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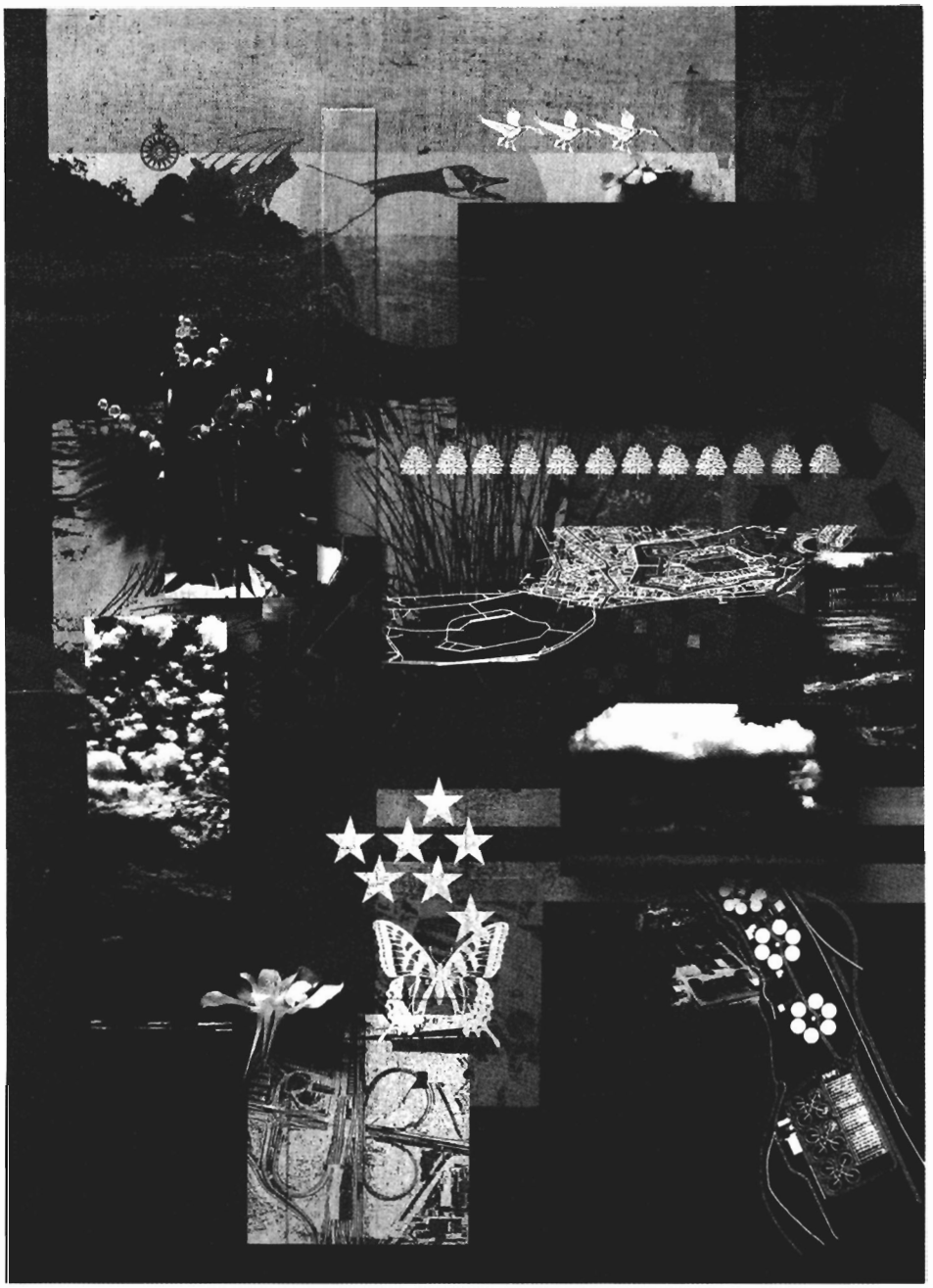

Quality through teamwork

DUREZ INLET REMEDIATION PROJECT

INLET MONITORING PLAN

Prepared for:

Occidental Chemical Corporation
360 Rainbow Boulevard S.
Niagara Falls, New York
14302

Prepared by:

Rust Environment & Infrastructure
12 Metro Park Road
Albany, New York 12205

October, 1995

RUST
Rust Environment & Infrastructure

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1.0 INTRODUCTION

This Inlet Monitoring Plan addresses the operation, maintenance and monitoring requirements for Occidental Chemical Corporation's (OCC) Durez Inlet Remediation Project Site (Inlet) located on the private property of Riverside Boat Shop & Marina, 560 River Road, North Tonawanda, New York. These requirements include the dense non-aqueous phase liquid (DNAPL) extraction program, the groundwater monitoring program, post-remediation site inspections and periodic reporting. The Inlet Monitoring Plan is consistent with Section 11.0 of the August 1993 Approved Inlet Remedial Plan (AIRP), except for minor modifications based on the DNAPL-related progress made during remedial activities. The AIRP is Appendix A of the Third Stipulation and Partial Consent Judgment (Third PCJ) filed with the United States District Court - Western District of New York on October 22, 1993.

Five DNAPL extraction wells (see Figure 1) were installed in the North Lobe area of the Site during the Inlet Remediation Project. Extraction well construction diagrams are provided in Appendix A. These extraction wells were pumped during remedial activities and successfully removed 850 gallons of free or mobile DNAPL from the pervious alluvium layer underlying the Site. Details of the extraction program were provided in the Inlet DNAPL Extraction Well Program Report, provided as Appendix D of the Inlet Final Engineering Report (Rust, 1995) as well as the Program Bimonthly Status Reports issued throughout the site remedial program.

After completion of the cutoff wall, seven groundwater monitoring wells were installed to monitor North Lobe post-remediation groundwater flow directions, gradients and quality. Monitoring well construction logs are provided in Appendix A. Six wells were screened in the lower alluvium at its interface with the underlying confining clay layer and are designated as intermediate (I) wells. One shallow (S) well, screened at the interface between the alluvium and overlying fill layer, was installed to evaluate the relationship between the water table and the top of the cutoff wall. The locations of the cutoff wall and the groundwater monitoring wells are shown on Figure 1. Details of cutoff wall installation and monitoring well installation and development are provided in the Inlet Final Report (Rust, 1995).

2.0 DNAPL/GROUNDWATER MONITORING PROGRAM

DNAPL and groundwater monitoring will be performed to verify the effectiveness of the remedy in the North Lobe, i.e. extraction of free or mobile DNAPL and isolation of the residuals. Specific objectives of the DNAPL/groundwater monitoring program for the North Lobe will be as follows:

- to identify, and remove as necessary, DNAPL in the extraction well sumps;
- to characterize groundwater flow directions and gradients in the vicinity of the North Lobe cutoff wall;
- to identify and document long-term changes in groundwater quality in the cutoff wall area; and

- to inspect groundwater samples collected from the lower alluvium monitoring wells for the presence of free DNAPL.

The monitoring will consist of measuring DNAPL levels, river stage and groundwater levels; collecting groundwater samples to visually inspect for DNAPL and conduct chemical analysis for Durez-type chemicals as listed in the "first" Durez "Stipulation and Partial Consent Judgment - Attachment B-1 - Protocols for Sampling and Analysis of groundwater"; and reporting the findings. DNAPL and groundwater level measurements will be made monthly, and groundwater samples collected and analyzed quarterly for one year following the installation of the monitoring wells and approval of this Plan. After one year, the measurement and sampling frequency will be reevaluated by OCC, and if judged appropriate, an alternative schedule will be proposed to the State. The first year monitoring frequency is summarized in Table 1 and the monitoring schedule is provided in Table 2. As appropriate, Inlet monitoring and sampling will be integrated with monitoring and sampling events underway at the Durez Plant.

DNAPL level monitoring will determine the extent to which DNAPL has migrated into the extraction well sumps. In accordance with Section 2.2 of this Plan, DNAPL will be removed if DNAPL levels reach the top of the sump. Since the North Lobe is located at an active, privately owned marina, DNAPL removal will be coordinated with off-season activities and performed during the six month period between October 15 and April 15 to minimize the potential for interference with the marina business.

DNAPL level, groundwater level, groundwater quality monitoring, and visual inspection of the Site will be used to evaluate the long-term integrity of the cutoff wall. If any observations lead to suspicion that the integrity of the cutoff wall may have been compromised, the possible need for use of additional monitoring techniques on the cutoff wall will be addressed in the next Monitoring Report.

2.1 NOTIFICATION OF GROUNDWATER SAMPLING AND DNAPL REMOVAL

Implementation of the Inlet Monitoring Plan will be coordinated by OCC's Engineer, Rust Environment & Infrastructure:

OCC'S ENGINEER
Durez Inlet Project Manager [Jerry Miller, as of 10/95]
Rust Environment & Infrastructure
495 Commerce Drive
Amherst, New York 14228
Telephone 716-691-3866

The following individuals will be notified by OCC's Engineer approximately 7 days prior to groundwater sampling and/or removal of DNAPL from the extraction wells:

OCC
Director - Remedial Operations [Gerald F. Schuur, as of 10/95]
Occidental Chemical Corporation
360 Rainbow Boulevard, South
Niagara Falls, New York 14302-0728
Telephone 716-286-3416

*OCC	Senior Environmental Engineer [Robert Simmington, as of 10/95] Occidental Chemical Corporation Buffalo Avenue & 47th Street Niagara Falls, New York 14302 Telephone 716-278-7545 *OCC Coordinator, responsible for arranging transportation and/or receiving Inlet DNAPL at the Niagara Storage Facility (NSF).
NYSDEC	Durez Project Engineer [Dan King, as of 10/95] New York State Department of Environmental Conservation Division of Solid and Hazardous Waste - Region 9 270 Michigan Avenue Buffalo, New York 14203-2999 Telephone 716-851-7220
NYSDOH	New York State Department of Health [Matt Forcucci, as of 10/95] 584 Delaware Avenue Buffalo, New York 14202 Telephone 716-847-4502
PROPERTY OWNER	Daniel H. Williams and Clarence C. Williams Riverside Boat and Marine Shop 560 River Road North Tonawanda, New York 14120 Telephone 716-674-7455

2.2 DNAPL MONITORING AND REMOVAL

Specific procedures for DNAPL monitoring, and criteria and procedures for DNAPL removal and disposal are described in the following sections.

2.2.1 DNAPL Level Monitoring and Removal Criteria

DNAPL levels will be measured in extraction wells with a Keck Model KIR-89 interface probe or equivalent, and recorded on a form similar to the Water Elevation/DNAPL Elevation form provided in Appendix C. DNAPL elevations will be compared to the elevations of both the top of the extraction well sump and till, and summarized on a form similar to the DNAPL Level Summary form in Appendix C. Table 3 summarizes extraction well sump depths and elevations.

Since the top of the sump is approximately one foot below the top of the till, DNAPL levels at or below the top of the sump would be indicative of an inward gradient toward the extraction well. Under these circumstances, any mobile DNAPL present would move into the stainless steel well sump. If the DNAPL rises above the top of an extraction well sump, DNAPL will be removed from the sump. This removal would take place between October 15 and April 15 to minimize interference with summertime marina activities. If the DNAPL elevation is below the top of an extraction well sump, no further action is required other than routine monitoring.

If, during the boating season, DNAPL levels rise above the top of till, the local geologic conditions, including the trough-like clay confining layer, combined with the remedial structures at the site, including the cutoff wall, would contain DNAPL until the next off-season DNAPL removal period. If the Engineer has reason to believe, due to observations made during any site visit or resulting from data evaluation, that the pumping frequency should be modified, the Engineer will propose such changes both by verbal communication through OCC to NYSDEC and in the next Monitoring Report.

2.2.2 DNAPL Removal Procedures

DNAPL removal activities at an individual extraction well will be conducted within a temporarily restricted access (roped off and labeled) area. Because the DNAPL extraction wells are located in a marina parking lot, extra caution will be used to prevent a spill during DNAPL removal and handling. The ground surface of the appropriate area will be covered with disposable polyethylene sheeting to prevent spillage from contacting the underlying soil. The polyethylene sheeting will overlie temporary berms placed at the perimeter of the work area and will extend into the flush mounted extraction well casements. This will help funnel spillage, if any, back into the extraction well. Absorbent towels and a shovel will be immediately available should a spill occur which requires clean-up. Materials used for spill prevention, containment, clean-up and/or personal protection, i.e. personal protective equipment (PPE), will be placed in an appropriately lined and labeled, USDOT approved container upon completion of DNAPL removal.

DNAPL will be removed from the extraction well sump utilizing flexible tubing with a check valve system or with a hand vacuum pump system. Removal will be conducted in such a manner as to minimize the volume of water removed. DNAPL will be pumped directly from the extraction well into an appropriately lined and labeled USDOT approved container. Pumping will continue until water is observed in the discharge tubing. The DNAPL level will then be measured in the well to confirm removal of the DNAPL from the sump. The volume of DNAPL recovered and fluid level measurements will be recorded.

Upon completion of DNAPL removal, the discharge tubing will be pulled from the extraction well. To minimize the potential for exposure to chemicals adhering to the discharge tubing, the discharge tubing will be cut into short lengths and placed directly into an appropriately lined and labeled USDOT approved container as it is pulled from the extraction well.

2.2.3 Transport of DNAPL to the Niagara Storage Facility

All DNAPL and associated materials generated during DNAPL removal will be transported to the Niagara Storage Facility (NSF). The OCC Coordinator will be contacted by OCC's Engineer 7 days prior to DNAPL removal to establish a date and time for transport of the DNAPL containers and associated materials to the NSF. Transportation arrangements will be coordinated so that DNAPL is transported to the NSF on the same day as DNAPL removal is performed so that the containers are not left unattended at the Inlet area.

Pursuant to the Third PCJ, Section 27(d) State Transportation and Generator fees shall not be applicable; however all DNAPL transported from the Inlet shall include a standard NYSDEC Hazardous Waste Manifest (EPA Form 8700-22). The transporter, either OCC or a contractor,

shall comply with applicable provisions of 6 NYCRR 372 "Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities" in accordance with 6 NYCRR 364 "Waste Transporter Permits". Each manifest shall incorporate the following information in the specified sections:

Section	Information Required
1.	Generator's USEPA No. - NYD 986 885 440
3.	Generator's Name and Mailing Address - Occidental Chemical Durez Division, 673 Walck Road, North Tonawanda, New York 14120
4.	Generator's Phone - (716) 696-6066
9.	Designated Facility Name and Site Address - Occidental Chemical Corporation, Buffalo Avenue & 47th Street, Niagara Falls, New York 14302
10.	Designated Disposal Facility USEPA ID Number - NYD 000 824 482
11a.	USDOT Description - Hazardous Waste Liquid, NOS, 9, NA3082, III (U019, U037, U070, U071, U072) U019 - benzene U037 - chlorobenzene U070 - 1,2-dichlorobenzene U071 - 1,3-dichlorobenzene U072 - 1,4-dichlorobenzene
12.	Container Type - DM (metal drum, barrel or keg)
15.	Special Handling Instructions and Additional Information - "Material is Dense Non-Aqueous Phase Liquid (DNAPL) comprised primarily of the U code constituents shown in 11a above. This waste is generated and/or transported in accordance with a court ordered remedial plan and is exempt from fee and/or assessments." Telephone number of Emergency Contact: 278-7795, Main Gate Guard at the Niagara Storage Facility (NSF) at Occidental Chemical Corporation's Niagara Falls Plant.
B.	Generator's ID - "Same"
J.	DNAPL (U019, U037, U070, U071, U072)
K.	Handling Codes - B

(Note: The information in this section shall be verified and confirmed at the time of shipment to incorporate regulatory changes and provide additional information, as necessary, for other materials to be disposed of such as PPE and materials used for spill prevention, containment, and clean-up.)

2.3 GROUNDWATER MONITORING

Specific procedures for groundwater monitoring are described in the following sections.

2.3.1 Groundwater Flow Direction and Gradients

Groundwater flow directions and gradients will be identified by measuring water levels in the newly constructed wells and at the river staff gauge as shown on Figure 1 and according to the schedule included on Table 2. Well construction details are provided for reference in Table 4. The water levels will be measured with the KIR-89 interface probe used for DNAPL level measurement and recorded on the Water Elevation/DNAPL Elevation form shown in Appendix C. The first round of water levels from the intermediate wells will be tabulated, plotted and contoured and evaluated by a hydrogeologist. Water levels from the shallow well will be compared with the top of the sheet pile wall elevation to evaluate overflow. The contour map and evaluation results will be provided annually in one Monitoring Report as long as monitoring of the Site is required.

