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Supplemental Site Inspection for Air Force Plant 59, Johnson City, New York

Volume 3: Appendices F – Q

Energy Systems Division
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Supplemental Site Inspection for Air Force Plant 59, Johnson City, New York

Volume 3: Appendices F – Q

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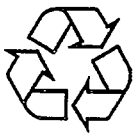
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Appendix F:

Analytical Data

Contents

F.1 Analytical Results for AFP 59 ..... F-5

F.2 Galson Laboratory Data Package F-72

F.3 Crosswalk Index to Data Packages F-72

Tables

F.1 Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Volatile Organic Analysis F-7

F.2 Analytical Results for AFP 59, Johnson City: Groundwater Samples — Volatile Organic Analysis F-10

F.3 Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Volatile Organic Analysis F-15

F.4 Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Volatile Organic Analysis F-16

F.5 Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Volatile Organic Analysis F-17

F.6 Analytical Results for AFP 59, Johnson City: Field Blank/ Equipment Rinsate Samples — Volatile Organic Analysis F-18

F.7 Analytical Results for AFP 59, Johnson City: Trip Blank/ Field Blank Samples — Volatile Organic Analysis F-19

F.8 Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Semivolatile Organic Analysis F-24

F.9 Analytical Results for AFP 59, Johnson City: Groundwater Samples — Semivolatile Organic Analysis F-30

F.10 Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Semivolatile Organic Analysis F-40

F.11 Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Semivolatile Organic Analysis F-42

F.12 Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Semivolatile Organic Analysis F-44

F.13 Analytical Results for AFP 59, Johnson City: Field Blank/ Equipment Rinsate Samples — Semivolatile Organic Analysis F-46

Tables

F.14 Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Pesticide/PCB Analysis F-48

F.15 Analytical Results for AFP 59, Johnson City: Groundwater Samples — Pesticide/PCB Analysis F-51

F.16 Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Pesticide/PCB Analysis F-56

F.17 Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Pesticide/PCB Analysis F-57

F.18 Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Pesticide/PCB Analysis F-58

F.19 Analytical Results for AFP 59, Johnson City: Field Blank/ Equipment Blank Samples — Pesticide/PCB Analysis F-59

F.20 Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Inorganic Analysis F-60

F.21 Analytical Results for AFP 59, Johnson City: Groundwater Samples — Inorganic Analysis F-63

F.22 Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Inorganic Analysis F-68

F.23 Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Inorganic Analysis F-69

F.24 Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Inorganic Analysis F-70

F.25 Analytical Results for AFP 59, Johnson City: Field Blank/ Equipment Rinsate Samples — Inorganic Analysis F-71

F.26 Well Borehole Soil Samples F-73

F.27 Groundwater Samples F-75

F.28 Outfall, Creek Sediment, and Creek Water Samples F-78

F.29 Named-Site Test Bore and Hand-Soil Samples F-79

F.30 Background and Equipment Rinsate Samples F-80

F.31 Trip Blanks F-81

F.1 Analytical Results for AFP 59

TABLE F.1
Analytical Results for AFP 59, Johnson City:
Well Borehole Soil Samples —
Volatile Organic Analysis (1)

Sample ID		JCDW1AS	JCDW1BS	JCDW1CS	JCDW3AS	JCDW3BS	JCSW4AS
Lab ID		5832-008	5832-009	5832-010	5602-001	5602-002	5909-001
SDG #		1	1	1	1	1	1
Date Received		11/21/91	11/21/91	11/21/91	11/5/91	11/5/91	11/26/91
Date Analyzed		11/28/91	11/28/91	11/28/91	11/8/91	11/8/91	11/30/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL						
Chloromethane*	10	12U	12U	11U	10U	11U	11U
Bromomethane*	10	12U	12U	11U	10U	11U	11U
Vinyl Chloride*	10	12U	12U	11U	10U	11U	11U
Chloroethane*	10	12U	12U	11U	10U	11U	11U
Methylene Chloride	5	6U	6U	5U	5U	6U	5U
Acetone*	10	12U	12U	13U	10U	11U	11U
Carbon Disulfide	5	6U	6U	5U	5U	6U	5U
1,1-Dichloroethene	5	6U	6U	5U	5U	6U	5U
1,1-Dichloroethane	5	6U	6U	5U	5U	6U	5U
1,2-Dichloroethene (total)	5	6U	6U	5U	5U	6U	5U
Chloroform	5	6U	6U	5U	5U	6U	5U
1,2-Dichloroethane	5	6U	6U	5U	5U	6U	5U
2-Butanone*	10	12U	12U	11U	10U	11U	11U
1,1,1-Trichloroethane	5	6U	6U	5U	5U	6U	5U
Carbon Tetrachloride	5	6U	6U	5U	5U	6U	5U
Vinyl Acetate*	10	12U	12U	11U	10U	11U	11U
Bromodichloromethane	5	6U	6U	5U	5U	6U	5U
1,2-Dichloropropane	5	6U	6U	5U	5U	6U	5U
cis-1,3-Dichloropropene	5	6U	6U	5U	5U	6U	5U
Trichloroethene	5	6U	6U	5U	5U	6U	5U
Dibromochloromethane	5	6U	6U	5U	5U	6U	5U
1,1,2-Trichloroethane	5	6U	6U	5U	5U	6U	5U
Benzene	5	6U	6U	5U	5U	6U	5U
trans-1,3-Dichloropropene	5	6U	6U	5U	5U	6U	5U
Bromoform	5	6U	6U	5U	5U	6U	5U
4-Methyl-2-Pentanone*	10	12U	12U	11U	10U	11U	11U
2-Hexanone*	10	12U	12U	11U	10U	11U	11U
Tetrachloroethene	5	6U	6U	5U	5U	6U	5U
1,1,2,2-Tetrachloroethane	5	6U	6U	5U	5U	6U	5U
Toluene	5	6U	6U	5U	5U	6U	5U
Chlorobenzene	5	6U	6U	5U	5U	6U	5U
Ethylbenzene	5	6U	6U	5U	5U	6U	5U
Styrene	5	6U	6U	5U	5U	6U	5U
Xylene (total)	5	6U	6U	5U	5U	6U	5U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

Sample JCDW1BS is a field replicate of JCDW1AS

(1) Superfund method 89-1 as referenced in NYSDEC - ASP (9/89)

TABLE F.1 (Cont.)

Sample ID		JCSW4BS	JCSW4CS	JCSW5AS	JCSW5BS	JCSW6AS	JCSW6BS
Lab ID		5909-002	5909-003	5832-001	5832-002	5770-001	5770-002
SDG #		1	1	1	1	1	1
Date Received		11/26/91	11/26/91	11/21/91	11/21/91	11/18/91	11/18/91
Date Analyzed		11/30/91	11/28/91	11/28/91	11/28/91	11/22/91	11/22/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL						
Chloromethane*	10	12U	13U	11U	13U	11U	11U
Bromomethane*	10	12U	13U	11U	13U	11U	11U
Vinyl Chloride*	10	12U	13U	11U	13U	11U	11U
Chloroethane*	10	12U	13U	11U	13U	11U	11U
Methylene Chloride	5	6U	6U	5U	6U	6	5U
Acetone*	10	12U	13U	11U	13U	11U	11U
Carbon Disulfide	5	6U	6U	5U	6U	5U	5U
1,1-Dichloroethene	5	6U	6U	5U	6U	5U	5U
1,1-Dichloroethane	5	6U	6U	5U	6U	5U	5U
1,2-Dichloroethene (total)	5	6U	6U	5U	6U	5U	5U
Chloroform	5	6U	6U	5U	6U	5U	5U
1,2-Dichloroethane	5	6U	6U	5U	6U	5U	5U
2-Butanone*	10	12U	13U	11U	13U	11U	11U
1,1,1-Trichloroethane	5	6U	25U	5U	6U	5U	5U
Carbon Tetrachloride	5	6U	6U	5U	6U	5U	5U
Vinyl Acetate*	10	12U	13U	11U	13U	11U	11U
Bromodichloromethane	5	6U	6U	5U	6U	5U	5U
1,2-Dichloropropane	5	6U	6U	5U	6U	5U	5U
cis-1,3-Dichloropropene	5	6U	6U	5U	6U	5U	5U
Trichloroethene	5	6U	6J	5U	6U	5U	5U
Dibromochloromethane	5	6U	6U	5U	6U	5U	5U
1,1,2-Trichloroethane	5	6U	6U	5U	6U	5U	5U
Benzene	5	6U	6U	5U	6U	5U	5U
trans-1,3-Dichloropropene	5	6U	6U	5U	6U	5U	5U
Bromoform	5	6U	6U	5U	6U	5U	5U
4-Methyl-2-Pentanone*	10	12U	13U	11U	13U	11U	11U
2-Hexanone*	10	12U	13U	11U	13U	11U	11U
Tetrachloroethene	5	6U	6U	5U	6U	5U	5U
1,1,2,2-Tetrachloroethane	5	6U	6U	5U	6U	5U	5U
Toluene	5	6U	6U	5U	6U	5U	5U
Chlorobenzene	5	6U	6U	5U	6U	5U	5U
Ethylbenzene	5	6U	6U	5U	6U	5U	5U
Styrene	5	6U	6U	5U	6U	5U	5U
Xylene (total)	5	6U	6U	5U	6U	5U	5U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCSW4CS is a field replicate of JCSW4BS

(1) Superfund method 89-1 as referenced in NYSDEC - ASP (9/89)

TABLE F.1 (Cont.)

Sample ID		JCSW7AS	JCSW7BS	JCSW8AS	JCSW8BS	JCSW9AS	JCSW9BS	JCBG1AS
Lab ID		6044-001	6044-002	5554-001	5554-002	6069-001	6069-002	6044-003
SDG #		3	3	1	1	3	3	3
Date Received		12/9/91	12/9/91	11/5/91	11/5/91	12/10/91	12/10/91	12/9/91
Date Analyzed		12/11/91	12/11/91	11/8/91	11/9/91	12/14/91	12/11/91	12/11/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
Chloromethane*	10	12U	11U	13U	12U	11U	11U	11U
Bromomethane*	10	12U	11U	13U	12U	11U	11U	11U
Vinyl Chloride*	10	12U	11U	13U	12U	11U	11U	11U
Chloroethane*	10	12U	11U	13U	12U	11U	•11U	11U
Methylene Chloride	5	6J	5U	7U	6U	3J	10	6U
Acetone*	10	8J	12	45U	17U	10J	11U	11U
Carbon Disulfide	5	6U	5U	7U	6U	5U	6U	6U
1,1-Dichloroethene	5	6U	5U	7U	6U	5U	6U	6U
1,1-Dichloroethane	5	6U	5U	7U	6U	5U	6U	6U
1,2-Dichloroethene (total)	5	6U	5U	7U	6U	5U	6U	6U
Chloroform	5	6U	5U	7U	6U	5U	6U	6U
1,2-Dichloroethane	5	6U	5U	7U	6U	5U	6U	6U
2-Butanone*	10	12U	11U	13U	12U	11U	11U	11U
1,1,1-Trichloroethane	5	6U	5U	7U	6U	5U	1J	6U
Carbon Tetrachloride	5	6U	5U	7U	6U	5U	6U	6U
Vinyl Acetate*	10	12U	11U	13U	12U	11U	11U	11U
Bromodichloromethane	5	6U	5U	7U	6U	5U	6U	6U
1,2-Dichloropropane	5	6U	5U	7U	6U	5U	6U	6U
cis-1,3-Dichloropropene	5	6U	5U	7U	6U	5U	6U	6U
Trichloroethene	5	6U	5U	7U	6U	14	8	6U
Dibromochloromethane	5	6U	5U	7U	6U	5U	6U	6U
1,1,2-Trichloroethane	5	6U	5U	7U	6U	5U	6U	6U
Benzene	5	6U	5U	7U	6U	5U	6U	6U
trans-1,3-Dichloropropene	5	6U	5U	7U	6U	5U	6U	6U
Bromoform	5	6U	5U	7U	6U	5U	6U	6U
4-Methyl-2-Pentanone*	10	12U	11U	13U	12U	11U	11U	11U
2-Hexanone*	10	12U	11U	13U	12U	11U	11U	11U
Tetrachloroethene	5	6U	5U	7U	6U	5U	6U	6U
1,1,2,2-Tetrachloroethane	5	6U	5U	7U	6U	5U	6U	6U
Toluene	5	6U	5U	7U	6U	5U	6U	6U
Chlorobenzene	5	6U	5U	7U	6U	5U	6U	6U
Ethylbenzene	5	6U	5U	7U	6U	5U	6U	6U
Styrene	5	6U	5U	7U	6U	5U	6U	6U
Xylene (total)	5	6U	5U	7U	6U	5U	6U	6U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCBG1AS is a background sample
Sample JCSW9BS is a field replicate of JCSW9AS

(1) Superfund method 89-1 as referenced in NYSDEC - ASP (9/89)

TABLE F.2
Analytical Results for AFP 59, Johnson City: Groundwater Samples — Volatile Organic Analysis (1)

Sample ID		JCDW1AW	JCDW1BW	JCSW1AW	JCSW1BW	JCDW3AW	JCDW3BW	JCDW3RW
Lab ID		6384-001	6749-005	6384-002	6749-006	6415-002	6761-001	6761-002
SDG #		5	6	5	6	5	6	6
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/8/92	2/3/92	2/3/92
Date Analyzed		1/7/92	2/6/92	1/7/92	2/6/92	1/9/92	2/6/92	2/6/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	2U	2U	2U	2UJ	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2UJ	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2UJ	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2UJ	2U	2U
Methylene Chloride	1	1U	1U	1U	1U	1UJ	1U	1U
Acetone*	2	2U	2U	2U	2U	2UJ	2U	2U
Carbon Disulfide	1	1U	1U	1U	1U	1UJ	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	1UJ	1U	1U
1,1-Dichloroethane	1	1U	1U	1U	1U	1UJ	0.3J	0.3J
1,2-Dichloroethene (total)	1	1UJ	1U	1UJ	1U	1UJ	1U	1U
Chloroform	1	1U	1U	1U	1U	1UJ	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1UJ	1U	1U
2-Butanone*	2	R	R	R	R	R	R	R
1,1,1-Trichloroethane	1	0.4J	0.6J	1U	0.5J	0.3J	0.2J	0.3J
Carbon Tetrachloride	1	1U	1U	1U	1U	1UJ	1U	1U
Vinyl Acetate*	2	R	R	R	R	R	R	R
Bromodichloromethane	1	1U	1U	1U	1U	1UJ	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1UJ	1U	1U
cis-1,3-Dichloropropene	1	1UJ	1U	1UJ	1U	1UJ	1U	1U
Trichloroethene	1	1U	1U	1U	1U	1UJ	1U	1U
Dibromochloromethane	1	1U	0.2J	1U	1U	1UJ	1U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1UJ	1U	1U
Benzene	1	1UJ	1U	1UJ	1U	1UJ	1U	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1UJ	1U	1U
Bromoform	1	1U	0.3J	1U	1U	1UJ	1U	1U
4-Methyl-2-Pentanone*	2	2U	2U	2U	2U	2UJ	2U	2U
2-Hexanone*	2	R	R	R	R	R	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1UJ	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1UJ	1U	1U
Toluene	1	1U	1U	1U	0.2J	1UJ	0.2J	1U
Chlorobenzene	1	1U	1U	1U	1U	1UJ	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1UJ	1U	1U
Styrene	1	1UJ	1U	1UJ	1U	1UJ	1U	1U
Xylene (total)	1	1U	1U	1U	1U	1UJ	0.2J	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCDW3RW is a field replicate of JCDW3BW

(1) Analyzed by EPA Method 524.2

TABLE F.2 (Cont.)

Sample ID		JCSW3AW	JCSW3BW	JCDW4AW	JCDW4BW	JCSW4AW	JCSW4BW	JCDW5AW
Lab ID		6415-003	6761-003	6415-006	6703-001	6415-009	6703-004	6384-003
SDG #		5	6	5	6	5	6	5
Date Received		1/8/92	2/3/92	1/8/92	1/30/92	1/8/92	1/30/92	1/6/92
Date Analyzed		1/9/92	2/7/92	1/10/92	2/4/92	1/14/92	2/4/92	1/8/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	2U	2U	2U	2U	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2U	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2U	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2U	2U	2U
Methylene Chloride	1	1U	1U	1U	3	1U	4	1U
Acetone*	2	2U	2U	2U	2U	2U	2U	35
Carbon Disulfide	1	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	0.3J	1U	1U
1,1-Dichloroethane	1	5	2	1U	1U	0.4J	0.6J	1U
1,2-Dichloroethene (total)	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
Chloroform	1	0.3J	1U	1U	1U	1U	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1U	1U	1U
2-Butanone*	2	R	R	R	R	R	R	R
1,1,1-Trichloroethane	1	12	6U	0.3J	0.9J	2	2	1.5
Carbon Tetrachloride	1	1U	1U	1U	1U	1U	1U	1U
Vinyl Acetate*	2	R	R	R	R	R	R	R
Bromodichloromethane	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
Trichloroethene	1	9	7	1U	0.2J	95	97	1U
Dibromochloromethane	1	1U	1U	1U	1U	1U	1U	0.3J
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1U	1U	1U
Benzene	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1U	1U	1U
Bromoform	1	1U	1U	1U	1U	1U	1U	0.6J
4-Methyl-2-Pentanone*	2	2U	2U	2U	2U	2U	2U	2U
2-Hexanone*	2	R	R	R	R	R	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1U	1U	1U
Toluene	1	1U	1U	1U	0.2J	1U	1U	0.3J
Chlorobenzene	1	1U	1U	1U	1U	1U	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1U	1U	1U
Styrene	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
Xylene (total)	1	1U	1U	1U	1U	1U	1U	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.2 (Cont.)

Sample ID		JCDW5BW	JCSW5AW	JCSW5BW	JCDW6AW	JCDW6BW	JCSW6AW	JCSW6BW
Lab ID		6749-001	6384-004	6749-002	6384-005	6749-003	6384-006	6749-004
SDG #		6	5	6	5	6	5	6
Date Received		2/1/92	1/6/92	2/1/92	1/6/92	2/1/92	1/6/92	2/1/92
Date Analyzed		2/6/92	1/8/92	2/6/92	1/8/92	2/6/92	1/8/92	2/6/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	2U	2U	2U	2U	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2U	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2U	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2U	2U	2U
Methylene Chloride	1	1U	1U	1U	1U	1U	1U	1U
Acetone*	2	2U	2U	2U	2U	2U	2U	2U
Carbon Disulfide	1	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1	1U	1U	1U	1U	1U	1U	0.2J
1,2-Dichloroethene (total)	1	1U	1UJ	1U	1UJ	1U	1UJ	1U
Chloroform	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1U	1U	1U
2-Butanone*	2	R	R	R	R	R	R	R
1,1,1-Trichloroethane	1	2	1U	0.3J	1U	1U	1	1
Carbon Tetrachloride	1	1U	1U	1U	1U	1U	1U	1U
Vinyl Acetate*	2	R	R	R	R	R	R	R
Bromodichloromethane	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	1	1U	1UJ	1U	1UJ	1U	1UJ	1U
Trichloroethene	1	1U	1U	1U	1U	1U	1	1
Dibromochloromethane	1	0.2J	1U	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1U	1U	1U
Benzene	1	1U	1UJ	1U	1UJ	1U	1UJ	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1U	1U	1U
Bromoform	1	0.3J	1U	1U	1U	1U	1U	1U
4-Methyl-2-Pentanone*	2	2U	2U	2U	2U	2U	2U	2U
2-Hexanone*	2	R	R	R	R	R	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1U	1U	1U
Toluene	1	0.3J	1U	1U	1U	1U	1U	1U
Chlorobenzene	1	1U	1U	1U	1U	1U	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1U	1U	1U
Styrene	1	1U	1UJ	1U	1UJ	1U	1UJ	1U
Xylene (total)	1	0.4J	1U	1U	1U	1U	1U	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.2 (Cont.)

Sample ID		JCSW7AW	JCSW7BW	JCDW8AW	JCDW8RW	JCDW8BW	JCSW8AW	JCSW8BW
Lab ID		6415-010	6703-005	6446-001	6446-002	6703-006	6446-003	6703-007
SDG #		5	6	5	5	6	5	6
Date Received		1/8/92	1/30/92	1/10/92	1/8/92	1/30/92	1/10/92	1/30/92
Date Analyzed		1/14/92	2/5/92	1/15/92	1/14/92	2/5/92	1/16/92	2/5/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	2U	2U	2U	2U	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2U	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2U	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2U	2U	2U
Methylene Chloride	1	1U	1U	0.7J	1U	4	0.7J	1U
Acetone*	2	2U	2U	2U	2U	2U	2U	2U
Carbon Disulfide	1	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloroethene (total)	1	1UJ	1U	1UJ	1UJ	1U	1UJ	1U
Chloroform	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1U	1U	1U
2-Butanone*	2	R	R	R	R	2U	R	R
1,1,1-Trichloroethane	1	0.2J	0.2J	0.3J	0.2J	0.6J	1U	1U
Carbon Tetrachloride	1	1U	1U	1U	1U	1U	1U	1U
Vinyl Acetate*	2	R	R	R	R	2U	R	R
Bromodichloromethane	1	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	1	1UJ	1U	1UJ	1UJ	1U	1UJ	1U
Trichloroethene	1	0.4J	0.4J	1U	1U	1U	1.3	1
Dibromochloromethane	1	1U	1U	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1U	1U	1U
Benzene	1	1UJ	1U	1UJ	1UJ	1U	1UJ	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1U	1U	1U
Bromoform	1	1U	1U	1U	1U	1U	1U	1U
4-Methyl-2-Pentanone*	2	2U	2U	2U	2U	2U	2U	2U
2-Hexanone*	2	R	R	R	R	2U	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1U	1U	1U
Toluene	1	1U	1U	1U	1U	1U	1U	1U
Chlorobenzene	1	1U	1U	1U	1U	1U	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1U	1U	1U
Styrene	1	1UJ	1U	1UJ	1UJ	1U	1UJ	1U
Xylene (total)	1	1U	1U	0.2J	0.2J	1U	1U	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCDW8RW is a field replicate of JCDW8AW

(1) Analyzed by EPA Method 524.2

TABLE F.2 (Cont.)

Sample ID		JCDW9AW	JCDW9BW	JCSW9AW	JCSW9BW	JCDPWAW	JCDPWBW	JCBG2BW
Lab ID		6415-004	6761-004	6415-005	6761-005	6446-004	6761-006	6415-001
SDG #		5	6	5	6	5	6	5
Date Received		1/8/92	2/3/92	1/8/92	2/3/92	1/10/92	2/3/92	1/8/92
Date Analyzed		1/9/92	2/7/92	1/14/92	2/10/92	1/16/92	2/10/92	1/9/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2UJ	2U	2U	2U	2U	2U	2UJ
Bromomethane*	2	2UJ	2U	2U	2U	2U	2U	2UJ
Vinyl Chloride*	2	2UJ	2U	2U	2U	2U	2U	2UJ
Chloroethane*	2	2UJ	2U	2U	2U	2U	2U	2UJ
Methylene Chloride	1	1UJ	6U	1U	0.9JB	1U	0.6JB	1UJ
Acetone*	2	2UJ	2U	2U	2U	2U	2U	2UJ
Carbon Disulfide	1	1UJ	1U	1U	1U	1U	1U	1UJ
1,1-Dichloroethene	1	1UJ	1U	1U	1U	1U	1U	1UJ
1,1-Dichloroethane	1	1UJ	1U	1.9	2	3	3	1UJ
1,2-Dichloroethene (total)	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
Chloroform	1	1UJ	1U	1U	1U	1U	1U	1UJ
1,2-Dichloroethane	1	1UJ	1U	1U	1U	1U	1U	1UJ
2-Butanone*	2	R	R	R	R	R	R	R
1,1,1-Trichloroethane	1	0.2J	1U	15.2	15	2	3	3J
Carbon Tetrachloride	1	1UJ	1U	1U	1U	1U	1U	1UJ
Vinyl Acetate*	2	R	R	R	R	R	R	R
Bromodichloromethane	1	1UJ	1U	1U	1U	1U	1U	1UJ
1,2-Dichloropropane	1	1UJ	1U	1U	1U	1U	1U	1UJ
cis-1,3-Dichloropropene	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
Trichloroethene	1	1UJ	1U	9.5	10	5	7	0.7J
Dibromochloromethane	1	1UJ	1U	1U	1U	1U	1U	1UJ
1,1,2-Trichloroethane	1	1UJ	1U	1U	1U	1U	1U	1UJ
Benzene	1	1UJ	1U	1UJ	1U	1UJ	1U	1UJ
trans-1,3-Dichloropropene	1	1UJ	1U	1U	1U	1U	1U	1UJ
Bromoform	1	0.2J	1U	1U	1U	1U	1U	1UJ
4-Methyl-2-Pentanone*	2	2UJ	2U	2U	2U	2U	2U	2UJ
2-Hexanone*	2	R	R	R	R	R	R	R
Tetrachloroethene	1	1UJ	1U	1U	1U	0.2J	0.2J	1UJ
1,1,2,2-Tetrachloroethane	1	1UJ	1U	1U	1U	1U	1U	1UJ
Toluene	1	1UJ	1U	1U	1U	1U	1U	1UJ
Chlorobenzene	1	1UJ	1U	1U	1U	1U	1U	1UJ
Ethylbenzene	1	1UJ	1U	1U	1U	1U	1U	1UJ
Styrene	1	1UJ	0.1J	1UJ	1U	1UJ	1U	1UJ
Xylene (total)	1	1UJ	1U	1U	1U	1U	1U	1UJ

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCBG2BW is a background sample

(1) Analyzed by EPA Method 524.2

TABLE F.3
Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Volatile Organic Analysis (1)

Sample ID		JCOF1AW	JCOF2AW	JCCW1AW	JCCW2AW	JCCNCAW
Lab ID		5868-001	5868-002	5807-002	5807-001	5808-001
SDG #		2	2	2	2	2
Date Received		11/23/91	11/23/91	11/18/91	11/18/91	11/19/91
Date Analyzed		11/27/91	11/27/91	11/22/91	11/22/91	11/22/91
Matrix		WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL					
Chloromethane*	2	2U	2U	2U	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2U
Methylene Chloride	1	2U	2U	1U	1U	1U
Acetone*	2	2U	17J	2U	2U	2U
Carbon Disulfide	1	1U	1U	1U	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	1U
1,1-Dichloroethane	1	1U	1U	1U	1U	1U
1,2-Dichloroethene (total)	1	1U	1U	1U	1U	1U
Chloroform	1	1U	1U	1U	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1U
2-Butanone*	2	R	R	R	R	R
1,1,1-Trichloroethane	1	0.6J	1U	1U	1U	1U
Carbon Tetrachloride	1	1U	1U	1U	1U	1U
Vinyl Acetate*	2	2U	2U	2U	2U	2U
Bromodichloromethane	1	1U	1U	1U	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	1	1U	1U	1U	1U	1U
Trichloroethene	1	0.3J	4J	1U	1U	1U
Dibromochloromethane	1	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1U
Benzene	1	1U	1U	1U	1U	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1U
Bromoform	1	0.4J	1U	1U	1U	1U
4-Methyl-2-Pentanone*	2	R	R	R	R	R
2-Hexanone*	2	R	R	R	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1U
Toluene	1	1U	1U	1U	1U	1U
Chlorobenzene	1	1U	1U	1U	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1U
Styrene	1	1U	1U	1U	1U	1U
Xylene (total)	1	1U	1U	1U	1U	1U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

Sample JCCNCAW is a background sample

(1) Analyzed by EPA Method 524.2

TABLE F.4
Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Volatile Organic Analysis (1)

Sample ID		JCSD1AS	JCSD2AS	JCCNSCS
Lab ID		5770-006	5770-004	5832-007
SDG #		1	1	1
Date Received		11/18/91	11/18/91	11/21/91
Date Analyzed		11/22/91	11/22/91	11/28/91
Matrix		SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg
COMPOUND	CRQL			
Chloromethane*	10	13U	13U	12U
Bromomethane*	10	13U	13U	12U
Vinyl Chloride*	10	13U	13U	12U
Chloroethane*	10	13U	13U	12U
Methylene Chloride	5	6U	8	6U
Acetone*	10	13U	13U	12U
Carbon Disulfide	5	6U	6U	6U
1,1-Dichloroethene	5	6U	6U	6U
1,1-Dichloroethane	5	6U	6U	6U
1,2-Dichloroethene (total)	5	6U	6U	6U
Chloroform	5	6U	6U	6U
1,2-Dichloroethane	5	6U	6U	6U
2-Butanone*	10	13U	13U	12U
1,1,1-Trichloroethane	5	6U	6U	6U
Carbon Tetrachloride	5	6U	6U	6U
Vinyl Acetate*	10	13U	13U	12U
Bromodichloromethane	5	6U	6U	6U
1,2-Dichloropropane	5	6U	6U	6U
cis-1,3-Dichloropropene	5	6U	6U	6U
Trichloroethene	5	6U	6U	6U
Dibromochloromethane	5	6U	6U	6U
1,1,2-Trichloroethane	5	6U	6U	6U
Benzene	5	6U	6U	6U
trans-1,3-Dichloropropene	5	6U	6U	6U
Bromoform	5	6U	6U	6U
4-Methyl-2-Pentanone*	10	13U	13U	12U
2-Hexanone*	10	13U	13U	12U
Tetrachloroethene	5	6U	6U	6U
1,1,2,2-Tetrachloroethane	5	6U	6U	6U
Toluene	5	6U	6U	6U
Chlorobenzene	5	6U	6U	6U
Ethylbenzene	5	6U	6U	6U
Styrene	5	6U	6U	6U
Xylene (total)	5	6U	6U	6U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits
Sample JCCNSCS is a background sample

(1) Superfund method 89-1 as referenced in NYSDEC - ASP (9/89)

TABLE F.5
Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Volatile Organic Analysis (1)

Sample ID		JC1H1AS	JC1H1CS	JC2L1AS	JC3H1AS	JC4H1AS	JC4H2AS	JC6H1AS
Lab ID		6007-001	6007-002	6779-001	6007-003	5983-001	5983-002	6007-004
SDG #		3	3	7	3	3	3	3
Date Received		12/5/91	12/5/91	1/31/92	12/5/91	12/4/91	12/4/91	12/5/91
Date Analyzed		12/6/91	12/10/91	2/6/92	12/9/91	12/5/91	12/5/91	12/9/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
Chloromethane*	10	11U	1500U	13U	12U	11U	11U	11U
Bromomethane*	10	11U	1500U	13U	12U	11U	11U	11U
Vinyl Chloride*	10	11U	1500U	13U	12U	11U	11U	11U
Chloroethane*	10	11U	1500U	13U	12U	11U	11U	11U
Methylene Chloride	5	7	770U	6U	6U	6U	6U	6U
Acetone*	10	11U	1500U	13U	37	9J	9J	11U
Carbon Disulfide	5	5U	770U	6U	6U	6U	6U	6U
1,1-Dichloroethene	5	5U	770U	6U	6U	6U	6U	6U
1,1-Dichloroethane	5	5U	770U	6U	6U	6U	6U	6U
1,2-Dichloroethene (total)	5	5U	770U	6U	6U	6U	6U	6U
Chloroform	5	5U	770U	6U	6U	6U	6U	6U
1,2-Dichloroethane	5	5U	770U	6U	6U	6U	6U	6U
2-Butanone*	10	11U	R	13U	12U	11U	11U	11U
1,1,1-Trichloroethane	5	5U	770U	6U	6U	6U	6U	6U
Carbon Tetrachloride	5	5U	770U	6U	6U	6U	6U	6U
Vinyl Acetate*	10	11U	1500U	13U	12U	11U	11U	11U
Bromodichloromethane	5	5U	770U	6U	6U	6U	6U	6U
1,2-Dichloropropane	5	5U	770U	6U	6U	6U	6U	6U
cis-1,3-Dichloropropene	5	5U	770U	6U	6U	6U	6U	6U
Trichloroethene	5	5U	770U	6U	6U	6U	6U	6U
Dibromochloromethane	5	5U	770U	6U	6U	6U	6U	6U
1,1,2-Trichloroethane	5	5U	770U	6U	6U	6U	6U	6U
Benzene	5	5U	770U	6U	6U	6U	6U	6U
trans-1,3-Dichloropropene	5	5U	770U	6U	6U	6U	6U	6U
Bromoform	5	5U	770U	6U	6U	6U	6U	6U
4-Methyl-2-Pentanone*	10	11U	1500U	13U	12U	11U	11U	11U
2-Hexanone*	10	11U	1500U	13U	12U	11U	11U	11U
Tetrachloroethene	5	5U	770U	6U	6U	6U	6U	6U
1,1,2,2-Tetrachloroethane	5	5U	770U	6U	6U	6U	6U	6U
Toluene	5	5U	770U	6U	6U	6U	6U	6U
Chlorobenzene	5	5U	770U	6U	6U	6U	6U	6U
Ethylbenzene	5	5U	770U	6U	6U	6U	6U	6U
Styrene	5	5U	770U	6U	6U	6U	6U	6U
Xylene (total)	5	5U	770U	6U	6U	6U	6U	6U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

Sample JCCNSCS is a background sample

(1) Superfund method 89-1 as referenced in NYSDEC - ASP (9/89)

TABLE F.6
Analytical Results for AFP 59, Johnson City: Field Blank/Equipment Rinsate Samples — Volatile Organic Analysis (1)

Sample ID		JCQC1TW	JCQC2BW	JCQC3XW	JCQC5XW	JCQC4WW
Lab ID		5602-003	5602-004	5630-001	6703-009	6703-008
SDG #		1	1	1	6	6
Date Received		11/6/91	11/7/91	11/8/91	1/30/92	1/30/92
Date Analyzed		11/8/91	11/9/91	11/9/91	2/3/92	2/3/92
Matrix		WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL					
Chloromethane*	2	10U	10U	10U	2U	2U
Bromomethane*	2	10U	10U	10U	2U	2U
Vinyl Chloride*	2	10U	10U	10U	2U	2U
Chloroethane*	2	10U	10U	10U	2U	2U
Methylene Chloride	1	5U	5U	5U	1.4	0.6J
Acetone*	2	11	11	12	2U	2U
Carbon Disulfide	1	5U	5U	5U	1U	1U
1,1-Dichloroethene	1	5U	5U	5U	1U	1U
1,1-Dichloroethane	1	5U	5U	5U	1U	1U
1,2-Dichloroethene (total)	1	5U	5U	5U	1U	1U
Chloroform	1	5U	5U	5U	1U	1U
1,2-Dichloroethane	1	5U	5U	5U	1U	1U
2-Butanone*	2	10U	10U	10U	R	R
1,1,1-Trichloroethane	1	5	2J	4J	7	5
Carbon Tetrachloride	1	5U	5U	5U	1U	1U
Vinyl Acetate*	2	10U	10U	10U	R	R
Bromodichloromethane	1	5U	5U	5U	1U	1U
1,2-Dichloropropane	1	5U	5U	5U	1U	1U
cis-1,3-Dichloropropene	1	5U	5U	5U	1U	1U
Trichloroethene	1	5U	5U	5U	1U	1U
Dibromochloromethane	1	5U	5U	5U	1U	1U
1,1,2-Trichloroethane	1	5U	5U	5U	1U	1U
Benzene	1	5U	5U	5U	1U	1U
trans-1,3-Dichloropropene	1	5U	5U	5U	1U	1U
Bromoform	1	5U	5U	5U	1U	1U
4-Methyl-2-Pentanone*	2	10U	10U	10U	2U	2U
2-Hexanone*	2	10U	10U	10U	R	R
Tetrachloroethene	1	5U	5U	5U	1U	1U
1,1,2,2-Tetrachloroethane	1	5U	5U	5U	1U	1U
Toluene	1	5U	5U	5U	0.2J	0.2J
Chlorobenzene	1	5U	5U	5U	1U	1U
Ethylbenzene	1	5U	5U	5U	1U	1U
Styrene	1	5U	5U	5U	1U	1U
Xylene (total)	1	5U	5U	5U	0.1J	0.1J

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.7
Analytical Results for AFP 59, Johnson City: Trip Blank/Field Blank Samples — Volatile Organic Analysis (1)

Sample ID		Trip Blank 1	Trip Blank 2	Trip Blank 3	Trip Blank 4	Trip Blank 5	Trip Blank 6	Trip Blank 7
Lab ID		5554-003	5602-005	5630-002	5807-003	5808-002	5832-011	5868-007
SDG #		1	1	1	2	2	1	2
Date Received		11/5/91	11/6/91	11/8/91	11/18/91	11/19/91	11/21/91	11/23/91
Date Analyzed		11/8/91	11/8/91	11/9/91	11/23/91	11/22/91	11/28/91	11/30/91
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	10U	10U	10U	2U	2U	10U	2U
Bromomethane*	2	10U	10U	10U	2U	2U	10U	2U
Vinyl Chloride*	2	10U	10U	10U	2U	2U	10U	2U
Chloroethane*	2	10U	10U	10U	2U	2U	10U	2U
Methylene Chloride	1	5U	5U	5U	0.9J	1	5U	1
Acetone*	2	10U	10U	10U	2U	2U	10U	2U
Carbon Disulfide	1	5U	5U	5U	1U	1U	5U	1U
1,1-Dichloroethene	1	5U	5U	5U	1U	1U	5U	1U
1,1-Dichloroethane	1	5U	5U	5U	1U	1U	5U	1U
1,2-Dichloroethene (total)	1	5U	5U	5U	1U	1U	5U	1U
Chloroform	1	5U	5U	5U	0.6J	1U	5U	1U
1,2-Dichloroethane	1	5U	5U	5U	1U	1U	5U	1U
2-Butanone*	2	10U	10U	10U	R	R	10U	R
1,1,1-Trichloroethane	1	5U	5U	5U	1U	1U	5U	1U
Carbon Tetrachloride	1	5U	5U	5U	1U	1U	5U	1U
Vinyl Acetate*	2	10U	10U	10U	2U	2U	10U	2U
Bromodichloromethane	1	5U	5U	5U	1U	1U	5U	1U
1,2-Dichloropropane	1	5U	5U	5U	1U	1U	5U	1U
cis-1,3-Dichloropropene	1	5U	5U	5U	1U	1U	5U	1U
Trichloroethene	1	5U	5U	5U	1U	1U	5U	1U
Dibromochloromethane	1	5U	5U	5U	1U	1U	5U	1U
1,1,2-Trichloroethane	1	5U	5U	5U	1U	1U	5U	1U
Benzene	1	5U	5U	5U	1U	1U	5U	1U
trans-1,3-Dichloropropene	1	5U	5U	5U	1U	1U	5U	1U
Bromoform	1	5U	5U	5U	1U	1U	5U	1U
4-Methyl-2-Pentanone*	2	10U	10U	10U	R	R	10U	2U
2-Hexanone*	2	10U	10U	10U	R	R	10U	R
Tetrachloroethene	1	5U	5U	5U	1U	1U	5U	1U
1,1,2,2-Tetrachloroethane	1	5U	5U	5U	1U	1U	5U	1U
Toluene	1	5U	5U	5U	1U	1U	5U	1U
Chlorobenzene	1	5U	5U	5U	1U	1U	5U	1U
Ethylbenzene	1	5U	5U	5U	1U	1U	5U	1U
Styrene	1	5U	5U	5U	1U	1U	5U	1U
Xylene (total)	1	5U	5U	5U	1U	1U	5U	1U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.7 (Cont.)

Sample ID		Trip Blank 8	Trip Blank 9	Trip Blank 10	Trip Blank 11	Trip Blank 13	Trip Blank 14	Trip Blank 15
Lab ID		5909-004	5983-003	6007-005	6044-004	6384-007	6415-011	6446-005
SDG #		1	3	3	3	5	5	5
Date Received		11/26/91	12/4/91	12/5/91	12/9/91	1/6/92	1/8/92	1/10/92
Date Analyzed		11/28/91	12/5/91	12/6/91	12/9/91	1/7/92	1/14/92	1/16/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	10U	10U	10U	10U	2U	2U	2U
Bromomethane*	2	10U	10U	10U	10U	2U	2U	2U
Vinyl Chloride*	2	10U	10U	10U	10U	2U	2U	2U
Chloroethane*	2	10U	10U	10U	10U	2U	2U	2U
Methylene Chloride	1	5U	5U	5U	5U	1U	0.2J	1
Acetone*	2	10U	10U	10U	10U	2U	2U	2U
Carbon Disulfide	1	5U	5U	5U	5U	1U	1U	1U
1,1-Dichloroethene	1	5U	5U	5U	5U	1U	1U	1U
1,1-Dichloroethane	1	5U	5U	5U	5U	1U	1U	1U
1,2-Dichloroethene (total)	1	5U	5U	5U	5U	1U	1U	1U
Chloroform	1	5U	5U	5U	5U	1U	1U	1U
1,2-Dichloroethane	1	5U	5U	5U	5U	1U	1U	1U
2-Butanone*	2	10U	10U	10U	10U	R	R	R
1,1,1-Trichloroethane	1	5U	5U	5U	5U	1U	1U	1U
Carbon Tetrachloride	1	5U	5U	5U	5U	1U	1U	1U
Vinyl Acetate*	2	10U	10U	10U	10U	R	R	R
Bromodichloromethane	1	5U	5U	5U	5U	1U	1U	1U
1,2-Dichloropropane	1	5U	5U	5U	5U	1U	1U	1U
cis-1,3-Dichloropropene	1	5U	5U	5U	5U	1U	1U	1U
Trichloroethene	1	5U	5U	5U	5U	1U	1U	1U
Dibromochloromethane	1	5U	5U	5U	5U	1U	1U	1U
1,1,2-Trichloroethane	1	5U	5U	5U	5U	1U	1U	1U
Benzene	1	5U	5U	5U	5U	1U	1U	1U
trans-1,3-Dichloropropene	1	5U	5U	5U	5U	1U	1U	1U
Bromoform	1	5U	5U	5U	5U	1U	1U	1U
4-Methyl-2-Pentanone*	2	10U	10U	10U	10U	2U	2U	2U
2-Hexanone*	2	10U	10U	10U	10U	R	R	R
Tetrachloroethene	1	5U	5U	5U	5U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	5U	5U	5U	5U	1U	1U	1U
Toluene	1	5U	5U	5U	5U	1U	1U	1U
Chlorobenzene	1	5U	5U	5U	5U	1U	1U	1U
Ethylbenzene	1	5U	5U	5U	5U	1U	1U	1U
Styrene	1	5U	5U	5U	5U	1U	1U	1U
Xylene (total)	1	5U	5U	5U	5U	1U	1U	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.7 (Cont.)

Sample ID		Trip Blank 16	Trip Blank 17	Trip Blank 18	Hold Blank 1	Hold Blank 2	Hold Blank 3	Hold Blank 4
Lab ID		6703-010	6749-007	6761-007	5554-004	5602-006	5630-003	5807-004
SDG #		6	6	6	1	1	1	2
Date Received		1/30/92	2/1/92	2/3/92	11/5/91	11/7/91	11/8/91	11/18/91
Date Analyzed		2/5/92	2/7/92	2/10/92	11/8/91	11/9/91	11/13/91	11/22/91
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	2U	2U	10U	10U	10U	2U
Bromomethane*	2	2U	2U	2U	10U	10U	10U	2U
Vinyl Chloride*	2	2U	2U	2U	10U	10U	10U	2U
Chloroethane*	2	2U	2U	2U	10U	10U	10U	2U
Methylene Chloride	1	0.6J	3B	1U	5U	5U	5U	1
Acetone*	2	2U	2U	2U	10U	10U	10U	2U
Carbon Disulfide	1	1U	1U	1U	5U	5U	5U	1U
1,1-Dichloroethene	1	1U	1U	1U	5U	5U	5U	1U
1,1-Dichloroethane	1	1U	1U	1U	5U	5U	5U	1U
1,2-Dichloroethene (total)	1	1U	1U	1U	5U	5U	5U	1U
Chloroform	1	1U	1U	1U	5U	5U	5U	1U
1,2-Dichloroethane	1	1U	1U	1U	5U	5U	5U	1U
2-Butanone*	2	R	R	R	10U	10U	10U	2U
1,1,1-Trichloroethane	1	1U	3	1U	5U	5U	5U	1U
Carbon Tetrachloride	1	1U	1U	1U	5U	5U	5U	1U
Vinyl Acetate*	2	R	R	R	10U	10U	10U	2U
Bromodichloromethane	1	1U	1U	1U	5U	5U	5U	1U
1,2-Dichloropropane	1	1U	1U	1U	5U	5U	5U	1U
cis-1,3-Dichloropropene	1	1U	1U	1U	5U	5U	5U	1U
Trichloroethene	1	1U	1U	1U	5U	5U	5U	1U
Dibromochloromethane	1	1U	1U	1U	5U	5U	5U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	5U	5U	5U	1U
Benzene	1	1U	1	1U	5U	5U	5U	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	5U	5U	5U	1U
Bromoform	1	1U	1U	1U	5U	5U	5U	1U
4-Methyl-2-Pentanone*	2	2U	2U	2U	10U	10U	10U	2U
2-Hexanone*	2	R	R	R	10U	10U	10U	2U
Tetrachloroethene	1	1U	1U	1U	5U	5U	5U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	5U	5U	5U	1U
Toluene	1	1U	0.2J	1U	5U	5U	5U	1U
Chlorobenzene	1	1U	1U	1U	5U	5U	5U	1U
Ethylbenzene	1	1U	1U	1U	5U	5U	5U	1U
Styrene	1	1U	1U	1U	5U	5U	5U	1U
Xylene (total)	1	1U	1U	1U	5U	5U	5U	1U

Qualifiers

J: Concentration was estimated

U: Compound not detected

UJ: Compound not detected - sample quantitation limit is an estimate

R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.7 (Cont.)

Sample ID		Hold Blank 5	Hold Blank 6	Hold Blank 7	Hold Blank 8	Hold Blank 9	Hold Blank 10	Hold Blank 11
Lab ID		5808-003	5832-012	5868-008	5909-005	5983-004	6007-006	6044-005
SDG #		2	1	2	1	3	3	3
Date Received		11/19/91	11/21/91	11/23/91	11/26/91	12/4/91	12/5/91	12/9/91
Date Analyzed		11/22/91	11/28/91	11/27/91	11/28/91	12/5/91	12/6/91	12/9/91
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Chloromethane*	2	2U	10U	2U	10U	10U	10U	10U
Bromomethane*	2	2U	10U	2U	10U	10U	10U	10U
Vinyl Chloride*	2	2U	10U	2U	10U	10U	10U	10U
Chloroethane*	2	2U	10U	2U	10U	10U	10U	10U
Methylene Chloride	1	1U	5U	3	5U	5U	5U	5U
Acetone*	2	2U	10U	12	10U	10U	10U	10U
Carbon Disulfide	1	1U	5U	1U	5U	5U	5U	5U
1,1-Dichloroethene	1	1U	5U	1U	5U	5U	5U	5U
1,1-Dichloroethane	1	1U	5U	1U	5U	5U	5U	5U
1,2-Dichloroethene (total)	1	1U	5U	1U	5U	5U	5U	5U
Chloroform	1	1U	5U	1U	5U	5U	5U	5U
1,2-Dichloroethane	1	1U	5U	1U	5U	5U	5U	5U
2-Butanone*	2	2U	10U	2U	10U	10U	10U	10U
1,1,1-Trichloroethane	1	1U	5U	1U	5U	5U	5U	5U
Carbon Tetrachloride	1	1U	5U	1U	5U	5U	5U	5U
Vinyl Acetate*	2	2U	10U	2U	10U	10U	10U	10U
Bromodichloromethane	1	1U	5U	1U	5U	5U	5U	5U
1,2-Dichloropropane	1	1U	5U	1U	5U	5U	5U	5U
cis-1,3-Dichloropropene	1	1U	5U	1U	5U	5U	5U	5U
Trichloroethene	1	1U	5U	1U	5U	5U	5U	5U
Dibromochloromethane	1	1U	5U	1U	5U	5U	5U	5U
1,1,2-Trichloroethane	1	1U	5U	1U	5U	5U	5U	5U
Benzene	1	1U	5U	1U	5U	5U	5U	5U
trans-1,3-Dichloropropene	1	1U	5U	1U	5U	5U	5U	5U
Bromoform	1	1U	5U	1U	5U	5U	5U	5U
4-Methyl-2-Pentanone*	2	2U	10U	2U	10U	10U	10U	10U
2-Hexanone*	2	2U	10U	2U	10U	10U	10U	10U
Tetrachloroethene	1	1U	5U	1U	5U	5U	5U	5U
1,1,2,2-Tetrachloroethane	1	1U	5U	1U	5U	5U	5U	5U
Toluene	1	1U	5U	1U	5U	5U	5U	5U
Chlorobenzene	1	1U	5U	1U	5U	5U	5U	5U
Ethylbenzene	1	1U	5U	1U	5U	5U	5U	5U
Styrene	1	1U	5U	1U	5U	5U	5U	5U
Xylene (total)	1	1U	5U	1U	5U	5U	5U	5U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.7 (Cont.)

Sample ID		Hold Blank 13	Hold Blank 14	Hold Blank 15	Hold Blank 16	Hold Blank 17	Hold Blank 18
Lab ID		6384-008	6415-012	6446-006	6703-011	6749-008	6761-008
SDG #		5	5	5	6	6	6
Date Received		1/6/92	1/8/92	1/10/92	1/30/92	2/1/92	2/3/92
Date Analyzed		1/7/92	1/14/92	1/15/92	2/5/92	2/7/92	2/10/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL						
Chloromethane*	2	2U	2U	2U	2U	2U	2U
Bromomethane*	2	2U	2U	2U	2U	2U	2U
Vinyl Chloride*	2	2U	2U	2U	2U	2U	2U
Chloroethane*	2	2U	2U	2U	2U	2U	2U
Methylene Chloride	1	1U	1U	1U	1U	0.3JB	1U
Acetone*	2	2U	2U	2U	2U	2U	2U
Carbon Disulfide	1	1U	1U	1U	1U	1U	1U
1,1-Dichloroethene	1	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1	1U	1U	1U	1U	1U	1U
1,2-Dichloroethene (total)	1	1U	1U	1U	1U	1U	1U
Chloroform	1	1U	1U	1U	1U	1U	1U
1,2-Dichloroethane	1	1U	1U	1U	1U	1U	1U
2-Butanone*	2	R	R	R	R	R	R
1,1,1-Trichloroethane	1	1U	1U	1U	1U	1U	1U
Carbon Tetrachloride	1	1U	1U	1U	1U	1U	1U
Vinyl Acetate*	2	R	R	R	R	R	R
Bromodichloromethane	1	1U	1U	1U	1U	1U	1U
1,2-Dichloropropane	1	1U	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	1	1U	1U	1U	1U	1U	1U
Trichloroethene	1	1U	1U	1U	1U	1U	1U
Dibromochloromethane	1	1U	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	1	1U	1U	1U	1U	1U	1U
Benzene	1	1U	1U	1U	1U	1U	1U
trans-1,3-Dichloropropene	1	1U	1U	1U	1U	1U	1U
Bromoform	1	1U	1U	1U	1U	1U	1U
4-Methyl-2-Pentanone*	2	2U	2U	2U	2U	2U	2U
2-Hexanone*	2	R	R	R	R	R	R
Tetrachloroethene	1	1U	1U	1U	1U	1U	1U
1,1,2,2-Tetrachloroethane	1	1U	1U	1U	1U	1U	1U
Toluene	1	1U	1U	1U	1U	1U	1U
Chlorobenzene	1	1U	1U	1U	1U	1U	1U
Ethylbenzene	1	1U	1U	1U	1U	1U	1U
Styrene	1	1U	1U	1U	1U	1U	1U
Xylene (total)	1	1U	1U	1U	1U	1U	1U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limits

(1) Analyzed by EPA Method 524.2

TABLE F.8
Analytical Results for AFP 59, Johnson City:
Well Borehole Soil Samples —
Semivolatile Organic Analysis (1)

Sample ID		JCDW1AS	JCDW1BS	JCDW1CS	JCDW3AS	JCDW3BS	JCSW4AS	JCSW4BS	JCSW4CS
Lab ID		5832-008	5832-009	5832-010	5602-001	5602-002	5909-001	5909-002	5909-003
SDG #		1	1	1	1	1	1	1	1
Date Received		11/21/91	11/21/91	11/21/91	11/7/91	11/7/91	11/26/91	11/26/91	11/26/91
Date Extracted		11/26/91	11/26/91	11/26/91	11/8/91	11/8/91	11/30/91	11/30/91	11/30/91
Date Analyzed		12/14/91	12/14/91	12/14/91	11/16/91	11/16/91	12/16/91	12/16/91	12/16/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL								
Phenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
bis(2-chloroethyl)ether	330	810U	1100U	740U	700U	760U	720U	840U	820U
2-Chlorophenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
1,3-Dichlorobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
1,4-Dichlorobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Benzyl Alcohol	330	810U	1100U	740U	700U	760U	720U	840U	820U
1,2-Dichlorobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
2-Methylphenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
bis(2-Chloroisopropyl)ether	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Methylphenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
N-Nitroso-Di-n-propylamine	330	810U	1100U	740U	700U	760U	720U	840U	820U
Hexachloroethane	330	810U	1100U	740U	700U	760U	720U	840U	820U
Nitrobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Isophorone	330	810U	1100U	740U	700U	760U	720U	840U	820U
2-Nitrophenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
2,4-Dimethylphenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
Benzoic Acid	1600	810U	1100U	740U	700U	760U	720U	840U	820UJ
bis(2-Chloroethoxy)methane	330	810U	1100U	740U	700U	760U	720U	840U	820U
2,4-Dichlorophenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
1,2,4-Trichlorobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Naphthalene	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Chloroaniline	330	810U	1100U	740U	700U	760U	720U	840U	820U
Haxachlorobutadiene	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Chloro-3-methylphenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
2-Methylnaphthalene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Hexachlorocyclopentadiene	330	810U	1100U	740U	700U	760U	720U	840U	820U
2,4,6-Trichlorophenol	330	810U	1100U	740U	700U	760U	720U	840U	820UJ
2,4,5-Trichlorophenol	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100UJ
2-Chloronaphthalene	330	810U	1100U	740U	700U	760U	720U	840U	820U
2-Nitroaniline	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100U
Dimethylphthalate	330	810U	1100U	740U	700U	760U	720U	840U	820U
Acenaphthylene	330	810U	1100U	740U	700U	760U	720U	840U	820U
3-Nitroaniline	330	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100U
Acenaphthene	330	810U	1100U	740U	700U	760U	720U	840U	820U

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TABLE F.8 (Cont.)

Sample ID		JCDW1AS	JCDW1BS	JCDW1CS	JCDW3AS-DL	JCDW3BS	JCSW4AS	JCSW4BS	JCSW4CS
Lab ID		5832-008	5832-009	5832-010	5602-001	5602-002	5909-001	5909-002	5909-003
SDG #		1	1	1	1	1	1	1	1
Date Received		11/21/91	11/21/91	11/21/91	11/7/91	11/7/91	11/26/91	11/26/91	11/26/91
Date Extracted		11/26/91	11/26/91	11/26/91	11/8/91	11/8/91	11/30/91	11/30/91	11/30/91
Date Analyzed		12/14/91	12/14/91	12/14/91	11/16/91	11/16/91	12/16/91	12/16/91	12/16/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL								
2,4-Dinitrophenol	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100UJ
4-Nitrophenol	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100UJ
Dibenzofuran	330	810U	1100U	740U	700U	760U	720U	840U	820U
2,4-Dinitrotoluene	330	810U	1100U	740U	700U	760U	720U	840U	820U
2,6-Dinitrotoluene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Diethylphthalate	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Chlorophenyl-phenylether	330	810U	1100U	740U	700U	760U	720U	840U	820U
Fluorene	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Nitroaniline	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100U
4,6-Dinitro-2-methylphenol	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100UJ
N-Nitrosodiphenylamine	330	810U	1100U	740U	700U	760U	720U	840U	820U
4-Bromophenyl-phenylether	330	810U	1100U	740U	700U	760U	720U	840U	820U
Hexachlorobenzene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Pentachlorophenol	1600	4100U	5500U	3700U	3500U	3800U	3600U	4200U	4100UJ
Phenanthrene	330	160J	1100U	740U	390J	760U	720U	840U	820U
Anthracene	330	17J	1100U	740U	60J	760U	720U	840U	820U
Di-n-Butylphthalate	330	220J	260J	740U	700U	760U	720U	840U	820U
Fluoranthene	330	140J	65J	740U	980	760U	720U	840U	820U
Pyrene	330	110J	52J	740U	1100	760U	720U	840U	820U
Butylbenzylphthalate	330	810U	1100U	740U	700U	760U	720U	840U	820U
3,3'-Dichlorobenzidine	660	1600U	2200U	1500U	1400U	1500U	1400U	1700U	1600U
Benzo(a)Anthracene	330	810U	1100U	740U	530J	760U	720U	840U	820U
bis(2-ethylhexyl)phthalate	330	810U	1100U	740U	700U	760U	720U	840U	820U
Chrysene	330	810U	1100U	740U	520J	760U	720U	840U	820U
Di-n-octylphthalate	330	810U	1100U	740U	700U	760U	720U	840U	820U
Benzo(b)fluoranthene	330	810U	1100U	740U	550J	760U	720U	840U	820U
Benzo(k)fluoranthene	330	810U	1100U	740U	180J	760U	720U	840U	820U
Benzo(a)pyrene	330	810U	1100U	740U	340J	760U	720U	840U	820U
Indeno(1,2,3-cd)pyrene	330	810U	1100U	740U	140J	760U	720U	840U	820U
Dibenzo(a,h)anthracene	330	810U	1100U	740U	700U	760U	720U	840U	820U
Benzo(g,h,i)perylene	330	810U	1100U	740U	700U	760U	720U	840U	820U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected -the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
Sample JCDW1BS is a field replicate of JCDW1AS

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.8 (Cont.)

Sample ID		JCSW4CS-RE	JCSW5AS	JCSW5BS	JCSW6AS	JCSW6BS	JCSW7AS	JCSW7AS-RE	JCSW7BS
Lab ID		5909-003-RE	5832-001	5832-002	5770-001	5770-002	6044-001	6044-001-RE	6044-002
SDG #		1	1	1	1	1	3	3	3
Date Received		11/26/91	11/21/91	11/21/91	11/18/91	11/18/91	12/9/91	12/9/91	12/9/91
Date Extracted		12/17/91	11/26/91	11/26/91	11/21/91	11/21/91	12/10/91	12/30/91	12/10/91
Date Analyzed		12/19/91	12/13/91	12/13/91	12/14/91	12/13/91	12/20/91	1/9/92	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL								
Phenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
bis(2-chloroethyl)ether	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2-Chlorophenol	330	820U	710U	840U	110JD	730U	770U	780U	810U
1,3-Dichlorobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
1,4-Dichlorobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Benzyl Alcohol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
1,2-Dichlorobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2-Methylphenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
bis(2-Chloroisopropyl)ether	330	820U	710U	840U	1400UD	730U	770U	780U	810U
4-Methylphenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
N-Nitroso-Di-n-propylamine	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Hexachloroethane	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Nitrobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Isophorone	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2-Nitrophenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2,4-Dimethylphenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Benzoic Acid	1600	820U	710U	840U	1400UD	730U	770U	780U	810U
bis(2-Chloroethoxy)methane	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2,4-Dichlorophenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
1,2,4-Trichlorobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Naphthalene	330	820U	710U	840U	240JD	730U	770U	780U	810U
4-Chloroaniline	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Haxachlorobutadiene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
4-Chloro-3-methylphenol	330	820U	710U	840U	100JD	730U	770U	780U	810U
2-Methylnaphthalene	330	820U	710U	840U	92JD	730U	770U	780U	810U
Hexachlorocyclopentadiene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2,4,6-Trichlorophenol	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2,4,5-Trichlorophenol	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
2-Chloronaphthalene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2-Nitroaniline	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
Dimethylphthalate	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Acenaphthylene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
3-Nitroaniline	330	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
Acenaphthene	330	820U	710U	840U	1100JD	730U	770U	780U	810U

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TABLE F.8 (Cont.)

Sample ID		JCSW4CS-RE	JCSW5AS	JCSW5BS	JCSW6AS-DL	JCSW6BS	JCSW7AS	JCSW7AS-RE	JCSW7BS
Lab ID		5909-003-RE	5832-001	5832-002	5770-001	5770-002	6044-001	6044-001-RE	6044-002
SDG #		1	1	1	1	1	3	3	3
Date Received		11/26/91	11/21/91	11/21/91	11/18/91	11/18/91	12/9/91	12/9/91	12/9/91
Date Extracted		12/17/91	11/26/91	11/26/91	11/21/91	11/21/91	12/10/91	12/30/91	12/10/91
Date Analyzed		12/19/91	12/13/91	12/13/91	12/14/91	12/13/91	12/20/91	1/9/92	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL								
2,4-Dinitrophenol	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
4-Nitrophenol	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
Dibenzofuran	330	820U	710U	840U	390JD	730U	770U	780U	810U
2,4-Dinitrotoluene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
2,6-Dinitrotoluene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Diethylphthalate	330	820U	710U	840U	1400UD	730U	770U	780U	810U
4-Chlorophenyl-phenylether	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Fluorene	330	820U	710U	840U	740JD	730U	770U	780U	810U
4-Nitroaniline	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
4,6-Dinitro-2-methylphenol	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
N-Nitrosodiphenylamine	330	820U	710U	840U	1400UD	730U	770U	780U	810U
4-Bromophenyl-phenylether	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Hexachlorobenzene	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Pentachlorophenol	1600	4100U	3500U	4200U	7200UD	3600U	3900U	3900U	4100U
Phenanthrene	330	820U	710U	840U	6000D	730U	33J	780U	810U
Anthracene	330	820U	710U	840U	1600D	730U	770U	780U	810U
Di-n-Butylphthalate	330	140J	710U	200J	210JD	410J	770U	160J	810U
Fluoranthene	330	820U	710U	840U	9800D	110J	100J	100J	810U
Pyrene	330	820U	710U	840U	9100D	110J	770U	84J	810U
Butylbenzylphthalate	330	820U	710U	840U	1400UD	730U	770U	780U	810U
3,3'-Dichlorobenzidine	660	1600U	1400U	1700U	2900UD	1500U	1500U	1600U	1600U
Benzo(a)Anthracene	330	820U	710U	840U	5300D	730U	770U	780U	810U
bis(2-ethylhexyl)phthalate	330	820U	710U	530J	11000D	230J	330J	540J	210J
Chrysene	330	820U	710U	840U	4900D	68J	770U	780U	810U
Di-n-octylphthalate	330	820U	710U	840U	1400UD	730U	770U	780U	810U
Benzo(b)fluoranthene	330	820U	710U	840U	5200D	730U	770U	780U	810U
Benzo(k)fluoranthene	330	820U	710U	840U	1900D	730U	770U	780U	810U
Benzo(a)pyrene	330	820U	710U	840U	3700D	730U	770U	780U	810U
Indeno(1,2,3-cd)pyrene	330	820U	710U	840U	1600D	730U	770U	780U	810U
Dibenzo(a,h)anthracene	330	820U	710U	840U	440JD	730U	770U	780U	810U
Benzo(g,h,i)perylene	330	820U	710U	840U	1500D	730U	770U	780U	810U

Qualifiers

D: Dilution
J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected -the sample quantitation limitis an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
DL: Sample was diluted

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.8 (Cont.)

Sample ID		JCSW7BS-RE	JCSW8AS	JCSW8BS	JCSW9AS	JCSW9BS	JCBG1AS	JCBG1AS-RE
Lab ID		6044-002-RE	5554-001	5554-002	6069-001	6069-002	6044-003	6044-003-RE
SDG #		3	1	1	3	3	3	3
Date Received		12/9/91	11/5/91	11/5/91	12/10/91	12/10/91	12/9/91	12/9/91
Date Extracted		12/30/91	11/8/91	11/8/91	12/15/91	12/15/91	12/10/91	12/30/91
Date Analyzed		1/10/92	11/19/91	11/16/91	12/23/91	12/23/91	12/20/91	1/10/92
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
Phenol	330	800U	870U	860U	710U	900U	750U	750U
bis(2-chloroethyl)ether	330	800U	870U	860U	710U	900U	750U	750U
2-Chlorophenol	330	800U	870U	860U	710U	900U	750U	750U
1,3-Dichlorobenzene	330	800U	870U	860U	710U	900U	750U	750U
1,4-Dichlorobenzene	330	800U	870U	860U	710U	900U	750U	750U
Benzyl Alcohol	330	800U	870U	860U	710U	900U	750U	750U
1,2-Dichlorobenzene	330	800U	870U	860U	710U	900U	750U	750U
2-Methylphenol	330	800U	870U	860U	710U	900U	750U	750U
bis(2-Chloroisopropyl)ether	330	800U	870U	860U	710U	900U	750U	750U
4-Methylphenol	330	800U	870U	860U	710U	900U	750U	750U
N-Nitroso-Di-n-propylamine	330	800U	870U	860U	710U	900U	750U	750U
Hexachloroethane	330	800U	870U	860U	710U	900U	750U	750U
Nitrobenzene	330	800U	870U	860U	710U	900U	750U	750U
Isophorone	330	800U	870U	860U	710U	900U	750U	750U
2-Nitrophenol	330	800U	870U	860U	710U	900U	750U	750U
2,4-Dimethylphenol	330	800U	870U	860U	710U	900U	750U	750U
Benzoic Acid	1600	800U	870U	860U	710U	900U	750U	750U
bis(2-Chloroethoxy)methane	330	800U	870U	860U	710U	900U	750U	750U
2,4-Dichlorophenol	330	800U	870U	860U	710U	900U	750U	750U
1,2,4-Trichlorobenzene	330	800U	870U	860U	710U	900U	750U	750U
Naphthalene	330	800U	870U	1300	710U	900U	750U	750U
4-Chloroaniline	330	800U	870U	860U	710U	900U	750U	750U
Haxachlorobutadiene	330	800U	870U	860U	710U	900U	750U	750U
4-Chloro-3-methylphenol	330	800U	870U	860U	710U	900U	750U	750U
2-Methylnaphthalene	330	800U	870U	550J	710U	900U	750U	750U
Hexachlorocyclopentadiene	330	800U	870U	860U	710U	900U	750U	750U
2,4,6-Trichlorophenol	330	800U	870U	860U	710U	900U	750U	750U
2,4,5-Trichlorophenol	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
2-Chloronaphthalene	330	800U	870U	860U	710U	900U	750U	750U
2-Nitroaniline	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
Dimethylphthalate	330	800U	870U	860U	710U	900U	750U	750U
Acenaphthylene	330	800U	870U	280J	710U	900U	750U	750U
3-Nitroaniline	330	4000U	4300U	4300U	3500U	4500U	3700U	3700U
Acenaphthene	330	800U	870U	230J	710U	900U	750U	750U

(continued on next page)

TABLE F.8 (Cont.)

Sample ID		JCSW7BS-RE	JCSW8AS	JCSW8BS	JCSW9AS	JCSW9BS	JCBG1AS	JCBG1AS-RE
Lab ID		6044-002-RE	5554-001	5554-002	6069-001	6069-002	6044-003	6044-003-RE
SDG #		3	1	1	3	3	3	3
Date Received		12/9/91	11/5/91	11/5/91	12/10/91	12/10/91	12/9/91	12/9/91
Date Extracted		12/30/91	11/8/91	11/8/91	12/15/91	12/15/91	12/10/91	12/30/91
Date Analyzed		1/10/92	11/19/91	11/16/91	12/23/91	12/23/91	12/20/91	1/10/92
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
2,4-Dinitrophenol	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
4-Nitrophenol	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
Dibenzofuran	330	800U	870U	510J	710U	900U	750U	750U
2,4-Dinitrotoluene	330	800U	870U	860U	710U	900U	750U	750U
2,6-Dinitrotoluene	330	800U	870U	860U	710U	900U	750U	750U
Diethylphthalate	330	800U	870U	860U	710U	900U	750U	750U
4-Chlorophenyl-phenylether	330	800U	870U	860U	710U	900U	750U	750U
Fluorene	330	800U	870U	750J	710U	900U	750U	750U
4-Nitroaniline	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
4,6-Dinitro-2-methylphenol	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
N-Nitrosodiphenylamine	330	800U	870U	860U	710U	900U	750U	750U
4-Bromophenyl-phenylether	330	800U	870U	860U	710U	900U	750U	750U
Hexachlorobenzene	330	800U	870U	860U	710U	900U	750U	750U
Pentachlorophenol	1600	4000U	4300U	4300U	3500U	4500U	3700U	3700U
Phenanthrene	330	800U	870U	2700	710U	900U	63J	750U
Anthracene	330	800U	870U	520J	710U	900U	750U	750U
Di-n-Butylphthalate	330	800U	870U	860U	120J	110J	750U	750U
Fluoranthene	330	800U	870U	2000	140J	900U	96J	750U
Pyrene	330	800U	870U	1800	710U	900U	750U	750U
Butylbenzylphthalate	330	800U	870U	860U	710U	900U	750U	750U
3,3'-Dichlorobenzidine	660	1600U	1700U	1700U	1400U	1800U	1500U	1500U
Benzo(a)Anthracene	330	800U	870U	850J	710U	900U	750U	750U
bis(2-ethylhexyl)phthalate	330	800U	870U	150J	710U	900U	750U	750U
Chrysene	330	800U	870U	780J	710U	900U	750U	750U
Di-n-octylphthalate	330	800U	870U	860U	710U	900U	750U	750U
Benzo(b)fluoranthene	330	800U	870U	850J	710U	900U	750U	750U
Benzo(k)fluoranthene	330	800U	870U	220J	710U	900U	750U	750U
Benzo(a)pyrene	330	800U	870U	580J	710U	900U	750U	750U
Indeno(1,2,3-cd)pyrene	330	800U	870U	280J	710U	900U	750U	750U
Dibenzo(a,h)anthracene	330	800U	870U	860U	710U	900U	750U	750U
Benzo(g,h,i)perylene	330	800U	870U	140J	710U	900U	750U	750U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected -the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
Sample JCSW9BS is a field replicate of JCSW9AS
Sample JCBG1AS is a background sample
(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.9
Analytical Results for AFP 59, Johnson City: Groundwater Samples — Semivolatile Organic Analysis (1)

Sample ID		JCDW1AW	JCDW1BW	JCSW1AW	JCSW1BW	JCDW3AW	JCDW3BW	JCDW3BW-RE	JCDW3RW
Lab ID		6384-001	6749-005	6384-002	6749-006	6415-002	6761-001	6761-001-RE	6761-002
SDG #		5	6	5	6	5	6	6	6
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/9/92	2/3/92	2/3/92	2/3/92
Date Extracted		1/9/92	2/6/92	1/9/92	2/6/92	1/9/92	2/4/92	2/26/92	2/4/92
Date Analyzed		1/29/92	2/28/92	1/29/92	2/28/92	1/30/92	2/24/92	2/29/92	2/26/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL								
Phenol	10	10U	10U	11U	11U	10U	10U	11U	10U
bis(2-chloroethyl)ether	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2-Chlorophenol	10	10U	10U	11U	11U	10U	10U	11U	10U
1,3-Dichlorobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
1,4-Dichlorobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Benzyl Alcohol	10	10U	10U	11U	11U	10U	11UJ	11U	10U
1,2-Dichlorobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2-Methylphenol	10	10U	10U	11U	11U	10U	10U	11U	10U
bis(2-Chloroisopropyl)ether	10	10U	10U	11U	11U	10U	11UJ	11U	10U
4-Methylphenol	10	10U	10U	11U	11U	10U	10U	11U	10U
N-Nitroso-Di-n-propylamine	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Hexachloroethane	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Nitrobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Isophorone	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2-Nitrophenol	10	10U	10U	11U	11U	10U	10U	11U	10U
2,4-Dimethylphenol	10	10U	10U	11U	11U	10U	10U	11U	10U
Benzoic Acid	50	10U	10U	11U	11U	10U	10U	11U	10U
bis(2-Chloroethoxy)methane	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2,4-Dichlorophenol	10	10U	10U	11U	11U	10U	10U	11U	10U
1,2,4-Trichlorobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Naphthalene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
4-Chloroaniline	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Haxachlorobutadiene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
4-Chloro-3-methylphenol	10	10U	10U	11U	11U	10U	10U	11U	10U
2-Methylnaphthalene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Hexachlorocyclopentadiene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2,4,6-Trichlorophenol	10	10U	10U	11U	11U	10U	10U	11U	10U
2,4,5-Trichlorophenol	50	49U	49U	53U	55U	48U	48U	56U	49U
2-Chloronaphthalene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2-Nitroaniline	50	49U	49U	53U	55U	48U	56UJ	56U	49U
Dimethylphthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
Acenaphthylene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
3-Nitroaniline	10	49U	49U	53U	55U	48U	56UJ	56U	49U
Acenaphthene	10	10U	10U	11U	11U	10U	11UJ	11U	10U

(continued on next page)

TABLE F.9 (Cont.)

Sample ID		JCDW1AW	JCDW1BW	JCSW1AW	JCSW1BW	JCDW3AW	JCDW3BW	JCDW3BW-RE	JCDW3RW
Lab ID		6384-001	6749-005	6384-002	6749-006	6415-002	6761-001	6761-001-RE	6761-002
SDG #		5	6	5	6	5	6	6	6
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/9/92	2/3/92	2/3/92	2/3/92
Date Extracted		1/9/92	2/6/92	1/9/92	2/6/92	1/9/92	2/4/92	2/26/92	2/4/92
Date Analyzed		1/29/92	2/28/92	1/29/92	2/28/92	1/30/92	2/24/92	2/29/92	2/26/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL								
2,4-Dinitrophenol	50	49U	49U	53U	55U	48U	48U	56U	49U
4-Nitrophenol	50	49U	49U	53U	55U	48U	48U	56U	49U
Dibenzofuran	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2,4-Dinitrotoluene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
2,6-Dinitrotoluene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Diethylphthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
4-Chlorophenyl-phenylether	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Fluorene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
4-Nitroaniline	50	49U	49U	53U	55U	48U	56UJ	56U	49U
4,6-Dinitro-2-methylphenol	50	49U	49U	53U	55U	48U	48U	56U	49U
N-Nitrosodiphenylamine	10	10U	10U	11U	11U	10U	11UJ	11U	10U
4-Bromophenyl-phenylether	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Hexachlorobenzene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Pentachlorophenol	50	49U	49U	53U	55U	48U	48U	56U	49U
Phenanthrene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Anthracene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Di-n-Butylphthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
Fluoranthene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Pyrene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Butylbenzylphthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
3,3'-Dichlorobenzidine	20	19U	19U	21U	22U	19U	22UJ	22U	19U
Benzo(a)Anthracene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
bis(2-ethylhexyl)phthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
Chrysene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Di-n-octylphthalate	10	10U	10U	11U	11U	10U	10U	11U	10U
Benzo(b)fluoranthene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Benzo(k)fluoranthene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Benzo(a)pyrene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Indeno(1,2,3-cd)pyrene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Dibenzo(a,h)anthracene	10	10U	10U	11U	11U	10U	11UJ	11U	10U
Benzo(g,h,i)perylene	10	10U	10U	11U	11U	10U	11UJ	11U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
Sample JCDW3RW is a field replicate of JCDW3BW

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.9 (Cont.)

Sample ID		JCSW3AW	JCSW3BW	JCDW4AW	JCDW4BW	JCSW4AW	JCSW4BW	JCDW5AW	JCDW5BW
Lab ID		6415-003	6761-003	6415-006	6703-001	6415-009	6703-004	6384-003	6749-001
SDG #		5	6	5	6	5	6	5	6
Date Received		1/9/92	2/3/92	1/9/92	1/30/92	1/9/92	1/30/92	1/6/92	2/1/92
Date Extracted		1/9/92	2/4/92	1/9/92	2/4/92	1/9/92	2/4/92	1/9/92	2/6/92
Date Analyzed		1/30/92	2/26/92	1/30/92	2/21/92	1/31/92	2/28/92	1/29/92	2/28/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL								
Phenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
bis(2-chloroethyl)ether	10	10U	10U	11U	10U	10U	10U	10U	10U
2-Chlorophenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
1,3-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
1,4-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
Benzyl Alcohol	10	10U	10U	11U	10U	10U	10U	10U	10U
1,2-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
2-Methylphenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
bis(2-Chloroisopropyl)ether	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Methylphenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
N-Nitroso-Di-n-propylamine	10	10U	10U	11U	10U	10U	10U	10U	10U
Hexachloroethane	10	10U	10U	11U	10U	10U	10U	10U	10U
Nitrobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
Isophorone	10	10U	10U	11U	10U	10U	10U	10U	10U
2-Nitrophenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
2,4-Dimethylphenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
Benzoic Acid	50	10U	10U	11U	13UJ	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	10	10U	10U	11U	10U	10U	10U	10U	10U
2,4-Dichlorophenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
1,2,4-Trichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
Naphthalene	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Chloroaniline	10	10U	10U	11U	10U	10U	10U	10U	10U
Haxachlorobutadiene	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Chloro-3-methylphenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
2-Methylnaphthalene	10	10U	10U	11U	10U	10U	10U	10U	10U
Hexachlorocyclopentadiene	10	10U	10U	11U	10U	10U	10U	10U	10U
2,4,6-Trichlorophenol	10	10U	10U	11U	13UJ	10U	10U	10U	10U
2,4,5-Trichlorophenol	50	48U	48U	54U	63UJ	48U	48U	48U	49U
2-Chloronaphthalene	10	10U	10U	11U	10U	10U	10U	10U	10U
2-Nitroaniline	50	48U	48U	54U	48U	48U	48U	48U	49U
Dimethylphthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
Acenaphthylene	10	10U	10U	11U	10U	10U	10U	10U	10U
3-Nitroaniline	10	48U	48U	54U	48U	48U	48U	48U	49U
Acenaphthene	10	10U	10U	11U	10U	10U	10U	10U	10U

(continued on next page)

TABLE F.9 (Cont.)

Sample ID		JCSW3AW	JCSW3BW	JCDW4AW	JCDW4BW	JCSW4AW	JCSW4BW	JCDW5AW	JCDW5BW
Lab ID		6415-003	6761-003	6415-006	6703-001	6415-009	6703-004	6384-003	6749-001
SDG #		5	6	5	6	5	6	5	6
Date Received		1/9/92	2/3/92	1/9/92	1/30/92	1/9/92	1/30/92	1/6/92	2/1/92
Date Extracted		1/9/92	2/4/92	1/9/92	2/4/92	1/9/92	2/4/92	1/9/92	2/6/92
Date Analyzed		1/30/92	2/26/92	1/30/92	2/21/92	1/31/92	2/28/92	1/29/92	2/28/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL								
2,4-Dinitrophenol	50	48U	48U	54U	63UJ	48U	48U	48U	49U
4-Nitrophenol	50	48U	48U	54U	63UJ	48U	48U	48U	49U
Dibenzofuran	10	10U	10U	11U	10U	10U	10U	10U	10U
2,4-Dinitrotoluene	10	10U	10U	11U	10U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	11U	10U	10U	10U	10U	10U
Diethylphthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Chlorophenyl-phenylether	10	10U	10U	11U	10U	10U	10U	10U	10U
Fluorene	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Nitroaniline	50	48U	48U	54U	48U	48U	48U	48U	49U
4,6-Dinitro-2-methylphenol	50	48U	48U	54U	63UJ	48U	48U	48U	49U
N-Nitrosodiphenylamine	10	10U	10U	11U	10U	10U	10U	10U	10U
4-Bromophenyl-phenylether	10	10U	10U	11U	10U	10U	10U	10U	10U
Hexachlorobenzene	10	10U	10U	11U	10U	10U	10U	10U	10U
Pentachlorophenol	50	48U	48U	54U	63UJ	48U	48U	48U	49U
Phenanthrene	10	10U	10U	11U	10U	10U	10U	10U	10U
Anthracene	10	10U	10U	11U	10U	10U	10U	10U	10U
Di-n-Butylphthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
Fluoranthene	10	10U	10U	11U	10U	10U	10U	10U	10U
Pyrene	10	10U	10U	11U	10U	10U	10U	10U	10U
Butylbenzylphthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	20	19U	19U	22U	19U	19U	19U	19U	19U
Benzo(a)Anthracene	10	10U	10U	11U	10U	10U	10U	10U	10U
bis(2-ethylhexyl)phthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
Chrysene	10	10U	10U	11U	10U	10U	10U	10U	10U
Di-n-octylphthalate	10	10U	10U	11U	10U	10U	10U	10U	10U
Benzo(b)fluoranthene	10	10U	10U	11U	10U	10U	10U	10U	10U
Benzo(k)fluoranthene	10	10U	10U	11U	10U	10U	10U	10U	10U
Benzo(a)pyrene	10	10U	10U	11U	10U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	10	10U	10U	11U	10U	10U	10U	10U	10U
Dibenzo(a,h)anthracene	10	10U	10U	11U	10U	10U	10U	10U	10U
Benzo(g,h,i)perylene	10	10U	10U	11U	10U	10U	10U	10U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.9 (Cont.)

Sample ID		JCSW5AW	JCSW5BW	JCDW6AW	JCDW6BW	JCSW6AW	JCSW6BW	JCSW7AW
Lab ID		6384-004	6749-002	6384-005	6749-003	6384-006	6749-004	6415-010
SDG #		5	6	5	6	5	6	5
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/6/92	2/1/92	1/9/92
Date Extracted		1/9/92	2/6/92	1/9/92	2/6/92	1/9/92	2/6/92	1/9/92
Date Analyzed		1/30/92	2/28/92	1/30/92	2/28/92	1/30/92	2/28/92	1/31/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Phenol	10	10U	10U	11U	10U	10U	10U	10U
bis(2-chloroethyl)ether	10	10U	10U	11U	10U	10U	10U	10U
2-Chlorophenol	10	10U	10U	11U	10U	10U	10U	10U
1,3-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U
1,4-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U
Benzyl Alcohol	10	10U	10U	11U	10U	10U	10U	10U
1,2-Dichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U
2-Methylphenol	10	10U	10U	11U	10U	10U	10U	10U
bis(2-Chloroisopropyl)ether	10	10U	10U	11U	10U	10U	10U	10U
4-Methylphenol	10	10U	10U	11U	10U	10U	10U	10U
N-Nitroso-Di-n-propylamine	10	10U	10U	11U	10U	10U	10U	10U
Hexachloroethane	10	10U	10U	11U	10U	10U	10U	10U
Nitrobenzene	10	10U	10U	11U	10U	10U	10U	10U
Isophorone	10	10U	10U	11U	10U	10U	10U	10U
2-Nitrophenol	10	10U	10U	11U	10U	10U	10U	10U
2,4-Dimethylphenol	10	10U	10U	11U	10U	10U	10U	10U
Benzoic Acid	50	10U	10U	11U	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	10	10U	10U	11U	10U	10U	10U	10U
2,4-Dichlorophenol	10	10U	10U	11U	10U	10U	10U	10U
1,2,4-Trichlorobenzene	10	10U	10U	11U	10U	10U	10U	10U
Naphthalene	10	10U	10U	11U	10U	10U	10U	10U
4-Chloroaniline	10	10U	10U	11U	10U	10U	10U	10U
Haxachlorobutadiene	10	10U	10U	11U	10U	10U	10U	10U
4-Chloro-3-methylphenol	10	10U	10U	11U	10U	10U	10U	10U
2-Methylnaphthalene	10	10U	10U	11U	10U	10U	10U	10U
Hexachlorocyclopentadiene	10	10U	10U	11U	10U	10U	10U	10U
2,4,6-Trichlorophenol	10	10U	10U	11U	10U	10U	10U	10U
2,4,5-Trichlorophenol	50	48U	49U	57U	49U	48U	50U	48U
2-Chloronaphthalene	10	10U	10U	11U	10U	10U	10U	10U
2-Nitroaniline	50	48U	49U	57U	49U	48U	50U	48U
Dimethylphthalate	10	10U	10U	11U	10U	10U	10U	10U
Acenaphthylene	10	10U	10U	11U	10U	10U	10U	10U
3-Nitroaniline	10	48U	49U	57U	49U	48U	50U	48U
Acenaphthene	10	10U	10U	11U	10U	10U	10U	10U

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TABLE F.9 (Cont.)

Sample ID		JCSW5AW	JCSW5BW	JCDW6AW	JCDW6BW	JCSW6AW	JCSW6BW	JCSW7AW
Lab ID		6384-004	6749-002	6384-005	6749-003	6384-006	6749-004	6415-010
SDG #		5	6	5	6	5	6	5
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/6/92	2/1/92	1/9/92
Date Extracted		1/9/92	2/6/92	1/9/92	2/6/92	1/9/92	2/6/92	1/9/92
Date Analyzed		1/30/92	2/28/92	1/30/92	2/28/92	1/30/92	2/28/92	1/31/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER*	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
2,4-Dinitrophenol	50	48U	49U	57U	49U	48U	50U	48U
4-Nitrophenol	50	48U	49U	57U	49U	48U	50U	48U
Dibenzofuran	10	10U	10U	11U	10U	10U	10U	10U
2,4-Dinitrotoluene	10	10U	10U	11U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	11U	10U	10U	10U	10U
Diethylphthalate	10	10U	10U	11U	10U	10U	10U	10U
4-Chlorophenyl-phenylether	10	10U	10U	11U	10U	10U	10U	10U
Fluorene	10	10U	10U	11U	10U	10U	10U	10U
4-Nitroaniline	50	48U	49U	57U	49U	48U	50U	48U
4,6-Dinitro-2-methylphenol	50	48U	49U	57U	49U	48U	50U	48U
N-Nitrosodiphenylamine	10	10U	10U	11U	10U	10U	10U	10U
4-Bromophenyl-phenylether	10	10U	10U	11U	10U	10U	10U	10U
Hexachlorobenzene	10	10U	10U	11U	10U	10U	10U	10U
Pentachlorophenol	50	48U	49U	57U	49U	48U	50U	48U
Phenanthrene	10	10U	10U	11U	10U	10U	10U	10U
Anthracene	10	10U	10U	11U	10U	10U	10U	10U
Di-n-Butylphthalate	10	10U	10U	11U	10U	10U	10U	10U
Fluoranthene	10	10U	10U	11U	10U	10U	10U	10U
Pyrene	10	10U	10U	11U	10U	10U	10U	10U
Butylbenzylphthalate	10	10U	10U	11U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	20	19U	19U	23U	19U	19U	20U	19U
Benzo(a)Anthracene	10	10U	10U	11U	10U	10U	10U	10U
bis(2-ethylhexyl)phthalate	10	10U	10U	11U	10U	10U	10U	10U
Chrysene	10	10U	10U	11U	10U	10U	10U	10U
Di-n-octylphthalate	10	10U	10U	11U	10U	10U	10U	10U
Benzo(b)fluoranthene	10	10U	10U	11U	10U	10U	10U	10U
Benzo(k)fluoranthene	10	10U	10U	11U	10U	10U	10U	10U
Benzo(a)pyrene	10	10U	10U	11U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	10	10U	10U	11U	10U	10U	10U	10U
Dibenzo(a,h)anthracene	10	10U	10U	11U	10U	10U	10U	10U
Benzo(g,h,i)perylene	10	10U	10U	11U	10U	10U	10U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.9 (Cont.)

Sample ID		JCSW7BW	JCDW8AW	JCDW8RW	JCDW8BW	JCDW4BW-RE	JCSW8AW	JCSW8BW
Lab ID		6703-005	6446-001	6446-002	6703-006	6703-001-RE	6446-003	6703-007
SDG #		6	5	5	6	6	5	6
Date Received		1/30/92	1/10/92	1/10/92	1/30/92	1/30/92	1/10/92	1/30/92
Date Extracted		2/4/92	1/13/92	1/13/92	2/4/92	2/27/92	1/13/92	2/4/92
Date Analyzed		2/24/92	1/31/92	1/31/92	2/26/92	3/1/92	1/31/92	2/24/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Phenol	10	11U	10U	10U	10U	13U	10U	10U
bis(2-chloroethyl)ether	10	11U	10U	10U	10U	13U	10U	10U
2-Chlorophenol	10	11U	10U	10U	10U	13U	10U	10U
1,3-Dichlorobenzene	10	11U	10U	10U	10U	13U	10U	10U
1,4-Dichlorobenzene	10	11U	10U	10U	10U	13U	10U	10U
Benzyl Alcohol	10	11U	10U	10U	10U	13U	10U	10U
1,2-Dichlorobenzene	10	11U	10U	10U	10U	13U	10U	10U
2-Methylphenol	10	11U	10U	10U	10U	13U	10U	10U
bis(2-Chloroisopropyl)ether	10	11U	10U	10U	10U	13U	10U	10U
4-Methylphenol	10	11U	10U	10U	10U	13U	10U	10U
N-Nitroso-Di-n-propylamine	10	11U	10U	10U	10U	13U	10U	10U
Hexachloroethane	10	11U	10U	10U	10U	13U	10U	10U
Nitrobenzene	10	11U	10U	10U	10U	13U	10U	10U
Isophorone	10	11U	10U	10U	10U	13U	10U	10U
2-Nitrophenol	10	11U	10U	10U	10U	13U	10U	10U
2,4-Dimethylphenol	10	11U	10U	10U	10U	13U	10U	10U
Benzoic Acid	50	11U	10U	10U	10U	13U	10U	10U
bis(2-Chloroethoxy)methane	10	11U	10U	10U	10U	13U	10U	10U
2,4-Dichlorophenol	10	11U	10U	10U	10U	13U	10U	10U
1,2,4-Trichlorobenzene	10	11U	10U	10U	10U	13U	10U	10U
Naphthalene	10	11U	10U	10U	10U	13U	10U	10U
4-Chloroaniline	10	11U	10U	10U	10U	13U	10U	10U
Haxachlorobutadiene	10	11U	10U	10U	10U	13U	10U	10U
4-Chloro-3-methylphenol	10	11U	10U	10U	10U	13U	10U	10U
2-Methylnaphthalene	10	11U	10U	10U	10U	13U	10U	10U
Hexachlorocyclopentadiene	10	11U	10U	10U	10U	13U	10U	10U
2,4,6-Trichlorophenol	10	11U	10U	10U	10U	13U	10U	10U
2,4,5-Trichlorophenol	50	54U	48U	48U	48U	63U	48U	48U
2-Chloronaphthalene	10	11U	10U	10U	10U	13U	10U	10U
2-Nitroaniline	50	54U	48U	48U	48U	63U	48U	48U
Dimethylphthalate	10	11U	10U	10U	10U	13U	10U	10U
Acenaphthylene	10	11U	10U	10U	10U	13U	10U	10U
3-Nitroaniline	10	54U	48U	48U	48U	63U	48U	48U
Acenaphthene	10	11U	10U	10U	10U	13U	10U	10U

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TABLE F.9 (Cont.)

Sample ID		JCSW7BW	JCDW8AW	JCDW8RW	JCDW8BW	JCDW4BW-RE	JCSW8AW	JCSW8BW
Lab ID		6703-005	6446-001	6446-002	6703-006	6703-001-RE	6446-003	6703-007
SDG #		6	5	5	6	6	5	6
Date Received		1/30/92	1/10/92	1/10/92	1/30/92	1/30/92	1/10/92	1/30/92
Date Extracted		2/4/92	1/13/92	1/13/92	2/4/92	2/27/92	1/13/92	2/4/92
Date Analyzed		2/24/92	1/31/92	1/31/92	2/26/92	3/1/92	1/31/92	2/24/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
2,4-Dinitrophenol	50	54U	48U	48U	48U	63U	48U	48U
4-Nitrophenol	50	54U	48U	48U	48U	63U	48U	48U
Dibenzofuran	10	11U	10U	10U	10U	13U	10U	10U
2,4-Dinitrotoluene	10	11U	10U	10U	10U	13U	10U	10U
2,6-Dinitrotoluene	10	11U	10U	10U	10U	13U	10U	10U
Diethylphthalate	10	11U	10U	10U	10U	13U	10U	10U
4-Chlorophenyl-phenylether	10	11U	10U	10U	10U	13U	10U	10U
Fluorene	10	11U	10U	10U	10U	13U	10U	10U
4-Nitroaniline	50	54U	48U	48U	48U	63U	48U	48U
4,6-Dinitro-2-methylphenol	50	54U	48U	48U	48U	63U	48U	48U
N-Nitrosodiphenylamine	10	11U	10U	10U	10U	13U	10U	10U
4-Bromophenyl-phenylether	10	11U	10U	10U	10U	13U	10U	10U
Hexachlorobenzene	10	11U	10U	10U	10U	13U	10U	10U
Pentachlorophenol	50	54U	48U	48U	48U	63U	48U	48U
Phenanthrene	10	11U	10U	10U	10U	13U	10U	10U
Anthracene	10	11U	10U	10U	10U	13U	10U	10U
Di-n-Butylphthalate	10	11U	10U	10U	10U	13U	10U	10U
Fluoranthene	10	11U	10U	10U	10U	13U	10U	10U
Pyrene	10	11U	10U	10U	10U	13U	10U	10U
Butylbenzylphthalate	10	11U	10U	10U	10U	13U	10U	10U
3,3'-Dichlorobenzidine	20	22U	19U	19U	19U	25U	19U	19U
Benzo(a)Anthracene	10	11U	10U	10U	10U	13U	10U	10U
bis(2-ethylhexyl)phthalate	10	11U	10U	10U	10U	13U	10U	10U
Chrysene	10	11U	10U	10U	10U	13U	10U	10U
Di-n-octylphthalate	10	11U	10U	10U	10U	13U	10U	10U
Benzo(b)fluoranthene	10	11U	10U	10U	10U	13U	10U	10U
Benzo(k)fluoranthene	10	11U	10U	10U	10U	13U	10U	10U
Benzo(a)pyrene	10	11U	10U	10U	10U	13U	10U	10U
Indeno(1,2,3-cd)pyrene	10	11U	10U	10U	10U	13U	10U	10U
Dibenzo(a,h)anthracene	10	11U	10U	10U	10U	13U	10U	10U
Benzo(g,h,i)perylene	10	11U	10U	10U	10U	13U	10U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
Sample JCDW8RW is a field replicate of JCDW8AW

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.9 (Cont.)

Sample ID		JCDW9AW	JCDW9BW	JCSW9AW	JCSW9BW	JCDPWAW	JCDPWBW	JCBG2BW
Lab ID		6415-004	6761-004	6415-005	6761-005	6446-004	6761-006	6415-001
SDG #		5	6	5	6	5	6	5
Date Received		1/9/92	2/3/92	1/9/92	2/3/92	1/10/92	2/3/92	1/9/92
Date Extracted		1/9/92	2/4/92	1/9/92	2/4/92	1/13/92	2/4/92	1/9/92
Date Analyzed		1/30/92	2/26/92	1/31/92	2/27/92	1/31/92	2/27/92	1/30/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Phenol	10	11U	10U	11U	10U	10U	10U	11U
bis(2-chloroethyl)ether	10	11U	10U	11U	10U	10U	10U	11U
2-Chlorophenol	10	11U	10U	11U	10U	10U	10U	11U
1,3-Dichlorobenzene	10	11U	10U	11U	10U	10U	10U	11U
1,4-Dichlorobenzene	10	11U	10U	11U	10U	10U	10U	11U
Benzyl Alcohol	10	11U	10U	11U	10U	10U	10U	11U
1,2-Dichlorobenzene	10	11U	10U	11U	10U	10U	10U	11U
2-Methylphenol	10	11U	10U	11U	10U	10U	10U	11U
bis(2-Chloroisopropyl)ether	10	11U	10U	11U	10U	10U	10U	11U
4-Methylphenol	10	11U	10U	11U	10U	10U	10U	11U
N-Nitroso-Di-n-propylamine	10	11U	10U	11U	10U	10U	10U	11U
Hexachloroethane	10	11U	10U	11U	10U	10U	10U	11U
Nitrobenzene	10	11U	10U	11U	10U	10U	10U	11U
Isophorone	10	11U	10U	11U	10U	10U	10U	11U
2-Nitrophenol	10	11U	10U	11U	10U	10U	10U	11U
2,4-Dimethylphenol	10	11U	10U	11U	10U	10U	10U	11U
Benzoic Acid	50	11U	10U	11U	10U	10U	10U	11U
bis(2-Chloroethoxy)methane	10	11U	10U	11U	10U	10U	10U	11U
2,4-Dichlorophenol	10	11U	10U	11U	10U	10U	10U	11U
1,2,4-Trichlorobenzene	10	11U	10U	11U	10U	10U	10U	11U
Naphthalene	10	11U	10U	11U	10U	10U	10U	11U
4-Chloroaniline	10	11U	10U	11U	10U	10U	10U	11U
Haxachlorobutadiene	10	11U	10U	11U	10U	10U	10U	11U
4-Chloro-3-methylphenol	10	11U	10U	11U	10U	10U	10U	11U
2-Methylnaphthalene	10	11U	10U	11U	10U	10U	10U	11U
Hexachlorocyclopentadiene	10	11U	10U	11U	10U	10U	10U	11U
2,4,6-Trichlorophenol	10	11U	10U	11U	10U	10U	10U	11U
2,4,5-Trichlorophenol	50	55U	52U	54U	48U	48U	48U	53U
2-Chloronaphthalene	10	11U	10U	11U	10U	10U	10U	11U
2-Nitroaniline	50	55U	52U	54U	48U	48U	48U	53U
Dimethylphthalate	10	11U	10U	11U	10U	10U	10U	11U
Acenaphthylene	10	11U	10U	11U	10U	10U	10U	11U
3-Nitroaniline	10	55U	52U	54U	48U	48U	48U	53U
Acenaphthene	10	11U	10U	11U	10U	10U	10U	11U

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TABLE F.9 (Cont.)

