Pfizer Inc
7000 Portage Road
Kalamazoo, MI 49001-0199

Pfizer Global Supply

June 16, 2022

EGLE
MMD
525 West Allegan Street, PO Box 30241
Lansing, MI 48933

RE: Pharmacia & Upjohn Company LLC
Hazardous Waste Management Facility Operating License Renewal Application
MID 000 820 381

To who it may concern:

Pharmacia & Upjohn Company LLC operates a pharmaceutical plant facility located at 7000 Portage Road, Kalamazoo, Michigan (the "Facility"). As required by Part 111 of Act 451, Pharmacia & Upjohn Company LLC is submitting a completed Renewal Application (Form EQP 5111) for the hazardous waste container storage management unit located in Building 388. The Application fee has been paid electronically through the EGLE system and the invoice is included with this letter.

Sincerely,

John Ring

John Ring

EHS Manager

Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division

OPERATING LICENSE APPLICATION FORM FOR HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

Required under authority of Part 111, Hazardous Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Failure to submit this information may result in civil or criminal penalties.

Note: Copies of the current EGLE Site Identification Form, EQP 5150, and the EPA Part A Permit Application Form, 8700-23, must be submitted with this application.

I. FACILITY SITE ID NUMBER	MID000820381

II. FACILITY'S LEGAL OWNER

A. Name	Pharmacia & Upjohn Company, LLC
B. Street or P.O. Box	7171 Portage Rd PORT-091-106
C. City/State/ZIP	Kalamazoo, MI 49001
D. Telephone Number (area code included)	269-833-4000

E. Owner Type	P	F. Ownership Change?	Y		N	X	N/A		Date	

III. FACILITY OPERATOR

A. Name	Pharmacia & Upjohn, LLC
B. Street or P.O. Box	7171 Portage Rd PORT-091-106
C. City/State/ZIP	Kalamazoo, MI 49001
D. Telephone Number (area code included)	269-833-9040

E. Operator Type	P	F. Operator Change?	Y		N	X	N/A		Date	

IV. TITLEHOLDER OF LAND

A. Name	Pfizer, INC
B. Street or P.O. Box	235 East 42nd Street
C. City/State/ZIP	New York, NY 10017
D. Telephone Number (area coded included)	212-733-2323

V. OPERATING LICENSE APPLICATION

Place an "X" in the appropriate box under either A or B (select only one box)

A. Operating License Application

☐	First Application for *Existing Facility	Place an "X" here if application is for a facility that has not been previously licensed in Michigan to treat, store, or dispose of hazardous waste and has interim status pursuant to 40 CFR §270.70.
☒	Renewal Application for *Existing Facility	Place an "X" here if renewal application for a facility that was previously licensed in Michigan to treat, store, or dispose hazardous waste and whose hazardous waste operations have not had any new construction or been altered, enlarged, or expanded.
☐	Application for Modification of License	Place an "X" here if application is for a license modification.
☐	First Application for Research, Development, and Demonstration (RDD) License	Place an "X" here if application for a temporary license for RDD.
☐	Renewal Application for RDD License	Place an "X" here if application for the renewal of a temporary license for RDD.

B. Operating License Application for New, Altered, Enlarged, or Expanded Facility

☐	First Application	Place an "X" here if application is for a new facility or a facility that wishes to alter, enlarge, or expand its hazardous waste operations.

For existing facilities, provide date operation began.	Date	11/19/1980
For RDD activities, provide the date RDD began or expected to begin.	Date	
For new, altered, enlarged, or expanded facilities, provide date expected construction to begin.	Date	

***Existing Facility** means a hazardous waste treatment, storage, or disposal facility (TSDF) that either received all necessary state-issued environmental permits or licenses before January 1, 1980, or for which approval of construction was received from the Air Pollution Control Commission before November 19, 1980, or before promulgation of new federal rules that caused the facility to become subject to regulation as a TSDF. Existing facilities also include TSDFs that were operating before January 1, 1980, under existing authority, or before promulgation of new federal rules that caused the facility to become subject to regulation as a TSDF and that did not require state-issued environmental permits or licenses.

VI. OPERATING LICENSE APPLICATION FEES			
☒	A. Operating License Application Fixed Fee		$ 500
☐	B. Additional License Application Fees for New, Altered, Enlarged, or Expanded Facility		$ 25,000
	Check Type of Facility		
☐	Land Disposal ($9,000)		$
☐	Incineration or Other Treatment ($7,200)		$
☒	Storage ($500)		$
Total Operating License Fee			$

Note: Checks shall be made payable to the “State of Michigan” and the state accounting code “HWOL” written in the memo portion. Checks shall be mailed to EGLE, Cashier’s Office, P.O. Box 30657, Lansing, Michigan 48909-8157, with a copy of payment included with application that is mailed to the EGLE, MMD, P.O. Box 30241, Lansing, Michigan 48909-7741.

VII. EXISTING ENVIRONMENTAL PERMITS (attach copies of each as proof of issuance)		
☒	A. NPDES (Discharges to Surface Water) Permit Number	MI0002941
☒	B. UIC (Underground Injection of Fluids) Permit Number	MI-077-1W-001/137-744-839 & MI-077-1W-002/327-794-829
☒	C. RCRA (Hazardous Waste) Permit Number	MID 000 820 381
☐	D. PSD (Air Emissions From Proposed Sources) Permit Number	
☒	E. Other (Specify below) Permit Number	USNRC - 21-00182-03; Groundwater Discharge - GW1110251

Title V Air Permit: MI-ROP-B3610-2008

VIII. NATURE OF BUSINESS (Provide a brief description)

This facility is a manufacturer of pharmaceuticals and fine chemical products.

IX. MAP

Attach to this application a topographic map of the area extending at least one mile beyond the property boundaries (Figure 1). The map must show the legal boundaries of the facility; the location of each of its existing and proposed intake and discharge structures; each of its hazardous waste treatment, storage, or disposal facilities, including the location of all processes listed in Items XII and XIII identified by process code; and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area, plus all drinking water wells within a quarter mile of the facility that are identified in the public record or otherwise known to you. (see instructions for specific requirements)

X. FACILITY DRAWING

All existing facilities must include a scale drawing of the facility showing the property boundaries of the facility; the areas occupied by treatment, storage, or disposal operations that will be used during interim status; the name of each operation (drum storage area, etc.); areas of past TSD operations; areas of future TSD; and the approximate dimensions of the property boundaries and all TSD areas (Figure 2). Where applicable, use the process codes listed in Items XII and XIII to indicate the location of all TSD. This drawing should fit on an 8.5 by 11 inch sheet of paper.

XI. PHOTOGRAPHS

All existing facilities must include photographs that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas (Figure 3). Use the process codes and descriptions in Items XII and XIII to indicate the location of all TSD areas. Indicate the date of the photograph on the back of each photograph. Photographs may be in color or black and white, aerial or ground-level.

XII. PROCESS CODES AND DESIGN CAPACITIES (see instructions)

Line Number	A. Process Code (from list)	B. Process Design Capacity			Line Number	A. Process Code (from list)	B. Process Design Capacity		
		B.1. Quantity	B.2. Unit of Measure	For Official Use Only			B.1. Quantity	B.2. Unit of Measure	For Official Use Only
1.	S01	15400	G		5.				
2.					6.				
3.					7.				
4.					8.				

XIII.DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
								The information required for this section is included in the attached pages

XIV. OTHER REQUIRED ATTACHMENTS

A. General Information (each item should be a separate attachment to the application)

1. General facility description
2. Chemical and physical analyses*
3. Waste Analysis Plan*
4. Security procedures and equipment
5. Inspection schedules*
6. Preparedness/prevention or waiver*
7. Contingency Plan*
8. Traffic information
9. Location information
10. Personnel training program*
11. Closure and Postclosure (C/PC) Plan*
12. C/PC cost estimates*
13. Topographic map
14. Liability mechanism
15. Financial assurance instrument

* Use template provided to complete application

B. Supplemental Information (each item, if needed, should be a separate attachment to the application)

1. Status of compliance with other federal laws
2. Corrective action information*
3. Hydrogeological Report*
4. Environmental Assessment*
5. Environmental monitoring Programs*
6. Engineering plans
7. Proof of issuance of other permits or licenses
8. Capability certification/compliance schedule
9. Restrictive covenant (landfills only)
10. Construction certification (new, altered, enlarged, or expanded)

* Use template provided to complete application

C. Facility Specific Information (each item, if needed, should be a separate attachment to the application)

1. Containers*
2. Tanks*
3. Incineration or thermal treatment
4. Treatment
5. Surface impoundments
6. Waste piles
7. Landfills
8. Land treatment
9. Miscellaneous units
10. Underground mines or caves
11. Drip pads
12. Boilers and industrial furnaces
13. Air emissions from process vents, equipment leaks, tanks, containers, and surface impoundments**

* Use template provided to complete application

** Use templates C.11-AA, C.11-BB, and C.11-CC provided to complete application

XV. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

David Breen	DocuSigned by: David Breen CBB53461C18D425...	June 15, 2022
OWNER NAME (type or print)	SIGNATURE	DATE SIGNED
Steven Maynard	DocuSigned by: Steve L Maynard A413EBE7B807417...	June 14, 2022
OPERATOR NAME (type or print)	SIGNATURE	DATE SIGNED
TITLEHOLDEROF LAND NAME (type or print)	SIGNATURE	DATE SIGNED

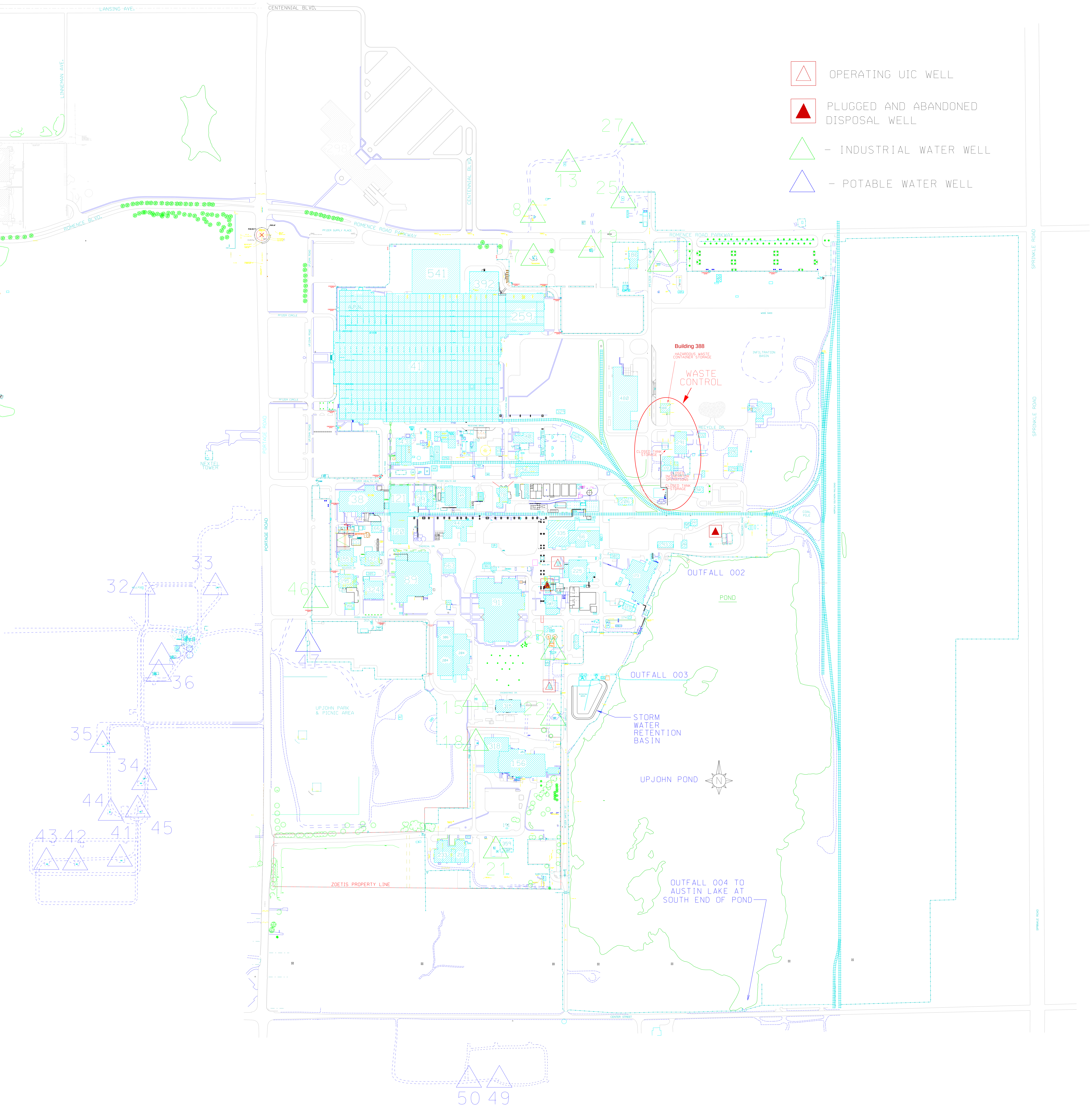
OPERATING UIC WELL
PLUGGED AND ABANDONED DISPOSAL WELL
- INDUSTRIAL WATER WELL
- POTABLE WATER WELL
LANSING AVE.
CENTENNIAL BLVD.
LINKEMAN AVE.
ROMENCE BLVD.
ROMENCE ROAD PARKWAY
CENTENNIAL BLVD.
PORTAGE ROAD
SPRINKLE ROAD
CENTER STREET
NEXTEL TOWER
PFIZER QUALITY
RECYCLE DR.
RECOVERY ROAD
WOOD SHED
INFILTRATION BASIN
COAL PILE
Building 388
HAZARDOUS WASTE CONTAINER STORAGE
WASTE CONTROL
CLOSED TANK STORAGE
CLOSED INCINERATOR OPERATIONS
CLOSED TANK STORAGE
OUTFALL 002
POND
OUTFALL 003
STORM WATER RETENTION BASIN
UPJOHN POND
N
OUTFALL 004 TO AUSTIN LAKE AT SOUTH END OF POND
UPJOHN PARK & PICNIC AREA
ZOETIS PROPERTY LINE
27
13
25
8
33
32
46
36
47
15
2
1
35
34
44
45
43
42
41
21
50
49
541
392
259
41
480
388
291
172
332
229C
223
229A
50
206
381
444
124
427
605
297
93
299
481
301
173
386
38
126
89
336
225
316
156
416
212
359

Figure 3

B388 Hazardous Waste Storage

Permit ID: MID000820381

June 2022 – RCRA Permit Renewal

XIII. DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
1	F001	See Line 6 (D001)	T	T03	D80			
2	F002	See Line 6 (D001)	T	T03	D80			
3	F003	See Line 6 (D001)	T	T03	D80			
4	F004	0.1	T	T03	D80			
5	F005	See Line 6 (D001)	T	T03	D80			
6	D001	7000	T	T03	D80			
7	D002	10	T	T03	D80			
8	D003	20	T	T03	D80			
9	D004	0.1	T	T03	D80			
10	D005	0.1	T	T03	D80			
11	D006	0.1	T	T03	D80			
12	D007	20	T	T03	D80			
13	D008	0.1	T	T03	D80			
14	D009	0.1	T	T03	D80			
15	D010	0.1	T	T03	D80			
16	D011	0.1	T	T03	D80			
17	D018	0.1	T	T03	D80			
18	D019	4	T	T03	D80			
19	D020	0.1	T	T03	D80			
20	D021	10	T	T03	D80			
21	D022	10	T	T03	D80			
22	D023	0.1	T	T03	D80			
23	D024	0.1	T	T03	D80			
24	D025	0.1	T	T03	D80			
25	D026	0.1	T	T03	D80			
26	D027	10	T	T03	D80			
27	D028	0.1	T	T03	D80			
28	D029	10	T	T03	D80			
29	D030	0.1	T	T03	D80			
30	D032	0.1	T	T03	D80			
31	D033	0.1	T	T03	D80			
32	D034	0.1	T	T03	D80			
33	D035	10	T	T03	D80			
34	D036	0.1	T	T03	D80			
35	D037	0.1	T	T03	D80			
36	D038	10	T	T03	D80			
37	D039	0.1	T	T03	D80			
38	D040	0.1	T	T03	D80			
39	D041	0.1	T	T03	D80			
40	D042	0.1	T	T03	D80			

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Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
41	D043	0.1	T	T03	D80			
42	P003	0.1	T	T03	D80			
43	P004	0.1	T	T03	D80			
44	P010	0.1	T	T03	D80			
45	P011	0.1	T	T03	D80			
46	P012	0.1	T	T03	D80			
47	P013	0.1	T	T03	D80			
48	P014	0.1	T	T03	D80			
49	P017	0.1	T	T03	D80			
50	P018	0.1	T	T03	D80			
51	P022	0.1	T	T03	D80			
52	P023	0.1	T	T03	D80			
53	P024	0.1	T	T03	D80			
54	P028	0.1	T	T03	D80			
55	P029	0.1	T	T03	D80			
56	P030	0.1	T	T03	D80			
57	P037	0.1	T	T03	D80			
58	P042	0.1	T	T03	D80			
59	P043	0.1	T	T03	D80			
60	P047	0.1	T	T03	D80			
61	P051	0.1	T	T03	D80			
62	P059	0.1	T	T03	D80			
63	P063	0.1	T	T03	D80			
64	P064	0.1	T	T03	D80			
65	P067	0.1	T	T03	D80			
66	P068	0.1	T	T03	D80			
67	P074	0.1	T	T03	D80			
68	P075	0.1	T	T03	D80			
69	P076	0.1	T	T03	D80			
70	P077	0.1	T	T03	D80			
71	P087	0.1	T	T03	D80			
72	P088	0.1	T	T03	D80			
73	P089	0.1	T	T03	D80			
74	P093	0.1	T	T03	D80			
75	P095	0.1	T	T03	D80			
76	P098	0.1	T	T03	D80			
77	P101	0.1	T	T03	D80			
78	P102	0.1	T	T03	D80			
79	P103	0.1	T	T03	D80			
80	P104	0.1	T	T03	D80			
81	P105	0.1	T	T03	D80			

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Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
82	P106	0.1	T	T03	D80			
83	P108	0.1	T	T03	D80			
84	P113	0.1	T	T03	D80			
85	P115	0.1	T	T03	D80			
86	P116	0.1	T	T03	D80			
87	P121	0.1	T	T03	D80			
88	P123	0.1	T	T03	D80			
89	U001	0.1	T	T03	D80			
90	U002	0.1	T	T03	D80			
91	U003	0.1	T	T03	D80			
92	U004	0.1	T	T03	D80			
93	U006	0.1	T	T03	D80			
94	U007	0.1	T	T03	D80			
95	U008	0.1	T	T03	D80			
96	U009	0.1	T	T03	D80			
97	U012	0.1	T	T03	D80			
98	U019	0.1	T	T03	D80			
99	U021	0.1	T	T03	D80			
100	U029	0.1	T	T03	D80			
101	U031	0.1	T	T03	D80			
102	U032	0.1	T	T03	D80			
103	U034	0.1	T	T03	D80			
104	U036	0.1	T	T03	D80			
105	U037	0.1	T	T03	D80			
106	U039	0.1	T	T03	D80			
107	U041	0.1	T	T03	D80			
108	U043	0.1	T	T03	D80			
109	U044	0.1	T	T03	D80			
110	U045	0.1	T	T03	D80			
111	U046	0.1	T	T03	D80			
112	U052	0.1	T	T03	D80			
113	U053	0.1	T	T03	D80			
114	U056	0.1	T	T03	D80			
115	U057	0.1	T	T03	D80			
116	U061	0.1	T	T03	D80			
117	U067	0.1	T	T03	D80			
118	U068	0.1	T	T03	D80			
119	U070	0.1	T	T03	D80			
120	U071	0.1	T	T03	D80			
121	U072	0.1	T	T03	D80			
122	U073	0.1	T	T03	D80			

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Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
123	U076	0.1	T	T03	D80			
124	U077	10	T	T03	D80			
125	U080	0.1	T	T03	D80			
126	U081	0.1	T	T03	D80			
127	U082	0.1	T	T03	D80			
128	U083	0.1	T	T03	D80			
129	U088	0.1	T	T03	D80			
130	U092	0.1	T	T03	D80			
131	U097	0.1	T	T03	D80			
132	U098	0.1	T	T03	D80			
133	U099	0.1	T	T03	D80			
134	U101	0.1	T	T03	D80			
135	U102	0.1	T	T03	D80			
136	U103	0.1	T	T03	D80			
137	U105	0.1	T	T03	D80			
138	U106	0.1	T	T03	D80			
139	U107	0.1	T	T03	D80			
140	U108	0.1	T	T03	D80			
141	U109	0.1	T	T03	D80			
142	U110	0.1	T	T03	D80			
143	U112	0.1	T	T03	D80			
144	U113	0.1	T	T03	D80			
145	U115	0.1	T	T03	D80			
146	U117	0.1	T	T03	D80			
147	U118	0.1	T	T03	D80			
148	U119	0.1	T	T03	D80			
149	U120	0.1	T	T03	D80			
150	U122	0.1	T	T03	D80			
151	U123	0.1	T	T03	D80			
152	U124	0.1	T	T03	D80			
153	U127	0.1	T	T03	D80			
154	U128	0.1	T	T03	D80			
155	U131	0.1	T	T03	D80			
156	U132	0.1	T	T03	D80			
157	U133	0.1	T	T03	D80			
158	U134	0.1	T	T03	D80			
159	U135	0.1	T	T03	D80			
160	U136	0.1	T	T03	D80			
161	U138	0.1	T	T03	D80			
162	U140	0.1	T	T03	D80			
163	U144	0.1	T	T03	D80			

XIII.DESCRIPTION OF HAZARDOUS WASTES								
Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
164	U145	0.1	T	T03	D80			
165	U147	0.1	T	T03	D80			
166	U148	0.1	T	T03	D80			
167	U149	0.1	T	T03	D80			
168	U151	0.1	T	T03	D80			
169	U154	0.1	T	T03	D80			
170	U156	0.1	T	T03	D80			
171	U157	0.1	T	T03	D80			
172	U159	0.1	T	T03	D80			
173	U160	0.1	T	T03	D80			
174	U161	0.1	T	T03	D80			
175	U162	0.1	T	T03	D80			
176	U163	0.1	T	T03	D80			
177	U165	0.1	T	T03	D80			
178	U169	0.1	T	T03	D80			
179	U170	0.1	T	T03	D80			
180	U171	0.1	T	T03	D80			
181	U181	0.1	T	T03	D80			
182	U182	0.1	T	T03	D80			
183	U183	0.1	T	T03	D80			
184	U184	0.1	T	T03	D80			
185	U185	0.1	T	T03	D80			
186	U186	0.1	T	T03	D80			
187	U188	0.1	T	T03	D80			
188	U189	0.1	T	T03	D80			
189	U196	0.1	T	T03	D80			
190	U197	0.1	T	T03	D80			
191	U200	0.1	T	T03	D80			
192	U201	0.1	T	T03	D80			
193	U202	0.1	T	T03	D80			
194	U203	0.1	T	T03	D80			
195	U204	0.1	T	T03	D80			
196	U206	0.1	T	T03	D80			
197	U207	0.1	T	T03	D80			
198	U208	0.1	T	T03	D80			
199	U209	0.1	T	T03	D80			
200	U210	0.1	T	T03	D80			
201	U211	0.1	T	T03	D80			
202	U213	0.1	T	T03	D80			
203	U214	0.1	T	T03	D80			
204	U215	0.1	T	T03	D80			

XIII.DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
205	U217	0.1	T	T03	D80			
206	U218	0.1	T	T03	D80			
207	U219	0.1	T	T03	D80			
208	U220	0.1	T	T03	D80			
209	U222	0.1	T	T03	D80			
210	U223	0.1	T	T03	D80			
211	U225	0.1	T	T03	D80			
212	U226	0.1	T	T03	D80			
213	U227	0.1	T	T03	D80			
214	U228	0.1	T	T03	D80			
215	U234	0.1	T	T03	D80			
216	U236	0.1	T	T03	D80			
217	U237	0.1	T	T03	D80			
218	U238	0.1	T	T03	D80			
219	U239	0.1	T	T03	D80			
220	U240	0.1	T	T03	D80			
221	U244	0.1	T	T03	D80			
222	U246	0.1	T	T03	D80			
223	U328	0.1	T	T03	D80			
224	U353	0.1	T	T03	D80			
225	U358	0.1	T	T03	D80			
226	U404	0.1	T	T03	D80			
227	001U	0.1	T	T03	D80			
228	002U	0.1	T	T03	D80			
229	003U	0.01	T	T03	D80			
230	004U	0.1	T	T03	D80			
231	005U	0.01	T	T03	D80			
232	006U	0.01	T	T03	D80			
233	007U	0.01	T	T03	D80			
234	008U	0.01	T	T03	D80			
235	009U	0.01	T	T03	D80			
236	011U	0.01	T	T03	D80			
237	012U	0.01	T	T03	D80			
238	014U	0.01	T	T03	D80			
239	015U	0.01	T	T03	D80			
240	016U	0.01	T	T03	D80			
241	017U	0.01	T	T03	D80			
242	020U	0.01	T	T03	D80			
243	021U	0.01	T	T03	D80			
244	022U	0.01	T	T03	D80			
245	023U	0.01	T	T03	D80			

XIII.DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
246	024U	0.01	T	T03	D80			
247	025U	0.01	T	T03	D80			
248	027U	0.01	T	T03	D80			
249	028U	0.01	T	T03	D80			
250	029U	0.01	T	T03	D80			
251	033U	0.1	T	T03	D80			
252	034U	0.01	T	T03	D80			
253	036U	0.01	T	T03	D80			
254	038U	0.01	T	T03	D80			
255	040U	0.01	T	T03	D80			
256	042U	0.01	T	T03	D80			
257	043U	0.01	T	T03	D80			
258	044U	0.01	T	T03	D80			
259	046U	0.1	T	T03	D80			
260	047U	0.01	T	T03	D80			
261	048U	0.01	T	T03	D80			
262	049U	0.01	T	T03	D80			
263	050U	0.01	T	T03	D80			
264	051U	0.01	T	T03	D80			
265	052U	0.01	T	T03	D80			
266	054U	0.01	T	T03	D80			
267	055U	0.01	T	T03	D80			
268	056U	0.1	T	T03	D80			
269	057U	0.01	T	T03	D80			
270	058U	0.01	T	T03	D80			
271	059U	0.01	T	T03	D80			
272	061U	0.01	T	T03	D80			
273	063U	0.01	T	T03	D80			
274	064U	0.01	T	T03	D80			
275	065U	0.01	T	T03	D80			
276	068U	0.01	T	T03	D80			
277	070U	0.01	T	T03	D80			
278	071U	0.01	T	T03	D80			
279	072U	0.01	T	T03	D80			
280	073U	0.01	T	T03	D80			
281	074U	0.01	T	T03	D80			
282	075U	0.01	T	T03	D80			
283	076U	0.01	T	T03	D80			
284	077U	0.1	T	T03	D80			
285	078U	0.1	T	T03	D80			
286	079U	0.01	T	T03	D80			

XIII.DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
287	080U	0.01	T	T03	D80			
288	082U	0.1	T	T03	D80			
289	083U	0.1	T	T03	D80			
290	086U	0.01	T	T03	D80			
291	088U	0.01	T	T03	D80			
292	089U	0.01	T	T03	D80			
293	090U	0.01	T	T03	D80			
294	092U	0.01	T	T03	D80			
295	094U	0.01	T	T03	D80			
296	095U	0.01	T	T03	D80			
297	096U	0.1	T	T03	D80			
298	097U	0.01	T	T03	D80			
299	098U	0.01	T	T03	D80			
300	099U	0.01	T	T03	D80			
301	100U	0.01	T	T03	D80			
302	101U	0.01	T	T03	D80			
303	102U	0.01	T	T03	D80			
304	103U	0.01	T	T03	D80			
305	104U	0.01	T	T03	D80			
306	106U	0.01	T	T03	D80			
307	108U	0.01	T	T03	D80			
308	110U	0.01	T	T03	D80			
309	111U	0.01	T	T03	D80			
310	112U	0.01	T	T03	D80			
311	113U	0.01	T	T03	D80			
312	114U	0.01	T	T03	D80			
313	115U	0.1	T	T03	D80			
314	116U	1	T	T03	D80			
315	117U	1	T	T03	D80			
316	118U	0.01	T	T03	D80			
317	119U	0.01	T	T03	D80			
318	120U	0.01	T	T03	D80			
319	121U	0.01	T	T03	D80			
320	122U	0.01	T	T03	D80			
321	124U	0.01	T	T03	D80			
322	127U	0.01	T	T03	D80			
323	128U	0.01	T	T03	D80			
324	129U	0.01	T	T03	D80			
325	131U	0.01	T	T03	D80			
326	132U	0.01	T	T03	D80			
327	134U	0.01	T	T03	D80			

XIII.DESCRIPTION OF HAZARDOUS WASTES

Line Number	A. Hazardous Waste Number (enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes				
				D.1 Process Codes (enter code)				D.2 Process Description (if no code entered in D.1)
32	135U	0.01	T	T03	D80			
330	136U	0.01	T	T03	D80			
331	137U	0.01	T	T03	D80			
332	138U	0.01	T	T03	D80			
333	139U	0.1	T	T03	D80			
334	140U	0.01	T	T03	D80			
335	141U	0.01	T	T03	D80			
336	142U	0.01	T	T03	D80			
337	143U	0.01	T	T03	D80			
338	144U	0.01	T	T03	D80			
339	147U	0.01	T	T03	D80			
340	148U	0.01	T	T03	D80			
341	150U	0.01	T	T03	D80			
342	151U	0.01	T	T03	D80			
343	152U	0.01	T	T03	D80			
344	153U	0.01	T	T03	D80			
345	154U	0.01	T	T03	D80			
346	157U	0.01	T	T03	D80			
347	158U	0.1	T	T03	D80			
348	159U	0.01	T	T03	D80			
349	161U	0.1	T	T03	D80			
350	162U	0.01	T	T03	D80			
351	163U	0.01	T	T03	D80			
352	164U	0.01	T	T03	D80			
353	165U	0.01	T	T03	D80			
354	166U	0.01	T	T03	D80			
355	167U	0.01	T	T03	D80			
356	168U	0.01	T	T03	D80			
357	169U	0.01	T	T03	D80			
358	170U	0.01	T	T03	D80			
359	171U	0.01	T	T03	D80			

ATTACHMENT A2
CHEMICAL AND PHYSICAL ANALYSES

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, and R 299.9605, and Title 40 of the Code of Federal Regulations (CFR) §§264.13(a) and 270.14(b)(2), establish requirements for chemical and physical analyses at hazardous waste management facilities. All references to the 40 CFR citations specified herein are adopted by reference in R 299.11003

This license application template addresses requirements for chemical and physical analyses at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in *Kalamazoo*, Michigan. The information included in the template demonstrates how the facility meets the chemical and physical analyses requirements for hazardous waste management facilities.

Type of applicant: (*Check as appropriate)*

☒ Applicant for Operating License for Existing Facility

☐ Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility

Type of Facility: (*Check as appropriate)*

☒ On-site Facility (generates hazardous waste)

☐ Off-site Facility (accepts hazardous waste from other generators)

Type of Units to be Constructed or Operated at the Facility: *(Check as appropriate)*

☒ Containers

☐ Tank(s)

☐ Waste Pile(s)

☐ Landfilled Waste

☐ Waste Incineration

☐ Land Treatment

☐ Miscellaneous Unit(s)

☐ Boilers and Industrial Furnaces

A2.A WASTE DESCRIPTION
[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

A2.A.1 Waste Description (generate on-site wastes)
[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

The following are the chemical and physical characterizations of hazardous wastes to be handled at the Pharmacia & Upjohn Co LLC facility. These characterizations contain all the information that must be known to properly treat, store, and dispose of the waste. Wastes for container storage may be liquids, semi-solids, solids, or compressed gases. The specific identification numbers of the waste types to be stored in containers can be found in Table A2-1.

These are hazardous waste materials generated from all site operations and consist primarily of spent solvents; expired or off-specification raw materials, products, returned goods and pharmaceutical raw materials; process filter cakes; and laboratory chemicals. Incompatible materials will be segregated with containment pallets according to the 49 CFR Part 177.848, Segregation Table for Hazardous Material.

A2.A.2 Waste Description (receive wastes from off-site generators)
[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

Waste from another *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* facility may be accepted at this facility as LQG consolidation of VSQG waste per R 299.9307(6). The characteristic of the waste from this facility will be the same as those generated on-site and described above.

Table A2.A.1 Hazardous Waste Generated at the Facility (page 7)

Attachment A2.A.1 Laboratory Report Detailing Chemical and Physical Analyses of Representative Samples

Most waste sent to B388 is profiled by generator knowledge – for example drums of expired solvents or raw materials. Samples are collected as needed to characterize waste or to determine if the waste is hazardous.

Table A2.A.2 Hazardous Wastes Accepted at the Facility (page 8)

A2.B CONTAINERIZED WASTE
[R 299.9504(1)(c) and 40 CFR §264.172]

A2.B.1 Wastes Compatible with Container

All materials will be packaged in appropriate DOT containers such as compatible glass, plastic, metal or fiber containers of sound integrity, properly packaged labpacks, or cartons containing prepackaging goods in glass or metal containers.

A2.B.2 Containers without Secondary Containment System

Not applicable, B388 has a secondary containment system.

TABLE A2.A.1 HAZARDOUS WASTE GENERATED AT THE FACILITY

Hazardous Waste Code	Waste Description	Hazardous Waste Characteristics	Basis for Hazardous Designation	Hazardous Waste Management Unit
D001	Flammable Liquids	Ignitability	Generator Knowledge	B388
D001	Oxidizers	Ignitability	Generator Knowledge	B388
D001	Flammable Solids	Ignitability	Generator Knowledge	B388
D001	Ignitable Compressed Gas	Ignitability	Generator Knowledge	B388
D002	Corrosive Liquid (base)	Corrosivity	Generator Knowledge	B388
D002	Corrosive Liquid (acid)	Corrosivity	Generator Knowledge	B388
D002	Corrosive Solid	Corrosivity	Generator Knowledge	B388
D003	Water reactive	Reactivity	Generator Knowledge	B388
D003	Cyanide Waste	Reactivity	Generator Knowledge	B388
D003	Sulfide Waste	Reactivity	Generator Knowledge	B388
D003	Unstable Waste readily undergoes violent change without detonation	Reactivity	Generator Knowledge	B388
D004	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D005	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D006	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D007	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D007	Production Waste	Toxicity	Generator Knowledge	B388
D008	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D008	Maintenance Waste	Toxicity	Generator Knowledge	B388
D009	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D009	Production Waste	Toxicity	Generator Knowledge	B388
D010	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D011	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D018	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D019	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D020	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D021	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D022	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D023	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D023	Production Waste	Toxicity	Generator Knowledge	B388
D024	Lab Pack Waste	Toxicity	Generator Knowledge	B388

D024	Production Waste	Toxicity	Generator Knowledge	B388
D025	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D025	Production Waste	Toxicity	Generator Knowledge	B388
D026	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D026	Production Waste	Toxicity	Generator Knowledge	B388
D027	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D028	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D029	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D030	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D032	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D033	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D034	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D035	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D036	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D037	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D038	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D039	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D040	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D041	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D042	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D043	Lab Pack Waste	Toxicity	Generator Knowledge	B388
F001	Spent solvents from production	Toxicity	Generator Knowledge	B388
F002	Spent solvents from production	Toxicity	Generator Knowledge	B388
F003	Spent solvents from production	Ignitability	Generator Knowledge	B388
F004	Spent solvents from production	Toxicity	Generator Knowledge	B388
F005	Spent solvents from production	Toxicity and Ignitability	Generator Knowledge	B388
P003	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P004	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P010	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P011	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P012	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P013	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P014	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P017	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P018	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P022	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P023	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P024	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P028	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P029	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P030	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P037	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388

P042	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P043	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P047	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P051	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P059	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P063	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P064	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P067	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P068	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P074	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P075	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P076	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P077	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P087	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P088	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P089	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P093	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P095	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P098	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P101	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P102	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P103	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P104	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P105	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P106	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P108	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P113	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P115	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P116	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P121	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P123	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
U001	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U002	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U003	Discarded Commercial Chemical Product;	Toxic and Ignitability	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
U004	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U006	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic, Corrosive, and Reactive	Generator Knowledge	B388
U007	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U008	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U009	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U012	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U019	Discarded Commercial Chemical Product; Off-specification	Toxic and Ignitability	Generator Knowledge	B388

	species; container residues; and spill residues			
U021	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U029	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U031	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U032	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U034	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U036	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U037	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
U039	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U041	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U043	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U044	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U045	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U046	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U052	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill	Toxic	Generator Knowledge	B388

	residues			
U053	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U056	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U057	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U061	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U067	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U068	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U070	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

U071	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U072	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U073	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U076	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U077	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U080	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U081	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U082	Discarded	Toxic	Generator Knowledge	B388

	Commercial Chemical Product; Off-specification species; container residues; and spill residues			
U083	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U088	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U092	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U097	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U098	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U099	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U101	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
U102	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U103	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U105	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U106	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U107	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U108	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U109	Discarded Commercial Chemical Product;	Toxic	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
U110	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U112	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U113	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U115	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U117	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U118	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U119	Discarded Commercial Chemical Product; Off-specification	Toxic	Generator Knowledge	B388

	species; container residues; and spill residues			
U120	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U122	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Corrosivity	Generator Knowledge	B388
U123	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U124	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U127	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U128	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U131	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
U132	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U133	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Reactivity	Generator Knowledge	B388
U134	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Corrosivity	Generator Knowledge	B388
U135	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U136	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U138	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U140	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill	Toxic	Generator Knowledge	B388

	residues			
U144	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U145	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U147	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U148	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U149	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U151	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U154	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

U156	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U157	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U159	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U160	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U161	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U162	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U163	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U165	Discarded	Toxic	Generator Knowledge	B388

	Commercial Chemical Product; Off-specification species; container residues; and spill residues			
U169	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U170	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U171	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U181	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U182	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U183	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U184	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
U185	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U186	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U188	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U189	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Reactivity	Generator Knowledge	B388
U196	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U197	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U200	Discarded Commercial Chemical Product;	Toxic	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
U201	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U202	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U203	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U204	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U206	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U207	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U208	Discarded Commercial Chemical Product; Off-specification	Toxic	Generator Knowledge	B388

	species; container residues; and spill residues			
U209	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U210	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U211	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U213	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U214	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U215	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U217	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
U218	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U219	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U220	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U222	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U223	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Reactivity	Generator Knowledge	B388
U225	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U226	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill	Toxic	Generator Knowledge	B388

	residues			
U227	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U228	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U234	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U236	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U237	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U238	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U239	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388

U240	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U244	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U246	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U328	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U353	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U358	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U404	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
001U	Discarded	Toxic	Generator Knowledge	B388

	Commercial Chemical Product; Off-specification species; container residues; and spill residues			
002U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
003U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
004U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
005U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
006U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
007U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
008U	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
009U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
011U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
012U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
014U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
015U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
016U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
017U	Discarded Commercial Chemical Product;	Toxic	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
020U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
021U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
022U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
023U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
024U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
025U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
027U	Discarded Commercial Chemical Product; Off-specification	Toxic	Generator Knowledge	B388

	species; container residues; and spill residues			
028U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
029U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
033U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
034U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
036U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
038U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
040U	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
042U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
043U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
044U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
046U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
047U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
048U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
049U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill	Toxic	Generator Knowledge	B388

	residues			
050U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
051U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
052U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
054U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
055U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
056U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
057U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

058U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
059U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
061U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
063U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
064U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
065U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
068U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
070U	Discarded	Toxic	Generator Knowledge	B388

	Commercial Chemical Product; Off-specification species; container residues; and spill residues			
071U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
072U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
073U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
074U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
075U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
076U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
077U	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
078U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
079U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
080U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
082U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
083U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
086U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
088U	Discarded Commercial Chemical Product;	Toxic	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
089U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
090U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
092U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
094U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
095U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
096U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
097U	Discarded Commercial Chemical Product; Off-specification	Toxic	Generator Knowledge	B388

	species; container residues; and spill residues			
098U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
099U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
100U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
101U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
102U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
103U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
104U	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
106U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
108U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
110U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
111U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
112U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
113U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
114U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill	Toxic	Generator Knowledge	B388

	residues			
115U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
116U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
117U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
118U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
119U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
120U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
121U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

122U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
124U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
127U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
128U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
129U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
131U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
132U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
134U	Discarded	Toxic	Generator Knowledge	B388

	Commercial Chemical Product; Off-specification species; container residues; and spill residues			
135U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
136U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
137U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
138U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
139U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
140U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
141U	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
142U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
143U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
144U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
147U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
148U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
150U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
151U	Discarded Commercial Chemical Product;	Toxic	Generator Knowledge	B388

	Off-specification species; container residues; and spill residues			
152U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
153U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
154U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
157U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
158U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
159U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
161U	Discarded Commercial Chemical Product; Off-specification	Toxic	Generator Knowledge	B388

	species; container residues; and spill residues			
162U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
163U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
164U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
165U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
166U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
167U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
168U	Discarded Commercial Chemical Product; Off-specification species; container	Toxic	Generator Knowledge	B388

	residues; and spill residues			
169U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
170U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
171U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

TABLE A2.A.2 HAZARDOUS WASTES ACCEPTED AT THE FACILITY

Hazardous Waste Code	Waste Description	Hazardous Waste Characteristics	Basis for Hazardous Designation	Hazardous Waste Management Unit
N/A	N/A	N/A	N/A	N/A

ATTACHMENT A3
WASTE ANALYSIS PLAN (WAP)

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, and R 299.9605, and Title 40 of the Code of Federal Regulations (CFR) §§270.14(b)(3) and 264.13(b) and (c), establish requirements for WAPs for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for a WAP for the hazardous waste management units and the hazardous waste management facility for the *Pharmacia & UpJohn Co LLC, a subsidiary of Pfizer, Inc* facility. All activities associated with the WAP will be conducted at the *Pharmacia & UpJohn Co LLC, 7171 Portage Rd, Kalamazoo, MI 49001* facility.

Ensure that all samples collected for the purposes of waste characterization are collected, transported, analyzed, stored, and disposed by trained and qualified individuals in accordance with the Quality Assurance/Quality Control (QA/QC) Plan. The QA/QC Plan should, at a minimum, include the written procedures outlined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency (EPA) Publication No. SW-846, Third Edition, Chapter 1 (November 1986), and its updates.

A3.B CAPTIVE FACILITY

☐ *Pharmacia & UpJohn Co LLC, a subsidiary of Pfizer, Inc* generates waste on site. *Pharmacia & UpJohn Co LLC, a subsidiary of Pfizer, Inc* does not receive waste generated off site.

OR

☒ *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* generates waste on site. *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* may also receive waste generated off site as LQG consolidation of VSQG waste per R 299.9307(6). Waste screening procedures for receiving wastes from off-site generators is discussed in Section A3.A.

Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc facility is a private facility that generates waste on site and receives wastes generated off site from other Pfizer, Inc facilities as LQG consolidation of VSQG waste per R 299.9307(6). *Pharmacia & Upjohn Co LLC* has developed a WAP to ensure that its facility at *7171 Portage Rd in Kalamazoo, MI* will accept only wastes that it is authorized to accept. All hazardous waste received at the facility will be placed into storage upon receipt to be sent off-site for treatment. The hazardous waste treated will be properly characterized using generator knowledge or chemical analysis to ensure that it is properly managed within the facility.

All analysis performed pursuant to this application will be consistent with the QA/QC Plan in accordance with *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency (EPA) Publication No. SW-846, Third Edition, Chapter 1 (November 1986)*. All samples for the purpose of waste characterization will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan.

In accordance with R 299.9609 and 40 CFR §264.73 and Part 264, Appendix I, *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* will retain all records and results of waste determinations performed as specified in 40 CFR §§264.13, 264.17, 264.314, 264.1034, 264.1063, 264.1083, 268.4(a), and 268.7 in the facility operating record until closure of the facility.

A3.B.1 Selection of Waste Analysis Parameters

[R 299.9605(1) and 40 CFR §264.13(B)(1)]

Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc will select waste analysis parameters to confirm the identity of waste streams generated at the facility. The selection of waste analysis parameters will be based on knowledge of the raw material, analytical results, and physical and chemical processes that produce the waste stream. Knowledge of the process and/or analytical testing will be used to determine if the hazardous wastes exhibit one or more characteristics to: (1) ensure compliance with LDR regulations and (2) provide waste compatibility information to determine appropriate waste storage.

Table A3.B.1 lists the waste analysis procedures, including the waste analysis parameters for each hazardous waste, the rationale for the selection of these parameters, test methods that will be used to test for these parameters, the appropriate reference, the frequency of waste characterization, and the rationale for frequency. The sampling method that will be used to obtain a representative sample of the wastes to be analyzed, the sampling equipment to use, and rationale to use are presented in Table A3.B.2.

A3.B.2 Additional Waste Analysis Requirements

[R 299.9605(1) and R 299.9504(1)(c) and 40 CFR §264.13(b)(6) and (c)(3)]

Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc will review the waste characterization information to ensure that the facility is authorized to manage the waste in compliance with the following:
(Check as appropriate)

☒	R 299.9605 and 40 CFR §264.17	General requirements for ignitable, reactive, or incompatible wastes [Template , Section]
☒	R 299.9605 and 40 CFR §264.314	Special requirements for bulk and containerized liquids [Template , Section]

Table A3.B.1 Waste Analysis Procedures

Waste Analysis Parameter *(Check as appropriate)*	**Rationale for Parameter**	**Test Method**	**Reference**	**Frequency**	**Rationale for Frequency**
☒ Waste Code	Identification of proper waste codes	SW-846	*"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency (EPA) Publication No. SW-846, Third Edition, Chapter 1 (November 1986)*	As needed	If not determined from generator knowledge and waste profile review
☒ Free Liquids	See Waste Code	See Waste Code	See Waste Code	See Waste Code	See Waste Code
☒ Ignitability	See Waste Code	See Waste Code	See Waste Code	See Waste Code	See Waste Code
☒ Reactivity	See Waste Code	See Waste Code	See Waste Code	See Waste Code	See Waste Code
☐ Compatibility					
☐ Land Disposal Restrictions					
☐ Volatile Organic Compound Content[1]					
☐ Radioactivity					
☐ Other *[describe]*:					

[1] *According to R 299.9630 and 40 CFR §264.1034(d), TSDFs must identify and meet specific technical requirements for all process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air/stream stripping processes that manage wastes with a 10 part per million by weight (ppmw) or greater total organics concentration on a time-weighted annual average basis. Total organic concentrations in the waste can be measured using SW-846 Method 8260B. According to R 299.9631 and 40 CFR §264.1050, TSDFs must also determine if its equipment contains or contacts organic wastes with 10 percent or greater total organic content. The total organic content can be determined using (1) American Society of Testing and Materials Methods D2267-88, E169-87, or E260-85, (2) SW-846 Method 8260B, or (3) knowledge of the nature of the wastes stream or the waste generating process.*

Table A3.B.2 Sampling Procedures

Container Type or Material	Sampling Method[1]	Sampling Equipment	Rationale
Containerized Liquid	Coliwasa or grab	Coliwasa or jar/dip tool	Homogenous substances may be taken with a grab sample. Otherwise a coliwasa tube will be used.
Liquid Waste in Secondary Containment	Grab	Jar or dip tool	Not suitable for coliwasa sampling
Crushed or powdered material	ASTM D346-75	Jar	Appropriate method
Extremely viscous material	ASTM D140-70	Jar	Appropriate method
Soil-like material	ASTM D1452-65	Jar	Appropriate method

[1] The sampling method should demonstrate equivalence with the sampling methods described in 40 CFR, Part 261, Appendix I.

☞ ***For owners or operators of surface impoundments exempted from LDRs under 40 CFR §268.4(a):***

A3.B.3 Procedures to Ensure Compliance with LDRs Requirements

[R 299.9627 and 40 CFR, Part 268]

All shipments of wastes subject to LDR received at the facility will be accompanied by appropriate generator notification and LDR notification in accordance with R 299.9627 and 40 CFR §268.7. The LDR notification accompanying generator wastes will be reviewed, and any discrepancies in the LDR notification and the associated manifest, analytical records, or Waste Profile Form will require shipment rejection unless additional, satisfactory, clarifying information is provided by the generator. All information obtained to document LDR compliance will be maintained in the facility operating record until closure of the facility.

Pharmacia & Upjohn Co LLC will supply LDR notifications and certification, including appropriate analytical records to support the certification, to the receiving facility with each shipment of waste. The notifications and certifications will contain the information required under R 299.9627 and 40 CFR §268.7.

A3.B.3(a) Spent Solvent and Dioxin Wastes

[R 299.9627 and 40 CFR §§264.13(a)(1), 268.7, 268.30, 268.31, 268.40, 268.41, 268.42, and 268.43]

Spent solvent wastes (F001-F005) are generated at the facility. Generator process knowledge will be used to determine the presence of spent solvent wastes (F001-F005). Generator process knowledge will be documented on the waste material profile report and LDR notification. The LDR notification will provide additional information regarding the appropriate treatment standards for the waste and whether it has already been treated to the appropriate standards.

A3.B.3(b) Listed Wastes

[R 299.9627, R 299.9213, and R 299.9214 and 40 CFR, Sections 264.13(a)(1), 268.7, 268.33, 268.34, 268.35, 268.36, 268.39, 268.40, 268.41, 268.42, and 268.43]

Generator process knowledge will be used to determine whether listed waste meets the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. In accordance with R 299.9627 and 40 CFR §268.41, where treatment standards are based on concentrations in the waste extract, the facility will use TCLP to determine if wastes meet treatment standards.

Generator process knowledge will be documented on the waste material profile report and LDR notification.

A3.B.3(c) Characteristic Wastes

[R 299.9627, R 299.9208, and R 299.9212 and 40 CFR §261.3(d)(1), 264.13(a)(1), 268.7, 268.9, 268.37, 268.40, 268.41, 268.42, and 268.43 and Part 268, Appendix I and Appendix IX]

Generator process knowledge will be used to determine whether characteristic wastes meet the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. In accordance with R 299.9627 and 40 CFR §268.41, where treatment standards are based on concentrations in the waste extract, the facility will determine if wastes meet treatment standards.

Characteristic D008 lead nonwastewaters and D004 arsenic nonwastewaters will be analyzed using TCLP to determine compliance with treatment standards. If after treatment a hazardous waste displays a characteristic for the first time, the characteristic waste code will be added to the LDR notification and facility records. Wastes will be retreated, as appropriate, to meet the characteristic treatment standard prior to land disposal. In addition, the *Generator process knowledge* will be used to identify the underlying hazardous constituents that are expected to be present in D001 and D002 wastes. The *Generator process knowledge* will be documented on the waste material profile report and LDR notification.

A3.B.3(d) Radioactive Mixed Waste

[R 299.9627 and 40 CFR §§268.7, 268.35(c), 268.35(d), 268.36, and 268.42(d)]

☒ The facility does not generate radioactive mixed waste.

☐ *Generator process knowledge* will be used to determine whether a radioactive mixed waste meets the applicable treatment standard.

A3.B.3(e) Leachates

[R 299.9627 and 40 CFR §§260.10, 268.35(a), and 268.40]

☒ The facility does not generate single-source or multi-source F039 leachates.

☐ Single-source leachate will not be combined to produce multi-source leachates.

A3.B.3(f) Laboratory Packs

[R 299.9627 and 40 CFR §268.7, 268.42(c) and Part 268, Appendix IV and Appendix V]

☐ The facility does not generate laboratory packs.

☒ The laboratory packs generated at the facility are not land disposed.

If a laboratory pack hazardous waste is combined with nonlaboratory pack hazardous waste prior to, or during, treatment, the entire mixture will be treated to meet the most stringent treatment standards for each waste constituent before being land disposed.

A3.B.3(g) Contaminated Debris

[R 299.9627 and 40 CFR §§268.2(g), 268.7, 268.9, 268.36, 268.45, and 270.13(n)]

☒ Hazardous debris generated at the facility that exhibits the characteristics of ignitability, corrosivity, or reactivity will be treated using one of the extraction, destruction, or immobilization technologies identified in Table 1 of 40 CFR §268.45.

A3.B.3(h) Waste Mixtures and Wastes with Overlapping Requirements

[R 299.9627 and 40 CFR §§264.13(a), 268.7, 268.41(b), 268.43(b), and 268.45(a)]

Generator process information and analytical data will be used to demonstrate that waste mixtures and wastes carrying multiple codes are properly characterized. Wastes that carry more than one characteristic will be identified with a number for each characteristic.

A3.B.3(i) Dilution and Aggregation of Wastes

[R 299.9627 and 40 CFR §268.3]

Listed wastes, if destined for land disposal, may not be diluted from the point of generation to the point of land disposal. Characteristic wastes may only be diluted if (1) the waste is managed in a CWA/CWA-equivalent surface unit or a Class I Safe Drinking Water Act injection well, (2) the waste has a concentration-based treatment standard or is treated using the DEACT technology-based treatment standard, and (3) the waste is not a D003 reactive waste.

The facility may not dilute or partially treat a listed waste to change its treatability category (i.e., from nonwastewater to wastewater), in order to comply with different treatment standards. If the wastes are all legitimately amenable to the same type of treatment to be performed, the facility may aggregate wastes for treatment.

A3.C NOTIFICATION, CERTIFICATION, AND RECORDKEEPING REQUIREMENTS

[R 299.9627 and R 299.9609 and 40 CFR §§264.73, 268.7, and 268.9(d)]

Pharmacia & UpJohn Co LLC will perform the following procedures for preparing and/or maintaining applicable notifications and certifications to comply with LDRs:

A3.C.1 Retention of Generator Notices and Certifications

[R 299.9627 and 40 CFR §268.7(a)(7)]

Pharmacia & UpJohn Co LLC will retain a copy of all notices, certifications, demonstrations, data, and other documentation associated with compliance to LDRs.

A3.C.3 Waste Shipped to Subtitle C Facilities
[R 299.9627 and 40 CFR §§268.7(a) and 268.7(b)(6)]

☐ The facility does not ship waste to Subtitle C facilities.

☒ For restricted waste or waste treatment residues that will be further managed at a Subtitle C (hazardous waste management) facility, the facility will submit notifications and certifications in compliance with the notice and certification requirements applicable to generators under R 299.9627 and 40 CFR §268.7(a) and (b)(6).

A3.C.4 Waste Shipped to Subtitle D Facilities
[R 299.9627 and 40 CFR §§268.7(d) and 268.9(d)]

☒ The facility does not ship waste to Subtitle D facilities.

☒ If the facility does ship a hazardous debris or characteristic waste to a Subtitle D facility, the facility will submit a one-time notification and certification for characteristic wastes, or listed wastes that are listed only because they exhibit a characteristic, that have been treated to remove the hazardous characteristic and are no longer considered hazardous. The facility will place a certification and all treatment records in the facility's file and send a notification and certification to the Director, or delegated representative, describing the wastes and applicable treatment standards and identifying the Subtitle D (solid waste management) disposal facility receiving the waste. On an annual basis, the notification and certification will be updated and refiled if the process or operation generating the waste changes and/or if the Subtitle D facility receiving the waste changes.

A3.C.5 Recyclable Materials
[R 299.9627 and 40 CFR §268.7(b)(6)]

☒ The facility does **not accept** recyclable materials used in a manner constituting disposal.

☐ For wastes that are recyclable materials used in a manner constituting disposal, in accordance with R 299.9206 and 40 CFR §266.20(b), the facility will submit a notice and certification to the Director, or delegated representative, with each shipment of waste describing the waste and applicable treatment standards and identifying the facility receiving the waste.

A3.C.6 Record Keeping
[R 299.9608(4), R 299.9609, R 299.9610(3), and R 299.9627 and
40 CFR §§264.72, 264.73, 268.7(a)(5), 268.7(a)(6), 268(a)(7), and 268.7(d)]

Pharmacia & UpJohn Co LLC maintains a facility operating log in accordance with R 299.9609 and 40 CFR §264.73. The operating log consists of waste profiles, analytical data, inventory records, inspection records, LDR notifications, and manifests.

Copies of all necessary notifications and certifications, as well as relevant inspection forms and monitoring data, are also maintained on file at the facility. Files will be maintained for a minimum of three years (for inspection records and LDR notification), or until facility closure (for inventory records).

If a significant manifest discrepancy is discovered (such as variation in one-piece count or misrepresentation of the type of waste or corrosive rather than flammable) that cannot be resolved with the generator or transporter within 15 days of receipt, facility personnel will submit to the Director and Regional Administrator a letter describing the discrepancy and all attempts to reconcile the discrepancy. The letter will include a copy of the discrepant manifest or shipping document.

Facilities managing a restricted waste that is excluded from the definition of a hazardous or solid waste or exempt from Subtitle C regulations:
The facility will place a one-time notice in the facility files describing the generation, basis for exclusion or exemption, and disposal of the waste. For each shipment of treated debris, the facility will place a certification of compliance with applicable treatment standards in the facility's files.

A3.C.7 Required Notice

[R 299.9605(1) and 40 CFR §264.12(a) and (b))]

The facility will notify the Division Director in writing at least four weeks before the date the facility expects to receive hazardous waste from a foreign source. Notice of subsequent shipments of the same waste from the same foreign source is not required. When receiving such hazardous waste, the facility will comply with applicable treaties or other agreements entered into between the country in which the foreign source is located and the United States.

When the facility is to receive hazardous waste from an off-site source, the facility will inform the generator in writing that the facility has the appropriate license for and will accept the waste the generator is shipping. The facility will keep a copy of this written notice in the operating record.

ATTACHMENT A4
SECURITY PROCEDURES & EQUIPMENT

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, R 299.9605, and Title 40 of the Code of Federal Regulations (CFR) §§264.14 and 270.14(b)(4), establish requirements for security procedures and equipment at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003

This license application attachment addresses requirements for inspections at the following hazardous waste management facility: _Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc_ in _Kalamazoo_, Michigan.

☒ Operating License applicant

☐ Construction Permit applicant

INTRODUCTION

The Pharmacia & Upjohn Company utilizes security equipment and procedures to prevent unauthorized contact with the hazardous waste management unit at the facility.

A4.A 24-HOUR SURVEILLANCE SYSTEM AND MEANS TO CONTROL ENTRY

The 24-hour surveillance system comprises of a six-foot chain-link fence with three strands of barbed wire that top the fence line. This fence surrounds the active manufacturing portion of the facility (approximately 400 acres in size). The fence is inspected at a frequency that will identify deterioration of the fence. Security personnel patrol all areas of the facility every two hours, seven days a week. The fence line is all equipped with a remotely operated surveillance system.

The entrance at Romence Road is manned 24-hours a day, seven days a week. All other entrances are manned during the hours that gates are open. These hours vary depending on the gate.

A4.B WARNING SIGNS

Warning signs are displayed prominently near the hazardous waste management unit. Signs are placed so that they are visible from all approaches to the waste management unit. The signs contain the phrase "Danger - Unauthorized Personnel Keep Out" and are legible and visible from a distance of 25 feet.

ATTACHMENT A5
INSPECTION REQUIREMENTS

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, R 299.9605 and Title 40 of the Code of Federal Regulations (CFR) §§264.15 and 270.14(b)(5), establish requirements for inspections at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003

This license application template addresses requirements for inspections at the following hazardous waste management facility: Pharmacia & UpJohn Co LLC in Kalamazoo, Michigan. (Check as appropriate)

☒ Applicant for Operating License for Existing Facility

☐ Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility

INTRODUCTION

Pharmacia & Upjohn Co LLC will inspect the facility for malfunctions and deterioration, operator errors, and discharges that may be causing, or may lead to: (1) release of hazardous waste constituents into the environment or (2) a threat to human health. Pharmacia & Upjohn Co LLC will conduct these inspections often enough to identify problems in time to correct them before they harm human health or the environment [R 299.9605 and 40 CFR §264.15(a)].

A5.A WRITTEN SCHEDULE

[R 299.9605 and 40 CFR §264.15(b)(1)]

Written Schedule *[R 299.9605 and 40 CFR §264.15(b)(1)]*	**Types of Problems** *[R 299.9605 and 40 CFR §264.15(b)(3)]*	**Frequency** *[R 299.9605 and 40 CFR §§264.15(b)(4), 264.174, 264.1086, 264.1088 and 264.1089, where applicable]*	**Remedy Schedule** *[R 299.9605 and 40 CFR §264.15(c)]*
Containment Structure	Presence of a release, water from eyewash/safety shower testing, rainwater, cracking of containment floor, and the deterioration of concrete.	*Daily*	*Immediate clean-up released material. Water from eye wash/safety shower testing or vehicle runoff will be removed as necessary to ensure containment capacity is maintained. Sumps will be emptied of water with 24-hrs when full. Within 24-hrs submit work orders to have containment repaired.*
Aisle Spacing	Narrow spacing or blocked isle ways.	*Weekly*	*Immediate remove/relocate material to maintain proper aisle spacing.*
Labels Intact	Labels not legible, visible or damage.	*Weekly*	*Immediately relocate, repair, or replace effected labels.*
Container Condition	Shell damaged/bulging, bungs missing, or container leaking	*Weekly*	*Immediate repair and/or overpack damaged containers*
Safety Shower, Eye Wash, and Alarm	Equipment damage, leaking, low flow, alarm malfunction	*Monthly*	*Within 24-hrs submit work orders to have equipment repaired and or replaced.*
Emergency Response Equipment	Equipment damaged or missing	*Yearly*	*Within 24-hrs submit work orders to have equipment repaired and or replaced.*

A5.C INSPECTION LOG OR SUMMARY

[R 299.9605 and 40 CFR §264.15(d)]

Table A.5C.1 Container Storage Area Inspection Log Example

Copies of these records must be kept for at least three years from the date of inspection. At a minimum, these records must include the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions taken. An example inspection log is provided as Table A5.C.1.

Table A5.C.1 Container Storage Area Inspection Log Example

Daily				Weekly					
Date	Time	Inspector (Full Name) Example: John Smith	Containment Structure (Free of liquid, good condition)	Aisle Spacing	Labels are clearly visible	Labels contain applicable waste codes	Containers are clearly dated	Container Condition (Shell, bungs, leaks, etc)	Comments/Repairs /Remedial Actions

ATTACHMENT A6
PREPAREDNESS AND PREVENTION

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504, R 299.9508, and R 299.9606 and Title 40 of the Code of Federal Regulations (CFR) §§264.30 through 264.37 establish requirements for preparedness for and prevention of releases of hazardous wastes or constituents at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for preparedness for and prevention of releases of hazardous wastes or constituents at the following hazardous waste management facility for the *Pharmacia & UpJohn Co LLC, a subsidiary of Pfizer, Inc.* in *Kalamazoo]*, Michigan.

(Check as appropriate)

Applicant for Operating License for Existing Facility:

☒ No waiver requested

☐ Waiver requested for one or more units for required equipment

☐ Waiver requested for one or more units for required aisle space

Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility:

☐ No waiver requested

☐ Waiver requested for one or more units for required equipment

☐ Waiver requested for one or more units for required aisle space

INTRODUCTION

The preparedness and prevention standards are intended to minimize and prevent emergency situations at hazardous waste management facilities. This is in contrast to the contingency plan standards that are intended to ensure that facilities have instituted plans and procedures to use in response to an emergency situation (See Template A7).

To meet the preparedness and prevention standards, facilities must be operated and maintained in a manner that minimizes the possibility of a fire, explosion, or any unplanned sudden or nonsudden release of hazardous waste or hazardous waste constituents. The regulations require maintenance of equipment, alarms, minimum aisle space, and provisions for contacting local authorities (R 299.9606 and 40 CFR §264.31).

A6.A REQUIRED EQUIPMENT

[R 299.9606 and 40 CFR §264.32]

A6.A.1 Internal Communication System

[R 299.9606 and 40 CFR §264.32(a)]

The facility utilizes PA/strobes as the primary method to communicate emergency notifications. Alarm autocalls may be used as the secondary method of emergency notifications, except in those areas where a PA system is not available then the alarm autocalls will be the primary system.

A6.A.2 Emergency Response Communication System

[R 299.9606 and 40 CFR §264.32(b)]

Dialing 1-2-3 from any internal phone within the facility or 833-4799 from an external phone will reach the on-site fire department. The fire department can also be contacted on the facilities two-way radio system. Operators in the B388 hazardous waste management unit are equipped with a two-way radio and/or a cell phone capable of contacting emergency personnel.

A6.A.3 Unloading Operations

[R 299.9504(c) and 40 CFR §270.14(b)(8)(i)]

Trucks unloading at the container storage facility are required to shut-off their engines and place wheel chocks under the tires to prevent the vehicle from rolling forward while unloading. The building is equipped with a mechanical dock plate to assist in moving containers off of the truck with either a manual pallet jack or powered industrial unit.

A6.A.4 Fire, Spill, and Decontamination Equipment

[R 299.9606 and 40 CFR §264.32(c)]

The B388 hazardous waste management unit is equipped with a 30-nozzle sprinkler system, portable fire extinguishers, and spill kits with decontamination equipment. Each nozzle is capable of displacing 25 GPM with a total system worst case of 750 GPM. Each nozzle operates independently of each other. The facility also supports an on-site HAZMAT response team capable of responding in the event of an emergency.

A6.A.5 Adequate Water Volume

[R 299.9606 and 40 CFR §264.32(d)]

There are four fire pumps on site. Two fire pumps take suction from the pond and two taking suction from the city water system. The B388 hazardous waste management unit is equipped with a 30-nozzle sprinkler system, portable fire extinguishers, and spill kits with decontamination equipment. Each nozzle is capable of displacing 25 GPM with a total system worst case of 750 GPM. Each nozzle operates independently of each other.

A6.B TESTING AND MAINTENANCE OF EQUIPMENT

[R 299.9606 and 40 CFR §264.33]

The facility internal communication system, fire protection equipment, and emergency response equipment and decontamination equipment is tested on a monthly basis to ensure that the equipment is in place and operational.

A6.C ACCESS TO COMMUNICATIONS OR ALARM SYSTEM

[R 299.9606 and 40 CFR §264.34]

A6.C(1) Multiple Employees Present

[R 299.9606 and 40 CFR §264.34(a)]

Operators in the B388 hazardous waste management unit are equipment with a two-way radio and/or a cell phone capable of contacting emergency personnel. In the event of an emergency, activation of the safety shower/eye wash station in B388 will sound an alarm and strobe light to personnel in the adjacent office building and the site emergency dispatch center.

A6.C(2) Single Employee Present

[R 299.9606 and 40 CFR §264.34(b)]

Operators in the B388 hazardous waste management unit are equipment with a two-way radio and/or a cell phone capable of contacting emergency personnel. In the event of an emergency, activation of the safety shower/eye wash station in B388 will sound an alarm and strobe light to personnel in the adjacent office building and the site emergency dispatch center.

A6.D REQUIRED AISLE SPACE

[R 299.9606 and 40 CFR §264.35]

A minimum aisle space of 2 feet will be maintained to facilitate inspections, allow access for fire-fighting equipment and personnel if required, and allow deployment of spill control and clean up equipment. The containers in this area will be inspected at least weekly as discussed in attachment A5 to detect and remedy any degradation of waste containers or the containment system.

A6.E IGNITABLE AND REACTIVE WASTES

[R 299.9504(1)(c) and 40 CFR §270.14(b)(9)]

The storage of all ignitable wastes in the container storage building takes place more than 50 feet away from the facilities fence lines. The labeling, sealing, handling, stacking of these containers is done in a manner that minimizes the possibility of these wastes experiencing any fires, explosions, or reactions.

The company policy prohibits smoking on facility property. “No Smoking” signs are prominently displayed within the plant and wherever ignitable wastes in containers are stored. The wastes are also separated or protected from sources of ignition, such as open flames, smoking, cutting, and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. If any type of work is to be done in the container storage area, a “safe work permit” must first be obtained from the facility manager to ensure that all work within the storage area conforms to these necessary hazard prevention procedures.

The only reactive wastes expected to be handled at the facility are chemicals that are not explosive or shock sensitive. Inspections are performed as described in Attachment A5 to ensure that containers bearing reactive wastes retain their integrity and that the contents do not come into contact with air or moisture.

A6.F STATE AND LOCAL AUTHORITIES

[R 299.9606 and 40 CFR §264.37]

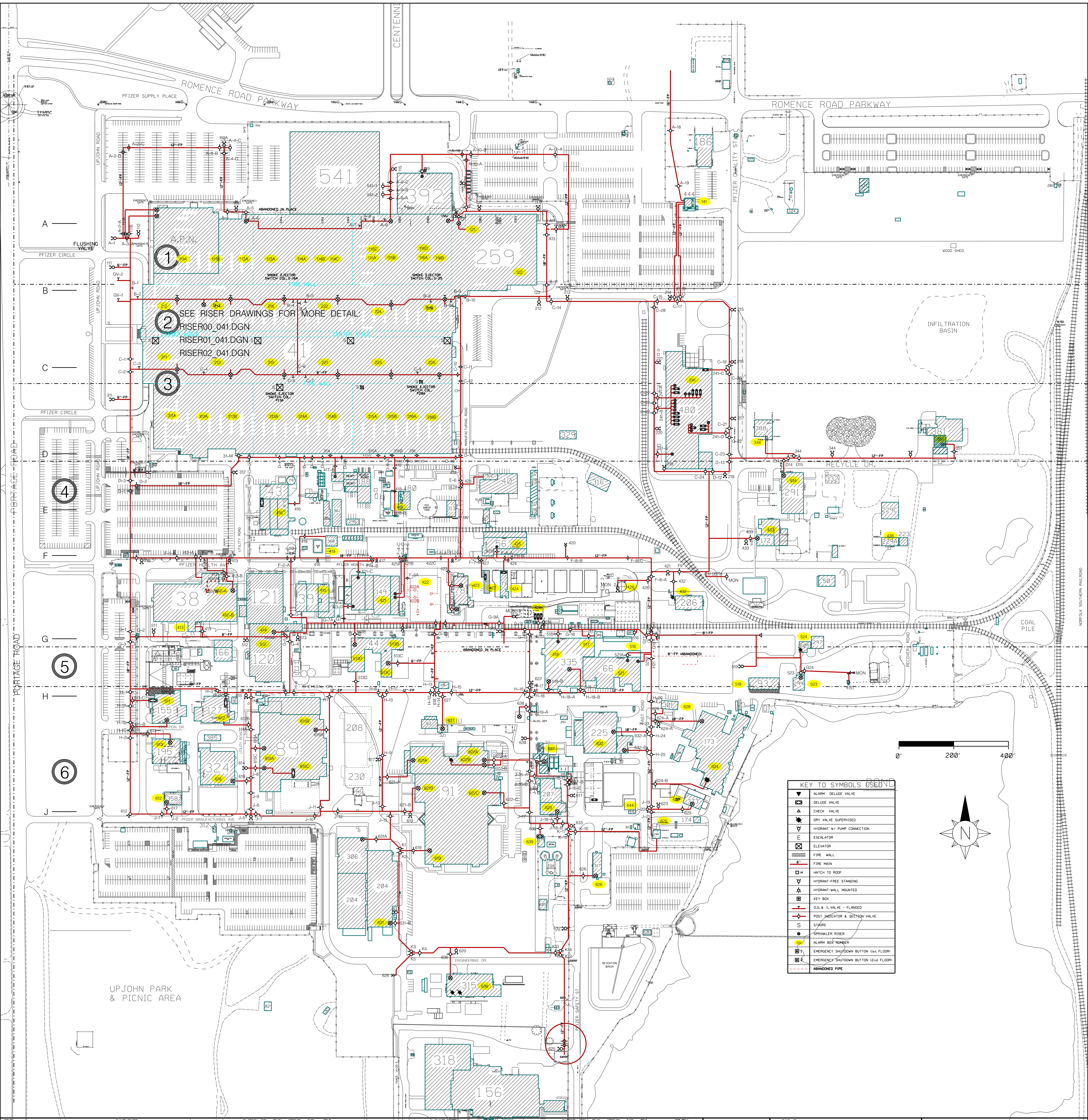
A6.F.1 Arrangements with State and Local Authorities

[R 299.9606 and 40 CFR §264.37(a)(1)]

Pursuant to R 299.9606 and 40 CFR 264.37, arrangements have been made with state and local emergency response groups to address and coordinate emergency response activities of incidents involving the Pharmacia & Upjohn facility. Pharmacia & Upjohn will ensure that organizations listed in the most current version of the Contingency Plan receive a copy of the plan. Following are the organizations currently listed in the plan:

Kalamazoo Department of Public Safety (for Fire & Police)
Kalamazoo County Office of Emergency Management
Portage Fire Department
Portage Police Department
Bronson Methodist Hospital
Bronson Vicksburg Hospital
City of Kalamazoo Water Reclamation Plant
SET Environmental

Pharmacia & Upjohn has provided these agencies, whose assistance may be needed, with opportunities and/or resource materials to familiarize them with the facility layout, properties and associated hazards of hazardous materials handled at the facility, location of facility personnel, entrances to and from roads inside the facility, and possible evacuation routes.
Updates to the local emergency response groups will be made thru an updated Contingency Plan.



ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE	ISSUE
A	REVISED					06/20/17	
B	PR1692777, UKZ16371, PR1573925, KZ0160120	JTH	BP&R	TD	MAF	09/20/2017	

SCALE:
DATE DRAWN

CADD INFORMATION
DESIGN FILE NAME:
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PLOTTED BY:$USERNAME$$$
PLOT DATE: $SYTIME$$$$$$$$$$

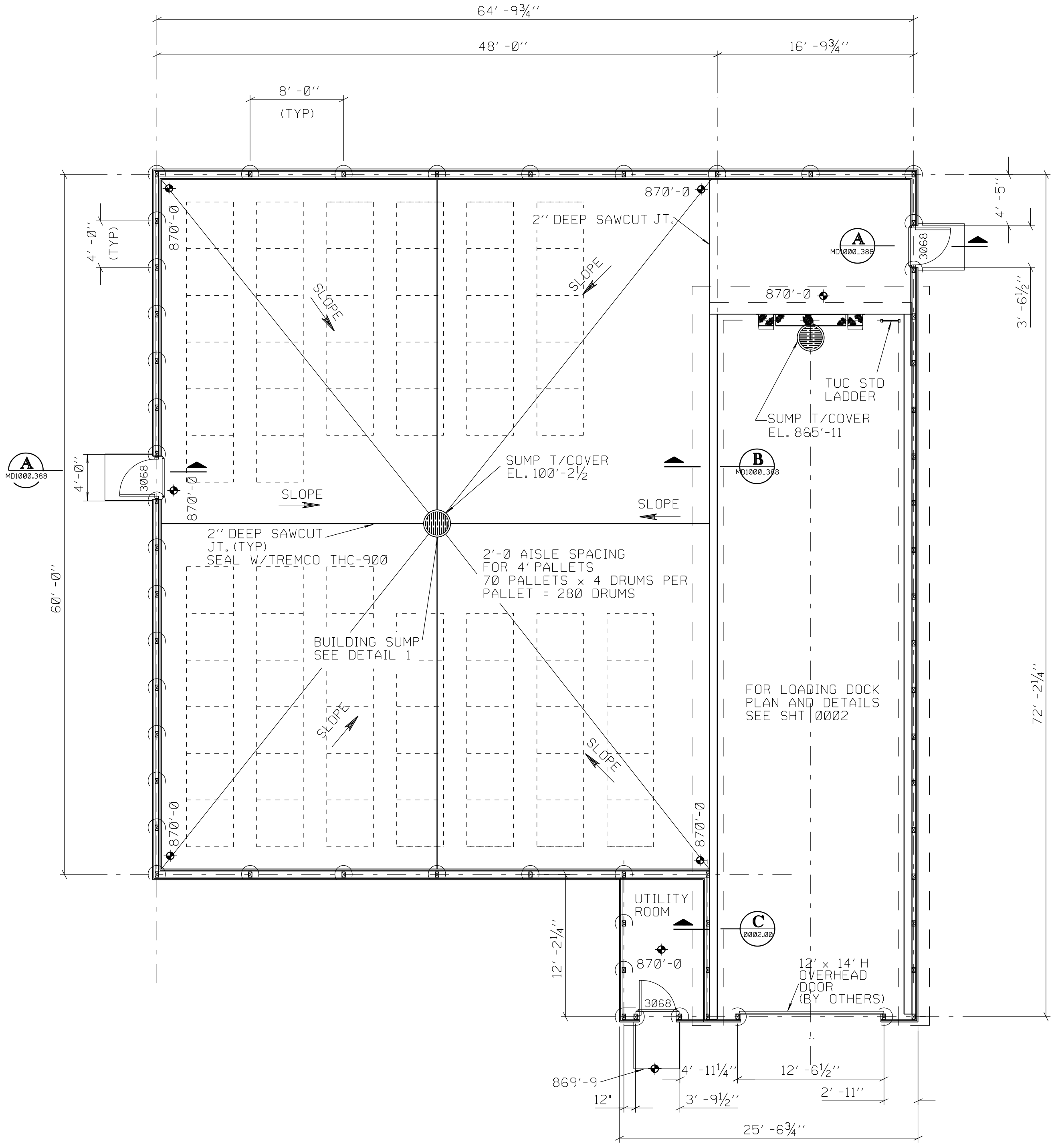
Pfizer

TITLE:
PORTAGE SITE
FIRE PROTECTION PIPING

DISCIPLINE	CATEGORY	SECTION	LEVEL
04	SITE		

DRAWING NUMBER
FIP0063_POR.DGN

ISSUE
B



ORIENTATION

NOTES:

FACILITY SPILL CAPACITY:

BLDG FLOOR & SUMP = 1,865+ gal.
TRUCK DOCK & SUMP = 10,840 gal.

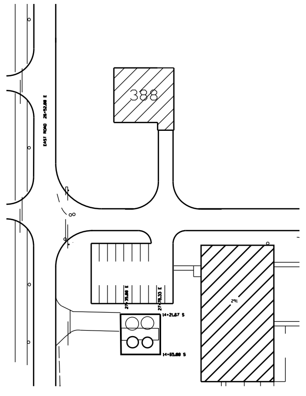
TOTAL CAPACITY BEFORE
GROUND CONTACT = 12,705 gal.

DRY FIT FIRE PROTECTION:

30 NOZZLE SYSTEM
EACH NOZZLE DISPLACES 25 GPM
TOTAL SYSTEM WORSE CASE 750 GPM
EACH NOZZLE ACTIVATES INDEPENDENT OF EACH OTHER

REFERENCE DRAWINGS:

MD1000_388.DGN, DETAIL SHEET



KEYPLAN

TITLE:	ACT 64 DWG. NO.	HISTORICAL REFERENCE
PLAN AND SECTIONS, BUILDING 388 CONTAINER STORAGE AREA	D-1	PROJECT NUMBER: SEQUENTIAL NUMBER: 02-0001.00 AREA NO:

ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE

ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE
A	ISSUED FOR BIDS - SITE WORK AND BUILDING CONSTRUCTION					7/28/94
B	ISSUED FOR CONSTRUCTION - SITE WORK AND BUILDING CONSTRUCTION					8/16/94
C	AS-BUILT FOR GCR2009-4K401-0013					12/2/09
D	ALIGNED FLOOR PLAN WITH SITE & MOVED DETAILS TO DETAIL SHEET MD1000_338.DGN: NO PHYSICAL OR DESIGN CHANGES.	SOD	HKA			10/11/16

SCALE: 3/16"=1'-0"
DATE DRAWN 2/14/94

Pfizer

TITLE:
BUILDING 388
ARCHITECTURAL
FIRST FLOOR PLAN
HAZ. WASTE STORAGE BUILD.

DISCIPLINE	CATEGORY	SECTION	LEVEL
01	B388	47	01

DRAWING NUMBER
MA1000_388.DGN
ISSUE

Attachment A7
TSDF FACILITIES
PGS KALAMAZOO – WASTE CONTROL RCRA CONTINGENCY PLAN
[R 299.9607, R299.9504(1)(C); 40 CFR 264 Subpart D, 270.14 (B)(7)]

Pharmacia & Upjohn LLC (subsidiary of Pfizer)
Kalamazoo, Michigan

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[R 299.9607, R299.9504(1)(C);
40 CFR 264 Subpart D, 270.14 (B)(7)]

(Permit reference Section G)

G.1 GENERAL INFORMATION

The Pharmacia & Upjohn Company LLC (P&U), a subsidiary of Pfizer Inc., is located at 7171 Portage Road, Kalamazoo, Michigan 49001, as shown in Figure 1. This facility is a major manufacturer of pharmaceuticals and fine chemical products which operates its own permitted Storage Facility, as part of the site's Waste Control operations, as shown in Figure 2. The Waste Control operations manage hazardous wastes in containers for off-site internment, as depicted in Figure 3. There are no satellite waste containers located in B388.

G.2 ENVIRONMENTAL EMERGENCY COORDINATORS

The following personnel are designated as Environmental Emergency coordinators and are authorized to commit necessary resources to implement the Contingency Plan. They are thoroughly familiar with all operations and activities, characteristics of the waste materials handled, and the location of all records pertinent to the facility's operations. All environmental emergency coordinators are on call 24 hours a day.

Primary Emergency Coordinator

Eric Lyons

Phone Numbers:	Work (269) 833.7250 Cell (269) 599-7422
Residence:	7000 Portage Rd Kalamazoo, MI 49001

Secondary Emergency Coordinator

Sarah Kusisto

Phone Numbers:	Work (269) 833.4841 Cell (269) 655.5320
Residence:	3055 Brynmawr Dr. Portage, MI 49024

G.3 IMPLEMENTATION

P&U maintains a comprehensive Emergency Plan for its Kalamazoo County operations. Personnel designated as Emergency Coordinators and Emergency Officers are responsible for coordinating environmental emergency activities. Personnel assigned to hazardous material areas in the facility have been trained in emergency response in accordance with R 299.9306 and 40 CFR 265 Subpart D.

G.4 EMERGENCY RESPONSE PROCEDURES

G.4.1 First Responders

First responders initiate response action and, based on the degree, nature and safety of the situation, attempt to take actions necessary to minimize the environmental effects of a fire, explosion, or release of hazardous waste or materials. Initial actions include:

1. Maintain a safe distance from the immediate danger.
2. Secure the area and notify unit management and nearby work areas which may be affected.
3. For emergency assistance call:
   - For Hazardous Materials spills: Call 3-3800.
   - For other emergencies (injury, fire, etc.): Call 1-2-3 or 833-4799 from an external line.
   - State the nature and location of the emergency.
4. Send someone to meet emergency personnel.

Subsequent initial response actions may require:

- Close or activate valves and devices that will stop the flow or release of liquids or gases.

- In the event of a fire or explosion, alert P&U Emergency Services by dialing 3-5122, 123, or 833-4799 from an external line on a nearby telephone, or by pulling a fire alarm box. Spills are reported to P&U Emergency Dispatch at 3-3800. In the event of a fire in early stage development, an attempt may be made by area personnel to extinguish using portable fire extinguishers.

- Contain the spill to prevent horizontal and vertical migration, as quickly as possible. Absorbent booms, sand bags, or earthen dikes may be utilized for containment.

G.4.2 Notification

When an emergency situation occurs, (i.e. fire, explosion or release of hazardous waste constituents that could threaten human health or the environment) the following Emergency Coordination is implemented:

- Internal facility alarms or communication systems are activated as applicable by P&U Emergency Services to notify facility personnel of the event. A more detailed discussion of the Evacuation Plan is provided in Section G.7.

- Requirements for regulatory agency notifications are assessed and notification to the appropriate authorities is made based on the situation involved.

G.4.3 Identification of Hazardous Materials

In the event of a release, fire or explosion, emergency coordination will identify the material, source, amount, and area extent of the release.

If the released material cannot be immediately identified, then Environmental will arrange to have samples collected for chemical analysis at the Company's laboratory or a contract laboratory. Other resources for identifying the release could include manifests, waste characterizations, records review, generator knowledge and/or operation logs.

G.4.4 Assessment

Emergency Coordination will assess possible hazards, both direct and indirect, to human health and the environment (e.g., toxicity, irritability, generation of asphyxiating gases, heat-induced explosions). Upon evaluation of the incident, appropriate actions will be followed to ensure containment and cleanup of the release.

If the Emergency Coordination assessment determines that the release, fire, or explosion could threaten human health or the environment outside the facility, the following will occur:

- If the assessment indicates that evacuation of local areas may be advisable, the Emergency Coordinator will notify the City of Portage and, if necessary, the Kalamazoo County Office of Emergency Management.

- Environmental will notify the National Response Center and EGLE PEAS. Environmental will verbally provide:

    1. Name and telephone number of the reporter.
    2. Name and address of the facility including EPA I.D. No. MID 000 820 381.
    3. Date, time and type of incident.
    4. Name and quantity of material(s) involved.
    5. Extent of injuries, if any
    6. Estimated quantity and disposition of recovered material resulting from the incident.
    7. Potential hazards to human health and the environment outside the facility
    8. The initial response action taken.

- In addition, the following agencies will be notified, as required or if their assistance is necessary:

City of Portage Fire Department	269.329.4487 Emergency: 9-1-1
City of Portage Police Department	269.329.4567 Emergency: 9-1-1
Kalamazoo Department of Public Safety	269.337.8120
Kalamazoo County Office of Emergency Management	269.383.8743
City of Kalamazoo Water Reclamation Plant	269.337.8681

G.4.5 Control Procedures

Controls for designated hazardous waste areas are discussed in Section G.4.10, below.

G.4.6 Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the Emergency Coordinator will take reasonable measures to ensure that fires, explosions and releases do not occur, recur, or spread to other hazardous waste management areas at the facility. This includes stopping processes and operations, collecting released waste, and recovering or isolating containers. Applicable employees are trained on specific actions to be taken in response to an emergency. In addition, if the facility stops operations during an emergency response, area supervision will be advised to monitor valves and other equipment for leaks, pressure buildup, gas generation, or ruptures.

G.4.7 Storage and Treatment of Released Material

As control is established, Environmental will make arrangements for treatment, storage, and disposal of recovered waste, contaminated soil, surface water or any other contaminated material as is appropriate based on its characteristics. Samples of contaminated material may be analyzed to determine its characteristics or composition for proper handling and disposal.

G.4.8 Incompatible Wastes

Environmental will assess the compatibility of released materials with activities or material storage within the impacted area.

G.4.9 Post-Emergency Actions

Federal, state and local authorities may develop a sampling plan for the collection of waste, groundwater, soil, ash, airborne dust, debris, surface water, and/or wipe samples as appropriate. Post event off-site sampling may not be necessary based on air monitoring data and lack of off-site migration or deposition. Based upon the results of the samples collected P&U will perform corrective actions as required.

Before operations are resumed at the facility, Environmental will notify appropriate federal, state and local authorities that the facility response and cleanup are complete in the affected areas, as required. Written report(s) on the incident will be submitted, as required (see Section G.8).

After an emergency event, emergency equipment is cleaned so that it is fit for use or it is replaced. Before operations resume, an inspection of safety equipment is conducted. Affected containment areas are effectively emptied and washed, capturing residuals and rinses for proper disposal.

If the incident required the activation of the Contingency Plan, Environmental will advise the operator in the area of the release to complete an incident investigation and assign appropriate corrective actions.

G.4.10 Container Spills and Leaks

Routine inspections are conducted on the storage areas for contained wastes to ensure that the containers are in good condition. Prior to storage, all wastes in the permitted storage area (Building 388) are determined to be compatible with the drums in which they are contained and with other wastes in the storage area. Secondary containment is provided for the container storage area via co-located sumps.

If a spill is observed or a leak detected, sand bags or barriers of absorbent material may be used to contain the spilled liquid in the immediate vicinity of the affected container. The P&U Spill Dispatch Center will be notified at 3-3800, and they will in turn notify Environmental of the situation, provide status of initial actions and implement Emergency Coordination, as needed. Small amounts of spilled liquid may be captured using absorbents and shovels. Materials captured or contaminated absorbent(s) will be characterized, placed in an appropriate container, properly labeled, and shipped off site for proper disposal. Salvage drums are maintained in supply if needed to over pack leaking containers.

G.5 EMERGENCY EQUIPMENT

A list of emergency equipment available in the event of an accident or incident resulting in the release of hazardous waste to the environment is provided in Tables 1 and 2. This equipment is located in P&U Emergency Services, which is shown in Figure 2, including the locations of spill kits available in proximity to the hazardous waste management area. Table 2 describes equipment that is maintained by the P&U HAZMAT Team response vehicle. Absorbent booms and pads are also available to be deployed at the outfalls from the P&U Pond, in the unlikely event of a spill reaching the outfall. Permanent booms are in place at both sites for containing spills. Spill residues contained in those surface waters would then be absorbed, vacuumed, or skimmed.

Telephones for internal and external communications are available near each hazardous waste management unit. Additionally, operations personnel routinely carry internal/external communication devices (e.g. 2-way radios, cell phones). Telephone communication with P&U Emergency Services would be the first step in activating facility alarms in case of an emergency. Fire alarm boxes that notify Emergency Services automatically are also located near many of the storage areas.

G.5.1 Spill Response Contractors

Pharmacia & Upjohn has retained the following spill response contractors who are available to respond to spills:

SET Environmental, Inc - Portage, MI
Business Telephone: 269.323.8444

The above emergency spill response contractor employs personnel specifically trained in handling hazardous materials. The contractor has a wide range of equipment, including absorbent material, oil booms, vacuum trucks and tankers, bulk tankers, dump trucks, excavation equipment, and mobile treatment and filtration systems.

G.5.2 Fire Extinguishing and Safety Equipment

First response personnel have the opportunity to be trained in portable fire extinguisher response and are capable of using extinguishing equipment as needed. These extinguishers are inspected monthly, serviced annually, and located so that travel distance to each extinguisher location is kept to a minimum. Additional fire extinguishing capability includes strategically located fire hoses. Figure 4 shows the location of fire alarms and portable fire suppression equipment in proximity to the hazardous waste management area.

P&U Emergency Services is responsible for primary response for the Portage facilities. P&U Emergency Services is located on site, with personnel specifically trained in industrial and chemical fires. The Portage Fire Department is the municipal fire department of this jurisdiction and responds to all alarms. P&U also play an active role as a member of the Kalamazoo County Local Emergency Planning Committee.

G.6 COORDINATION AGREEMENTS

Pursuant to R 299.9606 and 40 CFR 264.37, arrangements have been made with state and local emergency response groups to address and coordinate emergency response activities of incidents involving P&U. Copies of this emergency plan have been distributed to the organizations listed below. P&U will ensure that the following organizations receive the most current version of the Contingency Plan:

- Kalamazoo Department of Public Safety (for Fire & Police)
- Kalamazoo County Office of Emergency Management
- Portage Fire Department
- Portage Police Department
- Bronson Methodist Hospital
- Bronson Vicksburg Hospital
- City of Kalamazoo Water Reclamation Plant

- SET Environmental, Inc

P&U has provided these agencies, whose assistance may be needed, with opportunities and/or resource materials to familiarize them with the facility layout, properties and associated hazards of hazardous materials handled at the facility, location of facility personnel, entrances to and from roads inside the facility, and possible evacuation routes.

G.7 EVACUATION PLAN

The facility telephone system may be used to report an imminent emergency or event perceived as a threat. By dialing 1-2-3 or 833-4799 from an external line, an individual can report the incident to the 24-hour manned P&U Emergency Services. An audible and strobe alert system is used to alert employees of an emergency. Action to be taken will be determined by the Emergency Coordinator. Instructions will be provided for evacuation routes and meeting points through PA announcements. Employees are trained in the recognition of and response to emergency alerts.

The evacuation route, relative to the proximity of the hazardous waste management area, is shown in Figures 4.

G.8 REQUIRED REPORTS

The Michigan Department of Environment, Great Lakes, and Energy will be notified in writing within 15 days of an emergency incident requiring notification of a hazardous waste release at the facility. The report will include:

1. Name, address and telephone number of the facility and owner or operator:
2. Date, time and type of incident;
3. Type and quantities of materials(s) involved;
4. Extent of injuries, if any;
5. Assessment of any hazards to human health or the environment, if applicable;
6. Estimated quantity of recovered material and its disposition.

G.9 AMENDMENTS TO CONTINGENCY PLAN

This plan will be reviewed and amended, as necessary, under any of the following circumstances:

- If applicable regulations are revised;
- Following an emergency;
- Whenever the facility changes its design, construction, operations, maintenance or other conditions in a way that increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency; or
- Whenever the list of Emergency Coordinators or emergency equipment changes.

Table 1: Facility Response Equipment

INDOOR EQUIPMENT LISTING

AVAILABLE EQUIPMENT	CAPABILITIES
Radios	communication
Fire Extinguisher, ABC	fire control
Fire hose	fire control
Eye Wash	rinse eyes
Face shield, regular splash shield	PPE
Safety Glasses	PPE
Safety Goggles	PPE
Gloves	PPE
Suit, Coveralls	PPE
Disposal Bags	waste containment
COMMON SPILL KIT CONTENTS	**CAPABILITIES**
Sorbent pads	spill absorption
Sorbent socks	spill absorption & containment

OUTDOOR EQUIPMENT LISTING

AVAILABLE EQUIPMENT	CAPABILITIES
Radios	communication
Fire Extinguishers ABC	fire control
Drain Plug	spill containment
COMMON SPILL KIT CONTENTS	**CAPABILITIES**
Plastic sheeting	spill containment
Sand bags	spill containment
Sorbent pads	spill absorption
Sorbent socks	spill absorption & containment

Table 2: HAZMAT VEHICLE INVENTORY

EQUIPMENT	CAPABILITIES
Radios	communication
Barricade, Orange	communication
NIOSH Guide	guidance
Resource Manuals	guidance
CHRIS (Condensed guide to Chemical Hazards)	guidance
Permeation Reference Manual	guidance
Emergency Action Guides	guidance
Matheson Gas Data Book	guidance
Fire Extinguishers ABC	fire control
Foam Fire Extinguisher	fire control
Fire hoses	fire control
EMS Medical Bag	basic medical treatment
SKED Stretcher	medical response
Chlorine Kit “A”	medical response
Chlorine Kit “B”	medical response
Stethoscope	medical response
Eye Wash	rinse eyes
Face shield, regular splash shield	PPE
Hard Hats	PPE
Respirators	PPE
Safety Glasses	PPE
Safety Goggles	PPE
Gloves	PPE
Suit, Coveralls	PPE
Ear Plugs	PPE
Suit, level B	PPE
Boots	PPE
Suit, level A	PPE
Air bottles	PPE
SCBA	PPE
Respirator cartridges	air filtration/purification
Decon Pool, Folding	decontamination
Decon Coveralls, brushes, bucket	decontamination
HAZMAT Vacuum Sample Kit	sample collection
Snoop Solution	leak detection
pH Test Paper	pH determination
Citric Acid Powder	neutralization
Sodium Bicarbonate	neutralization

EQUIPMENT	CAPABILITIES
Chlorine Bleach	neutralization
Base spill kit	neutralization and spill cleanup
Acid Spill Kit	neutralization and spill cleanup
Drum Bungs	drum closure
Drum Lifter	drum handling
Metal Drum Hoist	drum handling
Drum Dolly	drum handling
Grounding Cable with clamps	spark prevention
Sorbent pads	spill absorption
Sorbent socks/booms	spill absorption & containment
Hazmat Waste Disposal Bags	spill containment
Drum Liners	spill containment
Plugs	spill containment
Belly Patch Kit	spill containment

Figure 1: Site Location

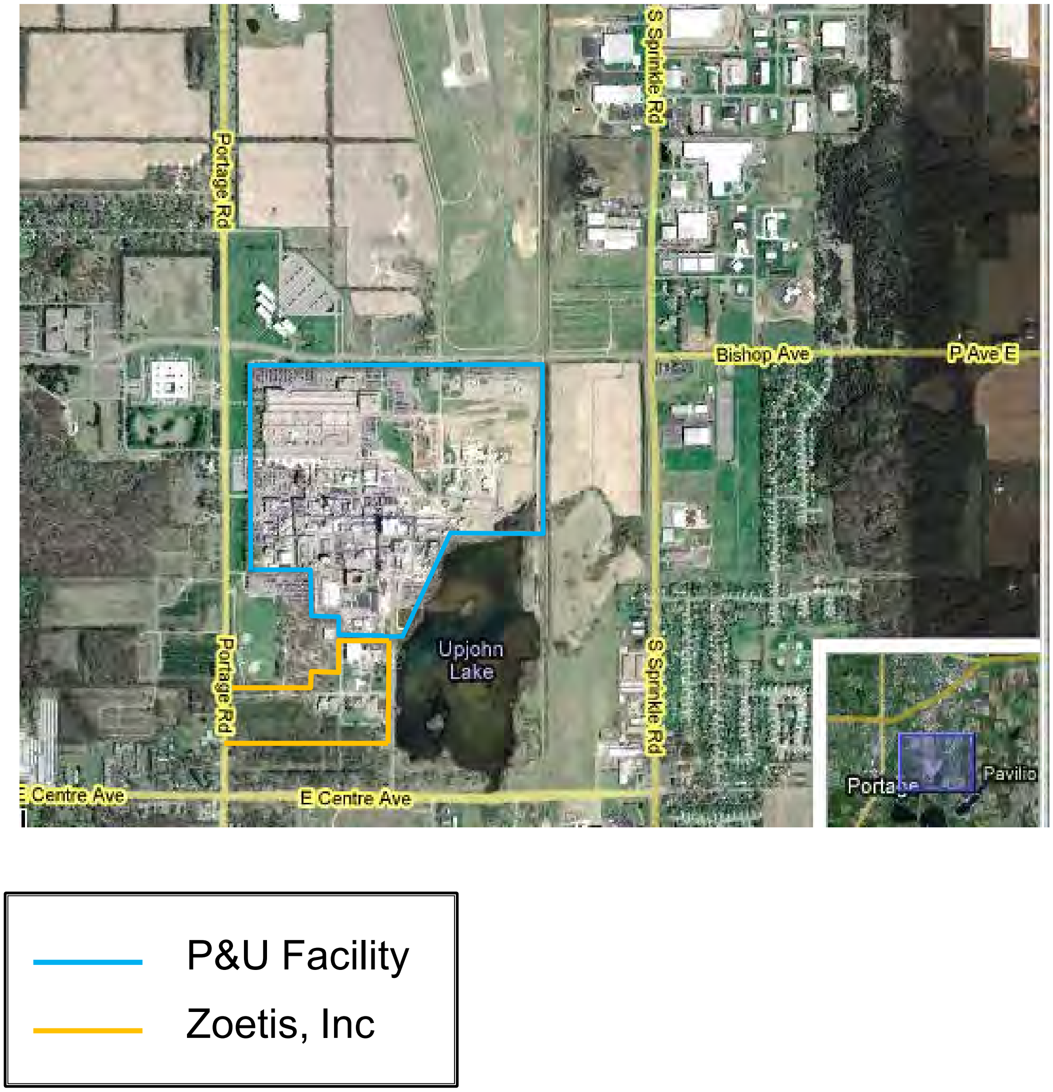
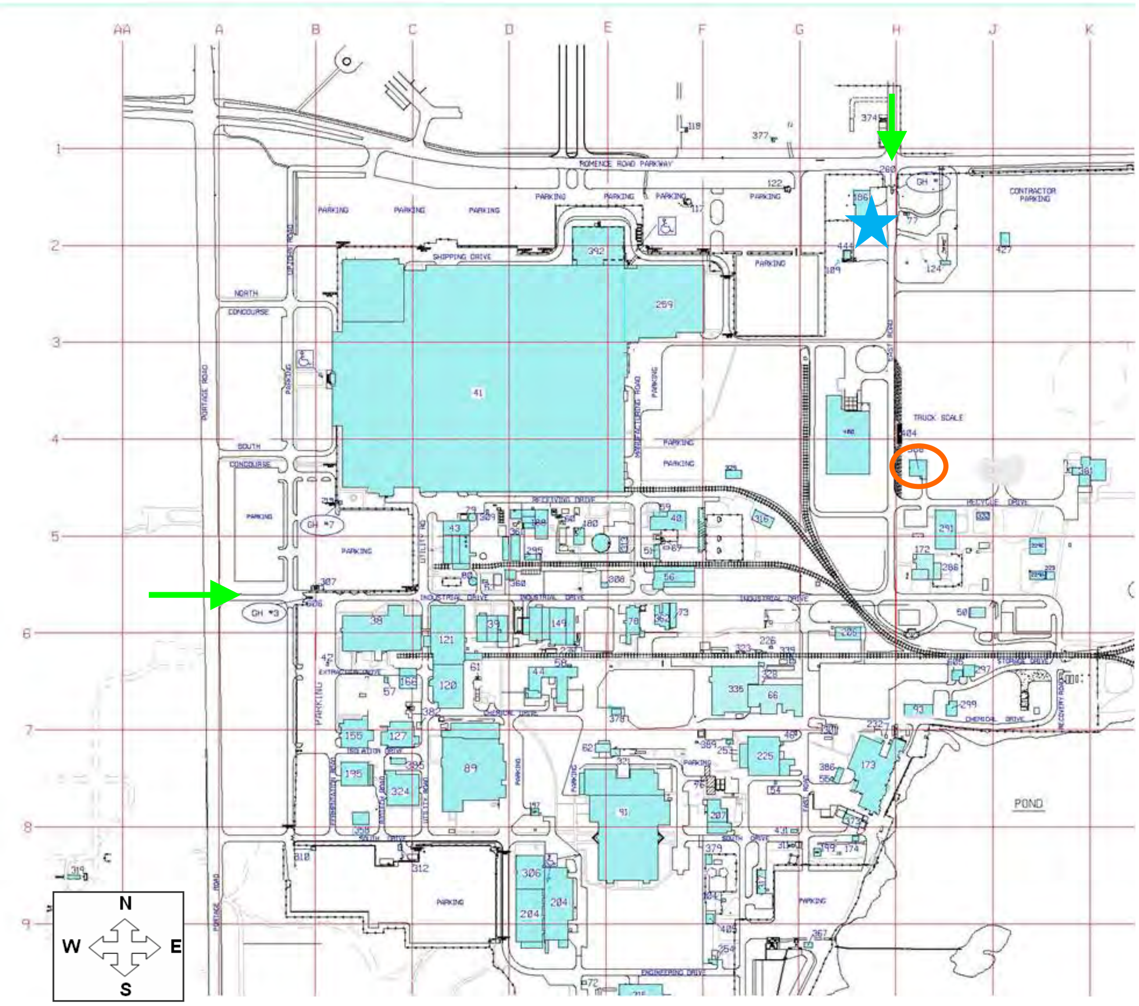


Figure 2: Site Map
7171 Portage Road, Kalamazoo, MI



Legend

→ - Facility Entrance

★ - P&U Fire Department

○ - Building 388

FIGURE 3: WASTE CONTROL HAZARDOUS WASTE PERMITTED STORAGE LOCATION

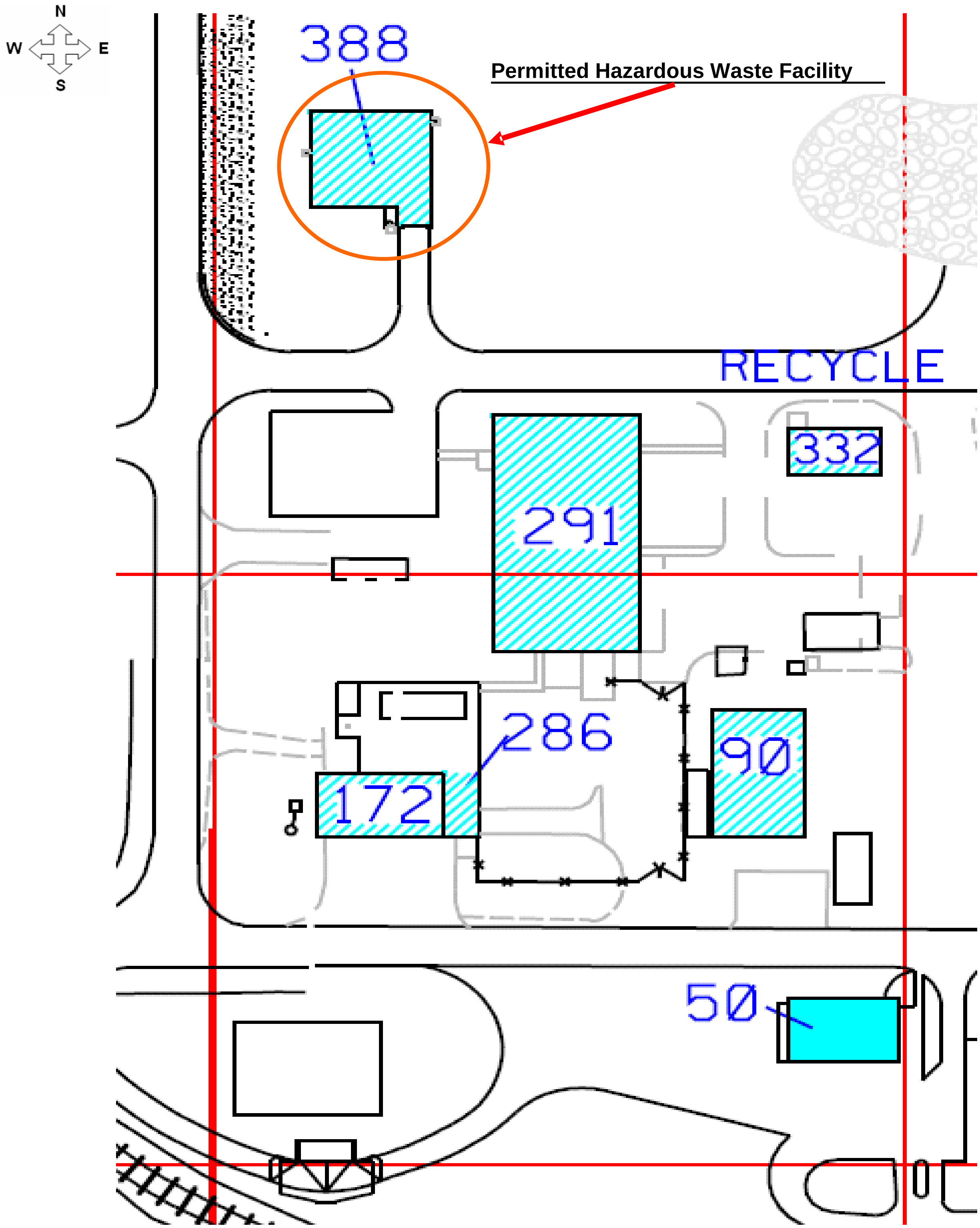
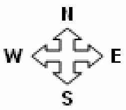
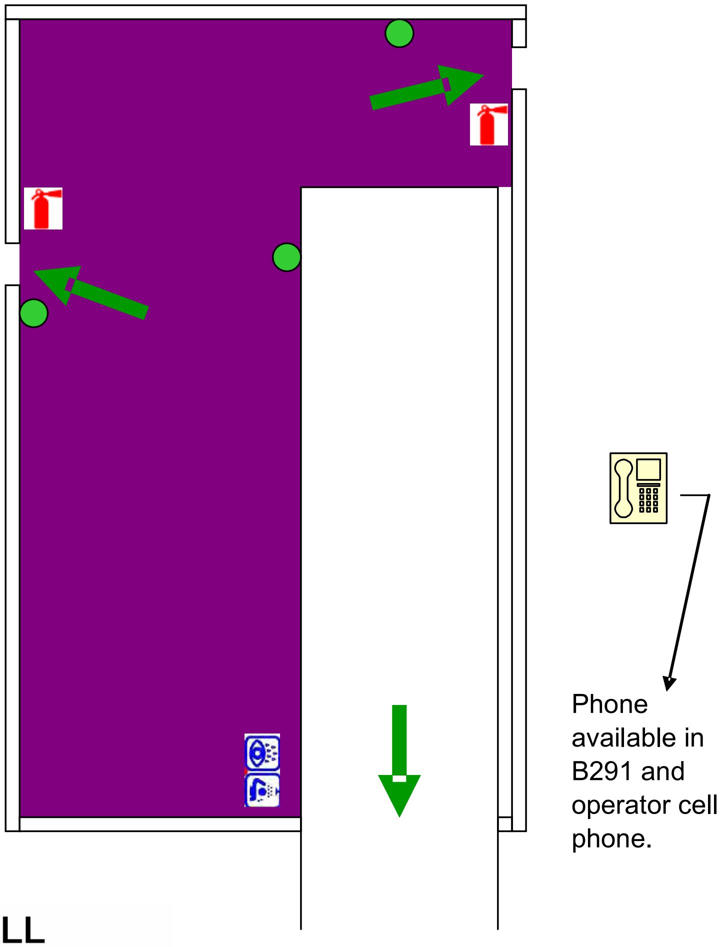


FIGURE 4: WASTE CONTROL - BUILDING 388 HAZARDOUS WASTE ACCUMULATION

with associated emergency equipment, and exit routing


Waste Control




Phone available in B291 and operator cell phone.