2.3.2 Groundwater Quality

Long-term changes in groundwater quality will be documented by collecting and analyzing groundwater samples collected from four intermediate monitoring wells, one located upgradient (MW-16I) and three located downgradient (MW-18I, MW-19I and MW-20I) of the cutoff wall. These wells are identified on Figure 1. The sampling schedule is presented in Table 2. The samples will be analyzed for the following Inlet Site-specific compounds:

- benzene,
- toluene,
- monochlorobenzene,
- dichlorobenzenes, and
- trichlorobenzenes.

Well purging and sample collection data and chain-of-custody information will be recorded on forms similar to the examples provided in Appendix C. Sampling and analytical protocols and detection limits are set forth in the original PCJ Appendix B-1, a copy of which is included herein as Appendix B. Note that Appendix B includes an analytical protocol for total phenols, total organic carbon content, pH, conductivity and temperature; however, analyses for these parameters will not be performed on the samples collected from the Inlet.

Groundwater samples will also be visually inspected for the presence of DNAPL. Any observations of free DNAPL or globules in water samples from wells that did not previously contain DNAPL will be reported in an Incident Report to the State within 21 days of confirmation by OCC.

2.4 WELL INSPECTION AND MAINTENANCE

Monitoring wells will be inspected during each monitoring activity and repaired or modified as appropriate. Inspection will include annually measuring the total depth of the wells, documenting

visual characteristics of water samples, observing physical condition of the wells, and documenting water level recovery during sampling events.

3.0 OTHER INSPECTIONS

The general condition of the remediated Inlet will be assessed by visual inspection at the time of groundwater sampling. The inspection will include:

- the shoreline, river bank and aquatic areas (for evidence of erosion or problems with vegetation reestablishment);
- any exposed portions of the Cove cap (for evidence of erosion or disturbance);
- the submerged portion of the Cove cap (for indirect evidence of disturbance, e.g., cloudy water, submerged objects, or areas of disturbance leading in or out of the Inlet); and
- the North Lobe (for evidence of activity or penetrations that could compromise the effectiveness of the cutoff wall).

Results of the inspections, including a summary of recommended maintenance activities, if any, will be included in the routine Monitoring Reports. Sample copies of the inspection forms are included in Appendix C.

The viability of the aquatic vegetation in the Cove will be evaluated each year near the end of the growing season (October), for a period of five years or until the vegetation is firmly established, whichever is less. Areas with vegetation die-off, if any, will be reevaluated and recommendations made regarding the type of vegetation appropriate for the location and the need for replanting.

4.0 DOCUMENTATION

The following information will be recorded, as appropriate, during implementation of Inlet Monitoring Plan site inspections and follow up activities:

- Date and time of arrival and departure,
- Weather conditions,
- Personnel performing work,
- Brief description of work proposed for the day,
- Location where work is performed,
- All fluid level measurements, DNAPL and water, in the extraction wells,
- Volume of DNAPL and water removed from each extraction well,
- All pertinent information regarding the transportation of waste and DNAPL off the Site,
- Problems and corrective actions taken, and
- Site visitors (and their affiliations).

5.0 REPORTING

The results of monitoring, physical inspection and maintenance activities will be summarized in quarterly Monitoring Reports for the first year of operation. These reports will be distributed to the individuals listed in Section 2.1 (except the Property Owner). After one year, OCC will evaluate the need for continued quarterly reporting and, if appropriate, may propose to the State that the reporting frequency be modified. The Monitoring Reports will summarize DNAPL recovery data, groundwater monitoring data, and inspection and maintenance activities, and will include an evaluation of remediation performance. Recommendations for changes to the program, if any, will be made.

A copy of each Monitoring Report will be distributed to each party listed in the Third PCJ - Appendix C - List of Designated Representatives.

6.0 MODIFICATION

This Inlet Monitoring Plan may be modified upon the written consent of OCC and the State. A Minor Change Form to be used for this purpose is included in Appendix D.

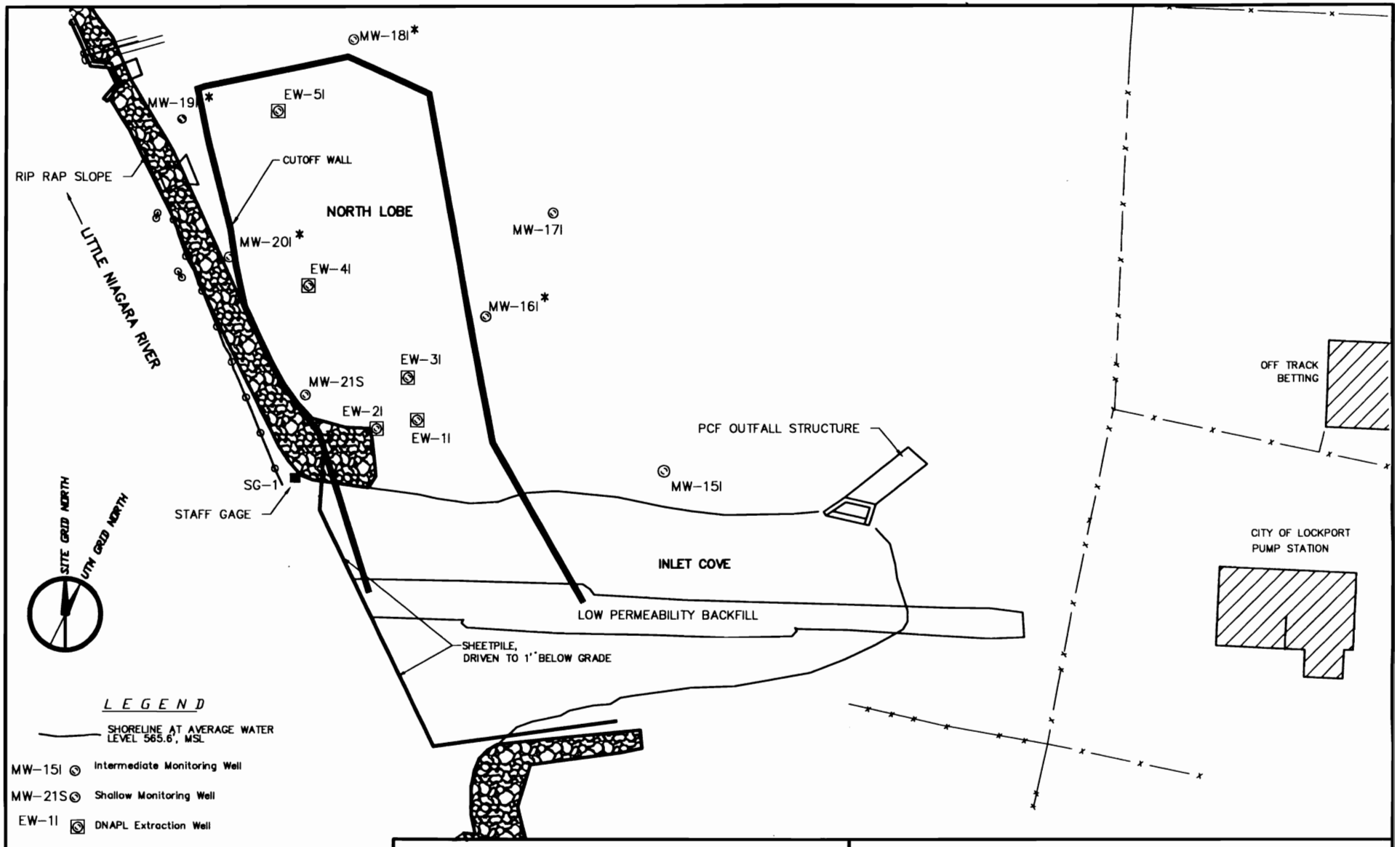
7.0 HEALTH AND SAFETY

All activities associated with the Inlet Monitoring Plan will be conducted in accordance with the Inlet Remediation Project Health and Safety Plan, dated September 24, 1993, as amended.

8.0 INSTITUTIONAL CONTROLS

Institutional controls were instituted in an easement agreement with the Property Owner to minimize the potential for damage to permanent remedial structures at the site. These controls were addressed in the AIRP. Any violation of terms of the easement agreement by the Property Owner affecting the integrity of the institutional controls as described in the AIRP will be: a) addressed with the Property Owner by OCC both verbally and in writing, b) reported to NYSDEC for appropriate action against the Property Owner under all applicable laws and regulations and c) reported in the next Monitoring Report.

FIGURES



RUST ENVIRONMENT & INFRASTRUCTURE

LOCATION OF DNAPL EXTRACTION WELLS AND MONITORING WELLS

OCCIDENTAL CHEMICAL CORP.
NORTH TONAWANDA, N.Y.

PROJECT No. 35630.540	DATE 10/11/95	DWG. No. 5630FIG1	SCALE 1"=60'	FIGURE No. 1

TABLES

TABLE 1
First Year Monitoring Frequency
Inlet Monitoring Plan

	Activity	Frequency
DNAPL/Groundwater Monitoring Program		
1	DNAPL level measurement at five extraction wells	monthly
2	Groundwater level measurement at five extraction wells and seven monitoring wells	monthly
3	Extraction and monitoring well inspection	monthly
4	DNAPL removal	as necessary if the DNAPL level rises above the top of the extraction well sump
5	Groundwater sampling of four monitoring wells (MW-16I, MW-18I, MW-19I and MW-20I), analysis for Durez-type compounds and visual inspection for the presence of DNAPL	quarterly
Other Inspections		
1	Inspection of shoreline, river bank and aquatic areas	in spring of first year following restoration; vegetation will be inspected and based on survival rates, will be replanted as necessary. Inspections will continue annually at end of growing season for five years or until vegetation is established, whichever is less.
2	Inspection of cove cap	quarterly
3	Inspection of North Lobe area for evidence of activities that could impact the cutoff wall	quarterly
Reporting		
1	Submit Monitoring Report	quarterly for routine Monitoring Reports; within 21 days of discovery for Incident Reports for DNAPL spills or DNAPL in monitoring wells
2	Submit Minor Change Form	as necessary; if change of Inlet Monitoring Plan is required

Note: After one year following completion of remedial construction activities, OCC will reevaluate frequency and duration and if appropriate, propose alternative schedule to State for approval.

TABLE 2
First Year DNAPL/Groundwater Monitoring Schedule
Inlet Monitoring Plan

Site Owner	Riverside Boat Shop & Marina 560 River Road North Tonawanda, New York 14120 Att: Dan or Bill Williams Tel: (716) 674-7455 or 628-3816
Engineering Coordinator	Rust Environment & Infrastructure 495 Commerce Drive Amherst, New York 14228 Att: John Berry Tel: (716) 691-3866
Confirmation	Engineering Coordinator to call Owner at least one week in advance to confirm each site visit.

Proposed First Year DNAPL/Groundwater Monitoring Schedule

May 26, 1995 -	Monthly DNAPL/groundwater level monitoring (complete)
Jun. 27, 1995 -	Monthly DNAPL/groundwater level monitoring (complete)
July 27, 1995 -	Monthly DNAPL/groundwater level monitoring and quarterly groundwater sampling (complete)
Aug. 24, 1995 -	Monthly DNAPL/groundwater level monitoring (complete)
Sep. 22, 1995 -	Monthly DNAPL/groundwater level monitoring (complete)
Oct. 19, 1995 -	Monthly DNAPL/groundwater level monitoring, quarterly groundwater sampling and DNAPL extraction (complete)
Nov. 15, 1995 -	Monthly DNAPL/groundwater level monitoring
Dec. 13, 1995 -	Monthly DNAPL/groundwater level monitoring
Jan. 17, 1996 -	Monthly DNAPL/groundwater level monitoring, quarterly groundwater sampling and DNAPL extraction, if necessary.
Feb. 14, 1996 -	Monthly DNAPL/groundwater level monitoring
Mar. 13, 1996 -	Monthly DNAPL/groundwater level monitoring
Apr. 10, 1996 -	Monthly DNAPL/groundwater level monitoring, quarterly groundwater sampling and DNAPL extraction, if necessary.
Occidental Contact	Occidental Chemical Corporation P.O. Box 728 Niagara Falls, New York 14302-0728 Att: J. Coveney Tel: (716) 286-3474

TABLE 3

Extraction Well Sump Depths and Elevations

OCC Inlet Remediation Project
North Tonawanda, New York

Extraction Well	Rim of Road Box Elevation (ft amsl)	Measuring Point Elevation (ft amsl)	Depth of Meas. Point below Grnd. Surface (ft)		Top of Till (ft)	Top of Sump (ft)	Bottom of Sump (ft)
EW-1	572.73	572.13	0.60	depth	32.0	33.50	35.10
				elevation	540.1	538.63	537.03
EW-2	572.42	572.12	0.30	depth	32.7	33.45	35.05
				elevation	539.4	538.67	537.07
EW-3	573.00	572.62	0.38	depth	33.1	33.90	35.50
				elevation	539.5	538.72	537.12
EW-4	573.31	572.94	0.29	depth	33.5	34.28	35.88
				elevation	539.5	538.66	537.06
EW-5	573.58	573.28	0.30	depth	33.3	33.55	35.15
				elevation	540.0	539.73	538.13

Note:

All depths are reported in feet below the measuring point, defined as the top of the casing.

All elevations are reported in feet above mean sea level (ft. amsl).

TABLE 4

Monitoring Well Construction Depths and Elevations

OCC Inlet Remediation Project
North Tonawanda, NY

Monitoring Well	Ground Elevation when Drilled (ft amsl)	Rim of Road Box Elevation (ft amsl)	Measuring Point Elevation (ft amsl)	Stickdown(-) (ft)		Bottom of Boring	Bottom of Sand Pack	Bottom of 5' Screen (10 slot)	Top of Till or GLC	Top of 5' Screen (10 slot)	Top of Sand Pack	Top of Bentonite Seal
MW-15I	569.0	570.34	570.05	0.29	depth	23.0	22.7	22.7	21.0	17.7	16.3	13.8
					elevation	547.0	547.3	547.3	549.0	552.3	553.7	556.2
MW-16I	574.0	573.82	573.53	0.29	depth	32.5	32.5	32.5	30.7	27.5	25.9	22.5
					elevation	541.0	541.0	541.0	542.8	546.0	547.6	551.0
MW-17I	575.8	574.98	574.61	0.37	depth	28.6	28.6	28.6	26.3	23.6	21.8	18.8
					elevation	546.0	546.0	546.0	548.3	551.0	552.8	555.8
MW-18I	573.6	574.06	573.66	0.40	depth	35.0	34.9	34.9	33.5	29.9	27.0	24.0
					elevation	538.6	538.7	538.7	540.1	543.7	546.6	549.6
MW-19I	572.6	572.98	572.54	0.44	depth	35.4	35.4	35.4	33.4	30.4	27.7	23.3
					elevation	537.1	537.1	537.1	539.1	542.1	544.8	549.2
MW-20I	572.1	572.86	572.58	0.28	depth	34.5	34.5	34.5	32.5	29.5	28.0	25.8
					elevation	538.1	538.1	538.1	540.1	543.1	544.6	546.8
MW-21S	572.0	572.49	572.2	0.29	depth	10.2	10.2	10.2	See note	5.2	3.2	1.2
					elevation	562.0	562.0	562.0	4	567.0	569.0	571.0

Note:

1. All depths are reported in feet below the measuring point, defined as the top of casing.
2. All elevations are reported in feet above mean sea level (amsl).
3. GLC = Glacio-Lacustrine Clay
4. MW-21S screen straddles the Fill/Upper Alluvium interface.

