<<< >>> <<<A >>> ORGANIC CHEMISTRY <<< >>> <<< >>>

GC/LC Analyses	Test ID	Matrices	A	B	C	D	E
SDWA Trihalomethanes	THM SDW	01					
* Halogenated Volatile Organics **	601LI	01,20 ,16,46					
Halogenated VOA's (LOW DETECTION LIMIT)	601LIL	20					
* Aromatic Volatile Organics **	602LI	01,20 ,16,46					
Aromatic VOA's (LOW DETECTION LIMITS)	602LIL	20					
Benzene, Tolnene, Ethylbenzene, Xylenes	602BTEX	01,20 ,16,46					
SDWA Volatiles	MCL SDW	01					
Acrolein & Acrylonitrile	*603LI*	*01,20*					
Phenols	604LI	01,20					
Benzidines	*605LI*	*01,20*					
Phthalate Esters	606LI	01,20					
Nitrosamines	607LI	01,20					
Organochlorine Pesticides/PCB's 608	OCP PP	01,20 ,16,46					
OC Pest's/PCB's (LOW DETECTION LIMIT)	OCP PPL	20					
NPDES Organochlorine Pesticides/PCB's	OCP PP	01,20					
* HSL Organochlorine Pesticides/PCB's **	OCP HSL	01,20					
HSL OCP's/PCB's (LOW DETECTION LIMIT)	OCPHSLL	20					
CLP/HSL Organochlorine Pesticides/PCB's	OCP CLP	01,20					
Appendix 8 or 9 Organochlorine Pest/PCB's	OCP AP9	01,20					
TCLP Characteristic Organochlorine Pests.	OCPTCLP	01,20,16,46					
* SDWA Organochlorine Pesticides	OCP SDW	01					
* RCRA Organochlorine Pesticides	OCP RCR	01,20					
PCB's	PCB	01,20, 45					
Nitro-Aromatics & Cyclic Ketones	*609LI*	*01,20*					
* Polynuclear Aromatic Hydrocarbons / 610	LC PNA	01,20 ,16,46					
Haloethers	*611LI*	*01,20*					
Chlorinated Hydrocarbons	*612LI*	*01,20*					
Organophosphate Pesticides **	OPP	01,20					

** Most Modifiable Test C - Change Noted
* Preferred Standard Product (01 & 20 Bolded) 01 & 20 Bolded - Std.Prd. DL

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 2. *Last Revision: 6/8/87 Current Revision: 9/15/87*

GC/LC Analyses (cont.)	Test ID	Matrices	A	B	C	D	E
Appendix 8 or 9 Organophosphorus Pesticides	OPP AP9	01,20					
Appendix 8 or 9 Herbicides	HRB AP9	01,20					
TCDF Herbicides	HRBTCDF	01,20, 16,46					
* SDWA Herbicides	HRB SDW	01					
* RCRA Herbicides **	HRB RCR	01,20					
Triazines	*619LI*	*01,20*					
Carbamate & Urea Pesticides/ HPLC	632LI	01,20					
Penta & Tetrachlorophenol	PCP	01,20					
Ethylene Dibromide (EDB)	504LI	01,20					
Hydrocarbon Scan by FID	GC HYD	01,20					
Boiling Point Distribution By GC	GC BPD	01,20					
Water Miscible Solvents	GC DRI	01					
Semivolatiles by MSD	MSD BNA	01,20					
Volatiles by MSD	MSD VOA	01,20					
Semivolatiles by FID	GC BNA	01,20					
Base Neutrals by FID	GC BN	01,20					
Acids by FID	GC ACD	01,20					
Land Treatment Demonstration / HPLC	LC LTD	01,20,43, 16,46					

GC / MS Analyses							
Priority Pollutant Volatiles	VOA 624	01,20 ,40 16,46					
Pri. Pollutant VOA's (LOW DETECTION LIMIT)	VOA624L	20					
Priority Pollutant Semivolatiles	BNA 625	01,20 ,40 16,46					
Priority Pollutant Acid Organics	ACD 625	01,20 ,40					
Priority Pollutant Base/Neutral Organics	BN 625	01,20 ,40					
* Hazardous Substance List Volatiles	VOA HSL	01,20 ,40 16,46					
HSL Volatiles (LOW DETECTION LIMIT)	VOAHSLL	20					
* Hazardous Substance List Semivolatiles	BNA HSL	01,20,40 16,46					
* Hazardous Substance List Acid Organics	ACD HSL	01,20 ,40					
* Hazardous Substance List Base/Neutral Org	BN HSL	01,20,40					
CLP/HSL Volatiles (TIO's Included)	VOA CLP	01,20,25					

** Most Modifiable Test C-Change noted. Bolded 01 & 20 - Std.Prd.

* Preferred Standard Product (01 & 20 Bolded)

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 3. *Last Revision: 6/8/87 Current Revision: 9/15/87*

GC / MS Analyses (cont.)	Test ID	Matrices	A	B	C	D	E
CLP/ESL Semivolatiles (TID's Included)	BNA CLP	01,20,25					
NPDES Volatiles Organics	VOA 624	01					
NPDES Semivolatiles Organics	BNA 625	01					
Appendix 8 or 9 Volatiles	VOA AP9	01,20,40, 16,46					
Appendix 8 or 9 Semivolatiles	BNA AP9	01,20,40, 16,46					
Appendix 8 or 9 Chlorinated Dioxins & Furans	DXN AP9	01,20 *Div.22*					
CL4-CL8 Dioxions & Furans	DXN	01,20 *Div.22*					
Appendix 8 TID Volatiles	VOATID8	01,20,40, 16,46					
Appendix 8 TID Semivolatiles	BNATID8	01,20,40, 16,46					
TCLP / Waste Characteristic Volatiles	VOATCLP	01,20,40, 16,46					
TCLP / Waste Characteristic Semivolatiles	BNATCLP	01,20,40, 16,46					
TCLP / Land Restriction Volatiles	VOA LRR	01,20,40, 16,46					
TCLP / Land Restriction Semivolatiles	BNA LRR	01,20,40, 16,46					
Refinery Hazardous Constituents Volatiles	VOA REF	01,20,40, 16,46					
Refinery VOA's (LOW DETECTION LIMIT)	VOAREFL	20					
Refinery Hazardous Constituents BNA	BNA REF	01,20,40, 16,46					
Polynuclear Aromatic Hydrocarbons	BN PNA	01,20,40, 16,46					
Polynuclear Aromatic Hydrocarbons SIM	BNSIPNA	01,20,40, 16,46					
Tentative Identification Volatiles	VOA TID	01,20,40, 16,46					
Tentative Identification Semivolatiles	BNA TID	01,20,40, 16,46					
Characterization Volatiles	VOA CHR	01,20,40, 16,46					
Characterization Semivolatiles	BNA CHR	01,20,40, 16,46					
Direct Aqueous Injection Volatiles	VOA DAI	01					
Direct Aqueous Injection Semivolatiles	BNA DAI	01					

Bolded 01 & 20 - Std. Prd.

C - Change Noted

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 4. *Last Revision: 6/8/87 Current Revision: 9/15/87*

<<< >>> <<< >>> INORGANIC CHEMISTRY <<< >>> <<< >>>

Physical Tests	Test ID	Matrices	A	B	C	D	E
@Corrosivity By pH	METPH #	01,20					
Corrosivity, NACE	NACE	01,20					
@Color	NESCOLR	01					
@Odor	ODOR	01					
Particle Size / Hydrometer		20					
Particle Size / Sieve		20					
Ignitability, Closed Cup	FLSHPT	01,20,40					
Percent Oil/Water/Solid (O/W/S)	%OWS	40					
Percent O/W/S (Modified Oven Technique)	%OWSMOD	40					
Oil & Grease / Gravimetric	BAL O&G	01,20					
Oil & Grease / Infrared Spectrometer (IR)	IR O&G	01,20					
Aromatic Oil & Grease / (IR)	IR AO&G	01,20					
Total Petroleum Hydrocarbons (TPH) / (IR)	IR TPH	01,20					
Mineral Tests							
@Specific Conductance	CELSC #	01,20					
@Acidity	METACID	01,20					
@pH	METPH #	01,20					
pH, Paste	METPHP	20					
@Alkalinity, Total/Carb/Bicarb/Hydroxide	METALK	01,20					
Hardness, Titration	HURDARD						
Hardness, ICP	ICPHAR*						
Sodium Adsorption Ratio (SAR)	ICP SAR	01,20					
Cation Exchange Capacity	ICP CEC	20					
Ion Balance Calculation	IONBALCALC						
Ion Balance (Major Cations/Anions)	See Job Code: IONBALANCE						
Oxygen Demand / Carbon							
@Biochemical Oxygen Demand (BOD)	METBOD	01					
Chemical Oxygen Demand (COD)	METCOD	01,20					
Total Organic Carbon (TOC)	TOCTOC#	01 *(20 Div.12)*					
Purgeable Organic Carbon (POC)	TOCPOC	01					
Dissolved Organic Carbon (DOC)	TOCDOC	01					

S-Single & Q-Quad for 01 Matrix Only; Other matrices do not need an additional letter
* T-Total, D-Dissolved, R-Recoverable.
@ SHORT HOLDING TIMES C-Change Noted.

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 5. *Last Revision: 06/08/87 Current Revision: 09/15/87*

Nitrogen	Test ID	Matrices	A	B	C	D	E
Total Kjeldahl Nitrogen (TKN)	TECTKN	01,20					
Ammonia, Nitrogen	TECNH3	01,20					
Ammonia, Distilled	TECNH3T	01,20					
@Nitrite, Nitrogen	TECNO2	01,20					
@Nitrate, Nitrogen	TECNO3	01,20					
Nitrite Plus Nitrate, Nitrogen	TECNOXT	01,20					
@ *Nitrate, IC*	*IC NO3*	*01,20*					
@ *Nitrite, IC*	*IC NO2*	*01,20*					
Total Organic Nitrogen	See Job Code : TON01						
Phosphorus							
@Orthophosphate, Colorimetric	TECO P	01,20					
@Orthophosphate, IC	IC PO4	01,20					
Polyphosphate, IC	IC PPO4	01,20					
Total Phosphorus, Colorimetric	TECT P	01,20					
Phosphorus, ICP	See ICP Suite Compounds						
Solids							
Total Solids (TS)	BALTS	01,20					
Total Suspended (TSS)	BALTSS	01					
@Total Dissolved Solids (TDS)	BALTDS	01					
Total Volatile Solids (TVS)	BALTVS	01,20					
Volatile Suspended Solids (VSS)	BALVSS	01					
@Turbidity (NTU)	SPETURB	01					
Settleable Solids (SS)	CONESS	01					
Microbiology							
@Coliform, Total	COLIF T	01					
@Coliform, Fecal	COLIF F	01					

* S-Single & Quad for 01 Matrix Only; Other matrices do not need an additional letter
T-Total, D-Dissolved, R-Recoverable.
C-Change noted.

@ SHORT HOLDING TIMES Underlined Items Are Preferred

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 6. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Sulphur	Test ID	Matrices	A	B	C	D	E
Sulfate, IC	IC SO4	01,20					
Sulfate, Turbidimetric	SPESO4	01,20					
@Sulfite, Titrimetric	BURSO3	01,20					
@Sulfite, IC	IC SO3	01,20					
Sulfide, Colorimetric	SPES *	01,20					
Sulfide, IC	IC S	01,20					
Sulfur, ICP	See ICP Sulfa Compounds						
Sulfide - Reactive	SPES R	01,20					
Thiosulfate, IC	IC S2O3	01,20					
Thiocyanate, IC	IC SCN	01,20					
Cyanide							
Cyanide, Total	TECCN T	01,20					
Cyanide, Amenable to Chlorination	TECCN F	01,20					
Cyanide, Weak & Dissociable	TECCN W	01,20					
Cyanide, IC	IC CN	01,20					
Cyanide - Reactive	TECCN R	01,20					
Halogens							
Bromide, IC	IC BR	01,20					
Chloride, Titrimetric	BURCL	01,20					
Chloride, IC	IC CL	01,20					
@Chlorine, Residual	POTCL2R	01,20					
Perchlorate, IC	IC ClO4	01,20					
Fluoride, Electrode	METF	01,20					
Fluoride, Distilled, Electrode	METF T	01,20					
Fluoride, IC	*IC F*	*01,20*					
Iodide, IC	IC I	01,20					
Total Organic Halogen (TOX)	TOXTOX*	01,20					
Purgeable Organic Halogen (POX)	TOXPOX	01					
Dissolved Organic Halogen (DOX)	TOXDOX	01					

* S-Single & Q-Quad for 01 matrix only; Other matrices do not need an additional letter
* T-Total, D-Dissolved, R-Recoverable.
@ SHORT HOLDING TIMES, C-Change Noted. Underlined Items Are Preferred

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG-FORM. pg 7. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Radiochemistry	Test ID	Matrices	A	B	C	D	E
Gross Alpha & Beta	RADA&B	01,20					
Lead 210	RAPB210	01,20					
Radium 226	RAD226	01,20					
Radium 228	RAD228	01,20					
Thorium 230	RATH230	01,20					
Uranium, Natural	TOXDOX	01,20					
Other Tests							
Tannin / Lignin		01,20 *Div.22*					
Phenolics (4-AAP)	SPEPHEN	01,20					
@ Surfactants (MBAS)	SPEMBAS	01,20					
CLIENTHOLD							
TCLP Master Preps							
TCLP Prep / EXTRACTABLE Organics Only**	M40TCLPO	40					
TCLP Prep / VOLATILE Organics Only	M40ZHE	40					
TCLP Prep / METALS Only	M40TCLPM	40					
TCLP Prep / METALS & EXRACT. ORGS Only	M40TCLP	40					

** Includes Pesticides

S-Single & Q-Quad for 01 Matrix Only; Other matrices do not need an additional letter.
* D-Dissolved, T-Total, R-Recoverable;
@ SHORT HOLDING TIMES C-Change Noted.

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 8. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Trace Metals by ICP & AA	Test ID	Matrices	A	B	C	D	E
* ICP Scan / 27 Metals, Standard Product	ICP LI*	01,20					
ICP Metals, Soluble Salts	ICP SS	01,20					
ICP Suite / Choose From List Below	ICP*	01,20,T16,T46	See below				

Choose: ICP Suite, AA Metals	Test ID	A	B	C	D	E	Choose: ICP Suite, AA Metals	Test ID	A	B	C	D	E
Aluminum, ICP							Manganese, ICP						
Antimony, Furn AA	FSB*						Mercury, CV AA	CVHG*					
Antimony, ICP							Molybdenum, ICP						
Arsenic, Furn AA	FAS*						Nickel, ICP						
Arsenic, Hyd Gen	DIV. 22						Osmium, ICP						
Arsenic, ICP							Phosphorus, ICP						
Barium, ICP							Potassium, ICP						
Beryllium, ICP							Selenium, ICP						
Boron, ICP							Selenium, Furn AA	FSE*					
Cadmium, Furn AA	FCD*						Selenium, Hyd Gen	*Div. 22*					
Cadmium, ICP							Silica (SiO2), ICP						
Calcium, ICP							Silicon, ICP						
Chromium (III)	CR+3♦						Silver, Furn AA	FAG*					
Chromium (VI)	SPECR6*						Silver, ICP						
Chromium, ICP							Sodium, ICP						
Cobalt, ICP							Strontium, ICP						
Copper, ICP							Sulphur						
Iron, ICP							Thallium, Furn	FTL*					
Lead, Tot Organic							Tin, ICP						
Lead, Furnace AA	FPB*						Titanium, ICP						
Lead, ICP							Uranium, Natural						
Lithium, ICP							Vanadium, ICP						
Magnesium, ICP							Zinc, ICP						

* D-Dissolved, T-Total, R-Recoverable; (01,20,16,46 matrices for ICP* & Furnace Tests)
♦ DIS - Dissolved, TOT- Total.