EMERGENCY CALL

Fire/Injury: 1-2-3

Spill/Release: 3-3800

EMERGENCY GUIDELINES

Familiarize yourself with all → exit locations.

Know the location of fire, safety and spill equipment.

Evacuation – Follow public address announcement instructions.

Follow shutdown protocol.

Remain calm and orderly.

Do not use the elevators.

LEGEND

● Hazardous Waste Facility

● Spill Kit

🧯 Portable Fire Extinguisher

☎ Phone

TSDF FACILITIES
PGS KALAMAZOO – WASTE CONTROL
RCRA CONTINGENCY PLAN: REFERENCE DOCUMENT
[R 299.9607, R299.9504(1)(C). 40 CFR 264 Subpart D, 270.14 (B)(7)]

Pharmacia & Upjohn LLC (subsidiary of Pfizer)
Kalamazoo, Michigan

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1.0 B388 Potential Materials and Hazardous Waste

Item	Component Description	Quantity	UOM	Hazard Code *
1	Zinc Waste	515	Gallons	B, C, F-1, K-1, J-2, Q
2	Methyldihydrocinnamate	60	Gallons	U
3	HCS Sodium Succinate	25	Gallons	Q
4	CIP 200/H_2O	1265	Gallons	C, K-1
5	CIP 100	25	Gallons	C, K-1
6	CIP 200	80	Gallons	C, K-1
7	Polysorbate 80	55	Gallons	S
8	Cyanide Lab Packs	40	Gallons	A, C, Q
9	Loose Pack Flammable	75	Gallons	F-1, K-1
10	Cyanamide Anhydrous	15	Gallons	A
11	4’ Fluorescent bulbs (Universal Waste)	1200	Bulbs	N/A
12	BCMA	750	Gallons	Q-1, Q-2, P
13	Coral Snake Venom	10	Gallons	P, K-1, K-2, K-3, D
14	Ceftiofur HCL	30	Gallons	K-2
15	PCB Ballasts (Universal Waste)	5	Gallons	N/A
16	Diethylene Triamine	730	Gallons	B, C, K-1
17	Aerosols (Universal Waste)	275	Gallons	N/A
18	Compact Bulbs (Universal Waste)	250	Bulbs	N/A
19	Production Waste	1105	Gallons	N/A
20	Formamide	165	Gallons	C
21	Phenyl Propionic Acid	45	Gallons	C
22	Lithium Chloride Inhibitor	169	Gallons	K-1, M
23	Dimethylmethyl phosphonate	25	Gallons	F-2, K-1, K-2
24	Pyridine 1 Degree	20	Gallons	F-1, K-1, Q
25	Methane Sulfonic Acid	55	Gallons	C
26	Selamectin w/THF	660	Gallons	C, B, F-1, H-2, K-1, K-2, N-2
27	Bld 73 SRD Tank Rust (Acetone)	55	Gallons	F-1, K-1
28	Fluoroboric Acid 48%	40	Gallons	C
29	Sodium Methylate Solution 25%	55	Gallons	B, C, F-1, Q-1
30	Potassium Carbonate Solution	55	Gallons	K-1, B
31	Selamectin Product	55	Gallons	K-1, K-2
32	CIP 100/ H_2O	1250	Gallons	C, K-1
33	Sodium Hydroxide Solution	695	Gallons	C
34	Tributyl methylammonium Chloride	55	Gallons	K-1
35	Lab Pack Metals waste w/ HCL	100	Gallons	N/A
36	Hg Contaminated Material	810	Gallons	M
37	Benzenesulfonic Acid	330	Gallons	C, K-1
38	Paint Related Material	75	Gallons	K-1, M-2. N-2

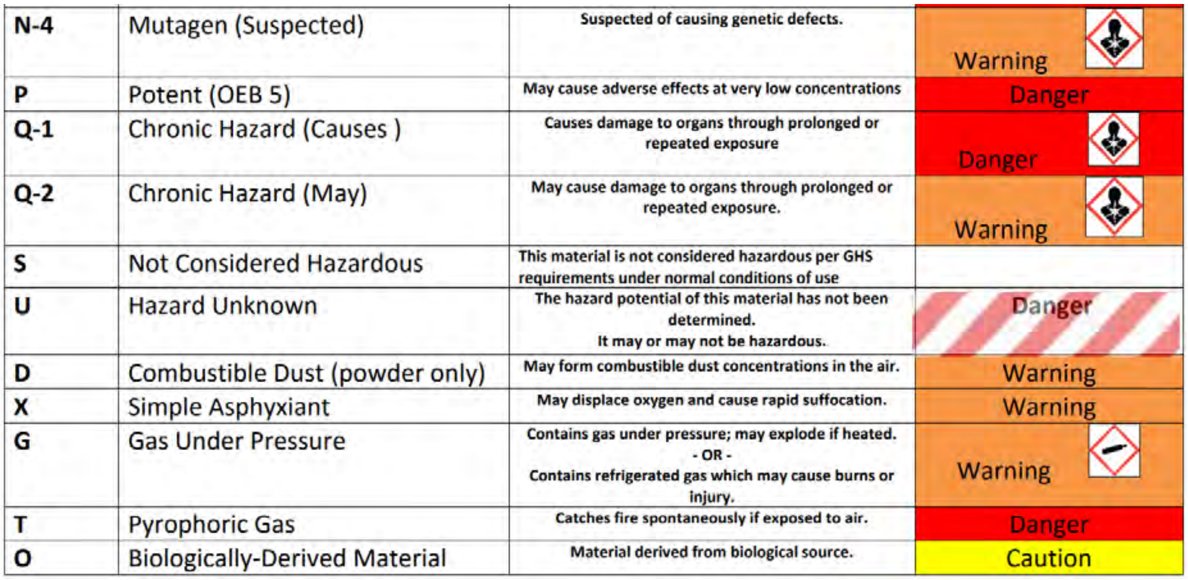
Item	Component Description	Quantity	UOM	Hazard Code
39	2 Molar Methyl Magnesium Chloride in THF	55	Gallons	C, F-2, K-1, M-2,
40	TOx Clean Out/ H_2O/Phosphoric Acid	100	Gallons	B, C, K-1
41	TBAL Waste Cake w/ Ethyl Acetate, Acetone, Branched Octane	175	Gallons	A, C, F-1, K-1, H-2, N-2
42	Non-PCB Ballasts (Universal Waste)	65	Gallons	N/A
43	Aqua Ammonia	10	Gallons	B, C
44	P-Toluene Sulfonic Acid	60	Gallons	C, K-1
45	Cis-2, 6 Dimethyl Piperidine	20	Gallons	F-1
46	Lab Packs (Base)	50	Gallons	C

***Refer to the Table starting on page 4**

Note: This inventory was pulled as of June 2, 2022. The materials will change depending on what operations are being produced or what the labs are using. Total Gallons at this time was 11,454 gallons.

SITE PRECAUTIONARY LABELS

Code	Hazard	Hazard statement	Signal Word Pictogram
A	Highly Toxic	May be fatal if swallowed, inhaled or absorbed through the skin.	Danger 
B	Toxic	May be harmful if swallowed, inhaled or absorbed through the skin.	Warning 
C	Corrosive	Causes severe skin burns and eye damage. May be fatal if swallowed, inhaled or absorbed through the skin.	Danger 
F-1	Flammable (Extremely or Highly)	Extremely or highly Flammable Liquid/Vapor/Gas/Solid/Aerosol *or* catches fire if exposed to the air *or* in contact with water *or* may be self-heating.	Danger 
F-2	Flammable/Combustible Liquid	Flammable liquid, vapor, aerosol or solid. Heating may cause fire.	Warning 
H-1	Oxidizer	May cause or intensify fire or explosion; Oxidizer.	Danger 
H-2	Peroxide or Peroxide Former	Heating may cause or intensify fire or explosion; may form explosive peroxides. Heat, shock or contact with other materials may cause fire or explosive decompositions. Oxidizer.	Danger 
J-1	Unstable/Reactive	Heating may cause a fire or explosion. May become self-reactive, release dangerous gas or cause violent reaction under conditions of shock, pressure or temperature.	Danger 
J-2	Water Reactive	In contact with water releases flammable gases which may ignite spontaneously	Danger 
K-1	Irritant	Causes skin, respiratory or serious eye irritation.	Warning 
K-2	Sensitizer (Respiratory)	May cause allergy or asthma symptoms or breathing difficulties if inhaled.	Danger 
K-3	Sensitizer (Skin)	May cause an allergic skin reaction.	Warning 
M-1	Reproductive Hazard (May)	May damage fertility or the unborn child.	Danger 
M-2	Reproductive Hazard (Suspected)	Suspected of damaging fertility or the unborn child.	Warning 
N-1	Carcinogen (May)	May cause cancer.	Danger 
N-2	Carcinogen (Suspected)	Suspected of causing cancer.	Warning 
N-3	Mutagen (May)	May cause genetic defects.	Danger 



N-4	Mutagen (Suspected)	Suspected of causing genetic defects.	Warning
P	Potent (OEB 5)	May cause adverse effects at very low concentrations	Danger
Q-1	Chronic Hazard (Causes)	Causes damage to organs through prolonged or repeated exposure	Danger
Q-2	Chronic Hazard (May)	May cause damage to organs through prolonged or repeated exposure.	Warning
S	Not Considered Hazardous	This material is not considered hazardous per GHS requirements under normal conditions of use	
U	Hazard Unknown	The hazard potential of this material has not been determined. It may or may not be hazardous.	Danger
D	Combustible Dust (powder only)	May form combustible dust concentrations in the air.	Warning
X	Simple Asphyxiant	May displace oxygen and cause rapid suffocation.	Warning
G	Gas Under Pressure	Contains gas under pressure; may explode if heated. - OR - Contains refrigerated gas which may cause burns or injury.	Warning
T	Pyrophoric Gas	Catches fire spontaneously if exposed to air.	Danger
O	Biologically-Derived Material	Material derived from biological source.	Caution

2.0 Site Maps and B388 Hazardous Waste Accumulation Site

Figure 1: Site Location

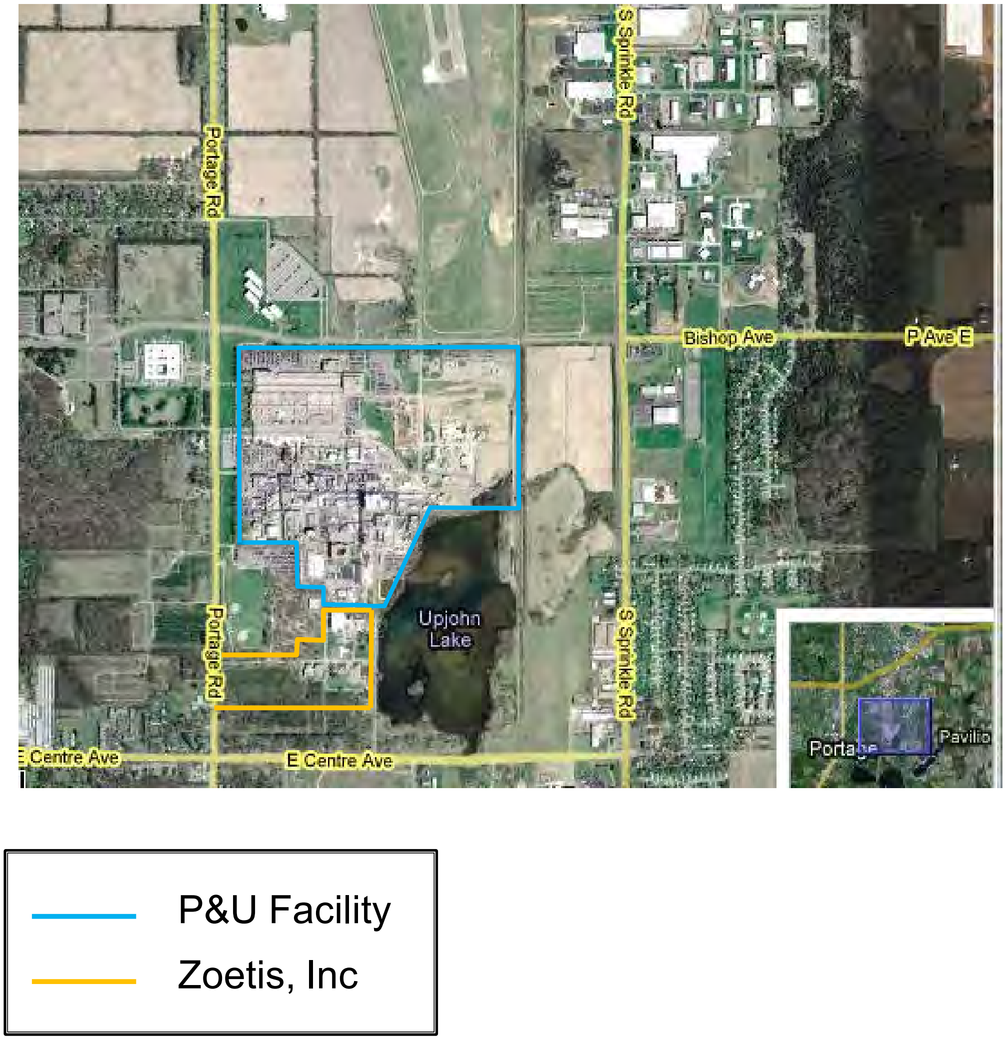
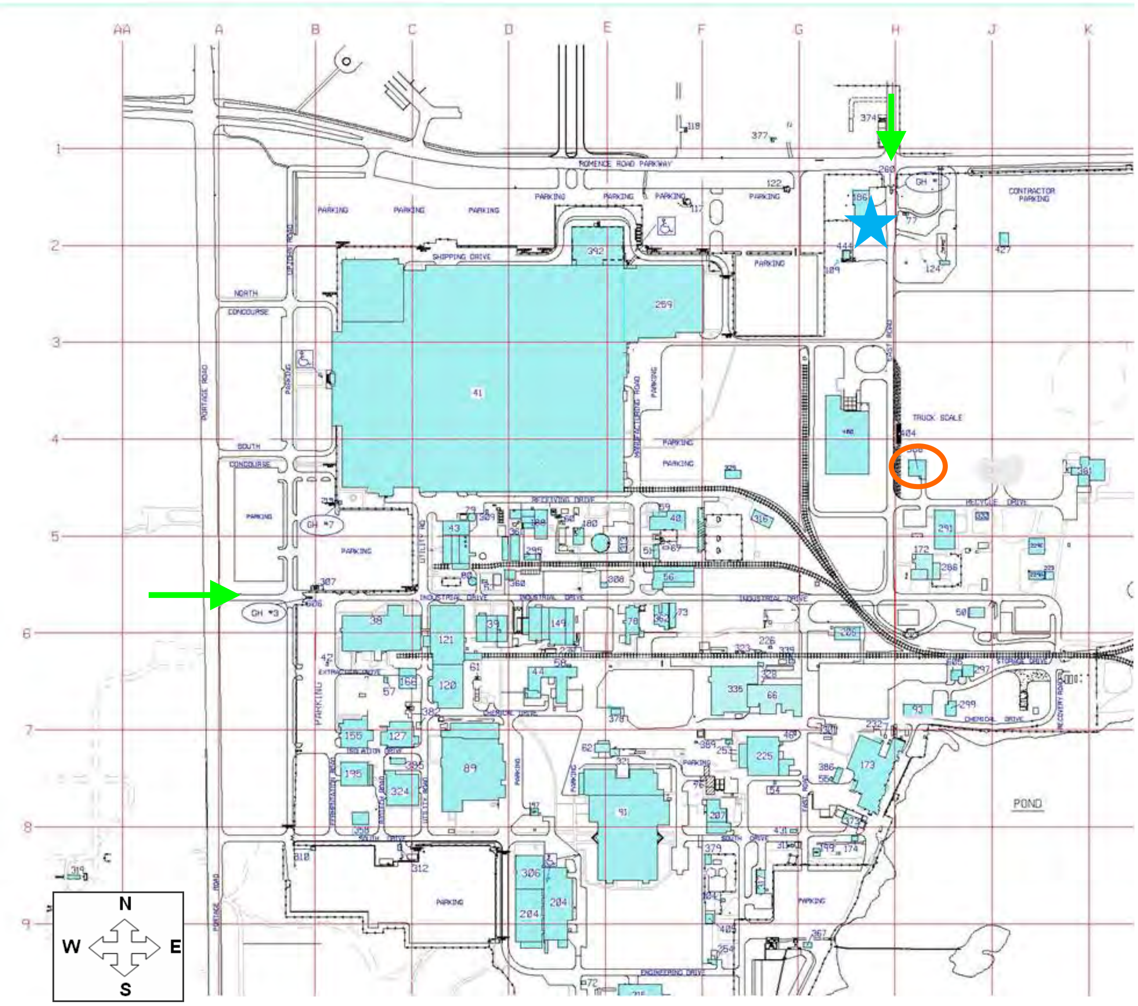


Figure 2: Site Map
7171 Portage Road, Kalamazoo, MI



Legend

→ - Facility Entrance
★ - P&U Fire Department
○ - Building 388

FIGURE 3: WASTE CONTROL
HAZARDOUS WASTE
PERMITTED STORAGE LOCATION

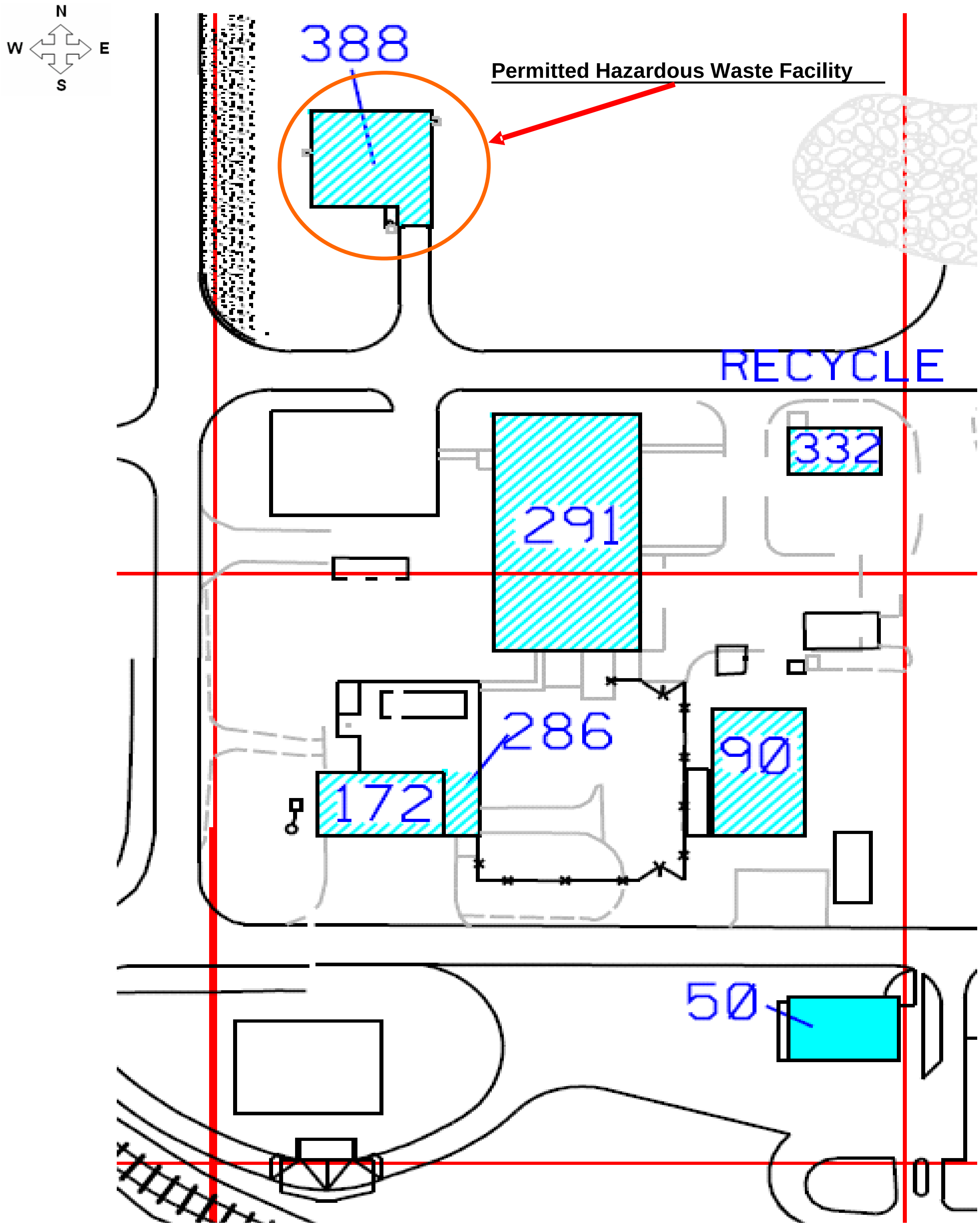
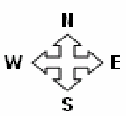
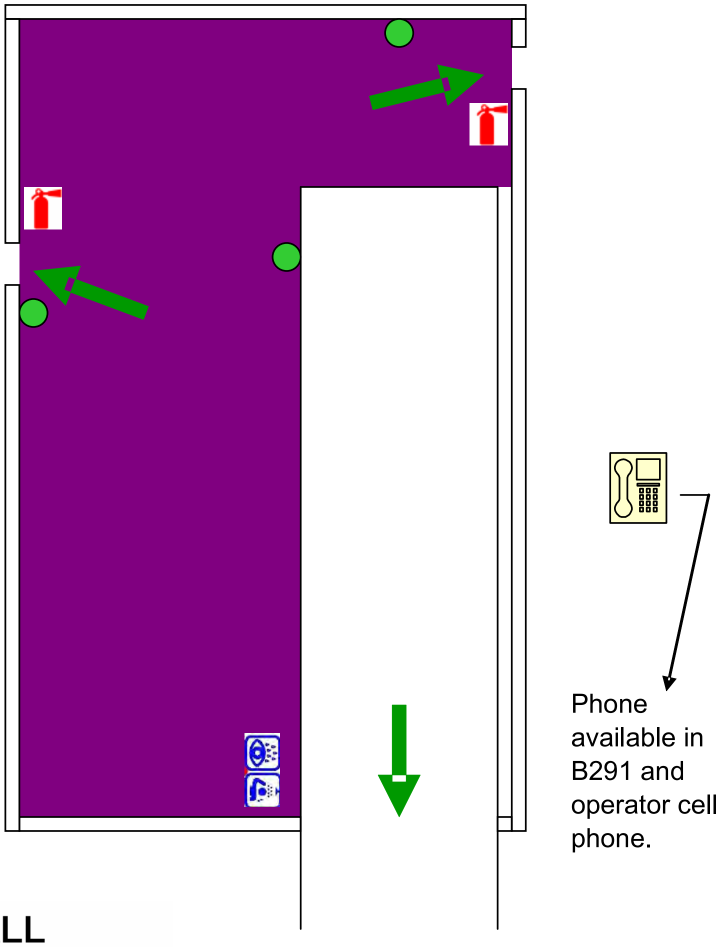


FIGURE 4: WASTE CONTROL - BUILDING 388 HAZARDOUS WASTE ACCUMULATION

with associated emergency equipment, and exit routing

Waste Control





Phone available in B291 and operator cell phone.

EMERGENCY CALL

Fire/Injury: 1-2-3

Spill/Release: 3-3800

EMERGENCY GUIDELINES

Familiarize yourself with all → exit locations.

Know the location of fire, safety and spill equipment.

Evacuation – Follow public address announcement instructions.

Follow shutdown protocol.

Remain calm and orderly.

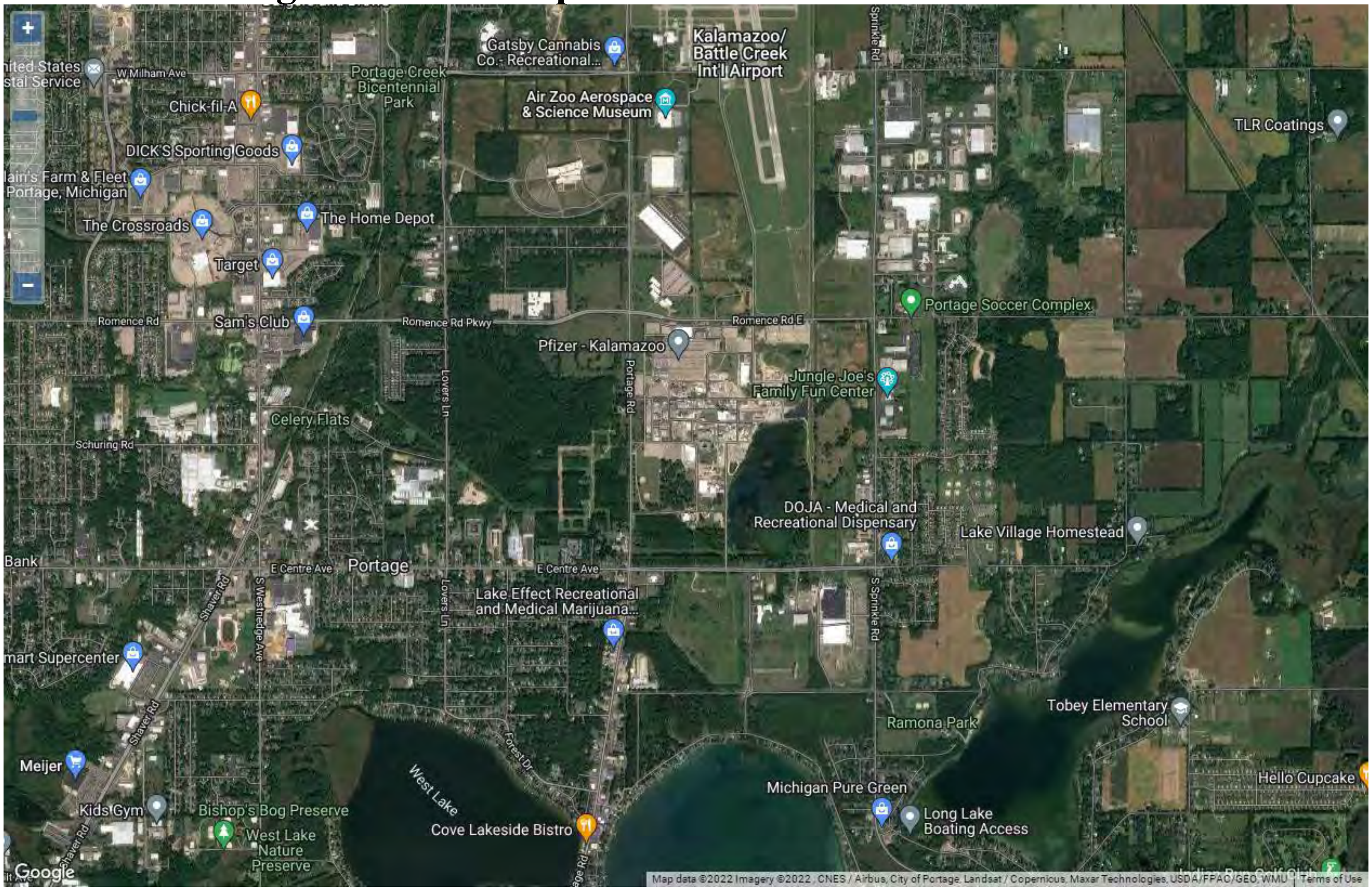
Do not use the elevators.

LEGEND

- ● Hazardous Waste Facility
- ● Spill Kit
- 🧯 Portable Fire Extinguisher
- ☎ Phone

3.0 Map of Site in Relation to Public Facilities

Figure 5: Site Map in Relation to Public Facilities



4.0 Water Supply Locations

The B388 hazardous waste management unit is equipped with a 30-nozzle sprinkler system, portable fire extinguishers, and spill kits with decontamination equipment. Each nozzle is capable of displacing 25 GPM with a total system worst case of 750 GPM. Each nozzle operates independently of each other. The facility also supports an on-site HAZMAT response team capable of responding in the event of an emergency.

There are four fire pumps on site. Two fire pumps take suction from the pond and two taking suction from the city water system.

Pharmacia & Upjohn LLC most recent pump test results show the flow rate of the pumps to be as follows:

- Pump 1 (199-1): 2000 gallons/minute (gpm) @ 100 psi
- Pump 2 (199-2): 2000 gpm @ 103 psi
- Pump 3 (444-3): 2500 gpm @ 144 psi
- Pump 4 (444-4): 2500 gpm @ 144 psi

For more local water supplies:

- Any hydrant will have ~1000 gpm @125 psi (minimum).
- Any building supply will be ~2000 gpm @ 100 psi (minimum).

Refer to Attachment 1: Fire Protection Piping Drawing for locations of fire protection piping.

5.0 On-Site Notification

The facility utilizes PA/strobes as the primary method to communicate emergency notifications. Alarm autocalls may be used as the secondary method of emergency notifications, except in those areas where a PA system is not available then the alarm autocalls will be the primary system. Since Pharmacia Upjohn LLC has a proprietary supervising station fire alarm system manned by a 24-hour, 7 days/week Central Dispatch system there are no direct connections off site.

The facility’s internal communication system, fire protection equipment, and emergency response equipment and decontamination equipment is tested on a monthly basis to ensure that the equipment is in place and operational.

Dialing 1-2-3 from any internal phone within the facility or 833-4799 from an external phone will reach the on-site fire department. The fire department can also be contacted on the facilities two-way radio system. Operators in the B388 hazardous waste management unit are equipped with a two-way radio and/or a cell phone capable of contacting emergency personnel.

6.0 Emergency Coordinator Information

The following personnel are designated as Emergency Coordinators and are authorized to commit necessary resources to implement the Contingency Plan. They are familiar with the operations, activities, characteristics of materials handled, and the location of records pertinent to the facility's operations. Emergency coordinators are subject to call and capable of being reached 24 hours a day.

Primary Emergency Coordinator

Eric Lyons

Phone Numbers:	Work (269) 833.7250 Cell (269) 599-7422
Residence:	7000 Portage Rd Kalamazoo, MI 49001

Secondary Emergency Coordinator

Sarah Kusisto

Phone Numbers:	Work (269) 833.4841 Cell (269) 655.5320
Residence:	3055 Brynmawr Dr. Portage, MI 49024

ATTACHMENT A8
TRAFFIC INFORMATION

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of the Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504(1)(c) and Title 40 Code of Federal Regulations (CFR) §§270.14(b)(10) establish requirements for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.
This license application attachment addresses requirements for traffic information at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo, Michigan.

A8.A TRAFFIC INFORMATION
[40 CFR §§270.14(b)(10)]

The main truck access is via Romence Rd to the north of the facility. There is also an entry gate at the entrance to the industrial facility from Portage Road to the east. Romence Road is a three-lane paved city road that is well maintained for the volume of truck traffic it experiences. Portage road is a major five-lane roadway.

Containerized wastes are transported primarily in van trucks. Forklift or truck transports containerized wastes generated on site to B388.

All roads at the facility that are used for containerized waste transport at the facility are paved. Traffic on the site is controlled with appropriate speed limits, speed bumps and the placement of stop signs as necessary at intersections.

The roads on the site are capable of carrying vehicles with 32,000-pound axle loads. Roads are 11 to 12 feet wide per lane, and constructed of three to four inches bituminous concrete, with a six to eight inches gravel base. Road pitch is ¼ inch per foot.

ATTACHMENT A9
LOCATION INFORMATION

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of the Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504(1)(c) and Title 40 Code of Federal Regulations (CFR) §§270.14(b)(11) establish requirements for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application attachment addresses requirements for location information at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo, Michigan.

A1.C FACILITY LOCATION INFORMATION

[40 CFR §§270.14(b)(11)]

This section addresses geographical information concerning the Pfizer Inc facility, including seismic standard, floodplain standard, and general facility location information.

A1.C.1 Seismic Standard

This requirement applies only to facilities in those political jurisdictions that are listed in Appendix VI of 40 CFR Part 264 as having areas that are seismically active. No part of the State of Michigan is included in Appendix VI. Therefore, the seismic standard does not apply to the Pfizer Inc facility.

A1.C.2 Floodplain Standard

As determined by the Flood Insurance Rate Map (FIRM) for the City of Portage, Michigan, the active portion of the Pfizer Inc facility is not located in the 100-year floodplain. Figure 1 shows the property boundary of the Pfizer Inc facility, and also the delineation of that portion of the property, which is the active manufacturing plant. All of the hazardous waste management activities occur in the central plant area. The surrounding Pfizer Inc property does include small areas along the perimeter that are designated floodplain. These flood prone areas do not affect waste management units at the facility.

A1.C.3 Location Information

[R 299.9603]

The Pharmacia & Upjohn Co, Inc facility is located at a longitude 42 degrees, 12 minutes, and 42 seconds and latitude of 85 degrees, 33 minutes, and 25 seconds. The building 388 hazardous waste management unit is located within the existing facility, which has been in operation for more than 50 years. This permit application does not cover any new treatment, storage, or disposal facilities or expansions, enlargements, or alterations of the existing facility. Therefore, the location information requirement in R 299.9603 does not apply.

ATTACHMENT A10
PERSONNEL TRAINING

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of the Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9501, R 299.9605, and Title 40 Code of Federal Regulations (CFR) §§264.16 and 270.14(b)(12), establish requirements for personnel training programs at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application attachment addresses requirements for a personnel training program at the hazardous waste management facility for the Pharmacia and Upjohn Company LLC, a subsidiary of Pfizer Inc in Kalamazoo, Michigan. This attachment includes personnel training requirements for construction permits and operating license applications. The information included in the attachment demonstrates how the facility meets the personnel training requirements for hazardous waste management facilities.

A10.A CONTENT OF INTRODUCTORY AND CONTINUING EDUCATION TRAINING PROGRAMS

[R 299.9605 and 40 CFR §264.16(a)]

A10.A.1 Outline for Introductory Training Program

[R 299.9605 and 40 CFR §§264.16(a)(1) and 264.16(d)(3)]

The goal of the personnel training program is to provide instructions for the proper management of hazardous waste and use of equipment involved in waste production/disposal and emergency response procedures. Training is scheduled and recorded electronically through a training database. Environmental professionals are responsible for developing and implementing initial and refresher training for employees at the facility. The training can be classroom training, computer based training, or on-the-job training.

The Environmental professional's training is supplemented by their attendance at outside technical seminars, conferences, webcasts, or other professional training.

Contractors directly involved with managing waste at the TSD are provided with training which includes the safe handling and management of hazardous waste and RCRA issues pertinent to contingency plan implementation. Specific requirements for the Pfizer Site Contingency Plan are provided by Pharmacia & Upjohn Co LLC.

A10.A.2 Outline for Continuing Education

[R 299.9605 and 40 CFR §§264.16(a)(1) and 264.16(d)(3)]

Personnel, Environmental professionals, and contractors directly involved with managing waste at the TSD are refreshed on the requirements for the proper management of hazardous waste, use of equipment involved in waste production/disposal, and emergency response procedures annually.

A10.B PERSONNEL SUBJECT TO TRAINING REQUIREMENTS

[R 299.9605 and 40 CFR §§264.16(a),(d)]

A10.B.1 Job Titles and Job Descriptions

[R 299.9605 and 40 CFR §§264.16(d)(1),(2)]

The job titles and job descriptions for each employee directly involved with the handling of hazardous waste are kept on file at the facility.

A10.B.2 Description of How Training is Designed to Meet Actual Job Tasks

[R 299.9605 and 40 CFR §§264.16(a)(1) and (d)(3)]

The RCRA training program includes an introduction for handling and managing hazardous waste and spill and fire response.

The annual refresher covers general hazardous waste management and updates as needed to reflect new regulatory requirements and to introduce changes in management procedures.

The training program described above is designed to ensure that personnel not only handle hazardous wastes in a safe manner, but also properly respond to emergency situations. The program trains hazardous waste handling/management personnel to maintain compliance under both normal operation conditions and emergency conditions. Training elements address both routine and emergency situations, including the following areas:

- Procedures for using, inspecting, and replacing facility emergency and monitoring equipment.
- Key parameters for automatic waste feed cutoff.
- Communications or alarm systems.
- Response to fire/explosions.
- Response to ground-water contamination incidents; and,
- Shutdown of operations.

Pharmacia & Upjohn Co LLC offers firefighting classes to all Pharmacia & Upjohn Co LLC employees, including those working in waste management activities. This training is presented by the Pharmacia & Upjohn Co LLC firefighters to promote the knowledge of hazardous chemicals and to present appropriate firefighting techniques for specific classes of chemicals used at Pharmacia & Upjohn Co LLC. Training includes information on the use of firefighting equipment for response to chemical emergencies. This information is updated as needed to address new types of chemicals used at Pharmacia & Upjohn Co LLC and new emergency response equipment as it is obtained.

A10.C FREQUENCY OF REQUIRED TRAINING

[R 299.9605 and 40 CFR §§264.16(b), (c)]

A10.C.1 Initial Training

[R 299.9605 and 40 CFR §264.16(b)]

All new contractors who work at the TSD receive training prior to starting at the facility. Personnel and Environmental Professionals receive training within six months and do not work unsupervised until training is complete.

A10.C.2 Continuing Education

[R 299.9605 and 40 CFR §264.16(c)]

Personnel, Environmental professionals, and contractors directly involved with managing waste at the TSD are refreshed on the requirements for the proper management of hazardous waste, use of equipment involved in waste production/disposal, and emergency response procedures annually.

A10.D TRAINING DIRECTOR

[R 299.9605 and 40 CFR §264.16(a)(2)]

Environmental professionals are responsible for developing and providing initial and refresher training for employees at the facility.

A10.E DOCUMENTATION AND RECORD KEEPING REQUIREMENTS

[R 299.9605 and 40 CFR §§264.16(d) and (e)]

A10.E.1(a-d) Documentation

[R 299.9605 and 40 CFR §264.16(d)]

The following documents will be maintained at each facility to fulfill RCRA requirements:

- Job titles and names of employees filling each job
- Written job descriptions
- Written description of type and amount of training given to each position
- Documentation that training has been given to and completed by facility personnel

A10.E.2 Record Keeping

[R 299.9605 and 40 CFR §264.16(e)]

The completion of appropriate RCRA training is tracked electronically. An environmental professional monitors the training database to ensure compliance with the RCRA training requirements. The training records are kept for current personnel until the closure of the facility and former personnel for at least three years.

ATTACHMENT A11
CLOSURE AND POSTCLOSURE CARE PLANS

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (Act 451), R 299.9613 and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart G, establishes requirements for the closure and, if necessary, postclosure care of hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003. This license application template addresses requirements for the proper closure and, if necessary, postclosure care of the hazardous waste management units and the hazardous waste management facility for the Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc in Kalamazoo, Michigan. The information provided in this template was used to prepare the closure and postclosure care cost estimate provided in Template A12, "Closure and Postclosure Care Cost Estimates."

A11.A CLOSURE PLAN

A11.A.1 Closure Performance Standard
[R 299.9613 and 40 CFR §264.111]

This Closure Plan is designed to ensure that the facility will be closed in a manner that achieves the following:

a. Minimizes the need for further maintenance; and

b. Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition byproducts to the groundwater, surface water, or atmosphere; and, as applicable

c. Complies with the unit-specific closure requirements for each of the following units:

(Check as appropriate)

☒ Use and management of containers	R 299.9614 and 40 CFR §264.178
☐ Tank systems	R 299.9615 and 40 CFR §264.197
☐ Surface impoundments	R 299.9616 and 40 CFR §264.228
☐ Waste piles	R 299.9617 and 40 CFR §264.258
☐ Land treatment[a]	R 299.9618 and 40 CFR §264.280
☐ Landfill	R 299.9619 and 40 CFR §264.310
☐ Incinerators	R 299.9620 and 40 CFR §264.351
☐ Drip pads[b]	R 299.9621 and 40 CFR §264.575

☐ Miscellaneous units	R 299.9623 and 40 CFR §§264.601-603
☐ Hazardous waste munitions and explosive storage[b]	R 299.9637 and 40 CFR §264.1202
☐ Boilers and industrial furnaces	R 299.9808 and 40 CFR §266.102(e)(11)

[a] Not included in the template
[b] *Not yet included in 40 CFR §264.111; therefore, not considered*

Unit-specific closure procedures are discussed in Section A11.A.5 of this template for each unit type indicated above.

Table A11.A.1 Hazardous Waste Management Units Information

The following table identifies each hazardous waste management unit at the *Pharmacia & Upjohn Co LLC* facility subject to the closure requirements of this hazardous waste management facility operating license. The table also includes: each unit's maximum licensed hazardous waste inventory, a list of the waste codes managed in the unit, the anticipated date of closure (if known), and the estimated duration of closure activities once closure begins. Unit-specific methods for closure and detailed schedules are discussed in Section 11A.5 of this attachment.

Unit Designation	Maximum Inventory (Include Units)	Waste Codes of Hazardous Wastes Managed	Scheduled Closure Date	Estimated Duration of Closure
B388	280 55-gallon drum equivalent	Refer to section XIV.	N/A	N/A

A11.A.2 Unit-Specific Information

[R 299.9613 and 40 CFR §§264.112(b)(3) and (6)]

A11.A.3 Schedule of Final Facility Closure

[R 299.9613 and 40 CFR §264.112(b)(6)]

The *Pharmacia and UpJohn* facility:

(Check as appropriate)

☐ Anticipates completing final closure of the entire facility by *[insert estimated date]*

☒ Has not determined when the facility will close and does not anticipate completing final closure of the entire facility prior to expiration of the facility's hazardous waste operating license.

Closure Activity	Time Completed
Inventory Removal	7- 8 weeks
Decontamination of Equipment	5-6 weeks
Sampling and Analysis	8 – 10 weeks
Certification of Closure	2 weeks

A11.A.4 Notification and Time Allowed for Closure
[R 299.9613 and 40 CFR §§264.112(d)(2) and 264.113(a) and (b)]

Final closure activities will be initiated within 90 days of receipt of the final volume of hazardous wastes and completed within 180 days of receipt of the final volume of waste. The tasks and Closure and Post-closure Care Plans estimated time required for partial closure shall follow the schedule specified in Section 11A.3. The Director will be notified by *Pharmacia & Upjohn Co LLC* facility 60 days before final closure begins. Final closure will be certified by both Pharmacia & Upjohn Co LLC facility and an independent, qualified, registered professional engineer of the state of Michigan.

A11.A.4(a) Extensions for Closure Time
[R 299.9613 and 40 CFR §264.113(a) and (b)]

In the event that an extension for closure for the facility or any unit is necessary, the Pharmacia & Upjohn Co LLC facility will request an extension in accordance with the requirements of 40 CFR §264.113(a).

A11.A.5 Unit-Specific Closure Procedures

Unit-specific closure procedures are provided for each unit identified in Section A11.A.2 of this template.

🕮 **GUIDANCE/REFERENCES**

- Part 201, Environmental Remediation, of Act 451. September 1996.
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW 846, Update III plus Variations. December 1996. EPA

A11.A.5(a) Closure of Container Storage Areas
[R 299.9614 and 40 CFR §264.178]

This section describes the procedures for closure of *B388.* The general closure requirement and specific closure procedures are discussed below.

A. General Closure Requirement

At closure, all hazardous waste and hazardous waste residues will be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues will be decontaminated or removed.

B. Specific Closure Procedures

Specific procedures for inventory management, unit inspection, decontamination, sampling and analysis, and additional waste management are discussed below.

1. Inventory and Remedial Waste Management Procedures

It is anticipated that the unit will continue to receive hazardous waste during and following the closure activities; therefore, the building will be divided into two sections. The closure activities will be conducted through completion in one section prior to beginning closure activities in the other section. Once closure activities are completed in one section, it will be returned to service as Generator status hazardous waste container storage area according to Part 3 of the Rules and will resume receiving hazardous waste while the other section undergoes closure activities. The shipping and receiving dock area in the building will need to have closure activities conducted separately from the two storage area sections as it will continue to be used during the closure activities for those sections. Once the closure activities are completed for the two storage sections, closure activities will commence for the shipping and receiving dock area. Shipping and receiving activities will be discontinued while closure activities are being conducted in the shipping and receiving dock area.

All hazardous wastes stored in the section of the building undergoing closure will either be moved to the portion of the building that is not undergoing closure activities or will be manifested and shipped by a licensed hazardous waste transporter to an off-site licensed hazardous waste facility.

2. Unit Inspection Procedures

Once the waste inventory has been removed from a section of the building, an independent registered professional engineer will inspect the concrete floor, collection sump, and secondary containment area for the presence of cracks. Should cracks be noted at the time of closure, their exact location will be documented for further investigation. Prior to any decontaminating of surfaces, cracks will be sealed with mastic to ensure that potentially contaminated rinse water does not impact underlying soils.

3. Decontamination Procedures

The concrete floor, collection sump, pallets with their own individualized secondary containment and secondary containment curb will be decontaminated by pressure washing with tap water. The wash water and rinse water will be collected in a licensed hazardous waste vacuum tank truck and disposed of through the local POTW via the facilities sewer system and/or sent off-site to a licensed hazardous waste treatment facility in accordance with all applicable local, state, and federal regulations.

To ensure complete decontamination, a composite sample of wash water and rinse water, and a sample of the final rinse, will be collected and analyzed for the parameters indicated in Table A11.A.2. In addition to these samples, an equipment blank sample will be prepared by collecting a sample of the tap water from its source directly into a laboratory-supplied container. The equipment blank will be analyzed for the parameters listed in Table A11.A.2.

4. Sampling and Analysis Procedures

Upon closure of all section of the unit, the following activities will be conducted at the B388 Container Storage Area:

- If cracks are found, the soil under the cracks will be observed for visible signs of contamination and examined with a portable organic vapor analyzer (OVA), which measures the total concentration of volatile organic compound vapors. Soil samples for OVA screening will be taken using an appropriate core drilling device to retrieve undisturbed samples for analysis at a depth of one foot.

- Upon collection of each sample, the soil recovery shall be measured, and general soil type, color, and moisture content noted and recorded on a field log. During the field testing, three undisturbed samples will be split into two samples. The first portion will be placed in two 40-mL septum top vials for laboratory analysis. This sample will be immediately preserved with Methanol in accordance with SW846, Method 5035 and will be analyzed for the organics listed in Table A11.A.2. The second portion, for field examination, will be placed in a virgin eight-ounce glass jar, aluminum foil placed on the mouth, and the jar sealed with the lid and labeled. After a minimum of 30 minutes, the lid will be removed and an OVA probe inserted through the aluminum foil into the glass jar, and the vapor concentration measured in the headspace of the jar. The maximum level measured will be recorded for each sample.

- The sample screened for OVA readings will be submitted for laboratory analysis for the metal parameters listed in Table A11.A.2. In addition, a perimeter soil sample will be obtained for analysis for the parameters listed in Table A11.A.2.

- A soil sample for laboratory analysis will be obtained from a depth of approximately one foot beneath the sumps in the containment area. Soil samples beneath the sumps will be collected by cutting through the sump floor or the containment area concrete floor using a diamond bit drill, to remove a concrete core. If drilling through the containment area, the hole will be cut at an appropriate angle to ensure advancement of the coring device to a depth approximately one foot beneath the sump where an undisturbed core soil sample will be collected. Upon completion of the sample analysis, and providing that the soil sample indicates no contamination, the borehole will be filled with clean material. The surface location of the angle boring will be determined at the time of unit closure. In addition, if any cracks are found in the containment surfaces, the concrete will be penetrated and underlying soil samples for laboratory analysis will be collected and analyzed as described above.

- Between samples, the sampling device will be either used once and disposed or decontaminated with a non-sudsing detergent and water solution, followed by a tap water rinse and a double rinse with distilled water. All rinse water will be collected and placed in drums for proper disposal.

- The laboratory analytical results of the soil sampling will be statistically compared to the soil background concentrations that have been determined in conjunction with the current closure activities and the Pharmacia & Upjohn Co LLC facility. The statistical comparison will use the mean plus three times the standard deviation to identify soils potentially impacted by spills. For organic constituents stored in Building 388, (Table A11.A.2) concentrations above the level of detection for each constituent will be considered contamination.

- In the event that contamination caused by hazardous waste operations if found at any of the sample locations, the soil will either be remediated during closure activities if B388 will be demolished or be handled as part of the site-wide corrective action program due to the building’s structural interference if B388 will continue to be utilized.

- If any contamination is detected that is not caused by hazardous waste operations, it will be handled as part of the site-wide corrective action program.

Table A11.A.2 Parameters to be Analyzed

Parameter	Method of Analysis		Detection Limits	
	Solids	**Water**	**Solids µg/kg**	**Water µg/L**
Inorganic Compounds				
Barium	Note 1	Note 1	Note 1	Note 1
Cadmium	Note 1	Note 1	Note 1	Note 1
Chromium	Note 1	Note 1	Note 1	Note 1
Cyanides, Total	Note 1	Note 1	Note 1	Note 1
Lead	Note 1	Note 1	Note 1	Note 1
Lithium	Note 1	Note 1	Note 1	Note 1
Mercury	Note 1	Note 1	Note 1	Note 1
Nickel	Note 1	Note 1	Note 1	Note 1
Silver	Note 1	Note 1	Note 1	Note 1
Zinc	Note 1	Note 1	Note 1	Note 1
Organic Compounds				
Acetone (2-Propanone)	Note 1	Note 1	Note 1	Note 1
Acetonitrile	Note 1	Note 1	Note 1	Note 1
Bromobenzene	Note 1	Note 1	Note 1	Note 1
n-Butanol	Note 1	Note 1	Note 1	Note 1
Carbon Tetrachloride	Note 1	Note 1	Note 1	Note 1
Chlorobenzene	Note 1	Note 1	Note 1	Note 1
Chloroform (Trichloromethane)	Note 1	Note 1	Note 1	Note 1
Dichlorodifluoromethane	Note 1	Note 1	Note 1	Note 1
Ethyl Acetate	Note 1	Note 1	Note 1	Note 1
Ethyl Benzene	Note 1	Note 1	Note 1	Note 1
Formaldehyde	Note 1	Note 1	Note 1	Note 1

Heptane	Note 1	Note 1	Note 1	Note 1
Hexane	Note 1	Note 1	Note 1	Note 1
Hydrazine (1,2-Diphenylhydrazine)	Note 1	Note 1	Note 1	Note 1
Iodomethane (Methyl Iodide)	Note 1	Note 1	Note 1	Note 1
Methanol	Note 1	Note 1	Note 1	Note 1
Methyl Chloride (Chloromethane)	Note 1	Note 1	Note 1	Note 1
Methyl Ethyl Ketone	Note 1	Note 1	Note 1	Note 1
Methyl t-Butyl Ether	Note 1	Note 1	Note 1	Note 1
Methylene Chloride (Dichloromethane)	Note 1	Note 1	Note 1	Note 1
Naphthalene	Note 1	Note 1	Note 1	Note 1
Pyridine	Note 1	Note 1	Note 1	Note 1
Styrene	Note 1	Note 1	Note 1	Note 1
Tetrahydrofuran	Note 1	Note 1	Note 1	Note 1
Toluene	Note 1	Note 1	Note 1	Note 1
o-Toluidine	Note 1	Note 1	Note 1	Note 1
Trichlorofluoromethane	Note 1	Note 1	Note 1	Note 1
1,2,4-Trimethylbenzene	Note 1	Note 1	Note 1	Note 1
1,3,5-Trimethylbenzene	Note 1	Note 1	Note 1	Note 1
Xylene (Dimethylbenzene)	Note 1	Note 1	Note 1	Note 1

Note 1: The most recent Test Methods and detection limits for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, and all of its updates will be utilized to analyze these constituents at the time of closure. SW-846 methods not available at the time of closure will be developed and submitted to the MDEQ for approval.

5. Additional Waste Management Procedures

   Not Applicable

A11.A.5(i) Other Closure Activities

[R 299.9504(1)(c), R 299.9508(1)(b), and R 299.9613(1) and 40 CFR §§270.14(b)(13) and 264.112(b)(5)}

Not Applicable

A11.A.6 Certification of Closure
[R 299.9613]

Within 60 days of completion of closure *Pharmacia And Upjohn CO LLC, A Subsidiary Of Pfizer INC* will submit to the Director, by registered mail, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan. The certification will be signed by the *Pharmacia And Upjohn CO LLC, A Subsidiary Of Pfizer INC* and by an independent registered professional engineer. Documentation supporting the independent registered engineer's certification will be furnished to the Director in accordance with R 299.9613(3), including:

1. The results of all sampling and analysis.
2. Sampling and analysis procedures.
3. A map showing the location where samples were obtained.
4. Any statistical evaluations of sampling data.
5. A summary of waste types and quantities removed from the site and the destination of these wastes; and
6. If soil has been excavated, the final depth and elevation of the excavation and a description of the fill material used.

The *Pharmacia And Upjohn CO LLC, A Subsidiary Of Pfizer INC* facility will maintain financial assurance for closure until the Director releases the *Pharmacia And Upjohn CO LLC, A Subsidiary Of Pfizer INC* facility from the financial assurance requirements for closure under R 299.9703.

The certification must be worded as follows:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A11.A.7 Postclosure Notices Filed
[R 299.9504(1)(c) and R 299.9508(1)(b) and 40 CFR §270.14(b)(14)]

The applicant must provide documentation that the postclosure notices required under 40 CFR §264.119 have been filed for hazardous waste disposal units that have been closed at the facility.

A11.B POSTCLOSURE PLAN
[R 299.9613 and 40 CFR §264.118]

A11.B.1 Applicability

(Check as appropriate)

☒ **Not applicable**: Hazardous waste will not be left behind at closure. A survey plat, postclosure care, postclosure certifications, and other notices are not required.

☐ **Applicable**:

- ☐ Contingent plan
- ☐ Landfill unit

ATTACHMENT A12
CLOSURE AND POSTCLOSURE CARE COST ESTIMATES

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9702 and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart H, establishes requirements for providing financial assurance for closure and, if necessary, postclosure care. Specifically, R 299.9702(1) requires the preparation of associated cost estimates. This license application template addresses the requirement for preparing a closure cost estimate and, if necessary, a postclosure care cost estimate. The cost estimates provided in this attachment are based on the closure and postclosure care activities detailed in Template A11. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

A12.A CLOSURE COST ESTIMATE
[R 299.9702(1) and 40 CFR §264.142]

The closure cost estimate covers the corresponding closure activities in the approved closure plan. These activities may include, but are not limited to, removal of waste inventory, decontamination, sampling and analysis, and closure certification. Unless otherwise specified in Section A11.A.3 of Template A11, the date of closure of the hazardous waste management units has not been determined. As such, it is not possible to predict, with any high degree of certainty, actual facility conditions or regulatory requirements at time of closure. Therefore, this closure cost estimate is based on closure of the unit within the next six months and includes a contingency estimate to account for media sampling and analysis, and removal based on current conditions.

The estimate assumes closure procedures are completed by a third party at the time facility closure would be most expensive (e.g., with a maximum inventory). The cost estimate for disposal assumes wastes will be treated and contaminated equipment disposed rather than recovered or salvaged. The total closure cost for the closure of the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* is estimated at $$182,380.00. The closure cost estimate breakdown by unit is provided in Section A12.A.1. Unit-specific work sheets are provided, as applicable, in Tables A12.A.1 through A12.A.[_].

Additional cost estimate assumptions are listed below.

1. All hazardous waste will be transported off site to a licensed facility in accordance with all applicable state and federal regulations.

2. Costs are based on current year costs. All labor rates reflect commercial rates and include fringe benefits, payroll burden, and taxes.

3. Total costs include a 10 percent contingency for administrative and a 10 percent contingency for miscellaneous operating costs.

This closure cost estimate will be maintained at the facility. It will be revised whenever a change in the closure plan affects the cost of closure. It will be adjusted annually as required by pertinent regulations or when the types and quantity of wastes received at the facility change.

A12.A.1 Closure Cost Estimate Breakdown

Table A12.A.1 Facility Closure Cost Estimate Breakdown by Unit*

1.	Container Storage Areas	$ $182,380
Total Facility Closure and Postclosure Care Estimate (add lines 1 through 11)		$ $182,380

* Tables not included at this time for Land Treatment Units, Drip Pads, and Hazardous Waste Munitions and Explosives Storage Units

Table A12.A.2 Container Storage Areas Closure Cost Estimate

Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc

Activity If certain activities are not expected to be performed, enter “NA” as the Estimated Cost.		**Estimated Cost**
1.	Demolition and Removal of Containment	N/A
2.	Removal of Soil	N/A
3.	Backfill	N/A
4.	Decontamination	$ $8,000
5.	Sampling and Analysis	$ $22,000
6.	Monitoring Well Installation	N/A
7.	Transportation	N/A
8.	Treatment and Disposal of Waste Inventory and Other Cleanup Wastes	$ $118,000
9.	**Subtotal of Closure Costs** (Add lines 1 through 8)	$ $148,000
10.	Engineering Expenses (typically 10% of closure costs, excluding certification of closure.)	$ $14,800
11.	Certification of Closure	$ $3,000
12.	**Subtotal** (Add Lines 9, 10, and 11])	$ $165,800
13.	Contingency Allowance (typically 20% of closure costs, engineering expenses, and cost of certification of closure.)(10% for report writing).	$ $16,580
14.	Landfill Closure	N/A
Total Closure Cost (Add Lines 12, 13, and 14)		$ $182,380

A12.B POSTCLOSURE COST ESTIMATE

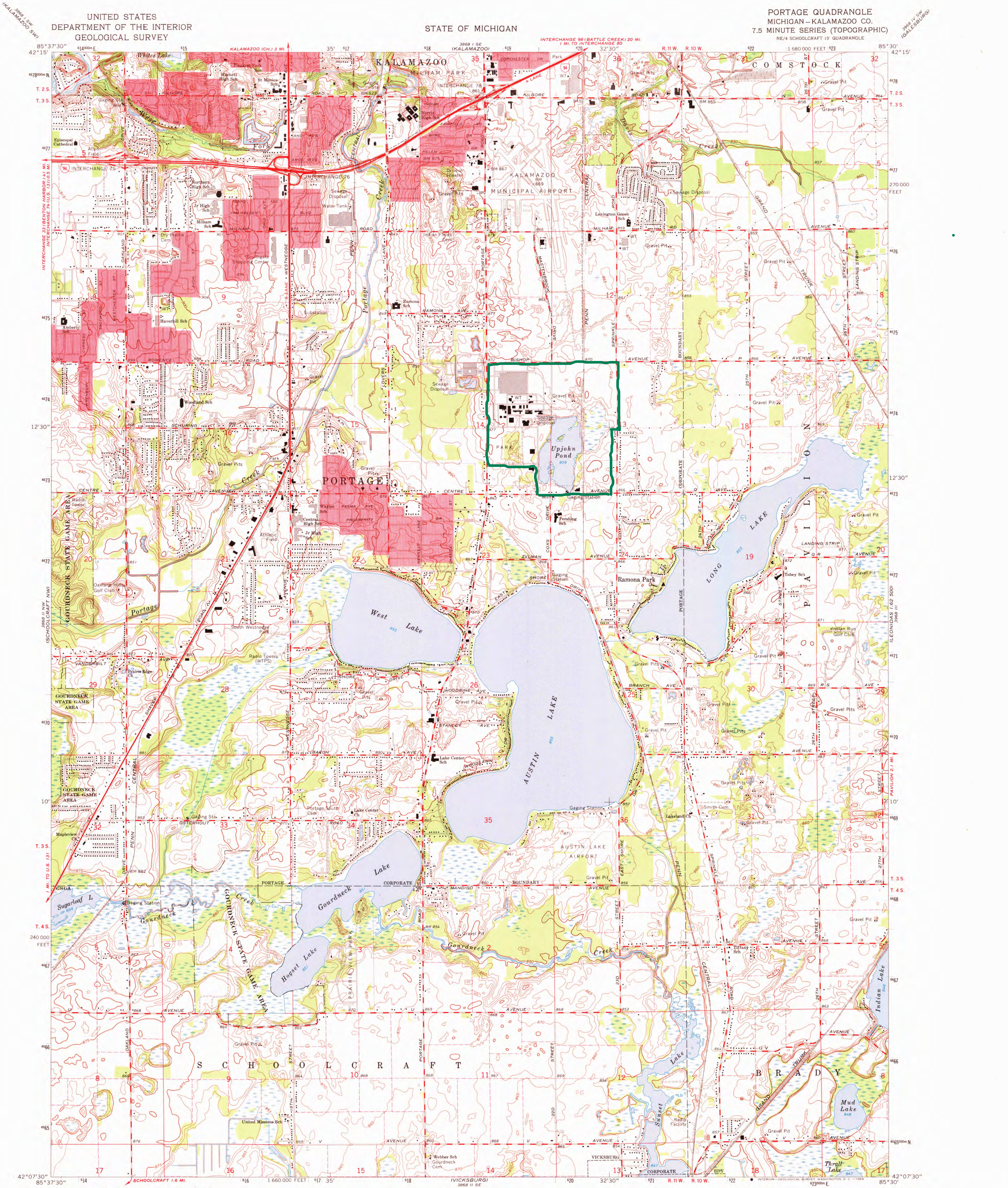
[R 299.9702(1) and 40 CFR §264.144]

The postclosure care cost estimate covers activities that will be performed after closure of the landfill unit or any unit with waste left in place. All waste is expected to be removed upon closure. Therefore, post-closure care is not expected.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF MICHIGAN

PORTAGE QUADRANGLE
MICHIGAN—KALAMAZOO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 SCHOOLCRAFT 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey
in cooperation with State of Michigan agencies

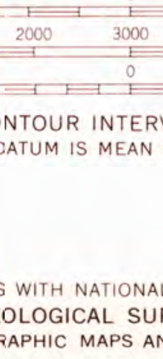
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Michigan coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 16, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked



UTM GRID AND 1967 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty	🟥	Light-duty	
Medium-duty		Unimproved dirt	
		Interstate Route	

PORTAGE, MICH.
NE/4 SCHOOLCRAFT 15' QUADRANGLE
N4207.5—W8530/7.5

1967

AMS 3868 II NE—SERIES V862

3830

Gareth J. Port
Senior Paralegal
Environment, Health and Safety - Legal

Pfizer Inc
235 East 42nd Street, New York, NY 10017
Tel 212 733 2814 Fax 646 487 9163
gareth.port@pfizer.com

April 26, 2016

BY U.S.P.S. EXPRESS MAIL

Keith Creagh
Director
Department of Environmental Quality
c/o Hazardous Waste Section
Office of Waste Management and Radiological Protection
P.O. Box 30241
Lansing, MI 48909-7741

Pharmacia & Upjohn Company LLC
c/o Cindalee Walsh, Director/Team Leader
EH&S Environmental, Pfizer Inc.
MS: PORT-91-106, 7000 Portage Road
Kalamazoo, MI 49001

Re: Pharmacia & Upjohn Company LLC (Kalamazoo, MI)
Annual RCRA Financial Assurance
7171 Portage Road, Kalamazoo, Michigan 49001
EPA ID # MID000820381

Dear Mr. Creagh and Ms. Walsh:

Pfizer Inc. is writing on behalf of Pharmacia & Upjohn Company LLC (Pharmacia & Upjohn Company LLC's ultimate corporate parent is Pfizer Inc.) to submit Letter of Credit No. S16065 and S16062 provided by Svenska Handelsbanken, New York Branch (the "Letters of Credit") to satisfy the above-referenced financial assurance requirements.

Letter of Credit No. S16065 has been secured in an amount exceeding the current cost estimate, as listed below, to account for projected inflation.

Letter of Credit No.	Demonstration	Current Cost Estimate	Secured Amount
S16065	Closure	$163,709	$170,356

In addition, Pharmacia & Upjohn Company LLC will also be utilizing a Standby Trust provided by Deutsche Bank Trust Company Americas, a New York banking corporation, to satisfy the above-referenced financial assurance requirements associated with liability coverage.

Please find enclosed the required Letters of Credit. The Standby Trust Agreement is being finalized and will be forwarded under separate cover.

If you have any questions, please feel free to contact me at your convenience.

Sincerely,

Gareth J. Port

Senior Paralegal
Environmental Law Group, Pfizer Inc.

Enclosure(s)

cc: Nadine M. Deak
Department of Environmental Quality
Waste & Hazardous Materials Division
Kalamazoo District Office
7953 Adobe Road
Kalamazoo, MI 49009

DeLores Montgomery
Chief, Hazardous Waste Section
Department of Environmental Quality
Office of Waste Management and Radiological Protection
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Robert A. Kaplan
Acting Regional Administrator
U.S. Environmental Protection Agency, Region V
77 West Jackson Boulevard
Chicago, IL 60604-3590

bcc: S. Fisk, Esq. (Environmental Law Group, Pfizer Inc.) (via email)

Svenska Handelsbanken
New York Branch

IRREVOCABLE STANDBY LETTER OF CREDIT NO. S16062

Date of Issuance: April 22, 2016

Expiry Date: April 21, 2017

Amount: $2,000,000.00 (United States Dollars Two Million and 00/100)

Applicant:
Pfizer Inc.
on behalf of
Pharmacia & Upjohn Company LLC
7000 Portage Road
Kalamazoo, Michigan 49001

Beneficiary:
Deutsche Bank Trust Company of Americas,
a New York banking corporation
60 Wall Street, 16th Floor
New York, New York 10005-2836,
AS TRUSTEE OF:
Director, Department of Environmental Quality
c/o Office of Waste Management and Radiological Protection
Hazardous Waste Section
P.O. Box 30241
Lansing, Michigan 48909-7741

We hereby issue our irrevocable Letter of Credit No. S16062 in the favor of Deutsche Bank Trust Company of Americas, a New York banking corporation, 60 Wall Street, 16th Floor, New York, New York 100005-2836, hereinafter known as the "Beneficiary", on behalf of Pfizer Inc. on behalf of Pharmacia & Upjohn Company LLC, 7000 Portage Road, Kalamazoo, Michigan 49001, hereinafter known as the "Company", for a sum of $2,000,000.00 (United States Dollars Two Million and 00/100), available by Beneficiary's drafts at sight drawn on our institution: Svenska Handelsbanken, New York Branch, 875 Third Avenue, 4th Floor, New York 10022-7218, marked "Drawn under Svenska Handelsbanken, New York Branch, Letter of Credit No. S16062 dated April 22, 2016." We are a bank or financial institution that has the authority to issue Letters of Credit. Our Letter of Credit operations are regulated and examined by New York State Department of Banking and Federal Reserve Bank of New York.

This Letter of Credit is issued to demonstrate financial responsibility as set forth in the Michigan Administrative Code, R 299.9710, for bodily injury and property damage to third parties caused by occurrences arising from operations of the following hazardous waste management facility(ies):

Pharmacia & Upjohn Company LLC
7000 Portage Road
Kalamazoo, Michigan 49001-7741
EPA Identification # MID000820381
Sudden Accidental Occurrences
$1,000,000.00 Per Occurrence
$2,000,000.00 Annual Aggregate

This Letter of Credit is effective immediately and shall expire on April 21, 2017, but such expiration date shall be automatically extended for periods of at least one year on April 21, 2017, unless, not less than 120 days before the current expiration date, we notify both you and the Company by Certified Mail of our decision not to extend the then expiration date. We agree that the 120 day period shall begin on the date when both you and the Company have received the notice, as evidenced by the return receipts.

Partial drawings are permitted. This original Letter of Credit must be submitted to us, together with any drawings hereunder for our endorsement of any payments effected by us and/or for cancellation.

This Letter of Credit is subject to the Uniform Customs and Practice for Documentary Credits (2007 Revision, International Chamber of Commerce Publication No. 600, with the exception of Article 38(c)), and the Michigan Uniform Commercial Code, where applicable. Where conflicts exist between the Uniform Customs and Practice for Documentary Credits and the Michigan Uniform Commercial Code, the Michigan Uniform Commercial Code shall control.

Letter of Credit No. S16062
Page Two
April 22, 2016

We shall honor drafts drawn under and in compliance with the terms of this Letter of Credit and these drafts will be duly honored upon presentation to us if presented on before April 21, 2017, or any automatically extended expiration date as provided in paragraph 3 above.

We certify that the wording of this Letter of Credit is identical to the wording provided by the Michigan Department of Environmental Quality as of the date shown immediately below.

Very truly yours,

Svenska Handelsbanken, New York Branch
875 Third Avenue, 4th Floor
New York, New York 10022-7218

Authorized Signature
Mark Cleary
Name: MARK CLEARY
Title: Senior Vice President
Date: 4/25/2016

Authorized Signature
Nancy D'Albert
Name: Nancy D'Albert
Title: Vice President
Date: 4/25/2016

S16062 Pfizer $2M.iss

Gareth J. Port
Senior Paralegal
Environment, Health and Safety - Legal

Pfizer Inc
235 East 42nd Street, New York, NY 10017
Tel 212 733 2814 Fax 646 487 9163
gareth.port@pfizer.com

May 10, 2016

BY U.S.P.S. EXPRESS MAIL

Keith Creagh
Director
Department of Environmental Quality
c/o Hazardous Waste Section
Office of Waste Management and Radiological Protection
P.O. Box 30241
Lansing, MI 48909-7741

Pharmacia & Upjohn Company LLC
c/o Cindalee Walsh, Director/Team Leader
EH&S Environmental, Pfizer Inc.
MS: PORT-91-106, 7000 Portage Road
Kalamazoo, MI 49001

Re: Pharmacia & Upjohn Company LLC (Kalamazoo, MI)
Annual RCRA Financial Assurance
7171 Portage Road, Kalamazoo, Michigan 49001
EPA ID # MID000820381

Dear Mr. Creagh and Ms. Walsh:

Pfizer Inc. is writing on behalf of Pharmacia & Upjohn Company LLC (Pharmacia & Upjohn Company LLC's ultimate corporate parent is Pfizer Inc.), in furtherance of its previous correspondence dated April 26, 2016, to submit a Standby Trust provided by Deutsche Bank Trust Company Americas, a New York banking corporation, to satisfy the above-referenced financial assurance requirements associated with liability coverage. Letters of Credit No. S16065 and S16062 were provided in the prior April 26, 2016 correspondence to meet financial assurance requirements.

Please find enclosed the required the Standby Trust Agreement.

If you have any questions, please feel free to contact me at your convenience.

Sincerely,

Gareth J. Port

Senior Paralegal
Environmental Law Group, Pfizer Inc.

Enclosure(s)

cc: Nadine M. Deak
Department of Environmental Quality
Waste & Hazardous Materials Division
Kalamazoo District Office
7953 Adobe Road
Kalamazoo, MI 49009

DeLores Montgomery
Chief, Hazardous Waste Section
Department of Environmental Quality
Office of Waste Management and Radiological Protection
525 West Allegan Street
P.O. Box 30241
Lansing, MI 48909-7741

Robert A. Kaplan
Acting Regional Administrator
U.S. Environmental Protection Agency, Region V
77 West Jackson Boulevard
Chicago, IL 60604-3590

STANDBY TRUST AGREEMENT

Trust Agreement ("Agreement") entered into as of May 9, 2016 by and between Pharmacia & Upjohn Company LLC, 7000 Portage Road, Kalamazoo, Michigan 49001, a Delaware limited liability company ("Grantor"), and Deutsche Bank Trust Company Americas, a New York banking corporation ("Trustee").

Whereas, the Grantor has made application for a license to establish, maintain, and/or operate a hazardous waste management facility within the state of Michigan in accordance with the provisions of Part 111, Hazardous Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and the administrative rules promulgated thereunder ("Act");

Whereas, the Director, Michigan Department of Environmental Quality, has promulgated administrative rules applicable to the Grantor, requiring that an owner or operator of a hazardous waste management facility or group of facilities must demonstrate financial responsibility for bodily injury and property damage to third parties caused by sudden and accidental and/or nonsudden accidental occurrences arising from operations of the facility or group of facilities;

Whereas, the Grantor has elected to establish a standby trust fund into which the proceeds from a letter of credit may be deposited to assure all or part of such financial responsibility for the facilities identified herein;

Whereas, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this agreement, and the Trustee is willing to act as trustee;

Whereas, the trust operations of the Trustee are regulated and examined by a state or federal agency and Trustee has authority to act as trustee; and

Whereas, Trustee is willing to act as trustee;

Now, therefore, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement:

(a) The term "Director" means the duly appointed and acting Director of the Department of Environmental Quality or any successor department or agency or his authorized representative.

(b) The term "Fiduciary" means any person who exercises any power of control, management, or disposition or renders investment advice for a fee or other compensation, direct or indirect, with respect to any moneys or other property of this trust fund, or has any authority or responsibility to do so, or who has any authority or responsibility in the administration of this trust fund.

(c) The term "Grantor" means the owner or operator who enters into this Agreement and any successors or assigns of the Grantor.

(d) The term "Trustee" means the Trustee who enters into this Agreement and any successor Trustee.

Section 2. Identification of Facilities and Coverages.

This agreement pertains to the following facility(ies) owned and/or operated by the Grantor as identified by name, EPA identification number, location, and the amount of liability coverage demonstrated by this agreement:

Pharmacia & Upjohn Company LLC
7171 Portage Road, Kalamazoo, Michigan 49001
EPA Identification # MID000820381
Sudden Accidental Occurrences
$1,000,000.00 Each Occurrence
$2,000,000.00 Annual Aggregate

Section 3. Establishment of Trust Fund.

The Grantor and the Trustee hereby establish a standby trust fund, hereinafter the "Trust Fund," for the benefit of any and all third parties injured or damaged by sudden accidental occurrences arising from operation of the facility(ies) covered by this Agreement in the amounts of $1,000,000.00 per occurrence and $2,000,000.00 annual aggregate for sudden accidental occurrences and $0.00 per occurrence and $ 0.00 annual aggregate for nonsudden accidental occurrences, except that the Trust Fund is not established for the benefit of third parties for the following:

(a) Bodily injury or property damage for which Grantor is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that Grantor would be obligated to pay in the absence of the contractor or agreement;

(b) Any obligation of Grantor under a workers' compensation, disability benefits, or unemployment compensation law or similar law;

(c) Bodily injury to an employee of Grantor arising from, and in the course of, employment by the Grantor, or bodily injury to the spouse, child, parent, brother, or sister of that employee as a consequence of, or arising from, and in the course of employment by Grantor. This exclusion applies whether Grantor may be liable as an employer or in any other capacity, and to any obligation to share damages with or repay another person who must pay damages because of the injury to the employee or the spouse, child, parent, brother, or sister of the employee;

(d) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle, or watercraft; or

(e) Property damage to any of the following:

(1) Any property owned, rented, or occupied by Grantor;

(2) Premises that are sold, given away, or abandoned by Grantor if the property damage arises out of any part of those premises;

(3) Property loaned to Grantor;

(4) Personal property in the care, custody, or control of Grantor; or

(5) That particular part of real property on which Grantor or any contractors or subcontractors working directly or indirectly on behalf of Grantor are performing operations, if the property damage arises out of these operations.

In the event of combination with another mechanism for liability coverage, the Trust Fund shall be considered "primary" coverage.

The Trust Fund is established initially as consisting of the proceeds of the letter of credit deposited into the Trust Fund. Such proceeds and any other property subsequently transferred to the Trustee is collectively referred to as the Trust Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Trust Fund shall be held by the Trustee, in trust, as hereinafter provided.

Section 4. Payment for Bodily Injury or Property Damage.

The Trust Fund so established shall be used solely to provide for the payment of third-party liability awards and settlements for bodily injury and property damage caused by occurrences arising from the operations of the facilities covered by this Agreement. The Trustee shall satisfy such awards and settlements by drawing on the letter of credit described in attached Exhibit A, and by making payments from the Trust Fund only upon receipt of one of the following documents:

(a) Certification from the Grantor and the third party claimant(s) that the liability claim should be paid. The certification must be worded as follows, except that instructions in brackets are to be replaced with the relevant information and the brackets deleted:

CERTIFICATION OF VALID CLAIM

> The undersigned, as parties [insert Grantor] and [insert name and address of third party claimant(s)], hereby certify that the claim of bodily injury and/or property damage caused by a [sudden or nonsudden] accidental occurrence arising from operating [Grantor's]

hazardous waste treatment, storage, or disposal facility should be paid in the amount of $[________].

[Signatures]
Grantor

[Signatures]
Claimant(s)

(b) A valid final court order establishing a judgment against the Grantor for bodily injury or property damage caused by sudden or nonsudden accidental occurrences arising from the operation of the Grantor's facility or group of facilities.

Payment shall be made directly to the third party(ies) and in the amount(s) as designated in the Certification of Valid Claim or Court Order, up to the value of the Trust Fund.

Section 5. Payments Comprising the Trust Fund.

Payments made to the Trustee by the Grantor shall consist of the proceeds from the letter of credit drawn upon by the Trustee in accordance with the requirements of the Michigan Administrative Code R 299.9710 and section 4 of this Agreement.

The Trustee shall not be responsible nor shall it undertake any responsibility for the amount or adequacy of, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor as required by the Act or any conditions of licensure.

Section 6. Trustee Management.

The Trustee shall invest and reinvest the principle and income, in accordance with general investment policies and guidelines that the Grantor may communicate in writing to the Trustee from time to time, subject however, to the provisions of this section. In investing, reinvesting, exchanging, selling, and managing the Trust Fund, the Trustee or any other Fiduciary shall discharge his duties with respect to the Trust Fund solely in the interest of the participants and the beneficiaries and with the care, skill, prudence, and diligence under the circumstances then prevailing that persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

(i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended, 15 U.S.C. 80a-2(a), shall not be acquired or held, unless they are securities or other obligations of the federal or a state government;

(ii) The Trustee is authorized to invest the Trust Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the United States of America or the State of Michigan; and

(iii) The Trustee is authorized to hold cash awaiting investment or distribution uninvested for a reasonable time and without liability for the payment of interest thereon.

Section 7. Commingling and Investment.

The Trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Trust Fund to any common, commingled, or collective trust fund created by the Trustee in which the Trust Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940, 15 U.S.C. 80a-1 et seq., including one which may be created, managed, underwritten, or to which investment advice is rendered or the shares of which are sold by the Trustee or its affiliate. The Trustee may vote such shares in its discretion.

Section 8. Express Powers of Trustee.

Without in any way limiting the powers and discretions conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered:

(a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale. No person dealing with the Trustees shall be bound to see to the application of the purchase money or to inquire into the validity or expediency of any such sale or other disposition;

(b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Trust Fund in its own name or in the name of a nominee and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee of such depository with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the United States of America, or any agency of instrumentality thereof, with a Federal Reserve Bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Trust Fund;

(d) To deposit any cash in the Trust Fund in interest- bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the United States of America or the State of Michigan; and

(e) To compromise or otherwise adjust all claims in favor of or against the Trust Fund.

Section 9. Taxes and Expenses.

All taxes of any kind that may be assessed or levied against or in respect of the Trust Fund and all brokerage commissions incurred by the Trust Fund shall be paid from the Trust Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust Fund, including fees for legal services rendered to the Trustee, the compensation of the Trustee (to the extent not paid directly by the Grantor), and all other proper charges and disbursements to the Trustee shall be paid from the Trust Fund.

Notwithstanding the foregoing, it is the express obligation of the Grantor and the Grantor agrees to pay directly to the Trustee for the benefit of the Trust Fund, on demand, any and all expenses, costs, and fees (other than taxes and disbursements pursuant to section 4 of this Agreement) occasioned by virtue of the Trust Fund so as to maintain the level, amount, and value of the Trust Fund exclusively available for the purposes for which the Trust Fund has been created; provided further, that should the Trustee utilize any portion of the Trust Fund for costs, expenses, and fees (other than taxes and disbursements pursuant to section 4 of this Agreement), the Grantor shall forthwith add to the Trust Fund an amount equal to the portion of the Trust Fund so utilized.

Section 10. Advice of Counsel.

The Trustee may from time to time consult with counsel, who may be counsel to the Grantor, with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting upon the advice of counsel.

Section 11. Trustee Compensation.

The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing from time to time with the Grantor.

Section 12. Successor Trustee.

The Trustee may resign by written notice to all parties, or the Grantor may replace the Trustee by written notice to all parties. Such resignation or replacement shall not be effective until the Grantor has appointed a successor trustee and this successor accepts the appointment. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor trustee or for instructions. The successor trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. Upon the successor trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor trustee the funds and properties then held on behalf of the Trust Fund. The successor trustee shall specify the date on which it assumes administration of the Trust Fund in writing sent to the Grantor, the Director, and the present Trustee by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this section shall be paid as provided in section 9.

Section 13. Instructions to the Trustee.

All orders, requests, certifications of valid claims, and instructions to the Trustee shall be in writing, signed by such persons as are designated in the attached Exhibit B. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or the Director hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or the Director, except as provided for herein.

Section 14. Amendment of Agreement.

This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and the Director, or by the Trustee and the Director if the Grantor ceases to exist.

Section 15. Irrevocability and Termination.

Subject to the right of the parties to amend this Agreement as provided in section 14, this Trust Fund shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the Director, or by the Trustee and the Director, if the Grantor ceases to exist. Upon termination of the Trust, all remaining trust property, less final trust administration expenses, shall be paid to the Grantor.

Section 16. Immunity and Indemnification.

The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith, in the administration of this Trust, or in carrying out any directions by the Grantor and the Director issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the Trust Fund, or both from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonable incurred in its defense in the event the Grantor fails to provide such defense.

Section 17. Choice of Law.

This Agreement shall be administered, construed, and enforced according to the laws of the State of Michigan.

Section 18. Interpretation.

As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each Section of this Agreement shall not affect the interpretation of the legal efficacy of this Agreement.

In Witness Whereof the parties have caused this Agreement to be executed by their respective officers duly authorized and their corporate seals to be hereunto affixed and attested as of the date first above written. The parties below certify that the wording of this Agreement is identical to the wording specified by the Michigan Department of Environmental Quality as of the date first above written.

FOR THE GRANTOR (Pharmacia & Upjohn Company LLC)

By: ______________ Date: 4/27/16

Name: FANY DE LA CRUZ

Title: VP & TREASURER

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: ______________ Date: MAY 9, 2016

Name: ONEAKA HENDRICKS

Title: VICE PRESIDENT

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: ______________ Date: MAY 9th 2016

Name: JIN CHOI

Title: ASSOCIATE

STATE OF New York)
)SS
COUNTY OF New York)

The foregoing instrument was acknowledged before me this 27 day of April, 2016 by FANY DELACRUZ the V.P. + Treasurer of Pharmacia & Upjohn Company LLC, a Delaware limited liability company, on behalf of the company, the Grantor named in the foregoing instrument.

BETTY ANN LOFASO
Notary Public - State of New York
NO. 01LO6158001
Qualified in New York County
My Commission Expires ~~D[illegible]~~ 3/30/19

Betty Ann Lofaso
New York County, ~~Michigan~~ New York, Notary Public
My Commission Expires: 3/30/19

STATE OF NEW YORK)
)SS
COUNTY OF ____________)

The foregoing instrument was acknowledged before me this 9th day of MAY, 2016 by ONEAKA HENDRICKS, the VICE PRESIDENT of Deutsche Bank Trust Company Americas, a NY BANKING corporation, on behalf of the corporation, the Trustee named in the foregoing instrument.

Maria N. Inoa
, Notary Public
KINGS County, ~~Michigan~~ NEW YORK
My Commission Expires: 2020

MARIA N. INOA
NOTARY PUBLIC, STATE OF NEW YORK
QUALIFIED IN KINGS COUNTY
REG #01IN6180861
MY COMM. EXP. JAN 22,

STATE OF ____________)
)SS
COUNTY OF ____________)

The foregoing instrument was acknowledged before me this 9th day of MAY, 2016, by JIN CHOI, the ASSOCIATE of Deutsche Bank Trust Company Americas, a NY BANKING corporation, on behalf of the corporation, the Trustee named in the foregoing instrument.

Maria N. Inoa
, Notary Public
KINGS County, ~~Michigan~~ NEW YORK
My Commission Expires: 2020

MARIA N. INOA
NOTARY PUBLIC, STATE OF NEW YORK
QUALIFIED IN KINGS COUNTY
REG #01IN6180861
MY COMM. EXP. JAN 22, 2020

EXHIBIT A

TRUST ASSETS

The Trust Fund is established initially as consisting of the proceeds from Letter of Credit Number S16062, issued on April 25, 2016, by Svenska Handelsbanken, New York Branch, in the amount of $2,000,000.00 (two million and 00/100 U.S. Dollars), in the favor of the Trustee.

By their signatures below, the parties agree that this Exhibit A is incorporated and made a part of the Standby Trust Agreement dated MAY 9th 2016

FOR THE GRANTOR (Pharmacia & Upjohn Company LLC)

By: ______________ Date: 4/27/16

Name: FANY DE LA CRUZ
Title: VP & TREASURER

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: ______________ Date: MAY 9, 2016

Name: ONEAKA HENDRICKS
Title: VICE PRESIDENT

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: ______________ Date: MAY 9th 2016

Name: JIN CHOI
Title: ASSOCIATE

EXHIBIT B

AUTHORIZED SIGNATORIES FOR GRANTOR

The following persons are authorized to sign orders, requests, certifications of valid claims, and instructions to the Trustee on behalf of the Grantor:

1. Fany De La Cruz
Treasurer, Pharmacia & Upjohn Company LLC
235 East 42nd Street, New York, New York 10017
Tele: (212) 733-8690
Email: fany.delacruz@pfizer.com

2. Merrill E. Fliederbaum
Assistant General Counsel, Pfizer Inc.
235 East 42nd Street, New York, New York 10017
Tele: (212) 733-1430
Email: merrill.e.fliederbaum@pfizer.com

By their signatures below, the parties agree that this Exhibit B is incorporated and made a part of the Trust Agreement dated MAY 9TH.

FOR THE GRANTOR (Pharmacia & Upjohn Company LLC)

By: Date: 4/27/16

Name: FANY DE LA CRUZ
Title: VP & TREASURER

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: Oneaka HAS Date: MAY 9, 2016

Name: ONEAKA HENDRICKS
Title: VICE PRESIDENT

FOR THE TRUSTEE (Deutsche Bank Trust Company Americas)

By: Date: MAY 9th 2016

Name: JIN CHOI
Title: ASSOCIATE

EXHIBIT C

NOTICES

Notices and other communications given under this Standby Trust Agreement shall be in writing, identify the Site, provide a contact person (and contact information), and be addressed to the parties as follows or to such other address as the parties shall by written notice designate:

(a) If to the Grantor, to:

Merrill E. Fliederbaum
Assistant General Counsel, Pfizer Inc.
235 East 42nd Street, New York, New York 10017
Tele: (212) 733-1430
Email: merrill.e.fliederbaum@pfizer.com

(b) If to the Trustee, to:

Jin Choi
Associate, Deutsche Bank Trust Company Americas
60 Wall Street, 16th Floor, New York, New York 10005-2836
Tele: (212) 250-8316
Fax: (732) 578-4593
Email: jin.choi@db.com

Oneaka Hendricks
Vice President, Deutsche Bank Trust Company Americas
60 Wall Street, 16th Floor, New York, New York 10005-2836
Tele: (212) 250-4964
Fax: (732) 578-4593
Email: oneaka.hendricks@db.com

Deutsche Bank Trust Company Americas
Group Email: TSS-NY_Escrow-Team@db.com

EXHIBIT D

USA PATRIOT ACT SECTION 326 CUSTOMER IDENTIFICATION PROGRAM

In order to comply with the laws, rules, regulations and executive orders in effect from time to time applicable to banking institutions, including, without limitation, those relating to the funding of terrorist activities and money laundering, including Section 326 of the USA PATRIOT Act of the United States ("Applicable Law"), the Trustee is required to obtain, verify, record and update certain information relating to individuals and entities which maintain a business relationship with the Trustee. Accordingly, each of the parties agree to provide to the Trustee, upon their request from time to time such identifying information and documentation as may be available for such party in order to enable the Trustee to comply with Applicable Law.

Gareth J. Port
Manager
Environmental & Sustainability Law

Pfizer Inc.
235 East 42nd Street, New York, NY 10017
Tel 212 733 2814   Fax 646 487 9163
gareth.port@pfizer.com

March 23, 2022

BY U.S.P.S. EXPRESS MAIL

Liesl Eichler Clark
Director
Michigan Department of Environment, Great Lakes, and Energy
c/o Materials Management Division
Hazardous Waste Section
Constitution Hall
525 West Allegan
P.O. Box 30241
Lansing, MI 48909-7741

Pharmacia & Upjohn Company LLC
c/o, Eric Ferrell, Director
EHS & Site Security, Pfizer Inc.
7000 Portage Road
Kalamazoo, MI 49001

Re: Pharmacia & Upjohn Company LLC (Kalamazoo, MI)
Annual RCRA Financial Assurance
7171 Portage Road, Kalamazoo, Michigan 49001
EPA ID # MID000820381

Dear Ms. Clark and Mr. Ferrell:

Pfizer Inc. is writing on behalf of Pharmacia & Upjohn Company LLC (Pharmacia & Upjohn Company LLC's ultimate corporate parent is Pfizer Inc.) to provide the following cost estimates:

cc: Fred Sellers
Michigan Department of Environment, Great Lakes, and Energy
7953 Adobe Road
Kalamazoo, MI 49009

Debra Shore
Regional Administrator
U.S. Environmental Protection Agency, Region V
77 West Jackson Boulevard
Chicago, IL 60604-3590

Kimberly Tyson
Chief, Hazardous Waste Section
Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division
350 Ottawa Avenue, N.W., Unit 10
Grand Rapids, MI 49503-2341

Svenska Handelsbanken
New York Branch

AMENDMENT TO IRREVOCABLE STANDBY LETTER OF CREDIT NO. S16065

Amendment Date:	**March 3, 2022**
New Amount:	**$232,467.00 (United States Dollars Two Hundred Thirty Two Thousand Four Hundred Sixty Seven and 00/100)**
Issuance Date:	April 22, 2016
Expiry Date:	April 21, 2022
Applicant:	Pfizer Inc. on behalf of Pharmacia & Upjohn Company LLC 7000 Portage Road Kalamazoo, Michigan 49001
Beneficiary:	Director, Michigan Department of Environment, Great Lakes, and Energy (EGLE) c/o Materials Management Division Hazardous Waste Section Constitution Hall 525 West Allegan Street P.O. Box 30241 Lansing, Michigan 48909-7741

AMENDMENT NO. 3

Dear Sir/Madam:

The above mentioned instrument, including any previous amendments, is hereby amended as follows:

- **L/C amount increased from $195,805.00 by $36,662.00 to a new amount of $232,467.00.**

All other terms and condition remain unchanged.

This Amendment forms an integral part of the original Letter of Credit and should be attached thereto.

Very truly yours,
Svenska Handelsbanken, New York Branch
900 Third Avenue, 17th Floor
New York, New York 10022-4792

LAM
I01
ARSI01

Authorized Signature
Digitally signed by MAEM01
Date: 2022.03.03 1[illegible]55 -05'00'
Name: Anna Gustafsson
Title: SVP
Date: 3/9/2022

Authorized Signature
Digitally signed by NACA01
Date: 2022.03.03 13:58:00 -05'00'
JOHAN CARNER
VP
3/9/2022
Name:
Title:
Date:

ORIGINAL

ATTACHMENT B1
OTHER FEDERAL LAWS

This document is an attachment to the Michigan Department of Environmental Quality's *Instructions for Completing Form EQP 5111, Hazardous Waste Treatment, Storage, and Disposal Facilities Construction Permit and Operating License Application Form.*

This license application addresses requirements compliance with other federal laws at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo, Michigan.

Federal laws in addition to those cited in other sections of this Operating License application that may apply to the facility will be evaluated and upheld. The following information is provided in order to enable MDNRE to carry out its duties under these other laws.

B1.A THE WILD AND SCENIC RIVERS ACT (16 U.S.C. 1273 et seq. Section 7)

The facility at 7171 Portage Road, Kalamazoo, Michigan, is a long-established industrial facility. The facility is not located on nor in close proximity to any rivers designated as “wild or scenic”.

B1.B THE NATIONAL HISTORIC PRESERVATION ACT (16 U.S.C. 470 et seq. Section 106)

This facility has been in existence as an industrial facility for over 100 years. There are no structures on the property that are eligible for National Historic Preservation under Section 106 of the National Historic Preservation Act. Therefore, the Section 106 review process, as outlined in 36 CFT 800, is not applicable to the facility.

B1.C THE ENDANGERED SPECIES ACT (16 U.S.C. 1531 et seq. Section 7)

This facility is situated in a long-established industrial zone. Therefore, it is not likely that any endangered or threatened species of plants or animals, or their critical habitat exist on or surrounding the facility. From this, it can be concluded that the facility is not subject to regulations for the protection of threatened or endangered species or their critical habitat as specified in 50 CFR Part 402.

B1.D THE COASTAL ZONE MANAGEMENT ACT (16 U.S.C. 1451 et seq. Section 307(c))

This facility does not affect land or water use in the coastal zone. Therefore, the Coastal Zone Management Act and its implementing regulations do not apply to the facility.

B1.E THE FISH AND WILDLIFE COORDINATION ACT (16 U.S.C. 661 et seq.)

The facility is not being expanded in any way that would cause a diversion or modification of any body of water or other wildlife resource. Therefore, the facility is not subject to regulation under the Fish and Wildlife Coordination Act.

ATTACHMENT B2
CORRECTIVE ACTION INFORMATION

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) R 299.9504(1)(c), R 299.9508(1)(b), R 299.9525, R 299.9629, R 299.9635, and R 299.9636; §§324.11115a and 324.11115b of Act 451; and Title 40 of the Code of Federal Regulations (CFR) §270.14(d) and Part 264, Subpart F, establish requirements for submitting corrective action information and implementing a corrective action program for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for corrective action information for the waste management units (WMU) at the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* facility in *Kalamazoo,* Michigan. This template includes facility background information, current conditions, and release assessment requirements for operating license applications. This template supplies information to support the corrective action program specified in R 299.9629. In this template, applicants must include appropriate justification for the proposed elimination of any WMU from the corrective action program under Part 111 of Act 451.

Ensure that all samples collected for waste characterization and environmental monitoring during corrective action are collected, transported, analyzed, stored, and disposed by trained and qualified individuals in accordance with a QA/QC Plan. The QA/QC Plan should at a minimum include the written procedures outlined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, Third Edition, Chapter 1 (November 1986), and its Updates.

(Check as appropriate)

Applicant for Operating License for Existing Facility:

☐ R 299.9629 Corrective Action

☒ Elimination from corrective action requirements proposed for one or more units

☞ *More than one box may be checked, if one or more WMUs are proposed for elimination from corrective action requirements*

Applicant for Operating License for New, Altered, Enlarged, or Expanded Operating License:

☐ R 299.9629 Corrective Action

☐ Elimination from corrective action requirements proposed for one or more units

B2.B FACILITY'S ASSESSMENT OF KNOWN NATURE AND EXTENT OF CONTAMINATION

The existing Act 451/RCRA Part B Facility License does not specify required corrective actions at any waste management unit. No additional corrective actions are warranted or proposed at this time.

B2.M JUSTIFICATION FOR PROPOSED ELIMINATION OF ANY WASTE MANAGEMENT UNIT FROM THE CORRECTIVE ACTION PROGRAM OR INTENT TO PROCEED WITH CORRECTIVE ACTIONS

No RCRA soil or groundwater related corrective actions are being performed at or around B388. There have been no spills from the building to the surrounding environment since the last permit renewal.

Groundwater in one area of the facility is impacted and being remediated under Part 201 of NREPA. Groundwater in the upper aquifer in the vicinity of purge well OS-2 is impacted above Part 201 cleanup criteria with benzene and chlorobenzene. Groundwater monitoring in the lower aquifer has not revealed the presence of any constituent exceeding Part 201 cleanup criteria. This groundwater impact is not related to spills or operations from B388.

The facility will continue to perform monitoring under Part 201 to assess groundwater impact at the facility. Groundwater level monitoring will be performed semi-annually (April and October). Data from these monitoring events will be processed and graphically evaluated to verify that hydraulic capture is being maintained at the site. If hydraulic capture is determined to have been lost Pfizer will conduct further investigations which may include additional water level monitoring alone or in conjunction with the collection and analysis of groundwater samples to verify that contamination has not impacted off-site receptors.

ATTACHMENT B3
HYDROGEOLOGIC REPORT

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9506, R 299.9508, and R 299.9612 and Title 40 of the Code of Federal Regulations (CFR) §§264.94, 264.95, 264.97, 264.98, 270.13(10)(l), and 270.14(b)(19) establish requirements for hydrogeologic reports for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for a hydrogeologic report for the hazardous waste management units and the hazardous waste management facility for the *Pharmacia & UpJohn Co LLC, a subsidiary of Pfizer, Inc* facility in Kalamazoo*,* Michigan. This template includes hydrogeologic report requirements, waiver demonstrations, and alternative information requests for operating license applications. This hydrogeologic report supplies information to support the groundwater monitoring program, or groundwater monitoring waiver request, proposed and included in Template B5, Environmental Monitoring Programs.

(Check as appropriate)

Applicant for Operating License for Existing Facility:

☐ R 299.9506 hydrogeologic report

☒ A waiver for the hydrogeologic report is requested for one or more units

☐ Alternative information is proposed for information required in the hydrogeologic report for one or more units

☐ A waiver is requested for groundwater monitoring requirements for one or more units, and is included in Template B5

Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility:

☐ R 299.9506 hydrogeologic report

☐ A waiver is requested for groundwater monitoring requirements for one or more units, and is included in Template B5

B3.A HYDROGEOLOGIC REPORT WAIVER REQUEST

[R 299.9508(2)]

☒ B388 is not a landfill, surface impoundment, waste pile, or land treatment unit, all hazardous waste management activities take place inside or under a structure that provides protection from precipitation and runon/runoff, and the unit is in compliance with the facility design and operating standards found in R 299.9604.

B3.B SITE HYDROGEOLOGY

[R 299.9506 (1)(a) through (g) and 40 CFR, Part 265, Subpart F, and §§270.13(l), 270.14(b)(19), and 264.97]

Refer to the Pharmacia & Upjohn Company RCRA Facility Investigation in EGLE files for information requested in Section B3.

ATTACHMENT B4
ENVIRONMENTAL ASSESSMENT

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) §324.11118(3) and R 299.9504(1)(e) and R 299.9504(1)(b) establish requirements for conducting environmental assessments at hazardous waste management facilities. Before receiving an operating license, owners and operators of hazardous waste treatment, storage, or disposal facilities must evaluate the (proposed) facility's impact on air, water, or other natural resources of the state. The evaluation must also include a failure mode assessment. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses requirements for an environmental assessment for hazardous waste management units at the *Pharmacia & Upjohn Co LLC, A Subsidiary Of Pfizer, Inc* facility.

🕮 Guidance for this template can be found in EGLE's document titled "Contents of the Environmental Assessment."

INTRODUCTION

This environmental assessment for *Pharmacia & Upjohn Co LLC, A Subsidiary Of Pfizer, Inc* describes current conditions, environmental impacts, and applicable exposure information for landfills and surface impoundments. The goals of the environmental assessment are to describe and discuss (1) the probable impact of the facility on natural resources, human life, and all environmental elements that affect these values; (2) probable unavoidable adverse effects of the facility; (3) alternatives for accomplishing the same objective; and (4) possible modifications that would minimize adverse effects.

Building 388 is located at the Pfizer facility which comprises ~2200 acres. The property has been in industrial use since the later 1940s and was previously open grassland. The hazardous waste storage building 388 is located in the central north portion of the property.

B4.A CURRENT CONDITIONS

B4.A.1 Facility Description

See building drawing in Figure 4. Building 388 is the primary storage area at the facility for liquid hazardous waste in containers. Wastes generated on-site and stored in building 388 include spent solvents; expired or off-specification products; filter cakes; and lab chemicals. Waste stored in building 388 is destined for off-site treatment and/or disposal.

The building floor is constructed of concrete, has secondary containment, and is totally enclosed to prevent accumulation of precipitation.

Hazardous wastes in building 388 are sent off-site in containers for proper disposal. The facilities environmental staff is responsible for determining the acceptability of wastes to building 388 in accordance with the permit requirements. Waste Control is responsible for inspections of building 388 and for tracking all waste container-handling activities.

The building is constructed to have sufficient capacity to contain much more than the required 10% of the volume of the containers stored within. The sump for this area is inspected daily for accumulation of liquids.

B4.A.2 Description of Existing Environmental Conditions

A description of existing environmental conditions at the facility and any surrounding areas that may be affected by the facility is included in this section. Detailed information that is provided in other attachment templates is not repeated here; however, references to appropriate attachment templates are provided. Maps, photographs, and other relevant information that are not included in other templates are included in this section. Important ecological relationships, functions, and interdependence of physical environmental elements and social and economic elements are discussed. Factual information from publications, reports, or personal communications is documented, with sources cited.

B4.A.2(a) Climate

Major influences:

- Latitudinal position – strong seasonal differences
- Within the Westerlies belt
- Interior North America location – less temperate weather
- Lake Michigan
- Mean average temperature – 48 degrees F. precipitation: rain mean average 40 inches per year; snow mean average 70 inches per year.

Severe weather: In a national tornado belt. As a result, subject to a higher number of storms and winds.

B4.A.2(b) Topography

Attachment A13, USGS Portage Quadrangle Topographic Map illustrates the geographical and cultural features surrounding the facility. A wind rose for the Kalamazoo area is included as Figure 5. This wind rose was obtained by using data from the Kalamazoo Airport from 2002-2009. The site topo and facility maps are included as Figures 1 and 2. A map of the Waste Control area is included in Figure 4 showing the current hazardous waste management unit and closed hazardous waste management unit. Figure 3 is a photo of Building 388 (B388), which is the current hazardous waste container storage unit.

B4.A.2(c) Geology

See Section B3. There are no existing or potential mineral extraction and oil and gas exploration and production.

For additional information for B4.A.2(c) through B4.A.2e refer to the Pharmacia & Upjohn Company RCRA Facility Investigation located in EGLE files.

B4.A.2(d) Soils

See Section B3. The container storage building is existing.

B4.A.2(e) Hydrology

The container storage building will not impact the hydrology of the area.

B4.A.2(f) Land Use and Zoning

The area is zoned industrial.

B4.A.2(g) Historical or Archaeological Resources

There are no historical or archaeological resources on or near the property.

B4.A.2(h) Social Environment

The social environment, in terms of demographics and infrastructure of the area, is discussed in the following two subsections.

B4.A.2(h)(i) Demographics

Kalamazoo-Portage has 200,000 to 300,000 residents. Kalamazoo is the urban nucleus with industry, commercial and retail business, and housing. Portage is primarily made up of suburban houses, retail businesses, farmland, and some industry. People are employed in farming, industry, commercial and retail business, or education (Western Michigan University, Kalamazoo Valley Community College, Kalamazoo College)

B4.A.2(h)(ii) Infrastructure

The area has public utilities for sewage disposal, public schools, law enforcement, fire stations, public transportation, and solid waste disposal services. Wastewater and domestic sewage are piped to the Kalamazoo Wastewater Treatment Plant.

B4.A.2(i) Transportation

Hazardous waste will be trucked off site via highways in accordance with regulations.

B4.A.2(j) Air Quality

Ambient air quality is in attainment. Emissions from the Pfizer facility are permitted in a Title V permit.

B4.A.2(k) Noise

No unusual sources of noise. Noise levels are consistent as those found in manufacturing zones.

B4.A.2(l) Appearance and Aesthetics

Not applicable, facilities already existing in a long-time industrial area.

B4.A.2(m) Terrestrial Ecosystem

The characteristics of the terrestrial ecosystem, in terms of flora, fauna, rare or endangered species, and critical habitat are described in the following subsections.

B4.A.2(m)(i) Flora

Flora typical of West Michigan. No impact is expected from the container storage building.

B4.A.2(m)(ii) Fauna

Fauna typical of West Michigan. No impact is expected from the container storage building.

B4.A.2(m)(iii) Rare or Endangered Species

There are no rare or endangered plant or animal species in the area immediately surrounding the container storage building.

B4.A.2(m)(iv) Critical Habitat

There are no habitats critical in the area surrounding the container storage building.

B4.A.2(n) Aquatic Ecosystem

The characteristics of the aquatic ecosystem, in terms of flora, fauna, rare or endangered species, and critical habitat are described in the following subsections. This section refers to Upjohn Pond, the closest aquatic ecosystem to B388.

B4.A.2(n)(i) Flora

Aquatic flora typical of West Michigan. No impact is expected from the container storage building.

B4.A.2(n)(ii) Fauna

Aquatic fauna typical of West Michigan. Since the water on Upjohn Pond is open in the winter, a population of waterfowl are present year-round. No impact is expected from the container storage building.

B4.A.2(n)(iii) Rare or Endangered Species

There are no rare or endangered plant or animal species in the area of Upjohn Pond.

B4.A.2(n)(iv) Critical Habitat

There are no habitats critical to the survival of aquatic species in Upjohn Pond.

B4.B ENVIRONMENTAL IMPACTS OF THE FACILITY

No environmental impacts are expected to result from the container waste storage building. Failure incidents in the container storage building can be subdivided into three types: 1) those that would result in a release of waste within secondary containment, 2) those that might result in a release of waste material outside of secondary containment, and 3) fire or explosion. The probability of these types of incidents are small because of storage containment procedures, spill prevention procedures, and routine inspections.

Potential causes of the first type of failure could be:

1. Container deterioration caused by weathering or corrosion
2. Damage to or overturning of container during handling

Potential causes of the second type of failure could be:

1. Cracks in secondary containment
2. Overflow of secondary containment
3. Spills during transport of waste to and from the storage area

Fire or explosion could be caused by:

1. An ignition source in the storage area
2. Reaction of incompatible or reactive wastes

Detection of failures: Any failure will be determined by visual observations made during the regular inspections or detected at the time of occurrence.

Because Building 388 container storage building has secondary containment, potential releases from containers within this area will have no impact on soils, ground water, or surface waters. No releases of hazardous constituents are expected as a result of cracks in the secondary containment of the container storage area. These containments do not normally hold any wastes and are routinely inspected and maintained to ensure integrity.

Similarly, overflow of the secondary containment due to spills is not reasonably foreseeable. Building 388 is constructed to exclude precipitation and has sufficient capacity to contain much more than the required 10% of the volume of the containers stored within. The sump is inspected daily for accumulation of liquids.

A spill during transportation could result in a release of containerized waste outside the containment area. Such an incident could result in a release of waste to soils within the plant and under certain circumstances, could result in a release to the plant storm sewer system if the incident happened to occur near a storm drain. Some of the wastes managed in the container storage areas contain volatile compounds. A transportation spill may result in a short-term release to the atmosphere; however, unless the spill occurred near the plant entrance no unacceptable exposure levels should occur outside the plant boundary.

Fires or explosions could be caused in the container storage areas if open flames or other ignition sources are introduced in these areas since ignitable wastes are stored in both areas. In building 388 reactions triggered by moisture sensitive materials is unlikely since those materials are in closed containers inside a totally enclosed building. All storage areas are located well within the plant boundary with more than the required buffer zone to protect the public from physical hazard or from exposure to combustion emissions. A fire should be adequately contained within the waste management areas until emergency responders can arrive.

Measures to Prevent Failures:

1. Routine inspections of the storage building to assess condition of containers, containment system, and fire hazards.

2. Expeditious removal of accumulated liquids in containment
3. Prompt repair of cracks in containment
4. Repackaging of containers that are in poor condition
5. Provision of spill response kits in strategic locations within the plant
6. No smoking is allowed anywhere in the plant

Corrective Actions for Failures

1. Expeditious cleanup of all spilled materials and affected soils, if applicable
2. Repair of transport vehicles as needed to prevent cause of spill

Implementation of contingency plan in case of fire, explosion, or release of wastes outside containment.