APPENDIX A

EXTRACTION AND MONITORING WELL CONSTRUCTION LOGS

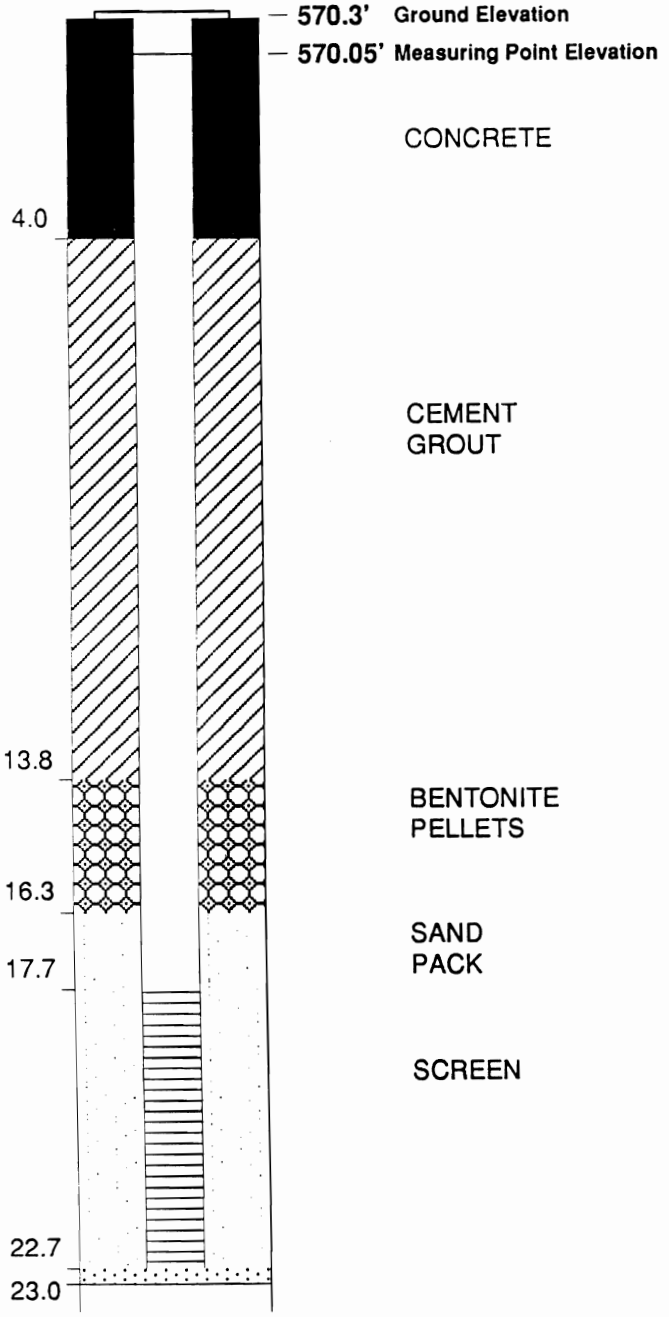
MONITORING WELL LOG

WELL NO. MW-15I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/23/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 22.7'
Total Depth of Boring 23.0'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *18.0 - 22.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 17.70'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 22.7-16.3'

Seal(s)
Type Bentonite Pellets Interval 16.3-13.8'
Type Cement Grout Interval 13.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 569.0'

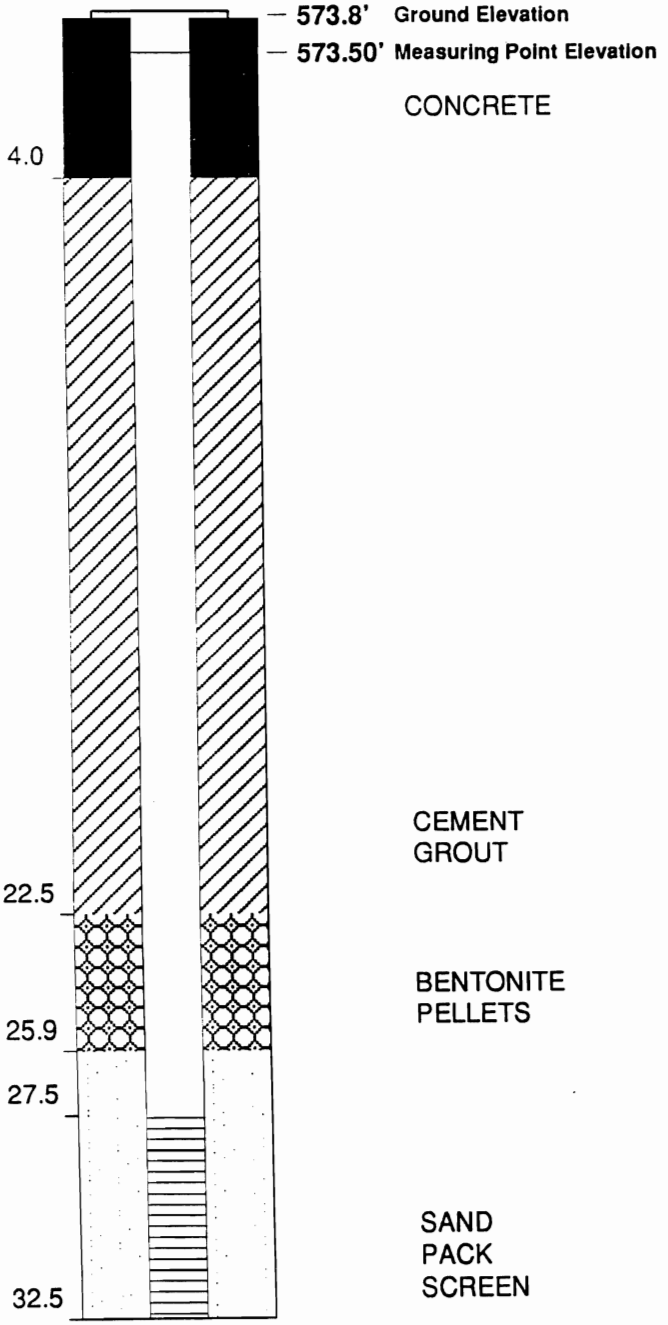
MONITORING WELL LOG

WELL NO. MW-16I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 32.5'
Total Depth of Boring 32.5'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *30.0 - 32.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 27.5'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/GLC

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 32.5-25.9'

Seal(s)
Type Bentonite Pellets Interval 25.9-22.5'
Type Cement Grout Interval 22.5-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 574.0'
GLC: Glacio-Lacustrine Clay

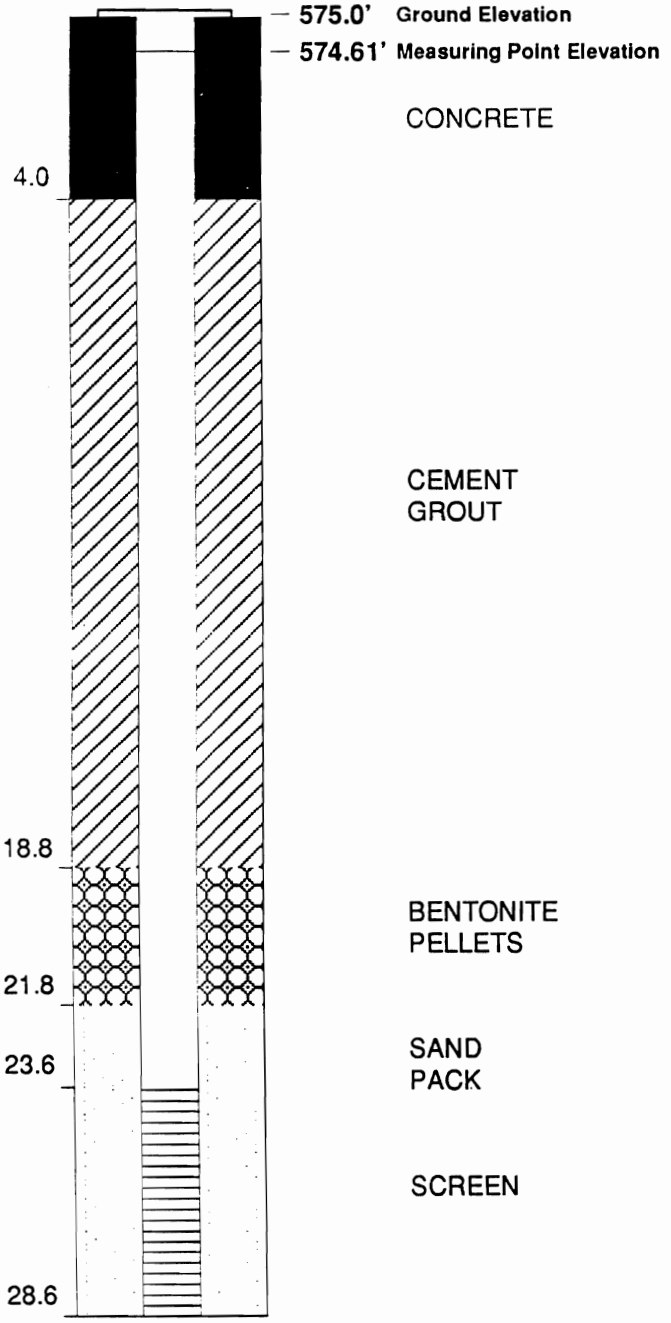
MONITORING WELL LOG

WELL NO. MW-17I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 28.6'
Total Depth of Boring 28.6'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *24.0-28.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 23.60'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/GLC

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 28.6-21.8'

Seal(s)
Type Bentonite Pellets Interval 21.8-18.8'
Type Cement Grout Interval 18.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 575.8'
GLC: Clacio-Lacustrine Clay

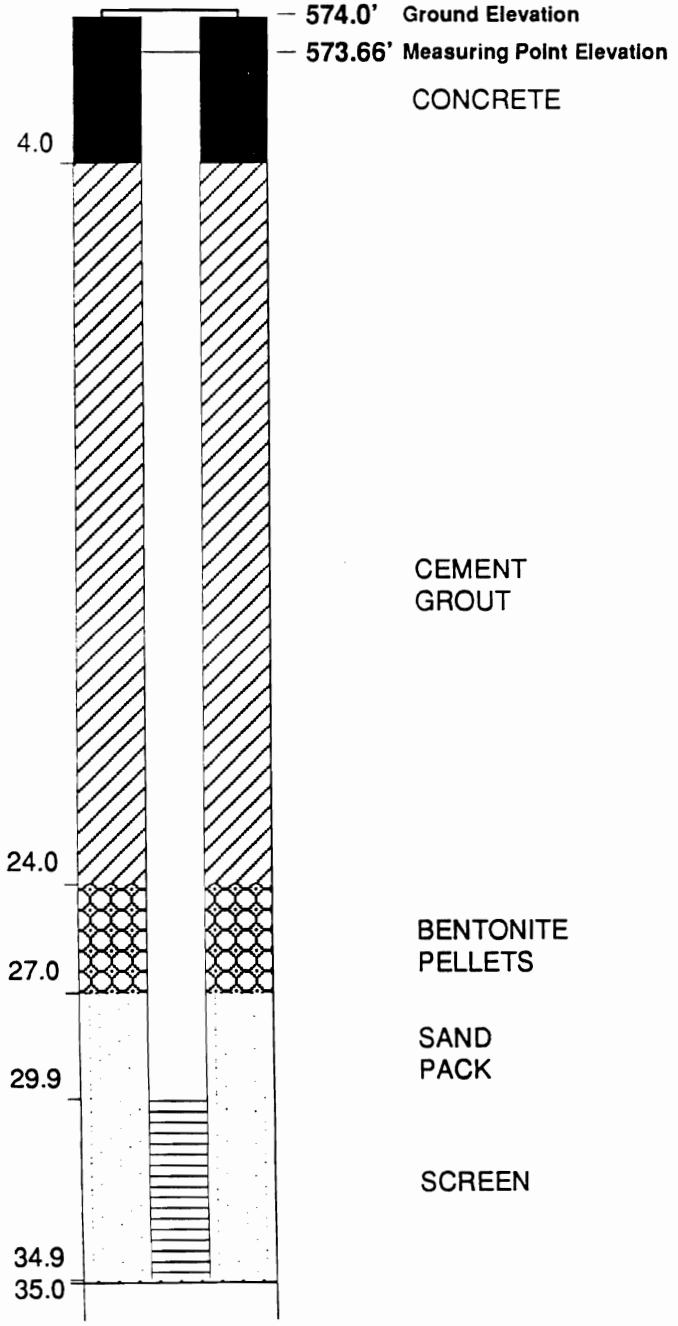
MONITORING WELL LOG

WELL NO. MW-18I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/20/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 34.9'
Total Depth of Boring 35.0'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30""
Interval *19.5-34.0

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 17.70'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 34.9-27.0'

Seal(s)
Type Bentonite Pellets Interval 27.0-24.0'
Type Cement Grout Interval 24.0-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 573.6'

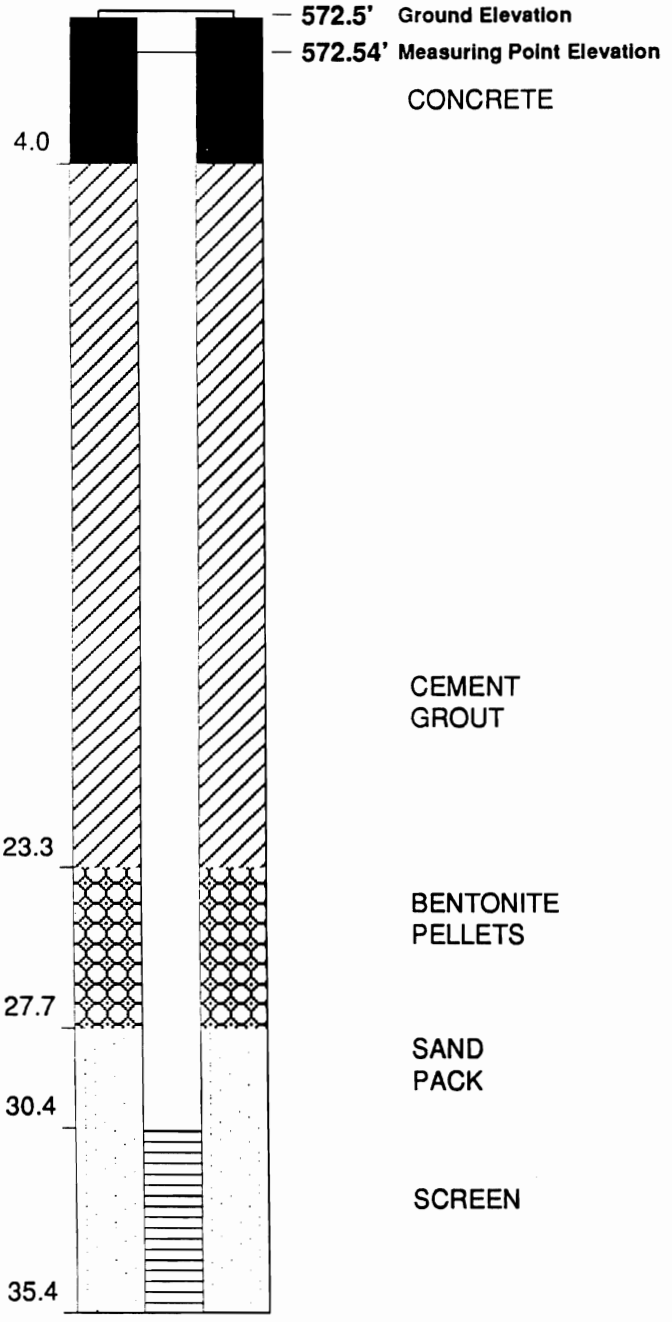
MONITORING WELL LOG

WELL NO. MW-19I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/20/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 35.4'
Total Depth of Boring 35.4'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *29.5-35.5 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 30.4'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 35.4-27.7'

Seal(s)
Type Bentonite Pellets Interval 27.7-23.3'
Type Cement Grout Interval 23.3-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 572.6

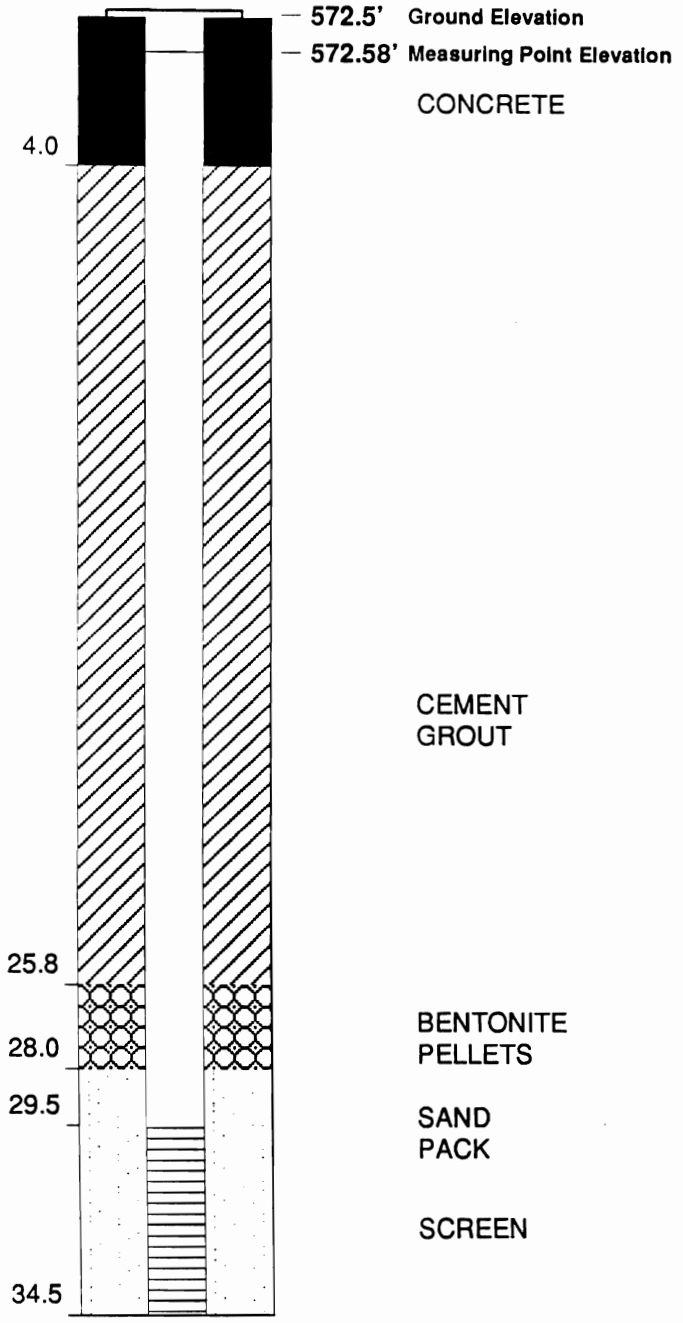
MONITORING WELL LOG

WELL NO. MW-20I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 34.5'
Total Depth of Boring 34.5'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *30.0-34.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 29.5'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 34.5-28.0'