Sample ID		JCDW9AW	JCDW9BW	JCSW9AW	JCSW9BW	JCDPWAW	JCDPWBW	JCBG2BW
Lab ID		6415-004	6761-004	6415-005	6761-005	6446-004	6761-006	6415-001
SDG #		5	6	5	6	5	6	5
Date Received		1/9/92	2/3/92	1/9/92	2/3/92	1/10/92	2/3/92	1/9/92
Date Extracted		1/9/92	2/4/92	1/9/92	2/4/92	1/13/92	2/4/92	1/9/92
Date Analyzed		1/30/92	2/26/92	1/31/92	2/27/92	1/31/92	2/27/92	1/30/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
2,4-Dinitrophenol	50	55U	52U	54U	48U	48U	48U	53U
4-Nitrophenol	50	55U	52U	54U	48U	48U	48U	53U
Dibenzofuran	10	11U	10U	11U	10U	10U	10U	11U
2,4-Dinitrotoluene	10	11U	10U	11U	10U	10U	10U	11U
2,6-Dinitrotoluene	10	11U	10U	11U	10U	10U	10U	11U
Diethylphthalate	10	11U	10U	11U	10U	10U	10U	11U
4-Chlorophenyl-phenylether	10	11U	10U	11U	10U	10U	10U	11U
Fluorene	10	11U	10U	11U	10U	10U	10U	11U
4-Nitroaniline	50	55U	52U	54U	48U	48U	48U	53U
4,6-Dinitro-2-methylphenol	50	55U	52U	54U	48U	48U	48U	53U
N-Nitrosodiphenylamine	10	11U	10U	11U	10U	10U	10U	11U
4-Bromophenyl-phenylether	10	11U	10U	11U	10U	10U	10U	11U
Hexachlorobenzene	10	11U	10U	11U	10U	10U	10U	11U
Pentachlorophenol	50	55U	52U	54U	48U	48U	48U	53U
Phenanthrene	10	11U	10U	11U	10U	10U	10U	11U
Anthracene	10	11U	10U	11U	10U	10U	10U	11U
Di-n-Butylphthalate	10	11U	10U	11U	10U	10U	10U	11U
Fluoranthene	10	11U	10U	11U	10U	10U	10U	11U
Pyrene	10	11U	10U	11U	10U	10U	10U	11U
Butylbenzylphthalate	10	11U	10U	11U	10U	10U	10U	11U
3,3'-Dichlorobenzidine	20	22U	21U	22U	19U	19U	19U	21U
Benzo(a)Anthracene	10	11U	10U	11U	10U	10U	10U	11U
bis(2-ethylhexyl)phthalate	10	11U	10U	11U	10U	10U	10U	11U
Chrysene	10	11U	10U	11U	10U	10U	10U	11U
Di-n-octylphthalate	10	11U	10U	11U	10U	10U	10U	11U
Benzo(b)fluoranthene	10	11U	10U	11U	10U	10U	10U	11U
Benzo(k)fluoranthene	10	11U	10U	11U	10U	10U	10U	11U
Benzo(a)pyrene	10	11U	10U	11U	10U	10U	10U	11U
Indeno(1,2,3-cd)pyrene	10	11U	10U	11U	10U	10U	10U	11U
Dibenzo(a,h)anthracene	10	11U	10U	11U	10U	10U	10U	11U
Benzo(g,h,i)perylene	10	11U	10U	11U	10U	10U	10U	11U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
Sample JCBG2BW is a background sample

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.10
Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Semivolatile Organic Analysis (1)

Sample ID		JCOF1AW	JCOF2AW	JCCW1AW	JCCW2AW	JCCNCAW
Lab ID		5868-001	5868-002	5807-002	5807-001	5808-001
SDG #		2	2	2	2	2
Date Received		11/24/91	11/24/91	11/18/91	11/18/91	11/18/91
Date Extracted		11/26/91	11/26/91	11/21/91	11/21/91	11/21/91
Date Analyzed		12/18/91	12/18/91	12/17/91	12/17/91	12/17/91
Matrix		WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL					
Phenol	10	12U	10U	11U	11U	10U
bis(2-chloroethyl)ether	10	12U	10U	11U	11U	10U
2-Chlorophenol	10	12U	10U	11U	11U	10U
1,3-Dichlorobenzene	10	12U	10U	11U	11U	10U
1,4-Dichlorobenzene	10	12U	10U	11U	11U	10U
Benzyl Alcohol	10	12U	10U	11U	11U	10U
1,2-Dichlorobenzene	10	12U	10U	11U	11U	10U
2-Methylphenol	10	12U	10U	11U	11U	10U
bis(2-Chloroisopropyl)ether	10	12U	10U	11U	11U	10U
4-Methylphenol	10	12U	10U	11U	11U	10U
N-Nitroso-Di-n-propylamine	10	12U	10U	11U	11U	10U
Hexachloroethane	10	12U	10U	11U	11U	10U
Nitrobenzene	10	12U	10U	11U	11U	10U
Isophorone	10	12U	10U	11U	11U	10U
2-Nitrophenol	10	12U	10U	11U	11U	10U
2,4-Dimethylphenol	10	12U	10U	11U	11U	10U
Benzoic Acid	50	12U	10U	11U	11U	10U
bis(2-Chloroethoxy)methane	10	12U	10U	11U	11U	10U
2,4-Dichlorophenol	10	12U	10U	11U	11U	10U
1,2,4-Trichlorobenzene	10	12U	10U	11U	11U	10U
Naphthalene	10	12U	10U	11U	11U	10U
4-Chloroaniline	10	12U	10U	11U	11U	10U
Hexachlorobutadiene	10	12U	10U	11U	11U	10U
4-Chloro-3-methylphenol	10	12U	10U	11U	11U	10U
2-Methylnaphthalene	10	12U	10U	11U	11U	10U
Hexachlorocyclopentadiene	10	12U	10U	11U	11U	10U
2,4,6-Trichlorophenol	10	12U	10U	11U	11U	10U
2,4,5-Trichlorophenol	50	60U	50U	57U	56U	49U
2-Chloronaphthalene	10	12U	10U	11U	11U	10U
2-Nitroaniline	50	60U	50U	57U	56U	49U
Dimethylphthalate	10	12U	10U	11U	11U	10U
Acenaphthylene	10	12U	10U	11U	11U	10U
3-Nitroaniline	10	60U	50U	57U	56U	49U
Acenaphthene	10	12U	10U	11U	11U	10U

(continued on next page)

TABLE F.10 (Cont.)

Sample ID		JCOF1AW	JCOF2AW	JCCW1AW	JCCW2AW	JCCNCAW
Lab ID		5868-001	5868-002	5807-002	5807-001	5808-001
SDG #		2	2	2	2	2
Date Received		11/24/91	11/24/91	11/18/91	11/18/91	11/18/91
Date Extracted		11/26/91	11/26/91	11/21/91	11/21/91	11/21/91
Date Analyzed		12/18/91	12/18/91	12/17/91	12/17/91	12/17/91
Matrix		WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL					
2,4-Dinitrophenol	50	60U	50U	57U	56U	49U
4-Nitrophenol	50	60U	50U	57U	56U	49U
Dibenzofuran	10	12U	10U	11U	11U	10U
2,4-Dinitrotoluene	10	12U	10U	11U	11U	10U
2,6-Dinitrotoluene	10	12U	10U	11U	11U	10U
Diethylphthalate	10	12U	10U	11U	11U	10U
4-Chlorophenyl-phenylether	10	12U	10U	11U	11U	10U
Fluorene	10	12U	10U	11U	11U	10U
4-Nitroaniline	50	60U	50U	57U	56U	49U
4,6-Dinitro-2-methylphenol	50	60U	50U	57U	56U	49U
N-Nitrosodiphenylamine	10	12U	10U	11U	11U	10U
4-Bromophenyl-phenylether	10	12U	10U	11U	11U	10U
Hexachlorobenzene	10	12U	10U	11U	11U	10U
Pentachlorophenol	50	60U	50U	57U	56U	49U
Phenanthrene	10	12U	10U	11U	11U	10U
Anthracene	10	12U	10U	11U	11U	10U
Di-n-Butylphthalate	10	12U	10U	11U	11U	10U
Fluoranthene	10	12U	4J	11U	11U	10U
Pyrene	10	12U	3J	11U	11U	10U
Butylbenzylphthalate	10	12U	10U	11U	11U	10U
3,3'-Dichlorobenzidine	20	24U	20U	23U	22U	19U
Benzo(a)Anthracene	10	12U	10U	11U	11U	10U
bis(2-ethylhexyl)phthalate	10	12U	8J	11U	11U	10U
Chrysene	10	12U	2J	11U	11U	10U
Di-n-octylphthalate	10	12U	10U	11U	11U	10U
Benzo(b)fluoranthene	10	12U	10U	11U	11U	10U
Benzo(k)fluoranthene	10	12U	10U	11U	11U	10U
Benzo(a)pyrene	10	12U	10U	11U	11U	10U
Indeno(1,2,3-cd)pyrene	10	12U	10U	11U	11U	10U
Dibenzo(a,h)anthracene	10	12U	10U	11U	11U	10U
Benzo(g,h,i)perylene	10	12U	10U	11U	11U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample Re-analyzed
Sample JCCNCAW is a background sample

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.11
Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Semivolatile Organic Analysis (1)

Sample ID		JCSD1AS	JCSD2AS	JCCNSCS	JCCNSCS-RE
Lab ID		5770-006	5770-004	5832-007	5832-007-RE
SDG #		1	1	1	1
Date Received		11/18/91	11/18/91	11/21/91	11/21/91
Date Extracted		11/21/91	11/21/91	11/26/91	12/15/91
Date Analyzed		12/13/91	12/13/91	12/16/91	12/19/91
Matrix		SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL				
Phenol	330	880U	860U	890U	890U
bis(2-chloroethyl)ether	330	880U	860U	890U	890U
2-Chlorophenol	330	880U	860U	890U	890U
1,3-Dichlorobenzene	330	880U	860U	890U	890U
1,4-Dichlorobenzene	330	880U	860U	890U	890U
Benzyl Alcohol	330	880U	860U	890U	890U
1,2-Dichlorobenzene	330	880U	860U	890U	890U
2-Methylphenol	330	880U	860U	890U	890U
bis(2-Chloroisopropyl)ether	330	880U	860U	890U	890U
4-Methylphenol	330	880U	860U	890U	890U
N-Nitroso-Di-n-propylamine	330	880U	860U	890U	890U
Hexachloroethane	330	880U	860U	890U	890U
Nitrobenzene	330	880U	860U	890U	890U
Isophorone	330	880U	860U	890U	890U
2-Nitrophenol	330	880U	860U	890U	890U
2,4-Dimethylphenol	330	880U	860U	890U	890U
Benzoic Acid	1600	880U	860U	890U	890U
bis(2-Chloroethoxy)methane	330	880U	860U	890U	890U
2,4-Dichlorophenol	330	880U	860U	890U	890U
1,2,4-Trichlorobenzene	330	880U	860U	890U	890U
Naphthalene	330	880U	270J	890U	890U
4-Chloroaniline	330	880U	860U	890U	890U
Haxachlorobutadiene	330	880U	860U	890U	890U
4-Chloro-3-methylphenol	330	880U	860U	890U	890U
2-Methylnaphthalene	330	880U	110J	890U	890U
Hexachlorocyclopentadiene	330	880U	860U	890U	890U
2,4,6-Trichlorophenol	330	880U	860U	890U	890U
2,4,5-Trichlorophenol	1600	4400U	4300U	4400U	4500U
2-Chloronaphthalene	330	880U	860U	890U	890U
2-Nitroaniline	1600	4400U	4300U	4400U	4500U
Dimethylphthalate	330	880U	860U	890U	890U
Acenaphthylene	330	880U	860U	890U	890U
3-Nitroaniline	330	4400U	4300U	4400U	4500U
Acenaphthene	330	880U	380J	890U	890U

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TABLE F.11 (Cont.)

Sample ID		JCSD1AS	JCSD2AS	JCCNSCS	JCCNSCS-RE
Lab ID		5770-006	5770-004	5832-007	5832-007-RE
SDG #		1	1	1	1
Date Received		11/18/91	11/18/91	11/21/91	11/21/91
Date Extracted		11/21/91	11/21/91	11/26/91	12/15/91
Date Analyzed		12/13/91	12/13/91	12/16/91	12/19/91
Matrix		SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL				
2,4-Dinitrophenol	1600	4400U	4300U	4400U	4500U
4-Nitrophenol	1600	4400U	4300U	4400U	4500U
Dibenzofuran	330	880U	230J	890U	890U
2,4-Dinitrotoluene	330	880U	860U	890U	890U
2,6-Dinitrotoluene	330	880U	860U	890U	890U
Diethylphthalate	330	880U	860U	890U	890U
4-Chlorophenyl-phenylether	330	880U	860U	890U	890U
Fluorene	330	880U	430J	890U	890U
4-Nitroaniline	1600	4400U	4300U	4400U	4500U
4,6-Dinitro-2-methylphenol	1600	4400U	4300U	4400U	4500U
N-Nitrosodiphenylamine	330	880U	860U	890U	890U
4-Bromophenyl-phenylether	330	880U	860U	890U	890U
Hexachlorobenzene	330	880U	860U	890U	890U
Pentachlorophenol	1600	4400U	4300U	4400U	4500U
Phenanthrene	330	880U	2300	890U	890U
Anthracene	330	880U	520J	890U	890U
Di-n-Butylphthalate	330	270J	300J	890U	890U
Fluoranthene	330	150J	2200	890U	890U
Pyrene	330	880U	1800	890U	890U
Butylbenzylphthalate	330	880U	860U	890U	890U
3,3'-Dichlorobenzidine	660	1800U	1700U	1800U	1800U
Benzo(a)Anthracene	330	880U	860U	890U	890U
bis(2-ethylhexyl)phthalate	330	210J	860U	890U	890U
Chrysene	330	880U	790J	890U	890U
Di-n-octylphthalate	330	880U	860U	890U	890U
Benzo(b)fluoranthene	330	880U	830J	890U	890U
Benzo(k)fluoranthene	330	880U	330J	890U	890U
Benzo(a)pyrene	330	880U	610J	890U	890U
Indeno(1,2,3-cd)pyrene	330	880U	190J	890U	890U
Dibenzo(a,h)anthracene	330	880U	860U	890U	890U
Benzo(g,h,i)perylene	330	880U	190J	890U	890U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
Sample JCCNSCS is a background sample

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.12
Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Semivolatile Organic Analysis (1)

Sample ID		JC1H1AS	JC1H1CS	JC1H1CS-DL	JC2L1AS	JC3H1AS	JC3H1AS-DL	JC4H1AS	JC4H2AS	JC6H1AS
Lab ID		6007-001	6007-002	6007-002-DL	6779-001	6007-003	6007-003-DL	5983-001	5983-002	6007-004
SDG #		3	3	3	7	3	3	3	3	3
Date Received		12/5/91	12/5/91	12/5/91	2/1/92	12/5/91	12/5/91	12/4/91	12/4/91	12/5/91
Date Extracted		12/6/91	12/6/91	12/6/91	2/6/92	12/6/91	12/6/91	12/5/91	12/5/91	12/6/91
Date Analyzed		12/19/91	12/19/91	1/9/92	2/18/92	12/23/91	1/9/92	12/19/91	12/19/91	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL									
Phenol	330	250J	820U	20000UD	760U	790U	20000UD	800U	830U	740U
bis(2-chloroethyl)ether	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2-Chlorophenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
1,3-Dichlorobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
1,4-Dichlorobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Benzyl Alcohol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
1,2-Dichlorobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2-Methylphenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
bis(2-Chloroisopropyl)ether	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
4-Methylphenol	330	210J	820U	20000UD	760U	790U	20000UD	800U	830U	740U
N-Nitroso-Di-n-propylamine	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Hexachloroethane	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Nitrobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Isophorone	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2-Nitrophenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2,4-Dimethylphenol	330	100J	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Benzoic Acid	1600	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
bis(2-Chloroethoxy)methane	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2,4-Dichlorophenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
1,2,4-Trichlorobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Naphthalene	330	4100	3000	2500JD	760U	3900	4200JD	800U	830U	35J
4-Chloroaniline	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Hexachlorobutadiene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
4-Chloro-3-methylphenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2-Methylnaphthalene	330	1400	1100	20000UD	760U	1300	970JD	800U	830U	740U
Hexachlorocyclopentadiene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2,4,6-Trichlorophenol	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2,4,5-Trichlorophenol	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
2-Chloronaphthalene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2-Nitroaniline	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
Dimethylphthalate	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Acenaphthylene	330	88J	820U	20000UD	760U	790U	20000UD	800U	830U	740U
3-Nitroaniline	330	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
Acenaphthene	330	1900	820U	20000UD	760U	790U	20000UD	800U	830U	120J

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TABLE F.12 (Cont.)

Sample ID		JC1H1AS	JC1H1CS	JC1H1CS-DL	JC2L1AS	JC3H1AS	JC3H1AS-DL	JC4H1AS	JC4H2AS	JC6H1AS
Lab ID		6007-001	6007-002	6007-002-DL	6779-001	6007-003	6007-003-DL	5983-001	5983-002	6007-004
SDG #		3	3	3	7	3	3	3	3	3
Date Received		12/5/91	12/5/91	12/5/91	2/1/92	12/5/91	12/5/91	12/4/91	12/4/91	12/5/91
Date Extracted		12/6/91	12/6/91	12/6/91	2/6/92	12/6/91	12/6/91	12/5/91	12/5/91	12/6/91
Date Analyzed		12/19/91	12/19/91	1/9/92	2/18/92	12/23/91	1/9/92	12/19/91	12/19/91	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL									
2,4-Dinitrophenol	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
4-Nitrophenol	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
Dibenzofuran	330	2100	820U	20000UD	760U	790U	20000UD	800U	830U	43J
2,4-Dinitrotoluene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
2,6-Dinitrotoluene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Diethylphthalate	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
4-Chlorophenyl-phenylether	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Fluorene	330	2900	820U	20000UD	760U	790U	20000UD	800U	830U	120J
4-Nitroaniline	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
4,6-Dinitro-2-methylphenol	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
N-Nitrosodiphenylamine	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
4-Bromophenyl-phenylether	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Hexachlorobenzene	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Pentachlorophenol	1600	3600U	4100U	102000UD	3800U	3900U	102000UD	4000U	4200U	3700U
Phenanthrene	330	9800	2000	20000UD	55J	990	20000UD	800U	830U	1000
Anthracene	330	2800	820U	20000UD	12J	790U	20000UD	800U	830U	250J
Di-n-Butylphthalate	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Fluoranthene	330	9900	1700	20000UD	180J	790U	20000UD	800U	830U	2000J
Pyrene	330	7900	1000	20000UD	140J	67J	20000UD	800U	830U	1900
Butylbenzylphthalate	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
3,3'-Dichlorobenzidine	660	1400U	1600U	41000UD	1500U	1600U	41000UD	1600U	1700U	1500U
Benzo(a)Anthracene	330	4200	820U	20000UD	120J	790U	20000UD	800U	830U	1000
bis(2-ethylhexyl)phthalate	330	94J	600J	20000UD	760U	770J	20000UD	800U	91J	74J
Chrysene	330	3500	450J	20000UD	120J	790U	20000UD	800U	830U	1000
Di-n-octylphthalate	330	710U	820U	20000UD	760U	790U	20000UD	800U	830U	740U
Benzo(b)fluoranthene	330	4900	570J	20000UD	150J	89J	20000UD	800U	830U	1300
Benzo(k)fluoranthene	330	1400	170J	20000UD	48J	92J	20000UD	800U	830U	600J
Benzo(a)pyrene	330	3500	320J	20000UD	89J	75J	20000UD	800U	830U	830
Indeno(1,2,3-cd)pyrene	330	710U	190J	20000UD	67J	62J	20000UD	800U	830U	740U
Dibenzo(a,h)anthracene	330	400J	820U	20000UD	760U	790U	20000UD	800U	830U	140J
Benzo(g,h,i)perylene	330	1700	180J	20000UD	89J	64J	20000UD	800U	830U	470J

Qualifiers

D: Dilution

J: Concentration was estimated

U: Compound not detected

UJ: Compound not detected -the sample quantitation limitis an estimate

Notes

CRQL: Contract Required Quantitation Limit

DL: Sample was diluted

(1) Superfund method 89-2 as referenced in NYSDEC - ASP (9/89)

TABLE F.13
Analytical Results for AFP 59, Johnson City: Field Blank/Equipment Rinsate Samples — Semivolatile Organic Analysis (1)

Sample ID		JCQC1TW	JCQC2BW	JCQC3XW
Lab ID		5602-003	5602-004	5630-001
SDG #		1	1	1
Date Received		11/7/91	11/7/91	11/8/91
Date Extracted		11/11/91	11/11/91	11/11/91
Date Analyzed		11/20/91	11/20/91	12/13/91
Matrix		WATER	WATER	WATER
Units		µg/L	µg/L	µg/L
COMPOUND	CRQL			
Phenol	10	10U	10U	10U
bis(2-chloroethyl)ether	10	10U	10U	10U
2-Chlorophenol	10	10U	10U	10U
1,3-Dichlorobenzene	10	10U	10U	10U
1,4-Dichlorobenzene	10	10U	10U	10U
Benzyl Alcohol	10	10U	10U	10U
1,2-Dichlorobenzene	10	10U	10U	10U
2-Methylphenol	10	10U	10U	10U
bis(2-Chloroisopropyl)ether	10	10U	10U	10U
4-Methylphenol	10	10U	10U	10U
N-Nitroso-Di-n-propylamine	10	10U	10U	10U
Hexachloroethane	10	10U	10U	10U
Nitrobenzene	10	10U	10U	10U
Isophorone	10	10U	10U	10U
2-Nitrophenol	10	10U	10U	10U
2,4-Dimethylphenol	10	10U	10U	10U
Benzoic Acid	50	10U	10U	10U
bis(2-Chloroethoxy)methane	10	10U	10U	10U
2,4-Dichlorophenol	10	10U	10U	10U
1,2,4-Trichlorobenzene	10	10U	10U	10U
Naphthalene	10	10U	10U	10U
4-Chloroaniline	10	10U	10U	10U
Haxachlorobutadiene	10	10U	10U	10U
4-Chloro-3-methylphenol	10	10U	10U	10U
2-Methylnaphthalene	10	10U	10U	10U
Hexachlorocyclopentadiene	10	10U	10U	10U
2,4,6-Trichlorophenol	10	10U	10U	10U
2,4,5-Trichlorophenol	50	48U	48U	48U
2-Chloronaphthalene	10	10U	10U	10U
2-Nitroaniline	50	48U	48U	48U
Dimethylphthalate	10	10U	10U	10U
Acenaphthylene	10	10U	10U	10U
3-Nitroaniline	10	48U	48U	48U
Acenaphthene	10	10U	10U	10U

(continued on next page)

TABLE F.13 (Cont.)

Sample ID		JCQC1TW	JCQC2BW	JCQC3XW
Lab ID		5602-003	5602-004	5630-001
SDG #		1	1	1
Date Received		11/7/91	11/7/91	11/8/91
Date Extracted		11/11/91	11/11/91	11/11/91
Date Analyzed		11/20/91	11/20/91	12/13/91
Matrix		WATER	WATER	WATER
Units		µg/L	µg/L	µg/L
COMPOUND	CRQL			
2,4-Dinitrophenol	50	48U	48U	48U
4-Nitrophenol	50	48U	48U	48U
Dibenzofuran	10	10U	10U	10U
2,4-Dinitrotoluene	10	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	10U
Diethylphthalate	10	10U	10U	10U
4-Chlorophenyl-phenylether	10	10U	10U	10U
Fluorene	10	10U	10U	10U
4-Nitroaniline	50	48U	48U	48U
4,6-Dinitro-2-methylphenol	50	48U	48U	48U
N-Nitrosodiphenylamine	10	10U	10U	10U
4-Bromophenyl-phenylether	10	10U	10U	10U
Hexachlorobenzene	10	10U	10U	10U
Pentachlorophenol	50	48U	48U	48U
Phenanthrene	10	10U	10U	10U
Anthracene	10	10U	10U	10U
Di-n-Butylphthalate	10	10U	10U	10U
Fluoranthene	10	10U	10U	10U
Pyrene	10	10U	10U	10U
Butylbenzylphthalate	10	10U	10U	10U
3,3'-Dichlorobenzidine	20	19U	19U	19U
Benzo(a)Anthracene	10	10U	10U	10U
bis(2-ethylhexyl)phthalate	10	10U	10U	10U
Chrysene	10	10U	10U	10U
Di-n-octylphthalate	10	10U	10U	10U
Benzo(b)fluoranthene	10	10U	10U	10U
Benzo(k)fluoranthene	10	10U	10U	10U
Benzo(a)pyrene	10	10U	10U	10U
Indeno(1,2,3-cd)pyrene	10	10U	10U	10U
Dibenzo(a,h)anthracene	10	10U	10U	10U
Benzo(g,h,i)perylene	10	10U	10U	10U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - the sample quantitation limit is an estimate
R: Data rejected

TABLE F.14
Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Pesticide/PCB Analysis (1)

Sample ID		JCDW1AS	JCDW1BS-RE	JCDW1CS	JCDW3AS	JCDW3BS	JCSW4AS	JCSW4BS
Lab ID		5832-008	5832-009-RE	5832-010	5602-001	5602-002	5909-001	5909-002
SDG #		1	1	1	1	1	1	1
Date Received		11/21/91		11/21/91	11/7/91	11/7/91	11/26/91	11/26/91
Date Extracted		11/25/91	12/5/91	11/25/91	11/8/91	11/8/91	11/30/91	11/30/91
Date Analyzed		12/4/91	12/6/91	12/4/91	12/4/91	12/4/91	12/5/91	12/5/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
Alpha-Chlordane	80	97U	130U	89U	84U	91U	86U	100U
Aldrin	8	7.6J	9.2J	8.9U	8.4U	9.1U	8.6U	10U
Alpha-BHC	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Aroclor-1016	80	97U	130U	89U	84U	91U	86U	100U
Aroclor-1221	80	97U	130U	89U	84U	91U	86U	100U
Aroclor-1232	80	97U	130U	89U	84U	91U	86U	100U
Aroclor-1242	80	97U	130U	89U	84U	91U	86U	100U
Aroclor-1248	80	97U	130U	89U	84U	91U	86U	100U
Aroclor-1254	160	190U	270U	180U	170U	180U	170U	200U
Aroclor-1260	160	190U	270U	180U	170U	180U	170U	200U
Beta-BHC	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
4,4'-DDD	16	19U	27U	18U	17U	18U	17U	20U
4,4'-DDE	16	19U	27U	18U	17U	18U	17U	20U
4,4'-DDT	16	19U	27U	18U	17U	18U	17U	20U
Delta-BHC	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Dieldrin	16	19U	27U	18U	17U	18U	17U	20U
Endrin Ketone	16	19U	27U	18U	17U	18U	17U	20U
Endosulfan Sulfate	16	19U	27U	18U	17U	18U	17U	20U
Endosulfan I	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Endosulfan II	16	19U	27U	18U	17U	18U	17U	20U
Endrin	16	19U	27U	18U	17U	18U	17U	20U
Gamma-Chlordane	80	97U	130U	89U	84U	91U	86U	100U
Heptachlor Epoxide	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Heptachlor	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Gamma-BHC (Lindane)	8	9.7U	13U	8.9U	8.4U	9.1U	8.6U	10U
Methoxychlor	80	97U	130U	89U	84U	91U	86U	100U
Toxaphene	160	190U	270U	180U	170U	180U	170U	200U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit
RE: Sample was re-analyzed

Sample JCDW1BS is a field replicate of JCDW1AS
(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.14 (Cont.)

Sample ID		JCSW4CS	JCSW5AS	JCSW5BS	JCSW6AS	JCSW6BS	JCSW7AS
Lab ID		5909-003	5832-001	5832-002	5770-001	5770-002	6044-001
SDG #		1	1	1	1	1	3
Date Received		11/26/91	11/21/91	11/21/91	11/18/91	11/18/91	12/9/91
Date Extracted		11/30/91	11/25/91	11/25/91	11/20/91	11/20/91	12/10/91
Date Analyzed		12/5/91	12/4/91	12/4/91	12/4/91	12/4/91	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL						
Alpha-Chlordane	80	99U	83U	100U	87U	88U	93U
Aldrin	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Alpha-BHC	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Aroclor-1016	80	99U	83U	100U	87U	88U	93U
Aroclor-1221	80	99U	83U	100U	87U	88U	93U
Aroclor-1232	80	99U	83U	100U	87U	88U	93U
Aroclor-1242	80	99U	83U	100U	87U	88U	93U
Aroclor-1248	80	99U	83U	100U	87U	88U	93U
Aroclor-1254	160	200U	170U	200U	170U	180U	180U
Aroclor-1260	160	200U	170U	200U	170U	180U	180U
Beta-BHC	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
4,4'-DDD	16	20U	17U	20U	17U	18U	18U
4,4'-DDE	16	20U	17U	20U	6J	18U	18U
4,4'-DDT	16	20U	17U	20U	17U	18U	18U
Delta-BHC	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Dieldrin	16	20U	17U	20U	17U	18U	18U
Endrin Ketone	16	20U	17U	20U	17U	18U	18U
Endosulfan Sulfate	16	20U	17U	20U	17U	18U	18U
Endosulfan I	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Endosulfan II	16	20U	17U	20U	17U	18U	18U
Endrin	16	20U	17U	20U	17U	18U	18U
Gamma-Chlordane	80	99U	83U	100U	87U	88U	93U
Heptachlor Epoxide	8	9.9U	8.3U	10U	62J	8.8U	9.3U
Heptachlor	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Gamma-BHC (Lindane)	8	9.9U	8.3U	10U	8.7U	8.8U	9.3U
Methoxychlor	80	99U	83U	100U	87U	88U	93U
Toxaphene	160	200U	170U	200U	170U	180U	180U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCSW4CS is a field replicate of JCSW4BS
(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.14 (Cont.)

Sample ID		JCSW7BS	JCSW8AS	JCSW8BS	JCSW9AS	JCSW9BS	JCBG1AS
Lab ID		6044-002	5554-001	5554-002	6069-001	6069-002	6044-003
SDG #		3	1	1	3	3	3
Date Received		12/9/91	11/5/91	11/5/91	12/10/91	12/10/91	12/9/91
Date Extracted		12/10/91	11/8/91	11/8/91	12/15/91	12/15/91	12/10/91
Date Analyzed		12/20/91	12/4/91	12/4/91	12/20/91	12/20/91	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL						
Alpha-Chlordane	80	97U	100U	100U	85U	110U	90U
Aldrin	8	9.7U	10U	10U	8.5U	11U	9U
Alpha-BHC	8	9.7U	10U	10U	8.5U	11U	9U
Aroclor-1016	80	97U	100U	100U	85U	110U	90U
Aroclor-1221	80	97U	100U	100U	85U	110U	90U
Aroclor-1232	80	97U	100U	100U	85U	110U	90U
Aroclor-1242	80	97U	100U	100U	85U	110U	90U
Aroclor-1248	80	97U	100U	100U	85U	110U	90U
Aroclor-1254	160	190U	210U	210U	170U	220U	180U
Aroclor-1260	160	190U	210U	210U	170U	220U	180U
Beta-BHC	8	9.7U	10U	10U	8.5U	11U	9U
4,4'-DDD	16	19U	21U	21U	17U	22U	18U
4,4'-DDE	16	19U	21U	21U	17U	22U	18U
4,4'-DDT	16	19U	21U	21U	17U	22U	18U
Delta-BHC	8	9.7U	10U	10U	8.5U	11U	9U
Dieldrin	16	19U	21U	21U	17U	22U	18U
Endrin Ketone	16	19U	21U	21U	17U	22U	18U
Endosulfan Sulfate	16	19U	21U	21U	17U	22U	18U
Endosulfan I	8	9.7U	10U	10U	8.5U	11U	9U
Endosulfan II	16	19U	21U	21U	17U	22U	18U
Endrin	16	19U	21U	21U	17U	22U	18U
Gamma-Chlordane	80	97U	100U	100U	85U	110U	90U
Heptachlor Epoxide	8	9.7U	10U	84	8.5U	11U	9U
Heptachlor	8	9.7U	10U	10U	8.5U	11U	9U
Gamma-BHC (Lindane)	8	9.7U	10U	10U	8.5U	11U	9U
Methoxychlor	80	97U	100U	100U	85U	110U	90U
Toxaphene	160	190U	210U	210U	170U	220U	180U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCSW9BS is a field replicate of JCSW9AS

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.15
Analytical Results for AFP 59, Johnson City: Groundwater Samples — Pesticide/PCB Analysis (1)

Sample ID		JCDW1AW	JCDW1BW	JCSW1AW	JCSW1BW	JCDW3AW	JCDW3BW	JCDW3RW
Lab ID		6384-001	6749-005	6384-002	6749-006	6415-002	6761-001	6761-002
SDG #		5	6	5	6	5	6	6
Date Received		1/6/92	2/1/92	1/6/92	2/1/92	1/8/92	2/3/92	2/3/92
Date Extracted		1/8/92	2/6/92	1/8/92	2/6/92	1/13/92	2/4/92	2/4/92
Date Analyzed		1/25/92	2/13/92	1/25/92	2/13/92	1/25/92	2/13/92	2/13/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Alpha-Chlordane	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.25U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.50U	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U

Qualifiers

- J: Concentration was estimated
- U: Compound not detected
- UJ: Compound not detected - sample quantitation limit is an estimate
- R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCDW3RW is a field replicate of JCDW3BW

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.15 (Cont.)

Sample ID		JCSW3AW	JCSW3BW	JCDW4AW	JCDW4BW	JCSW4AW	JCSW4BW	JCDW5AW
Lab ID		6415-003	6761-003	6415-006	6703-001	6415-009	6703-004	6384-003
SDG #		5	6	5	6	5	6	5
Date Received		1/8/92	2/3/92	1/8/92	1/30/92	1/8/92	1/30/92	1/6/92
Date Extracted		1/13/92	2/4/92	1/13/92	2/4/92	1/13/92	2/4/92	1/8/92
Date Analyzed		1/25/92	2/13/92	1/25/92	2/13/92	1/26/92	2/13/92	1/25/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.15 (Cont.)

Sample ID		JCDW5BW	JCSW5AW	JCSW5BW	JCDW6AW	JCDW6BW	JCSW6AW	JCSW6BW
Lab ID		6749-001	6384-004	6749-002	6384-005	6749-003	6384-006	6749-004
SDG #		6	5	6	5	6	5	6
Date Received		2/1/92	1/6/92	2/1/92	1/6/92	2/1/92	1/6/92	2/1/92
Date Extracted		2/6/92	1/8/92	2/6/92	1/8/92	2/6/92	1/8/92	2/6/92
Date Analyzed		2/12/92	1/25/92	2/12/92	1/25/92	2/12/92	1/25/92	2/13/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.15 (Cont.)

Sample ID		JCSW7AW	JCSW7BW	JCDW8AW	JCDW8RW	JCDW8BW	JCSW8AW	JCSW8BW
Lab ID		6415-010	6703-005	6446-001	6446-002	6703-006	6446-003	6703-007
SDG #		5	6	5	5	6	5	6
Date Received		1/8/92	1/30/92	1/10/92	1/10/92	1/30/92	1/10/92	1/30/92
Date Extracted		1/13/92	2/4/92	1/13/92	1/13/92	2/4/92	1/13/92	2/4/92
Date Analyzed		1/26/92	2/13/92	1/26/92	1/26/92	2/13/92	1/26/92	2/13/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCDW8RW is a field replicate of JCDW8AW
(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.15 (Cont.)

Sample ID		JCDW9AW	JCDW9BW	JCSW9AW	JCSW9BW	JCDPWAW	JCDPWBW	JCBG2BW
Lab ID		6415-004	6761-004	6415-005	6761-005	6446-004	6761-006	6415-001
SDG #		5	6	5	6	5	6	5
Date Received		1/8/92	2/3/92	1/8/92	2/3/92	1/10/92	2/3/92	1/8/92
Date Extracted		1/13/92	2/4/92	1/13/92	2/4/92	1/13/92	2/4/92	1/13/92
Date Analyzed		1/25/92	2/13/92	1/25/92	2/13/92	1/26/92	2/13/92	1/25/92
Matrix		WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
COMPOUND	CRQL							
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U	0.48U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCBG2BW is a background sample

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.16
Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Pesticide/PCB Analysis (1)

Sample ID		JCOF1AW	JCOF2AW	JCCW1AW	JCCW2AW	JCCNCAW
Lab ID		5868-001	5868-002	5807-002	5807-001	5808-001
SDG #		2	2	2	2	2
Date Received		11/23/91	11/23/91	11/18/91	11/18/91	11/19/91
Date Extracted		11/27/91	11/27/91	11/22/91	11/22/91	11/22/91
Date Analyzed		12/12/91	12/12/91	12/12/91	12/12/91	12/12/91
Matrix		WATER	WATER	WATER	WATER	WATER
COMPOUND	CRQL					
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.49U	0.48U	0.49U	0.48U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCCNCAW is a background sample

(1) Superfund method 9-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.17
Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Pesticide/PCB Analysis (1)

Sample ID		JCSD1AS	JCSD2AS	JCCNSCS
Lab ID		5770-006	5770-004	5832-007
SDG #		1	1	1
Date Received		11/18/91	11/18/91	11/21/91
Date Extracted		11/20/91	11/20/91	11/25/91
Date Analyzed		12/4/91	12/4/91	12/4/91
Matrix		SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg
COMPOUND	CRQL			
Alpha-Chlordane	80	100U	100U	100U
Aldrin	8	8.8J	18	10U
Alpha-BHC	8	10U	10U	10U
Aroclor-1016	80	100U	100U	100U
Aroclor-1221	80	100U	100U	100U
Aroclor-1232	80	100U	100U	100U
Aroclor-1242	80	100U	100U	100U
Aroclor-1248	80	100U	100U	100U
Aroclor-1254	160	210U	210U	200U
Aroclor-1260	160	210U	210U	200U
Beta-BHC	8	10U	10U	10U
4,4'-DDD	16	21U	21U	20U
4,4'-DDE	16	21U	21U	20U
4,4'-DDT	16	21U	21U	20U
Delta-BHC	8	10U	10U	10U
Dieldrin	16	21U	21U	20U
Endrin Ketone	16	21U	21U	20U
Endosulfan Sulfate	16	21U	21U	20U
Endosulfan I	8	10U	10U	10U
Endosulfan II	16	21U	21U	20U
Endrin	16	21U	21U	20U
Gamma-Chlordane	80	100U	100U	100U
Heptachlor Epoxide	8	10U	10U	10U
Heptachlor	8	10U	10U	10U
Gamma-BHC (Lindane)	8	10U	10U	10U
Methoxychlor	80	100U	100U	100U
Toxaphene	160	210U	210U	200U

Qualifiers

J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate
R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

Sample JCCNSCS is a background sample

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.18
Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Pesticide/PCB Analysis (1)

Sample ID		JC1H1AS	JC1H1AS-DL	JC2L1AS	JC3H1AS-DL	JC4H1AS	JC4H2AS	JC6H1AS
Lab ID		6007-001	6007-002	6779-001	6007-003	5983-001	5983-002	6007-004
SDG #		3	3	7	3	3	3	3
Date Received		12/5/91	12/5/91	2/1/92	12/5/91	12/4/91	12/4/91	12/5/91
Date Extracted		12/6/91	12/6/91	2/6/92	12/6/91	12/5/91	12/5/91	12/6/91
Date Analyzed		12/19/91	12/19/91	2/12/92	12/20/91	12/19/91	12/19/91	12/20/91
Matrix		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
COMPOUND	CRQL							
Alpha-Chlordane	80	86U	490UD	92U	470UD	93U	100U	89U
Aldrin	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Alpha-BHC	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Aroclor-1016	80	86U	490UD	92U	470UD	93U	100U	89U
Aroclor-1221	80	86U	490UD	92U	470UD	93U	100U	89U
Aroclor-1232	80	86U	490UD	92U	470UD	93U	100U	89U
Aroclor-1242	80	86U	490UD	92U	470UD	93U	100U	89U
Aroclor-1248	80	86U	490UD	92U	470UD	93U	100U	89U
Aroclor-1254	160	170U	990UD	180U	940UD	180U	200U	180U
Aroclor-1260	160	170U	990UD	130J	940UD	180U	200U	180U
Beta-BHC	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
4,4'-DDD	16	17U	99UD	18U	94UD	18U	20U	18U
4,4'-DDE	16	17U	99UD	18U	94UD	18U	20U	18U
4,4'-DDT	16	17U	99UD	18U	94UD	18U	20U	18U
Delta-BHC	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Dieldrin	16	17U	99UD	18U	94UD	18U	20U	18U
Endrin Ketone	16	17U	99UD	18U	94UD	18U	20U	18U
Endosulfan Sulfate	16	17U	99UD	18U	94UD	18U	20U	18U
Endosulfan I	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Endosulfan II	16	17U	84JD	18U	94UD	18U	20U	18U
Endrin	16	17U	99UD	18U	94UD	18U	20U	18U
Gamma-Chlordane	80	24J	490UD	92U	470UD	93U	100U	89U
Heptachlor Epoxide	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Heptachlor	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Gamma-BHC (Lindane)	8	8.6U	49UD	9.2U	47UD	9.3U	10U	8.9U
Methoxychlor	80	86U	490UD	92U	470UD	93U	100U	89U
Toxaphene	160	170U	990UD	180U	940UD	180U	200U	180U

Qualifiers

D: Dilution
J: Concentration was estimated
U: Compound not detected
UJ: Compound not detected - sample quantitation limit is an estimate

Notes

CRQL: Contract Required Quantitation Limit

DL: Sample was diluted

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.19
Analytical Results for AFP 59, Johnson City: Field Blank/Equipment Blank Samples — Pesticide/PCB Analysis (1)

Sample ID		JCQC1TW	JCQC2BW	JCQC3XW
Lab ID		5602-003	5602-004	5630-001
SDG #		1	1	1
Date Received		11/7/91	11/7/91	11/8/91
Date Extracted		11/11/91	11/11/91	11/11/91
Date Analyzed		12/4/91	12/4/91	12/4/91
Matrix		WATER	WATER	WATER
Units		µg/L	µg/L	µg/L
COMPOUND	..			
Alpha-Chlordane	0.5	0.24U	0.24U	0.24U
Aldrin	0.05	0.02U	0.02U	0.02U
Alpha-BHC	0.05	0.02U	0.02U	0.02U
Aroclor-1016	0.5	0.24U	0.24U	0.24U
Aroclor-1221	0.5	0.24U	0.24U	0.24U
Aroclor-1232	0.5	0.24U	0.24U	0.24U
Aroclor-1242	0.5	0.24U	0.24U	0.24U
Aroclor-1248	0.5	0.24U	0.24U	0.24U
Aroclor-1254	1	0.24U	0.24U	0.24U
Aroclor-1260	1	0.24U	0.24U	0.24U
Beta-BHC	0.05	0.02U	0.02U	0.02U
4,4'-DDD	0.1	0.05U	0.05U	0.05U
4,4'-DDE	0.1	0.05U	0.05U	0.05U
4,4'-DDT	0.1	0.05U	0.05U	0.05U
Delta-BHC	0.05	0.02U	0.02U	0.02U
Dieldrin	0.1	0.05U	0.05U	0.05U
Endrin Ketone	0.1	0.05U	0.05U	0.05U
Endosulfan Sulfate	0.1	0.05U	0.05U	0.05U
Endosulfan I	0.05	0.02U	0.02U	0.02U
Endosulfan II	0.1	0.05U	0.05U	0.05U
Endrin	0.1	0.05U	0.05U	0.05U
Gamma-Chlordane	0.5	0.24U	0.24U	0.24U
Heptachlor Epoxide	0.05	0.02U	0.02U	0.02U
Heptachlor	0.05	0.05U	0.05U	0.05U
Gamma-BHC (Lindane)	0.05	0.02U	0.02U	0.02U
Methoxychlor	0.5	0.24U	0.24U	0.24U
Toxaphene	1	0.48U	0.48U	0.48U

Qualifiers

J: Concentration was estimated

U: Compound not detected

UJ: Compound not detected - sample quantitation limit is an estimate

R: Data rejected

Notes

CRQL: Contract Required Quantitation Limit

(1) Superfund method 89-3 as referenced in NYSDEC - ASP (9/89)

TABLE F.20
Analytical Results for AFP 59, Johnson City: Well Borehole Soil Samples — Inorganic Analysis

Sample ID			JCDW1AS	JCDW1BS	JCDW1CS	JCDW3AS	JCDW3BS	JCSW4AS	JCSW4BS
Lab ID			5832-008	5832-009	5832-010	5602-001	5602-002	5909-001	5909-002
SDG #			1	1	1	1	1	1	1
Date Received			11/21/91	11/21/91	11/21/91	11/7/91	11/7/91	11/26/91	11/26/91
Matrix			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	40	9830	10200	5070	9060	5260	7150	9360
Antimony	204.2 CLP-M (2)	12	0.44UJ	0.48UJ	0.41UJ	0.39UJ	0.34UJ	0.33UJ	0.51UJ
Arsenic	206.2 CLP-M (2)	2	5.2J	5.5J	3.2J	4.7J	6.3J	5.9J	6.7J
Barium	200.7 CLP-M (2)	40	46.2	54.3	23.5B	60.7	75.9	42.2	32.4B
Beryllium	200.7 CLP-M (2)	1	1.1U	0.95U	0.81U	0.97	0.86	0.66U	1.0U
Cadmium	200.7 CLP-M (2)	1	0.65U	0.71U	0.61U	0.58U	0.51U	0.49U	0.76U
Calcium	200.7 CLP-M (2)	1000	988B	307B	52200	24500	80400	21000	3790
Chromium	200.7 CLP-M (2)	2	14.6	16.4	8.3	13.6	8.1	11.5	14.9
Cobalt	200.7 CLP-M (2)	10	10.5B	10.9B	6.9B	8.2B	5.7B	8.1B	10.1B
Copper	200.7 CLP-M (2)	5	13.7	14.5	15	21.2	13.9	18.4	13.9
Iron	200.7 CLP-M (2)	20	22000	22800	13600	21400	15000	18900	21700
Lead	239.2 CLP-M (2)	0.6	10.5J	10.8J	5.2J	7.4J	8.2J	7.1J	14.4J
Magnesium	200.7 CLP-M (2)	1000	3230	3280	5240	5120	6030	6380	3840
Manganese	200.7 CLP-M (2)	3	505J	533J	401J	451J	2110J	528J	336J
Mercury (1)	245.1/245.5 CLP-M (2)	0.1	0.05U	0.06U	0.05U	0.05U	0.05U	0.05U	0.07U
Nickel	200.7 CLP-M (2)	8	19.2	20	13	17.1	13	15.8	18.2
Potassium	200.7 CLP-M (2)	1000	695B	642B	537B	961B	451B	582B	885B
Selenium	270.2 CLP-M (2)	1	0.21UJ	0.20UJ	0.19UJ	0.19UJ	0.17UJ	0.19UJ	0.23UJ
Silver	200.7 CLP-M (2)	2	0.87U	0.95U	0.81U	0.78U	0.69U	0.66U	1.0U
Sodium	200.7 CLP-M (2)	1000	92.4U	109U	26.2U	46.1B	19.0U	18.2U	113U
Thallium	279.2 CLP-M (2)	2	0.42UJ	0.41UJ	0.37UJ	0.38UJ	0.34UJ	0.37UJ	0.47UJ
Vanadium	200.7 CLP-M (2)	10	12.9	14	11	13.8	13.4	12.3	11.4B
Zinc	200.7 CLP-M (2)	4	60.8J	73.5J	41.8J	54.3J	43.4J	49.5J	50.8J
Cyanide	335.2 CLP-M (2)	2.5	1.4UJ	1.2UJ	1.1UJ	1.0UJ	1.2UJ	3.2J	1.2UJ

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCDW1BS is a field replicate of JCDW1AS
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.20 (Cont.)

Sample ID			JCSW4CS	JCSW5AS	JCSW5BS	JCSW6AS	JCSW6BS	JCSW7AS
Lab ID			5909-003	5832-001	5832-002	5770-001	5770-002	6044-001
SDG #			1	1	1	1	1	3
Date Received			11/26/91	11/21/91	11/21/91	11/18/91	11/18/91	12/9/91
Matrix			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ANALYTE	METHOD	CRDL						
Aluminum	200.7 CLP-M (2)	40	8200	6720	12900	7390	9130	13200
Antimony	204.2 CLP-M (2)	12	0.50UJ	0.41UJ	0.42UJ	0.42UJ	0.31UJ	0.46UJ
Arsenic	206.2 CLP-M (2)	2	9.0J	3.6J	7.9J	4.1J	4.2J	6.9J
Barium	200.7 CLP-M (2)	40	30.3B	47.6	52.3	35.1B	46.9	66.7
Beryllium	200.7 CLP-M (2)	1	1.0U	0.81U	1.1U	0.83B	0.77	0.23U
Cadmium	200.7 CLP-M (2)	1	0.75U	0.61U	0.63U	0.62U	0.46U	0.68U
Calcium	200.7 CLP-M (2)	1000	2660	44400	5740	63800	12000	4550
Chromium	200.7 CLP-M (2)	2	12	10.6	18.6	11.4	12.5	18.2
Cobalt	200.7 CLP-M (2)	10	9.0B	6.9B	13.3	6.4B	8.3	10.0B
Copper	200.7 CLP-M (2)	5	11.5	13	16.7	13.9	24.8	22.3
Iron	200.7 CLP-M (2)	20	18300	17100	27200	16100	21400	23900
Lead	239.2 CLP-M (2)	0.6	13.5J	5.5J	12.7J	14.8J	9.9J	7.5J
Magnesium	200.7 CLP-M (2)	1000	3060	6330	5900	10800	4040	3410
Manganese	200.7 CLP-M (2)	3	346J	484J	601J	420J	608J	701J
Mercury (1)	245.1/245.5 CLP-M (2)	0.1	0.05U	0.04U	0.07U	0.05B	0.06B	0.08B
Nickel	200.7 CLP-M (2)	8	14	13.2	24.5	13.9	16.5	21.2
Potassium	200.7 CLP-M (2)	1000	867B	623B	1520	878B	935	1380
Selenium	270.2 CLP-M (2)	1	0.24UJ	0.17UJ	0.27UJ	0.19BJ	0.15UJ	0.22J
Silver	200.7 CLP-M (2)	2	1.0U	0.81U	0.84U	0.83U	0.62U	0.91U
Sodium	200.7 CLP-M (2)	1000	89.7B	22.6U	145U	23.1U	50.9B	59.4B
Thallium	279.2 CLP-M (2)	2	0.48UJ	0.34UJ	0.53UJ	0.38UJ	0.31UJ	0.43UJ
Vanadium	200.7 CLP-M (2)	10	10.5B	11.8	17.3	75.2	13.6	14.6
Zinc	200.7 CLP-M (2)	4	45.1J	45.6J	65.4J	50.5J	67.6J	64.2
Cyanide	335.2 CLP-M (2)	2.5	7.9J	1.1UJ	1.7UJ	1.1UJ	1.1UJ	1.2UJ

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCSW4CS is a field replicate of JCSW4BS
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.20 (Cont.)

Sample ID			JCSW7BS	JCSW8AS	JCSW8BS	JCSW9AS	JCSW9BS	JCBG1AS
Lab ID			6044-002	5554-001	5554-002	6069-001	6069-002	6044-003
SDG #			3	1	1	3	3	3
Date Received			12/9/91	11/5/91	11/5/91	12/10/91	12/10/91	12/9/91
Matrix			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ANALYTE	METHOD	CRDL						
Aluminum	200.7 CLP-M (2)	40	6070	16300	14100	7770	7120	9310
Antimony	204.2 CLP-M (2)	12	0.47UJ	0.45UJ	0.40UJ	0.41UJ	0.42UJ	0.46UJ
Arsenic	206.2 CLP-M (2)	2	3.5J	3.0J	5.7J	4.5J	5.4J	8.2J
Barium	200.7 CLP-M (2)	40	30.6B	92.9	61.8	53.5U	52.9U	47.8
Beryllium	200.7 CLP-M (2)	1	0.24U	1.3U	1.0U	0.21U	0.21U	0.23U
Cadmium	200.7 CLP-M (2)	1	0.71U	0.67U	0.60U	1.7U	1.0U	0.68U
Calcium	200.7 CLP-M (2)	1000	29900	915B	2960	35700	49800	1340
Chromium	200.7 CLP-M (2)	2	10.2	22.6	20.5	11.2	10.1	14.3
Cobalt	200.7 CLP-M (2)	10	5.2B	12.1	12.9	5.6U	6.3U	6.1B
Copper	200.7 CLP-M (2)	5	16.1	14.5	20.3	19.8	21.2	24.8
Iron	200.7 CLP-M (2)	20	13200	26200	24200	18000	16900	19400
Lead	239.2 CLP-M (2)	0.6	5.8J	15.8J	13.3J	5.9J	8.1J	19.9J
Magnesium	200.7 CLP-M (2)	1000	3940	3800	4130	5100	4140	2250
Manganese	200.7 CLP-M (2)	3	368J	682J	405J	403J	506J	555J
Mercury (1)	245.1/245.5 CLP-M (2)	0.1	0.06U	0.05U	0.07U	0.07B	0.06B	0.1
Nickel	200.7 CLP-M (2)	8	11.6U	26.6	25.8	13.2	13.2	13.4
Potassium	200.7 CLP-M (2)	1000	1120B	828B	1330	808B	760B	653B
Selenium	270.2 CLP-M (2)	1	0.23UJ	0.35BJ	0.38BJ	0.19UJ	0.19UJ	0.38J
Silver	200.7 CLP-M (2)	2	0.95U	0.89U	0.81U	0.83U	0.84U	0.91U
Sodium	200.7 CLP-M (2)	1000	26.3U	180U	145U	22.9U	23.3U	25.3U
Thallium	279.2 CLP-M (2)	2	0.47UJ	0.49UJ	0.45UJ	0.38UJ	0.37UJ	0.42UJ
Vanadium	200.7 CLP-M (2)	10	8.8B	19.5	18.5	9.5B	9.9B	13.2
Zinc	200.7 CLP-M (2)	4	36.5	72.9J	79.2J	74.2	53.1	60.5
Cyanide	335.2 CLP-M (2)	2.5	1.2UJ	1.3UJ	1.3UJ	1.1UJ	1.1UJ	1.1UJ

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCSW9BS is a field replicate of JCSW9AS
Sample JCBG1AS is a background sample
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.21
Analytical Results for AFP 59, Johnson City: Groundwater Samples — Inorganic Analysis

Sample ID			JCDW1AW	JCDW1BW	JCSW1AW	JCSW1BW	JCDW3AW	JCDW3BW	JCDW3RW
Lab ID			6384-001	6749-005	6384-002	6749-006	6415-002	6761-001	6761-002
SDG #			5	6	5	6	5	6	6
Date Received			1/6/92	2/1/92	1/6/92	2/1/92	1/8/92	2/3/92	2/3/92
Matrix			WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	200	818J	152J	355J	1000J	1040J	4330J	8750J
Antimony	204.2 CLP-M (2)	60	3.0UJ	3.0U	3.0UJ	3.0U	3.0UJ	3.0U	3.0U
Arsenic	206.2 CLP-M (2)	10	2.0U	2.0U	2.0U	2.0U	2.4B	2.5B	4.1B
Barium	200.7 CLP-M (2)	200	109B	71.0B	101B	122B	123B	125B	182B
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Cadmium	200.7 CLP-M (2)	5	4.0U	7	4.0U	8	4.0U	6	8
Calcium	200.7 CLP-M (2)	5000	132000	93900	165000	168000	82100	67500	87000
Chromium	200.7 CLP-M (2)	10	17	16	10	5.0U	25	22	23
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U	5.0U	5.0U	6.0U	5.0U
Copper	200.7 CLP-M (2)	25	9.0BJ	3.0UJ	7.0BJ	3.0BJ	3.0UJ	3.0BJ	17.0BJ
Iron	200.7 CLP-M (2)	100	1970J	151J	848J	1340J	2070J	6170J	12400J
Lead	239.2 CLP-M (2)	3	5.5	1.7J	1.5J	1.9B	2.3B	4.1	5.9
Magnesium	200.7 CLP-M (2)	5000	31400	22400	26000	26900	24600	22900	25900
Manganese	200.7 CLP-M (2)	15	255	100J	40	78.0J	385	380J	554J
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.1U	0.10U	0.10U	0.10U	0.10U	0.10U
Nickel	200.7 CLP-M (2)	40	22.0U	4.0U	20.0U	5.0U	15.0U	4.0U	11.0U
Potassium	200.7 CLP-M (2)	5000	4600B	7360	2380B	2690B	42000	41200	34500
Selenium	270.2 CLP-M (2)	5	1.1B	1.0UJ	1.3B	1.0UJ	1.0U	1.0UJ	1.0UJ
Silver	200.7 CLP-M (2)	10	9.0B	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U
Sodium	200.7 CLP-M (2)	5000	91200	75600	283000	301000	50200	52300	47800
Thallium	279.2 CLP-M (2)	10	1.4J	1.0UJ	1.0UJ	1.0UJ	1.0U	1.0UJ	1.0J
Vanadium	200.7 CLP-M (2)	50	27.0U	3.0U	27.0U	7.0U	4.0U	10.0U	18.0U
Zinc	200.7 CLP-M (2)	20	85.0J	92.0J	80.0J	30.0UJ	29.0J	31.0UJ	87.0J
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCDW3RW is a field replicate of JCDW3BW
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.21 (Cont.)

Sample ID			JCSW3AW	JCSW3BW	JCDW4AW	JCDW4BW	JCSW4AW	JCSW4BW	JCDW5AW
Lab ID			6415-003	6761-003	6415-006	6703-001	6415-009	6703-004	6384-003
SDG #			5	6	5	6	5	6	5
Date Received			1/8/92	2/3/92	1/8/92	1/30/92	1/8/92	1/30/92	1/6/92
Matrix			WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	200	1270J	808J	2930J	1250J	1850J	5900J	218J
Antimony	204.2 CLP-M (2)	60	3.0UJ	3.0U	3.7J	3.0U	3.0UJ	3.0U	3.0UJ
Arsenic	206.2 CLP-M (2)	10	4.1B	2.8B	2.0U	2.0U	3.1B	3.3B	2.0U
Barium	200.7 CLP-M (2)	200	71B	64.0B	91.0B	72.0B	123B	133B	44.0B
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U	3.0B	1.0B
Cadmium	200.7 CLP-M (2)	5	4.0U	6	4.0U	7	4.0U	14	4.0U
Calcium	200.7 CLP-M (2)	5000	122000	115000	130000	115000	120000	109000	30800
Chromium	200.7 CLP-M (2)	10	5.0U	7.0B	5.0U	5.0U	38	29	59
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U	5.0U	5.0U	6.0U	5.0U
Copper	200.7 CLP-M (2)	25	6.0BJ	3.0BJ	5.0UJ	3.0UJ	19.0UJ	14.0BJ	3.0UJ
Iron	200.7 CLP-M (2)	100	1640J	1070J	4200J	1560J	2930J	7390J	489J
Lead	239.2 CLP-M (2)	3	1.0B	1.1B	2.5J	1.3B	4.9B	4.2B	1.8B
Magnesium	200.7 CLP-M (2)	5000	21400	21400	31800	28900	23800	22300	9370
Manganese	200.7 CLP-M (2)	15	65	33.0J	659	528J	1380	795J	133
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10U	0.10U	0.10J	0.10U	0.10U
Nickel	200.7 CLP-M (2)	40	36.0U	4.0U	5.0U	5.0U	31.0U	57	28.0U
Potassium	200.7 CLP-M (2)	5000	4050B	3770B	6700	10300	2860B	3830B	45800
Selenium	270.2 CLP-M (2)	5	1.0U	1.0UJ	1.0U	1.0UJ	1.0U	1.0UJ	1.0U
Silver	200.7 CLP-M (2)	10	7.0U	7.0U	7.0U	7.0B	7.0U	7.0B	7.0U
Sodium	200.7 CLP-M (2)	5000	49400	41300	30600	33200	49500	42900	52900
Thallium	279.2 CLP-M (2)	10	1.0UJ	1.0UJ	1.2B	1.4J	1.3B	5.0UJ	1.0U
Vanadium	200.7 CLP-M (2)	50	8.0B	5.0U	11.0U	6.0U	4.0U	16.0U	30.0U
Zinc	200.7 CLP-M (2)	20	72.0J	43.0UJ	28.0J	34.0UJ	44.0J	73.0J	66.0J
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.21 (Cont.)

Sample ID			JCDW5BW	JCSW5AW	JCSW5BW	JCDW6AW	JCDW6BW	JCSW6AW	JCSW6BW
Lab ID			6749-001	6384-004	6749-002	6384-005	6749-003	6384-006	6749-004
SDG #			6	5	6	5	6	5	6
Date Received			2/1/92	1/6/92	2/1/92	1/6/92	2/1/92	1/6/92	2/1/92
Matrix			WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	200	1450J	1360J	497J	1640J	2120J	3990J	19800J
Antimony	204.2 CLP-M (2)	60	28.5B	3.0UJ	3.0U	3.0UJ	13.8B	3.0UJ	3.0U
Arsenic	206.2 CLP-M (2)	10	2.0U	2.0U	2.0U	4.8B	4.1B	2.9B	6.7B
Barium	200.7 CLP-M (2)	200	67.0B	57B	101B	93.0B	94.0B	122B	211
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0B
Cadmium	200.7 CLP-M (2)	5	4.0U	4.0U	9	4.0U	4.0U	4.0U	14
Calcium	200.7 CLP-M (2)	5000	45500	163000	158000	49500	30200	186000	181000
Chromium	200.7 CLP-M (2)	10	41	63	47	5.0U	5.0U	13	30
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	13.0U
Copper	200.7 CLP-M (2)	25	3.0UJ	13.0BJ	3.0UJ	5.0BJ	4.0BJ	15.0BJ	26J
Iron	200.7 CLP-M (2)	100	1840J	3070J	674J	3280J	2860J	9030J	26700J
Lead	239.2 CLP-M (2)	3	1.5B	14.6	1.9B	1.5B	2.7B	5.3	14.6
Magnesium	200.7 CLP-M (2)	5000	14200	32100	29100	17000	10100	31800	36600
Manganese	200.7 CLP-M (2)	15	263J	3090	451J	122	65.0J	521	1010J
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U
Nickel	200.7 CLP-M (2)	40	4.0U	100	39.0B	21.0U	6.0U	18.0U	25.0U
Potassium	200.7 CLP-M (2)	5000	34300	4840B	4430B	12700	17800	4240B	9970
Selenium	270.2 CLP-M (2)	5	1.0UJ	1.0U	1.0UJ	1.0U	1.0UJ	1.0U	1.0UJ
Silver	200.7 CLP-M (2)	10	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U
Sodium	200.7 CLP-M (2)	5000	45500	92100	106000	31800	34500	41700	40000
Thallium	279.2 CLP-M (2)	10	1.0UJ	1.0UJ	1.0UJ	1.0U	1.0UJ	1.0UJ	1.0UJ
Vanadium	200.7 CLP-M (2)	50	4.0U	30.0U	8.0U	28.0U	3.0U	32.0U	35.0B
Zinc	200.7 CLP-M (2)	20	60.0UJ	153J	40.0UJ	26.0J	41.0UJ	81.0J	106J
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.21 (Cont.)

Sample ID			JCSW7AW	JCSW7BW	JCDW8AW	JCDW8RW	JCDW8BW	JCSW8AW	JCSW8BW
Lab ID			6415-010	6703-005	6446-001	6446-002	6703-006	6446-003	6703-007
SDG #			5	6	5	5	6	5	6
Date Received			1/8/92	1/30/92	1/10/92	1/10/92	1/30/92	1/10/92	1/30/92
Matrix			WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	200	1060J	2290J	174BJ	146BJ	591J	9590J	11300J
Antimony	204.2 CLP-M (2)	60	3.0UJ	3.0U	3.0UJ	3.0UJ	3.0U	3.0UJ	3.0U
Arsenic	206.2 CLP-M (2)	10	2.0U	2.0U	2.0U	2.0U	2.4B	4.3B	5.2B
Barium	200.7 CLP-M (2)	200	108B	147B	55.0B	42.0B	30.0B	124B	128B
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Cadmium	200.7 CLP-M (2)	5	4.0U	10	4.0U	4.0U	4.0B	4.0U	5
Calcium	200.7 CLP-M (2)	5000	163000	151000	90100	92000	80700	96700	96300
Chromium	200.7 CLP-M (2)	10	5.0U	5.0B	26	18	17	15	19
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U	5.0U	5.0U	10.0B	5.0U
Copper	200.7 CLP-M (2)	25	19.0UJ	8.0BJ	5.0BJ	5.0BJ	3.0UJ	23.0BJ	20.0BJ
Iron	200.7 CLP-M (2)	100	1760J	4590J	378J	386J	1130J	10300J	12100J
Lead	239.2 CLP-M (2)	3	2.1J	3.5B	1.3J	1.0UJ	1.0U	7	10.5
Magnesium	200.7 CLP-M (2)	5000	26700	25400	28100	27900	28200	15500	16500
Manganese	200.7 CLP-M (2)	15	234	722J	407	408	304J	4400	4030J
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10U	0.10U	0.10U	0.11J	0.10U
Nickel	200.7 CLP-M (2)	40	18.0U	4.0U	8.0U	6.0U	4.0U	115	13.0U
Potassium	200.7 CLP-M (2)	5000	4120B	3960B	50300	45600	43400	4330B	4730B
Selenium	270.2 CLP-M (2)	5	2.1B	1.4J	1.0U	1.0U	1.0UJ	1.0U	1.0UJ
Silver	200.7 CLP-M (2)	10	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U
Sodium	200.7 CLP-M (2)	5000	50400	46000	112000	104000	93800	23800	20700
Thallium	279.2 CLP-M (2)	10	1.1B	1.0UJ	1.2B	1.0U	1.0UJ	1.0U	1.0UJ
Vanadium	200.7 CLP-M (2)	50	5.0U	9.0U	3.0UJ	3.0UJ	3.0U	14.0U	24.0U
Zinc	200.7 CLP-M (2)	20	64.0J	31.0UJ	38.0J	39.0J	37.0UJ	195.0J	70.0J
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCDW8RW is a field replicate of JCDW8AW
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.21 (Cont.)

Sample ID			JCDW9AW	JCDW9BW	JCSW9AW	JCSW9BW	JCDPWAW	JCDPWBW	JCBG2BW
Lab ID			6415-004	6761-004	6415-005	6761-005	6446-004	6761-006	6415-001
SDG #			5	6	5	6	5	6	5
Date Received			1/8/92	2/3/92	1/8/92	2/3/92	1/10/92	2/3/92	1/8/92
Matrix			WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL							
Aluminum	200.7 CLP-M (2)	200	1150J	3940J	9750J	8290J	70.0BJ	151J	47.0UJ
Antimony	204.2 CLP-M (2)	60	3.0UJ	3.0U	3.0UJ	3.0U	3.0UJ	3.0U	3.0UJ
Arsenic	206.2 CLP-M (2)	10	2.7B	2.8B	4.9B	5.1B	2.0U	2.0U	2.0U
Barium	200.7 CLP-M (2)	200	44.0B	53.0B	124B	100B	90.0B	94.0B	170B
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Cadmium	200.7 CLP-M (2)	5	4.0U	7	4.0U	7	4.0U	7	4.0U
Calcium	200.7 CLP-M (2)	5000	95900	113000	157000	121000	143000	145000	123000
Chromium	200.7 CLP-M (2)	10	27	16	24	12	5.0U	5.0U	5.0U
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	24B	5.0U	5.0U	5.0U	5.0U
Copper	200.7 CLP-M (2)	25	3.0UJ	10.0BJ	35J	19.0BJ	10.0BJ	12.0BJ	3.0UJ
Iron	200.7 CLP-M (2)	100	2810J	7800J	12100J	10900J	358J	547J	21.0UJ
Lead	239.2 CLP-M (2)	3	1.5J	4.1	8.1	8.7	1.0UJ	3.3J	1.0U
Magnesium	200.7 CLP-M (2)	5000	16900	18800	28100	20700	27000	28600	25800
Manganese	200.7 CLP-M (2)	15	1090	1430J	736	656J	452	444J	3.0B
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10J	0.10U	0.10U	0.10U	0.10U
Nickel	200.7 CLP-M (2)	40	25.0U	4.0U	48	21.0U	6.0U	9.0U	8.0U
Potassium	200.7 CLP-M (2)	5000	33100	25800	6350	6490	1900B	1840B	2390B
Selenium	270.2 CLP-M (2)	5	1.0U	1.0UJ	1.0U	1.0UJ	1.0UJ	1.0UJ	1.0U
Silver	200.7 CLP-M (2)	10	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U	7.0U
Sodium	200.7 CLP-M (2)	5000	59200	58100	21600	21100	48300	48700	70600
Thallium	279.2 CLP-M (2)	10	1.0UJ	1.0UJ	1.0UJ	1.0UJ	1.0B	1.0UJ	1.0UJ
Vanadium	200.7 CLP-M (2)	50	8.0U	13.0U	37.0U	22.0U	3.0UJ	7.0U	3.0U
Zinc	200.7 CLP-M (2)	20	74J	88.0J	110J	73.0J	17.0UJ	72.0J	25.0J
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCBG2BW is a background sample
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.22
Analytical Results for AFP 59, Johnson City: Outfall and Creek Water Samples — Inorganic Analysis

Sample ID			JCOF1AW	JCOF2AW	JCCW1AW	JCCW2AW	JCCNCAW
Lab ID			5868-001	5868-002	5807-002	5807-001	5808-001
SDG #			2	2	2	2	2
Date Received			11/23/91	11/23/91	11/18/91	11/18/91	11/19/91
Matrix			WATER	WATER	WATER	WATER	WATER
Units			µg/L	µg/L	µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL					
Aluminum	200.7 CLP-M (2)	200	72.0B	399	122B	136B	317
Antimony	204.2 CLP-M (2)	60	2.0U	2.0U	2.0U	2.0U	2.0U
Arsenic	206.2 CLP-M (2)	10	1.0U	1.0U	1.0U	1.0U	1.0U
Barium	200.7 CLP-M (2)	200	94.0B	34.0U	29.0U	33.0U	25.0U
Beryllium	200.7 CLP-M (2)	5	1.0U	1.0U	1.0U	1.0U	1.0U
Cadmium	200.7 CLP-M (2)	5	3.0U	3.0U	3.0U	3.0U	3.0U
Calcium	200.7 CLP-M (2)	5000	99100	32600	33400J	35400J	18400J
Chromium	200.7 CLP-M (2)	10	6.0B	4.0U	4.0U	4.0U	4.0U
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U	5.0U	5.0U
Copper	200.7 CLP-M (2)	25	46.0U	40.0U	4.0U	14.0U	4.0U
Iron	200.7 CLP-M (2)	100	134	310	145	183	362
Lead	239.2 CLP-M (2)	3	1.6B	5.3	1.0U	1.0U	1.3B
Magnesium	200.7 CLP-M (2)	5000	21400	6190	6590	6470	4530B
Manganese	200.7 CLP-M (2)	15	168	36	13.0B	40	83
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10U	4.9	0.10U
Nickel	200.7 CLP-M (2)	40	6.0U	5.0U	5.0U	5.0U	5.0U
Potassium	200.7 CLP-M (2)	5000	2010B	795B	1950B	1680B	1090B
Selenium	270.2 CLP-M (2)	5	1.1B	1.0U	1.0U	1.0U	1.0U
Silver	200.7 CLP-M (2)	10	5.0B	4.0U	4.0U	4.0U	4.0U
Sodium	200.7 CLP-M (2)	5000	57200	19300	23400	19200	10800
Thallium	279.2 CLP-M (2)	10	2.0U	2.0U	2.0U	2.0U	2.0U
Vanadium	200.7 CLP-M (2)	50	9.0U	4.0U	4.0U	5.0U	4.0U
Zinc	200.7 CLP-M (2)	20	37.0U	93	10.0U	17.0U	418
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0UJ	10.0U	10.0U	10.0U

Qualifiers

J: Concentration was estimated
U: Analyte not detected
UJ: Analyte not detected - sample quantitation limit is an estimate
R: Data rejected
B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCCNCAW is a background sample
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.23
Analytical Results for AFP 59, Johnson City: Creek Sediment Samples — Inorganic Analysis

Sample ID			JCSD1AS	JCSD2AS	JCCNSCS
Lab ID			5770-006	5770-004	5832-007
SDG #			1	1	1
Date Received			11/18/91	11/18/91	11/21/91
Matrix			SOIL	SOIL	SOIL
Units			mg/kg	mg/kg	mg/kg
ANALYTE	METHOD	CRDL			
Aluminum	200.7 CLP-M (2)	40	9240	9260	10500
Antimony	204.2 CLP-M (2)	12	0.52UJ	0.47UJ	0.52UJ
Arsenic	206.2 CLP-M (2)	2	5.6J	5.4J	4.3J
Barium	200.7 CLP-M (2)	40	49.3B	46.3B	58.9
Beryllium	200.7 CLP-M (2)	1	1.0B	0.94B	1.0U
Cadmium	200.7 CLP-M (2)	1	0.79U	0.71U	0.78U
Calcium	200.7 CLP-M (2)	1000	12200	7450	1210B
Chromium	200.7 CLP-M (2)	2	16	16.5	16.5
Cobalt	200.7 CLP-M (2)	10	10.0B	10.3B	13.4
Copper	200.7 CLP-M (2)	5	16.5	20.5	16.3
Iron	200.7 CLP-M (2)	20	27000	26100	30500
Lead	239.2 CLP-M (2)	0.6	92.1	22.2	13.4
Magnesium	200.7 CLP-M (2)	1000	4430	3410	3330
Manganese	200.7 CLP-M (2)	3	464J	461J	584J
Mercury (1)	245.1/245.5 CLP-M (2)	0.1	0.07B	0.08B	0.06U
Nickel	200.7 CLP-M (2)	8	20.5	19.7	22.2
Potassium	200.7 CLP-M (2)	1000	834B	851B	602B
Selenium	270.2 CLP-M (2)	1	0.29J	0.21UJ	0.21U
Silver	200.7 CLP-M (2)	2	1.0U	0.94U	1.0U
Sodium	200.7 CLP-M (2)	1000	72.4B	82.0B	91.2U
Thallium	279.2 CLP-M (2)	2	0.45UJ	0.42UJ	0.41UJ
Vanadium	200.7 CLP-M (2)	10	13.4	14.1	13.7
Zinc	200.7 CLP-M (2)	4	134J	119J	66.4J
Cyanide	335.2 CLP-M (2)	2.5	1.1U	1.2U	1.4U

Qualifiers

J:	Concentration was estimated
U:	Analyte not detected
UJ:	Analyte not detected - sample quantitation limit is an estimate
R:	Data rejected
B:	Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample JCCNSCS is a background sample
Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.24
Analytical Results for AFP 59, Johnson City: Named-Site Test Bore and Hand-Soil Samples — Inorganic Analysis

Sample ID			JC1H1CS	JC2LIAS	JC3H1AS	JC4H1AS	JC4H2AS	JC6H1AS
Lab ID			6007-002	6779-001	6007-003	5983-001	5983-002	6007-004
SDG #			3	7	3	3	3	3
Date Received			12/5/91	2/1/92	12/5/91	12/4/91	12/4/91	12/5/91
Matrix			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ANALYTE	METHOD	CRDL						
Aluminum	200.7 CLP-M (2)	40	9910	11500	10300	7690	9190	10100
Antimony	204.2 CLP-M (2)	12	0.49UJ	1.6J	0.46UJ	0.43UJ	0.41UJ	0.44UJ
Arsenic	206.2 CLP-M (2)	2	6.8	10.2	6.6	4.7	2.9	7.8
Barium	200.7 CLP-M (2)	40	79.9	109	78.9	40B	52.6	55.5
Beryllium	200.7 CLP-M (2)	1	0.25U	0.79B	0.23U	0.21U	0.20U	0.22U
Cadmium	200.7 CLP-M (2)	1	0.74U	7.5	0.69U	1.7U	2.9U	0.67U
Calcium	200.7 CLP-M (2)	1000	5600J	28200J	1270J	3700J	1980J	4260J
Chromium	200.7 CLP-M (2)	2	14.6	428	14.6	21.4	91.3	15.2
Cobalt	200.7 CLP-M (2)	10	7.4B	12.7B	8.2B	6.4U	8.8B	9.6B
Copper	200.7 CLP-M (2)	5	28.6	85.9	28.1	21.6	45.7	22.3
Iron	200.7 CLP-M (2)	20	18000	28400	21300	18500	23300	22700
Lead	239.2 CLP-M (2)	0.6	13.2J	572J	13.4J	12.2J	12.3J	41.1J
Magnesium	200.7 CLP-M (2)	1000	2840	6530	2970	2760	2990	3460
Manganese	200.7 CLP-M (2)	3	1360J	1160J	864J	657J	856J	700J
Mercury (1)	245.1/245.5 CLP-M (2)	0.1	0.07B	0.13B	0.07B	0.06B	0.10B	0.07B
Nickel	200.7 CLP-M (2)	8	17.5	124	22.6	45.6	41	20.1
Potassium	200.7 CLP-M (2)	1000	1300	1370B	885B	818B	735B	972B
Selenium	270.2 CLP-M (2)	1	0.18UJ	0.40J	0.23J	0.17UJ	0.18UJ	0.22UJ
Silver	200.7 CLP-M (2)	2	0.99U	2.8B	0.91U	0.86U	0.82U	0.89U
Sodium	200.7 CLP-M (2)	1000	27.4U	578B	33.4B	25.3B	31.3B	58.0B
Thallium	279.2 CLP-M (2)	2	0.36U	0.67B	0.41U	0.33U	0.37U	0.44U
Vanadium	200.7 CLP-M (2)	10	10.4B	19.4B	10.1B	9.6U	12.5U	13.4
Zinc	200.7 CLP-M (2)	4	52.5	109	57.4	50.3	72.3	64.7
Cyanide	335.2 CLP-M (2)	2.5	2.6	2.0U	1.2U	1.2U	1.2U	1.1U

Qualifiers

- J: Concentration was estimated
- U: Analyte not detected
- UJ: Analyte not detected - sample quantitation limit is an estimate
- R: Data rejected
- B: Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits

IDL: Instrument Detection Limit

Sample results reported on a dry weight basis

(1) Mercury method 245.1 is for water and 245.5 is for soils

(2) Referenced in NYSDEC - ASP (9/89)

TABLE F.25
Analytical Results for AFP 59, Johnson City: Field Blank/Equipment Rinsate Samples — Inorganic Analysis

Sample ID			JCQC1TW	JCQC2BW	JCQC3XW
Lab ID			5602-003	5602-004	5630-001
SDG #			1	1	1
Date Received			11/7/91	11/7/91	11/7/91
Matrix			WATER	WATER	WATER
Units			µg/L	µg/L	µg/L
ANALYTE	METHOD	CRDL			
Aluminum	200.7 CLP-M (2)	200	60.0U	60.0U	60.0U
Antimony	204.2 CLP-M (2)	60	2.0U	2.0U	2.0U
Arsenic	206.2 CLP-M (2)	10	1.0U	1.0U	1.0U
Barium	200.7 CLP-M (2)	200	4.0U	4.0U	4.0U
Beryllium	200.7 CLP-M (2)	5	3.0B	3.0B	3.0B
Cadmium	200.7 CLP-M (2)	5	3.0U	3.0U	3.0U
Calcium	200.7 CLP-M (2)	5000	17.0U	494B	17.0U
Chromium	200.7 CLP-M (2)	10	4.0U	4.0U	4.0U
Cobalt	200.7 CLP-M (2)	50	5.0U	5.0U	5.0U
Copper	200.7 CLP-M (2)	25	4.0U	4.0U	4.0U
Iron	200.7 CLP-M (2)	100	13.0B	948	10.0B
Lead	239.2 CLP-M (2)	3	2.5B	1.6B	1.0U
Magnesium	200.7 CLP-M (2)	5000	42.0U	42.0U	42.0U
Manganese	200.7 CLP-M (2)	15	1.0U	8.0B	1.0U
Mercury (1)	245.1/245.5 CLP-M (2)	0.2	0.10U	0.10U	0.10U
Nickel	200.7 CLP-M (2)	40	5.0U	5.0U	5.0U
Potassium	200.7 CLP-M (2)	5000	308B	1510B	437B
Selenium	270.2 CLP-M (2)	5	1.0U	1.0U	1.0U
Silver	200.7 CLP-M (2)	10	4.0U	4.0U	4.0U
Sodium	200.7 CLP-M (2)	5000	521B	1250B	157B
Thallium	279.2 CLP-M (2)	10	2.0U	2.0U	2.0U
Vanadium	200.7 CLP-M (2)	50	4.0U	4.0U	4.0U
Zinc	200.7 CLP-M (2)	20	15.0B	15.0B	5.0B
Cyanide	335.2 CLP-M (2)	10	10.0U	10.0U	10.0U

Qualifiers

J:	Concentration was estimated
U:	Analyte not detected
UJ:	Analyte not detected - sample quantitation limit is an estimate
R:	Data rejected
B:	Analyte concentration >IDL but <CRDL

Notes

CRDL: Contract Required Detection Limits
IDL: Instrument Detection Limit

Sample results reported on a dry weight basis
(1) Mercury method 245.1 is for water and 245.5 is for soils
(2) Referenced in NYSDEC - ASP (9/89)

F.2 Galson Laboratory Data Package

One copy of the complete laboratory data package will form part of the formal submission of the final version of this report. This material will be provided under separate cover. The index provided in Section F.3 identifies the location of data summary sheets for each analysis reported within the data package.

F.3 Crosswalk Index to Data Packages

The following is an index of samples reported in the Galson Summary Data Packages for Sample Delivery Groups SDG#1-5554, #2-5807, #3-5983, #5-6384, #6-6703, and #7-6779. SDG#4 pertained only to a sample that was discarded by Galson. These account for all samples submitted. The page number of the data sheets pertaining to each sample is shown.

In the index, "U" means that no listed analytes were detected or that no TICs (VOs or BNAs) were recorded; "D" means that one or more list analytes were detected (with or without qualification), or that TICs were reported.

TABLE F.26 Well Borehole Soil Samples

Sample	Type	SDG	Page	List	TIC
DW-1					
JCDW1AS	VOA	1	124-5	U	U
	SV	1	188-190	D	D
		(JCDW1AS shown as JDCW1AS)			
	P/P	1	251	U	N/A
	MET	1	273	D	U
JCDW1BS	VOA	1	126-7	U	U
	SV	1	191-3	D	D
	MET	1	274	D	N/A
JCDW1BS RE	P/P	1	252	U	N/A
JCDW1CS	VOA	1	128-9	D	U
	SV	1	194-5	U	D
	P/P	1	253	U	N/A
	MET	1	275	D	N/A
DW-3					
JCDW3AS	VOA	1	130-31	U	U
	SV	1	197-99	D	D
	P/P	1	254	U	N/A
	MET	1	276	D	N/A
JCDW3BS	VOA	1	132-3	U	U
	SV	1	200-2	U	D
	P/P	1	255	U	N/A
	MET	1	277	D	N/A
SW-4					
JCSW4AS	VOA	1	138-9	U	U
	SV	1	218-20	U	D
	P/P	1	261	U	N/A
	MET	1	283	D	N/A
JCSW4BS	VOA	1	140-1	U	U
	SV	1	221-3	U	D
	P/P	1	262	U	N/A
	MET	1	284	D	N/A
JCSW4CS	VOA	1	142-3	D	U
	SV	1	224-5	U	D
	P/P	1	263	U	N/A
	MET	1	285	D	N/A
JCSW4CS RE	SV	1	227-229	D	D
SW-5					
JCSW5AS	VOA	1	144-5	U	U
	SV	1	230-2	U	D
	P/P	1	264	U	N/A
	MET	1	286	D	N/A

TABLE F.26 (Cont.)

Sample	Type	SDG	Page	List	TIC
SW-5 (Cont.)					
JCSW5BS	VOA	1	146-7	U	U
	SV	1	233-4	D	U
	P/P	1	265	U	N/A
	MET	1	287	D	N/A
SW-6					
JCSW6AS	VOA	1	148-9	D	U
	SV	1	236-8	D	hit
	P/P	1	266	D	N/A
	MET	1	270	D	N/A
JCSW6BS	VOA	1	150-51	U	U
	SV	1	239	D	N/A
	MET	1	288	D	N/A
SW-7					
JCSW7AS	VOA	3	76-7	D	U
	SV	3	123-4	D	U
	P/P	3	157	U	N/A
	MET	3	168	D	N/A
JCSW7AS RE	SV	3	147-9	D	D
JCSW7BS	VOA	3	147-9	D	U
	SV	3	138-10	D	D
	P/P	3	158	U	N/A
	MET	3	169	D	N/A
JCSW7BS RE	SV	3	141-3	U	D
SW-8					
JCSW8AS	VOA	1	152-3	D	D
	SV	1	242-6	U	D
	P/P	1	268	U	N/A
	MET	1	289	D	N/A
JCSW8BS	VOA	1	154-5	D	U
	SV	1	245-6	D	D
	P/P	1	269	D	N/A
	MET	1	271	D	N/A
SW-9					
JCSW9AS	VOA	3	80-1	D	U
	SV	3	150-2	D	D
	P/P	3	159	U	N/A
	MET	3	170	D	N/A
JCSW9BS	VOA	3	82-3	D	U
	SV	3	153	D	U
	P/P	3	160	U	N/A
	MET	3	171	D	N/A

TABLE F.27 Groundwater Samples

Sample Type	SDG	Page	List	TIC	SDG	Page	List	TIC
DW-1								
Round One: JCDW1AW					Round Two: JCDW1BW			
VOA	5	88-9	D	U	6	87-88	D	U
SV	5	138-40	U	U	6	138-9	U	U
P/P	5	189	U	N/A	6	194	U	N/A
MET	5	207	D	N/A	6	211	D	N/A
SW-1								
Round One: JCSW1AW					Round Two: JCSW1BW			
VOA	5	104-5	U	U	6	103-4	D	U
SV	5	162-4	U	U	6	141-3	U	U
P/P	5	197	U	N/A	6	202	U	N/A
MET	5	215	D	N/A	6	219	D	N/A
DW-3								
Round One: JCDW3AW					Round Two: JCDW3BW			
VOA	5	90-1	D	D	6	89-90	D	D
SV	5	141-3	U	U	6	144-6	U	D
P/P	5	190	U	N/A	6	195	U	N/A
MET	5	208	D	N/A	6	212	U	NA
					Round Two: JCDW3RW			
					6	101-2		D
					6	150-152		U
					6	196		U
					6	213		D
SW-3								
Round One: JCSW3AW					Round Two: JCSW3BW			
VOA	5	106-7	D	D	6	105-6	D	U
SV	5	165-7	U	U	6	153-5	U	D
P/P	5	198	U	N/A	6	203	U	N/A
MET	5	216	D	N/A	6	220	D	N/A
DW-4								
Round One: JCDW4AW					Round Two: JCDW4BW			
VOA	5	92-3	D	U	6	91-2	D	D
SV	5	144-6	U	U	6	156-8	U	D
P/P	5	191	U	N/A	6	197	U	N/A
MET	5	209	D	N/A	6	214	D	N/A
SW-4								
Round One: JCSW4AW					Round Two: JCSW4BW			
VOA	5	108-9	D	D	6	107-8	D	D
SV	5	168-70	U	D	6	162-4	U	D
P/P	5	199	U	N/A	6	204	U	N/A
MET	5	217	D	N/A	6	221	D	N/A

TABLE F.27 (Cont.)

Sample Type	SDG	Page	List	TIC	SDG	Page	List	TIC
DW-5								
Round One: JCDW5AW					Round Two: JCDW5B			
VOA	5	94-5	D	U	6	93-4	D	D
VOA	5	147-9	U	hit	6	165-7	U	J
P/P	5	192	U	N/A	6	198	U	N/A
MET	5	210	D	N/A	6	215	D	N/A
SW-5								
Round One: JCSW5AW					Round Two: JCSW5AW			
VOA	5	110-11	U	U	6	109-10	D	U
SV	5	171-3	U	D	6	168-70	U	D
P/P	5	200	U	N/A	6	205	U	N/A
MET	5	218	D	N/A	6	222	U	N/A
DW-6								
Round One: JCDW6AW					Round Two: JCDW6BW			
VOA	5	96-7	U	U	6	95-6	U	U
SV	5	150-2	U	U	6	171-3	U	U
P/P	5	193	U	N/A	6	199	U	N/A
MET	5	211	D	N/A	6	216	D	N/A
SW-6								
Round One: JCSW6AW					Round Two: JCSW6BW			
VOA	5	112-3	D	U	6	111-12	D	U
SV	5	174-6	U	U	6	174-6	U	U
P/P	5	201	U	N/A	6	206	U	N/A
MET	5	219	D	N/A	6	223	D	N/A
SW-7								
Round One: JCSW7AW					Round Two: JCSW7BW			
VOA	5	114-5	D	U	6	113-14	D	U
SV	5	177-9	U	D	6	177-79	U	D
P/P	5	202	U	N/A	6	207	U	N/A
MET	5	220	D	N/A	6	224	D	N/A
DW-8								
Round One: JCDW8AW					Round Two: JCDW8BW			
VOA	5	98-9	D	U	6	97-8	D	D
SV	5	153-5	U	D	6	180-82	U	D
P/P	5	195	U	N/A	6	200	U	N/A
MET	5	212	D	N/A	6	217	D	N/A
Round One: JCDW8RW								
VOA	5	100-1	D	U				
SV	5	156-8	U	U				
P/P	5	194	U	N/A				
MET	5	213	D	N/A				

TABLE F.27 (Cont.)

Sample Type	SDG	Page	List	TIC	SDG	Page	List	TIC
SW-8								
Round One: JCSW8AW					Round Two: JCSW8BS			
VOA	5	116-7	D	U	6	115-16	D	D
SV	5	180-2	U	D	6	183-5	U	D
P/P	5	203	U	N/A	6	208	U	N/A
MET	5	221	D	N/A	6	225	D	N/A
DW-9								
Round One: JCDW9AW					Round Two: JCDW9BW			
VOA	5	102-3	D	U	6	99-100	D	U
SV	5	159-61	U	D	6	186-8	U	D
P/P	5	196	U	N/A	6	201	U	N/A
MET	5	214	D	N/A	6	218	D	NA
SW-9								
Round One: JCSW9AW					Round Two: JCSW9BW			
VOA	5	118-9	D	U	6	117-18	D	D
SV	5	183-5	U	U	6	189-90	U	U
P/P	5	204	U	N/A	6	209	U	N/A
MET	5	222	D	N/A	6	226	D	N/A
DPW								
Round One: JCDPWAW					Round Two: JCDPWBW			
VOA	5	86-7	D	D	6	85-6	D	D
SV	5	135-7	U	U	6	135-8	U	U
P/P	5	188-90	U	N/A	6	193	U	N/A
MET	5	206	D	N/A	6	210	D	N/A

TABLE F.28 Outfall, Creek Sediment, and Creek Water Samples

Sample	Type	SDG	Page	List	TIC
Outfall					
JCOF1AW	VOA	2	69-70	D	D
	SV	2	91-3	U	D
	P/P	2	104	U	N/A
	MET	2	109	D	N/A
JCOF2AW	VOA	2	71-2	D	D
	SV	2	94-6	D	U
	P/P	2	105	U	N/A
	MET	2	110	D	N/A
Creek Sediment					
JCSD1AS	VOA	1	134-5	U	U
	SV	1	212-4	D	D
	P/P	1	259	U	N/A
	MET	1	281	D	N/A
JCSD2AS	VOA	1	136-7	D	U
	SV	1	215-6	D	D
	P/P	1	260	U	N/A
	MET	1	282	D	N/A
Creek Water					
JCCW1AW	VOA	2	65-6	D	U
	SV	2	88-90	U	U
	P/P	2	102	U	N/A
	MET	2	107	D	N/A
JCCW2AW	VOA	2	67-8	D	U
	SV	2	97-99	U	U
	(ID wrongly shown as JC2AW)				
	P/P	2	103	U	N/A
	MET	2	108	D	N/A

TABLE F.29 Named-Site Test Bore and Hand-Soil Samples

Sample	Type	SDG	Page	List	TIC
Site A-1					
JC1H1AS[a]	VOA	3	84-5	D	D
	SV	3	108-10	D	D
	P/P	3	161	D	N/A
JC1H1CS	VOA	3	86-7	U	D
	SV	3	111-13	D	D
	P/P	3	162	D	N/A
	MET	3	172	D	N/A
JC1H1CS DL	SV	3	114-16	D	D
Site A-2					
JC2L1AS	VOA	7	26-7	U	U
	SV	7	28-30	U	D
	P/P	7	31-32	U	N/A
	MET	7	33	D	N/A
Site A-3					
JC3H1AS	VOA	3	88-9	D	D
	SV	3	117-19	D	D
	P/P	3	163	?	N/A
	MET	3	173	D	N/A
JC3H1AS DL	SV	3	120-22	D	D
Site A-4					
JC4H1AS	VOA	3	90-1	D	U
	SV	3	126-8	U	D
	P/P	3	164	U	N/A
	MET	3	174	D	N/A
JC4H2AS	VOA	3	92-3	D	U
	SV	3	129-131	D	D
	P/P	3	165	U	N/A
	MET	3	175	D	N/A
Site A-6					
JC6H1AS	VOA	3	94-5	U	U
	SV	3	144-5	D	see note
	P/P	3	166	U	N/A
	MET	3	176	D	N/A

[a] Only 120 mL of JC1H1AS was collected.