B4.D EVALUATION OF ALTERNATE HAZARDOUS WASTE MANAGEMENT TECHNOLOGIES

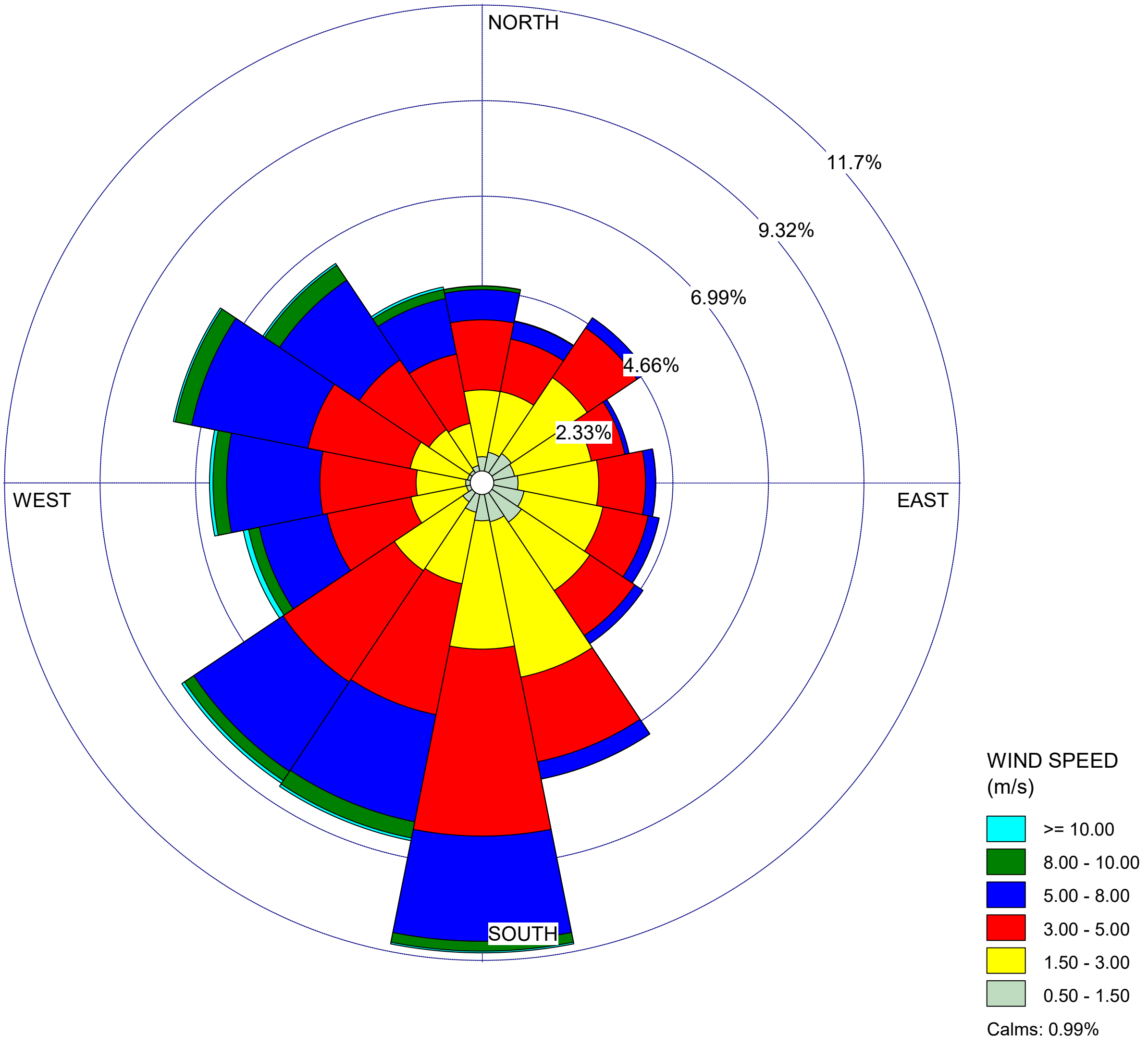
No applicable alternatives are considered as the facility is existing. No impact is expected on flora-fauna from the hazardous waste storage activities at the facility.

WIND ROSE PLOT:

7 Year Wind Rose (2015-2021)
Kalamazoo/Battle Creek Airport

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 1/1/2015 - 00:00
End Date: 12/31/2021 - 23:59

COMPANY NAME:

Barr Engineering Co.

MODELER:

CALM WINDS:

0.99%

TOTAL COUNT:

122230 hrs.

AVG. WIND SPEED:

3.71 m/s

DATE:

6/3/2022

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

ATTCHMENT B5
ENVIRONMENTAL MONITORING PROGRAMS

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities.* See the instructions for Form EQP 5111 for details on how to use this attachment. All references to Title 40 of the Code of Federal Regulations (40 CFR) citations specified herein are adopted by reference in R 299.11003.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9611 establishes requirements for the environmental monitoring programs for hazardous waste management facilities. Owners and operators of hazardous waste treatment, storage, or disposal facilities must develop an environmental monitoring program capable of detecting a release of hazardous waste or hazardous waste constituents from the facility to groundwater, air, or soil.

This license application template addresses requirements for an environmental monitoring program for hazardous waste management units and the hazardous waste management facility for the Pharmacia and UpJohn Co LLC facility. The template includes either a monitoring program description or a demonstration for a waiver from the monitoring requirements in accordance with R 299.9611(3)(a) and (b) and R 299.9611(4) as indicated below:

Groundwater Monitoring Program *(Check as appropriate)*

☐ R 299.9612 compliance monitoring program and sampling and analysis plan for one or more units
☒ Waiver for one or more units

If appropriate, both boxes may be checked if different monitoring programs and waivers apply to the units at the facility.

Ambient Air Monitoring Program (Check as appropriate)

☐ Monitoring program and sampling and analysis plan

☒ Waiver

Annual Soil Monitoring Program (Check as appropriate)

☐ Monitoring program and sampling and analysis plan

☒ Waiver

Ensure that all samples collected for environmental monitoring are collected, transported, analyzed, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan. The QA/QC Plan should at a minimum include the written procedures outlined in "Test

Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, Third Edition, Chapter 1 (November 1986), and its Updates.

B5.A GROUNDWATER MONITORING PROGRAM

[R 299.9611(2)(b) and (3), R 299.9612, and R 299.9629 and 40 CFR, Part 264, Subpart F, except 40 CFR §§264.94(a)(2) and (3), (b), and (c), 264.100, and 264.101]

The Pharmacia & Upjohn Co LLC is requesting a waiver from the groundwater monitoring requirements of R 299.9611(2)(b) and (3), R 299.9612, and R 299.9629 and 40 CFR, Part 264, Subpart F, except 40 CFR §§264.94(a)(2) and (3), (b), and (c), 264.100, and 264.101.

B5.A.1 Unit-Specific Groundwater Monitoring Program

Table B5.A.1 Groundwater Monitoring Program

Unit	Name of Unit Subject to Monitoring[1]	Conditional Non-LDF Waiver[2]	No Migration Waiver[3]	Detection Monitoring[4]	Compliance Monitoring[5]	Corrective Action Monitoring[6]
B388	B388	Yes	No	No	No	No

[1] *Please refer to R 299.9612. All treatment, storage, and disposal units are covered unless the groundwater monitoring requirements are waived.*

[2] *Please refer to R 299.9611(3)(a). The Director shall waive the groundwater monitoring requirements of R 299.9612 if the facility is not a land disposal facility and the applicant complies with one of the following provisions: (1) All treatment, storage, and waste handling activities take place inside or under a structure that provides protection from precipitation and runoff and the facility is in compliance with the provisions of R 299.9604; (2) the applicant demonstrates, to the director's satisfaction, that monitoring is not required; or (3) the applicant demonstrates, to the director's satisfaction, that a lesser degree of monitoring, or that alternate monitoring conducted in conjunction with a response activity, can be used to demonstrate compliance with the provisions of Part 111.*

[3] *Please refer to R 299.9611(3)(b). The Director shall waive the groundwater monitoring requirements of R 299.9612 if the Director finds that there is no potential for migration of liquid from the facility to the uppermost aquifer during the active life of the facility and the postclosure care period specified pursuant to the provisions of 40 CFR §264.117. The demonstration shall be certified by a qualified geologist or geotechnical engineer. The applicant shall base any predictions on assumptions that maximize the rate of liquid migration.*

[4] *If an applicant is not required to implement a compliance monitoring program or a corrective action program, in all other cases, the applicant must institute a detection monitoring program under R 299.9612 and 40 CFR §264.98. The applicant must complete Sections B5.A.2 and 3.*

[5] *Whenever hazardous constituents, as defined under 40 CFR §264.93, are detected at a compliance point, the applicant must institute a compliance monitoring program under 40 CFR §264.99. Detected is defined as statistically significant evidence of contamination as described in 40 CFR §264.98(f). The applicant must complete Sections B5.A.2 and 4.*

[6] *If an unit is undergoing corrective action in accordance with R 299.9629 and 40 CFR Part 264, Subpart F, except for 40 CFR §§264.100 and 264.101, the application should refer to Template B2, Corrective Action Information, that discusses the groundwater monitoring associated with corrective action.*

B5.A.2 Groundwater Monitoring Program Waiver

[R 299.9611(3)]

B5.A.2(a) Other Units

[R 299.9611(3)(a)]

B388 is not a land disposal unit and complies with one of the following provisions:

- All treatment, storage, and waste handling activities at Pharmacia and UpJohn Co LLC facility take place inside or under a structure that provides protection from precipitation and runoff, and the facility is in compliance with the provisions of R 299.9604.
- The building 388 hazardous waste management unit is not a land disposal unit and all treatment, storage, and waste handling activities at the facility take place inside or under a structure that provides protection from precipitation and runoff, and the facility is in compliance with the provisions of R 299.9604.

B5.A.3 General Groundwater Monitoring Requirements

[R 299.9612 and 40 CFR §§264.97 and 264.91(b)]

The Pharmacia and UpJohn Co, LLC facility will comply with the requirements for a groundwater monitoring program by implementing the program described in this section. This program was developed to satisfy the requirements of R 299.9612 and R 299.9629 and 40 CFR §§264.98 and 264.99, except 40 CFR §§264.94(a)(2) and (3) and 264.94(b) and (c). The basis for determining the groundwater monitoring program for each unit is provided in Template B3, Hydrogeologic Report, of this application that was prepared in accordance with R 299.9506.

B5.A.3(a) Sampling and Analysis Plan

[R 299.9611(2)(a)]

A sampling and analysis plan for groundwater monitoring at B388 is included in the QA/QC Plan. The sampling and analysis plan was prepared in accordance with the requirements specified in R 299.9611(2)(a). All sampling and analysis performed pursuant to this application will be consistent with the QA/QC Plan. All samples for the purpose of environmental monitoring will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan. See Figure 6 - RCRA GSAP

B5.A.3(b) Description of Wells
[R 299.9612 and 40 CFR §264.97(a), (b), and (c)]

See Figure 6 - RCRA GSAP

B5.A.3(c) Procedure for Establishing Background Quality
[R 299.9612 and 40 CFR §264.97(a)(1) and (g)]

See Figure 6 - RCRA GSAP

B5.A.3(d) Statistical Procedures
[R 299.9612 and 40 CFR §§264.97(h) and 264.97(i)(1), (5), and (6)]

See Figure 6 - RCRA GSAP.

B5.A.4 Detection Monitoring Program
[R 299.9612 and 40 CFR §§264.91(a)(4) and 264.98]

The basis for determining the detection monitoring program for each unit is provided in Template B3, Hydrogeologic Report, of this application that was prepared in accordance with R 299.9506.

Monitoring of Corrective Action Detection wells is proposed to be reduced from quarterly to biannually. This monitoring will be conducted in the Second (April) and fourth (October) quarters. The rationale for this is the extended history of non-detection of organic constituents and the infrequency of inorganic constituents that exceed permissible statistical limits.

B5.A.4(a) Indicator Parameters, Waste Constituents, and Reaction Products
[R 299.9506(3)(a) and (f), R 299.9506(4)(a), and R 299.9612 and 40 CFR §264.98(a)]

See Figure 6 - RCRA GSAP.

B5.A.4(b) Groundwater Monitoring System
[R 299.9612 and 40 CFR §§264.97(a)(2), (b), and (c) and 264.98(b)]

See Figure 6 - RCRA GSAP.

B5.A.4(c) Background Concentration Values for Proposed Parameters
[R 299.9612 and 40 CFR §§264.98(c) and 264.97(g)(1) and (2)]

See Figure 6 - RCRA GSAP.

B5.A.4(d) Proposed Sampling and Analysis Procedures

[R 299.9506(3)(e) and R 299.9612 and 40 CFR §§264.97(d), (e), and (f) and 264.98(d), (e), and (f)]

See Figure 6 - RCRA GSAP.

B5.A.5 Compliance Monitoring Program

The basis for determining the compliance monitoring program for each unit is provided in Template B3, Hydrogeologic Report, in this application that was prepared in accordance with R 299.9506. The compliance monitoring program must include a characterization of contaminated groundwater pursuant to R 299.9506(4)(b).

Monitoring of Corrective Action Characterization (CAC) wells is proposed to be reduced from quarterly to biannually. This monitoring will be conducted in the Second (April) and fourth (October) quarters. In addition, the number of CAC wells is requested to be reduced from five wells to one well (OS-2). The rationale for the reduced monitoring frequency is the stability in monitoring results from OS-2. The basis for the elimination of the four CAC wells (OS-5, OS-6b, W-19, & W-46) is the extended history of non-detection of the organic constituents that each well was assigned to monitor to assess corrective actions. The data supports the conclusion that corrective actions have been successfully accomplished at the location of CAC wells OS-5, OS-6b, W-19, & W-46.

B5.A.5(a) Hazardous Constituents to be Monitored in Compliance Program

[R 299.9612 and 40 CFR §§264.99(a)(1) and 264.98(g)(3)]

See Figure 6 - RCRA GSAP

B5.A.5(b) Concentration Limits

[R 299.9612 and 40 CFR §§264.99(a)(2) and (c)(3) and 264.97(g) and (h)]

See Figure 6 - RCRA GSAP

B5.A.5(c) Concentration Limit Other than Background

[R 299.9612(d)] Not Applicable.

B5.A.5(d) Groundwater Monitoring System

[R 299.9612 and 40 CFR §§264.95, 264.97(a)(2) and (c)] See Figure 6 - RCRA GSAP.

B5.A.5(e) Sampling and Analysis Procedures

[R 299.9612 and 40 CFR, Sections 264.97(d), (e), and (f) and 264.99(c), (d), (e), (f), and (g)]

See Figure 6 - RCRA GSAP

B5.B AMBIENT AIR MONITORING PROGRAM

[R 299.9611(2)(c) and (4)]

The Pharmacia & Upjohn Co LLC is requesting a waiver from the ambient air monitoring requirements of R 299.9611(2)(c) and (4).

All containers stored in building 388 will be in good condition, free of visible leaks, severe rust or apparent structural damage that might compromise the integrity of the container. Containers are visually inspected prior to being accepted into building 388 for cracks, holes, gaps, or other open spaces into the interior of the container when the container cover and closure devices are secured in the closed position.

A minimum of aisle space of 2 feet will be maintained to facilitate inspections, allow for fire-fighting equipment and personnel if required, and allow deployment of spill control and clean-up equipment. The containers in this area will be inspected at least weekly as described in attachment A5 to detect and remedy any degradation of waste containers or the containment system.

Air emissions from containers will be managed as specified in R299.96.34 and described in attachment C2.

B5.C ANNUAL SOIL MONITORING PROGRAM

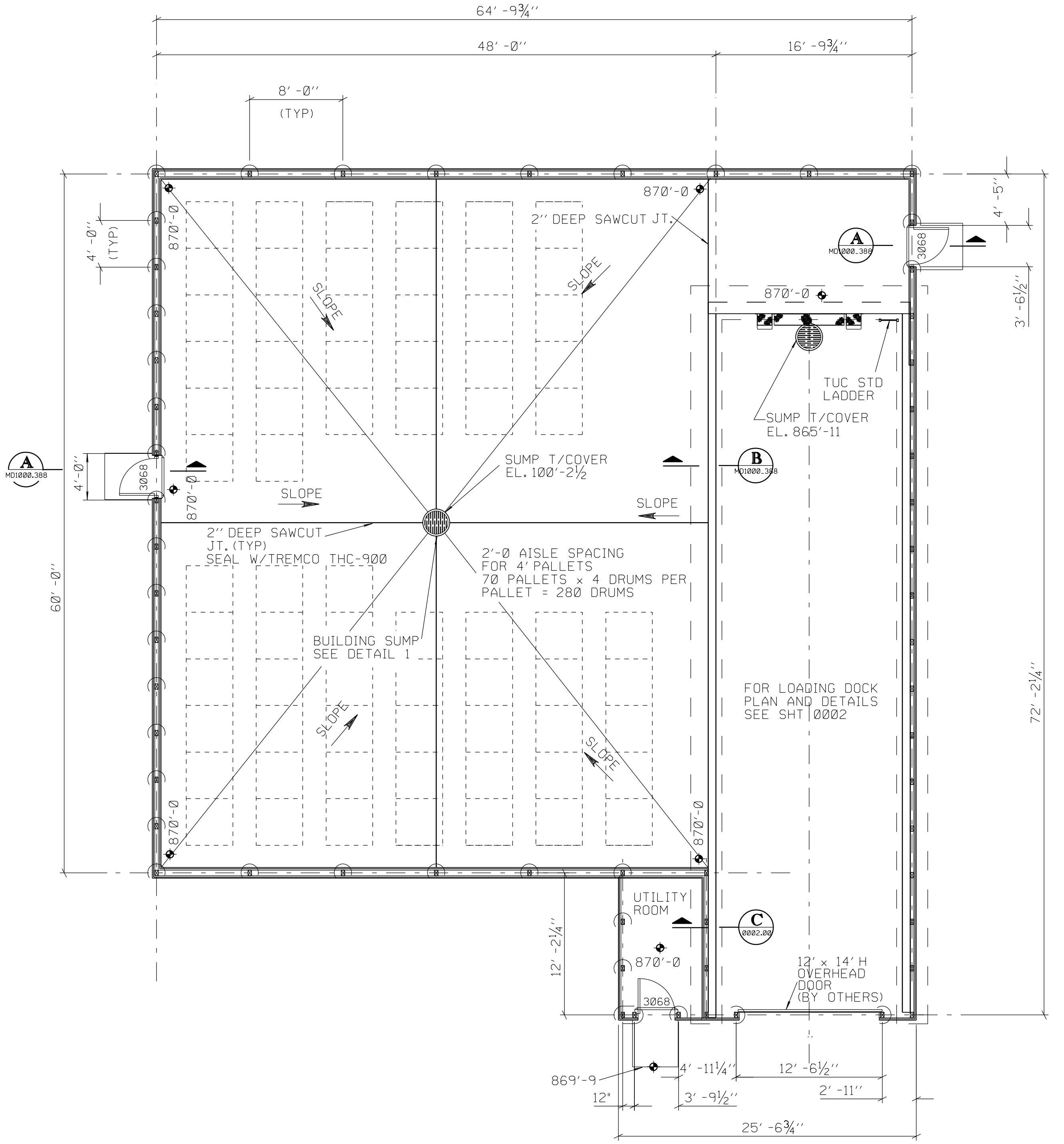
[R 299.9611(2)(d) and (4)]

The Pharmacia & Upjohn Co LLC is requesting a waiver from the soil monitoring requirements of R 299.9611(2)(d) and (4).

The building 388 hazardous waste management unit is used to store containers including 55-gallon drums, overpack drums, and other approved containers. The total number of drums that can be stored in building 388 is 280 drums (approximately 15,400 gallons). Drum contents include liquids, solids, or semi-solids, and contain organic and inorganic compounds consisting of spent solvents, expired or off-specification products, filter cakes, and laboratory chemicals. These wastes are subsequently transported off-site for disposal. Incompatible wastes will be stored in specially designed secondary containment pallets and appropriate segregation distances for the wastes will be preserved.

The building 388 is totally enclosed, any spill or release of hazardous materials will be contained. Should such a release occur, the spill response procedures outline in the Contingency Plan would be followed. Because the liquid container storage area is constructed with a seal-coated concrete and is totally enclosed, there is no reason to conclude that a release of hazardous materials from this unit would migrate beyond the building.

The load/unload area for the building is a paved area which is sloped to contain potential spills during loading activities and is designed to exclude precipitation onto the area. In the event of a spill, the presence of pavement, the self-contained drainage, the containment sump, and the spill response procedures outlined in the Contingency Plan, eliminate the potential for migration of any spilled materials to underlying soil.



ORIENTATION

NOTES:

FACILITY SPILL CAPACITY:

BLDG FLOOR & SUMP = 1,865+ gal.
TRUCK DOCK & SUMP = 10,840 gal.

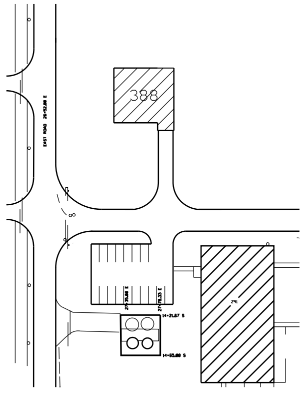
TOTAL CAPACITY BEFORE
GROUND CONTACT = 12,705 gal.

DRY FIT FIRE PROTECTION:

30 NOZZLE SYSTEM
EACH NOZZLE DISPLACES 25 GPM
TOTAL SYSTEM WORSE CASE 750 GPM
EACH NOZZLE ACTIVATES INDEPENDENT
OF EACH OTHER

REFERENCE DRAWINGS:

MD1000_388.DGN, DETAIL SHEET



KEYPLAN

TITLE:	ACT 64 DWG. NO.	HISTORICAL REFERENCE
PLAN AND SECTIONS, BUILDING 388 CONTAINER STORAGE AREA	D-1	PROJECT NUMBER: SEQUENTIAL NUMBER: 02-0001.00 AREA NO:

ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE

ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE
A	ISSUED FOR BIDS - SITE WORK AND BUILDING CONSTRUCTION					7/28/94
B	ISSUED FOR CONSTRUCTION - SITE WORK AND BUILDING CONSTRUCTION					8/16/94
C	AS-BUILT FOR GCR2009-4K401-0013					12/2/09
D	ALIGNED FLOOR PLAN WITH SITE & MOVED DETAILS TO DETAIL SHEET MD1000_338.DGN: NO PHYSICAL OR DESIGN CHANGES.	SOD	HKA			10/11/16

SCALE: 3/16''=1'-0''
DATE DRAWN 2/14/94

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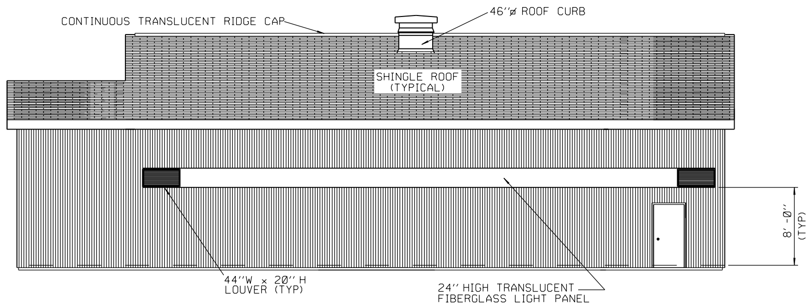
TITLE:
BUILDING 388
ARCHITECTURAL
FIRST FLOOR PLAN
HAZ. WASTE STORAGE BUILD.

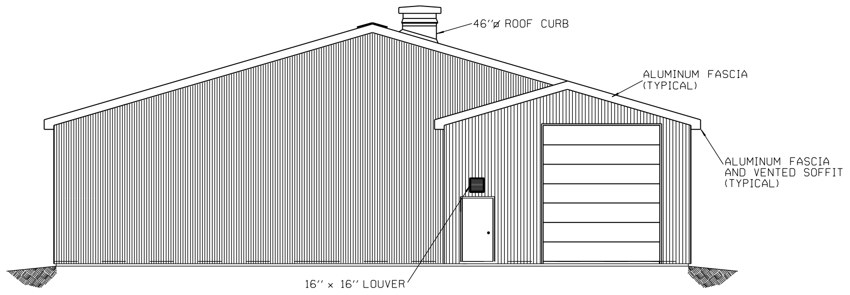
DISCIPLINE	CATEGORY	SECTION	LEVEL
01	B388	47	01

DRAWING NUMBER
MA1000_388.DGN
ISSUE



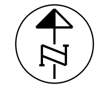
EAST ELEVATION

SCALE: 1/8" = 1'-0



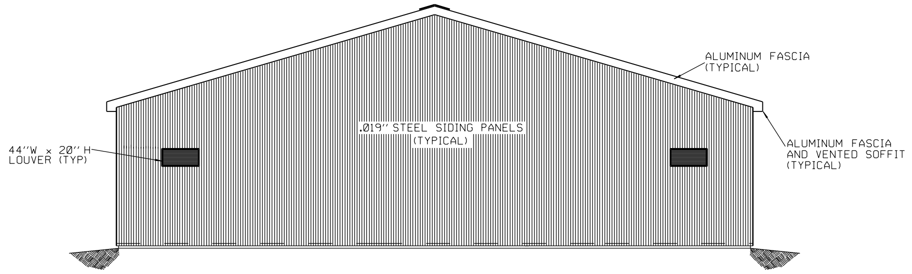
SOUTH ELEVATION

SCALE: 1/8" = 1'-0



ORIENTATION

NOTES:

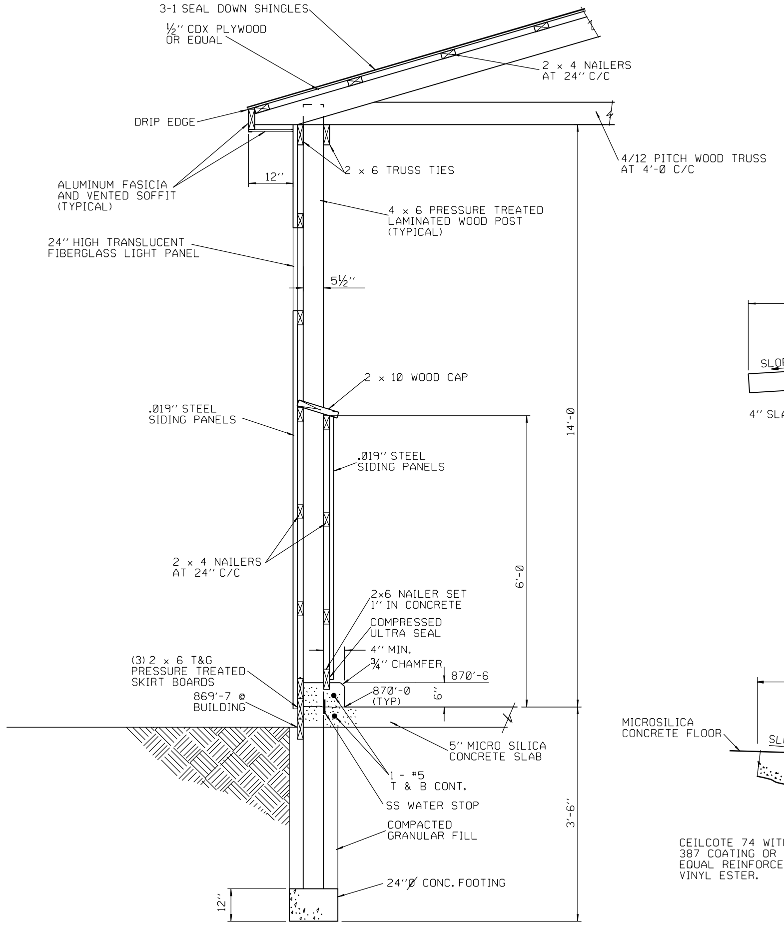


NORTH ELEVATION

SCALE: 1/8" = 1'-0

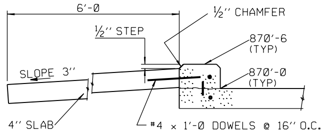
REFERENCE DRAWINGS:

MA1000_388.DGN, FLOOR PLAN



WALL DETAIL

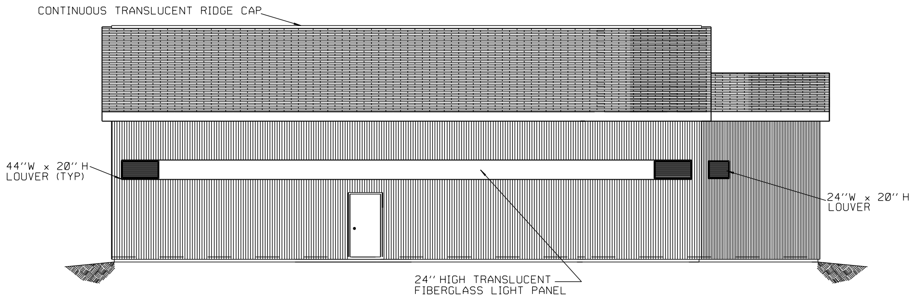
NO SCALE



SECTION (A)

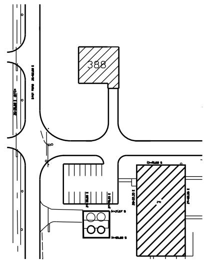
SCALE : NTS

TYPICAL SECTION @ DOORS

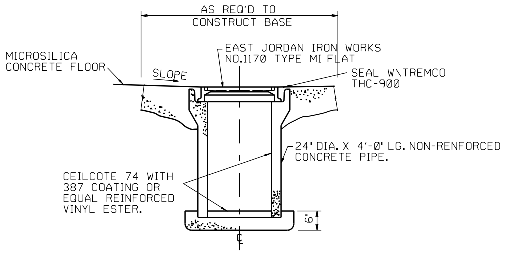


WEST ELEVATION

SCALE: 1/8" = 1'-0



KEYPLAN



DETAIL (1)

TITLE:	ACT 64 DWG. NO.	HISTORICAL REFERENCE
PLAN AND SECTIONS. BUILDING 388 CONTAINER STORAGE AREA	D-1	PROJECT NUMBER: SEQUENTIAL NUMBER: AREA NO:

ISSUE	DATE	CHANGE CONTROL REVISION	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE

ISSUE	CHANGE CONTROL	BY/DESIGN	FIRM	REVIEW	APPROVED	DATE
A	ISSUED FOR BIDS - SITE WORK AND BUILDING CONSTRUCTION	BMP		AMB		7/28/94
B	ISSUED FOR CONSTRUCTION - SITE WORK AND BUILDING CONSTRUCTION	GLD		GLD		8/16/94
C	AS-BUILT FOR GCR2009-4K401-0013			GLD		12/2/09
D	CREATED MASTER - NO PHYSICAL OR DESIGN CHANGES. SEPERATED FROM FLOOR PLAN: ARCHIVED 6819021_388.DGN	SOD	HKA			10/11/16

SCALE: AS NOTED

DATE DRAWN 2/14/94

Pfizer

TITLE:

BUILDING 388
ARCHITECTURAL
DETAIL SHEET
HAZ. WASTE STORAGE BUILDING

DISCIPLINE	CATEGORY	SECTION	LEVEL
01	B388	47	01

DRAWING NUMBER MD1000_388.DGN

ISSUE D

MORTON BUILDINGS, INC. 616/279-5271
P.O. Box 326 Three Rivers, Michigan 49093-0326

October 20, 1992

UpJohn Company
Kalamazoo, MI 49001

Dale French,

I have put together the revised proposal for the Hazardous Waste Building project.

Building:	18'x14'x8' Gabled loading dock shelter 66'x14'x40' Built on customers level site Plans for local building permit Permit and site plan by UpJohn
Roof:	.019 Mil thickness steel with plasticol coated roof steel, with 20 year warranty. Continuous vented ridge 1'-0" Overhangs, vented on sides Gutters and downspouts Roof insulated with 1/2" thermax embossed heavy duty.
Sidewall:	.019 Mil thickness steel with Kynar 500 Paint System, 20 year warranty on color and exterior rust. 6 - 36"x24" Paint louvers with screen, boxed with 2x4 frame so they can be closed. 80 LF of 3'-6" Sidelite for both sides of building.
Doors:	1 - 3068 Steel walkdoors, closure, lockset & deadbolt 1 - 12'x14' Aluma Steel sliding door with seal kit
Cement:	2640 Sq. Ft. Micro Silca concrete 144 Sq. Ft. Micro Silca concrete 212 LF of 6" curb Curb up for door ways, sliding doors and walkdoors
Price as quoted:	$ 42,504.00 Net Erected (Price subject to change 12/1/92)

Option:

1) Insulate walls with 1/2" thermax embossed and install flat sheet vapor barrier for skylites
$ 3,987.00

Thank you for your time and consideration of Morton Buildings.

Respectfully,

Steve

Steve Olson
Morton Buildings, Inc.

SO:cp

cc: Ronald Pool
Fred Overton

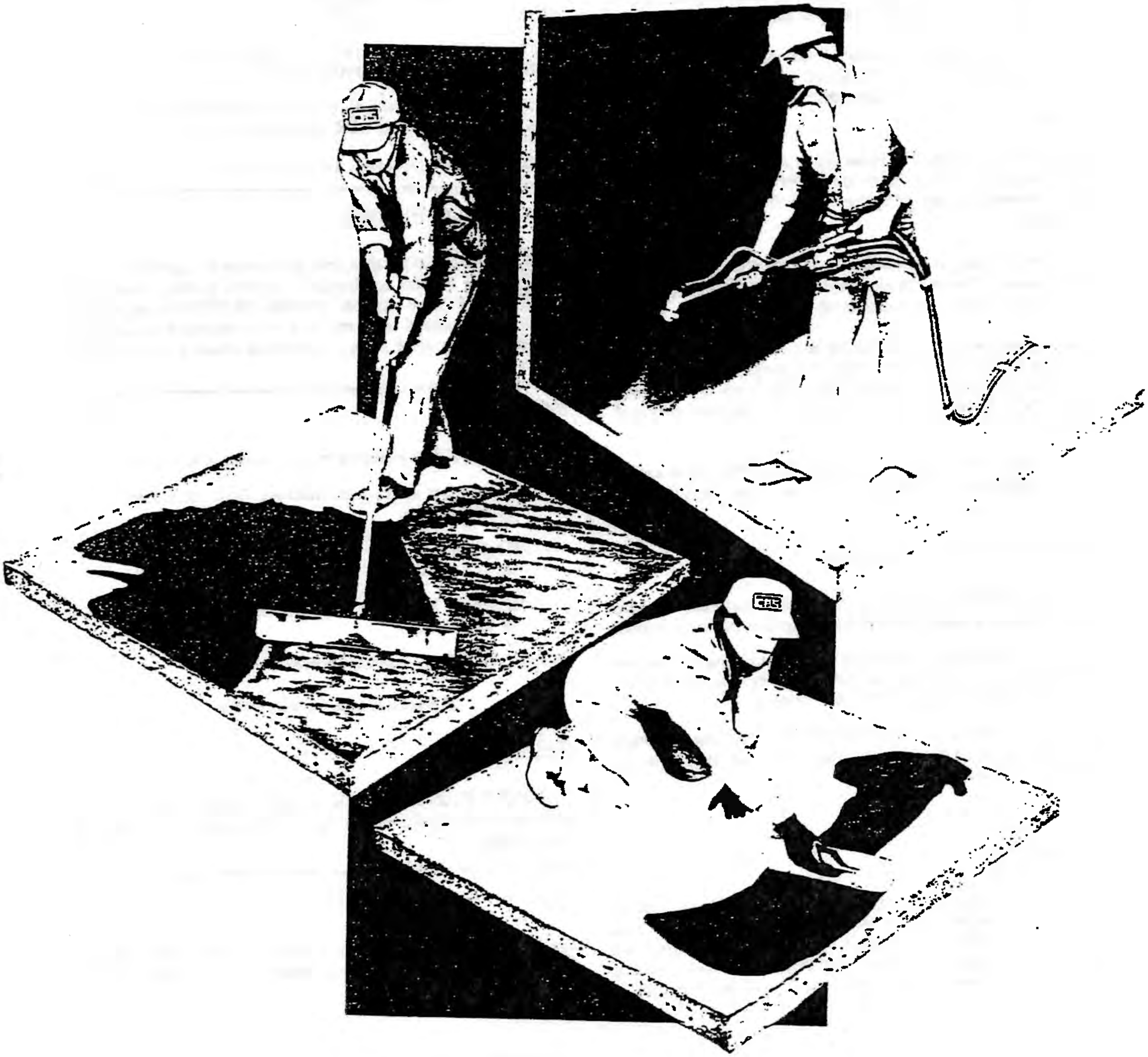
Excellence - Since 1903

¼ System 2.00 1/ft.

OVERKOTE PLUS®

INDUSTRIAL FLOORING

Process Technology & Controls, Inc.
3827 S. Westnedge
Kalamazoo, MI 49008
Phone: (616) 345-5222 Fax: (616) 345-6688



CONCRETE PROTECTION SYSTEMS, INC.

OVERKOTE PLUS®

Product Description

OVERKOTE PLUS is a heavy-duty flooring material, designed for resisting severe chemical service, such as 98% sulfuric acid and many other strong chemicals and solvents. OVERKOTE PLUS is a tough, abrasion resistant, 100% solids copolymer resin system. When applied at a thickness of $^1/_4$ inch, OVERKOTE PLUS will withstand steel wheeled traffic and severe mechanical abuse.

OVERKOTE PLUS is a permanent flooring using proven Concrete Protection Systems, Inc. (CPS) concepts* insuring:

- **Freedom from porosity:** Porosity is the most common cause of flooring failures. OVERKOTE PLUS is nonporous and does not require a sealer coat to prevent chemical penetration to the concrete.

  Sealer coats are subject to break down due to wear, fracture, or chemical attack. When this occurs on porous flooring, the underlying concrete is attacked by the chemicals and the flooring starts debonding.

- **Uniform flooring composition and properties:** CPS flooring material cannot be overloaded with silica, which means consistent physical properties are maintained.

- **Ease of application:** CPS flooring material can be applied by troweling, screed rake spreading, or aggregate-resin spraying, the preferred method for large area applications. Maintenance personnel can learn to apply OVERKOTE PLUS with minimal training.

- **Rapid application rates:** CPS flooring material can be applied at full thickness with one pass over the floor; no primer or sealer is required.

Adhesion to wet concrete

OVERKOTE PLUS has tenacious adhesion to concrete. Its bond strength exceeds the tensile and shear strengths of the concrete itself.

OVERKOTE PLUS can be applied on high moisture and wet concrete (with no standing water) and at 100% humidity. These conditions will not affect its bond strength or performance.

This unique characteristic of OVERKOTE PLUS eliminates a major uncertainty in applying flooring since moisture conditions are difficult to control in the field.

Nonwicking

OVERKOTE PLUS applied to concrete at $^1/_4$ inch will not crack or craze when subjected to the most severe impact blows. This characteristic is built into the resin system without the need for fiberglass cloth, eliminating the problem of chemicals wicking along the length of the fibers, causing deterioration and delamination.

Corrosion resistance

OVERKOTE PLUS has the highest overall chemical resistance of the CPS product line.

The Corrosion Resistance Chart on page four is based on continuous exposure for unlimited service life at ambient temperatures. For chemicals not listed on the Corrosion Resistance Chart consult your CPS representative.

Rapid turn around time

At application temperatures above 70°F, the OVERKOTE PLUS floor can support foot traffic in 5-8 hours and full use after 12-24 hours.

Spray Application

CPS has perfected spray equipment that permits state of the art, cost effective application of OVERKOTE PLUS flooring.

This machine is a compact, portable, inexpensive unit that combines mixing, pumping, and spraying functions.

The highest quality, heavy duty, $^1/_4$ inch floors can be applied in one pass, at rates in excess of 1,000 square feet per hour.

Contact your CPS representative for information.

For Vertical Surfaces

OVERKOTE PLUS is a fluid system and cannot be applied to vertical surfaces. For vertical applications, a special product, designated OVERKOTE PLUS V, is used. OVERKOTE PLUS V is applied $^1/_8$ inch thick on vertical surfaces. This is the standard thickness for vertical surfaces since severe mechanical abuse is not normally encountered.

Packaging

OVERKOTE PLUS is available in three standard kit sizes:

20 square foot at $^1/_4$ inch thickness, 720 cubic inches, or 3.12 gallons.

100 square foot at $^1/_4$ inch thickness, 3,600 cubic inches, or 15.6 gallons.

1000 square foot at $^1/_4$ inch thickness, 36,000 cubic inches, or 156 gallons.

OVERKOTE PLUS V is available in one kit size:

25 Sq. Ft. Kit, at $^1/_8$ inch thickness.

Colors

OVERKOTE PLUS is available in eight standard colors shown separately on the Product Color Guide. Other colors are available on special order.

Application

The following is a summary of application procedures used for OVERKOTE PLUS. For detailed procedures refer to the product application bulletins.

Concrete Preparation

New Concrete
Laitance must be removed by muriatic acid etching, shotblasting, or sandblasting. On concrete that does not take muriatic acid etching, shotblasting or sandblasting is required.

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* U.S. Patent No. 4761313

Existing Concrete
Concrete must be sound and old coatings and toppings must be removed. Concrete must be clean and free of oil, wax, paint, and other contaminates. Water soluble contaminates can be hosed off with water. Some water insoluble materials are difficult to remove and may require sandblasting, scabbling, or other methods of removal.

Concrete may be damp or wet at time of application, as long as there is no standing water.

Mixing Equipment

20 Sq. Ft. kit - Use 5 gallon mixer that rotates pail and scrapes the bottom and sides.

100 Sq. Ft. kit- Use 2 1/2 to 3 cubic foot mortar mixer. Alternative- special propeller mixer recommended by CPS.

1000 Sq. Ft. kit- Use same as 100 Sq. Ft. kit except Part "A" must be premeasured to 100 Sq. Ft. kit batch sizes.

With all material, hand mixing will produce inconsistent results and is not an approved method.

Mixing

Note: Before starting, assure that the material, the floor surface, and the ambient air are all at 65 - 90° F.

Mixing ratios are supplied in kits.

For spray application refer to Spray Application Bulletin.

For application of OVERKOTE PLUS V, refer to Vertical Application Bulletin.

Part "A" Preparation - Mix or rotate drums before use.

Pour Part "A" (Resin) and add appoximately 1/2 of Part "C" (Silica) to the mixer. Mix only long enough to clean mixer from previous batch, about 30 seconds.

Add Part "B" (Hardener) only whenbatch is ready to use. Mix for about 30 seconds.

Add balance of Part "C" (Silica). Mix until homogeneous, about 1 to 2 minutes. Immediately pour on floor.

Finishing

Use trowel or screed rake to spread material over required area. Within 5 to 15 minutes broadcast Part "D" (Silica) until flooring is saturated.

For special surfaces or decorative effects consult application bulletin.

Filling and Patching

Use the same procedure as above with the following exception: Add the Part "D" (Silica) directly to the mix before pouring.

Clean Up

Water or detergents can be used to remove material from equipment if it is cleaned before the material has started to set up; otherwise stronger solvents such as methylene chloride will be necessary. Refer to vendor Material Safety Data Sheets (MSDS) for clean up materials.

If there are any questions on the use of this product, please consult your area distributor or CPS, Inc.. Their technical service representatives will be glad to assist.

Safety

OVERKOTE PLUS contains amine curing agents. Avoid skin contact. In case of eye contact or ingestion, contact a physician immediately. In case of skin sensitivity to these materials, use protective clothing and gloves. MSDS are available for this product.

Physical Properties

Compressive Strength ASTM C 579 82	14,300 psi
Flexural Strength ASTM C 790	5,600 psi
Tensile Strength ASTM C 190 85	2,400 psi
Bond Strength to Concrete ASTM D 4541 89	(Exceeds tensile strength of concrete. Concrete fails first.)
Taber Abrasion ASTM D 4060 84 with 2,000 grams	Loss/1000 Cycles = 25 mg
Water Absorption ASTM D 570 63	0.10 % maximum
Linear Shrinkage ASTM C 531	0.01% maximum
Flammability ASTM D 635 81	Self extinguishing
Impact Resistance Mil-D-3134F	6 ft lb with no failure
Coefficient of Friction ASTM D 2047 82	0.6 minimum
Hardness, Shore D ASTM D 2240	85
Porosity with no Sealer Coat NACE Stand TM-01-74	0.00

NOTE: OVERKOTE and OVERKOTE PLUS are USDA authorized for use in federally inspected meat and poultry plants.

OVERKOTE PLUS®

Corrosion Resistance Chart

Note: Overkote Plus is compatible with chemicals listed here based on continuous immersion. Other chemicals not listed may also be recommended as non - corrosive. Consult your CPS Representative.

Acetic Acid (0-15%)	R
Acetone (0-50%)	R
Adipic Acid Solution	R
Alcohol, Isopropyl	R
Alcohol, Methyl	R
Alcohol, Ethyl	R
Allyl Chloride	R
Aluminum Bromate	R
Aluminum Bromide	R
Aluminum Chloride	R
Aluminum Fluoride (25%)	R
Aluminum Hydroxide	R
Aluminum Iodide	R
Aluminum Nitrate	R
Aluminum Sodium Chloride	R
Aluminum Sulfate	R
Alums	R
Ammonia - Wet	R
Ammonium Benzoate	R
Ammonium Chloride	R
Ammonium Chlorostanate	R
Ammonium Fluoride (25%)	R
Ammonium Hydroxide (0-30%)	R
Ammonium Iodate	R
Ammonium Iodide	R
Ammonium Nitrate	R
Ammonium Oxalate	R
Ammonium Phosphate	R
Ammonium Silicate	R
Ammonium Sulfate	R
Ammonium Sulfide	R
Ammonium Trichloride	R
Barium Bromide	R
Barium Carbonate	R
Barium Chlorate	R
Barium Chloride	R
Barium Citrate	R
Barium Dichromate	R
Barium Hydroxide (0-10%)	R
Barium Iodate	R
Barium Iodide	R
Barium Nitrate	R
Barium Nitrite	R
Barium Oxalate	R
Barium Sulfate	R
Barium Sulfide	R
Barium Sulfite	R
Beer	R
Benzene	R
Benzene (5% in Kerosene)	R
Benzene Sulfonic Acid	R
Benzoic Acid	R
Beverages - Carbonated	R
Bizmuth Oxychloride	R
Black Liquor	R
Bleach Liquor	R
Blood	R
Borax	R
Boric Acid	R
Bromic Acid	R
Bromine Water	R
Butadiene	R
Butyl Cellosolve	R
Butyric Acid	R
Cadmium Bromate	R
Cadmium Bromide	R
Calcium Bisulfite	R
Calcium Bromate	R
Calcium Bromide	R
Calcium Carbonate	R
Calcium Chlorate	R
Calcium Chloride	R
Calcium Citrate	R
Calcium Hydroxide (0-50%)	R
Calcium Hypochlorite (0-20%)	R
Calcium Iodide	R
Calcium Nitrate	R
Calcium Nitrite	R
Calcium Oxychloride	R
Calcium Phosphate	R
Calcium Sulfate	R
Calcium Thiosulfate	R
Carbon Disulfide	R
Carbon Tetrachloride	R
Carbonic Acid	R
Castor Oil	R
Chlorine, Dry Gas	R
Chlorine Water - All	R
Chlorine, Wet Gas	R
Chloroacetic Acid (0-25%)	R
Chlorobenzene	R
Chloroform	R
Chlorostannic Acid	R
Chromated Copper Arsenate (CCA) 3%	R
Chrome Plating (Hard)	R
Chromic Acid (0-32%)	R
Chromic Sulfate	R
Chromous Chloride	R
Chromous Iodide	R
Citric Acid	R
Copper Chloride	R
Copper Fluoride	R
Copper Nitrate	R
Copper Sulfate	R
Crude Oil - Sour	R
Crude Oil - Sweet	R
Cupric Bromate	R
Cupric Bromide	R
Cupric Sulfate	R
Cuprous Sulfite	R
Cuprous Thiocyanate	R
Cyclohexane	R
Deionized Water	R
Detergents, All	R
Diacetone Alcohol	R
Dichlorobenzene, Ortho	R
Dichlorobutane	R
Diesel Fuel	R
Diethyl Sulfate	R
Diethylene Glycol	R
Dimethylsulfate	R
Diocty Pthalate	R
Ethyl Acetate	R
Ethyl Acrylate (100%)	R
Ethyl Cellosolve	R
Ethylene Glycol	R
Fat	R
Fatty Acids	R
Ferric Bromide	R
Ferric Chloride	R
Ferric Formate	R
Ferric Nitrate	R
Ferric Oxalate	R
Ferric Sulfate	R
Ferric Sulfide	R
Ferric Thiocyanate	R
Ferrous Chloride	R
Ferrous Chloroplatinate	R
Ferrous Ferricyanide	R
Ferrous Fluoride	R
Ferrous Formate	R
Ferrous Iodide	R
Ferrous Perchlorate	R
Ferrous Potassium Oxalate	R
Ferrous Sulfate	R
Ferrous Thiocyanate	R
Ferrous Thiosulfate	R
Fluorosilicic Acid (0-32%)	R
Formaldehyde (0-40%)	R
Freon	R
Fumaric Acid (50%)	R
Gasoline Refined, All	R
Glucose	R
Glycerine	R
Glycol, Ethylene	R
Glycol, Propylene	R
Hydrazine, 35% Catalyzed	R
Hydraulic Fluid	R
Hydrobromic Acid (0-50%)	R
Hydrochloric Acid (0-37%)	R
Hydroflouric Acid (0-25%)	R
Hydrogen Peroxide (10%)	R
Hydrogen Sulfide, Aqueous	R
Hypochlorous Acid (0-10%)	R
Isopropyl Biphenyl	R
Jet Fuel	R
Kerosene	R
Lard	R
Lauric Acid	R
Lead Acetate	R
Lead Persulfate	R
Levulinic Acid (25%)	R
Lithium Acetate	R
Lithium Nitrate	R
Lithium Sulfide	R
Lix 84 (Henkel)	R
Magnesium Acetate	R
Magnesium Bromide	R
Magnesium Carbonate	R
Magnesium Chloride	R
Magnesium Hydroxide	R
Magnesium Nitrate	R
Magnesium Perchlorate	R
Magnesium Sulfate	R
Magnesium Thiosulfate	R
Maleic Acid (100%)	R
Manganese Chloride	R
Manganese Iodide	R
Manganese Lactate	R
Manganese Sulfate	R
Mercurous Nitrate	R
Mercury	R
Methyl Isobutyl Carbitol	R
Methyl Isobutyl Ketone	R
Methyl Methacrylate	R
Mineral Oils	R
Molasses	R
Molybdenum Oxybromide	R
Molybdenum Tetrabromide	R
Molybdenum Oxychloride	R
Naphthalene	R
Naphthas	R
Nickel Bromide	R
Nickel Chloride	R
Nickel Formate	R
Nickel Nitrate	R
Nickel Potassium Cyanide	R
Nitric Acid (0-40%)	R
Nitrobenzene	R
Oakite Cleaning Solutions	R
Oleic Acid	R
Oxalic Acid	R
Palladium Chloride	R
Perchlorethylene	R
Phosphoric Acid (0-85%)	R
Pickling Acids,Sulfuric & HCl	R
Picric Acid	R
Plating Solutions (ALL)	R
Platinic Acid	R
Platinum Chloride	R
Platinum Sulfate	R
Potassium Aluminum Silicate	R
Potassium Arsenate	R
Potassium Arsenite Acid	R
Potassium Bicarbonate	R
Potassium Borate	R
Potassium Bromide	R
Potassium Carbonate	R
Potassium Chloride	R
Potassium Cyanate	R
Potassium Cyanide	R
Potassium Dichromate	R
Potassium Fluoride	R
Potassium Hydrosulfide	R
Potassium Hydroxide	R
Potassium Hypochlorite	R
Potassium Hypophosphite	R
Potassium Iodide	R
Potassium Nitrate	R
Potassium Phosphate, Hydrogen	
Potassium Phosphate, Pyro	R
Potassium Phosphite	R
Potassium Silicate	R
Potassium Sulfate	R
Potassium Sulfide	R
Potassium Sulfite	R
Potassium Thiocarbonate	R
Potassium Thiocyanate	R
Pulp Mill Liquors	R
Rhodium Chloride	R
Rhodium Sulfate	R
Selenic Acid	R
Silicic Acid	R
Silicon Fluoride	R
Silver Nitrate	R
Silver Perchlorate	R
Silver Permanganate	R
Silver Thiosulfate	R
Sorbitol	R
Soaps	R
Sodium Acetate	R
Sodium Benzoate	R
Sodium Bicarbonate	R
Sodium Bisulfate	R
Sodium Bromide	R
Sodium Carbonate	R
Sodium Chloride	R
Sodium Cyanide	R
Sodium Dichromate	R
Sodium Ferrocyanide	R
Sodium Fluoride	R
Sodium Hydroxide (0-59%)	R
Sodium Hypochlorite (0-15%)	R
Sodium Methoxide (0-40%)	R
Sodium Nitrate	R
Sodium Phosphate	R
Sodium Silicate	R
Sodium Sulphate	R
Sodium Sulphite	R
Sodium Tetraborate	R
Sodium Thiosulfate	R
Stannic Chloride	R
Stearic Acid	R
Sugars	R
Sulfamic Acid (0-25%)	R
Sulfite Liquors	R
Sulfuric Acid (0-100%)	R
Sulfurous Acid (0-7%)	R
Tannic Acid	R
Tantalum Flouride	R
Tartaric Acid	R
Tetraethyl Lead	R
Titanium Chloride	R
Titanium Fluoride	R
Titanium Nitrate	R
Titanium Tetrachloride	R
Toluene	R
1-1-1 Trichloroethane	R
Trichloroethylene	R
Tricresyl Phosphate	R
Triethylenetetramine	R
Trisodium Phosphate	R
Tung Oil	R
Turpentine	R
Urine	R
Vegetable Oils, All	R
Vinegar	R
Vinyl Acetate	R
Water, Distilled	R
Water, Deionized	R
Water, Salt	R
Wine	R
Xylene	R
Zinc Chloride	R
Zinc Sulfate	R
Zinc Fluorosilicate	R
Zinc Formate	R
Zinc Permanganate	R

* All information within the chemical corrosion chart above is based on continuous immersion at ambient temperatures to assure unlimited service life.

Registered Trademarks
OVERKOTE PLUS, OVERKRETE, OVERKOTE, OVERKRETE V, and OVERKRETE 45/65 are registered trademarks of Concrete Protection Systems, Inc.

PRINTED IN USA

Concrete Protection Systems, Inc.
P.O. Box 9545

7/91

MICROSILICA CONCRETE

1. Minimum Requirements

Microsilica (condensed silica fume) concrete mix for interior slab-on-grade and supported slabs shall meet the following minimum requirements:

Cement:	ASTM C150 Type 1, Minimum 658 pcy
Microsilica:	Minimum 100 pcy
Fly Ash:	ASTM C494, Type C or F, Substitution for cement, Maximum 15% by wt.
W-C Ratio:	Maximum ratio of water to cementitious materials 0.37
Aggregates:	ASTM C33, Exposure 55; coarse aggregate to meet Size Classification 67

2. Submittals

Submit the following information:

a. Proposed mix proportions

b. Proposed brand/supplier of microsilica, cement, fine aggregate, coarse aggregate, high range water reducers, fly ash, and any other proposed admixtures.

c. Certification that materials meet requirements of above referenced standards.

d. Maximum slump after the addition of HRWR.

e. Proposed procedures for placing, finishing, and curing microsilica concrete.

f. Proposed procedures for protecting microsilica concrete from drying and plastic shrinkage cracking during the placing and finishing process.

3. Microsilica Admixtures

Approved microsilica (condensed silica fume) additives are:

a. "EMSAC F-100" by Elkem Chemicals, Inc.
b. "Force 10,000" by W.R. Grace & Co.
c. "MB-SF" by Master Builders

4. Moisture Retaining Cover

Moisture retaining cover shall be one of the following, complying with ANSI/ASTM C171:

a. Waterproof paper over burlap
b. White polyethylene film over burlap
c. White polyethylene-coated burlap

5. Evaporation Retarder Moisture Barrier

Approved evaporation retarders are:

a. "Confilm" by Master Builders
b. "Eucobar" by Euclid Chemical Company

6. Microsilica Concrete Placing Requirements

Prior to beginning microsilica concrete placements and after approval of the proposed mixture proportions by the Engineer, contractor shall conduct a test placement of 100 square feet, minimum. Contractor shall use the mixing, placing, finishing, evaporation protection, and curing techniques proposed for use on the project. These techniques and the final finished appearance of the microsilica concrete shall be reviewed by the Engineer. Actual placements shall not begin until the test placement has been approved by the Engineer.

7. Finishing

a. Begin floating immediately after screeding of concrete. Provide trowel finish.

b. Finishing tolerance - Floor flatness shall meet or exceed ACI 302 Floor Flatness Classifications for "Flat", with a minimum flatness number F_F - 30, or a true plane within 3/16 inch in 10 feet as determined by a 10-foot straight edge placed anywhere on the slab in any direction.

c. No spraying of water directly on flat work will be allowed. Fog misting the air above microsilica flat work is recommended. Free standing water is not allowed.

d. Fog misting is required when conditions of hot weather concrete exist. Fogging shall continue after the finishing operation until wet burlap or moisture retaining cover has been placed over the concrete.

8. Curing and Protection

a. Begin curing as soon as possible after concrete has been placed and finishing has been completed.

b. Cure all slabs on grade and supported slabs not subject to conditions of hot or cold weather concreting using the method outlined in ACI 301, Article 12.2, 1.2. Unless otherwise noted, maintain concrete in a continuously moist condition for at least 7 days after placement.

c. Leave mats in place for 3 additional days after discontinuing moist cure.

soil and materials engineers, inc.

4460 Commercial Avenue Suite B Kalamazoo, MI 49001 (616) 323-3555 FAX (616) 323-3553

January 15, 1992

Mr. David Harris, Manager
The Upjohn Company
7171 Portage Road
Kalamazoo, MI 49001

RE: The Upjohn Building 335
Kalamazoo, Michigan
SME Project No. K15770

Dear Mr. Harris:

This letter presents the results of a permeability test performed on a concrete sample for the above-referenced project.

A 3 by 6 inch cylinder of concrete containing dry condensed silica fume was cast on November 26, 1991. The field test results and batch proportions are shown on the attached daily concrete report. The wet density of the cylinder was 146.3 pcf.

After curing for 28 days, a permeability test was performed on the cylinder in a triaxial cell. The permeability test consisted of placing a membrane around the cylinder, providing a confining pressure to keep the membrane tight around the cylinder, and forcing water through the axial length of the cylinder under pressure. Permeability readings were obtained over the course of a week. Based on the test results, the coefficient of permeability (k) of the tested sample was approximately 6×10^{-10} cm/sec.

We understand this data may be used to assist with the design of fluid containment structures. We recommend that you consider that this permeability test was performed on a small, molded specimen that appeared to be free of cracks. It is important that any containment structures constructed from this material are free of cracks or other discontinuities since the permeability through these areas could be much higher than the reported permeability of the test sample.

We have appreciated this opportunity to be of continued assistance. If you have any questions regarding this letter, or if we may be of further assistance, please call us.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Timothy J. Mitchell, P.E.
Project Engineer

cc: Mr. Eliad Bernstein - John Brown E&C
Mr. Ed Sharp - John Brown E&C (2)
Mr. Carl Thorson - TUC
Mr. Dilip Mandaker - TUC

MTC
Testing Consultants, INC.
GRAND RAPIDS • KALAMAZOO • PHONE 616/456-5469

Job No. 8070

Pour Date: 03\03\92

F

ROJECT:
PJOHN BLDG 44 ANNEX ADDITION

ALAMAZOO

CLIENT:
UPJOHN COMPANY
7000 PORTAGE ROAD
KALAMAZOO, MICHIGAN 49001

ONTRACTOR:
USTIN COMOPANY
25 EAST SPRING ST
ALAMAZOO, MICHIGAN 49003

ARCHITECT OR ENGINEER:

REPORT OF CONCRETE COMPRESSION TEST - ASTM C-39

ource of Concrete: CONSUMERS CONCRETE CORPORATION Ticket No.
ocation of Placement: FLOORS 1, 2 OF BLDG 44 ANNEX AND FLOOR 3

Specifications For Mix 8070C65

lump in inches 4 Min. Max. 4
ntrained Air in % 1.5 Min. Max.
ement in sks./cu.yd. Min.
ater Cement Ratio Max.

Unit Wt. 149.5 lbs./cu.ft.
Air Temp. 36 deg.F
Concrete Temp. 70 deg.F
Quantities in cu.yds.
Total this pour 55
At time of test 25
This truck 8

in[illegible]um strength specification
5[illegible] p.s.i. at 28 days

Laboratory Number	Age in Days	Days Field Cured	Type of Cap	Type of Fracture	Cross section area - sq.in.	Load in pounds	Compressive strength - p.s.i.	Percent of Design
38168	3	2	E	S	28.7	172500	6010	92
38169	7	2	E	C	28.5	231500	8120	124
38170	28	2	E	C	28.9	280000	9680	148
38171	28	2	E	C	28.7	281000	9790	150
38172	SP							

Average 28 day compressive strength = 9735 p.s.i.

roblems and Solutions:
ST TRUCK=SLUMP 3.5", 75DEG F, 2ND=SLUMP 4",
5DEG F, TRUCK 4=SLUMP 4.25", 72DEG F, TRUCK 5=
LUMP 5", 68DEG F, TRUCK 6=SLUMP 4", 70DEG F
RUCK 7=SLUMP 5", 72DEG F, TRUCK 8=SLUMP 4.5",

emarks:
3DEG F APPROX. 40 MIN. BREAK BETWEEN TRUCK 7&8.
YLS UNDER TRAILOR W OF BLDG 44 WRAPPED IN YELLOW
NSULATION. FLOOR 3 WAS ORIG. GOING TO BE REG. CON
UT DUE TO CONC ORDER FLR 3 IS ALSO SILICA CONCR)

ested by: GK
olded by: TS
Reviewed by:
is[illegible]bution:

Legend

Test data:
SP = Spare Cyl.

Cap type:
E = Elastometric
S = Sulfur

Fracture Type:
C = Cone
S = Shear
CS = Cone & Shear
CSP = Cone & Split
CO = Columnar
N = Not Fully Fractured

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
AIR QUALITY DIVISION

EFFECTIVE DATE: October 18, 2021
REVISION DATE: May 12, 2022

ISSUED TO

Pharmacia & Upjohn, LLC, a subsidiary of Pfizer Inc.

State Registration Number (SRN): B3610

LOCATED AT

7000 Portage Road, Kalamazoo, Michigan 49001-0199

RENEWABLE OPERATING PERMIT

Permit Number: MI-ROP-B3610-2021a

Expiration Date: October 18, 2026

Administratively Complete ROP Renewal Application Due
Between April 18, 2025 and April 18, 2026

This Renewable Operating Permit (ROP) is issued in accordance with and subject to Section 5506(3) of Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451). Pursuant to Rule 210(1) of the administrative rules promulgated under Act 451, this ROP constitutes the permittee's authority to operate the stationary source identified above in accordance with the general conditions, special conditions and attachments contained herein. Operation of the stationary source and all emission units listed in the permit are subject to all applicable future or amended rules and regulations pursuant to Act 451 and the federal Clean Air Act.

SOURCE-WIDE PERMIT TO INSTALL

Permit Number: MI-PTI-B3610-2021a

This Permit to Install (PTI) is issued in accordance with and subject to Section 5505(1) of Act 451. Pursuant to Rule 214a of the administrative rules promulgated under Act 451, the terms and conditions herein, identified by the underlying applicable requirement citation of Rule 201(1)(a), constitute a federally enforceable PTI. The PTI terms and conditions do not expire and remain in effect unless the criteria of Rule 201(6) are met. Operation of all emission units identified in the PTI is subject to all applicable future or amended rules and regulations pursuant to Act 451 and the federal Clean Air Act.

Michigan Department of Environment, Great Lakes, and Energy

Rex Lane

Rex Lane, Kalamazoo District Supervisor

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY UNDERGROUND INJECTION CONTROL PERMIT: CLASS I HAZARDOUS

Permit Number: MI-077-1W-0001

Well Name: Well #3

Pursuant to the Underground Injection Control regulations of the United States Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations (40 CFR), Parts 124, 144, 146, 147, and 148,

Pharmacia & Upjohn Company LLC, of Kalamazoo, Michigan

hereinafter, the permittee, is hereby authorized to operate an existing Class I Hazardous Waste injection well (Well #3) located in Michigan, Kalamazoo County, T3S, R11W, Section 14, NE Quarter Section. The injection zone, or zone which will contain the hazardous constituents, for this well is Munising Group between the depths of 4260 and 5615 feet. Injection is permitted into the interval of lower Eau Claire Formation and Mt. Simon Sandstone between the depths of 4750 and 5615 feet upon the express condition that the permittee meet the restrictions set forth herein. The designated confining zone for this injection well is Trempealeau Formation.

All references to 40 CFR are to all regulations that are in effect on the date that this permit is effective. The following attachments are incorporated into this permit: A, B, C, D, E, F and G.

This permit shall become effective on FEB 2 4 2020, and shall remain in full force and effect during the life of the permit, unless: 1) the statutory provisions of Section 3004(f), (g) or (m) of the Resource Conservation and Recovery Act ban or otherwise condition the authorization in this permit; 2) the Agency promulgates rules pursuant to these sections which withdraw or otherwise condition the authorization in this permit; or 3) this permit is otherwise revoked, terminated, modified or reissued pursuant to 40 CFR §§ 144.39, 144.40 and 144.41.

This permit and the authorization to inject shall expire at midnight, DEC. 20, 2029, unless terminated.

Signed and dated: December 20, 2019

acting for
Thomas R. Short Jr.
Acting Director, Water Division

This permit consists of 20 pages and Attachments A through G.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY UNDERGROUND INJECTION CONTROL PERMIT: CLASS I HAZARDOUS

Permit Number: **MI-077-1W-0002**

Well Name: **Well #4**

Pursuant to the Underground Injection Control regulations of the United States Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations (40 CFR), Parts 124, 144, 146, 147, and 148,

Pharmacia & Upjohn Company LLC, of Kalamazoo, Michigan

hereinafter, the permittee, is hereby authorized to operate an existing Class I Hazardous Waste injection well (Well #4) located in Michigan, Kalamazoo County, T3S, R11W, Section 14, SE Quarter Section. The injection zone, or zone which will contain the hazardous constituents, for this well is Munising Group between the depths of 4260 and 5602 feet. Injection is permitted into the interval of lower Eau Claire Formation and Mt. Simon Sandstone between the depths of 4750 and 5602 feet upon the express condition that the permittee meet the restrictions set forth herein. The designated confining zone for this injection well is Trempealeau Formation.

All references to 40 CFR are to all regulations that are in effect on the date that this permit is effective. The following attachments are incorporated into this permit: A, B, C, D, E, F and G.

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Signed and dated: December 20, 2019

acting for
Thomas R. Short Jr.
Acting Director, Water Division

This permit consists of 20 pages and Attachments A through G.

THE CITY OF Kalamazoo

CITY OF KALAMAZOO
WATER RECLAMATION PLANT

WASTEWATER SERVICE
INDIVIDUAL CONTROL DOCUMENT

FOR

PHARMACIA & UPJOHN COMPANY
PFIZER INC.

7000 Portage Road
Kalamazoo, Michigan 49001

ISSUE DATE:	January 1, 2019
MODIFICATION DATE:	October 20, 2020 – New Signature Person
EXPIRATION DATE:	December 31, 2023

James H Cornell
James Cornell
Wastewater Division Manager

Steven M. Rochow
Steven M. Rochow
Environmental Compliance Specialist

Amendment No. 2

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 70 and 71, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee

1. Pharmacia & Upjohn Company LLC

2. 7000 Portage Road
PORT-41-016
Kalamazoo, MI 49001

In accordance with letter dated March 22, 2018.

3. License number: 21-32848-04 is amended in its entirety to read as follows:

4. Expiration Date: October 31, 2022

5. Docket No.: 030-38566
Reference No.:

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license	9. Authorized use
A. Cesium-137	A. Sealed Sources (Kay-Ray/Sensall, Inc., Model 7700-Y Series)	A. 5 millicuries per source and 10 millicuries total	A. For use in Kay-Ray/Sensall, Inc. Model 7062BP fixed gauging devices to perform level measurements.
B. Cesium-137	B. Sealed Sources (Thermo Fisher Scientific, Model 696894)	B. 100 millicuries per source and 120 millicuries total	B. For use in Thermo Fisher Scientific, Model 5200 fixed gauging devices to perform level measurements.
C. Cesium-137	C. Sealed Sources (Thermo Process Instruments, L.P., Model 57157C; 696894)	C. 50 millicuries per source and 50 millicuries total	C. For use in Thermo Process Instruments, L.P., Model 5201 fixed gauging devices to perform level measurements.
D. Cesium-137	D. Sealed Sources (QSA Global, Inc., Model CDC.700; CDC.711M)	D. 10 millicuries per source and 20 millicuries total	D. For use in Thermo Process Instruments, L.P., Model 5205 fixed gauging devices to perform level measurements.

PERMIT NO. GW1110251

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

GROUNDWATER DISCHARGE PERMIT

In compliance with the provisions of Michigan's Natural Resources and Environmental Protection Act, 1994 P.A. 451, as amended (NREPA), Part 31, Water Resources Protection, and Part 41, Sewerage Systems,

Pharmacia & Upjohn Company, LLC
7000 Portage Road
Kalamazoo, MI 49001

is authorized to discharge 300 gallons per day, 13,200 gallons per year of portable power wash from the Pharmacia & Upjohn Company located at

7000 Portage Road
Kalamazoo, MI 49001

designated as **Pharmacia & Upjohn Company**

to the groundwater of the State of Michigan in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit.

Rule Authorization:	Rule 2211 Authorization
Wastewater Type:	Portable Power Wash
Wastewater Treatment Method:	Special Classification
Wastewater Disposal Method:	Seepage Bed - Slow/ Medium Rate

The issuance of this permit does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Michigan Department of Environmental Quality (Department) permits, or approvals from other units of government as may be required by law.

This permit is based on an original application submitted on March 2, 2016.

This permit takes effect on May 1, 2016. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules.

This permit and the authorization to discharge shall expire at midnight, May 1, 2021. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department by November 2, 2020.

PERMIT NO. MI0002941

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251 *et seq*., as amended; the "Federal Act"); Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

Pfizer Incorporated
7000 Portage Road
Kalamazoo MI, 49001

is authorized to discharge from the **Pharmacia & Upjohn Company LLC** located at

7000 Portage Road
Kalamazoo, MI 49001

designated as **Pharmacia & Upjohn-Portage Rd**

to the receiving waters named Portage Creek and Upjohn Pond in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on March 26, 2015.

This permit takes effect on June 1, 2017. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date this permit shall supersede NPDES Permit No. MI0002941 (expiring October 1, 2015).

This permit and the authorization to discharge shall expire at midnight, **October 1, 2020**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department of Environmental Quality (Department) by **April 4, 2020**.

Issued: April 25, 2017

Original signed by Christine Alexander
Christine Alexander, Manager
Permits Section
Water Resources Division

From:	MiWaters Support <EGLE-WRD-MiWaters@michigan.gov>
Sent:	Monday, March 30, 2020 6:46 PM
To:	Madsen, Caren
Subject:	[EXTERNAL] Submission Status Change Notification - HNX-EZRG-T3KW0, Pharmacia & Upjohn-Portage Rd

MiWaters User,

This notification is to inform you of a status change on your submission of "National Pollutant Discharge Elimination System (NPDES) Industrial/Commercial Application Form (Reissuance)" (submission **HNX-EZRG-T3KW0**) for Pharmacia & Upjohn-Portage Rd. The status has been updated to status "In Process" on 3/30/2020 6:38:15 PM.

The processor assigned to your submission is Glen Schmitt.

This is an automated notification generated by the MiWaters system.

CERTIFICATION OF FACILITY'S CAPABILITY FOR TREATING AND STORING HAZARDOUS WASTE

[R 299.9508(1)(d)]

I certify under penalty of law that, based upon my review of the information presented in this document, and my inquiry of those directly responsible for gathering this information, that to the best of my knowledge and belief the Upjohn facility at 7171 Portage Road, with the exception of the incinerator, is capable of treating and storing hazardous wastes, as described in this document. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Certified By:

CHARLES E. BUXTON
(Printed Name)

20837
(Michigan P.E. Registration)

5-30-90
(Date)

CHARLES E.
BUXTON
ENGINEER
NO.
20837

Attachment C1
USE AND MANAGEMENT OF CONTAINERS

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See Form EQP 5111 for details on how to use this attachment.

R 299.9614 of the administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451); R 29.4101 to R 29.4505 promulgated pursuant to the provisions of the Michigan Fire Protection Act, PA 207, as amended (Act 207); and Title 40 of the Code of Federal Regulations (CFR) §§270.14(d), 270.15, and Part 264, Subpart I, establish requirements for the use and management of containers. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application attachment addresses requirements for the use and management of containers at the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* facility in Kalamazoo, Michigan. This attachment addresses the condition of containers, compatibility of waste with containers, management of containers, inspections, containment, special requirements for ignitable or reactive waste, special requirements for incompatible wastes, and closure.

Applicant for Operating License for Existing Facility:

☒ R 299.9614 use and management of containers

Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility:

☐ R 299.9614 use and management of containers

INTRODUCTION

The container standards are performance standards for containers and container storage areas. Completion of this template should result in a demonstration of how your facility will meet these standards. A drawing of the B388 containment building in included in Figure 4.

C1.A DESCRIPTION OF CONTAINERS
[R 299.9614 and 40 CFR §264.171]

The B388 hazardous waste management unit shall store no more than 280, 55-gallon drums or equivalent. The volume of hazardous waste shall not exceed 15,400 gallons. All containers stored in B388 will be in good condition, free of visible leaks, severe rust or apparent structural damage that might compromise the integrity of the container. Good condition of containers will be assured by routine weekly inspections as described in Attachment A5.

C1.B CONDITION OF CONTAINERS

[R 299.9614 and 40 CFR §264.171]

All containers will be inspected upon receipt within the hazardous waste management unit. Containers will also be inspected on a weekly basis to ensure the containers remain in good condition. Containers that are not in good condition will be placed into an approved DOT overpack.

C1.C COMPATIBILITY OF WASTE WITH CONTAINERS

[R 299.9614 and 40 CFR §264.172]

All materials will be packaged in appropriate DOT containers such as compatible glass, plastic, metal, or fiber containers of sound integrity, properly packaged labpacks, or cartons containing prepackaging goods in glass or metal containers.

C1.D MANAGEMENT OF CONTAINERS

[R 299.9614 and 40 CFR §264.173]

Containers will remain closed while in storage except when adding waste or during sampling. Containers will be kept on pallets. The pallets may be stacked a maximum of two high. Special secondary containment pallets will be used for storage of incompatible wastes and appropriate separation distances will be observed.

C1.E INSPECTIONS

[R 299.9614 and 40 CFR §264.174]

A minimum of aisle space of 2 feet will be maintained to facilitate inspections, allow for fire-fighting equipment and personnel if required, and allow deployment of spill control and clean-up equipment. The containers in this area will be inspected at least weekly as described in Attachment A5 to detect and remedy any degradation of waste containers or the containment system.

C1.F CONTAINMENT

[R 299.9614 and 40 CFR §§264.175 and 270.15]

C1.F.1 Secondary Containment System Design and Operation for Containers with Free Liquids

[R 299.9614 and 40 CFR §§264.175(a) and 270.15(a)]

B388 is totally enclosed to prevent accumulation of precipitation. Secondary containment consists of a six-inch high curb that runs the entire length of the storage area and a sloped floor that directs accumulated liquids to a central blind sump.

C1.F.1(a) Requirement for Base or Liner

[R 299.9614 and 40 CFR §§264.175(b)(1) and 270.15(a)(1)]

The floor, curbing and sump are constructed of low permeable microsilica concrete and are free of cracks or gaps. Joints in the floor and sump wall are constructed with stainless steel water stops and filled with a dimeric sealant. The collection sump in the center of B388 is sealed with a Ceilcote 74 insert with 387 coating and the sump in the unloading station is sealed with Overkote Plus V coating system. Plans and specifications for the containment are provided in Appendix C-1. The materials of the containment structure were selected to be resistant to the wastes stored in this area.

C1.F.1(b) Containment System Drainage

[R 299.9614 and 40 CFR §§264.175(b)(2) and 270.15(a)(2)]

The floor in B388 is sloped in a manner to promote liquid flow away from the stored containers towards the collection sump. The load/unload area is also sloped to a collection sump.

C1.F.1(c) Containment System Capacity

[R 299.9614 and 40 CFR §§264.175(b)(3) and 270.15(a)(3)]

The collection sumps are 24-inch diameter by 4-foot-long non-reinforced concrete pipes providing a storage capacity of approximately 100 gallons each. The holding capacity of the floor of the storage area itself is 1,765 gallons. The holding capacity of the load/unloading area is approximately 10,800 gallons. The total spill containment capacity of the facility is 12,705 gallons. The maximum capacity of the storage area is 280 55-gallon drums (15,400 gallons). The dimensions and structural characteristics of the sump and containment capacities are provided in Figure 4.

C1.F.1(d) Control of Run-on

[R 299.9614 and 40 CFR §§264.175(b)(4) and 270.15(a)(4)]

B388 is roofed and totally enclosed to prevent precipitation from entering the containment area of the drum storage. The facility is elevated at a minimum of 10 inches from the surrounding ground level, which prevents run-on from entering the facility.

C1.F.1(e) Removal of Liquids from Containment System

[R 299.9614 and 40 CFR §§264.175(b)(5) and 270.15(a)(5)]

The containment sumps will be inspected on a daily basis. Accumulated water from eye wash/safety shower testing or vehicle runoff will be removed as necessary to ensure containment capacity is maintained. Sumps that are full of water or containing material from a spill or leaking container will be emptied with 24-hrs. Accumulated liquids are removed by a vacuum truck.

The nature of the accumulated liquids can be determined through an investigation of the origin of the materials (i.e., any evidence of spilled or leaked containers) or through evidence of discoloration or odor to determine appropriate disposition.

C1.G SPECIAL REQUIREMENTS FOR IGNITABLE OR REACTIVE WASTE

[R 299.9614 and 40 CFR §§264.176 and 270.15(b)(2)]

The storage of all ignitable wastes in container areas takes place more than 50 feet away from the facility's property lines. The labeling, sealing, handling, stacking, and storing of these containers is done in a manner that minimizes the possibility of these wastes experiencing any fires, explosions, or reactions.

It is the company's policy to prohibit all smoking on its property. "No Smoking" signs are prominently displayed within the plant and wherever ignitable wastes in containers are stored. The wastes are also separated or protected from sources of ignition, such as open flames, smoking, cutting, and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. If any type of work is to be done in these waste storage areas, a "hot work permit" must first be obtained to ensure that all work within the storage area conforms to these necessary hazard prevention procedures.

C1.H SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTES

[R 299.9614 and 40 CFR §§264.177(c) and 270.15(b)(2)]

Incompatible materials will be segregated with containment pallets according to the 49 CFR Part 177.848, Segregation Table for Hazardous Material.

C1.I CLOSURE

[R 299.9614 and 40 CFR §264.178]

At closure, all hazardous waste and hazardous waste residues will be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues will be decontaminated or removed as outlined in section A11.A.5(a).

ATTACHMENT C11
SUBPART AA
AIR EMISSIONS FROM PROCESS VENTS

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504, R 299.9508, R 299.9605, and R 299.9630; and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart AA, and 40 CFR §270.24 establish requirements for controlling organic air emissions from process vents. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template includes the information required by 40 CFR §270.24 to address air emission control requirements for process vents at hazardous waste management facilities for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo, Michigan.

(Check as Appropriate)

☐ Applicant for Operating License for Existing Facility

☐ Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility

☐ Process Vents Subject to 40 CFR Part 264, Subpart AA (R 299.9630)

☒ No Process Vents Exist That Are Subject to 40 CFR Part 264, Subpart AA (R 299.9630)

C11.A Air Emissions from Process Vents
[R 299.9630 and 40 CFR Part 264, Subpart AA]

Process vents are not used in building 388.

C11.A.1 Implementation Schedule
[R 299.9630 and 40 §CFR 270.24(a)]

Not applicable

C11.A.2 Waste Streams
[R 299.9630 and 40 CFR §264.1034(d)]

Not applicable

C11.A.2(a) Organic Compound Concentration Determination Via Direct Measurement
[R 299.9630 and 40 CFR §264.1034(d)(1)]

Not applicable

C11.A.2(a)(1) Sampling Parameters

[R 299.9630 and 40 CFR §264.1034(d)(1)(i) and (ii)]

Not applicable

C11.A.2(a)(2) Analytical Results

[R 299.9630 and 40 CFR §264.1034(d)(1)(iii)]

Not applicable

C11.A.2(a)(3) Calculation of Total Organic Compound Concentration

[R 299.9630 and 40 CFR §264.1034(d)(1)(iv)]

Not applicable

C11.A.2(b) Organic Compound Concentration Determination Via Process Knowledge

[R 299.9630 and 40 CFR §264.1034(d)(2)]

Not applicable

C11.A.2(c) Date and Frequency of Determination

[R 299.9630 and 40 CFR §264.1034(e)]

Not applicable

C11.A.3 Unit Description

[R 299.11003 and 40 CFR §270.24(b)(1)]

Not applicable

C11.A.4 Emission Estimates

[R 299.11003 and 40 CFR §270.24(b)(1)]

Not applicable

C11.A.4(a) Emission Rates

[R 299.11003 and 40 CFR §270.24(b)(2)]

Not applicable

C11.A.4(b) Emission Reductions

[R 299.11003 and 40 CFR §270.24(b)(2)]

Not applicable

C11.A.4(c) Engineering Calculations

[R 299.11003 and 40 CFR §270.24(b)(2)]

Not applicable

C11.A.4(d) Performance Test Plan

[R 299.9630 and 40 CFR §264.1032(c)]

Not applicable

C11.A.4(d)(1) Engineering Description of Control Device and Closed-Vent System

[R 299.9630 and 40 CFR §264.1034]

Not applicable

C11.A.4(d)(2) Planned Timing

[R 299.9630 and 40 CFR §264.1034(c)]

Not applicable

C11.A.4(d)(3) Sampling and Monitoring Procedures

[R 299.9630 and 40 CFR §264.1034(c)]

Not applicable

C11.A.4(e) Performance Test Results

[R 299.9630 and 40 CFR §264.1034(c)]

Not applicable

C11.A.4(e)(1) Description of Test Runs

/R 299.9630 and 40 CFR §264.1034(c)]

C11.A.4(e)(2) Velocity and Volumetric Flow Rate

[R 299.9630 and 40 CFR §264.1034(c)]

Not applicable

C11.A.4(e)(3) Organic Compound Content

[R 299.9630 and 40 CFR §264.1034(c)]

Not applicable

C11.A.4(e)(4) Total Organic Mass Flow Rate

[R 299.9630 and 40 CFR §264.1034(c)(1)(iv)]

Not applicable

C11.A.4(e)(5) Total Organic Compound Emissions

[R 299.9630 and 40 CFR §264.1034(c)(1)(v) and (vi)]

Not applicable

C11.A.5 Condenser and Closed-Vent System

[R 299.9630 and 40 CFR §§264.1033 and 264.1035]

Not applicable

C11.A.5(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(b)]

Not applicable

C11.A.5(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.5(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.6 Thermal Vapor Incinerator and Closed-Vent System

[R 299.9630 and 40 CFR §264.1033 and 264.1035]

Not applicable

C11.A.6(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(c)]

Not applicable

C11.A.6(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.6(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.7 Catalytic Vapor Incinerator and Closed-Vent System

[R 299.9630 and 40 CFR §§264.1033 and 264.1035]

Not applicable

C11.A.7(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(c)]

Not applicable

C11.A.7(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.7(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.8 Boiler/Process Heater and Closed-Vent System

[R 299.9630 and 40 CFR §§264.1033 and 264.1035]

Not applicable

C11.A.8(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(c)]

Not applicable

C11.A.8(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.8(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.9 Flare and Closed-Vent System

[R 299.9630 and 40 CFR §§264.1033 and 264.1035]

Not applicable

C11.A.9(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(d)]

Not applicable

C11.A.9(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.9(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.10 Carbon Absorber and Closed-Vent System

[R 299.9630 and 40 CFR §§264.1033 and 264.1035]

Not applicable

C11.A.10(a) Applicable Standards

[R 299.9630 and 40 CFR §264.1033(g) and (h)]

Not applicable

C11.A.10(b) Design

[R 299.9630 and 40 CFR §264.1035(b)(3)(ii)]

Not applicable

C11.A.10(c) Design Analysis

[R 299.9630 and 40 CFR §264.1035(b)(4)(iii)]

Not applicable

C11.A.11 Performance Test Plan for Other Control Devices

[R 299.9630 and 40 CFR §§270.24(c) and 264.1035(b)(3)]

Not applicable

C11.A.12 Certification Statements

[R 299.9630 and 40 CFR §264.1030(e)]

Not applicable

ATTACHMENT C11
SUBPART BB
AIR EMISSIONS FROM EQUIPMENT LEAKS

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy’s (EGLE) *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan’s Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504, R 299.9508, R 299.9605, and R 299.9631; and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart BB, and 40 CFR §270.25 establish requirements for controlling organic air emissions from equipment leaks. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses air emission control requirements for equipment leaks at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo*]*, Michigan.

(Check as Appropriate)

☒ Applicant for Operating License for Existing Facility

☐ Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility

☐ Equipment Subject 40 CFR Part 264, Subpart BB (R 299.9631)

☒ No Equipment Exists That Is Subject to 40 CFR Part 264, Subpart BB (R 299.9631)

☐ Applicant Elects to Document Compliance with the Relevant Provisions of the Regulations at 40 CFR Part 60, Part 61, or Part 63 Rather than 40 CFR Part 264, Subpart BB

C11.B AIR EMISSIONS FROM EQUIPMENT LEAKS

[R 299.9631 and 40 CFR Part 264, Subpart BB]

Not Applicable

C11.B.1 Waste Streams

[R 299.9631 and 40 CFR §264.1050(b)]

Not Applicable

C11.B.1(a) Organic Compound Concentration Determination Via Direct Measurement

[R 299.9631 and 40 CFR §264.1063(d)(1) and (2)]

Not Applicable

C11.B.1(a)(1) Sampling Parameters

[R 299.9631 and 40 CFR §264.1063(d)(1) and (2)]

☞ Not Applicable

C11.B.1(a)(2) Analytical Results

[R 299.9631 and 40 CFR §264.1063(d)(1) and (2)]

Not Applicable

C11.B.1(b) Organic Compound Concentration Determination Via Process Knowledge

[R 299.9631 and 40 CFR §264.1063(d)(3)]

Not Applicable

C11.B.1(c) Date and Frequency of Determination

[R 299.9631 and 40 CFR §264.1063(d)]

Not Applicable

C11.B.1(d) Light or Heavy Liquid Designation

[R 299.9631 and 40 CFR §264.1063(h)]

Not Applicable

C11.B.2 Equipment Identification

[R 299.9631 and 40 CFR §§264.1050 and 270.25(a)]

Not Applicable

C11.B.3 Equipment with No Detectable Emissions

[R 299.9631 and 40 CFR §264.1064(g)(2)]

Not Applicable

C11.B.3(a) Identification Numbers

[R 299.9631 and 40 CFR §264.1064(g)(1)]

Not Applicable

C11.B.3(b) Monitoring Procedures

[R 299.9631 and 40 CFR §264.1063]

Not Applicable

C11.B.3(c) Comparison to Background

[R 299.9631 and 40 CFR §264.1063(c)(2)]

Not Applicable

C11.B.3(d) Pump Standards

[R 299.9631 and 40 CFR §§264.1052 and 264.1058]

Not Applicable

C11.B.3(e) Compressor Standards

[R 299.9631 and 40 CFR §264.1053]

Not Applicable

C11.B.3(f) Valve Standards

[R 299.9631 and 40 CFR §264.1057 and 264.1058]

Not Applicable

C11.B.4 Closed-Vent Systems and Control Equipment

[R 299.9631 and 40 CFR §264.1060]

Not Applicable

C11.B.4(a) Condenser

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(a)(1) Identification Numbers

[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(a)(2) Applicable Standards

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(a)(3) Design

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(a)(4) Design Analysis

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(b) Thermal Vapor Incinerator

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(b)(1) Identification Numbers
[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(b)(2) Applicable Standards
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(b)(3) Design
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B(4)(b)(4) Design Analysis
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(c) Catalytic Vapor Incinerator
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(c)(1) Identification Numbers
[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(c)(2) Applicable Standards
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(c)(3) Design
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(c)(4) Design Analysis
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(d) Boiler or Process Heater
[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(d)(1) Identification Numbers

[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(d)(2) Applicable Standards

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(d)(3) Design

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(d)(4) Design Analysis

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(e) Flare

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(e)(1) Identification Numbers

[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(e)(2) Applicable Standards

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(e)(3) Design

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable
.

C11.B.4(e)(4) Design Analysis

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(f) Carbon Absorber

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(f)(1) Identification Numbers

[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(f)(2) Applicable Standards

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(f)(3) Design

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(f)(4) Design Analysis

[R 299.9631 and 40 CFR §264.1060(a)]

Not Applicable

C11.B.4(g) Implementation Schedule

[R 299.9630 and 40 CFR §270.25(b)]

Not Applicable

C11.B.4(h) Other Control Devices

[R 299.9631 and 40 CFR §§264.1060(a) and 270.25(c)]

Not Applicable

C11.B.4(h)(1) Identification Numbers

[R 299.9631 and 40 CFR §270.25(a)(1)]

Not Applicable

C11.B.4(h)(2) Performance Test Plan

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(2)(i) Engineering Description of Control Device and Closed Vent System

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(2)(ii) Planned Timing

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(2)(iii) Sampling and Monitoring Procedures

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3) Performance Test Results

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3)(i) Description of Actual Test Runs

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3)(ii) Velocity and Volumetric Flow Rate

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3)(iii) Organic Compound Content

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3)(iv) Total Organic Compound Mass Flow Rate

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.4(h)(3)(v) Total Organic Compound Emissions

[R 299.9631 and 40 CFR §§264.1035(b)(3) and 270.25(c)]

Not Applicable

C11.B.5 Pumps in Light Liquid Service

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.6 Compressors

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.7 Pressure Relief Devices in Gas or Vapor Service

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.8 Sampling Connection Systems

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.9 Open-ended Valves or Lines

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.10 Valves in Gas/Vapor Service or in Light Liquid Service

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.11 Pumps and Valves in Heavy Liquid Service, Pressure Relief Devices in Light Liquid or Heavy Liquid Service, Flanges, and Other Connectors

[R 299.9631 and 40 CFR §270.25(d)]

Not Applicable

C11.B.12 Certification Statements

[R 299.9631 and 40 CFR §270.25(e)(4) and (5)]

Not Applicable

C11.B.13 Documentation of Compliance with the Relevant Provisions of the Regulations at 40 CFR Part 60, Part 61, or Part 63 Rather than 40 CFR Part 264, Subpart BB

[R 299.9631 and 40 CFR §§264.1064(m) and 40 CFR 270.25(d)]

Not Applicable

ATTACHMENT C11
SUBPART CC
AIR EMISSIONS FROM TANKS, CONTAINERS, AND SURFACE IMPOUNDMENTS

This document is an attachment to the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) *Instructions for Completing Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See Form EQP 5111 for details on how to use this attachment.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9504, R 299.9508, R 299.9605, and R 299.9634; and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart CC, and 40 CFR §270.27, establish requirements for controlling organic air emissions from tanks, containers, and surface impoundments. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application template addresses air emission control requirements for tanks, containers, and surface impoundments at the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in Kalamazoo, Michigan.

(Check as Appropriate)

☒ Applicant for Operating License for Existing Facility

☐ Applicant for Operating License for New, Altered, Enlarged, or Expanded Facility

☒ Tanks, Containers, or Surface Impoundments Subject to 40 CFR Part 264, Subpart CC (R 299.9634)

☐ No Tanks, Containers, or Surface Impoundments Subject to 40 CFR Part 264, Subpart CC, Exist at the Facility (R 299.9634)

C11.C AIR EMISSIONS FROM TANKS, CONTAINERS, AND SURFACE IMPOUNDMENTS
[R 299.9634 and 40 CFR Part 264, Subpart CC]

Check appropriate boxed below to identify the types of units that exist at your facility.

☐ Tanks

☒ Containers

☐ Surface Impoundments

C11.C.1 Waste Streams
[R 299.9634 and 40 CFR §264.1082(c)]

Wastes for container storage may be liquids, semi-solids, solids or compressed gases. The specific identification numbers of the waste types to be stored in containers can be found in Table A2-1. These materials consist primarily of spent solvents; expired or off-specification raw materials, products, returned goods and pharmaceutical raw materials; process filter cakes; and laboratory chemicals. Incompatible materials will be segregated with containment pallets according to the 49 CFR Part *177.848, Segregation Table for Hazardous Material*.

C11.C.1(a) Average VO Concentration Determination Via Direct Measurement at the Point of Waste Origination

[R 299.9634 and 40 CFR §264.1083]

No exemption is claimed.

C11.C.1(b) Average VO Concentration Determination Via Process Knowledge at the Point of Waste Origination

[R 299.9634 and 40 CFR §264.1083(a)(2)]

Not Applicable. See C11.C.1(a)

C11.C.1(c) Average VO Concentration Determination Via Direct Measurement at the Point of Waste Treatment

[R 299.9634 and 40 CFR §264.1083(b)]

No exemption is claimed.

C11.C.1(d) Maximum Organic Vapor Pressure Determination of Hazardous Waste in a Tank Using Level 1 Controls Via Direct Measurement

[R 299.9634 and 40 CFR §264.1083(c)]

Tanks using Level 1 Controls are not used in building 388.

C11.C.1(d)(1) Sampling Parameters

[R 299.9634 and 40 CFR §264.1083(c)]

Not applicable

C11.C.1(d)(2) Analytical Results

[R 299.9634 and 40 CFR §264.1083(c)]

Not applicable

C11.C.1(e) Maximum Organic Vapor Pressure Determination of Hazardous Waste in a Tank Using Level 1 Controls Via Process Knowledge

[R 299.9634 and 40 CFR §264.1083(c)]

Not applicable

C11.C.1(f) Description of Procedures for Determining No Detectable Organic Compound Emissions

[R 299.9634 and 40 CFR §§264.1083(d) and 270.27(a)(6)]

Not applicable

C11.C.2 Tanks Description

[R 299.9634 and 40 CFR §270.27(a)(1) and (3)]

Not applicable

C11.C.2(a) Description of Level 1 Controls

[R 299.9634 and 40 CFR §264.1084(c)]

Not applicable

C11.C.2(a)(1) Maximum Organic Vapor Pressure Limit Design Capacity

[R 299.9634 and 40 CFR §264.1084(b)]

Not applicable

C11.C.2(a)(2) Description of Fixed Roof

[R 299.9634 and 40 CFR §264.1084(c)(2)]

Not applicable

C11.C.2(a)(3) Description of Closure Devices and Operating Procedures

[R 299.9634 and 40 CFR §264.1084(c)(3)]

Not applicable

C11.C.2(a)(4) Description of Inspection Procedures

[R 299.9634 and 40 CFR §264.1084(c)(4)]

Not applicable

C11.C.2(b) Description of Level 2 Controls

[R 299.9634 and 40 CFR §264.1084(d)]

Tanks using Level 2 Controls are not used building 388.

C11.C.2(b)(1) Fixed Roof and Internal Floating Roof

Not applicable

C11.C.2(b)(2) External Floating Roof

[R 299.9634 and 40 CFR §264.1084(f)]

Not applicable

C11.C.2(b)(3) Tank Vented to Closed-vent System

[R 299.9634 and 40 CFR §264.1084(g)]

Not applicable

C11.C.2(b)(4) Pressure Tank
[R 299.9634 and 40 CFR §264.1084(h)]

Not applicable

C11.C.2(b)(5) Tank Located Within an Enclosure Vented to a Combustion Device
[R 299.9634 and 40 CFR §264.1084(i)]

Not applicable

C11.C.3 Surface Impoundment Description
[R 299.9634 and 40 CFR §264.1085]

Surface Impoundments are not used in building 388.

C11.C.3(a)(1) Description of Floating Membrane Cover
[R 299.9634 and 40 CFR §§264.1085(c) and 270.27(a)(4)]

Not applicable

C11.C.3(a)(2) Description of Cover Vented through a Closed-Vent System
[R 299.9634 and 40 CFR §264.1085(d)]

Not applicable

C11.C.4 Container Descriptions
[R 299.9634 and 40 CFR §§264.1086, and 270.27(a)(2)]

The B388 hazardous waste management unit shall store no more than 280, 55-gallon drums or equivalent. The volume of hazardous waste shall not exceed 15,400 gallons. All containers stored in B388 will be in good condition, free of visible leaks, severe rust or apparent structural damage that might compromise the integrity of the container. Good condition of containers will be assured by *routine weekly inspections as described in attachment A5.*

C11.C.4(a) Description of Container Level 1 Controls
[R 299.9634 and 40 CFR §264.1086(b) and (c)]

Container Level 1 controls include:

- Using a container that meets the applicable US Department of Transportation (DOT) regulations on packaging hazardous materials for transportation.
- Each container is equipment with a cover, that is acceptable for that container, and is kept closed

C11.C.4(a)(1) Michigan Department of Transportation Specifications
[R 299.9634 and 40 CFR §264.1086(c)(1)]

All materials will be packaged in appropriate DOT containers such as compatible glass, plastic, metal or fiber containers of sound integrity, properly packaged labpacks, or cartons containing prepackaging goods in glass or metal containers.

C11.C.4(a)(2) Cover and Closure Devices
[R 299.9634 and 40 CFR §264.1086(c)]

All covers and closure devices on containers that are stored in B388 will be in good condition, free of visible leaks, severe rust or apparent structural damage that might compromise the integrity of the *container.*

C11.C.4(a)(3) Open-Top Containers with Organic Vapor-Suppressing Barrier
[R 299.9634 and 40 CFR §264.1086(c)]

Not Applicable.

C11.C.4(a)(4) Inspection Procedures
[R 299.9634 and 40 CFR §264.1086(c)(4)]

A minimum of aisle space of 2 feet will be maintained to facilitate inspections, allow for firefighting equipment and personnel if required and allow deployment of spill control and clean-up equipment. The containers in this area will be inspected at least weekly as described in attachment A5 to detect and remedy any degradation of waste containers or the containment system.

Containers are visually inspected prior to being accepted into building 388 for cracks, holes, gaps, or other open spaces into the interior of the container when the container cover and closure devices are secured in the closed position.

C11.C.4(b) Description of Container Level 2 Controls
[R 299.9634 and 40 CFR §264.1086(d)]

Container Level 2 controls include:

- Using a container that meets the applicable US Department of Transportation (DOT) regulations on packaging hazardous materials for transportation.

C11.C.4(b)(1) Michigan Department of Transportation Specifications
[R 299.9634 and 40 CFR §264.1086(d)(1)]

All materials will be packaged in appropriate DOT containers such as compatible glass, plastic, metal or fiber containers of sound integrity, properly packaged labpacks, or cartons containing prepackaging goods in glass or metal containers.

C11.C.4(b)(2) Container Operating with No Detectable Emissions
[R 299.9634 and 40 CFR §264.1086(d)(1)]

Not Applicable.

C11.C.4(b)(3) Containers Demonstrated to be Vapor-Tight
[R 299.9634 and 40 CFR §264.1086(d)(1)]

Not Applicable.

C11.C.4(b)(4) Container Waste Transfer Procedures
[R 299.9634 and 40 CFR §264.1086(d)(2)]

The transfer of hazardous waste in or out of a container is conducted in a manner to minimize exposure of hazardous waste to the atmosphere. This is accomplished by using any of the methods below:

- A submerged-fill pipe or other submerged fill-method to load liquids into a level 2 container.
- A vapor-balancing system or a vapor-recovery system to collect and control the vapors displaced by the container during the filling operations.
- A fitted opening in the top of a container through which the hazardous waste is filled and subsequently purging the transfer line before removing it from the container opening.

C11.C.4(b)(5) Cover and Closure Management Procedures

[R 299.9634 and 40 CFR §264.1086(d)(3)]

The covers on containers are opened only for the purpose of removing or adding waste and measuring waste levels or accessing interior container equipment.

C11.C.4(b)(6) Inspection Procedures

[R 299.9634 and 40 CFR §264.1086(d)(4)]

A minimum of aisle space of 2 feet will be maintained to facilitate inspections, allow for firefighting equipment and personnel if required and allow deployment of spill control and clean-up equipment. The containers in this area will be inspected at least weekly as described in attachment A5 to detect and remedy any degradation of waste containers or the containment system.

Containers are visually inspected prior to being accepted into building 388 for cracks, holes, gaps, or other open spaces into the interior of the container when the container cover and closure devices are secured in the closed position.

C11.C.4(c) Description of Container Level 3 Controls

[R 299.9634 and 40 CFR §264.1086(e)]

Not applicable: Containers using Level 3 Controls are not used in B388.

C11.C.4(c)(1) Closed-Vent System Vented to a Control Device

[R 299.9634 and 40 CFR §264.1086(e)(1)(i) and (2)(ii)]

Not applicable

C11.C.4(c)(2) Container Vented to an Enclosure That Is Vented to a Control Device

[R 299.9634 and 40 CFR §264.1086(e)(1)(ii) and (2)(i)]

Not applicable

C11.C.4(c)(3) Safety Devices

[R 299.9634 and 40 CFR §264.1086(e)(3)]

Not applicable

C11.C.4(c) 4) Inspection and Monitoring Procedures

[R 299.9634 and 40 CFR §264.1086(e)(4)]

Not applicable

C11.C.4(c)(5) Records Management
[R 299.9634 and 40 CFR §264.1086(e)(5)]

Not applicable

C11.C.4(c)(6) Waste Transfer Procedures
[R 299.9634 and 40 CFR §264.1086(e)(2)]

Not applicable

C11.C.5 Description of Closed-Vent Systems and Control Devices
[R 299.9634 and 40 CFR §§264.1087 and 270.27(a)(5)]

Not applicable: Closed-Vent Systems or Control Devices are not used building 388.

C11.C.5(a)(1) Description of Closed-Vent System
[R 299.9634 and 40 CFR §264.1087(b)]

Not applicable

C11.C.5(a)(2) Description of Control Devices
[R 299.9634 and 40 CFR §264.1087(c)]

Not applicable

C11.C.5(a)(3) Inspection Procedures
[R 299.9634 and 40 CFR §264.1087(b)(4) and (c)(7)]

Not applicable

C11.C.6 Description of Record Keeping Procedures
[R 299.9634 and 40 CFR §264.1089(a)]

The required record keeping in 264.1089(a) is not applicable to building 388.

C11.C.6(a) Description of Tank Record Keeping Procedures
[R 299.9634 and 40 CFR §264.1089(b)]

Not applicable: Tanks are not used to manage hazardous waste in building 388.

C11.C.6(a)(1) Tank Identification Numbers
[R 299.9634 and 40 CFR §264.1089(b)(1)(i)]

Not applicable

C11.C.6(a)(2) Inspection Records
[R 299.9634 and 40 CFR §264.1089(b)(1)(ii)]

Not applicable

C11.C.6(a)(3) Documentation for Determination of Maximum Organic Vapor Pressure for Fixed Roof Level 1 Controls

[R 299.9634 and 40 CFR §264.1089(b)(2)(i)]

Not applicable

C11.C.6(a)(4)2 Documentation Showing Internal Floating Roof Design

[R 299.9634 and 40 CFR §264.1089(b)(2)(ii)]

Not applicable

C11.C.6(a)(5) Documentation Showing External Floating Roof Design and Seal Inspections

[R 299.9634 and 40 CFR §264.1089(b)(2)(iii)]

Not applicable

C11.C.6(a)(6) Calculations and Records for Demonstrating Compliance with Enclosure Requirements for Level 2 Controls

[R 299.9634 and 40 CFR §264.1089(b)(2)(iv)]

Not applicable

C11.C.6(b) Description of Surface Impoundment Record Keeping Procedures

[R 299.9634 and 40 CFR §264.1089(c)]

Not applicable: Surface impoundments are not used to manage hazardous waste in building 388.

C11.C.6(b)(1) Surface Impoundment Identification Numbers

[R 299.9634 and 40 CFR §264.1089(c)(1)]

Not applicable

C11.C.6(b)(2) Floating Membrane or Cover Certifications

[R 299.9634 and 40 CFR §264.1089(c)(2)]

Not applicable

C11.C.6(b)(3) Inspection Records

[R 299.9634 and 40 CFR §264.1089(c)(3)]

Not applicable

C11.C.6(b)(4) Closed-Vent System and Control Device Certifications and Records

[R 299.9634 and 40 CFR §264.1089(c)(4)]

Not applicable

C11.C.6(c) Description of Container Level 3 Control Record Keeping Procedures

[R 299.9634 and 40 CFR §264.1089(d)]

Not applicable: Level 3 containers are not used to manage hazardous waste in building 388.

C11.C.6(c)(1) Calculations Verifying Compliance with Enclosure Requirements
[R 299.9634 and 40 CFR §264.1089(d)(1)]

Not applicable

C11.C.6(c)(2) Closed-Vent System and Control Device Certifications and Records
[R 299.9634 and 40 CFR §264.1089(d)(2)]

Not applicable

C11.C.6(d) Closed-Vent System and Control Device Records
[R 299.9634 and 40 CFR §264.1089(e)]

Not applicable: Closed-vent system and control device are not used for container compliance in building 388.

C11.C.6(d)(1) Performance Certification
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)]

Not applicable

C11.C.6(d)(2) Design Analysis Documentation
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(ii)]

Not applicable

C11.C.6(d)(3) Performance Test Plan and Results
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(iii)]

Not applicable

C11.C.6(d)(4) Descriptions of Sensors, Modifications, and Locations
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(iv)]

Not applicable

C11.C.6(d)(5) Planned Routine Maintenance Schedules
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(v)]

Not applicable

C11.C.6(d)(6) Descriptions of Unplanned Malfunctions
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(vi)]

Not applicable

C11.C.6(d)(7) Management of Carbon Removed from a Carbon Absorption System
[R 299.9634 and 40 CFR §264.1089(e)(1)(i)(vii)]

Not applicable

C11.C.6(e) Records Required for Exempt Units

[R 299.9634 and 40 CFR §264.1089(f)]

Not applicable: Building 388 does not have any exempt units that meet the requirements of 264.1089(f).

C11.C.6(e)(1) Waste Determination Results

[R 299.9634 and 40 CFR §264.1089(f)(1)]

Not applicable

C11.C.6(e)(2) Identification Numbers of Treatment Units

[R 299.9634 and 40 CFR §264.1089(f)(2)]

Not applicable

C11.C.6(f) Description of Covers Designated as Unsafe to Inspect and Monitor

[R 299.9634 and 40 CFR §264.1089(g)]

Not applicable

C11.C.6(g) Documentation of Alternative Compliance with 40 CFR Part 60, Subpart VV, or 40 CFR Part 61, Subpart V

[R 299.9634 and 40 CFR §264.1089(h)]

Building 388 is not subject to 40CFR, Part 60, Subpart VV or 40CFR, Part61, Subpart V.

C11.C.6(h) Documentation Required for Tanks and Containers Not Using Air Emission Controls

[R 299.9634 and 40 CFR §264.1089(i)]

Not applicable.

C11.C.6(h)(1) List of Organic Peroxide Compounds

[R 299.9634 and 40 CFR §264.1089(i)(1)]

Not applicable.

C11.C.6(h)(2) Management of Organic Peroxide Compounds

[R 299.9634 and 40 CFR §264.1089(i)(2)]

Not applicable.

C11.C.6(h)(3) Justification for Claiming that Air Emission Controls Would Create an Undue Safety Hazard

[R 299.9634 and 40 CFR §264.1089(i)(3)]

Not applicable.

C11.C.6(i) Certifications and Identification of Federal Clean Air Act of 1990 Requirements

[R 299.9634 and 40 CFR §264.1089(j)(1) and (2)]

Building 388 is not subject to the federal clean air act of 1990.

Receipt

State EGLE Site ID Fee

Payment Receipt

PRINT

Merchant: STATE EGLE SITE ID FEE
Merchant City/State: Lansing, Michigan
Merchant Location Code: 00001
Payment Status: Success
Payment Date: 06/15/2022
Posting Date: 06/15/2022
Confirmation Number: 22061518893963
Billing Address: Latonia R. Raines
7000 Portage RD
PORT-091-106
Kalamazoo, MI 49001
(269) 833-0256
E-Mail Address: latonia.r.raines@pfizer.com
Total Amount: 1000.00 USD
Card Type: AMEX
Account #: x1003
Authorization Code: 105606
Reference: Pharmacia UpJohn Co LLC ,7000 Portage Rd
PORT-091-106,2698330256,MID000820381

ATTACHMENT 9

PHARMACIA & UPJOHN HAZARDOUS WASTE OPERATING LICENSE APPLICATION; MID 000820381

GROUNDWATER SAMPLING AND ANALYSIS PLAN

Provided For:

Pharmacia and Upjohn Company, LLC
Portage Road Facility
Kalamazoo, Michigan

Prepared By:

American Hydrogeology Corporation
6869 South Sprinkle Road
Portage, Michigan 49002

JULY 18, 2012

REVISIONS APRIL 14, 2015 (ATTACHMENTS)

REVISED JUNE 13, 2022

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ATTACHMENTS

1.0 GROUNDWATER SAMPLING AND ANALYSIS PLAN

The Groundwater Sampling and Analysis Plan (GSAP) is utilized in three corrective action monitoring programs implemented by the Pharmacia and Upjohn Company, LLC (P&U):

- Corrective Action Characterization (CAC) monitoring program,
- Corrective Action Detection (CAD) monitoring program and,
- Corrective Action Water Level (CAWL) monitoring program.