Seal(s)
Type Bentonite Pellets Interval 28.0-25.8'
Type Cement Grout Interval 25.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 572.1'

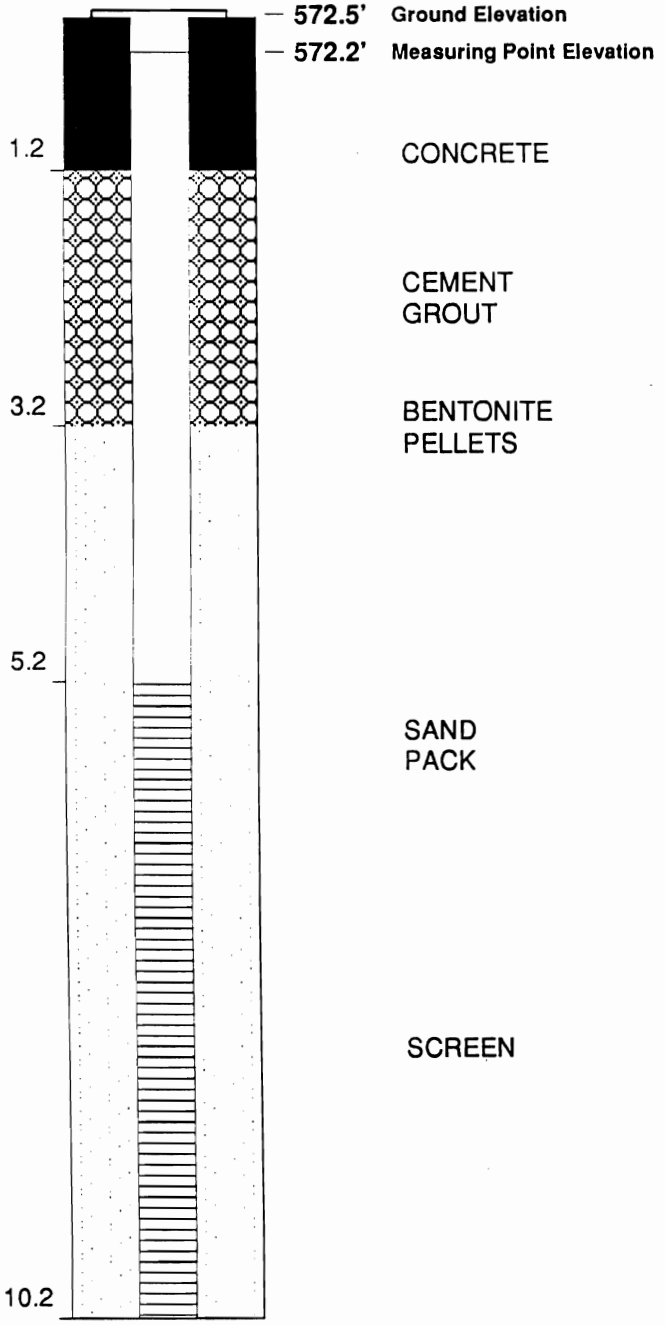
MONITORING WELL LOG

WELL NO. MW-21S

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/23/95 to
Date Developed 4/27/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 10.2'
Total Depth of Boring 10.2'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *6.0-10.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 5.2'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Upper Alluvium/Fill

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 10.2-5.2'

Seal(s)
Type Bentonite Pellets Interval 3.2-1.2'
Type _____ Interval _____
Type 3000 psi Concrete Interval 1.2 - 0.0'
Locking Casing YES

Notes: *Ground elevation when drilled = 572.0'

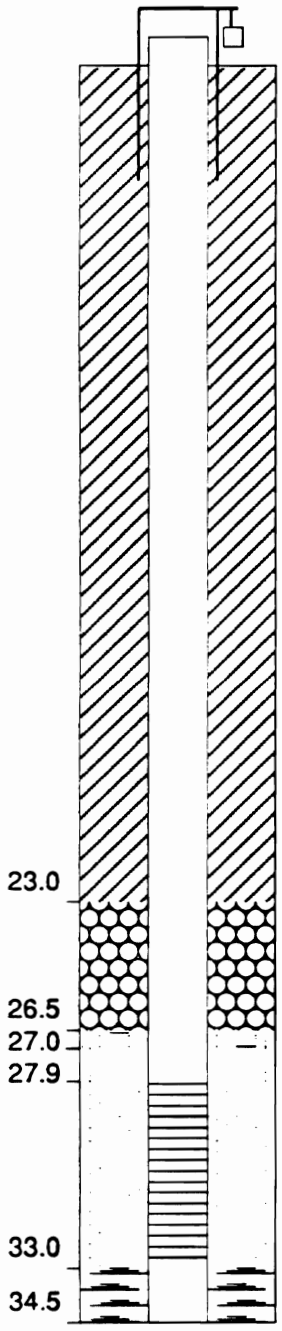
MONITORING WELL LOG

WELL NO. EW-1

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/14/93
Date Developed:

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services
Type of Well: 6" SS Extraction Well
Static Water Level Elev.: Date:
Static Water Level Depth (from M.P.):
Measuring Point (M.P.):
Total Depth of Well: 34.5'
Total Depth of Boring: 34.5'
Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA
Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.0-33.0
Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'
Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium
Filter Pack
Sand: X Gravel: Natural:
Grade: Morie #3 (#0)
Amount: 460 lbs Interval: 27-33'
Seal(s)
Type: Bentonite Pellets Interval: 23-26.5'
Type: Cement/Bent. Grout Interval: 0-23'
Type: Interval:
Type: Interval:
Type: Interval:
Locking Casing: Yes
Notes:

Tracking Code: 1569A, DECWE, 05/26/94

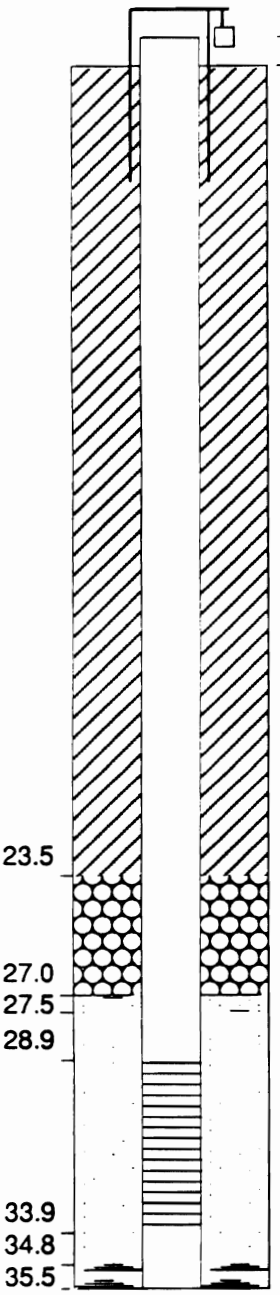
MONITORING WELL LOG

WELL NO. EW-2

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/10/93-12/13/93
Date Developed:

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services
Type of Well: 6" SS Extraction Well
Static Water Level Elev.: Date:
Static Water Level Depth (from M.P.):
Measuring Point (M.P.):
Total Depth of Well: 35.5'
Total Depth of Boring: 35.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.5'-33.5'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: Natural:
Grade: Morie #3 (#0)
Amount: 450 lbs Interval: 27.5-34.8'

Seal(s)
Type: Bentonite Pellets Interval: 23.5-27'
Type: Cement/Bent. Grout Interval: 0.0-23.5'
Type: Interval:
Type: Interval:
Type: Interval:

Locking Casing: Yes

Notes: Total length of screen and riser 37.31'

Tracking Code: 1560A, DECWE, 05/26/94

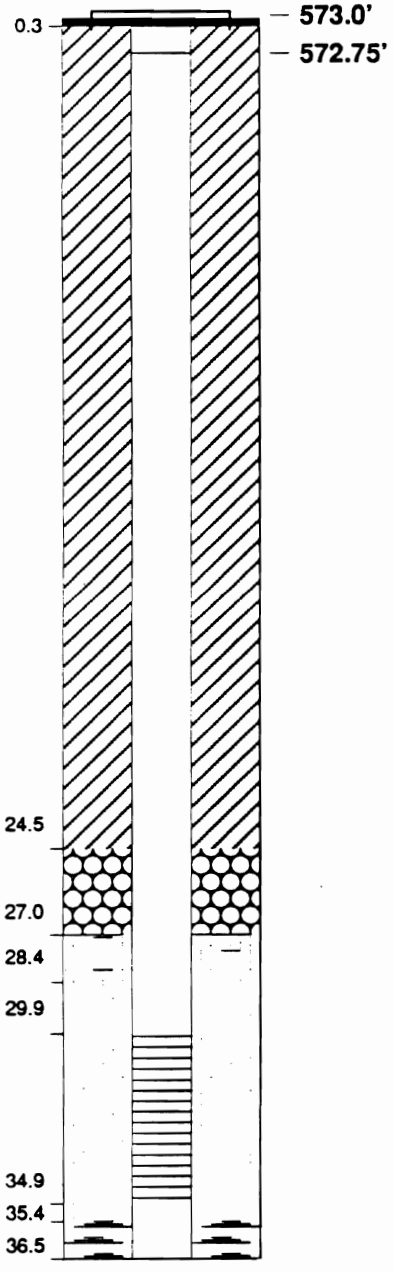
MONITORING WELL LOG

WELL NO. EW-3

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/15/93 to 12/16/93
Date Developed:

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services

Type of Well: 6" SS Extraction Well
Static Water Level Elev.: ____ Date: ____
Measuring Point (M.P.): ____
Total Depth of Well: 36.5
Total Depth of Boring: 36.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.5-35.5'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: ____ Natural: ____
Grade: Morie #3 (#0)
Amount: 405 lbs Interval: 27.5-35.4'

Seal(s)
Type: Bentonite Pellets Interval: 24.5-27'
Type: Cement/Bent. Grout Interval: 0.0-24.5'
Type: ____ Interval: ____
Locking Casing: No

Notes: Well was completed within a flush mounted road box.

Tracking Code: 1569A, DECFLUSH, 05/26/94

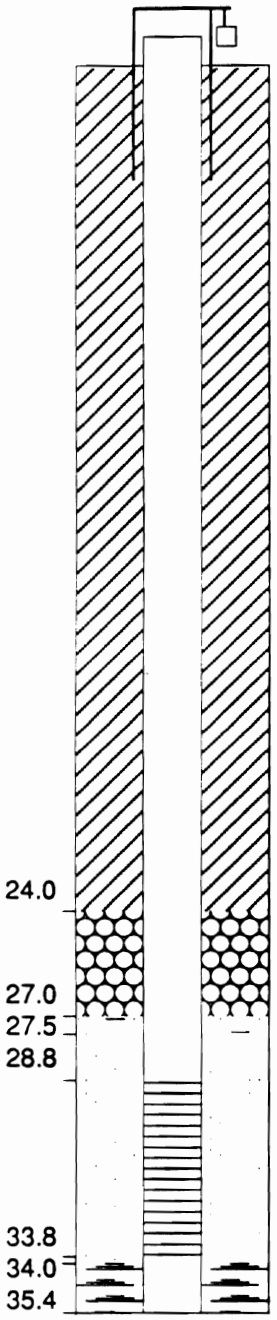
MONITORING WELL LOG

WELL NO. EW-4

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project Inlet Remediation
Client Occidental Chemical Corporation
Location N. Tonawanda, NY
Project No. 35630.540
Date Drilled 12/8/93-12/9/93
Date Developed

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. Jones
Drilling Contractor SJB Services
Type of Well 6" SS Extraction Well
Static Water Level Elev. _____ Date _____
Static Water Level Depth (from M.P.) _____
Measuring Point (M.P.) _____
Total Depth of Well 35.4'
Total Depth of Boring 36.0'
Drilling Method
Type Hollow Stem Auger Diameter 10 1/4" ID
Casing HSA
Sampling Method
Type SS Diameter 2" OD
Weight 140# Fall 30"
Interval 30.0-36.0'
Riser Pipe Left in Place
Material 304 Stain. Steel Diameter 6" ID
Joint Type Thread Length 30'
Screen
Material 304 Stain. Steel Diameter 6" ID
Slot Size 0.050" Length 5'
Strat. Unit Screened Till/ Alluvium
Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #3 (#0)
Amount 450 lbs Interval 27.5-34'
Seal(s)
Type Bentonite Pellets Interval 24-27'
Type Cement/Bent. Grout Interval 0.0-24'
Type _____ Interval _____
Type _____ Interval _____
Type _____ Interval _____
Locking Casing Yes
Notes:

Tracking Code: 1568A, DECWE, 05/26/94

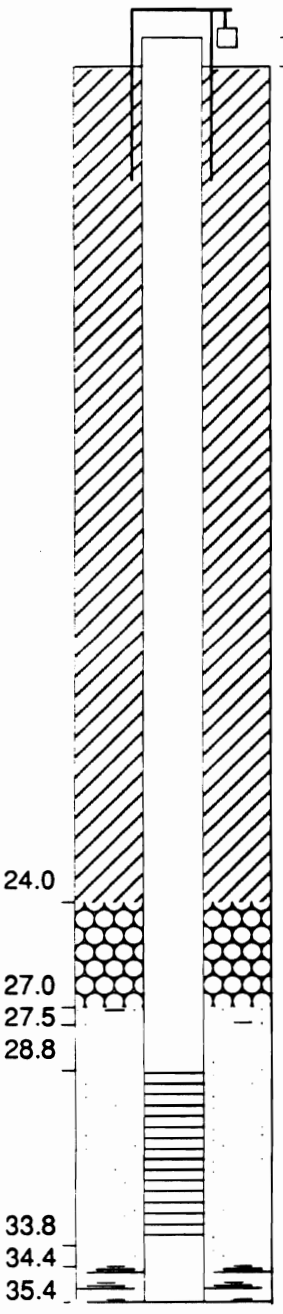
MONITORING WELL LOG

WELL NO. EW-5

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project Inlet Remediation
Client Occidental Chemical Corporation
Location N. Tonawanda, NY
Project No. 35630.540
Date Drilled 12/6/93-12/8/93
Date Developed

WELL CONSTRUCTION DETAIL



574.88' Measuring Point Elev.
573.0' Ground Elev.

Cement/Bentonite Seal

Bentonite Seal

Sand Choke (#0 Morie)

Sand Pack (#3 Morie)

Top of Till (33')

Sump 1.6' long (surrounded by collapsed till)

INSPECTION NOTES

Inspector J. Jones
Drilling Contractor SJB Services
Type of Well 6" SS Extraction Well
Static Water Level Elev. _____ Date _____
Static Water Level Depth (from M.P.) _____
Measuring Point (M.P.) _____
Total Depth of Well 35.4'
Total Depth of Boring 35.5'
Drilling Method
Type Hollow Stem Auger Diameter 10 1/4" ID
Casing HSA
Sampling Method
Type SS Diameter 2" OD
Weight 140# Fall 30"
Interval 29.5-33.5'
Riser Pipe Left in Place
Material 304 Stain. Steel Diameter 6" ID
Joint Type Thread Length 30'
Screen
Material 304 Stain. Steel Diameter 6" ID
Slot Size 0.050" Length 5'
Strat. Unit Screened Till/ Alluvium
Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #3 (#0)
Amount 450 lbs Interval 27.5-34.4'
Seal(s)
Type Bentonite Pellets Interval 24-27.5'
Type Cement/Bent. Grout Interval 0.0-24'
Type _____ Interval _____
Type _____ Interval _____
Type _____ Interval _____
Locking Casing Yes
Notes:

Tracking Code: 1568A, DECWE, 05/26/94

APPENDIX B

SAMPLING AND ANALYTICAL PROTOCOL

(PCJ APPENDIX B-1)

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NEW YORK

THE STATE OF NEW YORK,

Plaintiff,

-and-

THE CITY OF NORTH TONAWANDA,

Plaintiff-Intervenor,

-against-

OCCIDENTAL PETROLEUM CORPORATION, HOOKER CHEMICAL CORPORATION, and OCCIDENTAL CHEMICAL CORPORATION,

Defendants.