TABLE F.30 Background and Equipment Rinsate Samples

Sample	Type	SDG	Page	List	TIC	
Background						
JCBG1AS	VOA	3	74-5	U	U	(Soil)
	SV	3	132-4	D	D	
	P/P	3	156	U	N/A	
	MET	3	167	D	N/A	
JCBG1AS RE	SV	3	135-7	U	D	
JCCNCAW	VOA	2	63-4	U	U	(Surface Water)
	SV	2	85-7	U	U	
	P/P	2	101	U	N/A	
	MET	2	106	D	N/A	
JCCNSCS	VOA	1	122-3	U	U	(Sediment)
	SV	1	182-4	U	U	
	P/P	1	250	U	N/A	
	MET	1	272	D	N/A	
JCCNSCS RE	SV	1	185-187	U	U	
JCBG2BW	VOA	5	84-5	D	U	(Groundwater)
	SV	5	132-4	U	U	
	P/P	5	187-9	U	N/A	
	MET	5	205	D	N/A	
Equipment Rinsates						
JCQC1TW	VOA	1	156-7	D	U	(tool rinse)
	SV	1	203-5	U	D	
	P/P	1	256-7	U	N/A	
	MET	1	278	D	N/A	
JCQC2BW	VOA	1	158-9	D	U	(split spoon rinse)
	SV	1	206-8	U	D	
	P/P	1	257	U	N/A	
	MET	1	279	D	N/A	
JCQC3XW	VOA	1	160-1	D	U	(bailer rinse)
	SV	1	209-11	U	D	
	P/P	1	258	U	N/A	
	MET	1	280	D	N/A	
JCQC4WW	VOA	6	119-20	D	D	(ASTM II water)
JCQC5XW	VOA	6	121-2	D	D	(bailer/blank water)

TABLE F.31 Trip Blanks

Sample	Type	SDG	Page	List	TIC
Trip Blanks					
Trip 1	VOA	1	162-3	U	U
Hold 1	VOA	1	172-3	U	U
Trip 2	VOA	1	164-5	U	U
Hold 2	VOA	1	174-5	U	U
Trip 3	VOA	1	166-7	U	U
Hold 3	VOA	1	176-7	U	U
Trip 4	VOA	2	73-4	D	U
Hold 4	VOA	2	79	a	U
Hold 4	VOA	2	83	D	a
Trip 5	VOA	2	75-6	D	U
Hold 5	VOA	2	81-2	U	U
Trip 6	VOA	1	168-9	U	U
Hold 6	VOA	1	178-9	U	U
Trip 7	VOA	1	170-1	U	U
Trip 7	VOA	2	77-8	D	U
Hold 7	VOA	2	80-4	D	D
Trip 8[b]					
Hold 8	VOA	1	180-181	U	U
Trip 9	VOA	3	102-3	U	U
Hold 9	VOA	3	96-7	U	U
Trip 10	VOA	3	104-5	U	U
Trip 10	VOA	3	106-7	U	U
Hold 10	VOA	3	98-9	U	U
Hold 11	VOA	3	100-1	U	U
Trip 13	VOA	5	120-1	U	U
Hold 13	VOA	5	126-7	U	U
Trip 14	VOA	5	122-3	D	D
Hold 14	VOA	5	128-9	U	U
Trip 15	VOA	5	124-5	D	D
Hold 15	VOA	5	130-1	U	U
Trip 16	VOA	6	123-124	D	D
Hold 16	VOA	6	129-130	U	U
Trip 17	VOA	6	125-126	D	D
Hold 17	VOA	6	131-132	D	U
TRIP 18	VOA	6	127-128	U	D
Hold 18	VOA	6	133-34	U	U

[a] Missing data received separately and appended to data pack.

[b] Missing, but Hold 8 = U.

Appendix G:

Correspondence with Agencies

New York State Department of Environmental Conservation
Region 7 Binghamton Sub-Office
Rt. 11, R.D.#1 Box 1803
Kirkwood, New York 13795-9772
(607) 773-7763

Thomas C. Jorling
Commissioner

October 3, 1991

US/DOE/Argonne National Lab
9700 So. Cass Ave. Bldg. 5
Argonne, Illinois 60439

Attn: W. Harrison

Re: Air Force Plant #59
Installation Restoration Program (IRP)

Dear Mr. Harrison:

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the documents submitted for the IRP and has the following comments:

Quality Assurance Project Plan

1. Shallow Monitoring Well Installation

The Department recommends performing continuous split-spoon sampling for the entire length of the borehole, not just the saturated zone. The impact to the investigation (cost and time) will be minimal while the information gained should prove useful.

2. Deep Monitoring Well Installation

It may be of considerable benefit to use 6¼" hollow-stem augers in place of 4¼" augers. The larger augers may be useful for two reasons:

a. If the formation tends to "run" up the augers, 6¼" augers should be easier to "clean" out.

b. If a confining layer is encountered, precautions should be taken to minimize the risk of cross-contamination. Use of 6¼" augers will allow for installation of 4-6" casing to be "seated" into the confining layer. The remainder of the boring will then be completed through the "seated" casing.

3. Well Development

Well development should continue until turbidity is less than 50 NTU and other parameters have stabilized.

4. Aquifer Testing

   Consideration should be given to expand the area of aquifer testing by using wells currently being installed by the DEC as well as existing wells located in the area (NYSEG, Johnson City Supply Wells).

Work Plan

1. Hand Augered Soil Samples, Pg. 15

   There is no figure 12 showing sample sources.

2. The investigation plan calls for installation of shallow wells (top of groundwater table) and deep wells (screened approximately 75-95 feet below ground surface). During boring of the deep wells a confining layer may be encountered. The Department recommends installation of a third monitoring well (per location) screened at the top of the confining layer in instances where this layer is considerably deeper than the shallow well screened interval. If the confining unit is encountered near the groundwater table (within approximately 20 feet), the screen length of the shallow well should be increased to extend to the unit.

3. The Department recommends installation of an additional deep monitoring well at the SW-6 location, as well as installation of a shallow and deep monitoring well couplet on the southern boundary of the facility property near the outfall no. 1 location. These recommendations are based on the following:

   a. Groundwater flow in the deeper water zone is to the southwest towards the Johnson City-Camden Street Wellfield. The Johnson City wells are contaminated with chemicals found in the groundwater underlying the Air Force facility.

      It is therefore of utmost importance to ensure that groundwater flow in the Johnson City Wells direction is adequately monitored to ensure both present and future protection of the water supply.

   b. At present, there are no monitoring wells to the south of the facility production well. Installation of a couplet near the outfall No. 1 location will provide that monitoring point and should provide valuable information during performance of the aquifer test.

4. Throughout the IRP plans, it is indicated that Johnson City's supply wells are to the northwest and southeast of the Air Force facility. The supply wells are to the northeast and southwest of the facility.

5. The Waste Management Plan indicates on page 6 that deep monitoring wells will be installed at an angle of approximately 30 degrees from vertical. This would appear to be incorrect from review of the other submitted plans. If the wells are to be installed at an angle, please present the rational for this installation procedure.

It should be noted that the Department has not reviewed the entire submittal package, in particular Section 1 of the Quality Assurance Plan. If comments are needed on that section, review will require more time. If you have any questions or concerns on the above comments, please contact me at (607) 773-7763.

Sincerely,

Scott Rodabaugh

Scott Rodabaugh
Environmental Engineer
Div. of Hazardous Waste Remediation

SR:kr

cc: C. Branagh
A. Grant
R. Schick
S. Schmidt

Appendix H:

Data from Previous IRP Investigations

TABLE H.1 A Comparison of 1986 and 1992 Groundwater Organic Analysis Results for SW-1, SW-3 and the Deep Production Well. The 1992 results are shown for all organic compounds that were detected in 1986. Shading identifies organics that were found in distinctly different concentrations in the 1992 samples.

Units=ppb	CRDL	CDL	SW-1			SW-3				PRODUCTION WELL			
Collection Year:			1986	1992	1992	1986	1986	1992	1992	1986	1986	1992	1992
Reported by:	ANL	HART	HART	ANL	ANL	HART	HART	ANL	ANL	HART	HART	ANL	ANL
Sample ID***			1	JCSW1AW	JCSW1BW	3	3*	JCSW3AW	JCSW3BW	7	7*	JCDPWAW	JCDPWBW
1,1-Dichloroethane	1	1	<1	ND	ND	<1	<1	5	2	16	15	3	3
1,2-Dichloroethene (total)	1	1	<1	ND	ND	<1	<1	ND	ND	66	73	ND	ND
1,1,1-Trichloroethane	1	2	<2	ND	0.5J	<2	<2	12	ND	9	3	2	3
Trichloroethene	1	2	<2	ND	ND	6	2	9	7	11	8	5	7

*Second (confirmatory) column.

METHODS: HART: First Column=E601/602; Second Column=E624
ANL Superfund method 89-1 as referenced in NYSDEC - ASP (9/89).

NOTE: HART=TRANS-1,2-DICHLOROETHENE

TABLE H.2 Borehole Soil Inorganic Analysis Results for 1986 (using EP TOX) and 1991 (using CLP). Samples taken from comparable locations and depths. Borehole soils from shallow wells 1 and 3 (1986) are compared with soils from nearby deep wells 1 and 3 (1992).

Location:	(DL)	SW-1	SW-3	(CRDL)	DW-1	DW-3
Method:		EP TOX	EP TOX		CLP	CLP
Units (ppm):		mg/L	mg/L		mg/kg	mg/kg
Collection Year:		1986	1986		1991	1991
Reported by:		HART	HART		ANL	ANL
Sample ID***		4	10		JCDW1CS	JCDW3BS
Depth in feet:		18-20	24-26		18-20	24 - 28
Arsenic	0.01	0.02	0.03	2	3.2J	6.3J
Barium	0.05	0.52	0.5	40	23.5B	75.9
Cadmium	0.01	<0.04	0.06	1	0.61U	0.51U
Chromium	0.02	0.02	<0.02	2	8.3	8.1
Mercury	0.001	ND	ND	0.1	.05U	.05U
Lead	0.02	0.16	0.18	0.6	5.2J	8.2J
Selenium	0.01	<.01	0.01	1	0.19UJ	0.17UJ
Silver	0.01	0.01	0.01	2	0.81U	0.69U
Cyanide	0.35	ND	ND	2.5	1.1UJ	1.2UJ

J: Concentration was estimated
U: Analyte not detected
DL: Method detection limit.
UJ: Analyte not detected. Sample quantitation limit is an estimate.
B: Analyte concentration >IDL but <CRDL
IDL: Instrument Detection Limit
CRDL: Contract Required Detection Limit (assuming "average" matrix).
ND: Not Detected.
* Lead: 1986: E200.7 1992: E 239.2 Cyanide: 1886: A412D/SW9010 1992: E 335.2
** Source: Table IV-2, P. IV-4, Hart 1988. Hart data were reported in ppm values shown to the nearest 1/1000.
*** Hart field sample number for a given location is shown. See original for sample ID's.
**** Sample SW-3 001 is a duplicate of SW-3 009.

TABLE H.3 A Comparison of 1986 and 1992 Groundwater Inorganic Analysis Results for SW-1, SW-3, and the Deep Production Well. Shading identifies metals that were found in distinctly lower concentrations in the 1992 samples. Analytical methods were the same except for lead and cyanide.* All units = ppb.**

	CRDL	MDL	SW-1			SW-3				PRODUCTION WELL		
Collection Year:			1986	1992	1992	1986	1986	1992	1992	1986	1992	1992
Reported by:			HART	ANL	ANL	HART	HART	ANL	ANL	HART	ANL	ANL
Sample ID***			1	JCSW1AW	JCSW1BW	3	4****	JCSW3AW	JCSW3BW	7	JCDPWAW	JCDPWBW
Arsenic	10	5	20	2.0U	2.0U	10	10	4.1B	2.8B	10	2.0U	2.0U
Barium	200	10	210	101B	122B	50	<10	71B	64.0B	140	90.0B	94.0B
Cadmium	5	5	7	4.0U	8	<5	<5	4.0U	6	<5	4.0U	7
Chromium	10	20	<20	10	5.0U	20	<20	5.0U	7.0B	<20	5.0U	5.0U
Lead	3	20	300	1.5J	1.9B	140	70	1.0B	1.1B	130	1.0UJ	3.3J
Mercury	0.2	1	<1	0.10U	0.10U	<1	<1	0.10U	0.10U	<1	0.10U	0.10U
Selenium	5	5	<5	1.3B	1.0UJ	<5	<5	1.0U	1.0UJ	<5	1.0UJ	1.0UJ
Silver	10	10	<10	7.0U	7.0U	<10	<10	7.0U	7.0U	<10	7.0U	7.0U
Cyanide	10	10	<10	10.0U	10.0U	<10	<10	10.0U	10.0U	<10	10.0U	10.0U

J: Concentration was estimated
U: Analyte not detected
IDL: Instrument Detection Limit
UJ: Analyte not detected. Sample quantitation limit is an estimate.
B: Analyte concentration >IDL but <CRDL
MDL= Method detection limits.
CRDL: Contract Required Detection Limits assuming "average" matrix.
* Lead: 1986: E200.7 1992: E 239.2 Cyanide: 1986: A412D/SW9010 1992: E 335.2
** Source: Table 1, P. 9, Hart 1988. Hart data were reported in ppm values shown to the nearest 1/1000.
*** Field sample numbers for Hart groundwater samples shown. See original for sample ID's.
**** Sample 004 is a duplicate of 003.

Appendix I:

Soil-Contaminant Screening at AFP 59

Appendix I:

Soil-Contaminant Screening at AFP 59

I.1 Introduction

I.1.1 Background and Approach

On-site screening consisted of performing analyses for organic compounds by using portable gas chromatography/mass spectrometry equipment and for metals by using x-ray fluorescence spectrometry. This appendix details the activities undertaken for screening soil contaminants, which were summarized in Section 2.2.4. The references and figures cited in this appendix are shared with the main report. Tables pertain only to this appendix.

Argonne's approach to screening sites for chemical contamination is to utilize portable (field-deployable) analytical instrumentation that provides for minimal sample preparation, rapid sample turnaround time, analysis of a wide range of contaminant compounds and elements, has a dynamic range that corresponds to typical soil-contamination values, and furnishes an accurate quantitative analysis. Instrumentation to accomplish these objectives in current use by ANL includes the Bruker MEM ("mobile environmental monitor") gas chromatograph/mass spectrometer [GC/MS]) and the Spectrace 6000 energy-dispersive x-ray fluorescence (EDXRF) spectrometer. The utility and value of these two instruments for Superfund-type chemical-analytical work is discussed in recent papers by U.S. EPA (1990) and Watson et al. (1989).

I.1.2 Primary Objectives

The primary objective of this investigation was to sample and analyze the soil at the AFP 59 site to provide rapid screening for trace-metal and organic soil contaminants at gross (low ppm) concentration levels.

I.2 Approach

I.2.1 Field Investigation

I.2.1.1 Approach to Field Sampling and Analysis Activity

Nineteen soil samples for on-site screening were obtained from eighteen locations. These locations are plotted on the site map (see Figure 1.2). Sampling depths are given in Table I.1 of this appendix. As part of its Site Safety and Health Plan, ANL submitted a Site Sampling and Analysis Plan that explains in detail the procedures that ANL intended to follow in the field.

The MEM was driven to the site, parked in an enclosed area of the plant building, and used to screen each soil sample soon after it was removed from the ground to determine the level of ion activity associated with volatile organic compounds. This procedure provides a good measure of the overall level of organic contamination in a sample and allows for on-site modification of the sampling plan to permit more detailed sampling around any "hot-spots" that are detected. Argonne did not conduct on-site analyses for metal contaminants. Instead, soil samples were taken to ANL's field laboratory in Maryland for metals analysis.

TABLE I.1 Soil Sampling Locations and Depths at the AFP 59 Building Site

Location ID	Sample ID	Sample Depth (ft)
HA-1	00101[a]	3.25
HA-1	00102	4
HA-2	00201	4
HA-3	00301	4.3
HA-4	00401	4.3
HA-5	00501	5
HA-6	00601	4
HA-7	00701	3
HA-8	00801	3
HA-9	00901	3
HA-10	01001	3
HA-11	01101	2
HA-12	01201	3
HA-13	01301	2
HA-14	01401	3
HA-15	01501	3
HA-16	01601	3
HA-17	01701	6
HA-18	01801	0.0166 (surface)

[a] The first three digits of the Sample ID refer to the sample number shown in Figure 1.2.

I.2.1.2 Implementation of Field Sampling and Analysis Work

Soil sampling and testing at the AFP 59 site was conducted daily between the hours of 8:00 a.m. and 5:00 p.m., beginning December 2, 1991, through December 6, 1991. Three sets of soil samples were collected: the first set was obtained from the area of the JP-4 fluid storage building and pipes, the second set was obtained from the parking lot area and along Choconut Creek at the rear of the

building, and the third set consisted of one sample from the plating building and one near the former waste oil storage tanks (see Figure 1.2). Two samples were obtained from one of the sample locations over the buried JP-4 pipes; the first sample was acquired from a depth of about 3.25 ft, and the second sample was acquired from a depth of about 4 ft (see Table I.1). All holes were drilled by using a hand auger.

Each sample jar was labeled with a unique sample identification code. The jar was then placed at the sampling location that had been previously marked with a surveyor's flag within the AFP 59 site. After the sample was collected, the jar was hand-carried to a member of the MEM team. After each use, the hand augers were put through a decontamination procedure, whereby the augers were brushed to remove any gross soil contamination, washed with an Alconox solution, rinsed with tap water, rinsed with a 10% solution of nitric acid, and rinsed again with deionized water. The augers were then dried with paper towels.

In the collection of the samples, the MEM was not driven around the site because of the small number of sampling locations and the small size of the site.

I.2.2 Chemical Analysis of Soil Samples

I.2.2.1 Organic Compounds

Mobile gas chromatography/mass spectrometry (GC/MS) is the EPA-recommended method for the analysis of volatile and semivolatile organic compounds obtained from hazardous waste sites. This proven analytical technique identifies and quantifies organic compounds on the basis of molecular weight, characteristic fragmentation patterns, and retention time. ANL is using a Bruker Instruments, Inc., mobile GC/MS. The Bruker GC/MS has a mass range of 1–400 daltons; a MS-DOS 386-based data system to acquire, analyze, and archive all GC/MS data; a 3.5-m probe for immediate analysis of surfaces; and a GC oven.

The GC probe consists of a flexible 3.5-m hose containing a heated GC capillary column. One end of the hose is attached to the mass spectrometer, and the other end is equipped with a probe head. The probe head can be heated and touched to soil surfaces, thereby thermally desorbing organics from the soil through the GC column and into the mass spectrometer. When the GC probe is used in the air monitor mode, the mass spectrometer will scan the four characteristic masses of up to 22 compounds simultaneously. The air monitor mode enables rapid characterization of a soil sample.

The GC oven consists of a heated injection port and a temperature-programmable oven containing a 10- or 30-m GC capillary column. Organic compounds are removed from the soil and put into glass injection liners, either by a purge-and-trap technique or an extraction procedure. Compounds are thermally desorbed off the glass injection liners containing adsorbents or glass

wool in the injection port and sucked through the GC and into the mass spectrometer. The mass spectrometer is capable of scanning a mass range of 1–400 daltons. The GC oven enhances the ability of the mass spectrometer to quantify and identify compounds.

Characterization of soil samples from site AFP 59 was achieved by using the Bruker GC/MS in a two-step process. First, soil samples were analyzed with the GC probe/mass spectrometer in the air monitor mode for the target list of compounds. Second, those samples that exhibited the most significant ion activity were further analyzed by using the GC oven/mass spectrometer for either volatile or semivolatile organic compounds.

The design and operation of the GC probe (in-air monitor mode) enables it to have greater sensitivity than the MEM oven. The method detection limit of the GC probe for most organic compounds desorbed directly from the soil is at most 100 ng/g (0.1 ppm). The method detection limit by means of the GC oven is 200 ng/g (0.2 ppm) for volatiles and 10 µg/g (10 ppm) for semivolatiles. However, because very little chromatographic separation is achieved during a probe analysis, it is difficult to accurately identify a particular compound if more than one compound is present. Therefore, the GC probe is used to screen the samples in order to identify those samples that are most likely to contain organic compounds.

I.2.2.1.1 Analytical Procedures

Prior to any analyses, the GC/MS was run through a series of tests to verify and document that the instrument was operating accurately. These tests included verifying that all instrument temperatures were within operating limits, checking the linearity and sensitivity of mass 40, checking the response of several key masses to an internal calibration gas, and checking the ion abundances of 4-bromofluorobenzene to verify that the instrument meets the tuning criteria. After this daily procedure was completed, analyses were begun.

GC/MS Probe Analysis. All soil samples obtained in the field were analyzed by using the GC probe. Approximately 0.5–5 g of soil was placed on a new sheet of aluminum foil, and the hot probe tip was held onto the soil for approximately 20 s. The MEM monitors the four characteristic masses associated with each of the target compounds. Any response was recorded in the logbook.

Volatile Organics. Those GC probe analyses that indicated the presence of volatile organic compounds were further analyzed by using the GC oven. A 4-g sample of soil sample was removed from the original sample container, and 5 µL of a 200-µg/mL solution of 4-bromofluorobenzene was added to the soil as a surrogate. Then, 40 mL of water was added to the soil, and 5 µL of a 200-µg/mL solution of 1,4-difluorobenzene was also added to the mixture as an internal standard. The mixture was then purged with air for 5 min and the volatilized organics adsorbed onto Tenax and silica gel adsorbents contained in a glass injection liner. The

volatile organics were thermally desorbed from the glass injection liner in the injection port of the GC oven and analyzed with the mass spectrometer.

Semivolatile Organics. All samples were analyzed for semivolatile compounds using the GC oven. A 4-g sample of soil was added to 3 mL of methanol in a 10-mL vial. A known amount of nitrobenzene-d5 was then added to the mixture as a surrogate. The entire mixture was then shaken for three minutes. Twenty microliters of the methanol extract was then injected into a glass injection liner containing glass wool, and a known amount of acenaphthene-d10 was added to the same injection liner as an internal standard. The semivolatile organics were thermally desorbed off the glass wool in the injection port of the GC oven and analyzed with the mass spectrometer.

I.2.2.1.2 Target Compound List and Standards Used

The list of compounds specifically targeted during the GC probe analysis included the following:

a. Volatiles

Benzene
Carbon tetrachloride
Chlorobenzene
Chloroform
1,2-Dichloroethane
1,1-Dichloroethene
Ethylbenzene
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
1,1,1-Trichloroethane
Trichloroethene
Toluene
Xylene

b. Acid, Base/Neutrals

Acenaphthene
Anthracene
Butylbenzyl phthalate
Bis(2-chloroethyl) ether
1,4-Dichlorobenzene
Di-n-butyl phthalate
2,4-Dinitrotoluene
Fluoranthene
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
Naphthalene
Nitrobenzene
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
2,4,6-Trichloroaniline
1,2,4-Trichlorobenzene
2,4,6-Trichlorophenol

c. Pesticides

Aldrin
4,4'-DDT
Dieldrin
Endrin
Heptachlor
Lindane

d. Total PCBs

I.2.2.2 Metals

I.2.2.2.1 Analytical Procedures

Inorganic, or metals, analyses of the soil samples collected at AFP 59 were performed with an energy-dispersive x-ray fluorescence (EDXRF) spectrometer. This is a nondestructive technique of inorganic soil analysis that does not require any wet digestions. A 7- to 9-g sample of soil is heated to dryness in an oven. The sample is then ground to a fine powder with an agate mortar and pestle and transferred to an analysis cup. The cup is placed into the analysis chamber of the EDXRF unit where it is irradiated with x-rays. Energy emitted from the sample by fluorescence is measured by a detector. Specific analytes fluoresce at specific energy levels, and these levels can be used to identify or "fingerprint" an element. The intensity or peak area that occurs at a specific energy level is then used to quantify an analyte. Standards having known concentrations of the analytes are used to calibrate the instrument. This allows relatively precise quantification of the same analytes in a sample because their intensities can be compared with those of the standard.

Each day, and prior to any analysis of standards and samples, an energy calibration of the EDXRF is performed. This is an internal calibration of the system to correct for spectral peak shifts that can occur along an energy scale. Each analyte has a specific energy level along the energy scale that is used to identify peaks that occur in a sample spectrum. If analyte peaks are not properly aligned with their corresponding energy levels along the energy scale, the ability of the instrument to properly identify and quantify analytes is greatly reduced.

I.2.2.2.2 Target Metals List and Standards Used

Target metals that were analyzed in the soil samples collected from the AFP 59 site include the following:

Arsenic	Mercury
Barium	Nickel
Cadmium	Selenium
Chromium	Silver
Copper	Vanadium
Lead	Zinc

Two soil standards were used to calibrate the EDXRF spectrometer for metal analysis. These were ERA STD 209 (Priority Pollutant T/CLP Soil, a reference material for inorganic trace metals, Lot No. 209, supplied by Environmental Resource Associates) and NIST 8407 (Mercury Amended Sediment, Standard Reference Material 8407, National Bureau of Standards, NIST). Refer to Section 3.2 for analytical results generated for this sample group.

During preparation for analysis, each sample was weighed before and after drying to determine the weight of water in the samples relative to the total weight (soil + water) of the sample. Refer to Table I.2 for calculation of percent soil moisture in each sample.

TABLE I.2 Percent Moisture[a] in 19 Soil Samples Analyzed

Sample ID[b]	Cup Wt. (g)	Cup Weight + Wet Wt. (g)	Cup Weight + Dry Wt. (g)	Wet Wt.[c] (g)	Dry Wt.[c] (g)	H_2O Wt. (g)	Percent Moisture[d]
00101S	4.89	12.93	11.78	8.04	6.89	1.15	11.50
00102S	4.89	13.00	11.70	8.11	6.81	1.30	16.03
00201S	4.88	15.42	14.03	10.54	9.15	1.39	13.19
00301S	4.87	12.83	11.31	7.96	6.44	1.52	19.10
00401S	4.90	12.14	10.70	7.24	5.80	1.44	19.89
00501S	4.89	14.00	12.36	9.11	7.47	1.64	18.00
00601S	4.90	16.10	14.29	11.20	9.39	1.81	16.16
00701S	4.89	13.95	12.41	9.06	7.52	1.54	15.60
00801S	4.88	15.25	13.48	10.37	8.60	1.77	17.07
00901S	4.87	15.78	14.04	10.91	9.17	1.74	15.95
01001S	4.87	19.55	16.60	14.68	11.73	2.95	20.10
01101S	4.88	14.71	13.58	9.83	8.70	1.13	11.50
01201S	4.88	20.03	18.25	15.15	13.37	1.78	11.75
01301S	4.87	14.97	13.90	10.10	9.03	1.07	10.59
01401S	4.85	15.76	12.66	10.91	7.81	3.10	28.41
01501S	4.86	21.72	18.37	16.86	13.51	3.35	19.87
01601S	4.88	21.34	18.90	16.46	14.02	2.44	14.82
01701S	4.86	17.77	16.18	12.91	11.32	1.59	12.32
01801S	4.87	11.64	8.74	6.77	3.87	2.90	10.40

[a] Percent Moisture = (Wet Wt. - Dry Wt.) / Wet Wt. × 100.

[b] Because of space limitations, the sample ID has been condensed as follows:
JC00101S = 00101

[c] Wet or Dry Weight less the Cup Weight.

[d] Range: Maximum: 28.41
Minimum: 10.40
Average: 15.91
Standard Deviation: 4.46

I.3 Analytical Results

I.3.1 Organic Contaminants

Nineteen soil samples were analyzed by using the MEM probe for all the organic compounds given in the target compound list. The MEM probe results are given in Table I.3.

A sample was noted as having a positive response if any significant ion activity was noted for a particular compound. The MEM probe is a sensitive screening device that can characterize and detect most organic compounds in soil down to 100 ng/g (0.1 ppm). However, soil samples that contain a mixture of compounds may indicate false positive responses for other compounds because they have similar fragmentation ions. Therefore, any indication of contamination must be further investigated with the GC oven. In this project, the probe was used to screen all the soil samples and to identify those samples that were most likely to be contaminated. These samples, in turn, were analyzed with the GC oven.

Four soil samples were screened for volatile organic compounds with the GC oven. The method detection limit for the volatile analysis is estimated at 200 ng/g (0.2 ppm). Two of the four samples, JC00701S and JC01301S, contain an unidentified volatile organic contaminant. On the basis of retention time, this contaminant appears to be the same in both samples.

Nineteen soil samples were screened for semivolatile compounds with the GC oven. The method detection limit for semivolatile analysis is estimated at 10 µg/g. Samples JC01101S and JC01701S contain polyaromatic hydrocarbon (PAH)contaminants tentatively identified as anthracene/phenanthrene, fluoranthene, and pyrene.

Information on the daily routines for setting up instruments and running daily calibrations is provided in Appendix A. All the chromatographic runs are archived in a computer file and may be reviewed at any time.

I.3.2 Metal Contaminants

Ranges, averages, and standard deviations for the concentrations of each metal in the 19 soil samples analyzed by EDXRF are presented in Table I.4. The soil samples were also tested for moisture content — the percent moisture for the samples collected from AFP 59 is presented in Table I.2. The printout from the EDXRF analysis is presented in Appendix A.

TABLE I.3 Results of MEM Probe Analysis

Compound Type	Number of Samples with Ion Activity
Volatile	8
Semivolatile	19

TABLE I.4 Metal Concentration Ranges, Averages, and Standard Deviations for 19 Samples Analyzed

Analyte	Range (ppm)	Average (ppm)	Standard Deviation
Arsenic	6.8–373.8	34.1	76.5
Barium	64.9–426.6	320.9	73.7
Cadmium	ND–82.3	5.8	17.3
Chromium	31.3–445.5	76.7	84.5
Copper	11.6–4,722.0	275.8	1,000.4
Lead	4.6–201.0	33.5	41.4
Mercury	ND–2.6	1.0	1.0
Nickel	ND–49.7	2.4	10.6
Selenium	ND–8.7	1.0	1.9
Silver	ND–5.6	1.5	1.7
Vanadium	55.8–102.9	81.6	13.4
Zinc	66.1–1,522.0	167.2	306.7

It was not possible to collect an "uncontaminated" background soil sample at AFP 59 without knowledge of the soil types on-site. Thus, background levels of the metals analyzed were obtained from relevant scientific literature. Background concentrations provide a reference by which sample concentrations can be assessed as high, low, or moderate relative to those of background, or what is indigenous to soils in the area. On the basis of values found in the literature, background soil concentrations for the analytes of interest are given in Table I.5.

Cadmium, mercury, nickel, and silver were undetected in less than 50% of the samples, and average concentrations of cadmium, mercury, nickel, selenium, and silver were less than or approximately equal to the general lower detection limit of the instrument (10 ppm). Reported concentrations of analytes equal to or less than 10 ppm should, therefore, be considered estimated. These results exemplify the application of EDXRF analysis as a screening tool with limited capacity to detect inorganic constituents at lower concentrations (i.e., <10 ppm).

Comparison of means for background (Table I.5) versus sample concentrations (Table I.4) indicated that mean sample concentrations for barium, nickel, and zinc were relatively low, while the concentrations of arsenic, cadmium, chromium, copper, lead, mercury, selenium, silver, and vanadium were high. Recall that mean sample concentrations for arsenic, cadmium, mercury, selenium, and silver were equal to or less than 10 ppm, the general lower detection limit of the instrument. This suggests that although these analytes may have been present in the soil, their actual concentrations below the instrument detection limit remain unknown and should be qualified as estimated.

Three samples showed analyte concentrations worth noting. Sample JC01001S had the highest concentration of chromium (445 ppm). Sample JC01301S had a nickel concentration of 49 ppm (no other samples had nickel concentrations above the EDXRF detection limit), the highest concentration of cadmium (82 ppm), the second highest concentration of chromium (109 ppm), and the second highest concentration of copper (546 ppm). Sample JC01801S had the highest concentration of arsenic (373 ppm), copper (4,722 ppm), lead (201 ppm), silver (5 ppm), and zinc (1,522 ppm).

The percent moisture for 19 soil samples collected from AFP 59 ranged from 10.40 to 28.41, averaging 15.91 with a standard deviation of 4.46 (refer to Table I.2).

TABLE I.5 Background Concentrations for Analytes of Interest

Analyte	Mean (ppm)	Range (ppm)
Arsenic[a]	7.4	<0.1–73
Barium[a]	420	10–1,500
Cadmium[b]	0.35	0.01–2
Chromium[a]	52	1–1,000
Copper[a]	22	<1–700
Lead[a]	17	<10–300
Mercury[a]	0.12	0.01–3.4
Nickel[a]	18	<5–700
Selenium[a]	0.45	<0.1–3.9
Silver[b]	0.05	0.01–8
Vanadium[a]	66	<7–300
Zinc[a]	290	<20–2,000

[a] Shacklette and Boerngen (1984).

[b] Bodek et al. (1988).

I.4 Conclusions

The results of organic screening analyses of 19 soil samples collected from the AFP 59 site indicate that an uncharacterized volatile organic contaminant and several PAH organic contaminants are present in four samples. Three contaminated samples are from the paved parking lot area (see Figure 1.2) and could represent an asphalt hydrocarbon signature. The remaining sample is from beneath the porch of the plating building.

Although the majority of samples had metal concentrations similar to the average background levels, several samples had concentrations that were significantly higher: 01001S, 01301S, and 01801S.

Appendix J:

Contaminant Distributions at AFP 59 and Volatile Organic Compound Summary

J.1 Contaminant Distributions

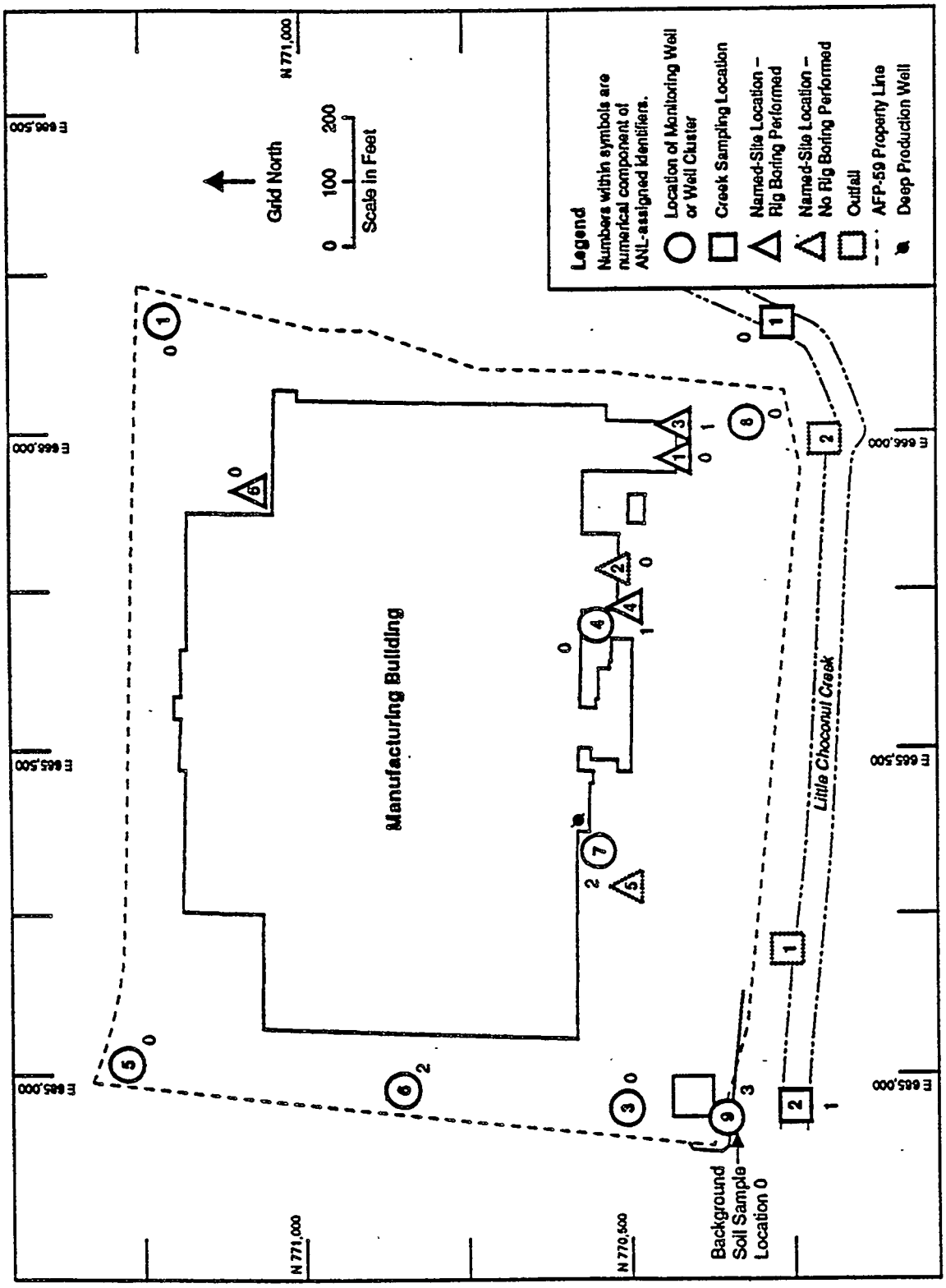


FIGURE J.1 Number and Location of VOCs Found in Concentrations above Detection Limits in Soil and Sediment Samples. The total number of separate compounds detected in all samples from a given location is shown. QC adjustments are not reflected.

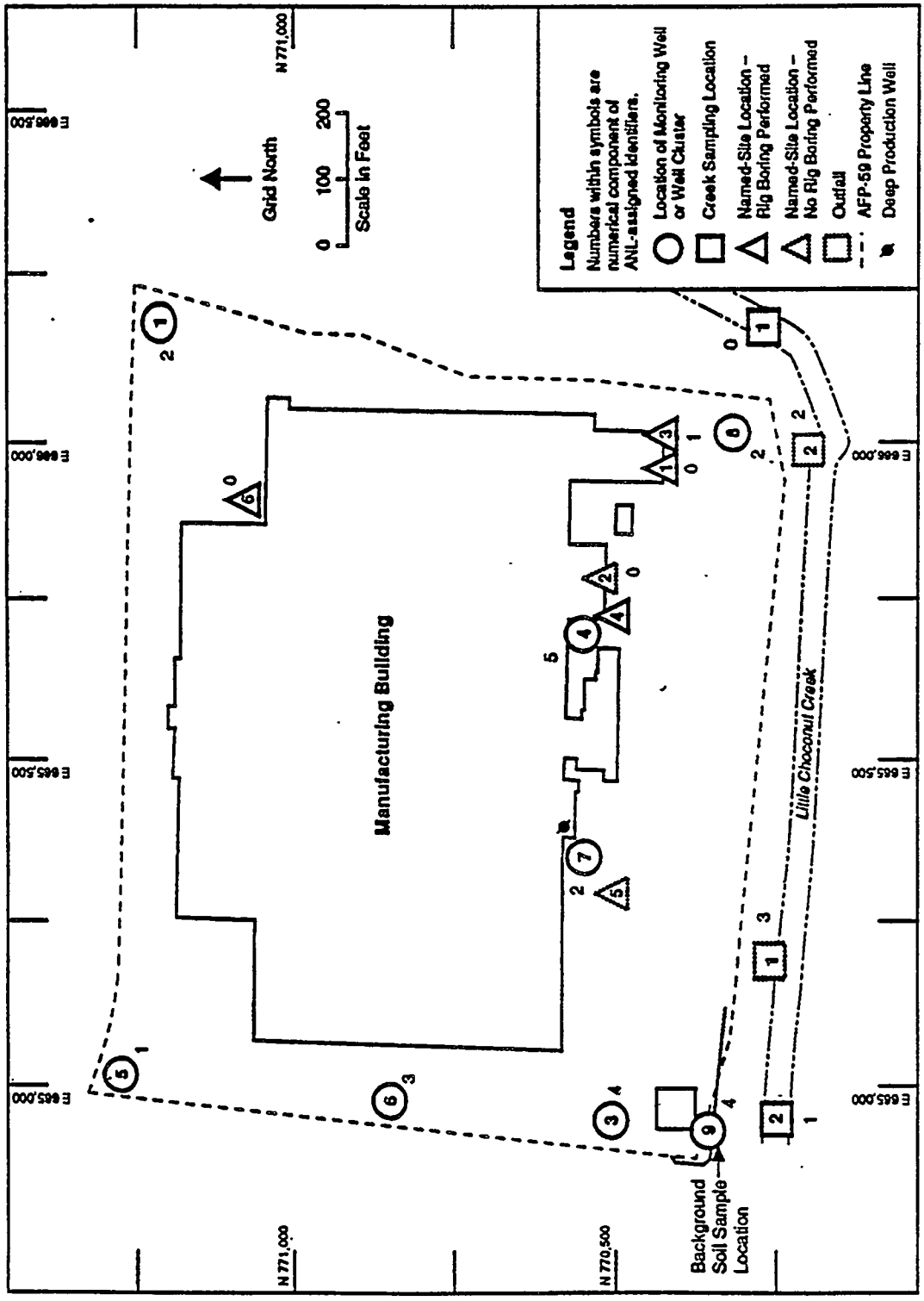


FIGURE J.2 Number and Location of VOCs Found in Concentrations above Detection Limits in Shallow Well Groundwater, Creek Water, and Outfall Water. The total number of separate compounds detected during two well sampling episodes is shown.

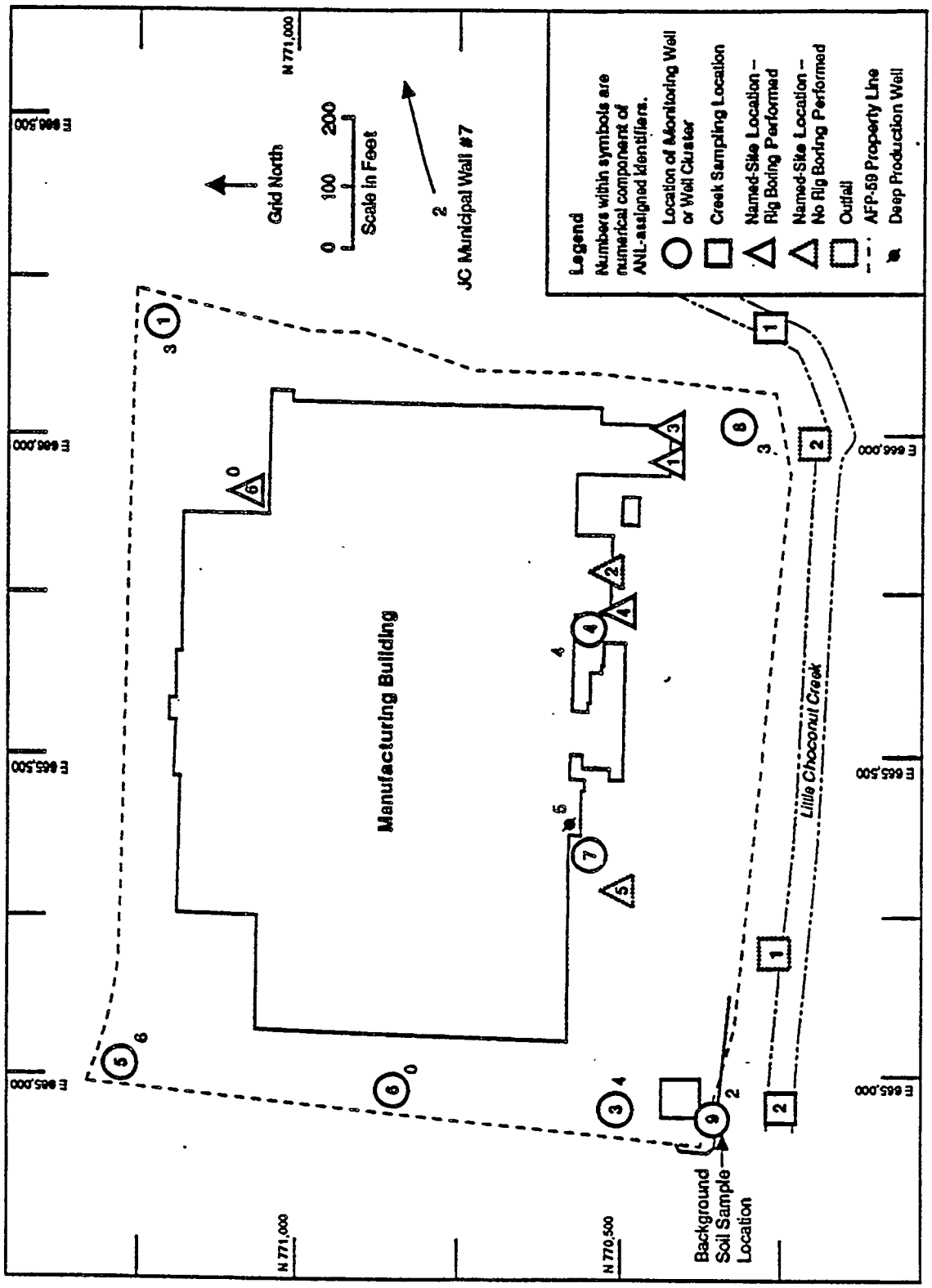


FIGURE J.3 Number and Location of VOCs Found in Concentrations above Detection Limits in Deep-Aquifer Groundwater, the Deep Production Well, and Municipal Well 7

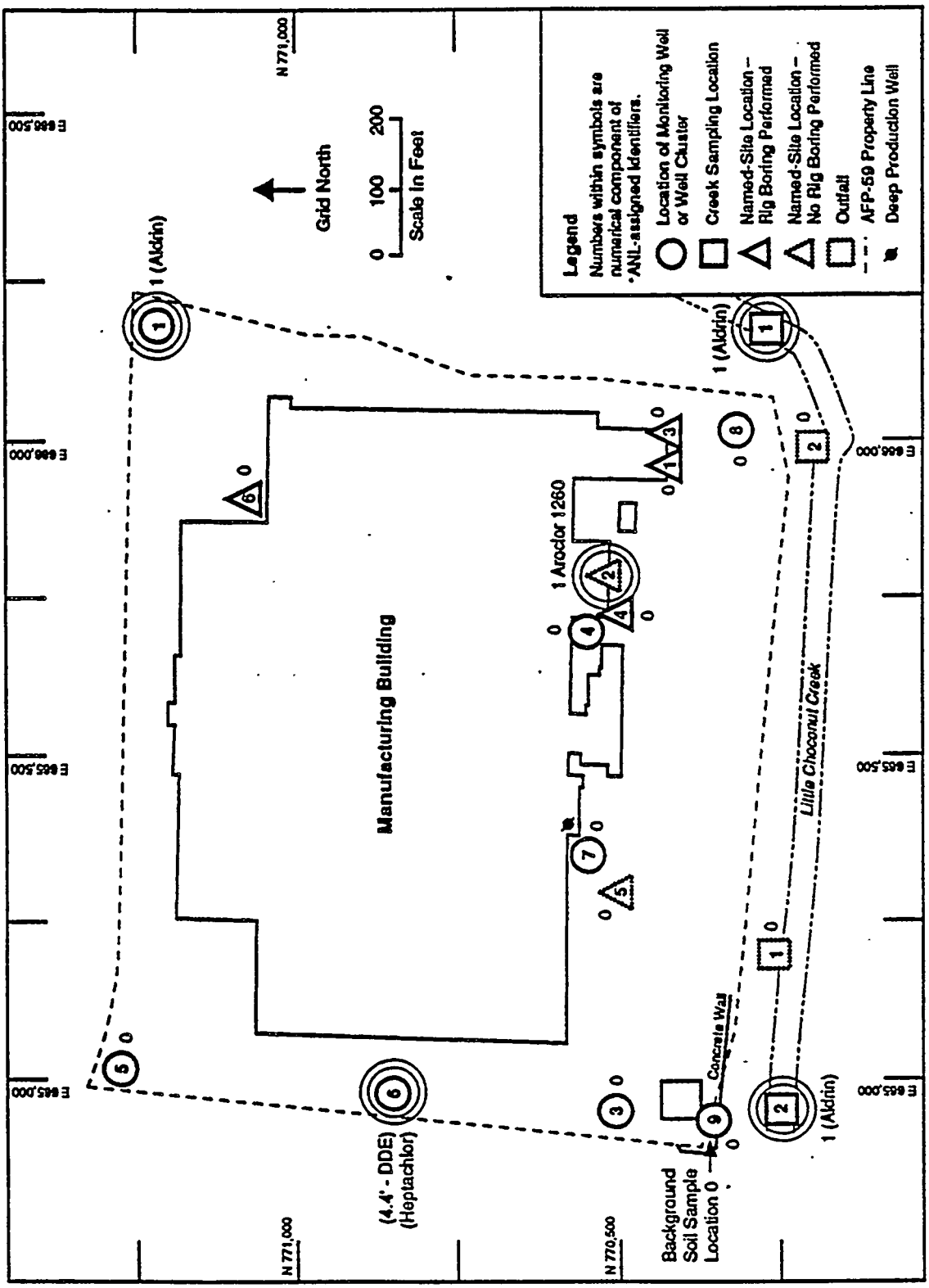


FIGURE J.4 Number, Name, and Location of PCBs and Pesticides Found in Concentrations above Detection Limits. These compounds were found only in soil and sediment samples.

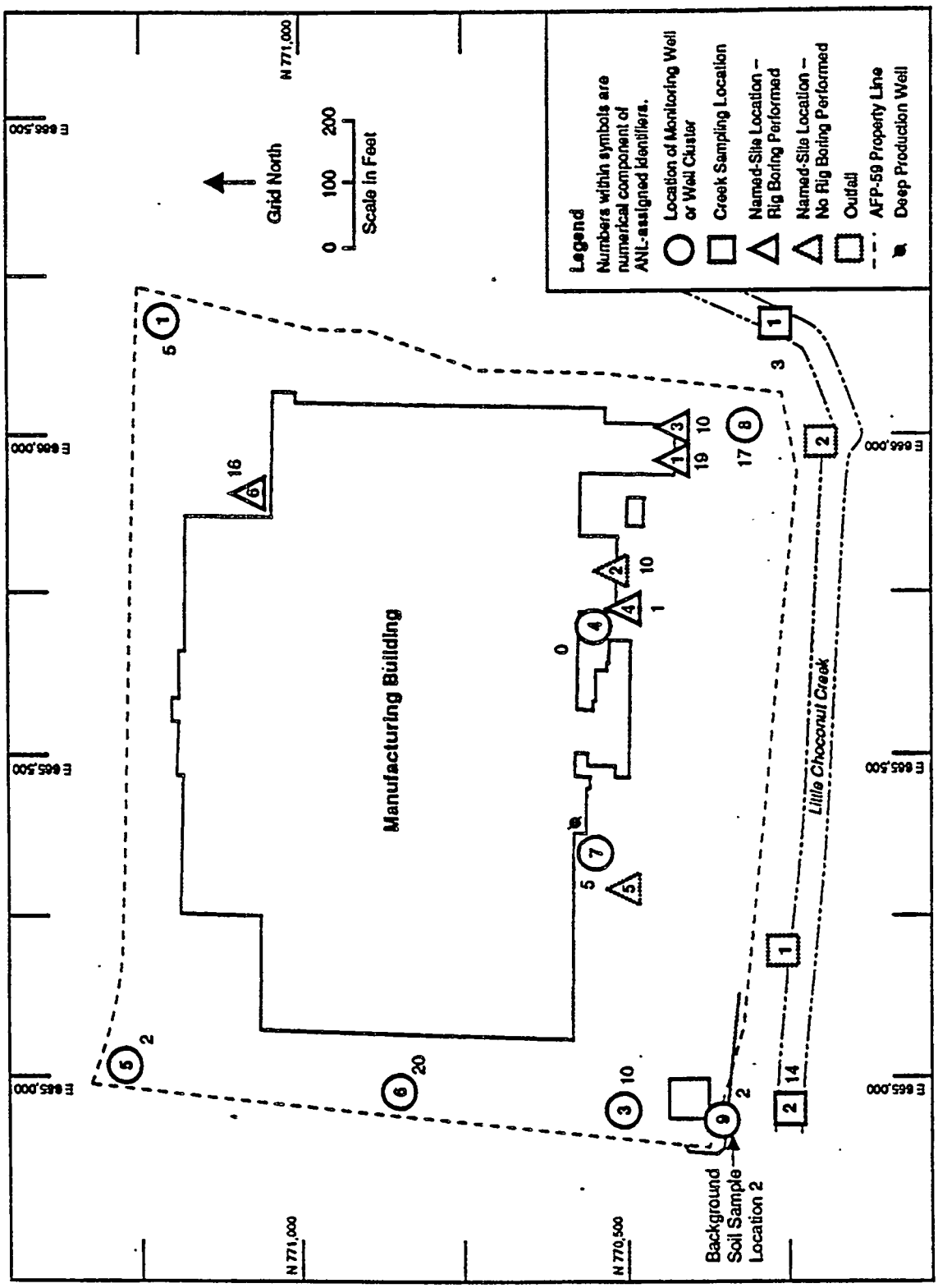


FIGURE J.5 Number and Location of SVOCs Found in Concentrations above Detection Limits in Soil and Sediment Samples. SVOCs were not found in water samples.

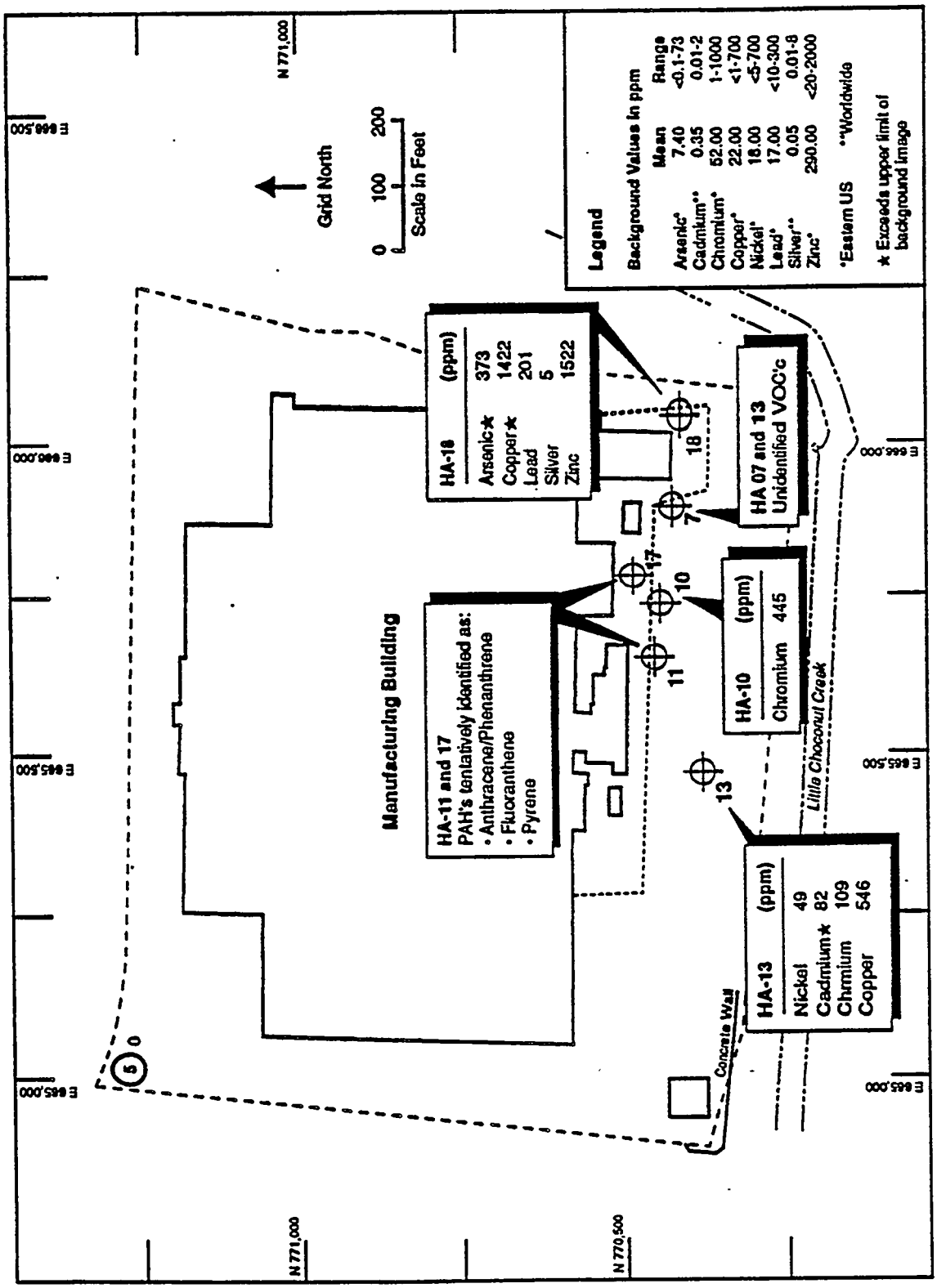


FIGURE J.6 Contaminants Detected in Hand-Augered Soil Samples through Screening with Portable Analytical Equipment. Only sampling locations where detections occurred are shown.

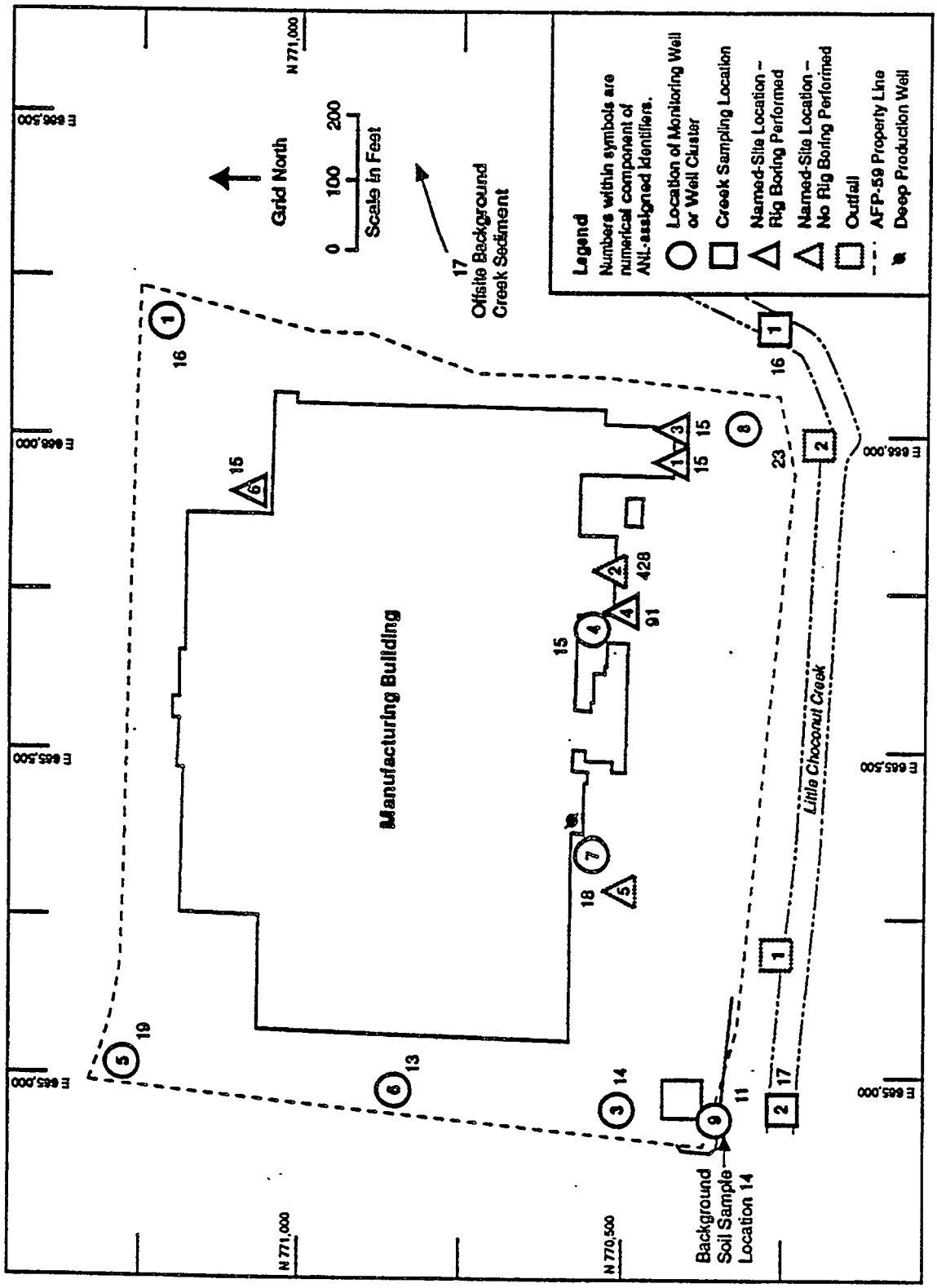


FIGURE J.7 Highest Value (in ppm) Obtained for Chromium in Soil at a Given Location

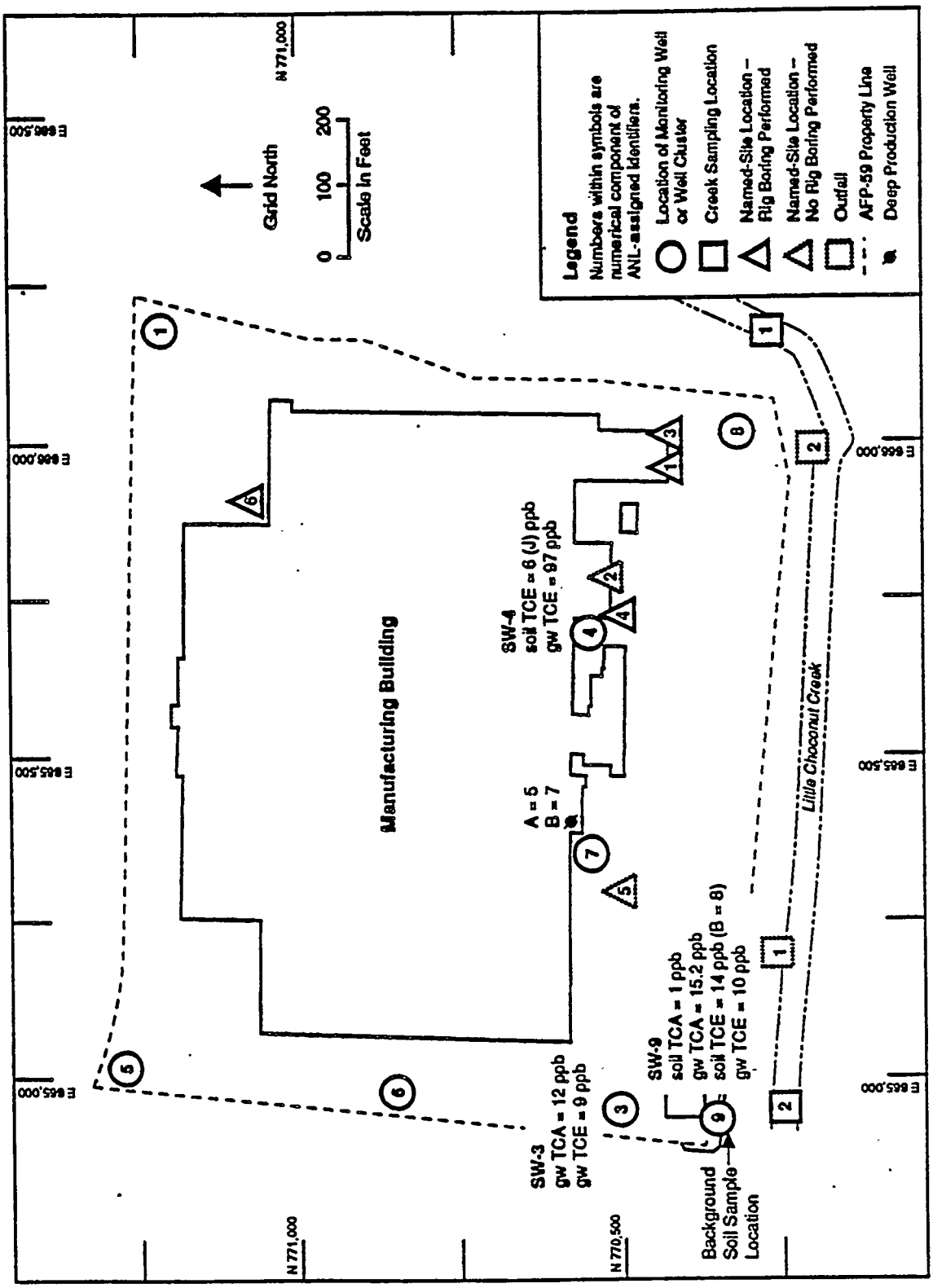


FIGURE J.8 Locations where TCA or TCE Was Detected in Soil and Locations where These Compounds Were Detected in Groundwater above the Drinking Water Standards (5 ppm) for These Compounds. The highest value for a given location is shown.

TABLE J.1 Highest and Lowest Concentrations of Organic Chemicals Detected in AFP 59 Soil, Sediment, Groundwater, and Surface Water Samples[a]

Compound	Concentration (µg/kg)							
	Soil High	Soil Low	Sed[b] High	Sed Low	GW[c] High	GW Low	Sur.W.[d] High	Sur.W. Low
Methylene chloride	10	3	8		4	0.6		
Acetone	37	8			35		17	
1,1-Dichloroethene					0.3			
1,1-Dichloroethane	6				5	0.2		
Chloroform					0.3			
1,1,-Trichloroethane	1				15	0.2	0.6	
Trichloroethene					97	0.2	4	0.3
Dibromochloromethane	14	8			0.3	0.2		
Bromoform					0.6	0.2	0.4	
Tetrachloroethene					0.2			
Toluene					0.3	0.2		
Xylene (total)					0.4	0.2		
Phenol	250							
2-Chlorophenol	110							
4-Methylphenol	210							
2,4-Dimethylphenol	100							
Naphthalene	4,200	35	270					
4-Chloro-3-methylphenol	100							
2-Methylnaphthalene	970	92	110					
Acenapthylene	280	88						
Acenapthene	1,900	120	280					
Dibenzofuran	2,100	43	230					
Fluorene	2,900	120	430					
Phenanthrene	9,800	33	2,300					
Anthracene	2,800	17	520					
Di-n-butylphthalate	410	110	300	270				
Fluoranthene	9,900	65	150				4	
Pyrene	9,100	52					3	
Benzo(a)anthracene	5,300	120						
Bis(2-ethylhexyl)phthalate	600	74	210				8	
Chrysene	4,900	68	790				2	
Benzo(b)fluoranthene	5,200	89	830					
Benzo(k)fluoranthene	1,900	48	330					
Benzo(a)pyrene	3,700	75	610					
Indeno(1,2,3-cd)pyrene	1,600	62	190					
Dibenzo(a,h)anthracene	440	140						
Benzo(g,h,i)perylene	1,700	64	190					
Aldrin	9.2	7.6	18	8.8				
Aroclor-1260	130							
4,4'-DDE	6							
Endosulfan II	840							
Gamma chlordane	24							
Heptachlor	62							

[a] Where only one detection or only one concentration of a given compound occurred, the value is shown as "high."

[b] Sed = sediment.

[c] GW = groundwater.

[d] Sur.W. = surface water.

TABLE J.2 Highest and Lowest Inorganic Concentrations above Detection Limits in Groundwater, Creek Water, and Outfall Water[a]

	Concentration (µg/L)					
Compound	GW[b] High	GW Low	CW[c] High	CW Low	OF[d] High	OF Low
Aluminum	19,800	70	317	122	399	72
Antimony	28.5	3.7				
Arsenic	6.7	2.4				
Barium	211	30	33	25	94	
Beryllium	3	1				
Cadmium	14	4				
Calcium	186,000	30,200	35,400	33,400	99,100	32,600
Chromium	63	5			6	
Cobalt	24	10				
Copper	35	3				
Iron	2,860	385	362	145	310	134
Lead	14.6	1.1	1.3		5.3	1.6
Magnesium	36,600	9,370	6,590	6,470	21,400	6,190
Manganese	1,010	3	83	13	168	36
Mercury	0.11	0.1	4.9			
Nickel	115	39				
Potassium	45,800	1,840	1,950	1,090	2,010	795
Selenium	2.1	1.3			1.1	
Silver	7	7			5	4
Sodium	301,000	21,100	23,400	10,800	57,200	19,300
Thallium	1.4	1				
Vanadium	35	8				
Zinc	153	25	418		93	
Cyanide						

[a] Where only one detection was made or all detections were the same, the value is shown as "high."

[b] GW = groundwater.

[c] CW = creek water.

[d] OF = outfall.

TABLE J.3 Highest and Lowest Inorganic Concentrations Compared with Human Ingestion and Regional Background Values

Inorganic Analyte	HEAST[a] Human Direct Ingestion Soil Concentrations (ppm)	AFP 59 Range[b] Soil High (ppm)	AFP 59 Range[b] Soil Low (ppm)	Background[c] Mean (ppm)	Background[c] Range (ppm)
Aluminum		16,300	5,070		
Antimony	30	1.6			
Arsenic	80	10.2	2.9	7.4	<0.1–73
Barium	4,000	109	23.5	420	10–1,500
Beryllium	1.6	0.97	0.77		
Cadmium	80	7.5		0.35[c]	0.01–2
Calcium	d	80,400	307		
Chromium	e	428	8.1	52	1–1,000
Cobalt	d	12.7	5.7		
Copper	d	85.9	11.5	22	<1–700
Iron	e	28,400	13,200		<10–300
Lead	250	572	5.2	17	
Magnesium	e	10,800	2,250		
Manganese	20,000	1,360	336		
Mercury	20	0.13	0.05	0.12	0.01–34
Nickel	2,000	124	13	18	<5–700
Potassium	d	1,520	451		
Selenium	e	0.4	0.19	0.45	<0.1–39
Silver	200	2.8		0.05[c]	0.01–8
Sodium	e	578	25.3		
Thallium	6	0.67			
Vanadium	600	75.2	8.8	66	<7–300
Zinc	20,000	109	41.8	290	<20–2,000
Cyanide	2,000	7.9	2.6		

[a] Human Direct Ingestion Soil Concentrations derived from HEAST Report current through December 1990 as found in Subappendix 1-A of Appendix C of NYSDEC October 91 Draft Cleanup Policy and Guidelines Volume II.

[b] High and low values of metals found in concentrations above detection limits in AFP 59 soil samples. Usability of these data is undetermined.

[c] Except for silver and cadmium, values shown are for the eastern U.S. per Shacklette and Boerngen (1984). Silver and cadmium values are worldwide per Bodek et al. (1988).

[d] Not listed.

[e] Listed; no value shown.

TABLE J.4 Sediment Criteria for Metals[a] Compared with Range of Detectable Concentrations Found in AFP 59 Sediment Samples

	Background[b] (ppm)	Criteria[c] (ppm)	Limit of Tolerance (ppm)	Sed High (ppm)	Sed Low (ppm)
Aluminum				10,500	9,260
Arsenic	12	5 (4.0–5.5)	33	5.6	4.3
Barium				58.9	46.3
Beryllium				1	0.94
Calcium				12,200	1,210
Chromium	75	26 (22–31)	111	16.5	16
Cobalt				13.4	10
Copper	65	19 (15–25)	114	20.5	16.3
Iron	5.9%	2.4%	4%	30,500	26,100
Lead	55	27 (23–31)		92.1	13.4
Magnesium				4,430	3,330
Manganese	1,200	428 (400–457)	1,100	584	461
Mercury	0.6	0.11 (0.1–0.12)	2	0.08	0.07
Nickel	75	22 (15–31)	90	22.2	19.7
Potassium				951	602
Selenium				0.29	
Sodium				82	72.4
Vanadium				14.1	13.4
Zinc	145	85 (65–110)	90	134	66.4

[a] As found in Table 4 of Appendix D of the October 91 Draft Version of NYSDEC Cleanup Policy and Guidelines Volume II.

[b] Upper 95% confidence limit of pre-industrial concentrations in Great Lakes sediments (MOE 1988).

[c] Values in parentheses are "no-effect" and "lowest-effect" levels, respectively (Persaud 1989).

TABLE J.5 Range of VOC Concentrations Detected in APF 59 Soil Compared with HEAST Values

Compound	HEAST[a] (ppm)	AFP 59 Soils High (ppb)	AFP 59 Soils High (ppm)	AFP 59 Soils Low (ppb)	AFP 59 Soils Low (ppm)	Alternate Name/Notes
Methylene chloride		10		3		
Acetone	6,000	37		8		2-Propanone
1,1-Dichloroethene						
1,1-Dichloroethane	8,000	6				
Chloroform	110					Trichloromethane
1,1,-Trichloroethane	7,000	1				Methyl chloroform
Trichloroethene						
Dibromochloromethane	8.3	14		8		Chlorodibromomethane
Bromoform						Tribromomethane
Tetrachloroethene						
Toluene						
Xylene (total)						
Phenol	50,000	250				
2-Chlorophenol	400	110				
4-Methylphenol		210				Not listed
2,4-Dimethylphenol	2,000	100				
Naphthalene	300	4,200		35		
4-Chloro-3-methylphenol	b	100				p-Chloro-m-cresol
2-Methylnaphthalene		970		92		Listed but not given
Acenapthylene	300	280		88		
Acenapthene	5,000	1,900		120		
Dibenzofuran		2,100		43		Listed but not given
Fluorene	3,000	2,900		120		
Phenanthrene		9,800		33		Listed but not given
Anthracene	20,000	2,800		17		
Di-n-butylphthalate	8,000	410		110		
Fluoranthene	3,000	9,900		65		
Pyrene	2,000	9,100		52		
Benzo(a)anthracene	0.22	5,300	5.3	120		Benz(a)anthracene Benzanthracene
Bis(2-ethylhexyl)phthalate	50	600		74		
Chrysene		4,900		68		Listed but not shown
Benzo(b)fluoranthene	0.22	5,200	5.2	89		
Benzo(k)fluoranthene	0.22	1,900	1.9	48		
Benzo(a)pyrene	0.061	3,700		75		
Indeno(1,2,3-cd)pyrene		1,600		62		Listed but not shown
Dibenzo(a,h)anthracene	0.014	440	0.44	140	0.14	
Benzo(g,h,i)perylene		1,700		64		Listed but not shown

TABLE J.5 (Cont.)

Compound	HEAST[a] (ppm)	AFP 59 Soils High (ppb)	AFP 59 Soils High (ppm)	AFP 59 Soils Low (ppb)	AFP 59 Soils Low (ppm)	Alternate Name/Notes
Aldrin	0.041	9.2		7.6		
Aroclor-1260		130				Not listed
4,4'-DDE	2.1	6				
Endosulfan II		840				Listed but not shown
Gamma chlordane	0.54	24				Chlordane
Heptachlor	0.16	62				

[a] Human Direct Ingestion Soil Concentrations derived from HEAST Report current through December 1990 as found in Subappendix 1-A of Appendix C of NYSDEC October 91 Draft Cleanup Policy and Guidelines, Volume II.

[b] Not given.

TABLE J.6 Range of Organic Contaminant Concentrations above Detection Limits Reported for Water Samples Collected at AFP 59 Compared with New York Standards and Guidance Values[a,b]

	AFP 1991-1992 Results				1989 Reg's		1990 NYS Ambient[d] Water S&G			
	Ground-water		Surface Water		Drinking Water[c]		Groundwater		Surface Water	
Compound	High	Low	High	Low	USEPA MCL	NYSDEC MCL	S[e]	G[f]	S	G
VOC										
Methylene chloride	4	0.6					5 (H)[g]			5 (H)
Acetone	35		17			50				
1,1-Dichloroethene	0.3					5	5 (H)			0.07 (H)
1,1-Dichloroethane	5	0.2				5	5 (H)			5 (H)
Chloroform	0.3				100+	100+	100 (H)[h]		0.2 (H)[h]	
1,1,1-Trichloroethane	15	0.2	0.6		200	5	5 (H)			5 (H)
Trichloroethene	97	0.2	4	0.3	5	5	5 (H)			3 (H)
Dibromochloromethane	0.3	0.2			100+	100+		50 (H)		50 (H)
Bromoform	0.6	0.2	0.4		100+	100+		50 (H)		50 (H)
Tetrachloroethene	0.2					5	5 (H)			0.7 (A)[i]
										1 (H)
Toluene	0.3	0.2				5	5 (H)			5 (H)
Xylene (total)	0.4	0.2					5 (H)			5 (H)
SVC										
Fluoranthene			4			50		50 (H)		50 (H)
Pyrene			3			50		50 (H)		50 (H)
Bis(2-ethylhexyl)phthalate			8			50	50 (H)		0.6 (A)	4 (H)
Chrysene			2			50		0.002 (H)		0.002 (H)

TABLE J.6 Footnotes

[a] All values in this table are ppb.

[b] Most stringent ambient values shown without regard to class of water.

[c] Drinking water maximum contaminant levels (MCL):
USEPA MCL: Ref. 40 CFR 141 8/11/89 Subpart B: 141.61; Subpart G 141.61.
NYSDEC MCL: Ref. state sanitary code, part 5, 6/30/81 (per revisions effective 1/9/89).

[d] Ambient: New York State Ambient Water Quality Standards and Guidance Values. Revision date: September 25, 1990 (per NYSDEC Draft Cleanup Policy & Guidelines Vol. II. October 1991)

[e] S: standard.

[f] G: guidance value.

[g] H: basis is protection of human health.

[h] Proposed for revision.

[i] A: basis is protection of aquatic life.

TABLE J.7 Samples in Which Cadmium was Detected at or above the NYSDEC Drinking Water Standard of 10 ppb

Sample ID	Concentration
Groundwater	
JCSW4BW	14 ppb
JCSW6BW	14 ppb
JCSW7BW	10 ppb
Soil	
JC2L1AS	7.5 ppm

J.2 Volatile Organic Compound Summary

This appendix contains a map showing the locations of where VOCs were detected in groundwater during this study. This appendix also contains maps showing the average concentrations of three selected VOCs (TCA, TCE, and DCA) detected during two rounds of groundwater sampling and a map illustrating results of soil and groundwater analyses for TCA and TCE.

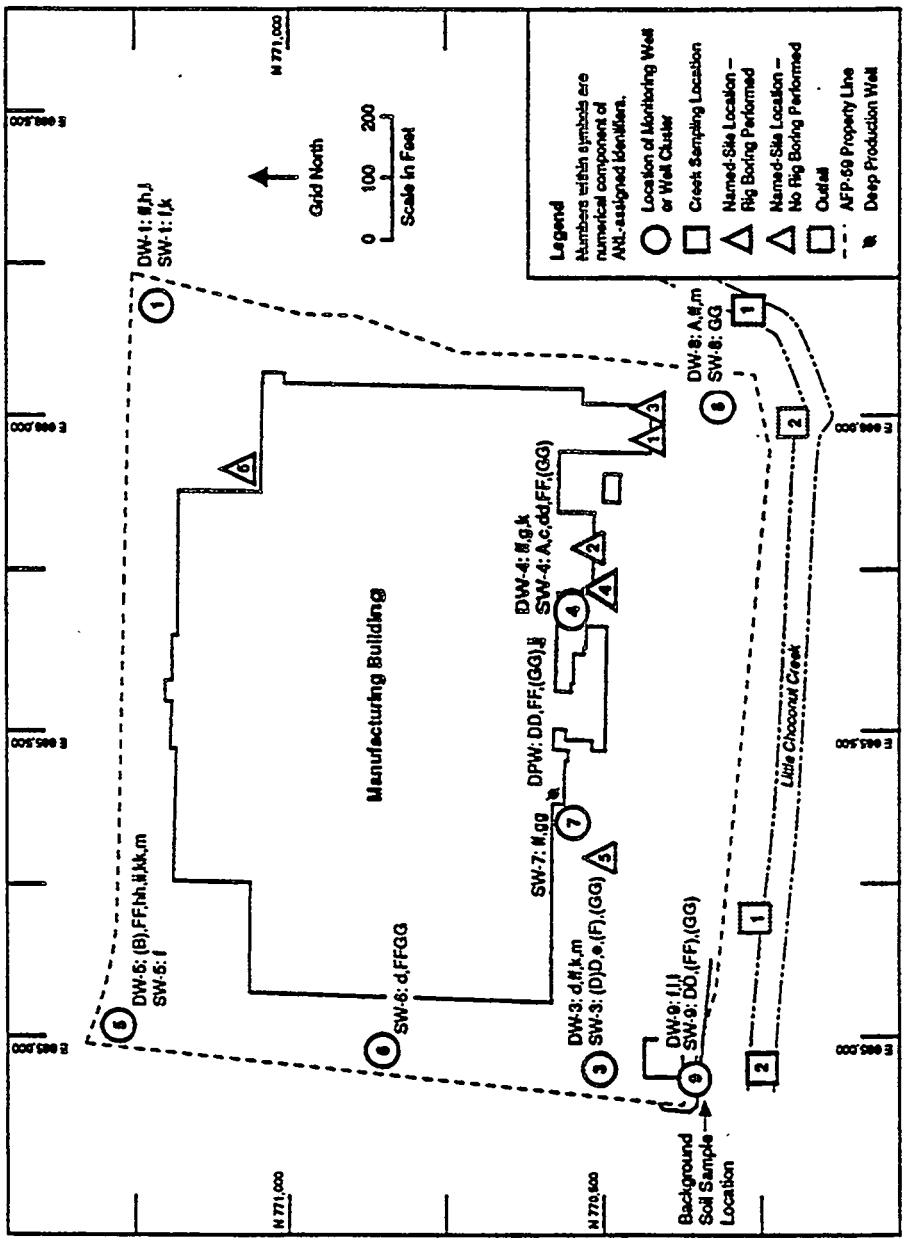


FIGURE J.9 Volatile Organic Compounds Detected in Groundwater at AFP 59. Consistency of detection and relative contaminant concentrations are shown. Allowances for background concentrations were not made. An estimated 0.7 ppb of TCE and 3 ppb of TCA were detected in JC Well No. 7. Results are not shown where associated lab or trip blanks and samples both showed traces of methylene chloride. (Key is as follows: lower case = detected at <1 ppb; upper case = detected at or >1 ppb; parentheses = detected at or >5 ppb; letter once = detected in one sampling round; letter twice = detected in two sampling rounds; a, A = methylene chloride; b, B acetone; c, C = 1,1 dichloroethene; d, D = 1,1 dichloroethane; e, E = chloroform; f, F = 1,1,1 trichloroethane; g, G = trichloroethene; h, H = dibromochloromethane; i, I = bromoform; j, J = tetrachloroethene; k, K = toluene; l, L = styrene; and m, M = xylene.)

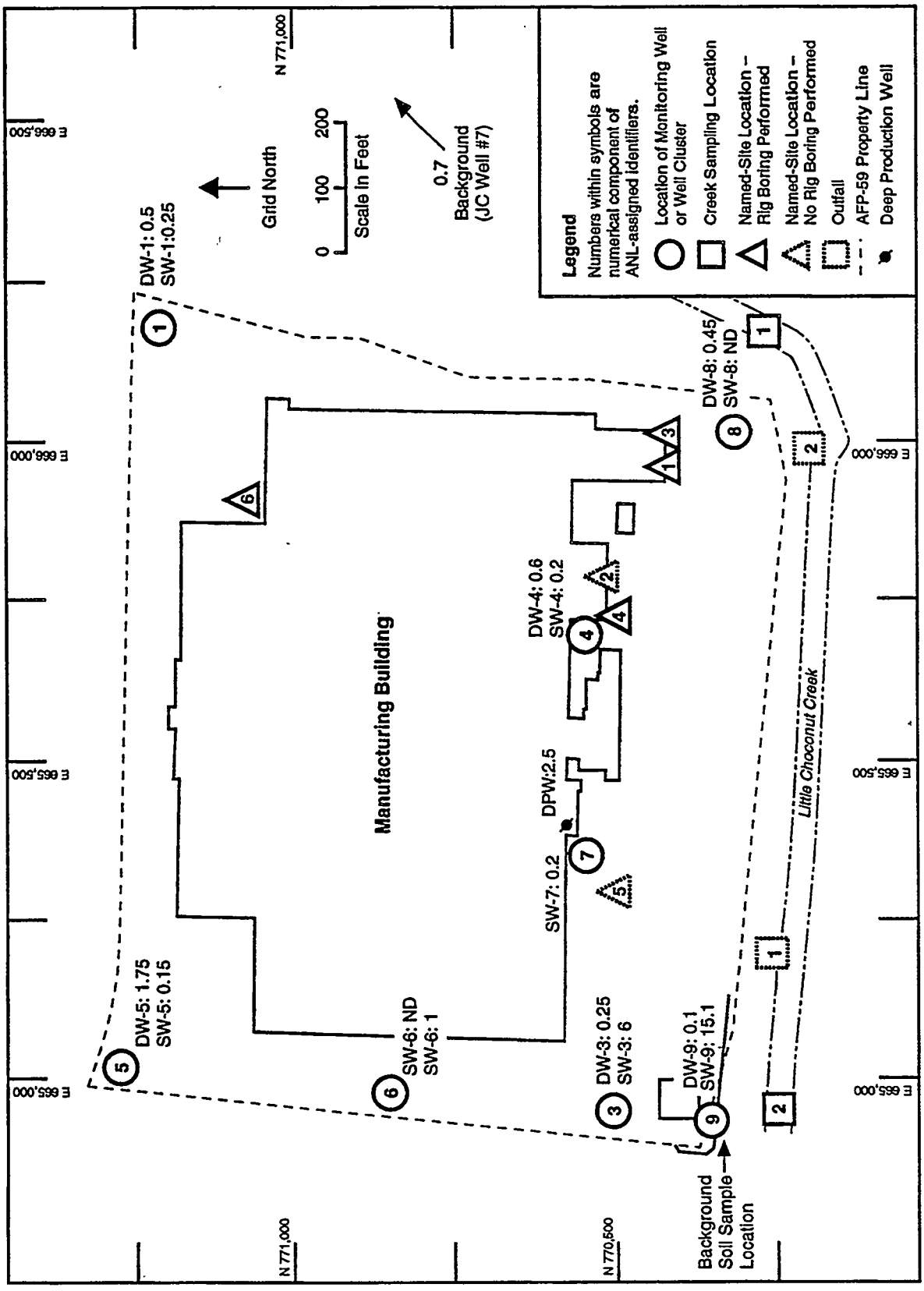


FIGURE J.10 Average Concentrations of 1,1,1-Trichloroethane Found during Two Rounds of Sampling at AFP 59. Values below 1 are estimated. ND = not detected. Units = ppb.

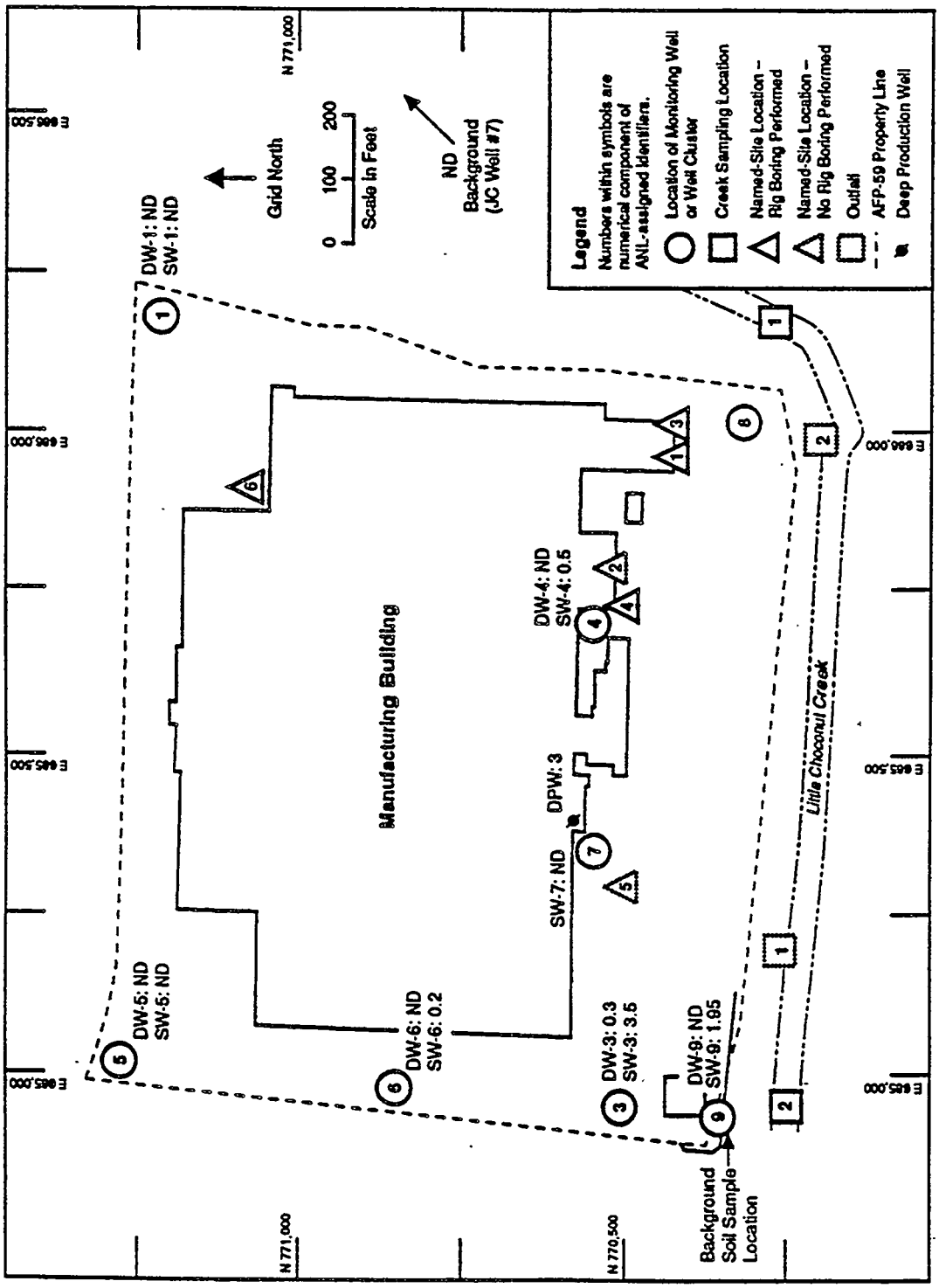


FIGURE J.11 Average Concentrations of 1,1-Dichloroethane Found during Two Rounds of Sampling at AFP 59. Values below 1 are estimated. ND = not detected. Units = ppb.

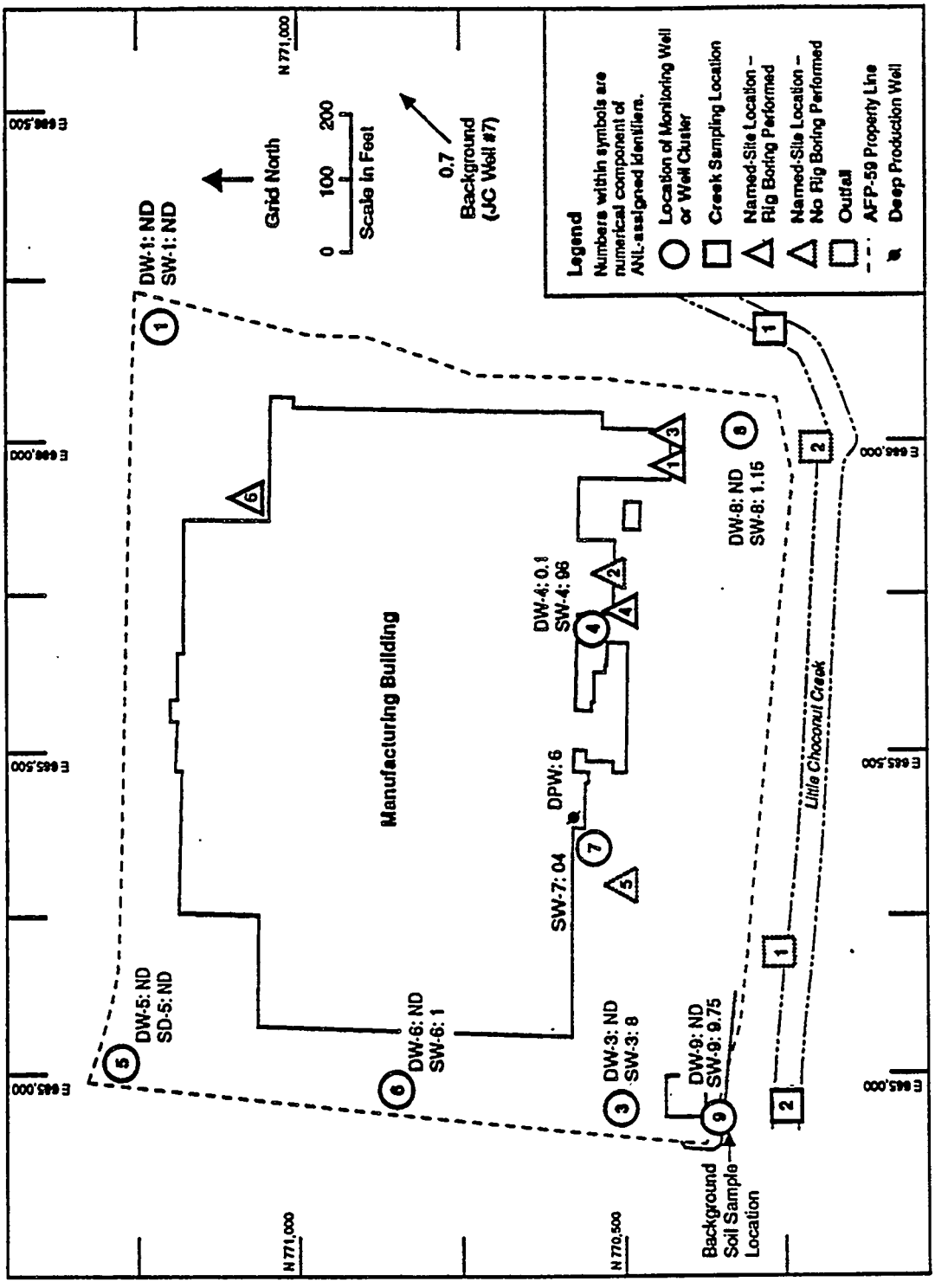


FIGURE J.12 Average Concentrations of Trichloroethene Found during Two Rounds of Sampling at AFP 59, Values below 1 are estimated. ND = not detected. Units = ppb.

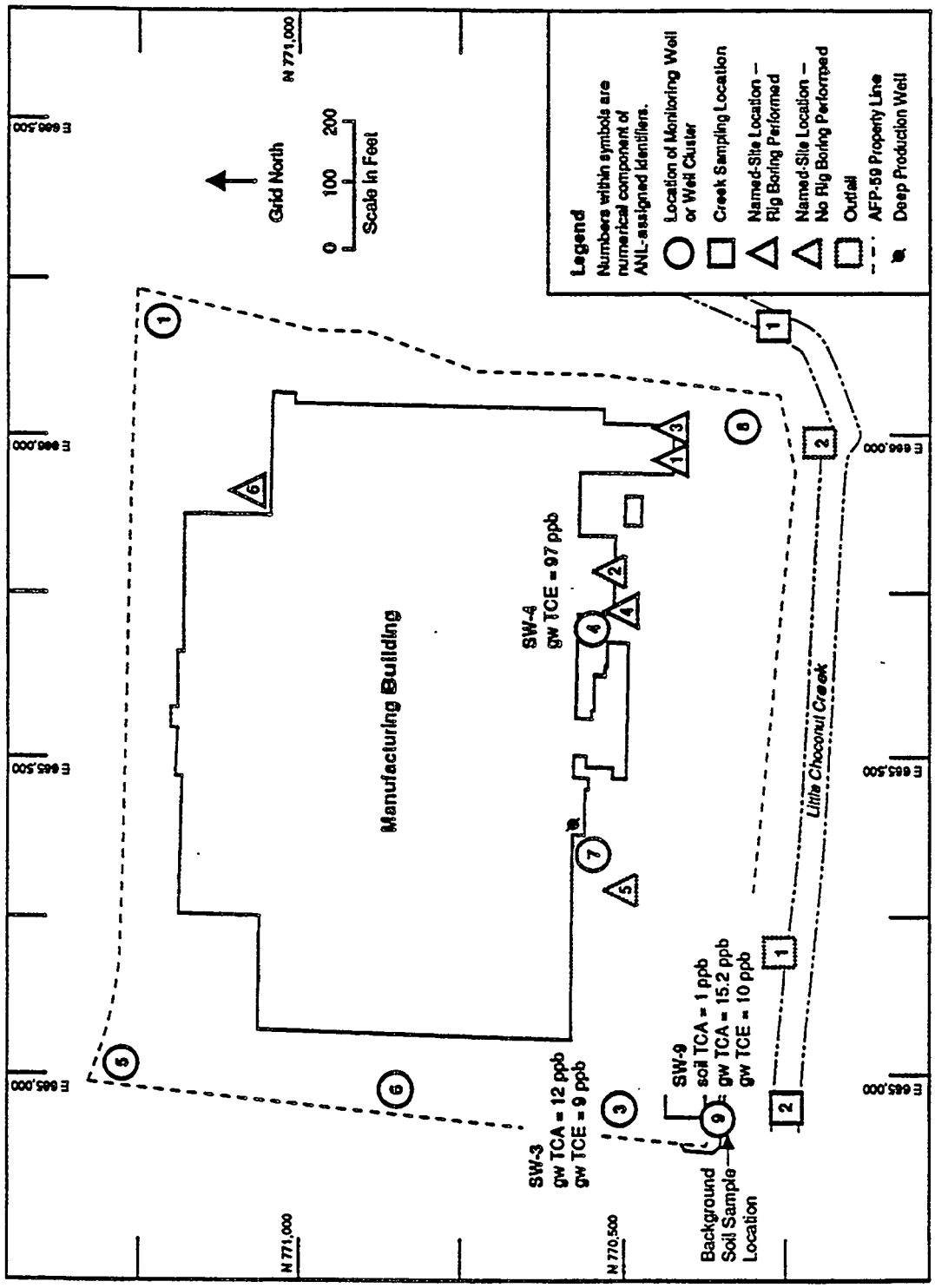


FIGURE J.13 All Locations Where TCA or TCE Contamination Was Detected in Soil and All Locations Where Groundwater Contamination Exceeded the Drinking Water Standards (5 ppb) for These Compounds. The highest value for a given location is shown.