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

LONG FORM pg 9. *Last Revision: 6/8/87* *Current Revision: 9/15/87*

Inorganic Regulatory Packages	Job Code	Matrices	A	B	C	D	E
Appendix VIII Metals/Inorganics	AP8**MI	01,09,20,40,16					
Appendix IX Metals/Inorganics	AP9**MI	01,09,20,40,16					
Appendix IX Optional-Water Chem. Parameters	IONBALANCE	09					
Hazardous Substance List (HSL) Met/Inorg	HSL**MI	01,09,20,40,16					
CLP / HSL Metals/Inorganics	CLP**MI	01,09,20,40					
SDWA Primary Metals / Inorganics	SDWAP**M/I	01,09					
SDWA Secondary Metals / Inorganics	SDWAS**MI	01,09					
RCRA Total Metals	RCRA**M	01,09,20,40					
RCRA EP I Metals	EPI RCRM	Std.Prd. DL					
RCRA EP II Metals	EPII RCRM						
RCRA Groundwater Suitability	RCRAS**M/I/R	01,09					
RCRA Water Quality Metals/Inorganics	RCRAQ**MI	01,09					
RCRA Groundwater Quality Indicators	RCRAI**MI‡	01,09					
Priority Pollutant Metals	PP**M	01,09,20,40,16					
Priority Pollutant Inorganics	PP**I	01,09,20,40					
Refinery Total Metals (Hazardous Constituent)	REFHC**M	01,09,20,40,16					
Refinery EP I Metals	EPI REFM	40					
Refinery EP II Metals	EPII REFM	40					
NPDES Part A Inorganics	NPDA**I	01					
NPDES Part B Metals / Inorganics / RAD	NPDB**MIR	01					
NPDES Part C Metals / Inorganics	PP**M/I	01,09,20,40					
TCLP Metals Aqueous Leachate	OTC**M	01,20,16					
TCLP Refinery Metals	See REFHC16M						

• S-Single, Q-Quad

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

S LONG FORM pg10. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Item Number	Changes

Comments To Sample Receiving :

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

JOB CODES pg 1 *Last Revision: 4/2/87 Issued: 6/8/87*

SDWA Drinking Water Parameters	LCODE ID	Matrices	A	B	C	D	E
Primary Complete	SDWAP**C	01,09					
Primary Metals	SDWAP**M	01,09					
Primary Inorganics	SDWAP**I	01,09					
Primary Radiochemistry	SDWAP**R	01,09					
Primary Organics	SDWAP**O	01,09					
Secondary Metals / Inorganics	SDWAS**MI	01,09					
Priority Pollutants							
Complete	PP**C	01,09,20,40					
Metals	PP**M	01,09,20,40,16					
Inorganics	PP**I	01,09,20,40					
Organics	PP**O	01,09,20,40,16					
Hazardous Substance List							
Complete	HSL**C	01,09,20,40					
Metals/Inorganics	HSL**MI	01,09,20,40,16					
Organics	HSL**O	01,09,20,40,16					
RCRA Groundwater - Monitoring Parameters							
Suitability Complete	RCRAS**C	01,09					
Suitability Metals	RCRAS**M	01,09					
Suitability Inorganics	RCRAS**I	01,09					
Suitability Radiochemistry	RCRAS**R	01,09					
Suitability Organics	RCRAS**O	01,09					
Quality Metals / Inorganics	RCRAQ**MI	01,09					
Indicator Inorganics	RCRAI**I#	01,09					
CLP / EPA Report Packages							
Complete	CLP C						
Metals / Inorganics	CLP MI						
Organics	CLP O						

S-Single, Q-Quad For 01 & 09 Matrices Only

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

STANDARD
OPERATING
PROCEDURE

Subject or Title: SAMPLE RECEIPT AND CHAIN OF CUSTODY		Page 1 of 3
SOP No.: LP-RMA-0005	Revision No.: 3.0	Effective Date: 1/04/93
Supersedes: 2.0		

ENSECO PROPRIETARY INFORMATION STATEMENT

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1. Purpose:

To document receipt of all samples to the laboratory. To notify lab personnel of all incoming samples. To notify lab personnel of arriving samples that contain short holding parameters. To record the transfer of samples from the client to the lab.

Prepared by:	Date: January 04, 1993
Management Approval:	Date: 1/6/93
QA Officer Approval:	Date: 1/6/93

2. Policies:

Always assign a project number to every group of samples that arrive at the lab regardless of whether work is begun on them or not.

Project numbers are assigned in numerical order, by the LIMS system.

3. Safety:

Proper personal protective equipment must be worn, including lab coats, safety glasses and gloves.

All newly received sample coolers must be opened in an exhaust ventilation hood, and inspected for leaking samples to prevent potential exposure to suspected or unknown hazardous substances that may have vaporized during cooler transport.

If, after initial inspection and during the course of unpacking the samples from the coolers, a situation arises where leaking occurs or any samples begin to offgas or are suspected of offgassing, the sample container and cooler must be returned to the sample receiving hood.

If there are any questions, consult the Enseco Health and Safety Manual or the Health and Safety officer.

4. Procedure:

a. As samples arrive they are given a unique project number for each group of samples from one client.
b. For samples arriving by a courier, check that the custody seals are intact. If broken, note this on the sample checklist. (Figure 1)
c. Sign and date the Chain of Custody (Figure 2). For samples hand delivered, have the client sign and relinquish the chain of custody. Always retain the top copy with the samples and only give a bottom copy to the client.
d. Open the coolers in a hood, unpack the samples and check the information written on the chain of custody against what was received. Compare the bottles with the Bottle Chain of Custody (Figure 3) and all paperwork received. Check for the correct test, sample matrix and properly preserved bottles for each test requested. Document any discrepancies. Note any discrepancies such as missing samples, broken bottles, pH or cooler temperatures greater than 4°C on the chain of custody form and/or the sample check list. Notify the project administrator of discrepancies so that the client may be contacted in a timely manner.

e. Fill out the Sample checklist while unpacking the samples. Be certain to fill out both sides of the checklist. Check all sections.

f. Label all the samples (usually by sampling sites) with a project number and unique sample number (1,2,3,etc.). Record these numbers on the chain of custody next to the client identifications. Have a peer double check that the labelling was done correctly and referenced properly on the chain of custody.

g. Check the pH of all aqueous non-volatile samples which require pH adjustment for preservation and record on the sample checklist. Use pH strips with a range from 0-14. DO NOT DIP THE STRIPS DIRECTLY INTO THE SAMPLE. Use a disposible micro pipet to extract a small amount of sample and saturate the reactive portion of the pH strip. Compare the pH to the pH indicator colors on the box. Notify the project administrator so that the client may be contacted in a timely manner of any discrepancies (Figure 4).

h. Look for any inorganic short holding parameters and sign in these samples on the inorganic short holding notification sheet (Figure 5).

i. Take a picture of the samples. Label a manila file folder with the project number. Place the picture, sample checklist, chain of custody, Level 3 checklist (Figure 6), Bottle Chain of Custody (Figure 3) and any paperwork received in the folder.

j. Bottles needed to analyze the short holding parameters are hand delivered to the laboratory. Have an analyst sign the short hold record to document receipt of samples.

k. Place the samples in boxes and store in the walk in cooler on the appropriate team shelves pending log in.

l. After log-in, deliver the file folder to the appropriate project administrator.

m. If samples or coolers are labeled with "Quarantine Sample" stickers or other USDA labels, consult the Quarantine Sample SOP for proper handling and storage procedures.

5. Responsibilities:

Sample receiving personnel are responsible for signing the chain of custody upon receipt of samples, for knowing the location of the samples except when used by an analyst, and for signing out maximum security samples. Sample receiving personnel are responsible for noting the short holding parameters only when indicated on the paperwork from the client. Project Administrators must notify sample receiving personnel if others are to be included. Sample receiving personnel are responsible for contacting the project administrator regarding any discrepancies so that the client may be notified in a timely manner.

6. Comments:

For maximum security of samples (beyond the storage in the secured facility) an internal chain of custody is provided. Analysts must sign for the samples in a book and sign them in on return. The samples are stored in one of the locked refrigerators.

JOB CODES DS 2. *Last Revision: 4/2/87 Issued: 6/8/87*

Waste Characteristics & Other Tests	JCODE ID	Matrices	A	B	C	D	E
WC Inorganics	RCRAWC40I	40					
EPI/ Metals	EPI RCRM						
EPI/ Organics	EPI RCRO						
EPII Oily Waste Metals	EPII RCRM						
TCLP Waste Characteristic *(mark one: M/O/C)*	OTC**M/O/C	01,20,16					
Land Restriction Rule	LRR**O	01,20,16					
RCRA Metals	RCRA**M	01,09,20,40,16					
Refinery Hazardous Constituents (HC)							
HC Complete	REFHC**C	01,09,20,40,16					
HC Metals	REFHC**M	01,09,20,40,16					
HC Organics	REFHC**O	01,09,20,40,16					
Waste Characteristics - Refinery							
Inorganics	REFWC**I	40					
EPI Metals	EPI REFM						
EPII Oily Waste Metals	EPII REFM						
Appendix 8 List							
Complete	AP8**C	01,09,20,40,16					
Metals / Inorganics	AP8**MI	01,09,20,40,16					
Organics	AP8**O	01,09,20,40,16					
Appendix 9 List							
Complete	AP9**C	01,09,20,40,16					
Metals / Inorganics	AP9**MI	01,09,20,40,16					
Organics	AP9**O	01,09,20,40,16					
Ionbalance							
Complete	IONBALANCE	01,09					
Cations	CATIONS	01,09					
Anions	ANIONS	01,09					

TCLP MASTER,(M40), PREPS : THESE ARE NO LONGER INCLUDED IN JOB CODES !!
YOU MUST PIECE THE M PREPS TOGETHER WITH DESIRED ANALYSES ; SEE FLOWCHARTS

TCLP Prep / EXTRACTABLE Organics Only *	M40TCLPO	40						
TCLP Prep / VOLATILE Organics Only	M40ZHE	40						
TCLP Prep / METALS Only	M40TCLPM	40						
TCLP Prep / METALS & EXTRACT. ORGS Only	M40TCLP	40						

* Includes Pesticides

Figure 1 - Long Form for GC/MS, Inorganic, Metal Analyses

INORG CHEMISTRY pg 1. *Last Revision: 6/8/87 Current Revision: 9/15/87* |Job Code : Y N

Project # |Proj. Mgr.: |Prepared By: |Date: / / |Spcl. Inst: Y N

Group	Smpl Mtx	Test Mtx	Client Description	RMA Sample Numbers
A				
B				
C				
D				
E				

Hazard Label:

Physical Tests	Test ID	Matrices	A	B	C	D	E
@ Corrosivity by pH	METPH #	01,20					
Corrosivity, NACE	NACE	01,20					
@ Color	NESCOLR	01					
@ Odor	ODOR	01					
Particle Size / Hydrometer		20					
Particle Size / Sieve		20					
Ignitability, Closed Cup	FLSHPT	01,20,40					
Percent Oil / Water / Solids	%OWS	40					
Oil & Grease / Gravimetric	BAL O&G	01,20					
Oil & Grease / Infrared Spectrometer (IR)	IR O&G	01,20					
Aromatic Oil & Grease / IR	IR AO&G	01,20					
Total Petroleum Hydrocarbons (TPH) / IR	IR TPH	01,20					
Mineral Tests							
@ Specific Conductance	CELSC #	01,20					
@ Acidity	METACID	01,20					
@ pH	METPH #	01,20					
pH, Paste	METPHP	20					
@ Alkalinity, Total/Carb/Bicarb/Hydroxide	METALK	01,20					
Hardness, Titration	BURHARD						
Hardness, ICP	ICPHAR*						
Sodium Adsorption Ratio (SAR)	ICP SAR	01,20					
Cation Exchange Capacity	ICP CEC	20					
Ion Balance Calculation	IONBALCALC						
Ion Balance (Major Cations/Anions)	See Job Code: IONBALANCE						
Oxygen Demand / Carbon							
@ Biochemical Oxygen Demand (BOD)	METBOD	01					
Chemical Oxygen Demand (COD)	METCOD	01,20					
Total Organic Carbon (TOC)	TOCTOC#	01,*(20 Div.12)*					
Purgeable Organic Carbon (POC)	TOCPOC	01					
Dissolved Organic Carbon (DOC)	TOCDOC	01					

S-Single & Quad for 01 Matrix Only; Other matrices do not need an additional letter
** T-Total, D-Dissolved, R-Recoverable.
C-Change noted.

@ SHORT HOLDING TIMES

Figure 2 - Inorganic and Metal Analyses

INORGANIC CHEMISTRY pg 2. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Nitrogen	Test ID	Matrices	A	B	C	D	E
Total Kjeldahl Nitrogen (TKN)	TECTKN	01,20					
Ammonia, Nitrogen	TECNH3	01,20					
Ammonia, Distilled	TECNHDT	01,20					
@Nitrite, Nitrogen	TECNO2	01,20					
@Nitrate, Nitrogen	TECNO3	01,20					
Nitrite Plus Nitrate, Nitrogen	TECNOXT	01,20					
@*Nitrate, IC*	*IC NO3*	*01,20*					
@*Nitrite, IC*	*IC NO2*	*01,20*					
Total Organic Nitrogen	See Job Code: TON01						
Phosphorus							
@Orthophosphate, Colorimetric	TECO P	01,20					
@Orthophosphate, IC	IC PO4	01,20					
Polyphosphate, IC	IC PPO4	01,20					
Total Phosphorus, Colorimetric	TECT P	01,20					
Phosphorus, ICP	See ICP Suite Compounds						
Solids							
Total Solids (TS)	BALTS	01,20					
Total Suspended Solids (TSS)	BALTSS	01					
Total Dissolved Solids (TDS)	BALTDS	01					
Total Volatile Solids (TVS)	BALTVS	01,20					
Volatile Suspended Solids (VSS)	BALVSS	01					
@Turbidity (NTU)	SPETURB	01					
Settleable Solids (SS)	CONESS	01					
Microbiology							
@Coliform, Total	COLIF T	01					
@Coliform, Fecal	COLIF F	01					
Sulphur							
Sulfate, IC	IC SO4	01,20					
Sulfate, Turbidimetric	SPESO4	01,20					
@Sulfite, Titrimetric	BORSO3	01,20					
@Sulfite, IC	IC SO3	01,20					
Sulfide, Colorimetric	SPES *	01,20					
Sulfur, ICP	See ICP Suite Compounds						
Sulfide - Reactive	SPES R	01,20					
Thiosulfate, IC	IC S2O3	01,20					
Thiocyanate, IC	IC SCN	01,20					

* T-Total, D-Dissolved: for 01 matrix:
Total sulfide only, for 20 matrix.

Underlined Items Are Preferred

Figure 2 - Inorganic and Metal Analyses

INORGANIC CHEMISTRY pg 3. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Cyanide	Test ID	Matrices	A	B	C	D	E
Cyanide, Total	TECCN T	01,20					
Cyanide, Amenable to Chlorination	TECCN F	01,20					
Cyanide, Weak & Dissociable	TECCN W	01,20					
Cyanide, IC	IC CN	01,20					
Cyanide - Reactive	TECCN R	01,20					
Halogens							
Bromide, IC	IC BR	01,20					
Chloride, Titrimetric	HGRCL	01,20					
Chloride, IC	IC CL	01,20					
@Chlorine, Residual	FONCL2R	01,20					
Perchlorate, IC	IC ClO4	01,20					
Fluoride, Electrode	*METF*	*01,20*					
Fluoride, Distilled, Electrode	METF T	01,20					
Fluoride, IC	IC F	01,20					
Iodide , IC	IC I	01,20					
Total Organic Halogen (TOX)	TOXOX#	01,20					
Purgeable Organic Halogen (POX)	TOXPOX	01					
Dissolved Organic Halogen (DOX)	TOXDOX	01					
Radiochemistry							
Gross Alpha & Beta	RADAB	01,20 *Div.12*					
Lead 210	RAPB210	01,20 *Div.12*					
Radium 226	RAD226	01,20 *Div.12*					
Radium 228	RAD228	01,20 *Div.12*					
Thorium 230	RATH230	01,20 *Div.12*					
Uranium, Natural	RADU	01,20 *Div.12*					
Other Tests							
@Tannin / Lignin	DIV. 22	01,20					
Phenolics (4-AAP)	SPEPHEN	01,20					
@Surfactants (MBAS)	SPEMBAS	01,20					
Major Anion Scan by Ion Chromatography	IC SCAN	01,20					
TCLP Master Prep							
TCLP Prep / METALS Only	M40TCLPM	40					

S-Single, Q-Quad, for 01 matrix only; Underlined Items Are Preferred
20 matrix leave blank.

Figure 2 - Inorganic and Metal Analyses

INORGANIC CHEMISTRY pg 4. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Trace Metals by ICP & AA	Test ID	Matrices	A	B	C	D	E
ICP Scan / 27 Metals, Standard Product	ICP LI*	01,20,16					
ICP Metals , Soluble Salts	ICP SS	01,20					
ICP Suite / Choose from Lists Below	ICP*	01,20,T16,T46	See below				

Choose: ICP Suite, AA Metals	Test ID	A	B	C	D	E	Choose: ICP Suite, AA Metals	Test ID	A	B	C	D	E
Aluminum, ICP							Magnese, ICP						
Antimony, Furn AA	FSB*						Mercury, CV AA	CVHG*					
Antimony, ICP							Molybdenum, ICP						
Arsenic, Furn AA	FAS*						Nickel, ICP						
Arsenic, Hyd Gen	DIV. 22						Osmium, ICP						
Arsenic, ICP							Phosphorus, ICP						
Barium, ICP							Potassium, ICP						
Beryllium, ICP							Selenium, ICP						
Boron, ICP							Selenium, Furn AA.	FSE*					
Cadmium, Furn AA	FCD*						Selenium, Hyd Gen	DIV. 22					
Cadmium, ICP							Silica (SiO2), ICP						
Calcium, ICP							Silicon, ICP						
Chromium (III)	CR+3♦						Silver, Furn AA	FAG*					
Chromium (VI)	SPECR6*						Silver, ICP						
Chromium, ICP							Sodium, ICP						
Cobalt, ICP							Strontium, ICP						
Copper, ICP							Sulphur						
Iron, ICP							Thallium, Furn	FTL*					
Lead, Tot Organic							Tin, ICP						
Lead, Furnace AA	FPB*						Titanium, ICP						
Lead, ICP							Uranium, Natural						
Lithium, ICP							Vanadium, ICP						
Magnesium, ICP							Zinc, ICP						

* D-Dissolved, T-Total, R-Recoverable: (01,20,16,46 matrix for ICP* and Furnace Tests)
♦ DIS - Dissolved, TOT- Total.