Index No. 83-552-C

ATTACHMENT B—1
PROTOCOLS FOR SAMPLING
and
ANALYSIS OF GROUNDWATER

ATTACHMENT B-1
Protocols for Sampling and Analysis of Groundwater

Table of Contents

ATTACHMENT B-1
PROTOCOLS FOR SAMPLING AND ANALYSIS OF GROUNDWATER

INTRODUCTION

The following protocols describe the methodology to be employed for sampling and analysis of groundwater at the Durez plant during remediation, as described in Appendix B -- Monitoring, Operations and Maintenance Plan and Appendix C -- Cell Report.

Water samples collected from the Durez Temporary Facility (DTF), selected groundwater monitoring wells and the Cell leak detection system will be analyzed for the following parameters:

Compound	Method Detection Limit (µg/L)
Benzene	1
Toluene	1
Monochlorobenzene	1
Orthochlorotoluene	1
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,2,3-Trichlorobenzene	1
1,2,4-Trichlorobenzene	1
Total Phenols	10
TOC	1000
Other Parameters	
pH	Field measurement
temperature	Field measurement
conductivity	Field measurement

The protocols have been divided into three sections. The first section describes the methodology to be used for sampling, safety, bottle cleaning, sample preservation, storage and chain of custody. The second section describes the methodology for the parameters which will be analyzed. The

third section describes a general quality assurance plan which an environmental laboratory should strive to achieve. Specific quality assurance protocols are included with the methodology for each analysis.

PROTOCOLS FOR SAMPLING

PROTOCOLS FOR SAMPLING

I. SAMPLING

A. General

Sampling will be performed by a two-person team with experience in environmental sampling. The senior member of the team will be responsible for complete documentation of sampling which will be kept in a field notebook with bound pages, appropriately dated and signed. The sampling team will be responsible for the preservation of all samples. They also will be responsible for conducting pH, temperature and conductivity tests. The team also shall maintain chain of custody records for all samples until they are shipped to the analytical laboratory. The chain of custody form is attached.

The State will have the option to obtain splits of samples taken in connection with the program.

B. Groundwater

Wells will be sampled after purging at least four volumes of the well casing. Samples for volatiles analysis will be bailed; all other purging and sampling will be performed using a peristaltic pump and teflon sampling lines. For each site, approximately 1 liter of water will be collected for field measurements. Additionally, 2 hypovials and 2 one-liter bottles of water will be collected for laboratory analyses.

TOC and phenol samples will be preserved with sulfuric acid to a pH of <2 (Ref. 1). All caps will be "Teflon" lined. All samples will be kept at 4°C in a refrigerator or on wet ice at all times.

Conductivity, pH and temperature measurements will be made in the field.

public are protected. In this event, OCC will provide notification thereof in writing to the State. The OCC Project Coordinator shall have a minimum of 40 hours of health and safety training. The Project Coordinator shall also have a sound working knowledge of State and Federal occupational safety and health regulations, Durez plant safety and health procedures, and protective equipment to be used during implementation of the monitoring program.

C. Protective Clothing and Equipment

Personnel involved in the field activities, as well as all others who come into direct contact with soil or water removed during sampling, will wear hard hats, safety glasses/goggles, protective gloves, and protective boots. Approved respirators for each person will be readily available and maintained in a clean location.

If disposable clothing is used, it will be disposed of properly with other waste from the project. Nondisposable garments will be cleaned either on-site or by commercial laundry.

D. Emergency Equipment and Procedures

Appropriate emergency equipment, including, without limitation, eye-wash stations, fire extinguishers, and first aid kits will be available and near any location where field sampling activities are being conducted. In addition, a safety station will be located near the work area. Personnel trained in first aid techniques will be present on the Property whenever such field sampling activities are being conducted.

VII. DISPOSAL OF WATER

Water removed during sampling will be disposed of in compliance with applicable regulations in an environmentally responsible manner.

VIII. REFERENCES

1) 40 CFR Part 136, as revised July 1, 1987: Table II, pp 264-266.

4. Sample Handling and Preservation
   4.1 Sampling and storage of samples in glass bottles is preferable. Sampling and storage in plastic bottles such as conventional polyethylene and cubitainers is permissible if it is established that the containers do not contribute contaminating organics to the samples. NOTE 1: A brief study performed in the EPA Laboratory indicated that distilled water stored in new, one quart cubitainers did not show any increase in organic carbon after two weeks exposure.
   4.2 Because of the possibility of oxidation or bacterial decomposition of some components of aqueous samples, the lapse of time between collection of samples and start of analysis should be kept to a minimum. Also, samples should be kept cool (4°C) and protected from sunlight and atmospheric oxygen.
   4.3 In instances where analysis cannot be performed within two hours (2 hours) from time of sampling, the sample is acidified ($pH \leq 2$) with HCl or H_2SO_4.
5. Interferences
   5.1 Carbonate and bicarbonate carbon represent an interference under the terms of this test and must be removed or accounted for in the final calculation.
   5.2 This procedure is applicable only to homogeneous samples which can be injected into the apparatus reproducibly by means of a microliter type syringe or pipette. The openings of the syringe or pipette limit the maximum size of particles which may be included in the sample.
6. Apparatus
   6.1 Apparatus for blending or homogenizing samples: Generally, a Waring-type blender is satisfactory.
   6.2 Apparatus for total and dissolved organic carbon:
      6.2.1 A number of companies manufacture systems for measuring carbonaceous material in liquid samples. Considerations should be made as to the types of samples to be analyzed, the expected concentration range, and forms of carbon to be measured.
      6.2.2 No specific analyzer is recommended as superior.
7. Reagents
   7.1 Distilled water used in preparation of standards and for dilution of samples should be ultra pure to reduce the carbon concentration of the blank. Carbon dioxide-free, double distilled water is recommended. Ion exchanged waters are not recommended because of the possibilities of contamination with organic materials from the resins.
   7.2 Potassium hydrogen phthalate, stock solution, 1000 mg carbon/liter: Dissolve 0.2128 g of potassium hydrogen phthalate (Primary Standard Grade) in distilled water and dilute to 100.0 ml.
   NOTE 2: Sodium oxalate and acetic acid are not recommended as stock solutions.
   7.3 Potassium hydrogen phthalate, standard solutions: Prepare standard solutions from the stock solution by dilution with distilled water.
   7.4 Carbonate-bicarbonate, stock solution, 1000 mg carbon/liter: Weigh 0.3500 g of sodium bicarbonate and 0.4418 g of sodium carbonate and transfer both to the same 100 ml volumetric flask. Dissolve with distilled water.

7.5 Carbonate-bicarbonate, standard solution: Prepare a series of standards similar to step 7.3.

NOTE 3: This standard is not required by some instruments.

7.6 Blank solution: Use the same distilled water (or similar quality water) used for the preparation of the standard solutions.

8. Procedure

8.1 Follow instrument manufacturer's instructions for calibration, procedure, and calculations.

8.2 For calibration of the instrument, it is recommended that a series of standards encompassing the expected concentration range of the samples be used.

9. Precision and Accuracy

9.1 Twenty-eight analysts in twenty-one laboratories analyzed distilled water solutions containing exact increments of oxidizable organic compounds, with the following results:

Increment as TOC mg/liter	Precision as Standard Deviation TOC, mg/liter	Accuracy as Bias, %	Accuracy as Bias, mg/liter
4.9	3.93	+15.27	+0.75
107	8.32	+ 1.01	+1.08

(FWPCA Method Study 3, Demand Analyses)

Bibliography

1. Annual Book of ASTM Standards, Part 31, "Water", Standard D 2574–79, p 469 (1976).
2. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 532, Method 505, (1975).

CONDUCTANCE

Method 120.1 (Specific Conductance, umhos at 25°C)

STORET NO. 00095

1. Scope and Application
   1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes.
2. Summary of Method
   2.1 The specific conductance of a sample is measured by use of a self-contained conductivity meter, Wheatstone bridge-type, or equivalent.
   2.2 Samples are preferably analyzed at 25°C. If not, temperature corrections are made and results reported at 25°C.
3. Comments
   3.1 Instrument must be standardized with KCl solution before daily use.
   3.2 Conductivity cell must be kept clean.
   3.3 Field measurements with comparable instruments are reliable.
4. Precision and Accuracy
   4.1 Forty-one analysts in 17 laboratories analyzed six synthetic water samples containing increments of inorganic salts, with the following results:

Increment as Specific Conductance	Precision as Standard Deviation	Accuracy as Bias, %	Accuracy as Bias, umhos/cm
100	7.55	-2.02	-2.0
106	8.14	-0.76	-0.8
808	66.1	-3.63	-29.3
848	79.6	-4.54	-38.5
1640	106	-5.36	-87.9
1710	119	-5.08	-86.9

(FWPCA Method Study 1, Mineral and Physical Analyses.)

   4.2 In a single laboratory (EMSL) using surface water samples with an average conductivity of 536 umhos/cm at 25°C, the standard deviation was ±6.
5. References
   5.1 The procedure to be used for this determination is found in:
   Annual Book of ASTM Standards, Part 31, "Water", Standard D1125-64, p 120 (1976).
   Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 71, Method 205, (1975).

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pH

Method 150.1 (Electrometric)

STORET NO.
Determined on site 00400
Laboratory 00403

1. Scope and Application
   1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes.
2. Summary of Method
   2.1 The pH of a sample is determined electrometrically using either a glass electrode in combination with a reference potential or a combination electrode.
3. Sample Handling and Preservation
   3.1 Samples should be analyzed as soon as possible preferably in the field at the time of sampling.
   3.2 High-purity waters and waters not at equilibrium with the atmosphere are subject to changes when exposed to the atmosphere, therefore the sample containers should be filled completely and kept sealed prior to analysis.
4. Interferences
   4.1 The glass electrode, in general, is not subject to solution interferences from color, turbidity, colloidal matter, oxidants, reductants or high salinity.
   4.2 Sodium error at pH levels greater than 10 can be reduced or eliminated by using a "low sodium error" electrode.
   4.3 Coatings of oily material or particulate matter can impair electrode response. These coatings can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing. An additional treatment with hydrochloric acid (1 + 9) may be necessary to remove any remaining film.
   4.4 Temperature effects on the electrometric measurement of pH arise from two sources. The first is caused by the change in electrode output at various temperatures. This interference can be controlled with instruments having temperature compensation or by calibrating the electrode-instrument system at the temperature of the samples. The second source is the change of pH inherent in the sample at various temperatures. This error is sample dependent and cannot be controlled, it should therefore be noted by reporting both the pH and temperature at the time of analysis.
5. Apparatus
   5.1 pH Meter-laboratory or field model. A wide variety of instruments are commercially available with various specifications and optional equipment.

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5.2 Glass electrode.

5.3 Reference electrode–a calomel, silver-silver chloride or other reference electrode of constant potential may be used.

NOTE 1: Combination electrodes incorporating both measuring and reference functions are convenient to use and are available with solid, gel type filling materials that require minimal maintenance.

5.4 Magnetic stirrer and Teflon-coated stirring bar.

5.5 Thermometer or temperature sensor for automatic compensation.

6. Reagents

6.1 Primary standard buffer salts are available from the National Bureau of Standards and should be used in situations where extreme accuracy is necessary.

6.1.1 Preparation of reference solutions from these salts require some special precautions and handling[1] such as low conductivity dilution water, drying ovens, and carbon dioxide free purge gas. These solutions should be replaced at least once each month.

6.2 Secondary standard buffers may be prepared from NBS salts or purchased as a solution from commercial vendors. Use of these commercially available solutions, that have been validated by comparison to NBS standards, are recommended for routine use.

7. Calibration

7.1 Because of the wide variety of pH meters and accessories, detailed operating procedures cannot be incorporated into this method. Each analyst must be acquainted with the operation of each system and familiar with all instrument functions. Special attention to care of the electrodes is recommended.

7.2 Each instrument/electrode system must be calibrated at a minimum of two points that bracket the expected pH of the samples and are approximately three pH units or more apart.

7.2.1 Various instrument designs may involve use of a "balance" or "standardize" dial and/or a slope adjustment as outlined in the manufacturer's instructions. Repeat adjustments on successive portions of the two buffer solutions as outlined in procedure 8.2 until readings are within 0.05 pH units of the buffer solution value.

8. Procedure

8.1 Standardize the meter and electrode system as outlined in Section 7.

8.2 Place the sample or buffer solution in a clean glass beaker using a sufficient volume to cover the sensing elements of the electrodes and to give adequate clearance for the magnetic stirring bar.

8.2.1 If field measurements are being made the electrodes may be immersed directly in the sample stream to an adequate depth and moved in a manner to insure sufficient sample movement across the electrode sensing element as indicated by drift free (<0.1 pH) readings.

8.3 If the sample temperature differs by more than 2°C from the buffer solution the measured pH values must be corrected. Instruments are equipped with automatic or manual

[1]National Bureau of Standards Special Publication 260.

compensators that electronically adjust for temperature differences. Refer to manufacturer's instructions.

8.4 After rinsing and gently wiping the electrodes, if necessary, immerse them into the sample beaker or sample stream and stir at a constant rate to provide homogeneity and suspension of solids. Rate of stirring should minimize the air transfer rate at the air water interface of the sample. Note and record sample pH and temperature. Repeat measurement on successive volumes of sample until values differ by less than 0.1 pH units. Two or three volume changes are usually sufficient.

9. Calculation

9.1 pH meters read directly in pH units. Report pH to the nearest 0.1 unit and temperature to the nearest °C.

10. Precision and Accuracy

10.1 Forty-four analysts in twenty laboratories analyzed six synthetic water samples containing exact increments of hydrogen-hydroxyl ions, with the following results:

pH Units	Standard Deviation pH Units	Accuracy as Bias, %	Accuracy as Bias, pH Units
3.5	0.10	–0.29	–0.01
3.5	0.11	–0.00	
7.1	0.20	+1.01	+0.07
7.2	0.18	–0.03	–0.002
8.0	0.13	–0.12	–0.01
8.0	0.12	+0.16	+0.01

(FWPCA Method Study 1, Mineral and Physical Analyses)

10.2 In a single laboratory (EMSL), using surface water samples at an average pH of 7.7, the standard deviation was ±0.1.

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1. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 460, (1975).
2. Annual Book of ASTM Standards, Part 31, "Water", Standard D1293–65, p 178 (1976).

TEMPERATURE

Method 170.1 (Thermometric)

STORET NO. 00010

1. Scope and Application
   1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes.
2. Summary of Method
   2.1 Temperature measurements may be made with any good grade of mercury-filled or dial type centigrade thermometer, or a thermistor.
3. Comments
   3.1 Measurement device should be routinely checked against a precision thermometer certified by the National Bureau of Standards.
4. Precision and Accuracy
   4.1 Precision and accuracy for this method have not been determined.
5. Reference
   5.1 The procedure to be used for this determination is found in:
   Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 125, Method 212 (1975).