The objective of each of the corrective action monitoring programs are discussed below. Other aspects of the GSAP are described in the following sections of this document.

The CAC monitoring program is intended to provide data to measure the effectiveness of existing corrective actions managed by P&U to remediate groundwater.

The CAD monitoring program is intended to provide data to measure the vertical and horizontal extent of potential groundwater contaminant plumes to comply with Act 451 R 299.9612. Furthermore, the CAD monitoring program provides data that is evaluated to alert P&U of other potential changes in groundwater quality beneath the facility.

The CAWL monitoring program is intended to provide data to measure the hydraulic control that production wells at the facility exert upon the two aquifers present beneath the site.

Implementation of all of the above monitoring programs by P&U ensures that effective control of the groundwater plume at the facility occurs and is supported by monitoring data as part of the Corrective Action program.

Information concerning the installation, physical characteristics, and elevational data for the wells referenced in the GSAP is included in Table 1 in Attachment A. The locations of the wells are depicted on Figure 1 in Attachment B and boring logs and well construction diagrams are included as Attachment C.

2.0 CORRECTIVE ACTION CHARACTERIZATION MONITORING PROGRAM

The Corrective Action Characterization (CAC) monitoring program involves the collection of data to verify the effectiveness of corrective actions. Based on historic data the CAC network consists of one upper aquifer remediation well at the P&U manufacturing facility. As corrective actions at the site have been completed, the CAC monitoring program has reduced the number of wells in the network from five wells to its current one.

2.1 CAC Monitoring Well Network

One CAC well (Table 2 in Attachment A) was selected for the purpose of characterizing the current corrective action effectiveness. This well (OS-2) allows for identification and characterization of remediation effectiveness by measuring the constituent concentrations in the groundwater. The location of this well is shown on Figure 1 in Attachment B. Well OS-

2 is an upper aquifer pump well with an eight-inch casing diameter located upgradient and southeast of the South Tank Farm.

2.2 Groundwater CAC Monitoring Parameters and Frequency

Chemical characterization of the groundwater is performed biannually by analyzing sample(s) for the parameters listed in Table 3 of this GSAP from OS-2. As part of the CAC monitoring program, the field parameters pH, temperature, and specific conductance will be measured during the groundwater monitoring of OS-2. A request may be made to reduce sampling parameters, frequency, or to terminate sampling activities after four consecutive biannual sample events of non-detections of constituents from OS-2 samples.

3.0 CORRECTIVE ACTION DETECTION (CAD) MONITORING PROGRAM

The wells in the Corrective Action Detection (CAD) network surrounding the P&U facility were selected to verify that no detections of constituents of concern have occurred in both the upper and the lower aquifers beyond the boundaries of the Corrective Action regulated units. Ten upper aquifer and eight lower aquifer monitoring wells comprise the CAD network.

3.1 CAD Monitoring Well Network

Eighteen CAD monitoring wells (Table 4 in Attachment A) were selected for the purpose of detecting statistically-based changes of constituent concentrations in the two aquifers present beneath the facility. The locations of these wells are depicted on Figure 1 in Attachment B. The CAD wells are situated along the perimeter of areas of manufacturing and material storage to allow for detection of a potential release of constituents from areas within the facility.

Two upper aquifer and two lower aquifer wells were selected as background wells. These four wells (MW-111, MW-112, MW-115A, and MW-116) will be sampled to establish and verify upgradient concentrations of constituents in the groundwater beneath the facility. These data will alert P&U to the presence of organic and inorganic contamination that may migrate onto the P&U facility from off-site sources.

3.2 Groundwater CAD Monitoring Parameters and Frequency

A partial list of constituents currently utilized in the P&U manufacturing process were selected as the primary CAD monitoring parameters. A sub-set of the primary CAD parameter list was also developed. The parameters on the sub-set list are high use volume solvents and chromium and therefore represent constituents that are most likely to indicate an undetected release.

Groundwater from the CAD wells is monitored on a biannual basis for parameters listed in Table 5 of this GSAP. As part of the CAD monitoring program, the field parameters pH, temperature, and specific conductance will be measured during the groundwater monitoring of each CAD well.

4.0 CORRECTIVE ACTION WATER LEVEL MONITORING PROGRAM

The CAC and CAD monitoring programs are complemented by the Corrective Action Water Level (CAWL) monitoring program, which collects water level data to verify the hydraulic control created by the Corrective Action program. The CAWL network wells are selected to evaluate the potential changes in groundwater flow due to natural conditions or from the influence of P&U production well operation.

4.1 CAWL Monitoring Well Network

The CAWL network consists of 53 wells and includes the 18 CAD wells. These wells are largely located at the P&U facility, but also include wells located outside the boundaries of the site. The location of these wells allows measurement of water level responses to short-term and/or long-term variations from natural conditions and facility production well pumping activities. Production wells provide hydraulic containment of groundwater beneath the facility.

A list of the CAWL wells, separated into upper and lower aquifers, is provided in Table 6 in Attachment A. The locations of these wells are depicted on Figure 1 in Attachment B. The CAWL network is comprised of 32 upper aquifer and 21 lower aquifer wells.

4.2 Groundwater CAWL Monitoring Frequency

A biannual monitoring program was implemented for the CAWL wells under which water levels are collected from the wells as part of the biannual CAD and CAC groundwater monitoring events. The biannual monitoring is complemented by monthly reporting of P&U production well discharges. If the average monthly pumping rates of the production wells is lower than 12.4 million gallons per day a monthly water level monitoring review may then be considered until normal pumping activities are resumed. Potentiometric maps are constructed from the biannual water level data to assess the effectiveness of hydraulic control at the facility.

5.0 GROUNDWATER SAMPLING AND ANALYSIS

The groundwater sampling and analysis plan (GSAP) was developed to direct the efforts of groundwater monitoring personnel. The GSAP includes sample preparation and procedures, personal protection equipment, sampling equipment, sampling methods, standard operating procedures, decontamination procedures, sample handling and analysis, chain-of-custody procedures, and field and laboratory quality control and quality assurance procedures. The GSAP describes sampling to be conducted for long-term groundwater monitoring at the facility. These sampling and analysis programs were derived from the Resource Conservation and Recovery Act (RCRA) groundwater monitoring Technical Enforcement Guidance Document (TEGD) and meet the requirements of 40 CFR 264.97 and Act 451 R 299.9612.

Well groundwater sampling logs (CAD and CAC examples) and chain-of-custody templates are included in Table 7 and Table 8 in Attachment A. Standard operating and decontamination procedures for field equipment, such as field water quality instruments, pumps, and bailers, are included in Section 5.5 and Section 5.6 of this GSAP.

5.1 Sampling Event Preparation and Procedures

Prior to initiating a sampling event, the senior member of the field team will ensure that the team members have the appropriate equipment and documents to complete the task. As the Quality Assurance officer (QAO), the senior team member will contact the appropriate contract laboratories at least one week prior to sample collection to obtain bottles and schedule the analyses. During sampling, the QAO will contact the laboratory manager to confirm sample collection and shipments. In the event samples are to be delivered on a Friday or holidays, the QAO will ensure that the laboratory will be able to complete any required preservations or preparations.

Prior to departure to the site for sampling, each member of the field team will have become familiar with the sampling and analysis plan for the facility. Prior to and during the sampling event, the field personnel will complete the sampling task by following these minimum procedures:

- Obtain site map, names of contacts, and access keys.
- Assemble necessary sampling and monitoring equipment, sample bottles and preservatives, trip blanks and coolers, and documentation.
- Decontaminate sampling and measuring equipment.
- Measure water levels in wells and determine volume of water in casing. If wells are to be sampled on multiple days, all water levels will be measured prior to conducting sampling in as short a period as possible.
- Inspect wells and note well condition during each sampling round.
- Measure field parameters and record data on sampling logs
- Collect samples, QA/QC samples, and place in cooler.
- Complete sample labels and logs. Portions of labels and logs may have been completed earlier in preparation for sampling. However, all other information, such as sampling date and time, must be completed immediately prior to sampling. Completed sampling logs will include sampler's initials, well identification, well depth, depth to water, presence of immiscible layer, purging methods, volume purged, containers, preservatives, field measurements, sample disposition, and other pertinent information such as the condition of the well and dedicated sampling equipment.
- Filter and preserve samples and place on ice as required.
- Complete chain-of-custody record.
- Decontaminate field sampling and measuring equipment. Pack and ship samples, deliver samples to laboratory, or sample pick-up by laboratory personnel.

5.2 Personal Protection Equipment

Based on an evaluation of the potential hazards present at the work site and the scope of work, the following minimal levels of personal protective equipment (PPE) are required for groundwater sampling:

Level: D
Visible outer wear: Reflective Safety Vest
Head Protection: Hard hat
Eye/Face Protection: Safety glasses
Boots: Steel-toe
Outer Gloves: Nitrile
Other: Per Company Requirements in Specific Locations as Listed on Safe Work Permits (if applicable)

Personal protective equipment must meet or exceed Federal, State, and Company requirements and sampler's health and safety plan. PPE will be upgraded if conditions warrant on a case-by-case basis.

5.3 Sampling Equipment

Sampling equipment to be used in this groundwater monitoring program includes the following:

- Field thermometer in Celsius (integrated or discrete);
- pH meter (integrated or discrete);
- Conductance meter (integrated or discrete);
- In-line high-capacity 0.45-micron filter;
- QED or equivalent dedicated air powered bladder (submersible) pump;
- Portable electric powered peristaltic pump;
- Portable electric powered submersible pump;
- Teflon™, polyethylene, or silicon pump hose; and
- Check-valve bottom-discharging polyvinyl chloride (PVC), polyethylene, Teflon™, or stainless steel bailer.

5.4 Sampling Methods

5.4.1 Groundwater Measurement Techniques

A number of measurement techniques may be used to determine depth to water in wells, total depth of wells, and measurements of any immiscible layer. These techniques are described in this section.

Static water levels are measured in CAD wells to determine groundwater elevations, water level fluctuations, flow patterns, and to calculate the volume of water in each monitor well and the minimum purge volume prior to sampling. Water levels are measured with an electronic water level measuring instrument in each of the CAD wells. Measurement of the water level in CAC well OS-2 is from a gauge installed on the well. Air pressure is supplied to a valve on the gauge and the depth to water is recorded.

Electrical measuring equipment cables are graduated in increments of hundredths of feet on Teflon™-coated tapes. The probe of the electrical measuring instrument is lowered into the well until the probe is in contact with the water surface at which time the electrical circuit closes and a signal is produced. These signals include audible buzzers, lights, and meters, or combinations thereof. The electrical measuring instrument is held to the known surveyed measuring point (usually the top-of-casing) of the well, and the reading is recorded to the nearest 0.01 foot. The water level elevation is calculated by subtracting the depth to water from the surveyed elevation of the measuring point.

The total depth of a well is measured by lowering the measuring instrument into the well until a weight change is detected. The depth to the bottom of the well is directly read from the instrument tape at the measuring point after the slack has been removed from the tape. Comparison of the measured depth of the well to the depth shown on well construction records provides the basis for determining casing continuity and possible sediment accumulation in wells. However, wells with packers, dedicated submersible pumps, and/or turbine pumps are precluded from total depth measurement, as discussed below.

If site conditions or data demonstrate that a change in well elevation may have occurred, or repairs to the well casing have been completed for a well, the subject well will be re-surveyed to establish a corrected top-of-casing elevation.

5.4.2 Well Purging Techniques

Purging removes stagnant and stratified water from the well and ensures that samples are representative of the aquifer water. Well purging occurs after the measurement of the static water level and measurement of the well depth (if feasible). Table 9 in Attachment A lists the means of sample collection for each of the CAC and CAD wells.

Purging equipment for the CAC well includes a dedicated turbine pump operated by P&U or a portable electric powered submersible pump. The use of a turbine pump is preferred. If the turbine pump is not pumping at the time of sample collection, P&U personnel are contacted to temporarily operate the turbine pump. If the CAC well does not have a turbine pump or it is not operable at that time, a portable electric powered submersible pump is used for purging and sampling.

Purging equipment for the CAD wells includes various types of bailers and well pumping equipment. The use of pumping equipment is preferred, providing that there is an adequate amount of water in the well. A dedicated air powered stainless steel/Teflon™ submersible QED bladder pump, or equivalent, is used for purging and sampling in the majority of the CAD wells including wells with packers.

A portable electric powered variable pumping rate (160 to 500 milliliters per minute) peristaltic pump with dedicated tubing may also be used for purging and sampling in some CAD wells with a depth to water that does not exceed 30 feet below ground surface (bgs). In the wells without packers and without a dedicated system, if a submersible pump is used, the pump intake must be immersed within the water column.

To avoid fuel contamination, gasoline is added to the fuel tank of the generator at a location away from the sampling equipment, wells, and samples. In addition, after equipment fueling and maintenance activities, sampling personnel will perform appropriate self-decontamination procedures to prevent contamination to the collected samples.

Some 2-inch diameter wells in the upper aquifer can be periodically evacuated with dedicated or disposable bailers designed for that purpose, if needed. Bailers used for well purging can be constructed of polyvinyl chloride (PVC), polyethylene, Teflon™, or stainless steel. The bailers are equipped with a check-valve and are lowered by hand into the well with polypropylene rope or Teflon™-coated stainless steel cord. These are attached to the bailer with stainless steel or Teflon™-coated fittings or tied directly to the bottom-discharging bailer.

To maintain continuity during a long-term sampling program, consistency is necessary for well evacuation methods and procedures. If possible, three to five casing volumes are purged from a well before sampling occurs. The volume of water to be purged is calculated using the following equation:

$$V = A \pi r^2 h n$$

where
V = volume of water to be purged (gallons)
A = conversion factor (7.48 = conversion from cubic feet to gallons)
π = pi (mathematical constant)
r = radius of well casing (feet)
h = length of water column (feet)
n = number of casing volumes to be purged

The time at which the required volume of water has been purged from the well can be determined by directly measuring the amount of water discharged into a container of known volume, or by measuring the time of pumping.

If a packer is present in a well, the variable "h" in the equation that represents the length of water column (feet) is calculated as the difference in the depth of the well and depth to the packer. The packer pressure (psi) at the start and end of sampling is documented.

Temperature, pH, and specific conductance are measured in the purge water and purging will continue, if possible, until these parameters have stabilized. Purge water from wells previously uncontaminated for four consecutive sampling events is disposed of at the well location. The purge water is disposed of in the facility's sanitary sewer for water in which organic constituents have been detected, or inorganic constituent detections exceeding Michigan Department of Environment, Great Lakes, and Energy Part 201 criteria.

In low-yielding wells (where the full three casing volumes cannot be obtained before the well is purged dry), purging operations use the following standard guideline. If the well recovery is greater than 75 percent of the minimum purge volume within 15 minutes after the well is purged dry, the purging prior to sampling continues until three to five casing volumes are removed. If the recovery after purging is less than 75 percent after 15 minutes, sampling is initiated with the next appearance of water.

All purging equipment is decontaminated using the specified decontamination procedures in Section 5.6. Careful consideration is given when using pumps to purge wells that are excessively contaminated with constituents since it may be difficult to adequately decontaminate severely contaminated pumps under field conditions. When such wells are encountered, alternative purging methods, such as dedicated or disposable bailers or a low-flow electric peristaltic pump with dedicated or disposable polyethylene tubing, may be used.

5.4.3 Groundwater Sample Collection

Sampling equipment for the CAD wells includes various types of bailers and well pumping equipment. The use of pumping equipment is preferred providing that there is an adequate amount of water in the well. A dedicated air-powered stainless steel/Teflon™ QED bladder pump or equivalent is used for purging and sampling in the majority of the CAD wells, including wells with packers. Groundwater samples may also be withdrawn from the CAD wells using either a peristaltic pump with dedicated or disposable polyethylene tubing or a dedicated or disposable check-valve bottom-discharging polyvinyl chloride (PVC), polyethylene, Teflon™, or stainless steel bailer.

The sampling pumps are designed so that only Teflon™, stainless steel parts, polyethylene or silicon tubing are in contact with the water sample. These materials are the most chemically-inert materials available for sampling the variety of organic and inorganic compounds monitored at the site. Other suitable materials meeting these requirements may be used. Cords or tubing attached to bailers or pumps shall be new, decontaminated, or dedicated. All groundwater samples are gently poured into the appropriate sample containers.

Groundwater samples are withdrawn from the CAC well using either a turbine pump, portable electric powered submersible pump with dedicated or disposable polyethylene tubing, or equivalent. The submersible pump is designed so that only Teflon™, stainless steel parts, polyethylene or silicon tubing are in contact with the water sample. Other suitable materials meeting these requirements may be used.

The field parameters temperature, pH, and specific conductance are measured and recorded at selected purge volumes until stabilized parameters are obtained. Comparison of succeeding measurements provides a basis for collection of samples representing ambient groundwater. Prior to obtaining these measurements, the field instrumentation is properly calibrated with reference standards in accordance with the manufacturer's recommendations and procedures. The field measurements are recorded on the sampling log along with the time and date of the groundwater sample collection. If a slowly recharging well is encountered, samples are collected as soon as feasible. The sample jars are filled in the following order: volatile organic and purgeable organic compounds, semi-volatile compounds, dissolved metals, and any remaining inorganic parameters.

Organic samples are collected and placed in glass volatile organic analysis (VOA) containers with Teflon™-lined Septa caps. All sample containers are provided by the laboratory. The containers are pre-cleaned and meet USEPA SW-846 protocol. The VOA containers are filled to zero headspace. The samples are prepared and preserved in accordance with the requirements of SW-846.

Hydrochloric acid (HCl) will be used to preserve the samples to be analyzed for volatile organic compounds. This treatment conforms with USEPA 8000 methodology for chemical analysis of water and wastes. If the sample bottles already contain preservatives, care will be taken to avoid washing preservatives out of the container. Contact between the preservative and body or clothing is to be avoided. After the VOA samples are collected, the next sample bottles filled are for other organic parameters.

The samples collected for dissolved metals analyses are filtered through a 0.45-micron filter to remove sediment prior to acidification. Preferably, filtration is done at the sampling location, but laboratory filtration is also acceptable if done on the same day as the sample is collected. Filtering must occur before preservatives are added to the sample. The standard operating procedures (SOP) described in Section 5.5 will be followed. Sample labels include the well number, sampler’s initials, date and time of collection. Once the samples are collected, they are placed on ice in a cooler or refrigerated until delivery to the laboratory.

5.5 Standard Operating Procedures

5.5.1 Turbidity Observations of Water Samples

Comment will be made on the turbidity (fine materials in suspension such as, clay, rust, fine sand, etc.) of the samples at the time of collection. A clear bottle of the groundwater is held up to the sun or another bright source of natural light for observations (clear, cloudy or dirty) of turbidity.

5.5.2 Temperature Measurements

Temperature measurements are collected in the field during purging and immediately before sample collection using an instrument possessing a thermal sensor integrated with other water quality sensors. Temperature measurements are taken in a container other than the sample bottle.

The following procedure is used to conduct field measurements using a thermometer integrated with other instrumentation:

1. Rinse the instrument sensor thoroughly with de-ionized water.
2. Immerse the sensor in a freshly collected sample.
3. Verify the instrument is in temperature mode.
4. Wait for the temperature to equilibrate (no more than 30 seconds).
5. Read and record the temperature to the nearest 0.1 degree Celsius while the sensor is immersed in the sample.
6. After completion of all parameter measurements, rinse the sensor with de-ionized water, and place it back into its protective sleeve.

5.5.3 pH Measurements

The pH of the sample is measured in the field during purging and immediately prior to collecting the water sample. The pH measurements are collected using an instrument possessing a pH electrode integrated with other water quality parameter sensors. In lieu of this pH measurement technique, a discrete pH meter may be used. The pH measurements are taken in a container other than those used for sample collection according to the following procedure:

1. Prior to sampling, set up and calibrate the pH meter according to the manufacturer's specifications to cover the expected range of values, e.g., at three pH calibration points of 4, 7, and 10. The temperature of the buffers and the sample need to be within 5 degrees Celsius of each other.
2. Rinse the electrode thoroughly with de-ionized water.
3. Immerse the electrode in the sample.
4. Wait for the reading to stabilize, but no longer than 2 minutes.
5. Read and record the pH to the nearest 0.01 units.
6. Remove the electrode from the sample and rinse it with de-ionized water.
7. Store the electrode in the buffer solution between sample measurements. Never leave the electrode outside of a solution for an extended period of time.
8. Recalibrate no less frequently than every well prior to beginning sampling.

9. When pH monitoring is completed, replace the cap over the electrode. Check that the cap contains a moist piece of cotton inside to protect the electrode from drying out.

5.5.4 Specific Conductance Measurements

Specific conductance is measured in the field during purging and immediately prior to collecting the water sample. Specific conductance measurements are collected using an instrument possessing a conductivity sensor integrated with other water quality sensors. In lieu of this specific conductance measurement technique, a discrete conductivity meter may be used. Specific conductance measurements are taken in a container other than the sample bottle:

Specific conductance measurements are taken in a different container than the sample bottle according to the following procedure:

1. Prior to sampling, set up and calibrate the conductivity meter according to the manufacturer's specifications.
2. Rinse the electrode thoroughly with de-ionized water.
3. Immerse the electrode in the sample and rotate the cell several times until the reading stabilizes.
4. Read and record the conductivity in µmhos/cm.
5. Rinse the probe thoroughly with de-ionized water.
6. Recalibrate no less frequently than every well prior to beginning sampling.

5.5.5 Groundwater Field-Filtration

The following procedure is used in filtering water for inorganic analysis utilizing an in-line high-capacity 0.45-micron disposable groundwater filter from a well with a dedicated bladder or portable submersible pump:

1. Following the collection of volatile organic samples and semi-volatile water samples for laboratory analysis from the bladder or submersible pump within the well, attach an in-line high-capacity 0.45-micron groundwater filter to the discharge line that extends from the pump.
2. Allow a minimum of 100 milliliters of sample water to pass through the filter before sample collection.
3. Fill the laboratory supplied sample container with the appropriate volume of water requested by laboratory. Place sample container in a plastic bag

and place the sample in cooler with ice. Use one filter per well and discard the filter.

The following procedure is used in filtering water for inorganic analysis utilizing an in-line high-capacity 0.45-micron groundwater filter from a well when utilizing a peristaltic pump for groundwater sampling:

1. Following the collection of volatile organic samples and semi-volatile water samples for laboratory analysis utilizing a peristaltic pump, attach a short section of silicon tubing to the discharge end of the short section of polyethylene tubing. Attach the in-line high-capacity 0.45-micron groundwater flow filter to the discharge end of the silicon tubing.

2. Allow a minimum of 100 milliliters of sample water to pass through the filter before sample collection.

3. Fill the laboratory supplied sample container with the appropriate volume of water requested by laboratory. Place sample container in a plastic bag and place the sample in a cooler with ice. Use one filter per well and discard the filter. Do not reuse the polyethylene and silicon tubing. Prepare new tubing for each new well sampled and discard all of the filter tubing.

The following procedure is used in filtering water for inorganic analysis utilizing an in-line high-capacity 45-micron groundwater filter from a well when utilizing a bailer for groundwater sampling.

1. Following the collection of volatile organic samples and semi-volatile water samples for laboratory analysis utilizing a bailer, collect a water sample from the well and place the water in a new or triple rinsed one liter glass bottle.

2. Cut an appropriate length of new polyethylene tubing and place the tubing into the one liter glass bottle. Attach a section of silicon tubing to the end of the polyethylene tubing to fit into the peristaltic pump. Attach another short section of polyethylene tubing to the discharge portion of the silicon tubing extending from the peristaltic pump. Attach a short section of silicon tubing to the discharge end of the short section of polyethylene tubing. Attach the in-line high-capacity 0.45-micron groundwater flow filter to the discharge end of the silicon tubing.

3. Allow a minimum of 100 milliliters of sample water to pass through the filter before sample collection.

4. Fill the laboratory supplied sample container with the appropriate volume of water requested by laboratory. Place sample container in a plastic bag and place the sample in a cooler with ice. Use one filter per well and discard the filter. Do not reuse the polyethylene and silicon tubing. Prepare new tubing for each new well sampled and discard all of the filter tubing.

5.5.6 Purging and Sampling with a 2-Inch Dedicated Submersible Pump

The following procedure is used in purging and sampling water with a 2-inch dedicated QED air powered bladder pump, or equivalent:

1. Attach the compressor supply line to the pump controller. Attach the controller supply line to the air-line fitting on the well.

2. Attach the dedicated pump discharge line to the discharge fitting on the well.

3. Start the compressor to supply air to the bladder pump.

4. Begin purging the well with the pump controller set at minimum settings for bladder refill and discharge. Adjust the refill and discharge settings so that the bladder fills completely, and discharges the entire bladder volume during each cycle.

5. After purging and collecting the sample, disconnect all fittings and return the dedicated discharge line to its receptacle on the well cap.

5.5.7 Purging and Sampling with a Peristaltic Pump

The following procedure is used in purging and sampling water with an electric operated variable pumping rate (160 to 500 milliliters per minute) peristaltic pump, or equivalent:

1. Dedicated or disposable ¼ inch diameter polyethylene tubing is lowered into the well and placed within approximately 6 inches of the bottom of the well.
2. A section of silicon tubing is placed at the end of the polyethylene tubing extending from the well and placed in the peristaltic pump.

3. Another section of polyethylene tubing is attached to the silicon tubing extending from the peristaltic pump for sampling purposes.

4. The volume of water purged from the well is controlled by a flow control knob on the pump and is adjusted such that there is minimal drawdown within the well.

5.5.8 Purging and Sampling with a Portable Submersible Pump

The following operating and decontamination procedure is used in purging, sampling, and filtering water with a Geotech Redi-Flo2 portable submersible electric/mechanical pump or equivalent:

1. Remove the pump from the case and assemble it according to the manufacturer's specifications.

2. To decontaminate the pump, place the entire pump into a shallow container. Fill the container with an appropriate detergent/potable water mixture, place the pump unit into the detergent/water solution, and pump the solution out of the container through the discharge pipe into a separate bucket. Then place the pump unit into the container with analytically tested de-ionized distilled water and pump out of the container through the discharge pipe into a separate bucket. Refer to Steps 3 through 4 for pump operating procedures. Pour the discharged detergent/water solution over the coiled line and brush off any soil or other visible contaminants. Repeat the process using the distilled water. After finishing with the distilled water rinse, reverse the pumping direction and draw out the remaining water in the tubing. Dispose of the rinsate as specified in the work plan. DO NOT RUN THE PUMP DRY.

3. Check the water level in the well. Install protective cover over the pump and secure the protective cover to the pump. Connect the discharge tubing to the hose barb at the top of the pump and submerge the pump so that the unit is vertical and the water level is at a minimum of six inches above the hose barb. Carefully lower the pump into the well to keep it fully vertical. If allowed to come out of plumb, the pump may become stuck in the well casing. Allow the pump to sit in the water for at least five minutes without running to equalize in temperature.

4. Connect the pump power cable to the variable frequency drive (VFD) unit. Ensure that the three VFD knobs are in the off position. Connect the VFD unit into a generator or utility power supply; ensure incoming power is compatible with the unit’s configured power. Turn the bottom power knob to the “ON” position. Turn the middle knob to the “FWD” position. “HZ 0.0” will be on the display. To begin pumping use the speed knob (top knob) to increase or decrease pumping speed. Note that at 350 Hz, five gallons of water will be pumped out in one minute.

5.5.9 Purging and Sampling with a Dedicated or Disposable Bailer

The following procedure is used to sample 2-inch diameter monitor wells with a dedicated or disposable check-valve, bottom-discharging bailer:

1. Open the top of the well and pull the bailer cord up off of the hook. Check the cord to be sure that it is not worn, frayed, or tangled. If the cord is worn or frayed, replace it with a new, clean cord of the appropriate length. Check the

bailer for any visible damage. Make sure that the check-ball assembly is functional and that the cord is tied securely to the top of the bailer. If the free movement of the bottom check-valve is impeded by silt or clay, disassemble and rinse the bailer components with de-ionized water.

2. Lower the bailer slowly to the top of the groundwater table and slowly immerse it in the water. Let it fill approximately half-way with water and then pull it up out of the well slowly. Check this first bailer of water for the presence of an immiscible layer. If an immiscible layer is present, measure the apparent thickness of the layer and obtain a sample, if possible.

3. Lower the bailer again into the well in the same manner. However, this time, allow it to fill completely with water. When removing the bailer from the well, be sure not to let the cord come in contact with the ground or other potential sources of cross-contamination.

4. After removing the bailer from the well, decant the water into an appropriate container.

5. Repeat Steps 3 and 4 until a sufficient volume of water has been purged and a sufficient volume of sample has been obtained.

6. After removing the bailer from the well, decant the water into an appropriate sample jar or vial.

7. Repeat Steps 3, 4, and 6 until a sufficient volume of sample has been obtained.

8. If sampling for inorganics, upon removal of the bailer from the well, collect a water sample in a new or triple rinsed bottle then use a peristaltic pump to pump the water sample through an in-line high-capacity 0.45-micron filter as described in Section 5.5.5. Allow 100 milliliters of water to pass through the filter prior to sample collection.

9. When sampling is complete, coil the bailer cord and hang it on the hook located inside the well casing. No decontamination is necessary when using disposable or dedicated bailers.

10. If the bailer requires cleaning or a non-dedicated bailer is used, wash the bailer thoroughly using de-ionized water and a non-phosphate soap. If possible, unscrew the ends of the bailer and wash the interior of the bailer thoroughly. Rinse the bailer with de-ionized water until free of soap. Finally, rinse the bailer twice with de-ionized water. Inspect the check-ball and, when re-assembling the bailer, check to ensure its proper working order. Dispose of all wash water in the manner referenced in Section 5.4.2. Whenever cleaning equipment, review the area for the presence of airborne contaminants that may contaminate the bailer.

5.6 Decontamination Procedures

Equipment used for monitoring and sampling are properly decontaminated prior to use at each location. Decontamination effectively eliminates the potential for cross-contamination between sampling locations and is conducted using the appropriate materials so as to prevent the introduction of external contaminants (such as phosphate from detergents, aromatic hydrocarbons from motor vehicles, or oil and grease from dirty hands). The decontamination procedures specified in this section are used by all sampling personnel to decontaminate sampling and other field equipment.

- <u>Laboratory Detergent and Cleaning Solvent</u>. For laboratory detergent used in equipment decontamination, use a standard brand of phosphate-free laboratory detergent such as Alconox™, Liquinox™, or Micro™. The use of any other detergent or solvent must be approved by the senior member of the sampling team, and its use must be documented in the field sampling logs.

- <u>Cleaning Water</u>. Tap water from any municipal water supply may be used for initial equipment rinses and steam-cleaning prior to decontamination. The use of an untreated potable water supply is not an acceptable substitute for tap water. Use analytically tested distilled and de-ionized water to prepare soap solutions and to complete final rinses during field equipment cleaning. Do not reuse the laboratory detergent and rinse water used to clean equipment.

- <u>Location of Decontamination Process</u>. When possible, decontaminate equipment in batches at a central staging area. When necessary, conduct decontamination of water sampling equipment at a designated location. Contain liquids generated at the sampling sites during equipment decontamination in accordance with relevant regulations.

- <u>Required Decontamination Procedures</u>. The different pieces of equipment that are used have varying degrees of contact with the sample media. Primary equipment is used to contain and handle the sample and is in direct contact with the portion of the sample that will be analyzed in a quantitative fashion by the laboratory. Decontaminate all primary sampling equipment that is non-dedicated such as, Teflon™ bailers, portable electric powered submersible pumps, and glass jars, using the following procedure:

    - Rinse equipment thoroughly with de-ionized or distilled water in the field as soon as possible after use.

    - Wash equipment thoroughly with laboratory detergent and de-ionized water using a brush to remove particulate matter or surface film.

    - Rinse equipment thoroughly with analytically tested de-ionized water.

    - Air dry.

  - Wrap equipment completely in aluminum foil to prevent contamination during storage and/or transport to the field.

- Secondary Equipment Cleaning Procedures. Secondary equipment such as bailers, bladder pumps or submersible pumps used to purge wells, temperature, pH and specific conductivity probes, and Teflon coated water level measuring tapes, come in contact with the sample media. However, this equipment does not contact the sample that will be analyzed in the laboratory.

  - Decontaminate non-dedicated secondary equipment using laboratory detergent and wash water followed by rinses of de-ionized water.

- Equipment Storage. Store all decontaminated field and sampling equipment in covered containers or wrap them in aluminum foil to minimize contamination. Clearly identify decontaminated equipment by labeling the wrapping material.

- Quality Control Procedures for Cleaning Operations. Monitor the effectiveness of field-cleaning procedures during the groundwater sampling round by collecting equipment blanks (Section 5.9). However, sources of potential contamination could include the chemical preservatives and the sample bottles used during the investigations as well as laboratory sample handling procedures. Additional quality control samples (field blanks) may be analyzed to help evaluate all sources of potential contamination (Section 5.9).

5.7 Sample Handling

Immediately following collection, each water sample is transferred to laboratory-supplied, properly labeled, new, clean, sample containers compatible with the analyses to be performed. Water samples submitted for organic analyses are placed in appropriately sized glass sample bottles; water samples submitted for inorganic analyses are placed in appropriately sized plastic sample bottles. Water samples submitted for volatile organic analyses completely fill the sample container to minimize sample jar headspace following USEPA SW-846 protocols.

Water sample containers supplied by the laboratory for each well are grouped in separate plastic bags and stored in a clean, insulated cooler with appropriate packing containing ice or frozen blue-ice packs for refrigeration. Preservation techniques, other than storage in an insulated cooler, are not necessary. At the completion of sampling, the water samples are dropped off, picked-up, or shipped by overnight delivery in the insulated cooler to the analytical laboratory.

Sample collection documentation is recorded in indelible ink on the field sampling logs used in the monitoring program. An individual sampling log is created for each well that is sampled. The information recorded on the field sampling logs consists of the following:

- The name(s) of the sampler(s);

- The date and time of sample collection;

- Field observations regarding weather conditions;

- Sample identification and location;

- Purging information including purging equipment, purge volumes and parameter stabilization measurements; and

- Sample container type and number and preservative(s).

5.8 Sample Analysis

Table 3 in Attachment A lists the organic parameters that are monitored biannually in the CAC well. After four consecutive biannual monitoring events showing non-detections of the constituent, the constituent may be considered for removal from the list of parameters monitored.

The CAD wells are monitored biannually for the parameters listed on Table 5 in Attachment A.

All analyses are performed in conformance with SW-846 requirements for detection limits, holding times, container, filtering, and preservation. Constituents not included in SW-846 are analyzed according to SW-846 requirements as applicable. The reporting limits for the organic and inorganic constituents analyzed are shown on Tables 3 and 5 in Attachment A.

5.9 Quality Assurance/Quality Control

To evaluate the reliability and validity of the field and analytical laboratory data, a Quality Assurance/Quality Control (QA/QC) program has been developed. The following is a description of QA/QC programs to be used in the field portion of the groundwater monitoring program. These measures are also described in the USEPA groundwater monitoring TEGD.

- <u>Trip Blank</u> - Include one trip blank (40 mL preserved VOA) with the groundwater samples collected each day during the biannual sampling. The trip blank is provided by the analytical laboratory and accompanies the sample containers during the sampling event and the shipment. The trip blank is not opened. Submit the trip blank to the laboratory for analysis of the organic constituents listed in Table 5. A second trip blank is necessary if more than one laboratory shipment/pick-up is completed.

- <u>Equipment Blank</u> – To validate decontamination procedures, collect one equipment blank after any well is sampled with a portable (non-dedicated) pump that is placed into the well. The equipment blank is prepared by exposing analytically pure water to the water sampling equipment after its decontamination. Submit the equipment blank to the laboratory for analysis of the organic constituents listed in Table 3 or Table 5. Document the information regarding equipment blank preparation and identification in the groundwater field sampling log.

- Field (Blind) Duplicate - To validate sampling methods and laboratory analytical methods, analyze 10 percent of all CAD wells sampled (e.g., 18 X 0.10 = 1.8). Label the second sample in a manner to distinguish the duplicate from the original well sample, e.g., the duplicate sample from MW-104 would be labeled MW-201, and the origin of the sample recorded on the MW-104 groundwater sampling log. Submit the field blind duplicate(s) to the laboratory for analysis of the organic and inorganic constituents listed in Table 5. If the duplicate does not show reasonable correlation with its split, re-evaluate the sampling and analysis methods.

- Field (Labeled) Duplicate – To validate sampling methods and laboratory analytical methods, analyze 10 percent of all CAD wells sampled (e.g., 18 X 0.10 = 1.8). These duplicate samples are labeled the same as the well sampled, e.g., the duplicate sample from MW-116 would be labeled MW-116 duplicate #1 and the second duplicate sample would be collected from a second well such as MW-153 and labeled MW-153 duplicate #2. The duplicate samples are collected from different wells during each sampling event. Submit the field labeled duplicate(s) to the laboratory for analysis of only organic and inorganic constituents listed in Table 5.

All laboratory analyses conform to SW-846 QA/QC requirements. Any inorganic analyses that do not have a designated test method under SW-846 are performed following "Standard Methods for the Examination of Water and Wastewater, 1985".

P&U has selected ALS Group USA, Corporation as the primary analytical laboratory to perform analyses of groundwater samples collected during this monitoring program. Trace Analytical Laboratories, Inc. is identified as an alternate to perform analyses. The laboratory QA/QC manuals for each are included as Attachment D.

5.10 Chain-of-Custody Procedures

Sample custody is a vital aspect of site investigations. Samples must be traceable from the time of sample collection through analysis. Samples are considered in custody if the following conditions are not violated:

- The responsible person maintains possession;

- After the samples are received, they remain in the view of, or in the physical possession of, the responsible person;

- Samples are locked so that no one can tamper with them; and,

- Samples are maintained in a secured area, restricted to authorized personnel.

All samples are maintained in the custody of the sampling personnel. At the end of each sampling day and prior to the transfer of the samples off-site, a chain-of-custody record is completed. Upon transfer of custody, the chain-of-custody record is signed and dated by the sample team leader. When samples are shipped, forms are placed in the cooler in a plastic bag and a signed, dated custody seal is placed over the lid opening of the sample cooler.

Chain-of-custody records sent to the laboratory must be signed and dated by the senior staff member assigned to the field team.

The chain-of-custody records include well identification, signature of collector, date and time of collection, sample type, number of containers, parameter analysis request, and signatures of those in the chain of possession. The forms accompany the samples to the laboratory. All packages are delivered personally by field technicians, laboratory courier, or via overnight courier to the laboratory for analysis.

Upon receipt of the samples at the laboratory, the laboratory sample custodian notes the condition of each sample received. The laboratory sample custodian also initiates the laboratory sample-tracking record that follows each sample through all stages of laboratory processing. The sample-tracking records document sample removal from storage, the date and time of sample extraction or preparation, and sample analysis.

6.0 STATISTICAL DATA EVALUATION

The Statistical Evaluation Program (SEP) is presented in Attachment E. Statistical evaluations of groundwater monitoring data collected from CAD wells are performed biannually. The biannual evaluations are presented annually in the Operating License Annual Groundwater Monitoring Report. The statistical methods used in the SEP will be re-evaluated periodically to confirm the validity of the statistical models utilized and at that time other methods may be proposed.

ATTACHMENT A

TABLES

Table 1
CAC, CAD, and CAWL Well Installation, Elevation, and Construction Data
Pharmacia and Upjohn Company LLC, Kalamazoo, Michigan

Well ID	Well Network	Coordinates	Installation Date	Installed By	TOC	Casing Diameter (inches)	Casing Material	Screen Length (feet)	Screen Diameter (inches)	Screen Material	Screen Slot Size	Aquifer	Top of Screen	Bottom of Screen	Ground Elevation
CW 28	CAWL	N6542.0, E14659.5	NA	ODC	868.49	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	826.4	823.4	865.0
CW 29	CAWL	N5971.5, E14667.0	NA	ODC	876.01	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	835.8	832.8	872.9
CW 30A	CAWL	N8428.0, E14538.5	May/18/1994	Stearns	864.97	2.0	Galvanized Steel	7.0	2.0	Stainless Steel	NA	Upper	854.2	847.2	862.2
CW 31	CAWL	N9093.5, E14539.5	NA	ODC	871.66	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	837.9	834.9	869.1
CW 35	CAWL	N7311.5, E15058.0	Jun/19/1989	ODC	863.51	2.0	Galvanized Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.7	826.7	861.4
CW 37	CAWL	N8891.0, E12200.5	Jan/09/1990	ODC	871.90	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	NA	Upper	834.1	831.1	870.1
DF 4	CAWL	N10129.0, E11350.0	Mar/07/1989	ODC	871.96	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	828.0	825.0	868.5
DF 17	CAWL	N4567.0, E12224.5	May/03/1983	ODC	866.68	2.0	Steel	3.5	2.0	Stainless Steel	NA	Upper	839.6	836.3	864.8
DF 18	CAWL	N4065.0, E12233.5	May/04/1983	ODC	873.21	2.0	Steel	3.5	2.0	Stainless Steel	NA	Upper	846.1	842.6	871.6
DF 20	CAWL	N7294.5, E7869.5	Nov/01/1983	ODC	855.29	2.0	Steel	3.0	2.0	Stainless Steel	NA	Upper	820.2	817.2	852.9
LA 01	CAWL	N7993.5, E11047.0	Dec/09/1986	ODC	872.47	3.0	Steel	3.0	3.0	Stainless Steel	NA	Lower	714.8	711.8	871.8
MW 17	CAWL/CAD	N8381.5, E10805.0	Dec/30/1993	ETI	871.05	2.0	PVC	5.0	2.0	PVC	0.01	Upper	821.4	816.4	871.4
MW 101A	CAWL/CAD	N94849.5, E10090.0	Oct/19/1990	STS	870.23	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	807.9	802.9	870.5
MW 104	CAWL/CAD	N9831.0, E10072.0	Nov/07/1990	ODC	870.25	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	643.5	638.5	870.6
MW 108R	CAWL/CAD	N10057.3, E12120.7	Oct/03/2000	Cook	869.28	2.0	Stainless Steel	15.0	2.0	Stainless Steel	0.01	Upper	834.2	819.2	867.7
MW 109R	CAWL/CAD	N10063.6, E13194.8	Oct/03/2000	Cook	872.17	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	831.6	821.6	869.6
MW 110	CAWL/CAD	N9416.0, E13838.0	Jul/04/1990	STS	873.55	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	849.0	839.0	872.0
MW 111	CAWL/CAD	N7923.5, E13909.5	Jul/09/1990	STS	867.06	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	854.3	849.3	864.4
MW 112	CAWL/CAD	N7923.0, E13909.5	Aug/08/1990	STS	867.08	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	792.8	787.8	865.1
MW 114	CAWL	N5888.5, E13852.0	Jul/01/1990	STS	874.63	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	853.2	848.2	872.1
MW 115A	CAWL/CAD	N4995.5, E13885.0	Oct/29/1990	ODC	869.24	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.8	826.8	866.9
MW 116	CAWL/CAD	N5089.0, E13782.5	Oct/09/1990	STS	868.67	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	690.5	685.5	866.7
MW 117	CAWL	N4731.0, E10079.0	Jul/09/1990	STS	866.03	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	839.0	829.0	863.9
MW 119	CAWL	N4780.0, E10080.5	Oct/14/1990	ODC	865.50	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	720.5	715.5	863.9
MW 122	CAWL	N6026.5, E10344.5	Sep/10/1990	STS	871.15	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.2	826.2	869.6
MW 129A	CAWL	N8170.5, E12896.0	Oct/17/1990	STS	873.60	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	824.9	819.9	871.1
MW 131	CAWL	N8143.5, E12854.0	Nov/28/1990	ODC	873.46	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	670.5	665.5	871.4
MW 133	CAWL/CAD	N5129.0, E12208.0	Jul/11/1990	STS	861.86	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	849.5	844.5	860.0

CAC: Corrective Action Characterization Network
CAD: Corrective Action Detection Network
CAWL: Corrective Action Water Level Network
NA: Not Available

Table 1
CAC, CAD, and CAWL Well Installation, Elevation, and Construction Data
Pharmacia and Upjohn Company LLC, Kalamazoo, Michigan

Well ID	Well Network	Coordinates	Installation Date	Installed By	TOC	Casing Diameter (inches)	Casing Material	Screen Length (feet)	Screen Diameter (inches)	Screen Material	Screen Slot Size	Aquifer	Top of Screen	Bottom of Screen	Ground Elevation
MW-134s	CAWL	N4746.5, E11195.5	Aug/21/1990	STS	870.07	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	840.0	835.0	866.8
MW 135	CAWL	N7911.5, E9191.0	Nov/29/1990	STS	867.34	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	825.3	815.3	865.2
MW 136	CAWL	N7900.0, E9217.0	Jan/22/1991	STS	868.20	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	731.2	726.2	865.0
MW 139	CAWL	N7114.0, E9037.0	Jan/13/1991	STS	863.35	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	725.4	720.4	860.7
MW 141	CAWL/CAD	N7548.5, E8813.0	Dec/06/1990	STS	860.50	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	823.5	813.5	858.4
MW 142	CAWL/CAD	N7542.5, E8801.0	Dec/19/1990	STS	860.51	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	733.5	728.5	858.4
MW 144	CAWL	N6404.0, E9918.5	Mar/06/1991	STS	874.35	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	741.3	736.3	871.7
MW 146	CAWL	N5917.0, E10334.5	Feb/08/1991	STS	873.64	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	743.0	738.0	871.3
MW 148	CAWL	N9954.0, E13498.0	Feb/03/1991	STS	872.00	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	740.1	735.1	871.8
MW 149	CAWL/CAD	N9891.5, E13545.5	Jan/31/1991	STS	868.52	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	653.8	648.8	869.0
MW 151	CAWL	N10389.5, E11474.0	Feb/03/1991	STS	872.16	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	737.9	732.9	869.7
MW 152	CAWL/CAD	N10335.0, E11524.0	Jan/24/1991	STS	870.58	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	706.6	701.6	868.7
MW 153	CAWL/CAD	N11026.0, E12664.5	Apr/04/1991	STS	869.34	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	730.2	725.2	866.7
MW 158	CAWL/CAD	N6305.39, E9282.70	Dec/18/1992	EDAS	862.64	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	725.3	720.3	860.3
MW 161R	CAWL/CAD	N6488.0, E9846.3	Mar/27/1995	ETI	874.05	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	814.1	809.1	872.4
OS 2	CAC	N8073.5, E13233.0	Nov/20/1984	ODC	868.72	8.0	Stainless Steel	10.0	8.0	Stainless Steel	0.02	Upper	839.9	829.9	NA
PZ 1A	CAWL	N7144.0, E12517.0	Jun/30/1990	STS	862.32	1.0	PVC	5.0	1.0	PVC	0.01	Upper	846.2	841.2	862.5
PZ 1B	CAWL	N7168.0, E12477.0	Jun/30/1990	STS	862.90	1.0	PVC	5.0	1.0	PVC	0.01	Upper	847.9	842.9	863.2
PZ 1C	CAWL	N7190.5, E12435.0	Jun/30/1990	STS	863.64	1.0	PVC	5.0	1.0	PVC	0.01	Upper	848.6	843.6	863.8
PZ 3A	CAWL	N5917.0, E13714.5	Jul/02/1990	STS	874.07	1.0	PVC	5.0	1.0	PVC	0.01	Upper	852.0	847.0	872.5
PZ 3B	CAWL	N5908.5, E13774.5	Jul/02/1990	STS	877.14	1.0	PVC	5.0	1.0	PVC	0.01	Upper	854.9	849.9	876.5
PZ 4A	CAWL	N7486.5, E10361.5	Aug/24/1990	STS	879.17	1.0	PVC	5.0	1.0	PVC	0.01	Lower	696.1	691.1	877.2
PZ 4B	CAWL	N7468.0, E10342.0	Sep/12/1990	STS	881.39	1.0	PVC	5.0	1.0	PVC	0.01	Lower	699.4	694.4	878.3
PZ 4C	CAWL	N7503.0, E10305.0	Sep/19/1990	STS	878.27	1.0	PVC	5.0	1.0	PVC	0.01	Lower	698.0	693.0	878.6
PZ 8R	CAWL	N6673.43, E11847.66	Aug/16/2013	EDAC	868.16	2.0	Galvanized Steel	5.0	2.0	Stainless Steel	0.01	Lower	754.0	749.0	866.0
PZ 17A	CAWL	N5074.00, E12156.14	Aug/06/2013	WMD	865.02	2.0	Galvanized Steel	5.0	2.0	Stainless Steel	0.01	Upper	850.3	845.3	862.3

TOC and Ground Elevations from 12/2006 survey

Replacement wells PZ-8R and PZ-17A surveyed 10/2013

MW-133 TOC resurveyed 2/2018 after repair

CAC: Corrective Action Characterization Network
CAD: Corrective Action Detection Network
CAWL: Corrective Action Water Level Network
NA: Not Available

Table 2

Corrective Action Characterization (CAC) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
OS-2	36.5	10

Revised 6/6/22

Table 3

CAC Groundwater Monitoring Parameters, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

OS-2 **Sampling Events (2nd and 4th Quarters)**		
Organic Constituents and Reporting Limits		**Field Parameters**
Benzene	<1 µg/L	pH
Chlorobenzene	<1 µg/L	Temperature
Cyclohexane	<5 µg/L	Specific Conductance
Methyl cyclopentane	<5 µg/L	
Toluene	<1 µg/L	
Xylenes	<1 µg/L	

Table 4

Corrective Action Detection (CAD) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Lower Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
MW-104	232.0	5
MW-112	77.4	5
MW-116	181.4	5
MW-142	130.1	5
MW-149	219.9	5
MW-152	167.3	5
MW-153	141.0	5
MW-158	140.0	5

Upper Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
MW-17	55.0	5
MW-101A	67.6	5
MW-108R	48.5	15
MW-109R	48.4	10
MW-110	32.0	10
MW-111	15.3	5
MW-115A	39.9	5
MW-133	15.5	5
MW-141	45.1	10
MW-161R	63.0	5

Revised 6/6/22

Table 5

CAD Groundwater Monitoring Parameters, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Sampling Event (2nd Quarter)				
Primary Organic Constituents and Reporting Limits		**Primary Inorganic Constituents and Reporting Limits**		**Field Parameters**
Acetone	<20 µg/L	Chromium	<0.025 mg/L	pH
t-Butanol	<50 µg/L	Copper	<0.02 mg/L	Specific Conductance
Chlorobenzene	<1 µg/L	Zinc	<0.01 mg/L	Temperature
Ethyl benzene	<1 µg/L			
Hexane	<5 µg/L			
Methylene chloride	<5 µg/L			
Methyl cyclopentane	<5 µg/L			
Methyl t-butyl ether	<5 µg/L			
Tetrahydrofuran	<5 µg/L			
Toluene	<1 µg/L			
Xylenes	<1 µg/L			

Sampling Event (4th Quarter)				
Sub-set Organic Constituents and Reporting Limits		**Sub-set Inorganic Constituents and Reporting Limits**		**Field Parameters**
Acetone	<20 µg/L	Chromium	<0.025 mg/L	pH
Methylene chloride	<5 µg/L			Specific Conductance
Tetrahydrofuran	<5 µg/L			Temperature
Toluene	<1 µg/L			

Table 6

Corrective Action Water Level (CAWL) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Lower Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
LA-01	160.0	3
MW-104	232.0	5
MW-112	77.4	5
MW-116	181.4	5
MW-119	147.9	5
MW-131	206.2	5
MW-136	138.6	5
MW-139	140.4	5
MW-142	130.1	5
MW-144	135.2	5
MW-146	133.1	5
MW-148	137.0	5
MW-149	219.9	5
MW-151	136.6	5
MW-152	167.3	5
MW-153	141.0	5
MW-158	140.0	5
PZ-4A	185.6	5
PZ-4B	183.9	5
PZ-4C	185.2	5
PZ-8R	117.0	5

Table 6 Continued

Corrective Action Water Level (CAWL) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Upper Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
CW-28	41.3	3
CW-29	40.0	3
CW-30A	15.0	7
CW-31	34.0	3
CW-35	35.0	5
CW-37	39.0	3
DF-4	43.0	3
DF-17	28.0	3.5
DF-18	30.0	3.5
DF-20	36.0	3
MW-17	55.0	5
MW-101A	67.6	5
MW-108R	48.5	15
MW-109R	48.4	10
MW-110	32.0	10
MW-111	15.3	5
MW-114	23.4	5
MW-115A	39.9	5
MW-117	34.6	10
MW-122	43.1	5
MW-129A	51.2	5
MW-133	15.5	5
MW-134s	31.7	5
MW-135	50.1	10
MW-141	45.1	10
MW-161R	63.0	5
PZ-1A	21.3	5
PZ-1B	20.0	5
PZ-1C	20.0	5
PZ-3A	25.4	5
PZ-3B	26.7	5
PZ-17A	17.0	5

TABLE 7

WELL GROUNDWATER SAMPLING LOGS

PHARMACIA & UPJOHN CO., LLC - GROUNDWATER SAMPLING LOG 226-1534

PROJECT: **RCRA CAC QUARTERLY MONITORING**	WELL ID: **OS-2**	DATE:
SAMPLER:	WEATHER: °,	
TIME BEGAN:	PUMP INFORMATION: **TURBINE PUMP**	
TIME COMPLETED:		

PURGING INFORMATION

RADIUS (**r**) OF WELL (FEET): **0.333**	AREA OF WELL CASING (FEET^2): **0.348** (Area = 3.14 x r^2)

DEPTH TO WATER* (FEET): **~** **(PUMP ________)**

DEPTH OF WELL* (FEET): **38.6**

EQUIPMENT CALIBRATED PRIOR TO PURGING (Yes/No):

PARAMETER MONITORING WHILE PURGING

pH:

CONDUCTIVITY (µS):

TEMPERATURE (°C):

SAMPLING

TURBIDITY:	ODOR:

pH:	CONDUCTIVITY:	TEMPERATURE:

ANALYSIS	BOTTLE TYPE & VOL.	FILTERED	PRESERVATIVE
VOA	**x 40 ml, glass**	**N**	**HCl**

SAMPLING EQUIPMENT CONDITION:

COMMENTS: **TURBINE PUMP ________ PRIOR TO SAMPLING.**

*from top of casing (TOC)
Turbidity descriptions (clear, cloudy, dirty)

PHARMACIA & UPJOHN CO., LLC - GROUNDWATER SAMPLING LOG 226-1534

PROJECT: **RCRA QUARTERLY MONITORING**

WELL ID: **MW-17**

DATE:

SAMPLER:

WEATHER: °,

TIME BEGAN:

PRESSURE OF PACKER AT START: **NA**

TIME COMPLETED:

PRESSURE OF PACKER AT END: **NA**

PUMP INFORMATION: **DEDICATED BLADDER PUMP**

DEPTH TO PACKER* (FEET): **NA**

PURGING INFORMATION

SETTINGS FOR BLADDER PUMP:
Pressure (psi): **35**
Discharge (sec): **6.5**
Refill (sec.): **8.5**

RADIUS (**r**) OF WELL (FEET): **0.083**

AREA OF WELL CASING (FEET^2): **0.022**
(3.14 x r^2 =0.022)

DEPTH TO WATER* (FEET):

DEPTH OF WELL* (FEET): **55.0**

LENGTH OF WATER COLUMN (FEET):
(DEPTH OF WELL - DEPTH TO WATER) OR
(DEPTH OF WELL - DEPTH TO PACKER = **h**)

VOLUME OF WATER IN WELL (FEET^3): 0.022 x 7.48 x **h** = 0.165 x **h** = **Gallons**
[LENGTH OF WATER COLUMN x (3.14 x r^2)](MULTIPLY BY 7.48 FOR GALLONS)

DEPTH TO PLUG BGS (FEET): **46.0**

MINIMUM PURGE VOLUME: **Gallons**
(VOLUME OF WATER IN WELL x 3)

EQUIPMENT CALIBRATED PRIOR TO PURGING (Yes/No):

PARAMETER MONITORING WHILE PURGING

pH:

CONDUCTIVITY (µS):

TEMPERATURE (°C):

ACTUAL PURGE VOLUME: **Gallons**

COMMENTS: pH, temperature, and conductivity taken after gallons had been purged.

SAMPLING

TURBIDITY:

ODOR:

pH:

CONDUCTIVITY:

TEMPERATURE:

ANALYSIS	BOTTLE TYPE & VOL.	FILTERED	PRESERVATIVE
VOA	**x 40 ml, glass**	**N**	**HCl**
METALS	**x 250 ml, plastic**	**Y**	**Nitric**

SAMPLING EQUIPMENT CONDITION:

COMMENTS:

*from top of casing (TOC)

TABLE 8

CHAIN-OF-CUSTODY TEMPLATES

☐ ALS Laboratory Group
10450 Stancliff Rd. #210
Houston, Texas 77099
(Tel) 281.530.5656
(Fax) 281.530.5887

Chain of Custody Form

Page ______ **of** ______

☑ ALS Laboratory Group
3352 128th Avenue
Holland, Michigan 49424
(Tel) 616.399.6070
(Fax) 616.399.6185

ALS Project Manager:

ALS Work Order #:

Customer Information		**Project Information**		**Parameter/Method Request for Analysis**	
Purchase Order		**Project Name**	RCRA CAC Monitoring	**A**	Benzene, Chlorobenzene, Cyclohexane, Methyl cyclopentane, Toluene, Xylenes (2nd and 4th Quarter)
Work Order		**Project Number**	226-1534		
Company Name	Pharmacia & Upjohn Co., LLC	**Bill To Company**	Pfizer, Inc.	**B**	
Send Report To		**Invoice Attn.**	North American Shared Service	**C**	
Address	7000 Portage Road	**Address**	PO Box 34600	**D**	
				E	
City/State/Zip	Kalamazoo, MI 49001	**City/State/Zip**	Bartlett, TN 38184-0600	**F**	
Phone	269-833-4000	**Phone**	901-215-1111	**G**	
Fax		**Fax**		**H**	
e-Mail Address				**I**	

No.	**Sample Description**	**Date**	**Time**	**Matrix**	**Pres. Key Numbers**	**# Bottles**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		**Hold**
1	OS-2			W	1	2	X										
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s): Please Print & Sign

Shipment Method:

Required Turnaround Time: (Check Box) ☐ Other ____________
☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour

Results Due Date:

Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**	**Notes:**
Relinquished by:	**Date:**	**Time:**	**Received by (Laboratory):**	**Date:**	**Time:**	
Logged by (Laboratory):	**Date:**	**Time:**	**Checked by (Laboratory):**			

ALS Cooler ID	**Cooler Temp**	**QC Package: (Check Box Below)**	
		☐ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other: ____________	

Preservative Key: **1**-HCl **2**-HNO_3 **3**-H_2SO_4 **4**-NaOH **5**-$Na_2S_2O_3$ **6**-$NaHSO_4$ **7**-Other **8**-4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

☐ ALS Laboratory Group
10450 Stancliff Rd. #210
Houston, Texas 77099
(Tel) 281.530.5656
(Fax) 281.530.5887

Chain of Custody Form

Page ______ **of** _______

☑ ALS Laboratory Group
3352 128th Avenue
Holland, Michigan 49424
(Tel) 616.399.6070
(Fax) 616.399.6185

ALS Project Manager:		**ALS Work Order #:**	

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	RCRA CAD Monitoring	A	Acetone, t-Butanol, Chlorobenzene, Ethylbenzene, Hexane, Methylene chloride, Methyl cyclopentane, Methyl t-butyl ether,Tetrahydrofuran, Toluene, Xylenes, Chromium, Copper, Zinc (2nd Quarter)
Work Order		Project Number	226-1534		
Company Name	Pharmacia & Upjohn Co., LLC	Bill To Company	Pfizer, Inc.		
Send Report To		Invoice Attn.	North American Shared Service	B	Acetone, Methylene chloride, Tetrahydrofuran, Toluene, Chromium (4th Quarter)
Address	7000 Portage Road	Address	PO Box 34600		
				C	
City/State/Zip	Kalamazoo, MI 49001	City/State/Zip	Bartlett, TN 38184-0600	D	
Phone	269-833-4000	Phone	901-215-1111	E	
Fax		Fax		F	
e-Mail Address				G	

No.	Sample Description	Date	Time	Matrix	Pres. Key Numbers	# Bottles	A	B	C	D	E	F	G				Hold
1				W	1,2	3											
2				W	1,2	3											
3				W	1,2	3											
4				W	1,2	3											
5				W	1,2	3											
6				W	1,2	3											
7				W	1,2	3											
8				W	1,2	3											
9				W	1,2	3											
10				W	1,2	3											

Sampler(s): Please Print & Sign

Shipment Method:

Required Turnaround Time: (Check Box) ☐ Other ____________
☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour

Results Due Date:

Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**	**Notes:**
Relinquished by:	**Date:**	**Time:**	**Received by (Laboratory):**	**Date:**	**Time:**	
Logged by (Laboratory):	**Date:**	**Time:**	**Checked by (Laboratory):**			

ALS Cooler ID	Cooler Temp	QC Package: (Check Box Below)	
		☐ Level II: Standard QC	☐ Level III: Raw Data
		☐ TRRP LRC	☐ TRRP Level IV
		☐ Level IV: SW846 Methods/CLP like	
		☐ Other: ______________________	

Preservative Key: **1-**HCl **2-**HNO_3 **3-**H_2SO_4 **4-**NaOH **5-**$Na_2S_2O_3$ **6-**$NaHSO_4$ **7-**Other **8-**4°C

Note: Any changes must be made in writing once samples and COC Form have been submitted to ALS.

TRACE ANALYTICAL LABORATORIES, INC.

CHAIN-OF-CUSTODY RECORD

Page________of________

Trace Analytical Laboratories, Inc.
2241 Black Creek Road
Muskegon, MI 49444-2673

Phone 231.773.5998
Fax 888.979.4469
www.trace-labs.com

Trace ID No.

Report Results To:

Company Name: Pharmacia & Upjohn Company, LLC
Report To:
Mailing Address: 7000 Portage Road
City, State, Zip Code: Kalamazoo,. MI 49001
Office Phone: 269.833.4000
Cell Phone:
Email Address:

Bill To:

PO #:
Contact Name:
Billing Address (if different): P.O. Box 34600
City, State, Zip Code: Bartlett, TN 38184-0600
Phone Number:
Billing Email Address: apinvoices@pfizer.com

Trace Use:

Logged By:
Checked By:
Soil Volatiles Preserved (circle if applicable):
MeOH Low Level Lab
Sampling Time:

Turnaround Requirements:

☒ Standard
☐ 4 Day*
☐ 3 Day*
☐ 48 Hour*
☐ 24 Hour*

** Requires Prior Approval*

Matrix Key:

S = Soil / Solid
W = Water
SL = Sludge
OI = Oil
WI = Wipes
LW = Liquid Waste
A = Air
D = Drinking Water

Project Name: Pfizer RCRA CAC Groundwater Monitoring

Sampled By:

Trace No.	Date Collected	Time Collected	Client Sample ID	Metals Field Filtered (Y / N)	Matrix	Number of Containers	Preservation						Analysis Requested												
							Cool	HCl	HNO_3	H_2SO_4	NaOH	Other	Benzene, Chlorobenzene, Cyclohexane, Methyl cyclopentane, Toluene, Xylenes (2nd and 4th Qtr.)		+		+							Remarks	Possible Health Hazards?
			OS-2		W			×																	

Please Sign

Released By	Received By	Date	Time	Released By	Received By	Date	Time
1)				2)			
3)				4)			

In executing this Chain of Custody, the client acknowledges the terms as set forth at www.trace-labs.com/terms-of-agreement.

☐ Check this box if you would not like your samples analyzed if received outside of the conditions outlined in the Trace Sample Acceptance Policy at www.trace-labs.com/downloads.

TRACE
ANALYTICAL LABORATORIES, INC.

Trace Analytical Chain of Custody (COC) Instructions

Report Results To: Fill out this section completely to ensure your results are sent to the correct contact. Include a company name and address, the name of the person who the report is being sent to, and their contact information including an email address and phone number.

Bill To: Fill this portion out if the billing information differs from the reporting information. Include a PO #, name, address, phone number and email to ensure proper and expedient invoicing.

Turnaround Requirements: Please select one box. The standard turnaround time is five to seven business days. Expedited turnaround times are available, but require prior approval by the Project Manager.

Project Name/Sampled By: Please provide a project name that will appear on your report and include the initials or full name of the person who collected the sample.

Samples: When dropping off samples, it is important you complete all information requested. If you have varying sample names, matrices, locations or dates for multiple samples, it is best to write each one on a separate line. A single sample point with multiple containers can be recorded on a single line.

> Date/Time/Client Sample ID: Include a date and time for every sample point, this ensures the laboratory meets any hold times. The Sample ID should be a name that differentiates it from the other sample points submitted.
>
> Metals Field Filtered: If a dissolved analysis has been requested, mark this box with a Y/N (yes or no) to inform the lab as to whether the required sample was filtered during collection.
>
> Matrix/Containers/Preservation: Mark down the sample matrix for each line using the Matrix Key. Record the total number of bottles for each sample point and place an “x” in each preservation type included for that sample point.
>
> Analysis Requested: Specify the analyses you want for each sample point by writing them in the vertical boxes in this section and marking an ‘x’ next to the sample point it corresponds to.

Release of Samples: Sign your name in box number one showing that you are releasing the samples to Trace for testing.

Check the box at the bottom of the COC only if you would not like your samples analyzed if received outside of the conditions outlined in the Trace Acceptance Policy at www.trace-labs.com/downloads. If samples are received outside of these conditions, the data may be qualified.

Form 70-Z.0
Effective 3/30/17

TRACE ANALYTICAL LABORATORIES, INC.

CHAIN-OF-CUSTODY RECORD

Page________of________

Trace Analytical Laboratories, Inc.
2241 Black Creek Road
Muskegon, MI 49444-2673

Phone 231.773.5998
Fax 888.979.4469
www.trace-labs.com

Trace ID No.

Report Results To:		**Bill To:**
Company Name: Pharmacia & Upjohn Company, LLC		PO #:
Report To:		Contact Name:
Mailing Address: 7000 Portage Road		Billing Address (if different): P.O. Box 34600
City, State, Zip Code: Kalamazoo,. MI 49001		City, State, Zip Code: Bartlett, TN 38184-0600
Office Phone: 269.833.4000	Cell Phone:	Phone Number:
Email Address:		Billing Email Address: apinvoices@pfizer.com

Trace Use:

Logged By:

Checked By:

Soil Volatiles Preserved (circle if applicable):
MeOH Low Level Lab

Sampling Time:

Turnaround Requirements:

☒ Standard ☐ 48 Hour*
☐ 4 Day* ☐ 24 Hour*
☐ 3 Day*
** Requires Prior Approval*

Matrix Key:

S = Soil / Solid
W = Water
SL = Sludge
OI = Oil
WI = Wipes
LW = Liquid Waste
A = Air
D = Drinking Water

Project Name: Pfizer RCRA CAD Groundwater Monitoring

Sampled By:

Trace No.	Date Collected	Time Collected	Client Sample ID	Metals Field Filtered (Y / N)	Matrix	Number of Containers	Preservation						Analysis Requested											Remarks	Possible Health Hazards?
							Cool	HCl	HNO_3	H_2SO_4	NaOH	Other	Acetone, t-Butanol, Chlorobenzene, Ethylbenzene, Hexane, Methylene chloride, Methyl cyclopentane, MTBE, Tetrahydrofuran, Toluene, Xylenes, Chromium, Copper, Zinc	Acetone, Methylene chloride, Tetrahydrofuran, Toluene, Chromium (4th Quarter)											
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																
					W			×	×																

Please Sign	Released By	Received By	Date	Time	Released By	Received By	Date	Time
	1)				2)			
	3)				4)			

In executing this Chain of Custody, the client acknowledges the terms as set forth at www.trace-labs.com/terms-of-agreement.

☐ Check this box if you would not like your samples analyzed if received outside of the conditions outlined in the Trace Sample Acceptance Policy at www.trace-labs.com/downloads.

TRACE
ANALYTICAL LABORATORIES, INC.

Trace Analytical Chain of Custody (COC) Instructions

Report Results To: Fill out this section completely to ensure your results are sent to the correct contact. Include a company name and address, the name of the person who the report is being sent to, and their contact information including an email address and phone number.

Bill To: Fill this portion out if the billing information differs from the reporting information. Include a PO #, name, address, phone number and email to ensure proper and expedient invoicing.

Turnaround Requirements: Please select one box. The standard turnaround time is five to seven business days. Expedited turnaround times are available, but require prior approval by the Project Manager.

Project Name/Sampled By: Please provide a project name that will appear on your report and include the initials or full name of the person who collected the sample.

Samples: When dropping off samples, it is important you complete all information requested. If you have varying sample names, matrices, locations or dates for multiple samples, it is best to write each one on a separate line. A single sample point with multiple containers can be recorded on a single line.

> Date/Time/Client Sample ID: Include a date and time for every sample point, this ensures the laboratory meets any hold times. The Sample ID should be a name that differentiates it from the other sample points submitted.
>
> Metals Field Filtered: If a dissolved analysis has been requested, mark this box with a Y/N (yes or no) to inform the lab as to whether the required sample was filtered during collection.
>
> Matrix/Containers/Preservation: Mark down the sample matrix for each line using the Matrix Key. Record the total number of bottles for each sample point and place an “x” in each preservation type included for that sample point.
>
> Analysis Requested: Specify the analyses you want for each sample point by writing them in the vertical boxes in this section and marking an ‘x’ next to the sample point it corresponds to.

Release of Samples: Sign your name in box number one showing that you are releasing the samples to Trace for testing.

Check the box at the bottom of the COC only if you would not like your samples analyzed if received outside of the conditions outlined in the Trace Acceptance Policy at www.trace-labs.com/downloads. If samples are received outside of these conditions, the data may be qualified.

Form 70-Z.0
Effective 3/30/17

Table 9

CAD/CAC Well Network – Purge Methods
Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Lower Aquifer

Well ID/Network	Dedicated/ Non-dedicated	Purge Method	Packer (P)/ No Packer (NP)
MW-104 (CAD)	Dedicated	BP/B	P
MW-112 (CAD)	Dedicated	BP/B	NP
MW-116 (CAD)	Dedicated	BP/B	P
MW-142 (CAD)	Dedicated	BP/B	P
MW-149 (CAD)	Dedicated	BP/B	P
MW-152 (CAD)	Dedicated	BP/B	P
MW-153 (CAD)	Dedicated	BP/B	P
MW-158 (CAD)	Dedicated	BP/B	P

Upper Aquifer

Well ID/Network	Dedicated/ Non-dedicated	Purge Method	Packer (P)/ No Packer (NP)
MW-17 (CAD)	Dedicated	BP/B	NP
MW-101A (CAD)	Dedicated	BP/B	NP
MW-108R (CAD)	Dedicated	BP/B	NP
MW-109R (CAD)	Dedicated	BP/B	NP
MW-110 (CAD)	Dedicated	BP/B	NP
MW-111 (CAD)	Dedicated	PP/B	NP
MW-115A (CAD)	Dedicated	BP/B	P
MW-133 (CAD)	Dedicated	PP/B	NP
MW-141 (CAD)	Dedicated	BP/B	NP
MW-161R (CAD)	Dedicated	BP/B	NP
OS-2 (CAC)	Dedicated	VTP/SP	NP

NOTES:
BP = Bladder Pump, PP = Peristaltic Pump, B = Bailer
VTP = Vertical Turbine Pump, SP = Submersible Pump
CAC = Corrective Action Characterization well sampled biannually.
CAD = Corrective Action Detection well sampled biannually.
Some wells have a BP/B designation indicating that a dedicated bailer and bladder pump have both been assigned to that well.
A PP/B designation indicates that a peristaltic pump with dedicated tubing and dedicated bailer have both been assigned to that well.

ATTACHMENT B

FIGURE

Base Map Adapted From Abrams Aerial Survey Corporation Map
Date Of Photography March 20, 1990

FIGURE 1 - BASE MAP

PHARMACIA & UPJOHN COMPANY, LLC
PORTAGE FACILITY
Section 14, T. 3 S., R. 11 W.
City Of Portage
Kalamazoo County, Michigan

Last Updated: June 3, 2022

1534

AMERICAN HYDROGEOLOGY CORP.

ATTACHMENT C

WELL BORING LOGS AND WELL CONSTRUCTION LOGS

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW-28

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
5 ft.	Topsoil	5 ft.		
6 ft.	Sand, Stones & Clay	11 ft.		
6 ft.	Fine Sand & Clay	17 ft.		
5 ft.	Sand, Stones & Clay	22 ft.		
6 ft.	Sand, Stones & Clay	28 ft.		
7 ft.	Sand, Little Gravel & Clay	35 ft.		
6 ft.	Sand, Little Gravel & Clay	41 ft.		
6 ft.	Sand, Stones & Clay	47 ft.		
1 ft.	Clay	48 ft.		

Static water level - 14' 10"

Set 2" stainless steel #10 slot screen from 38' 4" to 41' 4" on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

ED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW- 29

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

HICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
6 ft.	Topsoil	6 ft.		
5 ft.	Sand, Stones & Clay	11 ft.		
7 ft.	Fine Sand, Stones & Clay	18 ft.		
7 ft.	Sand, Stones & Clay	25 ft.		
6 ft.	Sand & Clay	31 ft.		
6 ft.	Sand, Little Gravel & Clay	37 ft.		
5 ft.	Sand & Clay	42 ft.		
1 ft.	Clay	43 ft.		

Static water level - 21' 10½"

Set 2" stainless steel, #10 slot screen from 34 to 37 feet on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

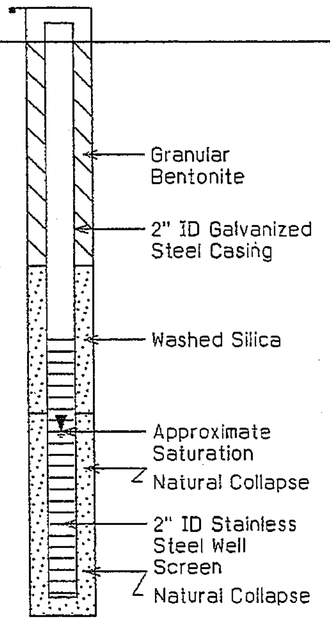
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Upjohn Monitoring
L[illegible]n: South side of northeast field north of lowland
Date (s) Drilled: May 18, 1994
Logged By: Michael T. Janeczko
Drilling Co.: Stearns
Weather Conditions: Sunny

Well/Boring ID: CW-30A
Page: 1 of 1
Boring Depth: 15.5'
Boring Diameter: 8.25"
Drilling Method: Hollow Stem Auger
Drilling Equipment: CME-55
Top of Slots: 8.0' b.g.l.
Bottom of Slots: 15.0' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
						SAND-fine to medium grained, subangular to subrounded, trace Clay, slightly cohesive, dry, dark brown.	
						SAND-fine to medium grained, subangular to subrounded, trace fine Gravel, loose, dry, brown.	
5							857.2
						SAND-medium to coarse grained, subangular to rounded, some fine to medium subangular to rounded Gravel, poorly sorted, loose, dry, gray.	
10		3 2 2 3	1.0'	ND		SAND-fine to medium grained, subangular to subrounded, well sorted, loose, saturated at ≈10.5' bgl, gray.	852.2
		3 2 2 2	1.5'	ND			
15		2 1 1 2	1.2'	ND			847.2
		2 4					
20							842.2
25							837.2
30							832.2
3							827.2

WELL CONSTRUCTION DETAIL



Notes:

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW- 3/

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Topsoil	3 ft.		
3 ft.	Red Sand	6 ft.		
4 ft.	Red Sand, Little Gravel & Clay	10 ft.		
3 ft.	Fine Sand, Stones & Clay	13 ft.		
5 ft .	Fine Sand & Clay	18 ft.		
2 ft.	Sand, Little Gravel & Clay (hard)	20 ft.		
11 ft.	Sand, Stones & Clay (hard)	31 ft.		
3 ft.	Sand, Little Gravel & Clay (hard)	34 ft.		
[illegible]	Clay	35 ft.		

Static water level - 22' 5"

Set 2" stainless steel, #10 slot screen from 31 to 34 feet on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW35

DRILLED BY Dwain Hanson DRILLER COMPLETED June 19, 19 89

LOCATION

HICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
1 ft.	Brown Silty Loam	1 ft.		
4 ft.	Brown Fine Sand & Clay (dry)	5 ft.		
2 ft.	Brown Fine Sand & Clay (moist)	7 ft.		
1 ft.	Brown Medium Sand & Clay (moist)	8 ft.		
3 ft.	Gray Medium Sand & Little Clay (wet)	11 ft.		
3 ft.	Gray Coarse Sand, Gravel & Little Clay	14 ft.		
10 ft.	Gray Medium Sand, Fine Gravel & Little Clay	24 ft.		
13 ft.	Gray Medium Sand, Fine Gravel, Little Clay & Some Stones	37 ft.		
8 ft.	Gray Clay, Sand & Stones (tight, dry)	45 ft.		
3 ft.	Clayey Sand, Interstratified with Fine Sand	48 ft.	yes	

First static water level - 7.09 feet at a depth of 12 feet

Second static water level - 9.76 feet at a depth of 48 feet

Set 2" stainless steel #10 slot screen from 32 to 37 feet on 2" galvanized pipe and cap.

Permeameter tests run at 13 to 16 feet.

Hole test pumped at 13 to 16 feet.

Q = 5.75 gpm Q/s = 3.21 gpm per ft.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company -- Kalamazoo, Michigan HOLE NO. CW 37

DRILLED BY George Fahrni DRILLER COMPLETED January 9, 19 90

LOCATION Near railroad tracks at spill area

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
7 ft.	Fine Sand & Clay	7 ft.		
6 ft.	Sand & Clay	13 ft.		
14 ft.	Sand, Gravel & Clay	27 ft.		
7 ft.	Fine Sand, Little Gravel & Clay	34 ft.		31 ft.
7 ft.	Fine Sand, Clay & Stones	41 ft.		31 ft.
7 ft.	Fine Sand & Clay	48 ft.		31 ft.

Set 2" stainless steel screen from 36 to 39 feet on 2" galvanized pipe and cap. Pipe is 2' 2" above ground surface.

Hole was pumped for a water sample at a depth of 34 feet.

THE OHIO DRILLING CO.
INCORPORATED
MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, M ichigan HOLE NO. DF-4
Monitoring Well

DRILLED BY Dwain Hanson DRILLER COMPLETED March 7, 19 89

LOCATION

ICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
2 ft.	Backfill	2 ft.		
3 ft.	Sand & Stones	5 ft.		
6 ft.	Sand & Stones	11 ft.		
5 ft.	Fine Sand	16 ft.		
6 ft.	Fine Sand	22 ft.		
2 ft.	Sand, Little Gravel & Stones	24 ft.		
7 ft.	Sand, Little Gravel & Stones	31 ft.		
6 ft.	Sand, Little Gravel & Stones	37 ft.		
	Static water level - 29' 1"			
	Set 2" stainless steel #10 slot screen from 40 to 43 feet on 2" galvanized pipe and cap.			
	10 feet of 8" casing set over the 2" and cemented into the ground.			

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. DF-17
3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED May 3, 19 83

5430S 2220E

LOCATION 468 ft. south of No. DF-15 Elevatn = 866.55

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Clay & Loam	3 ft.		
5 ft.	Clay, Sand & Gravel	8 ft.		
10 ft.	Gravel, Sand & Clay	18 ft.		
7 ft.	Sand, Little Gravel & Clay	25 ft.		14 ft.
3 ft.	Sand & Clay	28 ft.		14 ft.
	Set well point - 42"			
	Set 2" pipe - 27 ft.			
	2 ft. above ground			
	Pumped well between 25 - 28 ft.			

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. DF-18

3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED May 4, 19 83

6030 S 2220 E

LOCATION 600 ft. south of No. DF-17 Elevation = 873.09

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
2 ft.	Clay & Loan	2 ft.		
3 ft.	Sand & Clay	5 ft.		
3 ft.	Sand, Gravel & Clay	8 ft.		
9 ft.	Gravel, Sand & Clay	17 ft.		
10 ft.	Sand, Gravel & Clay	27 ft.		2 ft.
3 ft.	Sand, Gravel & Clay	30 ft.		2 ft.
	Set well point - 42"			
	Set 2" pipe - 29 ft.			
	2 ft. above ground			
	Pumped between 27 - 30 ft.			

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan

HOLE NO. DF-20

3" Test Hole

DRILLED BY George Fahrni DRILLER

COMPLETED Nov. 1, 19 83

LOCATION Elevation = 855.25 2700'S 2130W

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
1 ft.	Muck	1 ft.		
7 ft.	Clay & Fine Sand	8 ft.		
9 ft.	Sand & Clay	17 ft.		
10 ft.	Sand, Gravel & Clay	27 ft.		
6 ft.	Gravel, Sand & Clay	33 ft.		18 ft.
3 ft.	Gravel, Sand, Clay & Stones	36 ft.		18 ft.
	Pumped well between 33 - 36 ft.			
	Set 3 ft. of Clayton Mark screen			
	Set 33 ft. of 2" pipe			
	Set 2 ft. of 2" pipe above ground			

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. LA 1

3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED December 9, 19 86

LOCATION 11 ft. south of well No. 5

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVES	WATER FROM SURFACE
6 ft.	Sand & Clay	6 ft.		
4 ft.	Clay, Sand & Gravel	10 ft.		
10 ft.	Clay & Sand	20 ft.		
6 ft.	Sand & Clay	26 ft.		
6 ft.	Sand & Clay	32 ft.		
6 ft.	Sand, Gravel & Little Clay	38 ft.		20 ft.
6 ft.	Sand, Gravel & Little Clay	44 ft.		25 ft.
7 ft.	Fine Sand, Little Gravel & Clay	51 ft.		
5 ft.	Sand, Gravel & Little Clay	56 ft.		38 ft.
4 ft.	Sand, Little Gravel & Little Clay	60 ft.		
7 ft.	Clay & Sand	57 ft.		
10 ft.	Sand, Little Gravel & Clay	77 ft.		28 ft.
7 ft.	Sand, Little Gravel & Clay	94 ft.		31 ft.
7 ft.	Sand, Gravel & Clay	91 ft.		32 ft.
7 ft.	Sand & Clay	98 ft.		32 ft.
7 ft.	Sand & Clay	105 ft.		32 ft.
8 ft.	Sand & Little Clay	113 ft.		32 ft.
7 ft.	Sand	120 ft.		32 ft.
7 ft.	Sand & Little Gravel	127 ft.		32 ft.
7 ft.	Sand & Gravel	134 ft.		32 ft.
5 ft.	Sand & Little Gravel	139 ft.		32 ft.
4 ft.	Clay & Sand	143 ft.		
4 ft.	Clay, Sand & Gravel	147 ft.		
5 ft.	Sand, Little Gravel & Clay (tight)	152 ft.		36 ft. 6 in.
5 ft.	Sand, Little Gravel & Clay (tight)	157 ft.		36 ft. 6 in.
3 ft.	Sand & Clay (tight)	160 ft.		36 ft. 6 in.
1 ft.	Clay & Fine Sand	161 ft.		
	Pumped for water samples at:	70 ft.		
		100 ft.		
		130 ft.		
		160 ft.		
	Converted to a permanent sample well - screened 157 - 160 ft.			
	Set 157' 9" of 3" pipe			
	1 - 3" pipe cap			

ENVIROLOGIC TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-17

SHEET 1 of 2

CLIENT: THE UPJOHN COMPANY - 930142

LOCATION: PORTAGE, MICHIGAN

DRILLING CO: ED&S

START DATE: 12/30/93 10:30 AM

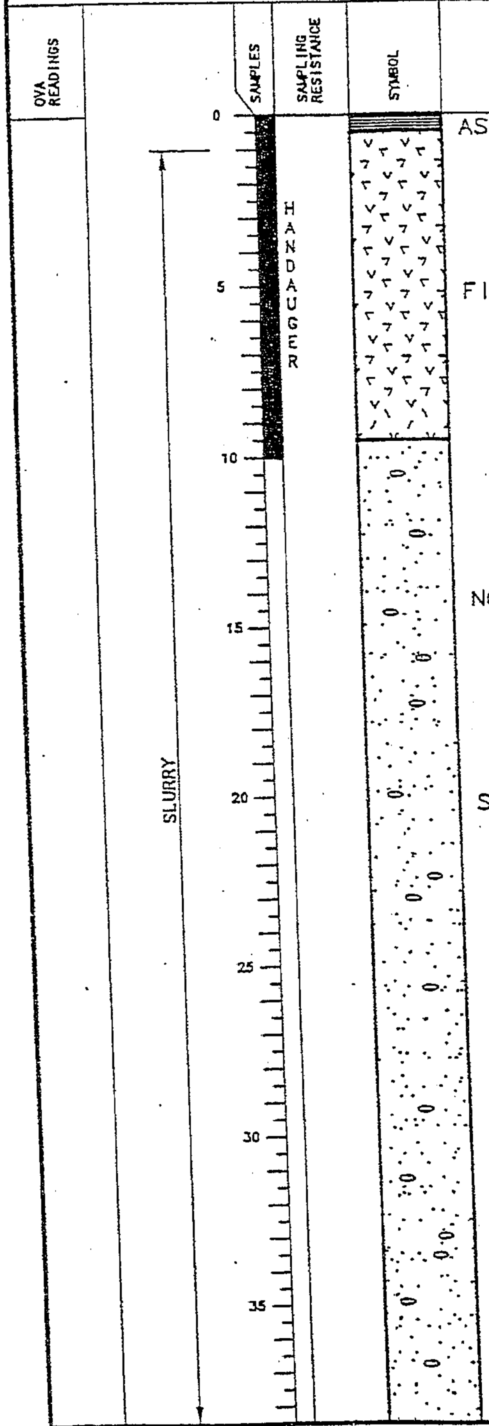
GEOLOGIST: KRS

COMPLETION DATE: 12/30/94 3:30 PM

ELEVATIONS:

SURFACE: 871.56 TOP OF CASING: 871.17

STATIC WATER LEVEL:



DESCRIPTION

ASPHALT

FILL
Sand and gravel.

NO SPLIT-BARREL SAMPLES UNTIL 55 FEET.
(Please refer to the Work Plan.)

SAND
Light brown, medium to coarse grained, some fine to medium gravel, damp.

▨	GRAVEL	▥	SILT	▨	ORGANIC	▤	SHALE	▨	MISC. FILL	▽	SATURATION LEVEL AT TIME OF DRILLING
▨	SAND	▨	CLAY	▨	TILL	▩	ROCK	▨	TOPSOIL	▼	STATIC WATER LEVEL
										N.D.	NOT DETECTED BY Hnu OR OVA

ENVIROLOGIC TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-17

SHEET 2 of 2

CLIENT: THE UPJOHN COMPANY - 930142

LOCATION: PORTAGE, MICHIGAN

ELEVATIONS:

SURFACE: 871.56 TOP OF CASING: 871.17

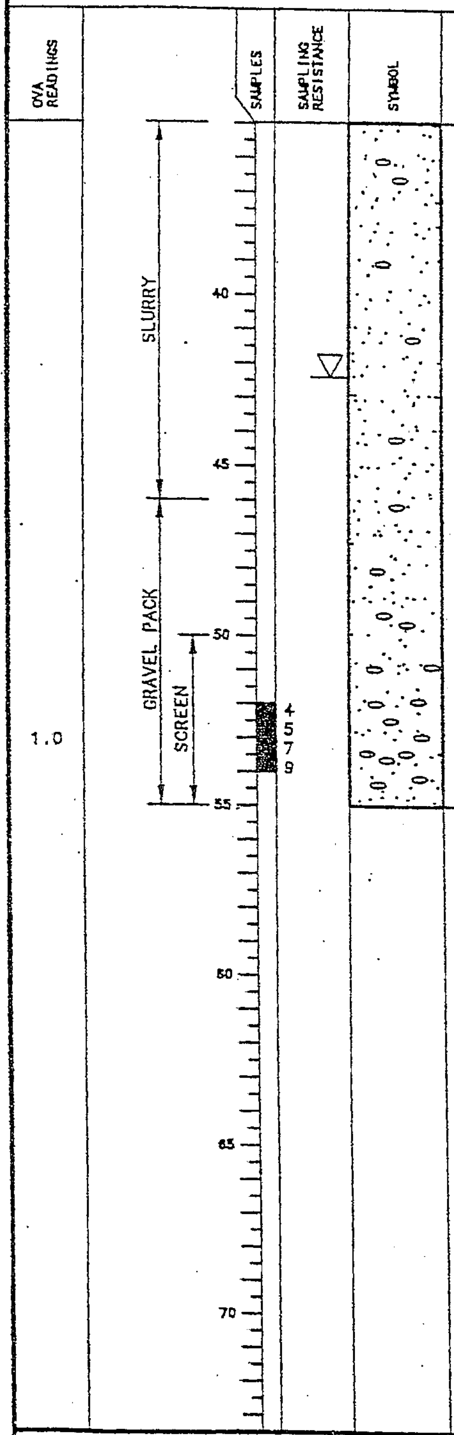
STATIC WATER LEVEL:

DRILLING CO: ED&S

GEOLOGIST: KRS

START DATE: 12/30/93 10:30 AM

COMPLETION DATE: 12/30/93 3:30 PM



DESCRIPTION

NO SPLIT-BARREL SAMPLES UNTIL 55 FEET.
(Please refer to the Work Plan.)

SAND
Brown, medium to coarse grained, some fine to medium gravel, wet.

SAND
Gray, fine to medium grained, with fine gravel, wet.

EOB

▨	GRAVEL	▨	SILT	▨	ORGANIC	▨	SHALE	▨	MISC. FILL	▽	SATURATION LEVEL AT TIME OF DRILLING
▨	SAND	▨	CLAY	▨	TILL	▨	ROCK	▨	TOPSOIL	▼	STATIC WATER LEVEL
										N.D.	NOT DETECTED BY Hnu OR OVA

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-101A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

UNIT DRY WT. LBS./FT.^{3}

SURFACE ELEVATION 870.6

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
		RB	Boring advanced without sampling to 60.0'. See MW-101 and MW-105 borings logs for soil classification.	
60.0	1	SS	Fine to medium sand, trace silt, gravel and coarse sand - gray - dense to very dense. (SP)	49
		RB		
65.0	2	SS		71
		RB		
70.0	3	SS		48
71.5	3A	SS	Silty sand, little clay, trace fine gravel - brownish gray - very dense. (SM)	25/6

END OF BORING

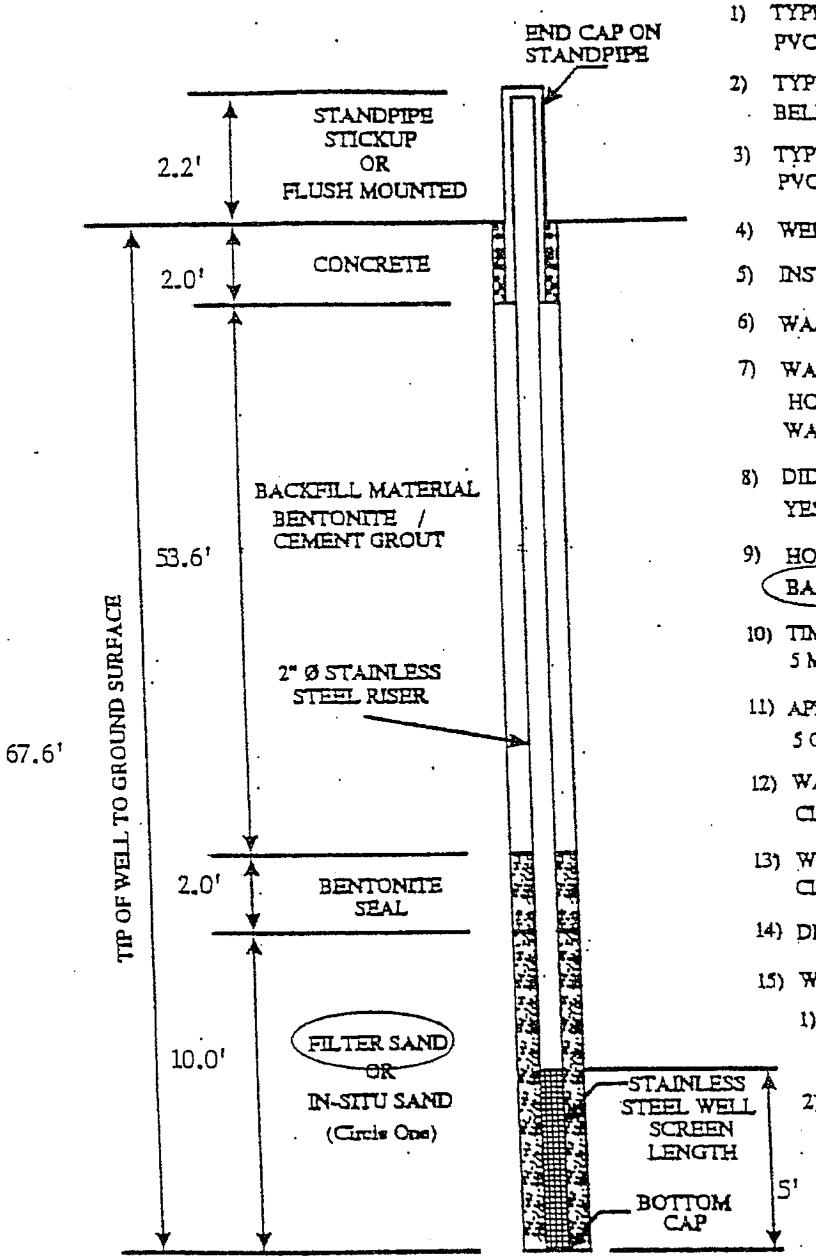
Boring advanced to 70.0' with washed rotary drilling techniques.
10.0' of 4.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL	WS OR WD	BORING STARTED 10/19/90	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 10/19/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL		RIG/FOREMAN B-61/TT	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
WATER, REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-22-90
5 MIN., 15 MIN., 30 MIN., OTHER 2 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 85 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
42.10' FT OR DRY
2) OTHER MEASUREMENTS:
DATE 10-31-90, 42.58 FT FROM T. ST. PIPE
DATE 11-04-90, 42.48 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW-101A DATE INSTALLED 10-19-90 DRILL RIG MOBILE B-61

DRILLER TT DRILL CREW DP

JOB/CLIENT The UpJohn Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-104

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

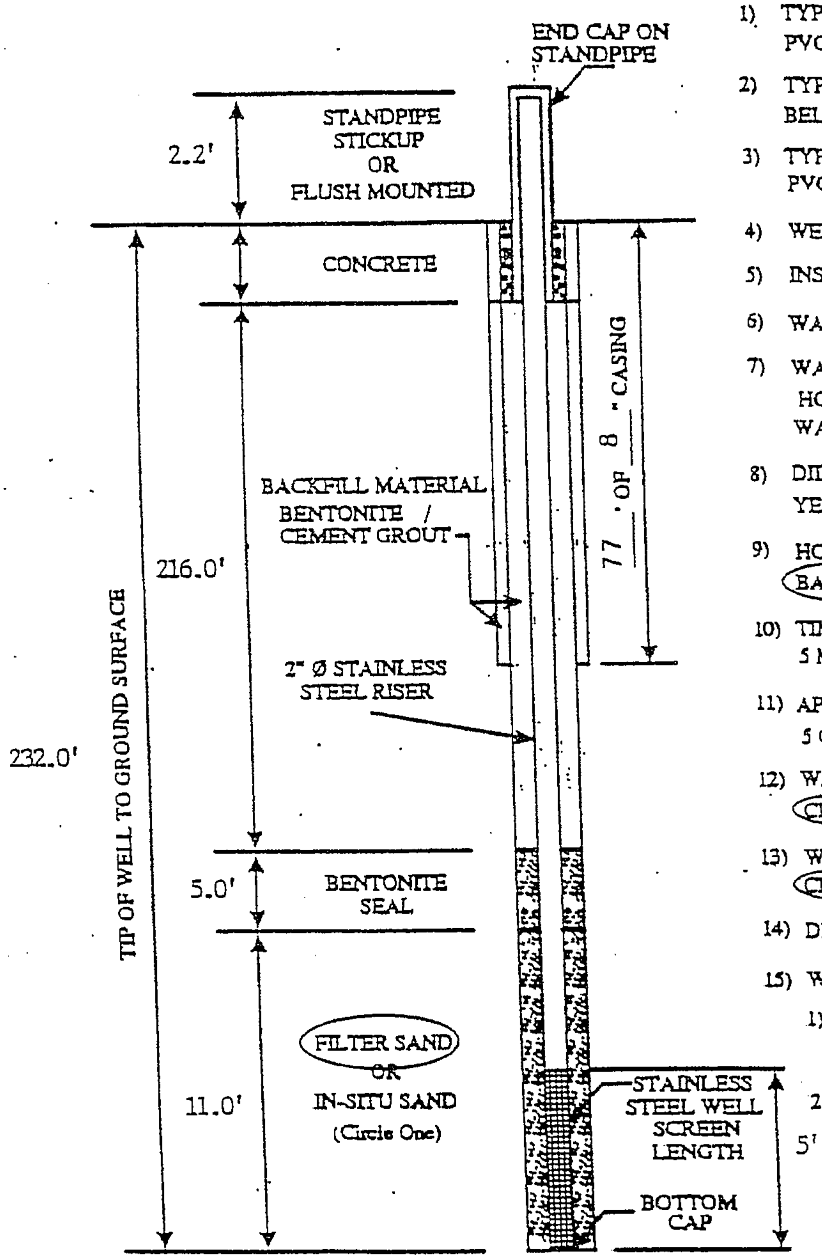
SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 870.7	UNIT DRY WT. LBS./FT.^{3}	—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
230.0			CT			Boring advanced without sampling to 230.0'. See MW-101, MW-105, and MW-106 for soil classifications.		
						END OF BORING Boring advanced to 230.0' using cable tool drilling techniques. 24.0' of 16.0" temporary casing; 156.0' of 12.0" temporary casing; 230.0' of 8.0" temporary casing. A 200 foot 5" permanent casing with 30 feet of stainless steel screen was installed for a temporary pumping well. 77.0' of 8.0" permanent casing. Monitoring well installed within 5.0" permanent casing. See well installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 08/30/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 09/11/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN OHIO/JK	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 11-09-90
5 MIN., 15 MIN, 30 MIN, OTHER 2½ Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 92 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
41.80 FT OR DRY

2) OTHER MEASUREMENTS:

DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

WELL NO. MW-104 DATE INSTALLED 11-07-90 DRILL RIG Cable Tool CME-550

DRILLER JH/ODC/DB DRILL CREW RP and DB

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Pharmacia Corporation

tion: Former MW 108 location

Date (s) Drilled: 10/3/00

Logged By: William K. Hunsberger

Drilling Co.: Cook Drilling

Weather Conditions: Partly cloudy ~70°

Well/Boring ID: MW 108R

Page: 1 of 2

Boring Depth: 52.0'

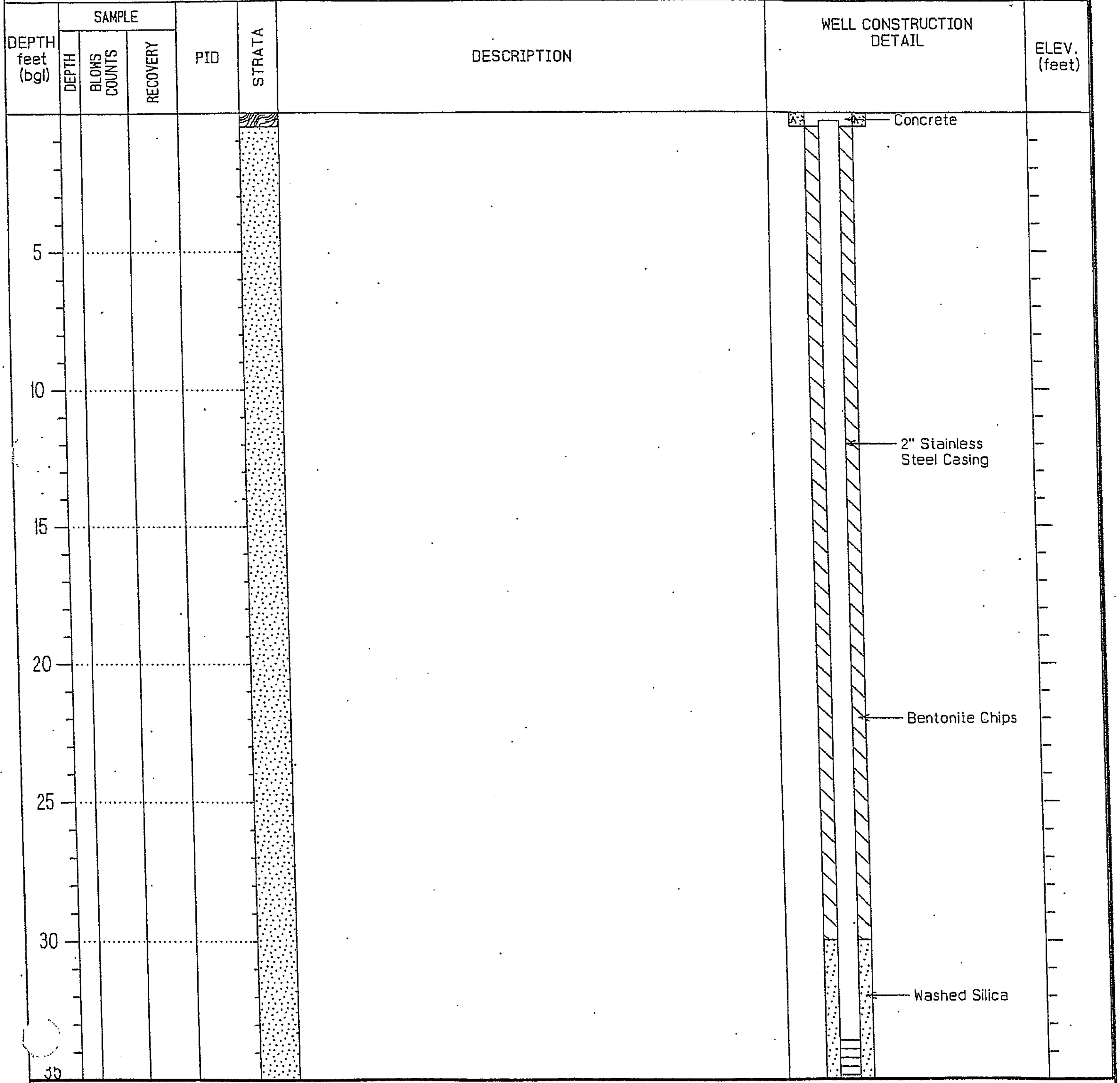
Boring Diameter: 8.5"

Drilling Method: 4.25" Hollow Stem Auger

Drilling Equipment: Diedrich D-50

Top of Slots: 33.6' bgs

Bottom of Slots: 48.5' bgs

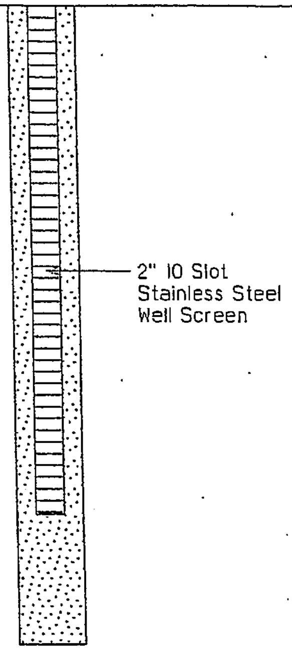


Notes: Lithology 0-40' from STS log of MW 108.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Pharmacia Corporation Well/Boring ID: MW 108R Page: 2 of 2

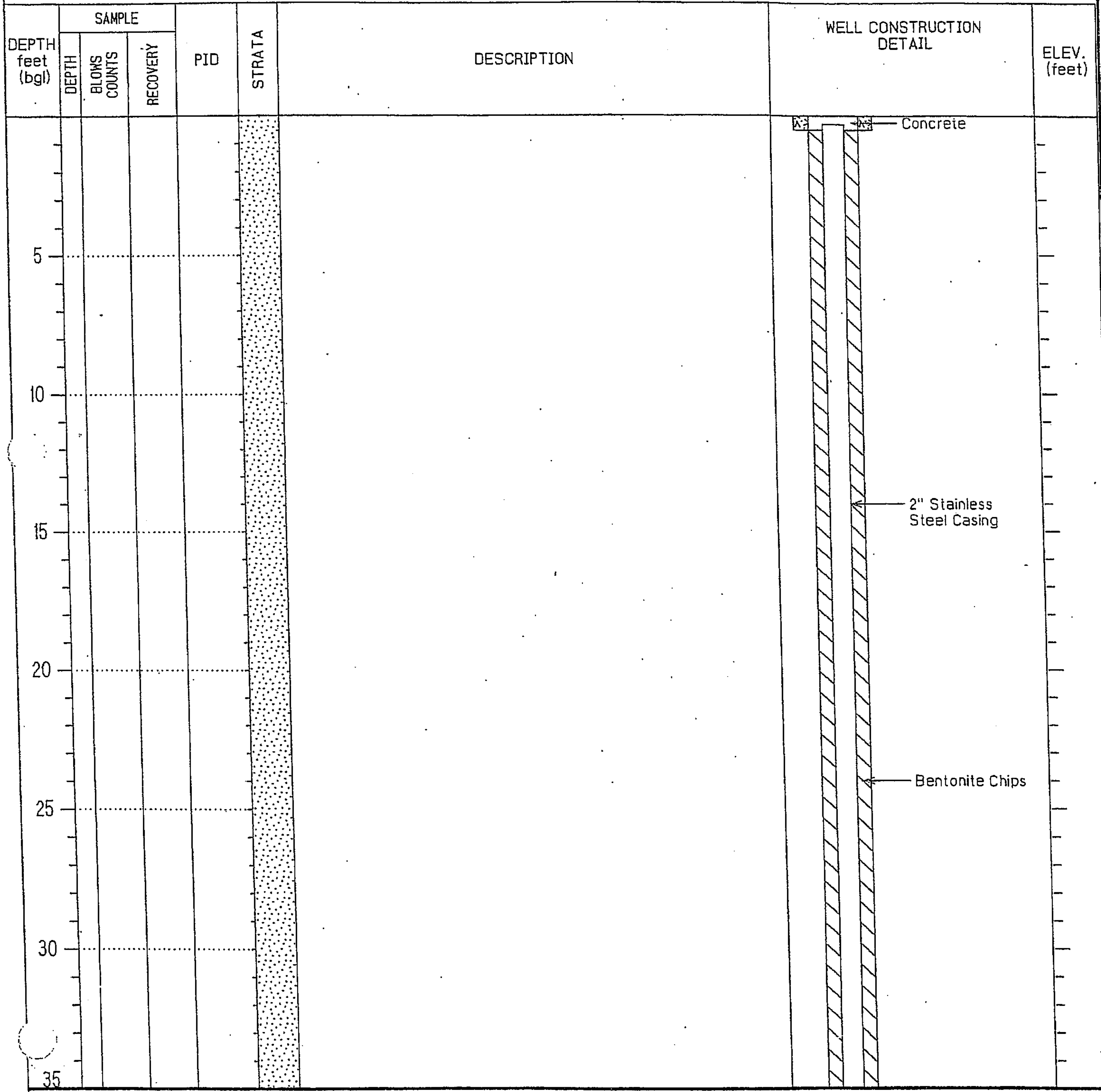
DEPTH feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
40								
		8 10 12 12	1.0'	<1		Medium dense gray-brown fine to medium SAND, little coarse Sand, trace fine to medium Gravel, trace Silt. Sand subrounded to subangular, Gravel subangular. Slightly moist.		
45		9 13 16 18	1.8'	<1		Dense brown-gray fine to medium SAND, some Clay, little coarse Sand, trace Silt. Sand subrounded to subangular. Slightly moist.		
		18 19 27 31	1.6'	<1 <1		Dense gray-brown fine to medium SAND, little Clay, little Silt. Sand subrounded to subangular. Moist.		
50		16 18 29 30	1.4'	<1		Dense gray-brown fine SAND, little medium to coarse Sand, some Clay, trace fine to medium Grave. Sand subrounded to subangular, Gravel subangular. Slightly moist.		
		12 12 14 21	1.7'	<1		Firm gray-brown CLAY & SILT. Medium plasticity. Slightly moist.		
55								
60								
65								
70								
75								



Notes: Lithology 0-40' from STS log of MW 108.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

ject: Pharmacia Corporation
Well/Boring ID: MW 109R
Page: 1 of 2
tion: Approximately 20'E, 10'S of former MW 109 location
Boring Depth: 49.5'
Date (s) Drilled: 10/3/00 and 10/6/00
Boring Diameter: 8.5"
Logged By: William K. Hunsberger
Drilling Method: 4.25" Hollow Stem Auger
Drilling Co.: Cook Drilling
Drilling Equipment: Diedrich D-50
Weather Conditions: Partly cloudy ~70˚, Partly cloudy ~50˚
Top of Slots: 38.5' bgs
Bottom of Slots: 48.4' bgs



Notes: Lithology 0-48' from STS log of MW 109.