Figure 2 - Inorganic and Metal Analyses

INORGANIC CHEMISTRY pg 5. *Last Revision: 6/8/87 Current Revision: 9/15/87*

Inorganic Regulatory Packages	Job Code	Matrices	A	B	C	D	E
Appendix VIII Metals / Inorganics	AP8**MI	01,09,20,40,16					
Appendix IX Metals / Inorganics	AP9**MI	01,09,20,40,16					
Appendix IX Optional-Water Chemistry Param	IONBALANCE	09					
Hazardous Substance List (HSL) Met / Inorg	HSL**MI	01,09,20,40,16					
CLP / RSL Metals / Inorganics	CLP**MI	01,09,20,40					
SDWA Primary Metals / Inorganics	SDWAP**M/I	01,09					
SDWA Secondary Metals / Inorganics	SDWAS**MI	01,09					
RCRA Total Metals	RCRA**M	01,09,20,40,16					
RCRA EP I Metals	EPI RCRM						
RCRA EP II Metals	EPII RCRM						
RCRA Groundwater Suitability	RCRAS**M/I/R	01,09					
RCRA Water Quality Metals/Inorganics	RCRAQ**MI	01,09					
RCRA Groundwater Indicators	RCRAI**MI#	01,09					
Priority Pollutant Metals	PP**M	01,09,20,40,16					
Priority Pollutant Inorganics	PP**I	01,09,20,40					
Refinery Total Metals (Hazardous Constituent)	REFHC**M	01,09,20,40,16					
Refinery EP I Metals	EPI REFM	40					
Refinery EP II Metals	EPII REFM	40					
NPDES Part A Inorganics	NPDA**I	01					
NPDES Part B Metals / Inorganics / RAD	NPDB**MIR	01					
NPDES Part C Metals / Inorganics	PP**M/I	01,09,20,40					
TCLP Metals Waste Characteristic Metals	CTC**M	01,20,16					
TCLP Refinery Metals	See REFHC**M						

Item Number	Changes

Comments For Sample Receiving:

S -Single, Q -Quad for 01 matrix only

Figure 2 - Inorganic and Metal Analyses

JOB CODES pg 1 *Last Revision: 4/2/87 Issued: 6/8/87*

SDWA Drinking Water Parameters	LCODE ID	Matrices	A	B	C	D	E
Primary Complete	SDWAP**C	01,09					
Primary Metals	SDWAP**M	01,09					
Primary Inorganics	SDWAP**I	01,09					
Primary Radiochemistry	SDWAP**R	01,09					
Primary Organics	SDWAP**O	01,09					
Secondary Metals / Inorganics	SDWAS**MI	01,09					
Priority Pollutants							
Complete	PP**C	01,09,20,40					
Metals	PP**M	01,09,20,40,16					
Inorganics	PP**I	01,09,20,40					
Organics	PP**O	01,09,20,40,16					
Hazardous Substance List							
Complete	HSL**C	01,09,20,40					
Metals/Inorganics	HSL**MI	01,09,20,40,16					
Organics	HSL**O	01,09,20,40,16					
RCRA Groundwater - Monitoring Parameters							
Suitability Complete	RCRAS**C	01,09					
Suitability Metals	RCRAS**M	01,09					
Suitability Inorganics	RCRAS**I	01,09					
Suitability Radiochemistry	RCRAS**R	01,09					
Suitability Organics	RCRAS**O	01,09					
Quality Metals / Inorganics	RCRAQ**MI	01,09					
Indicator Inorganics	RCRAI**I#	01,09					
CLP / EPA Report Packages							
Complete	CLP C						
Metals / Inorganics	CLP MI						
Organics	CLP O						

* S-Single, Q-Quad For 01 & 09 Matrices Only

Figure 2 - Inorganic and Metal Analyses

JOB CODES - Sr 2. *Last Revision: 4/1/87 Issued: 6/8/87*

Waste Characteristics & Other Tests	J.CODE ID	Matrices	A	B	C	D	E
WC Inorganics	RCRANC40I	40					
EPI/ Metals	EPI RCRM						
EPI/ Organics	EPI RCRO						
EPII Oily Waste Metals	EPII RCRM						
TCLP Waste Characteristic *(mark one: M/O/C)*	OTC**M/O/C	01,20,16					
Land Restriction Rule	LRR**O	01,20,16					
RCRA Metals	RCRA**M	01,09,20,40,16					
Refinery Hazardous Constituents (HC)							
HC Complete	REFHC**C	01,09,20,40,16					
HC Metals	REFHC**M	01,09,20,40,16					
HC Organics	REFHC**O	01,09,20,40,16					
Waste Characteristics - Refinery							
Inorganics	REFWC**I	40					
EPI Metals	EPI REFM						
EPII Oily Waste Metals	EPII REFM						
Appendix 8 List							
Complete	AP8**C	01,09,20,40,16					
Metals / Inorganics	AP8**MI	01,09,20,40,16					
Organics	AP8**O	01,09,20,40,16					
Appendix 9 List							
Complete	AP9**C	01,09,20,40,16					
Metals / Inorganics	AP9**MI	01,09,20,40,16					
Organics	AP9**O	01,09,20,40,16					
Ionbalance							
Complete	IONBALANCE	01,09					
Cations	CATIONS	01,09					
Anions	ANIONS	01,09					

TCLP MASTER,(M40), PREPS : THESE ARE NO LONGER INCLUDED IN JOB CODES !!
YOU MUST PIECE THE M PREPS TOGETHER WITH DESIRED ANALYSES ; SEE FLOWCHARTS

TCLP Prep / EXTRACTABLE Organics Only *	M40TCLPO	40						
TCLP Prep / VOLATILE Organics Only	M40ZHE	40						
TCLP Prep / METALS Only	M40TCLPM	40						
TCLP Prep / METALS & EXTRACT. ORGS Only	M40TCLP	40						

* Includes Pesticides

Figure 2 - Inorganic and Metal Analyses

ORGANIC CHEMISTRY pg 1 *Last Revision: 4/2/87 Issued: 6/8/87* | Job Code Y N

Project # | Proj Mgr: | Prepared By: | Date: / / | Spcl Inst: Y N

GROUP	Smpl Mtx	Test Mtx	Client Description	RMA Sample Numbers
A				
B				
C				
D				
E				

Hazard Label:

GC/LC Analyses	Test ID	Approved Test Matrices	A	B	C	D	E
* SDWA Trihalomethanes	THM SDW	01			-		
* Halogenated Volatile Organics **	601LI	01,20,16,46					
Halogenated VOA Orgs (LOW DETECTION LIMIT)	601LIL	20					
* Aromatic Volatile Organics **	602LI	01,20,16,46					
Aromatic VOA Orgs (LOW DETECTION LIMIT)	602LIL	20					
Benzene, Toluene, Ethylbenzene, Xylenes	602BTEX	01,20,16,46					
SDWA Volatiles	MCL SDW	01					
Acrolein & Acrylonitrile	*603LI*	*01,20*					
Phenols	604LI	01,20					
Benzidines	*605LI*	*01,20*					
Phthalate Esters	606LI	01,20					
Nitrosamines	607LI	01,20					
Organochlorine Pesticides/PCB's 608	OCP PP	01,20					
OCP's/PCB's 608 (LOW DETECTION LIMIT)	OCP PPL	20					
NPDES Organochlorine Pesticides/PCB's	OCP PP	01,20					
* HSL Organochlorine Pesticides/PCB's **	OCP HSL	01,20,16,46					
HSL OCP's/PCB's (LOW DETECTION LIMIT)	OCPHSLL	20					
CLP/HSL Organochlorine Pesticides/PCB's	OCP CLP	01,20					
Appendix 8 or 9 Organochlorine Pest/PCB's	OCP AP9	01,20					
TCLP Characteristic Organochlorine Pests.	OCPTCLP	01,20,16,46					
* SDWA Organochlorine Pesticides	OCP SDW	01					
* RCRA Organochlorine Pesticides	OCP RCR	01,20					
PCB's	PCB	01,20,45					
Nitro-Aromatics & Cyclic Ketones	*609LI*	*01,20*					
Polynuclear Aromatic Hydrocarbons / 610	LC PNA	01,20,16,46					
Haloethers	*611LI*	*01,20*					
Chlorinated Hydrocarbons	*612LI*	*01,20*					
Organophosphate Pesticides **	OPP	01,20					
Appendix 8 or 9 Organophosphate Pesticides	OPP AP9	01,20					
Appendix 8 or 9 Herbicides	HRB AP9	01,20					

** Most Modifiable Test C - Change Noted
* Preferred Standard Product (Bolded 01 & 20) 01 & 20 Bolded - Std.Prd. DL

Figure 3 - Chromotography Analyses

ORGANIC CHEMISTRY pg 2 *Last Revision: 4/2/87 Issued: 6/8/87*

GC/LC Analyses Cont.	Test ID	Matrices	A	B	C	D	E
TCLP Herbicides	HRBTCLP	01,20,16,46					
* SDWA Herbicides **	HRB SDW	01					
* RCRA Herbicides **	HRB RCR	01,20					
Triazines	*619LI*	*01,20*					
Carbamate & Urea Pesticides, HPLC	632LI	01,20					
Penta & Tetrachlorophenol	PCP	01,20					
Ethylene dibromide (EDB)	504LI	01,20					
Hydrocarbon Scan by FID	GC HYD	01,20					
Boiling Point Distribution By GC	GC BPD	01,20					
Water Miscible Solvents	GC DAI	01					
Semivolatiles by MSD	MSD BNA	01,20					
Volatiles by MSD	MSD VOA	01,20					
Semivolatiles by FID	GC BNA	01,20					
Base Neutrals by FID	GC BN	01,20					
Acids by FID	GC ACD	01,20					
Land Treatment Demonstration /HPLC	LC LTD	01,20,16,46					
CODEHOLD							
>>> Other <<<							
TCLP Prep / EXTRACTABLE ORGANICS Only	TCLPO	M40					
TCLP Prep / VOLATILES Only	ZHE	M40					

Item Number	Changes

Comments To Sample Receiving :

** Most Modifiable Test C- Change noted

* Preferred Standard Product (01 & 20 Bolded)

Figure 3 - Chromotography Analyses

JOB CODES pg 1 *Last Revision: 4/2/87 Issued: 6/8/87*

SDWA Drinking Water Parameters	J.CODE ID	Matrices	A	B	C	D	E
Primary Complete	SDWAP**C	01,09					
Primary Metals	SDWAP**M	01,09					
Primary Inorganics	SDWAP**I	01,09					
Primary Radiochemistry	SDWAP**R	01,09					
Primary Organics	SDWAP**O	01,09					
Secondary Metals / Inorganics	SDWAS**MI	01,09					
Priority Pollutants							
Complete	PP**C	01,09,20,40					
Metals	PP**M	01,09,20,40,16					
Inorganics	PP**I	01,09,20,40					
Organics	PP**O	01,09,20,40,16					
Hazardous Substance List							
Complete	HSLA**C	01,09,20,40					
Metals/Inorganics	HSLA**MI	01,09,20,40,16					
Organics	HSLA**O	01,09,20,40,16					
RCRA Groundwater - Monitoring Parameters							
Suitability Complete	RCRAS**C	01,09					
Suitability Metals	RCRAS**M	01,09					
Suitability Inorganics	RCRAS**I	01,09					
Suitability Radiochemistry	RCRAS**R	01,09					
Suitability Organics	RCRAS**O	01,09					
Quality Metals / Inorganics	RCRAQ**MI	01,09					
Indicator Inorganics	RCRAI**I*	01,09					
CLP / EPA Report Packages							
Complete	CLP C						
Metals / Inorganics	CLP MI						
Organics	CLP O						

* S-Single, Q-Quad For 01 & 09 Matrices Only

Figure 3 - Chromotography Analyses

JOB CODES ... 2. *Last Revision: 4/2/87 Issued: 6/8/87*

Waste Characteristics & Other Tests	J.CODE ID	Matrices	A	B	C	D	E
WC Inorganics	RCRAWC40I	40					
EPI/ Metals	EPI RCRM						
EPI/ Organics	EPI RCRO						
EPII Oily Waste Metals	EPII RCRM						
TCLP Waste Characteristic *(mark one: M/O/C)*	OTC**M/O/C	01,20,16					
Land Restriction Rule	LRR**O	01,20,16					
RCRA Metals	RCRA**M	01,09,20,40,16					
Refinery Hazardous Constituents (HC)							
HC Complete	REFHC**C	01,09,20,40,16					
HC Metals	REFHC**M	01,09,20,40,16					
HC Organics	REFHC**O	01,09,20,40,16					
Waste Characteristics - Refinery							
Inorganics	REFWC**I	40					
EPI Metals	EPI REFM						
EPII Oily Waste Metals	EPII REFM						
Appendix 8 List							
Complete	AP8**C	01,09,20,40,16					
Metals / Inorganics	AP8**MI	01,09,20,40,16					
Organics	AP8**O	01,09,20,40,16					
Appendix 9 List							
Complete	AP9**C	01,09,20,40,16					
Metals / Inorganics	AP9**MI	01,09,20,40,16					
Organics	AP9**O	01,09,20,40,16					
Ionbalance							
Complete	IONBALANCE	01,09					
Cations	CATIONS	01,09					
Anions	ANIONS	01,09					

TCLP MASTER,(M40), PREPS : THESE ARE NO LONGER INCLUDED IN JOB CODES !!
YOU MUST PIECE THE M PREPS TOGETHER WITH DESIRED ANALYSES ; SEE FLOWCHARTS

TCLP Prep / EXTRACTABLE Organics Only *	M40TCLPO	40						
TCLP Prep / VOLATILE Organics Only	M40ZHE	40						
TCLP Prep / METALS Only	M40TCLPM	40						
TCLP Prep / METALS & EXTRACT. ORGS Only	M40TCLP	40						

* Includes Pesticides

Figure 3 - Chromotography Analyses

ORGANIC CHEMISTRY pg 1 Issued: 01/07/87 Revised: 03/03/87 |Job Code : Y N

Project # |Proj Mgr: |Prepared By: |Date: / / |Spcl Inst: Y N

GROUP	Smpl Mtx	Test Mtx	Client Description	RMA Sample Numbers
A				
B				
C				
D				
E				

Hazard Label:

GC / MS ANALYSES	Test ID	Approved Test Matrices	A	B	C	D	E
Priority Pollutant Volatiles	VOA 624	01,20,40 16,46					
Priority Pollutant Semivolatiles	BNA 625	01,20,40 16,46					
Priority Pollutant Acid Organics	ACD 625	01,20,40					
Priority Pollutant Base/Neutral Organics	BN 625	01,20,40					
* Hazardous Substance List Volatiles	VOA HSL	01,20,40 16,46					
* Hazardous Substance List Semivolatiles	BNA HSL	01,20,40 16,46					
Hazardous Substance List Acid Organics	ACD HSL	01,20,40					
Hazardous Substance List Base/Neutral Org	BN HSL	01,20,40					
CLP/HSL Volatiles (TID's Included)	VOA CLP	01,20					
CLP/HSL Semivolatiles (TID's Included)	BNA CLP	01,20					
NPDES Volatile Organics	VOA 624	01					
NPDES Semivolatile Organics	BNA 625	01					
Appendix 8 or 9 Volatiles	VOA AP9	01,20,40, 16,46					
Appendix 8 or 9 Semivolatiles	BNA AP9	01,20,40, 16,46					
Appendix 8 or 9 Chlorinated Dioxins & Furans	DXN AP9	Div. 22					
Appendix 8 TID Volatiles	VOATID8	01,20,40, 16,46					
Appendix 8 TID Semivolatiles	BNATID8	01,20,40, 16,46					
TCLP Waste Characteristic Volatiles	VOATCLP	01,20,40, 16,46					
TCLP / Waste Characteristic Semivolatiles	BNATCLP	01,20,40, 16,46					
TCLP / Land Restriction Volatiles	VOA LRR	01,20,40, 16,46					
TCLP / Land Restriction Semivolatiles	BNA LRR	01,20,40, 16,46					
Refinery Hazardous Constituents Volatiles	VOA REF	01,20,40, 16,46					
Refinery Hazardous Constituents BNA	BNA REF	01,20,40, 16,46					
Polynuclear Aromatic Hydrocarbons	BN PNA	01,20,40, 16,46					
Polynuclear Aromatic Hydrocarbons SIM	BNSIPNA	01,20,40, 16,46					
Tentative Identification Volatiles	VOA TID	01,20,40, 16,46					
Tentative Identification Semivolatiles	BNA TID	01,20,40, 16,46					
Characterization Volatiles	VOA CHR	01,20,40, 16,46					
Characterization Semivolatiles	BNA CHR	01,20,40, 16,46					

C - Change Noted

* Preferred Standard Product (01 & 20 Bolded) Bolded 01 & 20 - Std. Prd.