Appendix K:

Quality Assurance/Quality Control for Production of Documents

Appendix K:

Quality Assurance/Quality Control for Production of Documents

Field data were logged by hand or electronically. Field notes were typed and data were tabulated upon the completion of field work. Discrepancies were resolved and an explanation was placed with the original log as a dated annotation. To minimize entry error, field data were translated into the IRPIMS format by the generators of the data prior to their submission for computer entry. To control any future discovery of transcription error, formatted data — as provided for computer entry — were retained and are shown in Sections C.5 and C.6 of Appendix C of this report. After entry into the IRPIMS system, field data were electronically checked for completeness.

Chemical-analytical data were validated and their usability was determined by individual contractors. Valid analytical data were plotted on spreadsheets. A system of parallel review of information within or concerning laboratory data packages, validation reports, and spreadsheets by ANL project personnel, the validator (E-Chem Corp.), and the generator of the usability report (Gradient Corp.) was employed to assure the reliability of final spreadsheet data. The original validation and usability reports that explain the values appearing on the final spreadsheets are provided as Appendix A of this report.

Reduced tables containing laboratory values of interest were produced by deleting "non-detects" from electronic copies of the spreadsheets — a method that obviated typographical errors. These tables, or the above-mentioned spreadsheets, were used as sources of data for reporting and for preparing further tables and figures. The responsibility for proofing for accurate transcription belonged to the authors. The entry of laboratory data into the IRPIMS system was made by using validated data from the spreadsheets and was electronically checked for completeness.

Author review assured the correspondence of tabulated data with field forms. Editorial review assured the conformity of tabulated data with discussions within the text. A word-processing service, using traditional proofreading methods, assured the accurate transcription of materials from the preliminary draft of the report to the final report.

Appendix L:

Dimensionless Henry's Law Constants and Octanol/Water Partition Coefficients Used to Select 12-h Skin Absorption Efficiencies for Sediment Contaminants

Appendix L:

Dimensionless Henry's Law Constants and Octanol/Water Partition Coefficients Used to Select 12-hr Skin Absorption Efficiencies for Sediment Contaminants

L.1 EPA-Provided Henry's Law Constant Values

The following Henry's Law constants (K_H) (Table L.1), expressed in units of atm-m^3/mol (and assumed to be for 25°C), were taken from the Superfund Public Health Evaluation Manual (EPA 1986) and converted to the dimensionless form by multiplying by the 25°C conversion factor 40.88 mol/atm-m^3.

TABLE L.1 Henry's Law Constants

Compound	K_H in (atm-m^3/mol)	K_H (dimensionless)
Methylene chloride	2.03×10^{-3}	8.30×10^{-2}
Acenaphthene	9.20×10^{-5}	3.76×10^{-3}
Dibenzofuran	Not available	Not available
Fluorene	6.42×10^{-5}	2.62×10^{-3}
Anthracene	1.02×10^{-3}	4.17×10^{-2}
Phenanthrene	1.59×10^{-4}	6.50×10^{-3}
Di-n-butyl phthalate	2.82×10^{-7}	1.15×10^{-5}
Fluoranthene	6.46×10^{-6}	2.64×10^{-4}
Pyrene	5.04×10^{-6}	2.06×10^{-4}
Chrysene	1.05×10^{-6}	4.29×10^{-5}
Benzo[b]fluoranthene	1.19×10^{-5}	4.86×10^{-4}
Benzo[k]fluoranthene	3.94×10^{-5}	1.61×10^{-3}
Benzo[a]pyrene	1.55×10^{-6}	6.33×10^{-5}
Indeno[1,2,3-cd]pyrene	6.86×10^{-8}	2.80×10^{-6}
Benzo[ghi]perylene	5.34×10^{-8}	2.18×10^{-6}
Aldrin	1.60×10^{-5}	6.54×10^{-4}

Source: EPA (1986).

L.2 Other Henry's Law Constant Values

The dimensionless K_H for *naphthalene* = 1.9×10^{-2} at 20°C, according to Burmaster and Maxwell (1991).

Input data required for the dimensionless K_H for *2-methylnaphthalene* are:

- Boiling point, predicted value, (T_1) = 516 K — where P_1 = 1 atm (White 1986);
- ΔH_V (predicted) = 47,780 J/mol (White 1986);
- Melting point = 35°C;
- Solubility at 25°C (i.e., at T_2 = 298 K) = 0.18 mol/m^3 (Pearlman et al. 1984);
- R = 8.3144 J mol^{-1} K^{-1}; and
- To convert K_H from atm-m^3/mol to the dimensionless form at 25°C, multiply by the conversion factor 40.88 mol/atm-m^3 (Rosenblatt et al. 1991).

The calculations are as follows:

$$\text{Log}\,(P_1/P_2) = [\Delta H_V/(2.303\ R)]\,[(1/T_2) - (1/T_1)] \text{ (White 1986)}$$

$$= 3.5376, \text{ where } P_2 = 2.900 \times 10^{-4} \text{ atm (supercooled liquid)}$$

$$K_H \text{ (dimensionless)} = (P_2 \times \text{conversion factor})/(\text{solubility})$$

$$= 6.59 \times 10^{-2} \text{ (supercooled liquid)}$$

The melting point correction at 25°C needed to consider 2-methylnaphthalene as a solid (Yalkowsky 1979, as cited by Rosenblatt et al. 1991) is:

$$\text{Log}\,(P_{solid}/P_{liquid}) = -0.00989\ (\text{melting point} - 25°)$$

$$= -0.0989.$$

Hence, $(P_{solid}/P_{liquid}) = 0.796$;

thus, K_H (solid, dimensionless) $= 0.796 \times 0.0659$

$= 5.24 \times 10^{-2}$.

The K_H value at 25°C for *bis(2-ethylhexyl) phthalate* calculated by Howard (1989) is 1.1×10^{-5} atm-m^3/mol, which is multiplied by 40.88 mol/m^3-atm to give the dimensionless constant, 4.52×10^{-4} (see Table L.2).

TABLE L.2 Log Octanol/Water Partition Coefficient (K_{ow} Values)

Compound	Log K_{ow}	Reference
Methylene chloride	1.25	Hansch & Leo (1979)[a]
Naphthalene	3.30	EPA (1992)
2-Methylnaphthalene	3.97	Estimated[b]
Acenaphthene	4.07	Versar (1979)[a]
Dibenzofuran	Not available	
Fluorene	4.18	Miller et al. (1985)[a]
Anthracene	4.45	EPA (1984)
Phenanthrene	4.46	EPA (1984)
Di-n-butyl phthalate	4.11	Giam et al. (1984)
Fluoranthene	4.95	EPA (1992)
Pyrene	4.88	EPA (1984)
Bis(2-ethylhexyl) phthalate	9.64	Giam et al. (1984)
Chrysene	5.66	EPA (1992)
Benzo[b]fluoranthene	6.12	EPA (1992)
Benzo[k]fluoranthene	6.84	Versar (1979)[a]
Benzo[a]pyrene	6.10	EPA (1992)
Indeno[1,2,3-cd]pyrene	6.58	EPA (1992)
Benzo[ghi]perylene	6.51	EPA (1984)
Aldrin	3.01	EPA (1992)

[a] Primary reference cited by CanTox (1990).

[b] Estimate based on value for naphthalene and addition of methyl fragment according to Lyman et al. (1990).

L.3 References

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Appendix M:

Estimate of the Maximum Potential Effect of Contaminants in AFP 59 Well Cluster 9 on Water Drawn from the Johnson City Well Field

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Estimate of the Maximum Potential Effect of Contaminants in AFP 59 Well Cluster 9 on Water Drawn from the Johnson City Well Field

M.1 Site-Related Assumptions

The surface surrounding Well Cluster 9 is not paved, but is covered with grass. Its area is estimated at 5,000 ft^2, and the depth to groundwater is approximately 20 ft. For purposes of the present discussion, the highest concentration of each contaminant found in well-borehole samples at this location (Table M.1) will be considered uniformly distributed in the soil beneath the grassy plot.

It is assumed that the water percolating through the plot in the course of a year amounts to 9 in. (i.e., it is supplied at the recharge rate posited in the main text).

M.2 Available Contaminant Residues

The soil mass under grass, down to the water table (density approximately 1.32 kg/L), equals 5,000 $ft^2 \times 20$ ft $\times$ 28.32 $L/ft^3 \times 1.32$ kg/L = 3.74×10^6 kg. The estimated amounts of contaminant available are shown in Table M.2.

TABLE M.1 Highest Concentration of Contaminants in Samples from Well Cluster 9

Compound	Concentration (µg/kg)	Solubility (µg/L)
Methylene Chloride	10	1.3×10^7 [a]
Acetone	10	Infinite[a]
Trichloroethene	14	1.1×10^6 [a]
1,1,1-Trichloroethane	1	3.5×10^5 [a]
Di-n-butyl Phthalate	120	11,200[b]
Fluoranthene	140	206[c]

[a] (Howard 1990).

[b] (Howard 1989).

[c] (Yalkowsky et al. 1988).

TABLE M.2 Estimated Amounts of Contaminants Available in Well Cluster 9

Compound	Mass (μg)
Methylene chloride	3.74×10^7
Acetone	3.74×10^7
Trichloroethene	5.23×10^7
1,1,1-Trichloroethane	3.74×10^6
Di-n-butyl phthalate	4.49×10^8
Fluoranthene	5.23×10^8 (2.19×10^7/yr[a])

[a] The annual volume of rainwater available to leach out soil contaminants is 5,000 $ft^2 \times 9/12$ ft $\times$ 28.32 L/ft^3 = 106,200 L. This is insufficient to dissolve all the fluoranthene (at saturation) in a single year, the maximum being 106,200 L $\times$ 206 μg/L = 2.19×10^7 μg.

M.3 Maximum Potential Average Concentration in Johnson City Wellfield

The annual volume of water consumed by Johnson City is estimated at 3.3×10^6 gal/day $\times$ 365 days/yr $\times$ 3.785 L/gal = 4.56×10^9 L. The ratio of annual mass of a contaminant (assuming that all contaminants except fluoranthene are leached out in a single year) to the annual volume of water consumed gives the maximum potential concentrations added by AFP 59 Well Cluster 9 to the Johnson City drinking water supply. These values are shown in Table M.3, along with the applicable New York State groundwater standards.

Examination of these numbers shows that they are all more than two orders of magnitude smaller than the groundwater standards.

TABLE M.3 Estimated Maximum Potential Concentrations Added by Well Cluster 9

	Maximum Potential Concentration (µg/L)	New York State Groundwater Standards (µg/L)
Methylene chloride	8.2	5
Acetone	8.2	50
Trichloroethene	11.5	3
1,1,1-Trichloroethane	0.82	5
Di-n-butyl phthalate	98	50
Fluoranthene	4.8	50

M.4 References

Howard, P.H., 1989, *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume I*, Lewis Publishers, Inc., Chelsea, Mich.

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Appendix N:

Toxicity Summaries for Contaminants Contributing to AFP 59 Site-Related Risks

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Toxicity Summaries for Contaminants Contributing to AFP 59 Site-Related Risks

The primary focus of this appendix is the summarization of available toxicity data for the contaminants of concern at AFP 59 that are the subjects of risk assessment with respect to human health.

N.1 Carcinogenic Polynuclear Aromatic Hydrocarbons: Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Chrysene, and Indeno[1,2,3-cd]pyrene

Polynuclear Aromatic Hydrocarbons (PAHs) are a diverse group of predominantly aromatic compounds that generally have two to six fused rings. PAHs are formed during the incomplete combustion or pyrolysis of organic materials containing carbon and hydrogen (U.S. Environmental Protection Agency [EPA] 1984). They occur in the heavier petroleum fractions, synthetic fuels, and coal tars. PAHs known to be carcinogenic have at least four fused rings. Because of their high molecular weights, low polarity, and low solubility in water, these compounds usually occur in the environment adsorbed to particulates. Although the EPA (1992a, 1992b) has characterized benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, chrysene, and indeno[1,2,3-cd]pyrene as carcinogens, only BAP currently has assigned slope factors (SFs), namely an oral SF of 7.3×10^{-1} mg/kg·d (EPA 1992b) and an inhalation SF of 6.1 $(mg/kg \cdot d)^{-1}$ (EPA 1992a). It is common practice to use these SFs for all other carcinogenic PAHs (McGaughy 1992); however, toxicity equivalence factors are available (ICF-Clements 1988) to account for the fact that other PAHs are not as potent carcinogens as BAP. The critical investigations of BAP are briefly described in the next two paragraphs; these discussions are based on information from the Integrated Risk Information System (IRIS) (EPA 1992b, primary references unavailable).

Neal and Rigdon (1967) added BAP (the purity was not reported) to the diets of male and female CFW-Swiss mice (Table N.1). The age of the mice ranged from 17 to 120 days old, and the treatment time ranged from 1 to 197 days. No forestomach tumors (squamous cell papillomas and carcinomas) were reported in the low-dose groups. The incidences of forestomach tumors in the higher dose groups were dose-related.

The effects of BAP on two groups of Sprague-Dawley rats was studied; each group had 32 rats of each sex. A dosage of 0.15 mg/kg (body weight) BAP (reported to be highly pure) was added to the diet of the rats either every ninth day (low-dose group) or five times per week (high-dose group). These treatments resulted in average annual doses of 6 or 39 mg/kg, respectively. An untreated group of 32 rats/sex served as the control. Rats were treated until moribund or dead; survival was similar in all groups. A histological examination was performed on each rat. The combined incidence of tumors of the forestomach, esophagus, and larynx were

3/64, 3/64, and 10/64 in the control group, the group fed BAP every ninth day, and the group fed BAP five times per week, respectively. A trend analysis showed a statistically significant tendency for the proportion of animals with tumors of the forestomach, esophagus, or larynx to increase steadily with dose (EPA 1992b, primary references unavailable).

Benzo[a]pyrene has also been shown to be carcinogenic in animals when administered by other routes (EPA 1992b). Many of the PAHs produce tumors in mouse skin when applied topically alone and/or in combination with a promoter (EPA 1984). As a result of the route of administration, these studies have limited utility for quantitative risk assessments. However, they provide qualitative data that can be used to estimate relative potency.

Noncarcinogenic effects of the carcinogenic PAHs have not been determined. Therefore, for the purposes of risk assessment, their potential noncarcinogenic effects are not evaluated.

TABLE N.1 Incidence of Forestomach Cancers in CFW-Swiss Mice Exposed to Benzo[a]pyrene (BAP) in the Diet for up to 197 Days

Concentration of BAP in Diet (ppm)	Incidence of Forestomach Tumors
0[a]	0/289
1	0/25
10	0/24
20	1/23
30	0/37
40	1/40
45	4/40
50	24/34
100	19/23
250	66/73

[a] Control.

Source: Neal and Rigdon (1967), as cited in EPA (1992b).

N.2 Noncarcinogenic Polynuclear Aromatic Hydrocarbons: Acenaphthene, Anthracene, Benzo[ghi]perylene, Fluoranthene, Fluorene, 2-Methylnaphthalene, Naphthalene, Phenanthrene, and Pyrene

The PAHs that have not been characterized as carcinogens are found or formed under conditions similar to those associated with the occurrence of carcinogenic PAHs (see above). Except for naphthalene, none of the noncarcinogenic PAHs are manufactured in quantity. In 1988, the United States produced 143,000 metric tons of naphthalene from coal tar fractionation or petroleum processing. Naphthalene is an intermediate in the production of phthalic anhydride, insecticides, and other organic chemicals (Agency for Toxic Substances and Disease Registry [ATSDR] 1990a); 2-Methylnaphthalene is used in the synthesis of organic chemicals, such as insecticides (ATSDR 1990b).

The toxicology of these compounds has not been extensively explored, although there is enough information to provide official reference doses (RfDs) for acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, and pyrene and estimates or surrogate values for 2-methylnaphthalene and phenanthrene.

In a mouse oral-subchronic study of acenaphthene, four groups of CD-1 mice (20 mice/sex in each group) were gavaged daily with 0, 175, 350, or 700 mg/kg·d acenaphthene, respectively, for 90 days. The study indicated no treatment-related effects on survival, clinical signs, body weight changes, total food intake, or ophthalmological alterations. Liver-weight changes accompanied by microscopic alterations (cellular hypertrophy) were noted in both mid- and high-dose animals and seemed to be dose-dependent. Additionally, high-dose males and mid- and high-dose females showed significant increases in cholesterol levels. Although increased liver weights (without accompanying microscopic alterations or increased cholesterol levels) were also observed at the low dose, this change was considered to be adaptive, not adverse. The lowest observed adverse-effects level (LOAEL) is 350 mg/kg·d based on hepatotoxicity; the no observed adverse-effects level (NOAEL) is 175 mg/kg·d. The NOAEL was divided by an uncertainty factor of 3,000 to derive the chronic oral reference dose (RfD) of 6×10^{-2} mg/kg·d (EPA 1992b).

In a mouse oral subchronic study of anthracene, four groups of CD-1 mice (20 mice/sex in each group) were gavaged daily with 0, 250, 500, or 1,000 mg/kg·d anthracene for at least 90 days. The study indicated no treatment-related effects. The NOEL was the highest dose tested. The NOEL was divided by an uncertainty factor of 3,000 to derive the chronic oral RfD of 3×10^{-1} mg/kg·d (EPA 1992b).

Several carcinogenicity studies of benzo[ghi]perylene alone or (as a cocarcinogen) with BAP gave largely negative results that led to the conclusion that the data were inadequate to classify the compound as a human carcinogen (EPA 1992b). There are no data regarding noncarcinogenic effects of benzo[ghi]perylene.

In a mouse oral-subchronic study of fluoranthene, four groups of CD-1 mice (20 mice/sex in each group) were gavaged daily for 13 weeks with 0, 125, 250, or 500 mg/kg·d fluoranthene. A fifth group of mice (30 mice/sex) was established for the study of baseline blood evaluations. At the end of 13 weeks, the animals were sacrificed and autopsied. All treated mice exhibited nephropathy, increased salivation, and increased liver enzyme levels in a dose-dependent manner. However, these effects were either not significant, not dose-related, or not considered at 125 mg/kg·d. Mice exposed to 500 mg/kg·d had increased food consumption and increased body weight. Those exposed to 250 and 500 mg/kg·d had statistically increased serum glutamic-pyruvic transaminase (SGPT) values and increased absolute and relative liver weights. Compound-related microscopic liver lesions (indicated by pigmentation) were observed in 65 and 87.5% of the mid- and high-dose mice, respectively. On the basis of increased SGPT levels, kidney and liver pathology, and clinical and hematological changes, the LOAEL is considered to be 250 mg/kg·d, and the NOAEL is 125 mg/kg·d. The NOAEL was divided by an uncertainty factor of 3,000 to derive the chronic oral RfD of 4×10^{-2} mg/kg·d (EPA 1992b).

In a mouse oral-subchronic study of fluorene, four groups of CD-1 mice (25 mice/sex in each group) were gavaged daily for 13 weeks with 0, 125, 250, or 500 mg/kg·d fluorene suspended in corn oil. Increased salivation, hypoactivity, and urine-wet abdomens in males were observed in all the treated animals. The percentage of animals exhibiting hypoactivity was dose-related. In mice exposed at 500 mg/kg·d, labored respiration, ptosis (drooping eyelids), and unkempt appearance were also observed. A significant decrease in red blood cell count and packed cell volume was observed in females treated with 250 mg/kg·d fluorene and in males and females treated with 500 mg/kg·d. Decreased hemoglobin concentration and increased total serum bilirubin levels were observed in the 500 mg/kg·d group. Decreases in erythrocyte count, packed cell volume, and hemoglobin concentration were all observed at 125 mg/kg·d; however, these effects, although apparently dose-dependent, were not statistically significant. A significant decreasing trend in blood/urea/nitrogen (BUN) and a significant increasing trend in total serum bilirubin were observed in high-dose males and high-dose females. A dose-related increase in relative liver weight was observed in treated mice; a significant increase in absolute liver weight was also observed in the mice treated with 250 and 500 mg/kg·d fluorene. A significant increase in absolute and relative spleen and kidney weight was observed in males and females exposed to 500 mg/kg·d and in males at 250 mg/kg·d. Increases in the absolute and relative liver and spleen weights in the high-dose males and high-dose females were accompanied by histopathological increases in the amounts of hemosiderin in the spleen and in the Kupffer cells of the liver. No other histopathological lesions were observed. On the basis of hematological effects, the LOAEL is 250 mg/kg·d, and the NOAEL is 125 mg/kg·d. The NOAEL was divided by an uncertainty factor of 3,000 to derive the chronic oral RfD of 4×10^{-2} mg/kg·d (EPA 1992b).

2-Methylnaphthalene is a relatively abundant petroleum hydrocarbon. It melts at 34.5°C and boils at 241°C (Weast 1979). It has an aqueous solubility of 25 mg/L at 25°C (Yalkowsky 1988). There is no official RfD for 2-methylnaphthalene and little in the way of toxicity data. The rat oral LD_{50} of 1,630 mg/kg suggests that this compound is about as toxic as naphthalene, with an oral rat LD_{50} of 1250 mg (Sweet 1987). Thus, one could make a case of assigning to 2-methylnaphthalene the chronic RfD of naphthalene, which is 0.04 mg/kg·d (EPA 1991). But according to Layton et al. (1987), one obtains a more conservative estimated value for the RfD, 0.0024 mg/kg·d by multiplying the LD_{50} by the factor 1.5×10^{-6}, which is likely to be below the "true" value 95% of the time.

Naphthalene, a common and familiar aromatic hydrocarbon, melts at 80.5°C and boils at 218°C. Its aqueous solubility is 31.7 mg/L at 20°C (ATSDR 1990a). It has the highest vapor pressure of all the PAHs. The largest sources of naphthalene emission are inadvertent releases due to the combustion of fossil fuel and use as a moth repellent (ATSDR 1990a). Symptoms of acute naphthalene intoxication in humans are usually delayed. The most common adverse effects are hemolytic anemia and jaundice. Other adverse effects include nausea, vomiting, diarrhea, abdominal pain, effects on the kidney and liver, and neurologic effects, such as convulsion and coma (ATSDR 1990a). In the longest chronic toxicity study, a group of 28 rats (in-house strains BDI and BDIII) was exposed to a diet supplemented with naphthalene six times per week (Schmahl 1955). Treatment was stopped when the total dose was 10 g per rat. The average daily dose was approximately 10-20 mg/d (approximately 30-60 mg/kg·d). Tumors were evaluated in animals that died spontaneously at about 700–800 days of age. No carcinogenic responses were reported (EPA 1992b). For the same study, ATSDR (1990a) reported a NOAEL of 41 mg/kg·d,

with death as the endpoint. Other, shorter term studies gave somewhat higher values for the NOAEL (ATSDR 1990a). On the basis of the critical effect of decreased weight, the best current recommended value for both the chronic and subchronic RfD of naphthalene is 0.04 mg/kg·d (EPA 1992a).

Phenanthrene melts at 101°C and boils at 340°C (Weast 1979). Its aqueous solubility at 25°C is about 1.0 mg/L (Yalkowsky et al. 1988). Phenanthrene tested negative as a complete carcinogen in two mouse studies that lacked adequate reporting. In other studies, phenanthrene was ineffective as either a tumor initiator or promoter (ATSDR 1990b). The data are not considered adequate to assess the carcinogenicity of this compound (EPA 1992b). According to Layton et al. (1987), by multiplying the mouse oral LD_{50} of 700 mg/kg by the factor 1.5×10^{-6}, one obtains an estimated value for the RfD, 0.0011 mg/kg·d, which is likely to be below the "true" value 95% of the time. This is a much more conservative figure than would result from adopting the RfD value for naphthalene.

The melting point of pyrene is 156°C; it boils at 393°C (Weast 1979). Its solubility in water at 25°C is 0.13 mg/L (Yalkowsky 1988). Available data (generally negative) are not considered adequate to assess the carcinogenicity of this compound (EPA 1992b). In a mouse oral-subchronic study of pyrene, four groups of CD-1 mice (20 mice/sex in each group) were gavaged daily for 13 weeks with pyrene suspended in corn oil (EPA 1992b). Nephropathy, characterized by the presence of multiple foci of renal tubular degeneration (often accompanied by interstitial lymphocytic infiltrates and/or foci of interstitial fibrosis) was observed (Table N.2). The kidney lesions were described as minimal or mild in all dose groups. Relative and absolute kidney weights were reduced in the two higher dosage groups. On the basis of these results, the LOAEL is considered to be 125 mg/kg·d (nephropathy and decreased kidney weights), and the NOAEL is considered to be 75 mg/kg·d. The NOAEL was divided by an uncertainty factor of 3,000 to derive the chronic oral RfD of 3×10^{-2} mg/kg·d (EPA 1992b).

N.3 Aldrin

Aldrin is a heavily chlorinated ($C_{12}H_8C_{16}$) insecticide melting at 104°C; it has a vapor pressure of 1.4×10^{-4} torr and an aqueous solubility of 0.20 mg/L at 25°C (Rosenblatt et al. 1975). It undergoes ready epoxidation to dieldrin in the environment.

Groups of 24 rats (12 per sex) were fed aldrin as part of their diet for two years at levels of 0, 0.5, 2, 10, 50, 100, or 150 ppm, respectively. Liver lesions characteristic of chlorinated insecticide

TABLE N.2 Incidence of Neuropathy in CD-1 Mice Exposed to Pyrene by Gavage for 13 Weeks

Dose (mg/kg·day)	Number of Lesions	
	Males	Females
0	4/20	2/20
75	1/20	3/20
125	1/20	7/20
250	9/20	10/20

Source: EPA (1992b).

poisoning were observed at dose levels of 0.5 ppm and greater. These lesions showed enlarged centrilobular hepatic cells, with increased cytoplasmic oxyphilia and peripheral migration of basophilic granules. A statistically significant increase in liver-to-body weight ratio was observed at all dose levels. Kidney lesions occurred at the highest dose levels. Survival was markedly decreased at dose levels of 50 ppm and greater. The composite uncertainty factor of 1,000 used to arrive at an RfD of 3×10^{-5} mg/kg·d for noncarciñogenic effects was adopted, in part, because the RfD is based on the LOAEL rather than the NOAEL (EPA 1991).

In 1962, Davis and Fitzhugh reported feeding a group of 215 C3HEB/Fe mice a dietary mixture containing 10 ppm aldrin for up to two years. The control group consisted of 217 mice. The aldrin-treated mice died two months earlier than the controls. Intercurrent disease, pneumonia, and intestinal parasitism may have influenced the long-term survival rate. A statistically significant increase of hepatomas was reported in the treated animals as compared with the controls. An independent evaluation of the liver lesions showed most of the hepatomas to be liver carcinomas. In a follow-up study, aldrin was administered at 10 ppm in the diet to 50 male and 50 female C3H mice and at 0 ppm in similar numbers of controls for two years. The incidence of hepatic hyperplasia and benign hepatomas in the aldrin group was approximately double that of the controls, whereas the number of hepatic carcinomas was about the same for both groups. Neither study provided a detailed pathologic examination or separated the data by sex. It was concluded from the studies that evidence of animal carcinogenicity is sufficient. The oral and inhalation SFs for aldrin are both 17 $(mg/kg\cdot d)^{-1}$ (EPA 1991).

N.4 Antimony

Antimony, which in the elemental state is a bluish white, extremely brittle metal melting at 631°C, is not at all abundant. Its main use is in alloys, including solder for water pipes (Weast 1979, ATSDR 1991a).

An experimental group of 50 male and 50 female rats was administered 5 ppm potassium antimony tartrate in water. Over the period of study, growth rates of treated animals were not affected, but male and female rats survived 106 and 107 fewer days, respectively, than did controls at median lifespans. Nonfasting blood glucose levels decreased in the treated males, and cholesterol levels increased in both sexes. A decrease of mean heart weight was noted for males. No increase in tumors was seen as a result of the treatment. Because only one level of antimony was administered, a NOAEL was not established in this study. Although it was not precisely stated, the concentration of antimony in the diet was expressed as an exposure of 0.35 mg/kg·d (the LOAEL). The LOAEL was divided by an uncertainty factor of 1,000 to derive the chronic oral RfD of 4×10^{-4} mg/kg·d (EPA 1992b).

N.5 Bis(2-ethylhexyl) Phthalate

Bis(2-ethylhexyl) phthalate [or di(2-ethylhexyl) phthalate, DEHP], a liquid at ambient temperatures, has a vapor pressure of 6×10^{-6} torr and a water solubility of 0.34 mg/L (Howard et al. 1985). Its half-life in soil is estimated to be in the range of 5 to 23 days (Howard et al. 1991).

Groups of 32 male and 32 female Sherman rats were maintained for two years on diets containing 0.04, 0.13, or 0.4% DEHP, respectively (equivalent to 20, 60, and about 195 mg/kg body weight per day (bw/d) on the basis of measured food consumption). An F1 group of 80 animals was fed the 0.04% diet for one year. Mortality in the F1 treated and control groups was high; 46.2 and 42.7%, respectively, survived to one year. There was, however, no effect of treatment on either parental or F1 group mortality, life expectancy, hematology, or histopathology of organs. Both parental and F1 rats receiving the 0.4% DEHP diet were retarded in growth and had increased liver and kidney weights (EPA 1992b).

The following numbers of guinea pigs were fed diets containing DEHP for one year: 24 males and 23 females consumed feed containing 0.13% DEHP, 23 males and 23 females consumed food containing 0.04% DEHP, and 24 males and 22 females were fed the control diet. These dietary levels corresponded to 64 or 19 mg/kg of body weight per day on the basis of food consumption. No treatment-related effects were observed on mortality, body weight, kidney weight, or gross pathology and histopathlogy of kidney, liver, lung, spleen, or testes. Statistically significant increases in relative liver weights were observed in both groups of treated females. Guinea pigs are apparently the more sensitive animal models for DEHP (noncarcinogenic) toxicity; the LOAEL was divided by an uncertainty factor of 1,000 to derive the chronic oral RfD of 2×10^{-2} mg/kg·d (EPA 1992b).

In a National Toxicology Program study, three groups of 50 male and 50 female Fisher 344 rats were fed diets containing 0, 6,000, or 12,000 ppm DEHP, respectively, for 103 weeks. Similarly, groups of 50 male and 50 female B6C3F1 mice were given 0, 3,000, or 6,000 ppm DEHP in the diet for 103 weeks. Animals were killed and examined histologically when moribund or after 105 weeks. No clinical signs of toxicity were observed in either species. A statistically significant increase in the incidence of hepatocellular carcinomas and combined incidence of carcinomas and adenoma were observed in female rats and in both sexes of mice. The combined incidence of neoplastic nodules and hepatocellular carcinomas was significantly increased in the high-dose male rats. A positive dose-response trend was also noted. On the basis of the foregoing study, the oral SF for DEHP is 0.014×10^{-1} mg/kg·d (EPA 1991, 1992b).

N.6 Di-n-butyl Phthalate

Di-n-butyl phthalate (DBP), a liquid at ambient temperatures, has a vapor pressure of 7.3×10^{-5} torr and a water solubility of 11.2 mg/L (Howard et al. 1985). Its half-life in soil is estimated to be in the range of 2 to 23 days (Howard et al. 1991).

Adverse effects of DBP to humans have not been reported. It is rapidly metabolized and excreted (ATSDR 1990c).

Male Sprague-Dawley rats in groups of 10 were fed diets containing 0, 0.01, 0.05, 0.25, and 1.25% DBP for a period of one year. One-half of all rats receiving the highest DBP concentration died during the first week of exposure. The remaining animals survived the study with no apparent ill effects. The treatment had no effect on gross pathology or hematology. No histopathological evaluation was reported. On the basis of the NOAEL and an uncertainty factor of 1000, an RfD of 0.1 mg/kg·d was derived (EPA 1992b).

N.7 Manganese

With a melting point of 1,244°C, the elemental form of manganese is used to form alloys; as MnO_2, it is an important component of dry-cell batteries (Weast 1979). At low (2.5–5 mg·d) dietary intake rates, manganese is an essential human nutrient (ATSDR 1991b).

Manganese miners or steel workers who breathe high levels of dust containing manganese may develop mental and emotional disturbances and impotence, and their body movements may become slow and clumsy. This combination of symptoms is a disease called "manganism." It is not certain whether exposure by routes other than inhalation causes manganism (ATSDR 1991b).

The World Health Organization (WHO) reviewed several investigations of adult diets with regard to the average daily consumption of manganese. Higher intakes are associated with diets high in whole cereals, nuts, green leafy vegetables, and tea. From manganese balance studies, the WHO concluded that 2–3 mg/d of manganese is adequate for adults and 8–9 mg/d is "perfectly safe." Evaluation of standard diets from the United States, England, and Holland reveals average daily manganese intakes of 2.3–8.8 mg/d. However, depending on individual diets, a normal intake may be even higher, especially from a vegetarian diet. These levels are considered safe for chronic human ingestion. No signs of toxicity were reported in patients given 9 mg/d of manganese (as manganese citrate) in food. Assuming the patients consumed an additional 2.5 mg/d of manganese in food, the total manganese intake would be approximately 11.5 mg/d. The Food and Nutrition Board of the National Research Council determined an "adequate and safe" intake of manganese to be 2–5 mg/d for adults; this level was chosen because it includes an "extra margin of safety" from the level of 10 mg/d — i.e., a NOAEL of 0.14 mg/kg·d — that can be considered to be safe. This NOAEL was rounded off to 0.1 mg/kg·d (and no uncertainty or modifying factors were applied) to obtain an RfD for food intake of 0.1 mg/kg·d (EPA 1992b).

A separate RfD was developed for manganese in water on the basis of a Greek study that found differences in neurological scores between areas with low concentrations of manganese in water (3.6–14.6 µg/L) and high concentrations of manganese in water (1,600–2,300 µg/L). The derivation of a separate water RfD assumes that the manganese exposure from drinking water is in addition to that found in the diet (i.e., the dietary intake of manganese is already assumed). Because the exposure pathway to manganese in this risk assessment is via drinking water, the oral

RfD of 5×10^{-3} (mg/kg·d) is used. This RfD is based on a NOAEL of 0.005 mg Mn/kg·d (assuming 2 L/day consumption and 70 kg body weight) from Kendakis et al. (1989) by using the arithmetic mean of the high level exposed group (1,950 µg/L).

N.8 Methylene Chloride

Methylene chloride (dichloromethane) is a solvent that boils at 40°C and has an aqueous solubility of 1.3% at 25°C (Howard 1990). Its half-life in groundwater is estimated to be in the range of two to eight weeks (Howard et al. 1991).

In a two-year study of methylene chloride in drinking water, four dose groups of Fisher 344 rats were used (85 rats/sex in each group) at nominal dose levels of 5, 50, 125, and 250 mg/kg·d. A high-dose recovery group of 25 rats/sex and two control groups of 85 and 50 rats/sex were also tested. Many effects were monitored. Treatment-related histological changes were evident at nominal doses of 50 mg/kg·d or higher. The low nominal dose of 5 mg/kg·d was used as a NOAEL, with an uncertainty factor of 100 to give an RfD of 0.06 mg/kg·d (EPA 1992b).

The foregoing study was also the main basis for derivation of an oral (carcinogenic) SF. In the female rats, the incidence of combined hepatocellular carcinoma and neoplastic nodules was significantly increased in the 50- and 250-mg/kg dose groups when compared with matched controls. The incidence of hepatocellular carcinoma alone was not significantly increased. The combined incidence of hepatocellular carcinoma and neoplastic nodules in controls and in the four dose groups (472 rats; 4 with carcinoma, 8 with neoplastic nodules) was similar to that for historical controls (419 rats; 5 with carcinoma, 19 with neoplastic nodules). Male rats showed no increase in liver tumors (EPA 1992b).

In a two-year inhalation study, four groups of 50 male and 50 female Fisher 344 rats and three groups of 50 male and 50 female B6C3F1 mice were exposed to methylene chloride six hours per day, five days per week. Exposure concentrations were 0, 1,000, 2,000, or 4,000 ppm for rats and 0, 2,000, or 4,000 ppm for mice. Survival of male rats was low, but apparently not treatment-related. Survival was decreased in a treatment-related fashion for male and female mice and female rats. Mammary adenomas and fibroadenomas were significantly increased in male and female rats after survival adjustment, as were mononuclear cell leukemias in female rats. Among treated mice of both sexes, there were significantly increased incidences of hepatocellular adenomas and carcinomas, and of alveolarbronchiolar adenomas and carcinomas, by life table tests. Adenomas and carcinomas were significantly increased alone, as well as in combination. In addition, there were significant dose-related increases in the number of lung tumors per animal multiplicity in both sexes of mice (EPA 1992b).

The oral SF, 0.0075 $(mg/kg \cdot d)^{-1}$, is an arithmetic mean of the slope factors derived from the drinking water [0.012 $(mg/kg \cdot d)^{-1}$] and inhalation [0.026 $(mg/kg \cdot d)^{-1}$] studies. The use of

the latter study is considered valid because methylene chloride is rapidly absorbed following either inhalation or ingestion (EPA 1992b).

N.9 Trichloroethene

Trichloroethene (trichloroethylene) is a solvent that boils at 87°C and has an aqueous solubility of 1,100 mg/L at 25°C (Howard 1990). Its half-life in groundwater is estimated to be in the range of 0.9 to 4.5 years (Howard et al. 1991).

Although there is currently no official RfD for the noncarcinogenic effects of trichloroethene, a 1985 Health Advisory (EPA 1985) cites Kimmerle and Eben (1973) to derive a LOAEL, and from that, to calculate an RfD of 0.00735 mg/kg·d (not used in this risk assessment). This study evaluated exposure of adult rats to 300 mg/m trichloroethylene in air five days a week for 14 weeks. Toxicity included hematological findings, results of liver and renal function tests, blood glucose, and organ/body weight ratios. Liver weights were shown to be elevated, while other test values were not different from the controls. The elevated liver weights could be interpreted as the result of hydropic changes or fatty accumulation. The NOAEL was not identified, because only a single concentration was administered. Oral exposure of humans to 21-35 g of trichloroethene resulted in vomiting and abdominal pain; occupationally exposed humans have shown an increase in serum transaminase, which indicates damage to the liver parenchyma (EPA 1985).

The EPA withdrew the IRIS carcinogenicity file in 1989, pending review of the weight-of-evidence classification, but has recently begun to provide SF values on request. The oral and inhalation SFs thus obtained are oral, 0.11×10^{-1} mg/kg·d, and inhalation, 0.006×10^{-1} mg/kg·d (EPA 1992c). According to the 1985 Health Advisory (EPA 1985), inhalation of trichloroethene, whether or not contaminated with epichlorohydrin, unequivocally produced liver neoplasms in B6C3F1 mice. According to another report (EPA 1980), similar experiments failed to increase the incidence of tumors in Osborne-Mendel rats. There is no evidence that trichloroethene causes cancer in humans.

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Appendix O:

Problems Noted during the Field Season

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All problems that were noted during the field program that were considered to have had the potential to affect analytical results or the interpretation of those results, or that led to decisions that bear noting, are detailed below.

- **Problems and Comments Concerning Well Borehole Soil Sampling for Laboratory Analyses.**

1. Cluster 1

   a. Contamination Potential. DW-1 was constructed and its soil was sampled in heavy rain. A small oil slick, caused by a leaky lift truck and spread by surface wash, was noted near and outside of the hazard zone. Efforts were made to avoid contacting the oil.

   b. Disparate sampling time. Note of Explanation: A blind field split (JCDW1BS) was made of JCDW1AS. The two samples were collected simultaneously, beginning at 0840 and ending at 0850. Different sampling times (0840 for JCDW1AS and 0850 for JCDW1BS) were assigned to help conceal the identity of the split.

2. Cluster 3

   a. Volatiles screening. There was no reliable PID reading because of an instrument problem.

   b. Origin of VOA JCDW3AS. Two samplers were driven to the same depth. The VOA sample was taken from the first-driven core. The remaining samples were taken from the second-driven core composited with material from the first-driven core.

   c. Explanation of sampling time. Because of a field delay, 55 min elapsed between the driving of the first 8- to 10-ft sampler and the driving of the second. For consistency, the time that sampling was initiated was used as a log time for all samples.

   d. Origin of VOA JCDW3BS. Sampling below water table. Comparability. Two attempts to recover material from the target depth of 18–20 ft and subsequent attempts to retrieve sample at 20–22 ft and 22–24 ft failed. Large cobbles (to ca 7 in.) jammed the sampler. Enough sample was recovered from 24–26 ft for a VOA sample. A

second sampler from 26–28 ft was composited with the first to provide for sample JCDW3BS.

- The JCDW3BS VOA sample does not represent the same sampling depth as do the non-VOA samples with the same ID.

- Sampling represented a deviation from sampling strategy and compromised comparability of well borehole samples. The water table at DW-3 was measured at 22.5 ft. Sample JCDW3BS represents material from 24–28 ft below surface.

3. Cluster 4

   a. Comparability. Normally, well boreholes were sampled at or immediately above the top of the water table. In order to sample point of greater interest, this convention was not strictly followed.

   b. Comparability. VOA samples for B and C were.taken from different depths and are not directly comparable. See following item.

   c. Note: Description of Sampling. The sampling target was the top of the capillary fringe at the interface of a clay (lower) and a sandy gravel stratum. This transition was encountered in the 14- to 16-ft core. The upper gravel portion was discarded, and the clay at the interface was used for the SW-4B VOA sample. In order to obtain enough material for two sets of samples, a second spoon was driven immediately below the first (16–18 ft). The second (SW-4BC) VOA was taken from the top of the second spoon, representing a depth about 10 in. lower than that of the "B" VOA. A lower portion of the latter core was discarded such that 24 ft of soil profile was represented on the utilized portions of the two cores. The retained portions of the two cores were field homogenized and used for all non-VOA samples.

   d. Sample quality. Field homogenization was poor because of the consistency of the matrix.

   e. Inconsistency of record. The geologists log (Field Log A) fails to indicate that the second (16- to 18-ft) core was used for sampling.

4. Cluster 5

   a. Depth represented by JCSW5BS: Very little usable material remained after rock was removed from the 23- to 25-ft core. The contribution of the 23- to 25-ft core to the 23- to 27-ft composite was small.

b. Origin of VOA samples. All three VOAs were taken from the vicinity of two discrete lenses of apparent OV-emanating material. OVM readings were within background range, which was because of the proximity of highway traffic, but the readings were steady (0.5 and 0.8 ppm), as distinguished from erratic wind and traffic-dependent fluctuations. All VOA samples were thus from defined positions on the lower core, and all non-VOA samples were composited from both upper and lower cores, with most material attributable to the lower core.

c. Explanation of replacement of a damaged sample. Three sets (JCSW5BS, JCSW5BS-M [MS-MSD], and JCSW5CS [blind split]) were taken from a composite of two cores taken at 23–25 ft and 25–27 ft, respectively. JCSW5CS was not analyzed. The MS/MSD VOA sample was broken while being transported from the drill site to the field lab. Galson lab was advised of the breakage, but not of the existence of a blind split. The ANL project QA/QC officer subsequently advised that MS/MSD and blind field splits should not be taken from the same sampling point. The blind-split VOA was therefore substituted for the broken MS/MSD VOA, and the remaining JCSW5CS containers were discarded.

5. Cluster 6

a. Note: Sample JCSW6AS was taken from a composite of a 2-in. spoon driven from 8 to 10 ft and an adjacent 3-in. split spoon driven from 8- to 10.5-ft.

b. VOA sample quality. The JCSW6AS VOA sample was collected from a number of locations within the 3-in. core. Because of high gravel content, sampling was difficult, and unavoidable excessive exposure to air and inclusion of gravel in sample occurred.

6. Cluster 7

a. Deviation from sampling protocol. Because of very poor recovery, it was necessary to use soil from inside the auger in the preparation of JCSW7AS in order to obtain requisite quantities. Because of poor recovery within the auger caused by a large rock, it was necessary to use material adhering to the auger walls.

b. Representativeness of sample. Because of the above, contamination stemming from the fill material at 0–7 ft below the surface was possible. Any such contamination would have been minimized by soil scouring and dilution.

c. Origin of VOA JCSW7BS. Because of poor recovery, two successive cores (14–16 and 16–18 ft below the surface) were composited during the preparation of sample JCSW7BS. The VOA sample was taken from the upper (14- to 16-ft) core. Otherwise, both cores contributed equal quantities of similar material.

7. Cluster 8

   a. Peak contamination. Unnatural staining and odor were noted in SW-8. The point of greatest contamination was probably between the two points sampled.

   b. Comment on OVM detections. DW-8: No OVM response above background was noted. SW-8: No closed-space OVM reading was attempted. An open-air scan was within background range. An OVM response of 3 ppm above background was briefly obtained at the wellhead at an unrecorded depth below the sampling point.

8. Cluster 9

   Comparability of representation. Because of poor recovery, samples JCSW9AS (6–10 ft) and BS (12–16 ft) each represent four core-feet of material.

- **Named-Site Soil Sampling**

1. SITE A-1

   a. Sample volume. Only 120 mL of material was submitted for sample JC1H1AS.

   b. Note. Sample JC1H1BS was discarded. Samples JC1H1AS and CS were submitted.

   c. Screening results. The MEM crew was given a sample from the nosepiece of the 12- to 14-ft core. On-site analysis showed the presence of semivolatiles, but the results were not incorporated into the permanent record.

2. SITE A-2

   a. Comparability. JC2L1AS soil represents the same location as hand-bored soil from HA-17, which was analyzed by MEM. These samples may be considered duplicates, but not splits.

   b. Homogeneity. JC2L1AS soil was placed directly into containers without field homogenization.

   c. QC. JC2L1AS was collected long after other P-59 soil samples. Although it was consequently submitted as a "stand-alone" sample, no associated QC samples were taken.

3. SITE A-3

Depth represented. One foot of core volume was recovered from four feet of cored depth and used to prepare JC3H1AS. Origin could not be further defined. Analysis values may or may not apply to the entire 10- to 14-ft stratum.

4. SITE A-4

(No problems affecting interpretation were noted.)

5. SITE A-6

Depth represented. One foot of core volume was recovered from four feet of cored depth and used to prepare JC6H1AS. Origin could not be further defined. Analysis values may or may not apply to the entire 10- to 14-ft stratum.

- **Groundwater Sampling**

1. Problems discussed with NYSDEC:

Turbidity problems were anticipated for several shallow wells. Early in the sampling program, ANL consulted with NYSDEC (Albany) concerning turbidity-related and other procedural issues, as described below.

a. Filtration: New York traditionally does not allow the filtration of samples. NYSDEC declined to waive this prohibition and approve ANL's request to filter metals samples.

b. Sampling Order: By convention, groundwater samples are taken in the order VOA, SV, Cn, and Met. NYSDEC approved sampling in the order VOA, MET, SV, and Cn to minimize the effects of turbidity upon metals results. Although turbidity problems were anticipated in only a few wells, this revised order was used for all samplings in order to maintain consistency between wells and to prevent confusion in the field.

c. Sampling Depth: Various column-depth sampling strategies were discussed. Deeper samples were desired from the standpoint of chemicals of concern. Shallower samples were desired from the standpoint of minimizing turbidity problems. Consistency of sampling procedures was desired from the standpoint of comparability of data. Consistent sampling near the bottom of the column, despite potential aggravation of the turbidity problem, was agreed upon.

d. Recharge: NYSDEC approved purging poor producing wells to dryness and sampling after a single recharge. NYSDEC approved sampling either the same day or the day after purging.

2. Field Problems

a. Field measures. A turbidity meter was available for well development and Round 2 sampling, but not for Round 1 sampling. Visual estimates of clarity were made during Round 1 sampling.

b. Materials. Stainless-steel couplings were used to connect the rigid PVC pipes used in conjunction with a submersible pump. Because of a temporary shortage of parts, however, one standard steel coupling was used below the water table in both Cluster 1 and Cluster 5 wells.

c. Comparability — bailer methods. Groundwater samples were taken through the top of the bailer. The first few samplings were taken by inserting a Teflon™ tube into the bottom of the bailer until the tube dislodged the ball-valve and allowed sample to run through the tube. This method was abandoned because of problems, caused by cold weather, with tube insertion. Recovery from the top necessitated the placement of a gloved finger over the bottom hole.

d. Comparability — sample recovery. Some difficulty was encountered in the form of failure of the ball valve to seat properly as the bailer moved through the top of the column. This occurrence was made immediately apparent by a characteristic sound. In such instances, bailers were re-lowered only enough to replace lost water.

e. Comparability — turbidity. Each full bailer held one liter of water, so that the first bailer provided for three VOA containers (120 mL total) and part of a metals container. Most shallow wells evidenced some (and some of those evidenced much) turbidity in the second bailer. Turbidity increased with successive entries.

- **Creek Water and Sediment Sampling**

1. Comparability of creek sediment samples in reference to location.

Midstream water and sediment samples were planned. Sediment sample location CSS-2 was at midstream. Location CWS water was taken from midstream of a shallow channel that had been cut by a bulldozer. Sampling points needed to be placed downstream from the three GE outfalls and upstream from the flow of cooling water from the Goudey Station. The choice of locations was therefore limited to a ca 50-ft segment of stream between the terminus of the outfall (#3) channel (upstream) and the Goudey cooling water flow (downstream). (The area chosen was, at the time of collection, protected from the

Gaudy outflow by a gravel bar.) The only available locations where the stream was moving quickly were within the bulldozed channel. The stream bottom at this point, because of disturbance and possible contamination by the bulldozer, was not considered suitable for sediment sampling. Location SS-2 sediment was consequently collected from a nearby point, between the bulldozed channel and the gravel bar, where the water was moving slowly.

2. Comparability of stream samples in reference to time.

To enhance comparability, a short time lapse between stream samplings, and especially between stream water samplings, was desired. All near-site creek samples were collected on the same day (November 17, 1991). The regional background creek samples were collected within 24 h of the near-site collection, although on the following day. Because of shipment damage, the regional background stream sediment sample was discarded, and the location was resampled on November 20, 1991. In sum, all creek water samples were collected within 24 h of one another, but regional background sediment samples were collected several days after the near-site sediment samples. No precipitation occurred between samplings. Water temperatures were equivalent at the different sampling times. Water temperature at the time of the regional background sediment sampling was 7°C warmer than at the time of the near-site samplings.

3. Representativeness of the location of regional background stream samples in reference to location.

An uncontaminated point within the stream was sought. The site selected was a point where the Little Choconut passes beneath Chenango Road. Because of conditions there, sediment and water samples were collected at different locations on opposite sides of the road. Though near its source, the stream between the source and the sampling points is potentially affected. What appeared at a distance to have been a small auto grave or salvage yard was noted within the creek's watershed to the north of both sampling points. A culvert (no water flowing) of unknown origin was noted in the highway ditch near stream level, between the sampling point for sediments and that for water.

4. Accuracy of reported coordinates for near-site stream sampling locations.

Field measures referenced to permanent features were taken, and flagged reference markers were placed at the two sediment sampling points. These markers were lost during a high-water event that occurred before the arrival of the survey crew. The surveyors consequently relocated the positions by using the field measures and logged sketch-maps. The coordinates obtained by the surveyors are believed to be within a few feet of the actual sampling points.

5. Accuracy of reported coordinates for regional background sampling locations.

ANL was not required to survey off-site sampling locations. Coordinates were obtained from a topographical map. A single set of coordinates, approximating the center of the bridge, was used in referencing the sediment and water sampling points that were, in fact, on opposite sides of the road. Actual locations relative to landmarks were recorded in the sampling log.

- **Problems Concerning Outfall Sampling**

1. Accuracy of reported coordinates for Outfall 001

There was not enough room between the top of the concrete pad and the highest point of issuance of discharge along the edge of the iron gate to accommodate the sampling containers. Rather than opening the gate, locations on and at the edge of the platform were used instead. (Because the VOA containers were small, it was possible to collect those samples immediately adjacent to the target sampling point.) Actual sampling point locations were described in the logbook, but the invert was used for location-reporting purposes.

2. Accuracy of reported coordinates for Outfall 002 and representativeness of Outfall 002 samples.

Sampling Outfall 001 was problematic. The creek was high, and a mix of outflow and creek water was standing 18 in. deep on the pad. Waters inside and outside the gate were in near equilibrium. The gate was forced open with a crowbar; upon close observation, it was decided that there was sufficient outflow pressure to obtain a sample that was uncontaminated by creek water. Samples were collected within the pipe. For reporting purposes, however, the invert was used as the sampling point reference.

Appendix P:

Quality Assurance Project Plan for AFP 59 IRP Supplemental SI and Laboratory Environmental Analysis QA/AC Manual

Appendix P-1: Quality Assurance Project Plan for AFP 59 IRP Supplemental SI

Appendix P-2: Laboratory Environmental Analysis QA/QC Manual

Appendix P-1:

Quality Assurance Project Plan for AFP 59 IRP Supplemental SI

Quality Assurance Project Plan
for
Air Force Plant 59
Johnson City, New York

Installation Restoration Program
Supplemental Site Inspection

Revision 2 December 19, 1991

Quality Assurance Project Plan
for
Air Force Plant 59
Johnson City, New York

Installation Restoration Program (IRP)
Supplemental Site Inspection

Prepared for
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Issued October 8, 1991
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Revision 2 December 19, 1991

Quality Assurance Project Plan
Air Force Plant 59
Johnson City, New York

IRP
Revision 2 December 19, 1991

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Preface

Because of serious time constraints related to implementing the drilling program described herein, and at the direction of Argonne's sponsor, this plan was modified from a plan covering the same subject that was developed for the Air Force by a previous contractor, EA Engineering, Science and Technology, Inc. Staff members of Argonne National Laboratory and Gradient Corporation updated or modified various sections of the earlier QAPP as a result of new information and/or the inclusion of project specific tasks and New York State Department of Environmental Conservation (NYSDEC) Analytical Service Protocol (ASP) requirements. The QAPP was issued on October 8, 1991, Revision 1 is December 9, 1991 and the final version, Revision 2, December 19, 1991.

Argonne has subcontracted the NYSDEC MP laboratory work to Galson Laboratories, in East Syracuse, New York. Galson is certified through NYSDEC to perform services under the NY CLP ASP program.

Table of Contents

		Page
Title Page		
Table of Contents		
Part A.	Quality Assurance/Quality Control Project Plan	
1	Introduction	1-1
2	Project Description	2-1
2.1	Site Description	2-1
2.2	Site History	2-1
2.2.1	Site No. 1 - Former Underground Waste Oil Storage Tanks	2-1
2.2.2	Site No. 2 - Plating Building	2-2
2.3	Project Objectives	2-2
3	Project Organization and Responsibility	3-1
3.1	Project Manager	3-1
3.2	Quality Assurance Director	3-1
3.3	Quality Assurance Officer	3-2
3.4	On-Site Chemistry Supervisor	3-4
3.5	Field Operations Supervisor	3-4
3.6	Analytical Laboratory	3-5
4	QA Objectives for Measurement Data	4-1
4.1	PSARCC Objectives	4-1
4.1.1	Precision	4-1
4.1.2	Sensitivity	4-2
4.1.3	Accuracy	4-3
4.1.4	Representativeness	4-3
4.1.5	Comparability	4-3
4.1.6	Completeness	4-4
4.2	QA Objectives Summary by Parameter	4-4
5	Sampling Procedures	5-1
5.1	Sample Containers, Preservation and Holding Times	5-1
5.2	Preparation of Sample Containers	5-2
5.3	Decontamination Procedures for Sampling Apparatus	5-2
5.4	Sample Handling, COC and Shipping	5-4
5.5	Sampling Documentation	5-5
5.6	Sampling Procedures for Groundwater, Surface Water, Soil and Sediment	5-5
5.6.1	Groundwater	5-5
5.6.2	Surface Water	5-7

Table of Contents (continued)

		Page
	5.6.3 Soil	5-7
	5.6.4 Sediment	5-7
6	Sample Custody	6-1
	6.1 Field Sampling Custody Procedures	6-2
	6.1.1 COC Documentation	6-2
	6.1.2 Sample Labeling	6-3
	6.1.3 Sample Packing/Shipping	6-4
	6.2 Laboratory Custody Procedures	6-5
	6.2.1 Duties and Responsibilities of Sample Custodian	6-6
	6.2.2 Sample Storage and Security	6-8
	6.3 Final Evidence File	6-8
7	Calibration Procedures and Frequency	7-1
	7.1 Field Instruments	7-1
	7.2 Laboratory Instruments	7-2
8	Analytical Procedures	8-1
	8.1 Laboratory Analytical Procedures	8-1
	8.2 On-Site (Field) Analytical Procedures	8-1
	8.1.1 Screening Procedures - Organics	8-2
	8.2.2 Screening Procedures - Metals	8-3
9	Data Reduction, Validation, and Reporting	9-1
	9.1 Data Reduction	9-1
	9.2 Data Validation	9-3
	9.3 Data Reporting	9-7
10	Internal Quality Control Checks	10-1
	10.1 Field Quality Control	10-1
	10.1.1 Blanks	10-1
	10.1.2 Duplicates/Replicates	10-2
	10.2 Matrix Specific Quality Control	10-3
	10.3 Laboratory Quality Control	10-4
	10.4 QC Acceptance Criteria	10-6
11	Performance and System Audits and Frequency	11-1
	11.1 Field Audits	11-1
	11.2 Laboratory Audits	11-2

Table of Contents (continued)

		Page
12	Preventative Maintenance Procedures and Schedules	12-1
	12.1 Field Equipment	12-1
	12-2 Laboratory Instrumentation	12-1
	12.2.1 Chromatographic Instruments	12-2
	12.2.2 Atomic Absorption Spectrophotometer	12-3
	12.2.3 Inductively Coupled Plasma Spectroscopy	12-3
	12.2.4 Autoanalyzers	12-4
	12.2.5 Analytical Balances	12-5
	12.2.6 Dispensing Devices	12-6
13	Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness	13-1
	13.1 Precision	13-1
	13.2 Accuracy	13-2
	13.3 Completeness	13-4
	13.4 Application of Controls	13-4
14	Corrective Action	14-1
	14.1 Immediate Corrective Action	14-1
	14.2 Long-Term Corrective Action	14-3
15	Quality Assurance Reports	15-1
16	References	16-1
17	List of Acronyms for QA/QC Criteria	17-1
Part B	Field Sampling Methods/Protocols	1-2
1	Introduction	1-2
2	Pre-Drilling Activities	2-1
3	Drilling and Well Construction	3-1
	3.1 Monitoring Well Installation	3-1
	3.2 Shallow Monitoring-Well Installation	3-3
	3.3 Deep Monitoring-Well Installation	3-6
	3.4 Well Development	3-8

Table of Contents (continued)

		Page
3.5	Decontamination	3-9
3.6	Well-Site Restoration	3-9
4	Sampling	4-1
4.1	Soil Sampling	4-1
4.2	Groundwater Sampling	4-3
4.3	Surface-Water/Sediment Sampling	4-5
4.4	Waste Materials Sampling	4-6
4.5	Field QA/QC Sampling	4-7
4.6	Sample Labeling Scheme	4-7
5	Aquifer Testing	5-1
6	Field Equipment	6-1
6.1	Water-Level Surveys	6-1
6.2	Well-Discharge Measurements	6-2
6.3	Equipment Calibration	6-5
6.4	Decontamination Procedures	6-6
7	Surveying	7-1
8	Site Management	8-1
9	Documentation	9-1

Appendices

A Bruker Mobile Environmental Monitor (MEM) GC/MS SOP (ANL)

B. Spectrace 6000 XRF SOP (ANL)

C. Field Audit Checklist

D. Laboratory Audit Checklist

E. Standard Operating Procedures - Modified NYSDEC-ASP 89 Volatile Organics Method Relative to EPA Method 5242

List of Tables

Part A

4-1 Data Quality Objectives
4-2 Accuracy and Precision Data Quality Objectives for Aqueous Organic Analyses
4-3 Accuracy and Precision Data Quality Objectives for Soil/Sediment Organic Analyses
4-4 Accuracy and Precision Data Quality Objectives for Aqueous and Soil/Sediment Inorganic Analyses
4-5 Accuracy and Precision Objectives for Field Measurements
4-6 Data Quality Objectives Defined as DQO Levels
5-1 Sample Volumes, Containers, Preservatives, Holding Times
7-1 Calibration of Field Equipment
8-1 ANL Target Compound List for On-Site Screening of Contaminants in Soil and Water
10-1 QC Frequency Summary
10-2 Quality Control Summary for Laboratory Analyses
10-3 QC Criteria for Laboratory Analyses
10-4 QC Criteria for Field Analyses

Part B

2-1 TCL/TAL Sampling Summary

List of Figures

Part A

2-1 Location and vicinity Map for AFP 59
2-2 Map of AFP 59 Showing Proposed Investigation Sites and Groundwater Monitoring Locations
3-1 Project Organization
4-1 Replicate Sampling Scheme Organic Constituents
4-2 Replicate Sampling Scheme Inorganic Constituents
5-1 Sample Bottle Label
6-1 Chain of Custody Record
6-2 Custody Seal
6-3 Galson Laboratories Internal Chain of Custody

Part B

2-1 Map of AFP 59 Showing Proposed Investigation Sites and Groundwater Monitoring Locations

Part A Quality Assurance/Quality Control (QA/QC)

1 Introduction

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities to ensure the validity of analytical data generated during by Argonne National Laboratory (ANL). The objective of the QA/QC Program is to assess, ensure, and document that all data generated, stored, and reported by ANL are scientifically valid, defensible, and of known precision and accuracy.

QC consists of a system of checks on field sampling and laboratory analyses (through the use of field blanks, duplicates, documentation of all sample movement, chain-of-custody records, etc.) to provide supporting information on the quality of the methods employed and the analytical data.

QA consists of overview checking to certify that the QC procedures have been properly implemented to produce accurate data.

All QA/QC procedures will be in accordance with applicable professional technical standards, New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP), U.S. Environmental Protection Agency (USEPA) requirements, and specific U.S. Air Force (USAF) project goals and requirements. This QAPP is prepared in accordance with USEPA QAPP guidelines, EPA-600/4-83-004, December 1980.

This QAPP is divided into two sections. Part A contains the standard items that define a QAPP as delineated in the USEPA guidelines referenced above. Part B contains the Field Sampling Protocols. So as not to be repetitive, the Part A sections which concern sampling

information will reference Part B wherever applicable. Therefore, the QAPP in it entirety satisfied the requirements for a field sampling plan and a quality assurance project plan.

2 Project Description

2.1 Site Description

AFP 59 is located in Johnson City, New York, in an urban area with significant industrial activity (Figure 1.2-1). The current occupant of the plant is General Electric (GE), whose operations at the plant include the manufacture of flight-control, laser-weapons-control, internal-navigation, and guidance systems. These systems are used in various military and commercial aircraft Between 1942 and 1945, the plant was occupied by Remington Rand for the manufacture of airplane propellers. From 1945 to 1949, the plant was idle; the USAF has managed the site since 1949.

2.2 Site History

To date, Phase I and Phase II, Stage I studies have been conducted at AFP 59. The Phase I report identified one main area of the plant property suspected to be a potential source of contamination. During the Phase II investigation, a second potential source of heavy-metal contamination from plating operations (contamination of the soil underneath the Plating Building) was identified (Figure 1.2-2). The field investigations and discussion of results were undertaken with the intent to fulfill the requirements of the USAF Phase II investigation philosophy.

2.2.1 Site No. 1 - Former Underground Waste Oil Storage Tanks

Contaminated site No. 1 was identified during the 1984 IRP Phase I - Records Search as a potential concern due to spillage associated with several underground oil storage tanks and the close proximity of municipal water supply wells. The Clinton Street-Ballpark Valley aquifer, the aquifer underlying the site, has been designated as a "sole source" aquifer in the Johnson City area.

Historical data indicate that waste oils were routinely spilled in this area and could have caused groundwater contamination.

2.2.2 Site No. 2. - Plating Building

GE identified site No. 2 as an area of concern at the beginning of the Phase II Stage I investigation. The potential source of contamination in this am is plating wastes, and is a concern because of the toxicity and persistence of the heavy metals found in plating wastes. GE personnel identified this area while repairing a leak in the underground sprinkler main beneath the plating building, when they observed discoloration in the soil. GE and USAF personnel expressed concern that heavy metal contaminants might be present and that these contaminants could migrate to the ground water. The influx of water from the leaking sprinkler main could accelerate the migration of these potential contaminant.

2.3 Project Objectives

The primary objective of the present Supplemental Site Investigation is to perform additional soil and groundwater testing to determine whether AFP 59 has significant contamination in its soils of a nature that would lead to contamination of the underlying aquifer. The investigative process involves determining which sites present a threat to human health and the environment and which sites do not.

The long-range objectives of the integrated remedial investigation and feasibility study at AFP 59 are to assess the extent and magnitude of contamination at past hazardous waste disposal and spill sites and to develop remedies consistent with the NCP for those sites that pose a threat to human health or the environment.

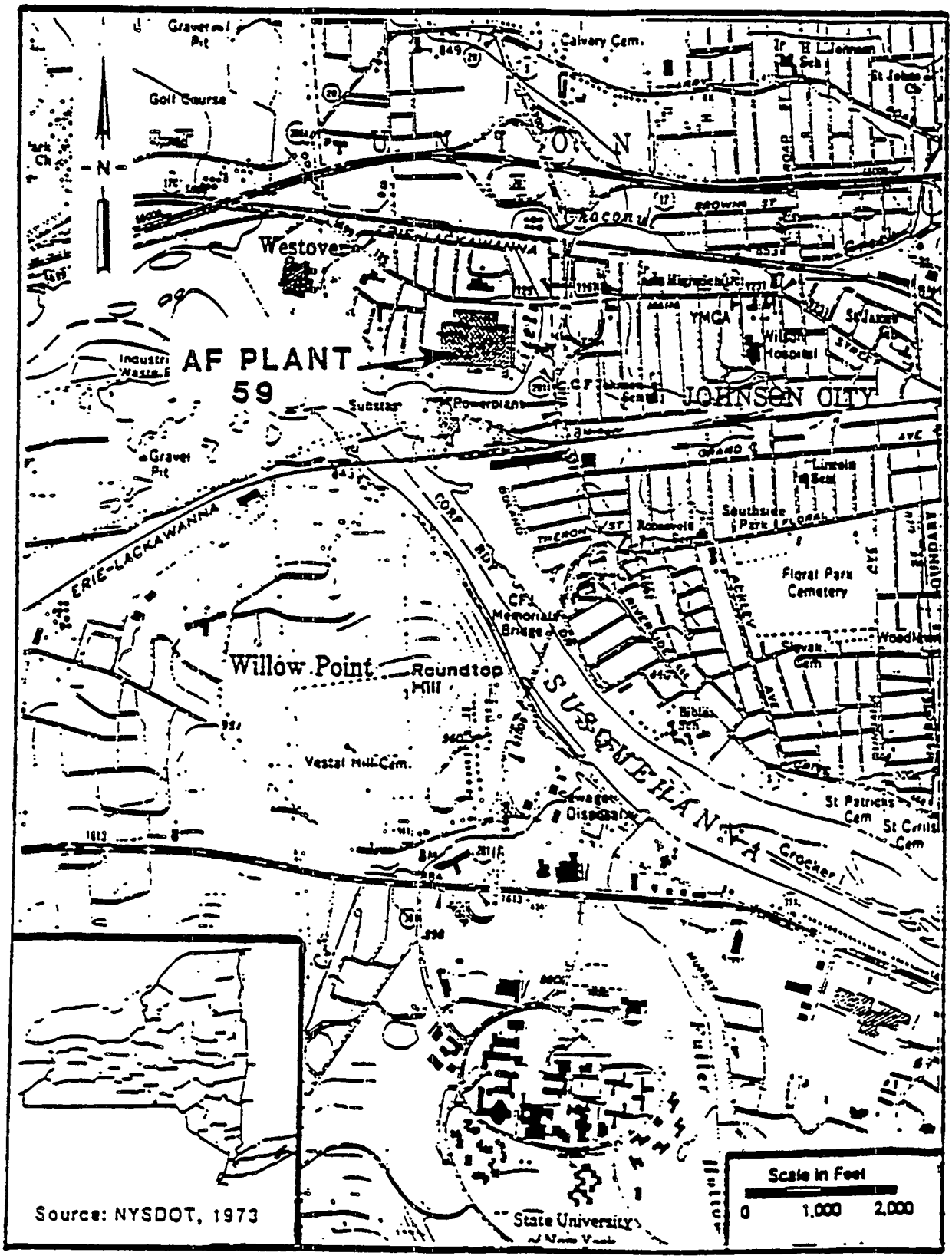


Figure 2-1 Location and vicinity map for AFP 59.

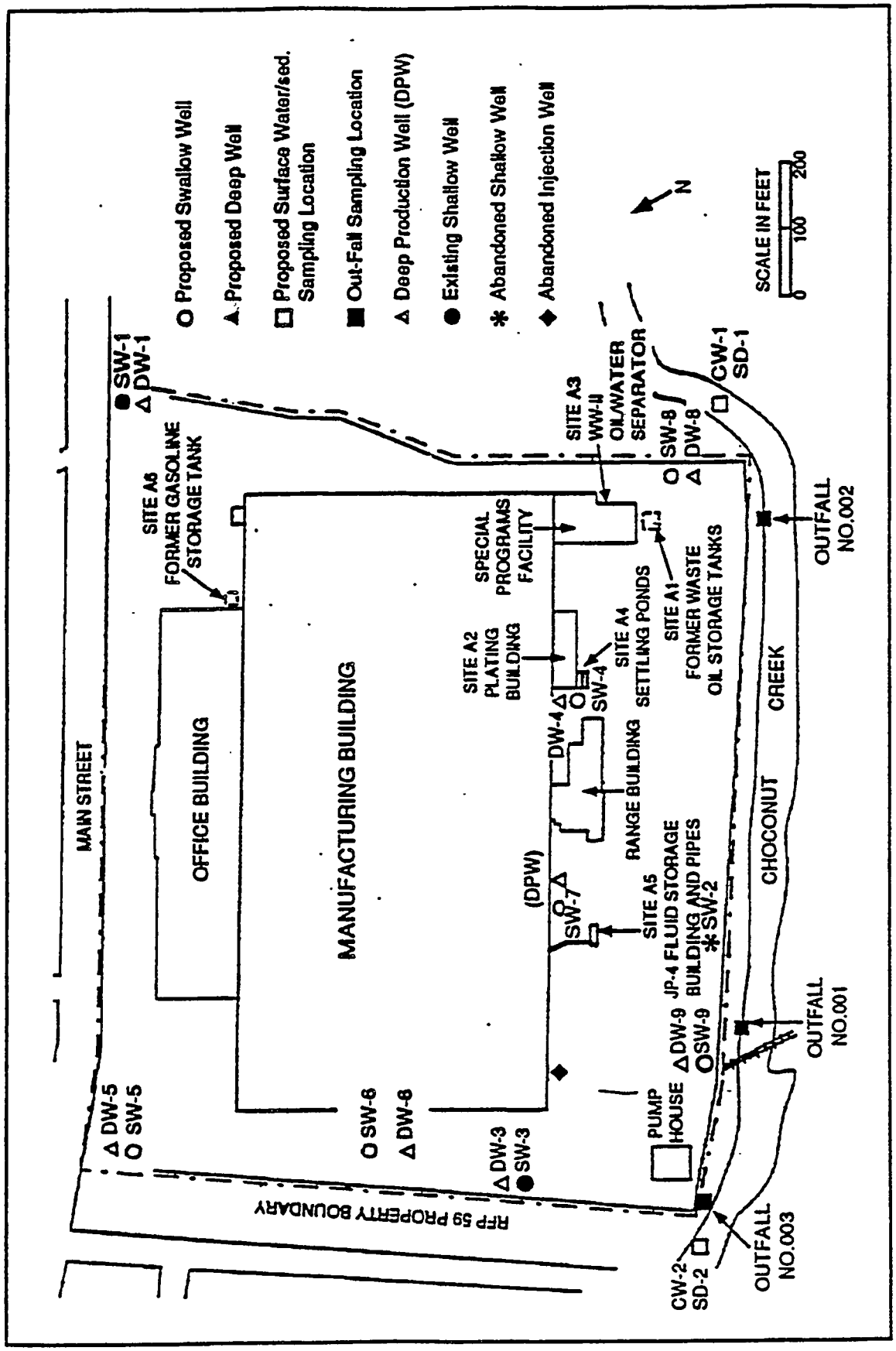


Figure 2-2 Map of AFP 59 showing proposed investigation sites and groundwater monitoring locations. (Note that some well designations are unlike those used in earlier drafts of this plan.)

3 Project Organization and Responsibility

The project team responsible for the implementation and quality of this program consists of representatives from Argonne National Laboratory (ANL), Gradient Corporation, Galson Laboratories, Inc., NYSDEC, and U.S. Air Force/Wright Patterson. A project organizational chart is provided in Figure 3-1.

The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The field operations, analytical laboratory, and quality assurance responsibilities are outlined below.

3.1 Project Manager

The ANL project manager, Wyman Harrison, is responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, fiscal, and scheduling objectives are successfully achieved.

3.2 Quality Assurance Director

The Quality Assurance (QA) director for ANL is John Kelley. The QA director will remain independent of direct job involvement and day-to-day operations, and will have direct access to staff as necessary to resolve any QA dispute. He is responsible for implementing the QA Program in conformance with the demands of specific investigations, ANL policies, and sponsor requirements. Specific functions and duties include:

- Identifies and substantiates conformance and nonconformance conditions or situations found during quality audits and reviews to cognizant management.

- Initiates, recommends, or facilitates solutions to identified quality problems with responsible staff.

- Verifies the implementation of effective corrective actions.

- Provides assistance to the program manager on matters affecting quality of work for this project.

- Provides for the maintenance of a record of project audits, including discrepancies and their resolutions.

- Provides for the review of controlled quality-related documents for each technical discipline to ensure that all applicable quality requirements are addressed.

3.3 Quality Assurance Officer

The Quality Assurance Officer is Dallas Wait of Gradient Corporation. He is responsible for maintaining quality assurance for the NYSDEC certified analytical chemistry laboratory. Specific functions and duties include:

- Performs facility/laboratory audits for compliance with the project requirements, based on this QAPP and NYSDEC ASP.

- Prepares detailed inspection reports, outlining problems encountered during audits and makes recommendations.

- Reviews procedures, methods, protocols, study and QA/QC plans for completeness, and provides written reports noting inconsistencies.

- Monitors daily QC activities to determine conformance to QA/QC Plan of project requirements.

  - frequency of control samples
  - instrument calibrations
  - quality control chart documentation

- Notifies laboratory and project management of out-of-control situations.

- Reviews on a scheduled basis all QC data and generates proficiency and status reports to management.

- Maintains nonconformance reports (NRs). Monitors for completeness and follows up where appropriate. Uses NRs for developing "trend analysis" of out-of-control situations.

- Maintains record of audits (internal and external), including discrepancies and their resolutions.

3.4 On-Site Chemistry Supervisor

The On-Site Chemistry Supervisor is Larry Reed. He is responsible for all on-site chemical analytical work and works in conjunction with the Field Operations Supervisor and on-site geohydrologist.

Specific duties include:

- Ensures on-site data quality in accordance with procedures involving ANL portable analytical equipment as outlined in this QAPP.
- Makes on-the-spot decisions on revised sampling strategies as a function of unexpected soil contaminant findings.
- Sets field analytical priorities

3.5 Field Operations Supervisor

The Field Operations Supervisor, Barney Nashold, is responsible for all field sampling activities ensuring that the field team maintains proper sampling and decontamination procedures in collecting samples and proper labeling and shipping procedures are followed for samples being sent to Galson for laboratory analyses. The Field Operations Supervisor is also responsible for initiating and maintaining chain-of-custody procedures as defined in this QAPP.

3.6 Analytical Laboratory

Galson Laboratories, a NYSDEC certified laboratory under the Environmental Laboratory Approval Program (ELAP), will be handling the ASP (Analytical Services Protocol) chemical laboratory analyses for this project. All laboratory work will be performed in accordance with guidelines established by NYSDEC ASP (September 1989). The laboratory is responsible for maintaining strict QA/QC programs as required under NYSDEC ASP for all the instruments, preparations and analytical procedures employed during this project.

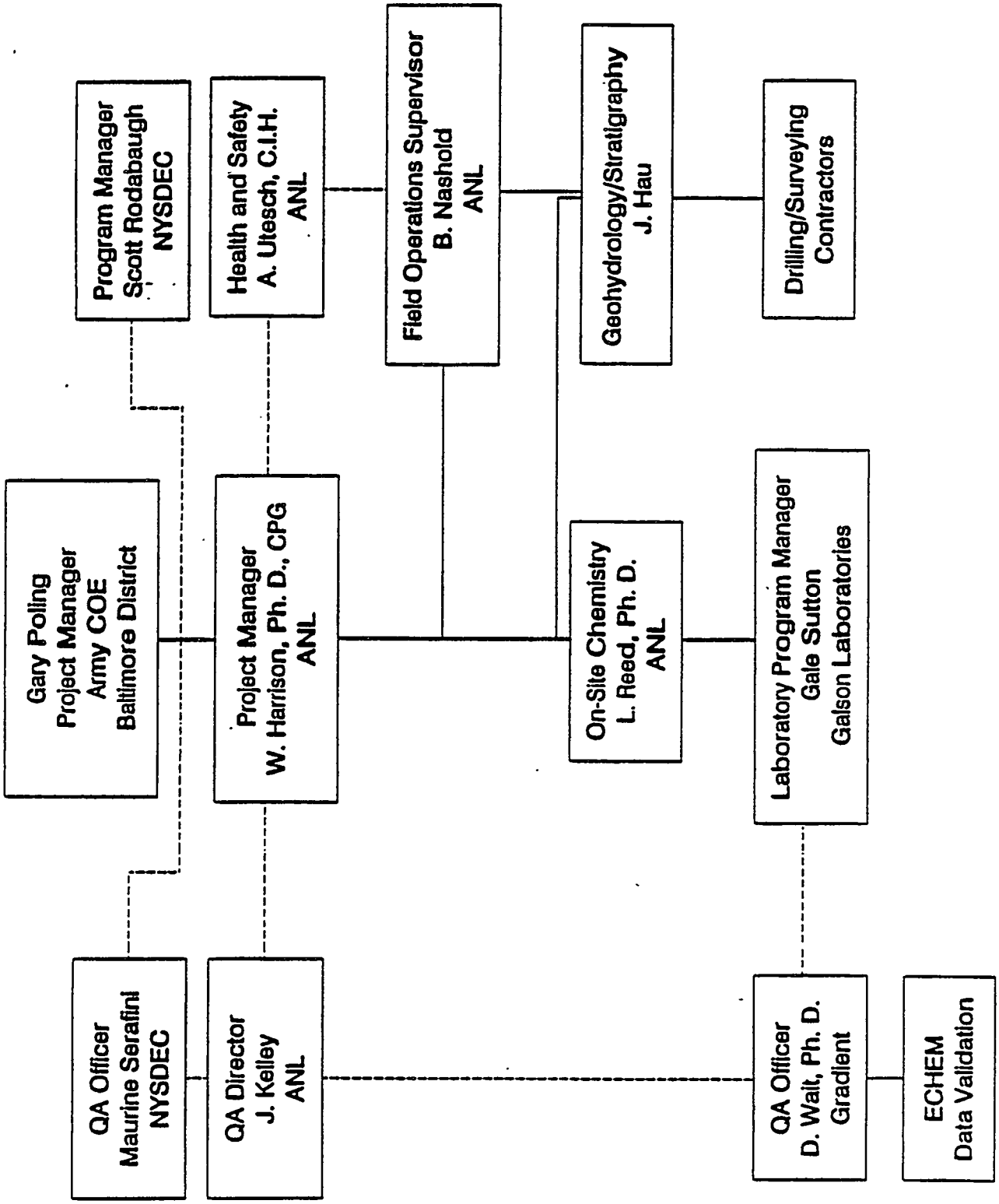


Figure 3-1 Project Organization

4 QA Objectives for Measurement Data

The primary objective of the Quality Assurance (QA) program is to provide data of sufficient quality and quantity to assure project objectives as stated in Section 3.0 are achieved. Data quality and quantity are measured through comparison of resulting data with established acceptable limits for data precision, sensitivity, accuracy, representativeness, comparability, and completeness (PSARCC) as described in USEPA/540/G-87-003, titled "Data Quality Objectives for Remedial Response Activities." Data that have certain aspects that may be outside PSARCC QA objectives will be evaluated to determine what, if any, aspects of the data can be defensibly used to meet the IRP objectives. Objectives for the PSARCC parameters for this project are described below.

4.1 PSARCC Objectives

PSARCC parameter objectives have been developed for soil/sediments and waters based on sample objectives, analytical methods, historical data (examined in a qualitative sense) and published guidelines for EPA's Contract Laboratory Program (CLP) and NYSDEC ASP (1989) as listed in Section 17 (References).

Data quality objectives are summarized on Table 4-1. Tables 4-2 through 4-4 contain PSARCC objectives for the laboratory analyses and Table 4-5 for the field measurements. PSARCC parameter objectives will be achieved through the use of standardized sample collection and analysis procedures.

4.1.1 Precision

Precision measures the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average

value. Precision is usually stated in terms of relative percent difference or relative standard deviation. Measurement of precision is dependent upon sampling technique and analytical method. Both sampling and analysis will be as consistent as possible.

To monitor that precision, QC samples, including field and laboratory duplicate samples, and matrix spike and matrix spike duplicate recoveries will be analyzed and used to measure precision. A scheme for spiking replicate samples for organic constituents is provided in Figure 4-1 and for inorganic parameters in Figure 4-2. An additional measure of precision for organic compounds is the comparison of surrogate recoveries between the unspiked, matrix spike, and matrix spike duplicate sample aliquots. A one-in-twenty frequency per matrix will receive a laboratory duplicate analysis (inorganics) and matrix spike/matrix spike duplicate (organics analysis). In general, field blanks will be collected at a frequency of one per 20 water samples per day and one per 20 sediment samples. The minimum frequency of field blanks will be one per matrix per day during a continuous sampling event.

Field duplicates/replicates will be collected once for every 20 samples per matrix. Field duplicate/replicate results will be evaluated during data validation with respect to the stated DQOs.

4.1.2 Sensitivity

Quantitation limits for all analysis scheduled to be completed for this project effort are specified in Section 8 of this QAPP. Quantitation limits may be affected by matrix interferences, such as those caused by highly contaminated samples. In a case in which method specified detection limits are not achieved, sample/extract cleanups will be performed. If the quantitation limits are still not achievable, the applicability of the data, with respect to meeting the IRP objectives, will be evaluated by the QA officer, QA director, and program manager.

4.1.3 Accuracy

Accuracy is a measure of the bias in a measurement system which may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are: laboratory error, sampling inconsistency, field contamination, laboratory contamination, handling, matrix interference, and preservation. Field and trip blanks, surrogate spikes, matrix spike blanks, laboratory control samples, check samples, and matrix spike QC samples will be used to measure accuracy for project samples where applicable to the specific method.

4.1.4 Representativeness

Representativeness expresses the degree to which sample data represents the characteristics of the media or matrix from which it is collected. Samples that are considered representative are ones that are properly collected to accurately characterize the nature and extent of contamination at a given location. Therefore, a large number of sampling locations, a high rate of sample replication and consistent sampling methods will be implemented. Representativeness will be measured by using the methods (*e.g.* sampling, handling, and preserving) specified in the Field Sampling Methods/Protocols Section of this QAPP (Pan B) and the consistent methodologies listed in NYSDEC/ASP (9/89). Comparison of the analytical results from field replicates (duplicates) will provide a direct measure of individual sample representativeness. At a minimum field duplicates will be collected once for every 20 samples for the soils/sediments and waters. Table 4-1 lists objectives for sample representativeness based on field replicate precision.

4.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which data sets can be compared. Comparability relies upon precision and accuracy to be within appropriate QC limits before the data can be used for comparison of data sets. This will be accomplished through the

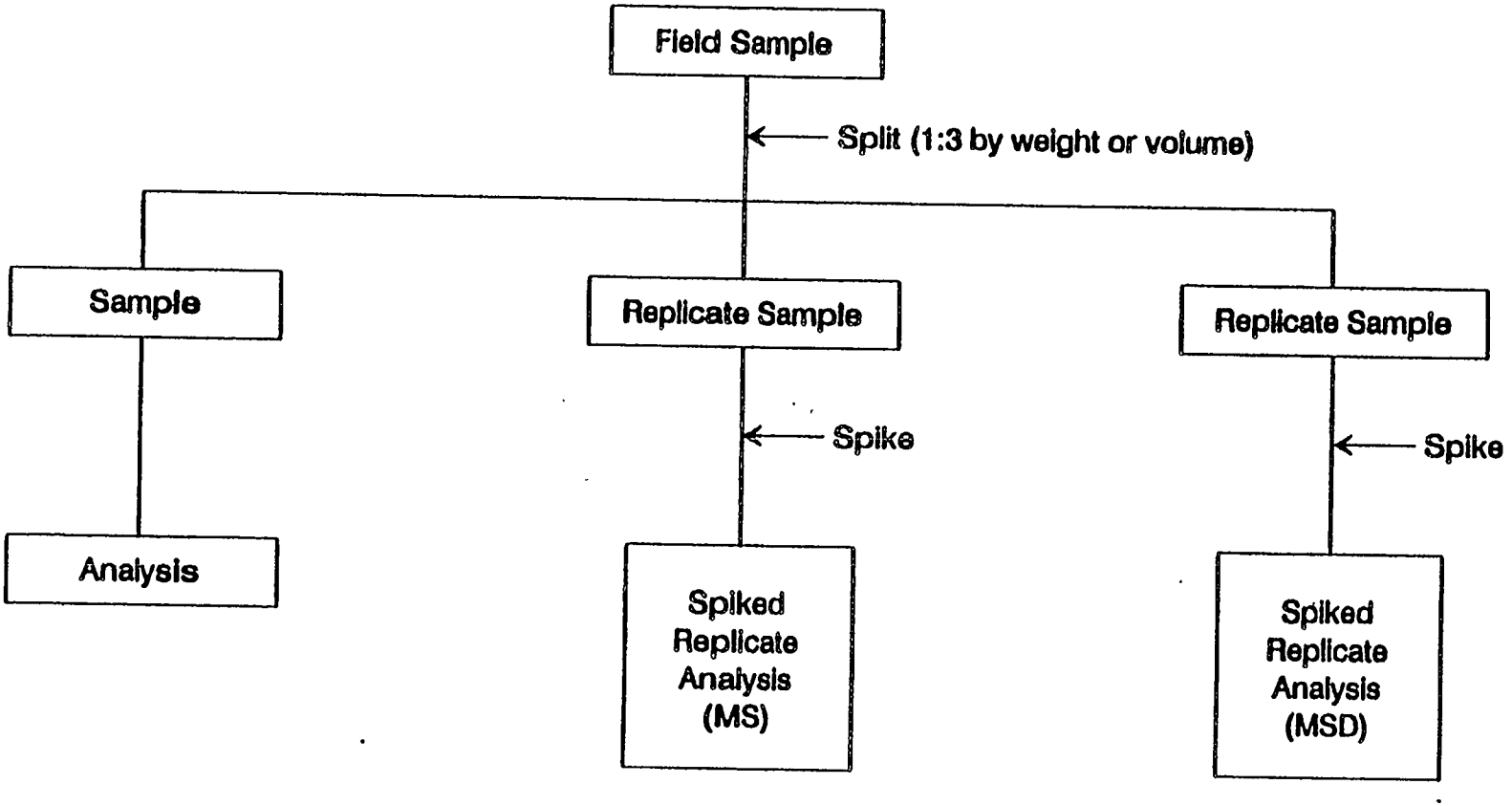
consistent use of the analytical and sampling methods described in this document. The use of NYSDEC ASP and USEPA CLP methods assures that the parameters being measured are comparable with data generated from other sources under these protocols.

4.1.6 Completeness

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the investigation compared to the total amount of data collected. Deficiencies in the data may be due to sampling techniques, poor accuracy or precision, or laboratory error. While these deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. Every effort will be made to avoid sample or data loss through accidents. Collection of sufficiently large sample volumes to allow for reanalysis in the event of loss of data due to inadvertent means will be implemented.

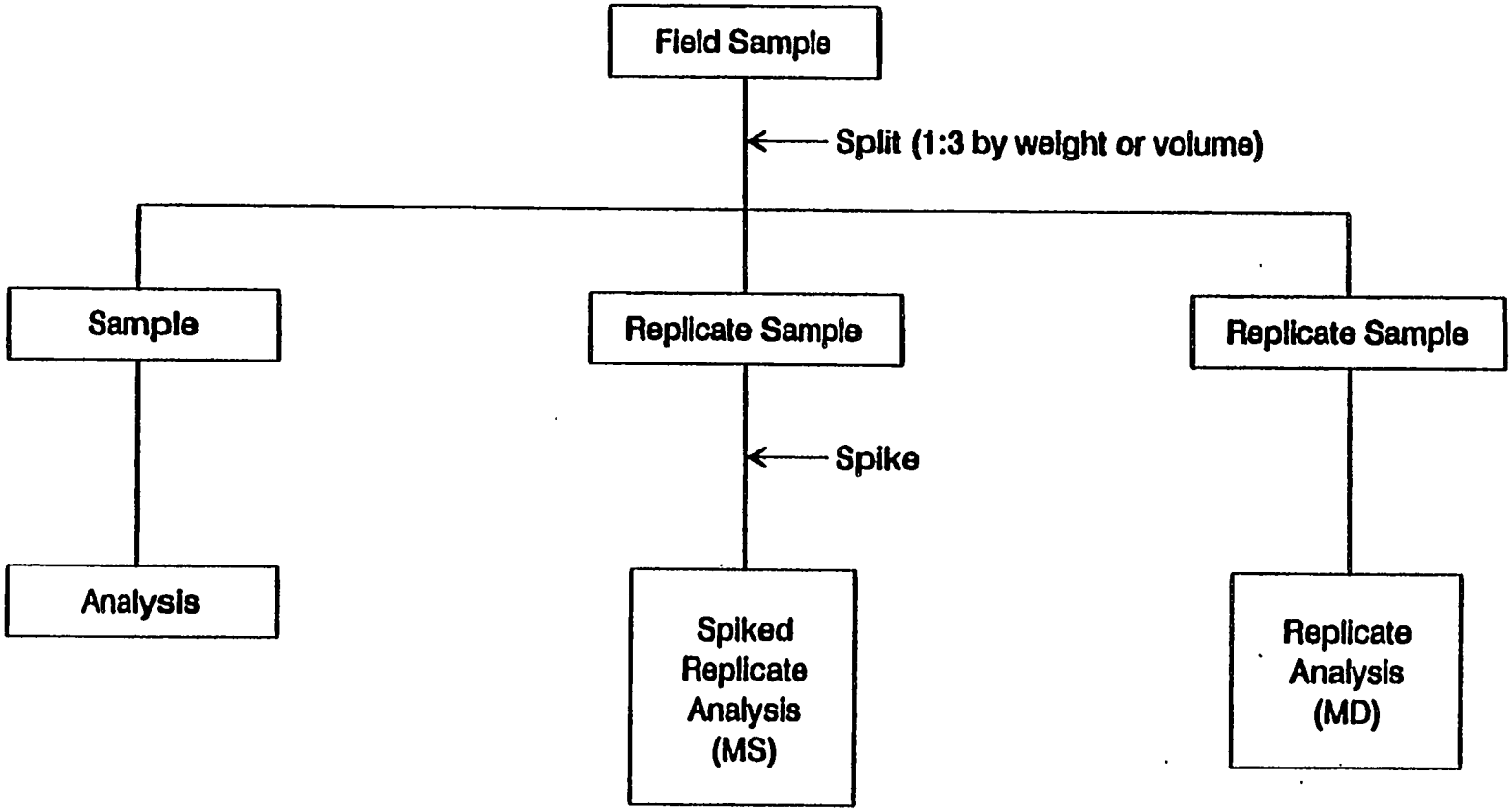
4.2 QA Objectives Summary by Parameter

The general QA objective for field measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of the data through the documented use of standardized procedures. The procedures for performing these activities and the standardized formats for documenting them are presented in Section 2 of this QAPP. Note that the intended use for several of the field parameters are as screening techniques and therefore the level of quality control differs from the more precise and accurate laboratory measurements. A summary of the overall project Data Quality Objectives (DQOs) for the field and laboratory measurements and the required levels of DQOs are presented as Table 4-5.



MS = Matrix Spike Sample
MSD = Matrix Spike Duplicate Sample

Figure 4-1 Replicate Sampling Scheme Organic Constituents



MS = Matrix Spike Sample
MD = Matrix Duplicate Sample

Figure 4-2 Replicate Sampling Scheme Inorganic Constituents

TABLE 4-1
DATA QUALITY OBJECTIVES

DQO Parameter	Objective
Precision	Tables 4-2 and 4-3
Accuracy	Tables 4-2 and 4-3
Sensitivity	Section 9 of the QAPP
Representativeness	Inorganic-Aq < 50% RPD @ > CRDL
	Inorganic-Sol < 100% RPD @ > CRDL
	Organic-VOA < 30% RPD (Aq), <50% RPD (Sol)
	Organic-BN < 30% RPD (Aq), <50% RPD (Sol)
	Organic-Acids < 30% RPD (Aq.), <50% RPD (Sol)
	Organic-Pesticides/PCBs <30% RPD (Aq), <50% RPD (Sol)
Completeness	90%
Comparability	Based on Precision and Accuracy and Media Comparison

Notes:

RPD = Relative Percent Difference
CRDL = Contract Required Detection Limit
BN = Base/Neutral

TABLE 4-2
ACCURACY AND PRECISION DATA QUALITY OBJECTIVES FOR AQUEOUS ORGANIC ANALYSES

Parameter	QC Compounds	Field Duplicate Precision (% RPD)	MS/MSD Precision (% RPD)	Blanks	MS/MSD Accuracy (% Recovery)	Surrogate Accuracy (% Recovery)
VOA	All analytes	<30		<5xCRQL for MeCl, acetone, toluene, 2-butanone ≤CRQL for all other compounds		
	1,1-dichloroethene		<14 (95% C.L)		61-145	
	trichloroethene		<14		71-120	
	benzene		<11		76-127	
	toluene		<13		76-125	
	chlorobenzene		<13		75-130	
	D_4-1,2dichloroethene					76-114
	D_8-toluene					88-110
	bromofluorobenzene					86-115
BNA Analysis	All analytes	<30		<5xCRQL phthalates ≤CRQL all other compounds		
	phenol		<42		12-89	
	2-chlorophenol		<40		27-123	
	1,4-dichlorobenzene		<28		36-95	
	N-nitroso-di-n-propylamine		<38		41-116	
	1,2,4-trichlorobenzene		<28		39-98	
	p-chloro-m-cresol		<42		23-97	
	acenaphthene		<31		46-118	
	4-nitrophenol		<50		10-80	
	2,4-dinitrotoluene		<38		24-96	
	pentachlorophenol		<50		9-103	
	pyrene		<31		26-127	
	d_5-nitrobenzene					35-14
	2-fluorobiphenyl					43-116
	D_{14}-terphenyl					33-141
	D_5-phenol					10-94
	2-fluorophenol					21-100
	2,4,6-tribromophenol					10-123
Pesticide/ PCB Analyses	All analytes	<30		<CRQL		
	lindane		<15		56-123	
	heptachlor		<20		40-131	
	aldrin		<22		40-120	
	dieldrin		<18		52-126	
	endrin		<21		56-121	
	4g,4'-DDT		<27		38-127	

TABLE 4-3
ACCURACY AND PRECISION DATA QUALITY OBJECTIVES FOR SOIL/SEDIMENT ORGANIC ANALYSES

Parameter	QC Compounds	Field Duplicate Precision (% RPD)	MS/MSD Precision (% RPD)	Blanks	MS/MSD Accuracy (% Recovery)	Surrogate Accuracy (% Recovery)
VOA	All analytes	<50		<5xCRQL for MeCl, acetone, toluene, 2-butanone ≤CRQL for all other compounds		
	1,1-dichloroethene		<22		59-172	
	tricloroetbene		<24		62-137	
	benzene		<21		59-139	
	toluene		<21		66-142	
	chlorobenzene		<21		60-133	
	D_4-1,2dichloroethene					70-121
	D_8-toluene					81-117
	bromofluorobenzene					74-121
BNA Analysis	All analytes	<50		<5xCRQL phthalates ≤CRQL all other compounds		
	phenol		<35		26-90	
	2-chlorophenol		<50		25-102	
	1,4-dichlorobenzene		<27		28-104	
	N-nitroso-di-n-propylamine		<38		41-126	
	1,2,4-trichlorobenzene		<23		38-107	
	p-chloro-m-cresol		<33		26-103	
	acenaphthene		<19		31-137	
	4-nitrophenol		<50		11-114	
	2,4-dinitrotoluene		<47		28-89	
	pentachlorophenol		<47		17-109	
	pyrene		<36		35-142	
	d_5-nitrobenzene					23-120
	2-fluorobiphenyl					30-115
	D_{14}-terphenyl					18-137
	D_5-phenol					24-113
	2-fluorophenol					25-121
	2,4,6-tribromophenol					19-122
Pesticide/ PCB Analyses	All analytes	<50		<CRQL		
	lindane		<50		46-127	
	heptachlor		<31		35-130	
	aldrin		<43		34-132	
	dieldrin		<38		31-134	
	endrin		<45		42-139	
	4g,4'-DDT		<50		23-134	

TABLE 4-4
ACCURACY AND PRECISION DATA QUALITY OBJECTIVES FOR AQUEOUS AND SOIL/SEDIMENT INORGANIC ANALYSES

Parameter	QC Compounds	Blanks	Field Duplicate Precision (% RPD)	MS/MD Precision (% RPD)	MS Accuracy (% Recovery)	LCS Accuracy (% Recovery)
Metals and Cyanide	All analytes	<±CRDL	<50	<20% RPD for results >5xCRDL; <±CRDL for results <5xCRDL	75-125[a]	80-120[b]

[a]Unless the sample concentration exceeds the spike added concentration by a factor of 4 or more.
[b]Solid LCS recovery criteria established as 95% confidence interval from mean true value, EPA provided LCS or equivalent.