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PHENOLICS, TOTAL RECOVERABLE

Method 420.2 (Colorimetric, Automated 4-AAP with Distillation)

STORET NO. 32730

1. Scope and Application
   - 1.1 This method is applicable to the analysis of drinking, surface and saline waters, domestic and industrial wastes.
   - 1.2 The method is capable of measuring phenolic materials from 2 to 500 *ug*/1 in the aqueous phase using phenol as a standard. The working ranges are 2 to 200 *ug*/1 and 10 to 500 *ug*/1.
2. Summary of Method
   - 2.1 This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 or 520 nm. The same manifold is used with the AAI or AAII.
3. Sample Handling and Preservation
   - 3.1 Biological degradation is inhibited by the addition of 1 g/1 of copper sulfate to the sample and acidification to a pH of less than 4 with phosphoric acid. The sample should be kept at 4°C and analyzed within 24 hours after collection.
4. Interference
   - 4.1 Interferences from sulfur compounds are eliminated by acidifying the sample to a pH of less than 4.0 with H_3PO_4 and aerating briefly by stirring and adding $CuSO_4$.
   - 4.2 Oxidizing agents such as chlorine, detected by the liberation of iodine upon acidification in the presence of potassium iodide, are removed immediately after sampling by the addition of an excess of ferrous ammonium sulfate (6.5). If chlorine is not removed, the phenolic compounds may be partially oxidized and the results may be low.
   - 4.3 Background contamination from plastic tubing and sample containers is eliminated by filling the wash receptacle by siphon (using Kel-F tubing) and using glass tubes for the samples and standards.
5. Apparatus
   - 5.1 Technicon AutoAnalyzer (I or II)
     - 5.1.1 Sampler equipped with continuous mixer.
     - 5.1.2 Manifold.
     - 5.1.3 Proportioning pump II or III.
     - 5.1.4 Heating bath with distillation coil.
     - 5.1.5 Distillation head.
     - 5.1.6 Colorimeter equipped with a 50 mm flow cell and 505 or 520 nm filter.
     - 5.1.7 Recorder.
6. Reagents
   - 6.1 Distillation reagent: Add 100 ml of conc. phosphoric acid (85% H_3PO_4) to 800 ml of distilled water, cool and dilute to 1 liter.

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6.2 Buffered potassium ferricyanide: Dissolve 2.0 g potassium ferricyanide, 3.1 g boric acid and 3.75 g potassium chloride in 800 ml of distilled water. Adjust to pH of 10.3 with 1 N sodium hydroxide (6.3) and dilute to 1 liter. Add 0.5 ml of Brij-35. Prepare fresh weekly.

6.3 Sodium hydroxide (1N): Dissolve 40 g NaOH in 500 ml of distilled water, cool and dilute to 1 liter.

6.4 4-Aminoantipyrine: Dissolve 0.65 g of 4-aminoantipyrine in 800 ml of distilled water and dilute to 1 liter. Prepare fresh each day.

6.5 Ferrous ammonium sulfate: Dissolve 1.1 g ferrous ammonium sulfate in 500 ml distilled water containing 1 ml H_2SO_4 and dilute to 1 liter with freshly boiled and cooled distilled water.

6.6 Stock phenol: Dissolve 1.00 g phenol in 500 ml of distilled water and dilute to 1000 ml. Add 1 g $CuSO_4$ and 0.5 ml conc. H_3PO_4 as preservative. 1.0 ml = 1.0 mg phenol.

6.7 Standard phenol solution A: Dilute 10.0 ml of stock phenol solution (6.6) to 1000 ml. 1.0 ml = 0.01 mg phenol.

6.8 Standard phenol solution B: Dilute 100.0 ml of standard phenol solution A (6.7) to 1000 ml with distilled water. 1.0 ml = 0.001 mg phenol.

6.9 Standard solution C: Dilute 100.0 ml of standard phenol solution B (6.8) to 1000 ml with distilled water. 1.0 ml = 0.0001 mg phenol.

6.10 Using standard solution A, B or C prepare the following standards in 100 ml volumetric flasks. Each standard should be preserved by adding 0.1 g $CuSO_4$ and 2 drops of conc. H_3PO_4 to 100.0 ml.

ml of Standard Solution	Conc. ug/l
Solution C	
1.0	1.0
2.0	2.0
3.0	3.0
5.0	5.0
Solution B	
1.0	10.0
2.0	20.0
5.0	50.0
10.0	100.0
Solution A	
2	200
3	300
5	500

7. Procedure

7.1 Set up the manifold as shown in Figures 1 or 2.

7.2 Fill the wash receptacle by siphon. Use Kel-F tubing with a fast flow (1 liter/hr).

7.3 Allow colorimeter and recorder to warm up for 30 minutes. Run a baseline with all reagents, feeding distilled water through the sample line. Use polyethylene tubing for

sample line. When new tubing is used, about 2 hours may be required to obtain a stable baseline. This two hour time period may be necessary to remove the residual phenol from the tubing.

7.4 Place appropriate phenol standards in sampler in order of decreasing concentration. Complete loading of sampler tray with unknown samples, using glass tubes.
NOTE 1: If samples have not been preserved as instructed in (3.1), add 0.1 g $CuSO_4$ and 2 drops of conc. H_3PO_4 to 100 ml of sample.

7.5 Switch sample line from distilled water to sampler and begin analysis.

8. Calculation

8.1 Prepare standard curve by plotting peak heights of standards against concentration values. Compute concentration of samples by comparing sample peak heights with standards.

9. Precision and Accuracy

9.1 In a single laboratory (EMSL), using sewage samples at concentrations of 3.8, 15, 43 and 89 *ug*/1, the standard deviations were ±0.5, ±0.6, ±0.6 and ±1.0 *ug*/1, respectively. At concentrations of 73, 146, 299 and 447 *ug*/1, the standard deviations were ±1.0, ±1.8, ±4.2 and ±5.3 *ug*/1, respectively.

9.2 In a single laboratory (EMSL), using sewage samples at concentrations of 5.3 and 82 *ug*/1, the recoveries were 78% and 98%. At concentrations of 168 and 489 *ug*/1, the recoveries were 97% and 98%, respectively.

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1. Technicon AutoAnalyzer II Methodology, Industrial Method No. 127–71W, AAII.
2. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 574, Method 510 (1975).
3. Gales, M.E. and Booth, R.L., "Automated 4 AAP Phenolic Method", AWWA 68, 540 (1976).

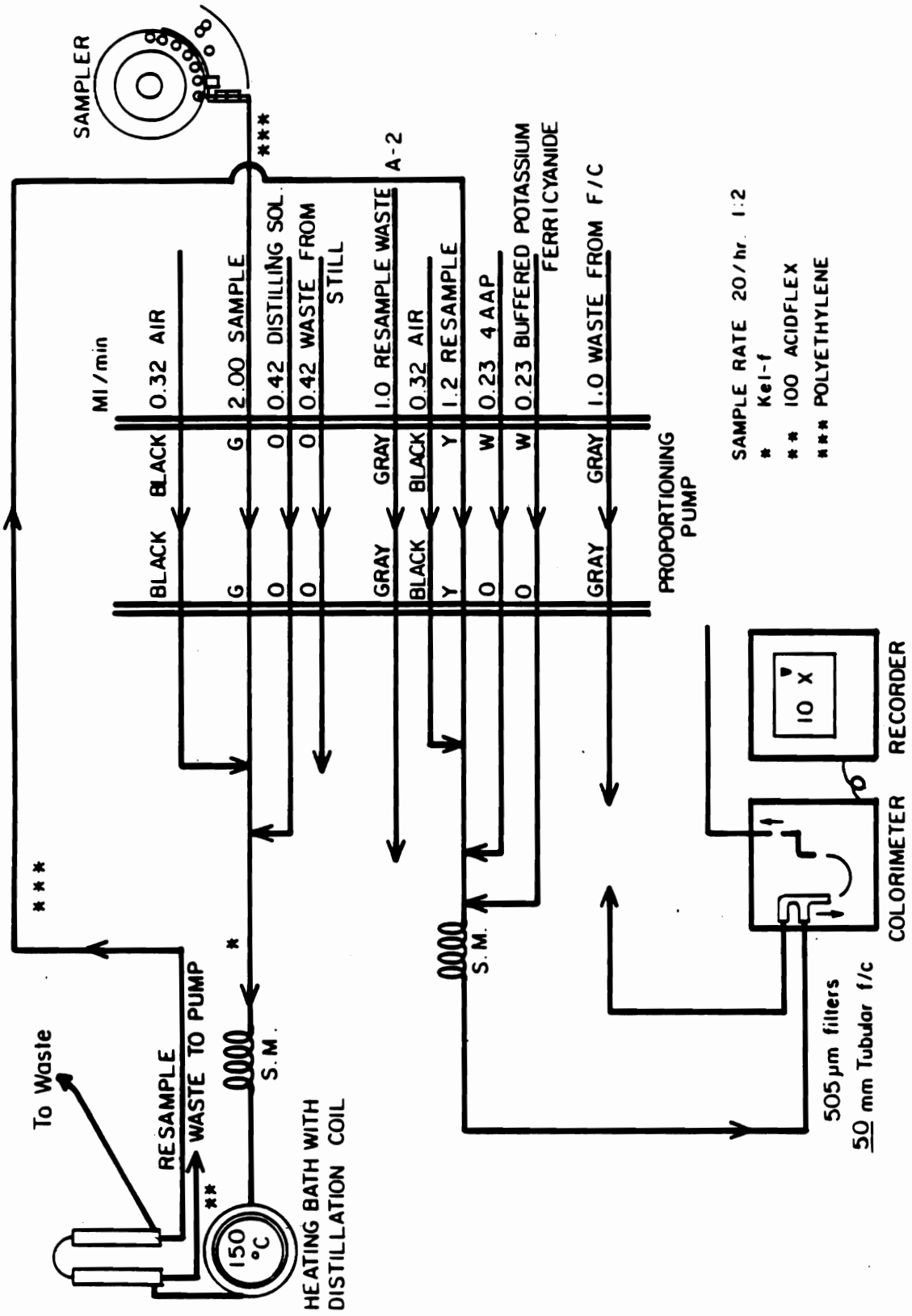

FIGURE 1. PHENOL AUTO ANALYZER I

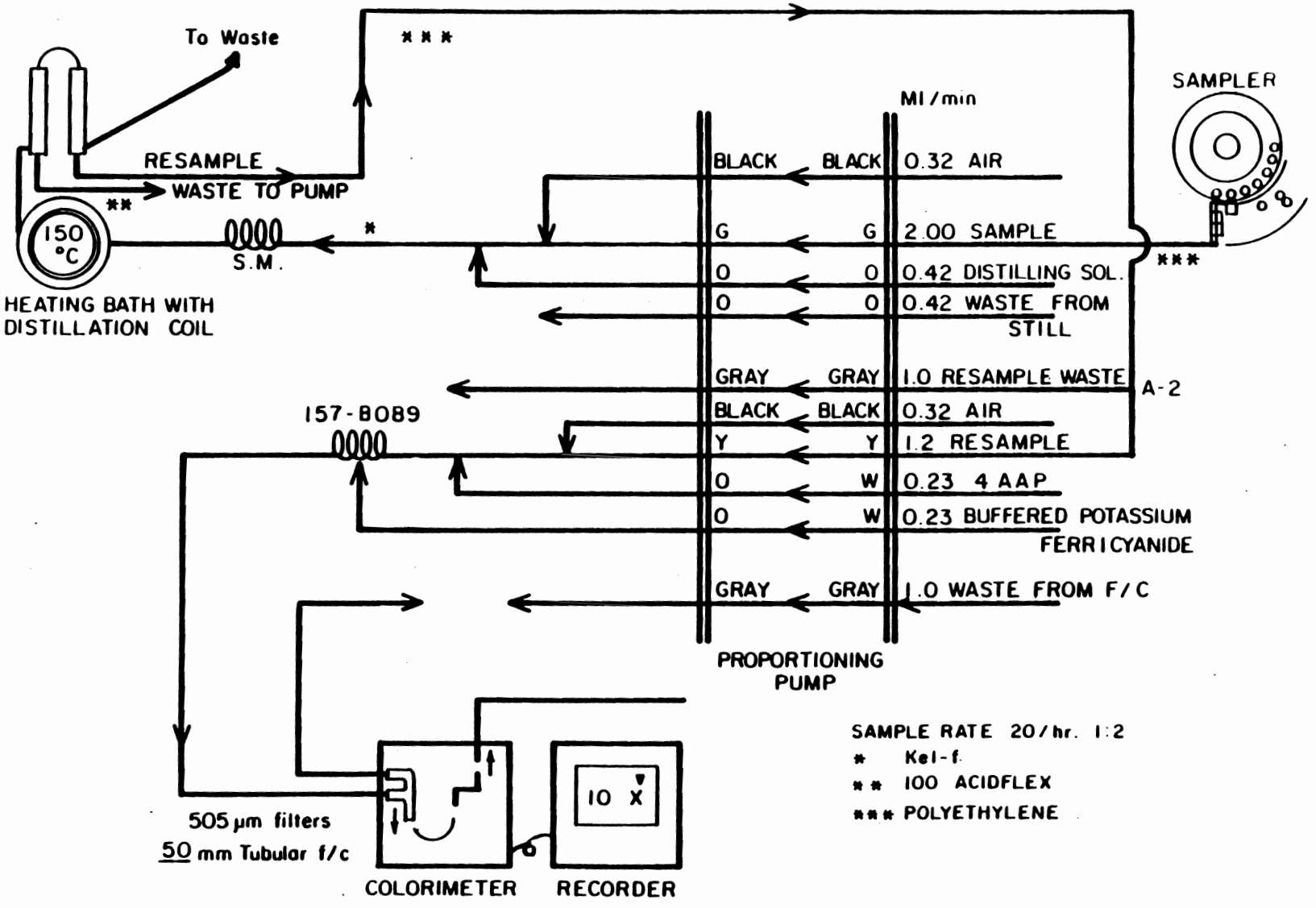

FIGURE 2. PHENOL AUTO ANALYZER II

509 D. Bibliography

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510 PHENOLS

Phenols, defined as hydroxy derivatives of benzene and its condensed nuclei, may occur in domestic and industrial wastewaters and in drinking water supplies. Chlorination of such waters may produce odoriferous and objectionable-tasting chlorophenols, which may include *o*-chlorophenol, *p*-chlorophenol, 2,6-dichlorophenol, and 2,4-dichlorophenol. Phenol removal processes in water treatment include superchlorination, chlorine dioxide or chlorine ammonia treatment, ozonation, and activated carbon adsorption.

Of the four analytical procedures offered here, three use the 4-aminoantipyrine colorimetric method that determines phenol, the ortho- and meta-substituted phenols, and, under proper pH conditions, those parasubstituted phenols in which the substitution is a carboxyl, halogen, methoxyl, or sulfonic

acid group. Presumably, the 4-aminoantipyrine method does not determine those para-substituted phenols in which the substitution is an alkyl, aryl, nitro, benzoyl, nitroso, or aldehyde group. A typical example of these latter groups is paracresol, which may be present in certain industrial wastewaters and in polluted surface waters. The fourth procedure is a gas-liquid chromatographic technic.

1. Selection of Method

The 4-aminoantipyrine method is given in three forms: Method B, for extreme sensitivity, is adaptable for use in water samples containing less than 1 mg/l phenol and concentrates the color in a nonaqueous solution; Method C, used for phenol concentrations greater than 1 mg/l in which a high degree of sensitivity is not required, retains the color in the unconcentrated aqueous solution. Because the percentage of various phenolic compounds in a given sample is unpredictable, it is not possible to provide a standard containing a mixture of phenols applicable to all samples. For this reason, phenol itself has been selected as a standard for colorimetric procedures, and any color produced by the reaction of other phenolic compounds is reported as phenol. Because substitution generally reduces response, this value represents the minimum concentration of phenolic compounds present. Method D, a tentative procedure, is used where an estimation of para-substituted phenols, especially the halogenated types, is required; 2,4 dichlorophenol is used as a standard for this technic. Method E, a tentative gas-liquid chromatographic procedure, may be applied to samples or concentrates that contain more than 1 mg/l of phenolic compounds.

2. Interferences

a. Domestic and industrial wastewaters may contain such interferences as phenol-decomposing bacteria, oxidizing and reducing substances, and alkaline pH values. Biological degradation is inhibited by the addition of $CuSO_4$ to the sample. Acidification with H_3PO_4 assures the presence of the copper ion and eliminates any chemical changes resulting from the presence of strong alkaline conditions.

b. Some of the treatment procedures used for the removal of interferences before analysis may result in an unavoidable loss of certain types of phenols. Consequently, some highly contaminated wastewaters may require specialized screening technics for elimination of interferences and for quantitative recovery of the phenolic compounds.

c. Eliminate major interferences as follows (see Section 510A for the required reagents):

1) Oxidizing agents, such as chlorine and those detected by the liberation of iodine upon acidification in the presence of KI—Remove immediately after sampling by adding an excess of $FeSO_4$ or $NaAsO_2$. If oxidizing agents are not removed, the phenolic compounds will be partially oxidized and the results will be low.

2) Sulfur compounds—Remove by acidifying the sample to a pH of less than 4.0 with H_3PO_4 and aerating briefly by stirring before adding $CuSO_4$.

This eliminates the interferences of H_2S and SO_2.

3) Oils and tars—These contain phenols. Perform an alkaline extraction before adding $CuSO_4$. Adjust sample pH to 12 to 12.5 by adding NaOH pellets. Extract oil and tar from the aqueous solution by CCl_4. Discard the oil- or tar-containing layer. Remove any excess of CCl_4 in the aqueous layer by warming on a water bath before proceeding with the distillation step.