Figure 4 - Mass Spectrometry Analyses

ORGANIC CHEMISTRY pg 2 Issued: 01/07/87 Revised: 03/03/87

GC / MS ANALYSES Cont.	Test ID	Matrices	A	B	C	D	E
Direct Aqueous Injection Volatiles	VOA DAI	01					
Direct Aqueous Injection Semivolatiles	BNA DAI	01					
>>> OTHER <<<							
TCLP Prep for Organics Only	TCLPO	M40					
TCLP Prep for Volatiles	ZHE	M40					
TCLP Prep for Organics & Metals	TCLP	M40					

Item Number	Changes

Comments To Sample Receiving :

Figure 4 - Mass Spectrometry Analyses

. JOB.CODES pg 1. Issued: 03/03/87 Revised: 02/03/87

SDWA Drinking Water Parameters	J.CODE ID	Matrices	A	B	C	D	E
Primary Complete	SDWAP**C	01,09					
Primary Metals	SDWAP**M	01,09					
Primary Inorganics	SDWAP**I						
Primary Radiochemistry	SDWAP**R	01,09					
Primary Organics	SDWAP**O	01,09					
Secondary Metals / Inorganics	SDWAS**MI	01,09					
Priority Pollutants							
Complete	PP**C	01,09,20,40					
Metals	PP**M	01,09,20,40					
Inorganics	PP**I	01,09,20,40					
Organics	PP**O	01,09,20,40					
Hazardous Substance List							
Complete	HSL**C	01,09,20,40					
Metals/Inorganics	HSL**MI	01,09,20,40					
Organics	HSL**O	01,09,20,40					
CLP / EPA Report Packages							
Complete	CLP C						
Metals / Inorganics	CLP MI						
Organics	CLP O						
RCRA Groundwater - Monitoring Parameters							
Suitability Complete	RCRAS**C	01,09					
Suitability Metals	RCRAS**M	01,09					
Suitability Inorganics	RCRAS**I	01,09					
Suitability Radiochemistry	RCRAS**R	01,09					
Suitability Organics	RCRAS**O	01,09					
Quality Metals / Inorganics	RCRAQ**MI	01,09					
Indicator Inorganics	RCRAI**I#	01,09					
Waste Characteristics Tests							
WC Inorganics	RCRAWC40I	40					
EPI/ Metals	EPI RCRM						
EPI/ Organics	EPI RCRO						
EPII Oily Waste Metals	EPII RCRM						

S-Single, Q-Quad For 01 & 09 Matrices Only

Figure 4 - Mass Spectrometry Analyses

JOB CODES pg 2. Issued: 03/03/87 Revised: 02/01/87

Refinery Hazardous Constituents (HC)	J.CODE ID	Matrices	A	B	C	D	E
HC Complete	REFHC**C	01,09,20,40					
HC Metals	REFHC**M	01,09,20,40					
HC Organics	REFHC**O	01,09,20,40					
Waste Characteristics - Refinery							
Inorganics	REFWC**I	40					
EPI Metals	EPI REFM						
EPII Oily Waste Metals	EPII REFM						
Appendix 8 List							
Complete	AP8**C	01,09,20,40					
Metals / Inorganics	AP8**MI	01,09,20,40					
Organics	AP8**O	01,09,20,40					
Appendix 9 List							
Complete	AP9**C	01,09,20,40					
Metals / Inorganics	AP9**MI	01,09,20,40					
Organics	AP9**O	01,09,20,40					
Ionbalance							
Complete	IONBALANCE	01,09					
Cations	CATIONS	01,09					
Anions	ANIONS	01,09					
TCLP - Refinery							
Complete	TCLPREF						
Metals	TCLPREFM						
Semivolatiles	TCLPREFBNA						
Volatiles	TCLPREFVOA						
TCLP - Waste Characteristics 6/13/86 Federal Registry							
(Federal Register) Complete	TCLPC						
Metals	TCLPM						
Semivolatiles	TCLPBNA						
Herbicides	TCLPHERB						
Pesticides	TCLPPEST						
TCLP - Land Restriction Rule							
Complete	TCLPLRRC						
TCLP Other							
601 List	TCLP601						
602 List	TCLP602						
PNA by 610	TCLPPNA						
Other							
RCRA Metals	RCRA**M	01,09,20,40					

Figure 4 - Mass Spectrometry Analyses

FIGURE 1

RMAL Industrial Sample Checklist Revision 3.0 February 27, 1992

Project #:_____ Date/Time Received:_____

Company Name & Sampling Site:_____

*Cooler #(s):_____ _____ _____ _____ * Place copy of airbill inside all non-RMAL coolers. Describe here.

Temperatures:_____ _____ _____ _____

UNPACKING & LABELING CHECK POINTS:	Y	N	INITIALS
1. Radiation Checked; (record reading if > 15 mr):	___	___	_____
2. Cooler seals Intact:	___	___	_____
3. Chain of Custody Present:	___	___	_____
4. Bottles broken or leaking (comment if Y): -photograph broken bottles-	___	___	_____
5. Containers labeled (comment if N):	___	___	_____
6. pH of samples taken: -any discrepancies between pH and bottle type? (list below)_____	___	___	_____
7. Chain of Custody signed with date, time & lab:	___	___	_____
8. CoC agrees with bottle count (comment if N):	___	___	_____
9. CoC agrees with labels (comment if N):	___	___	_____
10. VOA samples filled completely (comment if N):	___	___	_____
11. VOA samples preserved:	___	___	_____
12. Sediment present in "D" bottles:	___	___	_____
13. Short holding times:	___	___	_____
14. Matrix QC verified:	___	___	_____
15. Multi phase samples present (comment if Y): -photograph multiphase samples-	___	___	_____
16. Clear picture taken & labeled:	___	___	_____

Comments: include action taken to resolve discrepancies/problems. Include a hard copy of VAX mail or extra paper if more space is needed.

_____

_____

_____

Sign and Date:_____

FIGURE 1

RMAL Industrial Login Review Revision 3.0 February 27, 1992

Project #: _____ Dup'd from project #: _____

Set-up By: _____ Dup'd Group Codes: _____

Logged By: _____ Date: _____

SAMPLE CONTROL REVIEW

	Y	N	INITIALS
1. Chain of Custody filled out correctly:	___	___	_____
2. Short holding time worksheet correct:	___	___	_____
3. Sample bottle/type correct:	___	___	_____
4. Overflow sample storage in special instructions:	___	___	_____
5. All login paperwork included and correct: Sample list, group code report & acceptance letter	___	___	_____
6. Trip blanks, equipment blanks, and field blanks have correct aliquot designation:	___	___	_____
7. Sample disc., request list, and acceptance letter in folder:	___	___	_____

8. Comments: Include action taken to resolve discrepancies. Include hardcopy of VAX mail, or extra paper, if more space is needed. Sign and date.

_____

_____

PROJECT ADMINISTRATOR REVIEW:	Y	N	INITIALS	DATE
Report input sheet:	___	___	_____	_____
Invoice information:	___	___	_____	_____
All discrepancies resolved:	___	___	_____	_____
Sample and test matrices correct:	___	___	_____	_____
Sub paper work correct:	___	___	_____	_____
Clear picture of sub samples in folder	___	___	_____	_____
Special Instructions in LIMS:	___	___	_____	_____
Modified component lists checked:	___	___	_____	_____
Project due, TAT, received & collected dates OK:	___	___	_____	_____
Log released:	___	___	_____	_____

_____

_____

_____

FIGURE 2

Enseco
A Corning Company

Rocky Mountain Analytical Laboratory
4955 Yarrow Street
Arvada, CO 80002
303/421-6611 FAX: 303/431-7171

CHAIN OF CUSTODY

ENSECO CLIENT

PROJECT

SAMPLING COMPANY

SAMPLING SITE

TEAM LEADER

SAMPLE SAFE™ CONDITIONS

PACKED BY

SEAL NUMBER

SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY

CONDITION OF CONTENTS

SEALED FOR SHIPPING BY

INITIAL CONTENTS TEMP. °C

SEAL NUMBER

SAMPLING STATUS ☐ Done ☐ Continuing Until

SEAL INTACT UPON RECEIPT BY LAB ☐ Yes ☐ No

CONTENTS TEMPERATURE UPON RECEIPT BY LAB °C

DATE	TIME	SAMPLE ID/DESCRIPTION	SAMPLE TYPE	# CONTAINERS	ANALYSIS PARAMETERS	REMARKS

CUSTODY TRANSFERS PRIOR TO SHIPPING

RELINQUISHED BY (SIGNED)	RECEIVED BY (SIGNED)	DATE	TIME

SHIPPING DETAILS

DELIVERED TO SHIPPER BY

METHOD OF SHIPMENT

AIRBILL NUMBER

RECEIVED FOR LAB

SIGNED

DATE/TIME

ENSECO PROJECT NUMBER

ENS-1133

White - CLIENT Pink - LAB

Enseco
A Corning Company

Rocky Mountain Analytical Laboratory
4955 Yarrow Street
Arvada, CO 80002
303/421-6611 FAX: 303/431-7171

FIGURE 3

BOTTLE ORDER CHAIN OF CUSTODY

ENS—4002

CLIENT ID	CLIENT P.O. NUMBER		INVOICE NUMBER
SHIP TO	PICK-UP ON (DATE)	TIME ☐ AM ☐ PM	DELIVERED BY (DATE)
	SHIP BY		
	UPS CHARGES	FED EX CHARGES	CLIENT FED EX ACCOUNT NUMBER
	COOLERS BILLED TO (SPECIFY CLIENT ID)		

DI _____ GALLONS | CARBON FREE _____ GALLONS | MILLI-Q _____ GALLONS

NUMBER OF BOTTLES	STANDARD WATER	PARAMETERS
	1. 32 oz. poly (WM)	Alkalinity, BOD, Chloride, Color, Res. Chlorine, pH, Chromium (VI), Conductance, Flouride, Nitrite, MBAS, Ortho-Phos., Solics, Sulfate, Sulfite, Turbidity
	2. 16 oz. glass (BR) 50% H2SO4	Ammonia, COD, Nitrate, TKN, TON, Nitrate & Nitrite, Total Phos., TOC, Phenolics
	3. 32 oz. glass (BR) 50% H2SO4	TPH, Oil & Grease
	4. 16 oz. poly (WM) 20% HNO3	Metals, Hardness
	5. 2-32 oz. poly (BR) 20% HNO3	Gross Alpha, Gross Beta, Uranium, Radium 225, Radium 228
	6. 8 oz. poly (WM) 50% NaOH	Total and/or Free Cyanide
	7. 8 oz. poly (WM) Zn Ac & NaOH	Sulfide
	8. 4.5 oz. poly sterilize	Fecal or Total Coliform (use 2 bottles if both required)
	10. 3-40 ml glass w/septa, Na2S2O3	THM
	10A. Trip Blank	
	11. 3-40 ml glass w/septa, HCL w/out HCL	VOA, Purgeable Organics
	11A. Trip Blank	
	12. 2-32 oz. glass (BR)	Base Neutral/Acid Compounds
	13. 2-32 oz. glass (BR)	Pesticides, PCBs
	14. 32 oz. glass (BR)	Herbicides
	15. Single: 8 oz. amber glass (BR) Quad: 32 oz. amber glass (BR) 50% H2SO4	TOX–Single: –Quad:

NUMBER OF BOTTLES	BULK WATER	PARAMETERS
	20. ½ gallon glass	Bulk water analysis
	21. 1 gallon glass	
	SOLIDS	
	30. 16 oz. glass (WM)	Organics, TPH, Metals, RAD, Oil & Grease
	31. 8 oz. glass (WM)	Wet Chem not listed for "30
	32. 4 oz. glass (WM)	VOA
	TCLP	
	33. 32 oz. glass (WM) 4 oz. glass (WM)	All other analytes VOA
	OTHER	

BLUE ICE REQUIRED ☐ YES ☐ NO

SPECIAL REQUIREMENTS

SAMPLE SAFE/COOLER NUMBERS

REQUEST BY | DATE | TIME ☐ AM ☐ PM

RELINQUISHED BY SIGNATURE	RECEIVED BY SIGNATURE	DATE	TIME

FIGURE 4

ENSECO

pH GUIDELINE FOR SAMPLE RECEIPT

BOTTLE TYPE #	EXPECTED pH
1	neutral 5-7
2	<2
3	<2
4	<2
5	<2
6	>12
7	>9
8	neutral 5-7
10	Check done at analysis
10a	Check done at analysis
11	Check done at analysis
11a	Check done at analysis
12	Neutral 5-7
13	Neutral 5-7
14	Neutral 5-7
15	<2

FIGURE 3

SHORT HOLD SHEET

TEAM	P.A.	PROJECT NUMBER	WET CHEM:
CLIENT			SIGN FOR SY
COLLECTED	DATE RECEIVED	RAW DATA ☐ YES	DATE / TIME
SPECIAL INSTRUCTIONS		SAMPLE NUMBER REQUIRED ANALYSIS	

	HOLDING TIME ANALYSIS	METHOD NO.	CHECK		CHECK		CHECK	
AS SOON AS POSSIBLE	DISSOLVED OXYGEN (O_2)	360.1						
	SULFITE (SO_3^{-2})	377.1						
TWENTY-FOUR (24) HOURS	PH ☐ SINGLE ☐ DUP. ☐ QUAD.	9040						
	CONDUCTIVITY ☐ SINGLE ☐ DUP. ☐ QUAD.	120.1						
	ALKALINITY	310.1						
	CHLORINE RESIDUAL	330.1						
	CHROMIUM HEX (CR^6)	218.4						
	COLIFORM, FECAL	909C						
	COLIFORM, TOTAL	9132						
	ODOR	140.1						
FORTY-EIGHT (48) HOURS	BIO. O_2 DEMAND (BOD)	405.1						
	COLOR	110.2						
	MBAS - SURFACTANTS	425.1						
	NITRITE (NO_2) (SPEC)	354.1						
	NITRATE (NO_3) (TEC)	353.2						
	NITRATE (IC)	300.0						
	ORTHO - PHOSPHATE (SPEC)	365.3						
	ORTHO - PHOSPHATE (IC)	300.0						
	TURBIDITY	180.1						
	SETTLEABLE SOLIDS	209-E						
OTHER	TDS (NEED CONDUCTANCE)	160.1						
	SULFIDE (D, AT)	376.2						
	ION BALANCE (NEED ph, COND., ALK., TDS)	104C						

FIGURE 6

LEVEL 3 CHECKLIST

(To be completed at level 3 review prior to reporting projects.)