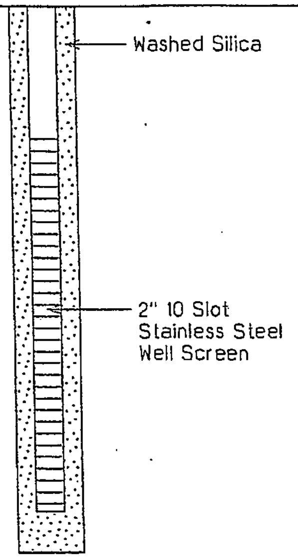
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Pharmacia Corporation

Well/Boring ID: MW 109R

Page: 2 of 2

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
40								
45								
	☒	39 48 53	1.5'	<1 <1		Very firm medium gray CLAY, some Silt, little fine to coarse Sand, trace fine to medium Gravel. Medium plasticity. Slightly moist.		
50						Very dense medium gray-brown fine to medium SAND, little Clay & Silt. Sand subangular. Very moist.		
55								
60								
65								
70								
75								



Notes: Lithology 0-48' from STS log of MW 109.

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-110

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

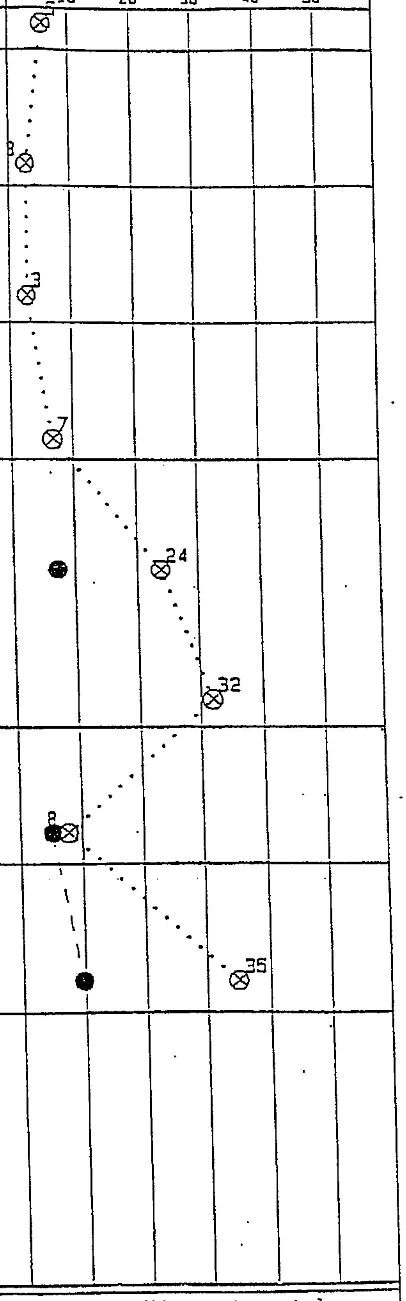
-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION 870.9

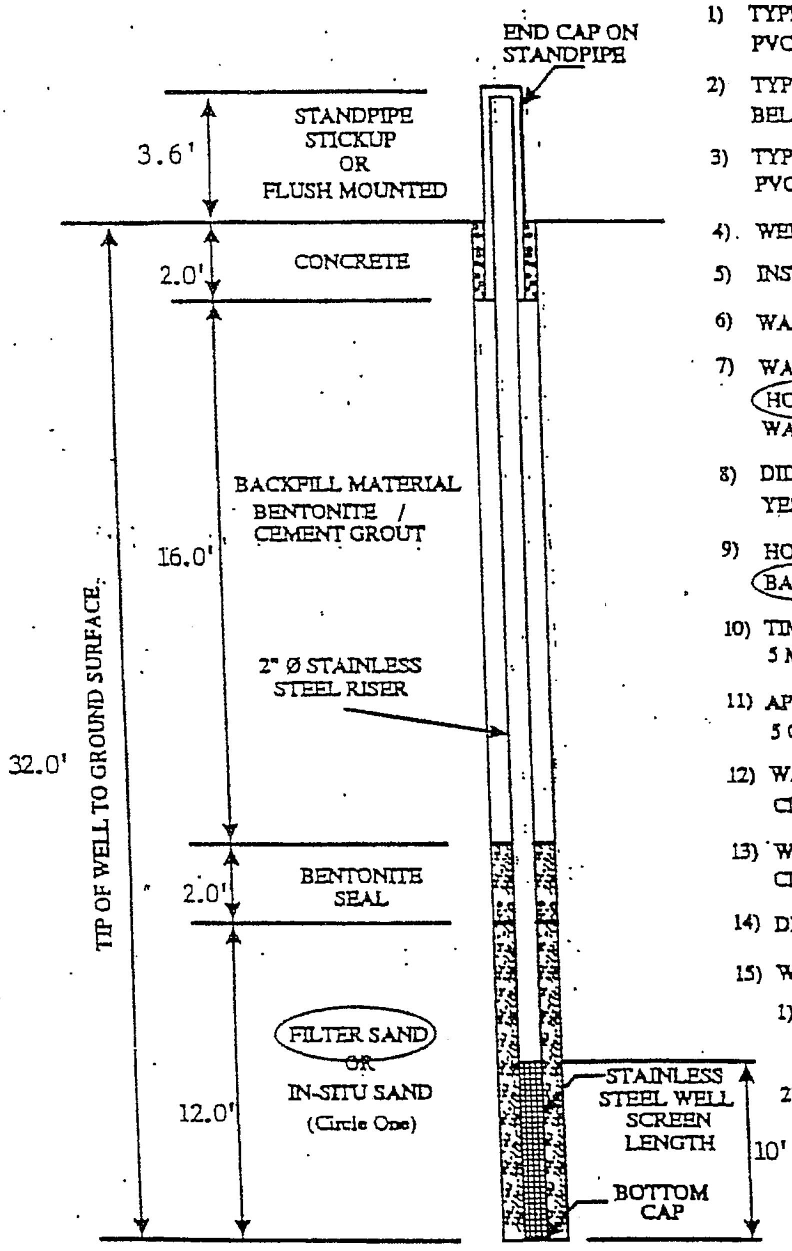
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
	1	SS	Silty fine sand and topsoil, trace gravel, coarse sand and roots - brown - loose. (TOPSOIL)
		HS	Fine to medium sand, little coarse sand, trace silt and gravel - brown - very loose - moist. (SW)
5.0	2	SS	
		HS	Fine to medium sand, trace coarse sand - brown - very loose - moist. (SP)
10.0	3	SS	
		HS	Fine sand - light brown - loose - moist. (SP)
15.0	4	SS	
		HS	Fine to medium sand, some silt, little fine to medium gravel and coarse sand, trace clay - light brown - medium dense to dense - moist. (SM)
20.0	5	SS	
		HS	
25.0	6	SS	
		HS	Gravelly medium to coarse sand, little fine sand, trace silt - loose - saturated. (SP-GP) Note: Obstruction encountered at 26.5 feet borehole offset 6.0' Northeast, and continued. Saturated at 29.6'.
30.0	7	SS	
		HS	Fine to medium sand, little coarse sand and fine to medium gravel, trace silt - gray - dense - saturated. (SW)
35.0	8	PL*	
37.0			END OF BORING Boring advanced to 35.0' with 4.25" hollow stem auger. Monitoring well installed. See well installation diagram. Note: PL* indicates 3.0" plastic liner.



The stratification lines represent the approximate boundary lines between soil types in-situ, the transition may be gradual.

WL WS OR WD
BORING STARTED 07/04/90
STS OFFICE Lansing-07
BCR ACR
BORING COMPLETED 07/04/90
ENTERED BY TJM
SHEET NO. 1 OF 1
WL 28.7 875 hrs AB
RIG/FOREMAN CME-550/JS
APP'D BY AMM
STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4). WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 30 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
29.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 24.69 FT FROM T. ST. PIPE
DATE 10-31-90, 30.24 FT FROM T. ST. PIPE
DATE 11-04-90, 30.28 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

WELL NO. MW-110 DATE INSTALLED 07-04-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - MI1DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-111

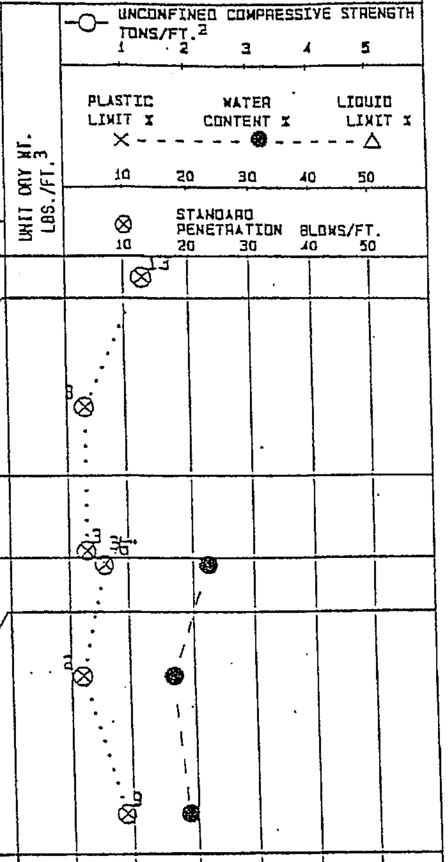
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

E LOCATION
TAGE. MICHIGAN

SURFACE ELEVATION 864.4

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
		1	SS			Fine to medium sand and topsoil, little silt and clay, trace gravel and roots - medium dense - moist. (TOPSOIL)
			HS			Fine to medium sand, little silt and clay, trace gravel - brown - very loose - moist. (SC-SM)
5.0		2	SS			
			HS			
			HS			Peat - black - loose - moist. (PT)
10.0		3	SS			
		3A	SS			Clayey sand, some silt, trace medium sand - gray - loose - moist to saturated. (SC-SM)
			HS			
			HS			Saturated at 13.8'.
15.0		4	SS			Fine to medium sand, trace silt, clay and coarse sand - gray - loose to very loose - saturated. (SP)
			HS			
20.0		5	PL*			



END OF BORING

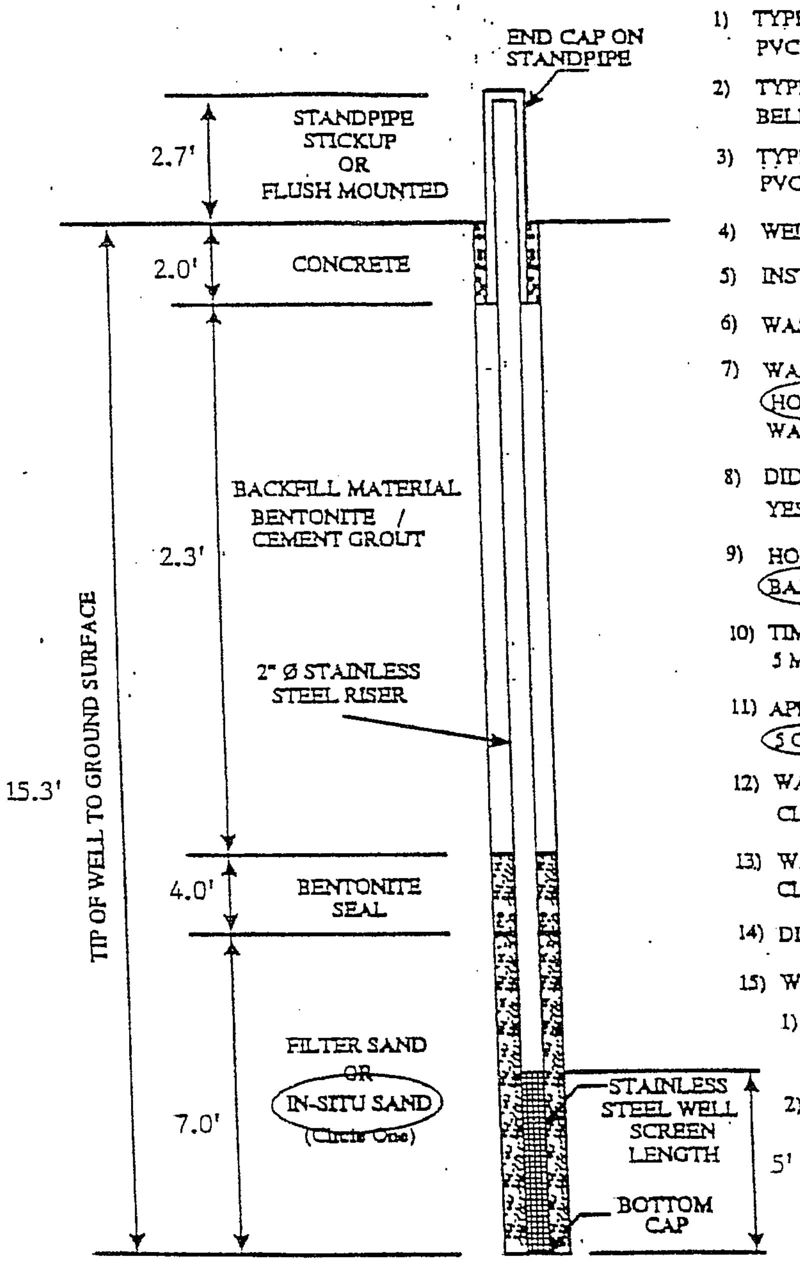
Boring advanced to 20.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD 13.8' WD	BORING STARTED 07/09/90	STS OFFICE Lansing-01	
BCR 12.7' ACR	BORING COMPLETED 07/09/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 11.9' 824 hrs AB	RIG/FOREMAN CME-550/JS	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-31-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
[✓ 5 GAL] 10 GAL, 15 GAL, OTHER ________

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
15.34' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 11-04-90 , 15.06 FT FROM T, ST. PIPE
DATE ________ , ________ FT FROM T, ST. PIPE
DATE ________ , ________ FT FROM T, ST. PIPE
DATE ________ , ________ FT FROM T, ST. PIPE

WELL NO. MW-111 DATE INSTALLED 07-09-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

onsultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-112

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

ITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

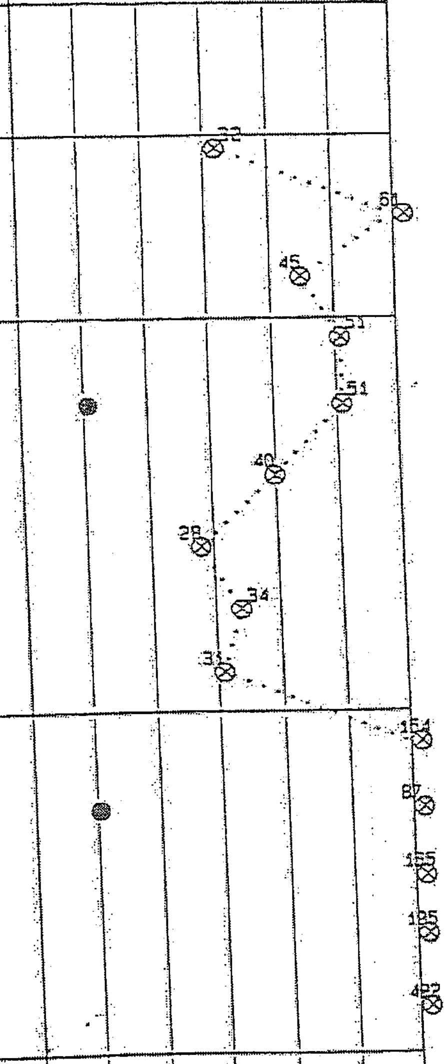
PLASTIC LIMIT % X WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

UNIT DRY WT. LBS./FT.^{3}

SURFACE ELEVATION 863.7

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
		HS	Boring advanced without sampling to 30.0'. See MW-111 boring log for soil classification.
30.0	1	SS	Medium to coarse sand, trace silt and gravel - gray - dense to very dense - moist. (SP)
		RB	
	2	SS	
35.0		RB	
	3	SS	
		RB	Fine sand, trace medium to coarse sand and fine gravel - brown - medium dense to very dense - moist. (SP)
	4	SS	
40.0		RB	
	5	SS	
		RB	
	6	SS	
		RB	
	7	SS	
		RB	
	8	SS	
50.0		RB	
	9	SS	
		RB	Fine to medium sand, little fine to medium gravel and silt, trace coarse sand - brown - extremely dense. (SM)
	10	SS	
55.0		RB	
	11	SS	
		RB	
	12	SS	
60.0		RB	
	13	SS	
		RB	
	14	SS	
65.0		RB	



... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-112
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

E LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
						Continued from previous page		
65.0		15	SS			Silty clay, trace sand - gray. (CL)		50
			RB					
		16	SS					
			RB					
70.0		17	PL*					287
			HS					
			HS			Medium to coarse sand, little to trace gravel, trace silt, gray - dense - saturated. (SP)		
75.0		18	SS					59
			HS					
80.0		19	SS					47
81.5								

END OF BORING

Boring advanced to 70.0' with washed rotary drilling techniques.
55.0' of 10.0" permanent casing set and grouted.
Boring redrilled from 0.0' to 80.0' with 4.25" hollow stem auger.

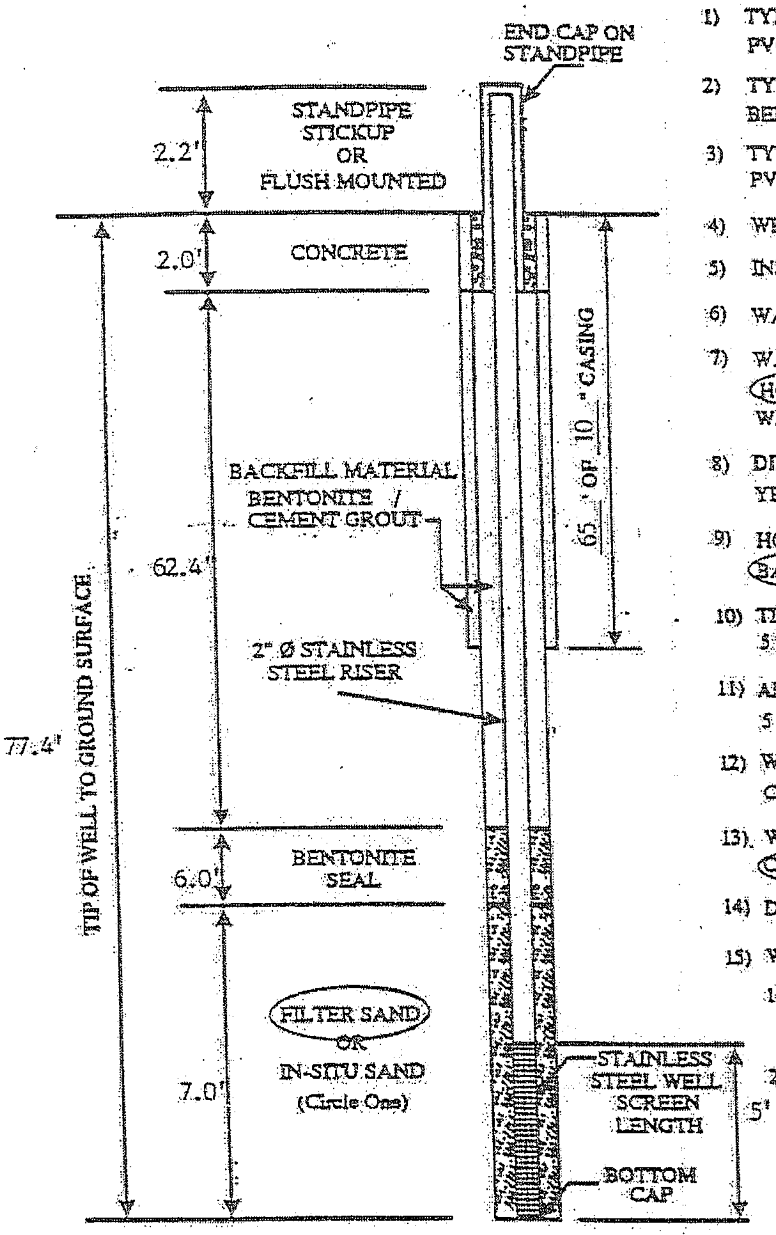
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types in-situ, the transition may be gradual.

WL 13.0'	WS OR WD WD	BORING STARTED 07/31/90	STS OFFICE Lansing-01	
WL BCR	ACR	BORING COMPLETED 08/08/90	ENTERED BY TJM	SHEET NO. 2 OF 2
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-09-90
5 MIN., 15 MIN, 30 MIN, OTHER 2 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 115 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
21.92 FT OR DRY

2) OTHER MEASUREMENTS:
DATE 10-31-90, 20.38 FT FROM T. ST. PIPE
DATE 11-04-90, 20.37 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW-112 DATE INSTALLED 08-08-90 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90-M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-114

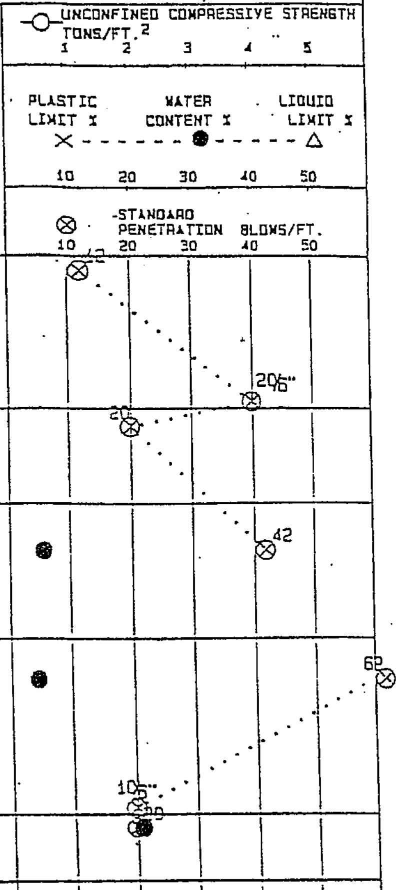
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 871.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
		1	SS			Fill - medium dense to dense. (FILL) Driller's observation: Glass, steel and brick rubble in boring.	
			HS				
5.0		2	SS				
		2A	SS			Silty sand and fill - grayish brown - medium dense - moist. (FILL)	
			HS				
10.0			HS			Medium gravel, little fine gravel and fine to coarse sand, trace silt - brown - dense - moist. (GP)	
		3	SS				
		3A	AS				
15.0			HS			Fine to coarse sand, little to some medium to coarse gravel, trace silt - brown - medium dense to very dense - moist to saturated. (SW-GW) Saturated at 20.0'.	
		4	SS				
			HS				
20.0		5	SS				
		5A	SS			Fine sand, trace silt and medium sand, light brown to yellowish - medium dense - saturated. (SP)	
23.0		6	PL*				



END OF BORING

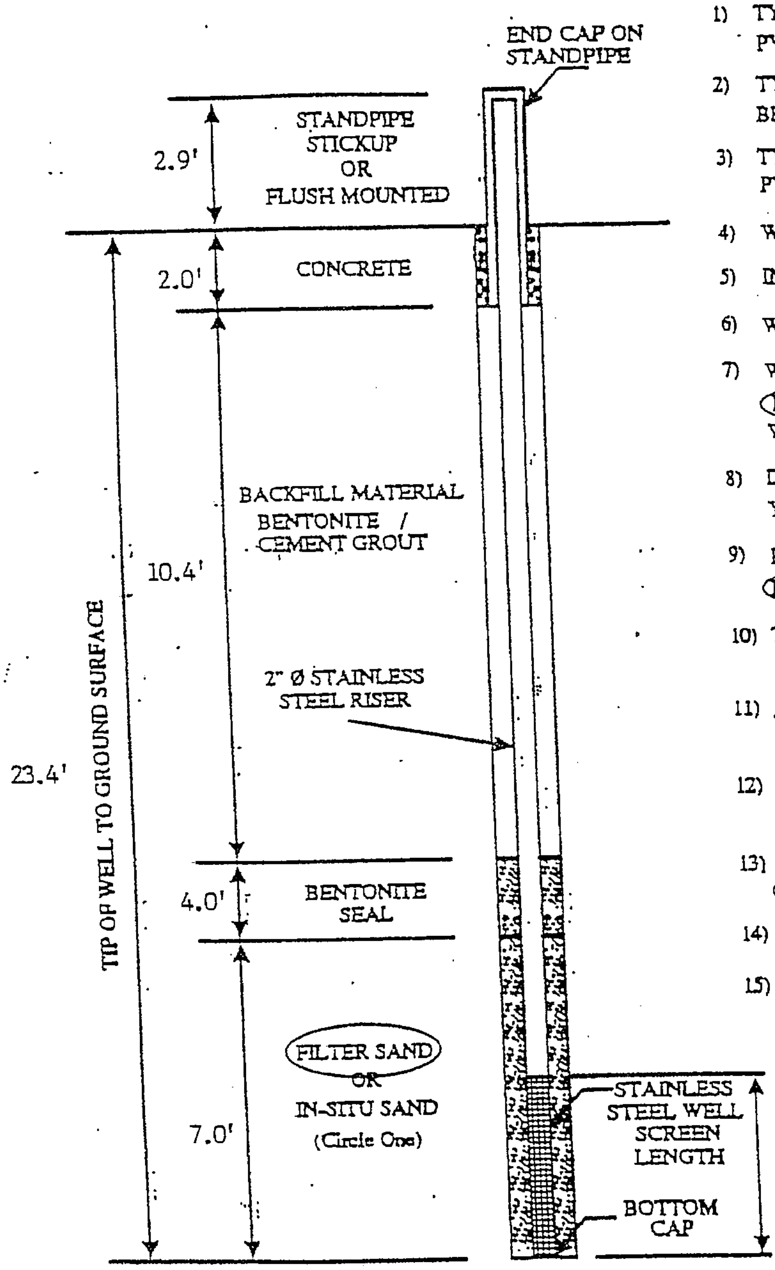
Boring advanced to 23.0' with 3.25" hollow stem auger.
Note: An obstruction was encountered at 21.5', boring was offset 3.0' and continued.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 20.0'	WS OR WD WS	BORING STARTED 07/01/90	STS OFFICE Lansing-07
BCR 18.9	ACR .16 HR	BORING COMPLETED 07/01/90	ENTERED BY TJM / SHEET NO. 1 OF 1
WL 18.75' 81.5 hrs AB		RIG/FOREMAN D-50/SB	APP'D BY AMM / STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN., 30 MIN., OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, [✓ 15 GAL] OTHER ______

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.17' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 08-26-90, 19.65 FT FROM T. ST. PIPE
DATE 10-09-90, 19.65 FT FROM T. ST. PIPE
DATE 11-04-90, 22.18 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW-114 DATE INSTALLED 07-01-90 DRILL RIG D-50/CME 550

DRILLER SB/JS DRILL CREW DZ/DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-115A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
						SURFACE ELEVATION 866.8	
			CT			Boring advanced without sampling to 39.0'. See MW-115 and MW-116 boring logs for soil classification.	
40.0		1	BA1			Fine to medium sand, little coarse sand and fine gravel, trace silt and clay. (SP)	
			CT				
		2	BA1			Clayey sand, little coarse sand - gray. (SC)	
			CT				
44.0		3	BA1			Gravel and coarse sand. (GP-SP)	

END OF BORING

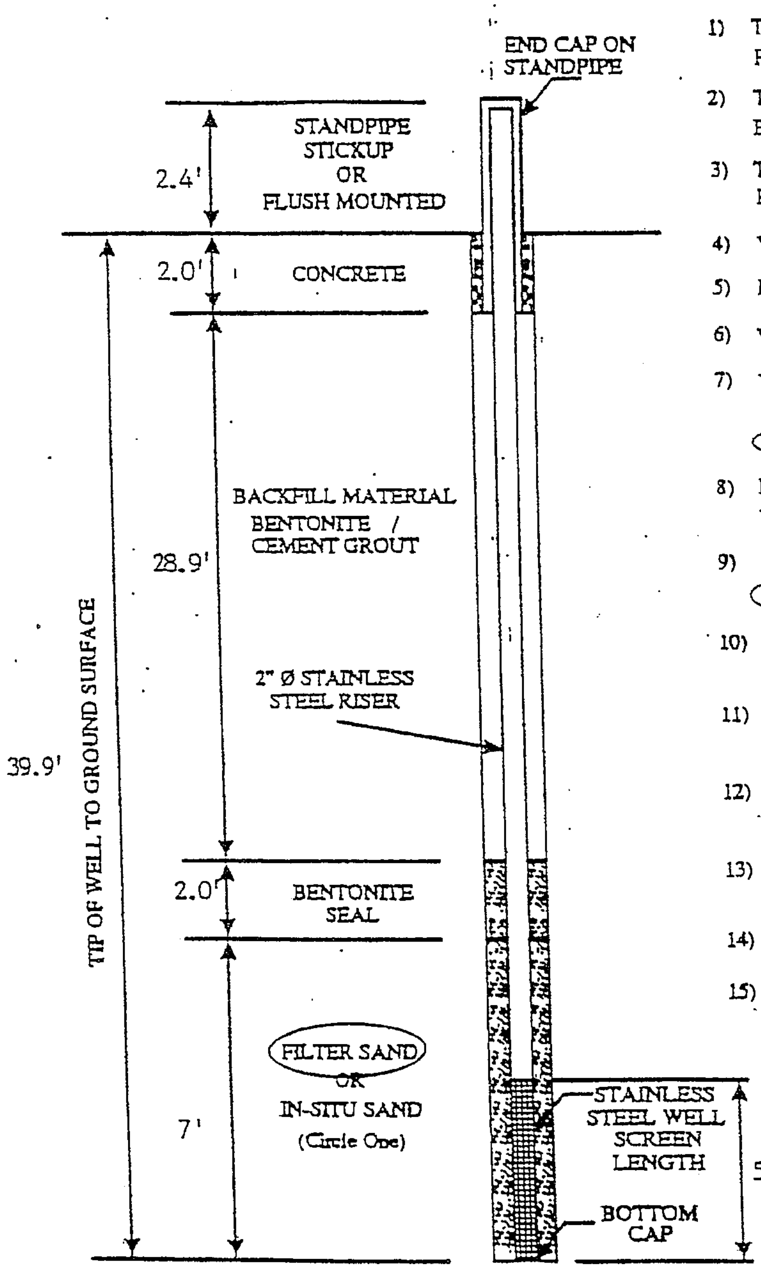
Boring advanced to 44.0' with cable tool drilling techniques.
15.0' of 16.0" temporary casing.
44.0' of 8.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 10/26/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 10/29/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN OHIO/JH	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
HOLLOW STEM AUGER, ROTARY, [✓ CABLE TOOL], [✓ WATER] REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 50 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
18.0 ' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 10-31-90 , 18.10 FT FROM T. ST. PIPE
DATE 11-04-90 , 18.08 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

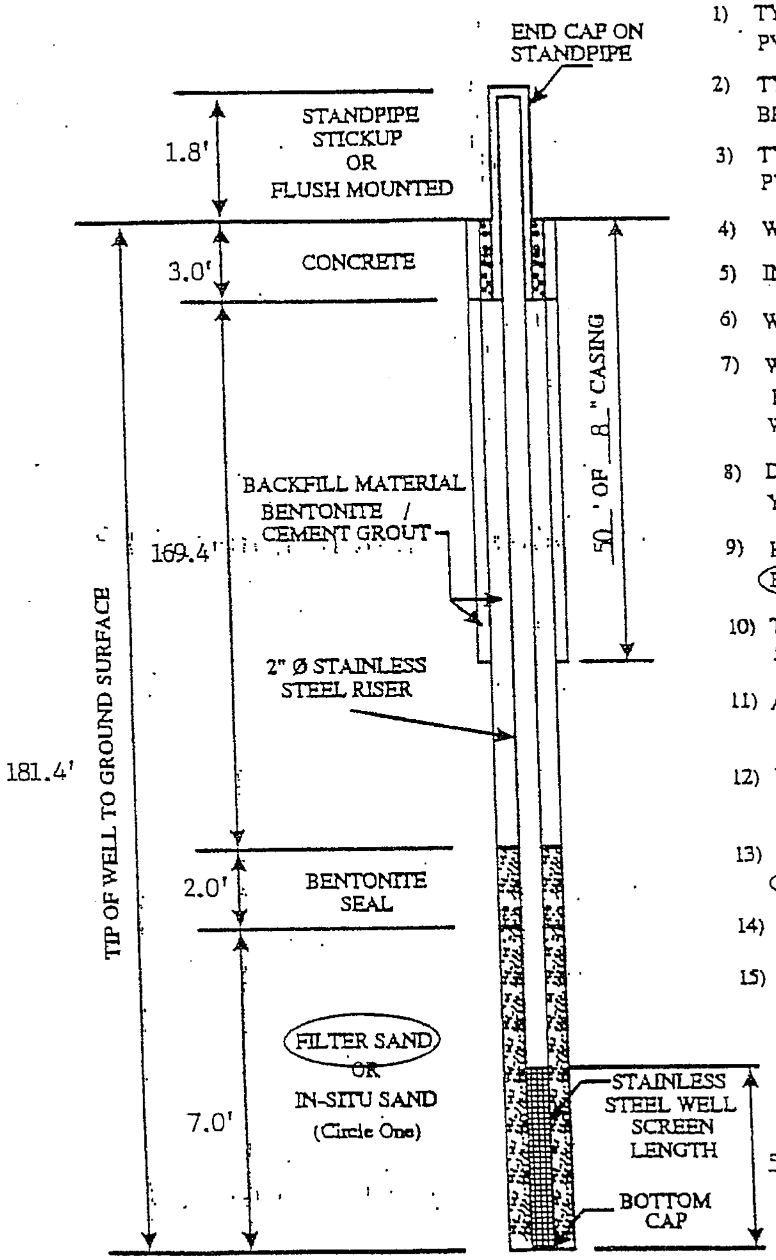
WELL NO. MW-115A DATE INSTALLED 10-29-90 DRILL RIG CABLE TOOL

DRILLER JH/ODC DRILL CREW DB

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED?
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING], PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN, 30 MIN, OTHER 2 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 170 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR], TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.83' FT OR DRY
2) OTHER MEASUREMENTS:
DATE 10-31-90 , 22.23 FT FROM T. ST. PIPE
DATE 11-04-90 , 22.65 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO. MW-116 DATE INSTALLED 10-09-90 DRILL RIG MOBILE B-61

DRILLER TT DRILL CREW DP

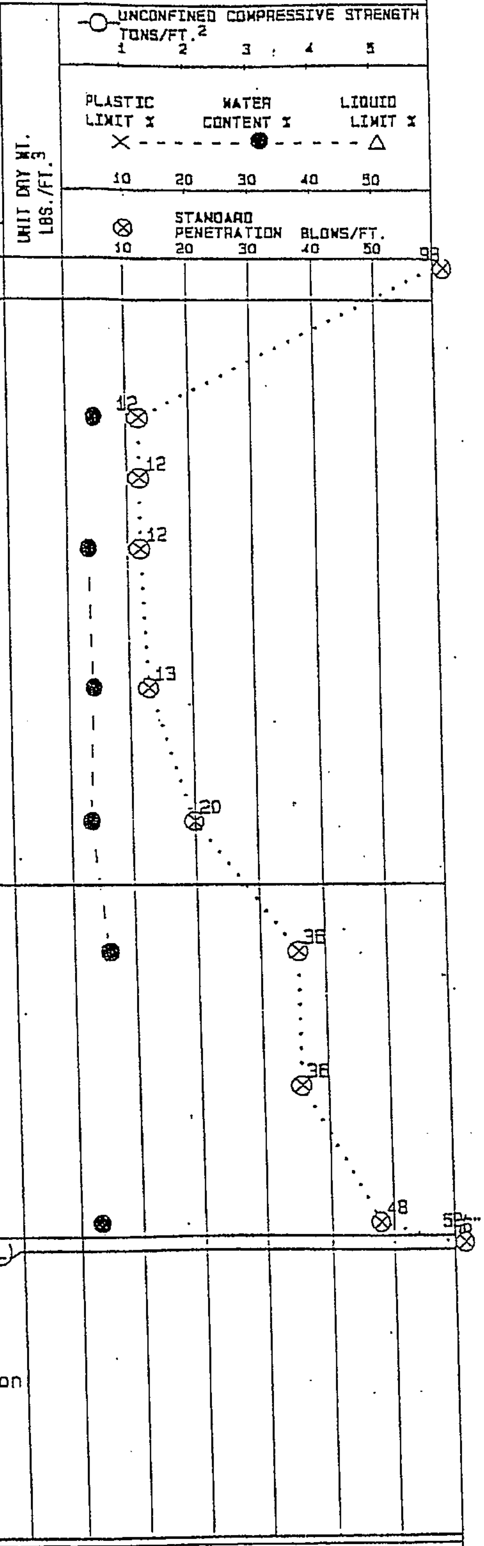
JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-117
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

SURFACE ELEVATION 863.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
		1	SS			Sandy topsoil, little silt, trace clay - brown - extremely dense - moist. (TOPSOIL)
			HS			Fine to medium sand, little to trace fine to medium gravel, trace coarse sand and silt - light brown - medium dense - moist. (SW)
5.0		2	SS			
			HS			
		2A	SS			
			HS			
10.0		3	SS			
			HS			
15.0		4	SS			
			HS			
20.0		5	SS			
			HS			
			HS			Medium to coarse sand, some gravel, trace fine sand and silt - brown - dense - wet to saturated. (SW) Saturated at 27.0'.
25.0		6	SS			
			HS			
30.0		7	SS			
			HS			
35.0		8	PL*			
35.5		8A	PL*			Geologist's observation: Silty clay - gray. (CL)



END OF BORING

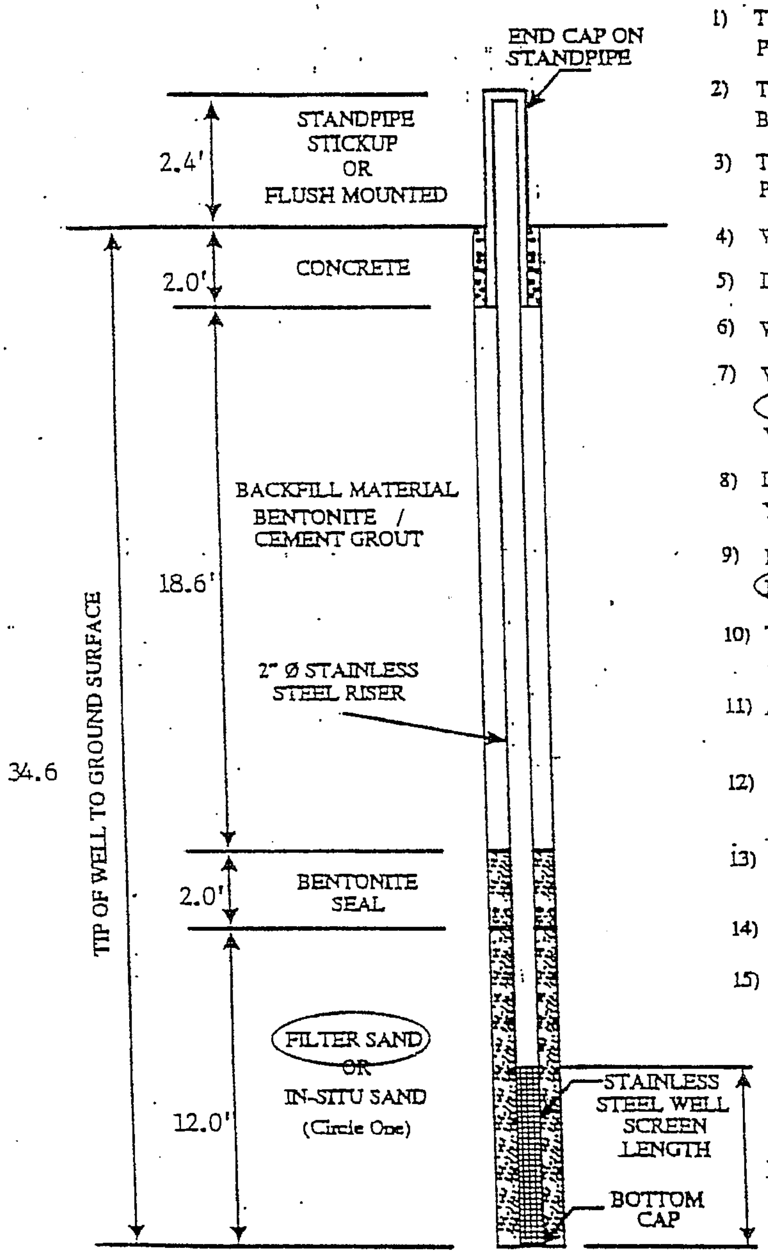
Boring advanced to 35.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 27.0'	WS OR WD WD	BORING STARTED 07/10/90	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 07/10/90	ENTERED BY TJM / SHEET NO. 1 OF 1
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM / STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ____

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 20 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
31.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90, 32.36 FT FROM T. ST. PIPE
DATE 11-04-90, 37.00 FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE

WELL NO. MW-117 DATE INSTALLED 07-09-90 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-119

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

UNIT DRY WT. LBS./FT.^{3}

SURFACE ELEVATION 863.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
			CT			Boring advanced with out sampling to 140.0'. See MW-117, MW-118, and MW-121 soil borings for soil classification.
140.0		1	BA II			Medium to coarse sand, some silt, little clay, trace gravel. (SM)
145.0			CT			Medium to coarse sand and fine to medium gravel, trace silt. (SP-GP)
150.0		2	BA II			

END OF BORING

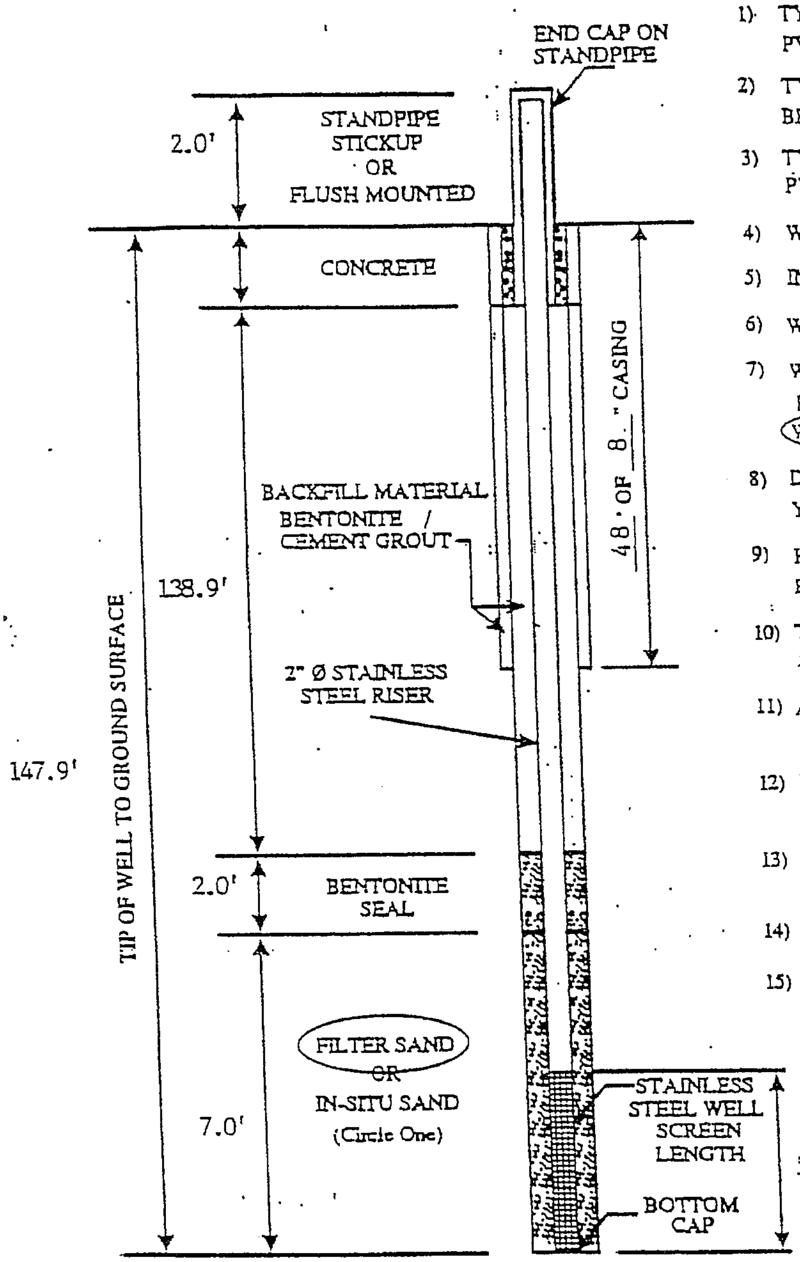
Boring advanced to 150.0' with cable tool drilling techniques.
48.0' of 8" permanent casing.
150.0' of 5.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD
BORING STARTED 10/09/90
STS OFFICE Lansing-07
BCR ACR
BORING COMPLETED 10/19/90
ENTERED BY TJM
SHEET NO. 1 OF 1
WL
RIG/FOREMAN OHIO/JH
APP'D BY AMM
STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
HOLLOW STEM AUGER, ROTARY [✓ CABLE TOOL]
[✓ WATER] REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-24-90
5 MIN., 15 MIN, 30 MIN, OTHER 3 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 260 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
35.25' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 10-31-90, 34.12 FT FROM T, ST. PIPE
DATE 11-04-90, 34.56 FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE

WELL NO. MW-119 DATE INSTALLED 10-14-90 DRILL RIG CABLE TOOL

DRILLER JH/ODC- DRILL CREW DB

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

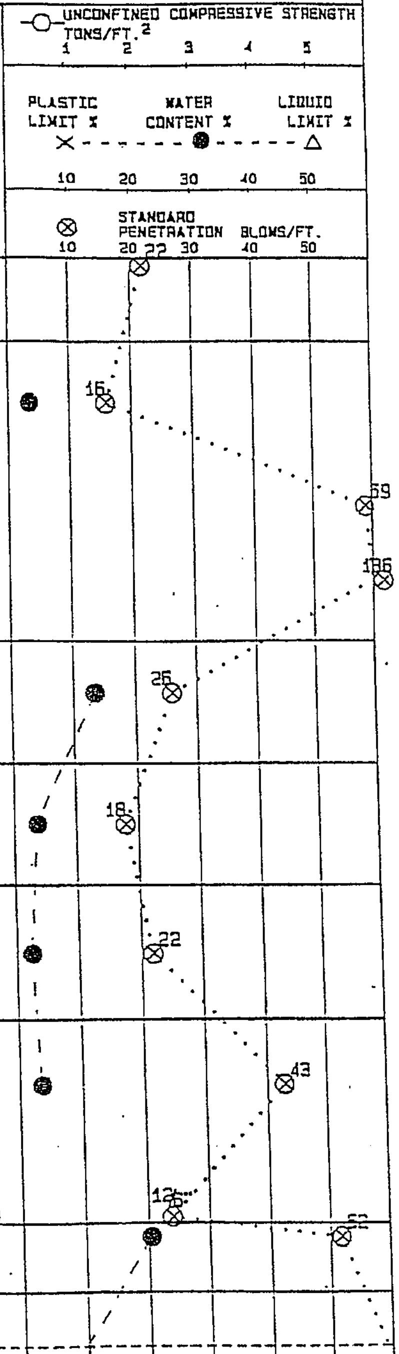
STS Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-122
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 869.4

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS			Silty sand, little gravel and organics, trace clay - brown - medium dense - moist. (SM)	0/0
			HS				
			HS			Medium to coarse sand and fine to medium gravel, little fine sand, trace silt - brown - medium dense to extremely dense - moist. (SP-GP)	
5.0		2	SS				0/0
			HS				
10.0		3	SS				
		3A	SS				0/0
			HS				
15.0			HS			Fine sand, some silt, trace medium to coarse sand - brown - medium dense - moist. (SM)	
		4	SS				0/0
			HS				
			HS			Fine sand, trace silt and medium sand - brown - medium dense - moist. (SP)	
20.0		5	SS				0/0
			HS				
25.0			HS			Fine to medium sand, trace silt, coarse sand and fine gravel - brown - medium dense - moist. (SP)	
		6	SS				0/0
			HS				
30.0			HS			Gravelly sand, trace silt - brown - medium dense to dense - moist. (SW-GW)	
		7	SS				0/0
			HS				
35.0		8	SS				0/0
		8A	SS			Fine sand, some silt, trace medium to coarse sand and clay - gray - very dense - moist. (SM)	
			HS				
40.0			HS			Silty sand, little fine gravel - brownish gray - very dense - moist to wet. (SM)	



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.	STS JOB NO. 71840	SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-122

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

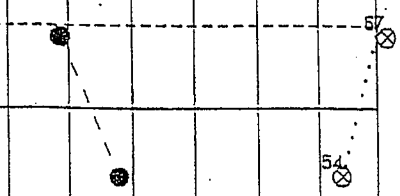
SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		9	SS			Silty sand, little fine gravel - brownish gray - very dense - moist to wet. (SM)	0/0
			HS				
			HS			Fine sand, trace medium to coarse sand, silt and fine gravel - brownish gray - very dense - moist to wet. (SP)	
45.0		10	PL*				0/0
46.5							



END OF BORING

Boring advanced to 45.0' with 4.25" hollow stem auger.

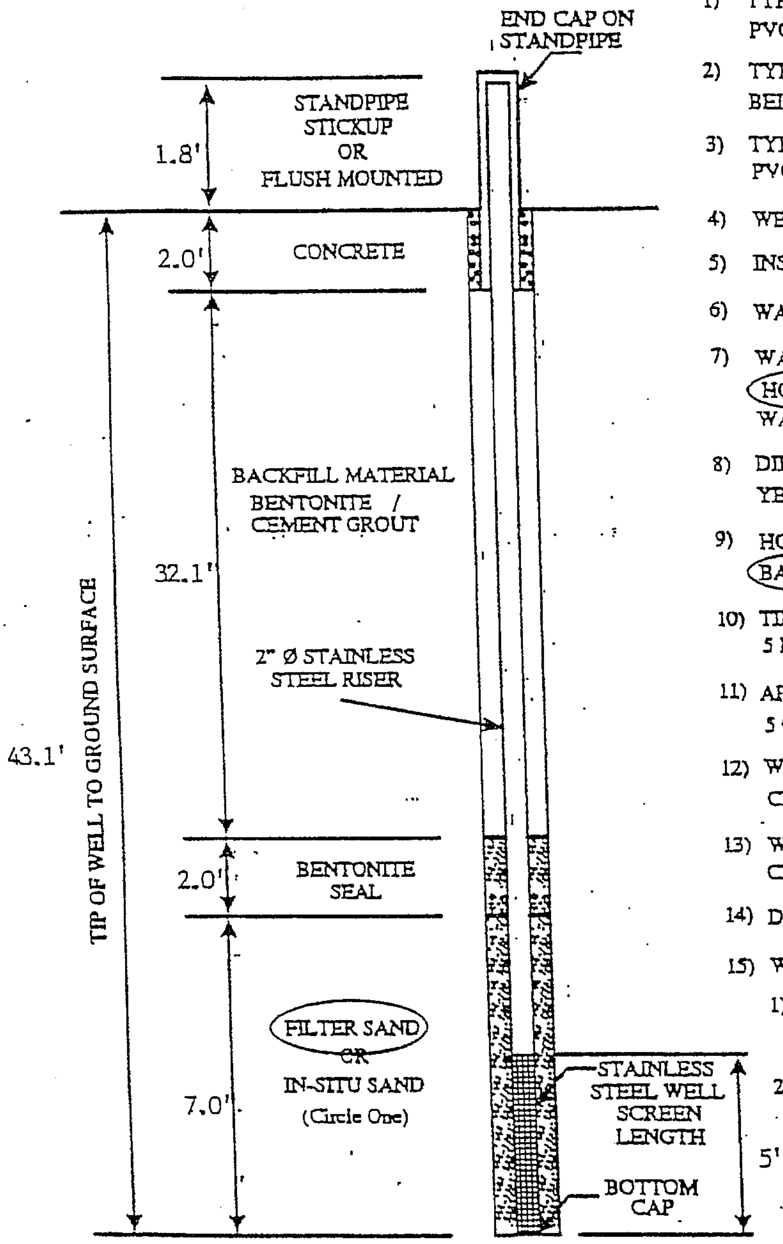
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 41.0'	WS OR WD WS	BORING STARTED 07/09/90	STS OFFICE Lansing-07
WL BCR	ACR	BORING COMPLETED 07/10/90	ENTERED BY TJM	SHEET NO. 2 OF 2
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT-SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 01-01-90
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 32 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
42.4' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 43.27 FT FROM T, ST. PIPE
DATE 10-31-90, 44.05 FT FROM T, ST. PIPE
DATE 11-04-90, 44.25 FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE

WELL NO. MW-122 DATE INSTALLED 07-10-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-129A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 871.1

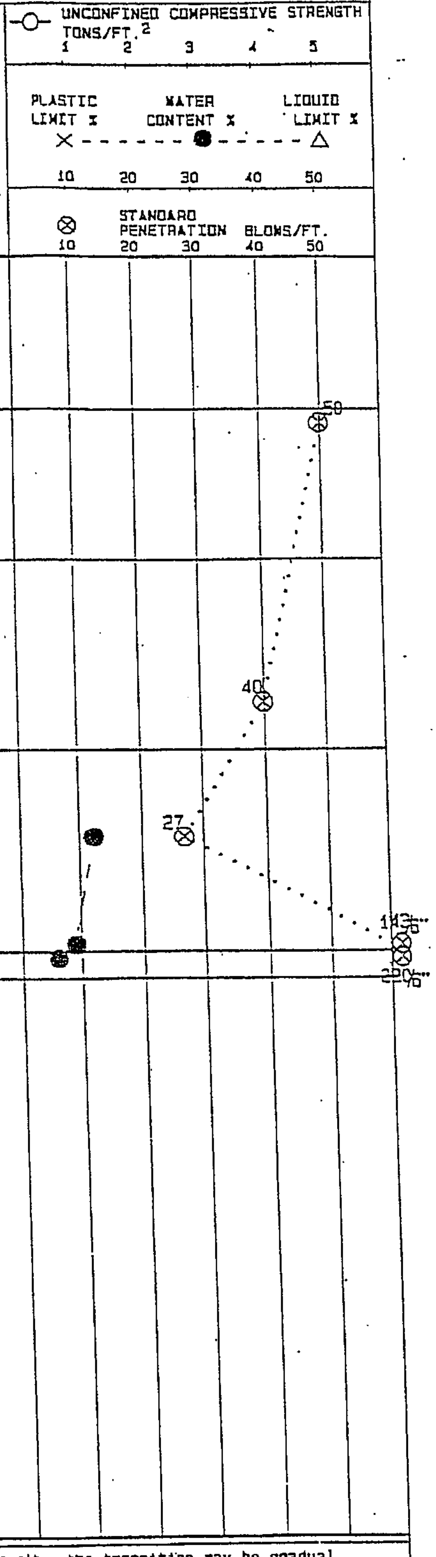
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
		HS	Boring advanced without sampling to 30.5'. See MW-129 boring logs for soil classification.
30.0			
	1	PL*	Fine to coarse sand - gray - very dense - saturated. (SP)
35.0		HS	
		HS	Fine sand, little medium to coarse sand - grayisn brown - dense - saturated. (SP)
40.0			
	2	SS	
		HS	
		HS	Fine sand, little fine to medium gravel and medium to coarse sand - grayish brown - medium dense to extremely dense. (SP)
45.0			
	3	SS	
		HS	
50.0	4	SS	
51.5	4A	SS	Fine to medium sand, some clay, little silt and coarse sand, trace fine gravel - gray - extremely dense. (SC)

END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

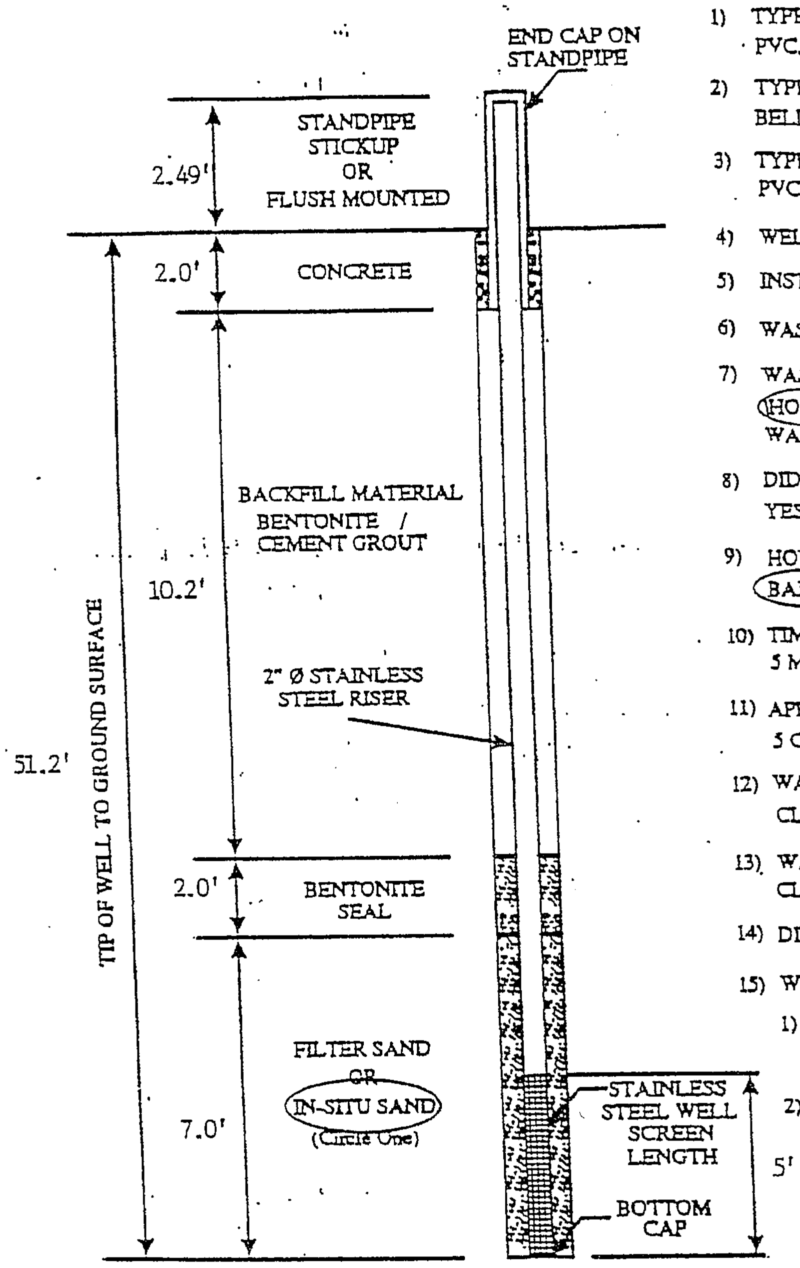
UNIT DRY WT. LBS./FT.^{3}



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

25.0' WS OR WD WD	BORING STARTED 10/17/90	STS OFFICE Lansing-07	
BCR 25.35' ACR	BORING COMPLETED 10/17/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN., 30 MIN., OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 125 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? [✓ YES] OR NO

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
28.5' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90, 38.39 FT FROM T. ST. PIPE
DATE 11-04-90, 27.20 FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE

WELL NO. MW-129A DATE INSTALLED 10-17-90 DRILL RIG CME 550

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-131

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

SURFACE ELEVATION 871.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
			CT			Boring advanced without sampling to 170.0'. See MW-129 and MW-132 boring logs for soil classification.	
170.0		1	BAI			Fine sand, trace medium sand - gray. (SP)	
			CT				
175.0		2	BAI				
			CT				
			CT			Medium to coarse sand, little fine sand, trace gravel, silt and cobbles. (SW)	
180.0		3	BAI				
			CT				
			CT			Fine sand, little medium sand, trace fine gravel, silt, and coarse sand - gray. (SP)	
185.0		4	BAI				
			CT				
190.0		5	BAI				
			CT				
195.0		6	BAI				
			CT				
200.0		7	BAI				
			CT				
205.0							

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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-131

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
						Continued from previous page	
205.0		8	BAI			Fine sand, little medium sand, trace fine gravel, silt, and coarse sand - gray. (SP)	
			CT				
210.0		9	BAI				
			CT				
215.0		10	BAI				
216.0							

END OF BORING

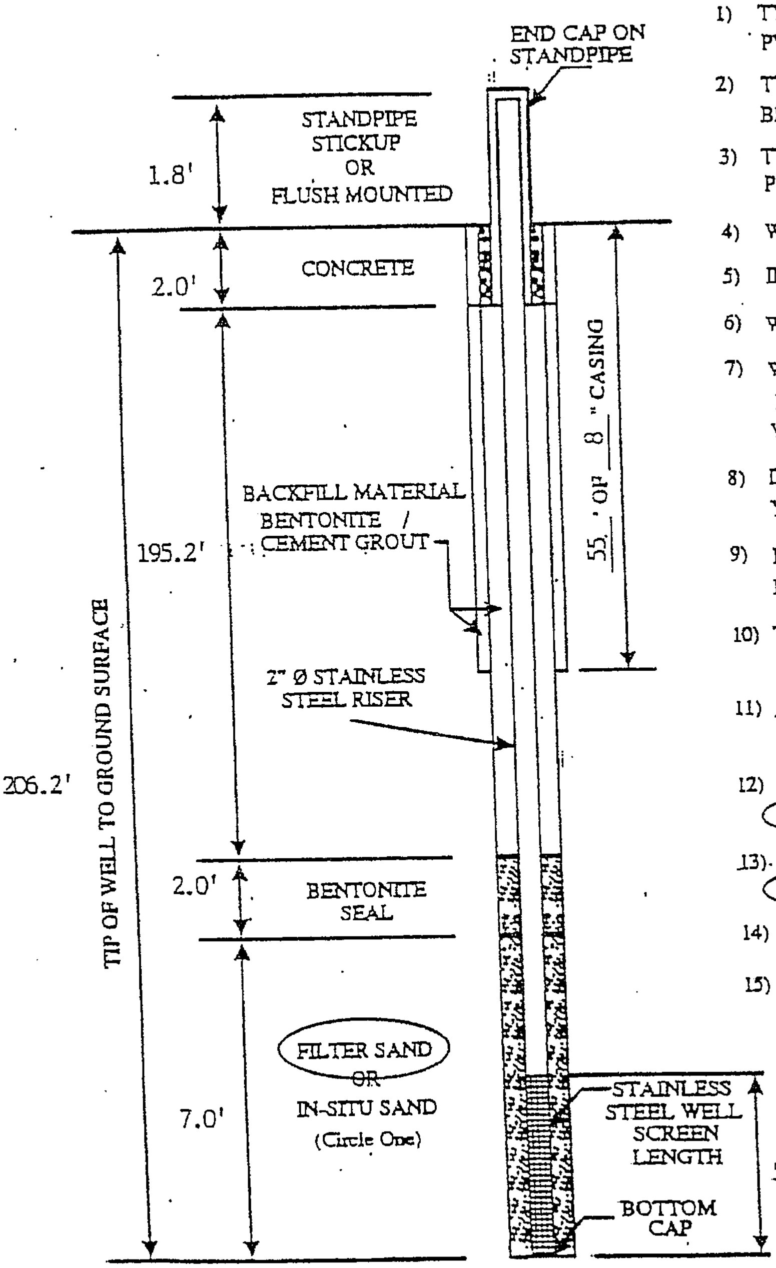
Boring advanced to 216.0' with cable tool drilling methods.
19.0' of 20.0" temporary casing;
19.0' of 16.0" temporary casing;
173.0' of 12.0" temporary casing;
215.0' of 8.0" temporary casing.
55.0' of 8.0" permanent casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 10/08/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 11/26/90	ENTERED BY TJM	SHEET NO. 2 OF 2
WL	RIG/FOREMAN OHIO/JK	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
HOLLOW STEM AUGER, ROTARY, [✓ CABLE TOOL]
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING,] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 11-28-90
5 MIN., 15 MIN, 30 MIN, OTHER 7½ Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 90 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR,] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR,] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
38.10' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 3-17-91 , 37.52' FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

WELL NO. MW-131 DATE INSTALLED 11-28-90 DRILL RIG CABLE TOOL

DRILLER JK/ODC DRILL CREW DB

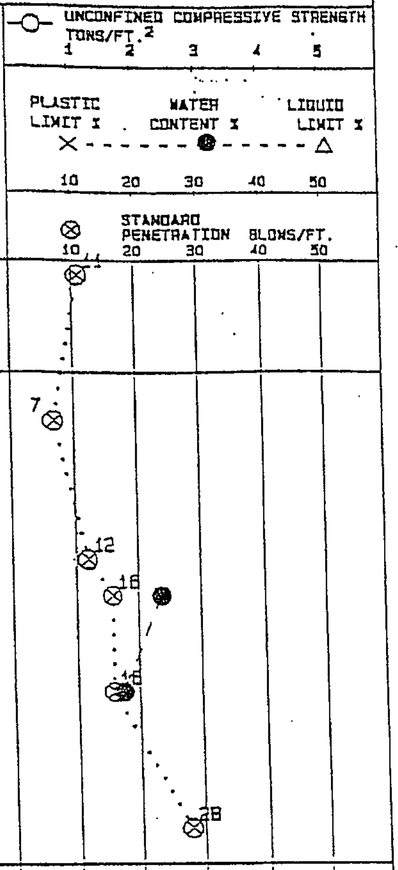
JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-133
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN	

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 860.0	UNIT DRY WT. LBS./FT.^{3}
		1	SS			Gravelly fine sand, little medium to coarse sand, trace roots - brown - medium dense - desiccated. (SP-GP)	
			HS				
5.0			HS			Fine to medium sand, trace silt, fine gravel and coarse sand - light brown - loose to medium dense - wet. (SP)	
		2	SS				
			HS				
10.0		3	SS				
		3A	SS				
			HS				
15.0		4	SS				
			HS				
20.0		5	SS*				



END OF BORING

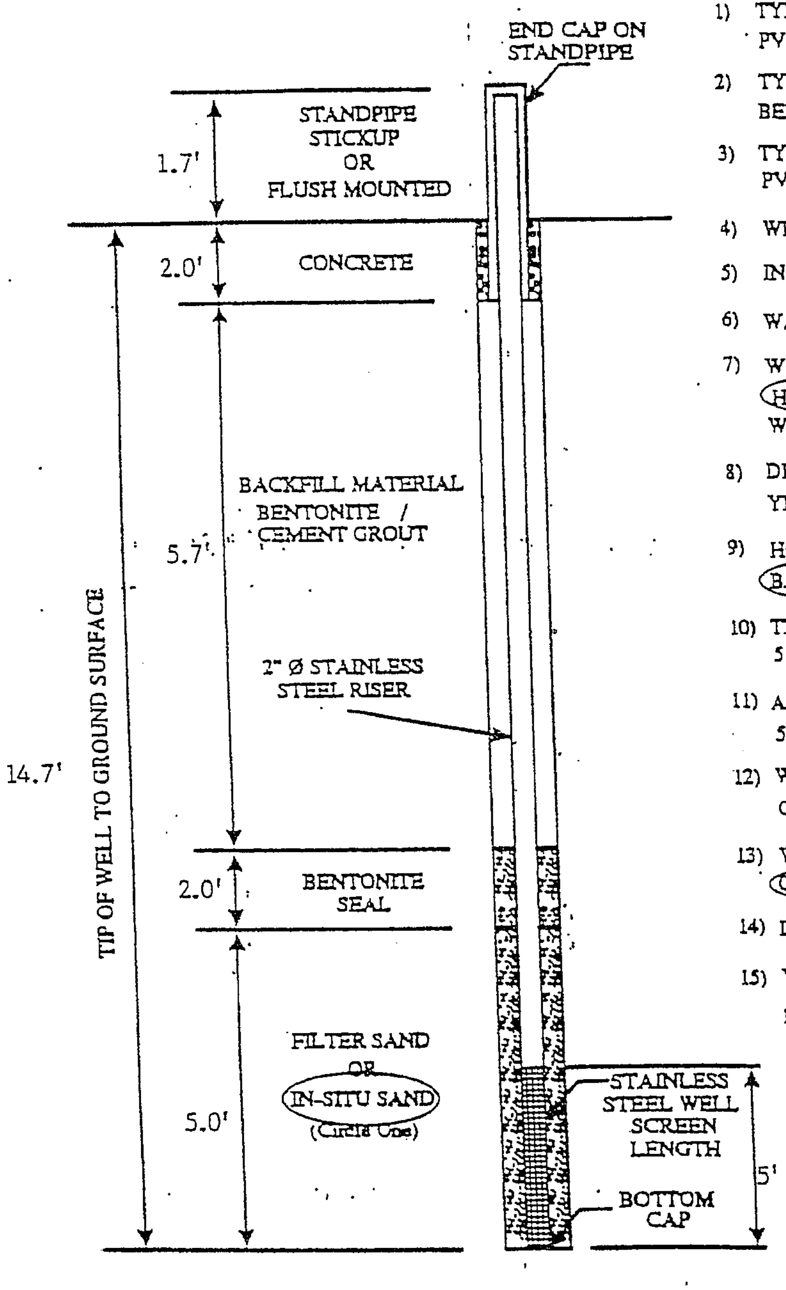
Boring advanced to 20.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: SS* indicates 3.0" split spoon.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 07/11/90	STS OFFICE Lansing-07	
BCR 16.1' ACR 11.55	BORING COMPLETED 07/11/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-550/JS	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ____________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, [✓ 15 GAL] OTHER ____________

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
14.0' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 07-19-90, 13.07 FT FROM T. ST. PIPE
DATE 08-26-90, 9.60 FT FROM T. ST. PIPE
DATE 10-31-90, 14.33 FT FROM T. ST. PIPE
DATE 11-04-90, 13.16 FT FROM T. ST. PIPE

WELL NO. MW-133 DATE INSTALLED 07-11-90 DRILL RIG CME-550

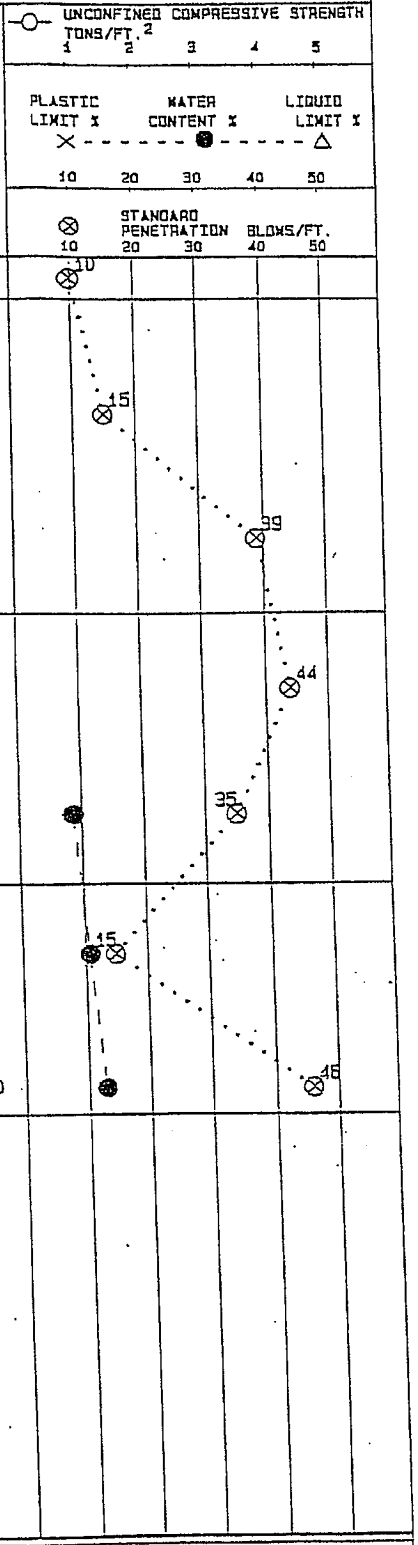
DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90-M11DRAW)

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER	MW-134
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER	
	SITE LOCATION PORTAGE, MICHIGAN		

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION 866.8	
		1	SS			Fine topsoil, trace roots - brown - medium dense - moist. (TOPSOIL)	0/0
			HS			Medium to coarse sand, trace gravel - brown - medium dense to dense - moist. (SP)	
5.0		2	SS				0/0
			HS				
10.0		3	SS				0/0
			HS				
			HS			Fine to medium sand, some silt, trace coarse sand - brown - dense - moist. (SM)	
15.0		4	SS				
			HS				
20.0		5	SS				0/0
			HS				
			HS			Fine to medium sand, trace silt, coarse sand and fine gravel - light brown - medium dense to dense - saturated. (SP)	
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
31.5							



END OF BORING

Boring advanced to 30.0' with 4.25" hollow stem auger.
Monitoring well installed with screen set from 22.0 to 27.0" on 7-11-90. Boring abandoned on 8-21-90. See well abandonment form.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 25.0'	WS OR WD .WS	BORING STARTED 07/11/90	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 07/11/90	ENTERED BY TJM / SHEET NO. 1 OF 1
WL		RIG/FOREMAN 8-61/DG	APP'D BY AMM / STS JOB NO. 71840

WELL/DRILLHOLE ABANDONMENT

Form 3300-5 Rev. 6-87

(1) GENERAL INFORMATION

Well/Drillhole Location: MW-134

County: Kalamazoo

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

(If applicable)

___ Gov't Lot ___ Grid Number

Civil Town Name:

Street Address of Well: 7171 Portage Road

City, Village: Kalamazoo, MI 49002

Date of Abandonment: 08-21-90

(2) FACILITY NAME

Original Well Owner (If Known): The UpJohn Company

Present Well Owner: The UpJohn Company

Street or Route: 7171 Portage Road

City, State, Zip Code: Kalamazoo, MI 49002

Well Number and/or Name (If Applicable): MW-134

Reason For Abandonment:

WELL/DRILLHOLE INFORMATION

(3) Original Well/Drillhole Construction Completed on (Date) 07-11-90

☒ Monitoring Well

☐ Water Well ☐ Drillhole

Construction Report Available? ☐ Yes ☐ No

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify)

Well Type:

☒ Unconsolidated Formation Well ☐ Bedrock Well

Total Well Depth (ft.) 31.5' Casing Diameter (ins.) 2"

Casing Depth (ft.) 26.5'

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 31.5' Feet

(4) Depth to Water (Feet) 25 Feet

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable

Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable

Screen Removed? ☒ Yes ☐ No ☐ Not Applicable

Casing Left in Place? ☐ Yes ☒ No

If No, Explain

Was Casing Cut Off Below Surface? ☐ Yes ☐ No NA

Did Sealing Material Rise to Surface? ☒ Yes ☐ No

Did Material Settle After 24 Hours? ☐ Yes ☒ No

If Yes, Was Drillhole Retopped? ☐ Yes ☐ No

(5) Required Method of Placing Sealing Material

☐ Conductor Pipe-Gravity ☒ Conductor Pipe-Pumped

☐ Dump Bailer ☐ Other (Explain)

(6) Acceptable Sealing Materials

Neat Cement Grout; Concrete Grout; Concrete; Clay Slurry; Sodium Bentonite Slurry

(7)

Kind of Sealing Material	From (Ft.)	To (Ft.)	No. Yards or Sacks Sealant	Mix Ratio or Mud Weight
BENTONITE/CEMENT GROUT	Surface	31.5'	200 Gallons	

(8) Comments:

(9) Name of Person or Firm Doing Sealing Work: STS CONSULTANTS, LTD.

Signature of Person Doing Work:

Date Signed:

Street or Route: 3340 RANGER ROAD

Telephone Number: (517) 321-4964

City, State, Zip Code: LANSING, MI 48906

STS Consultants Ltd.

PROJECT: THE UPJOHN COMPAN

TITLE: HYDROGEOLOGIC
STUDY WORK PLAN

DATE: 12-12-90

STS Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-134A	
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER	
SITE LOCATION PORTAGE, MICHIGAN		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

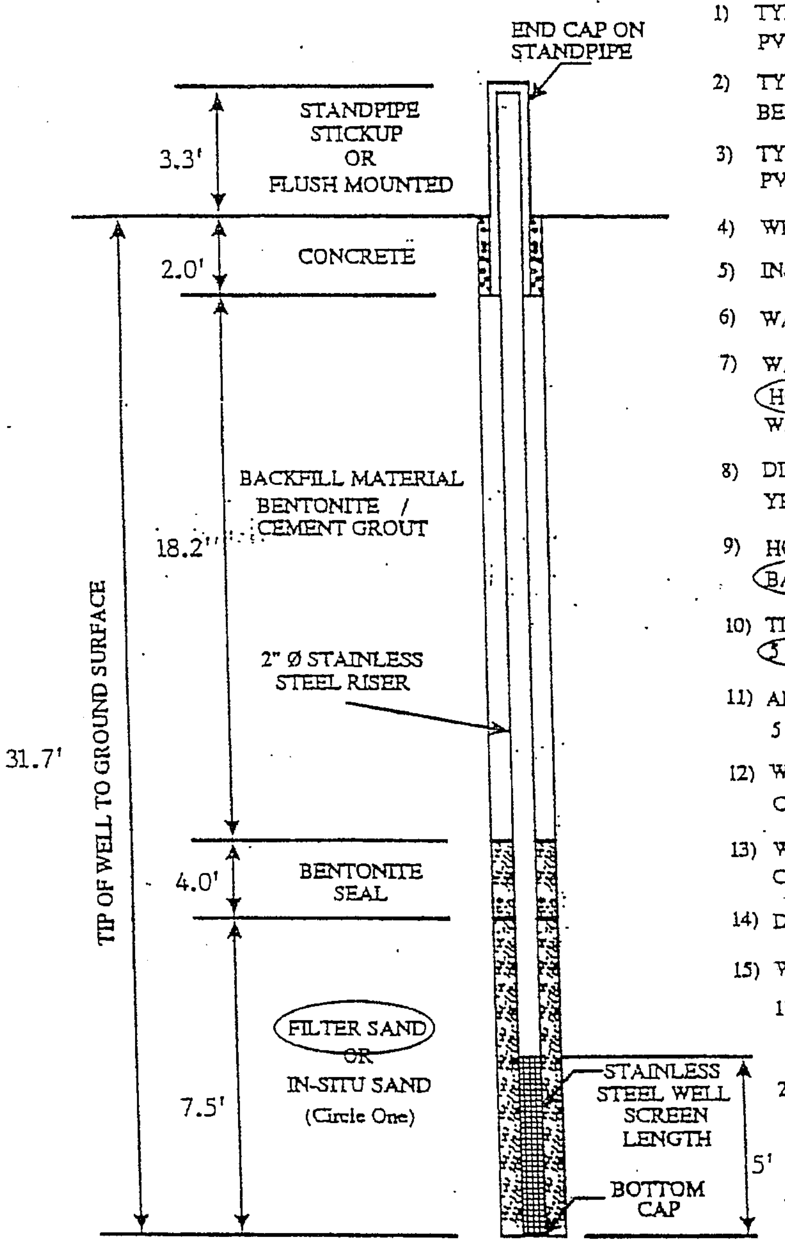
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 866.8	UNIT DRY WT. LBS./FT.^{3}
30.0 32.0			HS			Note: Boring advanced without sampling to 32.0'. See MW-134 for soil classification.	
						END OF BORING Boring advanced to 32.0' with 4.25" hollow stem auger. Monitoring well installed. See well installation diagram.	

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 08/21/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 08/21/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-04-90
[✓ 5 MIN.] 15 MIN, 30 MIN, OTHER ______

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 1 Gallon

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
30.0' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90	31.61	FT FROM T, ST. PIPE
DATE 11-04-90	31.76	FT FROM T, ST. PIPE
DATE ______	______	FT FROM T, ST. PIPE
DATE ______	______	FT FROM T, ST. PIPE

WELL NO. MW-134A DATE INSTALLED 08-21-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-135

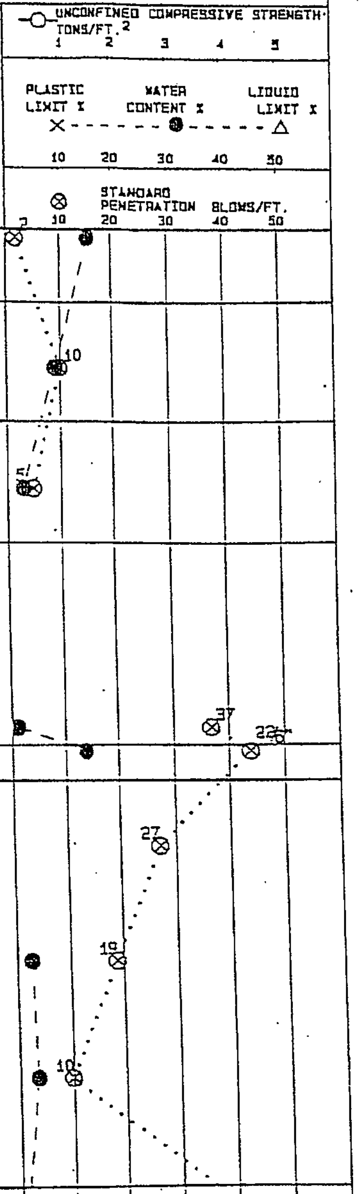
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 865.4

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
	1	SS	Fine to medium sand, little silt and clay, trace roots, coarse sand and fine gravel - brown - very loose - moist. (Topsoil)	TH/0
		HS		
		HS	Fine to medium sand, little to trace silt, gravel and coarse sand - light brown - medium dense - moist. (SP-SM)	
5.0	2	SS		0/0
		HS		
		HS	Fine to medium sand, trace silt - light brown - loose - moist. (SP)	
10.0	3	SS		0/0
		HS		
		HS	Fine to medium sand, trace coarse sand, silt and gravel - light brown - medium dense - moist. (SP)	
15.0	4	SS		0/0
		HS		
20.0	5	PLX		
	5A	PLX	Fine to medium sand, little silt, trace coarse sand and fine gravel - brown - dense - moist. (SM)	
		HS		
		HS	Fine to coarse sand, some gravel, trace silt and cobbles - brown - medium dense - moist. (SW)	
25.0	6	SS		0/0
		HS		
30.0	7	SS		0/0
		HS		
35.0	8	SS		0/0
		HS		
40.0				



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-135

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
40.0		9	PL×			Fine to medium sand, trace coarse sand, fine gravel and silt - brown - medium dense - moist. (SP)		39
			HS					
			HS			Fine sand, little medium sand, little to trace silt, trace clay - gray - dense - moist to saturated. (SP-SM)		
45.0		10	SS				TR/0	35
			HS					
			HS			Fine to medium sand, little gravel, trace coarse sand and silt - gray - medium dense - saturated. (SP)		
50.0		11	SS				0/0	18
51.5								

END OF BORING

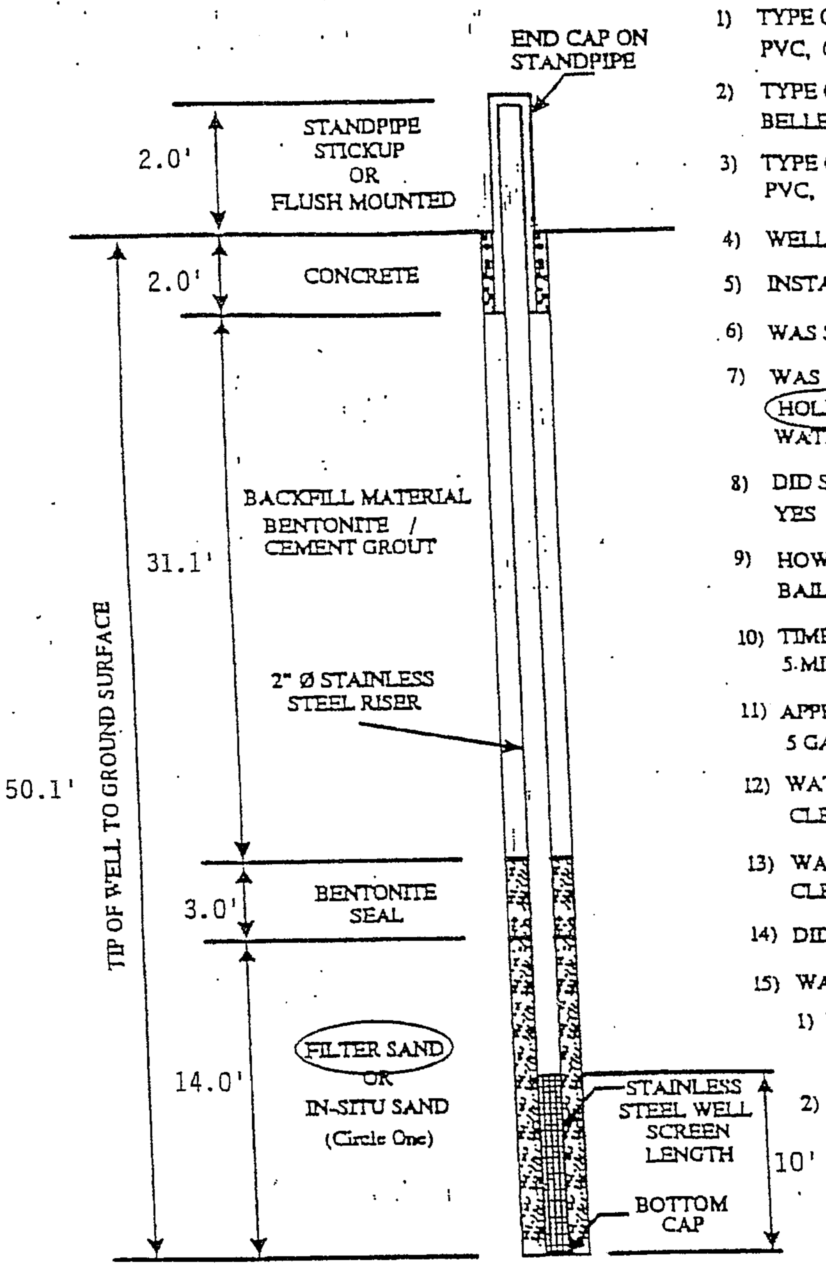
Boring advanced to 50.0' with 4.25" hollow stem auger.
Monitoring well installed. See monitoring well installation diagram.

PL× indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 45.0 WS OR WD WS	BORING STARTED 11/28/90	STS OFFICE Lansing-07	
WL BCR 44.8 ACR	BORING COMPLETED 11/29/90	ENTERED BY DDS	SHEET NO. 2 OF 2
WL	RIG/FOREMAN CME-550/DH	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL,
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING,] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 12-6-91
5 MIN., 15 MIN, 30 MIN, OTHER 3 hrs. 25 min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 75 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE Clear to Slightly Turbi

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE Clear to Slightly Turbi

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
46.7' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 12-6-90 , 49.65 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO. MW - 135 DATE INSTALLED 11-29-90 DRILL RIG CME - 550

DRILLER B.P. DRILL CREW E.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY

LOG OF BORING NUMBER MW-136

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 864.8

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
			AB			Boring advanced without sampling to 80.0'. See MW-135 and MW-137 boring logs for soil classification.			
80.0		1	PL×			Fine to medium sand, trace silt, coarse sand and gravel - gray - extremely dense - saturated. (SP)		●	186 ⊗
			AB						
85.0			AB			Boring advanced without sampling from 81.5 to 138.0 See MW-137 boring log for soil classification from samples. Field observation: Fine to medium sand - gray - saturated.			
90.0									
95.0									
100.0									
105.0									
110.0									
115.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 1 OF 2

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-136
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

─O─ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}	TEST DATA
						Continued from previous page		
115.0 120.0			RB			Field observation: Sandy medium to coarse gravel - brown - saturated.		
125.0 130.0 135.0			RB			Fine to medium sand, trace coarse sand, fine gravel and silt - brown - extremely dense - saturated. (SP)		
		2	PL*					● 242 ⊗
140.0			RB					
						END OF BORING		

Boring advanced to 140.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

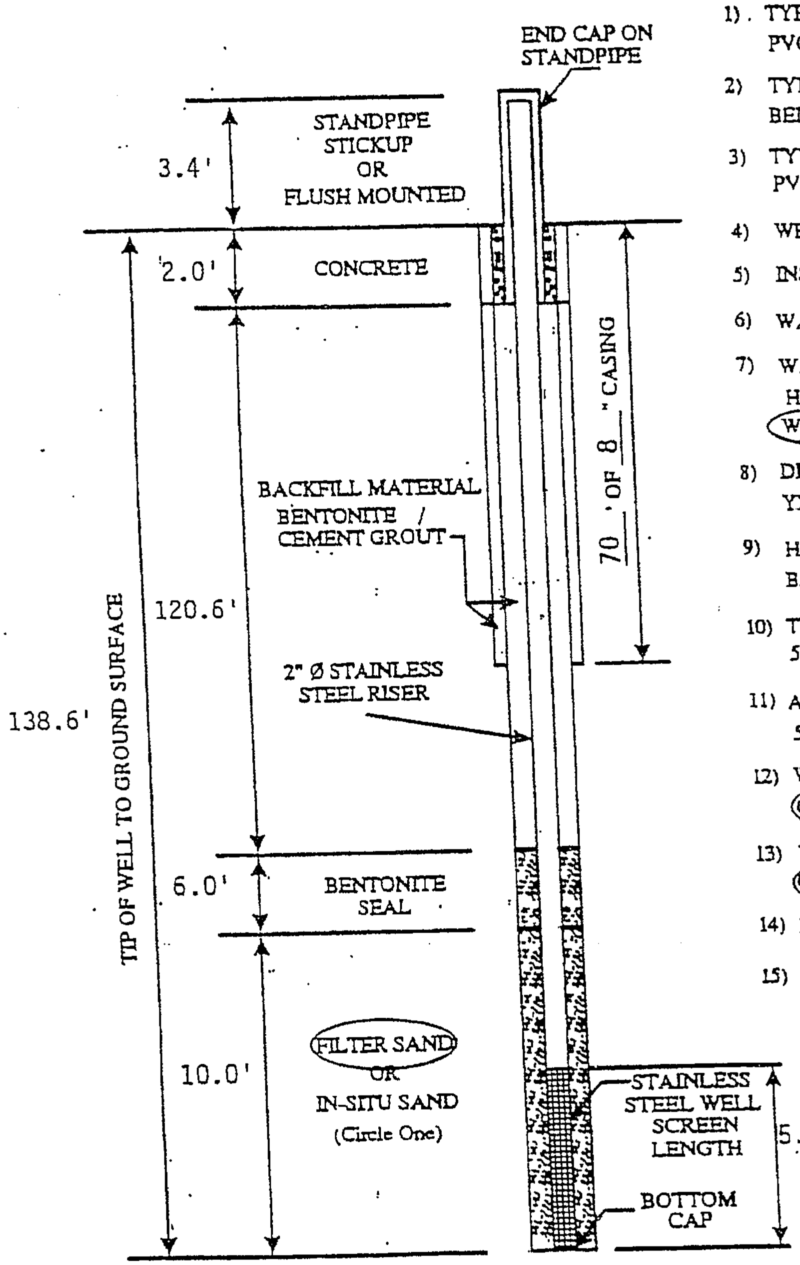
70.0' of 8.0" permanent casing
80.0' of 6.0" temporary casing

Note: PL* indicated 3.0" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.5 WS OR WD WD	BORING STARTED 01/20/91	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 01/21/91	ENTERED BY DDS	SHEET NO. 2 OF 2
WL	RIG/FOREMAN B-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) . TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-29-91
5 MIN., 15 MIN, 30 MIN, OTHER 3 hrs. 15 min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 350 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-29-91 , 45.35 FT FROM T. ST. PIPE
DATE 2-17-91 , 43.35 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

WELL NO MW-136 DATE INSTALLED 1-22-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-139**

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 860.7	UNIT DRY WT. LBS./FT.^{3}	
			AB			Boring advanced without sampling to 140 ft. See MW-138 and MW-140 boring logs for soil classification.		
140.0 141.0		1	PL*			Fine to medium gravel, some fine to coarse sand, little cobbles, trace silt - grayish brown - extremely dense - saturated. (GP)		● 180 ⊗

END OF BORING

Boring advanced to 140.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

Drillers observation: Boulders and cobbles encountered from 120 to 140 ft.

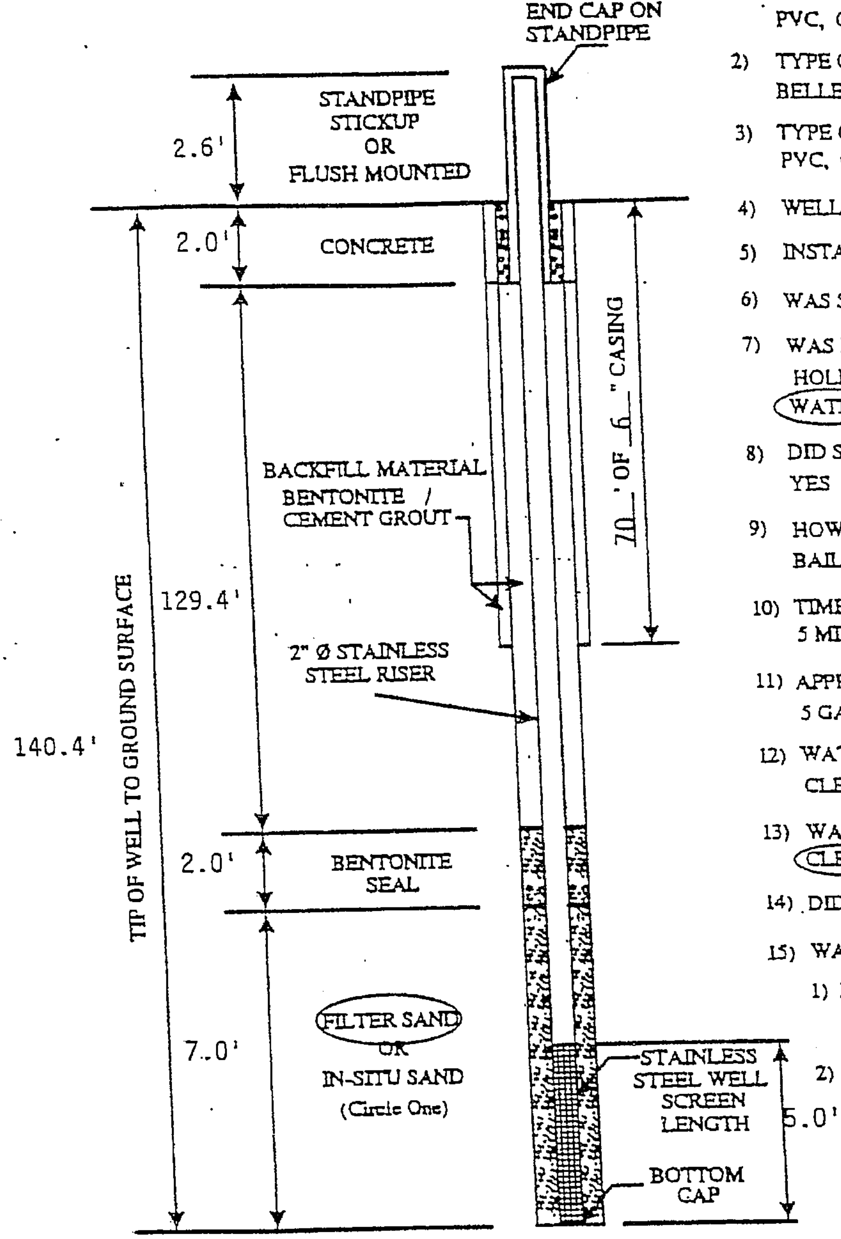
70' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

42.0 WS OR WD WD	BORING STARTED 01/11/91	STS OFFICE Lansing-07
BCR ACR	BORING COMPLETED 01/13/91	ENTERED BY DDS — SHEET NO. 1 OF 1
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM — STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10(0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 2 ½ Hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 2-17-91 , 44.46 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO. M W- 139 DATE INSTALLED 1-13-91 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW P.P.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-141

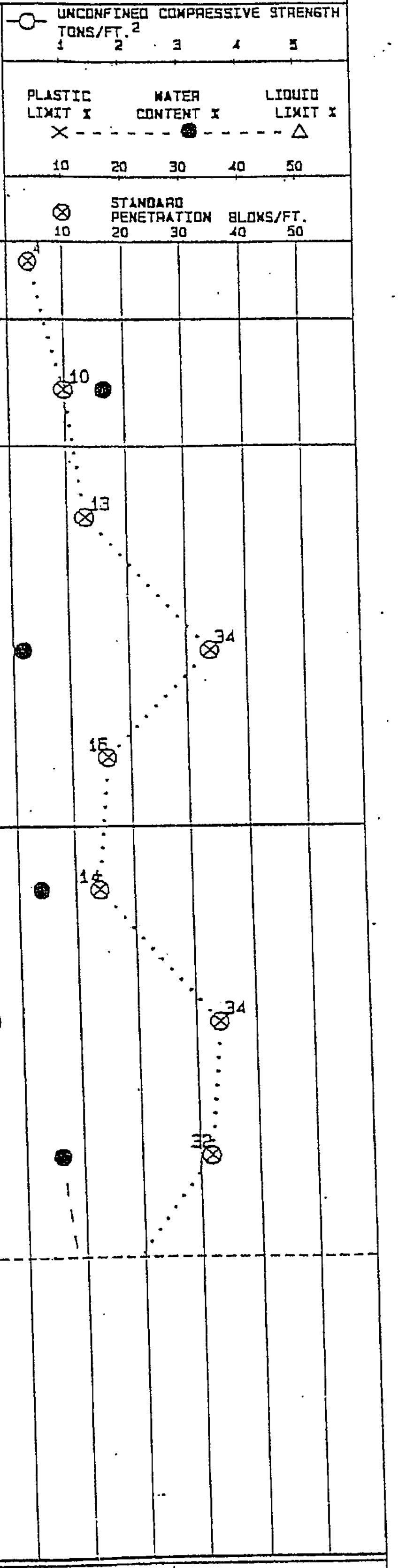
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

SURFACE ELEVATION 858.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS	Clayey fine sand, some silt, trace organics - brown - loose - moist. (TOPSOIL)	0/0
			HS		
			HS	Fine sandy silt, trace medium to coarse sand, and fine gravel - brownish gray - medium dense - wet. (ML)	
5.0		2	SS		0/0
			HS		
			HS	Fine to medium sand, trace silt, clay and gravel - brown - medium dense - moist. (SP)	
10.0		3	SS		0/0
			HS		
15.0		4	PL*		
			HS		
20.0		5	SS		0/0
			HS		
			HS	Fine to coarse sand, some to little gravel, little to trace silt - brownish gray - medium dense to dense - moist to saturated. (SP-SM)	
25.0		6	SS		0/0
			HS		
30.0		7	SS		0/0
			HS		
35.0		8	PL*		
			HS		
40.0					



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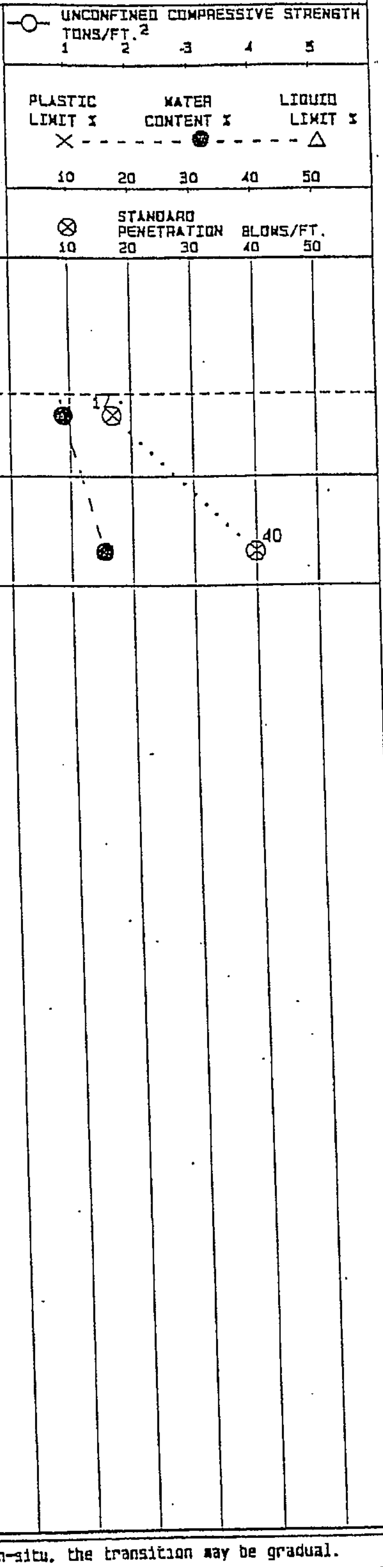
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.	OWNER **THE UPJOHN COMPANY**	LOG OF BORING NUMBER MW-141
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER
SITE LOCATION **PORTAGE, MICHIGAN**		

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		9	SS			Fine to coarse sand, some to little gravel, little to trace silt - brownish gray - medium dense to dense - moist to saturated. (SP-SM)	0/0
			HS				
			HS			Fine to medium sand, trace coarse sand and silt - brownish gray - dense - saturated. (SP)	
45.0		10	SS				0/0
47.0							



END OF BORING

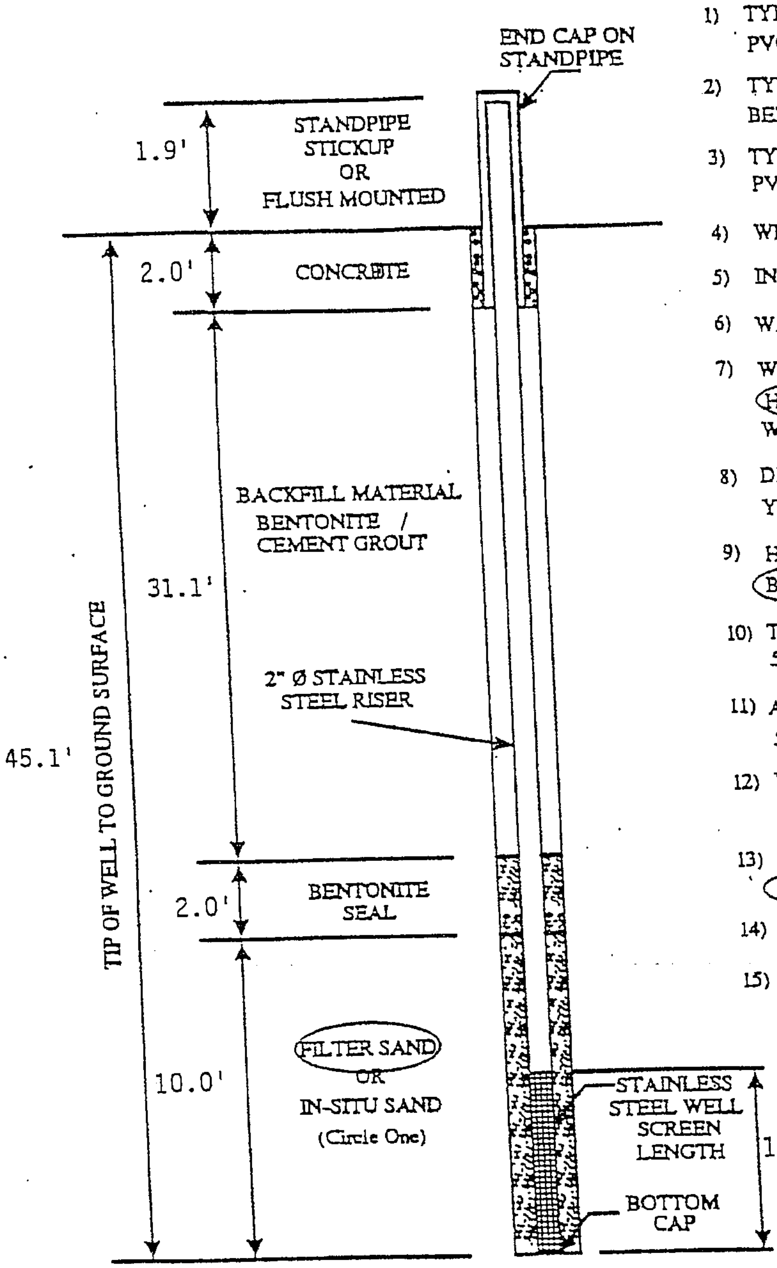
Boring advanced to 45.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.0	WS OR WD WS	BORING STARTED 12/06/90	STS OFFICE Lansing-07	
BCR	ACR 38.0	BORING COMPLETED 12/06/90	ENTERED BY DGS	SHEET NO. 2 OF 2
WL		RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN [✓ 30 MIN.] OTHER ______

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 10 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 3-17-91, 37.10' FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE
DATE ______, ______ FT FROM T, ST. PIPE

WELL NO. M W -141 DATE INSTALLED 12-6-90 DRILL RIG CME 63-550

DRILLER BP DRILL CREW D H

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

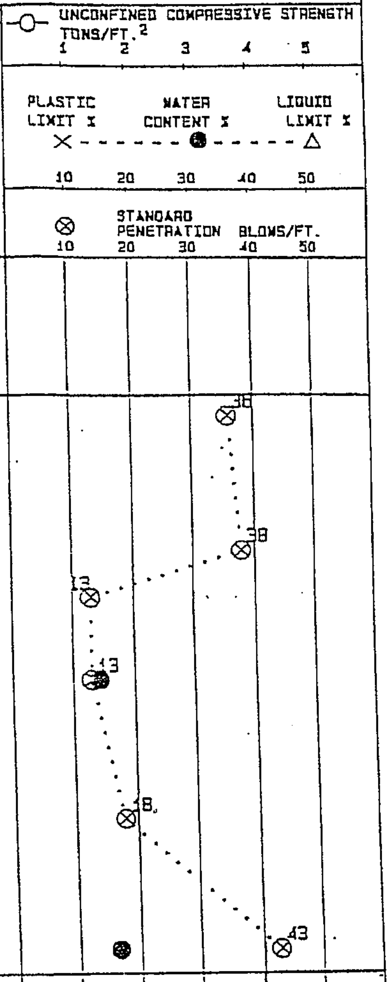
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 858.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Boring advanced without sampling to 50.0 ft. See MW-141 boring log for soil classification.	
50.0		1	SS			Fine to medium sand, little to trace fine to medium gravel, trace coarse sand and silt - brown - medium dense to dense - saturated. (SP)	0/0
			HS				
55.0		2	SS				0/0
		3	SS				0/0
			HS				
60.0		4	PL×				
			HS				
65.0		5	SS				0/0
			HS				
70.0		6	PL×				
75.0 80.0 85.0			AB			Boring advanced without sampling from 71.5 to 138.0'. See MW-143 boring log for soil classification from samples. Field observation: Silty fine sand - gray.	



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

TE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY

DESCRIPTION OF MATERIAL

SURFACE ELEVATION

FIELD PHOTO-IONIZATION DETECTOR READING (PPM)

-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

Continued from previous page

85.0

Boring advanced without sampling from 71.5 to 138.0'. See MW-143 boring log for soil classification from samples.

Field observation: Silty fine sand - gray.

90.0

95.0

Field observation: Silty fine to coarse sand - gray.