3. Sampling

Sample domestic and industrial wastewaters in accordance with the instructions of Section 105.

4. Preservation and Storage of Samples

a. Phenols in concentrations usually encountered in wastewaters are subject to biological and chemical oxidation. Preserve and store samples unless they will be analyzed within 4 hr after collection.

b. Acidify to a pH of approximately 4.0 with H_3PO_4, using methyl orange or a pH meter. If H_2S or SO_2 is known to be present, briefly aerate or stir the sample with caution.

c. Add 1.0 g $CuSO_4 \cdot 5H_2O$/l sample to inhibit biodegradation of phenols.

d. Keep the sample cold (5 to 10 C). Analyze the preserved and stored samples within 24 hr after collection.

510 A. Distillation Step for Methods B and C

1. Principle

The phenols are distilled at a more or less constant rate from the nonvolatile impurities. The rate of volatilization of the phenols is gradual, so that the volume of the distillate must equal that of the sample being distilled. The use of $CuSO_4$ during distillation of an acidic sample permits the formation of cupric sulfide without subsequent decomposition to H_2S. The acidic solution also prevents the precipitation of cupric hydroxide, which acts as an oxidizing agent toward phenols.

2. Apparatus

a. Distillation apparatus, all-glass, consisting of a 1-l pyrex distilling apparatus with Graham condenser* (see Figure 318:1.)

b. pH meter.

3. Reagents

Prepare all reagents with distilled water free of phenols and chlorine.

a. Copper sulfate solution: Dissolve 100 g $CuSO_4 \cdot 5H_2O$ in distilled water and dilute to 1 l.

b. Phosphoric acid solution, 1+9: Dilute 10 ml 85% H_3PO_4 to 100 ml with distilled water.

c. Methyl orange indicator: Dissolve 0.5 g methyl orange in 1 l distilled water.

d. Special reagents for turbid distillates:

*Corning No. 3360 or equivalent.

1) *Sulfuric acid*, 1*N*.
2) *Sodium chloride*.
3) *Chloroform or ethyl ether*.
4) *Sodium hydroxide*, 2.5*N*: Dilute 41.7 ml 6*N* NaOH to 100 ml or dissolve 10 g NaOH in 100 ml distilled water.

4. Procedure

a. Measure 500 ml sample into a beaker, lower the pH to approximately 4.0 with the 1+9 H_3PO_4 solution using the methyl orange indicator or a pH meter, add 5 ml $CuSO_4$ solution, and transfer to the distillation apparatus. Use a 500-ml graduated cylinder as a receiver. Omit adding H_3PO_4 and $CuSO_4$ if the sample was preserved as described in 510.4.

b. Distill 450 ml sample, stop the distillation, and when boiling ceases add 50 ml phenol-free distilled water to the distilling flask. Continue distillation until a total of 500 ml has been collected.

c. One distillation should purify the sample adequately. Occasionally, however, the distillate is turbid. In this case, acidify the distillate with 1+9 H_3PO_4, add 5 ml $CuSO_4$ solution, and distill as described in ¶4*b* above. If the second distillate is still turbid, use the extraction process described in ¶4*d* following *before* distilling the sample.

d. Treatment when second distillate is turbid: Extract a 500-ml portion of the original sample as follows: Add 4 drops methyl orange indicator and sufficient 1*N* H_2SO_4 to make the solution acidic. Transfer to a separatory funnel and add 150 g NaCl. Shake with five increments of chloroform, using 40 ml in the first increment and 25 ml in each of the increments following. Transfer the chloroform layer to a second separatory funnel and shake with three successive increments of 2.5*N* NaOH solution, using 4.0 ml in the first increment and 3.0 ml in each of the next two increments. Combine the alkaline extracts, heat on a water bath until the chloroform has been removed, cool, and dilute to 500 ml with distilled water. Proceed with distillation as described in ¶s 4*a* and *b* above.

NOTE: Diethyl ether may be used instead of chloroform, especially if an emulsion forms when the chloroform solution is extracted with NaOH. When ether is used, a better distribution coefficient is obtained for phenol between the ether and water phases and it is not necessary to use NaCl. Chloroform is preferred because of the hazards in handling ether.

510 B. Chloroform Extraction Method*

1. General Discussion

a. Principle: The steam-distillable phenols react with 4-aminoantipyrine at a pH of 10.0±0.2 in the presence of potassium ferricyanide to form a colored antipyrine dye. This dye is extracted from aqueous solution with chloroform and the absorbance is measured at 460 nm. The concentration of phenolic compounds is expressed as µg/l of phenol (C_6H_5OH). This method covers the

*Similar in principle to, but different in detail from, ASTM D-1783-62 (Standard). Both methods were adapted from E. Emerson, 1938. *J. Organic Chem.* 3:153.

phenol concentration range of 0.0 to 1.000 µg/l with a sensitivity of 1 µg/l.

b. Interference: All interferences are eliminated or reduced to a minimum if the sample has been preserved, stored, and distilled in accordance with the foregoing instructions.

c. Minimum detectable concentration: The minimum detectable quantity is 0.5 µg phenol when a 25-ml $CHCl_3$ extraction with a 5-cm cell, or a 50-ml $CHCl_3$ extraction with a 10-cm cell, is used in the photometric measurement. The minimum detectable quantity is 1 µg/l phenol in a 500-ml distillate.

2. Apparatus

a. Photometric equipment: Use one of the following, equipped with absorption cells providing light paths of 1 to 10 cm (depending on the absorbances of the colored solutions and the individual characteristics of the photometer; in general, if the absorbance readings are greater than 1.0 in a given cell size, use the next smaller size cell):

1) *Spectrophotometer*, for use at 460 nm.

2) *Filter photometer*, equipped with a filter exhibiting maximum light transmission near 460 nm.

b. Funnels: Buchner type with fritted disk (such as 15-ml Corning No. 36060 or equivalent).

c. Filter paper: An appropriate 11-cm filter paper may be used for filtration of the chloroform extracts in place of the Buchner-type funnels and anhydrous Na_2SO_4.

d. pH meter.

e. Separatory funnels, 1,000-ml, Squibb form, with ground-glass stoppers and teflon stopcocks. At least eight are required.

f. Nessler tubes, matched, 50-ml, tall form.

3. Reagents

Prepare all reagents with distilled water free of phenols and chlorine.

a. Stock phenol solution: Dissolve 1.00 g phenol in freshly boiled and cooled distilled water and dilute to 1,000 ml. Ordinarily this direct weighing of the phenol yields a standard solution. However, if extreme accuracy is required, standardize as follows:

1) To 100 ml distilled water in a 500-ml glass-stoppered conical flask, add 50.0 ml stock phenol solution and 10.0 ml 0.1*N* bromate-bromide solution. Immediately add 5 ml conc HCl and swirl the stoppered flask gently. If the brown color of free bromine does not persist, add 10.0-ml portions of bromate-bromide solution until the color does persist. Keep the flask stoppered and let stand for 10 min; then add approximately 1 g KI. Usually four 10-ml portions of bromate-bromide solution are required if the stock phenol solution contains 1,000 mg/l phenol.

2) Prepare a blank in exactly the same manner, using distilled water and 10.0 ml 0.1*N* bromate-bromide solution. Titrate the blank and sample with the 0.025*N* sodium thiosulfate titrant, using starch solution as the indicator.

3) Calculate the concentration of the phenol solution as follows:

$$\text{mg/l phenol} = 7.842\,(AB - C)$$

where A = ml thiosulfate for blank; B = ml bromate-bromide solution used for sample divided by 10, and C = ml thiosulfate used for sample.

b. Intermediate phenol solution: Dilute 10.0 ml stock phenol solution to

1,000 ml in freshly distilled water: 1 ml = 10.0 μg phenol. Prepare a fresh solution on each day of use.

c. Standard phenol solution: Dilute 50.0 ml intermediate phenol solution to 500 ml with freshly boiled and cooled distilled water: 1 ml = 1.0 μg phenol. Prepare this solution within 2 hr of use.

d. Bromate-bromide solution, 0.10*N*: Dissolve 2.784 g anhydrous $KBrO_3$, in distilled water, add 10 g KBr crystals, dissolve, and dilute to 1,000 ml.

e. Hydrochloric acid, HCl, conc.

f. Standard sodium thiosulfate titrant, 0.025 *N*: See Section 422B.2*f*.

g. Starch solution: See Section 422B.2d.

h. Ammonium chloride solution: Dissolve 50 g NH_4Cl in distilled water and dilute to 1,000 ml.

i. Ammonium hydroxide, NH_4OH, conc.

j. Aminoantipyrine solution: Dissolve 2.0 g 4-aminoantipyrine in distilled water and dilute to 100 ml. Prepare a fresh solution on each day of use.

k. Potassium ferricyanide solution: Dissolve 8.0 g $K_3Fe(CN)_6$ in distilled water and dilute to 100 ml. Filter if necessary. Prepare fresh each week of use.

l. Chloroform, $CHCl_3$.

m. Sodium sulfate, anhydrous Na_2SO_4, granular.

n. Potassium iodide, KI, crystals.

4. Procedure

a. Treatment of sample:

1) Place 500 ml of the distillate, or a suitable portion containing not more than 50 μg phenol, diluted to 500 ml, in a 1-l beaker.

2) If the approximate phenol concentration of the original sample is not known, determine by a preliminary check the proper volume of distillate and of $CHCl_3$ to use for the final determination. Make the check without $CHCl_3$ extraction by carrying out the reaction in 50-ml nessler tubes and comparing suitable phenol standards.

3) Prepare a 500-ml distilled water blank and a series of 500-ml phenol standards containing 5, 10, 20, 30, 40, and 50 μg phenol.

4) Treat sample, blank, and standards as follows: Add 10 ml NH_4Cl solution and adjust with conc NH_4OH to pH 10.0±0.2. Transfer to a 1-l separatory funnel, add 3.0 ml aminoantipyrine solution, mix well, add 3.0 ml potassium ferricyanide solution, again mix well, and let the color develop for 3 min. The solution should be clear and light yellow.

5) Extract immediately with $CHCl_3$, using 25 ml for 1- to 5-cm cells and 50 ml for a 10-cm cell. Shake the separatory funnel at least 10 times, let the $CHCl_3$ settle, shake again 10 times, and let the $CHCl_3$ settle again.

6) Filter each of the chloroform extracts through filter paper or fritted-glass funnels containing 5-g layer of anhydrous Na_2SO_4. Collect the dried extracts in clean cells for the absorbance measurements; do not add more $CHCl_3$.

7) Read the absorbance of the sample and standards against the blank at a wavelength of 460 nm. Plot absorbance against micrograms phenol for the calibration curve. Estimate the phenol concentration of the sample from the calibration curve. Construct a separate

calibration curve for each photometer and check each curve periodically to insure reproducibility.

b. Alternative procedure:

1) If infrequent analyses for phenol are made, prepare only one standard phenol solution instead of a series of solutions and a calibration curve.

2) In this case, prepare 500 ml standard phenol solution approximately equal to the phenolic content of that portion of the original sample used for final analysis. Also prepare a 500-ml distilled water blank.

3) Proceed as described in ¶s 4*a* through 7), but measure the absorbances of sample and standard phenol solution against the blank at 460 nm.

5. Calculation

a. Use of calibration curve:

$$\mu g/l \text{ phenol} = \frac{A}{B} \times 1.000$$

where A = µg phenol in sample, from calibration curve, and B = ml original sample.

b. Use of alternative procedure:

$$\mu g/l \text{ phenol} = \frac{CD}{E} \times \frac{1.000}{B}$$

where C = µg standard phenol solution, D = absorbance reading of sample, E = absorbance of standard phenol solution, and B = ml original sample.

6. Precision and Accuracy

The precision of this method depends on the skill of the analyst and on the interferences present after the distillation procedure. Because the "phenol" value is based on C_6H_5OH, this method can be regarded only as an approximation and as representing the minimum amount of phenols present. This is true because the phenolic value varies with the types of phenols within a given sample. Therefore, it is impossible to express the accuracy of the method.

510 C. Direct Photometric Method*

1. General Discussion

a. Principle: The steam-distillable phenols react with 4-aminoantipyrine at a pH of 10.0±0.2 in the presence of potassium ferricyanide to form a colored antipyrine dye. This dye is kept in an aqueous solution and the absorbance is measured at 510 nm. Because extreme sensitivity is not required in this method, smaller distillate volumes may be used for analysis. For example, this permits determination of 0.5 mg phenol, expressed as C_6H_5OH, in a 100-ml volume of distillate. Practically, the smallest distillate volume would be 10 ml. Consequently, this method covers the phenol concentration range of 0.0 to 50 mg/l, with a sensitivity of 1 mg/l.

b. Interference: All interferences are eliminated or reduced to a minimum by

*Adapted ASTM D-1783-Standard, as published in ASTM *Book of Standards*, Part 23 (1968).

ENVIRONMENTAL LABORATORY

GENERAL QUALITY ASSURANCE PLAN

ENVIRONMENTAL LABORATORY
GENERAL QUALITY ASSURANCE PLAN

The purpose of the Quality Assurance Plan is to assure the generation of quality analytical data, i.e. data which has the degree of precision, accuracy, completeness and comparability to meet the requirements of the user. Quality data is achieved through the use of proven methodology and good laboratory practices.

Essential to the Quality Plan are a staff of skilled personnel and adequate lab facilities. The labs must be sufficiently clean to avoid contamination of the samples, have adequate space and lighting for work being performed, have hoods, and proper disposal and safety equipment.

The general criteria which are addressed in the Quality Assurance Plan are as follows:

1. Sampling
2. Chain of Custody
3. Analytical Methodology
4. Method Calibration
5. Precision and Accuracy
6. Reagents and Apparatus
7. Maintenance of Equipment
8. Calibration of Equipment
9. Records
10. Data Validation
11. Data Reporting Format

1) Sampling

Sampling is an important part of the total system of measuring the quality of the material to be tested. An inadequate sampling procedure will lead to inaccurate results and misleading conclusions. It is important that a proper sample is submitted to the lab to assure the accuracy and precision of the analytical results.

Following are the guidelines which must be followed to insure a proper sample is obtained for analysis.

A. There must be good lines of communication among the personnel requesting the analysis and the sampling and analytical groups. Information must be exchanged on the purpose of the study being done, specifications of the methods used, the detection level desired and the quantity of sample required for each analysis including duplicates.

B. Instructions for sample collection, labeling, preservation (if applicable), chain of custody, and transport to the lab must be provided and in written form.

C. The sampling procedure and equipment and the location and timing of sampling must result in representative samples.

D. Personnel must be trained in the sampling techniques and procedures.

E. The proper containers must be selected for transporting the samples depending upon the analysis to be performed. The containers must be prepared in a manner which is compatible with the analysis being performed. The container must be free of any contaminants which will interfere with the analysis to be performed.

F. Preservative, free of contamination, must be added where necessary to retain the integrity of the sample. Environmental samples must be shipped at 4°C and stored at 4°C or less depending on the nature of the sample. Wet ice has been found to be the preferred coolant for shipment.

G. Each sample must be completely identified. The following information must be recorded in a bound book:

a. Identification number
b. Sample date
c. Sample taken by
d. Sample time (start-finish)
e. Sampling method and apparatus used
f. Source of sample
g. Sample point location
h. Preservative added (if applicable)
i. Analysis required
J. Notable sampling conditions such as meteorological information, flowrates, pipe dimensions, etc.
k. Description of physical appearance of the sample
l. Volume of sample
m. Date submitted to lab.

H. A chain of custody must be prepared by the sampler.

I. Accuracy and Precision
A field blank and duplicate samples must be submitted for analysis. The field blank is analyzed to check for contamination which might occur during sampling and transportation. An example of a field blank is distilled and/or deionized water which is taken to the site and transferred from a blank water bottle into a regular sample bottle and returned to the lab.

The duplicate samples are analyzed to validate the precision of the sampling technique.

J. Equipment Maintenance
All sampling equipment must be kept clean and free of contamination.

A maintenance program must be instituted for all equipment used in the sampling procedure. The maintenance must be performed on a regular basis to insure that all equipment is kept in good operating condition.

A written log must be kept in a bound book with the following information recorded:

a. Equipment description
b. Model number
c. Serial number
d. Date of installation
e. Maintenance schedule
f. Maintenance performed by
g. Maintenance performed by
h. Date maintenance performed
i. Date of next maintenance

Records must also be kept of emergency service.

K. Equipment Calibration
Calibration of sampling equipment must be performed on a regularly scheduled basis.

Records must be kept in a bound book with the following information recorded:

a. Equipment description
b. Model number
c. Serial number
d. Date of installation
e. Calibration procedure
f. Calibration schedule
g. Date calibration performed
h. Calibration performed by
i. Calibration data
j. Date of next scheduled calibration.