CLIENT:_____ PROJECT #:_____

	YES	NO
1. Is the chain of custody complete and properly signed? (CHECK: client IDs, date/time collected, date/time received, sample matrix.)	____	____
2a. Have all requested parameters been reported for each sample, including sub-out work and raw data? (CHECK: tests requested and methods referenced.)	____	____
b. Have all miscellaneous items been checked? (CHECK: dry weight vs. wet weight, units, "J" values, "B" flags, reporting limits/dilutions, field parameters reported.)	____	____
c. Will reanalysis data be reported with original data (if requested)?	____	____
3. Are the following forms/checklists available and complete?:		
-industrial report writing checklists	____	____
-anomaly forms	____	____
-out-of-control forms	____	____
-holding time violation forms	____	____
4. Are ALL changes effecting project/program specifications documented and present in the project folder? (This includes phone logs pertinent to the project specifications and project anomalies, all change orders, HT violations, and changes in TAT.)	____	____
5. Is the report consistent with the specifications in the Program Assessment Checklist (PAC)? (This includes format, DQOs, etc.)	____	____
6. Are the project data consistent with related measurements and parameters, including sub-out work? (Does the data make sense from an historical or site specific perspective?)	____	____
7a. Have all non-analytical items and invoice text items been added to the invoice?	____	____
b. If the primary deliverable was late, or holding time violations occurred, have penalties been assessed and has the invoice been adjusted (if applicable)?	____	____

Comments: _____

_____

_____

PA Initials: _____ Date: _____

APPENDIX B

STANDARD OPERATING PROCEDURES

INDEX OF STANDARD OPERATING PROCEDURES

SOP NUMBER	SUBJECT	NO. OF PAGES
DEN-MS-0005	Polynuclear Aromatic Hydrocarbons by Selective Ion Monitoring for City of St. Louis Park	23
DEN-WC-0002	Total Recoverable Phenolics - City of St. Louis Park	15

Quanterra
Environmental Services

Controlled Copy UNCONTROLLED COPY
Copy No._____

SOP No. DEN-WC-0002
Revision No. 0
Revision Date: 5/24/96
Page: 1 of 15

OPERATION-SPECIFIC STANDARD OPERATING PROCEDURE

TITLE: TOTAL RECOVERABLE PHENOLICS - CITY OF ST. LOUIS PARK (MANUAL)

(SUPERSEDES: LM-RMA-1112, REVISION 1.0)

Prepared by: Thom Schumann

Reviewed by: _____ 5/29/96
Technical Specialist, Kurt Ill

Approved by: _____ 5/29/96
Quality Assurance Manager, Larry Penfold

Approved by: _____ 5/30/96
Environmental Health and Safety Coordinator, Brett Allison

Approved by: _____ 5/29/96
Laboratory Director, Thomas Daniels

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1. SCOPE AND APPLICATION

1.1. This method measures steam-distillable phenolic materials which react with the color reagents under the conditions of the analysis.

1.2. The detection limit is 5 µg/L as Phenol.

1.3. This method is applicable to the analysis of drinking, surface and saline waters, domestic and industrial wastes, and soil samples.

1.4. The range extends to 0.1 mg/L. The range can be extended by dilution of the samples.

1.5. Approximate preparation time is 2 hours for a group of 10 samples. Analytical time is about 15 minutes per sample.

2. SUMMARY OF METHOD

The sample is acidified and distilled to separate phenolics from interfering compounds. Phenolics in the distillate react with 4-aminoantipyrene in the presence of potassium ferricyanide at pH 10 to form a reddish-brown dye, which is extracted into chloroform and measured colorimetrically at 460 nm.

3. DEFINITIONS

Total Recoverable Phenols - hydroxy derivatives of benzene. Specifically, this procedure is limited to steam-distillable, recoverable, phenols. The 4-AAP color reagent is sensitive to ortho- and meta-substituted phenols. It is also sensitive to limited categories of para-substituted phenols. All forms of phenols are calculated and reported as phenol (C_6H_5OH).

4. INTERFERENCES

4.1. Most direct interferences are eliminated by distillation of an acidified sample. Phenolic compounds distill with the water but interfering compounds do not.

4.2. Some phenolic compounds are not steam-distillable and will not be determined.

4.3. The colors produced by various phenolic compounds are not the same, so the response will depend on the compounds actually present in the samples. Phenol has been selected as the calibration standard since it is not possible to reproduce the

mixture of compounds present in the sample. The result obtained will represent the minimum concentration of phenolics present in the sample.

4.4. Interference from sulfur compounds is eliminated by acidification and addition of copper sulfate.

4.5. Oxidizing agents such as chlorine will oxidize phenolic compounds and must be removed.

4.6. Oil may distill over and interfere with the analysis.

4.7. Aromatic amines may react with nitrite (if present) to produce phenolic compounds.

5. SAFETY

5.1. Procedures shall be carried out in a manner that protects the health and safety of all Quanterra associates.

5.2. Eye protection that satisfies ANSI Z87.1 (as per the Chemical Hygiene Plan), laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately. VITON gloves may be worn when halogenated solvents are used for extractions or sample preparation. Nitrile gloves may be worn when other solvents are handled.

Note: VITON is readily degraded by acetone: all solvents will readily pass through disposable latex rubber gloves.

5.3. The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the Material Safety Data Sheets (MSDS) maintained in the laboratory. The following specific hazards are known:

5.3.1. Phenol is **extremely** toxic and can be absorbed through the skin. Handle only in a fume hood and wear gloves. In case of skin contact, flush with water for at least 15 minutes. Notify your supervisor or safety officer of any exposures.

5.3.2. The following materials are known to be **corrosive**:

Sulfuric acid.

5.4. Exposure to chemicals must be maintained **as low as reasonably achievable**, therefore, unless they are known to be non-hazardous, all samples must be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.5. The preparation of standards and reagents and glassware cleaning procedures that involve solvents such as methylene chloride will be conducted in a fume hood with the sash closed as far as the operation will permit.

5.6. All work must be stopped in the event of a known or potential compromise to the health and safety of a Quanterra associate. The situation must be reported **immediately** to a laboratory supervisor.

6. EQUIPMENT AND SUPPLIES

6.1. All-glass distillation apparatus consisting of 500 mL round-bottom flask with side arm, coil condenser, heating mantle with controller, and associated adapters and hardware.

6.2. Recirculating chiller.

6.3. pH meter and electrode.

6.4. Separatory funnels, 500 mL, with supporting rack.

6.5. Porcelain spot-test plate.

6.6. Spectrophotometer with 2 cm cells and capable of measuring at 460 nm.

6.7. Filter funnels.

6.8. Filter paper, Whatman 41.

6.9. Micropipettes with disposable tips, 10 µL, 20 µL, 1 mL.

6.10. Miscellaneous laboratory apparatus and glassware.

7. REAGENTS AND STANDARDS

7.1. Sulfuric Acid, 50%

Slowly add 500 mL concentrated sulfuric acid to 500 mL deionized water with constant mixing and cool. The reaction is **very** exothermic and should be done with **extreme** caution.

7.2. Boiling stones.

7.3. Copper Sulfate, 10%

Dissolve 100 g cupric sulfate 5-hydrate in deionized water and dilute to 1000 mL.

7.4. Ferrous Ammonium Sulfate Solution

Add 1 mL concentrated sulfuric acid to 500 mL deionized water. Add 1.1 g ferrous ammonium sulfate, mix until dissolved, and dilute to 1000 mL.

7.5. Buffer Solution

Dissolve 16.9 g ammonium chloride in 143 mL concentrated ammonium hydroxide and dilute to 250 mL with deionized water. Prepare this solution in a hood. Two milliliters of this solution should adjust the pH of the 100 mL distillate to 10.

7.6. Aminoantipyrene Solution

Dissolve 2.0 g of 4-aminoantipyrene in deionized water and dilute to 100 mL.

7.7. Potassium Ferricyanide Solution

Dissolve 8 g potassium ferricyanide in deionized water and dilute to 100 mL.

7.8. Phenol Stock Standard, 1000 mg/L

Dissolve 1.000 g phenol in deionized water and dilute to 1000 mL.

7.9. Phenol Intermediate Standard, 1.0 mg/L

Dilute 1.0 mL 1000 mg/L Stock Standard to 1000 mL with deionized water.

7.10. Working Standards

Dilute the 1.0 mg/L Intermediate Standard with deionized water as follows:

Aliquot (mL)	Final Vol. (mL)	Conc. (mg/L)
0	200	Blank
1.0	200	0.005
2.0	200	0.010
4.0	200	0.020
10.0	200	0.050
20.0	200	0.100

Note: The standards are not distilled with the samples.

7.11. pH test strips

7.12. Starch/iodide test strips

7.13. Lead Acetate test strips

8. SAMPLE COLLECTION, PRESERVATION AND STORAGE

8.1. Samples are to be collected in glass containers and preserved by adding sulfuric acid to pH < 2 and refrigerating at 4° ± 2°C.

8.2. The holding time is 28 days.

9. QUALITY CONTROL

9.1. QC Samples

9.1.1. A blank (deionized water) is required with every batch of 20 or less samples. The blank must be taken through the entire prep and analysis with the samples. Additional blanks, termed "Initial Calibration blank" (ICB) and "Continuing Calibration Blank" (CCB) are also analyzed. These blanks are used only to evaluate the determinative step and are not distilled. They are analyzed at a frequency of one ICB per 20 samples and one CCB per 10 samples.

9.1.2. Duplicate analyses are performed at a frequency of 5%. Corrective action is performed if the relative difference from the duplicate analysis is greater than 20%.

9.1.3. Matrix spikes will be performed at a frequency of 5%. The spike level is 50 µg/L. The recovery of the matrix spike must be between 75% and 125%. Corrective action is performed if these criteria are not achieved.

9.2. Acceptance Criteria

9.2.1. An acceptable blank must not contain phenolics above the nominal reporting limit of 5 µg/L. If any of the blanks contain phenolics above 5 µg/L, the system is out of control and corrective action must be performed.

9.2.2. Matrix spike recoveries must be between 75% and 125%.

9.2.3. The calibration curve must have a correlation coefficient of at least 0.995.

9.3. Corrective Action

The color reaction is very sensitive to pH and the extraction technique. Check the pH of all samples before developing the color. Use the same extraction technique for all samples and standards.

10. CALIBRATION AND STANDARDIZATION

10.1. The calibration is verified by the analysis of two different laboratory check standards. An "Initial Calibration Verification" (ICV) check standard is analyzed at a frequency of one per 20 samples. This check is carried through the entire procedure, including the distillation step. The measured value from this check standard must be between 75% and 125% of the true value.

10.2. A "Continuing Calibration Verification" (CCV) check standard is analyzed at a frequency of one per 10 samples. This standard is used to verify the determinative step only. The measured value must be between 85% and 115% of the true value.

10.3. If the measured values from the check standards are not within control limits, the system is out of control and corrective action must be performed.

10.4. Save the original blank and standards; new ones do not have to be extracted.

11. PROCEDURE

11.1. One time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo and is approved by a Technical Specialist and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

11.2. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

11.3. Sample Preparation

11.3.1. Measure and record the pH of all water samples. pH test strips may be used.

11.3.2. Check for residual chlorine with starch/iodide test strips. A blue to black color indicates a positive test. Record the result on the bench sheet.

11.3.3. Check for sulfide using lead acetate test strips. A dark color indicates the presence of sulfide. Record the result on the bench sheet.

11.3.4. Measure 200 mL sample into a distillation flask and add a few boiling stones. For soil and waste samples, use 2.0 g and add 200 mL deionized water. Be sure to adjust the pH of soil and waste samples before distillation. Record the exact weight on the bench sheet.

11.3.5. If the chlorine test was positive, add ferrous ammonium sulfate solution until a negative test is obtained.

11.3.6. If the pH is not < 2, add 50% sulfuric acid drop-wise until it is.

11.3.7. If the sulfide test was positive, add 2 mL 10% copper sulfate.

11.3.8. Assemble the distillation apparatus, turn on the cooling water and hood, and start the distillation. Capture the distillate in a 250 mL beaker.

11.3.9. When 150 to 175 mL distillate has been collected, turn off the heating mantle and allow to cool.

11.3.10. Add 25 to 30 mL deionized water and resume distillation until 200 mL has been collected. Turn off the heating mantle and clean out the flask when cool. Do not over distill the samples as this will lead to interferences in the analysis.

11.3.11. Transfer the distillates to 250 mL glass bottles with teflon caps and refrigerate until they are analyzed.

11.4. Spot Test

11.4.1. Place 1 mL aliquots of each sample in the wells of a porcelain spot test plate. Also run a blank (deionized water) and the 0.10 mg/L standard.

11.4.2. Add 20 µL buffer solution to each well and stir.

11.4.3. Add 10 µL aminoantipyrene solution and stir.

11.4.4. Add 10 µL potassium ferricyanide solution and stir.

11.4.5. Compare the color of the samples to the color of the blank and standard. Any samples appearing darker than the standard will require dilution prior to analysis. Make note of these on the bench sheet along with the estimated dilution required. If necessary, dilute the sample and spot check the dilution.

11.5. Dilution Technique

11.5.1. Since the sample volumes may not be exactly 200 mL after distillation, it is not possible to make dilutions volumetrically. Dilutions must be done on a weight basis.

11.5.2. Place a beaker on a top loading balance and zero it.

11.5.3. Pour the entire sample into the beaker and note the weight.

11.5.4. Divide the weight by the required dilution factor to determine the sample weight to be analyzed. For example. if there are 205 g distillate and a 10x dilution is needed, 20.5 g of the distillate should be analyzed.

11.5.5. Measure out this weight of sample for analysis and dilute to a total volume of 200 mL. Return the unused portion of the sample to the original container. Record all dilutions made on the bench sheet.

11.6. Analysis

11.6.1. Place 200 mL sample (or standard) in a 500 mL separatory funnel. Analysis should be performed in a hood.

11.6.2. Add 4 mL buffer solution and mix.

11.6.3. Check the pH with a pH meter (pH paper is not sensitive enough). The pH should be 10 ± 0.2. If necessary, adjust the pH by drop-wise addition of ammonium hydroxide or hydrochloric acid.

11.6.4. Add 2 mL aminoantipyrene solution and mix.

11.6.5. Add 2 mL potassium ferricyanide and mix.

11.6.6. Wait 3 minutes, then add 25 mL chloroform.

11.6.7. Shake the separatory funnel 10 times. Vent chloroform fumes into the hood. Then allow the phases to separate.

11.6.8. Shake the funnel another 10 times and let the chloroform settle.

11.6.9. Filter the chloroform extracts through filter paper into 2 cm cuvettes.

11.6.10. Measure and record the absorbances at 460 nm, **zeroing on chloroform; not the blank.**

12. DATA ANALYSIS AND CALCULATIONS

12.1. Subtract the blank absorbance from the standard and sample absorbances. If the chloroform extract was diluted, divide the blank absorbance by the dilution factor before subtracting.

12.2. Enter the corrected standard readings into a linear least squares program to determine the calibration curve.

12.3. Calculate the sample results from their corrected absorbances using the least squares program. Multiply by any dilutions made during prep or analysis.

12.4. Data Reporting Deliverables

The data packages for total phenolics shall as closely follow CLP deliverables for inorganic analysis as possible. Reports shall contain all applicable CLP forms as well as the associated raw analytical data. The package includes Forms I - III, V and VI (results, initial and continuing calibration verification, blanks, matrix spike and duplicate). The report shall be organized as described in CLP SOW 7/88.

13. METHOD PERFORMANCE

The group/team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience.

14. POLLUTION PREVENTION

This method does not contain any specific modifications that serve to minimize or prevent pollution.

15. WASTE MANAGEMENT

Waste generated in this procedure must be segregated and disposed according to the facility hazardous waste procedure. The Environmental Health and Safety Director should be contacted if additional information is required.

16. REFERENCES

16.1. Method source: EPA Methods 420.1, 420.2

17. MISCELLANEOUS (TABLES, APPENDICES, ETC...)

17.1. Deviations from source method and rationale

17.1.1. There is a discrepancy between the preservation methods and holding times given in the method and those given in the table of containers and preservatives at the front the methods book. We have chosen to use sulfuric acid to adjust the sample pH to 2.