TABLE 4-5
ACCURACY AND PRECISION OBJECTIVES FOR FIELD MEASUREMENTS

Measurement	Precision	Accuracy
pH	±0.1 pH units	±0.1 pH units
Conductivity	±10/25/250 umho/cm[1]	±5/25/250 umho/cm[1]
Temperature	±0.1°C	±0.1°C
Turbidity	±0.5NTU	±0.5NTU

[1]Dependent upon scale used in measurements

TABLE 4-6
DATA QUALITY OBJECTIVES DEFINED AS DQO LEVELS

Sample Matrix	Parameter	Field	Laboratory	DQO Level[1]
Soil/Sediment	TCL Semivolatile Organics		x	IV
	TCL Volatile Organics		x	IV
	TCL Pest/PCBs		x	IV
	TAL Metals & Cyanide		x	IV
	Grainsize Distribution		x	III
	Atterberg Limits		x	III
	GCMS Screen	x		I
	EDXRF Screen	x		I
Water	TCL Semivolatile Organics		x	IV
	TCL Volatile Organics		x	IV
	TCL Pest/PCBs		x	IV
	TAL Metals & Cyanide		x	IV
	GCMS Screen	x		I
	pH	x		I
	Specific Conductance	x		I
	Temperature	x		I
	Turbidity	x		I

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1 Defined in "Data Quality Objectives for Remedial Response Activities", USEPA/540/G-87-003 (1987).

- Level IV - CLP Routine Analytical Services (RAS). This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data and is equivalent to DQO requirements under NYSDEC ASP (9/89).

- Level III - All analyses are performed in an off-site analytical laboratory using standard methods other than the EPA CLP RAS (e.g., ASTM methods for Atterberg Limits and Grainsize).

- Level I - Field screening. This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.

5 Sampling Procedures

Quality assurance in sampling is critical to the production of useful data because it must be assured that the acquired sample is representative of the process or effluent stream under investigation. Sampling activities will be carried out so as to provide laboratory personnel with sufficient material for analysis which is representative of the sample source and to do so without compromising sample integrity. In order to accomplish these ends, good sampling practices must be combined with a quality control program and these in turn will be monitored for effectiveness through the quality assurance program and field audits.

Part B of this QAPP, Field Sampling Methods/Protocols, delineates the sampling events which will comprise this IRP effort. Specific descriptions of sample site selection, the number and location of sampling points, and detailed sampling procedures are also provided in Part B. The following section contains information on sample volumes, containers, preservation, holding times, decontamination procedures, shipping, and field documentation, as well as brief descriptions of the general sampling procedures for groundwater, surface water, soils and sediments.

5.1 Sample Containers, Preservation, and Holding Times

For all inorganic analysis, water samples will be collected in high-density linear polyethylene bottles and soils in glass jars with teflon-lined caps. For organic analysis (except VOAs), waters will be collected in amber glass bottles with teflon-lined caps and soils in glass jars with teflon-lined caps. VOA samples will be collected in glass vials with teflon-lined septa. Table 5-1 lists sample volumes, containers, preservatives, and holding-times which comply with NYSDEC ASP for this project.

5.2 Preparation of Sample Containers

All sampling containers will be provided pre-cleaned by the analytical laboratory (Galson). Pre-cleaned containers will be purchased from a reputable vendor and will comply with EPA Grade 3 level of preparation.

5.3 Decontamination Procedures for Sampling Apparatus

All portions of the sampling apparatus that come into contact with the sampled stream will be cleaned both before the sampling apparatus is used for the first time and after a sample is acquired. After the apparatus has been cleaned and dried, it will be stored in boxes or covered with plastic in a contaminant-free environment. The following cleaning and decontamination procedures will be followed.

General Procedures

1. An decontamination and subsequent use of decontaminated equipment will be documented in the field notebook.

2. If visual signs such as discoloration indicate that decontamination was insufficient, the equipment will again be decontaminated. If the situation persists, the equipment will be taken out of service until the situation can be corrected.

3. Verification of the non-dedicated sampling equipment cleaning procedures will be documented by the collection of field blanks and trip blanks. Additionally rinsate blanks will be collected for analysis consisting of the potable water used to rinse apparatus in the cleaning procedures.

4. The need for containerizing drill cuttings and purge water are described in the site management section of Part B of this QAPP.

5. An properly decontaminated equipment will be stored in aluminum foil (for organics) and plastic bags (for inorganics) when not in use.

Heavy Equipment

Before drilling the first well, between drilling web, and after the final well, all drilling, measuring, and sampling equipment that have contacted potentially contaminated soils or water will be decontaminated. A decontamination area will be constructed so that heavy equipment can be laid out on blocks and steam-cleaned with potable (drinking water quality) water. Immediately prior to installation, the PVC well pipe, screen, and protective steel casing will be steam-cleaned. All pumps, pipes, hoses, and other equipment that cannot be internally scrubbed will be flushed with potable water.

Hand Sampling Tools and Small Sampling Equipment

Decontamination of hand-sampling tools and equipment will be accomplished as follows:

Inorganics	Organics
1. Non-phosphate detergent wash (Alconox)	1. Non-phosphate detergent wash (Alconox)
2. 0.1 N HCL rinse	2. Potable water rinse (drinking quality water)
3. Tap water rinse (drinking quality water)	3. Methanol spray rinse
4. Deionized water rinse (reagent grade II water)	4. Deionized/Distilled water rinse (reagent grade II water)
5. Air dry in a clean environment	5. Air dry in a clean environment

Temperature, Conductivity, Turbidity, and pH

These probes used during ground water and surface water sampling will be decontaminated via the procedures specified below:

1. Wash with non-phosphate detergent solution (Alconox).
2. Potable water rinse.
3. Deionized water rinse.

An equipment will be transported and stored in plastic sheeting. Decontamination fluids and other associated wastes will be collected in drums and stored in a temporary storage area for subsequent hazardous waste characterization and disposal.

5.4 Sample Handling, COC and Shipping

After the samples are collected, they will be split as necessary among containers and preservatives appropriate to the parameters to be determined (reference Table 5-1). Each container will be affixed with a sample label (Figure 5-1) which will be filled out at the time of collection by a member of the sampling teams. At this time, a chain-of-custody (COC) form will be initiated. See Section 6 for details on labeling and COC procedures. The collected samples will be cooled to 4°C and shipped to the laboratory on the day of collection, if possible, but no later than 24 h following collection to insure that holding times will be met. The chain-of-custody form will be signed and dated as necessary as the samples pass from the collectors to those persons responsible for their transportation. Shipping to the analytical laboratory (Galson laboratories) will be by overnight carrier for next-day delivery or same-day delivery by an ANL staff carrier.

5.5 Sampling Documentation

Field notebooks used by ANL personnel will be bound or maintained in a 3-ring notebook. All pertinent information regarding the site and sampling procedures will be documented in log book fashion, noting the time and date of all entries. Information recorded in this notebook will include, but not be limited to the following: place or site of investigation, exact location; date and time of arrival and departure; affiliation of persons contacted; name of sampling person keeping log; names of all persons on site; field instrument calibration information; location of sampling points (including justification); number of samples taken; volume of samples taken; method of sample collection and any factors that may affect its quality; date and time of sample collection; name of collector; all sample identification numbers; description of samples; weather conditions on the day of sampling and 48 hours previous; and any other pertinent field observations. All data entries will be made in indelible ink and all corrections to the data will be a single-line cross out, dated, and initialed.

5.6 Sampling Procedures for Groundwater, Surface Water, Soil and Sediment

5.6.1 Groundwater

All groundwater sampling will occur after the web have been developed according to specific geotechnical requirements specified in the contract. Because drilling and well construction disturb the natural groundwater system, the maximum possible length of time (two weeks nominal) shall pass between well development and sampling to allow the groundwater system to return to chemical equilibrium. All samples from the test web will be collected in Teflon bailers that are thoroughly decontaminated prior to sampling. All down-bole equipment used during the purging and sampling of the test wells will be carefully cleaned given procedures specified in Section 5.3.

The following procedures will be followed each time a monitor well is sampled:

1. Measure the depth from the top of the well casing (not protective casing) to the top of the water and record the depth in the or field notebook.

2. Measure and record (twice only, immediately after well installation) the depth from the top of the casing to the bottom of the well.

3 Subtract the depth to top of the water from the depth to the bottom of the well to determine the height of standing water in the casing.

4. Remove a quantity of water from the well equal to four times the calculated volume of water in the well casing.

   If the well goes dry during pumping or bailing one is assured of removing all water which had prolonged contact with the well casing or air. If the recovery rate is rapid, allow the well to recover to its original level and evacuate a second time before sampling. If recovery is very slow, samples may be obtained as soon as sufficient water is available.

5. Obtain a sample of ground water for temperature, conductivity, turbidity, and pH measurements. Record these measurements in the field notebook.

6. Obtain samples for chemical analysis. The order for sampling should be volatile organics, semivolatile organics, pesticides, metals, and cyanide.

7. Check that appropriate preservative has been added to sample containers and fill appropriate containers with samples.

8. Cap each filled sample container securely and wipe external surface of container thoroughly.

9. Label samples in accordance with standard procedures outlined in Sections 5 and 6 of this QAPP.

10. Complete chain-of-custody record for labeled samples as per procedures outlined in section 6 of this QAPP.

11. Place sample bottle(s) in a temperature controlled (4°C) chest immediately after sampling and deliver to the laboratory within 24 h of sample collection to be received by laboratory within 48 h of sample collection.

5.6.2 Surface Water

Before sampling, sample collection equipment shall be rinsed downflow or away from the sampling point, taking care not to disturb sediments at-the Sampling point. After sampling each location, any equipment used in collection of the samples shall be cleaned per procedures previously outlined. As proper cleaned sample containers will be provided by the laboratory with preservatives in the containers, no pre-rinsing of sample containers at the site will be performed.

To obtain field measurements and samples for analysis, follow steps 5 through 11 as for groundwater sampling.

5.6.3 Soil

The sampling team is responsible for collecting representative samples that can be analyzed as received from the field. The Field Operations Supervisor must train the sampling team in the

types of soils to be collected, the components of interest in them and how to collect the sample that will represent the matrix of interest. Specifically, the sampling team is trained to remove all items or artifacts in the sample aliquot that are not integral components of the matrix of interest.

All equipment will be thoroughly cleaned between use at different sampling locations to prevent cross-contamination of samples. Cleaning procedures are outlined in Section 5.3.

Samples will be obtained for analysis using clean hand-sampling tools (spoons, spatulas, etc.). Steps 6 through 11 as listed in groundwater sampling will be followed for sample procurement.

5.6.4 Sediment

The sampling team is responsible for collecting representative samples that can be analyzed as received from the field, or composited in the lab. The Field Operations Supervisor will instruct the sampling team in the types of sediments to be collected, the components of interest in the sample, and how to collect the sample that will represent the matrix of interest. Specifically, the sampling team will have training to remove all artifacts or items that are not integral components of the matrix of interest. The types of sampling equipment to be used are detailed in Part B of this QAPP.

Prior to sampling sediment in a stream, the sampling device will be rinsed with stream water at a point downstream from the sampling location to avoid disturbing the sediment at any sampling point. Also, sampling shall be accomplished upstream of any disturbances in the stream caused by the sampler or sampling team. Twigs, leaves, pebbles, and debris that are not integral components of the matrix of interest will be excluded from the sample by the sampling team.

All equipment will be thoroughly cleaned between use at different sampling locations to prevent cross-contamination of samples. Cleaning procedures have been outlined in Section 5.3.

Samples will be obtained for analysis using equipment and procedures outlined in Part B of this QAPP and following steps 6 through 11 as listed under groundwater sampling.

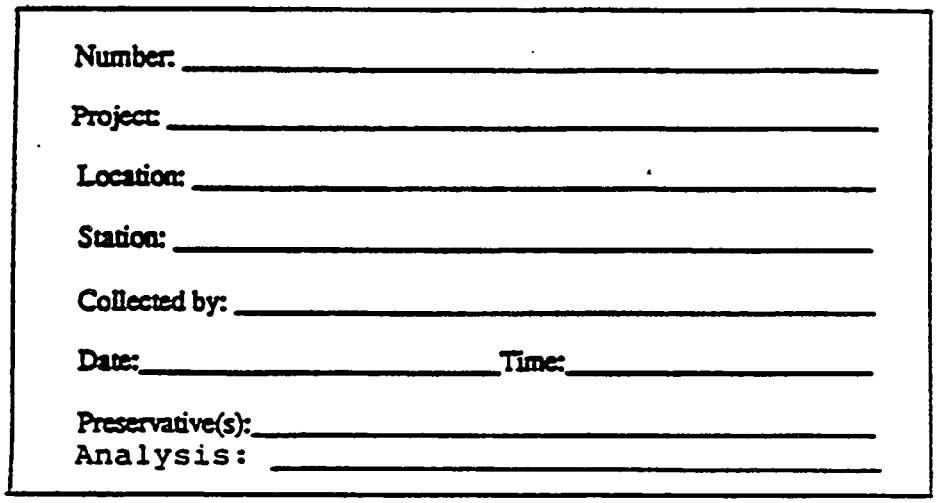


Figure 5-1 Sample bottle label.

TABLE 5-1
SAMPLE VOLUMES, CONTAINERS, PRESERVATIVES, HOLDING TIMES

Parameter	Matrix	Volume and Container[1]	Preservative	Holding Time[2] (d = days)
TCL Organics				
Semivolatiles	Water	2 x 1/2 gal amber glass bottles; teflon-lined caps	Cool 4°C	5 d to extraction/40 d to analysis
	Soil/Sediment	8 oz amber glass jar; teflon-lined caps	Cool 4°C	
Volatiles[3]	Water	3 x 40 ml glass VOA vials; teflon-lined septum	Cool 4°C	7 d to analysis
	Soil/Sediment	2 x 40 ml glass VOA vials; teflon-lined septum	Cool 4°C	
Pesticides/PCBs	Water	2 x 1/2 gal amber glass bottles; teflon-lined caps	Cool 4°C	5 d to extraction/40 d to analysis
	Soil/Sediment	8 oz amber glass jar; teflon-lined caps	Cool 4°C	
TAL Inorganics				
Metals (except mercury)	Water	1000 ml polyethylene bottle; poly or teflon-lined caps	HNO^3 to pH < 2 Cool 4°C	180 d to analysis
	Soil/Sediment	8 oz glass jar; teflon-lined caps		
Mercury	Water	(Will be aliquoted by the lab from the metals container)	HNO_3 to pH < 2 Cool 4°C	26 d to analysis
	Soil/Sediment			
Cyanide	Water	500 ml polyethylene bottle; poly or teflon-lined caps	NaOH to pH > 12 Cool 4°C	12 d to analysis
	Soil/Sediment	8 oz glass jar; teflon-lined caps		
Other				
Grainsize	Soil/Sediment	500 g glass jar	None	NA
Atterberg Limits	Soil/Sediment	500 g glass gar	None	NA

Notes:

1. Triplicate the sample volume for samples designated for Matrix QC.
2. Holding times are from Verified Time of Sample Receipt (VTSR) and the same for waters and soils/sediments.
3. Includes 524.2 methodology. See Appendix E.

NA = Not Applicable

6 Sample Custody

An essential part of any sampling/analytical scheme is the ability to document the history of samples. This is begun as soon M the samples are in custody. A sample is in custody when it meets any one of the following requirements:

- It is in your actual possession, or
- It is in your view after being in your physical possession, or
- It was in your possession, and then you locked or sealed it to prevent tampering, or
- It is in a secure area.

Chain of custody establishes the documentation and control necessary to identify and trace a sample from collection to final analysis. Such documentation includes labeling to prevent mix-up, container seals to prevent unauthorized tampering with contents, secure custody, and the necessary records to support potential litigation. These precautions are crucial for a valid chain of custody. It is policy to follow the USEPA sample custody or chain of custody protocol as described in "NEIC Policies and Procedures," EPA-330/9-78-001-R, Revised May 1986. This custody is in three parts: sample collection, laboratory, and final evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area. The original laboratory reports will be placed in the final evidence files six months after completion of the final report.

6.1 Field Sampling Custody Procedures

6.1.1 COC Documentation

Sampling team personnel will perform all sampling and will retain custody until shipment to the laboratory. One chain-of-custody form will be used for each sample shuttle shipped to the laboratory. Figure 6-1 shows the chain-of-custody (COC) form.

The field activities will be recorded dally in a serialized field logbook. The following information will be recorded in the logbook used at this site:

- Where, exactly, was the sample taken?
- Who took the sample, and who witnessed it?
- Date and time of sample collection.
- Sample number, airbill number, seal number.
- Sampling conditions, i.e., type of material, weather on-site, type of sampling container and preparation, description of sampling procedure, preservation, and shipping.

The sample packaging and shipment procedures summarized in Section 6.1.3 will be performed so that the samples will arrive at the laboratory with the chain of custody intact.

- The Field Operations Supervisor must review field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

- Samples will be accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving

will sign, date, and note the time on the record. This record documents transfer of custody of samples from sampler to another person to the analytical laboratory, or to/from a secure storage area.

- All shipments will be accompanied by the chain of custody record identifying the contents. The original record will accompany the shipment, and a copy will be retained by the Field Operations Supervisor as part of the field documentation.

- If the samples are sent by common carrier, a bill of lading will be used. Receipts of bills of lading will be retained as pan of the permanent documentation. Commercial carriers are not required to sign-off on the custody form as long as the custody form is already sealed within the cooler and the custody seals are intact.

6.1.2 Sample Labeling

The importance of sample labeling cannot be overstated. Improperly or inadequately labeled samples are of little value in a monitoring program. Improperly labeled samples lead to questions with regard to location, project, sampling station, date sampled, and sampled. All of this information is essential for proper sample handling.

The following information, at a minimum, is required on each sample label:

Client	Date collected
Project number	Time collected
Location	Collected by
Station	Preservative(s)
Analysis(s)	

Failure to provide the requested information may result in wasted time and resources if it is necessary to discard samples because of inadequate information.

6.1.3 Sample Packing/Shipping

The following summarizes the sample packing and transportation protocol that will be followed for this project.

- Waterproof metal (or equivalent strength plastic) ice chests or coolers will be used to ship samples.
- After filling out the pertinent information on the sample labels sample lids may be secured with strapping tape if necessary. Note, do not tape VOA vials as this may cause contamination.
- Mark volume level on bottle with grease pencil.
- Place about 3 in. of inert cushioning material, in the bottom of the cooler.
- Enclose the bottles in clear plastic bags through which sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and will not touch during shipment.
- Put in additional inert packing material to partially cover sample bottles (more than half-way). Place bags of ice around, among, and on top of the sample bottles.
- Fill cooler with cushioning material.

- Put paperwork (Chain-of-Custody Record) in a waterproof plastic bag and tape it with masking tape to the inside lid of the cooler.

- Tape the cooler drain shut.

- Secure cooler lid by taping. Wrap the cooler with strapping tape at a minimum of two locations.

- Attach completed shipping label to top of the cooler.

- Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides.

- Affix numbered and signed custody seals (Figure 6-2) on front right and back left of cooler. Cover seals with wide, clear tape.

- All samples must be received by the laboratory within 48 hours from day of collection. Therefore, transfer coolers to over-night carrier within 24 hours of collection.

Remember that each cooler cannot exceed the weight limit set by the shipper.

6.2 Laboratory Custody Procedures

The subcontractor laboratory has a designated sample custodian. This individual is responsible for receiving samples in the laboratory, opening the coolers and checking the sample integrity and the custody seal, logging samples into the laboratory system, and controlling the handling and storage of samples while in the laboratory. Specific responsibilities and procedures of the sample custodian and the laboratory sample tracking are described in "Laboratory Environmental Analysis QA/QC Manual", Galson Laboratories, 1990. This manual is included as Appendix A.

6.2.1 Duties and Responsibilities of Sample Custodian

Upon receipt at the laboratory, the sample custodian inspects the samples for integrity and checks the shipment against the Chain-of-Custody form. Discrepancies are addressed at this point and documented on the Chain-of-Custody Form. When the shipment and the chain-of-custody are in agreement, the custodian enters the samples into the internal chain-of-custody form (Figure 6-1) and the Laboratory Information Management System (LIMS) to assign each sample a unique laboratory numbed. This number is affixed to each sample bottle.

The duties and responsibilities of the sample custodian include the following:

- Receiving samples.
- Inspecting sample shipping containers for presence/absence and condition of:
  - Custody seals, locks, "evidence tape," etc.
  - Container breakage and/or container integrity
- Recording condition of both shipping containers and sample containers (bottles, jars, cans, etc.) in appropriate logbooks or on appropriate forms.
- Signing appropriate documents, shipped with samples (i.e., airbills, chain-of-custody records, etc.) and including these documents in the project file.
- Verifying and recording agreement or nonagreement of information on sample documents (i.e., sample tags, chain-of-custody records, traffic reports, airbills, etc.) in appropriate logbooks or on appropriate forms. If there is nonagreement,

recording the problems, and notifying appropriate laboratory personnel for contacting the Project Manager for direction

- Initiating the paperwork for sample analyses on appropriate laboratory documents (including establishing case and sample files and inventory sheets) as required for analysis or according to laboratory standard operating procedures.

- Marking or labeling samples with laboratory sample numbers as appropriate and cross-referencing laboratory numbers to client numbers and sample label numbers as appropriate.

- Placing samples, sample extracts, and spent samples into appropriate storage and/or secure areas.

- Controlling access to samples in storage and assuring that laboratory standard operating procedures are followed when samples are removed from and returned to storage and that the storage area is kept secure.

- All transfers of samples into and out of storage will be documented on the internal COC form (Fig. 6-1).

- Monitoring chain-of-custody of samples in the laboratory. This is accomplished through the internal COC form Figure 6-1. The internal laboratory COC traces the in-house custody of the samples from the time of receipt to the completion of the analyst. Additionally, samples are uniquely identified in the laboratory through the LIMS computer system.

- Monitoring storage conditions for proper sample preservation such as refrigeration temperature and prevention of cross-contamination.

- Returning shipping containers to the proper sampling teams.

6.2.2 Sample Storage and Security

While in the laboratory, the samples are maintained in walk-in coolers at 4°C prior to analysis. Samples for volatile organics determinations are stored in a separate refrigerator from other samples, sample extracts, and standards to prevent cross-contamination. Separate refrigerators within the laboratory are maintained for extracts and samples under analysis.

The samples are routinely retained at the laboratory for 2 weeks after the data have been forwarded to the client so that any analytical problems can be addressed. For this project the samples will be discarded 30 days after the final report has been submitted to the Argonne Project Manager.

6.3 Final Evidence File

The final evidence file for the project will consist of: laboratory data packages (summary and raw data from the analysis of QC samples and investigative samples including chromatograms, mass spectra, other instrumental output data, calibration data, worksheets, sample preparation information, COC), field logbooks, pictures, and subcontractor reports. The final evidence file will be retained by Argonne National Laboratory for one year and then the file will be purged to the Army COE, Baltimore District. A complete record will also be generated for the US Air Force Installation Restoration Program Information Management System (IRPIMS) and kept on file.

Chain of Custody Record

Page _____ of ___

Company Name	Project Manager/Contact
Project No.	Project Name

Galson Laboratories
6601 Kirkville Road East
E. Syracuse, New York 13057
315-432-0506 or 800-950-0506

Special QA/QC Protocol (Circle)
EPA CLP EPA SW 846
NYS DEC NYS DOH
NJ TIER I CALIFORNIA
NJ TIER II OTHER (Specify)

SAMPLE LOCATION / SAMPLE ID	Date	Time	TYPE Comp.	TYPE Grab	Aqueous	Soil	Other	A	B	C	D	E	F	G	H	I	J	K	Laboratory ID Number	PARAMETERS FOR ANALYSIS

REMARKS:

Task No. & (1) (2) (3) (4)

SAMPLERS NAME:

SIGNATURE:

SAMPLES RELINQUISHED BY:		SAMPLES RECEIVED BY:	
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:

Received For Laboratory By: (Signature) DATE: TIME:

Custody Seal Intact?Sample ☐ Yes ☐ No ☐ N.A.

Shipment Complete? ☐ Yes ☐ No

LabStor. Location (Ref. #)	A	B	C	D	E	F	G	H	I	J	K	L

2/89

Figure 6-1



Galson Laboratories

CUSTODY SEAL

_____

Sealed By: _____ Date: _____

6601 Kirkville Rd.
E. Syracuse, NY
13057
315-432-0506

Figure 6-2

GALSON LABORATORIES INTERNAL CHAIN OF CUSTODY PAGE ____ OF ____

TASK NUMBER	CLIENT NAME	JOB NUMBER	STORED BY	DATE OF TRANSFER

LAB ID	CLIENT ID	MATRIX	PLACE OF STORAGE REFTUG. SHELF	PRESERVATIVE				RECD TECH. REASON	DATE /TIME RETURNED INITIALS	RECD TECH. REASON	DATE /TIME RETURNED INITIALS	RECD TECH. REASON	DATE /TIME RETURNED INITIALS	HZD. CODE
				pH	ADDED	FINAL pH	SEP. BTLS							

Figure 6-3

7 This Page is Missing.

Instrument	Reference
pH Probe/Meter	USGS Method 1977*
Conductivity Probe/Meter	USGS Method 1977*
Temperature	USGS Method 1977*
Turbidity Nephelometer	per manufacturer's instructions
Broker MEM GC/MS	Appendix A
Tracer Spectruce 6000 EDXRF	Appendix B

*See Section 16, References.

7.2 Laboratory Instruments

The NYSDEC ASP analytical methods selected for use in this investigation specify the types and frequency of calibrations. The specific method references are provided in Section 8. For accessory analytical equipment such as balances and ovens that are required in preparation procedures, calibrations will be performed as per manufacturer's instructions and per the following guidelines:

1. Calibrations of balances (maintained on a service contract) and ovens must be checked daily and recorded in a logbook.

2. Corrective actions must be taken for out-of-control check measurements as described in the laboratory's QA/QC manual.

3. The equipment will not be used until either recalibrated or corrective action results in a subsequent check standard meeting control criteria.

4. Calibration of other miscellaneous analytical equipment (e.g. automatic pipettes) will be performed at a minimum prior to use.

For method specified analytical protocols, no deviations from the procedures will be acceptable. The only exception is for graphite furnace analysis where often a parabolic regression is a better fit to the data than a linear regression. In these cases, the graphite furnace software fits the best curve. Parabolic regression has been found useful for preparing calibration curves for some of these analyses. In parabolic regression, an equation of the form

$$y = a_0 + a_1 x + a_2 x^2$$

y = instrument response
x = amount or concentration of the analyte
a_0, a_1, a_2 = parabolic constants

is fitted to the data. The sample concentrations are calculated from the instrument responses by solving the parabolic equation for x. An equation of the form

$$x = \frac{\left(4a_2(y - a_0) + a_1^2\right)^{1/2} - a_1}{2a_2}$$

is obtained. (This equation represents only one root of the parabolic equation, corresponding to the leg of the parabola to which the data are fitted.)

For curvilinear response functions, the curve shape beyond the range of the standards cannot be predicted. For this reason, no sample response greater than that of the highest standard will be used to calculate a concentration. All samples that exceed the value of the highest standard will be diluted into range. This is a requirement for all of the inorganic analytical methods under NYSDEC ASP. The parabolic correlation coefficient (r) has the same meaning and criteria as for linear regression and therefore indicates how good a "fit" the defined curve is to the data.

TABLE 7-1
CALIBRATION ON FIELD EQUIPMENT

Instrument	Frequency	Calibration Procedure
pH meter[a]	Each use	Calibrate with 2 pH buffer solutions bracketing the range of samples.
Conductivity meter[a]	Each use	Calibrate against a known reference solution.
Temperature[a]	Prior to use in field	Calibrate against an NBS thermometer.
Turbidity	Prior to use in field	Calibrate with range of standards for linear regression $r \geq 0.995$. Thereafter, check prior to each use with 0.0 NTU reference standard.
Bruker MEM GC/MS	Prior to use in field	3 point initial calibration[b].
EDXRF	Each use	"Energy" calibration = internal calibration to align elemental peaks.
EDXRF	Each use and after energy calibration	Calibration against known reference standard.

[a] Field measurements must follow calibration protocols in USGS, 1977 listed in Section 16, References

[b] If continuing calibration fails criteria for any set of analytes (VOAs, SemiVOAs, or PCBs) an initial calibration must be rerun.

8 Analytical Procedures

8.1 Laboratory Analytical Procedures

Laboratory analytical methods and quality control procedures arc referenced NYSDEC ASP volumes 1-8 (1989). All laboratory analytical methods will strictly follow NYSDEC ASP procedures. The analytes and detection limits required for this project should therefore conform to the Superfund-CLP-Inorganics and Superfund-CLP-Organics. Volatile analyses for groundwater and surface water samples will follow a modified NYSDEC ASP method to be able to reach lower detection limits than the NYSDEC ASP (9/89) methodology can meet. This VOA method will Incorporate EPA method 524.2 with the NYSDEC ASP (9/89) QA/QC criteria. The modified 524.2 procedure will require analysis for TCL VOA Organics and Dichlorodifluoromethane (freon). See Appendix E for specific modifications.

To define the strata, soil tests for grainsize distribution and Atterburg Limits will be performed by Marcor, Inc. Method references are: ASTM D421-85, D422-63 for grainsize and ASTM D4318-84 for Atterburg Limits.

8.2 On-Site (Field) Analytical Procedures

For conventional field analysis (pH, conductivity, turbidity, temperature), manufacturer's instructions and specific field SOPs will be followed. For screening techniques (Bruker MEM for GC/MS and EDXRF for metals), the specific SOPs in Appendices A and B will be followed. The following section outlines the field screening techniques to be employed in this program. Field screening using the Bruker MEM gives detection limits of approximately 5 µg/L for screened organic constituents. Table 8-1 lists the ANL on-site screening target compound list.

8.2.1 Screening Procedures - Organics

On-site screening of organic contaminants in soils will be accomplished using ANL's mobile environmental monitor (MEM). Since March, 1991, an ANL team operating at Aberdeen Proving Ground under the direction of the principal investigator, has been developing analytical methods for a mobile gas chromatograph/mass spectrometer (GC/MS) to identity a wide range of organic compounds present in the soils of the Edgewood Arsenal. ANL will identify organic compounds rapidly in soils and groundwater at AFP 59, by developing appropriate GC/MS methods for its Bruker MEM. The purpose of the screening will be to identity areas of significant contamination and then sample these areas for laboratory analyses for further quantitate the type and level of contamination. This last activity is an Air Force sponsor requirement.

Some soil samples will be screened using the "rapid screening" mode with the MEM probe for a target list of organic compounds (TCL) which include selected volatile organic, semivolatile organic, pesticide, and PCB compounds (see Table 8-1). Additional soil analyses may be performed using the MEM's gas chromatograph in the "characterization" mode in order to quantity compounds on the TCL or to identify and quantify unknown compounds.

Gas chromatograph/mass spectrometry (GC/MS) is the EPA recommended method for the analysis of volatile and semivolatile organic compounds. This proven analytical technique identifies and quantifies organic compounds on the basis of molecular weight, characteristic fragmentation patterns, and retention time. Until recently, it was not feasible to bring a GC/MS instrument to a hazardous waste site because of its size and weight, the need for strict control of temperature and humidity, and the effect of vibration during transport. With the growing demand for field-portable instrumentation in the environmental area, rugged, smaller units have been developed. ANL is using a Bruker Instruments, Inc., mobile GC/MS. This device was tested by EPA under the Superfund Innovative Technology Evaluation (SITE) program. The performance of this system was recently demonstrated at two Superfund sites in Region I.

Argonne's Bruker MEM instrument is equipped with built-in power, resistance to shocks, and will operate from 30°C to 5°C with no eternal cooling or heating requirements. The mass spectrometer has a mass range of 1-400 Daltons, which minimizes power consumption. It can operate for 8-10 hours on battery power, or indefinitely using a generator or conventional AC power. An MS-DOS 386 based data system can be used to acquire, analyze, and archive all GC/MS data. Sampling accessories are available for a wide range of monitoring situations: the MEM probe with a 3.5 m GC column is used for thermal desorption of organics from a soil surface. A temperature-programmable GC oven with a capillary column is also available.

The Bruker MEM offers several analysis modes and sample introduction methods which can be chosen based on the data quality objectives (DQO) of the site. Two modes, "rapid screening" and "characterization," were tested in the SITE demonstration. The rapid screening mode allows a quick analysis for up to 22 organic compounds simultaneously. The more accurate characterization mode follows a CLP-type protocol, including extraction procedures, 3-point calibration, and data acceptance windows. Once the sample is introduced into the GC, it passes through a semipermeable membrane into the ionization source where it is fragmented into characteristic ions. These ions are then accelerated, focused, and detected. The resulting mass spectrum is compared against known compounds in the computer's library. The quantitation limits of the MEM vary depending on several factors including:

- analysis mode
- analytes detected
- matrix analyzed.

8.2.2 Screening Procedures - Metals

Energy dispersive X-ray fluorescence (EDXRF) analysis is a method of identifying and quantifying metal contamination in soils. The method is accepted by the U.S. EPA and meets the

EPA guidelines for data quality objectives for remedial response activities. Metals analysis by EDXRF consists of exposing soil samples to electromagnetic radiation in the x-ray wavelength. Metals present in a soil sample will absorb the electromagnetic radiation, inducing the electrons in the metal atoms to a higher, but unstable, energy level. The electrons will eventually return to the more stable, but lower energy level, by emitting electromagnetic energy in wavelengths characteristic to the parent atom. The emitted energy is then detected and analyzed to identity and quantify the metals present in a soil sample.

ANL will use a Tracor Spectrace 6000 EDXRF system, coupled with an IBM PC-based micro-computer to screen soil samples for metal contamination. The EDXRF consists of a 50-kV x-ray source, a 12.5-um beryllium window, and a Peltier thermo-electrically cooled Si(Li) detector. The typical resolution limit of the detector is approximately 185 eV. Sites that exhibit significant metal contamination by EDXRF will be sampled for subsequent laboratory analysis of TAL metals following NYSDEC ASP methodologies.

TABLE 8-1
ARGONNE NATIONAL LABORATORY TARGET COMPOUND LIST
FOR ON-SITE SCREENING OF CONTAMINANTS IN SOIL AND WATER

Volatile	Acid, Base/Neutrals	Pesticides	Metals
Benzene	Acenaphthene	Dieldzin	Arsenic
Carbon Tetrachloride	Anthracene	Aldrin	Barium
Chlorobenzene	Butylbenzylphthalate	4,4-DDT	Cadmium
Chloroform	bis(2-Chloroethyl)ether	Endrin	Chromium
1,2-Dichloroethane	1,4-Dichlorobenzene	Heptachlor	Copper
1,1-Dichloroethene	Di-n-butylphthalate	Lindane	Lead
Ethyl benzene	2,4-Dinitrotoluene		Mercury
Methylene Chloride	Fluoranthene		Nickel
1,1,2,2-Tetnchloroethane	Hexachlorobenzene		Silver
Tetrachloroethane	Hexachlorobutadiene		Zinc
1,1,1-Trichloroethane	Hexachloroethane		
Trichloroethane	Naphthalene		
Toluene	Nitrobenzene		
	Pentachlorophenol		
	Phenanthrene		
	Phenol		
	Pyrene		
	1,2,4-Trichlorobenzene		
	2,4,6-Trichlorophenol		
	Total PCBs		

9 Data Reduction, Validation, and Reporting

9.1 Data Reduction

For inorganic and general organic analyses, the raw data are instrument responses in the form of meter, recorder, or printer output. The technician performing the analysis either enters the bench-generated data in a laboratory workbook specific for each parameter or reduces the data via specific computerized software programs. These data consist of instrumental responses (absorbances, percent transmittances, etc.), standard and spike concentrations, sample ID numbers, and any other pertinent information.

For chromatographic organic analyses, the raw data are instrument responses in the form of chromatograms, integrator output, or computer-generated data files. The chromatograms and printer output are stored in project-specific files. The computer-generated data files are archived on magnetic media.

For on-site screening measurements by GC/MS and EXFRD, all data reduction will be performed in the field by the field team analysts and reviewed by the On-Site Chemistry Supervisor. The following protocols will be used for field (where applicable) and laboratory analyses.

The analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data. All laboratory data will be generated and reduced following protocols specified in the NYSDEC ASP methods. On-site analyses will be generated and reduced following ANL specific method SOP's included in Appendices A and B. Each analyst will review the quality of his/her work, based on an established set of guidelines. This will constitute the "primary review". The analyst will review the data package to ensure that:

- Sample preparation information is correct and complete;
- Analysis information is correct and complete;
- The appropriate SOPs have been followed;
- Analytical results are correct and complete (including calculations);
- QC samples are within established control limits;
- Blanks are within established control limits;
- Special sample preparation and analytical requirements have been met;
- Documentation is complete (e.g., all anomalies in the preparation and analysis have been documented; holding times are documented, etc.);
- All corrections on raw data and any generated forms are made with a single-line cross-out and initialed and dated by the analyst.

The primary analyst will initial and date all documents generated by him/her. A "secondary review" of the data generated by the primary analyst will be performed. This will entail a spot-check of the above listed items. Any errors found will trigger a 100% check of all data included in that item. The secondary reviewer will initial and date all reviewed documents.

Data reduction will include provision of periodically updated summary tables containing the following information to the Quality Assurance Officer:

- Collection Date
- Sample Identification Number
- Sample Description
- Sample Location
- Laboratory Number
- Parameter
- Concentration and units
- Analysis Date

Interpretation of raw data and calculation of results are signed and dated by the laboratory scientist performing the data reduction on the data report forms. Another scientist, often the laboratory manager, must verify the results and sign the data before it is released. Additionally, a member of the laboratory QA Staff should perform an audit of 5% of the data generated.

9.2 Data Validation

Data validation is the process of reviewing data and accepting, qualifying, or rejecting it on the basis of sound criteria. The data generated during this program must be validated according to established guidelines in this QAPP and NYSDEC ASP (9/89). The data validation approach must consist of a systematic review of the results, associated quality control methods and results, and all of the supporting data using professional judgment in any areas not specifically addressed by NYSDEC Guidelines. Data validation for this project will be performed by ECHEM.

At a minimum, the data validation must address the following:

- Completeness:

  The data package for each Sample Delivery Group (SDG) must include the following items.

  1. Traffic Report and Chain-of-Custody (COC) forms.

  2. Case narrative listing non-compliance issues.

  3. Cover page and all NYSDEC ASP Forms (as listed in vol. 8 of the ASP); tabulated QC results and sample results where ASP Forms are not appropriate (e.g. grainsize distribution). At a minimum these will include:

tabulated sample concentrations; MS/MSD/MD results with % recoveries and % RPD per analyte; all blanks tabulated (method blanks and laboratory blanks); LCSs with % recoveries; ICVs and CCVs with % recoveries; holding times; % solids for sediments; surrogate recoveries; and method detection limits. Additional details are listed in Section 9.3 entitled Data Reporting.

4. Raw data supporting all analyses.

5. Raw data supporting all standardizations, calibrations and QC samples.

6. Preparation or extraction logs for all tests, matrices and samples.

7. % solids determination log (soils/sediments only).

8. Laboratory and sampling team IDs are consistent and can be tracked throughout data.

9. Holding times are documented.

- Accuracy

Review of laboratory control samples (LCS) and matrix spiked (MS) samples and blank spike samples (where applicable) to determine accuracy based on % recovery of a known spiked compound.

$$\%\ recovery = \frac{(spiked\ sample\ value - sample\ value)}{spike\ added} \times 100\%$$

- Precision

  Review of laboratory matrix duplicates (MD), matrix spike duplicates (MSD) and field duplicates (FD) where applicable. Based on relative percent difference (RPD) between the duplicate values.

$$RPD = \frac{spiked\ sample\ value - duplicate\ value}{\left(\frac{sample\ value + duplicate\ value}{2}\right)} \times 100\%$$

- Detection Limits

  Review of data reporting limits with QAPP specific requirements.

- Blank Contamination

  Review of all blanks (field blanks, trip blanks, method/prep blanks, laboratory analytical blanks) to assess validity of the data based on criteria set for blank levels in the QAPP.

The data acceptance limits for LCS, MS/MSD, MD, all blanks, ICVs and CCVs are defined within the methods and this QAPP. QC charts will be plotted for % recovery of LCS and matrix

spikes samples. RPD of MD and MSD samples will be charted for this program as well. QC charts will be periodically submitted to the QA Officer for review during this program

It is imperative that quantitation limits be kept as low as possible for all analyses. It is expected that the quantitation limits defined in Section 8 will be met. Precision and accuracy requirements have been defined in Section 4. Guidelines for acceptable Surrogate standard recoveries in both waters and soils/sediments, spike recoveries and RPD of duplicates have been defined in this QAPP based on NYSDEC ASP, EPA Region II criteria and technical references as listed in Section 17. These guidelines will be used in evaluating data quality.

In addition to the above directives, protocols from the following documents will be used to validate the inorganic and organic data:

1. CLP Organics Data Review and Preliminary Review. March 1990, SOP No. HW-6, Rev. #7. U.S. EPA Region II.

2. Evaluation of Inorganic Data for the Contract Laboratory Program. February 1990, SOP No. HW-2, Rev. X, US EPA Region II.

3. New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP), September 1989, volumes 1-8.

If there are inconsistencies in criteria between the EPA and New York State DEC guidelines, the NYSDEC ASP guidelines will be adhered to.

9.3 Data Reporting

All water sample data for organic and inorganic parameters will be reported in µg/L. All soil/sediment data for organic and inorganic parameters will be reported in mg/kg on a dry-weight basis.

Data reports for each sample analyzed will include the following information at a minimum:

- Final analyte concentration.
- Laboratory sample ID#, field sample ID#, location.
- Percent solids (for soil/sediment samples).
- Final volume of extract or prepared sample.
- Preparation or extraction and analysis dates for holding time verifications.
- Calibration information, including (where applicable):
  - calibration curve
  - correlation coefficient, and
  - concentration response data of the calibration check standards.
- Results of the second column chromatography check including chromatograms.
- Amount of surrogate spiked and percent recovery of each surrogate.
- For matrix spike samples, the amount spiked and % recovery of each compound or analyte spiked.
- For matrix duplicate or spike duplicate samples, % RPD calculated for each compound or analyte.
- For laboratory control samples, true values and % recovery of each analyte quantitated.
- Blank results for method blanks, field blanks, trip blanks and laboratory analytical blanks.

- All raw data preparation and extraction logs must include:
  - analyst initials and date
  - initial and final sample volumes or weights
  - sample description artifacts (e.g. stones, standing water in sediment samples, color)
  - amount and concentration of stock spike solutions added to MS/MSD or LCS samples
  - Vendor or Lot Number identification for all initial and continuing check samples and true value concentrations of these check standards (ICV, CCV, etc.).

- All raw data analysis printouts and logs must include:
  - analyst initials and date
  - Model Number and type of instrument used for analysis
  - conditions of instrument (e.g. wavelength for atomic absorption analyses, retention times for GC, etc.)
  - time of start of analysis, time for all QC samples, time of end of analysis
  - Method Number or SOP reference
  - dilutions performed and amount of sample analyzed or injected
  - calibration standards labeled and time recorded
  - QC samples and blanks clearly labeled.

Note: All NYSDEC reporting forms as contained in volume 8 of the ASP (1989) must be used for final data reporting.

10 Internal Quality Control Checks

The following section summarizes the type and frequency of field, matrix, and laboratory specific Quality Control (QC) check Methods must be referenced for more detailed information (NYSASP 9/89 and Appendices of this QAPP). Tables 10-1 through 10-4 define internal QC checks and frequencies.

10.1 Field Quality Control

10.1.1 Blanks

To assess the field sampling equipment decontamination procedures and the affects of the sample handling on sample contamination, several types of field blanks will be taken.

Trip Blanks

The purpose of a trip blank is to place control on the sample handling, transport, and storage and indicate any contamination that may have occurred during these processes.

The trip blank consists of a set of sample containers filled with analyte-free water provided by the analytical laboratory. The sample containers themselves are not opened in the field. Rather, they just travel with the sample collector. Trip blanks will be used to assess contamination due to handling, shipping, and storage of samples. One trip blank will accompany every batch of VOA samples (both soil/sediment and water) sent to the laboratory.

Equipment Blanks

The purpose of an equipment blank is to provide a check on the integrity of field sampling equipment decontamination procedures. At the site location, analyte-free water will be passed through clean (decontaminated) sampling equipment, transferred to the appropriate sample bottle, preserved, and sent to the laboratory for analysis.

One set of equipment blanks will be collected for every day of groundwater and soil/sediment sampling (all parameters analyzed).

Rinsate Blanks

At least once during field sampling, the potable water used to rinse some of the field sampling equipment will be collected and preserved for laboratory analyses to assess possible contamination from this source.

10.1.2 Duplicates/Replicates

Duplicates

Field duplicates are two samples collected independently at a sampling location during a single act of sampling.

Field duplicates are used to assess sampling precision and representativeness. Field duplicates will be collected at a frequency of 5% (1 duplicate pair per 20 samples) per matrix per parameter. The field duplicates will be numbered so that laboratory personnel performing the analyses will not be able to determine which samples are duplicates.

Replicates

A replicate is a single sample (e.g., one bailer volume, one grab sample) collected, then divided into two or more equal parts for the purpose of analysis. Replicate samples are often called "splits." These samples will be termed matrix duplicates (MD for inorganics) or be spiked in the laboratory and termed Matrix Spike Duplicates (MSD for organics). Actually, a sample will be taken and split into 3 parts in order to have sufficient sample volumes for the original sample analysis, MD or MSD analysis and MS analysis. These replicate samples are used to assess field sampling precision and laboratory analytical precision. They will be performed at a frequency of 5% (1 set per 20 samples) per matrix per test or 1 set per SDG, whichever is more frequent.

10.2 Matrix Specific Quality Control

Matrix Spike (MS)/Matrix Spike Duplicate (MSD)/Matrix Duplicate (MD) Samples: a MS/MSD pair will be performed for all organic analyses at the frequency of 1 per 20 samples (5%) per matrix or per SDG, whichever is more frequent. A MS/MD pair will be performed for all inorganic parameters being analyzed in a laboratory (where applicable) at the 5% frequency or per SDG, whichever is more frequent. See Tables 10-1 through 10-3 for QC summary per parameter.

The purpose of the MS is to assess matrix effects on % recovery of the compound or analyte. MS data can also be used to measure accuracy of the method with the caution that specific matrix effects may obscure the results. MSD measures the same features as MS, with the additional information on relative percent difference (RPD) between the MS and MSD. This is a measure of the precision of the method. The MD measures precision for all inorganic analytes in this program. The % RPD between the sample and MD concentrations are determined and compared to the criteria specified in individual methods (NYSDEC ASP) and in Table 10-3.

10.3 Laboratory Quality Control

Control samples (QC checks) will be introduced into every batch of samples as required by the specific method in order to monitor performance of the analytical system.

Table 10-3 lists criteria for laboratory QC checks. Accuracy and precision for LCS, MS/MSD/MD are given in Section 4. Reference individual methods in NYSDEC ASP for method specific requirements. At a minimum, the following items will be included as laboratory QC:

- Method Blanks
  These blank samples are prepared in the laboratory and are analyzed in order to assess possible laboratory contamination during the preparation or extraction procedure. The method or preparation blank must be analyzed at a frequency of 1 per matrix per parameter and per each batch of 20 samples or per SDG whichever is more frequent

- Analytical Blanks
  Inorganic methods require the routine analysis of laboratory reagent-grade water at the beginning, during and at the end of an analytical run to assess contamination and instrument drift.

The laboratory will maintain its own internal QC program, as summarized below.

- For each parameter and each matrix, minimum of one method (procedural) blank in every batch of 20 samples or SDG whichever is more frequent will be analyzed to detect contamination.

- For inorganic parameters (as applicable see Table 10-1) a minimum of 1 laboratory control sample (LCS) per batch per matrix or every 20 samples, whichever is more frequent, is required. The LCS will be used to access laboratory performance of the method. LCS for soil/sediment samples will be EPA-provided solid LCS or equivalent LCS for water samples will consist of distilled deionized water spiked with the analytes of interest. For organic analyses, NYSDEC ASP requires that a "blank spike" be analyzed. (This is technically equivalent to the inorganic LCS.) The blank spike is distilled deionized water spiked with the same standard spike mix of analytes as for the MS. For organic analyses the blank spike must be prepared and analyzed at the frequency of 1 per 20 samples extracted.

- For organic analyses, a minimum of 1 MS/MSD pair per matrix per batch of 20 samples or per SDG, whichever is more frequent, to assess accuracy and determine matrix effects.

- Surrogate standards to estimate recoveries and to account for sample-to-sample variation as required in the organic analytical methods (NYSDEC ASP).

- For all analyses, method specific calibration criteria must be strictly followed.

- Continuing calibration checks for organic and inorganic analyses must strictly conform to NYSDEC ASP method frequencies and control limits.

- Initial calibration checks or verification (ICV) performed immediately following calibration to determine accuracy of the daily calibration curve as compared to a separate source check standard are required for all inorganic analyses under NYSDEC ASP. (Traceability of the ICV solution to an EPA or NBS standard solution is recommended.)

10.4 QC Acceptance Criteria

All criteria and frequency will strictly follow NYSDEC ASP (9/89) methods. Tables 10-3 and 10-4 summarize QC acceptance criteria for laboratory and field analyses respectively. See Section 17 for the definition of acronyms used in these tables.

TABLE 10-1
QC FREQUENCY SUMMARY

For tests that specify the following QC, this table summarizes the frequency requirements. See NYSDEC ASP (9/89) method SOPs and Tables 10-2 and 10-4 for applicable QC per parameter.

QC	Frequency
Initial Calibration Verification Check (ICV)	1 per analytical run immediately following calibration for TAL Inorganics
Initial Calibration Blank (ICB)	1 per analytical run immediately following the ICV for TAL Inorganics
Continuing Calibration Verification Check (CCV)	Every 10 samples for TAL Inorganics
Continuing Calibration Blank (CCB)	Every 10 samples immediately following CCV for TAL Inorganics
Laboratory Control Sample (LCS)	1 per 20 or SDG whichever is more frequent for TAL Inorganics
Matrix Spike (MS)	1 per 20 or SDG whichever is more frequent for all parameters
Matrix Spike Duplicate (MSD)	1 per 20 or SDG whichever is more frequent for TCL Organics
Matrix Duplicate (MD)	1 per 20 or SDG whichever is more frequent for TAL Inorganics
Method (Preparation) Blank (MB)	1 per 20 or SDG whichever is more frequent for all parameters
Field Blank (FB) includes rinsate blanks, equipment blanks	1 per matrix per parameter per sampling event
Field Duplicate (FD)	1 per matrix per parameter per 20 samples taken: minimum frequency of 5%
Continuing Calibration Check (CCC) Sample	for TCL Organics each run
Surrogate Spiked Sample (SS)	for TCL Organics each run
Matrix Spike Blank (MSB)	1 per 20 samples or SDG, whichever is more frequent for TCL organics
Trip Blank (TB)	1 per VOA per sampling event or per SDG whichever is more frequent

TABLE 10-2
QUALITY CONTROL SUMMARY FOR LABORATORY ANALYSES

	Applicable Quality Control Check											
Laboratory Analytes	ICV	ICB	CCV or CC	CCB	MB	MSB	MS	MSD	MD	LCS	PE	SS
Volatile Organic Compounds			X		X	X	X	X			X	X
B/N/A Compounds			X		X	X		X			X	X
Pesticides/ PCBs			X		X	X		X			X	X
Metals/ Cyanide	X	X	X	X	X		X		X	X	X	

TABLE 10-3
QC CRITERIA FOR LABORATORY ANALYSES

Parameter	MB	MS%R	MSD%R	MD%RPD	MSB%R	SS	CCC%RSD	LCS%R	ICV%R	CCV%R	ICB/CCB
TCL Semivolatile Organics	<CRQL	a	a	NA	75-125	a	≤25	NA	NA	NA	NA
TCL Volatile Organics	<CRQL	a	a	NA	75-125	a	≤25	NA	NA	NA	NA
Pest/PCBs	<CRQL	a	a	NA	75-125	a	≤25	NA	NA	NA	NA
TAL Inorganics Metals (except Hg)	< CRDL	75-125	NA	20	NA	NA	NA	80-120[b]	90-110	90-110	< CRDL
TAL Inorganics Mercury	< CRDL	75-125	NA	20	NA	NA	NA	80-120[b]	80-120	80-120	< CRDL
TAL Inorganics Cyanide	< CRDL	75-125	NA	20	NA	NA	NA	80-120[b]	85-115	85-115	< CRDL

NA = Not Applicable
CRDL = Contract Required Detection Limit per NYSDEC ASP (9/89) - Inorganics
CRQL = Contract Required Quantitation Limits per NYSDEC ASP (9/89) - Organics
The Quality Control parameters are defined in Table 10-1
[a]See Tables 4-2 and 4-3
bSolid LCS limits for TAL Inorganics may exceed 80-120% and are based upon 95% confidence interval about the mean for EPA-provided solid LCS or equivalent

TABLE 10-4
QC CRITERIA FOR FIELD ANALYSES

PARAMETER	MB	MD	ICV Check
GC/MS Screen	< CRQL	20% RPD	NA
pH	NA	±0.1 pH units	±0.01 pH units
Conductivity	< MDL	±10 umho/cm	90-110% R
Temperature	NA	±0.1°C	±0.1 °C
Turbidity	<MDL	±1 NTU	±0.5 NTU

*Specific for each parameter (VOA, Semivoa, PCB)

11 Performance and System Audits and Frequency

Audits of the field sampling team and of the laboratory performing work in support of this program will be performed under the direction of the Quality Assurance Officer. At least one on-site audit will be performed during sampling.

Laboratory audits during the program will be performed at a frequency to satisfy the QA Officer that the analyses are progressing within QC limits set forth in this QAPP and following the specific methods per NYSDEC ASP guidelines. At a minimum, one audit of Galson Laboratories will be performed during the analytical phase of the project.

11.1 Field Audits

Specific elements of the on-site audit will include the verification of the following items:

- Completeness and accuracy of sample Chain-of-Custody (COC) forms.
- Completeness and accuracy of sample identification labels.
- Completeness and accuracy of field notebooks.
- Following proper Health & Safety procedures as outlined in the Health & Safety Plan for this program.
- Following specific decontamination procedures as outlined in Section 5 of this QAPP and delineated in Part B - Field Sampling Methods/Protocols.

- Following specific collection, preparation, preservation and storage procedures outlined in Section 5 of this QAPP.

- Following specific calibration and analytical procedures for field parameters as outlined in field parameter method references and in Appendices A through B of this QAPP.

- Following handling and shipping procedures outlined in Section 5.

Appendix C is an example of a Field Sampling Audit Checklist.

11.2 Laboratory Audits

Galson Laboratories will be performing the analytical chemistry services under NYSDEC ASP methodologies. The QA Officer, Dr. A. Dallas Wait, will audit the laboratory at least once during the project. Emphasis in these audits will focus on evaluating the technical adequacy of the analyses as it pertains to program data quality objectives. In particular, the laboratory performance compared to NYSDEC ASP requirements will be scrutinized.

An example checklist for laboratory audits pertaining to routine technical requirements and document control systems is provided in Appendix D. Items will be addressed as applicable to the specific method being reviewed during the audit. The following items, at a minimum, will be addressed:

- Sample flow through lab and internal sample tracking

- Chain-of-Custody

- Sample storage
- Sample preparation/extraction and analysis including:
  - SOPs
  - Logbooks or benchsheets for all preparation procedures of samples, calibration standards, QC standards/check samples, blanks
  - Logbooks or benchsheets for all analytical procedures for samples, calibrations, QC checks, matrix QC samples, blanks
  - All above documentation must include:
    - analyst initials and date
    - single-line cross-out for corrections, initials and date
    - units recorded
    - method reference number or SOP reference
- QC samples documentation inclusive of items above and for all blanks, calibrations, calibration verification check samples, laboratory control samples, spikes, duplicates, spike duplicates, surrogates, control charts (were applicable)
- Data file storage including hard copy of all data, other media (disk tape, etc.)
- Laboratory safety procedures
- Laboratory QA procedures including internal audits, corrective action forms, QC control charts

Gradient Corporation
[redacted]

December 20, 1991

Mr. Wyman Harrison
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Dear Wyman:

Enclosed is the final version of the AFP59 IRP Quality Assurance Project Plan. This document should be used as guidance for performing the analytical chemistry program and assessing compliance to the data quality objectives.

If you have any questions about this document, please do not hesitate to contact me.

Sincerely,

GRADIENT CORPORATION

A. Dallas Wait, Ph.D.
Director, Chemistry Division

cc: Maureen Serafini, NYSDEC
Scott Rodabaugh, NYSDEC
Gale Sutton, Galson
Bruce Wallin, ECHEM

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12 Preventive Maintenance Procedures and Schedules

12.1 Field Equipment

Field sampling personnel will be familiar with the field calibration, operation and maintenance of the equipment, and will perform the prescribed field operating procedures outlined in the manufacturer's instructions accompanying the respective instruments and the SOPs attached in the Appendices A and B. All equipment will be inspected at least twice daily, once before start-up in the morning and again at the end of the workshift. All preventative maintenance performed will be entered in individual equipment maintenance logs.

12.2 Laboratory Instrumentation

Laboratory staff will be familiar with the maintenance requirements of the instrumentation they employ. This familiarity is the result of technical education, specialized courses and laboratory experience. Wherever possible, the laboratory will maintain a complete inventory of replacement parts needed for preventive maintenance and spare parts that routinely need replacement. It is the laboratory's responsibility to maintain maintenance log books for each instrument used in this program. These will be checked during the laboratory audits and must be kept current with information on routine and non-routine maintenance procedures.

Preventive maintenance schedules for analytical instrumentation will be specific to the laboratory's instrument manufacturer's specifications. Maintenance procedures and schedules will be outlined in the laboratory's SOPs and will be strictly adhered to for this program. Many of the laboratory's instruments are maintained on service contracts. Records of maintenance visits and procedures are maintained in the laboratory.

The following is a summary of maintenance procedures per instruments. Note that specific laboratory SOPs need to be consulted for more detail.

12.2.1 Chromatographic Instruments

The GC/MS/DS is maintained on a service contract which provides for routine preventive maintenance visits during the year. The services provided on these visits include: changing the oil and filter/drier on the mechanical pumps; cleaning the heads on the magnetic tape drive; cleaning and aligning the heads on the disk drive; changing air filters and checking the operation on the disk drive. The oil in the turbopumps is changed once a year. In-house maintenance includes cleaning the source and the quadropoles as required. The following spare parts are routinely kept on hand: filaments, electron multiplier, source parts, repeller assembly, O-ring seals, and pump oils. The maintenance contract assures the malfunctions are addressed in a priority manner, thereby minimizing instrument downtime.

The GC/MS is maintained on an in-house service schedule. This service includes: changing mechanical pump oil every three months; changing turbopump oil every six months; changing air filters every three months; cleaning the heads of the nine-track magnetic tape drive and the streamer tape drive every six months; checking the cooling fans on the turbopump, printer, chromatograph, electronics module and computer monthly; cleaning the printer head every six months; cleaning the source every month or as required; cleaning the quadropoles every six months or as required. The following spare parts are routinely kept on hand: a spare EI Source, filaments, miscellaneous source parts, pump oils, and air filters.

Gas chromatograph maintenance is performed as follows:

Area or Assembly	Type of Maintenance	Interval
Moisture Trap	Conditioning	2 months, or when gas source is changed
Moisture Trap	Repacking	Every 10 conditionings
Carrier Gas	Leak Check	As required
Injection Port	Cleaning	As required
Septum	Replacement	As required
Electron capture Detector (ECD)	Frequency Check	1 day
ECD	Carrier Gas Evaluation	When carrier gas is changed
ECD	Leak Check	When column is changed
ECD	Thermal Clean	1 month or as required
ECD	NRC Wipe Test	6 months

Spare parts for the gas chromatographs include: ferrules, septa, injection port liners, syringes and needles, and column packing materials.

12.2.2 Atomic Absorption Spectrophotometer

The atomic absorption spectrophotometers are maintained on a service contract. Routine service maintenance procedures include cleaning and realignment of the instrument's optics. In-house routine maintenance includes cleaning of the furnace windows, checking the graphite cones for wear, and cleaning or replacing them, checking autosampler tubing for wear, and replacing as necessary, checking lamps for wear (excessive "silvering" or discharging).

12.2.3 Inductively Coupled Plasma Spectroscopy

Routine maintenance of the ICP includes checking pump tubing and replacing when necessary, checking sensitivity by tracking the response ratio of two analytes daily and calling for a service visit and/or replacing photomultiplier tube when sensitivity drops significantly, checking nebulizer for even "spray" and remove for cleaning as necessary, and checking torch for plasma

height and shape which will indicate the need to clean the torch tip which may become clogged with salts or other matrix interferents from environmental samples.

12.2.4 Autoanalyzers

Because autoanalyzers are composite systems, quality control procedures appropriate to individual components, as well as the total system, are necessary. An autoanalyzer will be used for cyanide analysis.

1. Colorimeter electronics and optics. The major area of internal colorimeter adjustment is in optical alignment. This also, by virtue of influences on the two photocells, is the major internal electronic adjustment. The procedures for these adjustments are available in instruction manuals. The following adjustments are checked monthly and the results logged into appropriate notebooks.

    a. When flow cells must be replaced

    b. When light sources must be replaced

    c. When colorimeters must be transported or exchanged

    d. When repairs involving partial or complete dismantling of colorimeter optical "bench" are necessary

2. Check flow cells for cleanliness or defects. Clean or replace as necessary.

3. Check pump tubes at least weekly for pinch-wear, scuffing, reduced resiliency, imminent perforation, or other damage and replace as needed.

4. The analyst should be familiar with the recorder trace form and peak shapes pertinent to the analysis to be performed; often, a change in peak shape can serve as an indicator of a change in system performance.

12.2.5 Analytical Balances

Virtually every analytical procedure requires the use of side-loader and/or top-loader balances. Many of these requirements involve standards preparation and are therefore crucial to accurate determination. The Mettler side-loading analytical balances are maintained on a service contract. This contract includes annual servicing and calibration by a engineer. A calibration status label is affixed to each balance after calibration. 1216 Hydrogen Ion (pH) Meters

The most common cause of problems with pH meters is a faulty electrode, especially the reference electrode. To prevent "death" or malfunction of an electrode, the following practices should be adhered to.

1. Immerse the electrode continually in pH 7.00 buffer when not in use.

2. Inspect the reference electrode wick or junction and clean of debris, if necessary, (with extreme caution not to injure the glass electrode membrane) before each day's use.

3. Check electrode resistance.

4. Never leave the electrode in very alkaline solutions and thoroughly rinse with a squirt bottle immediately after each use to prevent poisoning of the glass membrane.

5. Keep the reference electrode full of the appropriate KCl solution.

6. When the sensitivity of an electrode begins to decrease, it can often be revived by immersion in a hot 1M trisodium phosphate solution for 5-10 minutes. If the sensitivity of the electrode is still low, a 1-2 minute immersion in 0.1 M ammonium bifluoride followed by rinsing and soaking in distilled water for 3-4 hours should restore electrode sensitivity; if not, the electrode must be replaced.

7. The sensitivity of the electrode can be readily assessed by immersion in serial 10:1 dilutions of pH 10.00 buffer and comparing the drift from a reading of 10 to that previously recorded (significant drift before 10^5:1 dilution suggests the need for electrode replacement).

8. Spare electrodes should always be on hand.

12.2.6 Dispensing Devices

Several very accurate and practical small volume dispensing devices are routinely used in the laboratory.

Adjustable volume pipetters are available in the laboratory with ranges varying from (ostensibly) zero to 5 ml, 50 ul, and 200 ul, and from 5 ml to 10 ml. Preventative maintenance of these include disassembling the unit and cleaning and greasing prior to reassembly. Additionally, volume delivery settings are verified prior to use. A significant deviation of volume "delivered" from volume "set" is an indication that the pipetter needs cleaning and/or replacement parts.

13 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

The following are specific definitions for precision, accuracy and completeness. Also, see Section 4 for further information.

13.1 Precision

Precision is frequently determined by the comparison of replicates, where replicates result from an original sample that has been split for identical analyses. Standard deviation of a sample is commonly used in estimating precision.

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

where a quantity x_i (e.g., a concentration) is measured n times with a mean x.

The relative standard deviation, RSD (or sample coefficient of variation, Cv), which expresses standard deviation as a percentage of the mean, is generally useful in the comparison of three or more replicates.

$$RSD = 100\ (s/x)$$

or

$$CV = 100\ (s/x)$$

where: RSD = relative standard deviation; or
Cv = coefficient of variation
s = standard deviation
x = mean

In the case of duplicates — samples that result when an original sample has been split into two for identical analyses — the relative percent difference (RPD) between the two samples may be used to estimate precision.

$$RPD = \frac{D_1 - D_2}{\left(\frac{D_1 + D_2}{2}\right)} x\ 100\%$$

where: D_1 = first sample value
D_2 = second sample value (duplicate)

All analyses performed in this program will have a measure of precision in terms of matrix duplicates, matrix spike duplicates, field duplicates or in the case of some selected analyses, triplicates. See specific method SOPs and Section II for further details.

13.2 Accuracy

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

$$Bias = \overline{X} - T$$

$$\%Bias = \frac{100(\overline{X} - T)}{T}$$

where: $\overline{X}$ = average observed value of measurement
T = "true" value

Accuracy may also be calculated in terms of the recovery of spiked samples as in the case of matrix spike samples for this program:

$$\% \ Recovery = 100\left[\frac{\overline{X}}{T}\right]$$

13.3 Completeness

Determining whether a data base is complete or incomplete may be quite difficult. To be considered complete, the data set must contain all QC check analysis verifying precision and accuracy for the analytical protocol. Less obvious is whether the data are sufficient to achieve the goals of the project. All data are reviewed in terms of goals in order to determine if the data base is sufficient. Following data validation, the % completeness can be obtained as the following calculation:

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

Assorted fixed column pipetters are also available in the laboratory. These devices are checked quarterly for delivery, accuracy, and precision. Routine maintenance includes careful cleaning of these dispensers properly when going from one reagent solution to another or when replacing outdated reagent solutions. Refer to manufacturers' instructions for cleaning suggestions.

13.4 Application of Controls

The daily accuracy and precision data for the analytical laboratory are plotted on control charts to determine if bias is developing or if the precision is less than expected. The vertical axis of the control charts is the value of the parameter being plotted, and the horizontal axis is the date of the determination. The control chart is characterized by a central line, warning limits, and control limits. The central line is the mean, theoretical, or most probable value for the parameter measured. The limits are values on either side of the central line with which are associated probabilities that measured values will exceed the value of the limits. The warning limits are the 2 or 95 percent limits; i.e., if the analysis is operating correctly and only random scatter is observed,

only one point in 20 should fall outside the warning limits. The control limits are the 3 or 99 percent limits; only one point in a hundred should fall outside these limits by chance alone. These are used to help assess laboratory control. Specific NYSDEC ASP requirements will be used to assess sample and QC data specific to this project. The control charts will be reviewed during the laboratory audit by the QA officer.

14 Corrective Action

When, as a result of audits or QC sample analysis, sampling or analysis systems are shown to be unsatisfactory, a corrective action shall be implemented. Also onetime corrective actions are taken during the course of analysis by chemists when the routine QC check criteria, e.g., GC/MS tuning, daily calibration, surrogate recovery, are not met. The project manager, laboratory manager, laboratory QA director, QA Officer, and analyst may be involved in the corrective action.

The acceptance limits for the sampling and analyses to be conducted in this program have been defined in Sections 4, 7, 8, and 10. The corrective actions are likely to be immediate in nature and most often will be implemented by the field sampling personnel or lab analyst. The corrective action will usually involve recalculation, repreparation, reanalysis, or repetition of a sample run.

14.1 Immediate Corrective Action

Specific QC procedures and checklists are designed to help analysts detect the need for corrective action. In addition, a scientist's experience will be valuable in alerting the operator to suspicious data or malfunctioning equipment.

If a corrective action is taken as part of normal operating procedures, the collection of poor quality data will be avoided. Instrument and equipment malfunctions are amenable to this type of corrective action, and the QC procedures will include troubleshooting guides and corrective action suggestions. The actions taken will be noted in field or laboratory notebooks or benchsheets and a memorandum issued to the QA Officer within 1 day of the corrective action. For field corrective actions, a Field Nonconformance Report (Figure 14-1) will be submitted. No other formal documentation will be provided, unless further corrective action is necessary. These on-the-spot corrective actions are an everyday part of the QA/QC system. Corrective action during the field

sampling portion of the program is most often a result of equipment failure or an operator oversight, and may require repeating a sampling event. Operator oversight is best avoided by having field crew members audit each other's work before and after a test. It is the responsibility of the Field Operations Supervisor to ensure that all QC procedures are followed.

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

- Daily calibration does not meet method specifications;
- QC data are outside the acceptable windows for precision and accuracy;
- Blanks contain contaminants above acceptable levels (>MDLs);
- Undesirable trends are detected in spike recoveries or the relative standard deviation between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the laboratory QA Director during internal audits or from the QA Officer during program audits;
- Inquiries concerning data quality are received from the client.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, and instrument sensitivity. If the problem persists or cannot be identified, the matter is referred to the Laboratory QA Manager or Director. Once resolved, full documentation of the corrective action procedure is filed with the laboratory QA department. A Nonconformance Record (Figure 14-2) for laboratory corrective actions will be submitted to the laboratory QA director and the project QA officer.

14.2 Long-Term Corrective Action

The need for long-term corrective action may be identified by standard QC procedures, control charts, performance, or system audits. Any quality problem which cannot be solved by immediate corrective action falls into the long-term category. The Laboratory QA Director shall use a system to ensure that the condition is reported to a person responsible for correcting it, who is part of a closed-loop action and follow-up plan.

The essential steps in the closed-loop corrective action system will include:

- Identification and definition of the problem.
- Delegation of responsibility for investigating the problem.
- Investigation and determination of the cause of the problem.
- Determination of a corrective action to eliminate the problem.
- Delegation and acceptance of responsibility for implementing the corrective action.
- Establishment of effectiveness of the corrective action and its implementation.
- Verification that the corrective action has eliminated the problem.

Documentation of the problem is important to the system. A Corrective Action Request Form (shown on Figure 14-1) or equivalent will be completed by the person finding the quality problem. This form identifies the problem, possible causes and the person responsible for action on the problem. The responsible person may be an analyst, Field Team Leader, or the QC Director. If no person is identified as responsible for action, the QC Director will investigate the situation and determine who is responsible in each case.

The Corrective Action Request Form includes a description of the corrective action planned, the date it was taken, and space for follow-up. The QC Director will check to be sure that initial action has been taken, appears effective, and at an appropriate later date will, check again to

see if the problem has been fully solved. The QC Director will receive a copy of all Corrective Action forms, and will enter them in the Corrective Action Log. This permanent record will aid the QC Director in follow-up action and this log will be reviewed by the QA officer during program audits.

15 Quality Assurance Reports

QA reports will be prepared by the QA Officer and submitted to the project manager, and the manager of the audited group to ensure that QA/QC objectives are met. The reports will include an assessment of the status of the project in relation to the agreed-upon timetable, for field sampling, and laboratory analysis, document audits, an assessment of the precision, accuracy, and completeness of sample batches analyzed to date, significant quality problems discovered and the status of any necessary corrective action procedures, and any required changes to the QAPP.

Reports for field and laboratory audits will be submitted within 10 days following the audit. Serious deficiencies will be reported within 1 day with corrective actions identified. The audit-reporting process will include a summary of audit results that will be developed from audit reports by the QA Officer. These summaries will be distributed quarterly to the project manager during periods when sampling and laboratory analyses are underway.

16 References

American Society of Testing Materials (ASTM), Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants, D421-85, July 1985.

ASTM, Standard Test Method for Particle-Size Analysis of Soils, D442-63, September 1990.

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Data Quality Objectives for Remedial Response Activities, USEPA/540/G-87-003, 1987.

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National Handbook of Recommended Methods for Water Data Acquisition, Office of Water Data Coordination, USGS, 1977.

New York State Department of Environmental Conservation Analytical Services Protocol (NYSDEC ASP), September 1989, volumes 1 - 8.

17 List of Acronyms for QA/QC Criteria

CC	Continuing Calibration Check Sample (Organics)
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification Sample (Inorganics)
COC	Chain-of-Custody
CRDL	Contract Required Detection Limit (Inorganics)
CRQL	Contract Required Quantitation Limit (Organics)
FB	Field Blank
FD	Field Duplicate Sample
ICB	Initial Calibration Blank
ICV	Initial Calibration Verification (Initial Calibration Check) Sample
LCS	Laboratory Control Sample
MB	Method (Preparation/Extraction) Blank
MBS	Matrix Blank Spike
MD	Matrix Duplicate Sample
MDL	Method Detection Limit
MS	Matrix Spike Sample
MSD	Matrix Spike Duplicate Sample
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SS	Surrogate Spike

Quality Assurance Project Plan
for
Air Force Plant 59
Johnson City, New York

Installation Restoration Program
Supplemental Site Inspection

Part B

Revision 2 December 19, 1991

Part B Field Sampling Methods/Protocols

1 Introduction

The field investigation program is intended to provide for timely and cost-effective collection of data for characterization of contaminated sites, and for use in evaluating potential risks to human health and the environment from the presence and migration of contaminants. Data gathered in the field program will also support development of no-further-action documents and/or of RI/FS and RD/RA work plans and cost estimates.

The types, locations, and numbers of samples to be collected have been determined from existing background data from previous IRP investigations and ANL site visits. The sampling locations are identified in Figure 2-1. Whenever possible, sampling locations will be documented by photographs and indicated on a site sketch in the field logbook. The number of samples and the analytical parameters are summarized in Table 2-1. Groundwater elevation data, stratigraphic logs (visual and geophysical), and pump-test data will also be collected. Organic vapor analyzers will be used to monitor the atmosphere and soil during all drilling and sampling operations.

This section describes the procedures to be followed by all personnel performing sample collections, field measurements, and field tests. The procedures presented are designed to ensure that:

- All sample and field measurements are consistent with project objectives.
- Samples are identified, preserved, and transported in such a manner as to ensure that samples are not lost during transport and that data are legally valid.

- Field measurements are collected in such a manner as to allow for comparisons between existing and newly collected data so as to provide as complete a database as possible for achieving the objectives of this phase of the remedial investigation

The objectives will be achieved by conforming to SOPs during designing and constructing monitoring wells, logging boreholes, measuring water levels, sampling, conducting on-site chemical analyses, and performing pumping tests.

The techniques for acquiring and documenting geologic and geohydrologic data, as identified and described in the Work Plan for AFP 59, are presented in the following sections.

2 Pre-Drilling Activities

Before entering the field to drill and install groundwater monitoring wells, drilling specifications will be prepared and submitted to qualified drilling subcontractors for bid solicitation. A qualified driller will be licensed in New York State, will have experience working on similar projects (this shall apply to both the individual drillers in the field and the drilling company as a whole), and will have the necessary equipment capabilities.

Prior to initiating the drilling program, appropriate state and local agencies will be contacted to obtain any necessary permits. Drilling activities and monitoring well construction will comply with regulatory and AFP 59 requirements regarding access, drilling, and groundwater extraction.

Within two weeks of initiating field activities, a preliminary site visit will also be conducted to identify sampling and monitoring locations and prepare the site for drilling activities. The following activities will be performed during the preliminary site visit:

- Meet with plant officials to present/discuss proposed field work activities, obtain a briefing on plant rules, obtain passes, and register vehicles and field personnel.

- Identify and stake final well and sampling locations, and access routes for approval by plant officials.

- Establish staging area for drilling equipment and supplies. Establish decontamination area; identify water source(s).

- Establish/identify staging area for drummed drilling waste material (cuttings, liquids, etc.).

- Clear well locations for the presence of underground utility lines.

- Establish a working schedule/plan with plant officials that will be least disruptive to ongoing plant activities.

3 Drilling and Well Construction

After the preliminary site visit activities are accomplished, well drilling activities will begin, and will follow the drilling/well-installation protocol presented in the following sections.

3.1 Monitoring Well Installation

Presently, there is an existing deep aquifer production well and three shallow-aquifer monitoring wells at AFP 59. Because of the limited number and positioning of these wells relative to the prevailing groundwater flow direction, the potential effects of past activities at AFP 59 on groundwater quality cannot be assessed adequately.

In order to quantify adequately the potential effect of past activities at AFP 59 on groundwater quality, a total of 22 soil borings and 13 scientifically-logged monitoring wells will be completed. These will include two individual deep wells (located within 10 ft of two of the existing three shallow wells), one shallow well next to the plant's production well, and five well clusters (a shallow and deep well positioned within a 10 ft radius from one another). Depending on the nature of the contaminants discovered while installing the proposed monitoring wells, up to three additional shallow wells will be installed next to other shallow well. These three pairs of shallow wells will, for any given pair, be screened to sample the upper and lower zones of the upper aquifer. These soil borings and groundwater monitoring wells will help to:

- Determine whether contaminated soils underlying AFP 59 property are contributing to groundwater contamination in the area.
- Determine the extent (rate and direction) of contaminant migration.

- Develop a conceptual hydrogeologic model for determining, via numerical modeling, groundwater flow direction and rated.

- Provide analytical data for evaluating potential sources of contaminants present in the deep aquifer

- Provide site-specific quantitative information upon which recommendations regarding further actions can be made

The proposed monitoring network is shown in Figure 2-1. The monitoring-well network is designed to characterize upgradient (background) and downgradient water quality within both the upper and lower water-bearing zones of the Clinton Street-Ballpark Valley aquifer, and is designed to monitor and accommodate natural variations in groundwater movement and induced shifts in groundwater flow directions that may occur as a result of alternate water use and pumping at Johnson City's municipal water supply well field (located within 1,000 ft to the northwest and southeast of AFP 59) and the plant's production well

Water-quality data obtained from monitoring wells SW-3 and DW-3, located downgradient of the former underground waste oil storage area (Site 1), the electroplating building (Site 2), the former WW-II oil/water separator (Site 3), and the settling ponds (Site 4) will provide for a determination of whether groundwater quality and the plant's production well have been impacted by past activities in these areas. Data from SW-7 will help to evaluate the degree of contamination that may be coming from the JP-4 fluid-storage building and pipes (see Fig. 2-1). Perimeter monitoring wells will provide for an assessment of groundwater quality changes as it enters and exits the geologic units underlying the facility as a whole. Lithologic data obtained during borehole drilling, combined with water-level and aquifer-test data, will provide for an assessment of the hydraulic properties of the shallow and deep water-bearing zones and their degree of interconnection, and the rate and direction of groundwater flow. Based on this information and the

results of sampling analyses, predictions can then be made concerning the extent to which contaminants may have migrated using groundwater flow/contaminant transport modeling.

The following sections detail the well-installation, aquifer-testing, sampling, and field-analytical methods and procedures that will be implemented.

3.2 Shallow Monitoring-Well Installation

A total of six to nine shallow monitoring wells will be installed to monitor the uppermost portion of the Clinton Street-Ballpark Valley aquifer. Each of the shallow wells will be completed and screened in observed zones of contamination or from bottom to top of the aquifer if this distance is 20 ft or less. The wells will be installed with a truck-mounted drill rig, using 4.25-in.-ID hollow-stem augers.

Drilling will not be performed until the selected site has been cleared for drilling by AFP 59 (GE) officials and a supervising ANL geologist is on site. Borehole drilling will proceed without the use of water, if possible, to avoid the introduction of foreign materials into the aquifer. If the use of water is necessary during drilling (e.g., to prevent sand from heaving up inside the augers), water from an approved potable water source will be used. The volume of water introduced into the well will be recorded by the supervisory geologist and approximately five times this amount will be purged from the well during well development. For purposes of lithologic descriptions, split-spoon samples will be obtained continuously in three of the deep boreholes and at 5-ft intervals to the water table in all other boreholes, using the Standard Penetration Test (ASMD-1586). Split-spoon samples and soil cuttings from the well will be monitored for the presence of organic compounds with a photoionization-type of organic vapor analyzer.

All auger-cutting descriptions, water-level readings, air-monitoring readings, and other pertinent observations will be logged by the ANL supervisory hydrogeologist. All split-spoon

samples of unconsolidated sediment will be collected and usually identified by the supervisory geologist using the Unified Soil Classification System. Standard identification practices detailed in ASTMD 2488 will be followed. The following information, at a minimum, will be recorded by the supervisory geologist.

- Soil sample interval.
- Sampling hammer weight and distance of fall.
- Blow count (per 6-in. interval).
- Amount of sample recovered.
- Sample color.
- Sample texture.
- Sample moisture content (dry, moist, wet).
- Organic vapor readings.
- Any unusual characteristics.
- Depth to water.
- Drill rig behavior.
- Penetration rate.

Shallow monitoring-well installation will be accomplished through in-place, hollow-stem augers. Each well will be constructed of Schedule 40, threaded (glue not allowed), flush-joint, 2-in. diameter PVC, and will include 10 ft of 2-in. diameter, machine-slotted PVC screen, bottom-plugged (installed 3 ft above and 7 ft below the water table) with a slot size of 0.01 in. Clean silica sand backfill, suitable for the formation and screen slot size (e.g., No. 1 well gravel), will be placed around the screen to 2 ft above the screen. A 5-ft bentonite seal will be placed immediately above the silica sand and the annular space above the bentonite seal grouted to land surface with a Type I Portland cement/bentonite slurry.

The following procedure will be used for shallow-well installation. Once the augers have been advanced to the finished depth and the auger plug removed, the screen and riser pipe will be

steam cleaned, assembled, and lowered down the hollow-stem and the augers not raised more than about 25 ft. Well gravel (clean silica sand backfill) will be added, as needed, and its level sounded. This procedure will be repeated until the sand pack extends a minimum of 2 ft above the top of the screen. The augers will then be raised approximately 5 ft above the top of the sand and a 5-ft layer of bentonite pellets will be added, and allowed to hydrate, to form a seal over the sand pack. A 1-in. tremie pipe will be lowered down the annulus between the PVC casing and augers to about 5 ft above the bentonite seal, and grout will be tremied into the annulus until grout is observed at ground surface. The grout will be composed by weight of 10 parts Portland Cement to one-half part bentonite, with a maximum 10 gals of water per 94-lb bag of cement. Simultaneously, the tremie pipe and augers will be slowly withdrawn, and additional grout added until it extends to a level which will allow surface completion.

Surface completion of the monitoring wells will be coordinated with the AFP 59 Point of Contact (POC) to determine whether they are to be completed flush with or projected above the ground surface. Depending on the concern in the area, well surface completion will be as follows:

1. If well stick-up is of concern in an area, the well will be completed flush with the land surface by cutting the casing 2-3 in. below land surface and installing a protective locking lid consisting of a cast-iron valve box assembly. The lid assembly will be centered in a 3-ft diameter concrete pad sloping away from the valve box to ensure that free drainage is maintained within the valve box. A screw-type casing to prevent infiltration of surface water and 1 ft clearance between the casing top and the bottom of the valve box will be provided.

2. If an above-ground surface completion is used, the PVC well casing will be extended 2-3 ft above land surface and will be fitted with a loose-fitting casing cap. The PVC casing will be shielded with a steel guard pipe (sleeve) placed over the casing and cap and seated in a 2-ft x 2-ft x 4-in.

concrete surface pad that slopes away from the well sleeve. A lockable cap or lid will be installed on the guard pipe. A maximum of four traffic ballards, consisting of 3-in. diameter, cement-filled steel guard posts, will be installed radially from each wellhead, recessed approximately 2-ft into the ground, and set in concrete. Both the flush and above-ground well assemblies will be provided with corrosion-resistant locks that have either identical keys or are keyed for opening with one master key.

3.3 Deep Monitoring-Well Installation

A total of seven deep wells will be installed into the lower portion of the Clinton Street-Ballpark Valley aquifer and screened at a depth interval coincident with that of the plant's production well.

Based on the available information, it is anticipated that the deep wells will be completed to an average depth of approximately 95 ft below ground surface and will contain 20 ft of screen.

The deep wells will be double-cased and installed using a combination of hollow-stem augers and spin-casing techniques. Borehole drilling, soil sampling, and data collection will be conducted as previously detailed for shallow monitoring-well installation. However, split-spoon sampling will be performed at two-ft intervals beginning from the bottom depth of the shallow monitoring wells to the completion depth using the Standard Penetration Test (ASTMD-1586). If soil samples cannot be obtained in the coarser material anticipated in the deeper zones using a standard 2-in. split-spoon, a large diameter (3-in.) split-spoon will be driven to obtain soil samples. The sampler dimensions, hammer weight, length of hammer drop, and blow counts will be recorded on the boring log by the on-site hydrogeologist

Deep monitoring wells will be double cased to preclude cross contamination between the upper and lower aquifers. The monitoring wells will be constructed by temporarily emplacing a 10-in. diameter, schedule 40 PVC casing riser into the suspected confining layer. An 8-in. diameter, schedule 40 PVC casing will then be inserted into the 10-in. casing. A cement/bentonite grout will then be tremied into the annular space between the casings and the 10-in. casing gradually withdrawn in a manner that ensures that the annular space is suitably sealed.

The borehole below the 8-inch casing will be advanced using spin-casing drilling techniques. Well installation will be accomplished through the spin-casing. Each well will be constructed of Schedule 40, threaded (glue not allowed), flush-joint, 4-in. diameter PVC, and will contain 20 ft of bottom-plugged, 4-in. diameter, machine-slotted PVC screen with a slot size of 0.01 in. Clean silica sand backfill, suitable for the formation and screen slot size, will be placed around the screen and up to the bottom of the confining layer. A 5-ft bentonite seal will be placed immediately above the silica sand, and the annular space above the bentonite seal grouted with a Portland Cement/bentonite slurry to 5 ft below the top of the confining layer. A 5-ft layer of bentonite will then be placed immediately above the cement/bentonite slurry to seal the upper water zone from the lower water-bearing zone. Immediately above the bentonite seal, the formation comprising the saturated interval of the shallow water-bearing zone will be allowed to collapse around the PVC riser. Clean silica sand, if necessary, will be added to supplement backfilling around the PVC casing until it extends to 2 ft above the prevailing water-table surface. A 2-ft bentonite seal will then be applied and the annular space above the bentonite seal grouted to land surface with a cement/bentonite slurry. This procedure is necessary to prevent grout contamination of the shallow water-bearing zone in the proximity of the shallow well screens.

Surface completion of the monitoring web will be coordinated with the General Electric AFP-59 POC to determine whether they are to be completed flush with or projected above the ground surface, as was described previously for shallow-well installation.

3.4 Well Development

All groundwater monitoring wells will be developed as part of the well installation process. Development will be performed in order to create a good hydraulic connection between the well and the aquifer in which it is screened. This is important for obtaining reliable groundwater data and representative groundwater samples. Well development is achieved by removing fine grained geologic materials away from the well screen. Each well will be developed as soon as practical after completion by surging and bailing to remove the heavy sediments, then surging and pumping with a centrifugal or submersible pump.

Development will begin at the bottom of the well, working up to the top of the screen and then back down to the bottom in increments of approximately 2-3 ft. Development will consist of surging and pumping each interval until the discharged water is turbid free to the unaided eye and up to five casing volumes plus five times the amount of water introduced during borehole drilling (if any) have been removed from the well. If a well should pump dry before the five casing volumes have been removed, the well will be allowed to recharge for a short period of time and then pumped dry again. This process will be repeated for a maximum of one hour.

Part of the well-development process will consist of washing the well cap and the interior of the PVC well riser using the water being purged from the well. The result of this operation will be a well casing free of extraneous materials (grout, bentonite, sand, etc.). This washing will be conducted during the development process, and not after.

The submersible pump or pump intake line will be raised slowly from the bottom until it breaks suction. This will ensure that no water that has been affected by the drilling will be left in the well. Water level measurements will be obtained before, during, and after well-development. All water removed from a well during development which is suspected to be contaminated will be containerized. Containers will be 55-gal drums approved by the NYSDOT for the transportation of

hazardous materials. Containers will be placed on wooden pallets and left onsite at a temporary staging area designated by AFP-59 officials for subsequent hazardous-constituency characterization. (See ANL's Waste Management Plan for further details.)

3.5 Decontamination

Before drilling the first well, between drilling of wells, and after drilling the final well, all drilling, measuring, and sampling equipment (augers, rods, split spoons, etc.) that have contacted potentially contaminated soils or water will be decontaminated. These procedures are necessary to prevent cross-contamination of wells.

All equipment to be decontaminated will be laid out on blocks (above ground) and steam-cleaned with water from the approved potable water source. A decontamination area will be constructed for this purpose. Immediately prior to installation, the PVC well pipe, screen, and protective steel casing will be steam-cleaned. All pumps, pipes, hoses, and other equipment that cannot be internally scrubbed will be flushed with clean water. Decontamination fluids and other associated wastes will be collected in drums and stored in a temporary storage area for subsequent hazardous-constituency characterization. It will be the responsibility of the on-site ANL hydrogeologist, or on-site ANL field-operations supervisor to ensure that complete equipment decontamination is carried out

3.6 Well-Site Restoration

At each boring/monitoring well location- polyethylene sheeting will be laid out and drilled through to help confine the borehole cuttings and keep the drilling area clean. Following well installation, uncontaminated cuttings will be spread over the general area in the vicinity of the

borehole or transported to more suitable areas for disposal, as determined and designated by AFP 59 officials. Borehole cuttings exhibiting potentially hazardous characteristics (e.g., unusual color, odor, organic-vapor-meter readings, etc.) will be containerized in NYSDOT-approved, 55-gal drums and moved to a temporary staging area designated by AFP 59 officials. Each well-site will be cleaned and restored to near pre-existing conditions.

4 Sampling

The purpose of data collection, sample collection, and laboratory analysis is to determine whether any contaminants generated from installation activities are entering the environment. The field investigation is used to determine the source, extent, and migration of any identified contaminants, and the magnitude of contamination relative to ARARs and any naturally occurring or background concentration for specific compounds. In order to provide a comprehensive baseline characterization for the facility as a whole, all new and existing wells, surface water, and sediment from Choconut Creek will be sampled and analyzed for the complete list of TCL organics and TAL inorganics as indicated in NYSDEC ASP. Figure 2-1 illustrates the location of all the sampling sites for this SI. Table 2-1 summarizes the minimum number and type of samples which will be collected during various phases of field activity performance. Section 3.6 summarizes the field/sample numbering system that will be implemented. All sampling will be conducted by experienced personnel under the direct supervision of the ANL on-site field operations manager. All sampling will be accomplished under a rigorous chain-of-custody protocol and will comply strictly with the sampling techniques contained in the Handbook for Sampling and Sample Preservation of Water and Wastewater, USEPA Document 600/4-82-029 (1982).

4.1 Soil Sampling

Monitoring well and test boreholes will be drilled using 24 inch split spoon samplers. The contents of each split spoon will be screened for potential contamination. Any soil exhibiting potentially hazardous characteristics (e.g., unusual coloration, odor, organic-vapor-meter readings, etc.) during borehole drilling will be collected for on-site GC/MS and EDXRF screening and/or TCL/TAL analyses. Samples will be obtained with a decontaminated split-spoon or Denison sampler, subsampled with a decontaminated stainless-steel table spoon or scoop, placed in an appropriate container for the analyte to be tested, labeled, packaged, placed in a cooler and chilled

to 4°C. If not analyzed on site, the sample will be shipped to Galson Laboratories for chemical analysis.

Two soil samples will be collected from each of eight well cluster locations. A total of six additional samples may be collected at the discretion of the supervisory geologist. The maximum number of samples will not exceed 22. The soil samples will be collected from either the deep or shallow well boreholes. If both a deep and shallow well borehole are planned for a well cluster location, information from the first borehole drilled will be used to determine sampling depths in the second borehole. If only a single well is to be installed in a given well cluster location, then samples will be collected from that borehole

If no soil samples exhibit potentially hazardous characteristics at a given well cluster location, then two soil samples will be collected at the following depths. One soil sample will be collected at a depth equal to half the distance between the ground surface and the estimated top of the water table or ten feet, whichever depth is shorter. A second sample will be collected at a depth located immediately above the water table as determined by the site geologist. If only a single well is to be installed in a given location, and no indications of contamination are observed down to ten feet below ground surface, then a sample should be collected at ten feet. This sample may be discarded if contaminated soils are observed and sampled at a depth below ten feet

A total of five test boreholes will be drilled in four potential contaminant source areas as follows: Site A1 (1 hole), Site A3 (1 hole), Site A4 (2 holes), and Site A6 (1 hole). The potential contaminant source areas (Site A1, A3, A4, and A6) are shown in Figure 2-1. The two holes at Site A4 will be drilled at an angle in order to sample beneath the settling tanks. Borehole target depths will be determined on a case by case basis in the field but are tentatively assumed to be between 10 and 15 feet. Continuous split spoon samples will be recovered and examined. Any instrumental or unusual signs of contamination will be recorded. The final (deepest) sample will be collected for TCL/FAL analyses.

In addition to the five samples selected for TCL/TAL analyses, a total of 22 samples will be collected using a hand auger and analyzed on site by GC/MS and EDXRF. One background soil sample will also be collected using a hand auger. The sample will be collected from an upgradient location and sent to the laboratory for TCL/TAL analysis. At the discretion of the supervising geologist, additional soil samples may be collected for on site analysis by GC/MS and EDXRF.

4.2 Groundwater Sampling

A total of 16-19 wells, which will consist of seven newly installed deep wells, six to nine newly installed shallow wells, two existing shallow wells, and one existing deep production well, will be sampled twice. The first sampling event will be performed at least two weeks after well development, to allow the aquifer to return to equilibrium. The second round of sampling will be performed after a 72 hour pump test, if such a test is done. If not done, the second round of sampling will be performed after any slug test are completed.

Prior to going into the field, the ANL hydrogeologist (the groundwater sampling field team leader) will gather all available information, such as the total depth, water level, and type of casing material for each well. This will aid in determining the bailer size to be used when sampling. The diameter of the well and the water-level measurement is also used to calculate the minimum purgewater volume to be evacuated from the well prior to sampling. Information on pumping rates, latest dynamic and pumping water levels, pump intake depths, and the length of time the pump has been on will also be gathered for the production well.