100.0

105.0

110.0

RB

115.0

120.0

125.0

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
25.0						Continued from previous page		
30.0						Field observation: Silty fine to coarse sand - gray.		
35.0			RB			Field observation: Silty fine to coarse sand, some fine gravel - gray.		
40.0		7	PL*			Fine to coarse sand, some fine to medium gravel, trace silt - brown - medium dense - saturated. (SW)		● ⊗

END OF BORING

Boring advanced to 70.0' with 4.25" hollow stem auger.
Boring advanced from 70.0 to 140.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

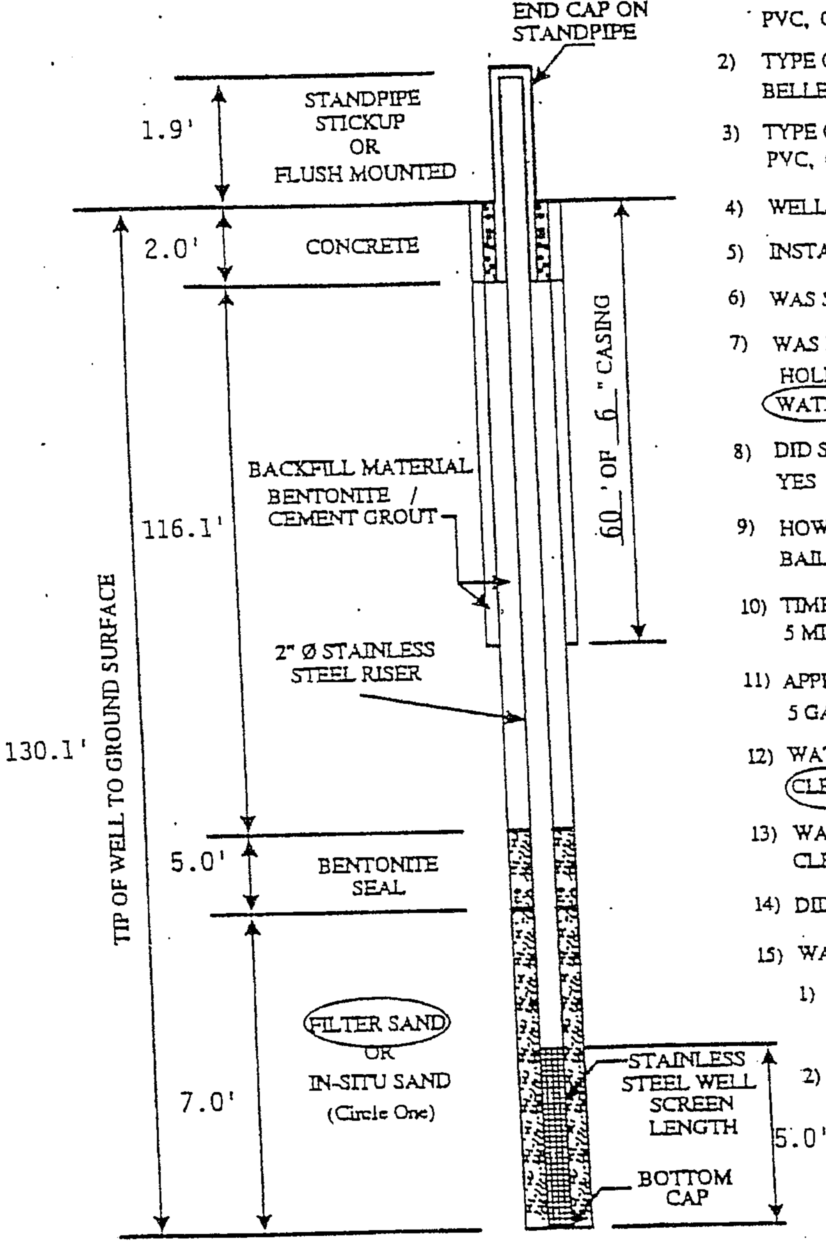
60.0' of 6" permanent casing

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

33.5	WS OR WD WD	BORING STARTED 12/04/90	STS OFFICE Lansing-07	
WL	BCR ACR	BORING COMPLETED 12/14/90	ENTERED BY DDS	SHEET NO. 3 OF 3
WL		RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE NO. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL, [✓ WATER] REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-28-91
5 MIN., 15 MIN., 30 MIN., OTHER 6 hrs

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 45 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY

2) OTHER MEASUREMENTS:

DATE 1-28-91 , 45.30 FT FROM T. ST. PIPE
DATE 2-17-91 , 35.76 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

WELL NO. MW-142 DATE INSTALLED 12-19-90 DRILL RIG CME 63-550

DRILLER B.P. DRILL CREW E.H.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER **MW-144**
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 871.6

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
			HS			Boring advanced without sampling to 40.0'. See MW-145 boring log for soil classification.		
40.0		1	SS			Fine to coarse sand, little fine gravel, trace silt - brown - very dense - moist. (SW)	0/0	52
			HS					
45.0		2	SS				0/0	71
			HS					
			HS			Fine sand and silty clay, trace medium to coarse sand and fine gravel - gray - dense - moist. (SC; CL-ML)		
50.0		3	PL				0/0	41
			AB					
55.0			AB			Boring advanced without sampling from 53.0 to 130.0'. See MW-145 boring log for soil classification from samples. Field observation: Clayey fine sand - gray.		
60.0						Field observation: Fine to coarse sand - brown.		
65.0			AB					
70.0								
75.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-144

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

TE LOCATION
ORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
☒						Continued from previous page	
75.0						Field observation: Fine to coarse sand - brown.	
80.0							
85.0							
90.0							
95.0			AB				
100.0							
105.0							
110.0							
115.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-144
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
						Continued from previous page.		
115.0						Field observation: Fine to coarse sand - brown.		
120.0			RB					
125.0								
130.0		4	PL*			Gravelly fine to coarse sand, trace silt - brown - very dense - saturated. (SP-GP)		150
			RB					
			RB			Fine to coarse sand, little fine to medium gravel and silt - brown to gray - very dense to extremely dense - saturated. (SM)		
135.0		5	PL*					120
			RB					
140.0		6	PL*					255
141.5								

END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Boring advanced from 50.0 to 140.0' using washed rotary drilling techniques.
Boring backfilled from 135.0 to 141.5' with filter sand.
Monitoring well installed. See well installation diagram.

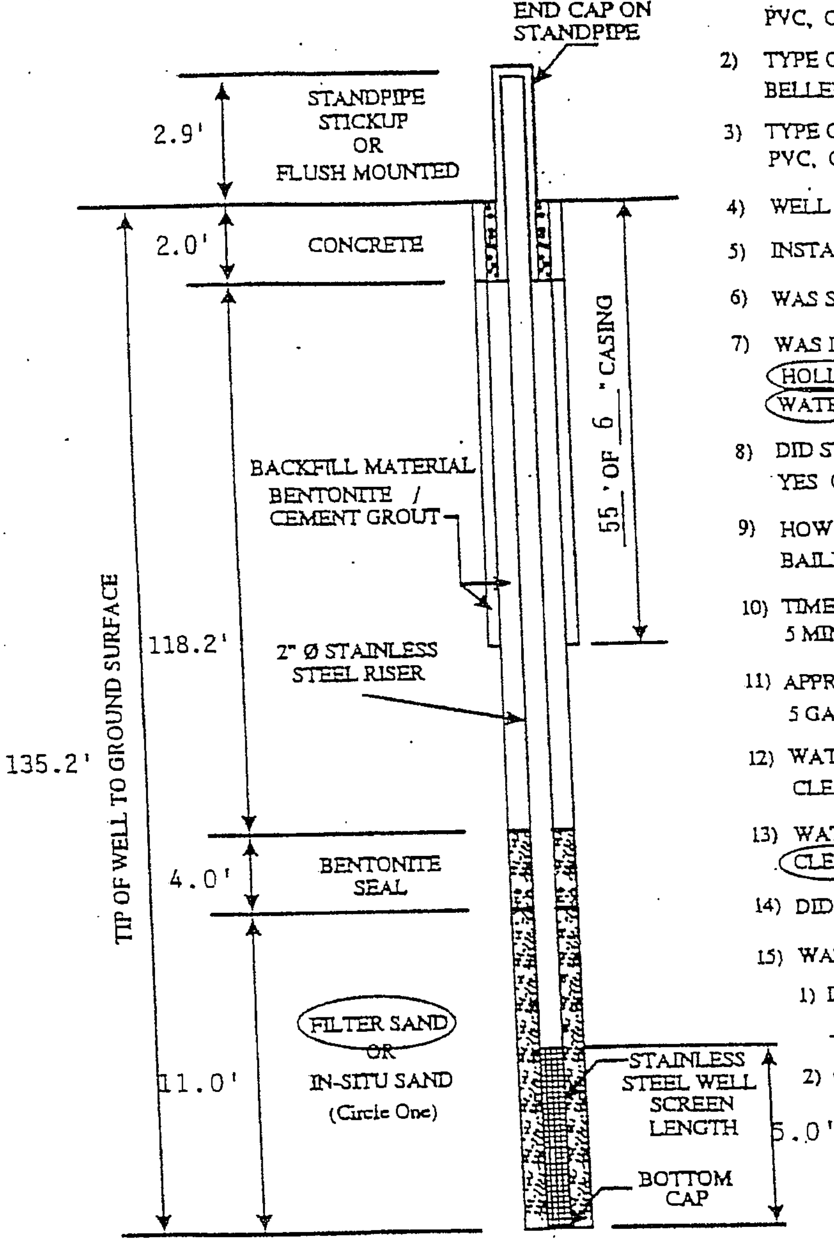
55' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

49.0	WS OR WD WD	BORING STARTED 02/28/91	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 03/06/91	ENTERED BY DDS	SHEET NO. 3 OF 3
WL		RIG/FOREMAN CME-550/DR	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS], OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED], OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS], OTHER ________

4) WELL SCREEN SLOT SIZE No. 10(0.01')

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER], [✓ ROTARY], CABLE TOOL,
[✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 45 Min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 250 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR], TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 3-15-91, 51.18' FT FROM T. ST. PIPE
DATE 3-17-91, 51.07' FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

WELL NO. MW-144 DATE INSTALLED 3-6-91 DRILL RIG B-61

DRILLER B.P. DRILL CREW R.H.D.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840XA

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY

LOG OF BORING NUMBER MW-146

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION 871.4

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	PLASTIC LIMIT % ×	LIQUID LIMIT % △	STANDARD PENETRATION ⊗
			HS			Boring advanced without sampling to 41.0'. See MW-147 boring log for soil classification.				
40.0										
		1	PL	×		Sandy clay, little silt, trace to little gravel - gray. (CL)		×	△	125 ⊗
						Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.				
45.0										
50.0										
55.0										
60.0										
65.0										
70.0										
75.0										

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-146

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./FT.^{3}

SURFACE ELEVATION

Continued from previous page

75.0

Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.

RB

80.0

85.0

90.0

95.0

100.0

105.0

110.0

115.0

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO.71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-146

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 / PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50	⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
						SURFACE ELEVATION			
						Continued from previous page			
115.0						Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.			
120.0									
125.0			RB						
130.0									
135.0		2	PLX			Silt, little clay and fine sand, trace medium to coarse sand - brownish gray - dense - moist to wet. (ML)		●	35 ⊗
136.5									

END OF BORING

Boring advanced to 40.0' with 4.25" hollow stem auger.
Boring advanced from 40.0' to 135.0' using washed rotary drilling techniques.
Boring backfilled from 133.0 to 136.5' with filter sand.
Monitoring well installed. See well installation diagram.

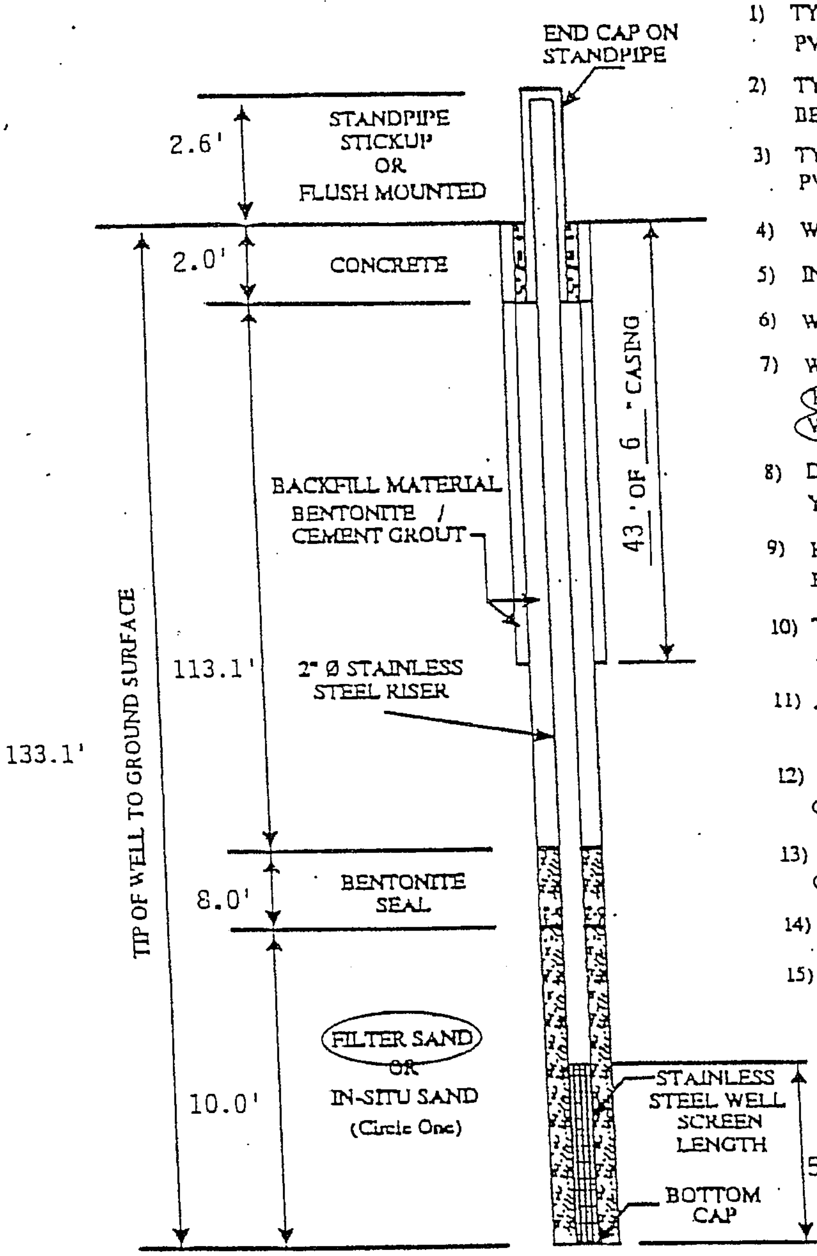
40' of 6" permanent casing.

PLX indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.0 WS OR WD WD	BORING STARTED 02/07/91	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 02/08/91	ENTERED BY DOS	SHEET NO. 3 OF 3
WL	RIG/FOREMAN B-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER], REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN., 30 MIN., OTHER 1.25 hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 3-17-91, 44.23' FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

WELL NO. MW - 146 DATE INSTALLED 2-8-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY

LOG OF BORING NUMBER MW-148

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

SURFACE ELEVATION 869.2

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	
			HS	Boring advanced without sampling to 50.0'. See MW-149 boring log for soil classification.		
60.0			HS	Silty clay, trace fine sand - gray. (CL-ML) Drillers observation: 6" layer of cobbles at 63'		
		1	SS		0/0	⊗×△
			RB			
65.0		1A	SS	Silty sand, little clay, trace fine gravel - brown - very dense - saturated. (SM)	0/0	⊗
			RB			
70.0				Boring advanced without sampling from 66.5 to 130.0'. See MW-147 boring log for soil classification from samples.		
75.0						
80.0			RB			
85.0						
90.0						
				Field observation: Fine to coarse sand - brown.		
95.0						

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-14B

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
					SURFACE ELEVATION	
					Continued from previous page	
95.0					Field observation: Fine to coarse sand - brown.	
100.0						
105.0						
110.0			RB			
115.0						
120.0						
125.0						
130.0		2	SS		Fine to medium sand, little coarse sand, trace silt, clay and fine gravel - brownish gray - extremely dense - saturated. (SP)	0/0
			RB			
135.0						

112

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO.71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

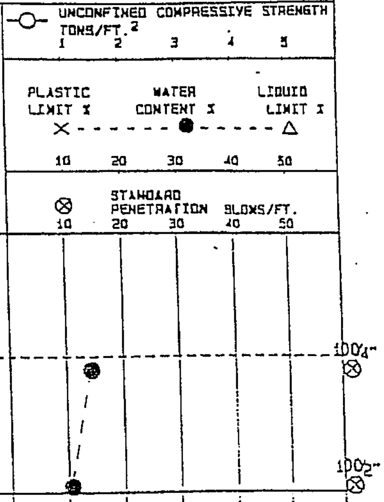
LOG OF BORING NUMBER MW-14B

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
135.0		3	SS			Fine to medium sand, little coarse sand, trace silt, clay and fine gravel - brownish gray - extremely dense - saturated. (SP)	0/0
			RB				
140.5							0/0
						END OF BORING	



Boring advanced to 60.0' with 4.25" hollow stem auger.
Boring advanced from 60.0 to 140.5' using washed rotary drilling techniques.
Boring backfilled from 135.0 to 140.5' with filter sand.
Monitoring well installed. See well installation diagram.

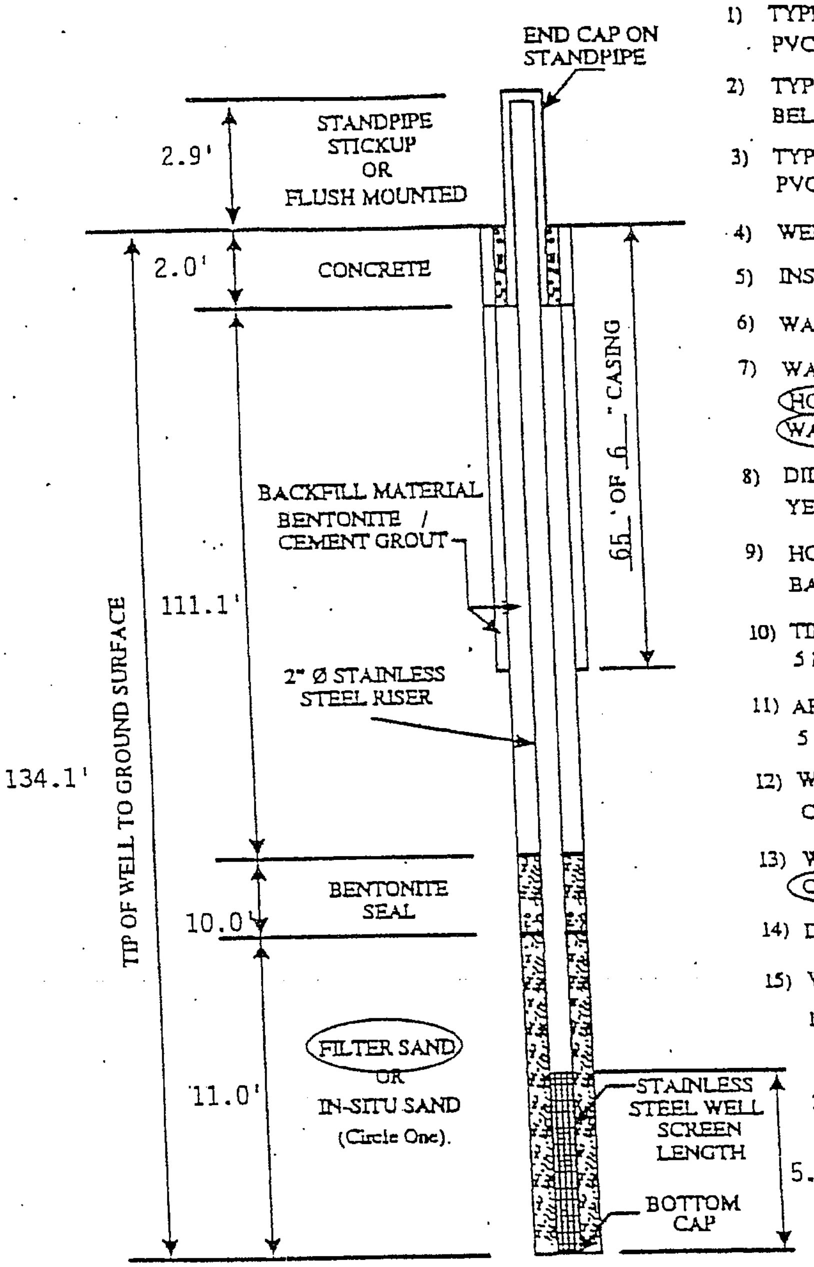
58' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 26.0	WS OR WD WD	BORING STARTED 02/01/91	STS OFFICE Lansing-07	
WL	BCR ACR	BORING COMPLETED 02/03791	ENTERED BY DDS	SHEET NO. 3 OF 3
WL		RIG/FOREMAN B-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01 ")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 2-5-91
5 MIN., 15 MIN, 30 MIN, OTHER 2.5 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 175 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE Slightly Turbid

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 2-5-91 , 28.20 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO MW - 148 DATE INSTALLED 2-3-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

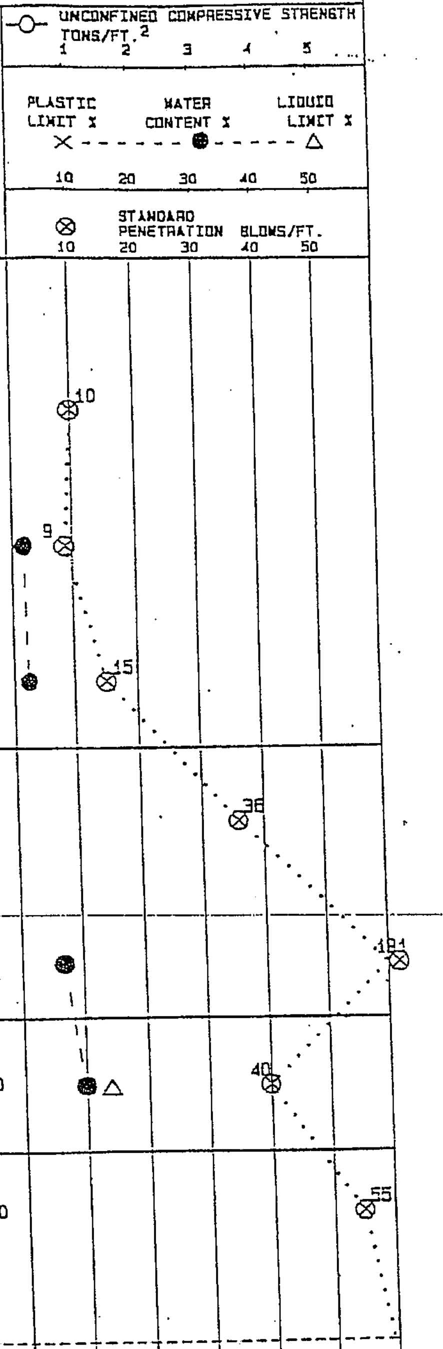
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 869.1

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Fine to medium sand, trace silt and coarse sand - brown - loose to medium dense - moist. (SP).	
5.0		1	SS				0/0
			HS				
10.0		2	SS				0/0
			HS				
15.0		3	SS				0/0
			HS				
			HS			Fine to medium sand, some silt, little coarse sand, little to trace gravel, trace clay - brownish gray - dense to extremely dense - moist (SM)	
20.0		4	SS				0/0
			HS				
25.0		5	PL	X			
			HS				
			HS			Sandy silt, some clay - brown - dense - moist to wet. (ML-CL)	
30.0		6	SS				0/0
			RB				
			RB			Silty fine sand, little clay, little fine gravel, trace medium to coarse sand - gray - very dense - saturated. (SM)	
35.0		7	SS				0/0
			RB				
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

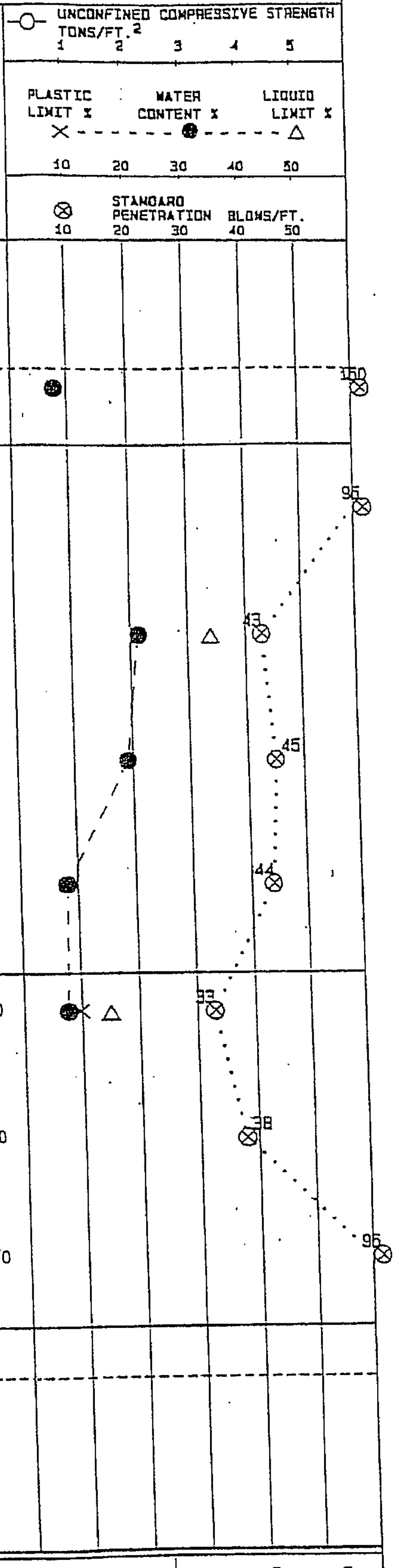
STS JOB NO. 71840

SHEET NO. 1 OF 6

STS Consultants Ltd.

OWNER	THE UPJOHN COMPANY
LOG OF BORING NUMBER	MW-149
PROJECT NAME	HYDROGEOLOGIC STUDY
ARCHITECT-ENGINEER	
SITE LOCATION	PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		8	PL			Silty fine sand, little clay, little fine gravel, trace medium to coarse sand - gray - very dense - saturated. (SM)	
			RB				
			RB			Fine sandy silt, trace fine gravel, and medium to coarse sand - gray - medium dense to extremely dense - saturated. (ML)	
45.0		9	SS				0/0
			RB				
50.0		10	SS				0/0
			RB				
55.0		11	SS				0/0
			RB				
60.0		12	PL				
			RB				
			RB			Silty clay, little to some sand, trace gravel - gray. (CL-ML)	
65.0		13	SS				0/0
			RB				
70.0		14	SS				0/0
			RB				
75.0		15	SS				0/0
			RB				
			RB			Silty fine sand, and clay, trace medium to coarse sand - brownish gray - very dense to extremely dense - saturated. (SM)	
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	PLASTIC LIMIT % ✕ / WATER CONTENT % ● / LIQUID LIMIT % △	STANDARD PENETRATION BLOWS/FT. ⊗
						Continued from previous page			
80.0		16	PL			Silty fine sand, and clay, trace medium to coarse sand - brownish gray - very dense to extremely dense - saturated. (SM)		● ✕ △	150
			RB						
85.0		17	SS				0/0		75
			RB						
			RB			Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)	0/0		100/6"
90.0		18	SS						
			RB				0/0		140/6"
95.0		19	SS						
			RB						140/4"
100.0		20	PL					●	
			RB						
105.0		21	SS				0/0		56
			RB						
110.0		22	SS				0/0		87
			RB						
115.0		23	SS				0/0		55
			RB						
120.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 3 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} ○ 1 2 3 4 5

PLASTIC LIMIT % ✕ – WATER CONTENT % ● – LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page			
20.0		24	PL*			Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)		●	150
			RB						
25.0		25	SS				0/0		110
			RB						
30.0		26	SS				0/0		107/6"
			RB						
35.0		27	SS				0/0		100/4"
			RB						
40.0		28	SS*				0/0		118
			RB						
45.0		29	PL*					●	119
			RB						
50.0		30	SS				0/0		44
			RB						
55.0		31	SS				0/0		53
			RB						
60.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 4 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
160.0		32	SS			Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)	0/0	52
			RB					
165.0		33	PL*					119
			RB					
			RB			Fine to medium sand, little gravel, trace silt and coarse sand - brownish gray - extremely dense - saturated. (SP)		
170.0		34	SS				0/0	104/6"
			RB					
175.0		35	SS				0/0	103
			RB					
180.0		36	PL*					100/3"
			RB					
185.0		37	SS				0/0	95/5"
			RB					
190.0		38	SS				0/0	100/6"
			RB					
195.0		39	SS				0/0	105/4"
			RB					
200.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 5 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page			
200.0		40	PL*			Fine to medium sand, little gravel, trace silt and coarse sand - brownish gray - extremely dense - saturated. (SP)		●	163/5" ⊗
			RB						
205.0		41	SS				0/0		147/6" ⊗
			RB						
210.0		42	SS				0/0		100/3" ⊗
			RB						
215.0		43	SS				0/0		100/3" ⊗
			RB						
220.0 221.0		44	PL*					●	80/3"* ⊗

END OF BORING

Boring advanced to 30.0' using 4.25" hollow stem augers.
Boring advanced from 30.0 to 221.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

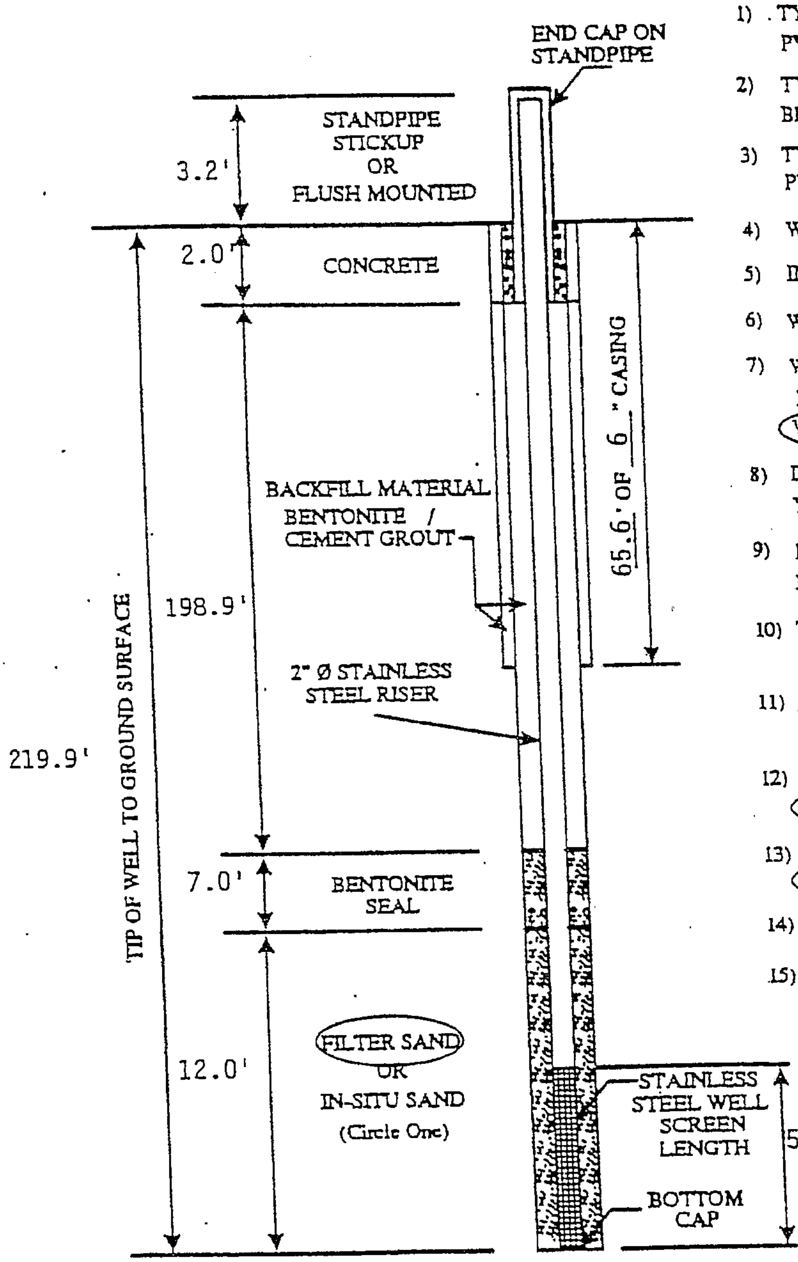
65' of 6" permanent casing.

Note: PL* indicates 3" plastic liner.
Note: ⊗* indicates 300 lb. hammer used.

The stratification lines represent the approximate boundary lines between soil types: in-situ. the transition may be gradual.

WL 32.0	WS OR WD WD	BORING STARTED 01/23/91	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 01/30/91	ENTERED BY COS / SHEET NO. 6 OF 6
WL		RIG/FOREMAN B-61/JL	APP'D BY AMM / STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10(0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
[✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN., 30 MIN., OTHER 2 ½ Hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL., 10 GAL., 15 GAL., OTHER 250 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-17-91, 34.59 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW -149 DATE INSTALLED 1-31-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-151

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

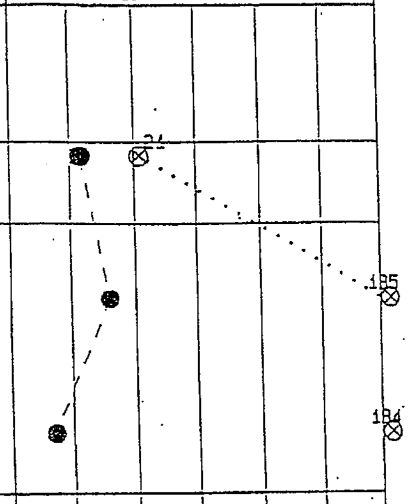
SITE LOCATION
PORTAGE, MICHIGAN

-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 869.5	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Boring advanced without sampling to 50.0 ft. See MW-152 boring log for soil classification.	
50.0		1	SS			Silty fine sand, trace clay - brownish gray - medium dense - saturated. (SM)	0/0
			AB				
			AB			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - extremely dense - saturated. (SP-SM)	
55.0		2	PL×				
			AB				
60.0		3	PL×				
			AB				
65.0						Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.	
70.0							
75.0							
80.0							
85.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-151**

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY

DESCRIPTION OF MATERIAL

SURFACE ELEVATION

FIELD PHOTO-IONIZATION DETECTOR READING (PPM)

-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - ● - - - - - - △ LIQUID LIMIT %
WATER CONTENT %
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

Continued from previous page

85.0

Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.

90.0

AB

95.0

100.0

105.0

110.0

115.0

120.0

125.0

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.	OWNER **THE UPJOHN COMPANY**	LOG OF BORING NUMBER **MW-151**
	PROJECT NAME **HYDROGEOLOGIC STUDY**	ARCHITECT-ENGINEER
SITE LOCATION **PORTAGE, MICHIGAN**		

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △ 10 20 30 40 50

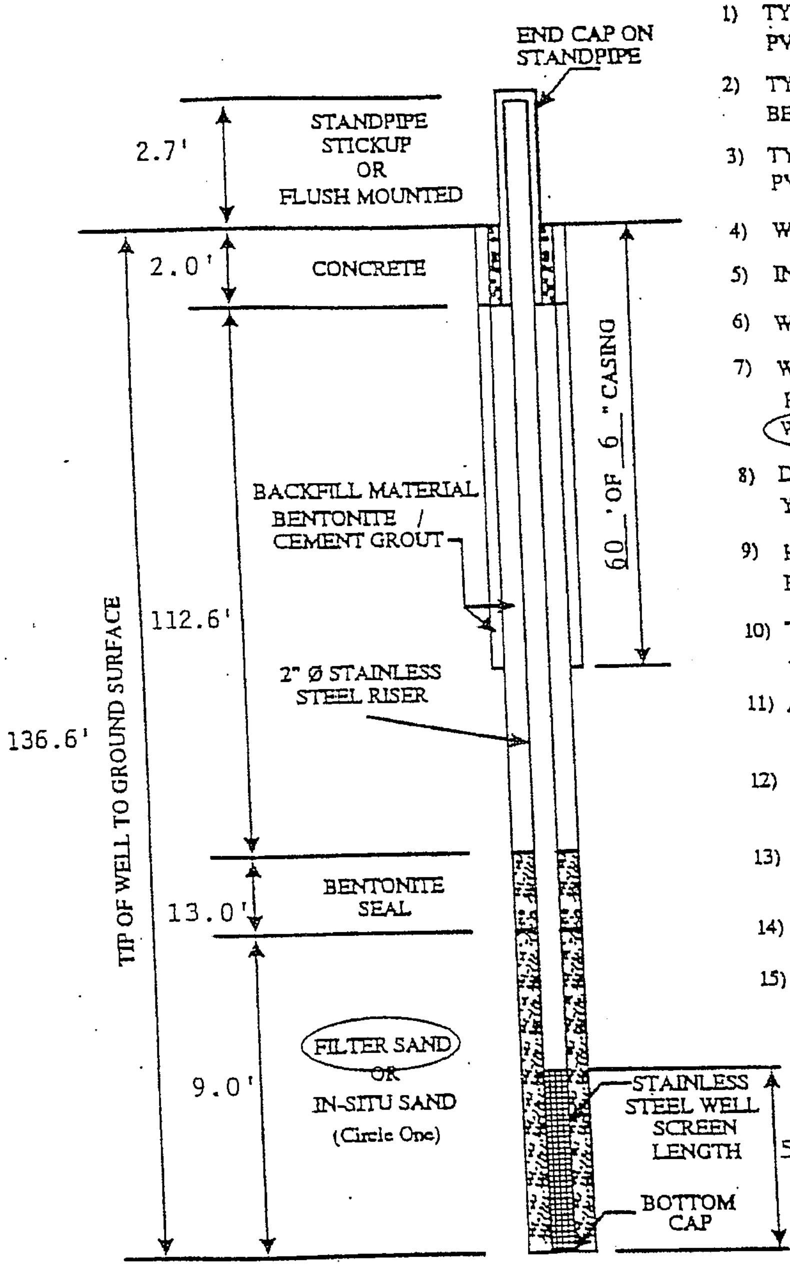
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT % / STANDARD PENETRATION
						Continued from previous page		
125.0						Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.		
130.0			RB					
135.0			RB			Drillers observation: Gravel and cobble strata; Water loss occured while drilling.		
		4	PL*			Sandy silt, trace coarse sand - gray - dense - saturated. (ML)		● 88 ⊗
140.0						END OF BORING Boring advanced to 50.0' with 4.25" hollow stem auger. Boring advanced from 50.0 to 140.0' using washed rotary drilling techniques. Boring backfilled from 137.0 to 140.0' with filter sand. Monitoring well installed. See well installation diagram. 60.0' of 6" permanent casing Note: PL* indicates 3" plastic liner.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 38.3	WS OR WD WD	BORING STARTED 02/02/91	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 02/03/91	ENTERED BY DDS	SHEET NO. 3 OF 3
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

.STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.10")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
[✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 2-5-91
5 MIN., 15 MIN, 30 MIN, OTHER 5 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 175 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, [✓ OPAQUE]

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-5-90 , 38.60 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO. MW - 151 DATE INSTALLED 2-3-91 DRILL RIG Mobile B-61

DRILLER D.G. DRILL CREW P.B.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

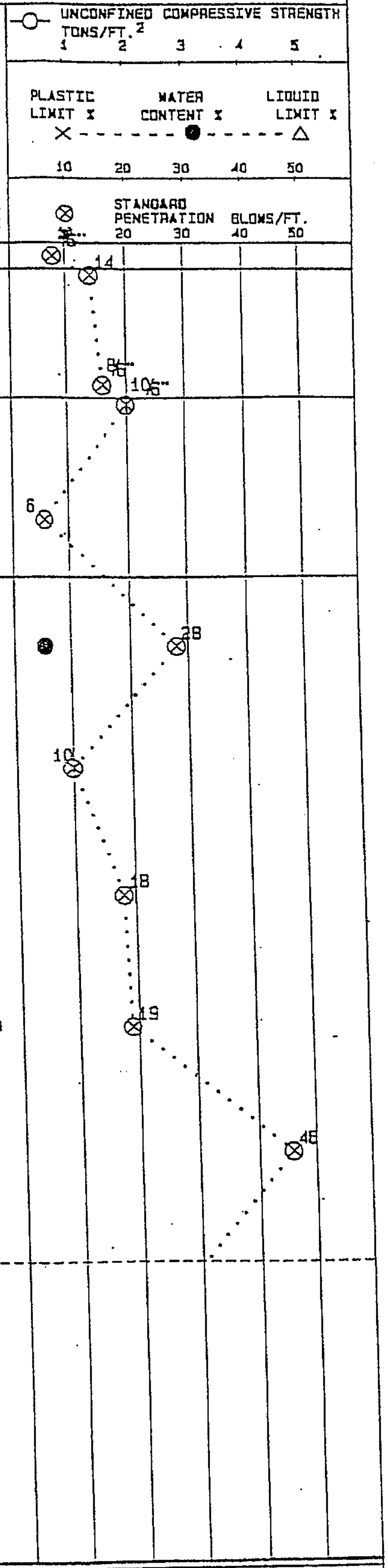
LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION 868.9	
		1	SS			Clayey sand, trace organics and silt - dark brown - loose - moist. (TOPSOIL)	
		1A	SS				0/0
			HS			Clayey sand, trace silt - brown - medium dense - moist. (SC)	
5.0		2	SS				0/0
		2A	SS			Sandy clay, trace silt and fine gravel - brown - (CL)	0/0
			HS				
10.0		3	SS				0/0
			HS				
			HS			Fine to medium sand, trace to some fine to medium gravel and coarse sand, trace silt - dark to light brown - medium dense to dense - moist to saturated. (SP-GP)	
15.0		4	PL*				
			HS				
20.0		5	SS				0/0
			HS				
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
			HS				
35.0		8	PL*				
			HS				
40.0							



... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 5

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

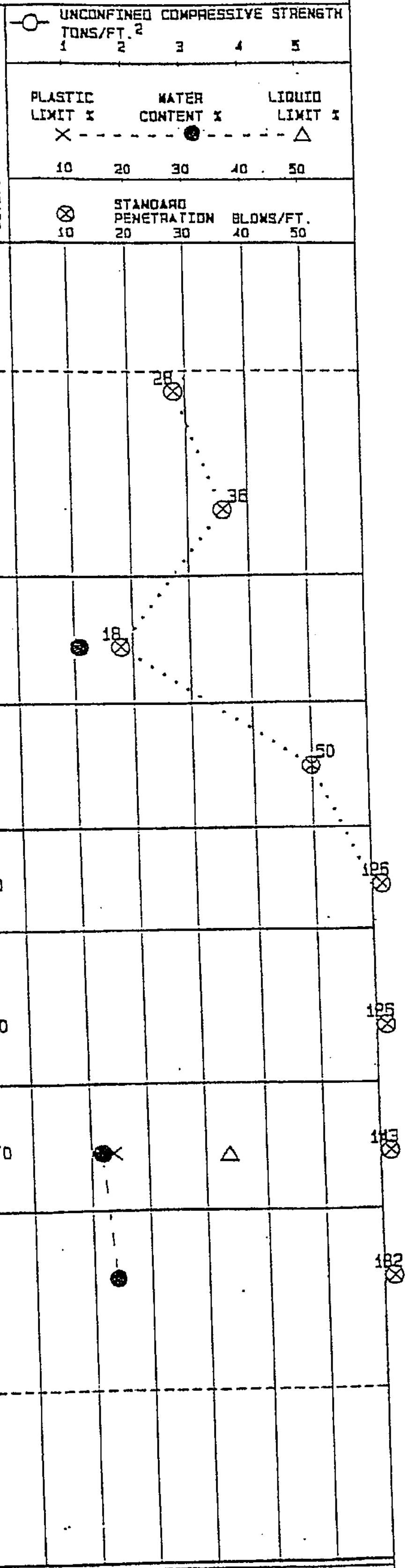
LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		9	SS			Fine to medium sand, trace to some fine to medium gravel and coarse sand, trace silt - dark to light brown - medium dense to dense - moist to saturated. (SP-GP)	0/0
			HS				
45.0		10	SS				0/0
			RB				
			RB			Silty fine sand, trace medium to coarse sand, fine gravel and clay - gray - medium dense - saturated. (SM)	
50.0		11	SS				0/0
			RB				
			RB			Fine to medium sand, trace silt - brownish gray - very dense - saturated. (SP)	
55.0		12	PL×				
			RB				
			RB			Silty clay, little fine to coarse sand and fine gravel - grayish brown. (CL)	
60.0		13	SS				0/0
			RB				
			RB			Fine to medium sand, trace silt, clay and fine gravel - grayish brown - extremely dense - saturated. (SP)	
65.0		14	SS				0/0
			RB				
			RB			Silty clay, little fine to coarse sand and fine gravel - grayish brown. (CL)	
70.0		15	SS				0/0
			RB				
			RB			Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP) Geologist observation: Black peat lenses from 110 to 111 ft.	
75.0		16	PL×				
			RB				
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 5

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-152
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
80.0		17	SS			Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP) Geologist observation: Black peat lenses from 110 to 111 ft.	0/0	88
			RB					
85.0		18	SS				0/0	84
			RB					
90.0		19	SS				0/0	68
			RB					
95.0		20	PL×					104
			RB					
100.0		21	SS				0/0	97
			RB					
105.0		22	SS				0/0	77
			RB					
110.0		23	SS				0/0	86
			RB					
115.0		24	PL×					1205"
			RB					
120.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 3 OF 5

STS STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-152
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ — WATER CONTENT % ● — LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page			
120.0		25	SS			Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP)	0/0		186
			RB						
125.0		26	SS				0/0		88
			RB						
130.0		27	SS				0/0		181
			RB						
135.0		28	SS				0/0		186
			RB						
			RB			Sandy silt, trace clay - gray - extremely dense - saturated. (ML)			
140.0		29	PLX					●	125/6"
			RB						
			RB			Fine to coarse sand, trace to little silt and fine to medium gravel - brown - extremely dense. saturated. (SP-SM)			
145.0		30	SS				0/0		124/6"
			RB						
150.0		31	SS				0/0		124/6"
			RB						
155.0		32	SS				0/0		180/6"
			RB						
160.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.	STS JOB NO. 71840	SHEET NO. 4 OF 5

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
160.0		33	PL*			Fine to coarse sand, trace to little silt and fine to medium gravel - brown - extremely dense-saturated. (SP-SM)		150/6"
			RB					
165.0		34	SS				0/0	96/6"
			RB					
170.0		35	SS				0/0	74/6"
			RB					
175.0		36	SS				0/0	146
			RB					
180.0								
180.5		37	PL*					198/6"

END OF BORING

Boring advanced to 45.0' with 4.25" hollow stem auger.
Boring advanced from 45.0 to 180.5' using washed rotary drilling techniques.
Boring backfilled from 170.0 to 180.5' with filter sand.
Monitoring well installed. See well installation diagram.

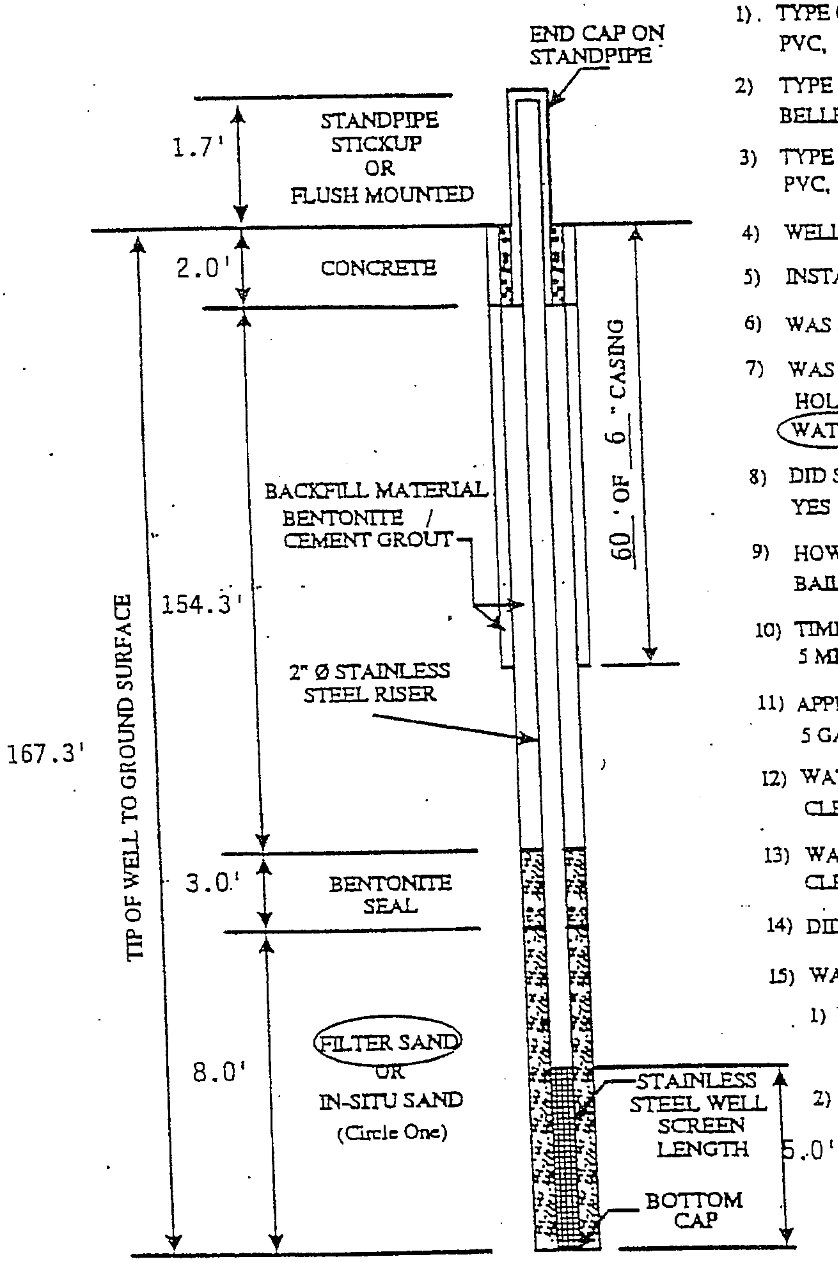
60.0' of 6" permanent casing.

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 36.0 WS OR WD WS	BORING STARTED 01/22/91	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 01/25/91	ENTERED BY DOS	SHEET NO. 5 OF 5
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1). TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
[✓ WATER REVERT], [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-31-91
5 MIN., 15 MIN, 30 MIN, OTHER 4 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 225 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 1-31-91 , 38.60 FT FROM T. ST. PIPE
DATE 2-17-91 , 38.60 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO MW-152 DATE INSTALLED 1-24-91 DRILL RIG Mobile B-61

DRILLER D.G. DRILL CREW P.P.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

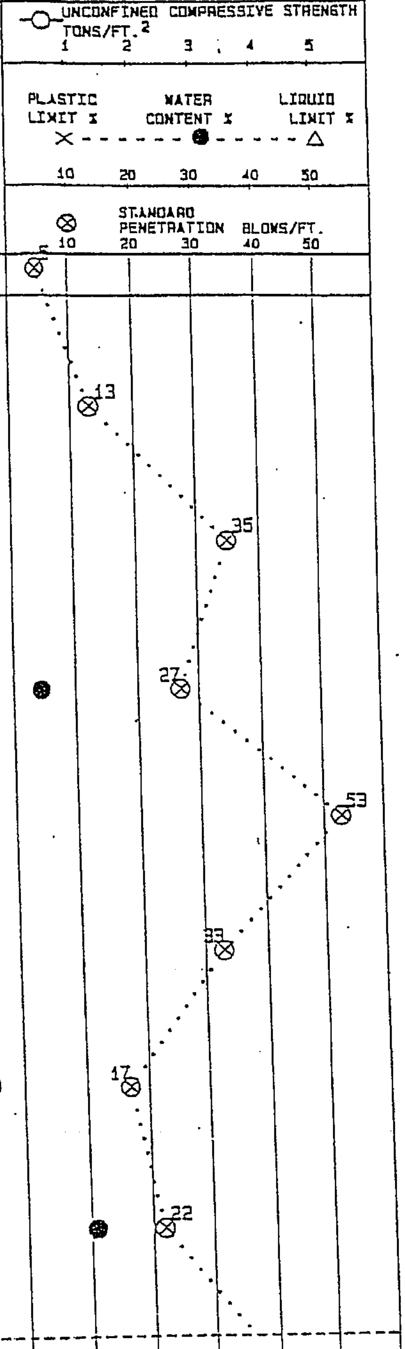
(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-153
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 866.2

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS			Sandy clay, little silt and organics, trace fine gravel - dark brown - loose - moist. (TOPSOIL)	0/0
			HS			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - medium dense to very dense - moist to saturated. (SP-SM)	
5.0		2	SS				0/0
			HS				
10.0		3	SS				0/0
			HS				
15.0		4	PL×				
			HS				
20.0		5	SS				0/0
			HS				
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
			HS				
35.0		8	PL×				
			HS				
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 4

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

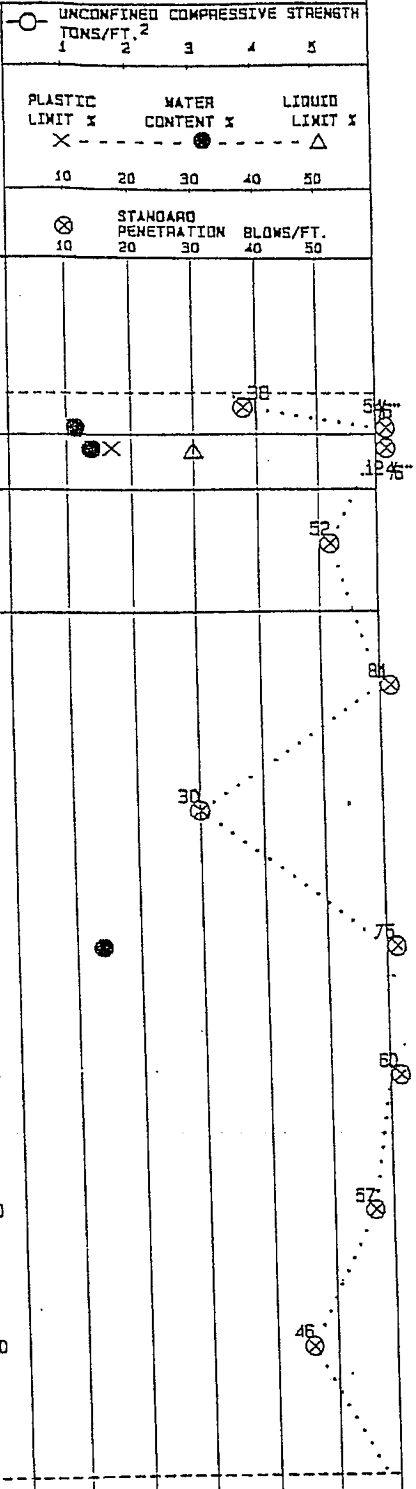
LOG OF BORING NUMBER MW-153

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION	
						Continued from previous page	
40.0		9	SS			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - medium dense to very dense - moist to saturated. (SP-SM)	0/0
		10	PL×				
		10A	PL×				
			AB				
			AB			Silty clay, some fine sand, trace fine gravel and medium to coarse sand - gray. (CL)	
45.0		11	SS			Silty fine sand, trace medium sand - gray - very dense - saturated. (SM)	0/0
			AB				
			AB			Fine to medium sand, little coarse sand, trace fine gravel, silt and clay - brown - dense to extremely dense - saturated. (SP-SW)	
50.0		12	SS				0/0
			AB				
55.0		13	SS				0/0
			AB				
60.0		14	PL×				
			AB				
65.0		15	SS				0/0
			AB				
70.0		16	SS				0/0
			AB				
75.0		17	SS				0/0
			AB				
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 4

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY

LOG OF BORING NUMBER MW-153

ARCHITECT-ENGINEER

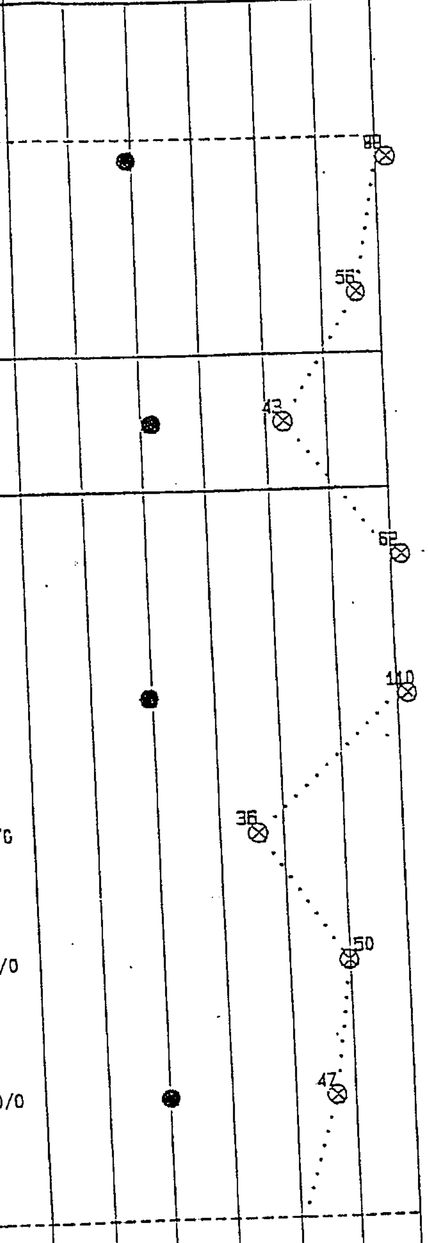
SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
☒						SURFACE ELEVATION	
						Continued from previous page	
80.0		18	PL*			Fine to medium sand, little coarse sand, trace fine gravel, silt and clay - brown - dense to extremely dense - saturated. (SP-SW)	
			AB				
85.0		19	SS				0/0
			AB				
			AB			Fine to medium sand, some silt, trace coarse sand - brownisn gray - dense - saturated. (SM)	
90.0		20	SS				0/0
			AB				
			AB			Fine sand, trace medium to coarse sand, fine gravel and silt - brown - dense to extremely dense - saturated. (SP)	0/0
95.0		21	SS				
			AB				
100.0		22	PL*				
			AB				
105.0		23	SS				0/0
			AB				
110.0		24	SS				0/0
			AB				
115.0		25	SS				0/0
			AB				
120.0							



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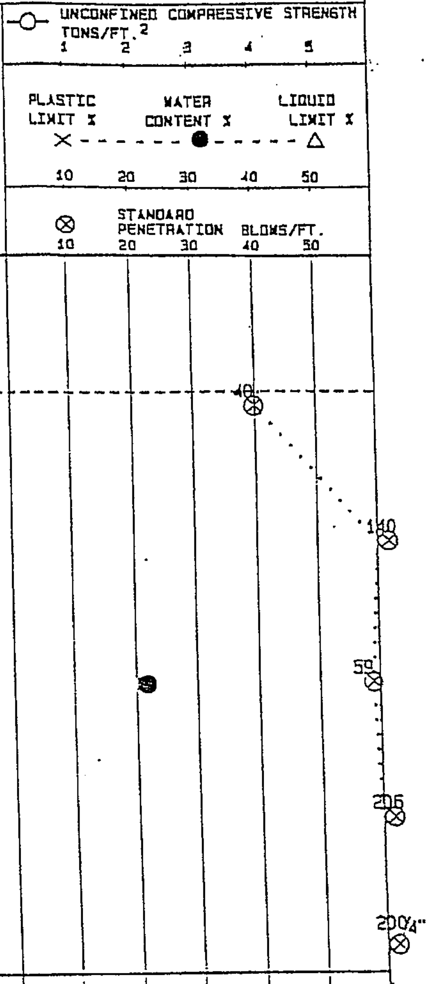
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 3 OF 4

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-153
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
120.0		26	PL*			Fine sand, trace medium to coarse sand, fine gravel and silt - brown - dense to extremely dense - saturated. (SP)	
			RB				
125.0		27	SS				0/0
			RB				
130.0		28	SS				0/0
			RB				
135.0		29	SS				0/0
			RB				
140.0		30	PL*				
141.5						END OF BORING	



END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Boring advanced from 50.0 to 141.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

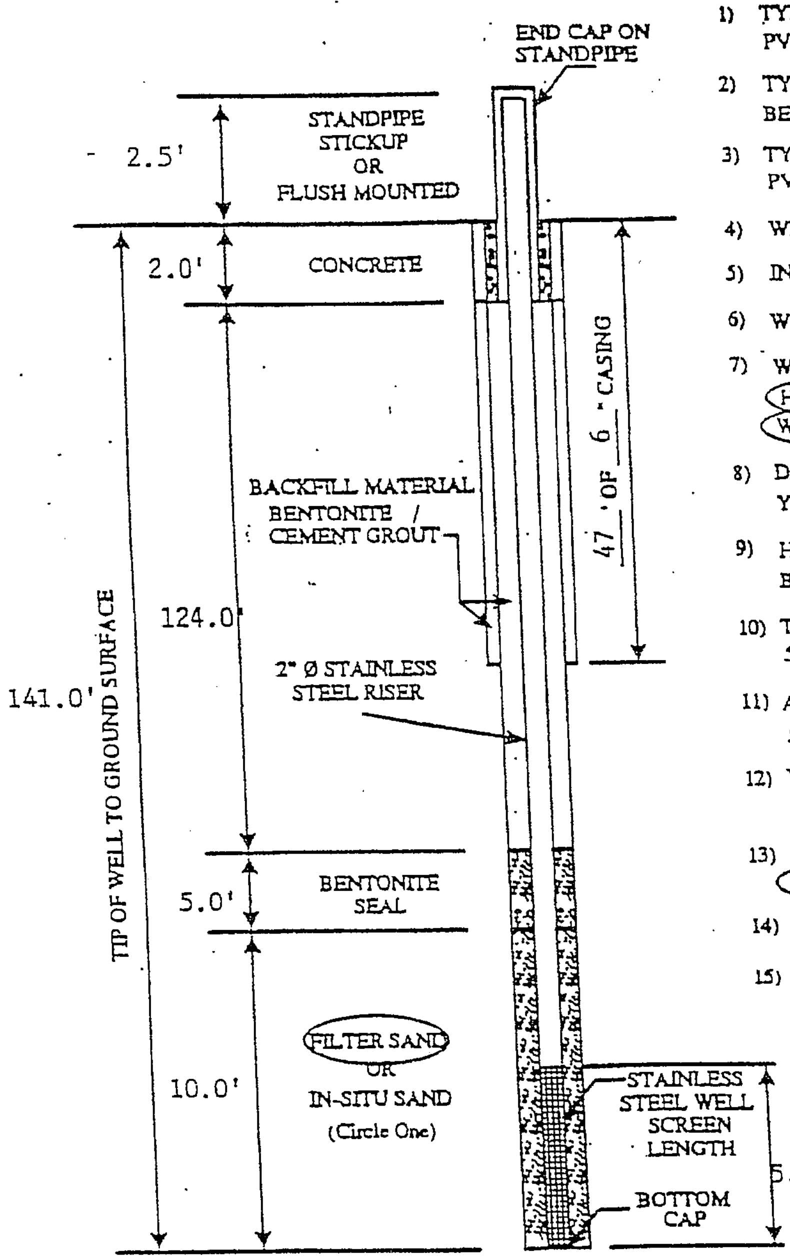
47' of 6" permanent casing

PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 31.0	WS OR WD WS	BORING STARTED 03/28/91	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 04/04/91	ENTERED BY DDS	SHEET NO. 4 OF 4
WL		RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 45 Min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR], TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 4-10-91, 37.75' FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW-153 DATE INSTALLED 4-4-91 DRILL RIG Mobile B-61

DRILLER B.P. DRILL CREW D.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company

Approx. 150' East of Production Well W-34

s) Drilled: 12-18-92 and 12-18-92

Logged By: Michael Janeczko

Drilling Co.: Environmental Drilling and Services

Weather Conditions: Cold

Well/Boring ID: MW-158

Page: 1 of 4

Boring Depth: 140'

Boring Diameter: 18.25"

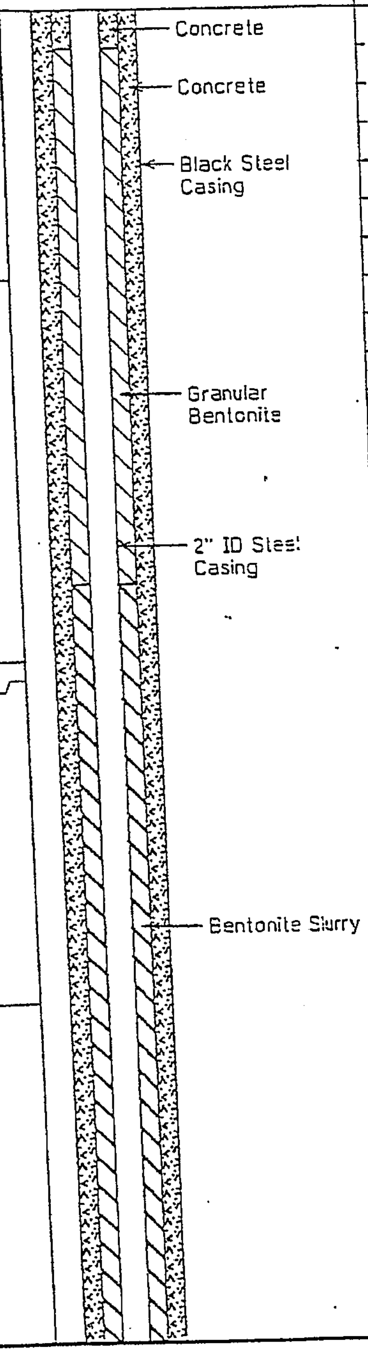
Drilling Method: 12.25" and 4.25" Hollow Stem Auger

Drilling Equipment: Mobile/Failing Drill Rig

Top of Slots: 135' b.g.l.

Bottom of Slots: 140' b.g.l.

DEPTH feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
						TOPSOIL.		
						SAND-fine, some clay, subangular to subrounded, well sorted, medium dense, slightly moist, reddish-brown.		
5								
						SAND-fine to medium, subangular to subrounded, well sorted, medium dense, dry, brown.		
10		4 5 6 5	1.2'	ND				
15								
						COBBLE SEAM.		
						SAND-medium, some fine to medium gravel, subangular to rounded, moderately sorted, loose, dry, brown.		
20		8 11 14 14	1.2'	ND				
25								
						GRAVELLY SAND-coarse, subangular to rounded, poorly sorted, loose, slightly moist, brown.		
30		30 60 70 50	0.5'	ND				
35								



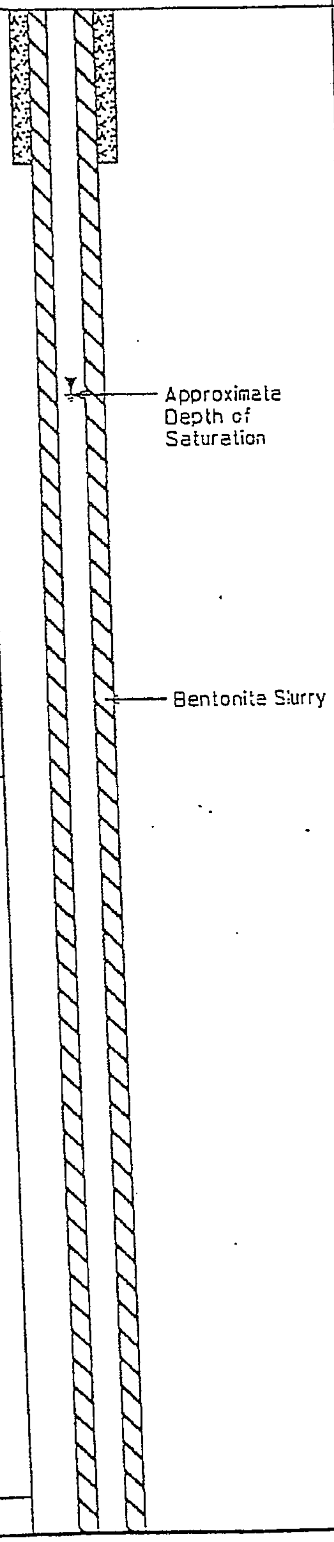
Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company
Well/Boring ID: MW-158
Page: 2 of 4

feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
	☒	11 15 17 18	1.4'	ND		CLAY-fine to medium, trace fine to coarse gravel, subrounded, moderately sorted, medium stiff, dry to saturated at about 44' bgl, gray.	
	☒	11 14 16 18	1.8'	ND			
40							
45							
						CLAYEY SAND.	
50							
55						GRAVELLY SAND-medium to coarse, subrounded, poorly sorted, very loose, saturated, brown.	
60	☒	8 13 18 19	1.0'	ND			
65							
70							
75						SAND- (see next page)	

WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company Well/Boring ID: MW-158 Page: 3 of 4

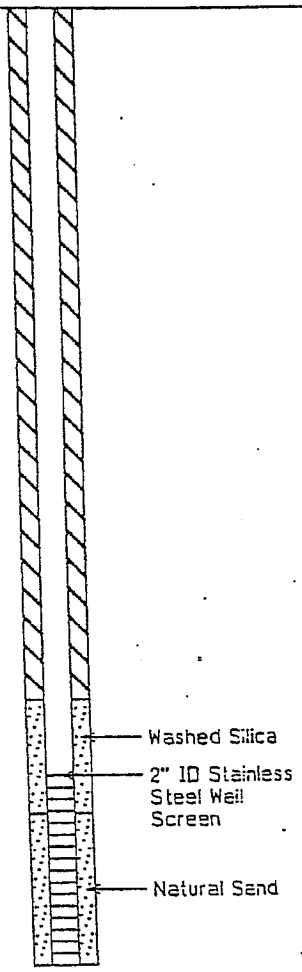
feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
						SAND–fine to medium, some fine gravel, subangular, moderately sorted, loose, saturated, brown.		
80	☒	32 20 10 15	1.0'	ND				
85								
90								
95								
100	☒	1 4 3 5	1.0'	ND			Bentonite Slurry	
105								
110						COBBLE SEAM.		
						SAND–fine to coarse, trace fine to medium gravel, subangular, poorly sorted, loose, saturated, brown.		
115								

Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company Well/Boring ID: MW-158 Page: 4 of 4

feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
						SAND-fine to coarse, trace fine to medium gravel, subangular, poorly sorted, loose, saturated, brown.		
120		60 80 60 70	-	ND				
125		2 4 7 8	1.2'	ND				
130		3 8 11 10	1.2'	ND				
135		60 80 50 45	-	ND				
140		50 70 80 50	-	ND				
145								
150								
155								



Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

ENVIROLOGIC TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-161R

SHEET 1 of 2

CLIENT: UPJOHN – 950013

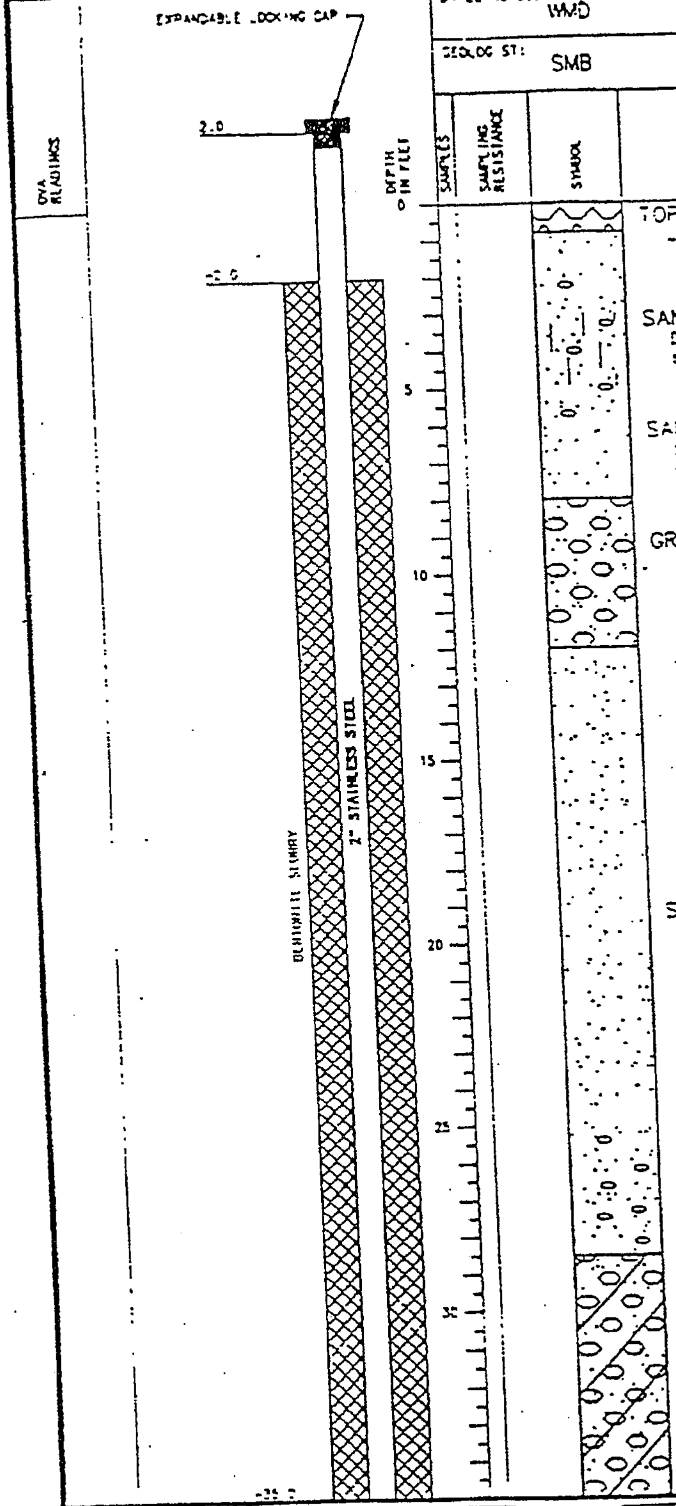
LOCATION: FIELD WEST OF PORTAGE ROAD

DRILLING CO: WMD

START DATE: 3/27/95

GEOLOGIST: SMB

COMPLETION DATE: 3/27/95



DESCRIPTION

TOPSOIL 8"
Light brown, sandy.

SAND
Dark reddish brown, medium grained, well sorted, some medium gravel, trace silt.

SAND
Light brown, medium to coarse grained, poorly sorted with medium and coarse gravel.

GRAVEL
Medium to coarse, poorly sorted, some medium to coarse grained sand, trace cobbles, dry.

SAND
Tan, fine grained, well sorted, dry.

GRAVEL
Fine to coarse, with coarse grained sand, poorly sorted, dry.

GRAVEL
SAND
SILT
CLAY
ORGANIC
TILL
SHALE
ROCK
MISC. FILL
TOPSOIL
▽ SATURATION LEVEL AT TIME OF DRILLING
▼ STATIC WATER LEVEL
N.D. NOT DETECTED BY HNU OR OVA

ENVIROLOGIC
TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-161R

SHEET 2 of 2

CLIENT: UPJOHN - 950013

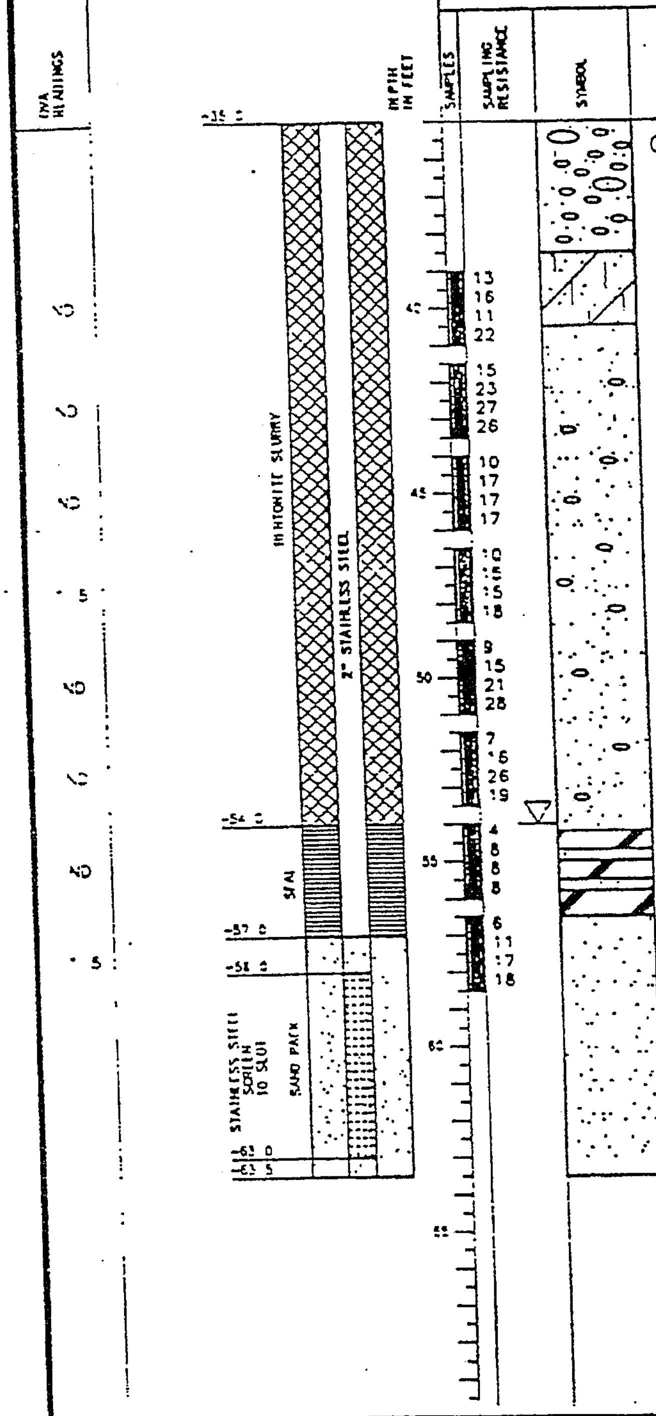
LOCATION: FIELD WEST OF PORTAGE ROAD

DRILLING CO: WMD

START DATE: 3/27/95

GEOLOGIST: SMB

COMPLETION DATE: 3/27/95



DESCRIPTION

GRAVEL
Fine to medium, with medium and coarse grained sand, poorly sorted, trace cobbles, dry.

SAND
Grayish brown, fine grained, with silt, some clay, trace gravel, damp.

SAND
Brown, coarse grained, moderately sorted, some gravel, dry.

SAND
Brown, coarse and medium grained, some gravel, poorly sorted, dry.

SAND
Tan, fine grained, well sorted, trace fine gravel, dry.

SAND
Orangish brown, medium grained, poorly sorted, trace gravel, dry.

CLAY AND SAND
Clay; Gray, cohesive, non-plastic, damp.
Sand; Brown, fine grained, well sorted, wet.
6" clay layers and 3" sand seams, intermittent

SAND
Brown, medium grained, moderately sorted, wet

Total depth = 63.5 feet

∘∘∘	GRAVEL	⁚	SILT	⁘	ORGANIC	▤	SHALE	⁖	MISC FILL	▽	SATURATION LEVEL AT TIME OF DRILLING
☐	SAND	▨	CLAY	☐	TILL	▩	ROCK	☐	TOPSOIL	▼	STATIC WATER LEVEL
										N.D.	NOT DETECTED BY HNU OR OVA

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. OS-2

DRILLED BY George Fahrni DRILLER COMPLETED November 20, 19 84

Elevation = 867 1910' S of Bishop + 3240' E of Portage

LOCATION West of East service road along tracks by old incinterator

CENESS OF STRATA	STRATA	TOTAL DEPTH	HEAVES	WATER FROM SURFACE
6' 0"	Sand and clay	6' 0"		
6' 0"	Sand, gravel & clay	12' 0"		
5' 0"	Sand, gravel & clay	17' 0"		
6' 0"	Sand and clay	23' 0"		
4' 0"	Sand, gravel and clay	27' 0"		16' 0"
5' 0"	Gravel, sand and clay	32' 0"		16' 0"
2' 0"	Fine sand, gravel and clay	34' 0"		
3' 0"	Fine sand and clay	37' 0"		

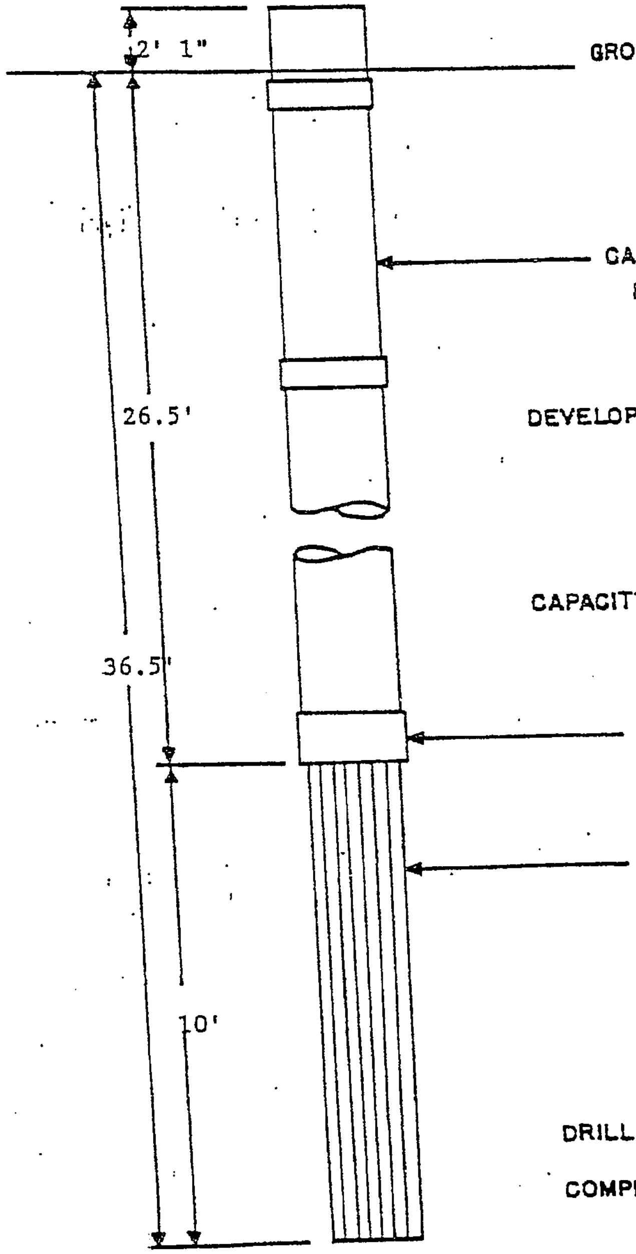
THE OHIO DRILLING COMPANY

MASSILLON, OHIO

The Upjohn Company

Kalamazoo, Michigan

Test hole No. OS-2



GROUND SURFACE

CASING
8" diameter with welded and banded joints.

DEVELOPMENT

Swabbed and bailed -
Treated with glassy phosphates and chlorine.

CAPACITY

Approximately 250 gpm

DRIVE SHOE

Steel shoe, 8" long

SCREEN

Stainless steel -

Top 2 feet - 20 slot
Middle 5 feet - 40 slot
Bottom 3 feet - 20 slot

DRILLED BY: George Fahrni

COMPLETED: November 20, 1984

STS Consultants Ltd.

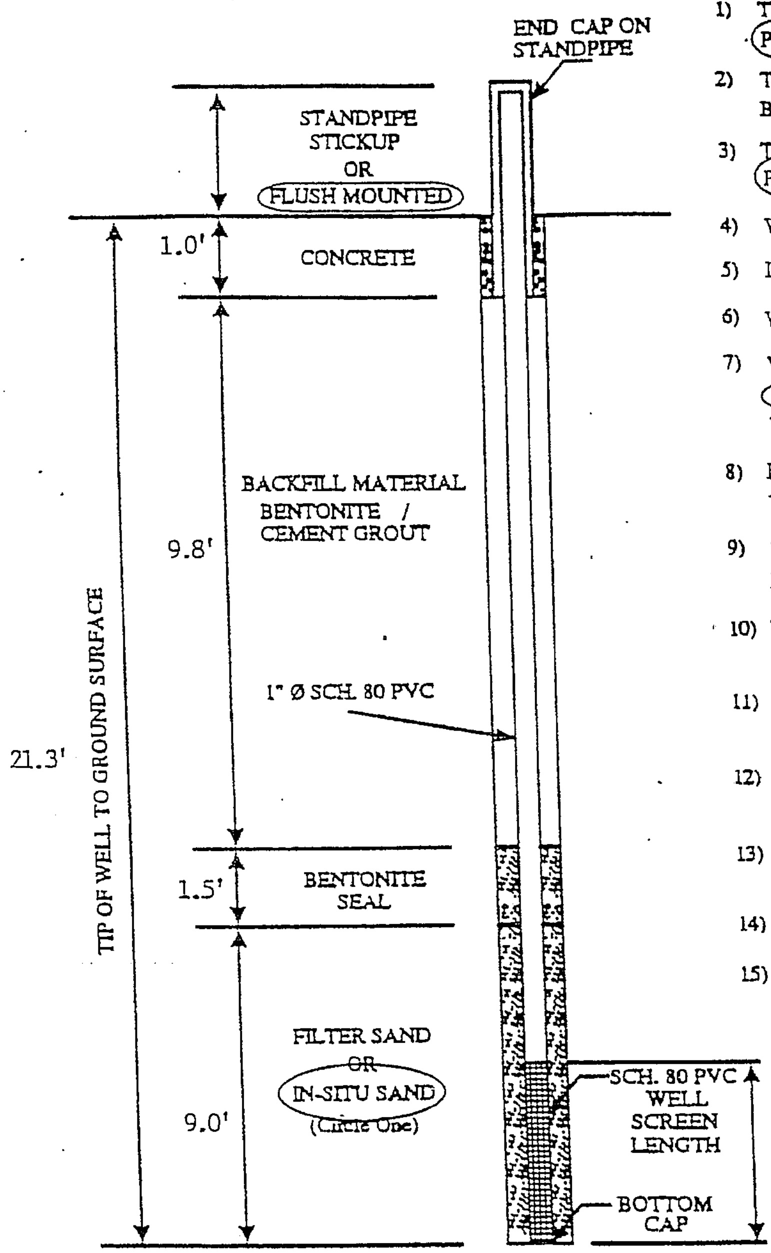
OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-1A	
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER	
SITE LOCATION PORTAGE, MICHIGAN		

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 862.6	UNIT DRY WT. LBS./FT.^{3}	─○─ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
			HS			Boring advanced without sampling to 20.0'		
20.0 21.5		1	SS			Medium to coarse sand, some fine sand, trace gravel and silt - gray - dense. (SP)		● ⊗ 47
						END OF BORING Boring advanced to 20.0' with 3.25" hollow stem auger. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 06/30/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 14.0' 8.5 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC], GALVANIZED, STAINLESS, OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
[✓ PVC], GALVANIZED, STAINLESS, OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ____

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID; OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
11.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 11.25 FT FROM T. ST. PIPE
DATE 10-09-90, 12.60 FT FROM T. ST. PIPE
DATE 10-31-90, 12.92 FT FROM T. ST. PIPE
DATE 11-04-90, 12.88 FT FROM T. ST. PIPE

WELL NO Pz-1a DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-18
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

–○– UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △ 10 20 30 40 50

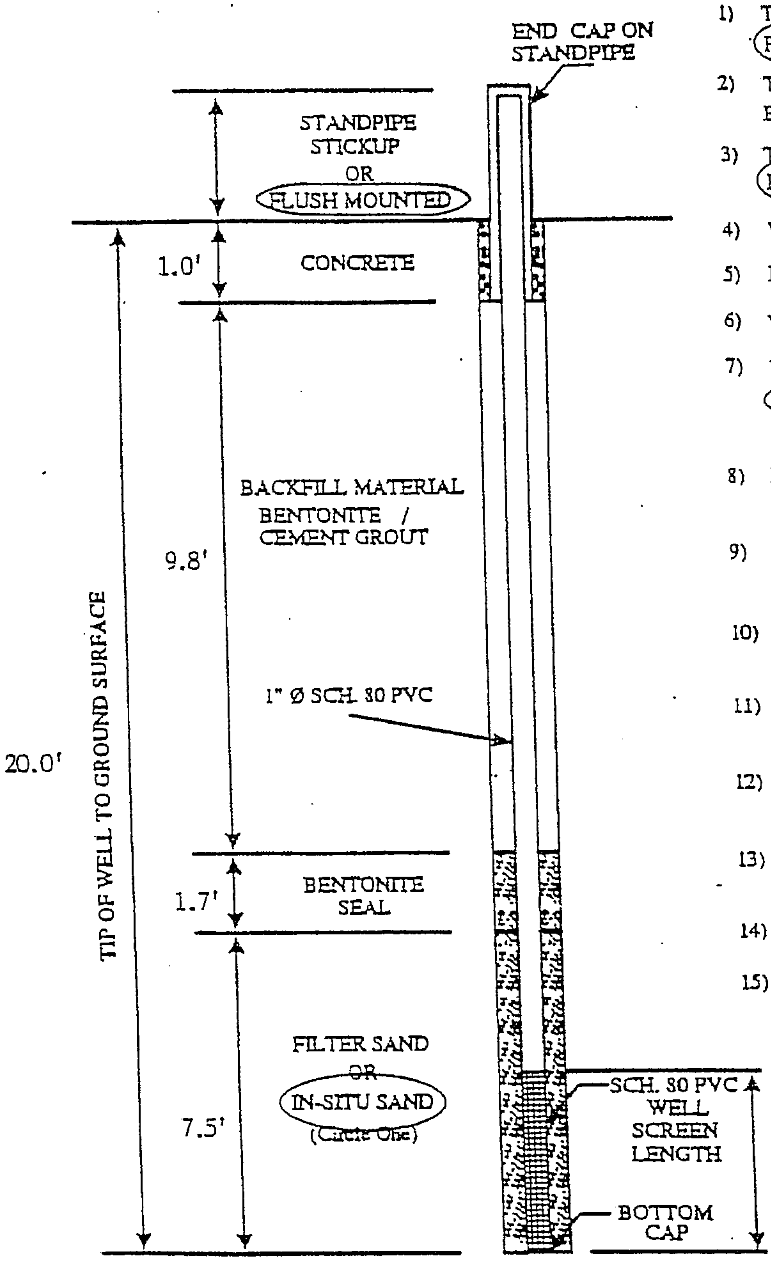
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 863.2	UNIT DRY WT. LBS./FT.^{3}	STANDARD PENETRATION BLOWS/FT.
			HS			Boring advanced without sampling to 20.0'.		
20.0		1	SS			Fine to medium sand, trace coarse sand, fine gravel, and silt - brownish gray - medium dense. (SP)		⊗ 11 ●
21.5								
						END OF BORING Boring advanced to 20.0' with 3.25" hollow stem auger. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 06/30/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 14.9' 8.5 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC], GALVANIZED, STAINLESS, OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED], OTHER ______

3) TYPE OF WELL SCREEN
[✓ PVC], GALVANIZED, STAINLESS, OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER], ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., 15 MIN, [✓ 30 MIN], OTHER ______

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
12.24' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 12.24 FT FROM T. ST. PIPE
DATE 10-09-90, 13.60 FT FROM T. ST. PIPE
DATE 10-31-90, 14.30 FT FROM T. ST. PIPE
DATE 11-04-90, 13.85 FT FROM T. ST. PIPE

WELL NO. Pz-1b DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-1C

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

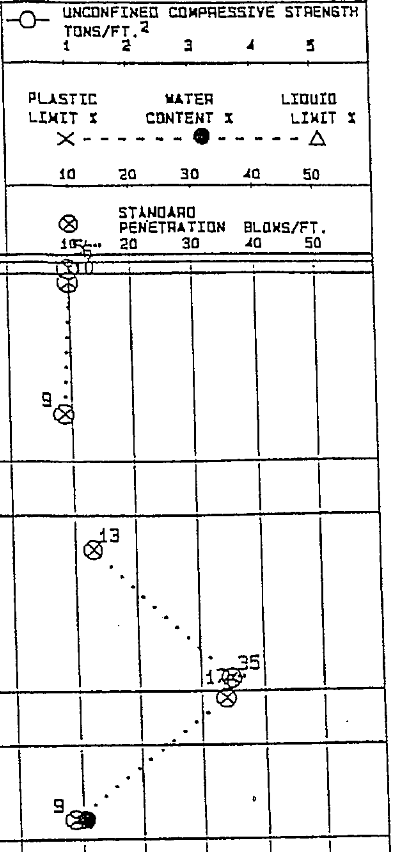
SURFACE ELEVATION 863.8

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
			Drillers' observation: Asphalt.
	1A	SS	Gravelly sand, trace silt - brown - medium dense - desiccated. (FILL)
		HS	Driller's observation: Road base.
5.0	2	SS	Fine to medium sand, some to little clay, trace silt, gravel and coarse sand - brown - loose to medium dense - moist. (SC)
		HS	
	2A	AS	Fine to medium sand, little to trace silt, trace clay and coarse sand - black - moist. (SP-SM)
	2B	AS	
10.0		HS	
	3	SS	Fine to medium sand, trace silt, gravel and coarse sand - brown - medium dense to dense - moist to wet. (SP)
		HS	
15.0	4A	SS	
	4B	SS	Fine sand, trace silt - light brown - dense - moist. (SP)
		HS	
		HS	Medium to coarse sand, some fine to medium gravel, little fine sand, trace silt - brown - loose - saturated. (SW)
20.0	5	SS	

END OF BORING

Boring advanced to 20.0' with 3.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.