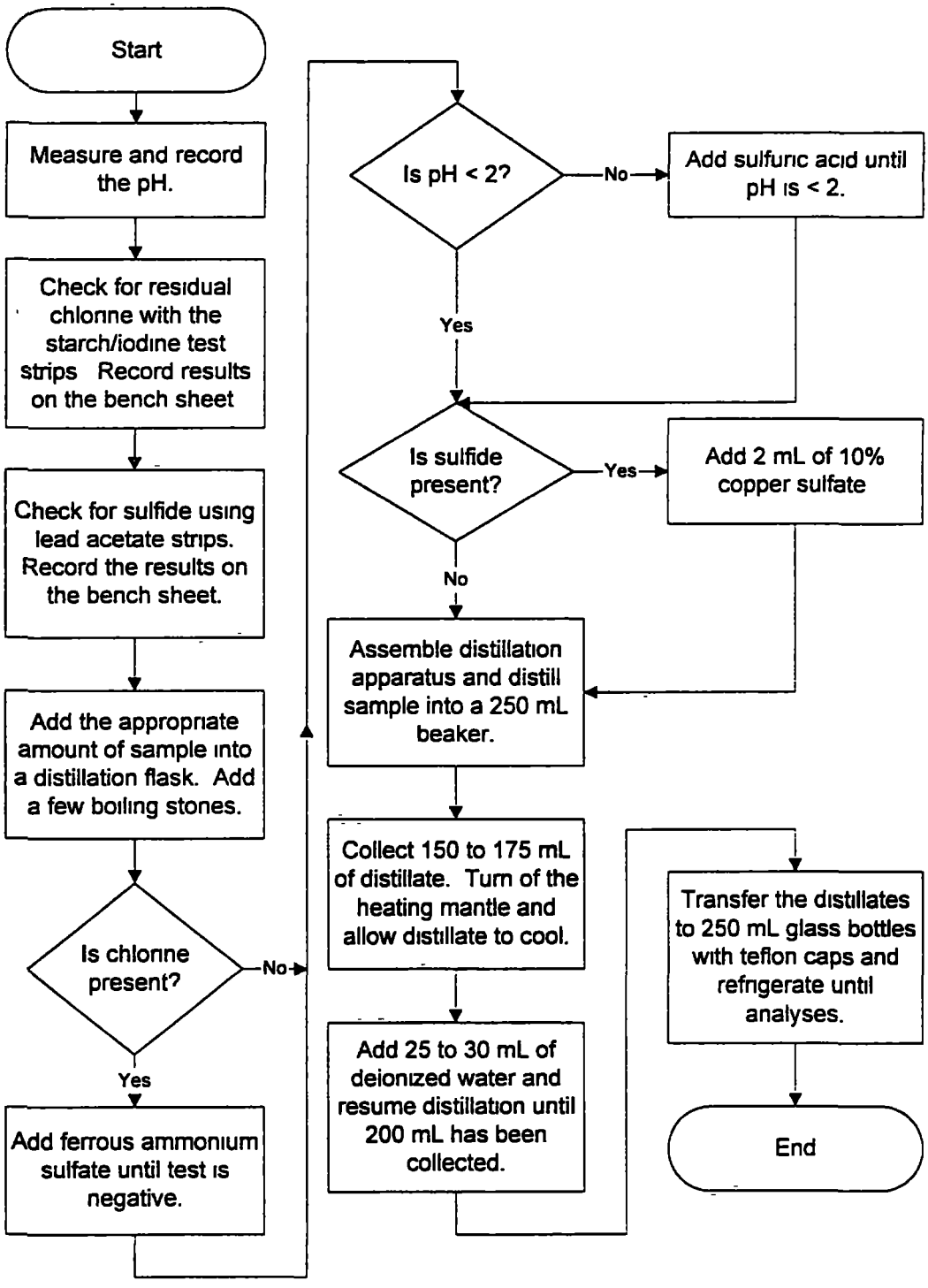
17.1.2. The size of the distillation apparatus and volumes of sample and reagent were reduced to conserve space and speed up the analysis.

17.2. Appendix I: Sample Preparation Flow Chart

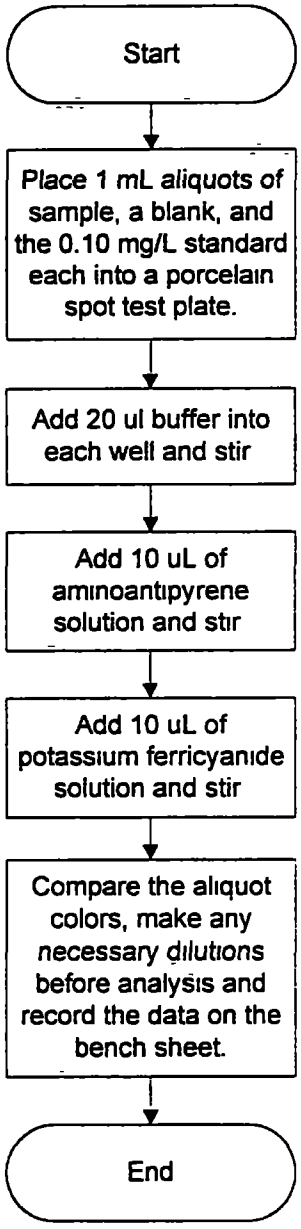
17.3. Appendix II: Spot Test Flow Chart

17.4. Appendix III: Analysis Flow Chart

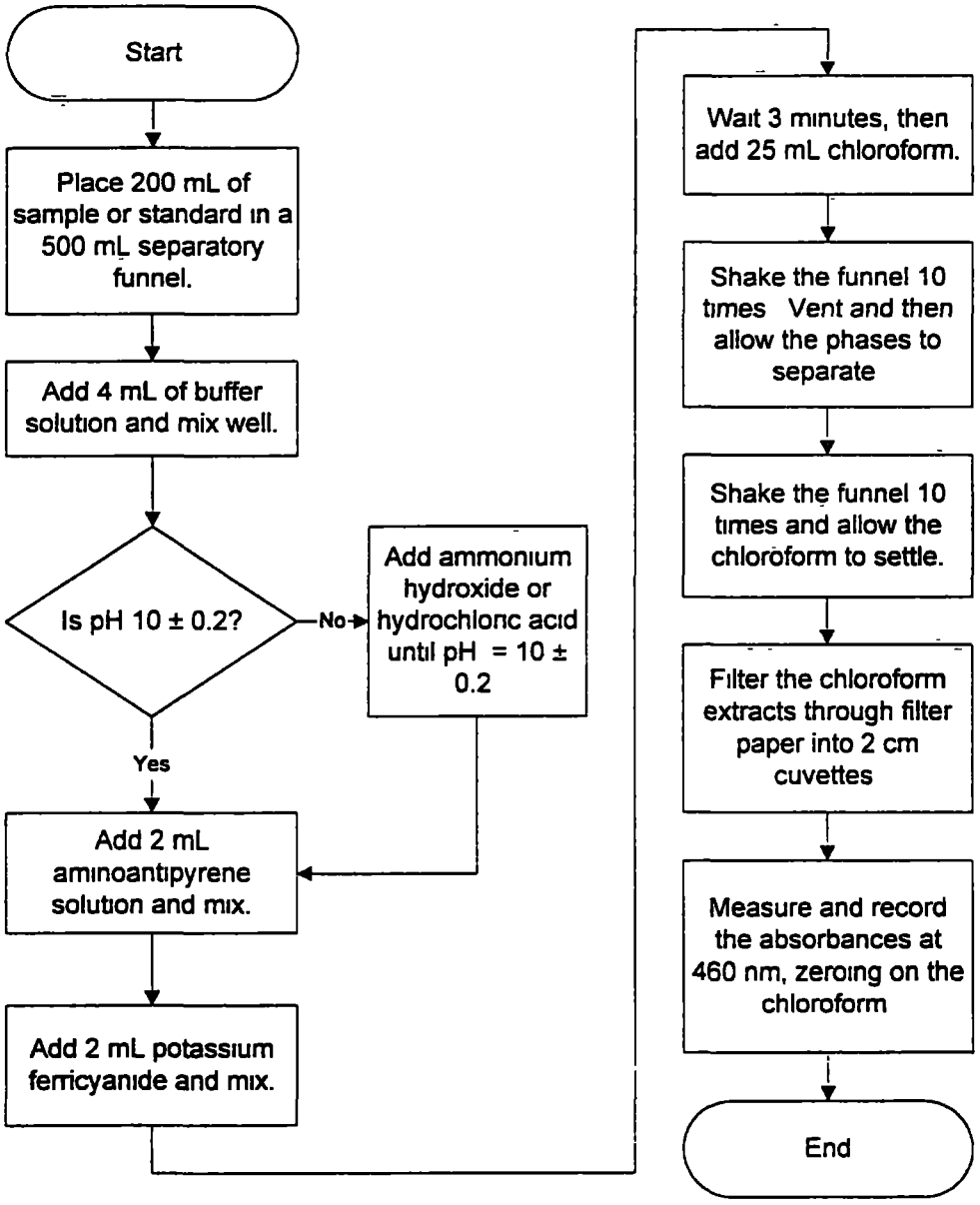
Appendix I: Flow Chart



Appendix II: Spot Test Flow Chart



Appendix III: Analysis Flow Chart



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SOP No DEN-MS-0005
Revision No. 0
Revision Date: 10/11/96
Page: 1 of 23

OPERATION-SPECIFIC STANDARD OPERATING PROCEDURE

TITLE: POLYNUCLEAR AROMATIC HYDROCARBONS BY SELECTIVE ION MONITORING FOR CITY OF ST. LOUIS PARK

(SUPERSEDES: NONE)

Prepared by: Thom Schumann

Reviewed by: _____ 10/11/96
Technical Specialist, Mark Dymerski

Approved by: _____ 10/15/96
Quality Assurance Manager, Larry Penfold

Approved by: _____ 10/14/96
Environmental Health and Safety Coordinator, Brett Allison

Approved by: _____ 10/14/96
Laboratory Director, Thomas Daniels

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1. SCOPE AND APPLICATION

This procedure is a Gas Chromatography/Mass Spectrometry (GC/MS) technique developed for the purposes of measuring polynuclear aromatic hydrocarbons (PAH) at the part per trillion (ppt, ng/L) level. The analyte list for which this method applies is attached. This method should be used for the analysis of water samples previously characterized by a method such as 8270B and containing organic components at less than 10.000 ng/L. Samples containing greater than 10,000 ng/L semivolatile organics should be analyzed by a method designed to detect at higher (ppb) levels.

2. SUMMARY OF METHOD

2.1. This method has been designed for the analysis of polynuclear aromatic hydrocarbons (PAH) and heterocyclic compounds at the part per trillion level (ppt.ng/L) in water. The analysis is carried out by isolation of the target analytes by liquid-liquid extraction of the water sample with an organic solvent. Quantitation of the isolated target analytes is performed by gas chromatography mass spectrometry (GC/MS) in the selected ion monitoring mode (SIM). The compounds listed in Table I can be quantitatively determined using this analytical method.

2.2. This method has three options for the extraction of the samples depending on the sample type. The three options include the low level, the ppt 75 level, and the medium level extraction. The low level and the ppt 75 level options have typical reporting limits of 1.0 ppt. The ppt 75 level includes a higher surrogate and spike level to accommodate dilutions. The medium level option is eighty times higher in detection limits. A volume of sample dependent of the extraction option chosen is extracted with methylene chloride. Analysis of the concentrated extract is performed by gas chromatography/mass spectrometry using the selected ion monitoring scanning mode under electron impact ionization conditions.

3. DEFINITIONS

3.1. Selected Ion Monitoring - A mass spectrometry technique that provides lower detection level capability.

3.2. Primary Ion Area - The signal chosen for quantitation purposes.

3.3. Secondary Ion Area - The signal chosen for identification and confirmation purposes.

4. INTERFERENCES

4.1. Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the ion current profiles. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running laboratory reagent blanks.

4.2. Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the environment being sampled.

4.3. An interference that is unique to selected ion monitoring techniques can arise from the presence of an interfering compound which contains the quantitation mass ion. This event results in a positive interference to the reported value for the compound of interest. This interference is controlled to some degree by acquiring data for a confirmation ion. If the ion ratios between the quantitation ion and the confirmation ion are not the specified limits, then interferences may be present.

5. SAFETY

5.1. Procedures shall be carried out in a manner that protects the health and safety of all Quanterra associates.

5.2. Eye protection that satisfies ANSI Z87.1 (as per the Chemical Hygiene Plan), laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately. VITON gloves may be worn when halogenated solvents are used for extractions or sample preparation. Nitrile gloves may be worn when other solvents are handled.

Note: VITON is readily degraded by acetone; all solvents will readily pass through disposable latex rubber gloves.

5.3. The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the Material Safety Data Sheets (MSDS) maintained in the laboratory. The following specific hazards are known:

5.3.1. Chemicals known to be **flammable** are:

Acetone, methanol, and toluene.

5.4. Exposure to chemicals must be maintained **as low as reasonably achievable**, therefore, unless they are known to be non-hazardous. all samples must be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.5. The preparation of standards and reagents and glassware cleaning procedures that involve solvents such as methylene chloride will be conducted in a fume hood with the sash closed as far as the operation will permit.

5.6. All work must be stopped in the event of a known or potential compromise to the health and safety of a Quanterra associate. The situation must be reported **immediately** to a laboratory supervisor.

6. EQUIPMENT AND SUPPLIES

6.1. Glassware

6.1.1. Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by rinsing with the last solvent used in it. This should be followed by detergent washing with hot water, and rinses with tap water, reagent water, and finally with acetone.

6.1.2. Glassware should **not** be oven dried or heated in a muffle furnace at 400°C for 15 to 30 minutes. Successive solvent rinses of the CLLE, separatory funnel and K/D glassware are required to minimize low level contamination of samples. All of the extraction and concentration glassware must be thoroughly rinsed with toluene, the methylene chloride and lastly acetone. The CLLE and K/D glassware must be rinsed an additional time with methylene chloride prior to usage.

6.1.3. Store glassware inverted or in sealed containers capped with aluminum foil. The use of high purity reagents and solvents helps to minimize interference problems.

6.2. Separatory funnel - 4000 mL with Teflon stopcock or continuous liquid-liquid extractor. 2000 mL or 4000 mL with a condenser.

6.3. Drying column - glass funnel with about 10 cm anhydrous sodium sulfate.

6.4. Concentrator tube, Kuderna-Danish - 10 mL. graduated with separate N-Evap tubes (Kontes K-570050-1025 or equivalent). Calibration must be checked at the volumes employed in the test. Aluminum foil is used to prevent evaporation of extracts.

6.5. Snyder column. Kuderna-Danish - Three-ball macro (Kontes K-503000-0121 or equivalent).

6.6. Evaporative flask, Kuderna-Danish - 500 mL (Kontes K-570001-0500 or equivalent). Attach to concentrator tube with springs or clips.

6.7. Nitrogen evaporation device equipped with a water bath that can be maintained at 30-35°C. The N-Evap by Organomation Associates. Inc.. South Berlin. MA (or equivalent) is suitable.

6.8. Micro reaction vessels. 1.8 mL vials with Teflon caps.

6.9. Gas Chromatograph

The analytical system includes a temperature programmable gas chromatograph and all required accessories including syringes. analytical columns. and gases. The injection port is designed for on-column injection when using packed columns and for splitless injection when using capillary columns.

6.10. A DB-625.5 30 meter fused silica capillary column. 0.5 mm film thickness, or equivalent.

6.11. Mass Spectrometer

6.11.1. A mass spectrometer operating at 70 eV (nominal) electron energy in the electron impact ionization mode and tuned to maximize the sensitivity of the instrument to the compounds being analyzed. The GC capillary column is fed directly into the ion source of the mass spectrometer.

6.11.2. A computer system interfaced to the mass spectrometer allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer has software that allows searching any GC/MS data file for ions of a specific mass and plotting such ion abundances versus time or scan number. The computer allows acquisition at pre-selected mass windows for selected ion monitoring.

7. REAGENTS AND STANDARDS

7.1. Reagent water

Reagent water is defined as water in which the target compounds are not observed at or above the method detection limit.

7.2. Acetone, distilled in glass, or equivalent.

7.3. Methanol, distilled in glass, or equivalent.

7.4. Methylene chloride, distilled in glass, or equivalent.

7.5. Sodium sulfate

(ACS) Granular, anhydrous. Purify by heating at 400°C for 4 hours in a shallow tray.

7.6. Surrogate Spiking Solutions

Depending on the extraction option chosen low, low 75, or medium a surrogate solution is made by weighing an appropriate aliquot of each purified crystal into a volumetric flask and diluting to volume with methanol and added to the sample prior to extraction with methylene chloride. The compounds in the surrogate solutions are naphthalene-d_8, fluorene-d_{10}, and chrysene-d_{12}. The low level surrogate spike solution is at 10 ng/mL. 1.0 mL of the surrogate spike solution is added to 2.0 L of sample. The ppt 75 level surrogate spike solution is at 150 ng/mL. 1.0 mL of the surrogate spike solution is added to 2.0 L of sample. The medium level surrogate spike solution is at 2000 ng/mL. 1.0 mL of the surrogate spike solution is added to 0.5 L of sample.

7.7. Internal Standard Solutions

A solution containing 400 ng/mL of each internal standard is prepared by weighing an appropriate aliquot of each purified crystal into a volumetric flask and diluting to volume with methylene chloride. Fifty microliters of this solution is added to the 0.5 mL extract prior to analysis to give a concentration of the internal standards in the extract of 40 ng/mL.

7.8. Matrix Recovery Standard Spiking Solution

A solution containing the following compounds at the listed concentrations is prepared by weighing an appropriate aliquot of each purified crystal into a volumetric

prepared by weighing an appropriate aliquot of each purified crystal into a volumetric flask and diluting to volume with methanol or acetone. The concentrations of the spiking solution for the low, ppt 75 and medium level extractions are shown below:

Compound	Low spiking Solution (ng/mL)	Medium spiking Solution (ng/mL)	Low 75 spiking Solution (ng/mL)
Naphthalene	20	2000	150
Fluorene	20	2000	150
Chrysene	20	2000	150
Indene	20	2000	150
Quinoline	20	2000	150
Benzo(e)pyrene	20	2000	150
2-methylnaphthalene	20	2000	150

The low level matrix spike solution is at 20 ng/mL. 2.0 mL of the surrogate spike solution is added to 4.0 L of sample. The ppt 75 level matrix spike solution is at 150 ng/mL. 2.0 mL of the surrogate spike solution is added to 4.0 L of sample. The medium level surrogate spike solution is at 2000 ng/mL. 1.0 mL of the surrogate spike solution is added to 0.5 L of sample.