To ensure that a representative sample of the aquifer is obtained, three to five times the calculated volume of standing water in the well will be purged from each well prior to sample acquisition. In the event of low yielding wells, the well will be purged to dryness and allowed to recover prior to sample acquisition. A round of static water-level measurements will be obtained

with an electronic water level indicator, both prior to and after purging to ensure recovery before sampling.

Monitoring-well purging will be accomplished with a centrifugal or submersible pump equipped with a 1/2- to 1-in- diameter flexible polyethylene pipe suction line. A new, unused length of pipe will be used for each well to prevent cross-contamination of wells. The pipe will be stored in large plastic bags until ready for use, and will be handled with new, clean surgical gloves for each well. Additionally, the pipe will not be allowed to become contaminated by touching the ground. The suction pipe will be lowered to the bottom of the well and the pump started. After the required volume of water has been nearly evacuated from the well, the suction line is raised in intervals to the water surface and allowed to pump for a short time at each stop. The suction line is then removed from the water and is allowed to purge itself and the discharge hose. The suction line or pump is then removed from the well and the volume purged recorded. Purged well water suspected to be contaminated will be collected and containerized in NYSDOT-approved drums and stored on-site for subsequent hazardous constituency characterization.

Upon completion of the purging operation, and prior to collecting groundwater samples, temperature, pH, and conductivity will be measured in each well using a Corning Checkwater 90 field instrument following Methods 2.G.2.A, 2.G.2.B, and 2.G.2.C described in the "National Handbook of Recommended Methods for Water Data Acquisition", prepared by the Office of Water Data Coordination (USGS, 1977). Groundwater samples will be obtained from each monitoring well using disposable bottom-filling teflon bailers. A new bailer will be used for each well. Argonne will take a single rinse sample, representing all 16-19 bailers in advance of using them. The rinse sample will be analyzed for TCL/TAL compounds. Tap samples will be obtained by directly filling appropriate sample containers at a discharge line at the wellhead of the plant's production well. The sampling effort will also include trip blanks for each batch of samples sent to the laboratory.

At each monitoring well, the bailer will be lowered into the well with new (unused) polypropylene twine. A new pair of disposable surgical gloves will be used to handle the bailer at each well. The bailer will be lowered into each well slowly to minimize the potential for agitation and aeration of the water sample. Samples will be placed into a sampling container containing an appropriate preservative for the parameter to be analyzed. An samples will be stored with ice to maintain 4°C or below. The samples will be packaged and shipped via overnight carrier (e.g., Federal Express) to the laboratory for chemical analysis.

4.3 Surface-Water/Sediment Sampling

Choconut Creek will be sampled for determination of TCL/TAL compounds at three locations in order to obtain baseline quantitative data for assessing whether past activities at AFP 59 may have impacted Choconut Creek, as well as for helping to determine whether the creek itself may be impacting groundwater quality at AFP-39. Surface water and sediment will be sampled at mid-stream locations. An on-site, downstream location near the western site boundary (see Figure 2-1) will represent the stream as affected by AFP-59. An off-site, upstream location near the eastern site boundary will serve as a local background sample in this comparison. A third pair of samples will be collected from Choconut Creek above Johnson City at a point to be chosen by the ANL field operations supervisor to provide regional stream background values. Additional samples may also be screened using ANL's MEM if it is on site at the time.

If conditions permit, creek-sampling stations will be reached by wading. Downstream samples will be taken first. Surface-water samples will be taken by submerging the sampling containers. VOA sampling containers will be submerged in such a way that water enters gently and forms a meniscus. Air bubbles will be eliminated by tapping the container prior to capping it. Sediment samples will be taken by a grab-type collector.

The AFP-59 outfalls have been periodically sampled in the past in accord with the SPDES permit requirements. Those samples have not, however, been subjected to full priority-pollutant analysis. One effluent sample for priority-pollutant analysis will therefore be collected from each of the two outfalls, by direct filling of sample containers.

All sampling equipment will be decontaminated prior to sample acquisition at each location. Each sampling location will be surveyed, and recorded on the project map.

4.4 Waste Materials Sampling

All waste materials generated during the field effort, that are suspected to be hazardous (based on color, odor, organic vapor readings, etc.), will be containerized in drums which have been approved by the NYSDOT for the transportation of hazardous materials. Waste materials to be containerized will include soil-boring/well-drilling cuttings, decontamination rinse waters, and discharge water from well development and purging (prior to sampling). Drums will be placed on wooden pallets and placed in a staging area designated by AFP 59 (GE) officials. AFP 59 will be responsible for the ultimate disposal of containerized wastes

After field sampling activities have been completed, and after all analytical results have been received, one composite waste liquid and one composite waste solid (soil) sample may be obtained from the contents of the drummed materials, if believed necessary by ANL and GE officials to have the wastes characterized by the Toxic Characteristics Leaching Procedure (TCLP). Composite sampling will be performed by obtaining an equivalent volume of grab sample from each of the drums that may need to be characterized by the TCLP.

4.5 Field QA/QC Sampling

During the sampling effort, quality control samples will be collected based on the numbers and types of sampling being conducted. At a minimum, the following quality control samples will be collected:

- One equipment blank per 20 laboratory samples will be prepared by pouring distilled-water into the sample container through the sampling equipment. The sample is then analyzed for the same parameters being tested for on the media samples on that given day. Equipment blanks are used to evaluate the field sampling.

- One randomly collected duplicate sample for every 20 samples of each matrix for each parameter to be tested. These duplicate samples are collected at the same time and in the same manner as the original sample. The results of the duplicate analysis are used to evaluate the representativeness of the field sampling and the RPD of field and laboratory methods.

- One trip blank for VOA analyses will accompany each batch of samples to the laboratory. Trip blanks are used to evaluate the sample-handling procedure.

The ANL Field Operations Supervisor will ensure that all sampling is performed in strict accordance with the Work Plan and QAPP.

4.6 Sample Labeling Scheme

For data entry into the Installation Restoration Program Information Management System (IRPIMS), each unique environmental sample is identified by a concatenation of seven sample fields.

The inclusion of all this information in the same format as the database would be too long and cumbersome for the purpose of labeling samples in the field. Instead, field Sample numbers will code information for Air Force Installation, specific location, sample code representing a specific depth or sample in a continuous series, and matrix. This scheme produces a sample number of 7 characters without hyphens that is unique for each sample generated.

5 Aquifer Testing

ANL will perform short-term slug tests at each of the monitoring wells to determine properties of the porous media beneath the plant property. The Hvorslev or other applicable method will be used to interpret the slug-test data. The purpose of the aquifer slug testing program proposed is to obtain data for use in assessing the hydraulic characteristics of the shallow and deep water-bearing zones of the Clinton Street-Ballpark Valley aquifer beneath AFP 59, the extent of their interconnection, such that an overall evaluation of potential groundwater flow and contaminant transport can be made.

Previous ANL work plans have proposed a 72-hour pumping test of the aquifer. However, it has been determined that such a rigorous aquifer test could potentially cause cross contamination between the upper and lower aquifers suspected to exist below the site. In addition, the test could also potentially cause off-site contamination from other parties to be drawn onto the property. Therefore, a 72 hour pumping test will not be performed.

Instead, the vertical and horizontal aquifer characteristics determined from the slug test data will be compared to previously published data (e.g., U.S.G.S. and/or New York State data). If the site specific aquifer characteristics are statistically comparable to previously published data, then no further testing will be conducted. If the characteristics are nonconformable and suspected of being erroneous, then a small scale pumping test will be proposed at that time.

Two of the existing shallow wells, the deep production well, and the thirteen new wells will be sampled before and after testing to determine water quality parameters for the groundwater aquifer.

Based on the results of field work, a conceptual model of the groundwater aquifer beneath the AFP 59 site will be developed. A groundwater flow and transport model will then be

employed to perform quantitative analyses required to meet the objectives of the study. Due to the apparent complexity of the hydrogeological system, a three-dimensional capability will probably be required. Possible candidate computer models include CFEST, SWIFT II, MOD-FLOW, and MOC. As much site-specific hydrogeological information as possible will he incorporated in the modeling effort to minimize uncertainty in the flow and transport calculations.

Documentation/reporting requirements will include not only results of the predictive simulations, but also tabulated existing data, data-input matrices, calibration efforts and results, and a narrative discussion of sensitivity analyses and error terms.

6 Field Equipment

6.1 Water-Level Surveys

An electronic water-level indicator (QED or equivalent) will be used to take water-level measurements during the field program. The water-level indicator will have marks on the sounder line at regular intervals (0.01 ft).

Each water-level indicator will be accompanied by a calibration logbook that will show the time and date of last calibration (before entering the field); the point of calibration (either the center of a mark on the sounding line or along the extreme of the first mark near the probe); the person doing the calibration; and how it was accomplished. A calibration check will be made in the field by taking a water-level measurement with the sounder and checking the measurement with a steel tape. The difference between the two measurements should be less than 0.1 ft per 100 ft of depth to water.

Electronic (or pneumatic) pressure transducers and data loggers will be used during pumping tests, if any, for continuous monitoring of water levels. Transducers will not be used for "spot" water level measurements unless all other methods fail to generate verifiable data.

The operation, calibration, maintenance, and storage of the data-loggers and transducers proposed for this project will be in accordance with the manufacturer's specifications. They will only be placed down the well when the pump is turned off and only within a protective air line or pipe if the pump is to be operated. The exact depth to the sensing tip of the transducer must be known, and the water level at time of placement must be measured. All electronic and atmospheric conditions that may affect the transducer's reading will be recorded.

During aquifer tests or pump tests in which transducers are being used, the water level will be routinely checked with a tape or sounder to ensure the accuracy of the transducer. The power supply to the data logger and transducer will also be checked routinely.

6.2 Well-Discharge Measurements

During aquifer tests, if any, and groundwater quality sampling events, field measurements will be made to determine the flow rate of the water discharging from the well. This will be accomplished by different methods that will be selected on the discharge rate of the well, as described below.

Discharges from a well with a low discharge rate will be directed into a 5- to 14-gal container. A stopwatch will be started as soon as the discharge begins. The stopwatch will be turned off when the container is full. This will give the time in minutes and seconds that it took to discharge the known volume of water from the well. The rate of discharge will be converted to gallons per minute. The time this measurement was taken will also be recorded.

Well-discharge measurements for wells discharging at large rates will be accomplished by one or more of the following methods:

- Orifice plate
- In-line flow meter
- Cox flow meter
- Open channel flow meter

The following items will be considered before selecting any of the above discharge-measuring methods:

- Well-completion details and pump setting specifications.

- Pump type, rating, power source, and type of discharge outlet
- Determination of the length of time the well has been discharging.
- The status of adjacent active web (those within a 1/2-mi radius).
- Estimates, records, or field measurements of pump discharge, time of pump or time since last pumping for the adjacent active wells.
- Method to be used for estimating discharge-

Once this information is established, one of the above discharge measurement methods will be employed at the time of measurement, atmospheric conditions, equipment, or well-head conditions which may ultimately affect the discharge measurements will be recorded along with the discharge date.

Below are brief descriptions of each discharge measurement method that may be used.

Orifice Plate (Circular Orifice Weir)

This technique will require custom design of equipment and piezometer tube for each specific well. The diameter of the orifice must be less than 0.8 of the total diameter of the discharge line where the plate is placed. The piezometer tube must be clear of obstructions and free of air bubbles.

The orifice plate will be used only at wells where it can be adapted and when other techniques will not produce verifiable data. At least two readings will be made using this method, until a ±10 percent difference or less is obtained.

In-Line Flowmeter

If the well is equipped with an operable in-line flowmeter, it will be used to measure well discharge. The meter reading will be compared to a discharge measurement from one of the other

acceptable methods to measure accuracy of the measurement. The type and manufacturer of the meter will be known prior to operating and reading the meter. At least two readings will be made, until a ±10 percent difference or less is obtained.

Cox Flowmeter

In most situations, the Cox flowmeter will be used for discharge measurements. It is portable, easily adapted, and accurate to within ±5 percent of the actual value. The Cox flowmeter will be used on wells discharging to either open or closed systems and will be used on wells with discharge pipe diameters from 2 to 20 in. (depending on model). If a tap and plug have not already been drilled into the discharge pipe, then one will be drilled at least eight pipe diameters down from the pump at a 45-degree angle from the horizontal. The manufacturer's specifications and operating procedures will be followed in installing, operating, and reading the flowmeter.

At any well that the Cox flowmeter will be used, it is necessary that the discharge pipe be full of water. If the pipe cannot be constructed to cause a full pipe, then an alternative flow measurement method is required. The component fitting so the flowmeter and discharge pipe adaptation must also be free of air. At each well where the Cox flow-meter will be used, at least two readings will be made, until a ±10 percent difference or less is obtained.

Open-Channel Flowmeter

Open channel flowmeters or current meters, such as the type-AA Price and Pygmy meter, will be used when there are no techniques available to measure discharge directly off the pump and discharge pipe at the well. These meters will be used to measure surface-water flow across ditches or open sewer lines, depending on where the well discharges. If the flow in the open channel is due to the well discharge only, then the current meter will be used at a point downgradient but near

the well, in an area free of turbulence within that channel. If the well discharges to an open channel with flow originating upgradient of the well, then two measuring points are required: one upgradient of the well discharge and one downgradient . The difference between these two measurements will be assumed to be the well discharge value, with no leakage within the channel. The channel flow will be measured according to the manufacturer's specifications and operating procedures of the specific current meter. The limits of velocities measurable by the meter must be known and never exceeded. Cross-section and depth profiles of channel velocity will be generated so as to accurately define the discharge to within +10 percent of the actual value. The same cross-section and depth profile will be used each time a discharge is to be measured. If possible, this method will be checked with another of the methods described herein to ensure its accuracy.

6.3 Equipment Calibration

Proper maintenance, calibration, and operation of each instrument will be the responsibility of the field technician and the lead equipment engineer assigned to the project. All instruments and equipment used during the studies will be maintained, calibrated, and operated according to the manufacturer's guidelines and recommendations. At a minimum, all instruments will be inspected and calibrated upon receipt from a vendor or from another office. When in the field, a photocopy of the manufacturer's operation and calibration recommendations will accompany the instrument. In the event that the instrument is not supplied with a manufacturer's recommendations for calibration and calibration frequencies, the following guidelines will apply:

- All equipment will be calibrated prior to a field program. This includes instruments used to measure water quality parameters and water levels, well discharge instruments, and air monitoring devices

- Air monitoring devices, temperature, pH, and conductivity meters will be calibrated daily and after maintenance and repair.

- Steel tapes used for measuring well depth will be calibrated twice a year to check for kinks, stretching, or work markings.

- Instruments for which calibration cannot be checked easily will be either tested against another instrument of a similar type, or will be returned to the manufacturer for appropriate calibration.

6.4 Decontamination Procedures

With the exception of drilling equipment (see Sec. 2.5), all equipment that will directly or indirectly contact sample material will be contaminant free. Decontamination of hand-sampling tools will be accomplished by use of a laboratory-grade detergent wash, followed by rinse with drinking quality water, and a reagent-grade II water spray rinse, followed by a methanol spray rinse and air drying in a clean environment.

7 Surveying

In order to determine the direction of groundwater flow, and to assess whether a hydraulic gradient exists from Choconut Creek to the underlying aquifer, the horizontal coordinates and elevations of each monitoring well and each surface-water and surface sediment-sampling location will be surveyed by a New York State registered licensed surveyor. Benchmarks shall be established from, and traceable to, a U.S. Coast and Geodetic Survey (USCGS) or U.S. Geological Survey (USGS) survey market. This will be a third order survey. For wells, vertical elevations and horizontal locations will be measured to an accuracy of 0.01 ft and 1 ft, respectively. Surveying of the wells will be to the top of the casing which will be notched where the elevations are established (no paint allowed). (The notch provides a reference point for all water level measurements.) All survey positions will be recorded on a base map of AFP 59. All benchmark locations will be clearly identified on the base map.

8 Site Management

ANL's Field Operations Supervisor will be responsible for ensuring the safe and proper conduct of employees and subcontractors in performing this work. All personnel under ANL supervision will adhere to the policies and procedures as they relate to access to security, safety, and health procedures in effect at AFP 59.

A field office will be established onsite, and lines of communications established with responsible General Electric (AFP 59) personnel.

Decontamination procedures will be conducted to ensure that potential contamination remains onsite. General cleanup of equipment and vehicles will be conducted consistent with accepted facility practices and in close coordination with the AFP 59 POC. The objective of site cleanup is to leave the area of investigation essentially as it was originally, except for the physical addition of monitoring wells and guard posts. Site cleanup requires close coordination with base personnel to ensure that cleanup operations are in accordance with the overall management of manufacturing-plant operations.

9 Documentation

The following information will be recorded in sewn or spiral-bound books with consecutive, prenumbered page

- Geologic and waste-materials logs of test borings, and drill holes advanced in connection with installation of water wells.
- Sampling conditions for soil samples.
- Sampling conditions for surface-water samples.
- Sampling conditions for groundwater samples.
- Sampling conditions for sediment samples.
- Sample shipment records, including copy of COC.
- Bruker MEM and Spectrace 6000 chemical analysis logbooks.

Table 2-1 TCL/TAL Sampling Summary

	TCL Volatiles	TCL Semivol.	TCL Pest/PCB	TAL Metals	TAL Cyanide
Well Boreholes	16	16	16	16	16
Field Duplicate	2	2	2	2	2
Split Spoon Rinse	2	2	2	2	2
Hand Tool Rinse	1	1	1	1	1
MS/MSD or MS/MD **	2	2	2	2	2
Background	1	1	1	1	1
Test Boreholes	5	5	5	5	5
Groundwater Samples	38	38	38	38	38
Field Duplicate	2	2	2	2	2
Bailer Rinse	1	1	1	1	1
MS/MSD or MS/MD **	2	2	2	2	2
Background	1	1	1	1	1
Creek Sediments	2	2	2	2	2
Field Duplicate	1	1	1	1	1
Background	1	1	1	1	1
Creek Surface Water	2	2	2	2	2
Field Duplicate	1	1	1	1	1
MS/MSD or MS/MD **	1	1	1	1	1
Background	1	1	1	1	1
Outfall Samples	3	3	3	3	3
Field Duplicate	1	1	1	1	1
MS/MSD or MS/MD **	1	1	1	1	1
Trip Blanks	16 *				
Totals	103	87	87	87	87

* The quantity listed represents a maximum number of samples.

** The quantity listed represents the number of MS/MSD (organics) or MS/MD (inorganics) pairs.

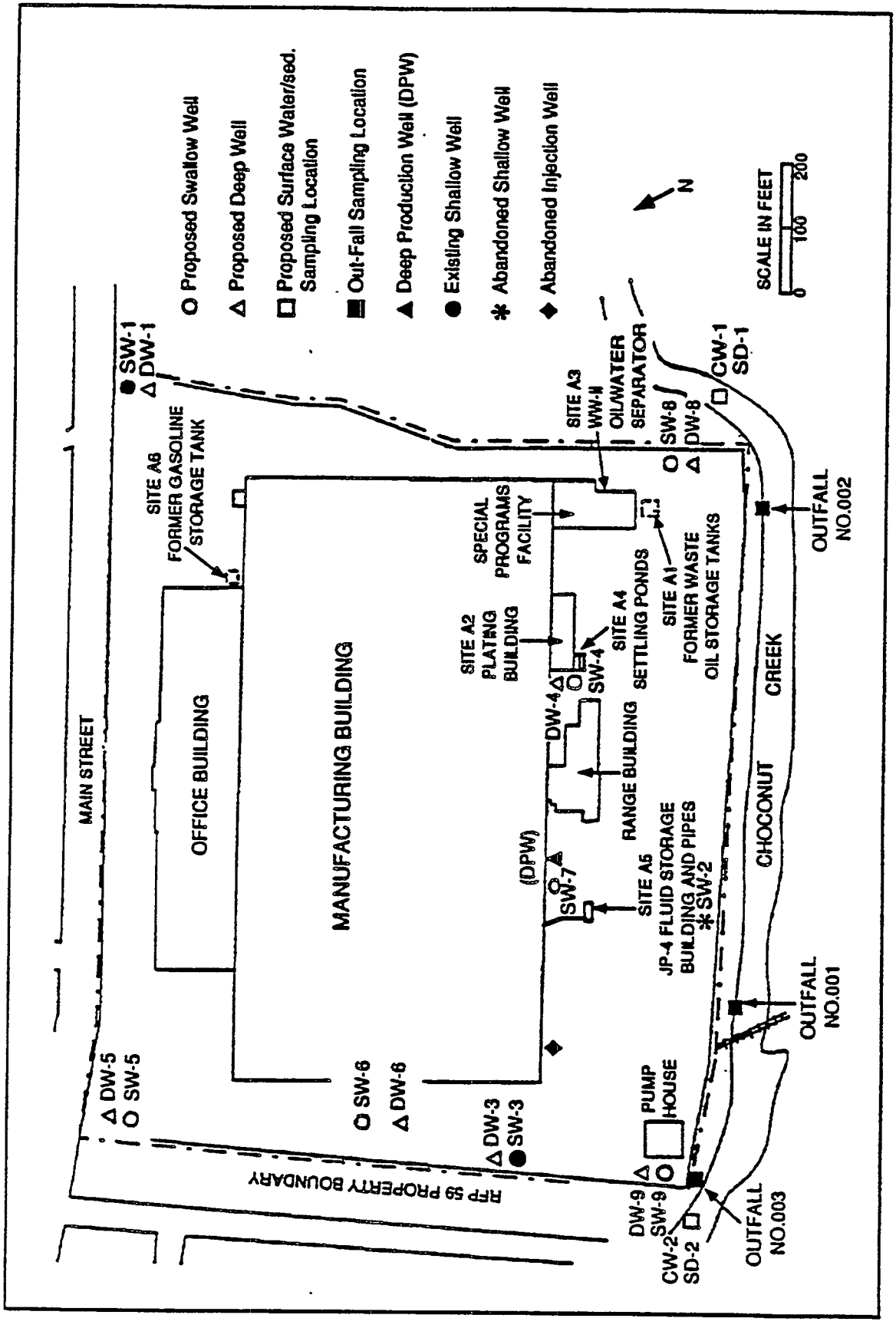


Figure 2-1. Map of AFP 59 showing proposed investigation sites and groundwater monitoring locations. (Note that some well designations are unlike those used in earlier drafts of this plan).

Appendix A

RESTRICTED INFORMATION
DO NOT DUPLICATE
OR CIRCULATE

BRUKER MOBILE ENVIRONMENTAL MONITOR (MEM)

GAS CHROMATOGRAPH/MASS SPECTROMETER

STANDARD OPERATING PROCEDURES

ARGONNE NATIONAL LABORATORY
ABERDEEN PROVING GROUNDS
EDGEWOOD, MARYLAND

October 24, 1991

Daily Start-up Procedures:

1. Operating Conditions
   a. MEM out of standby and sample heater off.
2. Check status of temperature table.
   a. MM1 checkup -> Temperature Table
   b. Save temperature table in MM1 screens on the Compaq in workfile labelled for the project.
3. Check linearity and sensitivity of mass 40.
   a. MS Measurements -> Profile Spectrum
   b. Profile spectrum (scan width=10, mass=40)
   c. Sensitivity = log value of argon peak should be 6.0 to 6.7
   d. Linearity = peak should be on the vertical line
   e. Recalibrate if necessary
   f. Save screen in MM1 screens on the Compaq in workfile labelled for the project.
4. Look for contamination
   a. Profile spectrum (mass 43 should be less than mass 44.)
   b. Mass 57 should be small
   c. If spectrum looks contaminated, make sure sample heater is off. Otherwise, let the MS run for a while to clean source.
4. Plot multi-profile of calibration gas
   a. MS Measurements -> Multi-Profiles
   a. Turn on calibration gas
   b. Plot masses 40, 100, 219, 331, 397
   c. All masses should be on the vertical line, each mass should not be off by more than 0.3 amu
   d. Save screen in MM1 screens on the Compaq in workfile labelled for the project.
5. Calibrate gas-ion abundances
   a. Go to Spectra mode (mass range = 45-400).
   b. Acquire spectra of calibration gas FC-77
   c. Turn off calibration gas
   d. Save screens which display the intensities of the criterion masses:
   d. Verify that the masses listed below are present. The ion abundance criteria is a guide of relative intensities, the abundances of each mass does not have to fall within the range.

Mass	Ion Abundance Criteria
69	Base Peak, 100%
100	20-40%
119	35-45%
131	35-45%
169	25-35%
181	10-15%
219	8-15%
231	2-5%
269	2-5%
331	<1%
397	<1%

   e. Return and correct mass range if necessary
5. Check BFB tuning criteria

a. Turn on sample heater and let the column heat to operating temperature (be sure column has baked off all contaminants before preceding).
b. Inject 5 uL of a 200 ng/uL standard of BFB onto a tenex tube or onto MEM probe head
c. Acquire Spectra
d. Save abundances of the criterion masses
e. Abundances must be within the following criteria:

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
174	greater than 50% of mass 95
176	greater than 95% but less than 101% of mass 174

f. If the analysis fails the BFB tuning criteria, autocalibrate and try again

6. Begin GC analysis

Standard Operating Conditions (Oven)

1. MEM Configuration for Volatile Analysis

2. MEM Configuration for Semi-Volatile Analysis

3. Volatile Purge-and-Trap Technique

   a. Desorption tube = Tenex w/ Silica Gel
   b. Purge flow rate = ?
   c. Purge time = 5 min
   d. Purge volume = 40 mL
   e. Soil mass = 4 grams

4. Semi-Volatile Sample Prep and Injection

   a. Solvent = methanol
   b. Solvent Volume = 3 mL
   c. Soil volume = 4 g
   d. Extraction time = shake for 3 minutes
   e. Sample injection = 20 uL of sample injected onto glass wool plug in a glass injection liner

Field Probe Analysis

1. Configure MEM for air monitor probe analysis.
2. Inject 5 ul of a 200 ug/G solution of a standard onto the aluminum foil and analyze with the probe. Print the identified compounds and compare to those in the standard. Repeat standard run every 10 samples analyzed
3. Put approximately 1.0 g of soil onto a small piece of foil
4. Place MEM probe onto the soil sample
5. Watch MEM monitor and observe ion activity. Note all compounds exhibiting ion activity for all four masses and print any compounds which the MEM identifies by pressing the print bottom of the MEM.

VOC Analysis

1. Initial calibration (done if continuing calibration fails criteria)
   a. Conduct three runs with the GC oven. Compounds are put onto a Tenex/Silica Gel tube with the purge and trap technique. Add the following amounts to 40 mL of water and purge and trap the mixture:

   i. 1 uL of a 200 ug/ml solution of Volatile Calibration Check Mix
   1 uL of a 200 ug/L solution of 4-bromofluorobenzene (surrogate)
   5 uL of a 200 ug/L solution of 1,4-difluorobenzene (IS)

   ii. 5 uL of a 200 ug/ml solution of Volatile Calibration Check Mix
   5 uL of a 200 ug/L solution of 4-bromofluorobenzene (surrogate)
   5 uL of a 200 ug/L solution of 1,4-difluorobenzene (IS)

   iii. 10 uL of a 200 ug/ml solution of Volatile Calibration Check Mix
   10 uL of a 200 ug/L solution of 4-bromofluorobenzene (surrogate)
   5 uL of a 200 ug/L solution of 1,4-difluorobenzene (IS)

   c. Calculate response factors (RF) and %RSD for the following compounds

   1,1-dichloroethene
   chloroform
   1,2-dichloropropane
   toluene
   ethylbenzene

   4-bromofluorobenzene (surr.)

   $RF = (A_X * C_{IS})/(A_{IS} * C_X)$

   $\%RSD = (RF_{STD}/RF_{MEAN}) * 100$

   e. If the % RSD is not less than 40% for each of the five compounds (excluding the surrogate), the calibration routine must be repeated.

2. VOA continuing calibration
   a. Add 5 uL of a 200 ug/L standard of each compound to 40 mL of water:

   4-bromofluorobenzene (surr..)
   1,4-difluorobenzene (IS)

   1,1-dichloroethene
   chloroform
   1,2-dichloropropane
   toluene
   ethylbenzene

   b. Purge and trap mixture, run on GC/MS
   c. Calculate response factor for each compound
   d. The response factor should be within 40% of initial calibration for 4 out of 5 compounds (excluding the surrogate)

e. Every other day, do the analysis in duplicate and calculate the percent recovery (%R) and the relative percent difference (RPD).

$$\%R = (C_{INJ}/C_{REC})*100$$

$$RPD = [(C_A-C_B)/((C_A+C_B)/2)] *100$$

f. Record the %R and RPD (the %R should be between 60 and 150% and the RPD should be less than 30%.

3. Run a method blank
   a. Add 5 uL of a 200 ug/L standard of each compound to 40 mL of water
      4-bromofluorobenzene (surr.)
      1,4-difluorobenzene (IS)
   b. Purge and trap
   c. Blank should not contain any analytes above the reporting detection limit
4. Begin running samples
   a. Weigh 4 g of soil sample and put in a 60 mL bottle
   b. Inject 5 uL of a 200 ug/L standard of 4-bromofluorobenzene onto soil
   c. Add 40 mL of water to the vial slowly
   d. Add 5 uL of a 200 ug/L standard of 1,4-difluorobenzene to the 15 mL mixture
   e. Purge and trap. Run on GC/MS
   f. Calculate the concentration of the surrogate based on the average response factor from the three point calibration.
   g. If a target compound is detected, a three point calibration will have to be conducted and the sample will have to be re-analyzed in order to accurately quantify the material.
   h. If a non-target compound is detected, the concentration will be estimated based upon comparison with the internal standard and assuming a response factor of 1.

Semi-Volatile Analysis

1. Initial calibration (done if continuing calibration fails criteria)
   a. Conduct three runs with the GC oven. . Inject the following amounts onto glass wool contained in a glass desorption tube:

   i. 1 uL of a 200 ug/ml solution of Base-Neutrals Matrix Spike Mix
   1 uL of a 200 ug/L solution of nitrobenzene-d_5 (surrogate)
   5 uL of a 200 ug/L solution of acenaphthene-d_{10} (IS)

   ii. 5 uL of a 200 ug/ml solution of Base-Neutrals Matrix Spike Mix
   5 uL of a 200 ug/L solution of nitrobenzene-d_5 (surrogate)
   5 uL of a 200 ug/L solution of acenaphthene-d_{10} (IS)

   iii. 10 uL of a 200 ug/ml solution of Base-Neutrals Matrix Spike Mix
   10 uL of a 200 ug/L solution of nitrobenzene-d_5 (surrogate)
   5 uL of a 200 ug/L solution of acenaphthene-d_{10} (IS)

   c. Calculate response factors (RF) and %RSD for the following compounds

   acenaphthene
   1,4-dichlorobenzene
   2,4-dinitrotoluene
   pyrene
   1,2,4-trichlorobenzene

   nitrobenzene-d_5 (surrogate)

   $RF = (A_X * C_{IS})/(A_{IS} * C_X)$

   $\%RSD = (RF_{STD}/RF_{MEAN}) * 100$

   e. If the % RSD is not less than 40% for four out of the five compounds (excluding the surrogate), the calibration routine must be repeated.

2. S-VOA continuing calibration
   a. Inject 5 uL of a 200 ug/uL standard of the following compounds onto a glass wool plug in a glass injection liner.

   acenaphthene-d_{10} (IS)
   nitrobenzene-d_5 (surr.)

   acenaphthene
   1,4-dichlorobenzene
   2,4-dinitrotoluene
   pyrene
   1,2,4-trichlorobenzene

   b. Run on GC/MS
   c. Calculate response factor for each compound
   d. Each response factor should be within 40% of initial calibration for 4 out of the five compounds (excluding the surrogate)

e. Every other day, do the analysis in duplicate and calculate the Percent Recovery (%R) and the Relative Percent Difference (RPD).

$$\%R = (C_{INJ}/C_{REC})*100$$

$$RPD = [(C_A-C_B)/((C_A+C_B)/2)] *100$$

f. Record the %R and RPD (the %R should be between 20 and 150% and the RPD should be less than 30%.)

3. Run a method blank
   a. Add 3 mL of methanol to a vial
   b. Add 25 uL of a 2000 ug/mL standard of nitrobenzene-d_5 into the methanol
   c. Inject 20 uL of extract into a glass injection liner
   d. Inject 5 uL of a 200 ug/mL standard of acenaphthene-d_{10} onto the glass injection liner
   d. Run on GC/MS
   d. No target analytes should be present above the instrument detection limit

4. Begin running samples
   a. Weigh 4 g of soil sample and put in a vial
   b. Inject 25 uL of a 200 ug/uL standard of nitrobenzene-d_5 onto the soil
   c. Add 3 mL of methanol into vial
   d. Shake for 3 minutes
   e. Inject 20 uL of extract into glass injection liner
   f. Inject 5 ul of a 200 ug/mL standard of acenaphthene-d_{10} into the glass injection liner
   g. Run tube in GC/MS
   f. Calculate the concentration of the surrogate based on the average response factor from the three point calibration.
   g. If a target compound is detected, a three point calibration will have to be conducted and the sample will have to be re-analyzed in order to accurately quantify the material.
   h. If a non-target compound is detected, the concentration will be estimated based upon comparison with the internal standard and assuming a response factor of 1.

PCB Probe Analysis

1. Initial calibration (done if continuing calibration fails criteria)
   a. Configure MEM in surface monitor and in the PCB method.
   b. Inject 1 uL of a 200 ng/uL PCB standard, IS and Surrogate onto clean piece of foil and let the solvent evaporate
      IS = acenaphthene-d_{10}
      surr.. = nitrobenzene-d_5
   c. Place MEM probe on the foil until ion activity is observed
   d. Print screen containing identified compounds
   e. Repeat calibration run at two different concentrations:
      1. 5 uL of a 200 ug/uL standard
      2. 10 uL of a 200 ug/uL standard
   c. Calculate response factors (RF) for all compounds

      $RF = (A_X * C_{IS})/(A_{IS} * C_X)$

      $\%RSD = (RF_{STD}/RF_{MEAN}) * 100$

   d. Calculate the % RSD for each of the following compounds:

      2-chlorobiphenyl
      2,3-dichlorobiphenyl
      2,4,5-trichlorobiphenyl
      2,2',4,4'-tetrachlorobiphenyl
      2,2',3',4,6-pentachlorobiphenyl
      2,2',4,4',5,6'-hexachlorobiphenyl
      2,2',3,3',4,4',6-heptachlorobiphenyl
      2,2',3,3',4,5',6,6'-octachlorobiphenyl

   e. If the % RSD is not less than 50% for five out of the eight PCB compounds, the calibration routine must be repeated.

2. PCB continuing calibration
   a. Inject 5 uL of a 200 ng/uL standard, IS and Surrogate onto small piece of aluminum foil and let evaporate

      acenaphthene-d_{10} (IS)
      nitrobenzene-d_5 (surr.)
      2-chlorobiphenyl
      2,3-dichlorobiphenyl
      2,4,5-trichlorobiphenyl
      2,2',4,4'-tetrachlorobiphenyl
      2,2',3',4,6-pentachlorobiphenyl
      2,2',4,4',5,6'-hexachlorobiphenyl
      2,2',3,3',4,4',6-heptachlorobiphenyl
      2,2',3,3',4,5',6,6'-octachlorobiphenyl

   b. Run on MEM probe with surface monitor and PCB method
   c. Calculate response factor for each compound
   d. Each response factor should be within 50% of initial calibration for five of the eight PCB compounds.
   e. Every other day, do the analysis in duplicate and calculate the

Percent Recovery (%R) and the Relative Percent Difference (RPD).

$$\%R = (C_{INJ}/C_{REC})*100$$

$$RPD = [(C_A-C_B)/((C_A+C_B)/2)] *100$$

f. Record the %R and RPD (the %R should be between 20 and 150% and the RPD should be less than 30%.

3. Run a method blank
   a. Add 3 mL of methanol to a vial
   b. Add 25 uL of a 2000 ug/mL standard of Nitrobenzene-d_5 into the methanol
   c. Inject 20 uL of extract onto aluminum foil
   d. Inject 5 ul of a 200 ug/mL standard of Acenaphthene-d_{10} onto the same aluminum foil
   d. Run on MEM probe
   d. No target analytes should be present above the instrument detection limit

4. Begin running samples
   a. Weigh 4 g of soil sample and put in a vial
   b. Inject 25 uL of a 200 ug/uL standard of nitrobenzene-d_5 onto the soil
   c. Add 3 mL of methanol into vial
   d. Shake for 3 minutes
   e. Inject 20 uL of extract onto a piece of clean aluminum foil
   f. Inject 5 ul of a 200 ug/mL standard of Acenaphthene-d_{10} onto the same aluminum foil
   g. Run on MEM probe.
   h. Calculate the concentration of each peak and surrogate
   i. Total all PCB concentrations and report one number.

Documentation

1. MEM Analysis Book
   a. Use a bound book with numbered pages
   b. Book contains the following information in a table format.

      File Name (Run No.)
      Sample ID
      Date
      Time
      Analyst
      Mode of Operation
      Method
      Temp. Program
      Comments

2. MEM Data Book
   a. Use a three-ring binder
   b. Use one binder for each site
   c. Each binder contains the following information:

      Printed chromatograms from sample analyses
      A printed spectrum of each significant peak
      Calculations and notes
      Taped-in printouts from MEM during all probe analyses
      All Lotus spread-sheet information

   d. All of data immediately above, pertaining to each sample, will be grouped together.

3. MEM Calibration Data Book
   a. Use a three ring binder
   b. Binder contains the following information

      Printed chromatograms of initial calibration, continuing calibration, blanks, and all calculations
      Print-outs from morning start-up procedures

4. MEM Service/Maintenance Log Book
   a. Chronological record of service and maintenance

5. Standards Log Book
   a. Use a bound book
   b. Book has a record of standards, which contains:

      Standard Number
      Concentration
      Date
      Initials of individual who made standard
      Calculations
      Taped in documentation which comes with the standard

Appendix B

STATEMENT OF PROCEDURES FOR INORGANIC ANALYSIS OF SOILS WITH THE SPECTRACE 6000 XRF

TABLE OF CONTENTS

	Page
1.0 Sample preparation	2
2.0 Instrument Calibration	
2.1 Energy Calibration	2
2.2 Standard Calibration	2
2.2.1 Setting Up Files	3
2.2.1.1 Procedure Files	4
2.2.1.2 Standard Files	4
2.2.2 Analysis of the Standards	6
3.0 Sample Analysis	8
4.0 QA/QC Practices	9
5.0 Instrument Maintenance and Trouble Shooting	10
6.0 Associated Health and Safety Hazards	11
	12

RESTRICTED INFORMATION
DO NOT DUPLICATE
OR CIRCULATE

1.0 Sample Preparation

Preparation of soil samples for analysis by energy dispersive x-ray fluorescence (EDXRF) is a non-destructive technique that preserves the original matrix of the sample. Approximately 7-9 grams of soil are weighed into a drying cup labeled with the corresponding ID number of the sample. The soil is then heated to dryness in a microwave oven and ground to a fine powder with an agate mortar and pestle. The powder is transferred to an analysis cup, also labeled with the corresponding sample ID number, and sealed with a clear mylar film. The mylar film prevents the absorption of atmospheric moisture by the sample and should be put in place immediately after the sample is transferred to an analysis cup. If at any time it is observed to be ripped, punctured, or ripped, the mylar film should be replaced with a new piece of film.

All equipment to be reused in the preparation of more than one sample, such as mortars and pestles, must be decontaminated with a rinse of 10 percent nitric acid. This reduces the possibility of cross contaminating samples subsequently prepared with the same equipment. Following decontamination, grinding equipment should be examined for residual moisture and dried if necessary to avoid rewetting dried samples.

2.0 Instrument Calibration

There are basically two calibrations of the EDXRF. These are an Energy Calibration, a daily internal calibration of the instrument, and a standard calibration with standard samples having known concentrations of analytes used as references to determine the unknown concentrations of these analytes in field samples of similar matrices.

2.1 Energy Calibration

Each day and prior to any analysis of standards and samples, an energy calibration of the EDXRF should be performed. This is an internal calibration of the system to correct for peak shifts that can occur along the spectrum energy scale. Each analyte has a specific energy level along the energy scale that is used to identify peaks that occur in a spectrum. If analyte peaks are not properly aligned with their corresponding energy levels along the energy scale, the accuracy of the analytical procedure is greatly reduced.

To perform an Energy Calibration, specific exciting conditions and filters must be set in the instrument. All commands are executed through the computer software. The sequence of steps to enter the directory which allows you to operate the system, SSXRF, and execute the Energy Calibration are shown as follows:

1. Type SSXRF <ENTER>
2. Select any directory you wish to work in via key F5
3. Select any procedure within a directory by moving the blue cursor with the arrow keys and depress key F2 (Set Up)
4. Within the Set up menu of a procedures file, depress key F4 (System Status)
5. Within System Status, check and record the following system readings in the "Calibration" notebook:
   - Fast Discriminator Rate. If not within 100 to 150, adjust.
   - Zero DAC
   - Zero Width
   - Gain DAC

6. Within System Status, depress F7 (Energy Calibration) and verify that the proper spectrum acquisition parameters have been set up for the energy calibration. These parameters should read as follows
   - 30 KV
   - 0.10 mA
   - Filter Five
   - 600 Seconds livetime

   If these parameters are not properly entered, make appropriate adjustments.
   Note: The Thin Rh (0.05 mm) filter may also be used for Energy Calibration, but will require and adjustment of both voltage and current.
7. Leave the Energy Calibration acquisition menu by depressing the F10 (Exit) key. Continue to press the F10 key until the Main Directory menu reappears on the screen.
8. Open the analysis chamber of the EDXRF and check to see that the appropriate filters are in place and then place the copper standard in the analysis position. Close the lid to the chamber checking that security locks have engaged.
9. Initiate the Energy Calibration by depressing the F7 key. From that point, the computer guides you through a brief procedure until the spectrum acquisition of the Energy Calibration has begun.
10. During spectrum acquisition of the copper standard, deadtime shown below the spectrum should fluctuate within a range of 40 to 50 percent. If it does not, deadtime can be adjusted while the spectrum is being acquired by depressing the F7 key followed by the F4 key. Spectrum acquisition parameters for the Energy Calibration will appear and the associated dead time will be displayed at the bottom of the screen. Dead time can be adjusted by changing the current (mA) or less frequently, the voltage.
11. Following adjustment of the deadtime, return to the spectrum acquisition by depressing the F10 key two times, a brief pause between each depression.

Once the Energy Calibration has properly aligned elemental peaks with their corresponding values along the energy scale of the spectrum, an error (ERR) notation below the spectrum will read = 0. The Energy Calibration will stop automatically when either a consistent error of zero is achieved or the full livetime set for spectrum acquisition has expired, whichever occurs first. Following Energy Calibration, all other analysis may be performed.

2.2 Standard Calibration

Prior to the analysis of any soil sample, a standard calibration of the EDXRF must be performed. Standards of known elemental concentration are analyzed and these analysis are then used as references of comparison to determine the elemental composition of samples. Analysis of both standards and samples, however, requires that specific analytical conditions be arranged within the instrument to produce the most accurate results. These conditions are "Set Up" within a Procedures file. Before developing a procedures file for analysis, the following should be considered:

- What are the analytes of interest in the analysis?
- Is there a representative background sample? If so, what is the minerology of this sample?
- What lines (ie. K or L) for each analyte along the spectrum energy scale are most intense below a maximum energy level of 40 KeV?
- What filter(s) optimize the peak intensities of the analytes of interest?
- What is the lower limit of instrument detection for each analyte of interest?

- Is there a standard available having a matrix similar to that of the samples to be analyzed and concentrations of the analytes of interest that are greater than the lower instrument detection limit by a minimum factor of 4 to 5?

Once these questions have been addressed, it is possible to set up procedure files for the desired analysis. One procedures file must be set up for each filter that will be used for the analysis of one or more analytes. Within a single directory, a maximum of only three such procedure files can be set up corresponding to three filter positions available in the EDXRF analysis chamber. If there are two or more procedure files in the directory menu, they are followed by a standards file. A standards file generally compiles and executes the analytical conditions set up by each procedures file preceding it. Within a standards file, there is also a subdirectory containing a table of the standard(s) that will be used to calibrate the instrument for a maximum of up to 19 analytes per standard.

Corresponding to the Standards file, there is an "Unknown" procedures file. This file generates concentration values for the unknown analytes in samples by comparing their peak intensities along the spectrum energy scale, with those of the standard(s). The Standards file must be run prior to the analysis of any samples to calibrate the EDXRF. Once standard calibration is performed, sample analysis is performed with the Unknowns file.

2.2.1 Setting Up Files

Before either standard or field samples can be analyzed, the PROCEDURE file(s) and a Standards file must be "set up" to calibrate the instrument. The set up procedure of these files will now be discussed.

2.2.1.1 PROCEDURE Files

Each PROCEDURE file, as previously mentioned, should correspond to a filter. More than one filter may be required for the determination of both analytes of interest and analytes imposing inter-element effects. The latter analytes must be included in the total analysis to properly calibrate the instrument. One filter may better optimize the intensity of K-alpha lines (generally the most intense spectral line) for a particular analyte, than would another filter. Therefore, analytes to be determined in the total analysis should be separated and assigned to a filter (or PROCEDURE file) that optimizes their spectral peak intensities. Refer to the Spectrace 5000 "Operators Manual", page 3-3 for general guidance on filters and associated acquisition parameters to use for specific elemental analysis. Prior to assigning analytes to filters and setting up the respective PROCEDURE files, confirm that a reference spectrum has been acquired of the pure elemental form for each analyte to be included in the total analysis. These pure element spectrum should be stored in in a reference directory
referred to as "REFS". To access this directory, perform the following steps:

1. Depress F5
2. Type in the directory name for the reference file:
   C:\REFS
3. Within the REFS directory, confirm that a reference spectrum for each analyte to be determined in the total analysis, has been acquired and saved. Reference spectrums are generally acquired of pure element standards, thereby providing the most intense peaks for K, L and other lines of the element and eliminating the interference caused by inter-element effects.
4. Return to the directory desired via the F5 key and the commands as directed.

It is not possible to standardize analytes for which no reference file exists in the REFS directory. If such analytes exist among those to be determined in the total analysis, they should be eliminated unless it is possible to acquire a spectrum of their pure elemental form and subsequently save it in the REFS directory. Once it has been determined that reference spectrum exist for the analytes to be determined, each analyte should be assigned to a filter. Generally, an analyte is assigned to only one filter, but analytes such as manganese and iron may be assigned to more than one.

Once it has been determined what filters will be used for analysis and what analytes are to be assigned to each filter, the PROCEDURE file(s) can be set up to execute the analysis. To set up a PROCEDURE file, perform the following steps:

1. Select an existing directory or make a new one in which the analytical procedures will be stored. Depress the F5 key and type in the name of the desired directory (ie. C:\METALS <return>).
2. Within an existing or new directory, there will be 10 numbered rows. The first row is not to be used for the storage of a PROCEDURES file and may or may not be labeled. Move the blue cursor down to the second row and depress F4 to enter a label for what will be the first procedure listed in the directory. A procedure label is generally named for the filter or combination of filters that it will employ for analysis. After entering the label for the PROCEDURE file, depress <RETURN> and enter additional PROCEDURE files up to a maximum of three by repeating this step.

To enter the analytes assigned to each filter, it is necessary to "SET UP" a PROCEDURE file for each filter. To SET UP a PROCEDURES file, first move the cursor to a PROCEDURE in the main menu and then depress the F2 (SET UP) key to enter the file. Within the menu of a PROCEDURE file, there are four subgroups or subdirectories which include AQUISITION PARAMETERS, SPECTRUM PROCESSING, ANALYSIS TECHNIQUE and SAVE ON DISK. Move the cursor to SPECTRUM PROCESSING, depress the F2 key and assign a "Reference File Number" to which the spectrum processing information will be saved. For the PROCEDURE files in the rows preceding the Standards file, the Reference File Number is the number of the row in which the PROCEDURE file is entered , followed by two zero's. For example, the file to which Spectrum Processing should be saved for the PROCEDURE file written in row 2 (or PROCEDURE 2) should be 200. Depress the Return key and for the next item, "Subtract Escape Peak", enter "yes". Move the cursor down again to "ROI Spectrum Directory" and enter "\REFS" (ROI is an acronym for Region of Interest). Move the cursor down to the last item, "Elements Of Interest" and depress the F2 key. Numbered rows will appear on the screen where the analytes assigned to that specific filter (or PROCEDURE file) will be entered. Move the cursor to the first row and enter the chemical symbol of an analyte followed by the spectral line anticipated to be most intense for that analyte under the acquisition parameters of the PROCEDURE file. Depress <Return> and indicate what type of "Fitting" procedure will be used to process the spectrum of the analyte. Auto XML is the most commonly used and is simply selected by entering the letter "a". Other fitting procedures may be selected by pressing the space bar to change the options until the desired choice appears in the cell. Depress the space bar to save the final selection and move the cursor down to the next row where another analyte will be entered. When all analytes have been entered, exit Spectrum Processing by depressing F10 twice. Repeat the above process for all other PROCEDURE files that must be prepared in the total analysis.

Once the Elements of Interest have been entered under SPECTRUM PROCESSING within a PROCEDURES file, move the cursor to "AQUISITION PARAMETERS". This subdirectory designates the parameters used to acquire a spectrum. Included among these

parameters, is the "Filter Used". Recall that each PROCEDURE file corresponds to a specific filter that must be used in the total analysis. Always review AQUISITION PARAMETERS within a new PROCEDURE file to confirm that the proper filter has been designated. If not, enter AQUISITION PARAMETERS by moving the blue cursor to this title and depress the F2 key. Move the cursor to the "Filter Used" position and change filters by depressing the space bar intermittently until the desired filter appears. The choice of filters available is set up within a program directory, TXCONFIG. This directory can not be accessed within SSXRF, but is a separate directory. Other Acquisition Parameters include "Tube Voltage" and "Tube Current" which vary according to the filter used. Refer to the Spectrace 5000 "Operators Manual", page 3-3 for recommended tube voltages to use with each filter.

Once the spectrum acquisition parameters have been checked and adjusted as necessary, move the cursor to ANALYTICAL TECHNIQUE and depress the F2 key. Move the cursor to "Method" and depress the space bar repeatedly until the selection "No Analysis" appears. Move the cursor down one line to "Mode" and depress the space bar as before until "Run Unknowns" appears. Move the cursor down once again to "Standard File" and enter the number of the PROCEDURE file followed by two zero's. For example, the Standard File for PROCEDURE 2 would be 200. In response to "Print Statistics", enter "No" and depress the Return key before exiting the subdirectory with the F10 key.

Before exiting the PROCEDURE file, move the cursor to SAVE ON DISK and depress the F2 key. In response to "Save Spectrum" and "Save Intensities", enter "Yes". For the "Standard File", enter the number of the PROCEDURE currently being set up followed by two zero's. For example, the Standard File for PROCEDURE 2 would be 200. In response to "Save Results", enter "No" and depress the Return key before exiting the subdirectory with the F10 key.

When all the above checks and modifications have been performed in the subdirectories of the current PROCEDURE, exit the file by depressing the F10 key and SET UP other PROCEDURE files by repeating the above steps. Set up PROCEDURE files corresponding only to the filters that will be needed for the total analysis.

2.2.1.1 Standards File

Once all PROCEDURE files have been set up for a total analysis, set up a Standards file. Generally, the label entered for the Standards file is "Soil Standard" for soil analysis. This is followed by a statement that executes the PROCEDURE files entered in the preceding rows when the standards file is run to analyze a standard sample. An example of a Standards file would be:

5. Soil Standard 2+3+4

This Standards file is entered in row 5 of the current directory and PROCEDURE files entered in rows 2, 3 and 4, will be executed sequentially and continuously when the Standards file is run (F1).

To set up the Standards file, move the cursor to the Standards file label in the main menu and then depress the F2 key. Within the Standards file, it will be necessary to make changes to the SPECTRUM PROCESSING, ANALYTICAL TECHNIQUE and SAVE ON DISK subdirectories, but not the AQUISITION PARAMETERS directory. Enter any subdirectory by moving the cursor to the title of the subdirectory and depress the F2 key (Set Up). Within SPECTRUM PROCESSING, change Reference File Number to "0" and enter "None" for Elements Of Interest. Within SAVE ON DISK, change the File Number to the number of the row in which the Standards file is entered in the main menu followed by two zero's. For example, a Standards file entered in row 5 should be assigned a the File

Number of 500. The ANALYTICAL TECHNIQUE subdirectory of the Standards file differs greatly from that of the preceding PROCEDURE files. It requires not only changes within the subdirectory, but designates the analytes that will be reported in the final analysis of a standard. The calibration set up for more than one standard can be saved in this subdirectory, but each new Standard File must be given a unique three digit number. The first digit always corresponds to the row number in which the Standards File is entered followed by any digits from 00 to 99. When making a new Standards File, enter the ANALYSIS TECHNIQUE subdirectory and move the cursor to Standards File (STD. FILE). Enter a number not currently used for any other Standard stored in that subdirectory and depress the return key. Change Method to "Fundamental Parameters" (FUN. PARAMS.) and Mode to "Standardize" by moving the cursor to these prompts, depressing the space bar repeatedly until the desired selection is displayed, and depressing the return key, following the sequence as given. Confirm that the Delta Value is 25 and make adjustments as necessary.

While still in the ANALYTICAL TECHNIQUE subdirectory, "Set Up" a new standard(s) file or edit an existing one by depressing the F2 key. A table will appear on the screen and the cursor will be in the upper left corner where a title for this standards file can be or is currently entered. Cursor down one line and enter a number for a new Standard File. Depress the Return key to save this number and the cursor will then move to the first line where the identification (ID) name of a standard is entered. It is generally best to enter abbreviated ID names or numbers due to limited space. When a standard ID name has been entered, a notation "IN" will appear to the right of it. In those rows where a standard ID name has not been entered, the notation will read "OUT". If a standard is removed from a row in the standards file, the message may remain as "IN", but should be changed to "OUT" by moving the cursor to the appropriate row and depressing the F1 key. In the columns to the right of the standards, will be entered the concentrations of analytes in the standard(s). Although an analyte may be determined by one of the PROCEDURE files, its concentration will not be reported by the Standards file unless it is listed in the table of the Standard file. Analytes that should be listed in the Standards file table include both analytes of interest and those which contribute inter-element effects. The chemical symbol of one analyte is entered per column in the first row to the right of the Standard file name. The sequence in which the analytes are listed generally follows the order of increasing energy level along the spectrum energy scale. This may vary, however, due to significant inter-element effects of adjacent analytes. When setting up a new Standard file, it may be necessary to discuss with a Spectrace representative what analytes should be reported and the order in which they should appear in the file. In the row below the chemical symbol of each analyte, enter the unit of concentration that will be used for the reported results (ie. ppm). Moving the cursor down to the first row in which the name of a standard has been entered, enter the concentration of each analyte listed across the top of the table as it occurs in that standard. Some analytes in the standard(s) occur at concentrations equal to or below the lower detection limits of the instrument. There are also those present at greater concentrations, yet undetected due to spectral overlaps by adjacent analytes present at even greater concentrations in the same standard. The concentration of these analytes, therefore, must be listed parenthetically (in parenthesis). The instrument will then make the necessary adjustments to approach the reported valued as closely as is possible. Repeat this step for all successive standards to be entered. Generally, it is not recommended to include more than one standard within a Standards file unless they are all of nearly identical minerology. Once a standard (or standards) and corresponding analyte concentrations are entered in a Standards file, save and exit the file by depressing the F10 key.

Exit ANALYTICAL TECHNIQUES by depressing the F10 key and move the cursor to SAVE ON DISK. Depress the F2 key, and change the File Number to the number of the

new standard file set up and shown above under ANALYTICAL TECHNIQUES. No other changes are necessary within this subdirectory.

2.2.2 Analysis of the Standards

It is now possible to calibrate the instrument with a soil standard by running the procedure for Soil Standard 2+.....etc. The standard(s) to be analyzed should correspond with the standard(s) entered in the standards file currently displayed under ANALYTICAL TECHNIQUE of the procedure, Soil Standard 2+.... etc. For example, given the standard ERA STD 209 is stored within Standard file 500 and this standard file is currently displayed under ANALYTICAL TECHNIQUE for the Soil Standard 2+....etc. procedure, the standard to be analyzed is ERA STD 209. Place the appropriate standard in the analysis chamber of the EDXRF and return the lid to a secure closed position. The EDXRF unit will not operate if the safety locks on the lid are not engaged. Move the cursor to the Standard calibration procedure in the main menu which, in this case, is Soil Standard 2+.... etc. Depress the F1 (RUN) key and a prompt will appear requesting the number of samples to be analyzed. Enter the the response "1", depress the return key and the ID name of the standard to be used for calibration will appear. Depress the return key again to initiate analysis of the standard and calibration of the instrument.

To analyze a soil standard, the Standard calibration procedure essentially sets up and executes the analytical conditions as specified in the PROCEDURE files that precede it. Each PROCEDURE file is run to completion and in sequence as it occurs in the main menu. Upon initiating the standard analysis for calibration, a spectrum will appear on the screen displaying in the upper left corner the voltage and current set up in the AQUISITION PARAMETERS of the first PROCEDURE file. The spectrum is acquired over a set period, stops and then another spectrum is acquired according to the AQUISITION PARAMETERS set up in the next PROCEDURE file. Acquisition of additional spectrum will continue by this process until all PROCEDURE files (up to a maximum of three) are run to completion. The information generated by these PROCEDURE files is then collectively used to calibrate the instrument for those analytes as specified in the standard file currently displayed under ANALYTICAL TECHNIQUES of the Standard calibration procedure, Soil Standard 2+.... etc.

Within the subdirectory, ANALYTICAL TECHNIQUES, as many as 100 Standard files may theoretically be stored and more than one standard may be entered per standard file. If more than one standard is entered in a standard file, however, the computer of the EDXRF units will try to fit a curve for each analyte listed between the values generated by all the standards. It is not suggested, therefore, that two standards of significantly diverging minerology be used simultaneously for calibration, particularly with regard to analytes of interest.

When more than one standard exists in a standard file, the Standard calibration procedure will stop between the analysis of each standard. This allows the operator to change standards in the analysis chamber of the EDXRF before continuing. Once the next standard is in place, analysis is again initiated by depressing the space bar.

During the analysis of standards, as well as samples, it is critical to monitor the dead time of spectrum. Dead time (DT) refers to that portion of fluorescing energy from the sample that is undetected by the instrument while it processes incoming detection signals. A DT of 40-50 percent is generally preferred, but at higher voltages,may not be attainable. During spectrum acquisition, the DT will be displayed at the bottom right-center of the screen. If it is observed that the DT is too high or low, it can be adjusted during spectrum acquisition by depressing the F7 key followed by the F4 key. AQUISITION PARAMETERS of the

PROCEDURE file currently being run will appear at the top of the screen, and the DT will appear at the bottom. While in this menu, acquisition of the spectrum previously displayed pauses. Of the parameters shown in the menu, the Tube Current (mA) is most commonly used to adjusted DT. Tube Voltage (KV) may also be used, but to a lesser extent and will require subsequent adjustments of the Current. As adjustments of these parameters are made, the response of the DT should be observed until the desired range is achieved. Resume spectrum acquisition by depressing the F10 key two times consecutively.

3.0 Sample Analysis

Once the EDXRF has been calibrated, it is possible to analyze for and determine the concentration of unknown constituents in field samples. Similar to the analysis of standards used for calibration, a group of PROCEDURE files must be set up for the analysis of field samples. These are essentially duplicated from the PROCEDURE files used for standard calibration. Following these PROCEDURE files, is an "Unknowns" file which, like the Standard calibration procedure (Soil Standard 2+.... etc.), performs a total analysis by executing in sequence and to completion, all the PROCEDURE files preceding it. Prior to setting up either PROCEDURE or Unknowns files to analyze field samples, labels must be designated for them in the main menu. Labels for the PROCEDURE files may or may not be those used for standard calibration. The label for the Unknowns file is generally "Soil Unknowns" followed by a statement that executes the PROCEDURE files in the preceding rows when the Unknowns file is run . An example of an Unknowns file would be:

9. Soil Unknowns 6+7+8

This Unknowns file is entered in row 9 of the current directory and PROCEDURE files entered in rows 6, 7 and 8 will be executed sequentially and continuously when the Standards file is run (F1).

Unknowns within a soil sample can not be determined unless a standard has been analyzed and the results of the analysis stored as a reference. Always include a Standards file and an Unknowns file within a directory used to perform analysis. The Standards file and its associated PROCEDURE files should also precede the Unknowns file.

Set up of the PROCEDURE files for field sample analysis exactly mimics the corresponding PROCEDURE file for standard calibration. The exception, however, is that the Standard File under ANALYSIS TECHNIQUE of each PROCEDURE file will change to the row number in which the PROCEDURE is entered, followed by two zero's. For example, the Standard file under ANALYSIS TECHNIQUE for PROCEDURE 6 will be 600. The File Number under SAVE ON DISK will also change with each new sample that is analyzed in both PROCEDURE and the Unknowns files. This number like the Standard File number under ANALYTICAL TECHNIQUE is a three digit number beginning with the number of the current PROCEDURE file, followed by any two digit number from 00 to 99. When there are less than 70 samples in a group to be analyzed, an attempt is made to select a file number that corresponds to the ID number of a sample. For example, given sample number 17 of 25 samples, the file number assigned to this sample under SAVE ON DISK for PROCEDURE files 6, 7, 8 and 9 would be 617, 717, 817 and 917, respectively.

Set up of the Unknowns file differs from the Standard calibration procedure with regard to ANALYTICAL TECHNIQUE and SAVE ON DISK subdirectories. Under ANALYTICAL TECHNIQUE, the Mode should be changed from "Standardize" to "Run Unknowns" and under SAVE ON DISK, the response to Save Results should be changed to "Yes". Always confirm that the Standard File as shown under ANALYTICAL TECHNIQUE for both the Unknowns file and the Standard calibration procedure are the same.

The analysis of a sample is similar to that of a standard as described under "2.2.2. Analysis of a Standard". The prepared soil sample is placed in the analysis chamber of the EDXRF and analysis is performed by running the Unknowns file, Soil Unknown 6+.... etc. A prompt will appear before the actual soil analysis occurs requesting the number of samples to be analyzed. Enter "1", depress the Return key and another prompt will appear requesting identification of the sample. Enter an ID name for the sample, depress the Return key again and analysis will then begin. As with the standard analysis, closely monitor the dead time of each spectrum acquired for the sample analysis. Once the analysis of a sample has been completed, the computer of the EDXRF collects the data generated by each PROCEDURE file to produce the results of a total analysis. Results will be saved and may be printed immediately following analysis or at any time thereafter.

4.0 QA/QC Practices

Each day prior to the analysis of samples, both an energy calibration and standard calibration of the EDXRF unit must be performed. The standard(s) used to perform the standard calibration should also be analyzed as "unknown" samples to compare how closely their analytical results match the expected calibration values. A large disparity between calibration and analytical values (>25%) for the standards would suggest that the instrument was not properly calibrated and should be recalibrated. Standard samples should be reanalyzed among field samples at a frequency of one per 20 or fewer samples and at the end of each day or every eight hours of instrument operation, whichever occurs more often.

For the analysis of field samples, two standards will be used to calibrate the EDXRF. These are ERA STD 209 (STD. file 508) and NIST 8407 (Std. file 509). ERA STD 209 calibrates the instrument for the determination of Cr, V, Ni, Se, As, Ag, Cd and Ba, while NIST 8407 calibrates for Cu, Zn, Pb and Hg. This requires two separate and complete analytical runs of all the samples. One run is calibrated with only ERA STD 209 and all samples are analyzed. This is followed by a second run calibrated with NIST 8407 repeating the sample sequence of the first run.

The directory to be used for the samples analysis is "ALTHIN6". Once in this directory, assign the appropriate standard file for the standard to be used to calibrate the instrument. For example, if the first standard to be used is ERA STD 209, the standard file to be assigned in PROCEDURES 5 and 9 should be 508. To access either procedure, place the cursor on a Procedure (5 or 9) and depress the F2 key (SET UP). Within PROCEDURE 5, check to see that 508 has been entered as the Standard File under ANALYSIS TECHNIQUE and the File Number under SAVE ON DISK. Within PROCEDURE 9, check to see that 508 is entered only under ANALYSIS TECHNIQUE as the Standard File. Once all the samples have been analyzed with this standard calibration, make the same changes in PROCEDURES 5 and 9 for the next standard to be used for calibration, in this case, NIST 8407 (Std. file 509).

Important to remember in PROCEDUREs 6, 7., and 8 of the directory ALTHIN6, it is not necessary to save the Results File under SAVE ON DISK. It is, however, required in PROCEDURE 9.

Currently, efforts are being made to obtain a background reference sample that can be used to distinguish indigenous vs. contaminant levels of inorganic substances in the soils at Edgewood Arsenal. The sample was collected from an area determined to be free of inorganic contamination and has been submitted to a certified laboratory for complete inorganic and organic analysis. The background reference sample should not be used to

calibrate the EDXRF, but should be analyzed as a sample to determine the degree of instrument accuracy achieved by calibrating the EDXRF with soil standards of differing minerology.

During sample preparation, a laboratory duplicate should be prepared of a field sample at a frequency of one per 20 or fewer samples. Large deviations (>25%) in the analytical results between a field sample and its duplicate might suggest that the preparation technique was not performed consistently and could, therefore, disqualify the analytical results of other samples in the batch. Analytical results generated by the EDXRF can vary significantly over time due to instrument fluctuations and external factors, such as temperature, humidity and shifts in the particle arrangement of the soil sample from one analysis to the next. It is recommended, therefore, that a sample and its laboratory duplicate be reanalyzed when the results for one or more analytes deviates by greater than 25% between them. Should reanalysis confirm that there is a significant difference in the analyte concentrations between the sample and its duplicate, analytical results for all samples preceding the sample/duplicate pair in preparation sequence to the next sample/duplicate pair found to have acceptable differences in concentration (<25%), should be disqualified. This also applies to those samples that follow the disqualified sample/duplicate pair. Under these circumstances, it would be necessary to repeat the preparation and analysis of all samples disqualified by the unacceptable sample/duplicate pair, including the pair itself.

Spike samples have not been included in the quality control (QC) protocol of the EDXRF analytical procedure due to specific limitations of this QC method for the application of EDXRF. Some of the greatest limitations to the use of spike samples are:

1. An uneven distribution of the spike solution and, thereby, the spiked analyte among the particles of the soil sample.
2. No confirmatory analysis of the spiking solution to verify its actual concentrations of the analytes it reportedly contains.
3. The complexity of preparing spike solutions containing more than one analyte at higher concentrations and the inter-element effect that occurs during EDXRF analysis.

After the sample analysis has been completed, the Spectrace files in the ALTHIN6 directory should be saved to a disk for archival purposes, and then deleted from the directory to eliminate any possible confusion when the next analysis is started. . However, certain Spectrace files should not be deleted from the ALTHIN6 directory, since they are needed for the operation of the instrument. These files are the PROCEDUR file, the FUNDASTD files regardless of the DOS extension number, the STANDARD files regardless of the DOS extension number, and the REFERNCE files regardless of the DOS extension number. Each archival disk should be labeled with the work request number, and if more than one disk is required, each disk should be numbered consecutively. A program called MULTIMOV may be used to facilitate copying files from the ALTHIN6 directory to the archival disk and deleting the files from the ALTHIN6 directory.

5.0 Instrument Maintenance and Trouble Shooting

Although operation of the Spectrace 6000 EDXRF is relatively simple in theory, this is an electronic, computer driven analytical instrument. Each of these features contributes to the analytical capabilities of the EDXRF, but may also create problems in the efficient operation of the instrument.

The EDXRF, as most sophisticated analytical equipment, is sensitive to temperature and humidity. The optimum temperature range for the operation of this instrument is between 70 and 75 degrees Fahrenheit. Low humidity in the work area is also preferred. As temperatures, deviate from this range, the instrument will display greater electrical fluctuations and shifts from the initial standard calibrations. A message, "CHECK SYSTEM STATUS", high lighted in yellow may also appear on the screen during spectrum acquisition. If this message is related to the system overheating, this can be remedied by cooling the air temperature of the work space. Also avoid storing objects within 16 inches of the counter space surrounding the EDXRF unit. Objects stored within this area may block the fans that cool the various components of the instrument.

During spectrum acquisition, a filter in the analysis chamber may occasionally fall out of position. This rarely occurs, but is immediately observed as a sharp increase or decrease in dead time. The problem is simply rectified by replacing the filter in its original position and securing it with the small hex screws on the side of the filter arm where the filter is cradled. Do not apply excessive pressure to tighten the hex screw to avoid stripping it.

6.0 Associated Health and Safety Hazards

There are numerous health and safety hazards associated with the operation and handling of the Spectrace 6000 EDXRF. For a complete discussion of these hazards, preventive measures and emergency response; refer to Chapter 2 "SAFETY" of the SPECTRACE 6000 Technical Manual.

Appendix C

Appendix C

Gradient Corporation

Field Quality Assurance Audit

Program: _____

Date of Audit: _____

Audit Conducted By: _____

On-Site Sampling Personnel: _____

_____

Audit Conducted on the Following:

_____ Soil/Sediment Sampling (Grab & Core) _____ Decontamination Procedures

_____ Well River Water Sampling _____ Sample Handling, Labeling, Aliquoting Procedures

_____ Surface Water Sampling _____ Field Measurements

Y = Yes N = No N/A = Not Applicable N/D = Not Determined

I. Overall Sample Collection

		Yes	No
1.	Do sampling locations agree with those specified in the Work Plan/Sampling Plan/QAPP?		
2.	Is the sampling location either documented sufficiently or marked to allow it to be found/sampled again in the future?		
3.	Are sampling times, Traffic Report Numbers and sample description noted in the Field Note Book (FNB)?		

		Yes	No
4.	Have all field measurements been properly taken as per Sampling Plan? • pH • conductivity/temperature • temperature		
5.	Have sample bottles been labeled properly?		
6.	Have proper containers and preservatives been used?		
7.	Are proper sample volumes procured?		
8.	Have sampling times been recorded in order to complete documentation on holding times per sample per parameter?		
9.	Have weather conditions been recorded?		
10.	Have MS and MSD(s) and MD(s) been collected as per QAPP frequencies?		
11.	Have field blanks been collected as per QAPP frequencies?		
12.	Have field duplicates been collected as per QAPP frequencies?		
13.	Are samples being refrigerated/iced immediately after collection?		
14.	Has condition of sample been recorded in the FNB and in the traffic report?		
15.	Does the potential for sample cross-contamination exist based on procedures observed?		
16.	Have samples been properly packaged and labeled for shipment to appropriate laboratory for analysis?		

		Yes	No
17.	Have legal seal(s) been properly filed out and attached to the shipping containers?		
18.	Has the Chain-of-Custody Form been properly filled out and a copy included with sample shipments?		
19.	Are samples being shipped to the analytical laboratory within 1 day of collection?		

II. Sediment Sampling

1. Type: core _____ If core, state type: gravity core _____
   hand core _____
   vibracore _____
   grab _____

		Yes	No
2.	Is a description of sediment cores being logged?		
3.	Have sediments been homogenized where applicable prior to aliquoting (specified by the Sampling Plan)?		
4.	Are proper slicing/aliquoting procedures being followed as per QAPP?		

Comments:

III. Water Sampling

	Yes	No
1. Are samples collected directly into precleaned bottles?		
2. Correct preservatives and bottles used?		
3. Depth recorded as necessary?		
4. Matrix QC samples identified on bottle labels?		
5. Is care being taken to collect VOA samples with no bubbles in vials?		
6. Are field pH, conductivity, and temperature being measured and documented? Is there documentation of calibrating the instruments?		

Comments:

IV. Decontamination Procedures

	Yes	No
1. Have all sampling materials (spatulas, spoons, etc.) and equipment (e.g. filter apparatus) been decontaminated properly for the given analytes as per QAPP?		
2. Have the proper decontamination solutions been used?		
3. Has decontamination water/solution been collected for proper disposal?		
4. Has disposable equipment that is contaminated been properly deconned and disposed of?		
5. Have decon samples been taken from the sampling equipment as per Sampling Plan?		

Comments:

V. General

	Yes	No
1. Has all appropriate information been recorded in the FNB?		
2. Are employees conducting the investigation in a professional manner?		
3. Are the objectives of the sampling activities understood by the field personnel?		
4. Are weather conditions affecting sample quality?		

Comments:

Audit Summary and Comments:

Signed by:

Sampler: _____ Print Name: _____

Auditor: _____ Date: _____

Appendix D

Appendix D

Gradient Corporation

Laboratory Being Audited:

Date of Audit:

Audit Conducted By:

LABORATORY EVALUATION CHECKLIST

Inorganic Laboratory Evaluation Checklist

I. Orientation Meeting

A. Organization and Personnel

1. Laboratory or Project Manager (individual responsible for overall technical effort):

_____

2. Inorganic Laboratory Supervisor (BS or BA in science and 3 years related experience, including 1 year as a supervisor):

_____

3. ICP Spectroscopist (BS or BA in science and 2 years ICP experience):

_____

4. ICP Operator (BS or BA in science and 1 year ICP experience):

_____

5. AA Operator (BS or BA in science and 1 year experience for each of the following AA techniques: flame, graphite furnace, and cold vapor):

_____

_____

6. Inorganic Sample Preparation Specialist (High School Diploma and college level course in chemistry and 6 months related experience):

_____

7. Cyanide Analyst (BS or BA in science and 6 months related experience, 2 years additional experience in lieu of the education requirement):

_____

8. Back-up Technical Person (BS or BA in science and 1 year experience in each of the following areas: ICP, AA, classical chemistry, and sample preparation):

_____

_____

9. Quality Assurance Supervisor:

_____

10. Glassware Preparation Technician:

_____

11. Sample Custodian:

_____

12. Is the organization adequately staffed to meet project commitments in a timely manner?

13. Are resumes for all listed personnel available? Do the resumes demonstrate that the personnel meet education and experience requirements?

14. Were all key personnel available during the on-site visit?

15. To whom does the QA Officer report? Senior Management?

Comments:

B. Documentation

1. Is the written QA Manual available and satisfactory for the following:

Personnel	_____
Facilities and equipment	
Operation of instruments	
Documentation of procedures	
Preventive maintenance	_____
Reliability of data	_____
Feedback and corrective action	_____
Archival of outdated SOPs	_____

Comments:

1. _____

2. _____

2. Are written SOPs available and satisfactory for the following?

Receipt and storage	_____	Data package preparation	_____
Security	_____	Standards preparation	_____
Glassware cleaning	_____	Technical review of data	_____
Sample preparation	_____	Instrument maintenance	_____
Analytical methods	_____	QA/QC self inspection	_____

Comments:

1. _____

2. _____

II. Laboratory Tour

A. Sample Receipt and Storage Area

Comments

1. Is the sample receiving area secure?

2. Are coolers opened in a contamination free area (preferably in a functional hood)?

3. Does the observed sample log-in procedure agree with the written SOP?

4. Is the appropriate portion of the SOP available to the Sample Custodian?

5. Are adequate facilities provided for storage of samples, including cold storage?

6. Are the sample receipt/storage and temperature records maintained in a manner consistent with good laboratory practice (GLP)?

7. Is there a periodic document review by the supervisor?

Comments:

Inorganic Laboratory Operations

B. Preparation Area - Metals Prep

1. General Operation

Comments

a. Does the laboratory appear to have adequate workspace (120 sq. feet, 6 linear feet of unencumbered bench space per analyst)?

b. Is the laboratory maintained in a clear and organized manner that is appropriate for trace level analysis?

c. Are the hoods functional?

d. Does the laboratory have source of distilled/demineralized water and is the water quality routinely checked and documented?

e. Is the analytical balance located away from drafts and areas subject to rapid temperature changes?

f. Has the balance been calibrated within 1 year by a certified technician?

g. Is the balance routinely checked with the appropriate range of class S weights before use and are the results recorded in a logbook?

h. Is an adequate drying oven available with a temperature measurement device? Is the temperature being monitored?

Comments:

2. Glassware Washing

a. Is the SOP for glassware washing posted and is it followed by the technician(s)?

b. Does the SOP prescribe an adequate amount of acid treatment of the glassware?

Comments:

3. Standards Preparation

Comments

a. Is the appropriate SOP available in the area?

b. Are unexpired standards used to prepare instrument calibration standards? Are standards dated upon receipt?

c. Are fresh analytical standards prepared at a frequency consistent with good QA?

d. Are standards properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample?

e. Is the reference/spiking/calibration standards preparation and tracking logbook(s) maintained?

f. Does the laboratory use automatic pipets for preparing their standards? If yes, are these pipet calibrated on a routine basis?

Comments:

4. Sample Preparation

Comments

a. Is the Sample Preparation SOP available in the area? Do the procedures followed by the analyst agree with those documented in the SOP?

b. Are the digestion logbooks/bench sheets maintained in a manner consistent with the contractual requirements?

c. Is the pH of the samples recorded and available for data review?

d. Are standards stored separately from the digestates?

e. Do the digested cases examined contain LCSs, duplicates, and matrix spikes? Case examined include:

f. How are the samples measured and transferred to the beakers for digestion?

g. What is the procedure for transferring the sample numbers from the sample bottles to the digestion beakers?

h. Is the QC digested with the samples?

i. Are the samples filtered before analysis or allowed to settle?

Comments:

C. Analytical Methods

1. ICP Instrumentation

	Manufacturer	Model	Type: Sequential or Simultaneous	Installation Date
ICP				
Data System				

a. Is the appropriate portion of the SOP available to the analyst? Does the analytical procedure followed by the analyst agree with the written SOP?

b. Are calibration intensity and gains kept in a permanent record so that instrument performance can be measured over time?

c. Has the instrument been modified in any way?

d. Is the instrument properly vented?

e. Is the mass flow controller used?

f. Is an auto-sampler used?

g. Is the interference correction automatically performed?

h. Are interelement correction (IEC) factors updated every 6 months or more frequently?

i. Is a permanent service record maintained in logbook?

j. Is service maintenance by contract?

k. Are analytes diluted into range for all samples? Is quantitation performed off of a single dilution?

ICP continued

l. Instrument calibrated daily? Profile element is _____.

m. Perform quarterly verification of IDLs and Linear Ranges?

n. ICSs run every 8 hours or beginning and end of run, whichever is more frequent? analyst checks criteria and watches for "false positives"? (False positives may indicate a need for updating IECs.)

o. Correct sequence of QC samples run during analysis?

Standardization
ICV
ICB
CRI
ICSA
ICSAB
CCV1
CCV2
PB
LCS
8 samples
CCV2
CCB2
etc.

Comments:

2. Atomic Absorption (AA) Spectrophotometer

Manufacturer/Model # Installation Date

AA

a. Is the appropriate portion of the analytical SOP available to the analyst? Are element specific SOPs listing instrument conditions, background correction, instrument conditions, and required instrument sensitivity available to the analyst? Are the written SOPs followed by the analysts?

b. Are calibration results (i.e. sensitivity) kept in a permanent record so that instrument performance can be measured over time?

c. Has the instrument been modified in any way?

d. Is the instrument properly vented?

e. Is the unit equipped with a graphite furnace? Background correction: Zeeman, Deuterium Arc, Smith-Hieftje

f. Are Lvov platforms used?

g. Is an auto-sampler used?

h. Are EPA or instrument manufacturer matrix modifiers used? As: $Ni(NO_3)_2$, Pb: $NH_4H_2PO_4$, and Se: $Ni(NO_3)_2$

i. Is the unit equipped with electrodeless discharge lamps?

j. Is a permanent service record maintained in a logbook? Service contract?

k. Double injections and spikes performed?

l. Decision-tree followed for dilutions, MSAs, qualifiers?

m. QC checked by analyst? Software checks?

Comments:

3. Mercury Analysis

Manufacturer/Model

a. Is the appropriate portion of the SOP available to the analyst? Does the analytical procedure followed by the analyst agree with the written SOP?

b. Are the preparation log or bench sheets kept in a manner consistent with the SOP and GLP? Are they reviewed on a periodic basis by the supervisor?

c. Are the calibration standards prepared with the samples? Is the ICV digested?

d. Is the instrument properly vented?

e. Is a permanent service record maintained in a logbook?

Comments:

4. Cyanide Analysis

Manufacturer/Model

Comments

a. Is the appropriate portion of the SOP available to the analyst? Does the analytical procedure followed by the analyst agree with the written SOP?

b. Are the preparation log or bench sheets kept in a manner consistent with SOP or CLP? Are they reviewed on a periodic basis by the supervisor?

c. Are sufficient cyanide distillation apparatus available to routinely analyze all samples within the required holding period?

d. Is the analysis by titrimetric or colorimetric method?

e. Is the manual or semi-automated method used? Method:

f. Is the pH of the samples recorded and available for data review?

g. Is a service log maintained for the instrument?

h. Macro or midi-distillation? Initial volume for water samples is _____. Initial weight for soils samples = _____. Final volumes for waters = _____; for soils = _____.

i. Holding times tracked? NYSDEC-ASP 12 days from VTSR understood and maintained?

j. QC run with each batch ($\leq$ 20 samples)? PB? LCS?

Comments:

D. Data Handling and Review

Comments

1. Are manual data calculations spot-checked by a second person?

2. Are there at least two layers of review of the data packages?

3. Is there an SOP for Review of Data available in the area?

4. Is a Laboratory Information Management System (LIMS) used?

5. Is the LIMS used for calculating results? If so, is it validated for that purpose?

6. Which analytes are hand-entered and which are uploaded into the data system for reporting?

   Is there a transcription check for hand-entered results?

7. Where is data package produced? In Inorganics lab or a central data production area?

8. Who uploads data? Analysts? Data personnel? Who generates report?

Comments:

OVERALL INORGANICS ASSESSMENT OF LABORATORY AUDIT

General Comments:

Recommendations:

Organic Laboratory Evaluation Checklist

I. Organization and Personnel

Item	Q*	UNQ	Comment
Laboratory or Project Manager (Individual) responsible for overall technical effort) Name: Requires BS chemistry/physical science + 3 yrs lab experience including 1 year as a supervisor.			
GC/MS Operator Name: Name: Requires BS chemistry/physical science + 1yr GC/MS/DS experience or 3 yrs GC/MS/DS experience.			
GC/MS Data Interpretation Specialist Name: Name: Requires BS chemistry/physical science + a training course in mass spectral interpretation + 2 years experience			
GC/MS Laboratory Supervisor Name: Requires BS chemistry/physical science + 3 yrs experience, including 1 yr as supervisor.			
Pesticide Residue Analyst Specialist Name: Requires BS chemistry/physical science + 2 yrs experience in operating/ maintaining GC and interpreting chromatograms.			

Sample Preparation Laboratory Supervisor
Name:
Name:
Requires BS chemistry/physical science + 3 yrs lab experience, including 1 year as a supervisor.

Extraction Concentration Specialist
Name:
Name:
Requires High School diploma and a knowledge of general chemistry.

Q - Indicates the individual is qualified for this position.
UNQ - Indicates the individual lacks the minimum qualifications for the position.

Item	Yes	NoComment
Is the sample custodian designated? If yes, name of sample custodian. Name:		
Was the Quality Assurance Officer Available during the evaluation? Name:		
Does the Laboratory Quality Assurance Officer report to senior management levels?		
Do personnel assigned to this project have the appropriate educational background to successfully accomplish the objectives of the program?		
Is the organization adequately staffed to meet project commitments in a timely manner?		
Were all key personnel available? If not, list those not available?		

Comments:

II. Sample Receipt and Storage Area

Item	Yes	No	Comment
Are written Standard Operating Procedures (SOPs) developed for receipt and storage of samples?			
Is the appropriate portion of the SOP available to the sample custodian at the sample receipt/storage area?			
Are the sample shipping containers opened in a manner which prevents possible laboratory contamination?			
Are samples that require preservation stored in such a way as to maintain their preservation?			
Are volatile samples stored separately from semivolatile samples?			
Are VOA holding blanks utilized at a frequency consistent with IFB requirements and is the data maintained for on-site inspection?			
Are adequate facilities provided for storage of samples, including cold storage?			

Item	Yes	NoComment
Is the temperature of the cold storage recorded daily in a logbook?		
Are temperature excursions noted and appropriate actions taken when required?		
Are corrective action SOPs posted on the cold storage units?		
Are the sample receipt/storage and temperature logbooks completed in a manner consistent with the laboratory's SOP?		
Has the supervisor of the individual maintaining the document(s) personally examined and reviewed the document(s) periodically, and signed his/her name therein, together with the date and appropriate comments as to whether or not document(s) are being maintained in an appropriate manner?		

Comments:

III. Sample Preparation Area

Item	Yes	No	Comment
Can the laboratory supervisor document that organic-free water is available for preparation of standards and blanks? (Method blank data must be available for confirmation of this.)			
Is the analytical balance located away from draft and areas subject to rapid temperature changes?			
Has the balance been calibrated and checked within one year by a certified technician?			
Are the balance(s) checked daily or before each weighing session with the appropriate range of weights and the results recorded?			
Are the routine weights calibrated against class S weights at least once per month and the results recorded in a permanent notebook?			
Are solvent storage cabinets vented or located in such a way as to prevent possible laboratory contamination> (Confirm by method blank data.)			
Are reagent grade or higher purity chemicals used to prepare standards?			
Are analytical reagents dated upon receipt?			
Are reagents inventories maintained on a first-in first-out basis?			
Is the purity of the analytical reagents verified before use? (Confirm by reagent blank data.)			

III. Sample Preparation Area

When touring the facilities, give special attention to: (a) the overall appearance of organization and neatness, (b) the proper maintenance of facilities and instrumentation, (c) the general adequacy of the facilities to accomplish the required work.

Item	Yes	NoComment
Is the laboratory maintained in a clean and organized manner?		
Does the laboratory appear to have adequate workspace (6 linear feet of unencumbered bench space per analyst)?		
Are laboratory benches made of suitable impervious materials or are they covered with absorbent materials?		
Are contamination-free areas provided for trace levels analytical work? (confirm by blank data.)		
Are contamination-free work areas provided for the handling of toxic materials (e.g., glove box)? (Confirm by blank data.)		
Are exhaust hoods provided to allow contamination-free work with volatile materials? (Confirm by blank data.)		
Is the flow of the hoods periodically checked and recorded in accordance with GLP? (i.e., once per quarter.)		

Item	Yes	NoComment
Does the laboratory have a back up sonicator?		
Are appropriate tips or horns available and free of erosion?		
Manufacturer and Model Number of sonicator:		
N/A		
Are spiking/calibration standards preparation and tracking logbook(s) maintained for:		
Base-neutral/acids		
Pesticide/PCBs		
Are the primary standards traceable to EPA reference standards for:		
Base-neutral/acids		
Pesticides		
Volatiles		
Does the laboratory have a SOP for Standards traceability?		

Item	Yes	NoComment
Are fresh analytical standards prepared at a frequency consistent with IFB requirements for:		
Base-neutral/acids (stock solutions-12 months)		
Pesticides (stock solutions - 12 months)		
Volatiles (gases - 2 mo., other 6 mo.)		
Are reference materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample and/or is a traceable reference code number used?		
Do the analysts record bench data in a neat and accurate manner?		
Are the sample preparation and temperature logbooks completed in a manner consistent with GLP?		
Has the supervisor of the individual maintaining the document(s) personally examined and reviewed the document(s) periodically, and signed his/her name therein, together with the date and appropriate comments as to whether or not document(s) are being maintained in an appropriate manner?		

Item	Yes	NoComment
Are standards stored separately from sample extracts?		
Are volatile and semivolatile solutions properly segregated?		
Is the appropriate portion of the SOP available to the analyst at the sample preparation area?		
Is the SOP for glassware posted at the cleaning station?		
Is the temperature of the refrigerator/freezers recorded daily?		
Are temperature excursions noted and appropriate actions taken when required?		
Are corrective action SOPs posted on the cold storage units?		
Does the laboratory utilize Gel Permeation Chromatography (GPC) for sample extract cleanup?		
If so, are injection and preventive maintenance logs maintained in a manner consistent with GLP?		

Manufacturer / Model / Calibration Method
_____/ _____/ _____

Comments:

IV. Sample Analysis Instrumentation

Item	Yes	No	Comment
Are manufacturer's operating manuals readily available to the operators?			
Does the laboratory purchase a service contract for instruments used for the CLP?			
Are extensive in-house replacement parts available?			
Is a permanent service record maintained in a logbook?			
Is the instrument properly vented or are appropriate traps in place?			
Is raw data being archived properly (i.e. magnetic tape storage)?			
Is a log of the contents of the raw data magnetic tapes available?			
Does the laboratory have the necessary equipment to perform heated purge and trap analysis on low level soil samples?			
Can the laboratory document the use of three separate calibration curves for volatile sample analysis? (water, low soil, medium soil)			
Can the instrument operator demonstrate, using the instrument run log, that corrective actions have been taken when required (e.g., reruns)?			

Item	Yes	NoComment
Reruns when internal standard areas are out.		
Blanks when the previous sample showed saturation.		

Comments:

Item	Yes	NoComment
Are manufacturer's operating manuals readily available to the operator		
Does the laboratory purchase a service contract for instruments used for CLP?		
Are extensive in-house replacement parts available?		
Does the laboratory perform regular preventive maintenance on the instruments used for the CLP?		
Is a prepared schedule available for inspection?		
Is a permanent service recorded maintained in a logbook?		
Is the instrument properly vented or are appropriate traps in place?		

Item	Yes	NoComment
Are Aroclor 1221 and 1232 standards run at least once per month and the data maintained for on site inspection?		
Are data generated by the Alumina Equivalency Check available for on-site inspection? If yes, following criteria must be met:		
Has the laboratory analyzed a diluted tribromophenol standard to verify its retention time and noted its absence on the alumina equivalency GC chromatograms?		
Is the percent recovery of all single component pesticides greater or equal to 80% except for endosulfan sulfate which must be greater than or equal to 60% and endrin aldehyde which should not be recovered?		

V. Data Handling and Review

Item	Yes	No	Comment
Are data calculations spot-checked by a second person?			
Do records indicate that appropriate corrective action has been taken when analytical results fail to meet QC criteria?			
Are computer programs validated before use?			
Do supervisory personnel review the data and QC results?			

VI. Quality Control Manual Checklist

Item	Yes	No	Comment
Can the Quality Assurance Officer document the analysis of blind laboratory QA samples?			
Does the laboratory maintain a project specific Quality Control Manual?			
Are outdated portions of the QC Manual properly archived?			
Does the manual address the important elements of a QC program, including the following?			
a. Personnel?			
b. Facilities and equipment?			
c. Operation of Instruments?			
d. Documentation of procedures?			
e. Preventive Maintenance?			
f. Reliability of Data?			
g. Data Validation?			
h. Feedback and corrective action?			
i. QA/QC self-inspection?			

VII. Summary

Summary Checklist

Item	Yes	No	Comment
Do responses to the evaluator indicate that project and supervisory personnel are aware of QA/QC and its applications to the project?			
Do project and supervisory personnel place positive emphasis on QA/QC?			
Have responses with respect to QA/QC aspects of the project been open and direct?			
Has a cooperative attitude been displayed by all project and supervisory personnel?			
Have any QA/QC deficiencies been discussed before leaving?			
Have corrective actions recommended during previous evaluations been implemented? If not, provide details below.			

Comments:

Appendix E

Appendix E

Standard Operating Procedure

Modified NYSDEC-ASP 89-1 Volatile Organics Method

Relative to EPA Method 524.2

The SOP for method 89-1 will be adhered to with the following exceptions:

- The 5 point calibration concentrations will range from 1.0 to 100 µg/l.
- The internal standards will be spiked at 5 µg/l.
- The surrogates will be spiked at 5 µg/l.
- The MS/MSD/BS and QC check standard will be spiked at 5 µg/l.
- A 25 ml sample volume will be used.
- Sample analysis will be performed on a capillary column.

Samples will be analyzed for compounds listed in the NYS-DEC volatile TCL list plus dichlorodifluoromethane (Freon).

Sample analysis will be based on a 12 hour analysis sequence.

Calibration requirements (%RSD and %D) will follow 89-1 guidelines.

89-1 specified surrogates, internal standards, and control limits will be used.

The 524.2 blank spike for each 12 hour sequence will not be run. 1 MD/MSD/BS per SDG will be analyzed as required by ASP.

89-1 specified holding times and preservations used will be adhered to.

The low level check standard required in 524.2 rev. 2 has been eliminated in 524.2 rev. 3. This standard will not be analyzed.

QC Comparison
NYSDEC ASP 89-1 *vs* EPA Method 524.2 (rev. 3)

NYSDEC ASP 89-1	
BFB	at the start of every 12 hour sequence
calibration	5 point calibration 30% RSD for CCC compounds 35% RSD for all others
continuing calibration standard	every 12 hour sequence, before blank and samples 25 %D for CCC compounds 35 %D for all others
method blank	1 every 12 hour sequence, after calibration standard but before samples
surrogates	every sample and QC spiked with 1,2-dichloroethane-d4, toluene-d8 and bromofluorobenzene at 50 µg/l
matrix spike	spiked with 5 compounds at 5 µg/l 1 md/msd/bs per SDG
QC check std	spiked with all target compounds at 20 µg/l 1 per SDG
holding time	7 days from VTSR
preservative	none
CRQL	5-10 µg/l
MDL	not specified
EPA Method 524.2	
BFB	performed at the beginning of each 8 hour sequence
calibration	3-6 point curve 20% RSD for all compounds
continuing calibration	every 8 hour sequence 30 %D for all compounds
method blank	every 8 hour sequence
surrogates	1,2-dichlorobenzene-d4 and bromofluorobenzene at 1 µg/l
internal std.	fluorobenzene spiked at 1 µg/l
BS	1 per 8 hour sequence spiked with all compounds, concentration not specified
MS/MSD	none required
QC check	1 quarterly
holding time	14 days from collection
preservative	pH <2 with 1:1 HCl if chlorine present, add ascorbic acid
MDL	0.02-0.35 µg/l
range	0.02-200 µg/l
CRQL	0.5-1.0 µg/l

Differences

89-1 12 hour sequence
524.2 8 hour sequence

calibration %RSD differ (lower for 524.2)

continuing calibration %D differ (lower for 524.2)

surrogates and internal standards differ

524.2 requires no MS/MSD

524.2 requires a BS for every 8 hour sequence

89-1 holding time - 7 days from VTSR
preservative - none
524.2 holding time - 14 days from collection
preservative - pH <2 with 1:1 HCl, ascorbic acid if chlorine is present

89-1 CRQL - 5-10 µg/l
524.2 CRQL - 0.5-1.0 µg/l

Appendix P-2:

Laboratory Environmental Analysis QA/QC Manual

LABORATORY ENVIRONMENTAL ANALYSIS QA/QC MANUAL

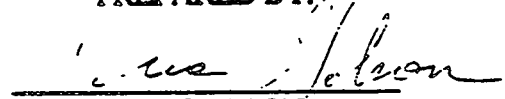


Galson Laboratories

LABORATORY ENVIRONMENTAL ANALYSIS
QUALITY ASSURANCE/QUALITY CONTROL MANUAL

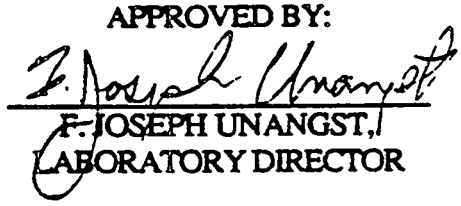
MARCH, 1987
REVISION 1: MARCH, 1989
REVISION 2: NOVEMBER 1990

PREPARED BY:



EVA GALSON,
QUALITY CONTROL COORDINATOR

APPROVED BY:



F. JOSEPH UNANGST,
LABORATORY DIRECTOR

GALSON LABORATORIES
DIVISION OF GALSON TECHNICAL SERVICES, INC.