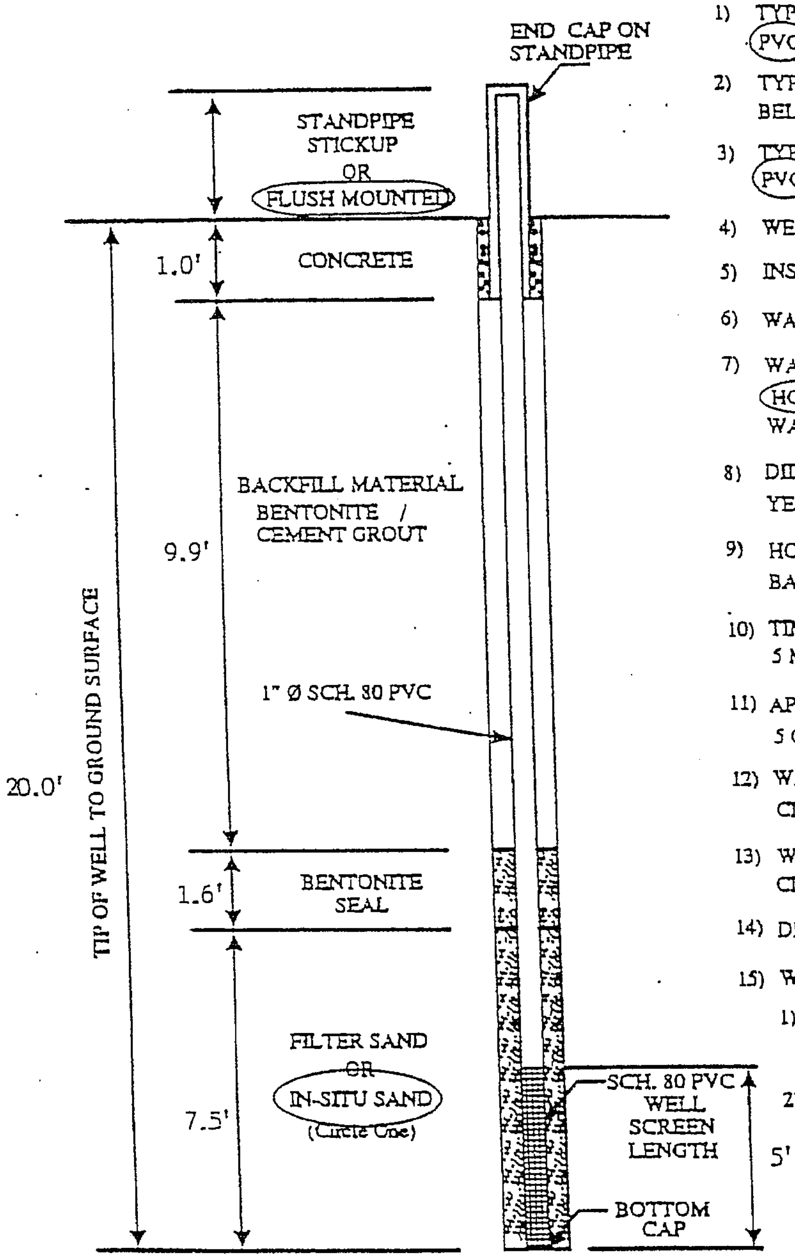
UNIT DRY WT. LBS./FT.^{3}



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 15.0'	WS OR WD WS	BORING STARTED 06/30/90		STS OFFICE Lansing-07	
WL BCR	ACR	BORING COMPLETED 06/30/90		ENTERED BY TJM	SHEET NO. 1 OF 1
WL		RIG/FOREMAN D-50/SB		APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ______

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
13.50' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 08-26-90, 13.50 FT FROM T. ST. PIPE
DATE 10-09-90, 14.90 FT FROM T. ST. PIPE
DATE 10-31-90, 15.12 FT FROM T. ST. PIPE
DATE 11-04-90, 14.95 FT FROM T. ST. PIPE

WELL NO. Pz-1c DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-3A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

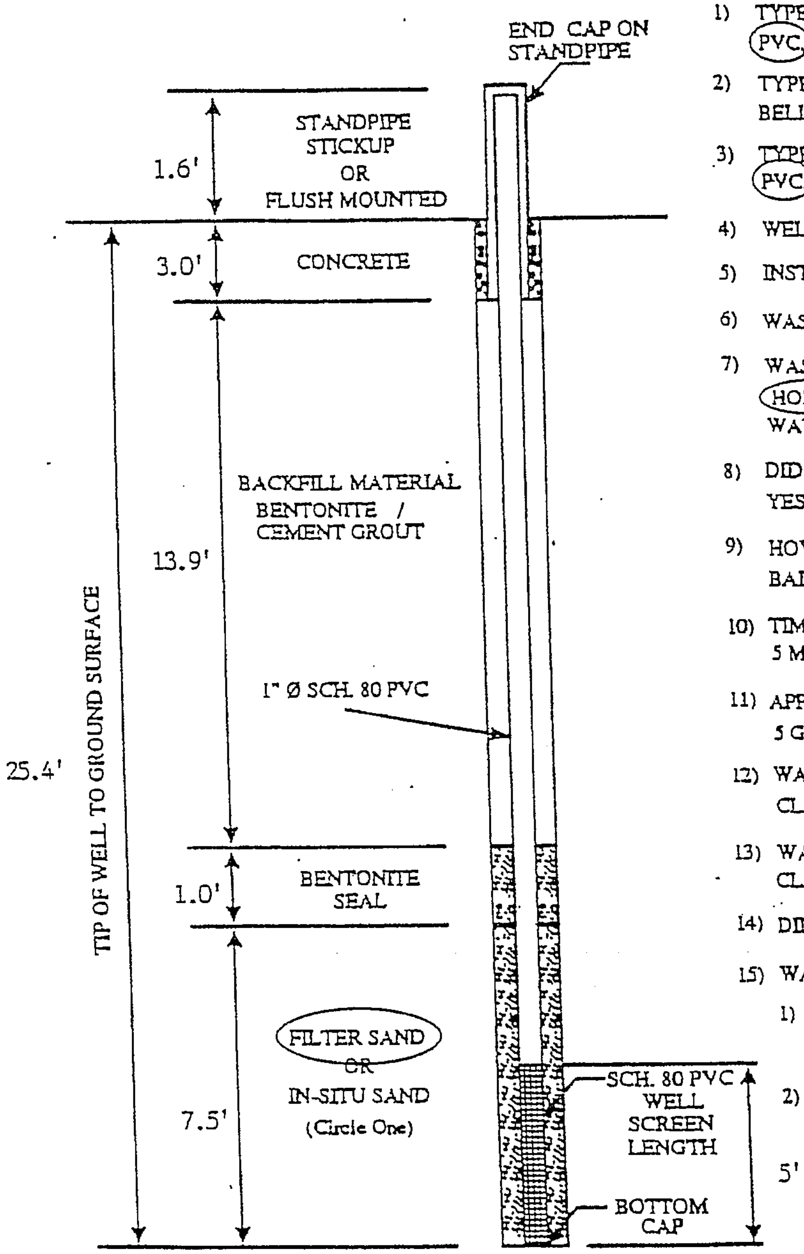
SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 872.5	UNIT DRY WT. LBS./FT.^{3}	─○─ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
25.0			HS			Boring advanced without sampling to 25.0'.		
27.0		1	SS			Fine to medium sand, little coarse sand, trace gravel and silt - brown - dense. (SP)		● ⊗40
						END OF BORING Boring advanced to 25.0' with 4.25" hollow stem auger. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 20.2' WS OR WD WD	BORING STARTED 07/01/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 07/02/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 19.2' 8.5 hrs AB	RIG/FOREMAN D-50/58	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-02-90
5 MIN., [✓ 15 MIN.] 30 MIN., OTHER ____

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
18.05' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90,	18.05	FT FROM T. ST. PIPE
DATE 10-09-90,	20.60	FT FROM T. ST. PIPE
DATE 10-31-90,	21.30	FT FROM T. ST. PIPE
DATE 11-04-90,	21.31	FT FROM T. ST. PIPE

WELL NO. Pz-3a DATE INSTALLED 07-02-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

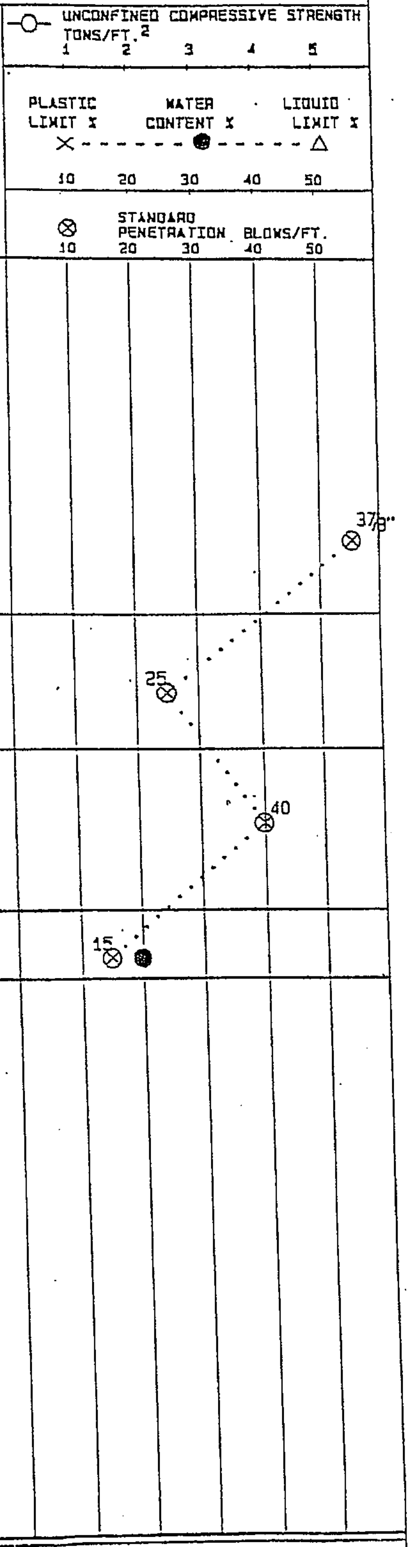
OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-38
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 875.2	UNIT DRY WT. LBS./FT.^{3}
		1	AS			Gravelly sand, little to trace silt and clay - brown and grayish brown - very dense - moist. (FILL) Driller's observation: Rubble and cobbles.	
5.0			HS				
10.0		2	SS				
			HS				
			HS			Fine to medium sand, little clay and gravel, trace coarse sand- brown - medium dense - moist. (SC)	
15.0		3	SS				
			HS				
20.0			HS			Gravelly medium to coarse sand, trace silt - light brown - dense - desiccated. (SP-GP) Driller's observation: Cobbles and broken gravel.	
		4	SS				
			HS				
25.0			HS			Fine sand - trace medium to coarse sand and silt - brown - medium dense - saturated. (SP) Saturated at 24.0'.	
25.5		5	SS				

END OF BORING

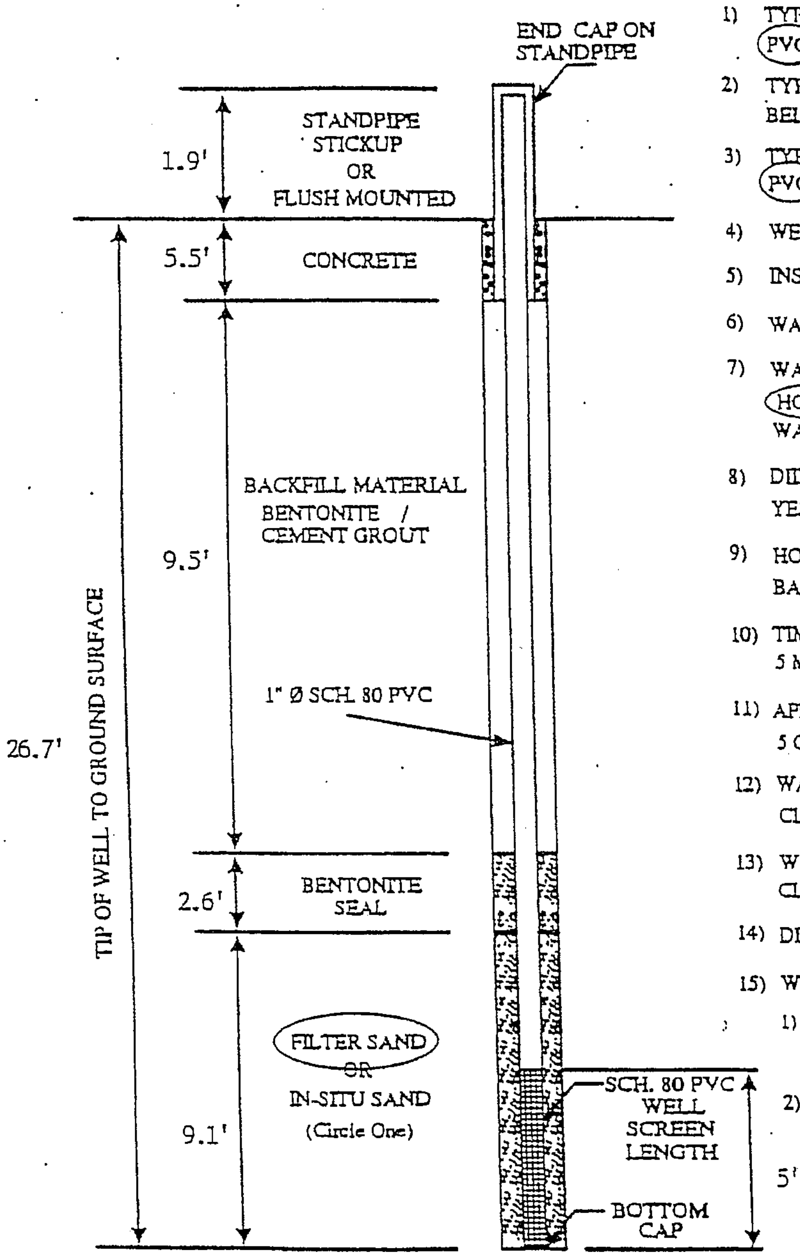
Boring advanced to 25.0' with 4.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

24.0' WS OR WD WD	BORING STARTED 07/02/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 07/02/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 22.3' @.25 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER______

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-02-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER______

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED]?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.00' FT OR DRY
2) OTHER MEASUREMENTS:

DATE 08-26-90	22.00	FT FROM T. ST. PIPE
DATE 10-09-90	24.30	FT FROM T. ST. PIPE
DATE 10-31-90	25.06	FT FROM T. ST. PIPE
DATE 11-04-90	24.46	FT FROM T. ST. PIPE

WELL NO. Pz-3b DATE INSTALLED 07-02-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-4A
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

TE LOCATION
ORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ — 10 20 30 40 50

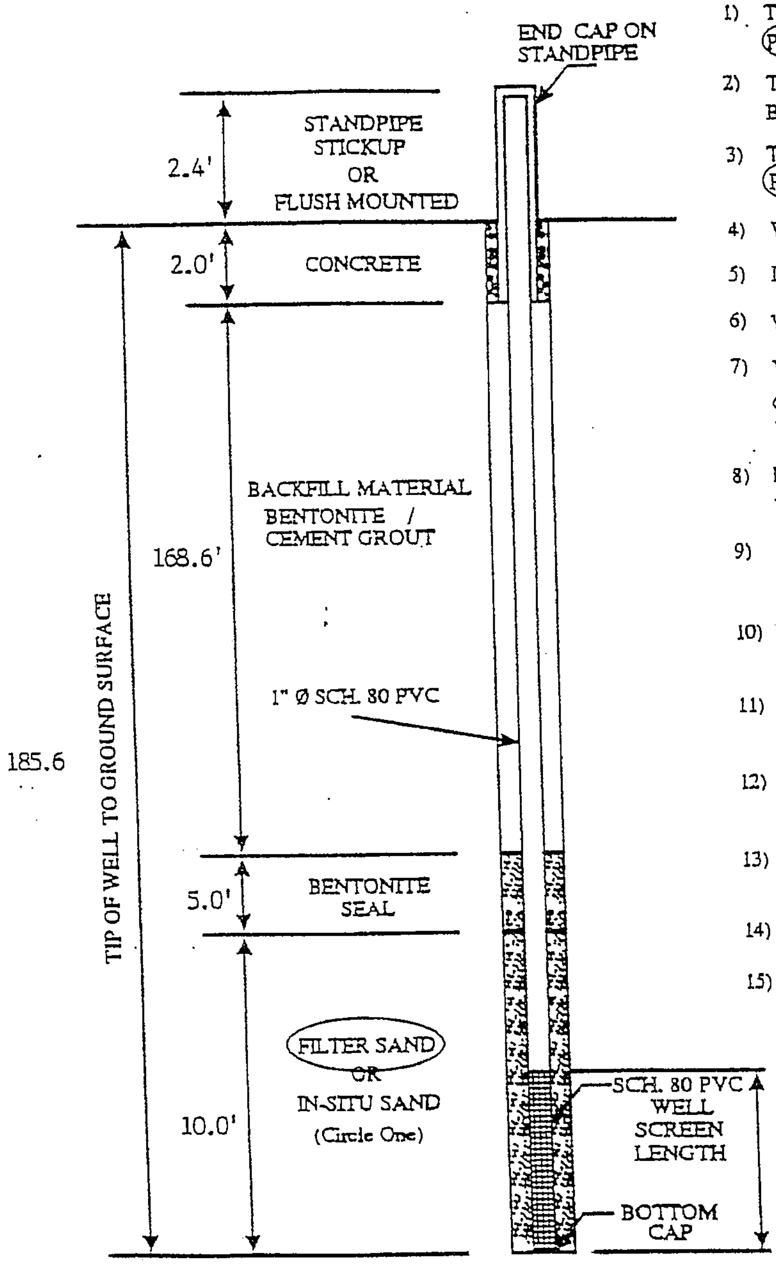
⊗ STANDARD PENETRATION BLOWS/FT. — 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 876.8	UNIT DRY WT. LBS./FT.^{3}	
186.0			AB			Boring advanced without sampling to 186.0'.		
						END OF BORING Boring advanced to 10.0' with hollow stem auger. Boring advanced from 10.0' to 186.0' with washed rotary drilling techniques. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 08/24/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL, WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 08-24-90
5 MIN., [✓ 15 MIN.] 30 MIN, OTHER ____

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
81.20' FT OR DRY

2) OTHER MEASUREMENTS:

5'

DATE 10-09-90, 81.20 FT FROM T. ST. PIPE
DATE 10-14-90, 73.03 FT FROM T. ST. PIPE
DATE 10-31-90, 54.65 FT FROM T. ST. PIPE
DATE 11-04-90, 56.48 FT FROM T. ST. PIPE

WELL NO. Pz-4a DATE INSTALLED 08-24-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-48

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

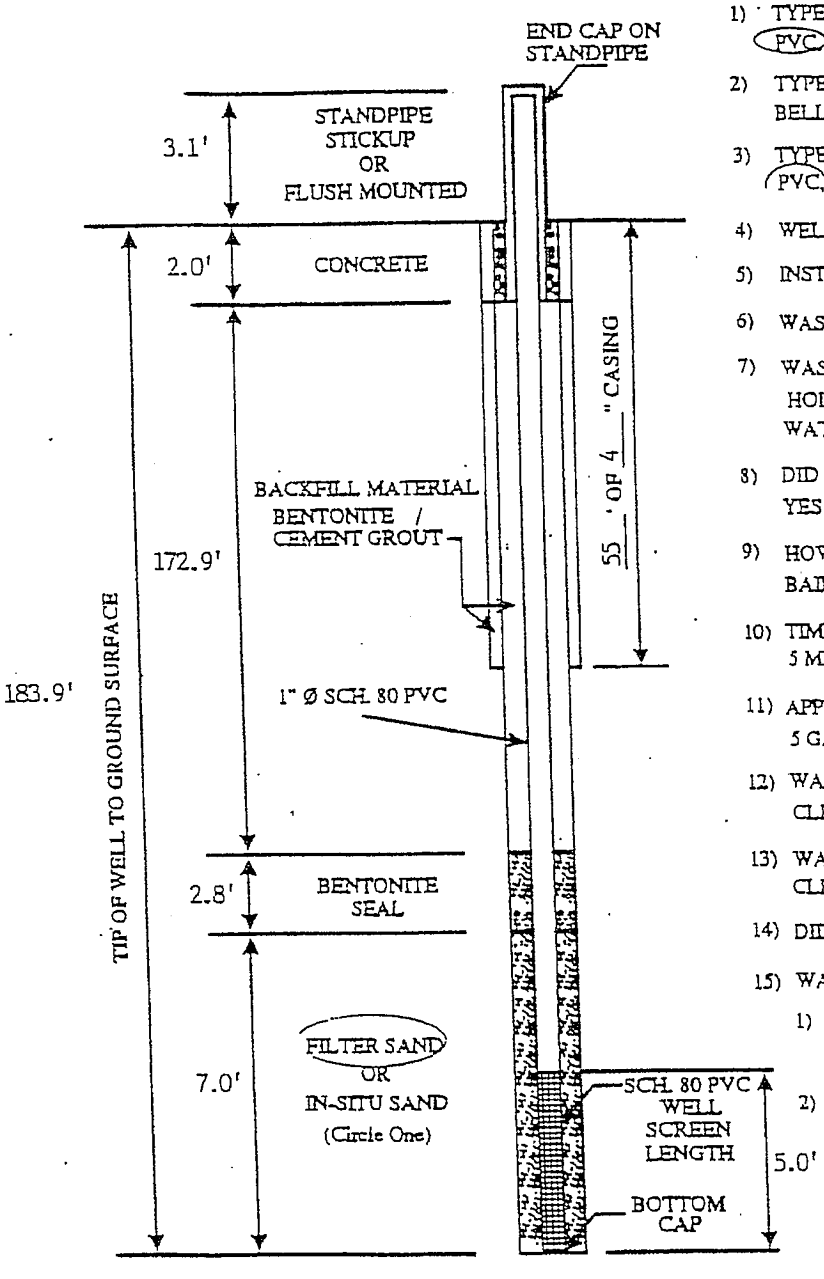
ITE LOCATION
ORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 878.3	UNIT DRY WT. LBS./FT.^{3}	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
			RB			Boring advanced without sampling to 186.0'.		
185.0								
186.0						END OF BORING Boring advanced to 186.0' with wash rotary drilling techniques. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 09/09/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 23.0' AB	RIG/FOREMAN B-61/BP	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER __________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED], OTHER __________

3) TYPE OF WELL SCREEN
[✓ PVC], GALVANIZED, STAINLESS, OTHER __________

4) WELL SCREEN SLOT SIZE No. 10 (0.01)

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? [✓ YES]
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING]; SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 09-12-90
5 MIN., [✓ 15 MIN.] 30 MIN, OTHER __________

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
63.75' FT OR DRY

2) OTHER MEASUREMENTS:

DATE	10-31-90	63.75	FT FROM T. ST. PIPE
DATE	11-03-90	63.92	FT FROM T. ST. PIPE
DATE			FT FROM T. ST. PIPE
DATE			FT FROM T. ST. PIPE

WELL NO. Pz-4b DATE INSTALLED 09-12-90 DRILL RIG MOBILE B-61

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-4C

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

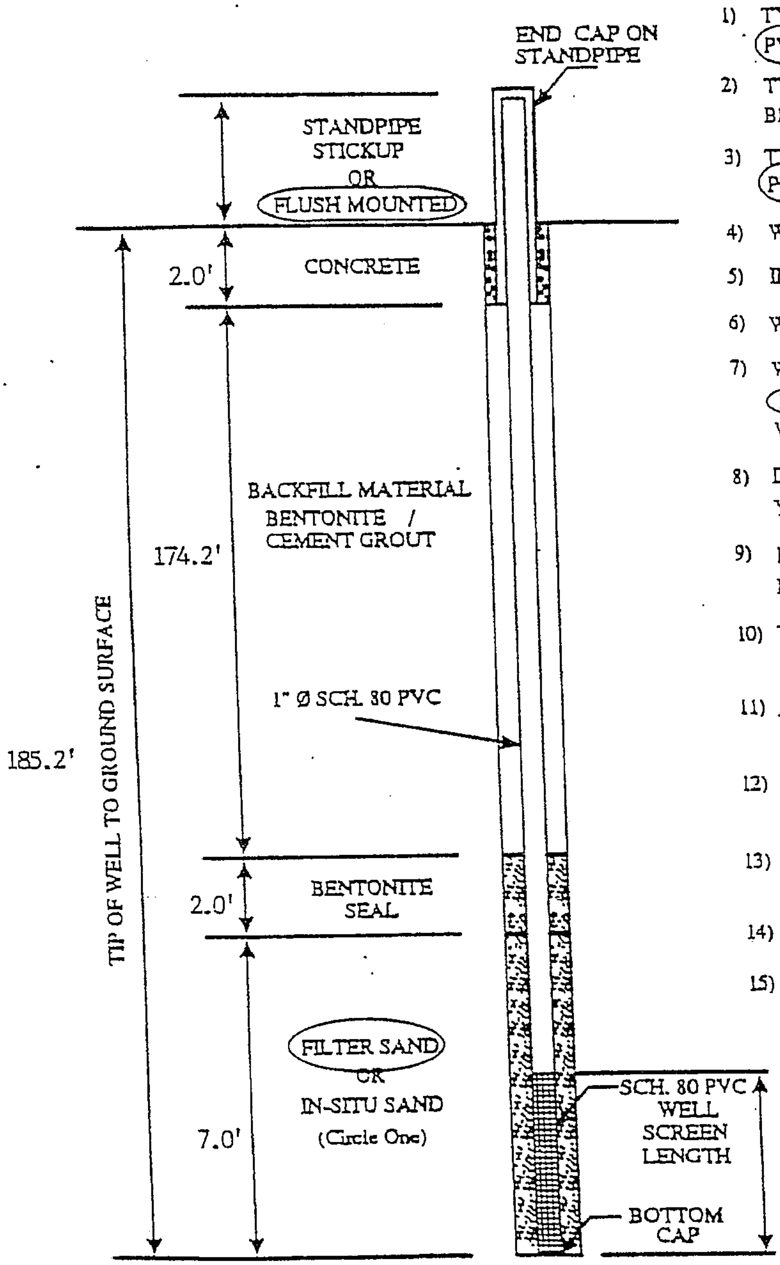
ITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 878.6	UNIT DRY WT. LBS./FT.^{3}	—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
			AB			Boring advanced without sampling to 185.0'.		
185.0						END OF BORING Boring advanced to 55.0' with hollow stem auger. Boring advanced from 55.0' to 185.0' with washed rotary drilling techniques. 65.0' of 4.0" permanent casing. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

55.0 WS OR WD WD	BORING STARTED 09/17/90	STS OFFICE Lansing-07	
WL BCR 21.0 ACR	BORING COMPLETED 09/20/90	ENTERED BY PSB	SHEET NO. 1 OF 1
WL	RIG/FOREMAN 8-61/BP	APP'D BY AMM	STS JOB NO. 71840

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER __________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER __________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER __________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 09-19-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER __________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
69.80' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-14-90 , 69.80 FT FROM T. ST. PIPE
5' DATE 10-31-90 , 62.56 FT FROM T. ST. PIPE
DATE 11-03-90 , 60.79 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

WELL NO. Pz-4c DATE INSTALLED 09-19-90 DRILL RIG MOBILE B-61

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

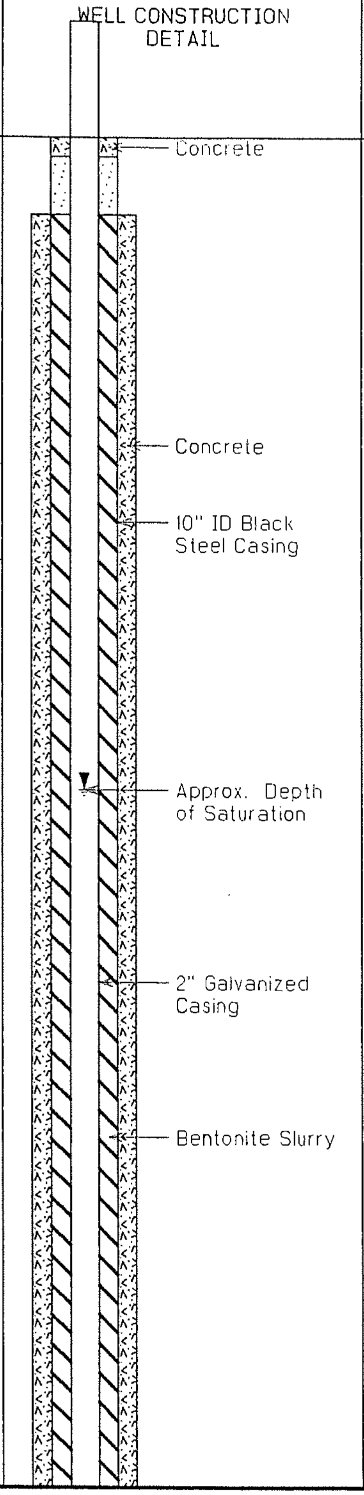
(VERSION 1: 11/90 - M11DRAW)

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-2672

Project: Pharmacia and Upjohn Co., LLC
Well/Boring ID: PZ-8R
Page: 1 of 4
Location: Grass field north of building 156 and former PZ-8
Boring Depth: 117'
Date (s) Drilled: August 12-16, 2013
Boring Diameter: 16.25"
Logged By: Kevin Bouw
Drilling Method: 12.25" and 4.25" Hollow Stem Auger
Drilling Co.: EDAC
Drilling Equipment: Gus Pech 1100
Weather Conditions: Cloudy 70° F
Top of Slots: 112' b.g.l.
Bottom of Slots: 117' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
						Brown fine to medium SAND, little fine to medium Gravel, trace Clay, trace Cobbles. Gravel subrounded to subangular. Moist.	
5		4 3 2 2	0.0'				
						Brown fine SAND, some Clay. Moist.	
10		18 19 16 15	1.5'	1 1		Brown fine to coarse SAND and fine to coarse GRAVEL. Sand subangular, Gravel subrounded. Slightly moist.	
						Yellowish tan very fine SAND. Well sorted. Slightly moist.	
15		11 11 15 15	1.1'	1			
						Dark tan fine SAND. Saturated at 17' bgs.	
20		9 8 9 8	1.1'	<1			
25		2 5 5 7	1.7'	<1		Dark tan fine to medium SAND, little coarse Sand. Saturated.	
30		3 8 11 12	2.0'	<1			
35		5 6 3 2	1.0'	<1			

WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-2672

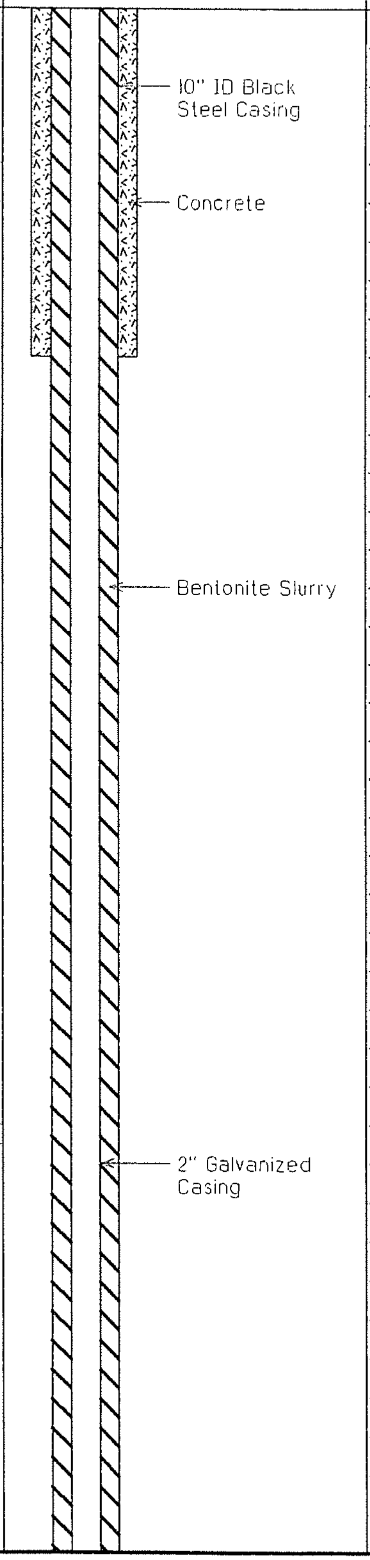
Project: Pharmacia and Upjohn Co., LLC

Well/Boring ID: PZ-8R

Page: 2 of 4

DEPTH feet (bgl)	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	DESCRIPTION
	7 3 3 5	1.5'	1	Greyish tan very fine to fine SAND and SILT, trace Clay, trace medium to coarse Gravel. Gravel subrounded. Saturated.
40	1 1 2 3	1.0'	1	Greyish tan Silty CLAY, little fine Sand. Soft, medium plasticity. Very moist to saturated.
	1 1 1 1	1.2'	<1	
45				
	2 6 12 18	1.0'	<1	Grey SILT, trace Clay, trace fine to coarse Gravel. Firm. Gravel subrounded. Very moist to moist.
50				
				Greyish tan fine SAND. Saturated.
	1 1 1 8	2.0'	<1	
55				
	8 11 16 18	0.8'	<1	
60				
				Greyish tan medium to coarse SAND, little medium to coarse Gravel. Gravel subrounded to rounded. Saturated.
	6 6 5 5	1.3'	<1	Greyish tan very fine to fine SAND and SILT, little Clay. Very moist.
65				Greyish tan very fine to fine SAND, little Silt. Saturated.
	4 6 9 4	1.7'	<1	
70				
	4 6 9 9	1.5'	<1	
75				

WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-2672

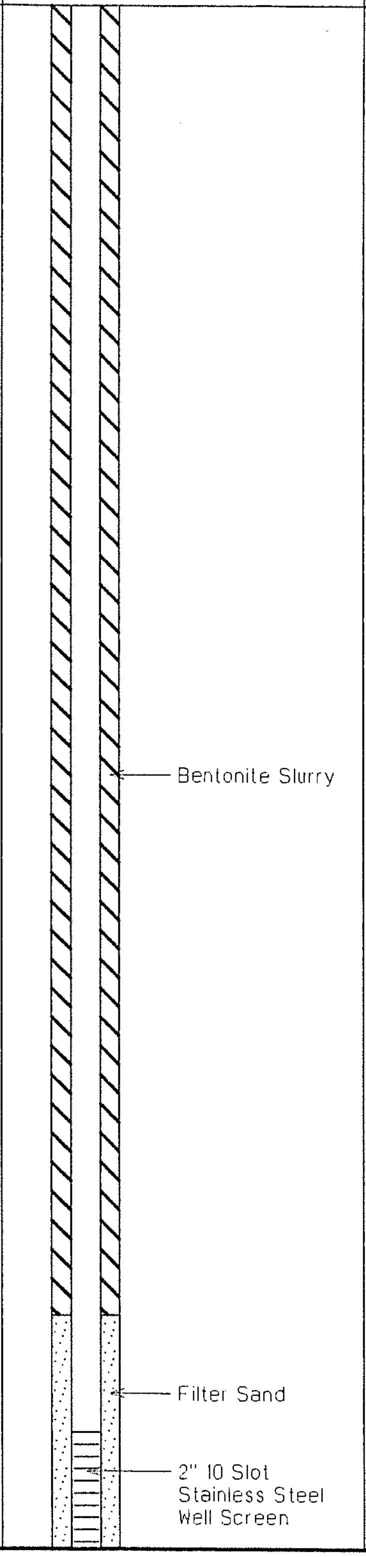
Project: Pharmacia and Upjohn Co., LLC

Well/Boring ID: PZ-8R

Page: 3 of 4

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
80		3 3 7 15	1.5'	<1		Grey CLAY, little Silt. Firm. Medium plasticity. Slightly moist.	
						Greyish tan fine to medium SAND, little coarse Sand, little fine to coarse Gravel. Gravel subrounded to subangular. Saturated.	
85		5 8 13 14	1.1'	<1			
90		4 19 34 50	1.5'	<1			
95		5 3 7 15	1.5'	<1			
						Greyish tan very fine to fine SAND, little medium to coarse SAND, trace fine to coarse Gravel. Sand subrounded, Gravel subrounded to rounded. Saturated.	
100		10 22 28 30	1.0'	<1			
105		8 10 17 17	0.8'	<1			
110		12 17 22 21	2.0'	<1			
115							

WELL CONSTRUCTION DETAIL

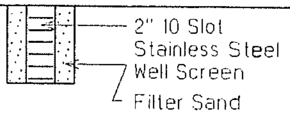


Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-2672

Project: Pharmacia and Upjohn Co., LLC

Well/Boring ID: PZ-8R

DEPTH feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	☒	10 16 26 30	1.5'	<1	▨			
120								
125								
130								
135								
140								
145								
150								
155								

Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

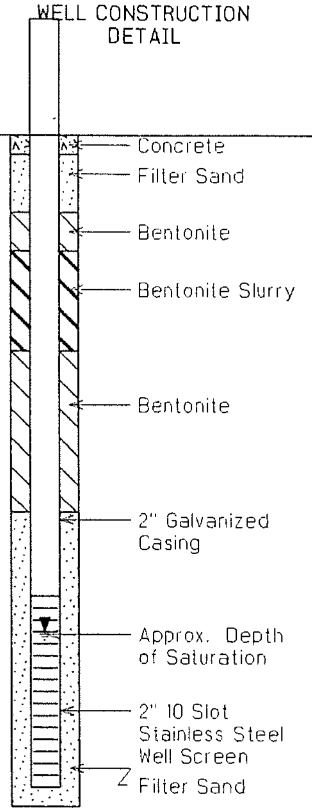
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-2672

Project: Pharmacia and Upjohn Co., LLC
Location: SW of MW-133
Date (s) Drilled: August 6, 2013
Logged By: Kevin Bouw
Drilling Co.: West Michigan Drilling
Weather Conditions: Cloudy 70° F

Well/Boring ID: PZ-17A
Page: 1 of 1
Boring Depth: 17.5'
Boring Diameter: 4.25"
Drilling Method: 4.25" Hollow Stem Auger
Drilling Equipment: CME 550X
Top of Slots: 12' b.g.l.
Bottom of Slots: 17' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY			
					Dark brown fine to medium SAND, some Silt, little fine to coarse Gravel. Gravel rounded to subangular. Slightly moist.	
					Brown fine to coarse SAND and fine to coarse GRAVEL, little Cobbles. Sand subangular to subrounded, Gravel subrounded. Slightly moist.	
5	☒	4 5 5 3	1.0'	<1		
10	☒	3 9 8 10	1.0'	<1	Light brown fine SAND and SILT. Slightly moist to saturated at 13' bgs.	
					Light brown fine SAND, some Silt. Saturated.	
15	☒	2 9 10 10	1.8'	<1		
20						
25						
30						
35						

WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

ATTACHMENT D

ENVIRONMENTAL LABORATORY QUALITY ASSURANCE MANUALS

QUALITY ASSURANCE MANUAL

ALS Environmental – Holland, MI
3352 128th Avenue
Holland, MI 49424
Phone: (616) 399-6070
www.alsglobal.com

QUALITY ASSURANCE MANUAL

Doc ID:	HN-QAM	Rev. Number:	16.0	Effective Date:	01/01/2022

Approved By: Les Arnold
Laboratory Director - Les Arnold
Date: 12/30/2021

Approved By:
QA Manager - Chad Stoike
Date: 12/30/2021

Approved By:
Technical Manager - Angela Karst
Date: 12/30/2021

Table of Contents

Cross Reference Table (ISO 17025:2017 to TNI Volume 1:2016)

QUALITY ASSURANCE MANUAL - CROSS REFERENCE TABLE

QAM, ISO/IEC 17025		TNI Volume 1, 2016
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1. Scope

This Quality Assurance Manual (QAM) describes the policies, procedures and accountabilities established by the Laboratory of ALS Environmental (ALS) to ensure that the test results reported from analysis of air, water, soil, waste, and other matrices are reliable and of known and documented quality. This document describes the quality assurance and quality control procedures followed to generate reliable analytical data.

This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

ALS maintains certifications pertaining to various commercial and government entities. Each certification requires that the laboratory continue to perform at levels specified by the programs issuing certification. Program requirements can be rigorous; they include performance evaluations as well as annual audits of the laboratory to verify compliance.

Quality Assurance Policy

ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of the Various States, United States Environmental Protection Agency (USEPA), TNI Volume 1 2009/2016 and ISO 17025:2005/2017.

ALS corporate management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM and other client and project related requirements.

ALS management reviews its operations on an ongoing basis and seeks input from staff and clients to make improvements.

It is the policy of ALS that all employees be familiar with all quality documentation.

Quality System

This QAM and SOPs referenced in this document comprise the ALS management system. This management system includes all quality assurance policies and quality control procedures.

Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, Procedures and email systems. All information essential for effective and consistent communication of analytical requirements and details affecting quality is available through these computerized systems.

Ethics and Data Integrity

It is the policy of ALS to perform work for clients in the most efficient manner possible, avoiding waste of resources. It is the role of both ALS management and employees to ensure that work for clients is performed most efficiently and effectively by properly utilizing ALS purchased materials, equipment, and the time and ability of personnel.

ALS policy on waste, fraud, and abuse is described in ALS SOP CE-GEN-001, “Laboratory Ethics and Data Integrity.” It is the policy of ALS to generate accurate and reliable data in accordance with contractual and regulatory requirements. As stated in the ALS policies manual, any undue pressure applied to employees in the performance of their duties must be reported as per procedures for reporting listed in ALS SOP CE-GEN-001.

It is against ALS policy to improperly manipulate or falsify data or to engage in any other unethical conduct as defined in ALS Corporate SOP CE-GEN-001. ALS provides mandatory initial and annual refresher training for all employees on SOP CE-GEN-001, "Laboratory Ethics and Data Integrity."

The pertinent ALS Project Manager must approve deviations from contractual requirements. The Project Manager obtains approval for any such deviations, either in writing or by phone (documented in a phone log) from pertinent contract authorities. In addition, ALS requires that deviations from contractual requirements that might affect data quality be reported to clients. Any employee who knowingly manipulates and/or falsifies data or documents or engages in any unethical conduct is subject to immediate release from employment.

ALS employees who are aware of, or reasonably suspicious of, any case of data manipulation, falsification of data, waste of resources, or other unethical practice or misconduct shall notify any manager. Under the direction of the laboratory director, every allegation of unethical conduct will be fully investigated.

2. Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO/IEC 17025:2005 and 2017, "General requirements for the competence of testing and calibration laboratories"
- TNI 2009 and 2016, VOLUME 1, "MANAGEMENT AND TECHNICAL REQUIREMENTS FOR LABORATORIES PERFORMING ENVIRONMENTAL ANALYSIS"
- USEPA SW-846 *Test Methods for Evaluating Solid Waste*, through Updates III - VI, and published new methods from SW-846.
- Selected USEPA Approved *Methods, as referenced in the "Methods Update Rule" (MUR),* 40 CFR, Part 136, Table 1B, changes in the published May 19, 2021.
- APHA, AWWA, and WEF *Standard Methods for the Examination of Water and Wastewater, 20th through 23rd Editions, (1997-2020).*
- USEPA Methods published in Appendix A, B and C of 40 CFR, Part 136.
- Selected USEPA Drinking Water methods published by the USEPA Office of Ground Water and Drinking Water
- Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition, USEPA 815-R-05-004, January 2005.
- State approved UST methods for TPH

3. Terms and Definitions

- Impartiality - presence of objectivity
- Complaint - expression of dissatisfaction by any person or organization to a laboratory, relating to the activities or results of that laboratory, where a response is expected
- Inter-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions
- Intra-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items within the same laboratory in accordance with predetermined conditions

- Proficiency testing - evaluation of participant performance against pre-established criteria by means of inter-laboratory comparisons
- Laboratory - body that performs one or more of the following activities:
  - — testing;
  - — calibration;
  - — sampling, associated with subsequent testing or calibration
- Decision rule - rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement
- Verification - provision of objective evidence that a given item fulfils specified requirements
- Validation - verification, where the specified requirements are adequate for an intended use

4. General Requirements

4.1 Impartiality

- 4.1.1 All employees are required to enter into the following agreements:

- **Code of Conduct Agreement**
  Provides a framework for decisions and actions in relation to conduct in employment. The agreement covers a wide range of topics including personal and professional behavior, conflicts of interest, gifts, confidentiality, legal compliance, security of information, among others. The code of conduct agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Confidentiality Agreement**
  Describes policies for identifying and protecting information owned by ALS and its customers, and for keeping this information in confidence. The confidentiality agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Ethics and Data Integrity Agreement**
  Provided to the employee as part of the hiring and induction process, and reviewed during periodic ethics refresher training. This is coordinated between the Human Resources and Quality Assurance (QA) departments. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed. All employees are required to take annual ethics and data integrity refresher training.

In addition to the agreements, project managers act as a firewall to insulate the analysts from clients so that the lab personnel have no contact with clients. Lab IDs are assigned to samples and used throughout preparation and analysis to make the samples ambiguous to lab personnel. Together these agreements and procedures ensure freedom from undue internal and external commercial, financial, and other pressures or influences that could adversely affect the quality of work. They protect customers' confidential information and ALS' proprietary rights. They ensure avoidance of activities that could diminish confidence in the competence, impartiality, judgment or integrity of any ALS laboratory and staff.

4.1.2 It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This and the peer review of all data will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results, opinions, and interpretation of data is outside the scope of the laboratory activities.

4.2 Confidentiality

All employees sign a confidentiality statement upon employment. These are maintained by Human Resources (HR).

Documents provided to the laboratory are held in strict confidence by project management staff. Documents pertaining to quality assurance and analytical requirements are reviewed with appropriate managers and staff through the project specific meetings and LIMS. Project related information provided by clients is securely archived using procedures described in the ALS SOP HN-QS-011 "Record Archival".

The transmittal of final results is specified by clients and follows those requirements unless specific changes are made by the ALS Project Manager assigned to the client/project. Client communication procedures and documentation requirements are listed in ALS SOP HN-ADM-003 "Work Order Reporting" and HN-GEN-004 "Confidentiality of Electronic Data".

5. Structural Requirements

5.1 The laboratory, a legal entity, is part of ALS Group USA, Corp and the Laboratory Director reports to the General Manager, Life Sciences, USA. There are other support functions such as human resources, accounting, safety oversight and computer systems that are provided to the laboratory by corporate entities, but none of which is responsible for managing laboratory activities. The support functions of this laboratory involved with testing and services are under the direction of the laboratory director.

5.2 The responsibility for this laboratory is under the direction of the Laboratory Director. Key employees in the management systems are identified in section 5.5.

5.3 This laboratory performs a full range of inorganic and organic analyses using EPA SW-846 methods, APHA Standard Methods, Methods outlined in 40 CFR Part 136, 40 CFR Part 141, and ALS proprietary methods for various target compounds. This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

5.4 ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of various states, United States Environmental Protection Agency (USEPA), TNI Volume 1 2009 or 2016 and ISO 17025:2005 or 2017.

5.5 Org Chart and Key personnel-see Appendix B.

5.5.1 ALS Laboratory Director, The Laboratory Director is responsible to ensure:

- ✓ Implementation of quality policy and applicable standards.
- ✓ Employees have sufficient experience and training to perform QAM-related duties and procedures.
- ✓ That the necessary facilities and equipment are available to meet the commitments of the laboratory.
- ✓ Sample handling, instrument calibration, sample analysis, and related activities are conducted and documented as described in this QAM, its related Standard Operating Procedures (SOPs), and its referenced methods.
- ✓ That routine QC samples are prepared, analyzed, and reviewed as required by this QAM.
- ✓ That at regular intervals audits are conducted and documented to assess compliance with this QAM.
- ✓ That corrective action is initiated and completed to remedy discrepancies or problems identified in any laboratory process.
- ✓ Management review of all processes and procedures associated with the management system.

5.5.2 Quality Assurance Manager, The Quality Assurance Manager reports directly to the Laboratory Director and is responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Understand, monitor and evaluate the quality assurance (QA) and quality control (QC) activities described in this QAM and its references, reporting deficiencies and identifying resource requirements to the Laboratory Director.
- ✓ Conduct and document an annual internal audit of laboratory procedures to ensure compliance with this QAM and its references.
- ✓ Conduct an annual update of this QAM.
- ✓ Review or update laboratory Standard Operating Procedures (SOPs) as outlined in section 8.3.2.
- ✓ Arrange for the analysis of demonstration of competency (DOC) and performance evaluation (PE) samples.
- ✓ Maintain a record of ongoing personnel training for QAM-related activities, reporting training deficiencies to the Laboratory Director.
- ✓ Maintain the laboratory documentation of nonconformance, corrective action, preventive action, and improvement programs.

5.5.3 Technical Manager(s), The Technical Manager(s) of these operations report directly to the Laboratory Director and are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Read, understand and follow this QAM with its references.
- ✓ Ensure that each set of reported results meets the requirements specified in this QAM and meets the client’s requirements as defined in the applicable project requirements.

- ✓ Ensure that personnel are trained, authorized and utilized effectively.
- ✓ Ensure that facilities and equipment are maintained and utilized effectively.
- ✓ Ensure that supplies are available and utilized effectively.
- ✓ Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- ✓ Delegate tasks to area managers who have the technical competence to oversee day-to-day operations of specified work areas.

5.5.4 Project Managers, Project Managers report directly to the Laboratory Director. Project Managers are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Complete and distribute project related information for each project before the laboratory starts work on the project.
- ✓ Immediately communicate to the laboratory changes made to projects in progress and document these changes as appropriate.
- ✓ Respond to client requests for information and coordinate responses to client audits.
- ✓ Ensure work orders are reviewed and meet client project requirements before release to the laboratory.
- ✓ Perform an initial review of results for large projects to verify that data reports submitted to the client meet all project requirements.

5.5.5 Support Management (IT, Client Services, Health and Safety) are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Read, understand and follow this QAM with its references.
- ✓ Ensure that procedures are followed and meet the client’s requirements as defined in the applicable project requirements.
- ✓ Ensure that personnel are trained, authorized and utilized effectively.
- ✓ Ensure that facilities and equipment are maintained and utilized effectively.
- ✓ Ensure that supplies are available and utilized effectively.
- ✓ Immediately report technical and quality problems to the Technical Manager or Quality Assurance Manager.
- ✓ Training staff to comply with all processes

5.6 It is the responsibility of all technical and support staff to comply with all procedures and be familiar with current quality systems and policies as established by management. At ALS, improvement of the quality systems and preventive action is effected through an ongoing systems review by management using input from all staff. ALS actively seeks employee and client input for improvements through surveys and questionnaires. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements. For clients, ALS surveys and gains feedback on services provided. This input to management is provided from the corporate level. To comply with these requirements all staff are responsible but not limited to the following:

- ✓ Follow project requirements as delineated by project managers to ensure analyses and commitments, including TAT, are performed as requested.
- ✓ Develop knowledge and understanding of the QAM requirements under which samples are handled and tested.
- ✓ Notify managers and Quality Assurance personnel when QA problems arise.
- ✓ Follow Quality Assurance requirements as outlined in the QAM and SOPs.
- ✓ Follow appropriate channels regarding modification of existing SOPs.
- ✓ Maintain accurate electronic and written records.
- ✓ Ensure that applicable data are included in each process in accordance with applicable SOPs.
- ✓ Record all nonconformance.
- ✓ Follow appropriate protocols when the handling and testing does not meet acceptance criteria.
- ✓ Apply integrity and professional judgment when dealing with analytical processes and laboratory operations.

5.7 Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, ALS Portals, Instruments used for testing, Policies and Procedures, and Email. All information essential for effective and consistent communication of analytical requirements, client requirements and details affecting quality are available through these computerized systems.

ALS management is committed to improvements of the management systems through compliance with its own policies and procedures. ALS management ensures improvements are made to the management systems and also ensures data integrity is maintained.

6. Resources Requirements

6.1 General

6.1.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.2 Personnel

6.2.1 It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results is outside the scope of the laboratory activities. The ALS laboratory employs sufficient personnel to complete required chemical analyses and support activities.

6.2.2 The ALS training program specified in the ALS SOP HN-QS-013 “Employee Training” includes quality training, technical training, safety training, and other training as described in this QAM. ALS managers are responsible to ensure that all staff training is initiated, completed, verified, and documented.

The specific training and experience of laboratory personnel is documented in individual training files maintained by Quality Management and includes records of analytical proficiency through the analysis of QC and PT samples.

Job Descriptions include requirements for education, qualification, training, technical knowledge, skills and experience.

6.2.3 All ALS staff assigned to perform tasks affecting or relating to testing receives training relative to pertinent areas of responsibility, both prior to performing work on client samples and on an ongoing basis. Such training comes from internal and external sources.

6.2.4 Laboratory personnel resources needed to carry out their duties. See section 5.6.

6.2.5 The laboratory procedure ALS SOP HN-QS-013 “Employee Training”, includes the following and records are retained for:

- ✓ determining the competence requirements;
- ✓ selection of personnel;
- ✓ training of personnel;
- ✓ supervision of personnel;
- ✓ authorization of personnel;
- ✓ monitoring competence of personnel.

6.2.6 It is the responsibility of Technical and Support Management to authorize staff to perform specific laboratory activities. These tasks include testing methods, peer review and authorization to report results. Records are retained for the pertinent authorizations by the Quality Assurance department.

6.3 Facilities and Environmental Conditions

6.3.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.3.2 Records are maintained for the requirements and conditions necessary for method and regulatory compliance in the facility.

6.3.3 Records are retained with analytical data for monitoring and control of environmental conditions to relevant method and regulatory specifications.

6.3.4 See Appendix D for floor plan.

To maintain facility security and thus sample security, entrance to the ALS facility can be attained only through security access, except at the main business entrance and sample receiving entrance; these are open only during normal business hours and monitored by the receptionist at the business entrance and Sample Receipt Technicians at the sample receiving entrance. All non-employees gaining access to the facility are required to sign in with the receptionist at the main entrance.

Laboratory areas are segregated by HVAC systems to contain contamination and to eliminate potential contamination from specific laboratory areas that require low ambient chemical background levels for successful analysis.

Each area in the laboratory has adequate lighting, conditions and bench space for instrumentation and for the processes assigned to that area.

Laboratory reagent water is prepared and maintained using any combination of deionization, reverse osmosis, purging and UV radiation.

Fume hoods have visual indicators to ensure flow is maintained during use and are performance tested semi-annually.

All safety inspection records are kept on file for a minimum of five years.

6.4 Equipment

6.4.1 A comprehensive list of instrumentation and support equipment utilized at ALS is included in Appendix E. Redundant instruments are maintained for particular analyses.

6.4.2 Laboratory equipment items such as analytical balances, pipets, and thermometers are verified against reference standards rather than reference materials. Laboratory reference weights and thermometers are certified by ISO accredited vendors against ISO or National Metrology Institute (NMI) traceable standards. All support equipment is maintained in proper working order and verified prior to use. Support equipment is calibrated or verified as described by the following SOPs: ALS SOP HN-EQ-001 “Balance Use and Maintenance”, ALS SOP HN-EQ-002 “Thermometer Calibration and Monitoring”, and ALS SOP HN-EQ-003 “Lab Volumetric Ware Calibration”.

6.4.3 Routine maintenance is performed on laboratory instruments and equipment according to manufacturer recommendations. Maintenance is provided under warranty, through service contracts, and by ALS in-house personnel. The ALS approach to preventive maintenance is described in ALS SOP HN-EQ-004 “Preventive Maintenance”. Records of routine maintenance and emergency maintenance are kept with the instruments in electronic maintenance logbooks according to ALS HN-QS-011 “Record Archival”.

6.4.4 All instruments are calibrated or verified before use, using reference materials with traceability established. Specific calibration requirements are detailed in the method or SOP and support equipment SOP.

6.4.5 The instrument manuals are provided in electronic format usually in the software programs, CDs, and available on network drives. Software is controlled through licensing and is the responsibility of computer support to maintain licenses required.

6.4.6 Testing instruments are calibrated as per method, regulatory and verification procedures listed in SOPs. Support equipment has verification and calibration frequencies specified in SOPs.

6.4.7 Calibration program. See 6.4.4

6.4.8 Calibration and verification periods are designated in support equipment and analytical method SOPs. This equipment is labeled with calibration dates and any correction factors, if needed.

6.4.9 Equipment that has been subjected to overloading or mishandling, gives questionable results, or has been shown to be defective or outside specified requirements, is taken out of service. It shall be recalibrated and not returned to service until it has been verified to perform correctly. The laboratory shall examine the defect or deviation from specified requirements and shall initiate the nonconformance process.

6.4.10 Support equipment is verified according to the frequency outlined in the applicable SOP and calibration verification is required on analytical instruments as per method, program and SOP requirements.

6.4.11 All reference materials ordered by ALS have available documentation of purity, traceability and uncertainty. Support equipment which require correction factors are documented.

6.4.12 Passing verification criteria ensures that unintended adjustment of equipment is identified.

6.4.13 Records of instruments are retained and include specifications, manufacturer, serial numbers, identification, software version, location, status and the date of purchase. The majority of firmware has no impact on laboratory activities.

6.4.14 Records of calibration, maintenance, reference materials used, calibration checks or verifications are kept with analytical data.

6.5 Metrological Traceability

6.5.1 All measurements made by the laboratory required an unbroken chain to NMI, Reference Standards or Reference Materials

6.5.2 Reference Standards and Reference Materials

a) Reference Standards

Reference standards used by the laboratory are calibrated at determined intervals by outside vendors for the following equipment. These reference standards are maintained under the control of QA personnel and are used for verifying intermediate materials used by the laboratory. Quality Assurance is responsible for maintaining records and schedules of calibration.

- Reference Thermometers
- Reference Weights

Intermediate checks are used in the laboratory to verify performance of support equipment and are verified to traceable reference standards. Records of such verifications are retained by Quality Assurance.

b) Reference Materials

Reference materials used at ALS must be of the grade or quality specified by the pertinent analytical procedure or methodology.

Purchased reference materials must be traceable to a National Metrology Institute (NMI) or equivalent national or international standards where possible.

6.5.3 Reference Standards are calibrated by vendors certified to ISO 17025 (current version).

Reference Materials are purchased, whenever possible. ALS uses reference materials from Guide 34 or ISO 17034 accredited vendors.

Second source reference materials are purchased and used in the testing process as an independent verification of primary reference materials. The secondary reference material does not require accredited vendors.

Procedures for reagent and standard tracking are outlined in ALS SOP HN-QS-001 “Reagent and Standard Tracking”.

6.6 Externally Provided Products and Services

6.6.1 Laboratories contracted to perform analytical services for ALS must maintain quality programs consistent with the quality requirements of ALS. Before a laboratory performs subcontracted work for ALS, the Quality Assurance Manager (or designee) must verify the acceptability of the quality program.

ALS uses vendors which supply the level of quality required to perform testing activities. ALS maintains a relationship with multiple vendors and uses vendors with comparable certifications or accreditations.

6.6.2 ALS SOP HN-GEN-010 “Procurement” outlines the process, evaluation, criteria and records maintained from the evaluation and reevaluation of supplies and services.

6.6.3 Processes are designed to ensure that materials and services purchased meet the quality specifications of ALS. Procurement and receiving services are provided at ALS by administrative personnel. Procurement and receiving quality requirements established by ALS are followed. All requisitions for purchase are approved by ALS operations management and specify 1) the level of service required or 2) the quality/specifications of material required. The receipt of materials not meeting specification in the purchase requisition requires investigation.

7. Process Requirements

7.1 Review of Requests Tenders and Contracts

Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. Specific procedures for client communication and required documentation are listed in ALS SOP HN-GEN-006 “Resource Review” and HN-ADM-003 “Work Order Reporting”.

7.2 Selection, Verification, and Validation of Methods

7.2.1 Reference methods for environmental samples are drawn primarily from the current version of Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Online Compendium. Reference methods for water analysis are taken from Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1983 with its updates, 40 CFR, Part 136, and 40 CFR, Part 141. To a lesser extent, methods referenced in ALS SOPs come from ASTM guides, and from Standard Methods for the Examination of Water and Waste Water.

SOPs are written for all environmental testing methods, any modified reference methods and any in-house developed methods. SOPs may be copies of reference methods that are not modified. All SOPs are reviewed using document control procedures as outlined in SOP HN-QS-014, Document Control.

All analytical methods and preparatory method combinations are routinely tracked and ALS maintains statistical control limits and reporting limits. The laboratory can perform testing using limits provided by clients or from referenced sources in the absence of historical data. The ALS SOP HN-QS-004 “Control Charting and Trend Analysis” describes how control limits are established and updated.

ALS policy is that all SOPs be compliant with the reference method. In the event that several methods are referenced in an SOP, all procedures must be compliant with all referenced methods. All SOPs include a section describing changes and clarifications from the reference method. In the event that an analytical method is modified, the SOP documentation must include a description of the modification, any justification of the method modification which includes, but is not limited to, method performance and recovery data, any other supporting data, and approval from the Technical Managers, Quality Assurance Manager, and Laboratory Director. In the event that an analytical method must be modified or is modified to perform on specific sample matrices, the modification and reason must be stated in the case narrative. All modified methods will be identified on the analytical report.

7.2.2 The policy of ALS is to apply analytical methods that have been approved, validated, and published by government agencies, professional societies and organizations, respected private entities, and other recognized authorities. These methods have been validated for their intended use and ALS uses the demonstration of competency procedures, calibration of instruments and MDL/RL procedures to verify laboratory capability.

Published methods may be modified as a result of the request of the client or operational conditions prevailing in the laboratory. Operational conditions might relate to, for example, the availability of equipment or the performance of the method as determined by calibration processes, detection limits, or the results obtained for quality control samples.

Validation procedures describe three different classifications of validations for method modification. New methods, permanent modifications to a published method which will be used in subsequent laboratory determinations, and temporary modifications applied only to immediate analytical projects. These methods are used with approval from the clients.

The essential quality control elements for modification and validation include:

Calibration - Number of levels and acceptance criteria must meet or exceed requirements of ALS SOPs HN-QS-019 “Chromatographic Calibration”, HN-QS-021 “Spectrophotometric Calibration”, and HN-QS-005 “Validation of New Instruments-Methods”.

QC Samples - QC samples prepared in the specific matrix, are assessed. If possible the recoveries are compared to method or historical control limits used for the reference method.

Sensitivity - Method Detection and Reporting Limit, Method Detection Limit is the lowest analyte concentration that produces a response statistically distinguishable from a blank and Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured. Method Detection Limits, if required, are generated. A reporting limit verification is accomplished using ALS SOP HN-QS-006 “MDL-PQL Procedures”.

If validation reports are required to validate methods, these reports must address the following elements and follow established testing industry protocols:

Calibration – a demonstration of a concentration range where the analyte response is proportional to concentration.

Sensitivity – Method Detection Limit is the lowest analyte concentration that produces a response statistically distinguishable from a blank and

Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured.

Selectivity - the ability of the method to accurately measure the analyte response in the presence of all potential sample components.

Precision and Bias - Precision – the type of variability that can be expected among test results. Bias - systematic error that contributes to the difference between the mean of a large number of test results and an accepted reference value.

Robustness – the ability of the procedure to remain unaffected by small changes in parameters or matrix.

7.3 Sampling

7.3.1 If field sampling is completed by laboratory personnel

7.3.1.1 Sampling is based, whenever reasonable or requested by the client, with appropriate statistical methods.

7.3.1.2 Sampling is performed according to the applicable sampling SOP.

7.3.1.3 Records are maintained of the sampling procedure, the environmental condition, sampling location, and identity of field personnel.

7.3.2 Sub-Sampling

7.3.2.1 Procedures for sub-sampling within the laboratory are documented in SOP-HN-QS-008, *Sub-Sampling and Sample Homogenization.*

7.4 Handling of Test or Calibration Items

From sample receipt to analytical completion, sample management is critical to maintaining quality measurements. Appendix F contains a list of sample containers, preservatives, and holding times for common analytical procedures. The following procedures are utilized to maintain sample integrity during the analytical process.

Sample Receipt and Acceptance

7.4.1 The following preservation checks are performed and documented upon receipt.

7.4.1.1 Thermal preservation

7.4.1.1.1 For samples that require preservation at 4˚C, the acceptable range is “from just above freezing to 6˚C”.

7.4.1.1.2 Samples that are delivered to the lab by local courier are likely not to have reached a fully chilled temperature. This is acceptable if there is evidence that chilling has begun. The laboratory receipt form provides a record if ice is present and the current temperature.

7.4.1.2 Residual chlorine (from chlorinated source)

7.4.1.2.1 Verify the presence of dechlorination agents (sufficient to neutralize 5mg/L chlorine for drinking water and 15 mg/L chlorine for wastewater).

7.4.1.2.2 Chlorine residual is checked in the field and documented.

7.4.1.3 pH checks

7.4.1.3.1 The pH of samples requiring acid and/or base preservation is checked upon sample receipt or, in the case of oil and grease, prior to analysis, or volatiles, upon completion of analysis.

7.4.1.3.2 Samples requiring pH adjustment after receipt at the bench level are monitored and documented by the analyst.

7.4.2 If the applicable checks performed upon sample receipt indicate the criteria are not met, then:

7.4.2.1 The sample is placed “on hold” until:

7.4.2.1.1 The decision to proceed is agreed upon with the client and documented, or

7.4.2.1.2 The decision to reject is confirmed with the client and documented.

7.4.2.2 The condition is noted on the Chain of Custody form and laboratory receipt form.

7.4.2.3 Affected data are qualified or narrated in the report.

7.4.3 Procedures for sample receipt and acceptance are documented in SOP-HN-SM-001, *Sample Receipt & Log-In*.

7.4.4 Sample submission sheets from the field are maintained by the applicable Project Manager and scanned in a secure format onto the shared server.

7.4.5 Sample acceptance policy is provided to all field crews and documented as an attachment in the above referenced SOP.

Sample Identification

7.4.6 Samples are uniquely identified in a permanent electronic record to maintain sample integrity and to document receipt of all sample containers.

7.4.7 Samples are assigned sequential numbers that cross reference specific information. This information is maintained in the LIMS database and includes:

a) Client or project name
b) Date and time of sampling
c) Date and time of receipt at lab
d) Unique laboratory identification number
e) Unique field identification

f) Initials of recorder
g) Analyses requested
h) Comments regarding rejection (if any)

Sample Storage

7.4.8 Storage conditions are routinely monitored and the conditions recorded.

7.4.9 Procedures for temperature monitoring are documented in SOP HN-EQ-002, *Thermometer Calibration and Temperature Monitoring*.

7.4.10 Samples are held in a secure environment with restricted access.

7.4.11 Samples are stored apart from standards, reagents, or other potentially contaminating sources such that cross-contamination is minimized.

7.4.12 Separate storage areas are maintained for samples requiring volatile organic analysis.

7.4.13 All portions of samples, including extracts, digestates, and leachates are maintained separately pending analysis.

Sample Disposal

7.4.14 Samples are disposed of according to Federal, State, and local laws and regulations.

7.4.15 Procedures for sample disposal are documented in SOP-HN-SAF-001, *Waste Disposal Procedures*.

Sample Transport

7.4.16 Samples that are transported under the responsibility of the laboratory are done so safely and according to method specific storage conditions.

7.5 Technical Records

7.5.1 ALS maintains records in accordance with ALS SOPs HN-IT-001 “Data Integrity and Verification”, HN-QS-009 “Data Reduction, Review, and Validation”, and HN-QS-011 “Record Archival”. ALS personnel are responsible for the retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, analyst laboratory notebooks, instrument maintenance logs, and training records, as established by procedure.

Electronic records or scans of records that relate to the analysis of field samples are compiled into folders on network drives for storage. These data packages are generally stored electronically as per ALS SOP HN-QS-011 “Record Archival”. Unless specified by contract, applicable statute, or program, data packages are retained for ten years.

Laboratory Notebooks and Logbooks - Laboratory notebooks and logbooks are retained by ALS for ten years and are not released to clients. Laboratory notebooks are assigned to specific analysts or areas. If corrections are made it requires a single-line cross-out, initials and date are entered. In some instances the reason for the change should be documented.

Quality Assurance Records - Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically for an indefinite period on networked drives.

The Quality Assurance Manager is responsible for maintaining and retrieving all records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports. Some of these records can be internally accessed by employees on network drives.

Client-Related Information - Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS.

7.5.2 ALS ensures that amendments to technical records are tracked to previous versions or to original observations. Both the original and amended data and files are retained, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.

7.6 Evaluation of Measurement Uncertainty

Uncertainty is associated with most of the results obtained in the laboratory testing conducted by ALS. It is meaningful to estimate the extent of the uncertainty associated with each result generated by the laboratory. It is also useful to recognize that this measurement of uncertainty is likely to be much less than that associated with sample collection activities.

In practice, the uncertainty of a result may arise from many possible sources. ALS has considered the relative contribution of major sources of error. The approach to estimating uncertainty adopted by the laboratory resulted in the conclusion that many sources of error are insignificant compared to the processes of sample preparation, calibration, and instrumental measurement. The uncertainty associated with the processes can be estimated from quality control data. Accordingly, ALS estimates uncertainty from data derived from quality control samples carried through the entire analytical process. A description of the uncertainty calculation is presented in ALS SOP HN-QS-022 “Estimation of Uncertainty”. The estimation of uncertainty applied by ALS relates only to measurements conducted in the laboratory. Uncertainty associated with processes conducted external to the laboratory (e.g., sampling activities) are not considered.

Calculation of uncertainty may use the precision measurement values for duplicate samples when LCS or QC samples are not used in testing.

The calculation of uncertainty is not required for qualitative tests. The process is assessed for contributors to uncertainty but the calculation of uncertainty has limited value when empirical values are not available.

7.7 Ensuring the Validity of Results

Before samples are analyzed, the analytical system must be in a controlled, reproducible state from which results of known and acceptable quality can be obtained. That state is verified through the use of Quality Control (QC) procedures intended to ensure accuracy, precision, selectivity, sensitivity, freedom from interference, and freedom from contamination. The QC procedures performed at ALS include: calibration and calibration verification; analysis and comparison of resultant data to predetermined control limits for method blanks, laboratory control samples, spiked matrix samples, duplicate matrix samples, and surrogates added to samples; analysis of performance evaluation samples; determination of Reporting Limits; and the tracking and evaluation of precision and accuracy. For specific analytical methods, other QC procedures are implemented as required by the method, such as but not limited to the analysis of field blanks, trip blanks, and positive/negative controls. Consult the Quality Control section of the determinative method SOP for guidance.

These QC procedures are performed and evaluated on a batch basis. A preparation batch must not exceed 20 field samples that are of a similar matrix type without additional method QC in the batch, unless specified differently in an SOP or reference method. The samples in a batch are processed together, through each step of the preparation and analysis, to ensure that all samples receive consistent and equal treatment. Consequently, results from the batch QC samples, not including field sample QC, are used to evaluate the results for all samples in the batch.

In general terms, instrument calibration, method quality control, and data evaluation is described in analytical SOPs.

All QC parameters set by the applicable ALS SOP or method reference shall not be exceeded without appropriate narration.

The hierarchy of quality control requirements begins with:

✓ Client Requirements (if specified and documented)

✓ Method and/or SOP requirements

✓ Guidance from QAM and other general SOPs

Calibration and Calibration Verification

Instrument calibration is a QC measure taken to verify selectivity and sensitivity. Calibration of instruments at ALS is accomplished through the use of reference materials of the highest quality obtainable. ISO or National Metrology Institute (NMI) traceable reference materials are procured and used if they are available. When ISO or National Metrology Institute (NMI) traceable reference materials are not available, certified reference materials from government agencies or reliable vendors are used. In all cases, written records are maintained that allow all analytical results to be traced unambiguously to the reference materials used for calibration.

In general, analytical instruments are initially calibrated with standard solutions made from the reference materials at levels appropriate for the analysis. This is called the initial calibration (ICAL). Low- and mid-point standards are then evaluated against the ICAL for method-specified acceptance. This step is called calibration re-fit. The calibration is then verified with a standard solution independently prepared from a different lot of the reference material, preferably from a different vendor. This step is called initial calibration verification or ICV. At specified intervals throughout the analytical sequence, the calibration is re-verified again through the analysis of a calibration check solution, usually the mid-point standard solution. This process is called the continuing calibration verification or CCV. If the ICAL, the ICV, or any CCV fails criteria in the analytical method, the system is recalibrated or the results are narrated. It is ALS' intention to only report results generated under acceptable calibration conditions. Specific calibration procedures are found in the SOPs associated with each method of analysis.

Alternative calibration sequences or procedures will be discussed with clients.

Calibration parameters set by the applicable ALS SOP or method reference shall not be exceeded without qualification.

Analysis of Method Blanks

The method blank (or preparation blank) contains no sample material; it is treated as a sample in every other way. It is analyzed to monitor any contamination to which the analytical batch might have been exposed during preparation and analysis. A method blank is analyzed with every analytical batch. Criteria set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Laboratory Control Samples and QC Samples

A control sample (LCS or QCS) contains the analyte(s) of interest in known concentration(s) in a laboratory matrix; it is used to monitor accuracy. It measures the success of the analysis in recovering the analyte(s) of interest from a QC matrix. Soil samples and other solid matrices are analyzed with an LCS made of clean sand or appropriate solid substrate spiked with the analyte(s) of interest. Water samples and other liquid matrices are analyzed with a method blank spiked with the analyte(s) of interest.

The results of the LCS are reported as percent recovery:

$$\%\,\mathrm{Recovery} = \frac{X}{K} \times 100$$

Where: X = Measured value and K = Expected value

LCS/QC criteria set by the applicable ALS SOP or method reference shall not be exceeded without appropriate narration.

Analysis of Spiked Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible, a duplicate LCS or QC should be analyzed in the batch.

A known concentration of the analyte(s) of interest is added to a second representative portion of a field sample to prepare a matrix spike. The matrix spike is used to determine acceptability of the method chosen on a specific field matrix. It measures the success of the analysis in recovering the analyte(s) of interest from the type of field sample matrix in the batch. A matrix spike is analyzed with every analytical batch of environmental samples. The results are reported as percent recovery.

$$\%\,\mathrm{Recovery} = \frac{(XS - Xu)}{K} \times 100$$

Where Xs = Measured value in the spiked sample, Xu = Measured value in the unspiked sample, and K= Expected value

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per client instructions.

Analysis of Duplicate Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible a duplicate LCS or QC should be analyzed in the batch.

A duplicate matrix spike sample or duplicate matrix sample is used to monitor the precision (repeatability) of the method chosen on a field sample. If a sufficient amount of the analyte(s) of interest is present in the field sample, a matrix duplicate sample is analyzed directly. A pair of duplicate samples (matrix/matrix duplicate or matrix spike/matrix spike duplicate) is analyzed with every analytical batch of environmental samples. The results of the analysis of duplicate samples are reported as relative percent difference (RPD).

$$\text{RPD} = \frac{|X1 - X2|}{[(X1 + X2)/2]} \times 100$$

Where: $|X_1 - X_2|$ = The absolute value of the difference between the two sample values, $[(X_1 + X_2)/2]$= The average of the two sample values

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per client instructions.

Analysis of Surrogates Added to Samples

Surrogates are compounds similar to the analyte(s) of interest but that are known not to be present in the environment. Examples are fluorinated or deuterated homologues of the organic analyte(s) of interest. When appropriate compounds are available, their use is specified in the analytical method SOP. When surrogates are used, they are added to the calibration solutions and to each field and QC sample in the batch. Surrogate recovery is a measure of the accuracy and selectivity of the method in the sample matrix. Surrogate results are reported as percent recovery.

$$\%\,\text{Recovery} = \frac{X}{K} \times 100$$

Where: X = Measured value and K = Expected value

Surrogate criteria set by the applicable ALS SOP or method reference on method QC samples shall not be exceeded without appropriate actions and narration.

The same criteria will be used for field samples although failure to meet these criteria will be noted in the report, narrative comments, or as per client requirements.

Analysis of Quality Control Checks for Microbiological Samples

Positive and Negative Controls must be run on each lot of media used in sample processing. See SOP HN-MB-004, Total Coliform and E. coli, Section 16 and SOP HN-MB-006, Heterotrophic Plate Count, Section 16.

Volume checks must be performed for each lot of sample containers and pipettes used for sample measurement. See SOP HN-EQ-003, Lab Volumetric Ware Calibration.

Fluorescence checks must be performed on each lot of sample containers and media. See SOP HN-MB-004, Total Coliform and E. coli, Section 16.

Dual colony counts are performed on all dilution levels. See SOP HN-MB-006, Heterotrophic Plate Count, Section 15.

Analysis of Performance Evaluation Samples (PT)

Proficiency testing (PT) samples are prepared by an authorized independent organization outside the laboratory. They are received and analyzed at regular intervals to monitor laboratory accuracy. ALS Laboratories sends the PT sample results to the independent organization, where they are evaluated and then forwarded directly from that organization to accreditation bodies as needed. PT samples are introduced into the regular sample stream of the laboratory and analyzed as routine samples by analysts who regularly perform the method. Laboratory personnel follow all instructions provided by the PT provider.

The Laboratory Director, Technical Managers or the Quality Assurance Manager can institute the analysis of additional PT samples or modify the performance evaluation program as appropriate.

The following guidelines are followed by ALS:

- Averaging results is prohibited.
- Only qualified ALS laboratory employees analyze PT samples.
- Results are not discussed with outside entities or other ALS laboratories prior to the deadline for receipt of the results.
- ALS does not subcontract to other laboratories or receive from other laboratories any PT samples.

When a PT sample result is not acceptable a NCAR is issued to determine and correct any problem(s) leading to the unacceptable result. For multiple failures or loss of certification for an analyte in a given test/matrix, a corrective action is required.

Tracking and Evaluation of Accuracy and Precision

When evaluating batch QC the analyst makes a sequence of decisions before reporting sample results regarding calibration, the method blank, LCS, surrogate recovery, matrix spike, and matrix spike duplicate recovery results.

Assessment of the accuracy of an analytical measurement is based upon the analysis of samples of known composition. ALS relies upon the analysis of LCS/QC samples to track accuracy. The percent recovery relative to the expected value is calculated and can be plotted.

Assessment of the precision (repeatability) of an analytical measurement is based upon repeated analysis of equivalent samples of known or unknown composition. ALS relies upon the analysis of pairs of LCS/LCSD samples, matrix samples (SAMP/DUP) or spiked matrix samples (MS/MSD) to assess precision. The range of the pair is expressed as a relative percent difference (RPD).

Control limits for the accuracy and precision charts are calculated assuming a normal (Gaussian) distribution of results. Historical data points are used to calculate mean values, two-standard deviation warning limits, and three-standard deviation control limits. The establishment and updating of control limits is described in ALS SOP HN-QS-004 “Control Charting and Trend Analysis”.

Trending

In addition to evaluating individual batch QC results against control limits, QC results from successive batches are also evaluated for possible trends. While a trend is not necessarily an out-of-control situation in itself, it can provide an early warning of a condition that can cause the system to go out of control. ALS SOP HN-QS-004 “Control Charting and Trend Analysis” describes in detail the assessment of QC data in the laboratory. The following conditions are trends that may initiate action and/or monitoring.

- A series of successive points on the same side of the mean
- A series of successive points going in the same direction
- A series of successive points between warning limits and control limits

ALS relies on analytical staff to identify trends in analytical systems. Quality Assurance can produce control charts as needed to assess trends but this activity by QA is not preventive and is only used to verify trends exist. The occurrence of a trend does not invalidate data that are otherwise in control. However, trends do require attention to determine whether a cause can be assigned to the trend so that appropriate preventive action can be undertaken.

Long term trends in control limits are evaluated annually by quality assurance and technical operations.

7.8 Reporting of Results

7.8.1 ALS relies upon a system of peer review to ensure the quality of analytical reports. Peer review procedures are specified in the ALS SOP HN-QS-009 "Data Reduction, Review, and Validation". An analyst, familiar with the analytical method used to produce the results (peer reviewer), reviews each report. The peer reviewer verifies that the calibration standards, type of calibration, and sample set with associated QC samples were selected correctly. The peer reviewer also verifies any manual transcriptions and calculations. The applicable Technical Manager can perform additional technical review.

Project Managers perform an initial review of results for to verify that data reports submitted to the client meet all project and client requirements.

7.8.2 When the peer review has been completed, a final report is generated. In most situations the report is produced from LIMS. In some cases part or all of the report can be produced from the data system of the analytical instrument. The reports produced by ALS meet the following requirements:

- ✓ The report identifies the method used. If the method is modified, it is noted as "modified" in the report.
- ✓ Any abnormal sample conditions, deviation from hold time, irregularities in preservation or other situations that might affect the analytical results are noted in the report and associated with the analytical results.

The contents of the report include:

- ✓ The report title with the name, address, and telephone number of the laboratory
- ✓ The name of the client or project and the client identification number
- ✓ The name of the sample collector
- ✓ Sample description and laboratory identification number
- ✓ The dates of sample collection, sample receipt, sample preparation, and analysis
- ✓ The time of sample preparation and/or analysis if the required hold time for either activity is 72 hours or less
- ✓ A method identifier for each method, including methods for preparation steps
- ✓ The MDL or minimum reporting limit for the analytical results
- ✓ The analytical results, with qualifiers as required
- ✓ A description of any quality control failures and deviations from the accepted method
- ✓ The name (electronic signature) and title of the individual(s) who accept responsibility for the content of the report

- ✓ The date the report is issued
- ✓ Clear identification of any results generated by a subcontract laboratory
- ✓ Page numbers and total number of pages

7.8.3 ALS does not evaluate or interpret results.

7.8.4 ALS does not perform calibration services.

7.8.6 The laboratory reports results based on the sample provided by the customer. If ALS reports to a specification it is only for the sample results and not involved with decision rules applied to the sampling site.

7.8.7 ALS does not make any statements concerning opinions and interpretation of results.

7.8.8 Revised reports of analytical results are issued to correct errors. Revised reports require the following items:

- ✓ Revisions to analytical reports will only be made in supplemental documents and shall contain identification similar to "Revised".
- ✓ Include the date revised or released to the client.
- ✓ Revised reports shall meet all reporting and client requirements.
- ✓ Revised Reports are stored with the original report, are uniquely identified, and make reference to original reports.
- ✓ A peer review process is used to ensure revised results are accurate.
- ✓ Any information changed in the report must have the reason for the change documented in the report.

7.9 Complaints

ALS has a documented process for how complaints are received and evaluated. Nonconformance or corrective actions are generated to ensure decisions and outcomes are monitored and communicated. These outcomes are reviewed by the Quality Assurance department. The ALS SOP on handling complaints is ALS SOP HN-ADM-004 "Complaint Resolution".

7.10 Nonconforming Work

7.10.1 The ALS SOP for handling nonconformance is ALS SOP HN-QS-003 "NC-CA Reporting".

This laboratory procedure shall be implemented when any aspect of its laboratory activities or results of this work do not conform to its own procedures or the agreed requirements of the customer. The procedure ensures that:

- ✓ the responsibilities and authorities for the management of nonconforming work are defined;
- ✓ actions (including halting or repeating of work and withholding of reports, as necessary) are based upon the risk levels established by the laboratory.
- ✓ Any employee may stop work when a task cannot be performed safely or the quality of data is determined to be or could be negatively affected. Metrics utilized for work stoppage may include but are not limited to exceeding instrument or sample control limits, QC trending, instrument

problems, etc. The appropriate manager shall be consulted for any work stoppage;

- ✓ an evaluation is made of the significance of the nonconforming work, including an impact analysis on previous results;
- ✓ a decision is taken on the acceptability of the nonconforming work;
- ✓ where necessary, the customer is notified and work is recalled;
- ✓ the responsibility for authorizing the resumption of work is defined.

7.10.2 The laboratory retains records on all nonconformance.

7.10.3 Quality Assurance Manager or designee reviews all nonconformance for completeness and adds comments as necessary on the acceptance. If this evaluation determines the problem has or can reoccur or it is against the laboratories own policies or procedures the event requires a corrective action as described in section 8.7.

7.11 Control of Data and Information Management

7.11.1 The laboratory has access to all data and information through the internet, intranet, network locations and hard copy.

7.11.2 All of the software used for data reduction, verification, and reporting is documented and validated by the ALS computer support staff or by the vendor from whom it is purchased. ALS software is controlled and secured according to ALS SOPs HN-IT-002 “Software Install and Maintenance”, HN-IT-003 “IT System Security”, and HN-IT-001 “Data Integrity and Verification”. A continuing effort is made at ALS to increase the use of automated data handling, improve efficiency, and minimize human error.

Software errors are treated as a nonconformance under section 7.10 or as a corrective action under 8.7.

7.11.3 Access to ALS networks are controlled through passwords and windows security. Network drives are backed up and disaster planning is evident.

7.11.4 ALS uses offsite locations from the laboratory but internal to ALS for data storage and is managed in accordance with these procedures.

7.11.5 Access to network locations is managed with windows security and roles throughout the system.

7.11.6 Calculations and data transfers are checked using the peer review process and through documentation of computer programs by the IT staff.

8. Management System Requirements

8.1 Options

8.1.1 The laboratory has implemented **Option A** from the ISO/IEC 17025:2017 standard as a management system. The following sections 8.2 through 8.9 address the required elements of Option A. This manual addresses management systems and demonstrates compliance with this document.

8.2 Management System Documentation

8.2.1 This manual describes the policies and objectives of the ALS management system. The laboratory procedures describe the details on how objectives are accomplished.

8.2.2 Policies and objectives of the management system address how competence is demonstrated and assessed, how testing is objectively reviewed and how consistent operations are accomplished. These are addressed in various procedures that define the processes used.

8.2.3 Evidence of commitment is the review of the manual annually and the records of reading by all employees. Additionally, employees are assigned pertinent procedures as needed to ensure objectivity and consistency.

8.2.4 The policies are supported in this management system with references to the procedures as appropriate.

8.2.5 All employees have access to the Quality Assurance Manual and the supporting procedures.

8.3 Control of Management System Documents

8.3.1 SOPs and the QAM are maintained under document control procedures described in ALS SOP HN-QS-014 "Document Control". External documents, such as reference methods, accreditation policies and requirements, and reference manuals are maintained under document control policies through the use of hardcopy and network drives. Additionally, quality assurance program documents, project plan documents, and contractual Statement of Work documents generated by a client can be designated as controlled documents at the discretion of the ALS Project Manager, Quality Assurance Manager, or the Laboratory Director.

8.3.2 Revisions are made to uniquely identified internal documents in accordance with ALS SOP HN-QS-014 "Document Control" and the following table. Assignments are made to the responsible ALS manager or designee to review and update SOPs applicable to the area of responsibility. At times it is also necessary to obtain approval by specific clients before written SOPs can be modified. After revision, the appropriate Manager, Quality Assurance Manager, and Technical Director must approve the updated SOP. Updated SOPs are then distributed on the laboratory network and to holders of controlled copies. All obsolete copies are removed from current locations and stored for historical purposes.

SOP Type	Review Cycle
Drinking Water Testing SOPs	12 Months
Environmental Testing SOPs	24 Months
Management Systems SOPs	24 Months
All other SOPs	24 Months

8.3.3 It is a policy of ALS Environmental to allow the use of electronic signatures. For data reporting an electronic signature may be applied to the report by an approved report signatory and is binding to the same extent as a handwritten wet signature.

8.3.4 To authenticate the electronic signature the identity of the signatory is verified before their electronic signature can be created. Each electronic signature shall be unique to a single individual and shall not be used by any other individual. These signatures are established using only defined procedures within the software and are verified using the two distinct components of username and password. Each use of the electronic signature requires entry of the username and the password. The report may not be changed once the signature has been applied.

8.3.5 Additionally, as a form of 'signature' used for LIMS, email, and certain internal documentation processes (e.g. acknowledgements, attestations, audit trails, etc.), and other electronic tools the user's system login credentials are used to verify and authenticate the identity of the user. Following login, these credentials are used to identify and document the user.

8.3.6 Approved Signatories:

8.3.6.1 Tenders and Contracts: Laboratory Director, Operations Manager, Technical Sales Representative, Project Manager

8.3.6.2 Chain of Custody and Sample Receiving Documentation: Client Services Personnel, Technical Sales Representative, Project Manager, Operations Manager, Laboratory Director

8.3.6.3 Purchase Orders: Operations Manager and Laboratory Director

8.3.6.4 Final Report: Project Manager, Operations Manager, Laboratory Director

8.3.6.5 Accreditation Documentation: QA Manager, Technical Director, Laboratory Director

8.3.6.6 Corrective Action Reports: QA Manager, Technical Director, Laboratory Director

8.3.6.7 Quality Manual and Standard Operating Procedure Documents: QA Manager, Technical Director, Laboratory Director, Department Supervisor

8.4 Control of Records

8.4.1 ALS maintains records in accordance with ALS SOP HN-QS-011 "Record Archival". ALS personnel are responsible for retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, laboratory notebooks, instrument maintenance logs, and training records.

Laboratory Notebooks and Logbooks

Laboratory notebooks and logbooks are retained by ALS for ten years and are not released to clients. Laboratory notebooks are assigned to specific analysts, who are responsible for their maintenance. If corrections are required, a single-line cross-out, initials and date are entered.

Quality Assurance Records

Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically for an indefinite period on networked drives.

The Quality Assurance Manager is responsible for maintaining and retrieving all records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports.

Client-Related Information

Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS.

8.5 Actions to Address Risks and Opportunities

ALS views risk management as a key component of its corporate governance responsibilities and an essential process in achieving and mandating a viable organization. ALS is committed to enterprise wide risk management to ensure its corporate governance responsibilities are met and its strategic goals are realized.

Refer to ALS Limited Risk Management Policy CAR-GL-GRP-POL-007 and Risk Appetite and Tolerance Statement CAR-GL-POL-011 for details.

Risk is defined at ALS as the effect of uncertainty on objectives. Objectives for the organization have different attributes and aspects, such as financial, service, quality, health & safety, environmental stewardship, and are considered at different levels, such as enterprise-wide, operational, and project levels. ALS interprets risk as anything that could impact meeting its corporate strategic objectives, and believes risks can provide positive opportunities as well as having negative impacts.

Tools for evaluating and managing risk include routine procedures such as employee evaluations, control limits trending, sensitivity data evaluation, corrective action reports, nonconforming events, SOP review, internal and external audits, and PT results.

Risk reporting mechanisms vary from routine reporting mechanisms and immediate action for lower risk situations to immediate notification of the ALS CEO in extreme cases.

Refer to: ALS Code of Conduct, ALS Whistleblower Policy, ALS Integrity Hotline, and Integrity and Compliance Helpline.

Regardless of the mechanism used, the policies and tools provide a framework for categorizing, assessing, analyzing, and addressing risk, as well as monitoring and reviewing actions taken. Roles and responsibilities are defined in the relevant procedures.

Risk severity is evaluated during the decision making process. For each risk there is an opportunity.

Risks to our business and how ALS addresses them include:

Impartiality by Employees

Analytical testing is completed with undue pressure to modify results to meet client objectives.
ALS does not view this as a risk. There are many firewalls in the lab process to prevent occurrence.

- Project Managers are in contact with clients but there is no ability to influence testing results
- All data generated must be peer reviewed by a second party
- Lab operations only see samples, sample names and numbers. They do not have direct contact with clients.
- Annual Ethics and Data Integrity Training for all employees
- ALS Code of Conduct, ALS Whistleblower Policy, ALS Integrity Hotline, and Integrity and Compliance Helpline.

Chemical Exposure

Failure to practice procedures as trained, issues with the facility, and poor engineering controls can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

ALS has policies, chemical exposure training, and readily available SDS sheets. Employees are expected to offer suggestions for improvement and formally report any conditions where concern for safety is recognized.

Explosion/Chemical Fire

Improper chemical storage and usage along with lack of equipment and facility upkeep can result in loss of life, loss of property, and laboratory down time.

ALS performs inspections and training, keep an inventory of chemicals, establish storage locations, and maintain minimal quantities of chemicals.

Supply Disruption

Natural disaster and vendors unable to provide needed supplies can disrupt the business, increase expenses, and result in lost production and lost clients.

ALS maintains multiple sources for supplies, develops relationships with our vendors, and emphasizes communication between analysts, managers, purchasing and vendors.

Loss of Key Employees

Resignation, leave for personal reasons or for other employment can negatively impact the business.

Communication, cross-training, designated backups, and having a pool of potential replacements minimizes this risk. ALS provides a positive atmosphere for employees and provides small perks to reward dedication.

Computer and Instrument Issues

Computer, instrument, or other IT failures can result in loss of revenue, loss of service, and loss of data.

ALS provides necessary IT resources for instruments and computers including replacing older computers, keeping related systems in good repair, and replacing when necessary. ALS continues to build robust data systems and makes provisions for back-up storage for all data.

Reputation

Falsifying test results can result in loss of credibility, loss of clients, loss of revenue, and suspension.

All new employees must sign an ethics agreement and have initial ethics and data integrity training. Annually, all employees must take ethics and data integrity refresher training. All data undergoes a proper peer review. ALS maintains a strong quality system.

Legal Ramifications

Not following workplace and environmental laws and failure to practice procedures as trained can result in license revocation, fines, and disruption of the business.

Targeted and ongoing training, inspections, and having established procedures minimizes this risk. ALS continues to follow all laws and regulations.

Loss Time Injury

Failure to practice procedures as trained and not having proper safeguards in place can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

Policies, specific task related training, targeted and ongoing training, inspections, workplace safeguards, cross training, and designated backups, minimize this risk. ALS continues to grow the safety program and culture.

Loss of Revenue

Can be caused by various audit fines and contract penalties for late data resulting in loss of revenue and disruption in business.

Policies, specific quality training, targeted and ongoing training, inspections, workplace safeguards, and internal audits minimize this risk. ALS continues to perform lab operations at the highest level.

There is a risk register in Laboratory Corrective Action SharePoint Site. Assigned risk is determined during the effectiveness review step (Follow-up).

8.6 Improvement

8.6.1 ALS management is committed to continually improving the effectiveness of the management and quality systems by implementing the requirements of this quality manual. ALS is also committed to improvements of the management systems through compliance with its own policies and procedures. ALS management is also committed to compliance with requirements related to current TNI and other client and project related requirements. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements.

8.6.2 ALS surveys clients and gains feedback on services provided. This input to management is managed at a corporate level and is reviewed monthly and during the management review processes.

8.7 Corrective Actions

8.7.1 ALS Laboratory operations are governed by documented procedures, requirements, quality assurance plans, project plans, and contracts. When any operation, for any reason, does not conform to the requirements of the governing documents, the aberrant event, item, or situation must be properly documented and evaluated. In addition, appropriate corrective action must be initiated. Procedures for the documentation and resolution of corrective action are detailed in the ALS SOP HN-QS-003 “NC-CA Reporting”. It is the policy of ALS that any corrective action which directly impacts results of testing must include notification to clients.

8.8 Internal Audits

8.8.1 Internal audits are conducted in accordance with ALS SOP HN-QS-012 “Internal Audits”. When internal and external audits or data assessments reveal a cause for concern with the quality of the data, an investigation is initiated by quality assurance personnel to determine the extent of the problem. Internal audits include examination of laboratory practice, the use of data handling systems, documentation and document control, personnel qualification and training records, procurement activities, and other systems that support and augment the laboratory analytical function. All audit findings and any event that casts doubt on the validity of the testing results requires corrective action and client notification within 30 days.

8.9 Management Review

8.9.1 Review of the Management System is completed on an ongoing basis in accordance with ALS SOP HN-QS-017 “QA Management Review”.

8.9.2 Inputs to management reviews may be kept in agenda notes and include but are not limited to:

a) Changes in internal and external issues that are relevant to the laboratory;

b) Fulfilment of objectives;

c) Suitability of policies and procedures;

d) Status of actions from previous management reviews;

e) Outcome of recent internal audits;

f) Corrective actions;

g) Assessments by external bodies;

h) Changes in the volume and type of the work or in the range of laboratory activities;

i) Customer and personnel feedback;

j) Complaints;

k) Effectiveness of any implemented improvements;

l) Adequacy of resources;

m) Results of risk and opportunity identification;

n) Outcome of the assurance of the validity of results; and

o) Other relevant factors, such as monitoring activities and training.

8.9.3 The outputs from the management review shall record all decisions and actions related to at least:
a) The effectiveness of the management system and its processes;
b) Improvement of the laboratory activities related to the fulfilment of the requirements of this document;
c) Provision of required resources;
d) Any need for change.

A summary of these outputs is generated annually.

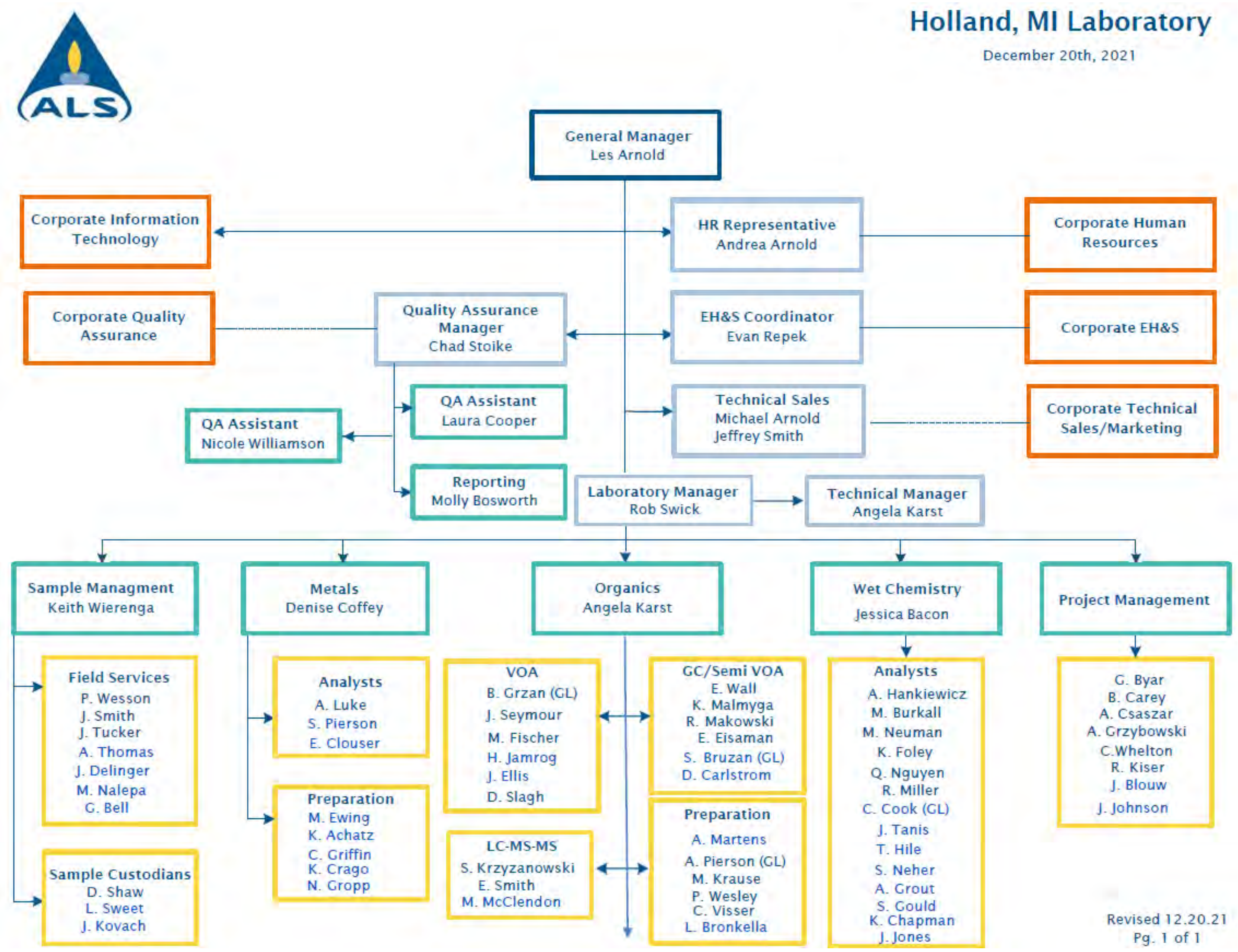
9. Appendices

The documents listed in this section are dynamic; accordingly they can change without notice or revision to this QAM. Please contact the laboratory for the most current documents.

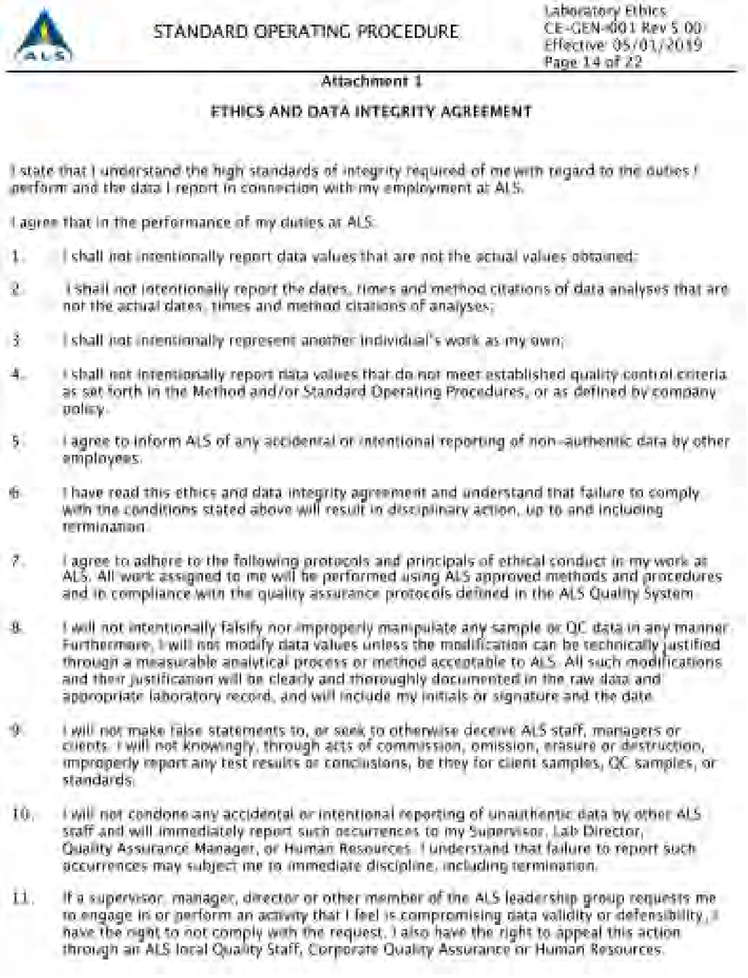
Appendix A – Definitions

AB	Accrediting Body
ANSI	American National Standards Institute
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
BLK	Blank
˚C	degrees Celsius
ICAL	Initial Calibration
CAS	Chemical Abstract Service
CCV	Continuing calibration verification
COC	Chain of custody
DO	Dissolved oxygen
DOC	Demonstration of Capability
EPA	Environmental Protection Agency
g/L	grams per liter
GC/MS	gas chromatography/mass spectrometry
ICP-MS	inductively coupled plasma-mass spectrometry
ICV	Initial calibration verification
IDC	Initial Demonstration of Capability
ISO/IEC	International Organization for Standardization/International Electrochemical Commission
lb/in2	pound per square inch
LCS	Laboratory control sample
LFB	Laboratory fortified blank
MDL	Method detection limit
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MRL	Minimum Reporting Level
MS	matrix spike
MSD	matrix spike duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
ODC	On-Going Demonstration of Capability
PQL	Practical Quantitation Limit
PT	Proficiency Test(ing)
PTOB	Proficiency Testing Oversight Body
PTPA	Proficiency Testing Provider Accreditor
QA	Quality Assurance
QC	Quality Control
QAM	Quality Assurance Manual
RPD	Relative percent difference
RSD	Relative standard deviation
SOP	Standard Operating Procedure
Std	Sandard
TNI	The NELAC Institute
ug/L	micrograms per liter
UV	Ultraviolet
VOC	Volatile organic compound
WET	Whole effluent toxicity

APPENDIX B – Key Personnel and Organization Charts



APPENDIX C – Ethics and Data Integrity Policy



STANDARD OPERATING PROCEDURE

Laboratory Ethics
CE-GEN-001 Rev 5.00
Effective: 05/01/2019
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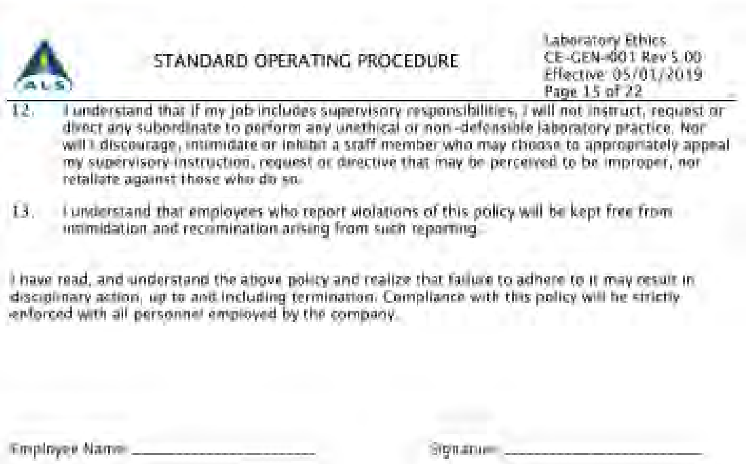
Attachment 1

ETHICS AND DATA INTEGRITY AGREEMENT

I state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at ALS.

I agree that in the performance of my duties at ALS:

1. I shall not intentionally report data values that are not the actual values obtained;
2. I shall not intentionally report the dates, times and method citations of data analyses that are not the actual dates, times and method citations of analyses;
3. I shall not intentionally represent another individual's work as my own;
4. I shall not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operating Procedures, or as defined by company policy.
5. I agree to inform ALS of any accidental or intentional reporting of non-authentic data by other employees.
6. I have read this ethics and data integrity agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination.
7. I agree to adhere to the following protocols and principals of ethical conduct in my work at ALS. All work assigned to me will be performed using ALS approved methods and procedures and in compliance with the quality assurance protocols defined in the ALS Quality System.
8. I will not intentionally falsify nor improperly manipulate any sample or QC data in any manner. Furthermore, I will not modify data values unless the modification can be technically justified through a measurable analytical process or method acceptable to ALS. All such modifications and their justification will be clearly and thoroughly documented in the raw data and appropriate laboratory record, and will include my initials or signature and the date.
9. I will not make false statements to, or seek to otherwise deceive ALS staff, managers or clients. I will not knowingly, through acts of commission, omission, erasure or destruction, improperly report any test results or conclusions, be they for client samples, QC samples, or standards.
10. I will not condone any accidental or intentional reporting of unauthentic data by other ALS staff and will immediately report such occurrences to my Supervisor, Lab Director, Quality Assurance Manager, or Human Resources. I understand that failure to report such occurrences may subject me to immediate discipline, including termination.
11. If a supervisor, manager, director or other member of the ALS leadership group requests me to engage in or perform an activity that I feel is compromising data validity or defensibility, I have the right to not comply with the request. I also have the right to appeal this action through an ALS local Quality Staff, Corporate Quality Assurance or Human Resources.



STANDARD OPERATING PROCEDURE

Laboratory Ethics
CE-GEN-001 Rev 5.00
Effective: 05/01/2019
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12. I understand that if my job includes supervisory responsibilities, I will not instruct, request or direct any subordinate to perform any unethical or non-defensible laboratory practice. Nor will I discourage, intimidate or inhibit a staff member who may choose to appropriately appeal my supervisory instruction, request or directive that may be perceived to be improper, nor retaliate against those who do so.
13. I understand that employees who report violations of this policy will be kept free from intimidation and recrimination arising from such reporting.

I have read, and understand the above policy and realize that failure to adhere to it may result in disciplinary action, up to and including termination. Compliance with this policy will be strictly enforced with all personnel employed by the company.

Employee Name ______________________ Signature ________________________

SOP excerpt from CE-GEN-001, Laboratory Ethics and Data Integrity. Full document is available upon request.

APPENDIX D – Laboratory Floor Plan

APPENDIX E – Analytical & Support Equipment

Instrument Type	Manufacturer	Model	Year Purchased
PFAS			
High Pressure Liquid Chromatograph - Mass Spectrometer	Shimadzu	8060	2019
Autosampler	Shimadzu	Nexera X2 SIL-30AC	2019
Pump	Shimadzu	Nexera X2 LC-30AD	2019
Pump	Shimadzu	Nexera X2 LC-30AD	2019
Column Oven	Shimadzu	CTO-20A	2019
Communications BUS Module	Shimadzu	CBM 20A	2019
Gas Generator	Proton	DualGas N251M	2019
Vacuum Pump	Oerlikon Leybold	Sogevac SV65VIFC	2019
PFAS Prep			
Vacuum Pump	GAST	DOA-P704-AA	2019
Solid Phase Extraction Manifold	Agilent	VAC ELUT	2019
Fume Hood	Air Science	PurAir-P30	2019
TurboVap Concentrator	Biotage	Turbovap LV	2019
Sonicating Bath	VWR	97043-952	2019
Refrigerator	Avantco	178GDS47HCB	2019
Refrigerator	Avantco	178GDS47HCB	2019
Volatiles			
Gas Chromatograph/Mass Spectrometer	Agilent	7890B/7077B	2018
Gas Chromatograph/Mass Spectrometer	Agilent	7890B/5977A	2015
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2010
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2010
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2009
Gas Chromatograph/Mass Spectrometer	Agilent	6890N/5975	2005
Gas Chromatograph PID/FID	Agilent	7890A	2010
Purge & Trap Autosampler/Concentrator	Teledyne-Tekmar	Atomx	2016
Purge & Trap Autosampler/Concentrator	Teledyne-Tekmar	Atomx	2016
Purge & Trap Autosampler/Concentrator	Teledyne-Tekmar	Atomx	2015
Purge & Trap Autosampler/Concentrator	Teledyne-Tekmar	Atomx	2010
Purge & Trap Concentrator	EST	Encon	2011
Purge & Trap Concentrator	EST	Encon	2011
Purge & Trap Auto-sampler	EST	Centurion	2011
Purge & Trap Auto-sampler	EST	Centurion	2011

Semi-Volatiles			
Gas Chromatograph/Mass Spectrometer	Agilent	8890/7077B	2019
Gas Chromatograph/Mass Spectrometer	Agilent	7890B/7077B	2018
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2014
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2012
Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C	2010
Gas Chromatograph ECD/ECD	Agilent	6890N	2012
Gas Chromatograph FID/FID	Agilent	7890A	2010
Gas Chromatograph ECD/ECD	Agilent	6890N	2007
Gas Chromatograph FID/NPD	Agilent	6890N	2002
Gas Chromatograph ECD/ECD	Agilent	6890N	2002
High Pressure Liquid Chromatograph	Agilent	G7121A	2020
High Pressure Liquid Chromatograph	Agilent	1100	2010
Liquid Auto-sampler	Agilent	7693	2018
Liquid Auto-sampler	Agilent	7693	2010
Liquid Auto-sampler	Agilent	7693	2010
Liquid Auto-sampler	Agilent	7693	2010
Liquid Auto-sampler	Agilent	7683B	2010
Liquid Auto-sampler	Agilent	7683B	2007
Liquid Auto-sampler	Agilent	7683	2002
Liquid Auto-sampler	Agilent	7683	2002
Metals			
Inductively Coupled Plasma/Atomic Emission Spectrometer	Thermo	ICAP 6500	2013
Inductively Coupled Plasma/Mass Spectrometer	Agilent	7800	2019
Inductively Coupled Plasma/Mass Spectrometer	Agilent	7800	2017
Cold Vapor Atomic Fluorescence Mercury Analyzer	CETAC	M-8000	2016
Cold Vapor Atomic Fluorescence Mercury Analyzer	CETAC	M-8000	2010
Cold Vapor Atomic Absorption Mercury Analyzer	CETAC	M-7600	2018
Auto-sampler	CETAC	ASX-560	2019
Auto-sampler	CETAC	ASX-560	2018
Auto-sampler	CETAC	ASX-560	2017
Auto-sampler	CETAC	ASX-520	2015

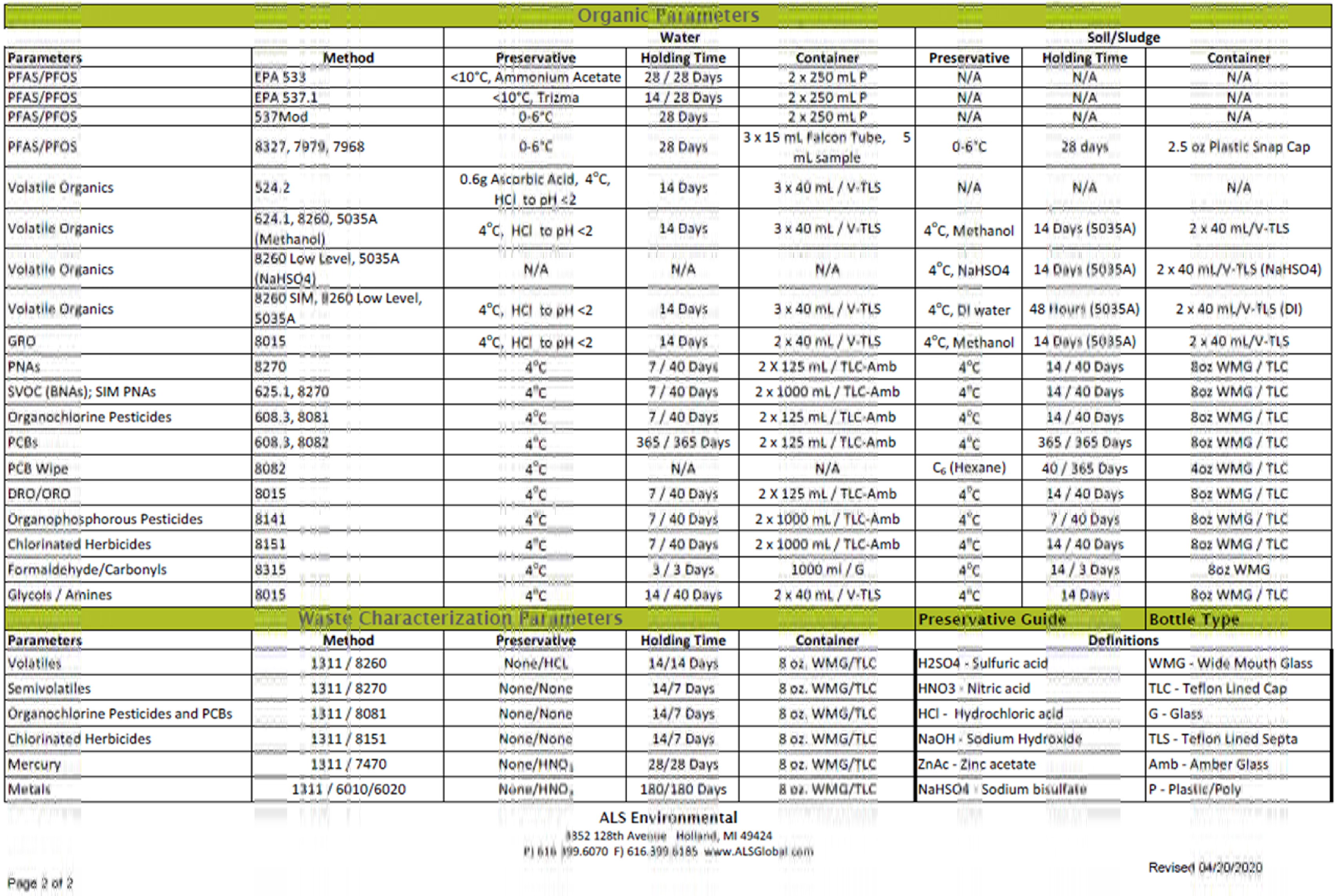
Auto-sampler	CETAC	ASX-520	2013
Inorganics			
Continuous Flow Analyzer	Skalar	San++ 5000	2019
Discrete Analyzer	Thermo	Gallery	2015
Auto-Titrator	Mantech	PC-1000	2012
Flow Injection Analyzer	OI Analytical	FS 3700	2017
Flow Injection Analyzer	OI Analytical	FS 3100	2008
Flow Injection Analyzer	Lachat	QuikChem 8500	2011
Flow Injection Analyzer	Lachat	QuikChem 8500	2005
Ion Chromatograph	Dionex	ICS-2100	2010
Ion Chromatograph	Dionex	ICS-2100	2010
Ion Chromatograph Auto-sampler	Dionex	AS-1	2010
Ion Chromatograph Auto-sampler	Dionex	AS-1	2010
Total Organic Carbon Analyzer	OI Analytical	Auroa 1030	2016
Total Organic Carbon Auto-sampler	OI Analytical	1088	2016
UV/VIS Spectrophotometer	Thermo	Genesys 30	2019
UV/VIS Spectrophotometer	Thermo	Genesys 30	2017
Prep/Support			
Autoclave	Tuttnauer	2540E	2019
Balance, Analytical	Ohaus	AX224	2019
Balance, Analytical	Ohaus	EX124	2016
Balance, Analytical	Ohaus	PA124C	2015
Balance, Analytical	Mettler Toledo	NewClassic	2011
Balance, Analytical	Sartorius	ED124S	2008
Balance, Analytical	Sartorius	ED124S	2008
Balance, Top-Loading	Ohaus	AX622	2019
Balance, Top-Loading	Ohaus	EX223	2016
Balance, Top-Loading	VWR	1002E	2015
Balance, Top-Loading	Mettler Toledo	ME303S	2014
Balance, Top-Loading	Mettler Toledo	ML203E	2014
Balance, Top-Loading	Ohaus	Scout Pro	2012
Balance, Top-Loading	Sartorius	ED153CW	2009
COD Reactor	Hach	DRB200	2015
COD Reactor	Hach	45600	2009
Conductivity Meter	Mettler Toledo	Five Easy	2009
Distillation System - Ammonia/Cyanide	Environmental Express	SimpleDist	2010
Dissolved Oxygen Meter	Hach	HQ40d	2012

Flashpoint Tester, Pensky-Martens	Syd	261	2018
Flashpoint Tester, Pensky-Martens	Syd	261	2016
Floor Shaker	Edmund Buhler	3-D Floor Shaker	2016
Floor Shaker - Separatory Funnel Extractor	Glas-Col	3-D Floor Shaker	2010
Floor Shaker - Separatory Funnel Extractor	Glas-Col	3-D Floor Shaker	2010
Freeze Dryer	Labconco	FreeZone 4.5L	2011
HotBlock™ Metals Digestion Block 54-Place	Environmental Express	SC-154	2015
HotBlock™ Metals Digestion Block 54-Place	Environmental Express	SC-154	2014
HotBlock™ Metals Digestion Block 54-Place	Environmental Express	SC-154	2008
HotBlock™ Metals Digestion Block 54-Place	Environmental Express	SC-154	2004
HotBlock™ MetalsDigestion Block 36-Place	Environmental Express	SC-100	2010
HotBlock™ MetalsDigestion Block 36-Place	Environmental Express	SC-100	2006
Incubator, BOD	VWR	2020	2012
Incubator, BOD	VWR	2020	2000
Incubator, Micro	VWR	1500E	2009
Incubator, Micro	VWR	1535	2000
Microwave Extraction Unit	CEM	MARS6	2017
Microwave Extraction Unit	CEM	MARS6	2015
MODBlock™ Mercury Digestion Block	CPI International	4370-010007	2004
MODBlock™ Mercury Digestion Block	CPI International	4370-010007	2004
Muffle Furnace	Thermo	Thermolyne	2009
Oven	Binder	ED115	2018
Oven	Binder	ED115	2012
Oven	Binder	ED115	2012
Oven	Binder	ED115	2010
pH Meter	Mettler Toledo	5 Easy	2014
pH Meter	sympHony	SB70P	2008
pH Meter	sympHony	SB70P	2008
Pressurized Fluid Extractor	CEM	EDGE	2019
SPE Manifold - SVOC	Sigma-aldrich	Envi-Disk	2011
SPE Manifold - Oil & Grease	Environmental Express	StepSaver	2007
Sonic Dismembrator	Fisher Scientific	FB705	2011
Stir Plate, 15 position	IKA	RT15	2016
TCLP Tumbler	Environmental Express	LE1002	2010
TCLP Tumbler	Environmental Express	LE1002	2008
Turbidimeter	VWR	76152-030	2021
TKN Mini Block Digestor	Skalar	TKN	2016

APPENDIX F – Sample Preservation, Containers, and Hold Times

SAMPLE HANDLING GUIDELINES

Inorganic Parameters							
		Water			Soil/Sludge		
Parameters	**Method**	**Preservative**	**Holding Time**	**Container**	**Preservative**	**Holding Time**	**Container**
Alkalinity	SM 2320B	4°C	14 Days	250 mL / P,G	N/A	N/A	N/A
Ammonia	SM 4500 NH3 G, 350.1	4°C, H_2SO_4 to pH <2	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Biochemical Oxygen Demand (BOD)	SM 5210B	4°C	48 Hours	1000 mL / P,G	N/A	N/A	N/A
Bromide	300, 9056	4°C	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Chemical Oxygen Demand (COD)	410.4	4°C, H_2SO_4 to pH <2	28 Days	250 mL / P,G	N/A	N/A	N/A
Chloride	300, 9056	4°C	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Chlorine, Residual	SM 4500 Cl G	4°C	Immediate	250 mL / P,G	N/A	N/A	N/A
Chromium VI (Hexavalent Cr)	7196A, SM 3500 Cr B	4°C	24 Hours	250 mL / P,G	4°C	30 / 7 Days	8oz WMG
Color	SM 2120B	4°C	48 Hours	250 mL / P,G	N/A	N/A	N/A
Cyanide	335.4, 9012, Kelada	4°C, NaOH to pH >12	14 Days	250 mL / P,G	4°C	14 Days	8oz WMG
Fluoride	300, 9056	4°C	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Hardness	SM 2340, 200.8, 6020	HNO_3 to pH <2	6 Months	250 mL / P,G	N/A	N/A	N/A
Metals	6020, 200.8, 200.7, 6010	HNO_3 to pH <2	6 Months	500 mL / P,G	4°C	6 Months	8oz WMG
Mercury	245.1, 7470, 7471	HNO_3 to pH <2	28 Days	500 mL / P,G	4°C	28 Days	8oz WMG
Moisture	3550C	N/A	N/A	N/A	4°C	14 Days	8oz WMG
Nitrogen, Kjeldahl (TKN)	SM 4500-NH3 G	4°C, H_2SO_4 to pH <2	28 Days	500 mL / P,G	4°C	28 Days	8oz WMG
Nitrate	300, 9056	4°C	48 Hours	250 mL / P,G	4°C	48 Hours	8oz WMG
Nitrite	300, 9056, SM 4500-NO2 B	4°C	48 Hours	250 mL / P,G	4°C	48 Hours	8oz WMG
Nitrate-Nitrite	353.2	4°C, H_2SO_4 to pH <2	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Oil and Grease	1664A, 9071	4°C, H_2SO_4/HCL to pH<2	28 Days	2 x 1000 mL / G	4°C	28 Days	8oz WMG
Phenolics	420.4, 9066	4°C, H_2SO_4 to pH <2	28 Days	1000 mL / G	4°C	28 Days	8oz WMG
Phosphorous, Total	365.1	4°C, H_2SO_4 to pH <2	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Phosphate, Ortho	365.1	4°C	48 Hours	250 mL / P,G	4°C	48 Hours	8oz WMG
pH	9040, 9045, SM 4500-H+	None	Immediate	250 mL / P,G	4°C	7 Days	8oz WMG
Solids, Dissolved (TDS)	SM 2540C	4°C	7 Days	250 mL / P,G	N/A	N/A	N/A
Solids, Suspended (TSS)	SM 2540D	4°C	7 Days	1000 mL / P,G	N/A	N/A	N/A
Solids, Volatile (TVS)	160.4	4°C	7 Days	250 mL / P,G	N/A	N/A	N/A
Solids, Total (TS)	SM 2540E/G	4°C	7 Days	250 mL / P,G	4°C	7 Days	8oz WMG
Specific Conductance	9050, SM 2510	4°C	28 Days	250 mL / P,G	N/A	N/A	N/A
Sulfate	300, 9056	4°C	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Sulfide	376.1, 9030, 9034	4°C, ZnAc, NaOH to pH >9	7 Days	500 mL / P,G	4°C	7 Days	8oz WMG
Sulfite	SM 4500-SO3	4°C	Immediately	500 mL / P,G	4°C	48 Hours	8oz WMG
Surfactants (MBAS)	SM 5540	4°C	48 Hours	250 mL / P,G	N/A	N/A	N/A
Total Organic Carbon (TOC)	SM 5310, 9060, W. Black (S)	4°C, H_2SO_4/HCl to pH<2	28 Days	250 mL / P,G	4°C	28 Days	8oz WMG
Turbidity	SM 2130	4°C	48 Hours	250 mL / P,G	N/A	N/A	N/A



Organic Parameters

		Water			Soil/Sludge		
Parameters	**Method**	**Preservative**	**Holding Time**	**Container**	**Preservative**	**Holding Time**	**Container**
PFAS/PFOS	EPA 533	<10°C, Ammonium Acetate	28 / 28 Days	2 x 250 mL P	N/A	N/A	N/A
PFAS/PFOS	EPA 537.1	<10°C, Trizma	14 / 28 Days	2 x 250 mL P	N/A	N/A	N/A
PFAS/PFOS	537Mod	0-6°C	28 Days	2 x 250 mL P	N/A	N/A	N/A
PFAS/PFOS	8327, 7979, 7968	0-6°C	28 Days	3 x 15 mL Falcon Tube, 5 mL sample	0-6°C	28 days	2.5 oz Plastic Snap Cap
Volatile Organics	524.2	0.6g Ascorbic Acid, 4°C, HCl to pH <2	14 Days	3 x 40 mL / V-TLS	N/A	N/A	N/A
Volatile Organics	624.1, 8260, 5035A (Methanol)	4°C, HCl to pH <2	14 Days	3 x 40 mL / V-TLS	4°C, Methanol	14 Days (5035A)	2 x 40 mL/V-TLS
Volatile Organics	8260 Low Level, 5035A (NaHSO4)	N/A	N/A	N/A	4°C, NaHSO4	14 Days (5035A)	2 x 40 mL/V-TLS (NaHSO4)
Volatile Organics	8260 SIM, 8260 Low Level, 5035A	4°C, HCl to pH <2	14 Days	3 x 40 mL / V-TLS	4°C, DI water	48 Hours (5035A)	2 x 40 mL/V-TLS (DI)
GRO	8015	4°C, HCl to pH <2	14 Days	2 x 40 mL / V-TLS	4°C, Methanol	14 Days (5035A)	2 x 40 mL/V-TLS
PNAs	8270	4°C	7 / 40 Days	2 X 125 mL / TLC-Amb	4°C	14 / 40 Days	8oz WMG / TLC
SVOC (BNAs); SIM PNAs	625.1, 8270	4°C	7 / 40 Days	2 x 1000 mL / TLC-Amb	4°C	14 / 40 Days	8oz WMG / TLC
Organochlorine Pesticides	608.3, 8081	4°C	7 / 40 Days	2 x 125 mL / TLC-Amb	4°C	14 / 40 Days	8oz WMG / TLC
PCBs	608.3, 8082	4°C	365 / 365 Days	2 x 125 mL / TLC-Amb	4°C	365 / 365 Days	8oz WMG / TLC
PCB Wipe	8082	4°C	N/A	N/A	C_6 (Hexane)	40 / 365 Days	4oz WMG / TLC
DRO/ORO	8015	4°C	7 / 40 Days	2 X 125 mL / TLC-Amb	4°C	14 / 40 Days	8oz WMG / TLC
Organophosphorous Pesticides	8141	4°C	7 / 40 Days	2 x 1000 mL / TLC-Amb	4°C	7 / 40 Days	8oz WMG / TLC
Chlorinated Herbicides	8151	4°C	7 / 40 Days	2 x 1000 mL / TLC-Amb	4°C	14 / 40 Days	8oz WMG / TLC
Formaldehyde/Carbonyls	8315	4°C	3 / 3 Days	1000 ml / G	4°C	14 / 3 Days	8oz WMG
Glycols / Amines	8015	4°C	14 / 40 Days	2 x 40 mL / V-TLS	4°C	14 Days	8oz WMG / TLC

Waste Characterization Parameters

Parameters	Method	Preservative	Holding Time	Container
Volatiles	1311 / 8260	None/HCL	14/14 Days	8 oz. WMG/TLC
Semivolatiles	1311 / 8270	None/None	14/7 Days	8 oz. WMG/TLC
Organochlorine Pesticides and PCBs	1311 / 8081	None/None	14/7 Days	8 oz. WMG/TLC
Chlorinated Herbicides	1311 / 8151	None/None	14/7 Days	8 oz. WMG/TLC
Mercury	1311 / 7470	None/HNO_3	28/28 Days	8 oz. WMG/TLC
Metals	1311 / 6010/6020	None/HNO_3	180/180 Days	8 oz. WMG/TLC

Preservative Guide	Bottle Type
Definitions	
H2SO4 - Sulfuric acid	WMG - Wide Mouth Glass
HNO3 - Nitric acid	TLC - Teflon Lined Cap
HCl - Hydrochloric acid	G - Glass
NaOH - Sodium Hydroxide	TLS - Teflon Lined Septa
ZnAc - Zinc acetate	Amb - Amber Glass
NaHSO4 - Sodium bisulfate	P - Plastic/Poly

ALS Environmental
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Revised 04/20/2020

APPENDIX H – Data Qualifiers

Data Qualifier	Description
*	Value exceeds Regulatory Limit
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte is present at an estimated concentration between the MDL and Report Limit
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL
X	Analyte was detected in the Method Blank between the MDL and Reporting Limit, sample results may exhibit background or reagent contamination at the observed level.