8. SAMPLE COLLECTION, PRESERVATION AND STORAGE

8.1. The samples are collected into four 1-liter or one 1-gallon amber glass containers chilled to 4°C ± 2°C and shipped via over-night carrier to the laboratory.

8.2. The samples must be protected from light and refrigerated at 4°C ± 2°C from the time of receipt until extraction and analysis. After analysis, extracts and unused sample volume must be protected from light and refrigerated at 4°C ± 2°C.

8.3. Samples must be extracted within 5 days of the time of sample receipt. Samples are required to be shipped the same day samples are collected using an overnight carrier.

8.4. Extracts must be analyzed within 40 days from sample extraction.

9. QUALITY CONTROL

The Quality Control measures defined for this method are summarized in Table 9-1

TABLE 9-1

QC Type	Frequency
Internal Standards	each sample
Surrogate	each sample
Matrix spike/spike duplicate	1 set per analytical batch or every 20 samples - which ever is most frequent
Laboratory Control Sample	1 per analytical batch or every 20 samples - which ever is most frequent
Method Blank	1 per analytical batch

9.1. Method Blank

9.1.1. Laboratory reagent water must be treated by extracting with methylene chloride prior to use as method reagent water for this method.

9.1.2. A Method Blank is analyzed with each analytical batch not exceeding 20 samples.

9.1.3. Due to the low level nature of this analysis. low level blank contamination of target analytes is routinely encountered. Target analytes that are detected above the reporting limit in the blank must be flagged on any associated sample's report with a "B" qualifier. If the method blank contains any of the carcinogenic PAHs at concentrations greater than the method detection limit (MDL), or any other target PAH compound at a concentration 5 times greater than the MDL. the method blank will be considered out of control. The blank acceptance criteria is shown in Table III. Corrective action will include reanalysis of the blank extract. an investigation into laboratory sources of contamination and qualifying that sample data relates to the blank. Blank level contamination should be considered the minimum level of contamination in all samples that are analyzed with the blanks.

9.2. Matrix Spike and Spike Duplicate Analyses

9.2.1. Samples designated for matrix spike analysis are spiked as described in section 7.8.

9.2.2. The laboratory will perform a matrix spike/ spike duplicate pair of QC samples for each analytical batch not exceeding 20 samples.

9.2.3. The initial matrix spike criteria are as follows:

Spike Component	Acceptance Criteria
1H- Indene	20-150
Naphthalene	20-150
Quinoline	20-150
2- Methylnaphthalene	20-150
Fluorene	69-118
Chrysene	20-132
Benzo(e)pyrene	20-150

One compound is allowed to be below the above acceptance criteria. The average recovery for the spike pair must also fall into the above criteria with one compound being allowed below the acceptance criteria.

9.2.4. Matrix spike compound criteria will be developed as results are collected and will be updated annually.

9.2.5. If the matrix spike criteria are not met. the matrix spike analysis will be repeated. If the subsequent matrix spike analysis meets the criteria. then the reanalysis data will be used. If not. the data for the sample will be reported but qualified as being outside the acceptance criteria of the method. Both the original and reanalysis data will be reported.

9.3. Laboratory Control Samples

9.3.1. A Laboratory Control Sample (LCS) is analyzed with each analytical batch not exceeding 20 samples.

9.3.2. The LCS results are compared to established spike recovery limits.

9.3.3. One DCS pair may be required for specific projects.

9.4. Internal Standards

The internal standards are monitored in all field samples and QC samples. The internals standards areas should be between 50% and 200% of the continuing calibration standard area.

9.5. Surrogate Compound Analysis

9.5.1. The laboratory will spike all samples and quality control samples with deuterated PAH surrogate compounds. The surrogate compounds will be spiked into the sample prior to extraction and will measure individual sample matrix effects associated with sample preparation and analysis. Surrogates will include naphthalene-d_8, fluorene-d_{10}, and chrysene-d_{12}.

9.5.2. Quanterra will take corrective action whenever the surrogate recovery for any one or more surrogates is outside the following acceptance criteria:

Surrogate	Acceptance Criteria % Low-Level
Naphthalene-d_8	21-108
Fluorene-d_{10}	41-162
Chrysene-d_{12}	10-118

9.5.3. Corrective Action

9.5.3.1. Check calculations to assure there are no errors:

9.5.3.2. Check internal standard and surrogate solutions for degradation, contamination, etc., and check instrument performance:

9.5.3.3. If the upper control limit is exceeded for only one surrogate, and the instrument calibration, surrogate standard concentration, etc. are in control, it can be concluded that an interference specific to the surrogate was present that resulted in high recovery and this interference would not affect the quantitation of other target compounds.

9.5.3.4. If the surrogate could not be measured because the sample required a dilution, no corrective action is required. The recovery of the surrogate is recorded as not calculated (NC).

9.5.3.5. Reanalyze the sample or extract if the steps above fail to reveal a problem. If reanalysis of the extract yields surrogate recoveries within the stated limits, then the reanalysis data will be used. Both the original and reanalysis data will be reported.

10. CALIBRATION AND STANDARDIZATION

10.1. The GC/MS is not be tuned to meet decafluorotriphenylphosphine (DFTPP) ion abundance criteria. This requirement is not appropriate for selected ion monitoring (SIM) methods. The analyst should tune the instrument to maximize the sensitivity for the compounds being analyzed as described below.

10.2. Mass tuning will be performed using the mass calibration compound FC43. Tuning will be performed to maximize the sensitivity of the mass spectrometer for the mass range of compounds being analyzed. In the FC43 spectra, the ion abundance of masses 131 and 219 are adjusted to a approximate ratio of 1:1. These two ions are then maximized to be approximately 50 to 70% of the ion abundance of the base mass 69. This procedure maximizes the sensitivity of the instrument in the mass region of interest for the PAH analysis.

10.3. A five-point initial calibration curve must be established showing the linear range of analysis. The same initial calibration is used for the two low level and the medium level ppt PAH analyses. The concentrations of standards used to construct the calibration curve are 20, 40, 240, 600, and 1200 ng/mL. The linear range for low level analysis (4 L to 0.5 mL) corresponds to sample concentrations of 2.5, 5, 30, 75, and 300 ng/L. If the concentration of any target compound in a sample exceeds the linear range defined by the above standards, the extracts must be diluted so that the concentrations of all target compounds fall within the range of the calibration curve.

The linear range for medium level analysis (0.5 L to 5.0 mL) corresponds to final sample concentrations of 200, 400, 2400, 6000 and 12000 ng/L.

10.4. If the initial calibration response factors are less than 35 relative percent difference sample analysis may proceed. If, for any analyte, the initial calibration response factor is greater than 35 relative percent difference the initial calibration curve must be repeated for that compound prior to the analysis of samples. The following compounds are excepted for this criteria due to poor response by this method: 7H-Dibenzo(c,g)carbazole, 3-Methylcholanthrene and the dibenzopyrene isomers.

10.5. Table II contains example RRT data for target compounds.

10.6. Continuing Calibration

Every 12 hours the mass spectrometer response for each PAH relative to the internal standard is determined using the 40 ng/mL calibration standard. The response factors for each compound must be compared to the initial calibration curve. If the continuing calibration response factors are within ± 35 percent of the corresponding calibration curve value the analysis may proceed. If, for any analyte, the continuing calibration response factor is not within ± 35 percent of the corresponding calibration curve value, a five-point calibration curve must be repeated for that compound prior to the analysis of samples. The following compounds are excepted for this criteria due to poor response by this method: 7H-Dibenzo(c,g)carbazole, 3-Methylcholanthrene and the dibenzopyrene isomers.

11. PROCEDURE

11.1. One time procedural variations are allowed only if deemed necessary in the professional judgment of a supervisor to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo and is approved by a Technical Specialist and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

11.2. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

11.3. Sample Extraction

11.3.1. Samples are extracted at a pH >12.

11.3.2. For the low level extraction, a measured amount of sample, approximately 4 liters, is poured into either two 2-liter continuous liquid-liquid extractors, one 4-liter continuous liquid-liquid extractor, or two 4 liter separatory funnels. The surrogate solution is added, basified and the pH confirmed, and the samples are extracted with methylene chloride. The samples are shaken three times with 80 mL of methylene chloride for the shake-out technique. The samples are allowed to reflux for eighteen hours if the liquid-liquid extractor technique is used for preparation, with pH check. The extracts from each of the two-liter extractions for a sample are then combined for concentration.

11.3.3. The medium level extraction requires that 500 mL of the sample be extracted with methylene chloride for 18 hours in a one liter continuous liquid-liquid extractor or shaken three times with 60 mL of methylene chloride in a 2-liter separatory funnel.

11.3.4. The extracts are passed through an anhydrous sodium sulfate into a 500 mL Kuderna-Danish evaporative concentrator.

Note: The Kuderna-Danish glassware is to be rinsed with methylene chloride immediately prior to the addition of the sample extract.

11.3.5. Concentrate the low level, ppt 75 and medium level extracts to approximately 5.0 mL using the Kuderna-Danish concentrator. Transfer the extracts to a calibrated N-Evap concentrator tube. The Kuderna-Danish tube is rinsed with methylene chloride. Transfer the rinsate to the N-Evap tube containing the sample extract.

11.3.6. Evaporate the extract using a nitrogen stream and a water bath at 30° to 35° C. Occasionally rinse the N-Evap tube walls with methylene chloride during this final concentration step. The low level and ppt 75 extracts are concentrated to 0.5 mL. The medium level extracts are concentrated to 5.0 mL.

11.3.7. Transfer the concentrated extracts to glass vials that are capped with a Teflon fitted septum. Store the extracts separate from ppb level extracts.

11.4. Gas Chromatography/Mass Spectrometry Analysis

11.4.1. All aliquoting, extract dilutions, and spike additions must be performed in the trace laboratory using equipment dedicated to PAH-SIM analysis. Extract aliquots are added to 0.1 mL vials for GC/MS analysis to allow for re-analysis, if necessary.

11.4.2. Prior to analysis an aliquot of internal standard solution is transferred to the sample vial using a 25 µL syringe to give a final internal standard concentration of 40 ng/mL in the extract.

11.4.3. Representative aliquots are injected into the gas chromatograph/mass spectrometer using similar conditions to those provided in the following table. The injection technique should include 4 second hold time of the syringe needle in the injector after the sample has been injected.

Injector Temp	300°C
Transfer Line Temp	290°C
Initial Oven Temp	30°C
Initial Hold Time	1 min.
Ramp Rate	10°C/min.
Final Temperature	325°C

11.4.4. The effluent from the GC capillary column is fed directly into the ion source of the mass spectrometer. The MS is operated in the selected ion monitoring (SIM) mode using appropriate windows to include the quantitation and confirmation masses for each PAH as shown in Table I. All compounds detected at a concentration above the MDL are checked to insure the confirmation ion is present at the appropriate ratio.

12. DATA ANALYSIS AND CALCULATIONS

12.1. Qualitative Identification

Obtain EICPs for the primary m/z and the confirmatory ion. The following criteria must be met to make a qualitative identification:

12.1.1. The characteristic masses of each parameter of interest must maximize in the same or within one scan of each other.

12.1.2. For the qualitative identification, the relative retention time (RRT) of unknown peaks must fall within ± 0.075 minutes.

12.1.3. The relative peak areas of the primary ion compared to the confirmation or secondary ion masses in the EICPs must fall within ± 20% of the relative intensities of these masses in a reference mass spectrum. The reference mass spectrum can be obtained from a standard analyzed in the GC/MS system or from a reference library. A compound that does not meet secondary ion confirmation criteria may still be determined to be present in a sample after close inspection of the data by the mass spectroscopist. Supportive information includes correct relative retention time and the presents of the secondary ion but the ratio is greater than ± 20% of the primary ion which may be caused by an interference of the secondary ion. When the primary ion is not affected by interferences and the decision is agreed to by the reviewer, the compound is flagged with an asterisk (*) on the sample summary sheet.

12.1.4. Structural isomers that have very similar mass spectra and less than 30 second difference in retention time. can be explicitly identified only if the resolution between authentic isomers in a standard mix is acceptable. Acceptable resolution is achieved if the baseline to valley height between the isomers is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

12.2. Calculations

12.2.1. The following formula is used to calculate the response factors of the internal standard to each of the calibration standards.

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

Where:

A_S = Area of the characteristic ion for the parameter to be measured.

A_{is} = Area of the characteristic ion for the internal standard.

C_{is} = Concentration of the internal standard. (ng/mL).

C_S = Concentration of the parameter to be measured. (ng/mL).

12.2.2. Based on these response factors, sample extract concentrations for each PAH is calculated using the following formula.

$$Ce = \left(\frac{A_s \times I_s}{A_{is} \times \overline{RF}} \right)$$

Where:

Ce = Sample extract concentration, ng/mL.

A_S = Area of the characteristic ion for the parameter to be measured.

A_{IS} = Area of the characteristic ion for the internal standard.

I_S = Amount of internal standard added to each extract, (ng/mL).

$\overline{RF}$ = The average response factor.

12.2.3. The actual sample concentration (C) for each compound is calculated by the following formula:

$$C = Ce \times \left(\frac{V_E}{V_s}\right)$$

Where:

C = Concentration of the sample, ng/mL.

V_E = The final extract volume, mL.

V_s = The original volume of sample extracted, L.

C_e = The amount measured in the analytical extract, ng/mL.

13. METHOD PERFORMANCE

The group/team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience.

14. POLLUTION PREVENTION

This method does not contain any specific modifications that serve to minimize or prevent pollution.

15. WASTE MANAGEMENT

Waste generated in this procedure must be segregated and disposed according to the facility hazardous waste procedure. The Environmental Health and Safety Director should be contacted if additional information is required.

16. REFERENCES

Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Methods 3520A, 8270A and 8280.

17. MISCELLANEOUS (TABLES, APPENDICES, ETC...)

17.1. Table I: Compounds and MS Quantitation Mass Ions

17.2. Table II: Relative Retention Times and Confidence For the Compounds Associated With the Low Level PAH and Heterocycle Methodology

17.3. Table III: CAS Numbers and Acceptance Criteria

17.4. Appendix I: Sample Preparation Flow Chart

17.5. Appendix II: Sample Analysis Flow Chart

Table I: Compounds and MS Quantitation Mass Ions*

Polynuclear Aromatic Hydrocarbons

Compound	Mass Ion	Confirmation Ion	Internal Standard Reference
Naphthalene	128	102	1
Acenaphthylene	152	151	1
Acenaphthene	154	153	1
Fluorene	166	165	1
Phenanthrene	178	176	2
Anthracene	178	176	2
Fluoranthene	202	200	2
Pyrene	202	200	2
Benzo(a)anthracene	228	226	3
Chrysene	228	226	3
Benzofluoranthenes	252	250	3
Benzo(a)pyrene	252	250	3
Indeno(1,2,3,cd)pyrene	276	138	3
Dibenz(a,h)anthracene	278	139	3
Benzo(g.h.i)perylene	276	138	3

Internal Standards

Compound	Mass Ion	Confirmation Ion	Internal Standard Reference
Acenaphthene-d_{10}	164	162	---
Phenanthrene-d_{10}	188	184	---
Benzo(a)pyrene-d_{12}	264	132	---

* The relative peak areas of the primary ion compared to the confirmation or secondary ion masses in the EICPs must fall within ± 20% of the relative intensities of these masses in a reference mass spectrum.