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TABLE OF CONTENTS

		Page
I.	WATER AND WASTEWATER SAMPLE COLLECTION HANDLING	I-1
	A. Introduction	I-1
	B. Sample Collection and Handling	I-1-5
II.	CUSTODY	II-1
	A. Chain of Custody	II-1
	B. Sample Labelling	II-2
	C. Sample Receipt and Logging	II-2
	D. Sample Storage and Security	II-3
	E. Data Handling and Transfer	II-3
	F. Document Control and Case File	II-3
III.	GENERAL LABORATORY CONDITIONS	III-1
	A. Lighting	III-1
	B. Ventilation	III-1
	C. Electrical Capacities	III-2
	D. Reagent Water	III-2
IV.	GLASSWARE AND PLASTICWARE	IV-1
	A. Glassware and Plasticware Cleaning	IV-1-2
V.	REAGENTS, SOLVENTS AND GASES	V-1
	A. Quality and Grade	V-1
	B. Reagent Preparation	V-2-3
VI.	ANALYTICAL EQUIPMENT	VI-1
	A. Analytical Balances	VI-1
	B. Temperature Control Systems	VI-1
	C. Filtration Systems	VI-2
	D. Centrifuges	VI-2
	E. Spectrophotometers	VI-2
	F. Atomic Absorption Spectrophotometer	VI-3
	G. Ion Chromatograph	VI-5
	H. Gas Chromatographic Equipment	VI-5
	I. Hydrogen Ion (pH) Meters	VI-5
	J. Conductivity Meter	VI-7
	K. Dissolved Oxygen Meter	VI-7
	L. Turbidimeter	VI-7
	M. Dispensing Devices	VI-7
	N. Gas Chromatograph/Mass Spectrometer	VI-8
	O. High Pressure Liquid Chromatograph	VI-8
	P. Inductively Coupled Plasma Emission Spectrometer	VI-9
VII.	ANALYTICAL QUALITY CONTROL (AQC)	VII-1
	A. Definitions and Rationale	VII-1
	B. Procedural Components and Criteria	VII-2
	C. The Calibration Curve	VII-3
	D. Method of Standard Addition	VII-5
	E. External Standards Accuracy Tests	VII-6

TABLE OF CONTENTS, CONT

VIII.	ANALYTICAL QUALITY CONTROL - ORGANIC ANALYSES	VIII-1
	A. Standard Operating Procedures for Volatiles by GC/MS	VIII-1
	B. Base Neutral and Acids (GC/MS)	VIII-5
	C. Pesticides (GC/ECD)	VIII-8
	D. Volatiles by Gas Chromatography	VIII-11
IX.	ANALYTICAL QUALITY CONTROL - METALS	IX-1
	A. Inductively Coupled Plasma Emission Spectroscopy (ICP)	IX-1
	B. Graphite Furnace Atomic Absorption	IX-3-4
	C. Mercury Analysis	IX-5
X.	STAFF QUALIFICATION, TRAINING AND RESPONSIBILITIES	X-1
XI.	INTERLABORATORY QUALITY CONTROL, PERFORMANCE AND SYSTEM AUDITS	XI-1
XII.	CORRECTIVE ACTION	XII-1

TABLES AND FIGURES

	TABLE & FIGURE #
Sample volumes, containers, preservatives and holding times for drinking water tests.	I-1
Sample volumes, containers preservatives and holding times for waste water tests.	I-2
Chain of Custody Record/Analytical Request Form	II-1
Custody Seal	II-2
Internal Chain of Custody	II-3
Chain of Custody Forms for Extracts	II-4 A&B
Sample Log-in Record	II-5
Cooler Security Log	II-6
Report Review Record	II-7
Laboratory Floor Plan	III-1 A&B
Function Key to Figures 1A & 1B	III-1
Hood Velocity report Form	III-2
Analytical Equipment List	VI-1
Instrument Run Log	VI-2
Method of Standard Additions	VII-1
Target compound list and Quantitation Limits required by EPA	VIII-1
Tuning Criteria for GC/MS Analysis	VIII-2
Recovery Criteria of GC/MS Volatiles Matrix Spikes	VIII-3
GC/MS Volatile Method Detection Limits	VIII-4
Precision and Accuracy of GC/MS Volatile Analysis	VIII-5
GC/MS (semi-volatile) Method Detection Limits	VIII-6
Surrogate, Internal Standard Recovery Limits GC/MS Semivolatiles	VIII-7
MS/MSD & RPD values (GC/MS Semivolatiles)	VIII-8
Pesticides & PCB Listing	VIII-9
Advisory Recovery Limits for Pesticide/PCB	VIII-10
Method Detection Limits and Practical Quantitation Limits (Pesticides and PCB)	VIII-11
QC Check Standard Recovery (GC Volatiles)	VIII-12
Sample Calculation (GC Volatiles)	VIII-13
Method Detection Limits (GC Volatiles)	VIII-14 A&B
Instrument Detection Limits (Metals)	IX-1
Practical Quantitation Limits (Metals)	IX-2
Minimum Educational/Experience Requirments for Lab Positions	X-1
Laboratory Organizational Chart	X-2
Laboratory Training Certificate	X-3
Closed Loop Corrective Action Report - QA/QC	XII-1

I. WATER AND WASTEWATER SAMPLE COLLECTION AND HANDLING

A. Introduction

A workable quality control program is essential to assure the precision and accuracy of field and laboratory measurement. Quality control begins when the objectives of a survey are defined, and continues through data reporting. Control procedures must be defined for every step of a program. Without controls in any or all phases of work, the data may be highly suspect and, therefore, of less value to the users of the analytical results.

This document deals specifically with the establishment of quality control procedures to be followed in the collection and handling of all water and wastewater samples associated with Galson Technical Services projects. These procedures should be recommended to all clients submitting samples for chemical analysis. Glassware preparation is included in this section because it is an integral part of any sampling program and because field-based sample container preparation is sometimes necessary. It is assumed that the objectives of a study for which samples are to be collected have been stated and the number of samples, types of samples, frequency of collection, and duration of the sampling program have been established. Finally, it is assumed that all personnel involved in sample acquisition are aware of the above factors.

If the procedures developed herein are followed, there will be more confidence in the data produced and the samples will be processed more efficiently. By standardizing sample collection and handling procedures there should be less confusion for project manager, field personnel, and the laboratory staff.

B. Sample Collection and Handling

The most important quality control aspects of sample collection and handling are sample integrity and representativeness.

1. Sample integrity. Preservation of samples is critical when transport delays and holding are necessary. After collection, some chemical species begin to change, and unfortunately, immediate analysis is not always possible. Although there is no universal chemical preservative for every parameter, the New York State Department of Health (NYS DOH) in conjunction with the U.S. Environmental Protection Agency has defined methods to extend the period of stability for most parameters (ELAP Certification Manual 1986). Tables I-1 and I-2 list the preservation methods, container type, sample size, and estimated maximum holding times for water, wastewater, and potable water.

   Solid samples are preserved in accordance with NYS DOH guidelines. Most solid samples are best preserved by refrigeration to 4°C. Analysis should begin as soon as possible. In no case should holding times exceed those listed for water samples. A complete record should be maintained on each sample to provide a history of sample handling from collection to analysis. Sample containers may be either plastic or glass with a Teflon lined screw cap. Volatile Organics must be collected in VOA bottles filled to the septum.

Prior to all sampling efforts a detailed sampling protocol based on the analytical requirements of the program is prepared by the laboratory and communicated to the sampling agency or project manager. These preservation methods are to be used in preparing all samples for analysis at all GALSON analytical facilities. If there are questions regarding sampling or preservation, the field agent must contact the laboratory. Reagent grade preservatives must be used.

2. Sample representativeness. Sampling precision is a means of determining sample representativeness. This is done by collecting duplicate samples until seven pairs of data are available. These data are used to determine acceptable sampling precision limits. When requested by the project manager, sampling precision is determined in the initial phase of a long-term sampling program and is checked periodically thereafter with a single duplicate sample.

   Field spiking is used to determine the adequacy of sample handling procedures and therefore provides a measure of sampling accuracy. The spiking technique depends upon the analytical method and the expected concentration of the parameter of interest. Therefore, field spiking is done only after consultation with the laboratory staff to determine the proper volume, concentration, and composition of the spike solution. If field spiking is to be done, it should be done after sufficient data have been accumulated to establish a concentration range for a given parameter. Duplicate samples are collected and only one is spiked. Both are analyzed in the laboratory.

   Field blanks allow identification of systematic and random sample contamination contributed by sampling equipment, storage containers, sampling agent, or the chemicals added to preserve samples. This contamination should be checked by filling a randomly selected bottle with distilled water and the appropriate chemical additive. These field blanks are then analyzed as samples. Field blanks must be treated exactly as samples: all aliquoting, preservation, filtration, and storage and handling procedures must be performed as if the field blanks were samples. Field blank "sample" bottles must be filled at the sampling site, not after returning to the field lab.

   The following notes may be helpful in reducing the impact of contamination upon data derived from field samples:

   a. There are two general classifications of contamination-random and systematic. Random contamination causes highly variable biases in data resulting from greater degrees of contamination in some samples than in others. Systematic contamination generally results in consistent shifts in baseline concentrations as demonstrated by field blanks. The point behind this explanation is that systematic contamination (hopefully, very low level) is much easier to eliminate and to deal with in interpreting the data, and the only way to restrict contamination of the systematic type is to treat every sample, blank, replicate, subsample, split samples, etc., exactly alike within the limits of preservation, holding and procedural prerequisites. It may, therefore, be necessary to do a few dry runs through filtering or preservation procedures to achieve a "routine." The greatest contamination impacts occur in parameters present in trace concentrations.

b. There are many sources of possible sample contamination including:

1) Sampling with a contaminated sampling bottle.

2) Unclean glassware and filters.

3) Use of cleaning products inappropriate for the proposed analysis.

4) Inadequate rinsing of glassware after cleaning.

5) Allowing the end of the sampling bottle sample discharge tube to come in contact with contamination sources (boat transom, hands, other equipment).

6) Inadequate presampling rinsing--the sample bottle should be rinsed two to three times with small volumes of the sample before the bottle is filled to overflowing. Presampling rinsing is not possible for certain parameters (e.g., oil and grease) or where preservatives have been added to the bottles.

7) Particulate matter (hair, dandruff, tobacco smoke, dust)--all sample handling should be done in as clean an area as possible; filtration apparatus should be protected from contamination; Kimwipes should be used with caution during handling of trace metals samples (they contain large amounts of zinc).

8) Filters should be rinsed several times with distilled water between samples and then pre-rinsed with 50 ml of sample by rinsing the walls of the filter funnel (under vacuum) and discarding the (50 ml) filtrate.

9) Filter pads should be handled by the extreme edge (that portion which will be clamped between the halves of the filtering apparatus and should be handled with forceps appropriate to the analyses to be performed (plastic forceps for metals, metal forceps for trace organics).

10) Use of improper sample container--it may seem obvious; however, trace metals samples should not come in contact with any metallic surfaces, trace organic samples should not come in contact with any plastic surface (plasticizers are the problem here), sterile samples (for bacteriological analysis) should not come in contact with non-sterile surfaces, nutrient samples should not come in contact with surfaces cleaned with phosphate detergents (and not properly rinsed).

3. Cleaning procedures for sample containers and filtering equipment.
The accurate measurement of chemical parameters requires clean sample containers. The following procedures will be used for sample containers and laboratory glassware.

a. Glassware for general use. Immediately after use, glassware is immersed in a solution of a synthetic detergent. Scrubbing with a brush followed by several rinses with tap water, then several deionized water rinses. Glassware so cleaned must not be used for procedures included in subsequent cleaning classifications without additional cleaning steps specific for that parameter. Alternatively, a four cycle automatic dishwasher with deionized final rinse is used for general glassware.

b. Organic parameters. Where the presence of gross organic contaminants (e.g., oil and grease, TOC, BOD, COD), may present a problem, a 1:1 sulfuric acid cleaning solution with ammonium presulfate added is used. Immerse the glassware in this solution and allow to stand two hours. After soaking, rinse the glassware well with tap water, then deionized water. The glass is clean when water drains uniformly without forming droplets.

c. Trace organic parameters. Glassware for trace organic parameters to be analyzed by GC or GC/MS (pesticides, herbicides, PCBs, halogenated hydrocarbons, etc.) is cleaned in very hot water with a synthetic (preferably inorganic) detergent. The glassware is then rinsed in hot tap water and deionized water.

Additional cleaning by firing at 450-500 C for one hour may be necessary for some trace organic parameters.

The final cleaning step should be an acetone (pesticide grade) or methylene chloride rinse.

It is very important to note that plastics (except for fluorocarbon based plastics) must not be used in conjunction with trace organic analyses, as exuded plasticizers (generally phthalates) interfere in the detection of certain compounds by gas chromatography, and are contaminants in GC-MS determinations.

d. Trace metal parameters. 1:1 Nitric Acid should be used to clean glassware or plasticware for trace metal analysis. Soak glassware or plasticware for four hours: rinse well with warm tap water, then with deionized water.

e. Phosphate-phosphorus. Glassware to be used in the determination of any of the phosphate fractions requires special cleaning. Glassware cleaned as described in the "General Use" category above is washed with HCl, soaked in mixed reagent, and final rinsed with deionized water.

f. Microbiological parameters. Glassware and plasticware to be used in determining microbiological characteristics of water samples is cleaned as described in the "General Use" category above. Labware thus cleaned is then autoclaved to kill any bacteria present. Disposable sterile glassware can be substituted for laboratory autoclaved preparation.

g. Glassware drying and storage. Clean glassware is air dried and stored according to the cleaning process.

h. Sampling Bottles. The laboratory supplies only new, comercially precleaned bottles to clients or for field sampling by our in-house staff. Bottles with two levels of pre-clenaing documentation are available:
Level 1 - These bottles are supplied with lot specific certification documenting the level of cleanliness.

Bottles are cleaned according to the following protocol:

1. Bottles, liners and caps washed in laboratory-grade, non-phosphate detergent.
2. Rinsed three times with distilled water.
3. Rinsed with1:1 nitric acid.
4. Rinsed three times with ASTM-TYpe 1 organic free water.
5. Oven-dried for one hour.
6. Rinsed with hexane.
7. Oven-dried for one hour.

Level 1 bottles are supplied to clients who specifically request them, and for all projects performed according to protocols of EPA Superfund, NYS DEC ASP level B and the Army Corps of Engineers.

Level 2 - These bottles are supplied without lot specific documentation, but are cleaned according to the same protocol as Level 1 bottles.
Level 2 bottles are supplied for all other projects.

TABLE I-1
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
DRINKING WATER SAMPLES ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Bacteriological Tests:				
Coliform (Total)	100	P,G	0.008% $Na_2S_2O_3$	30 hours
Standard Plate Count	100	P,G	0.008% $Na_2S_2O_3$	30 hours
Inorganic Tests:				
Alkalinity	100	P,G	Cool, 4°C	14 days
Arsenic	200[d]	P,G	HNO_3 to pH<2	6 months
Barium	200	P,G	HNO_3 to pH<2	6 months
Cadmium	200	P,G	HNO_3 to pH<2	6 months
Calcium	200	P,G	HNO_3 to pH<2	6 months
Chloride	100	P,G	None	7 days
Chlorine, Free Residual	200	P,G	None	1 hour
Chromium	200	P,G	HNO_3 to pH<2	6 months
Color	100	P,G	Cool, 4°C	48 hours
Fluoride	300	P,G	None	28 days
Lead	200	P,G	HNO_3 to pH<2	6 months
Mercury	200	G	HNO_3 to pH<2	38 days
		P	HNO_3 to pH<2	14 days
Nitrate	100			
Chlorinated Supplies		P,G	Cool, 4°C	28 days
Non-chlorinated Supplies		P,G	H_2SO_4 to pH<2	14 days
pH	50	P,G	None	1 hour
Selenium	200	P,G	HNO_3 to pH<2	6 months
Silver	200	P,G	HNO_3 to pH<2	6 months
Sodium	200	P,G	HNO_3 to pH<2	6 months
Sulfate	100	P,G	Cool, 4°C	7 days
Temperature	—	P,G	None	Analyze Immediately
Total Filterable Residue	200	P,G	Cool, 4°C	7 days
Turbidity	100	P,G	None	1 hour
Organic Tests:				
Pesticides: Endrin, Lindane, Methoxychlor, Toxaphene	1000	Glass with foil or Teflon-lined cap	Cool, 4°C	14 days until extraction and 30 days after extraction

TABLE I-1, CON'T
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
DRINKING WATER SAMPLES ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Herbicides: 2,4-D 2,4,5-TP (Silvex)	1000	Glass with foil or Teflon-lined cap	Cool, 4°C	7 days until extraction and 30 days after extraction
Trihalomethanes: Bromodichloromethane Bromoform Chlorodibromomethane Chloroform	2x25	Glass with Teflon-lined Septum	0.008% $Na_2S_2O_3$	28 days
Radiological Tests:				
Gross Alpha	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Gross Beta	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Strontium-89	1000	P,G	HCl or HNO_3 to pH<2	2 months
Strontium-90	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Radium-226	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Radium-228	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Cesium-134	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Iodine-131	1000	P,G	None	7 days
Tritium	1000	P,G	None	Not applicable
Uranium	1000	P,G	HCl or HNO_3 to pH<2	Not applicable
Photon Emitters	1000	P,G	HCl or HNO_3 to pH<2	Not applicable

(a) More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, pp. 72-82 (1976) Method D-3370.

(b) Polyethylene (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

(c) Holding times are recommended for properly preserved samples based on currently available data. For some sample types, extension of these times may be possible while for other types, these times may be too long. Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.

(d) 200 ml is required for metals; however more than one metal can be analyzed on each 200 ml sample.

TABLE I-2
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
WATER AND WASTEWATER SAMPLES
ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Bacteriological Tests:				
Coliform, Total and Fecal	100	P,G	Cool, 4°C	6 hours
Coliform, Total and Fecal in chlorinated samples	100	P,G	Cool, 4°C, 0.008% $Na_2S_2O_3$	6 hours
Fecal Streptococci	100	P,G	Cool, 4°C	6 hours
Inorganic Tests:				
Acidity	100	P,G	Cool, 4°C	14 days
Alkalinity	100	P,G	Cool, 4°C	14 days
Ammonia	500	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Biochemical oxygen demand	1000	P,G	Cool, 4°C	48 hours
Bromide	100	P,G	None	28 days
Biochemical oxygen demand, carbonaceous	1000	P,G	Cool, 4°C	48 hours
Chemical oxygen demand	200	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Chloride	100	P,G	None	28 days
Chlorine, total residual	200	P,G	Cool, 4°C	Analyze Immediately
Color	100	P,G	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	1000	P,G	Cool, 4°C NaOH to pH>12, 0.6g ascorbic acid	14 days
Fluoride	300	P	None	28 days
Hardness	200	P,G	HNO_3 to pH<2 H_2SO_4 to pH<2	6 months
Hydrogen ion (pH)	50	P,G	None	Analyze Immediately
Kjeldahl and organic nitrogen	500	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Metals, except chromium VI and mercury	200	P,G	HNO_3 to pH<2	6 months
Chromium VI	200	P,G	Cool, 4°C	24 hours
Mercury	200	P,G	HNO_3 to pH<2	28 days

TABLE I-2, CON'T
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
WATER AND WASTEWATER SAMPLES
ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Nitrate	200	P,G	Cool, 4°C	48 hours
Nitrate-nitrite	200	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrite	100	P,G	Cool, 4°C	48 hours
Oil and Grease	1000	G	Cool, 4°C H_2SO_4 to pH<2	28 days
Organic carbon	200	P,G	Cool, 4°C, HCl or H_2SO_4 to pH<2	28 days
Orthophosphate	200	P,G	Filter immediately Cool, 4°C	48 hours
Oxygen, Dissolved	—	G	None	Analyze Immediately
Probe				
Winkler		G	Fix on site and store in dark	8 hours
Phenols	1000	G	Cool, 4°C, H_3PO_4 to pH 4.0, 1.0g $CuSO_4$:5 H_2O/L	28 days
Phosphorus (elemental)	200	G	Cool, 4°C	48 hours
Phosphorus, Total	100	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Residue, Total	200	P,G	Cool, 4°C	7 days
Residue, Filterable	200	P,G	Cool, 4°C	7 days
Residue, Nonfilterable	200	P,G	Cool, 4°C	7 days
Residue, Settleable	200	P,G	Cool, 4°C	48 hours
Residue, Volatile	200	P,G	Cool, 4°C	7 days
Silica	200	P	Cool, 4°C	28 days
Specific Conductance	100	P,G	Cool, 4°C	28 days
Sulfate	100	P,G	Cool, 4°C	28 days
Sulfide	500	P,G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
Sulfite	200	P,G	None	Analyze Immediately
Surfactants	250	P,G	Cool, 4°C	48 hours
Temperature	—	P,G	None	Analyze Immediately
Turbidity	100	P,G	Cool, 4°C	48 hours

TABLE I-2, CON'T
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
WATER AND WASTEWATER SAMPLES
ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Organic Tests:				
Purgeable Halocarbons plus Benzyl Chloride and Epichlorohydrin	2x40	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ for residual chlorine	14 days
Purgeable Aromatics	2x40	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ for residual chlorine Preserve as above and HCl to pH<2	7 days 14 days
Acrolein and Acrylonitrile	2x40	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ for residual chlorine	14 days for Acrylonitrile 3 days for acrolein
			Preserve as above and pH to 4-5	14 days
Phenols	1000	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine	7 days until extraction 40 days after extraction
Benzidines	1000	G, Teflon-lined cap for residual	Cool, 4°C 0.008% $Na_2S_2O_3$ 7 days after chlorine inert gas	7 days until extraction extraction if stored under
Phthalate Esters	1000	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
Nitrosamines	1000	G, Teflon-lined cap	Cool, 4°C stored in dark 0.008% $Na_2S_2O_3$ for residual chlorine For diphenylnitro-samine add 0.008% $Na_2S_2O_3$ and adjust pH 7-10 with NaOH within 24 hours of sampling	7 days until extraction 40 days after extraction

TABLE I-2, CON'T
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF
WATER AND WASTEWATER SAMPLES
ACCORDING TO ANALYTE[a]

ANALYTE	VOLUME REQUIRED (ml)	CONTAINER[b]	PRESERVATION	MAXIMUM[c] HOLDING TIME
Nitroaromatics and Isophorone	1000	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$ for residual chlorine, stored in dark	7 days until extraction 40 days after extraction
PCBs	1000	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
Pesticides	1000	G, Teflon-lined cap	Cool, 4°C, Cool, 4°C pH 5-9, 0.008% $Na_2S_2O_3$ for residual chlorine if aldrin is to be determined	72 hours 7 days until extraction 40 days after extraction
Polynuclear Aromatic Hydrocarbons	1000	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine only, store in dark	7 days until extraction 40 days after extraction
Haloethers	1000	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine only	7 days until extraction 40 days after extraction
Chlorinated Hydrocarbons	1000	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
2,3,7,8-Tetra-chlorodibenzo-p-Dioxin	1000	G, Teflon-lined cap	Cool, 4°C, 0.008 $Na_2S_2O_3$ for residual chlorine only	7 days until extraction 40 days after extraction
Radiological Tests:				
Alpha	1000	P,G	HNO_3 to pH<2	6 months
Beta	1000	P,G	HNO_3 to pH<2	6 months
Radium	1000	P,G	HNO_3 to pH<2	6 months

TABLE I-2, CON'T
NYS DOH ENVIRONMENTAL LABORATORY APPROVAL PROGRAM
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER AND WASTEWATER SAMPLES ACCORDING TO ANALYTE[a]

(a) More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, pp. 72-82 (1976) Method D-3370.

(b) Polyethylene (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

(c) Holding times are recommended for properly preserved samples based on currently available data. For some sample types, extension of these times may be possible while for other types, these times may be too long. Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.

II. CUSTODY

Sample custody begins when a sample is collected and ends when analytical data are delivered to the client. It is important to be able to trace samples from collection to data reporting so that utmost confidence can be placed in the data. To adequately detail this aspect of analytical quality control, the following topics will be discussed in this section.

A. Sample custody.
B. Sample labelling.
C. Sample receipt, logging, and analytical assignment.
D. Sample storage and security.
E. Data handling, transfer, and reporting.

A. Sample Custody

A chain of custody is a mechanism for tracing custody from the time of collection through reporting of results. The chain is initiated by the sampling agent who completes a Chain of Custody form (Figure II-1). As the samples are passed from individual to individual the transfers are noted. This process continues until the samples are delivered to the laboratory, where the form is signed as received and entered into the project file. A copy of the completed form is returned to the originator for his records and as indication of sample receipt.

In most instances, this Chain of Custody is adequate; however, when samples have been collected which have strong potential to form the basis for evidence in an adjudicatory proceeding it becomes necessary to add security to the above system. The security is added to assure the client that the samples have not been in any way altered or tampered with during transport to the laboratory or during analysis. This extra measure of custody is added by sealing the coolersin which bottles are sent and samples are returned, with custody seals (Figure II-2). The coolers with clean bottles are sealed by the laboratory. Additional seals are sent with the bottles, which are filled out and affixed by the individual who sends the samples back to the laboratory.

In the laboratory, an internal chain of custody form is initiated (Figure II-3). This form remains with the sample custodian, and is initialed and dated whenever samples are removed or returned to storage.

For those samples which are extracted or digested, an additional chain of custody is initiated for the extracts/digests (Figure II-4A,4B). These forms are initiated by the extraction/digetion groups and remain with the extracts.

Copies of all chain of custody forms are included in the report package if required.

Samples/extracts are debulked or returned to the client on a time schedule determined by the project, contract or project manager, but not less than two weeks after the report has gone to the client. When disposal of samples occurs, this information is entered on the chain of custody forms. The forms are filed in the project file.

B. Sample Labelling

The importance of sample labelling cannot be overstated. Improper or inadequately labelled samples are of little value in a monitoring program. Improperly labelled samples lead to questions with regard to location, project, sampling station, date sampled, and sampler. All of this information is essential for proper sample handling.

The following information, at a minimum, is required on each sample label:

Client	Date Collected
Project Number (or Job No. if applicable)	Time Collected
Location	Collected By
Preservative(s) (or Bottle Type)	

Pre-printed pressure-sensitive labels containing the above are available from the laboratory.

Failure to provide the requested information may result in wasted time and resources if it is necessary to discard samples.

C. Sample Receipt and Logging

Upon receipt at the laboratory, the sample custodian inspects the samples for integrity and checks the shipment against the chain of custody/work order. Any discrepancies noted are addressed at this point and documented on the chain of custody form.

The client is contacted by the Sample Manager or the Project Manager to resolve discrepancies. When the shipment and the chain of custody are in agreement, the sample custodian checks sample preservation and enters the information on the chain of custody form. If approved by the client and necessary, adjustments in sample preservation are made and noted. The samples are then logged in to the Laboratory Information Managment System (LIMS), which assignes a unique number to each sample. Two labels are generated which contain the sample number, client name, job number and task number. One label is affixed to the sample bottle and one to the paper work associated with it. In addition to the computer log-in, an abbreviated hand written log is maintained (Figure 11-5). Each analysis required is specified by a Test Code which is assigned to the sample. The LIMS Test Codes contain information about the required holding times, preservative required, and QC requirements. Thus, a single analysis such as Volatile Aromatics will have a number of different test codes because of the difference quality control requirements and holding times specified by SW846, NYS DEC or the Drinking Water Act.

D. Sample Storage and Security

While in the laboratory, the samples and aliquots are maintained in a walkin coolers at 4°C unless they are being used for analysis. The coolers are equipped with locks and are under the control of the sample custodian who also maintains ultimate control of the samples while they are in the laboratory. The coolers have a security log that is initialled each time the cooler is locked or unlocked (Figure II-6). The samples are retained at the laboratory for two weeks (or longer if required by a client) after the report has gone out, so that any potential analytical problems can be addressed. At the end of the holding period the samples are discarded.

E. Data Handling and Transfer

Technicians perform specific analyses and enter bench-generated data into workbooks or laboratory records specific for each parameter. These notebooks are under control of the laboratory manager who is responsible for their security. After a set of analyses has been completed, the results are calculated according to the methods specified in the procedural protocols using verified calculation routines. At least ten percent of these calculations are double-checked by the group manager. Those calculations checked will be indicated with a checkmark. The signature of the reviewer and the date reviewed are placed on each document checked. The technician then enters the data into the LIMS system and the computer generated reports are obtained by the supervisor. The assembled data and the raw data are then given to the lab manager for review. The lab manager reviews the data for nonsense errors, computational errors, and transcriptional errors. When satisfied with the quality of the data, the lab manager approves the data and passes them to the secretary for editing. The final data is reviewed by the department manager and forwarded to the client. A report review record (Figure II-5) is completed for all data generated and filed in the respective client files. The QA manager reviews all reports that have gone out. If errors are found, revised reports are issued. The QA manager also notes opportunities for report improvement and circulates these comments to the laboratory management.

All data generated in the laboratory is stored for no less than seven years or until the client releases it. This storage includes bench notebook entries, reports, tables, chromatograms, and mass spectra. Data from instrument strip chart traces is transcribed to the respective notebooks. These strip chart traces are kept on file for future reference. At least ten percent of all laboratory transcripts are verified by a second person.

F. Document Control and Case Files.

The goal of the Document Control Program is to assure that all documents for a specified client (group of samples) will be accounted for when the project is completed. The program includes a document numbering and inventory procedure for preparation of the specified documentation packages for each client.

Each client is given an individual job number and all subsequent jobs for a specific client are given the same job number with individual task numbers. All documents pertaining to the specific job are filed in the work order files. These files are maintained for no less than 7 years. The client may release documents sooner or request a longer holding period.

In special cases where documentation has a strong potential to form the basis for evidence in an adjudicatory proceeding security can be added to this system. All documents will come under the security of the laboratory supervisor.

For cases where specific protocol dictates the special handling of documents, the necessary steps will be taken.

Chain of Custody Record

Page _____ of ___

Company Name	Project Manager/Contact
Project No.	Project Name

Galson Laboratories
6601 Kirkville Road East
E. Syracuse, New York 13057
315-432-0506 or 800-950-0506

Special QA/QC Protocol (Circle)
EPA CLP EPA SW 846
NYS DEC NYS DOH
NJ TIER I CALIFORNIA
NJ TIER II OTHER (Specify)

PARAMETERS FOR ANALYSIS

SAMPLE LOCATION / SAMPLE ID	Date	Time	TYPE Comp.	Grab	Aqueous	Soil	Other	A	B	C	D	E	F	G	H	I	J	K	Laboratory ID Number

REMARKS:

Task No.

SAMPLERS NAME: SIGNATURE:

SAMPLES RELINQUISHED BY:		SAMPLES RECEIVED BY:	
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:
NAME: SIGNATURE:	DATE: TIME:	NAME: SIGNATURE:	DATE: TIME:

Received For Laboratory By: (Signature) DATE: TIME:

Custody Seal Intact? Sample ☐ Yes ☐ No ☐ N.A.

Shipment Complete? ☐ Yes ☐ No

LabStor. Location (Ref. #)	A	B	C	D	E	F	G	H	I	J	K	L	2/89#

Figure II-1

Galson Laboratories

CUSTODY SEAL

_____

Sealed By: _____ Date: _____

6601 Kirkville Rd.
E. Syracuse, NY
13057
315-432-0506

Figure II-2

GALSON LABORATORIES INTERNAL CHAIN OF CUSTODY PAGE ____ OF ____

TASK NUMBER	CLIENT NAME	JOB NUMBER	STORED BY	DATE OF TRANSFER

LAB ID	CLIENT ID	MATRIX	PLACE OF STORAGE REFRIG. SHELF	PRESERVATIVE				RECD TECH. REASON	DATE /TIME RETURNED INITIALS	RECD TECH. REASON	DATE /TIME RETURNED INITIALS	RECD TECH. REASON	DATE /TIME RETURNED INITIALS	HZD. CODE
				pH	ADDED	FINAL pH	SEP. BTLS							

Figure II-3

EXTRACTABLE CHAIN OF CUSTODY

Page #____ of ____

Client:_____

Relinquished by:_____Date/Time_____/_____

Task #:_____

Received by:_____Date/Time_____/_____

Sample Analysis Requested: BNA 625/8270 Pest/PCB's 604/8040 610/8310 310-13 EPTOX TCLP Air Other:_____

Protocol: ELAP CLP RCRA SPDES Other:_____ Stored In Refrigerator #____ QC Batch #_____

Gateon. Sample ID	Client Sample ID	Bottle #	Sample Removal & Return Tracking													
			Date/Time Out	Removed By	For	Date/Time In	Date/Time Out	Removed By	For	Date/Time In	Date/Time Out	Removed By	For	Date/Time In	Comments & Date of Disposal	

*Reasons For Removal-- A:Analysis IS: Standardizing C:Combining D:Debulking & Reorganizing O:Other (Specify in Comments) 900606.0932

Figure II-4A

CHAIN OF CUSTODY

METALS EXTRACTS

CLIENT	SAMPLE #	MATRIX	PREP. DATE; TECHNICIAN	PLACE STORED	SIGNED OUT BY; TIME; DATE; REASON	SIGNED IN BY; TIME;DATE

GALSON Technical Services, Inc. SAMPLE LOG-IN RECORD

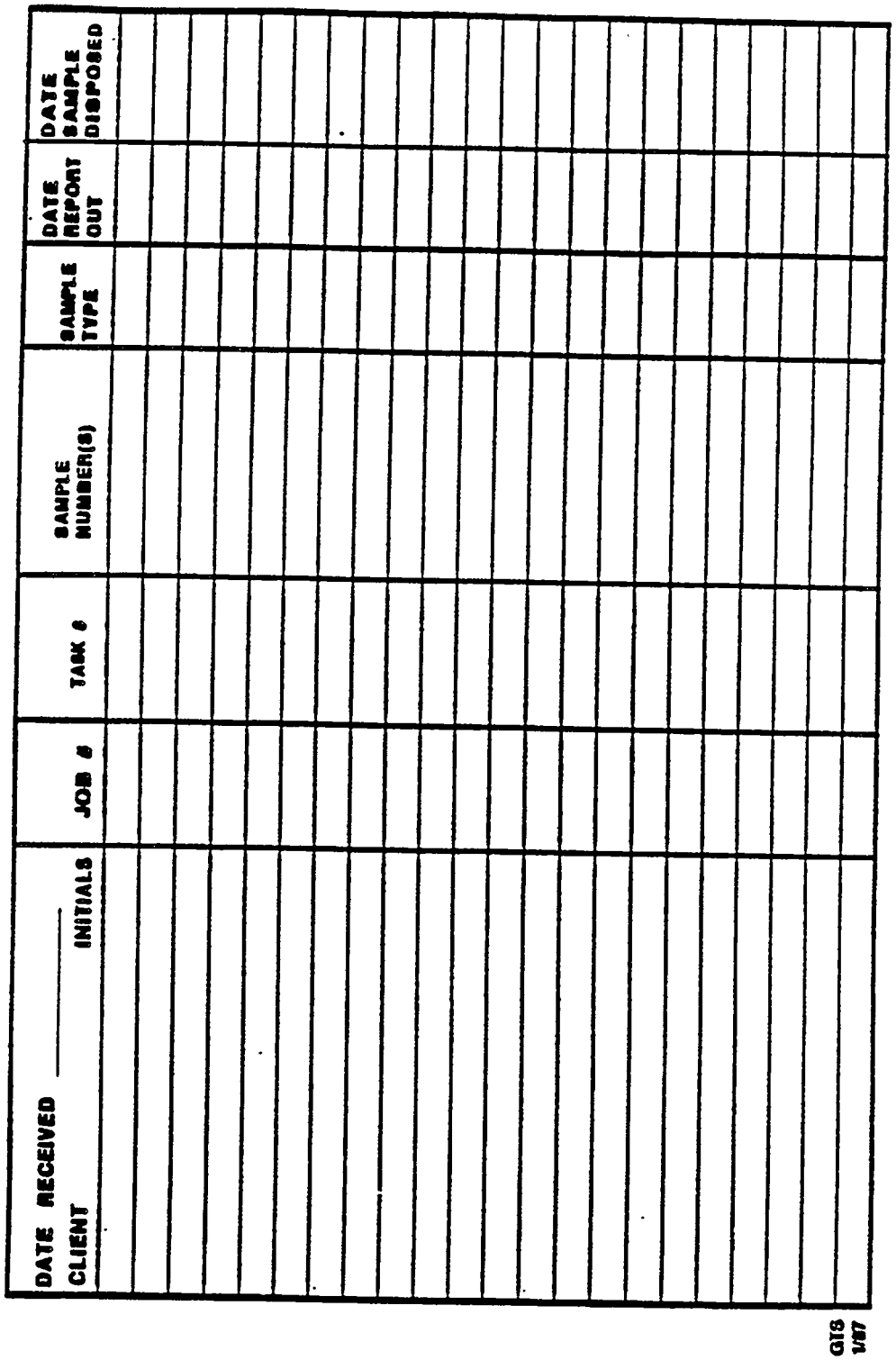


Figure II-5

GALSON TECHNICAL SERVICES WALK-IN SECURITY LOG 1/87 MONTH/YEAR

WALK-IN OPENED BY	DATE/TIME	WALK-IN LOCKED BY:	DATE/TIME	WALK-IN OPENED BY	DATE/TIME	WALK-IN LOCKED BY:	DATE/TIME
	/		/		/		/
	/		/		/		/
	/		/		/		/
	/		/		/		/
	/		/		/		/
	/		/		/		/
	/		/		/		/
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	/		/		/		/
	/		/		/		/
	/		/		/		/
	/		/		/		/

Figure II-6

REPORT REVIEW RECORD

CLIENT: _____

TASK NUMBER(S): _____

_____

_____

JOB NUMBER: _____

REQUIRED MATERIAL:

COVER LETTER (Y / N)
REPORT (# OF PGS) (Y / N)
INVOICE (Y / N)
C OF C (Y / N)
ENVELOPE/LABEL/NONE
WORKORDER (Y / N)
COMPUTER PRINT OUT (Y / N)
INSERTS: DW/EPTOX/OTHER

COMMENTS:

SECRETARY: ___MONA ___VAL ___TANIA ___SUE
___DARLENE ___VICKI

PROOFING — CORRECTIONS NEEDED — NO CORRECTION NEEDED

SIGNATURES REQUIRED	ENVELOPE	LETTER	REPORT	INVOICE	
_X_ MAUREEN					
___ ASB/MAJA					
___ MET/MARY					
___ WET/AMY					
___ GC/SHERRY					
___ VOA'S/SCOTT					
___ MS/LAURIE					
___ IHORG/MK					
___ ENVORG/DOTTIE					
DEPARTMENT MANAGERS					
___ORGANIC					
___INORGANIC					

PROOFING — CORRECTIONS NEEDED — NO FURTHER CORRECTION
FINAL DRAFT

SIGNATURES REQUIRED	ENVELOPE	LETTER	REPORT	INVOICE	
_X_ MAUREEN					
___ ASB/MAJA					
___ MET/MARY					
___ WET/AMY					
___ GC/SHERRY					
___ VOA'S/SCOTT					
___ MS/LAURIE					
___ IHORG/MK					
___ ENVORG/DOTTIE					
DEPARTMENT MANAGERS					
___ORGANIC					
___INORGANIC					

PROCESSING: MAILED: (Y / N) COPIES MADE: (Y / N) DATE FLAGGED: _____

FIGURE II-7

III. GENERAL LABORATORY CONDITIONS

A floor plan of the laboratory is found in Figure III-1 and III 1B. The numbered circles are fume hoods and exhausts. Identification of the function of each laboratory is proveded in Table III-1. Environmental conditions in a laboratory have direct bearing on data generated including:

- ventilation
- lighting
- electrical power source
- reagent water quality

A. Lighting

Adequate levels of illumination, light quality, and freedom from glare are necessary for reading glassware graduations, identifying titration endpoints, and reading instrument meters. Visual comfort is also an asset in maintaining personnel efficiency.

Lighting to meet these goals is provided. General illumination in laboratory spaces is provided by recessed three lamp fluorescent lights using light white and 34 watt energy saving bulbs. General illumination of 70 foot candles is provided.

At desk areas or areas where close or detailed work is done, the fluorescent lights are supplemented by other light sources, as needed.

B. Ventilation

Ventilation is provided to maintain the laboratory spaces at an even level of temperature and humidity.

The heat loads and ventilation needs of specialized instruments are taken into account.

Enough makeup air is provided to ensure that hoods are able to exhaust the required volume of air. To that end the following procedures of hood operations are to be followed.

1) Hoods sould be maintained free of clutter.

2) Acrylic doors should be set to close off as much of the hood "face" as possible when working (but without unduly influencing working comfort, safety, or efficiency) and should be completely closed when work is not actually being performed but fume producing systems are still to be controlled.

3) Hood velocities are checked every six months. (A copy of the hood velocity report form is found in Figure III-2).

C. Electrical Capacities

Electrical capacities are provided to meet the needs of all specialized laboratory instruments. Specified surge elimination or electrical isolation is provided in critical areas. Emergency lighting is also provided in critical areas of the laboratory.

D. Reagent Water

For inorganic analyses deionized water of reagent quality is provided by a Penpure system consisting of:

1 Prefilter
1 Carbon tank
2 Mixed bed deionizers
1 10" 0.2 micron post filter
2 Resistivity lights (1 mega-ohm and 2 kilo-ohm)

The system has a capacity of 10 gal/min. The conductivity of the water produced is checked daily to meet specifications of <2 micromhos.

The two resistivity lights provide warning that the tanks must be changed. Lights are on when the water quality is satisfactory. The first light is located between the two mixed bed deionizer tanks. When resistivity at that point falls below 200,000 ohms the light goes out, the Penpure company is called and provides a replacement tank within 24 hours. The second light at the delivery spigot goes out when resistivity at that point falls below $1x10^6$ ohms.

Further water purification is provided for specialized analysis:

1) Organic Free Water - Extraction Laboratory. Organic free water for the extraction laboratory is provided by a Millipore Milli-Q Plus ultra pure water system, preceded by a Milli-RO unit.

2) Organic Free Water - GC/MS Volatiles Laboratory Organic free water for GC/MS volatiles is provided by a Milli-Q Plus system equipped with a UV light to destroy organics. The system uses deionized water from the Penpure system.

3) Organic free water - GC volatile Laboratory. Organic free water for GC Volatile analysis is obtained by placing water obtained from the GC/MS Volatile System into a 5 gallon carboy and bubbling nitrogen through the water. Both Milli-Q plus systems are equipped with meters which provide a resistivity measurement.

4) Ammonia Free Water - Ammonia free water is obtained, when needed, by storing deionized water with Dowex 50 W resin.

5) CO_2 Free Water - CO_2 free water is obtained, when needed, by boiling deionized water for 15 minutes and cooling at room temperature.

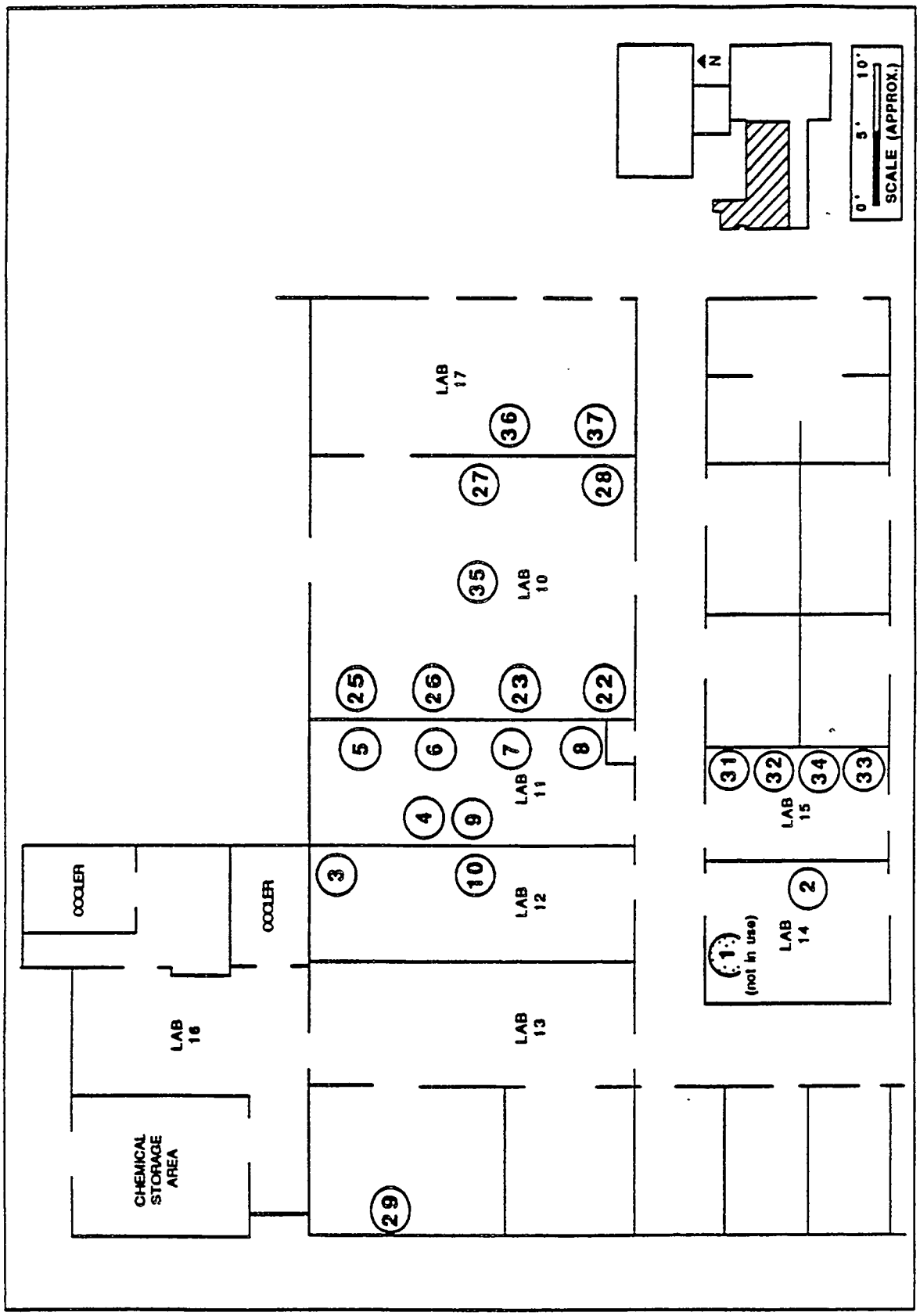


Figure III-1A

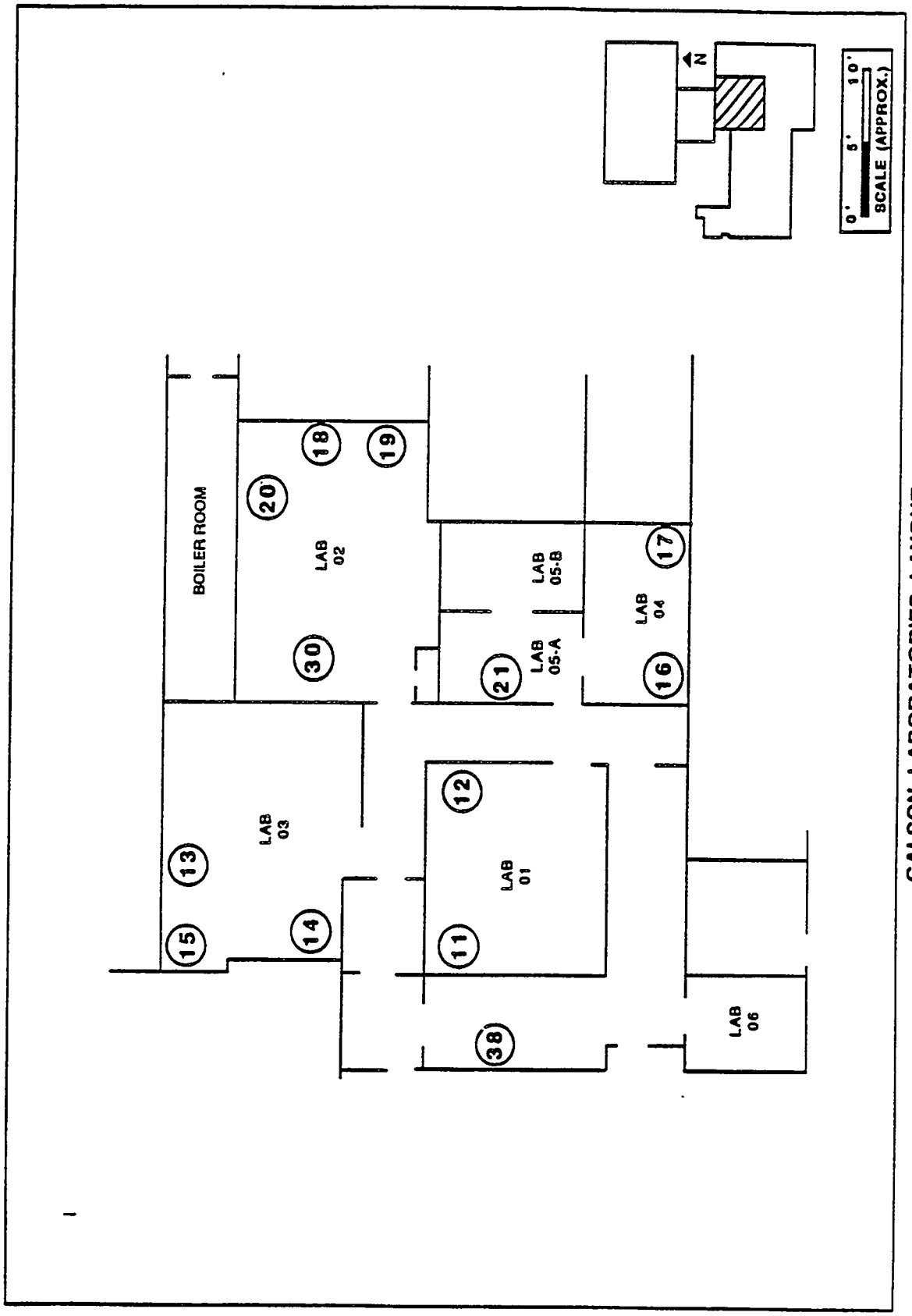


Figure III-1B

LABORATORY NUMBER	FUNCTION
01	Conventional Chemistries/Metal Digestion
02	Atomic Absorption/ICP
03	Conventional Chemistries
04	Bulk Asbestos/Ion Chromatography
05A	Mercury
05B	Asbestos Fiber Counts
06	Weight Room
07	Conventional Chemistries
10	Organic Extraction/Sample Prep
11	Gas Chromatography
12	Gas Chromatography/Mass Spectroscopy
13	Sample Receipt/Bottle Prep
14	GC and GC/Volatiles
15	GC and HPLC
16	Sample/Chemical Storage
17	Organic Extraction/Sample Prep

TABLE III-1

GALSON TECHNICAL SERVICES, INC.
Effective 6 December 1990
Revision 2

LAB FUME HOOD NO.: #1 DATE: 2/13/87
EXHAUST FAN NO.: EF-7

100	100	85
10	95	80
85 / 80	90 / 85	85 / 75

Side (Width)

Front (length)

LENGTH: 50.5

WIDTH: 27.5"

AREA: 9.64

AVG. FPM HIGH SPEED 80.5 FPM

AVG. FPM LOW SPEED 80 FPM

AVG. CFM HIGH 776.3

AVG. CFM LOW 771.5

COMMENTS:

HOOD FULL

Low = Sash up 6"

Figure III-2

IV. GLASSWARE AND PLASTICWARE

Glassware and plasticware used in the analytical laboratory are selected based on the anticipated application. Quality may range from ungraduated, uncalibrated, disposable, general purpose vials and pipets to high quality volumetric vials and pipets. All volumetric glassware is certified Class A based on NBS specifications.

Unclean or improperly cleaned glassware and plasticware can have a variety of adverse influences on analytical quality including:

- random error due to unequal contamination of different pieces of glassware or plasticware;
- drift in the early stages of an analysis as reused glassware is progressively "cleaned" by contact with reagents;
- determinant errors due to consistent or near consistent contamination during cleaning (especially true in the case of nutrients);
- high blanks, concurrent with the effect above;
- as a function of the above error sources, reduced precision and accuracy and increased detection limits;
- and, occasionally, analytical interferences.

A. Glassware and Plasticware Cleaning

1. Glassware for general use. Immediately after use, glassware is immersed in a solution of a synthetic detergent. Scrubbing with a brush followed by several tap water, then deionized water, rinses follow initial soaking. Glassware so cleaned must not be used for procedures included in subsequent cleaning classifications without additional cleaning steps specific for that parameter. Alternatively, a four cycle automatic dishwasher with DI final rinse is used for general glassware.

2. Organic parameters. Where the presence of gross organic contaminants (e.g., oil and grease, TOC, BOD, COD), may present a problem, a 1:1 sulfuric acid cleaning solution with ammonium persulfate added is used. Immerse the glassware in this solution and allow to stand two hours. After soaking, rinse the glassware well with tap water, then deionized water. The glass is clean when water drains uniformly without forming droplets.

3. Trace organic parameters. Glassware for trace organic parameters to be analyzed by GC or GC/MS (pesticides, herbicides, PCBs, halogenated hydrocarbons, etc.) is cleaned in very hot water with a synthetic (preferably inorganic) detergent. The glassware is then rinsed in hot tap water and deionized water.

   Additional cleaning by firing at 450-500 C for one hour may be necessary for some trace organic parameters.

The final cleaning step should be an acetone (pesticide grade) or methylene chloride rinse.

It is very important to note that plastics (except for fluorocarbon based plastics) must not be used in conjunction with trace organic analyses, as exuded plasticizers (generally phthalates) interfere in the detection of certain compounds by gas chromatography, and are contaminants in GC-MS determinations.

4. Trace metal parameters. 1:1 Nitric Acid should be used to clean glassware or plasticware for trace metal analysis. Soak glassware or plasticware for four hours; rinse well with warm tap water, then with deionized water.

5. Mercury. Glassware used for mercury determinations at the ug/level requires special cleaning. Soak the glassware in 1:1 nitric acid for four hours. Rinse well with warm tap water and finally with deionized water. This glassware is set aside in its own drawer.

6. Phosphate-phosphorus. Glassware to be used in the determination of any of the phosphate fractions requires special cleaning. Glassware cleaned as described in the "General Use" category above is washed with HCl, soaked in mixed reagent, and final rinsed with deionized water.

7. Microbiological parameters. Glassware and plasticware to be used in determining microbiological characteristics of water samples is cleaned as described in the "General Use" Category above. Labware thus cleaned is then autoclaved to kill any bacteria present. Disposable sterile glassware can be substituted for laboratory autoclaved preparation.

V. REAGENTS, SOLVENTS, AND GASES

A. Quality and Grade

A wide variety of grades and qualities of reagents and gases are commercially available. At any time several grades may be available for use in the laboratory. If there is any question about which of two available grades to use in an analysis, the analyst should opt for the grade of higher purity.

1. Reagent chemicals. Generally, analytical grade is of sufficient purity for most analyses. However, special conditions associated with certain types of analyses must be considered. Included among these are the following:

   a. The most significant source of sample contamination in trace metals analyses is from the reagent acids used in digestion. For this reason, extreme care must be exercised in the selection of analytical reagent grade nitric and hydrochloric acids to be used for this purpose. Redistilled acids are required.

   b. All analysts must be careful not to accidentally contaminate reagents by improper handling. The quality or grade of a reagent chemical when received from the manufacturer becomes immaterial at the point of contamination. A few simple rules, when adhered to, will prevent bulk contamination:

      1) Never use scoopulas, spatulas, pipettes, etc. in reagent bottles.
      2) Dispense the approximate amount of reagent needed into a secondary (clean) receptacle from which to weigh or dispense the reagent.
      3) Discard all excess reagent: do not return to the reagent bottle.

   c. The above note is very important in another regard--that of microbiological and related analyses (BOD, MPN, etc.). Accidental contamination of reagents which were to be used for culture media or dilution water preparation could, if contaminated with toxic materials, result in totally erroneous results. For this reason, reagents for biologically related analyses are stored in the microbiology area; thus reducing the potential for contamination.

   d. As a general rule, reagents associated with trace metals and trace organic analyses are also to be stored within the confines of the respective dedicated rooms. In addition to providing convenient access during on-going analyses, additional cross-contamination prevention is thus provided.

   e. Reagent chemicals degrade with time and exposure to light or air; thus it is necessary to rotate stocks and discard outdated or obviously degraded reagent chemicals. The receipt date is recorded on the bottle label along with the initials of the individual who opened the bottle. Individual analysts should also be alert, when looking for reagent chemicals, to the need to identify depleted, questionable, or apparently outdated chemicals. If the chemical is to be discarded (for whatever reason), it is removed at that time and the laboratory supervisor notified. Procedures similar to those above apply to isolated storage of AAS, GC, and microbiological chemicals and media stored in dedicated rooms. Analysts commonly working those rooms are responsible for reagent chemical control.

2. Organic solvents. The most common use of organic solvents is in trace organic determinations. Those solvents which enter into extraction/concentration procedures are most critical in terms of quality since they are evaporated in the process of extract concentrations. This process results in proportional concentration of solvent impurities and, concurrently, interference in the final analysis. The same statements apply to Freon TF used in oil and grease extraction (or any similar gross extraction procedure) except that the error percentage can be even more severe if solvent blanks are not run. Solvents for trace organic analyses are generally re-distilled in glass to provide utmost purity.

3. Gases. A wide variety of gas grades is available commercially. The applicability of various grades depends on the analysis to be performed.

   a. Generally, GC and GC/MS carrier and auxiliary gases must be of the highest possible, water-free, particulate-free, grade available. Even with these grades, it is necessary to have filter/driers molecular sieves in-line.

   b. Carrier, oxidant, and fuel gases for atomic absorption must also be of high (reagent) quality.

   c. The purity of TOC carrier gases (nitrogen and CO_2 standards, when used) is of slightly less concern since drying columns and scrubbers are used.

   d. Generally, technical grade gases may be used in stripping processes unless subsequent analyses may be compromised. In such an event, the reagent grade should be suited to the analyses most sensitive to contamination or interference.

   e. Gases are stored in a remote, secure area in the laboratory. Appropriate cautions to prevent attaching incorrect cylinders to manifold systems have been made. These consist of stamped tags identifying the associated instrument and the required gas or mixture. Any analyst having cause to change, replace, or open a gas cylinder should exercise due caution in doing so as it is possible to (1) disrupt an ongoing analysis, (2) damage very expensive equipment, or (3) create a very serious human health hazard.

4. Compressed air. A central air compressor and ballast tank are present in the building. This system supplies air under pressure to all laboratory areas. Within the laboratory, separate air outlets are provided for various pieces of instrumentation and for general laboratory requirements.

   These outlets are protected by a micropore filter/dryer and a secondary pressure regulator thereby preventing accidental overpressure damage. The filter/dryer cartridge is checked monthly, cleaned and replaced, if necessary.

B. Reagent Preparation

All reagent preparation is done as accurately and consistently as possible. This statement applies even to "excess" reagents such as those used in dissolved oxygen fixation for modified Winkler titrations.

VI. ANALYTICAL EQUIPMENT

Table VI-1 is a list of the major analytical equipment in the Galson Laboratory. For equipment such as gas chromatographs, gas chromatographs/mass spectrometers, high pressure liquid chromatographs, and ion-chromatographs, run logs are maintained which lists information concerning the run (Figure VI-1). Routine maintenance performed on the instrument is also recorded in the run-log.

A history file is maintained by the laboratory manager or his designee for each piece of equipment and associated apparatus. The history file contains a chronological record of each device from the time of purchase to the time of retirement or loss. The history file includes, where applicable, the following:

- Procurement Documents
- GALSON Assigned Identification Number
- Item Description
- Manuafacturer's Serial Numer
- Evidence of Acceptance
- Supplier Certificates (conformance, calibration, traceability)
- Service, Maintenance, and Repair Reports.

A. Analytical Balances

The Mettler and Ainsworth side-loading analytical balances are maintained on a service contract. This contract includes annual servicing and calibration by a Mettler engineer. A calibration status label is affixed to each balance after calibration.

B. Temperature Control Systems

Accuracy and stability of temperature control are usually specified by individual anaytical SOPs. This subsection will deal only with general practices and precautions required to produce valid data. All thermometers used in temperature control systems will be calibrated against an NBS traceable thermometer. The following equipment is available in the laboratory to control temperatures. The calibration methods and schedule are described.

1. Autoclave - The autoclave temperature is monitored during start-up and sterilization. Timing is begun when the proper temperature and pressure have been reached. In addition, sterilization indicating tape should be used to verify sterilization in bacterioloigcal work.

2. Freezers and refrigerators - Freezers and refrigerators are be checked daily and the temperature recorded on the form attached to the refrigerator/freezer door. If the temperature is outside the specified limits, it is read again a hour later. If still outside limits, adjustments are made in the controls. If the temperature cannot be brought within limits, the supervisor is notified and a service call is scheduled.

3. Incubators - Thermometers in incubators must be mounted in a stoppered bottle such that conditions in the samples are reproduced and temperature checks may be made without rapid changes due to short-term influx of room air. Incubators must be checked twice daily while in use and the temperatures recorded in the appropriate data books.

4. Muffle furnace - The temperature within the muffle furnace is monitored by a direct read-out pyrometer. Timing is started when the furnace reaches the required temperature and the temperature is monitored according to the standard operating procedure of the method.

5. Ovens - Two ovens are available in the laboratory for drying glassware and for analytical work. The oven temperatures are monitored while in use, using thermometers calibrated against NBS traceable thermometers. The temperatures may be monitored without opening the ovens. However, if constant opening and closing of the ovens takes place during an analysis the thermomter tips should be placed in sand to reproduce temperatures encountered by glassware and ceramics.

6. Water baths - Three waterbaths are available in the laboratory. The waterbaths should be checked with each analytical run and the results recorded. Each method will detail the frequency of the temperature checks, however, at a minimum, two checks should be made.

C. Filtration Systems

The primary filtration/vacuum system is a two pump system with a gassed, oil-less reciprocating vacuum centrally located in the boiler room.

Two individual pumps are used to eliminate total loss of vacuum which could results in exceeding holding-times for required filtration operations. Manufacturer's recommendations should be consulted for maintenance. A seperate vacuum system with dual pumps is located in the boiler room for the cyanide apparatus. This sytem can be opened to the primary system in the event of an emergency. There is sufficient vacuum in the ballasts to sustain the cyanide apparatus until they are cool in the event of a power failure.

D. Centrifuges

A general purpose centrifuge is available in the laboratory. It is a small "portable" machine useful for on-the-spot centrifugations. None of the available heads for this machine present serious explosion hazards as long as sample volumes are properly and symmetrically balanced.

Centrifuge heads and head chambers must be kept scrupulously clean if open centrifuge tubes must be used. The enormous speeds of rotation generate intense air circulation, thereby suspending dust and dirt particles and potentially contaminating samples.

E. Spectrophotometers

1. Types and applications A Bausch and Lomb Spectronic 1001 is the analytical spectrophotometer to be used in every possible colorimeteric analysis. In cases where the Spectronic 1001 is not available, or if the analysis is required to be performed in a hood, the smaller Spectronic 88 may be used. The Perkin-Elmer 467 Grating Infrared Spectrophotometer is used for all IR applications. The spectrophotometers are located in an analytical room seperate from corrosives and dust.

2. Control checks

a. Infrared Spectrophotometers Once each month the gain calibration should be checked following the procedure outlined in the instrument manual. Adequate warm-up time should be allowed (15-20 minutes) before using the instrument. The power should not be left on over night. Determine the proper GAIN control setting (as described in the manual) daily when in use, and adjust the zero setting at least once a week. Periodically a test run is performed where a 0.05 mm thick polystyrene film is scanned and the test spectra are compared to the reference spectra. The spectra should be comparable within the limits of the instrument specifications with respect to wavenumber accuracy, resolution, stray light, and noise.

b. Bausch and Lomb Spectrophotometers The manufacturer's instruction for proper use should be followed. In addition, the following steps should be taken to ensure instrument control. Instruments should be checked for wavelength alignment. If a particular colored solution is to be used at a closely specified wavelength, considerable loss of sensitivity can be encountered if the wavelength control is misaligned. A diluted solution of potassium permanganate will give maximum absorption of 526 and 546 nm. This should be used as a reference point in checking the alignment.

All absorption cells must be kept scrupulously clean, free of scratches, fingerprints, smudges, and evaporated film residues.

Complete analytical quality control (in the form of blanks, standards, spikes, and replicates) must be performed. The analyst should also be aware of any unusual changes in linearity or analytical sensitivities (calibration curve slopes).

F. Atomic Absorption Spectrophotometer

1. General considerations. For every analytical setup, the following precautions must be considered:

a. Lamp alignment must be performed with great care, as it is possible to achieve a false optimization (peak lamp energy).

b. Always use a single element lamp rather than a multi-element lamp due to the potential for signal drift, noisy baselines, short lamp lifespan (multi- element), and reduced overall sensitivity.

c. Where possible, and whenever detection limits may be at issue, electrodeless discharge lamps (EDLs) should be used because of their generally lower noise/signal rations relative to hollow cathode lamps (HCLs).

d. Detection limits are also much lower, generally speaking, for analyses using the graphite furnace as compared to flame aspiration analyses. Any method using an open flame (even inductively coupled arc plasma) will have a baseline noise component due to the relative instability of the flame (compared to the partially closed conditions in a graphite tube).

e. The manufacturer's recommendations for lamp currents (HCLs) and wattages (EDLs) should be followed as closely as possible, with close attention paid to cautionary notes.

f. Whenever a new lamp is received, the date of receipt must be recorded on the lamp label and in the cental lamp file.

g. Lamps must be inspected closely, before installation, for possible damage between uses.

h. Excessive "silvering" of lamps (HCLs) may occasionally serve as an indicator of shortening lifespans, although this is by no means a definitive guideline. Increased baseline noise, reduced sensitivity, large changes in background corrector (BC) balance settings, or the inability to achieve BC balance are definite indicators of lamp deterioration.

i. As a rule, if high metal concentrations are anticipated or known to exist in certain samples, the better choice will be flame aspiration due to the reduced sensitivity and concurrent small dilution ratios necessary. The large dilution rations frequently encountered when determining sodium, potassium, magnesium, calcium, and zinc will result in reduced precision and accuracy unless extreme care is taken in the dilution process.

j. The Perkin-Elmer Model 305 B and Model 5000 are double-beam instruments and therefore not greatly subject to lamp and electronic warm-up problems, but it is still advisable to allow a few minutes warm-up. This is not lost time generally because alignment and instrument settings for the analysis to be performed must still be made after the instrument is powered up.

k. Never assume that the wavelength dial indication is correct; peak lamp output (energy) must be determined at every setup. This precaution eliminates errors due to minor misadjustments in dial/wavelength alignments. The data book should be consulted for the proper wavelength setting and that wavelength double-checked before analysis begins. Also note that the Perkin-Elmer 305B/5000 have dial reading doubling circut function, yielding visible wavelenghts exactly double the direct (UV) settings. Any apparent drift in wavelength setting accuracy must be dealt with by a manufacturer's representative.

l. Care must be exercised in the alignment of burners and furnaces, a small misalignment can seriously reduce overall system energy and analytical sensitivity.

m. Alignment of the AS-40 automatic injection system for the HGA-500 graphite furnace must be performed with extreme care, as inconsistent placement of the sample aliquot in the tube, due to the injection tube brushing the graphite tube opening, can results in major reductions in precision. The tube can also be damaged by heat or abrasion, resulting in sudden, unnoticed shifts in response due to redirected injection.

n. If there is any aspect of instrument operation with which the analyst is unfamiliar, this should be remedied by consulting the instruction manual, the laboratory director, or in possible cases of malfunction, the manufacturer's maintenance representative.

G. Ion Chromatograph

The Dionex Model 2000 inert dual pump ion chromatograph is operated in accordance with the manufacturer's instructions. All maintenance specified in the instruction manual should be performed at the time intervals specified. Special note should be taken in regard to possible contamination at low levels of the analytes being measured. Extensive rinsing with de-ionized water is required of all glassware.

Complete anlaytical quality control (in the form of blanks, standards, spikes, and replicates) must be performed. The analyst should also be aware of any unusual changes in linearity or analytical sensitivities (calibration curve slopes).

Generally speaking, trained technicians may operate the ion chromatograph successfully; however, because interpretation of data from the I.C. is sometimes complex, mere compliance with the operations manual may not be sufficient for completely accomplishing the special techniques of sample preparation, instrument operation, troubleshooting, and interpretation of chromatograms. An experienced chromatographer is required in special cases.

H. Gas Chromatographic Equipment

The laboratory has two Hewlett Packard 5880's, four Hewlett Packard 5890, and Hewlett Packard 5890 interfaced with a Tekmar liquid sample concentrator. All have auto-sampler capabilities with computing integrators for data reduction. The GC's are equipped with a variety of detectors including: flame ionization, electron capture, nitrogen-phosphorus, photo-ionization, and electrolytic conductivity. Ultra-high purity carrier gases are used on all GC's together with traps to remove oxygen and water.

Service contracts maintained on all Hewlett Packard GC's provide preventative maintenance on an annual basis and all other necessary servicing within 48 hours. In-house maintenance includes septum changes and detector cleaning as required. Column maintenance is performed regularly by removing column packing and replacing inlet glass liners. In the case of capillary columns, the first few inches of column is removed or the column is solvent rinsed if necessary.

A complete calibration is done with each analysis. An evaluation standard is run to monitor GC response and column efficiency. A complete file listing from the GC integrator serves as a permanent record of analysis parameters. Sample clean-up is performed on samples requiring sensitive or selective detector analysis.

I. Hydrogen Ion (pH) Meters

The most common cause of problems with pH meters is a faulty electrode, especially the reference electrode. The prevent "death" or malfunction of an electrode, the following practices should be adhered to:

1. The electrode should be immersed continually in pH 7.00 buffer when not in use.

2. The reference electrode wick or junction should be inspected, and cleaned of debris if necessary (with extreme caution not to injure the glass electrode membrane) before each day's use.

3. The electrode should never be left in very alkaline solutions and should be thoroughly rinsed with a squirt bottle immediately after each use to prevent poisoning of the glass membrane.

4. The reference electrode should be kept full of the appropriate KCl solution.

5. When the sensitivity of an electrode begins to decrease, it can often be revived by immersion in a hot 1M trisodium phosphate solution for 5-10 minutes. If the sensitivity of the electrode is still low, a 1-2 minute immersion in 0.1 M ammonium bifluoride followed by rinsing and soaking in distilled water for 3-4 hours should restore electrode sensitivity; if not, the electrode must be replaced.

6. The sensitivity of the electrode can be readily assessed by immersion in serial 10:1 dilutions of pH 10.00 buffer and comparing the drift from a reading of 10 to that previously recorded (significant drift before 10^5:1 suggests the need for electrode replacement).

7. Spare electrodes should always be on hand.

The following rapid checks can be made to identify or isolate a potential problem:

1. With shorting strap inserted and meter in pH mode, turn calibration knob from one extreme to the other and determine if equal deflection from 7.0 results in both directions.

2. With calibration set to yield a 7.0 reading, turning the temperature compensation knob should produce no needle movement.

3. With calibration set to yield any value 4-5 units away from 7.0, turning the temperature compensation knob should produce a pronounced deflection.

Additional general use notes should be kept in mind when making pH measurements:

1. Always be certain the solution being measured is aqueous.

2. Measurement of pH should always be done with sample stirring, but be sure to isolate the sample from heat sources such as hot plates overheating stirrer motors, etc.

3. The filling hole must be open when making measurements.

4. A two-point calibration is always used (e.g., pH 7.0 and pH 4.0), the buffers used for calibration should bracket the pH of the sample.

5. Most commonly used electrodes exhibit a "sodium error" at pHs above 10.0. Generally, electrode manufacturer's include correction information with electrodes. This correction must be made for very alkaline samples.

J. Conductivity Meter

The conductivity meter used in this laboratory is a null balance meter with a conductivity bridge. A cell constant check should be performed each time the conductivity meter is operated. A potassium chloride solution is available at the meter for the cell constant check. Any significant deviations in the cell constant must be remedied prior to analysis.

The conductivity cell should be checked to be sure the plates are undamaged, throughly coated with platinum, clean, and free of air bubbles when submerged. A spare cell is available in the laboratory.

K. Dissolved Oxygen Meter

The D.O. probe in use in this laboraotry is a non oxygen consuming probe. It has a permanent membrane with no requirement for stirring during readings. The meter requires calibration against a Winkler titration for analytical measurements. The probe and meter should be visually checked for membrane damage, unusual drift, physical damage, and erratic readings. The operation manual should be referred to in the case of analytical problems.

L. Turbidimeter

The primary concern during use of this instrument is prevention of particulate contamination of samples. Therefore, cleanliness of the work area is of paramount importance in this type of analysis.

AMCO standards are used in calibrating this instrument. These standards have excellent stability but they should be refrigerated after opening. A calibration curve is generated each analysis date and readings should be compared between ranges. When the stability between ranges depreciate considerably the instrument will require servicing.

M. Dispensing Devices

Several very accurate and practical small volume dispensing devices are available commercially and some of these are available in the laboratory. These are especially useful in improving analytical efficiency, accuracy, and precision, especially during standards preparation and sample spiking. Before using any such device, the manufacturer's claims, instructions, and recommendations must be taken into consideration.

1. Adjustable volume pipetters. Several of these devices are available in the laboratory with ranges varying from (ostensibly) zero to 5 ml, 50 ul, and 200 ul, and from 5 ml to 10 ml.

   The most important precautions to be observed in the use of these devices are:

   a. Do not use any pipetter outside the range established as within (±1) percent of the nominal value.

   b. Do not use any pipetter outside the range established as most precise ((±)2 standard deviations shall not exceed the (±)1 percent boundaries established above at any point in the full pipetting range).

c. In general terms, the above limitations will prohibit use of adjustable pipetters near range extremes (outside the 10-90 percent of full volume range).

d. Be sure not to draw samples or reagent into tips so rapidly that metal parts are wetted.

e. Verify volume delivery settings before using adjustable pipetters, especially if using these to dispense standard volumes for serial dilution.

f. Do not use strong acids, bases, or solvents with these instruments.

2. Interchangeable-stop pipetters. These devices have distinct advantages over continually adjustable devices in that settings are fixed by threaded sleeves. Analytical set-up time savings are thus possible.

3. Miscellaneous dispensing devices. Assorted fixed volume pipetters are also available in the laboratory. These devices are also checked, at a minimum, quarterly for delivery, accuracy, and precision. Large volume dispensers are also available for appropriate needs. Care must be exercised to clean these dispensers properly when going from one reagent solution to another or when replacing out-dated reagent solutions. Refer to manufacturers' instructions for cleaning suggestions. These should be adjusted to match analytical requirements.

N. Gas Chromatograph/Mass Spectrometer

The computerized gas chromatograph/mass spectrometer (GC/MS) is a versatile and highly sophisticated analytical instrument. Thus, it is imperative that it be operated only be personnel who have participated in a manufacturer's training course or who have been certified by the chief GC/MS operator.

The GC/MS is maintained in accordance with the manufacturer's required schedule. There are many components of the system available in the laboratory for replacement in the case of failure. The instrument requires extensive performance checks and calibrations which are outlined in Section VIII of this manual. These checks are done daily and no sample data are generated until all performance criteria are met.

O. High Pressure Liquid Chromatograph

The high pressure liquid chromatograph (HPLC) is a Shimadzu Dual System LC-6A. The system is composed of an auto injector, system controller, source, UV-VIS detector, dual pumps, and dual computing integrators. The system can be operated manually, with one pump, or with one integrator. This capacity eliminates downtime associated with those components.

The system is equipped with a detection limit alarm, where the alarm is triggered if your designated detection limit sample is not integrated.

All new columns are checked with a specific mix of analytes when received and rechecked periodically, or when trouble is suspected. The detector is periodically checked with a solution (with columns removed) to determine its performance. Any descrepancies are corrected using the manufacturer's operator manual.

The system is checked daily when in use by a multiple point calibration curve. Method specific control criteria must be met.

P. Inductively Coupled Plasma Emission Spectrometers (ICP)

The computerized Inductively Coupled Plasma Emission Spectormeters (ICP) are valuable tools for analyzing samples for a number of metals. Two instruements are available in the laboratory, a Leman Plasma Spec, and a Lehman Model 3000. Both are equipped with automatic samplers.

The Lehman Plasma Spec is a sequencial instrument with the ability to analyze any wavelength. The Lehman Model 3000 is a simultaneous instrument which can analyze metals corresponding to 19 lines. This instrument is used for most analyses involving priority pollutant metals.

MAJOR ANALYTICAL INSTRUMENTS

INSTRUMENT	MANUFACTURER	MODEL
GC/MS MSD	Hewlett-Packard	5890/5970
GC/MS MSD	Hewlett-Packard	5890/5970
GC/MS MSD	Hewlett-Packard	5890/5970
GC/MS MSD	Hewlett-Packard	5890/5970
GC/MS Data System With Aquarious Software And NBS Library (E Series)	Hewlett-Packard	HP-1000 RTE/6
GC/MS Data System With Aquarious Software And NBS Library (A Series)	Hewlett-Packard	HP-1000 RTE-A
GC/MS Autosampler	Hewlett-Packard	7673
GC/MS Autosampler	Hewlett-Packard	7673
9-Track Magnetic (2) Tape Drive	Hewlett-Packard	7974
GC/MS Dynamic Headspace Sample Concentrator With Automated Heated Sampler Module	Tekmar	4000/4200
GC/MS Liquid Sample Concentrator With Automated Sampler Module	Tekmar	LSC-2/ALS
GC/MS Thermal Desorption unit for Multimedia Tubes	Tekmar	5010
Gas Chromatograph 2 FID, 1 ECD, 1 NPD	Hewlett-Packard	5880
Gas Chromatograph 1 FID, 1 ECD	Hewlett-Packard	5880
Gas Chromatograph 1 FID, 1 PID	Hewlett-Packard	5890

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Table VI-1

MAJOR ANALYTICAL INSTRUMENTS (Cont.)

INSTRUMENT	MANUFACTURER	MODEL
Gas Chromatograph 2 FID	Varian	3700
Gas Chromatograph 1 PID, 1 ELCD	Hewlett-Packard	5890A
Gas Chromatograph 1 PID, 1 ELCD	Hewlett-Packard	5890A
Gas Chromatograph 1 ECD, 1 NPD	Hewlett-Packard	5890
Gas Chromatograph 2 ECD	Hewlett-Packard	5890
Gas Chromatograph 2 FID	Hewlett-Packard	5890
Gas Chromatograph 2 ECD	Hewlett-Packard	5890A Series II
Gas Chromatograph 1 NPD, 1 ECD	Hewlett-Packard	5890A Series II
Gas Chromatograph 1 FID, 1 ECD	Hewlett-Packard	5890A Series II
GC Autosampler (5)	Hewlett-Packard	7673
GC Autosampler (6)	Hewlett-Packard	7673A
GC Autosampler	Hewlett-Packard	7672
HPLC With Autosampler UV/VIS and Fluorescence Detection	Shimadzu	LC-6A
GC Liquid Sample Concentrator With Automated Sampler Module	Tekmar	LSC-2/ALS
GC Sample Concentrator With Automated Heated Sampler Module	O.I. Analytical	4460A/MPM-16

MAJOR ANALYTICAL INSTRUMENTS (Cont.)

INSTRUMENT	MANUFACTURER	MODEL
GC Data System With HP LAS Software (A Series)	Hewlett-Packard	3350
Gel Permeation Chromatograph Automated Prep	ABC	1002B
Inductively Coupled Plasma Emission Spectrometer	Leeman	Plasma Spec 1
Inductively Coupled Plasma Emission Spectrometer	Leeman	PS2000
Atomic Absorption Spectrometer With Graphite Furnace, Leeman Background Correction and Autosampler	Perkin-Elmer	5100, AS-60
Atomic Absorption Spectrometer With Graphite Furnace and Autosampler	Perkin-Elmer	4000, AS-40
Atomic Absorption Spectrometer with Autosampler	Perkin-Elmer	460
Mercury Hydride Generator Automated	Varian	VGA-76
Microwave Digestion System	CEM	MDS 81D MDS 81
Autoanalyzer With Cyanide, Ammonia and Phenol Modules	Technicon	AA II
Ion Chromatograph With Conductivity Detection, Chemical Suppression and Autosampler	Dionex	2001 i
Spectrophotometer (UV/VIS)	Bausch & Lomb	Spec 1001
Spectrophotometer (IR)	Perkin-Elmer	467

MAJOR ANALYTICAL INSTRUMENTS (Cont.)

INSTRUMENT	MANUFACTURER	MODEL
Analytical Balances	Mettler	AK 160 PJ 400 AE 50
Analytical Balances	Sartorius	PT 600
Electro Balance	CAHN	4100 44
Phase Contrast Polarized Light Microscopes	LABOPHOT	Type 104
Stereomaster II Microscopes	Fisher	SPTITH
Specific Ion and Electrodes	Meter	Orion407

VII. ANALYTICAL QUALITY CONTROL (AQC)

A. Definitions and Rationale

The definitions and associated procedural functions used in the Analytical Services Laboratory are derived from those specified by the International Union of Pure and Applied Chemistry (IUPAC) published in Analytical Chemistry, Vol. 48, no. 14, page 2294, Dec. 1976.

1. Sensitivity. Defined as the change in the measured parameter for a change in concentration or quantity of the analyte; calculated as the slope of the analytical calibration curve derived from regression analysis of standard data.

2. Precision. Defined as the degree of agreement of repeated measurements of the same parameter; calculated as the standard deviation (s) and expressed as the coefficient of variation (CV) (also called the relative standard deviation).

$$s = \sqrt{\frac{\sum(x_i - \bar{x}_i)^2}{n-1}}$$

$$CV = \frac{s}{\bar{x}}$$

where

x_i = the ith measurement
$\bar{x}$ = mean of the measurements
n = number of measurements

   a. Standard precision. Precision estimates derived from replication of standard readings or measurements.

   b. Analytical precision. Precision estimates derived from replicates of sample analysis.

3. Method Detection Limit (MDL) The method detection limit is determined statistically for each type of analysis. The standard deviation of triplicate analyses of a matrix spike or blank spike containing the analyte(s) at a concentration of three to five times the estimated method detection limit is determined. This standard deviation mutiplied by 7 is the MDL.

4. Practical Quantitation Limit (PQL) The practical quantiation limit of a method and matrix is that concentration which can be detected routinely. PQL values are used when quantitites below the contract/project specified limits can be detected. PQLs are ususally above the statistically determined MDLs.

5. Accuracy. Defined as the degree of agreement between a measured concentration and the "true value"; calculated as the percent recovery.

$$\% \text{ recovery} = \frac{\text{Amount found}}{\text{Amount added}} \times 100$$

a. Sample accuracy. Determined by adding a known amount of the analyte (the spike) to the sample and measuring the change in the concentration.

b. Standard reference accuracy. Determined by analyzing an external standard reference material as a sample and comparing the measured concentration with the certified value.

B. Procedural Components and Criteria

The above definitions are no more than theoretical considerations without distinct procedures for providing the AQC data necessary to calculate the associated statistical indices. The sets of guidelines to follow are proposed as minimum requirements for providing an in-house quality control program. Individual project requirements may necessitate additional data.

Quality control measurements (replicates, spikes) must be scattered through the analytical run, not grouped near the end or the beginning of the run.

1. For all "relative" analyses that are calculated with reference to a standard curve (e.g., ion chromatography, atomic absorption), the following must be performed:

   a. Each set of standards shall consist of a minimum of four standards, plus a blank, encompassing the expected range of the samples.

   b. An additional set of standards shall be run at least once every 80 samples or five hours (whichever come first) during extended runs.

   c. A minimum of three analytical (reagent) blanks must be run during the analysis. These must be prepared and treated exactly as are the standards (e.g., do not draw blanks from a separate deionized water source) with at least one blank included in each set of standards (the "zero" standard).

   d. If there are more than 10 but less than 20 samples in the batch of the same matrix a high and low standard (and blank) are run at the end to provide a check of the sensitivity.

   e. A minimum of one out of each 20 samples is to be spiked to provide a check of accuracy. At least one sample must be spiked regardless of sample batch size. To satisfy project requirements, it may be necessary to spike at least one sample from each project when samples from different projects are grouped together for efficient running. The spikes should be performed such that the response remains within the range of the standards.

   f. One field blank will also be provided with each sample batch. These are to be analyzed exactly as the standards and samples. An estimate of field-based determinant bias is thus provided. A field blank is provided to clients who have not submitted one and is labeled "In-house blank".

g. A minimum of one sample out of each 20 is to be run in duplicate. At least one sample must be replicated regardless of sample batch size. To satisfy project requirements, it may be necessary to replicate at least one sample out of each project batch when batches are grouped together for efficient running.

2. For titrimetric determinations, the following must be performed.

   a. The analyst should make "dry run" blank analyses until his technique and variabilities in equipment and glassware have stabilized sufficiently to produce a relatively constant coefficient of variation and relatively low absolute values for three successive blanks. No concise guidelines for coefficients of variation or blank values are available since each analysis will exhibit its own characteristics. However, a very general guide might be to try to keep the coefficient of variation as far below 0.01 as possible.

   b. The titrant is standardized using the same coefficient of variation criteria as above (i.e., titrate replicates until a minimum C.V. is achieved).

   c. One sample out of 10 is to be run in duplicate. For a single duplicate measurement, the standard deviation (s) is estimated from the difference between the two measured values:

$$s = 0.866 \mid x_1 - x_2 \mid$$

   where x_1 and x_2 are the duplicate measurements. For multiple duplicate measurements, the pooled standard deviation is used (Section B.1.g). Where there is insufficient sample to allow duplication, this fact is noted on the data sheet.

3. Gravimetric analyses require the following:

   a. The balance should be checked with a special weight before analysis is begun. This specially designated weight will be under the control of the Quality Control Officer. The results of this weighing will be recorded in the laboratory notebook.

   b. Where appropriate to the analysis, gravimetric standards should be analyzed using the guidelines presented for "relative" analyses. These are to be run induplicate to provide a measure of analytical precision.

   c. One sample out of ten is to be run in duplicate as with titrimetric analyses.

C. The Calibration Curve

For all "relative" analyses, a calibration or standard curve is required to calculate sample concentrations from the measured instrument responses. The calibration curve is prepared by measuring the instrument responses for a series of standard solutions of the analyte. The sample concentrations are then calculated by interpolating between the standard points. One means to perform these calculations is to use regression analysis to fit a curve through the standard data. The sample concentrations can then be calculated using the resulting regression equations.

The regression analysis also provides parameters which can be used to assess the condition of the analysis. The majority of analyses in the laboratory give linear calibration curves or can be transformed to a linear form. Other analyses can be fitted to a parabolic curve. The following section discuss specific details of linear regression and its uses.

1. Linear Regression. In linear regression analysis, the standard data are fitted to an equation of the form:

$$y = a + bx$$

where

y = instrument resonse
x = concentration or amount of analyte
a = y-intercept
b = slope of the line (sensitivity)

After the regression equation has been computed, the sample concentration (x) can be calculated from the response readings (y) by rearranging the regression equation to give $x = (y-a)/b$. Because of the possibility of nonlinear response outside the range of the standards. No sample concentration should be calculated for final data when the sample response is more than the response of the highest standard. When the sample response is outside this range, the sample should be diluted and reanalyzed, or a higher standard can be run to extend the calibration curve.

The correlation coefficient (r), is a regression parameter which is a measure of how well the equation fitted to the data actually approximates the data. The closer the correlation coefficient is to a value of 1.000, the better the fit. With linear regression analysis, the correlation coefficient is influenced by two factors: first, how linear the data are and, second, how much scatter there is among replicate measurements. For most laboratory analysis, it should be possible to obtain correlation coefficients for the calculation curves of 0.995. No analyses should be continued if the r is less than 0.990 without consulting the group manager or department manager.

When the value of the correlation coefficient does not meet the criteria stated above or when the value is lower than is generally encountered for a given analysis, it is often helpful to prepare a graph of the standard curve. Visual inspection of the curve can often indicate the reason for the r value. The response may not be linear over the range measured. There may be a large amount of scatter among the data. One set of standard values may be out of line with the others--possibly improperly prepared. Possible remedial action should be discussed with the group leader or department manager the analysis is continued.

After regression analysis has been completed, it is often useful to compare the y-intercept of the regression line with the standard blank values. Since the y-intercept is the value of y (the response) when x (the concentration) equals zero, the y-intercept is the regression fitted blank. A large discrepancy between the y-intercept and the average blank readings can indicate a problem with either the balnks or the standard preparation. It could also indicate curvature of the response at low concentrations, which can significantly effect calculations in this region.

D. Method of Standard Additions

The method of standard additions is used to assess the accuracy of analyses of real-world samples and to determine the concentration of samples with severe matrix interferences. Standard additions are performed by analyzing a sample, and then adding amounts of standard solutions to the sample and repeating the analysis. The change in instrument response per concentration unit is the analytical sensitivity in the sample. In effect, a standard (or calibration) curve is constructed in the sample matrix. A difference between the sample sensitivity and that from the standard calibration curve indicates the presence of interferences. For a single standard addition, the fraction of anlayte determined by the method is expressed as the precent recovery, where

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

The spiking procedure descirbed in Section VII.A.4 consists of a single standard addition.

The method of multiple standard additions is illustrated in Figure VII-1, where the abscissa is the concentration of the additions and the ordinate is the response readings. For reference, a standard calibration line is shown as the lower solid curve. The dashed line represents multiple standard additions to a sample without interferences. The curve for a sample without interference will have the same slope as the standard curve but will be displaced upwards by the reading of the unspiked sample. A sample with a % recovery less than 100 would result in a curve with a slope less than the standard curve, illustrated in Figure VII-1 by the solid curve above the calibration curve. The horizontal dashed line from the y-axis to the standard curve and the vertical dashed line to the x-axis indicate the apparent sample concentration if it were calculated from the standard curve. The actual concentration of analyte in the sample is found by extrapolating the standard additions line to its intersection with the abscissa. This method of calculation is only valid when the reagent blank of the method is zero or has been subtracted from the responses. When there is a finite reagent blank, the sample concentration is the value corresponding to the intersection of the additions line with the reagent blank value (illustrated in Figure VII-1 by the horizontal dashed line just above the x-axis).

Multiple standard additions allow the use of linear regression analysis to fit a straight line though the data points. The regression percent recovery can be calculated by dividing the slope of the standard additions curve (the sample sensitivity) by the slope of the calibration curve (the standard sensitivity). The actual sample concentration in the absence of a reagent blank is found by solving the regression equation for x when y equals zero. With a reagent blank, the concentration is the value of x when y is equal to the response of the reagent blank.

For the method of standard additions as described above to work, the response must be linear with concentration over the range of the additions. For those analyses which generate nonlinear calibration curves, the method of standard additions can be used by replacing the instrument responses with the amonts found (the apparent concentration of the sample and the additions). Since the amounts found must be calculated from the standard curve, this method is not independent of the calibration data. The slope of the standard additions line is now direcity the percent recovery for the additions. As before, the original sample concentration can be calculated by extrapolating the regression line until it intersects the abscissa. Since the reagent blank, if present, will be used in calculating the amounts found, it is not necessary to use it when doing the extrapolation.

The following notes should be borne in mind when performing standard additions:

1. The method of standard additions will not indicate the presence of substances which either tie up a portion of the analyte and make it unavailable for determination or which react similarly to the analyte.

2. The effect of the interference cannot vary as the ratio of analyte concentration to sample matrix changes.

3. For a single standard addition, the concentration of the spiked sample must be within the range of the standards. Erratic percent recoveries are often observed when samples with concentration near the detection limit are spiked with concentrations less than 10 times the detection limit. A single spike should results in a concentration in the middle one-third of the analytical range, if possible.

4. For multiple standard additions with analyses with linear calibration curves, the concentration of the spiked samples must be within the linear range of the method. The highest concentration spike should be about 85 percent of the linear range, if possible.

5. For multiple standard additions with nonlinear calibration curves, the concentrations of the spiked samples must be within the range of the standards; no extrapolation outside the range of the standards to calculate sample calibrations is allowed. The regression of amount found on amount added should be liear (correlation coefficient of 0.995 or greater).

E. External Standards Accuracy Tests

The Analytical Services Laboratory regularly receives standards and standard reference materials from three sources:

- ERA, commercial reference standards source
- U.S. EPA

These include sediment, water, soil, oil and urban dust.

Analysis of these materials is performed routinely depending upon the nature of analyses required for ongoing projects. As was mentioned previously, external reference materials are analyzed whenever new analytical stock standards are placed into service to ensure their reliability. By performing these concurrent analyses, the client is provided with verification of the overall accuracy of the pertinent analytical procedure.

In many instances (i.e., metals, inorganics, GC/MS contract laboratory work), outside reference materials are analyzed at the beginning of each run and at speceified intervals during the run.

The analyst is responsible for acquiring the standard materials (appropriate to the type of anlaysis to be performed) from the QA/QC manager.

The results of these analyses are tabulated and charted. QC values which fall outside of specified limits require corrective action before analyses of samples may proceed.

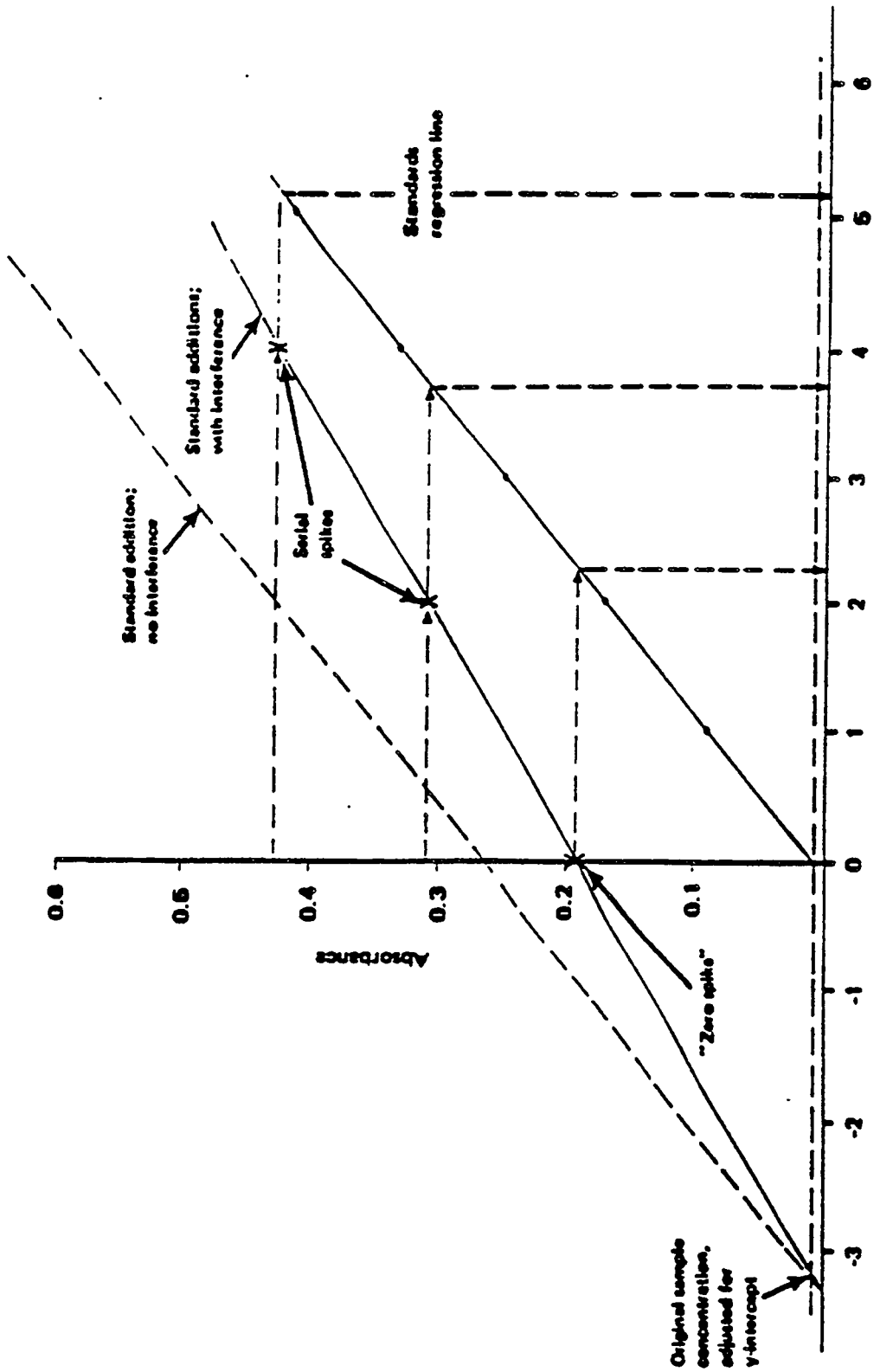


Figure VII-1. The method of standard additions.