2) <u>Chain of Custody</u>

The purpose of the chain of custody is to trace the sample from its origin to disposal. The following procedure must be adhered to in order that the sample can be accounted for from the time of sampling until its disposal.

A. The sample is assigned an identification number in the field.

B. A chain of custody form is prepared.

C. The sample is transported to the lab accompanied by the chain of custody form. Lockable shipping containers or containers secured by non-peelable seal should be used for shipping samples so any evidence of tampering may be readily detected.

D. The sample is submitted to the lab sample custodian and assigned a control number.

E. The signatures of the persons relinquishing and obtaining custody of the samples are required. For samples delivered by common carrier, receipts should be retained as part of the permanent chain of custody documentation.

F. The sample custodian records the date and time received, the amount of sample received, the source of the sample, method of transportation to lab, the condition of sample received (sealed, unsealed, broken container, etc.) and all data from the sample label in a bound book.

G. If the sample or a portion of it is transferred to another person(s) for analysis, the amount released, the name of the individual(s) receiving the sample and the date are recorded.

The person(s) receiving the sample assigns it an identification number and records all pertinent information in a bound book.

Upon completion of analysis, the sample is returned to the custodian. The date of return and the name of the person returning the sample are recorded.

H. Samples must be in a person's possession and view or secured from the time of sampling until disposal.

I. The person responsible for the analysis must arrange for the proper disposal of the sample and its container.

J. The date and method of disposing of the sample are recorded by the custodian.

3) Analysis

A. Analytical Methodology

Analytical procedures must be in written form and available to lab personnel. The procedures must include information on the precision, accuracy and detection limits of the method. Instructions must be provided for the continuous determination of precision and accuracy and where applicable the calibration and standardization, and analysis of blanks.

Analytical procedures must be reviewed at regular intervals and a document control system must be used to assure that the written procedures are current and complete.

B. Method Calibration

Method calibration, where required, must be performed on a regular basis to assure accurate data.

Calibration procedures must be in written form and included as part of the analytical method. Calibrations must be performed under the same conditions as those that will be used for the analysis and must be specified in the procedure.

The procedure must include information on the frequency of the calibration and quality control checks and where applicable, indicate the number and concentration of standards required to develop instrument signal response data.

A permanent written record must be kept of all calibration information i.e., reference to procedure, date, name of person(s) performing calibration, data, schedule, and equipment description including model number and serial number (if applicable).

C. Precision and Accuracy

Precision - Duplicates are analyzed on a certain percentage (typically 10%) of samples as received with a minimum of one duplicate analyzed with each set of samples run in one time period.

Accuracy - Spiked and/or synthetic samples are analyzed on a certain percentage (typically 10%) of samples as received with a minimum of one spike analyzed with each set of samples run in one time period. The routine introduction of blind samples of known content included with samples for analysis is recomended.

Precision and accuracy data must be obtained on analytical procedures and on each analyst. Quality control charts must be prepared and confidence limits established for each analysis.

D. Reagents and Apparatus

Reagent grade chemicals, ACS or equivalent, must be used unless a higher purity is specified in the method.

Procedures or pertinent references for the preparation and where required, the standardization of volumetric and reagent testing solutions, must be included in the analytical method. Solutions must be properly labeled with identification, concentration, date prepared, and if relevant, the initials of the preparer and the standardization temperature. A permanent record must be kept of all standardization information.

Non-volatile solutions and volatile stock solutions must be prepared fresh or if applicable, restandardized at intervals consistent with their stability and must be stored at specified recommended temperatures. Dilute volatile solutions must be prepared fresh daily as needed.

Volumetric class A glassware should be used. If other than class A is used, it must be calibrated prior to use. Procedures must be written and available for various cleaning techniques depending on the analysis being performed.

E. Maintenance of Equipment

A maintnenace program must be instituted to assure that all equipment is maintained in good operating condition. This program must include a schedule for maintenance intervals on each instrument. A written log must be kept in a bound book with the following information recorded:

a. Equipment description
b. Model number
c. Serial number
d. Date of installation
f. Maintenance performed
g. Maintenance performed by
h. Date maintenance performed
i. Date of next maintenance

Records must also be kept of emergency service.

F. Calibration of Equipment

All equipment must be maintained in calibration. This is accomplished by use of manufacturers specifications or the particular needs of the analysis. Permanent written records must be kept in bound books on each instrument. All pertinent information is entered including:

a. Equipment description
b. Model number
c. Serial number
d. Date of installation
e. Calibration procedure
f. Calibration schedule
g. Date calibration performed
h. Calibration performed by
i. Calibration data
j. Date of next calibration

G. Records

Records must be kept on all phases of the Quality Assurance Program. All information must be permanently recorded in bound books. This includes information on sampling, chain of custody, calibration, precision and accuracy maintenance and analytical data.

Records of submitted samples and completed analysis must be kept in a manner that provides for the retrievability, the preservation and traceability of the sample source, the procedure and the person(s) responsible for sampling and analysis.

H. Data Validation

The assurance of valid analytical data will be maintained by the use of monitoring programs which include the following:

a. Precision and recovery analysis programs
b. Known reference sample program
c. Auditing of analytical procedures.

I. Data Reporting Format

The results of tests must be reported as specified in the method of analysis or as agreed upon by the laboratory and the user of the report.

The laboratory must have a standard procedure for reporting detection level limits, significant figures, and range or reliability of results.

Minimum reportable levels established prior to the analysis must be reported to the designation ND, which indicates not detected (ND) at the level of x (minimal reportable level).

The report must include the following:

a. Sample description
b. Sampling location
c. Sample date and time
d. Date and time sample received in lab
e. Date analysis performed
f. Reference to analytical method used
g. Note of modifications to the method or unusual observations made
h. Name of person(s) who performed analysis
i. Parameters determined
j. Units for all parameters
k. Results
l. Precision and accuracy statement
m. Date and signature of person(s) responsible for results.

APPENDIX C

INSPECTION FORMS

RUST ENVIRONMENT & INFRASTRUCTURE

OCCIDENTAL CHEMICAL CORPORATION
DUREZ INLET SITE
NORTH TONAWANDA, NEW YORK

PROJECT NO. 35630.602

DATE _____

Well Number	Elevation of Top of Pipe	Depth to Water	Water Elevation	Depth to Bottom	Depth to NAPL	NAPL Elevation	Well Integrity				Comments
							Locked	Capped	Cracked	Obstruct	
MONITORING WELLS											
MW-15I	570.05										
MW-16I	573.53										
MW-17I	574.61										
MW-18I	573.66										
MW-19I	572.54										
MW-20I	572.58										
MW-21S	572.20										
EXTRACTION WELLS											
EW-1	572.13										
EW-2	572.12										
EW-3	572.62										
EW-4	572.94										
EW-5	573.28										
STAFF GAUGE											
SG-1	567.66										

Description Of Site_____

Soil Conditions _____

Weather_____Temperature_____

Entered on Computer_____ Signature _____ Date_____

NOTE: NN - NO NAPL MEASURED

HHM/H:INLET/WATERLEV.XLS

DNAPL Level Summary

OCCIDENTAL CHEMICAL CORPORATION
INLET SITE
NORTH TONAWANDA, NEW YORK

DATE:

Well Number	Elevation of DNAPL	Elevation of Top of Sump	Height of DNAPL above Top of Sump	Elevation of Top of Till	Height of DNAPL above Top of Till	Elevation of Bottom of Sump	Height of DNAPL above Bottom of Sump	Volume of DNAPL (gallons)
EW-1		538.63		540.1		537.03		
EW-2		538.67		539.4		537.07		
EW-3		538.72		539.5		537.12		
EW-4		538.66		539.5		537.06		
EW-5		539.73		540.0		538.13		

Note:
1) NN = No NAPL measured.
2) Negative sign signifies that the DNAPL level is below the reference point.
3) DNAPL volume was calculated based on a 1.5 gallon/foot multiplier for a 6" diameter pipe.

OCCIDENTAL CHEMICAL CORPORATION
DUREZ INLET SITE
NORTH TONAWANDA, NEW YORK

DATE _____ INSPECTION PERFORMED BY:_____

Evidence of Erosion

	Yes/No	If yes, provide description and recommend maintenance activities
Shoreline		
River Bank		
Aquatic Areas		

Cove Cap

Is there evidence of erosion or disturbance at exposed portions? yes no (circle one)
submerged portions? yes no (circle one)
If yes, provide description and recommended maintenance activities.

North Lobe

Is there evidence of activity or penetration that could compromise the effectiveness of the cutoff wall? yes no (circle one)
If yes, provide description and recommended maintenance activities.

OCCIDENTAL CHEMICAL CORPORATION
DUREZ INLET SITE
NORTH TONAWANDA, NEW YORK

Revegetation

See attached figure for locations of replanted areas (perennials, shrubs, and trees).

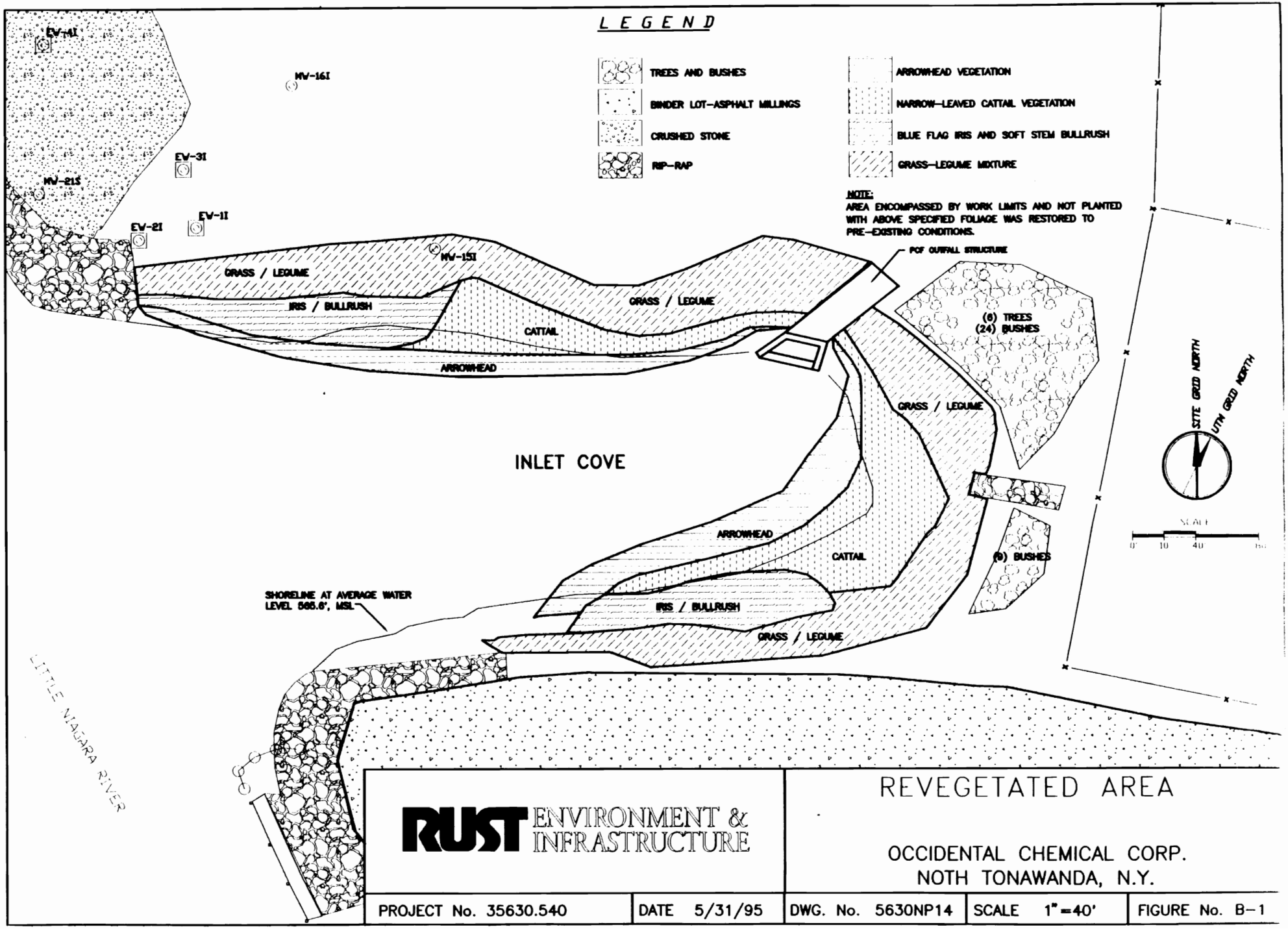
Areas of perennials:	If >25% die-off, evaluate need to replant vegetation the following spring. If >50% die-off, evaluate need to completely replant or reevaluate type of vegetation appropriate for the location.
Trees and shrubs:	Evaluate need to replace trees or shrubs that have died.

Type of Vegetation	Condition of Vegetation	Recommended Action
Cattails		
Iris/Bullrush		
Arrowhead		
Grass/Legume		
Trees and Bushes		

Tree Fertilization (Spring 1997; spring of second year following planting)

Silky Dogwood - 0.25 pounds of 5-10-5 per plant
Silver Maple and Cottonwood - 1 pound of 5-10-5 per inch of trunk diameter

Summary of Recommended Maintenance Activities



RUST ENVIRONMENT & INFRASTRUCTURE

REVEGETATED AREA

OCCIDENTAL CHEMICAL CORP.
NOTH TONAWANDA, N.Y.

PROJECT No. 35630.540	DATE 5/31/95	DWG. No. 5630NP14	SCALE 1"=40'	FIGURE No. B–1

RUST ENVIRONMENT & INFRASTRUCTURE

Well Purging and Sample Collection

Project No.: _____ Well No. ( ) Site: _____

Purging Method: Pumped ☐ Bailed ☐ Other: _____

Pump Type: _____ Bailer Type: _____

Weather Conditions: _____

Volume Calculation: _____

(D.T.B. – D.T.W. x vol./ft. = Gals./well vol.)
(Gals./well vol. x 5 = Total Volume to be removed)

Gals./well vol.: _____

Time	Depth to Water (D.T.W.)	Depth to Bottom (D.T.B.)	Volume Removed (gal.)	pH	Cond.	Temp.	Color	Odor Y/N	Turbidity
		Sample Readings							

Comments: _____

Inside Diameter	vol./ft.
1"	0.04
1.25"	0.06
2"	0.16
4"	0.65

Field Blank Taken ☐ Time: _____

Well Duplicate ☐ No.: _____

Signature: _____

Date: ____/____/____

HNu/PPM	LEL/%	O_2/%	H_2S/PPM	CO/PPM	

RUST ENVIRONMENT & INFRASTRUCTURE

Chain of Custody Record

Custody Seal #	RUST E&I Cooler #

Project Number	Project Name/Client
Sample Custodian: (Signature)	

Item No.	Sample Description (Field ID Number)	Date	Time	Grab	Comp.	PID Reading (ppm)	Label Number	Analysis Required	Matrix: Sample Type	Matrix: Sample Container
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date/Time
Relinquished by: (Signature)	Date/Time	Received by: (Signature) [Laboratory]	Disposed of by: (Signature)	Items:	Date/Time

Send Lab Results To:	Remarks:	Check Delivery Method:	Laboratory Receiving Notes:
	Federal Express Airbill No.: Lab:	☐ Samples delivered in person ☐ Common carrier	Custody Seal Intact? Temp. of Shipping Container: Sample Condition:

Rev. 4/94 White Copy – Lab Yellow Copy – File Pink Copy – Client F514/Earth.Sci

APPENDIX D

MINOR CHANGE FORM

Minor Change No. _____

Page # _____

Date _____

State of New York and City of North Tonawanda
vs.
Occidental Chemical Corporation
USDC WDNY 83-552-C

MINOR CHANGE TO INLET MONITORING PLAN

Proposed Change: _____

Inlet Monitoring Plan: Title _____ **Page No.** _____

Text of Change (attach additional pages if necessary):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Reason for Change (attach additional pages if necessary):

_____
_____
_____
_____
_____
_____
_____
_____
_____

Minor Change No. _____
Page # _____
Date _____

OCC Project Coordinator

Approved:

_____
Name (print)

_____ _____
Signature Date

DEC Project Coordinator

Approved:

_____
Name (print)

_____ _____
Signature Date

NOTE: Minor changes to the Inlet Monitoring Plan may be made by the written agreement of the State and OCC.

Distribution of final signed copies of this document, in accordance with the PCJ, is shown on Transmittal # _____.