Table I: Compounds and MS Quantitation Mass Ions(Continued)

Surrogates

Compound	Mass Ion	Confirmation Ion	Internal Standard Reference
Naphthalene-d_8	136	134	1
Fluorene-d_{10}	176	174	1
Chrysene-d_{12}	240	236	3

Heterocycles and Other PAH

Compound	Mass Ion	Confirmation Ion	Standard Reference
Indene	116	115	1
Indole	117	90	1
2.3-dihydroindene	117	118	1
2.3-benzofuran	118	90	1
Quinoline	129	102	1
Benzo(b)thiophene	134	89	1
2-methylnaphthalene	141	115	1
1-methylnaphthalene	141	115	1
Biphenyl	154	153	1
Carbazole	167	166	2
Dibenzofuran	168	139	1
Acridine	179	178	2
Dibenzothiophene	184	139	2
Perylene	252	250	3
Benzo(e)pyrene	252	250	3
7.12-Dimethylbenz(a)anthracene	256	241	3
3-Methylcholanthrene	268	252	3

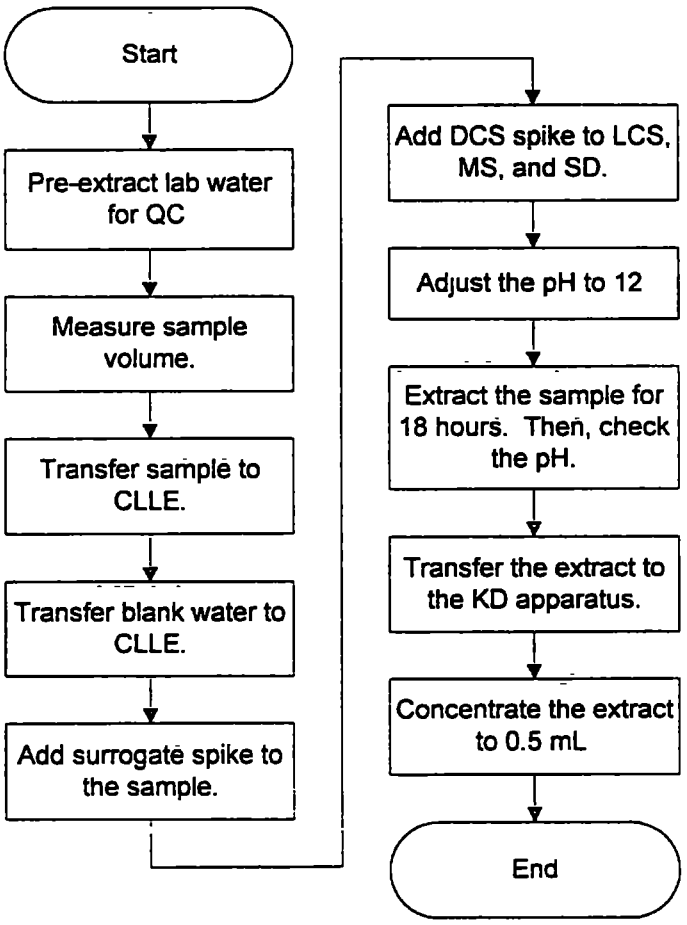
Table II: Relative Retention Times and Confidence For the Compounds Associated With the Low Level PAH and Heterocycle Methodology

	Absolute Retention Time (minutes)	Avg. RRT	SD	% RSD	95% Confidence Limits
Benzofuran	8.03	0.550	0.015	2.807	0 520-0.580
Dihydroindene	8:45	0.590	0.016	2.765	0 558-0 622
Indene	8:54	0.598	0.016	2.699	0.566-0.630
Naphthalene-d_8(Surr.)	11:14	0.733	0.017	2.289	0.699-0.767
Naphthalene	11:16	0.735	0.017	2.289	0.701-0.769
Benzo(b)thiophene	11:25	0.743	0.017	2 258	0.709-0.777
Quinoline	12:06	0.783	0.017	2.140	0.749-0.817
Indole	12:55	0.824	0.018	2.167	0 788-0.860
2-methylnaphthalene	12:59	0.832	0 017	2.084	0 798-0.866
1-methylnaphthalene	13:15	0 848	0.017	2.055	0.814-0 882
Biphenyl	14:12	0.901	0.017	1.921	0.867-0.935
Acenaphthylene	15:15	0.962	0.018	1.822	0.927-0.988
Acenaphthene	15.44	0.988	0.018	1.849	0.952-1 024
Dibenzofuran	16:09	1.011	0.018	1.791	0.975-1.047
Fluorene-d_{10}(Surr.)	16:57	0.872	0.015	1.735	0.842-0.902
Fluorene	17:01	0.875	0.015	1.745	0.845-0.905
Dibenzothiophene	19:08	0.974	0.016	1 617	0.942-1.006
Phenanthrene	19:28	0.988	0.016	1 589	0.956-1.020
Anthracene	19:34	0.994	0 016	1 597	0.962-1.026
Acridine	19:42	0 999	0.016	1 572	0.967-1.031
Carbazole	20:02	1.013	0.015	1.487	0.983-1 043
Fluoranthene	22:32	1.130	0.017	1.461	1.096-1.164
Pyrene	23:07	1.157	0.017	1.443	1.123-1.191
Benz(a)anthracene	26:16	0.873	0.012	1.325	0.849-0.897
Chrysene-d_{12} (Surr.)	26:18	0.874	0.012	1.320	0.850-0.898
Chrysene	26:22	0.876	0.012	1.320	0.852-0.900
Benzofluoranthenes	29:00	0.960	0.014	1.501	0.932-0.988
Benzo(e)pyrene	29:34	0.984	0.016	1.590	0.952-1.016
Benzo(a)pyrene	29:44	0.988	0.016	1.615	0.956-1.020
Perylene	29:55	0.996	0.016	1 644	0.964-1 028
Indeno(1.2.3 cd)pyrene	32:31	1.114	0.025	2.276	1.064-1.164
Dibenz(ah)anthracene	32:36	1.113	0.031	2.743	1.051-1.175
Benzo(ghi)perylene	33:17	1.149	0.028	2.422	1.093-1 205

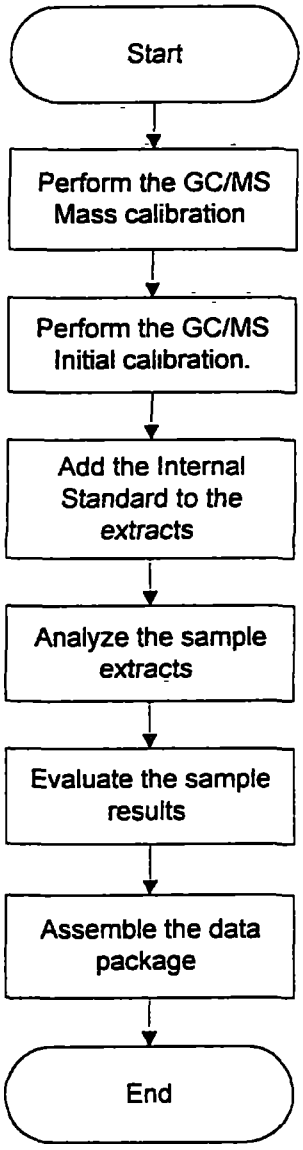
Table III: CAS Numbers and Acceptance Criteria

Compound	CAS #	Acceptance Criteria (ng/L)
2,3-Benzofuran	271-89-6	0.94 - 4.70
2,3-Dihydroindene	496-11-7	2 56 - 12.80
1H-Indene	95-13-6	0.71 - 3 55
Naphthalene	91-20-3	3.17 - 15 85
Benzo(B)thiophene	95-15-8	0.70 - 3.50
Quinoline	91-22-5	< 3 52
1H-Indole	120-72-9	1 22 - 6 10
2-Methylnaphthalene	91-57-6	1 99 - 8 30
1-Methylnaphthalene	90-12-0	1 44 - 7.20
Biphenyl	92-52-4	0 91 - 4.55
Acenaphthylene	208-96-8	0 60 - 3 00
Acenaphthene	83-32-9	0.71 - 3 55
Dibenzofuran	132-64-9	0.79 - 3.95
Fluorene	86-73-7	0 72 - 3 60
Dibenzothiophene	132-65-0	0 76 - .080
Phenanthrene	85-01-8	1.38 - 6 90
Anthracene	120-12-7	1.38 - 6.90
Acridine	260-94-6	3.12 - 15.6
Carbazole	86-74-8	1.84 - 9.20
Fluoranthene	206-44-0	1.58 - 7.90
Pyrene	129-00-0	1.27 - 6 38
Benzo(A)anthracene	56-55-3	< 0.68
Chrysene	218-01-9	< 1.46
Benzo(B)fluoranthrene	205-99-2	< 0 67
Benzo(K)fluoranthrene	207-08-9	1.07 - 5 35
7,12-Dimethylbenzanthracene	57-97-6	1 29 - 6 45
Benzo(E)pyrene	192-97-2	0.65 - 3.25
Benzo(A)pyrene	50-32-8	< 0.98
Perylene	198-55-0	0 50 - 2 50
3-Methylcholanthrene	56-49-5	2.49 - 12.4
Indeno(1.2.3-CD)pyrene	193-39-5	< 1 04 -
Dibenz(A.H)anthracene	53-70-3	< 1.06 -
Benzo(G.H.I)perylene	191-24-2	< 1 73 -

Appendix I: Sample Preparation Flow Chart



Appendix II: Sample Analysis Flow Chart



HEALTH AND SAFETY PLAN

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Introduction

This Health and Safety Plan applies to personnel who will potentially be exposed to groundwater affected by creosote or coal tar constituents during the retrieval of groundwater samples from active pumping wells, the GAC plant, monitor wells, and piezometers. This plan has been designated to comply with, as a minimum, the requirements set forth in 29 CFR 1910.120, the OSHA standards governing hazardous waste operations. In no case may work be performed in a manner that conflicts with the intent of or the safety concerns expressed in this plan.

Materials of Concern and Effects of Overexposure

The materials of concern which have been identified for this project are coal tar and creosote related materials including naphthalene, other polynuclear aromatic hydrocarbons (PAH) and phenolic compounds.

Coal tar and creosote are typically irritating to the eyes, skin and respiratory tract. Acute skin contact may cause burning and itching while prolonged contact and poor hygiene practices may produce dermatitis. Prolonged skin contact with creosote must be avoided to prevent the possibility of skin absorption.

Naphthalene is a hemolytic agent which, upon overexposure to the vapor or ingestion of the solid, may produce a variety of symptoms associated with the breakdown of red blood cells. Naphthalene is also irritating to the eyes and repeated or prolonged contact has been associated with the production of cataracts.

Repeated exposure to certain PAH compounds has been associated with the production of cancer. Contact of PAH compounds with the skin may cause photosensitization of the skin producing skin burns after subsequent exposure to ultraviolet radiation.

Phenolics are generally strong irritants which can have a corrosive effect on the skin and can also rapidly penetrate the skin. Overexposure to phenols and phenolic compounds may cause convulsions as well as liver and kidney damage.

Hazard Assessment

Initial

Because of the relatively low vapor pressures associated with PAH compounds (generally less than 10^{-4} mm Hg at 20^{0}C), they are not expected to present a vapor hazard. The most likely threat of exposure to these compounds will be via skin contact.

TABLE 1

ACTION LIMITS FOR AIR CONTAMINANTS

Limit	Persistent Concentration in the Breathing Zone	Procedure
Lower	5 ppm	Don respirators, step up monitoring.
Upper	50 ppm	Stop work and back off from immediate work area until levels subside in the breathing zone.

Action Limits

The American Conference of Governmental Industrial Hygienists (ACGIH) has established threshold limit values (TLV) for phenol and naphthalene at 5 and 10 ppm, respectively, as 8-hour time weighted averages (TWA). Based on these values, the action limits in Table 1 have been set. The lower limit of 5 ppm is based on the TLV for phenol while the upper limit of 50 ppm is based on a minimum protection factor of 10 for a half-mask, air purifying respirator.

Response

When the PID yields persistent breathing-zone readings at or above the lower action limit, workers in the affected area will don respirators. Air sampling will continue on a more frequent basis. If readings are persistent at or above the upper limit, workers shall back off from the immediate work area until measured breathing-zone concentrations fall below the lower limit, at which time operations will resume and normal air monitoring will continue. If breathing zone levels do not fall below the upper limit, workers are to leave the work area and report the condition immediately to the City, the Engineer, or its representative. If necessary, engineering controls will be instituted to maintain vapor concentrations below the upper limit or arrangements will be made to upgrade to Level B protection.

Personal Protective Equipment

Personal protective equipment (PPE) will be donned, as necessary, based on the hazards encountered. Listed below is the personal protective equipment to be utilized during this project and the conditions requiring its use.

Personal Protective Equipment

- Coveralls - Polyethylene coated Tyvek if work involves contact with affected soil or groundwater.
- Boots - Chemical resistant type if work involves contact with affected soil or groundwater.
- Hard Hat - When working in the vicinity of operating heavy machinery.
- Face shield - If splash hazard exists.
- Gloves - Nitrile for potential contact with affected soil or groundwater.
- Respirator - MSA Comfo II with GMC-H Cartridges if PID reading exceeds 5 ppm or if dust or odors become objectionable.
- Chemical Safety Goggles - If eye irritation occurs.

Because of the carcinogenicity of certain PAH compounds, and because of the skin hazards associated with PAH and phenolic compounds, it is important that appropriate protective clothing be worn during work activities, which may involve the possibility of skin contact with affected soil or groundwater. As a minimum, the presence of visible creosote or coal tar related material shall constitute evidence of affected soil or groundwater.

Health and Safety Training

Personnel covered by this Health and Safety Plan must have received appropriate health and safety training prior to their working on the site. Training will include:

- Requirements for and use of respirators and personal protective equipment.
- Required personal hygiene practices.
- Requirements for employees to work in pairs.
- Proper material handling.
- Proper sampling procedures.
- Maintenance of safety equipment.
- Effective response to any emergency.
- Emergency procedures.
- Hazard zones.
- Decontamination methods.
- General safety precautions.

A copy of the Standard Safety Procedures (Table 2) will be given to each worker covered by this Health and Safety Plan.

Decontamination

Administrative procedures require hygienic practices consistent with work hazards. Employees will be instructed in the training program on proper personal hygiene procedures.

Contaminated, reusable PPE, such as boots, hard hats, face shields and goggles, will be decontaminated prior to leaving the site. The decontamination procedure follows:

- Rinse with water to remove gross contamination.
- Wash in Alconox or equivalent detergent solution.
- Rinse with clean water.

Contaminated, disposable PPE, such as Tyvek coveralls and gloves will be placed in 55-gallon drums and stored while arrangements are made for disposal.

TABLE 2

STANDARD SAFETY PROCEDURES

- Employees are required to work in pairs.
- Wash face and hands prior to eating, smoking, or leaving the site.
- No smoking or eating is allowed in the work area during excavation or sampling activities.
- Wearing of contact lenses is not permitted in the work area.
- Contaminated material (e.g., Tyvek coveralls) must be properly disposed of before leaving the site.
- All work must be conducted in accordance with local, state and federal EPA and OSHA regulations, particularly 29 CFR 1910.120.

Respirators, if used, will be cleaned and disinfected after each day of use. The facepiece (with cartridge removed) will be washed in a hypochlorite (or equivalent) disinfecting solution, rinsed in warm water and air dried in a clean place.

Emergency Procedures

This Health and Safety Plan has been established to allow site operations to be conducted without adverse impacts on worker health and safety as well as public health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions at the site.

General

All accidents and unusual events will be dealt with in a manner to minimize a continued health risk to site workers. In the event that an accident or other unusual event occurs, the following procedure will be followed:

- First aid or other appropriate initial action will be administered by those closest to the accident/event. This assistance will be conducted so that those rendering assistance are not placed in a situation of unacceptable risk. In the event that a worker is caught in a trench collapse, call for emergency assistance immediately.

- All accidents/unusual events must be immediately reported to the Owner.

- All workers on site should conduct themselves in a mature, calm manner in the event of an accident/unusual event, to avoid spreading the danger to themselves, surrounding workers and the community.

Responses to Specific Situations

Emergency procedures for specific situations are given in the following paragraphs.

Worker Injury

If an employee in an affected area is physically injured, Red Cross first-aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought.

If the injury to the worker is chemical in nature (e.g., overexposure), the following first-aid procedures are to be instituted:

- Eye Exposure - If affected solids or liquids get into the eyes, wash eyes immediately using large amounts of water and lifting the lower and upper lid occasionally. Obtain medical attention immediately.

- Skin Exposure - If affected solids or liquids get on the skin, promptly wash the affected skin using soap or mild detergent and water. Obtain medical attention immediately when exposed to concentrated solids or liquids.

- Inhalation - If a person inhales large amounts of a toxic vapor, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

- Swallowing - When affected solids or liquids have been swallowed, the Poison Control Center will be contacted and their recommended procedures followed.

Emergency Notification

In an extraordinary event that might be damaging to personnel or adjacent property, immediate notification of the proper emergency service will be required. The proper emergency service is determined by the nature of the emergency.

EMERGENCY NOTIFICATION

Fire Department 911

Ambulance 911

Police Department 911

Methodist Hospital 932-5000

Poison Control Center 347-3141

OTHER CONTACTS

MPCA - Douglas Beckwith 612-296-7715

EPA - Darryl Owens 312-886-7089

City of St. Louis Park - Scott Anderson 612-924-2557

- William Gregg 612-924-0117

R94/HSPLNGAC

COMMUNITY RELATIONS PLAN

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The Sampling Plan is to be completed in accordance with the Consent Decree-Remedial Action Plan for Reilly Tar & Chemical Corporation's St. Louis Park, Minnesota, N.P.L. Site. All community relations programs related to this work will be coordinated through the following agencies:

United States	Ms. Judy Beck United States Environmental Protection Agency (312) 353-1325
State of Minnesota	Mr. Ralph Pribble Minnesota Pollution Control Agency (612) 296-7792
City of St. Louis Park	Ms. Lynn Schwartz City of St. Louis Park (612) 924-2521

Information necessary to conduct the Community Relations Plan will be provided by the City and Reilly Industries, Inc.

R94/CommPlan