VIII. ANALYTICAL QUALITY CONTROL - ORGANIC ANALYSES

A. Standard Operating Procedures For Volatiles By GC/MS Detailed standard operating procedure (SOP) for GC/MS Volatile analysis are found in the Laboratory Library and with the GC/MS Group. Volatiles are analyzed according to methods and quality control requirements of the New York State Analytical Services Protocol (ASP). This document includes the requirements of both CLP and SW846 method 8240. QC procedures meet requirements of both.

1. Application The Quality Control Procedures in this section are used whenever samples are analyzed for volatile organic compounds (Table VIII-1).

2. Summary of Method The water sample is purged with a stream of helium. For soil/sediment samples the purge device is heated. The purgeable compounds are transferred from the aqueous phase to the vapor phase and are swept through a short sorbent column where the compounds are trapped. After purging is complete, the trap is backflushed while being rapidly heated to desorb the absorbed components. These compounds are then separated via the gas chromatograph and detected using a mass spectrometer, which provides both qualitative and quantitative information. Quantitative analysis is performed using internal standard techniques.

3. Sample Collection, Preservation, and Handling Grab samples must be collected in glass containers having a total volume in excess of 20 ml. The sample bottles are filled so that no air bubbles pass through the sample or are entrained in the vial. A hermetic seal is maintained until analysis. All samples are maintained at 4°C in a seperate area, away from other samples and standards, until they are analyzed. If the samples contain free or combined chlorine, sodium thiosulfate is added (10 mg/40ml will suffice for up to 5 ppm Cl_2) to the empty sample bottle prior to shipment to the sampling site. Sample analysis is routinely performed within 9 days of sample collection. A blank organic-free water sample (trip blank) sealed in a glass vial must accompany the samples.

   All samples should be collected in duplicate.

4. Preparation of Standards Stock standard solutions can be prepared from pure reference materials or purchased as prepared certified solutions. Standards will not be used after their expiration dates. Dates of receiving and opening purchased standards will be noted on their containers and in the standard logbook. Preparation of standards in-house will be carefully documented in the standards logbook.

5. Purge and Trap Systems A Tekmar 4200/4000 or Tekmar ALS/LSC2 purge and trap is used. The trap packing consists of Tenax, silica gel and charcoal.

6. Gas Chromatograph The gas chromatography system is a Hewlett Packard 5890 suitable for temperature programming, on-column injection, and capillary column chromatography. The analytical column for the volatile organic pollutants is a 6 ft 1%.SP-1000 on 60/80 Carbopack B.

7. Mass Spectrometer The mass spectrometer is a Hewlett Packard 5970. It is capable of scanning from 20 to 260 a.m.u. every three seconds or less using a 70-volt ion source and producing a recognizable mass spectrum at the unit resolution when 50 ng BFB is injected through the GC inlet.

8. Data System The Hewlett Packard 1000 Computer is interfaced to the mass spectrometer and provides for continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of a chromatographic program. The associated software searches a given GC/MS data file for ions of a specific mass and plots ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). The software provides for integration of abundances in an EICP between specified time or scan number limits.

   Bulk storage of all raw data, calibration, and standard files is maintained on a magnetic tape for a least two years after sample analysis.

9. Calibration Before any standards or samples are analyzed, the tune of the instrument is checked by injecting 50 ng of BFB onto the trap, then thermally desorbing in the sample onto the capillary column of the GC. Ion abundance criteria specified in Table VIII-2 must be met before any standards or samples can be analyzed. The instrument must meet these abundance criteria daily or for each 12 hour time period, whichever is more frequent.

   Aqueous standards are prepared by adding methanolic solutions to organic free water immediately prior to analysis. Additional purgeable chemicals (i.e., xylene, MIBK, freons) may be added to the standard depending on client needs. After turning and prior to the analysis of any samples or blanks, the GC/MS system is calibrated with standards containing all compounds at five concentrations, 20, 50, 100, 150 and 200 ug/l. The relative standard deviation (RSD) for all compounds is calcualted. The % RSD for the calibration check compounds (CCC) vinyl chloride, 1,1 dichlorethene, chloroform, 1,2 dichloropropane, and ethyl benzene must be equal to or less than 30% in order for the calibration to be valid. A continuing calibration must be performed every 12 hours of a run. The CCC compounds must meet % difference criteria of 25% and all other volatile compounds must meet % difference criteria of 35% in order for anlaysis to continue. If these criteria are not meet a new calibration curve must be constructed.

   Use of the internal standard method requires the periodic determination of response factors (RF), which are calculated from the following:

$$RF = (A_S C_{IS})/(A_{IS} C_S)$$

where

A_S = area of the characteristic ion of the priority pollutant standard

A_{IS} = area of the characteristic ion of the internal standard

C_{IS} = amount of the internal standard

C_S = amount of the pollutant standard

10. Surrogate Spikes Each sample and standard is spiked with three internal standards (Bromochloromethane, 1,4 - Difluorobenzene, Chlorobenzene-d5) and three surrogate compounds (Toluene-d8, Bromofluoro- benzene, 1,2-Dichloro- ethane-d4) at 50 ug/l each prior to analysis. If dilution of a sample is necessary, the diluted sample is spiked.

    If the recovery of these compounds does not meet the specified percent (Table VIII-3), the sample analysis must be repeated. If insufficient sample is available, the report will reflect that the analysis did not meet quality assurance criteria. Recoveries of the surrogate compounds will also be noted in the report.

11. Method Blanks Method blank analysis must be performed once for every 12 hour time period to document that the anlaytical system is free of contamination. To be acceptable, the blank must contain no HSL compounds above the CLP specified quantiatiion limits (Table VIII-1) except for the common laboratory solvents methylene chloride, acetone, and 2-butanone which must not be present at concentation greater than 20 ug/l.

12. QC Reference Samples - A QC referece sample containing all compounds of interest must be analyzed with each group of 20 samples or monthly whichever is more frequent. The recovery of the QC compounds must meet the control limits determined by replicate analyses.

13. Matrix Spike/Matrix Spike Duplicate/Blank Spike - To evaluate matrix effects and analytical precision, a matrix spike/matrix spike duplicate analysis is performed with every set of 20 samples or less of the same matrix. To confirm the validity of the spiking solution used, a blank spike is also analyzed. The matrix spiking solution contains the compounds chlorobenzene, toluene, benzene, 1,1-dichloroethene and trichloroethele which are spiked to result ssin a concentration of 50 ug/l in the samples. Recoveries of the spiking compounds must meet the QC limits listed in Table VIII-3.

14. Identification of Compounds The characteristic masses listed in the analytical methods are used for qualitative identification of the volatile priority pollutants.

    The following must be met for qualitative identification:

    a. The characteristic ions for the compound must maximize in the same scan or within one scan of each other.
    b. The retention time must fall within ±10 seconds of the retention time of the reference compound.
    c. The relative peak heights of the three characteristic ions in the EICP must fall within ±20 percent of the relative intensities of these ions in a reference mass spectrum.

15. Quantitative Determination When a compound has been identified, the quantitation of that compound is based on the integrated abundance from the EICP of the primary ion(s). Listed in the applicable method in Table VIII-4. If the sample produces an interference for the primary ion, a secondary ion is used to quantify. Quantitation is performed using internal standard techniques. In this procedure, the concentration in the sample is calculated using the response factor (RF) as determined in Section 9 above.

Concentration (ug/l) = $(A_S C_{IS})/(A_{IS})(RF)$

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

16. Method Detection Limits - The Method Detection Limits for water and soil, determined according to the method described in Section VII-A3 are found in Table VIII-4.

17. Method Precision and Accuracy - The precision and accuracy of the GC/MS Volatile Method has been determined by analyzing 4 aliquots of a QC reference sample containing all analytes. The average recovery and standard deviation of each analyte was calcuated. Precision and accuracy data for volatiles in soil is found on Table VIII-5.

B. Base Neutral and Acids (GC/MS)

1. Application The quality control procedures in this section are used whenever samples are analyzed for base/neutral and/or acid/phenol compounds using EPA Method 625 and Method 8270 in SW8346, 3rd edition, Test Methods for Evaluating Solid Wastes. The GC/MS base/neutral and acid compound method detection limtis determined according to the methods described in Section VII-A-3 are found in Table VIII-6.

2. Summary of Procedure A one liter sample is extracted at a pH of 12 with methylene chloride to obtain the base/neutral extract. After adjusting the pH to 2, the aqueous phase is again extracted with methylene chloride to obtain the acid/phenol extract. Each extract is dried over sodium sulfate and concentrated to a volume of 1 ml using a Kuderna-Danish (K-D) evaporator. After concentration, the extracts are combined for analysis.

   Gel Permeation Chromatography (GPC) may be used for cleanup of exceptionally dirty extracts. After extraction and cleanup, the compounds are separated via the gas chromatograph and detected using a mass spectrometer which provides both qualitative and quantitative information.

3. Sample Collection, Preservation, and Handling Grab samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prerinsed with sample before collection. Each sample should be collected in duplicate to allow for re-extraction if problems are enountered. Enough sample should be provided to allow the analysis of a Matrix Spike/Matrix Spike Duplicate per batch of 20 samples.

   Composite sample should be collected in refrigerated glass containers in accordance with the requirements of the program. Automatic sampling equipment must be free of tygon and other potential sources of contamination.

   The samples must be iced or refrigerated from the time of collection until extraction. Chemical preservatives should not be used in the field unless more than 24 hours will elapse before delivery to the laboratory.

   All samples must be extracted within seven days of collection and completely analyzed within 40 days of collection.

4. Capillary Column Chromatography All GC analyses of base/neutral and acid/phenol extracts will be performed on bonded-phase fused silica capillary columns because of their inherent advantages over packed columns. In addition, the capillary column will be coupled directly to the ion source. At present, the preferred stationary phase is SPB-5 from Supelco Co. However, other phases may be used as the technology improves if the analyst can demonstrate that the newer phase is superior to SPB-5.

5. Sample Spiking Before a sample is extracted it must be spiked with at least three acidic and three neutral surrogate compounds. Monitoring the recovery of these compounds will provide the analyst with information concerning proper pH adjustment, treatment of emulsions, matrix effects, and extract concentration techniques with K.D. apparatus. The recovery of these surrogates must be noted in the report.

Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

	Volatile	CAS Number	Quantitation Limits** Water ug/l	Low Soil/Sediment[a] ug/Kg
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl Chloride	75-01-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene Chloride	75-09-2	5	5
6.	Acetone	67-64-1	10	10
7.	Carbon Disulfide	75-15-0	5	5
8.	1,1-Dichloroethene	75-35-4	5	5
9.	1,1-Dichloroethane	75-34-3	5	5
10.	1,2-Dichloroethene (total)	544-59-0	5	5
11.	Chloroform	67-66-3	5	5
12.	1,2-Dichloroethane	107-06-2	5	5
13.	2-Butanone	78-93-3	10	10
14.	1,1,1-Trichloroethane	71-55-6	5	5
15.	Carbon Tetrachloride	56-23-5	5	5
16.	Vinyl Acetate	108-05-4	10	10
17.	Bromodichloromethane	75-27-4	5	5
18.	1,2-Dichloropropane	78-87-5	5	5
19.	cis-1,3-Dichloropropene	10061-01-5	5	5
20.	Trichloroethene	79-01-6	5	5
21.	Dibromochloromethane	124-48-1	5	5
22.	1,1,2-Trichloroethane	79-00-5	5	5
23.	Benzene	71-43-2	5	5
24.	trans-1,3-Dichloropropene	10061-02-6	5	5
25.	Bromoform	75-25-2	5	5
26.	4-Methyl-2-pentanone	108-10-1	10	10
27.	2-Hexanone	591-78-6	10	10
28.	Tetrachloroethene	127-18-4	5	5
29.	Toluene	108-88-3	5	5
30.	1,1,2,2-Tetrachloroethane	79-34-5	5	5
31.	Chlorobenzene	108-90-7	5	5
32.	Ethyl Benzene	100-41-4	5	5
33.	Styrene	100-42-5	5	5
34.	Xylenes (Total)	1330-02-7	5	5

[a]Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TUNING CRITERIA FOR GC/MS ANALYSIS

DFTPP KEY ION ABUNDANCE CRITERIA (SEMIVOLATILES)

MASS	ION ABUNDANCE CRITERIA
51	30-60% OF MASS 198
68	<2% OF MASS 69
70	<2% OF MASS 69
127	40-60% OF MASS 198
197	<1% OF MASS 198
198	BASE PEAK, 100% RELATIVE ABUNDANCE
199	5-9% OF MASS 198
275	10-30% OF MASS 198
365	>1% OF MASS 198
441	PRESENT BUT < MASS 443
442	>40% OF MASS 198
443	17-23% OF MASS 442

BFB KEY ION ABUNDANCE CRITERIA (VOLATILES)

MASS	ION ABUNDANCE CRITERIA
50	10-40% OF MASS 95
75	30-60% OF MASS 95
95	BASE PEAK, 100% RELATIVE ABUNDANCE
96	5-9% OF MASS 95
173	<1% OF MASS 95
174	>50% OF MASS 95
175	5-9% OF MASS 174
176	>94% BUT <100% OF MASS 174
177	5-9% OF MASS 176

VOLATILE SURROGATE AND MATRIX SPIKE RECOVERY LIMITS (VOLATILES)

SURROGATE SPIKE QC LIMITS

S1 (TOL) = Toluene -d8	(81-117)
S2 (BFB) = Bromofluorobenzene	(74-121)
S3 (DCE) = 1,2-Dichloroethane-d4	(70-121)

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY LIMITS

	Water	Soil/Sediment
1,1-Dichloroethene	61-145	59-172
Trichloroethene	71-120	62-137
Chlorobenzene	75-130	60-133
Toluene	76-125	59-139
Benzene	76-127	66-142

METHOD DETECTION LIMITS HSL (VOLATILES)

Compound	Water UG/L	Soil UG/KG
Chloromethane	1.70	2.4
Bromomethane	2.25	2.4
Vinyl Chloride	1.24	3.0
Chloroethane	1.80	2.2
Methylene Chloride	1.95	10.5
Acetone	9.83	6.1
Carbon Disulfide	3.18	4.9
1,1-Dichloroethene	1.46	2.7
1,1-Dichloroethane	1.44	2.2
1,2-Dichloroethene-(total)	3.53	3.2
Chloroform	1.34	2.5
1,2-Dichloroethane	1.37	2.0
2-Butanone	7.98	2.4
1,1,1-Trichloroethane	2.56	2.5
Carbon Tetrachloride	3.36	2.7
Vinyl-Acetate	5.11	9.4
Bromodichloromethane	1.71	1.7
1,2-Dichloropropene	1.85	2.5
cis-1,3-Dichloropropene	1.26	1.7
Trichloroethene	1.38	4.4
Dibromochloromethane	1.94	1.6
1,1,2-Trichloroethane	1.91	1.8
Benzene	1.69	2.7
trans-1,3-Dichloropropene	1.41	1.9
Bromoform	2.14	1.8
4-Methyl-2-pentanone	3.21	4.3
2-Hexanone	2.52	3.8
Tetrachloroethene	1.43	2.4
1,1,2,2-Tetrachloroethane	2.79	2.2
Toluene	1.20	2.3
Chlorobenzene	0.77	1.5
Ethylbenzene	1.34	1.9
Styrene	1.08	2.4
Xylene (total)	2.68	4.2

ACCURACY AND PRECISION STUDY VOLATILES - SOIL

COMPOUND	1 XB291	2 XB292	3 XB294	4 XB295	X	SD
Chloromethane	18.09	17.43	14.33	16.85	16.7	1.61
Bromomethane	20.01	17.09	12.82	18.04	17.0	3.03
Vinyl Chloride	18.55	18.45	13.56	17.70	17.1	2.37
Chloroethane	19.11	17.84	14.27	17.90	17.3	2.09
Methylene Chloride	20.74	19.40	17.07	19.12	19.2	1.25
Acetone	22.66	20.37	20.47	15.94	19.9	2.82
Carbon Disulfide	18.14	17.02	24.72	7.52	19.4	3.61
1,1-Dichloroethene	18.95	18.79	14.97	19.81	18.1	2.15
1,1-Dichloroethane	19.37	19.13	16.89	20.04	18.9	1.37
1,2-Dichloroethene-(total)	18.58	18.00	14.98	19.81	17.8	2.05
Chloroform	19.30	20.06	18.15	21.49	19.8	1.40
1,2-Dichloroethane	20.12	21.30	20.63	22.91	21.24	1.21
2-Butanone	21.07	20.48	18.49	7.14	19.3	1.81
1,1,1-Trichloroethane	20.72	21.42	18.62	22.56	20.8	1.66
Carbon Tetrachloride	20.44	21.26	17.80	21.96	22.0	1.82
Vinyl-Acetate	18.51	18.53	16.67	16.59	17.6	1.09
Bromodichloromethane	21.73	21.75	21.08	22.94	21.9	0.78
1,2-Dichloropropene	20.01	19.79	19.13	20.14	19.8	0.45
cis-1,3-Dichloropropene	19.99	19.75	18.89	20.05	19.7	0.54
Trichloroethene	20.51	21.20	17.90	20.24	20.0	1.4
Dibromochloromethane	21.01	21.37	21.15	21.76	21.3	0.33
1,1,2-Trichloroethane	21.00	21.84	21.11	21.99	21.5	0.45
Benzene	21.49	20.94	18.28	21.02	20.2	1.29
trans-1,3-Dichloropropene	19.49	20.13	19.16	19.90	19.7	0.41
Bromoform	21.81	23.50	24.18	23.84	23.3	1.05
4-Methyl-2-pentanone	18.76	20.75	21.21	19.50	20.1	1.13
2-Hexanone	18.30	16.54	15.00	17.52	16.8	1.42
Tetrachloroethene	20.35	21.10	15.86	21.05	19.6	2.5
1,1,2,2-Tetrachloroethane	20.49	21.05	20.99	21.16	20.9	0.30
Toluene	19.78	19.64	17.41	21.26	19.5	1.59
Chlorobenzene	19.74	19.72	17.39	19.81	19.2	1.18
Ethylbenzene	19.82	19.84	15.87	20.63	19.0	2.15
Styrene	19.95	19.53	17.84	20.11	19.4	1.04
Xylene (total)	40.16	40.42	34.22	41.48	39.7	3.28

HP #2 (HP 5880) INSTRUMENT LOG

DATE	TECH	CLIENT	TASK #	PARA-METER	LAS MTH	COLUMN OVEN TEMP DETECTOR	BOTTLE #	SEQ/RESULT FILE	RUNNING HOURS	TOTAL RUNS	BILLABLE RUNS*	MAINT HOURS

* not to include stds, blanks, QC, reruns

Figure VI-1

6. Gas Chromatograph A Hewlett Packard 5890 equipped with temperature programming and a splitless capillary inlet (glass-lined) will be used. The capillary column shall be coupled directly to the ion source.

7. Mass Spectrometer (see VIII-A-7)

8. Data System (see VIII-A-8)

9. Calibration Before any standard or samples are analyzed, the tune of the instrument is be validated by injecting 50 ng of DFTPP onto the capillary column of the G.C. Ion abundance criteria specified in Table VIII-2 must be met before analysis begun.

10. Standards Stock standard solutions are prepared from pure standard reference materials or purchased as prepared solutions. The date received and date opened must be marked on each container. No standard may be used after its expiration date. Preparation information and the manufacturer and log number of all purchaed and prepared standards is recored in that stnadards preparation log book. After tuning and prior to the analysis of any samples or blanks, the GC/MS system is calibrated with standards containing all the compounds at five concentrations, 20, 50 80, 120 and 160 ug/l. The average relative response factor (RRF) and relative standard deviation (RSD) are calculated for all compounds. The % RSD for the calibration check compounds (CCC)
N-Nitrosodiphenylamine, Pentachlorphenol, Fluoranthene, Di-n-octylphthalate and Benzo(a)pyrene must be equal to or less than 30%, in order for the calibration to be valid. A continuing calibration must be performed every 12 hours of a run. The % difference criteria of 35% must be met for analysis ito continue. If these criteria are not met, a new calibration curve must be constructed. The System Performance Check compounds (SPCC) N-Nitroso-di-n-propylamine, Hexachlorcyclopentadine,
2,3,Dinitrophenol and 4-Nitrophenol must meet the criteria specified by the method both for inital an continuing calibation. Use of the internal standard method requires the periodic determination of response factors (RF), which are calculated from the following:

$$RF = (A_s C_{is})/(A_{is} C_s)$$

where

A_s = area of the characteristic ion of the priority pollutant standard

A_{is} = area of the characteristic ion of the internal standard

C_{is} = amount of the internal standard

C_s = amount of the pollutant standard

11. Surrogate Spikes - Each sample, blank and standard is spiked with 6 internal standards and 6 surrogate compounds. The list of surrogate compounds and internal standards and their recovery limits are found in Table VIII-7. If there is more than one base/neutral, or more than one acid extractable surrogate outside the specified limits, or if any surrogate recovery is less than 10%, the sample must be re-extracted and reanalyzed. If the internal standard retention times are not within 30 seconds of those of the latest calibration or the area is not within -50% to +100%, the GC/MS system must be inspected for malfunction, corrections made and the sample renalayzed. The sample may have to be reextracted to prove that problems originate with the sample matrix rather than the analytical system.

12. Method Blanks - A method blank is initated with every extraction batch. An extraction batch consitutes a group of no more than 20 samples of the same matrix and extraction method which are extracted on one day. The blank is spiked with the same surrogates and internal standards as the samples. Surrogate recoveries outside the specified limits, or contamination of the blank indicate problems which must be corrected by reanalysis or reextraction of both the blank and the samples.

13. Matrix Spike/Matrix Spike Duplicate/Blank Spike - To evaluate matrix effects and analytical precision, matrix spike/matrix spike duplicate analysis is performed with every set of 20 m samples of the same matrix. To confirm the validity of the spiking solution used, a blank spike is also analyzed. The matrix spiking solution contains the compounds listed on Table VIII-8 with their recommended recovery limits. Matrix effects will have an impact on recoveries.

14. QC Reference Sample - A QC reference sample containing all compounds of interest must be analyzed with each group of 20 samples or monthly, whichever is more frequent. The recovery of the QC compounds must meet the control limits determined by replicate analysis.

15. Identification of Compounds The characteristic masses listed in the method and SOP are used for qualitative identification of base/neutral and acid/phenol priority pollutants.

    The following must be met for qualitative identification:

    a. The characteristic ions for the compound must maximize in the same or within one scan of each other.

    b. The retention time must fall within ±30 seconds of the retention time of the reference compound.

    c. The relative peak heights of the three characteristic ions in the EICP must fall within ±20 percent of the relative intensities of these ions in a reference mass spectrum.

SEMIVOLATILE METHOD DETECTION LIMITS
WATER (ug/L)

Phenol	1.99
bis(2-Chloroethyl)ether	3.00
2-Chlorophenol	1.96
1,3-Dichlorobenzene	2.80
1,4-Dichlorobenzene	3.04
Benzyl Alcohol	3.38
1,2-Dichlorobenzene	3.11
2-Methylphenol	0.62
bis(2-Chloroisopropyl)ether	2.76
4-Methylphenol	1.17
N-Nitroso-Di-n-propylamine	2.46
Hexachloroethane	2.60
Nitrobenzene	2.95
Isophorone	2.97
2-Nitrophenol	1.77
2,4-Dimethylphenol	2.27
Benzoic Acid	9.87
bis(2-Chloroethoxy)methane	2.93
2,4-Dichlorophenol	1.62
1,2,4-Trichlorobenzene	3.18
Naphthalene	2.74
4-Chloroaniline	2.57
Hexachlorobutadiene	3.00
4-Chloro-3-methylphenol	1.53
2-Methylnaphthalene	3.34
Hexachlorocyclopentadiene	26.40
2,4,6-Trichlorophenol	1.64
2,4,5-Trichlorophenol	1.84
2-Chloronaphthalene	3.00
2-Nitroaniline	2.50
Dimethylphthalate	2.11
Acenaphthylene	3.10
3-Nitroaniline	2.94
Acenaphthene	3.21
2,4-Dinitrophenol	17.67
4-Nitrophenol	6.95
Dibenzofuran	3.02
2,4-Dinitrotoluene	2.95
2,6-Dinitrotoluene	2.42
Diethylphthalate	3.57
4-Chlorophenyl-phenylether	2.87
Fluorene	2.94
4-Nitroaniline	3.39
4,6-Dinitro-2-methylphenol	16.06
N-Nitrosodiphenylamine	1.76
4-Bromophenyl-phenylether	2.36
Hexachlorobenzene	2.05
Pentachlorophenol	17.64
Phenanthrene	1.93
Anthracene	1.86
Di-n-Butylphthalate	4.88
Fluoranthene	1.89
Pyrene	2.04
Butylbenzylphthalate	9.46
3,3'-Dichlorobenzidine	2.64
Benzo(a)Anthracene	1.28
Bis(2-Ethylhexyl)Phthalate	2.82
Chrysene	1.34
Di-n-octylphthalate	3.35
Benzo(b)Fluoranthene	0.91
Benzo(k)Fluoranthene	3.48
Benzo(a)Pyrene	1.46
Indeno(1,2,3-cd)Pyrene	1.80
Dibenzo(a,h)Anthracene	2.28
Benzo(g,h,i)Perylene	1.73

Table VIII-6

Semivolatile Surrogate/Standard Recovery Limits

Surrogates

	Water	Soil
(NBZ) =	Nitrobenzene-d5	(35-114) (23-120)
(FBP) =	2-Fluorobiphenyl	(43-116) (30-115)
(TPH) =	Terphenyl-d14	(33-141) (18-137)
(PHL) =	Phenol-d6	(10-94) (24-113)
(2FP) =	2-Fluorophenol	(21-100) (25-121)
(TBP) =	2,4,6-Tribromophenol	(10-123) (19-122)

Internal Standards

(DCB) = 1,3-Dichlorobenzene-d4	Upper limit = +100% of internal standard area.
(NPT) = Naphthalene-d8	
(ANT) = Acenaphthene-d10	Lower Limit = 50% of internal standard area.
(PHN) = Phenanthrene-d10	Upper limit = +100% of internal standard area.
(CRY) = Chrysene-d12	
(PRY) = Perylene-d12	Lower Limit = 50% of internal standard area.

Matix Spike/Matrix Spike Duplicate Recovery Limits (Semivolatiles)

	Water QC Limits		Soil QC Limits	
	RPD	REC.	RPD	REC.
Phenol	42	12-89	35	26-90
2-Chlorophenol	40	27-123	50	25-102
1,4-Dichlorobenzene	28	36-97	27	28-104
N-Nitroso-di-n-prop.(1)	38	41-116	38	41-126
1,2,4-Trichlorobenzene	28	39-98	23	38-107
4-Chloro-3-methylphenol	42	23-97	33	26-103
Acenaphthene	31	46-118	19	31-137
4-Nitrophenol	50	10-80	50	11-114
2,4-Dinitrotoluene	38	24-96	47	28-89
Pentachlorophenol	50	9-103	47	17-109
Pyrene	31	26-127	36	35-142

C. Pesticides (GC/ECD)

1. Application The following quality control measures will be utilized in the analysis of specified (Table VIII-9) organochlorine and organophosphate pesticides, polychlorinated biphenyls (PCBs), and chlorophenoxy acid herbicides (2,4-D and 2,4,5-TP). Aqueous samples will be analyzed for pesticides using EPA Method and Method 808 in EPA SW846 and for chlorophenoxy acid herbicides by Standard Method 509B (APHA et al. 1980). Alternate methods or modifications of the above will be used for other types of samples such as tissues or sediments.

2. Sample Collection and Handling Grab samples must be collected in glass containers with Teflon-lined caps. However, if the sample is noncorrosive, foil may be used to line the cap. Under no circumstances should the sample come in contact with plastics, as they are a potential source of contamination by compounds that can interfere with the analysis.

   Conventional sampling procedures should be followed except that the sampling container must not be prewashed with sample before collection. Composite samples should be collected in refrigerated glass containers in accordance with the requirements of the program. Automatic sampling equipment must be free of tygon and other potential sources of contamination.

   Aqueous and sediment samples must be iced or refrigerated from the time of collection until extraction. Tissue samples should be frozen. Chemical preservatives should not be used in the field.

   Aqueous samples will be extracted within 7 days of collection and analyzed with 40 days of extraction.

3. Extraction and Cleanup Methods Details of the extraction and cleanup procedures for the various methods are found in the Galson Laboratories Standard Operating Procedures (SOP) for the specific method. The SOPs are found in the laboratory library as well as with the group manager responsible for extraction and analysis.

4. Calibration. At the beginning of a specific contract, or if the column is changed, the system is calibrated with standards at five concentration levels for each analyte of interest. One concentration level is at the laboratory Practical Quantitation Limit (PQL), which is the concentration which can be routienly determined. The highest standard is a approximately full scale. Each standard must be spiked with the surrogate compound dibutylchlorendate. The cuve must have a correlation coefficient of 0.998 or greater and must meet linearity criteria of 20%. Average response factors are calculated for the curve. Before each analytical run, evaluation standards are analyzed which must meet RSD limits of 15% of all analytes. If the % RSD is between 16-29% a QC check standard, (see C8) is analyzed. If QC recoveries are within acceptable ranges, the analysis may proceed, since there was probably a change in detector response. If the QC recovery is not within the acceptable ranges, or the % RSD is greater than 30%, a new calibration curve must be made. If analysis is for polychlorinated biphenyls only, evaluation standards containing mixed Arochlors are used instead of pesticides, and must meet the same correlation coefficient and linearity criteria.

5. Retention Time Windows. Retention time windows for all compunds of interest are established at the time the inital calibration curve is made by making three injections off all pesticides mixtures used to establish the curve, within a 72 hour period. The retention time shift of dibutylchlorendate must be verified to be less than 2% for packed columns, 1.5% for wide bore capillary columns, and 0.3% for narrow bore capillary columns. If these criteria are met, the retention time windows for all the compounds of interest are established by calculating the standard deviations of the absolute retention times of all single component pesticides. For multicomponent pesticdes and PCB, the major peak is used. Using the first injection during the 72 hour time period as the center of the retention time window, the window is calucated to be +/- three times the standard deviatation of the three injections.

6. Endrin and 4,4'-DDT Breakdown. Endrin and DDT are labile compounds whose excessive breakdown indicates column degeneration. To evaluate this degeneration, a standard containing Aldrin, Endrin, and 4,4'-DDT is analyzed and evaluated for breakdown peaks in addition to the four main compounds as specified in the analytical method. To be acceptable, the combined breakdown of Endrin and DDT must not exceed 20%.

7. Blanks. A blank must be extracted and analyzed for each batch of 20 samples of the same matrix or every 14 days, whichever is most frequent. To be acceptable, method blanks must contain less than the PQL of any single pesticide or PCB. If the blank contains more than the PQL, it and the associated samples must be reextracted and reanalyzed.

8. QC Check Standard An EPA QC reference sample, or a check standard formulated from standards from a different source than the calibration standards and containing all compounds of interest, must be analyzed with each group of 20 samples or monthly, whichever is more frequent, or when a continuing calibration standard does not meet the <15% criterion. The recovery of the QC compounds must meet the control limits determined by replicate analysis.

9. Matrix Spike/Matrix Spike Duplicate/Blank Spike To evaluate matrix effects and analytical precision, matrix spike/matrix spike duplicate anlaysis is performed with every set of 20 samples of the same matrix. To confirm the validity of the spiking solution used, a blank spike is also analyzed. The matrix spiking solution contains the compounds of interest for a specific project. Matrix spike recoveries and RPD values should be within the advisory limits found in Table VIII-10, though matrix effects will have an impact on recoveries.

10. Analysis and Data Handling Qualitative and quantitative analysis of sample extracts will be done by gas chromatography. Inject 1-5 ul of the concentrated sample extract. If peaks of interest exceed the linear range of the system, the extract is diluted and reanalyzed. The resulting chromatograph is recorded on a data system. Chromatograms will be kept for 3+ years. Extracted samples will be retained two weeks past submittal of the report to the client unless otherwise specified. Records will be kept as to when samples are analyzed by GLC and a copy of the final report will be kept in the appropriate job file.

Retention times of unknown peaks occurring in the sample are compared against retention times of peaks in a known pesticide standard. Any pesticides found are then quantitatively determined against the standard. Peaks identified in a sample will be confirmed on another column with a complementary packing to the first column packing. Commonly used column packings are:

1.5 percent 2250/1.95 percent 2401 on 100/120 Supelcoport
3 percent OV-1 on 100/120 Gas Chrom Q

11. Calculations Quantitative determination of the concentration of the individual compunds is done according to the following formula:

$$C_i = \frac{A_i \times C_s \times V_f}{A_s V_i}$$

where

C_i = concentration of component of interest in sample (ug/liter)

A_i = peak size of identified component

A_s = peak size of matching standard

V_i = initial volume of sample extracted (ml)

C_s = concentration of standard (ug/liter)

V_f = final volume of extracted sample (ml)

This calculation has been programmed into the Laboratory Information Management System (LIMS), which is used to perform calculations and generate reports. At least monthly, a LIMS calculation is checked manually to assure the continuing integrity of the stored calculation routine.

Results are reported in micrograms per liter without correction of recovery data. (When duplicates and spike samples are analyzed, all data are recorded.)

12. Confirmation Each positive identification of a pesticide must be confirmed on a second column with different retention time characteristics. Initial and continuing calibration standards must be run on the confirmation column. Retention time windows and Endrin and DDT breakdown must be determined on the confirmation columns.

13. Method Detection Limits (MDL) and Practical Quantitation Limits (PQL) Table VIII-11 lists the polychlorinated biphenyl MDLs determined according to the methods described in Section VII-A-3. While determination of MDLs for all pesticides is in process, the laboratory uses PQLs (Table VIIA) which are concentrations that can be detected routniely in the listed matrix.

PESTICIDES and PCB's

Aldrin
αBBC
βBBC
γBBC
δBBC (Lindane)
Chlordane (technical)
4,4' -DDD
4,4' -DDE
4,4' -DDT
Deldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Heptachlor
Heptachlor epoxide
Methoxychlor
Mirex
Toxaphene
PCB1016
PCB1221
PCB1222
PCB1242
PCB1248
PCB1254
PCB1260
Kepone
Malathion
Parathion

HERBICIDES

2,4-D
2,4,5-TP (Silvex)

TABLE VIII-9

GALSON TECHNICAL SERVICES, INC.
Effective 6 December 1990
Revision 2

ADVISORY MATRIX SPIKE RECOVERY LIMITS
(Pesticides/PCB)

COMPOUND	WATER QC LIMITS RPD	WATER QC LIMITS REC.	SOIL QC LIMITS RPD	SOIL QC LIMITS REC.
Lindane	15	56-123	50	46-127
Heptachlor	20	40-131	31	35-130
Aldrin	22	40-120	43	34-132
Dieldrin	18	52-126	38	31-134
Endrin	21	56-121	45	42-139
4,4' DDT	27	38-127	50	23-134

TABLE VIII-10

PCB MDL Studies - November 1990

	A	B	C	D	E	F	G	H
1		3.5	0	MCB 4	MCB 5	MCB 6	Std of ug/l	MDL (ug/l)
2	Aroclor 1016							
3	7.39		117,983	102039	101673	103870		
4	2.43		195,145	185786	177327	184487		
5	3.1							
6	3.4							
7	3.6							
8	3.8							
9	4.4		200,926	208249	213364	213430		
10	4.6		165,950	207615	198306	203283		
11	Total		680,004	703689	690670	705070		
12	ug/l			0.207	0.203	0.207	0.002	0.016
13								
14	Aroclor 1232		0.2 ug/ml std	MCB 1	MCB 2	MCB 3		
15	7.74		30,162	51284	50539	48430		
16	9.95		105,111	169741	164606	167758		
17	Total		135,293	221025	215145	216188		
18	ug/l			0.327	0.318	0.320	0.005	0.032
19								
20	Aroclor 1232		0.2 ug/ml std	MCB 7	MCB 8	MCB 9		
21	2		127,221	103934	107406	107771		
22	2.4		97,376	99043	104602	107214		
23	3.1							
24	3.6							
25	3.8							
26	4.4		109,071	131068	144453	138141		
27	Total		333,668	334045	356661	353126		
28	ug/l			0.200	0.214	0.212	0.007	0.051
29								
30	Aroclor 1242		0.2 ug/ml std	MCB 13	MCB 14	MCB 15		
31	2		104,706	96858	88145	91104		
32	2.43		154,781	149075	136565	150879		
33	3.13							
34	3.38							
35	3.8							
36	5.56		302,926	364143	340148	372157		
37	Total		562,413	610076	564858	614220		
38	ug/l			0.2169	0.2009	0.2184	0.010	0.068
39								
40	Aroclor 1248			MCB 1	MCB 2	MCB 3		
41	2.4		82,514	88355	88576	88463		
42	3.13		0	0	0	0		
43	3.79		0	0	0	0		
44	4.37		239,348	240653	235403	233680		
45	4.62		231,326	258205	258357	261417		
46	5.18		203,516	182660	182293	183966		
47	5.55		487,791	456356	443922	448728		
48	6.39		391,024	344361	335395	339827		
49	Total		1,635,519	1570590	1543946	1556081		
50	ug/l			0.192	0.189	0.190	0.002	0.011
51								
52	Aroclor 1254			MCB 6	MCB 7	MCB 8		
53	7.9	1178873		418,581	410254	447420		
54	8.67	587789		196,730	206042	219506		
55	9.23	894331		327,530	343185	355183		
56	10.84	326590		109,052	130343	120799		
57	11.43	622295		210,255	210258	231109		
58	12.5	1249802		463,714	475968	493775		
59	Total	4859680	0	1725862	1776050	1867792		
60	ug/l			0.178	0.183	0.192	0.0074	0.052
61								
62	Aroclor 1260							
63	8	771599	329,551	298578	297327	263825		
64	8.78	818350	362,086	320363	319061	278890		
65	10.2	1194012	464,039	395301	395882	341950		
66	12.7	2471124	1,055,201	929933	892605	839778		
67	19.4	1780295	732,566	621386	605939	602704		
68	Total	7035380	2,943,443	2565561	2510814	2327147		
69	ug/l			0.174	0.171	0.158	0.008	0.059
70								
71								

TABLE VIII-IIA

PRACTICAL QUANTITATION LIMITS (Pesticides)

	WATER	SOIL	
		LOW LEVEL	MEDIUM LEVEL
alpha-BHC	0.05	3.3	100
beta-BHC	0.05	3.3	100
delta-BHC	0.05	3.3	100
gamma-BHC (Lindane)	0.05	3.3	100
Heptachlor	0.05	3.3	100
Aldrin	0.05	3.3	100
Heptachlor epoxide	0.05	3.3	100
Endosulfan I	0.05	3.3	100
Dieldrin	0.10	6.7	200
4,4'-DDE	0.10	6.7	200
Endrin	0.10	6.7	200
Endosulfan II	0.10	6.7	200
4,4'-DDT	0.10	6.7	200
Methoxychlor	0.50	33	1000
Endrin ketone	0.10	6.7	200
Alpha-Chlordane	0.50	33	1000
Gamma-Chlordane	0.50	33	1000
Toxaphene	1.0	67	2000
Arochlor 1016	0.50	33	2000
Arochlor 1221	0.50	33	2000
Arochlor 1232	0.50	33	2000
Arochlor 1242	0.50	33	2000
Arochlor 1248	0.50	33	2000
Arochlor 1254	0.50	33	2000
Arochlor 1260	0.50	33	2000

TABLE VIII-11B

GALSON TECHNICAL SERVICES, INC.
Effective 6 December 1990
Revision 2

D. VOLATILES BY GAS CHROMATOGRAPHY

1. Analytical Methods Analysis of volatile organics by gas chromatography utilizes a purge and trap gas chromatography system similar to that used for volatile analysis by GC/MS. The detection system, however, utilizes a photoionization detector (PID) for volatile aromatics, and an electrolytic conductivity detector (ELCD) for volatile halogenated compounds. Since the PID is non-destructive, only one purge is necessary for passing the sample though both detectors. The laboratory analyzes samples according to the requirements of numerous methods. The methods differ in the analyte list, calibration and QC requirements. Standard Operating Procedures (SOP) for each method are available in the Laboratory Library and with the GC Volatiles group leader. The SOPs recognize the differences among the methods, and specify QC procedures appropriate to each method. Methods utilized in the laboratory are:
EPA Methods 501.1, 502.2, 503.1, 601, 602, 8010, 8020

2. Calibration: A seven point curve is run. Using this curve the following criteria must be met:

Method	% RSD	# of Point
501/502/503	<15%	5
601/602	<10%	3
8010/8020	< 20%	5

Continuing Calibration: To show that the analytical system is in control, a calibration standard or a quality control check standard is analyzed and must meet the following criteria:

Method	% Recovery
501/502/503	+/- 40
601/602	See attached QC Standard Recovery List (Table VIII-12)
8010/8020	+/- 15

The frequency of a continuing calibration is at 12 hour intervals.

3. Surrogate and Internal Standards Each sample is spiked with an internal and surrogate standard (Table VIII-13). The recoveries of the surrogate is tabulated from this data, warning and control limits are calculated at +/- two times the standard deviation and +/- three times the standard deviation. The control limits for the internal standard is +/- 50%.

4. Blanks: Each day the analyst must analyze a reagent water blank to demonstrate that the interferences from the analytical system are under control. The system is free of interferences if the level of contamination is less than the method detection limit for all compounds except methylene chloride. Methylene chloride contamination must be less than three times the method detection limit. Any methylene chloride contamination over this level is brought to the attention of the group manager.

5. Matrix Spikes/Matrix Spike Duplicates/QC Check Standard. The spikes and standards must meet the criteria listed in Section 2, Continuing Calibration.

Spiking Compounds	Methods	Required	Control Limit
GC/MS Volatile MS/MSD List	501/502/503	QC check	+/- 40%
All compounds	601/602	MS or QC check	See table VIII-12
Either all compounds or GC/MS List	8010/8020	MS/MSD	In-house control limits

6. Method Detection Limits. Method Detection limits calculated according to the method described in Section VII-A-3 are found in Table VIII-14 A &B.

7. Calculation

   See Table VIII-13

8. Data Handling. All data is handled by a Hewlett Packard LAS. The LAS integrates the signals from the analytical system, performs any necessary calculations and generates a data report showing the chromatograms, the peak areas and the corresponding analyte concentrations. At least monthly, an LAS calculation is checked manually to assure the continuing validity of the stored calculation routine.

601/602 GC VOLATILE
QUALITY CONTROL STD RECOVERY

CLIENT: TASK:

DATE: LAB FILE ID:

TIME:

COMPOUND	RECOVERY%	LIMITS
Benzene		39-150
Bromodichloromethane		42-172
Bromoform		13-159
Bromomethane #		D-144
Carbon tetrachloride		43-143
Chlorobenzene		55-135
Chloroethane *		46-137
2-Chloroethylvinyl ether		14-186
Chloroform		49-133
Chloromethane		D-193
Dibromochloromethane		24-191
1,2 Dichlorobenzene		37-154
1,3 Dichlorobenzene		50-141
1,4 Dichlorobenzene		42-143
1,1 Dichloroethane		47-132
1,2 Dichloroethane		51-147
1,1 Dichloroethene		28-167
Trans-1,2 Dichloroethene		38-155
1,2-Dichloropropane		44-158
cis-1,3-Dichloropropene		22-178
Trans-1,3-Dichloropropene		22-178
Ethylbenzene		32-160
Methylene Chloride		25-162
1,1,2,2-Tetrachloroethane		8-184
Tetrachloroethene		26-162
Toluene		46-148
1,1,1-Trichloroethane		41-138
1,1,2-Trichloroethane		39-146
Trichloroethene		35-146
Trichlorofluoromethane		21-158
Vinyl Chloride		28-163

* = Recovery% not within limits
\# = Coeluting Compounds.

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EXAMPLE OF CALCULATION USED TO DETERMINE ANALYTE CONCENTRATION

$$\frac{\text{Area (Analyte)}}{\text{Area (Int. Std)}} \times \frac{\text{R.F. (Analyte)}}{\text{R.F. (Int. Std.)}} \times \text{Conc. Int. Std.}^{*} = \text{Conc. of Analyte}$$

R.F. - Average Response factor determined from curve data.

* All samples are spiked with 5 ul of a mixture containing 20 ug/ml of the following: Fluorobenzene, 1-Chloro-4-fluorobenzene, and 1-Chloro-2-fluorobenzene. The final concentration is 20 ug/L for each standard.

For the PID:
Internal Standard = 1-Chloro-4-fluorobenzene
Surrogate = Fluorobenzene

For the ELCD:
Internal Standard = 1-Chloro-2-fluorobenzene
Surrogate = 1-Chloro-4-fluorobenzene

TABLE VIII-13

METHOD DETECTION LIMITS

VOLATILES by ELCD

ANALYTES	DETECTION LIMITS
Dichlorodifluoromethane	0.418
Chloromethane	0.175
Vinyl Chloride	0.301
Bromomethane	0.396
Chloroethane	0.194
Trichlorofluoromethane	0.451
1,1-Dichloroethene	0.211
Methylene Chloride	0.384
Trans-1,2-Dichloroethene	0.160
1,1-Dichloroethane	0.087
2,2-Dichloropropane	0.205
cis 1,2-Dichloroethene	
Chloroform	0.141
Bromochloromethane	0.092
1,1,1-Trichloroethane	0.252
1,1- Dichloropropene	0.317
Carbon Tetrachloride	0.374
1,2-Dichlorethane	0.095
Trichloroethane	0.128
1,2-Dichloropropane	0.158
Bromodichloromethane	0.131
Dibromomethane	0.100
cis-1,3-Dichloropropene	0.121
trans-1,3-Dichloropropene	0.069
1,1,2-Trichloroethane	0.123
1,3-Dichloropropane	0.156
Tetrachloroethene	0.225
1,2-Dibromoethane	0.272
1,1,1,2-Tetrachloroethane	0.148
Bromoform	0.179
1,1,2,2-Tetrachloroethane	0.191
1,2,3-Trichloropropane	0.091
Bromobenzene	0.172
2-Chlorotoluene	0.182
4-Chlorotoluene	0.169
1,3 DCB 1,3-Dichlorobenzene	0.132
1,4 DCB 1,4-Dichlorobenzene	0.221
DCB 1,2-Dichlorobenzene	0.169
1,2-Dibromo-3-Chloropropane	0.238
1,2,4 Trichlorobenzene	0.171
Hexachlorobutadiene	0.119
1,2,3-Trichlorobenzene	0.288

GALSON TECHNICAL SERVICES, INC.
Effective 6-DECEMBER-1990
Revision 2

Table VIII-14-A

METHOD DETECTION LIMITS

VOLATILES by PID

ANALYTE	DETECTION LIMIT
Benzene	0.172
Trichloroethene	0.203
Toluene	0.107
Tetrachloroethene	0.140
Chlorobenzene	0.114
Ethylbenzene	0.096
M&P Xylene	0.096
O Xylene	0.047
Styrene	0.054
Isopropyl Benzene	0.143
N-Propyl Benzene	0.071
Bromobenzene	0.060
*2-Chlorotoluene 1,3,5-Trimethlybenzene	0.064
4 Chlorotoluene	0.050
Tert-Butyl Benzene	0.057
1,2,4, Trimethyl Benzene	0.050
Sec-Butyl Benzene	0.099
p-Isopropyl Toluene	0.114
1,3-Dichlorobenzene	0.030
1,4-Dichlorobenzene	0.220
N-Butyl Benzene	0.082
1,2-Dichlorobenzene	0.094
1,2,4 Trichlorobenzene	0.387
Hexachlorobutadiene	0.358
Naphthalene	0.431
1,2,3-Trichlorobenzene	0.432

*Coeluting Compounds

IX ANALYTICAL QUALITY CONTROL- METALS

Metals are analyzed using Inductively Coupled Plasma Spectroscopy according to EPA Methods 200.7 and 6010 as well as the Contract Laboratory Protocol. Furnace Atomic Absorption Spectroscopy is performed according to the spcific EPA furnace methods found in Methods for Chemical analysis of Water and Wastes, and in SW846. . Flameless atomic absoption Spectroscopy is used for mercury analysis according to EPA methods 245.2 and 7470.

A Inductively Coupled Plasma Emission Spectroscopy(ICP)

Two ICP instruments are available in the laboratory, the Leeman Plasma-Spec, a sequential instrument which is able to analyze any metal, and the Leeman Model 3000, a simultaneous instrument which can be used to analyze metals corresponding to 19 lines. This instrument is used when the analysis of Priority Pollutant metals is required. The analytical methods used are those found the CLP protocol and EPA SW846 6010.

1. Calibration

Both instruments are calibrated initially by running a calibration curve containing all elements at at least three concentrations. More standards are used for elements having a greater linear range. To be accepted, calibration curves must have a calculated correlation coefficient of at least 0.995. The initial curves are stored in instument memory.
The instrument calibration is checked daily or every time the instrument is set up, whichever is more frequent. The check is performed with a blank and a mid-range standard containing all metals of interest. Using those two solutions, the slope and intercept is updated.

Initial Calibration Verification- immediately after this update, the calibration is verified using an Initial Calibration Verification standard(ICV) containing all elements of interest,which has been formulated from a source separate from that used for constructing the standard curve. All values must be within +/-10 of the curve for analysis to continue.

Continuing Calibration Verification-At a frequency of 10% or every 2 hours, whichever is more frequent, a Continuing Calibration Verification Standard(CCV) is analyzed. All values must meet +/-10% criteria. If a CCV fails for any metal, all samples analyzed since the previous passing CCV for that metal must be reanalyzed.

Calibration Blank-A calibration blank is analyzed at each wavelength immediately after the analysis of each ICV and CCV. For Contract work, the blank concentration may not exceed the contract specified detection limit. For other analyses, the blank concentration may not exceed the lowest standard. High calibration blanks must be investigated, and corrective action taken.

2. Blanks: A preparation blank is initiated with the digestion of every batch of samples prepared. If the concentration of any metal in the blank exceeds the contract detection limit, the blank is only acceptable if the concentration in samples associated with it exceeds the blank concentration by a factor of 10. Otherwise the associated samples must be redigested and reanalyzed.

3. Quality Control Check Samples A Quality Control Check Sample formulated from a separate source is analyzed after every initial calibration verification, as a further check on the calibration. For contract work, the recoveries must fall within 80-120%. For non-contract work, control charts are maintained with limits determined by multiple analysis.

4. Matrix Spike A matrix spike is analyzed with every batch of 20 samples of the same matrix. The recovery must be within 75-125%, unless the sample concentration exceeds the spike concentration by a factor of four or more.

5. Duplicate A duplicates is analyzed with every set of 20 samples of the same matrix. For contract work, duplicates limits are calculated according to contract specifications. For non-contract work, control limits are calculated from repetitive analyses. Different control limits are used for different analytical ranges.

6. Instrument Detection Limits(IDL) Instrument detection limits are determined quarterly for each ICP instrument. They are determined by multiplying by 3, the average of the standard deviations obtained on three non-consecutive days from the analysis of a standard solution containing each analyte at a concentration of 3-5x the IDL suggested by the instrument maker. Seven consecutive analyses are performed per day. Table IX-1 lists the most current (IDLs). Table IX-2 lists the practical quantitation limits, which are those concentrations which can be reliably detected above background on a routine basis.

7.Interference Check Sample An interference check sample is analyzed with every batch of samples to document the effect of interfering elements on the analytes of interest.

8. Serial Dilution A five fold serial dilution is performed on any sample whose concentration is above 50 times the instrument detection limit. The diluted concentration must be within 10% of the original concentration when corrected for the dilution. If this agreement is not obtained, the presence of possible chemical or physical interference is noted in the report.

9. Calculation Both ICP instruments print out sample concentrations in mg/l(ppm) for water samples. For soil samples,further calculation is required using the original sample weight, % moisture and dilution . For CLP packages these calculations are performed on the instrument data system. At least one calculation per month is checked manually to assure the integrity of the computer stored calculation routine.

B Graphite Furnace Atomic Absorption Spectrometers

Two Atomic Absorption Spectrometers with graphite furnaces(FGAA) are available in the laboratory. One is a Perkin Elmer 4000 with a 400 HGA and Deuterium background correction.The other is a Perkin Elmer 5100 with a 600 HGA and Zeeman background correction. These instruments are routinely used for the analysis of Arsenic, Lead, Selenium, Antimony and Thallium. For drinking water, they are also used for Cadmium, and when analyzing dialysis water, for Silver and Aluminum. The analytical methods are those specified for each metal in EPA SW 846 and/or 600/4-79-020.

1.Calibration - Both instruments are calibrated before every run with three standards and a blank. To be acceptable, calibration curves must have a calculated calibration coefficient of at least 0.995. The instruments are recalibrated whenever the instruments are stopped, an element lamp is changed, or a continuing calibration verification does not pass the specified criterion.

Initial Calibration Verification- Immediately after calibration, the calibration is verified using an Initial Calibration Verification Standard (ICV) containing the element of interest, which has been formulated from a source separate from that used for constructing the standard curve. All values must be within +/-10% of the curve for analysis to continue.

Continuing Calibration Verification- At a frequency of 10% or every 2 hours, whichever is more frequent, a Continuing Calibration Verification Standard (CCV) is analyzed. All values must meet +/-10% criteria. If a CCV fails, all samples analyzed since the previous passing CCV must be reanalyzed.

Calibration Blank-A calibration blank is analyzed immediately after the analysis of each ICV and CCV. For contract work, the blank concentration may not exceed the contract specified detection limit. For other analyses, the blank concentration may not exceed the lowest standard. If a high calibration blank is found, the instrument is recalibrated.

2.Blanks- A preparation blank is initiated with the digestion of every batch of samples prepared. If the concentration of any metal in the blank exceeds the contract detection limit, the blank is only acceptable if the concentration in samples associated with it exceeds the blank concentration by a factor of 10. Otherwise the associated samples must be redigested and reanalyzed. For non-CLP work, the preparation blank may not exceed a concentration of 5 ppb.

3. Quality Control Check Samples A Quality Control Check Sample formulated from EPA ampules or a separate source is analyzed after every initial calibration verification, as a further check on the calibration. For contract work, the recoveries must fall within 80-120%. For non-contract work, control charts are maintained with limits determined by multiple analysis.

4. Matrix Spike- A matrix spike is analyzed with every batch of 20 samples of the same matrix. The recovery must be within 75-125%, unless the sample concentration exceeds the spike concentration by a factor of four or more.

5. Duplicate - A duplicate is analyzed with every set of 20 samples of the same matrix. For contract work, duplicates limits are calculated according to contract specifications. For non-contract work, control limits are calculated from repetitive analyses. Different control limits are used for different analytical ranges.

6. Instrument Detection Limits (IDL) - Instrument detection limits are determined quarterly for each AA instrument. They are determined by multiplying by 3, the average of the standard deviations obtained on three non-consecutive days from the analysis of a standard solution containing each analyte at a concentration of 3-5x the IDL suggested by the instrument maker. Seven consecutive analyses are performed per day. Table IX-1 lists the most current (IDLs). Table IX-2 lists the practical quantitation limits, which are those concentrations which can be reliably detected above background on a routine basis.

7. Duplicate Injections and Post-spikes- All injections are made in duplicate. Duplicate injections must have a %RSD of less than 20%. For every sample, a post spike is also performed, by spiking the sample with a spiking solution whose concentration is in the mid range of the calibration curve. Spike recovery must be +/-15%. If this recovery is not achieved, the sample is diluted and rerun. If the recovery is still not achieved, the sample is analyzed by the method of standard additions.

8. Calculations- Each instrument calculates and reports results in ug/liter. Soil sample results are manually calculated, using the original ample weight, % moisture and any applicable dilution.

C. Mercury Analysis

Mercury Analysis is performed using a Perkin Elmer 460 AA with a Varian VGA-76 Flameless Vapor Generation Accessory. Analysis follow EPA Methods 7470 and 7471.

1.Calibration
The instrument is calibrated before every run with four standards and a blank. To be acceptable, calibration curves must have a calculated calibration coefficient of at least 0.995. The instrument is recalibrated whenever it is stopped, or a continuing calibration verification does not pass the specified criterion.

Initial Calibration Verification- Immediately after calibration, the calibration is verified using an Initial Calibration Verification Standard (ICV) containing the element of interest,which has been formulated from a source separate from that used for constructing the standard curve. All values must be within +/-20% of the curve for analysis to continue.

Continuing Calibration Verification- At a frequency of 10% or every 2 hours, whichever is more frequent, a Continuing Calibration Verification Standard (CCV) is analyzed. All values must meet +/-20% criteria. If a CCV fails, all samples analyzed since the previous passing CCV must be reanalyzed.

Calibration Blank-A calibration blank is analyzed immediately after the analysis of each ICV and CCV. The concentration must be <0.2 ppb or the calibration must be repeated.

2.Blanks- A preparation blank is initiated with the digestion of every batch of samples prepared. If the concentration in the blank exceeds 0.2 ppb, samples must be redigested and reanalyzed.

3. Quality Control Check Samples - A Quality Control Check Sample formulated from EPA ampules or a separate source is analyzed after every initial calibration verification, as a further check on the calibration. The recoveries must fall within 80-120%.

4. Matrix Spike- A matrix spike is analyzed with every batch of 20 samples of the same matrix. The recovery must be within 75-125%, unless the sample concentration exceeds the spike concentration by a factor of four or more.

5. Duplicate -A duplicate is analyzed with every set of 20 samples of the same matrix. For contract work, duplicates limits are calculated according to contract specifications. For non-contract work, control limits are calculated from repetitive analyses. Different control limits are used for different analytical ranges.

6. Calculations The AA prints out sample concentrations in ug/l. A strip chart report is also generated. Soil sample results are calculated manually.

INSTRUMENT DETECTION LIMITS
(IDLS)

Effective 10.1.90
All Values in PPB

	ICP 1	ICP 2	GRAPHITE FURNACE 4000	5100
Silver Ag	11	5		
Aluminum Al	96	39		
Barrium Ba	2	1		
Beryllium Be	1	1		
Calcium Ca	17	7		
Cadmium Cd	5	2		
Cobalt Co	16	5		
Chromium Cr	9	4		
Copper Cu	10	5		
Iron Fe	39	15		
Potassium K	NA	600		
Magnesium Mg	9	44		
Manganese Mn	2	1		
Sodium Na	134	64		
Nickel Ni	19	8		
Arsenic As	115	73		1.0
Vanadium V	9	15		
Lead Pb	90	33	1.0	1.1
Zinc Zn	11	7		
Boron B	6	NA		
Antimony Sb			3.4	4.6
Selenium Se			1.0	1.0
Thallium Ti			1.0	1.8

TABLE IX-1

GALSON TECHNICAL SERVICES, INC.
Effective 6 December 1990
Revision 2

NON-CLP METALS
RELIABLE QUANTITATION LIMITS

ELEMENT	INSTRUMENT	RELIABLE QUANTITATION LIMIT (MG/L)
Aluminum (Al)	ICP 1+2	0.07
Antimony (Sb)	F 1+	0.0005
Arsenic (As)	ICP 1	1.0
"	ICP 2	0.2
"	F 1+2	0.005
Barium (Ba)	ICP 1+2	0.01
Beryllium (Be)	ICP 1+2	0.002
Bismuth (Bi)	ICP 1	0.25
Boron (B)	ICP 1	0.01
Cadmium (Cd)	ICP 1+2	0.005
Calcium (Ca)	ICP 1+2	0.02
Cerium (Ce)	ICP 1	0.05
Chromium (Cr)	ICP 1+2	0.01
Cobalt (Co)	ICP 1+2	0.03
Copper (Cu)	ICP 1+2	0.02
Europium (Eu)	ICP 1	0.006
Gallium (Ga)	ICP 1	0.7
Gold (Au)	ICP 1	0.1
Hafnium (Hf)	ICP 1	0.02
Indium (In)	ICP 1	0.07
Iron (Fe)	ICP 1+2	0.002
Lanthanum (La)	NA	NA
Lead (Pb)	ICP 1+2	0.09
"	F 1+2	0.005
Lithium (Li)	ICP 1	0.1
Magnesium (Mg)	ICP 1+2	0.03
Manganese (Mn)	ICP 1+2	0.007
Mercury (Hg)	FAA	0.0002
Molybdenum (Mo)	ICP 1	0.02
Nickel (Ni)	ICP 1+2	0.03
Palladium (Pd)	ICP 1	0.06
Phosphorus (P)	ICP 1	0.03
Platium (Pt)	ICP 1	0.02
Potassium (K)	ICP 2	0.06
Rhodium (Rh)	ICP 1	0.05
Selenium (Se)	F 1+2	0.005
Silicon (Si)	ICP 1	0.05

NON-CLP METAL
RELIABLE QUANTITATION LIMITS (cont'd)

ELEMENT	INSTRUMENT	RELIABLE QUANTITATION LIMIT (MG/L)
Silver (Ag)	ICP 1+2	0.03
Sodium (Na)	ICP 1+2	0.5
Strontium (Sr)	ICP 1	0.001
Tantalum (Ta)	ICP 1	0.2
Tellurium (Te)	ICP 1	0.3
Thallium (Tl)	F 1+2	0.005
Thorium (Th)	ICP 1	0.3
Tin (Sn)	ICP 1	0.2
Titanium (Ti)	ICP 1	0.008
Tungsten (W)	ICP 1	0.2
Uranium (U)	ICP 1	0.5
Vanadium (V)	ICP 1	0.01
Yttrium (Y)	ICP 1	0.005
Zinc (Zn)	ICP 1+2	0.02
Zirconium (Zr)	ICP 1	0.01

X. STAFF QUALIFICATIONS, TRAINING AND RESPONSIBILITIES

Galson Laboratories employs qualified staff and requires training, either short courses or formal in-house training, and demonstration of proficiency before an analyst is permitted to analyze client samples.

1. Qualification Figure X-1 lists the minimum educational/experiences requirements for laboratory positions.

2. Staff Responsibilities Figure X-2 is the laboratory organization chart.

3. Laboratory Director/Associate Laboratory Directors The Laboratory Directors are responsible for laboratory operations. The Laboratory Directors carry out administrative functions and oversee quality assurance activities within the laboratory.

4. Quality Control Coordinator The Quality Control Coordinator oversees all QA/QC activities. These activities include, but are not limited to:

   a. Evaluation of data quality.
   b. Maintenance of records, such as control charts, calibration records, standard inventory, etc.
   c. Coordination and/or performance of quality control investigations.
   d. Development and implementation of quality control progams, including statistical procedures and techniques.
   e. Writing and updating of QA/QC manuals and SOPs.
   f. Performance of system quality audits.

5. Group Leader The group leader is directly responsible for data analysis and reporting.

   Duties include:

   a. Scheduling of analyses.
   b. Supervision of analysts.
   c. Review of laboratory work and test reports.
   d. Tabulation of QC data.
   e. Performance review of analysts.
   f. Sample analysis.
   g. Telephoning clients.

6. Analysts

   a Sample analysis.
   b. Analysis of QC samples on a schedule determined by QC Coordinator and Group Leader.
   c. Entering of QC data into laboratory notebooks.

7. Sign-in/Sample Custodian

Responsible for sample receipt and custody:

a. Receives and logs in samples onto computer system and handwritten sign-in sheet.
b. Labels each sample with a unique number.
c. Notifies Client Services Manager and Group Leader if samples are unsuitable for analysis.
d. Notifies Group Leader if samples for rush analysis are received.
e. Maintains custody of sample from receipt to disposal.

8. Training for Laboratory Staff

Galsons training objective is to provide sufficient opportunity for each analyst to develop to the level of knowledge and skill required for the analysis performed. Several methods of training are available to achieve the knowledge and skill required.

A. In house training.
- Analysts are required to read the Galson laboratories Standard Operating Procedure (SOP) for the method, which supplements the detailed methods found in the EPA Method Manuals, Standard Methods for the Analysis of Water and Wastewater and the CLP and NYS DEC ASP.
- Analysts must observe an experienced analyst perform the different tasks in the analytical process.
- Analysts must study the published method and the Galson Laboratories SOP for the method and use it as a guide for performing the required procedures.
- Analysts perform the procedures under the direct supervision of an experienced analyst.
- Analysts must demonstrate proficiency by obtaining correct qualitative and quantitative results in the analysis of samples of known composition.
- Analysts then perform procedures independently with a high level of quality assurance checks.

B. Short Course Training
- Where courses are available, analysts attend short courses in the operations and applications of the analytical insturments used in the analyses they perform.

C. Demonstration of Proficiency
- Initial Demonstration of Proficiency
  Before being allowed to analyze client samples, a new analyst must demonstrate proficiency by correctly analyzing spiked samples of known composition and concentration.

- Continuing Demonstration of Proficiency
  Reanalysis of samples and analysis of Interlaboratory QC rounds are used to assure that analysts maintain their proficiency while performing routine sample analysis.

- Professional Development
  Galson Technical Services encourages professional development of the Industrial Analytical Staff by underwriting participation in Professional activities on both the local and national levels.

- Training Certificate
  At the completion of the training program, the analyst is awarded a training certificate which is placed into the analysts personnel file (Figure X-3).

MINIMUM EDUCATIONAL/EXPERIENCE REQUIREMENTS FOR LABORATORY POSITIONS

CHEMISTRY

Laboratory Assistant	H.S. Diploma or Equivalent No experience
Technician I	H.S. Diploma or Equivalent 3 months experience
Technician II	H.S. +2 A.A. +1 B.S.
Technician III	H.S. +4 A.A. +2 B.S. +1 M.S.
Senior Technician I	H.S. +6 A.A. +4 B.S. +2 M.S. +1
Seniro Technician II	H.S. +9 A.A. +6 B.S. +4 M.S. +2
Scientist I	A.A. +10 B.S. +8 M.S. +4 PhD
Scientist II	A.A. +15 B.S. +10 M.S. +6 PhD +3

1. B.A. is considered as an A.A. degree plus 2 years experience.

2. B.S. must be discipline-related, i.e. Biology/Engineering or other physical science field.

3. Experience worked as part time will be tabulated hourly and divided by 2080.

GALSON TECHNICAL SERVICES, INC.
Effective 6-December-1990
Revision 2

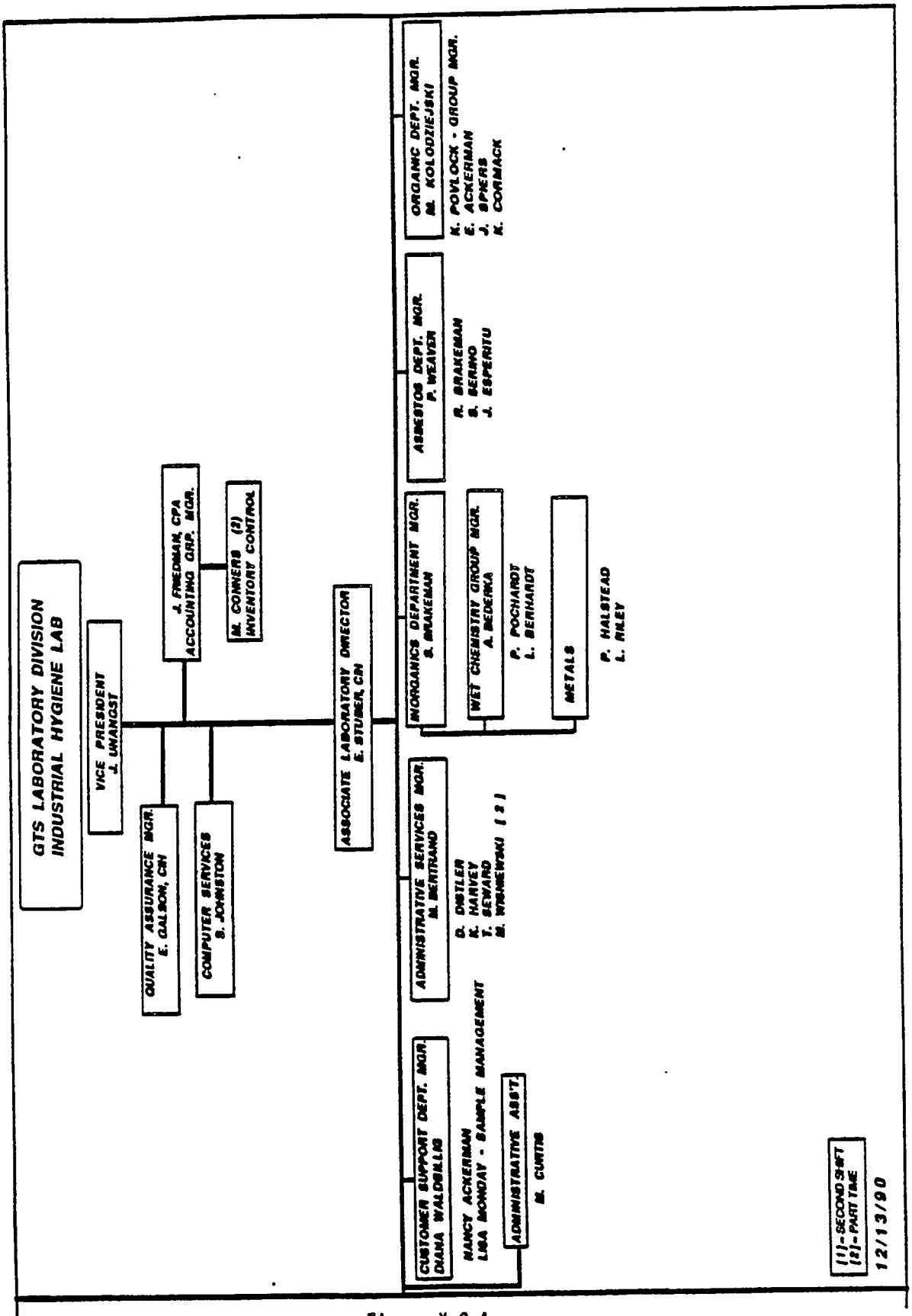
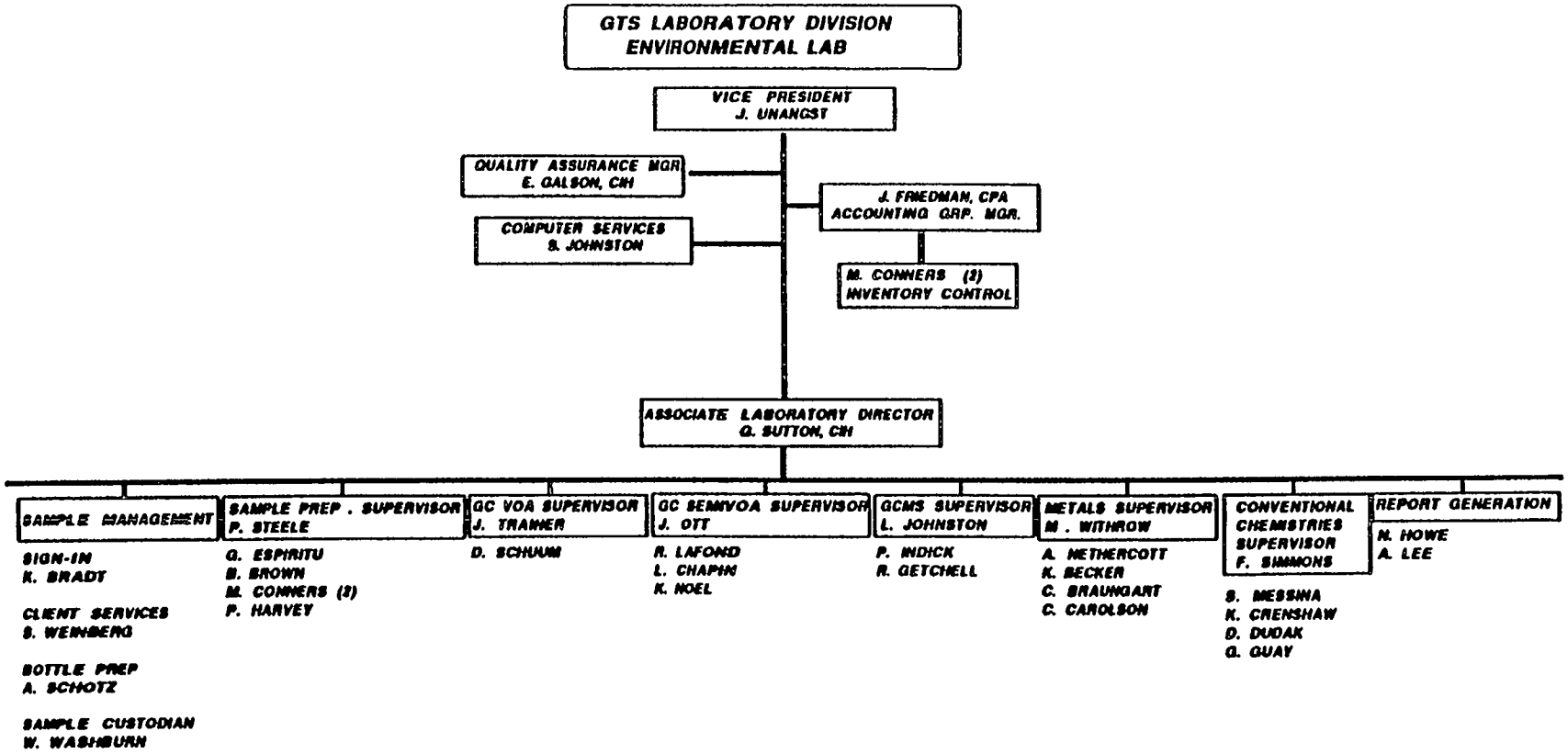

GTS LABORATORY DIVISION
INDUSTRIAL HYGIENE LAB
VICE PRESIDENT
J. UWANGST
QUALITY ASSURANCE MGR.
E. GALBON, CIH
COMPUTER SERVICES
S. JOHNSTON
J. FRIEDMAN, CPA
ACCOUNTING GRP. MGR.
M. CONNERS (I)
INVENTORY CONTROL
ASSOCIATE LABORATORY DIRECTOR
E. STUBER, CIH
CUSTOMER SUPPORT DEPT. MGR.
DIANA WALDRILLS
NANCY ACKERMAN
LISA MONDAY - SAMPLE MANAGEMENT
ADMINISTRATIVE ASST.
M. CURTIS
ADMINISTRATIVE SERVICES MGR.
M. BERTRAND
D. DIETLER
K. HARVEY
T. SEWARD
M. WRANKOWSKI (2)
INORGANICS DEPARTMENT MGR.
S. BRAKEMAN
WET CHEMISTRY GROUP MGR.
A. BEDERKA
P. POCHARDT
L. BERHARDT
METALS
P. HALSTEAD
L. RILEY
ASBESTOS DEPT. MGR.
P. WEAVER
R. BRAKEMAN
S. BERMO
J. ESPERITU
ORGANIC DEPT. MGR.
M. KOLODZIEJSKI
K. POVLOCK - GROUP MGR.
E. ACKERMAN
J. SPIERS
K. CORMACK
(1)-SECOND SHIFT
(2)-PART TIME
12/13/90

Figure X-2-A



(1) - SECOND SHIFT
(2) - PART TIME

12/13/90

Figure X-2-B

This is to certify that

_____

has successfully completed
Galson Laboratories Training Certification Program in

_____

1. Full comprehension of referenced method _____
2. Full comprehension of method's S.O.P. _____
3. Observation of method execution by qualified trainer _____
4. Performance of entire method under direct supervision _____
5. Successful completion of Initial Demonstration of Proficiency _____

_____
Quality Control Officer Date

_____
Laboratory Director Date

FIGURE X-3

XI. INTERLABORATORY QUALITY CONTROL AND PERFORMANCE AND SYSTEM AUDITS

1. Performance Audits Performance check standard are analyzed on the gas chromatographs to determine column and system performance. A mixture of compounds is injected which evaluates the resolution of closely eluting compounds, and tendency of the column to degrade or absorb labile compounds. Response factors must not vary by more than 15% from previous analysis.

Quarterly interelement correction standards are run on the Inductively Coupled Plasma Spectrometer to track changes in element interferences.

For other analysis, the calibration procedures of instruments that give a linear response is usedk to track changes in performance. Data produced during audits are retained in the laboratory for historical purposes.

2. System Audits Internal system audits are conducted on a quarterly basis by the Laboratory QC Coordinator. The audit documents whether written procedures are being followed:

The system audits are conducted to evaluate the following:

A. Sample Handling Procedures
B. Calibration Procedures
C. Analytical Procedures
D. QC Results
E. Safety Procedures
F. Recordkeeping Procedures
G. Timeliness of Analysis and Reporting

3. Outside Audits and Certifications

A. The laboratory participates in the following interlaboratory QC rounds:

a. New York State Department of Health Environmental Laboratory Approval Program (ELAP) - Semiannual samples for water, wastewater solid and hazardous waste air and emissions and asbestos.
b. New Jersey Department of Environmental Protection - Semiannual analysis of wastwater samples. EPA Performance evaluation samples are used.
c. California Department of Health Services - Annual analysis of wastewater samples.
d. EPA - Annual source emission samples for NOx and SO2.
e. American Industrial Hygiene Association - Quarterly air samples for metals, organics, silica and asbestos.
f. NIST National Voluntary Laboratory Accrediation Program (NVLAP) - Semiannual samples for bulk asbestos.

B. The laboratory is certified/accredited/approved by the following organizational programs:

a. *NYS Department of Health ELAP Program.
b. *NYS Department of Environmental Conservation "Technically Accepted" list.
c. *NJ Department of Environmental Protection (pending).
d. California Department of Health Services.
e. *California Air Resources Board.
Vermont Health Department.
Commonwealth of Massachusetts (formaldehyde).
f. *American Industrial Hygiene Association.

In addition to requiring the approval of qualifications and the analysis of QC check samples, the starred (*) organizations perform on-site audits on a periodic basis.

CLOSED LOOP CORRECTIVE ACTION REPORT - QA/QC

ORIGINATOR SIGNATURE	DATE	CLCAR NUMBER	DEPARTMENT	AREA
INDIVIDUAL(S) CONTACTED			AUDIT NUMBER	DATE

COMPLETED BY ORIGINATOR

REQUIREMENTS

FINDING

RECOMMENDED CORRECTIVE ACTION

SCHEDULED RESPONSE DATE	RESPONSIBLE FOR CORRECTIVE ACTION

COMPLETED BY PERSON RESPONSIBLE FOR CORRECTIVE ACTION

CORRECTIVE ACTION

DATE	SUBMITTED BY	MANAGEMENT APPROVAL

COMPLETED BY QUALITY ASSURANCE MANAGER

DATE RESPONSE RECEIVED	RESPONSE ACCEPTABLE YES NO

REASON FOR REJECTION

CLCAR VERIFICATION

DATE VERIFIED	SIGNATURE	DOCUMENT USED FOR CLOSEOUT	CLOSED DATE

FIGURE XII-1

XII CORRECTIVE ACTION

Galson Laboratories uses the immediate closed loop corrective action system. This method can be applied equally to non-conforming data, malfunctioning equipment, discovery of contamination or client complaints. The following actions are taken, as appropriate to remedy an out-of-control situation.

1. Define Problem.
2. Investigate and determine cause of problem.
3. Determine corrective action to eliminate problem.
4. Implement corrective action.
5. Verify corrective action has eliminated problem.
6. Fill out closed loop corrective action form. (See Figure XII-1).
7. Implement procedures to eliminate problem in the future.

Appendix Q:

Internal Documents

Appendix Q:

Internal Documents

This appendix consists of an annotated list of AFP 59 (GE) internal or internally filed documents relating to site environmental concerns. The list is followed by a bibliography of the sources commented upon.

Q.1 Annotated Listing

Simpson 1949–1952

Pumpage figures, logs of test wells, resistivity profiles, water sample analyses, and well hydrographs are provided for wells in the Johnson City area.

Ziarno 1961

Pumpage totals are provided for the Triple Cities area, which includes Johnson City, for the years 1955–1957.

Randall 1966

A preliminary opinion is offered as to the potential for additional wells in Johnson City.

Tomic 1966–1969

Inquiries are made into the hydrology of the Susquehanna River Basin in the Johnson City area and information provided to facilitate judgment in this regard.

Wright 1967

Johnson City is asked to provide information to the Delaware River Basin Commission on surface and ground water withdrawal and return flows for planning purposes. A filled-out return questionnaire is attached.

GE 1977

A two-page survey form lists usage of chemicals of concern.

Randall 1978

The appearance, composition, and origins of certain Susquehanna Valley pebbles and gravels are discussed in terms of the glaciers and streams that transported them.

Gilligan 1979

Gilligan Haulers and off-site disposal facilities for AFP 59 hazardous wastes are identified for corporate planners.

GE 1979–1984

Off-site waste disposal facilities and lists of wastes make up the disposal file.

Kessler 1980

A request is made to fill out two survey forms: (1) 1980 Industrial Wastewater Survey (2) Industrial Chemical Survey. The completed forms are attached to the correspondence.

GE 1980/1983

A RCRA Hazardous Waste Permit Application (Part A) is submitted to the U.S. EPA. It initially includes waste treatment, but this aspect is eliminated in the reapplication.

Goldstein et al. 1981

Maps and data sheets show the nature and location of hazardous waste disposal sites near AFP 59.

Donnalley 1981

GE corporate headquarters instructs AFP 59 management to address all potential problems with PCBs, especially spills.

1981–1988

Annual waste generator/waste transporter (or generator) reports for the New York State Department of Environmental Conservation are on file for all years but 1985.

GE 1982a

Application is made for a permit for AFP 59 to discharge to the Little Choconut Creek via Outfalls Nos. 001 and 002 under the state pollutant discharge elimination system (SPDES).

GE 1982b

A RCRA Hazardous Waste Facility Permit (Part B), concerning waste storage, is submitted to the U.S. EPA.

Regna 1982

The U.S. Environmental Protection Agency considers the RCRA Part B facility permit application on behalf of the Johnson City General Electric plant to be inadequate. Specifics are provided.

GE 1982–1990

At the beginning of the period, AFP 59 had 24 transformers and 162 capacitors on record, and these contained 36,339 kg of "Pyranol" fluids (consisting mainly of PCBs); in addition, there was an inventory of 272 kg of "Pyranol." Starting in 1986, but mainly in 1988, the PCB-containing fluid was disposed of and the transformers properly disposed of or retrofilled with non-PCB fluids. However, several additional transformers and large capacitors were discovered at the plant in 1990–1991; presumably, these PCB-containing units were also retrofilled or safely discarded.

USGS 1983

On this page (taken from a lengthy report), the maximum known stages and discharges are given locations, including the Little Choconut Creek and a nearby Susquehanna River station.

Coburn 1983

A permit valid until September 15, 1988, is granted for the General Electric Co. AFP 59 to discharge via Outfalls Nos. 001 and 002 to the Little Choconut Creek under the state pollutant discharge elimination system (SPDES).

Gilligan 1983

A packet providing information needed for the Air Force Environmental Assessment Program is transmitted with a cover letter. Included in this packet are an Environmental Compliance Data checklist and a slide presentation of the work plan under which JRB Associates will operate; forms listing hazardous wastes;certificates to operate air contamination sources; authorizations to discharge; effluent limitations and monitoring requirements; discharge monitoring reports; hazardous waste manifests; evaluation reports on emission sources; annual hazardous waste reports; compliance status reports; PCB inventory summaries; electrical power, gas, steam, and water summaries; disposal and treatment costs; and spill prevention plans.

JRB Associates 1984

Processes conducted at AFP 59 are listed in conjunction with a layout of the plant. Waste generation and management for the period described are summarized in Table 3.1 of the report. Waste recovery options are presented.

Gilligan 1984a

Trichloroethylene is revealed as the major identified component of a drum of unknown contents that was found in a storage area during the 1983 RCRA inspection.

Gilligan 1984b

The General Electric Company's failure to file a hazardous waste Treatment, Storage or Disposal Facility (TSDF) annual report for AFP 59 in 1983 is explained. The reason is that General Electric withdrew its RCRA permit application in 1983.

Gilligan 1984c

SCA Chemical Services, Inc., will not accept plating wastes for incineration because of the heavy metals they contain.

Gilligan 1984d

Alternatives to land disposal of three classes of AFP 59 hazardous wastes (flammable liquids, cyanide-bearing waste plating solutions, and spent plating bath solutions) are discussed in terms of technical feasibility, immediate costs, and possible future liabilities. The flammable wastes can be blended at a disposal contractor's facility for use as a fuel source in cement works. Cyanide can be eliminated from wastes by high-pH chlorination. Spent plating solutions can be disposed of by incineration, but only at high cost, so that maintenance of current land-disposal practices for such wastes is recommended.

Regna 1984

A U.S. EPA inspection under the Solid Waste Disposal Act reveals violations of 40 CFR 265.16(d) and 40 CFR 265.51.

Moleski 1984

A list is presented of degreasing solvents and where they are used.

GE 1984

A completed 16-page survey form provides a profile of manufacturing processes at AFP 59 that would involve generation of hazardous wastes.

Binghamton-Johnson City Joint Sewage Board

Rules and regulations governing use of the Binghamton-Johnson City Sewage Treatment Plant set uniform requirements for discharges into public sewers served by the Binghamton-Johnson City wastewater collection and treatment system.

Salankiewicz 1984

A list is provided of the components of a 55-gal drum of mixed laboratory waste being shipped for disposal.

CH2M Hill 1984

The records search at AFP 59 is a Phase I investigation of a four-phase Installation Restoration program. It consists of a detailed review of pertinent installation records that include a week-long installation visit. Special attention is paid to waste generation and disposal practices and to two hazardous waste spill sites, namely the underground waste oil storage tanks and the drum storage area.

Valente 1984

New York DEC comments on the CH2M Hill records search report and provides a preliminary hazard ranking score.

Wright-Patterson 1984

Results of the CH2M Hill Phase I records search are announced, though without great specificity.

GE 1984–1985

Off-site shipments from AFP 59 to Waste Conversion, Inc., Hatfield, PA, are documented for the State of Pennsylvania.

Sims 1984–1986

Correspondence with N.H. Nosenchuck concerns the Installation Restoration Program, a preliminary Hazard Ranking System score of 34.38 that was calculated for AFP 59, and related matters.

GE 1984–1989

Hazardous waste shipping manifests have been compiled for a 6-yr period.

Sunday Press 1985

A local newspaper quotes the Air Force to the effect that there is no immediate threat to public health from groundwater contamination originating at AFP 59. Nonetheless, a limited monitoring program is recommended.

O'Brien & Gere 1985

Analyses are reported for Johnson City and AFP 59 well waters, AFP 59 outfalls, and AFP 59-related Choconut Creek sediments in 1985.

Friend Laboratory 1985

PCBs were not detected (<10 ppm) in an AFP 59 hydraulic oil mix.

Lupe 1985

The presence of chromium in AFP 59 water samples indicates the desirability of analyzing water from Johnson City wells for all chemicals used at the plant.

Earth Technology 1985

Plans are discussed for minimizing the consumption of chlorinated solvents and for using less hazardous chlorinated solvents.

Gilligan 1985

A list is presented of potentially risky gases and other chemicals (presumably used at AFP 59, although the location is not mentioned in the document). Trichloroethene is not to be used after September 1985. Use of Freon TMS is also to be discontinued, with the surplus sold back to the supplier. Inventories of "Chlorothane VG" (1,1,1-trichloroethane) are to be reduced, by taking just-in-time delivery.

Schneider 1985a

Accomplished cost-cutting steps at AFP 59 are summarized. These help to reduce possible liabilities and minimize generation of hazardous waste. Among the most important measures are recovery of chlorinated solvents by distillation, elimination of the use of trichloroethene (TCE), and ion-exchange treatment of plating rinse water.

Schneider 1985b

As required by the U.S. EPA, this letter transmits information on all known PCB transformers and capacitors at AFP 59 to the local fire department.

Walka 1985

The U.S. Environmental Protection Agency again requests information related to potential hazardous waste releases. A reply is attached.

Hugus 1985

Recent efforts to minimize hazardous waste production at AFP 59 and to insure proper disposal are described. The Aerospace Control Systems Department's situation is assessed as one of "minimal risk."

GE 1985

AFP 59 uses about 450,000 gallons per day (gpd) of municipal water out of a total water use of 775,000 gpd (cooling, 600,000; process, 100,000; sanitary, 75,000). Only four monthly totals are given, for this year, ranging from 4.8 million to 10.5 million cubic feet. Ten percent of the water is recycled. The facility has 2,200 employees.

GE 1985/1988

New York State RCRA inspection forms provide data on waste generation and transporters.

NYS DEC 1985/1989

This correspondence removes AFP 59 from the status of permitted hazardous waste treatment, storage, or disposal facility, in apparent accordance with the wishes of the General Electric Company.

GE 1985–1991

This packet contains information on the chemical structure, properties, grades, uses, and history of PCBs, as well as correspondence on the removal of PCB items from AFP 59.

Fred C. Hart 1985a, 1985b, 1988

The contractor has planned and conducted a contaminant source investigation at AFP 59 to determine the presence, extent, and magnitude of contamination in specified areas and the environmental consequences and health risks these results implied.

Lucey 1986

Analysis of various waste streams at AFP 59 indicates that untreated effluents meet applicable contaminant limitations, except for copper. It is recommended that a 4,000-gal equalization tank be introduced; this would mix the high-copper streams with those containing less of that metal and even-out the peak copper concentrations.

Nirchi 1986

Effluent from AFP 59 is in compliance with the state pollutant discharge elimination system (SPDES) permit.

Goddard 1986

New York DEC comments on the Fred C. Hart IRP draft Statement of Work and its Technical Operations Plan and indicates the desirability of certain modifications.

Randall 1986

The distribution and hydraulic properties of aquifers of the Susquehanna River Valley in the vicinity of AFP 59, and patterns of ground-water recharge and withdrawal, are described. On the basis of this information, a model simulating horizontal water flow in two layers is designed, calibrated, and applied.

Lichtenberger 1986a

This letter, with its attached "Hazardous Waste Storage Facilities Closure Plan," is the instrument for voluntary withdrawal of AFP 59 from interim status as a [hazardous waste] treatment, storage, and disposal facility.

Lichtenberger 1986b

U.S. EPA is informed of a relatively small spill of ethylene glycol into the AFP 59 storm sewer system.

Hill 1986

Chrome contamination in soil under the plating area is revealed.

Lichtenberger 1986c

Plans are being made to investigate occurrence of chrome in soil at a recently discovered spill site.

Mitchell 1986

Measures have been taken to minimize the use of chlorinated solvents, especially of chlorinated solvent-containing wastes, to switch to less toxic solvents, and to minimize worker exposure. Efforts in this direction must continue.

Schneider 1986

Waste transporters, waste treatment facilities to which wastes are shipped, and quantities of hazardous waste shipped in 1986 are listed.

Various laboratories 1986–1991

The following volatile organic compounds have been found in groundwater or surface water associated with AFP 59 at levels at or above 5 ppb: 1,1-dichloroethane, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, 1,1,1-trichloroethane, and trichloroethene.

Schneider 1987

An NPDES discharge monitoring report for the month of March 1987 is sent to state regulators. Among the heavy metals, only chromium, lead, and nickel are reported.

Anonymous, circa 1987–1988

This "Attachment A" provides a lengthy critique of the adequacy of the December 1985 Fred C. Hart *Installation Restoration Program Phase II Presurvey Report for U.S. Air Force Plant No. 59, Johnson City, New York.*

GE 1987–1990a

Much of the correspondence between General Electric Co. (GE) and the Joint Sewage Board concerns the quantity and laboratory analyses of sewage discharges to the Treatment Plant. The record also reflects a decision by the Board in February 1988 to deny GE permission to tie in the discharge of its scaled-down plating room rinse water to the sanitary sewer system; this decision is apparently reversed a year later, with a startup date scheduled for March 1, 1989.

GE 1987–1990b

Forms required under SARA Title III, Section 312 (Emergency and Hazardous Chemical Inventory, Tiers I and II) and Section 313 (Toxic Chemical Release Inventory Reporting), are provided, along with ancillary information and correspondence.

Jorling 1988

New York DEC notifies AFP 59 of its inclusion in the state's Registry of Inactive Hazardous Waste Disposal Sites.

Earth Technology 1988

This report describes AFP 59 facilities and programs related to environmental protection, emphasizing waste minimization and maintenance procedures.

GE 1988a

General Electric files a rather undetailed U.S. Environmental Protection Agency form regarding efforts at waste minimization.

GE 1988b

General Electric Co. files for a National Pollutant Discharge Elimination System (NPDES) permit for Outfalls Nos. 001 and 002 of AFP 59.

Press & Sun-Bulletin 1988

Air Force officials say recent tests at AFP 59 indicate that groundwater and soil pollution pose no immediate health or environmental hazard. Nevertheless, a pollution problem exists and a new round of tests will be conducted to determine the extent and area of contamination.

Schneider 1988

Alternatives to the use of 1,1,1-trichloroethane (TCA) are presented, along with their impacts. Each has disadvantages.

Luftig 1988

A formal request for information about GE use of the Endicott Landfill, which is not far from AFP 59, elicits a notarized negative reply.

Kohlhaas 1988

This memorandum recalls static eliminators containing polonium-210, as required by the Nuclear Regulatory Commission, because the devices leak radioactivity.

EA Engineering 1988

A work plan is presented for the technical approach to the Phase II Stage 2 Remedial Investigation/Feasibility Study for AFP 59 under the Air Force's Installation Restoration Program. This work plan summarizes much of the work done previously.

Gilligan 1989

Comments concerning EA Engineering's statement of work and their safety and health plan are listed. The criticisms are not severe.

Leonhart 1989

A geohydrology consultant requests additional information on underground storage tanks (USTs) at AFP 59 in connection with a forthcoming UST evaluation.

Borrow 1989a

Instructions from the New York State Department of Environmental Conservation advise General Electric Co. on the advertisement of its application for a five-year state pollutant discharge elimination system permit (SPDES).

Borrow 1989b

A permit until Dec. 1, 1994, is granted for the General Electric Co. AFP 59 to discharge via Outfalls Nos. 001, 002, and 003 to the Little Choconut Creek under the state pollutant discharge elimination system (SPDES).

Galloway 1989

A 30-day extension is granted, above the normal limit of 90 days for hazardous waste storage, to permit identification of contents of two drums of uncharacterized waste and transport of five other drums.

Minerley 1990a

The production of wastes, especially of chlorinated degreasing solvents, has markedly decreased between 1988 and 1989.

Minerley 1990b

Three outside consultants are to be solicited competitively. The chosen consultant will evaluate and/or prepare AFP 59's Binghamton water discharge permit applications for completeness and accuracy.

Connors 1990

A form is used to provide the Air Force with information for the 1990 inventory of federal hazardous waste activities: these concern general facility information; environmental monitoring, contamination, and response actions; RCRA facilities; and disposal of hazardous substances.

GE 1990

GE reports the quantities of described wastes (one waste substance or mixture per Form GM) produced in 1988 and 1989. 1,1,1-Trichloroethane-containing wastes are reported in significant quantities.

GE 1991a

AFP 59 groundwater is sampled at the request of the Johnson City Water Department and found to be well within safe drinking water standards. Further information is obtainable from the Public Affairs Officer at Wright-Patterson Air Force Base.

GE 1991b

Preventive maintenance guidance is provided for degreasers. It involves emptying, cleaning, and replacing the solvent at prescribed frequencies. Examples of records for this activity are appended.

Sviatyla 1991

A memorandum expresses dissatisfaction with the proposal by a contractor (ALLWASH) to remove a concrete pad in a PCB-contaminated courtyard.

Dube 1991

After emptying, flushing, and refilling with non-PCB fluids, three transformers that formerly contained PCBs are now certified to contain fluid with less than 50 ppm of PCBs.

Dutter 1991

A news release addresses the finding of 1,1,1-trichloroethane (TCA) in the Johnson City water supply at a level above the New York State standard. There is no immediate health hazard.

NYSDEC 1991

A list of Superfund target compounds and analytes is provided, by the State of New York, along with their contract-required quantitation limits.

Cleanup Study Task Force 1991

Six appendices to the New York State Cleanup Policy and Guidelines are presented. In these, the most important data are the cleanup criteria for air, water, and soil that might be subject to human ingestion.

Angevine 1991

MARCOR reports slant-drilling beneath the settling tank and the spent plating storage tank at AFP 59, soil sampling, and soil sample analysis. All analyses are considerably below TCLP regulatory levels.

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