APPENDIX J – Laboratory Accreditations

By
Accrediting Agency

Agency	***Type***
Minnesota	NELAP
Illinois	NELAP
Pennsylvania	NELAP
Texas	NELAP
Florida	NELAP
Kansas	NELAP
New Jersey	NELAP
New York	NELAP
North Dakota	State
Ohio	State
Michigan	State
Wisconsin	State
Iowa	State
Kentucky	State
West Virginia	State
Indiana	State
Alabama	State
Connecticut	State
USDA	Soil Import

Approved scope of testing for each regulatory agency available upon request.

APPENDIX L – List of Tests and Offerings

By
Parameter & Methodology

2022 Capabilities - ALS Environmental - Holland, MI

Non-Potable Water, Hazardous, & Solid Waste	*Analytical Methodology*	*Applicable Accreditation*
• **Organic Chemistry**		
Non-Halogenated Organics	SW846 – 8015C	NELAC*-Aqueous only
Gasoline Range Organics	SW846 -- 8015C/8015D	NELAC
Diesel Range Organics	SW846 -- 8015C/8015D	NELAC
Pesticides	SW846 – 8081B	NELAC*
PCBs	SW846 – 8082A	NELAC*
Chlorinated Herbicides	SW846 – 8151A	NELAC*-Short List
Volatile Organics	SW846 – 8260B/8260D	NELAC*
SemiVolatile Organics	SW846 – 8270C/8270E	NELAC*
Polynuclear Aromatics (SIM)	SW846 – 8270C/8270E	NELAC*
EDB/DBCP	SW846 -- 8011	NELAC -Aqueous only
Gases	RSK-175	NELAC*-Aqueous only
PFAS/PFOS	EPA 8327 / 537Mod / ASTM D7979 / ASTM D7968	NELAC*
Wisconsin DRO	WI DRO-95	NELAC
Wisconsin GRO/PVOCs	WI GRO-95	NELAC*
Carbonyl Compounds	SW846 – 8315A	Various State*
Volatile Organics by Isotopic Dilution	USEPA – 1666	None
SemiVolatile Organics by Isotopic Dilution	USEPA – 1665	None
• **Inorganic Chemistry**		
Mercury	SW846 – 7470A / 7471B	NELAC
Metals	SW846 – 6020B	NELAC*
Metals	SW846 – 6010D	NELAC*
• **General Chemistry**		
Cyanide	SW846 – 9012B	NELAC
Hexavalent Chromium	SW846 -- 3060A/7196A	NELAC

Sulfide	SW846 – 9030B/9034	NELAC
pH	SW846 – 9040C / 9045D	NELAC
Conductance	SW846 – 9050A	NELAC
Anions	SW846 – 9056A	NELAC*
Oil and Grease	SW846 -- 9071B	NELAC
Paint Filter	SW846 – 9095B	NELAC
Reactive Cyanide	SW846 – 7.3.3.2	NELAC
Reactive Sulfide	SW846 – 7.3.4.2	NELAC
Total Organic Carbon	SW846 -- 9060A	NELAC
Total Phenolics	SW846 -- 9066	NELAC
Flashpoint/Ignitability	SW846 – 1010A	NELAC
• **Extractions**		
TCLP	SW846 – 1311	NELAC
SPLP	SW846 – 1312	NELAC
Wastewater	***Analytical Methodology***	***Applicable Accreditation***
• **Organic Chemistry**		
Pesticides	USEPA 608.3	NELAC*
PCBs	USEPA 608.3	NELAC*
Volatile Organics	USEPA 624.1	NELAC*
SemiVolatile Organics	USEPA 625.1	NELAC*
• **Inorganic Chemistry**		
Mercury (Low Level)	USEPA 1631E	NELAC
Mercury	USEPA 245.1	NELAC
Metals	USEPA 200.8	NELAC*
Metals	USEPA 200.7	NELAC*
• **General Chemistry**		
COD	USEPA 410.4	NELAC
Hexavalent Chromium	SM 3500 Cr-B	NELAC

Total Kjeldahl Nitrogen	SM 4500NH3-G	NELAC
Conductance	SM 2510B	NELAC
pH	SM 4500H+-B	NELAC
Total Dissolved Solids	SM 2540 -C	NELAC
Total Suspended Solids	SM 2540 -D	NELAC
Total Solids	SM 2540 -B	NELAC
Total Volatile Solids	USEPA 160.4	NELAC
Total Residual Chlorine	SM 4500Cl-G	NELAC
Oil & Grease (gravimetric)	USEPA 1664A	NELAC
Acidity	SM 2310 -B	NELAC
Alkalinity	SM 2320 -B	NELAC
Total Hardness	SM 2340 -B	NELAC
Bromide	USEPA 300.0	NELAC
BOD	SM 5210-B	NELAC
CBOD	SM 5210-B	NELAC
Chloride	USEPA 300.0	NELAC
Chloride	SM 4500CL-C	NELAC
Chloride	SM 4500CL-E	NELAC
Color	SM 2120-B	None
Amenable Cyanide	USEPA 335.1	NELAC
Amenable Cyanide	SM 4500CN-G	NELAC
Cyanide, Total	SM 4500CN-E	NELAC
Cyanide, Total	USEPA 335.4	NELAC
Cyanide, Total	ASTM D7511	NELAC
Cyanide, Total	Kelada-01	NELAC
Cyanide, Free and Available	OIA 1677	NELAC
Fluoride	USEPA 300.0	NELAC
Fluoride	SM 4500F-C	None
Ammonia	USEPA 350.1	NELAC
Ammonia	SM 4500NH3-G	NELAC
Nitrate-Nitrite	USEPA 353.2	NELAC
Nitrate-Nitrite	USEPA 300.0	NELAC
Nitrate	USEPA 300.0	NELAC
Nitrate	USEPA 353.2	NELAC
Nitrite	USEPA 353.2	NELAC
Nitrite	USEPA 300.0	NELAC
Nitrite	SM 4500 NO2-B	NELAC
Orthophosphate	USEPA 365.1	NELAC

Phenols	USEPA 420.4	NELAC
Phosphorus	USEPA 365.1	NELAC
Sulfate	USEPA 300.0	NELAC
Sulfate	SM 4500SO4-E	NELAC
Sulfide	SM 4500S2-F	NELAC
Surfactants (MBAS)	SM 5540-C	None
Total Organic Carbon	SM 5310-C	NELAC

Drinking Water	***Analytical Methodology***	***Applicable Accreditation***
Coliform (Presence/Absence)	SM 9223 (Colilert)	Michigan
Metals	USEPA 200.8*	Michigan & Indiana
Mercury	USEPA 245.1	Michigan & Indiana
Nitrate	USEPA 300.0	Michigan & Indiana
PFAS/PFOS	EPA 537.1	MI, FL, NY, OH, MN, NJ, PA, KS, AL, CT
PFAS/PFOS	EPA 533	None
Total Organic Carbon	SM 5310C	Michigan
Volatiles	USEPA 524.2*	Michigan & Indiana

* Specific Analyte listing available upon request

END OF DOCUMENT

Trace Analytical Laboratories, Inc.
2241 Black Creek Road, Muskegon, Michigan 49444-2673

Laboratory Operations and Quality Assurance Manual

Brad Hilleary, CEO-Owner — (231) 773-5998, extension 249

Gina Roe, Laboratory Manager — (231) 773-5998, extension 243

Alyson Yagiela, QA/QC Manager — (231) 773-5998, extension 252

Major Organizational Units Covered by this Manual:

- *Sample Receiving Department*
- *Organics Laboratory*
- *Metals Laboratory*
- *Wet Chemistry Laboratory*
- *Extractions Laboratory*
- *Reporting and Record Keeping Department*

Table of Contents

Mission, Vision, Value

Mission:
Our mission is to service our clients by providing prompt, accurate analysis of potential contaminants in water, soil, air, and hazardous waste. We are committed to the quality, traceability and defensibility of data.

Vision:
Our vision is to be known as the most valuable asset to our clients for environmental, regulatory, and investigative testing.

Value:
We are dedicated to producing analytical data in strict accordance with our quality control program. Ethics and integrity play the greatest fundamental role from sample collection to data reporting, setting us apart from the rest.

To that end, it shall be the purpose of TRACE Analytical Laboratories to implement internal programs, procedures, and policies that strengthen, augment and develop a sound environmental laboratory and meet the requirements outlined in the TNI Standard, the ISO/IEC 17025:2017 International Standard, the Department of Defense Quality Systems Manual, and guidelines developed by both regulatory agencies and private industries.

Disclaimer

The mention of trade names, commercial products or suppliers in this manual does not constitute any endorsement or recommendation for use by TRACE Analytical Laboratories, Inc.

Administrative Approval

Trace Analytical Laboratories, Inc.

Laboratory Operations and Quality Assurance Manual

Effective Date: 12-8-20

Concurrences and Approvals:

Name:	Gina Roe
Title:	Laboratory Manager
Signature:	

Name:	Alyson Yagiela
Title:	QA/QC Manager
Signature:	

Statement of Qualifications

OVERVIEW

TRACE Analytical Laboratories, Inc. was founded in 1989 by Dr. William Schroeder, a veteran of service in the U.S. Navy that holds a doctorate in chemistry. TRACE is a full service environmental laboratory, providing a complete range of environmental analyses and sampling services for our clients. These services include organic and inorganic analyses of water, soil, air, and hazardous waste. All of our routine services conform to strict methodologies and guidelines from sources such as the US EPA, ASTM, AOAC, NIOSH, Standard Methods, and the Code of Federal Regulations, Part 136.

TRACE has state-of-the-art analytical instrumentation using proven technology. Part of the Quality Assurance program is obtaining, maintaining, and calibrating equipment and instrumentation that is required to accurately and efficiently carry out the analysis of samples as prescribed in analytical test methods. TRACE purchases or prepares appropriate reagents and standards for analyses that are ACS grade, spectroquality, or traceable to NIST standards, whenever possible. TRACE collects and receives samples under strict chain-of-custody procedures and adheres to proper sample collection and preservation techniques. The ability to define and defend the analytical process is one of TRACE'S primary Quality Assurance program objectives.

TRACE has substantial experience with servicing the analytical needs of a diverse client base. TRACE is accredited in accordance with the National Environmental Laboratory Accreditation Program (NELAP), the Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), ISO/IEC 17025:2017, Drinking Water Certified by the State of Michigan, and is a registered Small Business with the SBA. This gives TRACE the ability to provide analytical services to residential, industrial, engineering, and consulting clients, as well as local, state, and federal agencies, including the Department of Defense. Our laboratory continually supports regulatory programs such as CERCLA/SARA, RCRA, Clean Air Act, Safe Drinking Water Act, NPDES and the Clean Water Act.

TRACE's Project Manager works closely with clients and laboratory personnel to ensure all details and project specifications are accurately performed. The Project Manager can assist in project planning, including the preparation of Quality Assurance Project Plans (QAPPs). Working with clients at the onset of a project assures that results are more conclusive and cost-effective.

TRACE Analytical Laboratories, Inc., is comprised of experienced professionals with degrees in chemistry, biology, and environmental science. Our team has specialized training in laboratory operations and experience in the industrial workplace. Their expertise guarantees our clients the range and depth of scientific disciplines, technical specialties, practical experience, and analytical services needed to meet the objectives of today's complex industrial and environmental demands.

Professional resumes for TRACE's key personnel are included in Appendix I.

Laboratory Identification

EPA Laboratory ID: MI00106

Laboratory Certification	**ID Number**
DoD-ELAP / ISO 17025:2017	1031
New Jersey NELAP	MI008
State of Michigan	8001
State of Wisconsin DNR	998044080
State of Connecticut DPH	PH-0149

Trace's current scope of accreditation and expiration is contained within each of the following:
- DoD-ELAP / ISO 17025:2017 Certificate and Scope
- New Jersey NELAP Certificate and Annual Certified Parameter List
- MDEQ Drinking Water Certificates
- State of Wisconsin DNR Scope of Accreditation
- State of Connecticut DPH Certified Analytes Report

These are maintained on file with the QA/QC Manager and can be obtained upon request. Please contact the QA/QC Manager for additional information.

How to Contact Trace

Mailing Address:

TRACE Analytical Laboratories, Inc.
2241 Black Creek Road
Muskegon, MI 49444-2673

When sending requests for quotation through regular mail, please add 'Quotation Request' to the address listed above.

Telephone: (231) 773-5998
Fax: (888) 979-4469
Web Site: www.trace-labs.com
General E-mail Delivery: info@trace-labs.com

SECTION 1: Introduction

Purpose:

The purpose of this manual is to document the Laboratory Operations and Quality Assurance (QA) Program employed by TRACE.

A well-defined system of quality control practices is an important part of providing quality data for our clients. The data produced by TRACE are well defined and defensible.

This manual, with the practices and policies contained in it, are not to be viewed as all-inclusive. Rather, they are to be used as a foundation by TRACE to build upon. The underlying principal for quality assurance is one of continued process improvement of laboratory operations.

The management of TRACE is committed to the continual improvement of its Laboratory Operations and QA Program. While it is the responsibility of the management to put these programs and policies into effect, it is also the responsibility of the entire TRACE team to follow these programs and policies and to make suggestions for the improvement of these programs.

This manual is intended to assist our clients with basic information of laboratory operations. It is also intended to be a resource for our clients so that their projects requiring analytical services will be built upon a strong foundation of quality.

Safety:

Safety is a primary focus at TRACE.

Safety takes precedence over all other laboratory operations.

The management at TRACE provides a safe working environment for its staff. TRACE staff includes individuals who are trained as Hazardous Materials Specialists. In addition, several staff members have first aid training to assist with health and safety issues.

A health and safety session is a required part of new employee orientation. As part of their training, employees are introduced to the specialized health and safety procedures in our Standard Operating Procedures (SOPs). As part of the OSHA 'Worker-Right-To-Know' Act, TRACE maintains an inventory of the chemicals, reagents, acids and solvents used in the course of its operations. Maintained with this inventory are the Safety Data Sheets (SDS) for these materials. These references are available for use by the staff. Should a client have need for information on a particular material, TRACE can provide the information upon request.

TRACE provides safety devices such as protective gloves, laboratory coats, eye protection and first aid stations for its staff.

For additional information, see the Trace Analytical Laboratories, Inc. Laboratory Safety Manual, Document DOC-2.

Each individual must also be responsible for his or her health and safety. They must also be aware of others who may be impacted by their actions. If they are unsure about the potential hazard to themselves and/or others, they must ask their Area Manager for assistance.

TRACE will work with our clients to ensure that the laboratory will do what is practicable to assure the safety of materials sent by the laboratory to its clients. Further, TRACE will seek to determine if a client's project poses a health and safety risk and will work with that client to minimize that risk.

Specific safety issues for the laboratory are addressed in general terms in this manual by laboratory area and in the laboratory safety manual. Analytical and field sampling SOPs also have more specific information on safety concerns for specific procedures.

Data Integrity:

Data integrity is a primary focus at TRACE.

Integrity is defined as 'the state of being unimpaired' as well as 'the adherence to moral and ethical principles'.

Data integrity depends on the ability to define and defend the entire analytical process and to prove that the data has been 'unimpaired' and analysis has been performed in accordance with the appropriate procedures and practices.

The ability to define and defend the entire analytical process and the integrity of the data that are produced is dependent upon the documentation of activities and actions. This manual will explain the documentation procedures employed by TRACE in order to produce data that is 'unimpaired.'

This documentation starts with project initiation by the client, project activities by the client and TRACE, and post project activities by TRACE.

All TRACE laboratory employees undergo data integrity training during initial orientation and on an annual basis and must sign that they have attended and understand TRACE's Data Integrity Policy. This training places an emphasis on proper documentation. TRACE's management reviews the data integrity policy annually and it is revised as necessary. It is important for all TRACE employees to understand that while TRACE's goal is to provide the highest quality of data, there are instances where data may be partially deficient and still useful to the client. Employee concerns regarding data integrity may be brought to the attention of either the Laboratory Manager or the QA/QC Manager in confidence. All investigations of data integrity issues will be kept confidential until they are completed and fully documented. The Laboratory Manager monitors data integrity as part of routine data review. Management will document and notify clients immediately if any issues arise that may have impacted client data and management will ensure that any actions will comply within the agreed timeframe that is established at the time the corrective action report is drafted.

This manual is designed to assist both our clients and TRACE personnel in the production of high quality data, which is usable and defensible.

Ethics:

It is the policy of Trace to provide accurate and reliable data in accordance with client and regulatory requirements. It is against Trace policy to improperly manipulate or falsify data or to engage in any other unethical conduct.

Any employee who knowingly manipulates and/or falsifies data or documents, or engages in any unethical conduct is subject to immediate release from employment.

Employees will be informed of their data integrity and ethics responsibilities at the time of hire and annually thereafter. Employees will be required to sign an Ethics and Data Integrity Agreement stating that they understand the Ethics and Data Integrity Policy and their responsibilities as a TRACE employee.

For additional information, see Trace's Ethic and Data Integrity Policy, Document 10-I.

SECTION 2: Quality Policy Statement and Objectives

Quality Policy Statement:

TRACE is a full service, independent, commercial testing laboratory that is accredited in accordance with the National Environmental Laboratory Accreditation Program (NELAP), the Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), ISO/IEC 17025:2017, Drinking Water Certified by the State of Michigan, and is a registered Small Business with the SBA. This gives TRACE the ability to provide analytical services to residential, industrial, engineering, and consulting clients, as well as local, state, and federal agencies, including the Department of Defense. Our laboratory continually supports regulatory programs such as CERCLA/SARA, RCRA, Clean Air Act, Safe Drinking Water Act, NPDES and the Clean Water Act.

TRACE was established in 1989 to specialize in environmental testing, particularly the analysis of water, wastewater, soil, drinking water, air, and hazardous waste. TRACE management is committed to good professional practice and continual improvement while providing quality analytical testing to its clients.

Any sample collected by, or submitted to, Trace for analysis may have significant implications to the environment or the health and safety of individuals. The importance of this information is such that it may be considered as court evidence or as the basis for conducting environmental remediation.

Therefore, it is the objective of Trace to follow a strict QA Program to maintain the reliability and defensibility of all generated data. TRACE management is committed to ensuring compliance with the standards set forth by their accrediting bodies, including TNI (The NELAC Institute) Standard and the DoD Quality Systems Manual for Environmental Laboratories. This document is provided to serve as a framework for fulfilling that objective.

TRACE recognizes that a good QA Program is not static but must be revised as new ideas and procedures become available. Above all, this document must serve as a reference to our employees to describe quality procedures and practices that must be followed during day-to-day operations. Management continually works to ensure that all personnel understand the importance of their work and how it contributes overall to the quality objectives set forth by management.

This QA Manual is made available upon request. However, to maintain the dynamic nature of the QA Program at TRACE, portions of this manual may change without client notification.

Quality Objectives:

- Obtain and maintain certifications and accreditations to demonstrate laboratory competence and allow tests covered by these programs to be performed.

- Maintain an organization of qualified and trained personnel who are knowledgeable in and follow the procedures and policies stated in the QA Program.

- Maintain adequate facilities (site and instrumentation) to allow personnel to perform accurate and valid chemical tests in a safe environment, and take appropriate precautions when tests are performed at sites other than the permanent laboratory.

- Ensure that personnel are not influenced or pressured by internal or external entities to the point that it may affect the quality of their work.

- Obtain, maintain, and calibrate equipment and instrumentation required to accurately and efficiently carry out chemical tests as prescribed in test methods.

- Collect and receive samples under strict chain-of-custody procedures and adhere to proper sample collection and preservation techniques.

- Ensure that the client's confidential information and proprietary rights are protected during sample receipt, analysis, reporting, data storage, and sample disposal. For additional information on client confidentiality, see Trace's Client Confidentiality Policy, Document 10-K.

- Ensure that personnel are not involved in conflicts of interest or other activities that may diminish client confidence in our competence, impartiality, judgment or integrity.

- Purchase, use, or prepare appropriate reagents and standards. When possible these will be ACS grade, spectroquality, or traceable to NIST standards.

- Use, adapt, or develop "rugged" analytical methods. Whenever available, EPA, ASTM, AOAC, NIOSH, Standard Methods or other recognized and accepted methods will be used.

- Establish levels for quality of laboratory data (accuracy and precision) whenever these are not specified by the analytical methods or a regulatory body.

- Maintain clear, complete and accurate records of all laboratory data and issue accurate reports thereof to clients.

- Perform quality control checks on instruments, methods and analysts to rapidly detect errors and prevent recurrence of errors. This will be accomplished through use of standards, blanks, replicated and spiked samples to check accuracy, precision, and matrix effects.

- Corrective actions will be taken and documented whenever a process is outside of the specified control limits.

- Monitor competence of personnel and adequacy of the Quality Control (QC) Program through intra-laboratory and inter-laboratory efforts.

- Maintain a complete, up-to-date QA Manual that describes the QA Program in sufficient detail to ensure that all personnel have a clear understanding of their responsibilities within the QA Program.

- Make the QA Manual available and adhered to by all employees. The manual will be available to laboratory auditors and clients upon request.

- Ensure that laboratory practices are in agreement with the contents of the QA Program as stated in the manual.

- Audit the QA Program periodically to assure compliance. Audits will consist of system audits, data audits, and performance evaluation samples.

- When work is subcontracted to other laboratories, be responsible to the client for the subcontractor's work. Subcontract laboratories used for Department of Defense work must have an established and documented laboratory quality system that complies with DoD-ELAP requirements, and must get project-specific approval by the specific DoD Component before any samples are analyzed.

SECTION 3: Organization and Responsibilities of Quality Control Staff

Statement of Purpose:

It is the policy of management that the assurance of analytical quality is the responsibility of all TRACE employees. TRACE Management is committed to good professional practice and the quality of testing performed for our customers. We believe that the production of accurate analytical data is the most important service we can offer to our clients. To that end, the following job descriptions and associated responsibilities are included in the TRACE QA Program.

CEO-Owner:

The CEO is responsible for the overall management of the company and coordinating changes within the laboratory to comply with changing regulatory requirements. Key areas of responsibility are vision, values, corporate culture, company leadership, and financial management. These include assisting with budget development, cash flow management, tax planning, financial strategies and organization of overall financial functions and setting corporate goals. The CEO also works with staff to develop and maintain a strong professional image for the company with respect to its clients, competitors, employees, and the community.

Laboratory Manager:

The Laboratory Manager shall oversee all aspects of laboratory operations and must be experienced in the fields of accreditation for which the laboratory holds certification. The Laboratory Manager shall work with the QA/QC Manager to ensure that analysts and technicians follow current and appropriate regulatory requirements, methodologies, protocols, and compliance with the TNI Standard and the DoD QSM.

If the Laboratory Manager is absent for a period of time exceeding 15 consecutive calendar days he/she shall designate another full-time staff member meeting the qualifications of the Laboratory Manager to temporarily perform this function. If this absence exceeds 35 consecutive calendar days, the primary TNI accrediting authority and the DoD-ELAP accrediting authority must be notified in writing. TRACE requires that the Laboratory Manager possess a Bachelor’s degree and recommends that they have relevant laboratory experience.

QA/QC Manager:

The QA/QC Manager will make sure that all aspects of the program comply with current and appropriate regulatory requirements, methodologies, and protocols. The QA/QC Manager will coordinate and manage the QA Program on a daily basis. The QA/QC Manager must have functions independent from laboratory operations for which he/she has QA/QC oversight and must be able to evaluate the data objectively and perform assessments without outside influence. He/she shall ensure compliance with the TNI standard and the DoD QSM. The QA/QC Manager shall keep members of the quality assurance group informed on issues relating to the laboratory QA Program. The QA/QC Manager reports to the company CEO.

Laboratory management will appoint the Project Manager as the deputy QA/QC Manager in the absence of the QA/QC Manager, to perform this function, ensuring that the person appointed meets all of the requirements. If at any time the QA/QC Manager performs any analyses, the Project Manager will then perform the internal audit for those analyses. TRACE requires that the QA/QC Manager possess a Bachelor's degree, must have a general knowledge of the methods for which any data review is performed, and recommends that they have relevant experience.

Analysts and Technicians:

All analysts and technicians are responsible to prepare and analyze the required quality control samples. Upon completion of each test, the laboratory area managers will compare results to the quality control limits that have been established for that test. TRACE recommends that all technicians possess a high school diploma and that analysts have completed at least 2 years of higher education. The education and experience is also dependent upon the role within the laboratory and Trace will ensure that requirements set forth by all accrediting bodies will be adhered to.

The Laboratory Manager and QA/QC Manager will ensure that all analytical and operational activities of the laboratory are properly documented.

Sample Receiving Personnel:

Sample Receiving Personnel will assure that all samples are logged into the laboratory accurately and completely and will ensure that samples received at TRACE represent those indicated on the accompanying chain-of-custody. They will check all sample paperwork for accuracy, obtain required signatures, complete the log-in checklist, and make sure that samples and required analytical tests are properly identified. TRACE recommends that sample receiving personnel possess a high school diploma or equivalent.

Project Managers:

The Project Managers are responsible for client services. Their primary role is to work with clients to identify project needs and discuss results as needed. The Project Managers will double-check all sample paperwork for accuracy, required signatures, and completed log-in checklist(s), and will make sure that samples and required analytical tests are properly identified. The Project Managers are responsible for accurately obtaining this information, entering it into the Laboratory Information Management System (LIMS), and communicating client needs to the laboratory.

If a Project Manager is appointed deputy for the Laboratory Manager or the QA/QC Manager, Trace will ensure that they meet all of the requirements of that position and must be familiar with the functions of that position.

The Project Managers are responsible for promptly notifying clients, in writing, of any event that jeopardizes the integrity of data in any report, and documenting this in the project file. TRACE recommends that a Project Manager possess a Bachelor's degree.

SECTION 4: Quotation Review and Contract Review

Quotation Review:

Requests for quotation may be sent to the following address:

Request for Quotation
c/o Trace Analytical Laboratories, Inc.
2241 Black Creek Road
Muskegon, MI 49444-2673

Each request for quotation received by TRACE will be reviewed by one of, or a combination of the following:

- Sales Team
- Project Manager
- Laboratory Manager

The review will determine if the project is within the capabilities of TRACE and ensure that all requested requirements can be met. After reviewing the request for quotation, a written response for the requested quotation will be provided.

Contract Review:

Contracts for review should be sent to the attention of the Sales Team, Project Manager, or QA/QC Manager.

Each contract received by TRACE will be reviewed by the appropriate team of individuals. This review will be conducted to determine whether or not the contract differs from the original project quotation. Such a review will also be made to determine if the project is within the capabilities of TRACE and to ensure that all contractual requirements can be met. After reviewing the contract, any requirements differing from the original project quotation will be noted and discussed verbally or in writing with the client. Any changes to a contract will undergo the same review process as the original contract and the client will be notified.

Subcontract laboratories used for Department of Defense Environmental Restoration work must be DoD ELAP accredited, and must get project-specific approval by the specific DoD Component before any samples are analyzed.

Subcontract laboratories used for NELAP work must be NELAP accredited and comply with the TNI Standard, and must get project-specific approval by the client before any samples are analyzed.

A register of our subcontractors is currently maintained by our Invoicing Specialist. Prior to any NELAP or DoD work, a review of any subcontractors certifications will be performed.

SECTION 5: Document Control, Record Keeping, and Computers and Electronic Data Related Requirements

Data generated by TRACE could potentially be legal evidence. Therefore, it is imperative that integrity and confidentiality are maintained, including all records pertaining to national security concerns. All records will be permanent, complete and retrievable. To this end, all records will be written in ink. All changes will be accomplished by drawing a single line through the error, initialing, dating, and writing the correct information nearby. All records are maintained for a minimum of 10 years and can be retrieved by TRACE staff if the Project Manager is notified within that timeframe. Metals data will be retained for 12 years. In the event that the company transfers ownership or closes, all clients will be notified for further instructions on the maintenance of their records. All records will be retained for 10 years and in cooperation with the appropriate regulatory and state legal requirements, with the exception of metals data, which will be retained for 12 years. See SOP 10-18, Record Keeping and Data Security Procedures for additional information. If any documents are to be retained for knowledge or legal purposes, they are to be noted as such. Documents, logs, and records include the items listed in this section:

Quality Assurance Manual:

The QA/QC Manager is responsible for the preparation, maintenance, and updating of the QA Manual. The master copy of the QA Manual is maintained in the QA/QC Manager's office. Any changes will require the signatures of the Laboratory Manager, QA/QC Manager, and CEO-Owner. Changes in the QA Manual due to changes in the company's practices and procedures will be made to ensure that the contents of the QA Manual accurately reflect laboratory operations. The updated text will be noted in blue. Because the QA Manual is considered a controlled document, one hard copy is stored in the QA/QC Manager’s office, and the only other controlled copy is a pdf file which is available to all analysts on the company network.

Standard Operating Procedures:

Standard Operating Procedures (SOPs) are required for all analytical procedures, log-in and custody procedures, and corrective action protocols. Although detailed analytical methods are available from the EPA, ASTM, Standard Methods, and other sources, each laboratory is responsible for developing, writing and implementing its own procedures.

Each SOP is given a unique number, which is specific to an area of laboratory operations. SOPs are reviewed and updated on an annual basis. The updated text in each SOP is noted in blue. Because SOPs are considered a controlled document, they are only available on the company network as a pdf file. The employees utilizing the SOPs are required to sign off that they have read and understand the most current version of each SOP they use. Obsolete copies of SOPs are retained, but are removed from all points of use and are watermarked as “obsolete”.

SOPs are approved by the Laboratory Manager and QA/QC Manager.

Reports of Analysis:

Reports of analysis are generated electronically through our LIMS software as PDF documents that cannot be altered. Hard copies are not generated unless required by the client. All verbal results are considered preliminary and do not necessarily reflect appropriate review. If a change needs to be made to a client report after it has been issued, an amended version will be created and sent to the client. The amended report will be indicated as such with the reason for the amendment within the cover page of the report.

Reports are confidential client information. The content of reports and other client data will not be divulged except upon request of the client, subpoena, or during state certification inspections which make certain data reviewable under statute (*e.g.*, drinking water data).

If it becomes necessary to remove reports of analysis from the premises for legal proceedings, duplicates will be prepared and placed in the files pending return of the original documents for those clients requiring hard-copy reports.

Electronic reports are kept for a minimum of ten years, with the exception of metals in drinking water, which are retained for twelve years,.and then destroyed except for specific client requests, government consent orders, or other legal requirements of record retention.

Laboratory Logbooks:

Laboratory logbooks are kept in the individual laboratories. A separate logbook is used for each type of analysis. Each logbook contains the date of analysis, analyst's initials, batch ID, observations, and may also contain raw data, and calculations for that analysis. Completed logbooks are stored in the QA/QC Manager's Office. Retention policies are the same as for the reports of analysis. Logbooks, which are no longer referred to by the laboratory are removed to a locked storage location off site. Unused portions of logbooks are marked out with a line, dated, and initialed.

Laboratory Data Worksheets:

Benchsheets are used to summarize data for word processing and to record data and data qualifiers from tests that do not supply hard copy or electronic output. Worksheets may also have places for calculations, formulae, etc. All observations will be recorded in laboratory notebooks or worksheets. Completed worksheets are to be forwarded to the Laboratory Area Manager for report assembly and are stored with the reports of analysis. Retention policies are the same as for the reports of analysis.

Equipment Logbooks:

Equipment logbooks are kept to record instrument condition and maintenance experience. Logbooks will be kept by the instrument or in a nearby drawer or cabinet. Retention policies are the same as for the reports of analysis following the last entry or after disposal of the equipment.

Chain-of-Custody Documents:

Chain-of-custody (C-O-C) documents are used to record the source and transfer of samples between the client and TRACE. The completed C-O-C forms are retained with the copy of the report of analysis. Retention policies are the same as for the reports of analysis.

Hard-Copy Instrument Output:

Instrument output for the organics laboratory such as quantitation reports, spectra, and chromatograms are marked with the sample identity and forwarded with the analytical benchsheets for storage with the retained copy of the reports of analysis. Hard-copy output such as instrument calibration, instrument tuning, blank data, and batch quality control data is retained and filed by the analyst. Instrument output for the metals laboratory consists of multiple samples and clients per page. For this reason, output is retained and filed by the analyst. The instrument hard-copy output for the inorganic laboratory is forwarded with the analytical benchsheets when appropriate, while other output must be retained and filed by the analyst. Retention policies for instrument output are the same as for the reports of analysis.

Client Correspondence:

All client correspondence related to a specific job is recorded on the client correspondence log on the front of each file folder. Any facsimile or e-mail correspondence to a client is to be retained with the related project. Retention policies are the same as for the reports of analysis.

Sample Run Logbooks:

Sample run logbooks are utilized when all the pertinent information cannot be captured on the hard-copy instrument output. In these cases, the information must be recorded in a controlled logbook and every sample, standard and quality control check that is analyzed in a sequence is entered into a sample run logbook to document the date of analysis, the analyst’s name, batch information, dilutions made, and other pertinent information. Each laboratory has sample run logbooks designed specifically for the analytical method being used. For example, the GC/MS logbook for volatiles includes calibration and instrument tuning requirements as well as a column to enter analytical run times. Several inorganic logbooks include sections that show both the preparative and analytical steps.

The information from the sample run logbooks can be used to check compliance with analytical protocols and as a diagnostic tool for troubleshooting analytical problems. For example, checking the sample run log can be done to ensure that the compounds identified in a sample are not the result of contamination from a previous run.

Sample run logbooks are comb-bound with pages sequentially numbered. When a sample run logbook is completed it is given to the QA/QC Manager for storage.

Retention policies for these logbooks are the same as for the reports of analysis.

Standards:

Every standard, whether prepared for calibration or spiking, is either entered into a standards logbook or into LIMS. These contain all necessary information about the standard including stock standard number, concentration, date prepared, vendor and lot number, purity, expiration date, and storage area. The organic laboratory uses the following format for the standards logbook. The front side of each page contains all relevant information about the stock standards, while the backside contains information about the working standards.

Every stock standard made, whether it is a single compound or a mixture of compounds and/or stock standards, gets a new stock standard number. A new number is required every time a stock is made or combined, even when making up the same stock standard again, with the exception of those made daily where the lot number has not changed. The identification numbers are assigned in one of two ways. The first is alphanumeric, beginning with a prefix that describes the lab area and type of standard, followed by the logbook number and page number where the stock standard preparation information can be found, and ending in zero (when dilutions of the stock standard are made, the zero changes to 1, 2, 3, etc, as appropriate). Additional instructions are found on the inside of each logbook, where applicable. The other option is to have LIMS assign a unique number based on the year, month, and day, followed by a sequential number

Standards logbooks are comb-bound with pages sequentially numbered. Retention policies for these logbooks are the same as for the reports of analysis.

Data Validation Checklists:

Data validation checklists are provided for those clients who require them. Data validation checklists consist of two parts: Analyst Review and Manager Review. Upon completion of their analyses, the analyst will fill out the appropriate Analyst Review checklist, making sure to sign and date it.

The checklist is method specific but typically includes items such as verification that method blank QC criteria have been met; all quantitation is within the calibration curve or linear dynamic range limit; the Initial Calibration Verification (ICV) and Continuing Calibration Verifications (CCVs) have passed QC criteria; Laboratory Control Sample (LCS) data have been checked against QC criteria; and samples have been analyzed within holding time.

The Laboratory Area Manager will fill out a Manager Review checklist after an Analyst Review has been completed. The analytical method or specific analysis will be filled out at the top of the form and the checklist is signed and dated at the bottom. The Manager Review includes items such as verification that the analyses in the file matches request on the COC; qualitative and quantitative results have been checked; transcriptions are correct; quality control issues are explained on the benchsheet; and so on.

The data validation checklists are kept with the reports of analysis.

QA/QC Data:

The raw quality control data, which validates the sample results, are retained by the laboratory in a manner allowing for easy retrieval. The method of storage depends on the nature of the raw data. Some instruments integrate calibration data, QA/QC data and sample data together on a page so that separating one from another would require dividing the page itself. In this case, all the data, (QA/QC included) is filed by the analyst according to the method and the date of analysis. Other instruments give each standard or sample a printout of its own so that there are no shared pages. In this case, the QA/QC data that are associated with particular samples (*e.g.*, surrogate data from chromatograms or Matrix Spike/Matrix Spike Duplicate-MS/MSD data) are maintained in the client's project file from which the particular samples come. The other QA/QC data, which are associated with a complete batch or run of samples and not with any one sample in particular (*e.g.*, laboratory control sample data or calibration verification data) are filed by the analyst by date analyzed.

Program Compliance Records:

All records related to compliance with the State of Michigan, Department of Defense, National Environmental Laboratory Accreditation Program, or any other agency or organization will be made available to certifying, validating, or accrediting authorities.

Computers and Electronic Data Related Requirements:

The Laboratory Information Management System (LIMS) is manufactured by Promium, and the software program is titled Element. The LIMS is on the company network, which is password protected. In addition, access to the LIMS itself is password protected. Only authorized users can access the LIMS. The LIMS is able to monitor log-on failures and break-in attempts. System operating privileges are controlled by the LIMS administrator.

As the laboratory receives samples, they are entered into the LIMS and provided with a barcode label. The samples are then scanned, initiating an internal chain-of-custody, and released to the designated storage area or directly to an analyst. The analyst retrieves a sample from storage and scans it into his/her custody. The analysis is performed and the sample is scanned back to storage or to disposal.

The analyst builds an analytical batch, analyzes the samples and then posts the results with the associated quality control (as controlled by the batch rule) into LIMS. The Laboratory Area Manager then reviews the data before being released for reporting.

The LIMS automatically uses the user's name and password to identify any entries made by that person. The system is equipped with an audit trail function, which tracks changes to a database. The audit trail function records:

- The original data and the modified data
- The identity of the person who made the change
- The dates of the original and modified data

The LIMS database and all electronic data on the company network are continuously backed up to prevent the loss of data on a separate server that is co-located with an off-site service. All electronic data/instrument data not located on the company network is backed up once a month. This back up is stored on site in a fire resistant storage cabinet.

Instructions for the proper use of the LIMS are provided by Promium, and can be accessed through LIMS. To access instructions, an employee must first gain access to the company network using their network user name and password, and then gain access to the LIMS using their LIMS user name and password, which are assigned by the system administrator. Each user belongs to a 'user class' which allows/restricts their privileges within the LIMS. Examples are the ability to make changes to data once it has been saved and the ability to schedule work.

Once access to LIMS has been attained, the "Help" category is selected from the top drop down menus. This provides the user seven choices for help windows:

- Help Topics
- New User Tutorial
- Data Tool Tutorial
- Promium (Internet)
- SW-846 Methods (Internet)
- About Element
- Revision History

Help Topics:

Help Topics provides instructions on the LIMS in the following categories:

- Introduction
- Quick Start
- File/Login
- Print
- Sample Control
- Laboratory
- Project Management
- QA Admin
- Database Admin
- Help
- Index

Specific instructions in the above categories can be accessed by:

- Clicking on the Chapter in the Contents drop-down
- Clicking on the specific topic in the Index drop-down
- Using the Search drop-down

New User Tutorial:

The New User Tutorial is a pdf version of the Element DataSystem Tutorial. This is a step-by-step introduction to Element, and is an excellent resource for the first time user.

DataTool^{TM} Tutorial:

DataTool^{TM} allows electronic data entry form the analytical instrument to the Element DataSystem^{TM} database. DataTool^{TM} Tutorial takes the user step-by-step through the data transfer operation.

Promium (Internet):

The Promium (Internet) is a link to the Promium Web site.

SW-846 Methods (Internet):

The SW-846 Methods (Internet) is a link to the Environmental Protection Agency SW-846 Analytical Methods.

About Element:

About Element provides software system information.

Revision History:

Revision History provides revision information on the current and previous revisions.

Electronic Signatures:

All electronic signatures carry the same weight as written signatures because of the use of unique login information. All entry and review in LIMS is considered signed due to the use of an employee's unique login. For this reason, all employees must logout of all programs or applications they are not using. Any programs with audit trail capability must have that feature enabled at all times.

LIMS Updates;

Any updates to LIMS software that will adversely affect customer electronic data will be communicated to all impacted clients by the Project Manager in writing via email prior to the change.

SECTION 6: Control of Supplies

In order to ensure that purchased supplies, reagents, and consumables comply with method specifications or requirements, these materials are specified for purchase by an analyst responsible for knowing the method requirements. When the items are received, the purchasing agent verifies the packing slip against the items received, and against the order to ensure what was received is what was ordered. The purchasing agent then signs and dates the packing slip.

Reagent Grade Chemical, Acids and Reagents:

Chemical reagents, solvents, gases, etc. are available in many grades of purity. In order to produce high quality, reproducible data, it is necessary to obtain materials of the appropriate quality required for the analyses to be performed. It is also important to ensure that the quality of reagents used for specific procedures is consistent over time.

It is the policy of TRACE to use only reagent grade, ACS grade, or better quality materials for the preparation of analytical standards and reagents. Where necessary, TRACE will order and utilize chemicals, acids, and reagents that have been assayed for purity.

Labels on all material will be inspected upon receipt to determine whether the reagent quality meets the specifications for the analytical method and to determine whether the material has adequate shelf life.

High Purity Solvents:

Solvents used for gas chromatography, high performance liquid chromatography and mass spectrometry are of the highest purity available, HPLC or Pesticide Residue grade. It is also the policy of TRACE to frequently run a solvent blank during an analysis sequence. The use of such blanks is beneficial to detect the presence of trace impurities, which may have been introduced from the solvents. Solvent blanks are normally run once a day, or more often as interference or suspect samples dictate.

Purchased Analytical Standards:

It is often beneficial to purchase analytical reference standards at prepared concentrations. TRACE purchases such standards for atomic absorption, ICP spectroscopy, HPLC, gas chromatography, wet chemistry, and mass spectrometry. Records are maintained which document the composition and purity of purchased standards. The following sources have been found to provide analytical standards of acceptable quality.

Metals Analysis: Atomic Absorption and ICP and ICP-MS Standards:

Standards are purchased from Fisher, Accustandard, Inorganic Ventures, SPEX Industries, Inc. and other suppliers.

HPLC, Gas Chromatography and Mass Spectroscopy Standards:

Standards are purchased from Supelco Chromatography Supplies, Accustandard, NSI, Ultra Scientific or Absolute Standards.

Wet Chemistry:

Standards are purchased from Fisher, Accustandard, or Hach Chemicals.

Microbiological Analysis:

Media purchased from vendors will be of a quality that is acceptable under the guidelines of the EPA approved drinking water certification program administered by the State of Michigan. Dilution water is DI water that is nutrient enriched and sterilized at 15 psi for 30 minutes.

Storage of Reagents:

Reagents, standards and solvents will always be stored in accordance with manufacturer's instructions. Incompatible materials, *e.g.*, organics and peroxides or perchlorates, will not be stored together. Acids and bases will be stored in appropriate cabinets. Flammable materials will be stored in flammable solvent storage cabinets.

Deionized Water:

The reagent used in the largest quantity in the laboratory is deionized water. Deionized water at TRACE is used by all of the laboratories and the field-sampling department. The water is prepared using deionization following reverse osmosis. The ion exchange tanks are supplied by Kohley's Eco-Water Systems and are located in the back storage area.

Deionized water is tested monthly for conductivity, heterotrophic plate count, and residual chlorine. The deionized water is continually monitored for resistivity and the deionization cartridges are changed when the conductivity is > 0.056 μmho/cm. Deionized water is checked annually for bacteriological suitability and for Lead, Cadmium, Chromium, Copper, Nickel, and Zinc.

SECTION 7: Equipment Calibration and Maintenance

Equipment Calibration and Maintenance:

To provide high quality data, it is essential that all laboratory and field equipment be in satisfactory operating condition. (For a list of major equipment, see Appendix IV) To this end, TRACE performs routine equipment calibration and maintenance. This includes the following:

Gas Chromatographs:

Analysis done by gas chromatography will follow SW-846 protocols except in those cases where 40 CFR Part 136 methods or drinking water methods are warranted. The instrument will be calibrated using a minimum of a five-point calibration curves for all analytes. Continuing calibrations utilizing a midpoint standard are performed after every ten samples to check the validity of the multi-point curve. The value of the continuing calibration standard must agree within plus or minus 15% of the initial value or appropriate corrective action is taken, which may include recalibrating the instrument. The calibration standards are commercially available certified standards and are spiked with internal standards. All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained. Reference standards are used for no other purpose other than instrument calibration and calibration verification.

Gas Chromatographs/Mass Spectrometers:

Prior to calibration, the instruments used for gas chromatography/mass spectrometry (GC/MS) analyses are hardware tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. The instrument tune will be verified every twelve hours of operation.

Once the tuning criteria for these reference compounds are met, the instrument is initially calibrated using a minimum of a five-point calibration curve. Continuing calibration is verified as specified in the method being used. Under SW-846 protocols, the Continuing Calibration Compounds (CCCs) and System Performance Check Compounds (SPCCs) are checked every twelve hours. Under 40 CFR Part 136 protocols, the continuing calibration is checked daily. The calibration standards are commercially available certified standards and are spiked with internal standards.

All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained. Reference standards are used for no other purpose other than instrument calibration and calibration verification.

Analytical and Top-Loading Balances:

The analytical and top-loading balances are checked for proper leveling at the beginning of each day. The accuracy of the calibration is then checked according to SOP 10-9, Daily Balance Calibrations. All calibrations are recorded in the Daily Balance Calibration Logbook.

The calibration weights are externally calibrated every 5 years against reference mass standards that are directly traceable to the NIST. The calibration weights are used for no other purpose other than to verify the calibration of the balances.

The balances are also maintained and calibrated annually by an outside firm. Calibration labels are placed on each balance during the annual inspection.

pH Meter Calibration:

The pH meters are calibrated against two (2) reference standards prior to each use. A third reference standard is analyzed to verify the accuracy of the calibration. All calibrations are recorded in the pH logbook.

Incubators:

The temperatures of the laboratory incubators are checked twice daily. Bacteriological incubators are maintained at 35 ± 0.5 ºC and BOD incubators are maintained at 20 ± 1ºC. All temperatures are recorded in the incubator temperature logbook.

Refrigeration Units:

The temperature of each walk-in cooler, refrigerator and freezer is checked at the beginning of each day. The coolers and refrigerators are maintained at 0 to 6 ºC, freezers are maintained at -10 to -20 ºC. All temperatures are recorded in the refrigerator/freezer temperature logbooks.

Atomic Absorption and Atomic Fluorescence Spectrophotometers:

TRACE employs an Atomic Absorption (AA) spectrophotometer using cold vapor (for mercury analysis) and an Atomic Fluorescence Spectrometer (for low-level mercury). These are calibrated daily with a blank and at least the number of standards required by the protocol of the method being applied. First-order regression is used to generate a calibration equation for the AA, which computes analyte concentration as a function of absorbance. Relative response factor is used to generate the calibration for the AFS. Initial and continuing calibration checks are analyzed to verify the validity of the curve.

The instrument operator responds to the failure of a calibration check by investigating and addressing any problem as necessary and recalibrating, thus assuring that all data is generated with a valid calibration curve.

All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained.

Inductively Coupled Plasma (ICP) Atomic Emission Spectrophotometers:

The ICP atomic emission spectrophotometer is calibrated daily with a blank and standard, unless client protocols call for a different procedure (*i.e*. the USACE requires the use of a blank and three standards.) One concentration is measured as a function of the intensity of light emitted by the element of interest at whatever discreet wavelength is being monitored. The calibration is verified by initial and continuing calibration checks and spectral interference checks. The instrument operator responds to the failure of a calibration check by investigating and addressing any problem as necessary and recalibrating, thus assuring that all data is generated with a valid calibration curve. The failure of a spectral interference check is remedied by monitoring a different wavelength free from interference or by adjusting background correction points.

All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained.

Inductively Coupled Plasma Mass Spectrometer (ICP-MS):

Calibration of the ICP-MS consists of a calibration curve that has one blank and a minimum of three calibration standards. Calibration is done on a daily basis for each element that is to be analyzed. Additionally, during the analysis of environmental samples an Initial Calibration Verification (ICV) and an Initial Calibration Blank (ICB) are run to verify calibration of the instrument. A Continuing Calibration Verification (CCV) is also run after every 10 samples along with a Continuing Calibration Blank (CCB).

A Linear Dynamic Range (LDR) is determined at least once a year or more often if the analyst believes that the response of the instrument has changed due to a change in instrument hardware or in instrument operating conditions. The LDR is determined by calibrating the instrument for the analyte of interest, and then analyzing successively higher standards in excess of the calibration standard concentration. The highest standard that can be analyzed which also has a recovery of 90% or greater is defined as the LDR limit. Sample concentrations that exceed 90% of the LDR limit must be diluted and reanalyzed.

All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained.

Lachat QuikChem ® 8500:

The Lachat QuikChem® 8500 is calibrated with a blank and five to nine standards, depending on the analyte that is being analyzed. A standard curve is prepared by plotting instrument response against the concentration values. Continuing calibration is checked by running a mid-range standard every ten samples.

All standard solutions are traceable to NIST or other reliable standards and certificates of analysis for these standards are maintained.

UV/VIS Spectrophotometers:

Calibrations for the Milton Roy Spectronic 21 spectrophotometer and the Spectronic Instruments Spectronic Genesys 5 spectrophotometer in the Wet Chemistry Laboratory are verified annually. This can be done either using cell standards or with potassium dichromate standards.

Laboratory Thermometers:

All laboratory thermometers will be checked for calibration upon initial usage. All liquid-in-glass thermometers are calibrated annually thereafter against the NIST thermometer and digital thermometers are calibrated on a quarterly basis. The calibration check will be recorded in the thermometer logbook and on a calibration label on each thermometer. The Thermometer Calibration Certificate is maintained in the QA/QC Manager’s office. The NIST thermometer is used for no other purpose other than to calibrate laboratory thermometers and is calibrated by a certified calibration company every 5 years.

Preventative Maintenance and Preventative Action:

As part of the QA/QC program, a routine preventative maintenance program is conducted by TRACE to minimize the occurrence of instrument failure and other system malfunctions. TRACE staff performs preventative maintenance and repairs, or coordinates with a vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular basis and is documented in the laboratory equipment logbook for each instrument. Emergency repair or scheduled manufacturer’s maintenance is provided by factory or vendor representatives. For many of the instruments, a supply of spare parts is kept on hand to expedite repairs.

Equipment or instrumentation that has been damaged, gives suspect results, or is otherwise considered defective is taken out of service, identified as defective, and when possible removed from the area of use. In addition, the effect that the damage or defect may have had on previous analyses is investigated, as appropriate. In addition, if instrumentation or equipment is functional, but not in use, it should be labeled as such.

TRACE employs the use of preventative actions as a proactive approach for improvements and prevention of nonconformities. When a potential nonconformity is identified, an action plan is implemented and evaluated for effectiveness. Refer to SOP 10-29.

Glassware:

Volumetric glassware used in the laboratory must be of “Class A” tolerances. Graduated cylinders and pipettes will be checked by the laboratory before being placed into service to make sure their tolerances are within the limits specified by the manufacturer. This check will be conducted by weighing the glassware on an analytical or top loading balance, filling the piece of glassware to the highest calibration mark with deionized water, and then weighing again on the balance. Ten measurements are made, and the precision and accuracy must meet the appropriate agency’s requirements.

All glassware will be rinsed by the analyst after its use and before being placed in the glassware washing areas. There should be a double rinse with the last solvent contained by that piece of glassware. Glassware containing chemicals, reagents, or samples will not be left so that these materials become dried onto the surface.

Glassware is cleaned using Liquinox and/or Detergent 8 when washed by hand. Glassware washed using the laboratory dishwasher is cleaned using Alconox Tergajet and NeoDisher Z. Glassware is inspected prior to use. If it is not clean, it is not used. Glassware that cannot be cleaned is discarded to prevent possible contamination during sample analysis.

Volumetric Dispensing Devices (mechanical pipettes)

Mechanical pipettes are checked for precision and accuracy initially with ten replicate measurements of water, and daily thereafter with three replicate measurements of water, calculating the volume of each, and determining standard deviation and percent accuracy. The relative standard deviation must be $\leq$ 1 and accuracy must be +/- 2% of the nominal volume.

Auto-pipettes that do not meet the requirements stated above are removed from service and cleaned, repaired or discarded.

SECTION 8: Sample Collection

Monitoring Well Sampling:

All monitoring well samples will be collected according to EPA guidelines (EPA Report No. 600/4-82-029, The Handbook for Sampling and Sample Preservation of Water and Wastewater and USEPA Ground Water Issue Document EPA/540/S-95/504, April 1996, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures.). Submersible sampling pumps, deep well jet pumps, or hand bailers will be used as necessary; however, no sample will be collected until the monitoring well has been evacuated to five (5) times the volume of water that is standing in the casing or when stabilization readings indicate a stable aquifer.

Composite Wastewater Sampling:

All composite wastewater samples will be collected according to EPA guidelines (EPA Report No. 600/4-82-029, The Handbook for Sampling and Sample Preservation of Water and Wastewater). Automatic interval sampling devices will be used where allowable.

Drum Sampling:

Drum samples are obtained by the use of a coliwassa sampler or other type of drum thief, which retrieves a cross-section of the entire drum.

Wipe Sampling:

Wipe samples are recommended for non-porous surfaces only. The area to be sampled is marked by the use of a disposal template, usually at least 100 square centimeters in area. The area within the template is wiped with a 2 by 2-inch sterile gauze pad or a piece of filter paper moistened with the appropriate reagent.

PCB Wipe Sampling:

To sample and test for PCBs, a gauze pad is moistened with hexane, wiped across the proposed area, then placed in a 4-oz. glass container with a Teflon-lined lid. The bottle is then labeled completely with the client sample ID, and the time and date of the sampling event. Nitrile gloves are used to hold the gauze during sampling and are disposed of after each sample to avoid cross-contamination.

Metals Wipe Sampling:

Wipe sampling to test for metals follows the same procedures as above except using a pre-moistened Ghost Wipe.

Sampling for Low Level Metals Analysis

Sampling for Low Level metals analysis is performed according to the guidelines set forth in US EPA Method 1669: *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria*. This method requires the use of techniques designed to prevent contamination of samples by environmental factors, field technicians and other sources of contamination.

SECTION 9: Sample Receipt and Storage

How samples are delivered to TRACE

Samples can be delivered to the laboratory in several ways:

Client drop off:

Clients may drop off samples at the laboratory between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday. Holiday and Saturday deliveries are available if special arrangements have been made with the Project Manager.

Upon sample delivery, the client will be requested to initiate a TRACE Chain-of-Custody (COC) record. The sample receiving department will document the apparent condition of samples on the COC record (e.g., whether samples were refrigerated upon receipt, contained headspace, etc.) and complete the sample login checklist.

Samples should be kept on ice from the time sampled to delivery to the laboratory. Proper and full documentation is required, including the information found in the "Chain-of-Custody Documentation" section of this manual.

Commercial Delivery Service:

Samples may be sent to the laboratory by commercial carrier. It is important that the proper precautions are taken when sending via commercial delivery service:

- Sample temperatures must be kept between just above 0 and 6 ºC.
- Make sure that coolers do not leak.
- Make sure that samples are shipped with the correct documentation and packaging, so that US DOT (US Department of Transportation), and the USDA (US Department of Agriculture) rules and regulations governing sample shipments are met.
- Call TRACE Analytical before shipping of any samples for Saturday or holiday delivery.

The sample receiving department will document the apparent condition of samples on the COC record (*e.g*., whether samples were refrigerated upon receipt, contained headspace, etc.) and complete the sample login checklist.

TRACE Analytical Laboratories, Inc., Courier Service:

TRACE is able to provide sample courier service to its clients. It is the courier's responsibility to collect all the pertinent paperwork from the client so that sample IDs, analyses requested, and sample preservation information will be readily apparent to laboratory personnel. The courier, upon return to the laboratory, will complete the COC record to document the transfer of the samples.

The sample receiving department will document the apparent condition of samples on the COC record (*e.g*., whether samples were refrigerated upon receipt, contained headspace, etc.) and complete the sample login checklist.

TRACE Analytical Laboratories, Inc., Field Sampling Department:

It is the responsibility of the Field Sampling Department to properly label samples when collected and to initiate COC records. Samples are to be placed in coolers packed with ice in order to bring the temperature to between just above 0 and 6º C as rapidly as possible.

Samples are to be kept on ice until delivery to the laboratory. Sample delivery should be accomplished as soon as possible.

Sample labels will contain the sample type, client name, site, sample identification, date and time of collection, preservatives used, test to be performed, and the name or initials of the person collecting the sample. This information must also be recorded on the COC.

Upon delivery of samples to the laboratory, the field sampler transfers custody of the samples to the sample receiving department by completing the COC.

The sample receiving department will document the apparent condition of samples on the COC record (*e.g.*, whether samples were refrigerated upon receipt, contained headspace, etc.) and complete the sample login checklist.

Sample Receiving by TRACE Analytical Laboratories, Inc.:

All samples received will be processed by the following procedures:

Chain-of-Custody Documentation:

The client or TRACE personnel will fill out a COC record for all samples submitted to the laboratory. A copy of the completed COC record will be given to the client while the original form will be placed in the client's project folder. The following information will be provided on the form:

- Sample identification names or numbers (*e.g.*, Well #1)
- Date and time of sample collection and analyses required for each sample
- Name of individual collecting samples and name of client submitting samples
- Address of client/telephone number/fax number/email address
- Client project number, where applicable
- TRACE quote number and/or client purchase order number
- Signature of individual delivering samples to the laboratory
- Signatures of any other individuals who took charge of the samples either during collection, transportation, or storage
- Date and time of delivery to the laboratory, signature of laboratory personnel accepting samples
- TRACE identification number
- Matrix and number of containers per sample
- Preservation and sample pH (where appropriate) and confirmation of field filtration
- Turnaround time requested

Sample Login Checklist:

All coolers and samples will be checked using the Sample Login Checklist, DOC 70-A. Each cooler must have its own checklist. The following information is documented on this checklist:

Shipping Information

- Date received
- Client Name
- Project Number
- TRACE personnel who logged in the submittal
- Package Description
- Bill of lading or tracking number
- Use of custody seals

Coolant and Temperature documentation

- The type of coolant used
- Date and time the cooler temperature is taken.
- Temperatures of temperature blank (if applicable)
- Sample temperature range

Method(s) of delivery

- TRACE personnel
- Client drop off
- Commercial courier

Chain-of-Custody documentation

- Sample condition
- Appropriate paper work present
- Special notations if needed

Methanol Preserved Soil Samples:

Soil samples that are to be analyzed for Volatile Organic Compounds (VOCs) and are field preserved with methanol should be recorded on the Field Worksheet for Methanol Preserved Soils. This document must be sent to the laboratory.

For Methanol preserved samples that are shipped to TRACE:

The U.S. Department of Transportation, Title 49 of the Code of Federal Regulations regulates the shipping of methanol. The DOT number for methanol is: **UN 1230**. The amount of methanol used in sample preservation falls under the exemption for small quantities. The following requirements must be observed when shipping methanol preserved samples:

- The maximum amount of methanol per sample vial is to be no greater than 30 mls.
- The sample container cannot be completely filled with methanol.
- Each cooler may have no more than 500 mls of methanol
- Each cooler must be identified as containing less than 500 mls of methanol
- Each cooler must have a total weight of less than 64 pounds

Violations of the items listed above can result in fines or other punitive measures by the US Department of Transportation.

TRACE Identification Numbers:

Each new project will be assigned a TRACE project number upon entry into the Laboratory Information Management System (LIMS). This number will be entered on the client project folder, raw data sheets, COC record, and on the individual sample bottle labels

Each individual sample container will be given its own TRACE identification number. This is described in Trace SOP 70-2.

Quality Control Check of Sample Receiving:

Each set of samples and the corresponding COC and sample login checklist is double-checked by a second person to confirm that the login procedure is accurate. The second person will initial the COC.

A new file folder will be obtained for each project and the following information will be recorded on the tab:

- Client name
- TRACE identification number

File folders may be color coded to identify specific project types or turnaround times.

The TRACE identification number will be recorded on the COC and entered into the LIMS system. It will be verified that the appropriate TRACE identification numbers have been recorded on the individual sample bottle labels and that all temperature-sensitive samples have been placed in the refrigerated storage room. All samples requiring volatile organic analysis are to be placed in segregated refrigerated storage.

Sample Custody, Security, Disposal and Subcontracted analysis:

Sample Custody:

It is important to minimize the number of people who physically handle samples in order to simplify record keeping. The traceability of sample custody is of vital importance for samples analyzed by TRACE Analytical Laboratories, Inc. According to the USEPA Contract Laboratory Program, Statement of Work, a sample is in your custody if:

- It is in your possession, or
- It is in your view after being in your possession, or
- It was in your possession and you locked it up, or
- It is in a designated secure area. (Secure areas shall be accessible only to authorized personnel)

All samples received by TRACE are maintained under custody at all times.

Sample Security:

All samples are stored in the laboratory, which is designated as a secure area. Security is maintained by locking all exterior entries into the laboratory and with keypad locks on all interior entryways.

No unauthorized personnel are allowed in the secure area unless escorted by authorized personnel. All non-TRACE employees are required to use the sign-in logbook (located in the lobby area) when entering and leaving the secured areas of the building.

Public areas at TRACE are designated as the front office areas, sample receiving and connecting hallways. These areas are accessible only during normal business hours.

Sample Disposal:

Samples are kept for a minimum of (30) days after the final report for a project has been released. If samples are to be retained by TRACE for a longer period of time, then the client must indicate this when a project is initiated.

TRACE, in the disposal of samples, maintains documentation of disposal in LIMS. Manifests for the disposal of hazardous waste samples are maintained as well. At no time is client confidentiality to be compromised when samples are disposed.

Control of subcontracted analyses:

TRACE will occasionally utilize other laboratories for conducting specific analyses. These laboratories are selected on the basis of their ability to meet certain subcontract requirements, applicable certifications, establishment of a formal QA/QC program, and data integrity reputation.

Trace will inform clients when analyses are subcontracted to another laboratory. Trace will ensure that the subcontracted laboratory has any validations/certifications required by the client. Transfer of samples to a subcontract laboratory will be performed under a chain-of-custody. This information will be filed in the project file.

Trace is responsible to the client for the quality and timeliness of subcontracted work.

SECTION 10: Sample Container and Preservation

Sample Containers:

When collecting samples, the proper containers should be used to ship samples to the laboratory. Some environmental contaminates can interact with certain materials and compromise sample integrity. Data quality could be affected as well. In addition, the proper amount of sample needs to be collected in order to ensure that analyses can be performed correctly. Tables in Appendix II list the proper containers and sample amounts needed for analysis.

Sample Preservation:

Proper sample preservation is critical to maintaining sample integrity. Preservation should not be overlooked when collecting environmental samples. Samples that are not properly preserved will have data that are qualified. The tables in Appendix II give the proper preservation techniques for environmental analyses.

SECTION 11: Analytical Methods and Standard Operating Procedures

Analytical Methods:

When properly used, analytical methods should provide reliable information about the composition and nature of the sample being tested. In order for this information to be of value, the methods used should:

- Give evidence of the presence of the analyte
- Be able to separate the analyte from any interferences
- Be consistent with the level of analyte expected
- Be consistent with the sample matrix
- Have the required accuracy and precision
- Have the required lower limit of detection
- Be "rugged", *i.e.*, not sensitive to minor changes in variables, analysts, or laboratory
- Meet the regulatory requirements pertaining to the sample

Sources of Analytical Methods:

The methods used at TRACE are for the purpose of evaluating samples to determine their environmental significance, their potential impact on the health and well-being of individuals, or the operability or condition of equipment or a process. All of these purposes have the potential for significant economic or legal impact. Therefore, it is important to select published methods that have been widely tested, used and accepted. Wherever possible, the methods should be "standard" methods, *i.e.*, methods promulgated by a regulatory agency or other scientifically recognized organizations.

A list of the primary sources used for obtaining analytical methods employed at TRACE can be found in Appendix III.

A list of the methods and Standard Operating Procedures (SOP's) used in the analysis of drinking water can be found in Appendix III.

Standard Operating Procedures:

TRACE develops in-house SOP's using the published methods as a reference. SOP's provide the analysts with detailed instruction on safety, sample preparation, analysis, quality control, and reporting. Any deviation from a SOP must first be approved by the Laboratory Area Manager and the QA/QC Manager.

SECTION 12: Data Validation, Reporting and Client Feedback

Routine Procedures for Data Validation:

All analytical data is thoroughly reviewed prior to report generation. The data review includes checks on data generation and reduction, and is performed as a three level review.

Level 1: Analyst Review

Level 1 is a technical data review performed by the analyst according to a prescribed set of guidelines. The review is designed to ensure the following:

- The sample preparation and analysis information are correct and complete
- The appropriate SOP's were followed
- The QC samples and blanks were analyzed and results are within established control limits
- The documentation is complete and any qualifications are recorded

Level 2: Technical Review

Level 2 is a technical review performed by the appropriate Laboratory Area Manager according to a prescribed set of guidelines. The review is designed to ensure the following:

- The appropriate SOP's were followed
- Calibration data is accurate and appropriate
- QC sample results are within established guidelines
- Qualitative identifications and quantitative results are correct
- Documentation is complete and the data is ready for incorporation into the final report

Level 3: Administrative Data Review

Level 3 is an administrative data review, which can be performed by the QA/QC Manager or the Laboratory Manager. The Level 3 review provides an overview of the entire data package. The review is designed to ensure the following:

- The completion and documentation of the Level 1 and 2 data reviews
- The performance of a primary proof reading by administrative support staff and a secondary proof reading by managerial staff of the compiled results
- Assurance that all qualifications and narrations are included in the compiled reports and are correct
- The data package is complete and ready for submittal to the client

Department of Defense Data Package Reviews:

The Quality Manager will review at least 10% of all Department of Defense data packages for technical completeness, accuracy, and DoD-QSM compliance. This review is part of the oversight program and does not have to be completed in “real time”.

Validation Checks:

In the event of client or regulatory question of data, the following validation checks may be made:

- Method - check to be sure the method was appropriate and performed properly
- Calculations - check all calculations for data in question
- Standards and Titrants - check to determine if expiration dates were exceeded or standards were contaminated or prepared improperly
- Instruments - check instrument function and calibration data
- Transcription Error – check data for errors, dilution factors, etc.

Repeat Analysis - if the above investigation identifies any problems or fails to confirm the data, it may be necessary to repeat the analysis in question.

Data Reporting:

Specific data reporting responsibilities for analysts are provided in the SOP’s.

For drinking water samples, all positive microbiological samples are reported immediately to the Project Manager and they are responsible for notifying the client within 24 hours of any positive samples. MCL violations are all noted in bold on the client report.

For reports that are not generated through the LIMS, the analyst’s bench sheets and raw data are reviewed by the Laboratory Area Manager and released to reporting.

For LIMS reports, the Laboratory Area Manager performs a batch review of the data in LIMS and the Project Manager, with assistance from administrative assistants, performs a work order review of the data before it is released to reporting.

After issuance of a report, the report must remain unchanged. If it is necessary to make changes to a report after it has been issued, it must be done so in the form of a further document, which is identified as a supplement to the original report.

Client Feedback:

TRACE actively seeks customer feedback in the form of client surveys, but any form of client feedback is addressed, however received. This is useful for TRACE’s management to better understand our clients’ needs and concerns and to make improvements to our overall operation. All customer correspondence with regard to complaints should be handled by the Project Manager using the procedure outlined in DOC-12. When necessary, these individuals can consult with the Laboratory Manager, Laboratory Area Managers, or QA/QC Manager to resolve and document complaints through the use of a non-conformance memo or other appropriate means. All correspondence must be documented on the client correspondence log or in the project file. Refer to section 14 for feedback on non-conforming work.

SECTION 13: Quality Control

There are a number of quality control tools employed by TRACE, in order to ensure that data are of satisfactory quality and within prescribed requirements for accuracy and precision. These tools and the minimum frequency of use are described below.

Blanks:

Blanks are artificial samples that are used to determine whether there has been contamination of samples, equipment or reagents. Analysis of a minimum of one blank sample per batch is required. There are several types of blank samples that may be analyzed. The types of blank samples to be employed for a particular project or analytical method may vary.

Field Blanks:

A sample of reagent water or sampling medium (*e.g.*, filter or absorption tube) that has been taken to the sampling site and exposed to the ambient air without exposing the material to sampling conditions. These samples will be used to determine the amount of background contamination that could arise from the sample being collected at the particular site.

Trip Blanks:

A sample of reagent water that accompanies a sampling crew to the sampling site and is carried back unopened to the laboratory under the same storage conditions as the actual samples. The purpose of these samples is to assess the potential for cross-contamination of volatile organics during sample shipment. A minimum of one trip blank per sampling event or per cooler is required by TRACE. Clients are encouraged to submit trip blanks as well.

Refrigeration Blanks:

A sample of reagent water or sampling medium (*e.g.*, filter or absorption tube, etc.) that is used to determine if there has been contamination of a cooler or refrigeration unit. These samples will be used to determine the amount of cross contamination that could arise from the samples being collected at the particular site.

Temperature Blanks:

Reagent water or other medium that is used to determine if the samples are being kept at the proper temperature during shipment.

Rinsate or Equipment Blanks:

A sample of clean water or solvent that is used to rinse equipment before or between samples to determine the potential for contamination from sampling equipment. The number of rinsate blanks to be submitted should be determined by the sampling crew based upon potential for cross-contamination at the site and whether disposable sampling equipment is being used, *i.e.*, no reuse of sampling equipment.

Reagent or Method Blanks:

A sample of reagent water or analytical medium (buffers, solvents, water with preservatives added, etc.) that is carried through the entire analytical process including sample preparation (extraction, digestion) and analysis. Frequency of these samples is a minimum of one per twenty or one per batch, whichever is more frequent.

Instrument Blanks:

A sample of reagent water or solvent that is analyzed between samples to assess the potential for cross-contamination in an analytical instrument or procedure. This sample is not carried through the sample preparation portion of the analytical method. The frequency of analysis of instrument blanks is variable and will be best determined by the analyst. For example, if a highly contaminated sample has been analyzed, instrument blanks will be analyzed until the analytical equipment fails to show any evidence of contamination. If a large number of samples that have no detectable contamination are analyzed, the necessity for instrument blanks is greatly reduced.

Spiked Samples:

Spiked samples are samples to which a known quantity of reagent or analyte has been added. Spiked samples are then analyzed to determine the performance of a method or analyst, or the stability of an analyte in the sample matrix. There are several types of spiked samples. These are usually analyzed at a minimum frequency of one spike per twenty samples or one per batch.

Laboratory Control Samples (BS):

Samples prepared by adding a known amount of analyte(s) to deionized reagent water, which are carried though the entire analytical procedure to assess the precision and accuracy of the procedure independent of sample matrix influence. Laboratory Control Samples (BS’s) will be run with every batch of samples. Results will be within calculated control limits or those specified in the method.

Matrix Spike and Matrix Spike Duplicates (MS/MSD):

Samples that have a separate aliquot spiked with a predetermined quantity of analyte(s). The results of the MS/MSD's are used to assess the precision and accuracy of the analytical procedure when analyzing real world matrices. Results will be within calculated control limits or those specified in the method.

Duplicate Samples:

Samples are analyzed in duplicate to verify the precision of the analytical procedure.

Duplicates:

One sample prepared and analyzed twice in the laboratory. Duplicate analytical results are utilized to assess the precision of the analytical procedure.

Field Duplicates:

Replicate samples collected in the field or duplicate samples submitted by a client. These samples are analyzed and the results compared to assess the precision of the entire sampling and analytical process. Duplicate analysis of one sample in the laboratory only tests the precision of the analytical procedure.

Surrogates:

Surrogate compounds are materials not usually expected to be found in environmental samples but are expected to behave similarly to an analyte of interest in the analytical process. Surrogates are often isotopic forms of environmentally significant materials.

These materials are added to a sample aliquot and carried through sample preparation and analysis. A satisfactory recovery of these materials demonstrates that the analytical process is in control.

Surrogate recoveries are calculated as follows:

$$SurrogateRecovery(\%) = \left(\frac{amount\ found}{amount\, spiked} \right) x100\,\%$$

Surrogates are added to all quantitative organic analyses.

Calibration:

All equipment, methods and procedures are to be calibrated prior to conducting analyses.

Calibration Standard:

A standard containing a known quantity of an analyte, which is used in conjunction with standards of other concentrations to determine instrument response (a standard curve). The number of calibration standards to be used is method dependent. The most common number of standards used to generate a response curve is five.

Calibration Check:

A standard containing a known quantity of an analyte, which has been purchased or prepared from a different source than the standards used to calibrate the equipment or method. These are used to verify the instrument calibration. These standards are not carried through the sample preparation portion of the analytical procedure. The normal frequency of analysis is defined in the appropriate SOP's. Some methods also require a calibration check prepared from the same source as the calibration standards.

Microbiological Quality Control:

For QC specific to microbiological analyses, please see each individual analytical SOP listed in Appendix III.

Laboratory Water Quality:

The laboratory water quality is monitored on a regular basis. See SOP 10-21 for details.

Method Detection Limits (MDL) and Practical Quantitation Limits (PQL):

TRACE conducts MDL studies where applicable according to SOP 10-23. In addition, MDL studies are performed each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis. At least seven reagent water samples and seven reagent soil samples are spiked at a concentration that is estimated to be the lowest level that can be reliably quantified. All processing steps of the analytical method are included in the MDL determination. All procedures are documented, including the matrix, and all supporting data is retained.

The calculated MDL value is compared to the spike amount. The U.S.A.C.E. requires that the calculated MDL value be compared to the mean recovery of the spikes. If the calculated value is larger than the spiked amount, the MDL study is not valid and the procedure is repeated at a higher spike concentration. If the calculated MDL is between 100% and 20% of the spiked amount, the study is considered valid. If the calculated MDL is less than 20% of the spiked amount, the study should be repeated at a lower spike concentration.

MDL's refer to the minimum concentration of an analyte that can be detected above instrument background noise. On the other hand, Practical Quantitation Limits (PQL's) refer to a minimum concentration of an analyte that can be measured within specified limits of precision and accuracy. PQL's are generally 5-10 times the MDL, but no lower than 3 times the MDL. PQL's are established for each method and they must be above the detection limit.

Most methods do not have a frequency requirement for MDL studies. In these instances, annual or quarterly LOD and/or LOQ verifications are performed as dictated by our accrediting bodies. Those methods that require routine MDL studies will be noted in each individual SOP.

Limit of Detection (LOD) and Limit of Quantitation (LOQ) Verification:

TRACE conducts annual LOD and/or LOQ verifications for analytes certified through NELAP as required by The NELAC Institute Standard. The LODs and LOQs of DoD-ELAP accredited analytes are verified quarterly as required by the DoD Quality Systems Manual for Environmental Laboratories. Although these are referred to as LOD and LOQ in the laboratory, our LIMS system refers to these samples as MRL and SRM respectively due to naming limitations.

Employee Training and Initial Demonstration of Competency:

New employees are required to complete a number of tasks as part of their initial orientation. This includes QA/QC training, Data Integrity Training, Safety Training, a review of TRACE's Client Confidentiality Policy, and a review of TRACE's QA Manual. Prior to conducting the analysis of any client samples, all new analysts and technicians (trainees) receive training from the appropriate Laboratory Manager and must complete an Initial Demonstration of Competency (IDC). At a minimum, training will consist of a thorough study of the appropriate SOP's, instruction from the Laboratory Manager and performance of the analytical procedure(s) in tandem with the Laboratory Manager and/or Senior Analyst.

When, in the opinion of the Laboratory Manager, the trainee is capable of successfully conducting the analytical procedure, the trainee is required to complete the IDC, which consists of analyzing four BS's of identical concentration. The trainee must demonstrate the ability to obtain satisfactory precision and accuracy for the given procedure. The IDC data is reviewed by the Laboratory Manager and compared to the established control limits. If all values are determined to be in control, then the trainee is deemed capable to conduct the analytical procedure.

The results of the IDC will be documented in the employee's training file.

Additionally, the IDC may include satisfactory completion of a MDL study if the procedure will be utilized for drinking water samples, and generation of a curve with a correlation coefficient of >0.995 for procedures utilizing a curve for analyte quantification.

A demonstration of capability must be completed each time there is a significant change in equipment, personnel, or test method. Additionally, each analyst is required to conduct an on-going demonstration of capability on an annual basis. This is discussed in detail in Standard Operating Procedure 10-8.

Performance Evaluation Samples:

TRACE participates in several performance evaluation studies, including the USEPA Water Pollution (WP), Water Supply (WS), and Solid (HW), and Microbiological (WSM and WPM) studies. These programs ensure that laboratory performance is checked and validated by an independent source on a regular basis and these samples are analyzed in the same manner as routine samples and help to the same quality control. Once all analyses have been reviewed by the Laboratory Manager, or designee, the QA/QC Manager prints a final report of all results. The results are then entered online and submitted to the PT provider for evaluation. All records resulting from PT evaluations will be retained according to TRACE's record retention policy outlined in Section 5. Trace will comply with all TNI and DoD-ELAP requirements with regard to proficiency test studies.

SECTION 14: Corrective Actions

Corrective actions are required for two classes of problems: analytical or equipment problems and noncompliance problems. Analytical or equipment problems may occur during sample preparation, laboratory instrumental analysis, or data review. Non-compliance issues include, but are not limited to, sampling methodologies, sample containers, holding times, and sample preservation. This also includes any issues resulting from client feedback. In instances where a Corrective Action Report is necessary, the analysts and management will work together to determine the root-cause of the problem and determine corrective action. After an established timeframe, the QA/QC Manager will determine the effectiveness of the corrective action and determine if further action is needed. See Trace SOP 10-20.

The QA/QC Manager is responsible for informing management of deficiencies in the quality program and following up on corrective actions.

Analytical or Equipment Problems:

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action is dependent on the analysis and the event. Laboratory personnel are alerted that corrective actions are necessary if:

- BS and matrix spike data are outside the acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or relative percent difference between duplicates.
- Surrogates or internal standards fail QC criteria.
- There are unusual changes in detection limits.
- Deficiencies are detected by the QA/QC Manager during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received from clients.
- There is a catastrophic failure in support equipment

Resolutions:

Analytical Problems:

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, and instrument sensitivity. If the problem persists or cannot be identified, the matter is referred to the appropriate Laboratory Area Manager for further investigation. This investigation may involve the preparation of new samples, standards, reagents, and quality control spikes to determine the exact nature of the problem.

Once the problem is resolved, all samples affected by the problem must be reanalyzed.

If the problem is not resolved, a Corrective Action Report is completed with assistance from the analyst, Laboratory Area Manager, and QA/QC Manager. If client data is affected by the non-conformance, the Project Manager is informed. If appropriate, the affected data is qualified using the suitable qualifier from TRACE's Narrative list. If the non-conformance cannot be addressed through the use of qualifiers, the client will notified immediately by the Project Manager. See Client Notification, below.

Inaccurate Procedures or Processes:

If it is determined that the problem causing the inaccuracy could have been prevented by following normal procedures or processes, actions will be taken by the QA/QC Manager or appropriate laboratory manager to inform or educate the analyst in an effort to prevent further occurrences of the problem.

Should the inaccuracy be due to an error, inconsistency, or ambiguity in a written procedure, the QA/QC Manager or Laboratory Manager will take all steps necessary to correct the problem. This corrective action may include rewriting the SOP.

Known departures from policies and procedures must be cleared by the Laboratory Manager and Project Manager. It is the Project Manager's responsibility to notify the client immediately to discuss these departures. See Client Notification, below. Any known departures will be noted in the final report with a data qualifier.

Data Error:

Should an error be discovered in reported data, it is the policy of TRACE to immediately notify the client of the error by the most expeditious means. See Client Notification, below. The analyses are repeated if necessary and the corrected results are reported as soon as possible. An amended written report will be prepared and will indicate the changed data and the reason for the change.

Resolution of Non-compliance Problems:

For non-compliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. At a minimum, a Corrective Action Report will be completed and the client notified immediately by the Project Manager for further instructions.

Catastrophic Failure of Support Equipment:

If a catastrophic failure of support equipment occurs, each sample affected will be pulled and each affected client will be notified by the Project Manager. The Project Manager and the client will then agree on the corrective action needed for each sample. See Client Notification, below.

Client Notification:

If any data that has been reported is suspected of being affected by a non-conformance that was not addressed through the use of qualifiers on a client's original report, the client must be notified immediately in writing. This must occur at no more than 15 business days following the discovery of the non-conformance. Records of the corrective action investigation shall be submitted to the client within 30 business of the original discovery.

SECTION 15: Internal Quality Control Audits and Management Reviews

Internal quality control audits will be conducted at a minimum of once a year. The audits are conducted by the QA/QC Manager. The purpose of these audits is to verify that all aspects of the QA program, including data integrity, are functioning properly and that the overall quality program is effective. Two types of audits are used; system audits and technical audits.

System audits review the quality system, including information such as:

- Published methods
- Standard Operating Procedures
- Training files
- Quality control charts
- Quality control data
- Corrective action procedures and documentation
- LIMS inspections

Technical audits are in depth reviews of data, with emphasis on data integrity issues. Technical audits involve a review of the following:

- Logbooks (Run logs and Standard prep. logs)
- Quantitation Reports
- Bench sheets
- Raw data
- Client reports
- Data review documentation
- Client correspondence
- Chain-of-Custody

Audit findings must be documented, and corrective actions established to address the findings. At the time that the corrective action is established, a mechanism must be defined to monitor the issue and ensure that the corrective action has been effective.

Management meetings will typically be held weekly, or as needed, to discuss issues such as:

- The use of appropriate policies, procedures and standard operating procedures
- Employee reports/concerns/issues
- Internal audit findings
- Corrective/preventive actions
- External audit/review/assessment findings
- Proficiency test results
- Work schedules
- Client complaints/comments/concerns
- Quality control issues, resources, training, etc.

The Owner/CEO, Laboratory Manager, QA/QC Manager, Project Managers, and Office Manager will attend these meetings if able.

QA/QC issue discussions will be documented on the Quality Control Management Review form. Action items and the person(s) responsible for the action will be defined. Action items will be tracked in subsequent meetings, and closure will be documented.

In addition to the management meetings, a meeting of all employees is held weekly. This serves as an opportunity to discuss workload and any issues that arise on a weekly basis.

Appendix I

Resumes of Key Personnel

Brad E. Hilleary – CEO/Owner

The Company CEO is responsible for the overall operation. Key areas of responsibility are vision, values, corporate culture, company leadership, and financial management.

RESPONSIBILITIES

- Assists with budget development, cash flow management, tax planning, financial strategies and organization of overall financial functions.
- Sets corporate goals
- Works with staff to develop and maintain a strong professional image for the company with respect to its clients, competitors, employees, and the community.
- Coordinates changes within the laboratory to comply with changing regulatory requirements.

PROFESSIONAL EXPERIENCE

TRACE Analytical Laboratories, Inc.
Muskegon, MI
April 4, 2016 – Present
Position held
CEO/Owner

Webb Chemical Service Corporation
Muskegon Heights, MI
March 1993 – Present
Positions held
Sales Representative, Sales Manager, Purchasing Representative, Purchasing Manager, Vice President, CEO

Webb is a full service commodity chemical distributor. From sales to purchasing to management, it is all about servicing the customer. Over my time with the company we have more than doubled in revenue and profit and employees.

Aerotek
Worked in 3 Michigan offices; Southfield, Flint, and Grand Rapids
May 1991 – March 1993
Position held
Technical Recruiter

Aerotek was a headhunter for high tech engineers and designers for the automotive and aerospace industries as well government contractors. My responsibilities were to work as part a 3 person team to find these qualified candidates from across the world and bring them to Michigan. I would make up to 100 phone calls a day, rewrite resumes, conduct personal interviews and facilitated travel and housing.

EDUCATION

- **B.A., Business Administration, Marketing**, Western Michigan University,

Minor in Finance 1991

GINA ROE, Laboratory Manager

The Laboratory Manager is responsible for all aspects of environmental chemistry as related to clients and projects. The Laboratory Manager is also responsible for the day to day operations of the laboratory.

RESPONSIBILITIES

- Production - Responsible for the overall production of the laboratory, including development of new methods, and scheduling of workloads
- Performance - Insures that the laboratory is meeting requirements regarding quality, procedures, volume, and turnaround. Schedules and reviews analyst certifications, MDL studies and SOP writing. Monitors on-time performance. Conducts annual review of employees.
- Data Validation - Accountable for the data released from the laboratory. Reviews analytical data prior to submission to data reporting, evaluates PE results, and implements corrective actions.
- Budget - Responsible for the development and maintenance of an operating budget.
- Training - Insures that employees are properly trained to meet the requirements of their positions.
- Client Interface - Serves as the in-house representative on all projects requiring technical expertise.
- Planning - Plans for future growth of the laboratory.

PROFESSIONAL EXPERIENCE

July 2010-Present: Trace Analytical Laboratories, Inc., Muskegon, MI, Laboratory Manager

October 2005 – July 2010: Trace Analytical Laboratories, Inc., Muskegon, MI,
Project Manager

February 1997 – October 2005: Trace Analytical Laboratories, Inc., Muskegon, MI,
Senior Analyst
Responsible for GC/MS volatiles and other organic analyses.

February 1990 – February 1997: Trace Analytical Laboratories, Inc., Muskegon, MI,
Analyst
Responsible for Organic, Inorganic, and Metals analysis.

September 1986 – May 1987: Muskegon Community College.
Interim Laboratory Director
Responsible for laboratory set-up for student use, and ordering of supplies.

EDUCATION

- **A.A.S**., Chemistry, Muskegon Community College
- **B.S.**, **Natural Resource Management**, Grand Valley State University

JON MINK, Senior Project Manager

The Senior Project Manager is responsible for working with clients to provide high quality testing to meet project objectives. Performs reviews of login, data and final results to make sure that all of the data quality objectives are met. The Senior Project Manager also provides pricing for project proposals.

RESPONSIBILITIES

- Determine project requirements with clients, as pertaining to instrumental and staff capabilities.
- Evaluate the ability of the laboratory to perform new methods with existing equipment and personnel.
- Work with clients for quotes, project requirements, and sampling requirements and building bottle order forms
- Assist with hazardous waste characterization
- Help manage LIMS/Computer systems.
- Set-up Clients in LIMS and then build profiles to meet project requirements. Load pricing into LIMS for proper invoicing
- Review final client reports and invoices

PROFESSIONAL EXPERIENCE

December 2010 – Present: TRACE Analytical Laboratories, Inc., Muskegon, MI,
Senior Project Manager

September 1995 – Present: TRACE Analytical Laboratories, Inc., Muskegon, MI,
Technical Systems Manager/Project Manager

July 1993 – September 1995: TRACE Analytical Laboratories, Inc., Muskegon, MI,
Project Manager
The Project Manager was responsible for the management of the mobile analytical services. Duties also included special project management. Included were the selection, set-up, and maintenance of instrumentation.

July 1992 - July 1993: TRACE Analytical Laboratories, Inc., Muskegon, MI,
Application Specialist
Responsible for determining the laboratories abilities to meet specific, non-standard, client analytical requests. Also responsible for the implementation of new EPA analytical methods not currently being performed by the laboratory.

July 1991 - July 1992: TRACE Analytical Laboratories, Inc., Muskegon, MI,
Client Services / Safety Manager
Corresponded with clients regarding analytical requirements. Included in this was the determination of proper sample techniques, volumes, containers, preservatives, and hold times. Also worked closely with the laboratory to determine the availability of analytical results and priority sample treatment. Other duties included ordering of supplies needed by the laboratory for day to day operations, and the development of the laboratory safety plan.

September 1990 - July 1991: TRACE Analytical Laboratories, Inc., Muskegon, MI, Analyst
Performed analyses in all areas of the laboratory. Set-up new equipment for analytical determinations, investigated and implemented new methodologies. Also responsible for field sampling.

January 1984 - September 1988: University of California at San Diego, School of Medicine Pathology Department. La Jolla, California,
Lab Assistant II
Worked with a principal investigator doing research on cholestasis and choleuresis as an electron microscopist and research assistant. Duties included small animal surgeries, tissue harvesting, tissue processing for light microscopy and transmission electron microscopy, electron micrograph development and printing, student assistant supervision, paper writing for journal publication, and laboratory purchasing.

EDUCATION

- **B.A., Microbiology**, University of California, San Diego, Revelle campus
  minors in Physiological Psychology and Chemistry

PROFESSIONAL ORGANIZATIONS/CERTIFICATIONS

- Hazardous Materials Specialist
- Firefighter I & II
- Confined Space Rescue Technician
- Member Muskegon County Hazmat Team
- Member Michigan Regional Response Team for Western Michigan District

Timothy Brewer, Project Manager

The Project Manager is responsible for client services. The primary role is to work with clients to identify project needs and discuss results as needed. The Project Managers will double-check all sample paperwork for accuracy, required signatures, and completed log-in checklist(s), and will make sure that samples and required analytical tests are properly identified. The Project Manager is also responsible for communicating client needs to the laboratory.

RESPONSIBILITIES

- Determine project requirements with clients
- Work with clients to determine sampling requirements
- Evaluate and submit bid proposals
- Review client data reports
- Assist with client sampling plans and helps coordinate sampling activities

PROFESSIONAL EXPERIENCE

December 2017 – Present: TRACE Analytical Laboratories, Inc., Muskegon, MI
Project Manager

2008 – December 2017: TRACE Analytical Laboratories, Inc., Muskegon, MI
Environmental Field Sample Technician

- Coordinate container shipment/delivery/sample pick-up for clients
- Perform collection of environmental samples for clients per their requirements, following EPA sampling requirements and OSHA regulations
- Track, monitor, schedule customer sample requirements and communicate to all appropriate personnel for on-time delivery of results
- Perform building maintenance repairs and maintain all company vehicles
- Maintain good client communication and solicit new business

1996-2007: Brewer Enterprises, Inc., Muskegon, MI
Owner

- Hire, train, schedule, & supervise staff
- Order, maintain inventory all supplies in compliance with regulations
- Schedule/Coordinate entertainment and planned events
- Business management including accounting, staffing, payroll, building maintenance, security

1996-1998: West Michigan Fire Protection, Muskegon, MI
Owner

- Field service and maintenance of all fire protection equipment
- Warehouse inventory, order and utilize & maintain Hi-Lo's
- Solicit new and maintain customers
- Small business management including accounting, staffing, payroll, security

1990-19968: Muskegon Fire Equipment Company, Muskegon, MI
Manager

- Supervision of all staff, including hiring, termination, disciplinary action

- Responsible for establishing new clients and managing existing clients
- Field service and maintenance of fire protection equipment

EDUCATION

Michigan Technological University, Houghton, MI

- Completed 2 years in the Engineering Program

PROFESSIONAL ORGANIZATIONS/CERTIFICATIONS

- S-5 Waterworks System Operator (MDEQ)

ALYSON YAGIELA, QA/QC Manager

The QA/QC Manager will make sure that all aspects of the program comply with current and appropriate regulatory requirements, methodologies, and protocols, will coordinate and manage the quality assurance program on a daily basis, and shall keep members of the quality assurance group informed on issues relating to the laboratory quality assurance program.

RESPONSIBILITIES

- Conducts internal and coordinates external laboratory audits.
- Coordinates efforts for state and federal certifications.
- Coordinates changes within the laboratory to comply with changing regulatory requirements.
- Assists laboratory staff in writing, reviewing, and implementing SOP's.
- Maintains Quality Control calculation programs.
- Updates and edits Quality Assurance Manual.
- Investigates non-conformances and drafts Corrective Action Reports.
- Responsible for safety program and coordinating hazardous waste pick-up
- Supervises Sample Receiving and Sampling Departments

PROFESSIONAL EXPERIENCE

May 2011 – Present: TRACE Analytical Laboratories, Inc., Muskegon, MI
QA/QC Manager

February 2007 – May 2011: Mead Johnson Nutrition, Zeeland, MI
Quality Control Laboratory Analyst
Held multiple roles within the QA/QC labs, including the collection, preparation, and analysis of infant formula samples. Worked to update SOPs and analytical methods, which required strict adherence to FDA regulations.

September 2005 – February 2007: Aerotek Scientific, Mead Johnson Nutrition, Zeeland, MI
Quality Assurance Technician
Laboratory sample preparation and analysis using microbial determination methods while complying with FDA regulations.

May 2002 – May 2004: Michigan State University, East Lansing, MI
Master’s Degree Candidate / Research Assistantship
Master’s thesis research studied the effects of nutrient enrichment on consumers in lacustrine wetlands using stable isotopes. Assisted with Muskegon River Watershed Assessment Project sampling and algal identification.

May 2001 – August 2001: Boston University, Woods Hole, MA
REU – Research Fellow
Worked on a sandplain restoration project and designed/implemented research project to study nitrogen concentrations at the seepage face of Edgartown Great Pond.

September 2000 – April 2001: University of Michigan, Ann Arbor, MI
Assistant-in-Research

Studied historical trends in diatom assemblages and effects on the diets of fish and zooplankton.

May 2000 – August 2000: National Oceanic and Atmospheric Administration, Muskegon, MI
Research Fellow
Studied zooplankton size and population distributions in Lake Michigan.

EDUCATION

- **B.S., Resource Ecology & Management**, The University of Michigan
- **M.S., Zoology**, Michigan State University

Appendix II

Sample Containers and Preservatives

SAMPLE REQUIREMENTS - WATER SAMPLES				
Test Parameter	**Method**	**Container**	**Preservative**	**Hold Time**
Acidity	305.1	250 mL Plastic	Cool to <6°C	14 days
Alkalinity	SM 2320B	250 mL Plastic	Cool to <6°C	14 days
Ammonia-Nitrogen	350.1	250 mL Plastic	H_2SO_4, Cool to <6°C	28 days
BOD	SM 5210B	1 Liter Plastic	Cool to <6°C	48 Hours
COD	410.1	250 mL Plastic	H_2SO_4, Cool to <6°C	28 days
Cyanide	335.4	125 mL Plastic	NaOH, Cool to <6°C	14 days
Chloride	300.0	125 mL Plastic	Cool to <6°C	28 days
Chlorine	SM 4500 Cl G	500 mL Plastic	Cool to <6°C	Immediate
Fluoride	300.0	250 mL Plastic	Cool to <6°C	28 days
Hardness	130.2	250 mL Plastic	HNO_3, Cool to <6°C	6 months
Herbicides	8151	(2) 1 Liter Ambers	Cool to <6°C	14 days/40 days
Hexavalent Chromium	SM 3500 Cr B	250 mL Plastic	Cool to <6°C	Immediate
Mercury	245.1	250 mL Plastic	HNO_3, Cool to <6°C	28 days
Low Level Mercury	1631	Call Trace	BrCl or HCl, Cool to <6°C	90 days
Metals	200/60x0/7000	500 mL Plastic	HNO_3, Cool to <6°C	6 months
Nitrate	300.0	250 mL Plastic	Cool to <6°C	48 Hours
Nitrate-Nitrite	300.0	250 mL Plastic	H_2SO_4, Cool to <6°C	28 days
Nitrite	300.0	250 mL Plastic	Cool to <6°C	48 Hours
Nitrogen, Total Kjeldahl	351.2	250 ml Plastic	H_2SO_4, Cool to <6°C	28 days
Oil & Grease	1664	1 Liter Amber	HCl, Cool to <6°C	28 days
Oxygen, Dissolved	SM 4500 O C	Call Trace	Call Trace	8 hours
PCBs	8081	(2) 1 Liter Ambers	Cool to <6°C	1 year/1 year
Pesticides	8081	(2) 1 Liter Ambers	Cool to <6°C	7 days/40 days
pH	SM 4500 H+ B	125 mL Plastic	Cool to <6°C	24 hours
Phenols (Total)	420.1	2 oz Amber	H_2SO_4, Cool to <6°C	28 days
Phosphorus, Ortho	365.1	125 mL Plastic	Filter, Cool to <6°C	48 Hours
Phosphorus, Total	365.1	250 mL Plastic	H_2SO_4, Cool to <6°C	28 days
PNAs	8270	(2) l Liter Ambers	Cool to <6°C	7 days/40 days
Semivolatile Organics (BNA)	8270	(2) 1 Liter Ambers	Cool to <6°C	7 days/40 days
Solids	SM 2540 B	250 mL Plastic	Cool to <6°C	7 days
Solids, Settleable	160.5	1 Liter Plastic	Cool to <6°C	48 Hours
Sulfate	300.0	250 mL Plastic	Cool to <6°C	28 days
Sulfide	SM 4500 S2 F	Call Trace	Call Trace	7 days
Sulfite	SM4500SO3B	BOD bottle	EDTA	Immediate
Surfactants (MBAS)	SM 5540 C	500 mL Plastic	Cool to <6°C	48 Hours
Total Organic Carbon	SM 5310 D	250 mL Plastic	H_2SO_4, Cool to <6°C	28 days
TPH	418.1	1 Liter Amber	H_2SO_4, Cool to <6°C	14 days

SAMPLE REQUIREMENTS - WATER SAMPLES (continued)

Test Parameter	Method	Container	Preservative	Hold Time
TOX/AOX	9020	250 mL Amber	H_2SO_4	28 days
Volatile Organics – not including Acrolein or Acryolnitrile	624.1/8260C	(3) 40 mL VOAs	HCl pH<2, Cool to <6°C	14 days
Volatile Organics – Acrolein or Acryolnitrile only	624.1/8260C	(3) 40 mL VOAs	HCl pH 4-5, Cool to <6°C	7 days
Volatile Organics –Drinking Water	524.2	(3) 40 mL VOAs	Ascorbid Acid and HCl pH <2, Cool to <6°C	14 days
Water Content	Karl Fischer	125 mL Plastic	Cool to <6°C	7 days

SAMPLE REQUIREMENTS - SOLID SAMPLES

Test Parameter	Method	Container	Preservative	Hold Time
Cyanide	335.2	4 ounce glass jar	Cool to 4°C	14 days
Flash Point	1010	4 ounce glass jar	Cool to 4°C	ASAP
Herbicides	8150	4 ounce glass jar	Cool to 4°C	14 days/40 days
Hexavalent Chromium	7196	4 ounce glass jar	Cool to 4°C	24 hrs after leach
Mercury	7471	4 ounce glass jar	Cool to 4°C	28 days
Metals	6010/7000	4 ounce glass jar	Cool to 4°C	6 months
Oil & Grease	413.1	4 ounce glass jar	Cool to 4°C	28 days
Paint Filter	9095	4 ounce glass jar	Cool to 4°C	7 days
PCBs	8081	4 ounce glass jar	Cool to 4°C	14 days/40 days
Pesticides	8081	4 ounce glass jar	Cool to 4°C	14 days/40 days
pH	9045	4 ounce glass jar	Cool to 4°C	24 hours
Phosphorus, Total	365.2	4 ounce glass jar	Cool to 4°C	28 days
PNAs	8270	4 ounce glass jar	Cool to 4°C	14 days/40 days
Reactivity	SW 846, Ch. 7	4 ounce glass jar	Cool to 4°C	7 days
Semivolatile Organics (BNA)	8270	4 ounce glass jar	Cool to 4°C	14 days/40 days
Sulfate	375.4	4 ounce glass jar	Cool to 4°C	28 days
TCLP/SPLP	1311/1312	(5) 4 ounce glass jars	Cool to 4°C	14 days
Total Organic Carbon	415.1	4 ounce glass jar	Cool to 4°C	28 days
TPH	418.1	4 ounce glass jar	Cool to 4°C	14 days
Volatile Organics	8021/8260	Methanol/Encor™	Cool to 4°C	48 Hrs/14 days

Appendix III

Method and Reference Sources

Standard Methods for the Examination of Water and Wastewater, A.D. Eaton, et. al, editors, American Water Works Assoc., On-Line.

Methods for Chemical Analysis of Water and Wastes, J.F. Kopp and G.D. McKerr, USEPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, EPA-600/4-79-020, revised March 1983.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Office of Solid Waste and Emergency Response, On-Line.

Official Methods of Analysis, 15th Edition, Kenneth Helrich, ed., Association of Official Analytical Chemists, Arlington, VA, 1990, 1990. (or earlier editions).

Annual Book of ASTM Standards, American Society for Testing and Materials, Philadelphia, PA, published annually.

NIOSH Manual of Analytical Methods, Second and Third Editions, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institutes for Occupational Safety and Health, Division of Physical Sciences and Engineering, Cincinnati, OH, 1981,1984, and updates.

Methods of Soil Analysis, Second Edition, Arnold Klute, Editor, American Society of Agronomy, Inc., Soil Society of America, Inc., Madison, WI, 1986.

Title 40 Code of Federal Regulations part 136, app. A and B, Most Current Edition, Office of the Federal Register National Archives and Records Administration, Washington D.C.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, June 1991.

Methods for the Determination of Metals in Environmental Samples Supplement, EPA/600/R-94-111, PB95-125472, Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, May 1994.

Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, December 1988 (Revised July 1991).

Plumb, R. H., Jr. 1981. Procedures for Handling and Chemical Analysis of Sediment and Water Samples, Technical Report EPA/CE-81-1

Laboratory Operations and Quality Assurance Manual, United States Environmental Protection Agency, Region 4, 900 College Station Road Atlanta, Georgia

Drinking Water Standard Operating Procedures

Drinking Water Methods and Standard Operating Procedures

Analyte	Analytical Method	TAL SOP #	SOP Title
Total and *E*. Coli	SM 9223B	100-42	The Determination of Total Coliform and *E*. Coli by Presence-Absence
Total and *E*. Coli	HACH M-Coli Blue 24	100-55	The Simultaneous Determination of Total Coliform and E. coli by m-ColiBlue24®
Heterotrophic Plate Count	SM 9215B	100-47	Heterotrophic Plate Count
Barium, Beryllium, Calcium, Chromium, Copper, Magnesium, Manganese, Nickel, Potassium, and Sodium	EPA 200.7	110-2	Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy: Method 200.7
Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Manganese, Nickel, Selenium, and Thallium	EPA 200.8	110-11	Analysis of Metals by Inductively Coupled Plasma Mass Spectroscopy: Method 200.8
Mercury	EPA 245.1	110-7	Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry: Method 245.1
Total Cyanide	EPA 335.4	100-1	The Determination of Total and Amenable Cyanide by Semi-Automated Colorimetry
Cyanide	EPA OIA-1677	100-67	The Determination of Available Cyanide by Flow Injection and Ligand Exchange
Nitrite	SM 4500-NO_2-B	100-8	The Determination of Nitrite-Nitrogen by Spectrophotometric Analysis
Fluoride, Nitrate, Nitrite, and Sulfate	EPA 300.0	100-19	The Determination of Inorganic Anions by Ion Chromatography
Nitrate and Nitrite	EPA 353.2	100-3	The Determination of Nitrate-Nitrite Nitrogen by Semi-Automated Colorimetry
Volatile Organics	EPA 524.2	140-5	Quadrupole Mass Spectrometry Analysis of Volatile Organic Analytes in Drinking Water by EPA 524.2

Appendix IV
Major Equipment List

Wet Chemistry Department

- Lachat QuikChem ® 8500 Instrument with XYZ Sampler (S/N: 101200001292)
- Mettler DL-21 auto-titrator with probes for Alkalinity and Chloride analyses (S/N: M06782)
- Hanna Instruments Auto-Titrator HI902C2-01 (S/N: 12171406)
- Kontes Midi Cyanide Distillation Unit
- Dionex ICS-1500 Ion Chromatograph system (S/N: 06120697)
- Dionex ICS-5000 Ion Chromatograph system (S/N: 11030335). Instrument Name: ROLAND
- Milton Roy Spectronic 21 spectrophotometer (S/N: 3151186012)
- Spectronic Instruments Spectronic Genesys 5 spectrophotometer (S/N: 3V89193004)
- Shimadzu TOC-L CSH TOC Analyzer (S/N: H54325732498 CS)
- O.I. Model FS 3000 Available Cyanide Instrument with a Model 5027 sampler (S/N: 351804496)
- Orion Model 830A dissolved oxygen meter
- YSI Model 4010-2W dissolved oxygen meter (S/N: 19071627)
- Orion Model 122 conductivity meter (S/N: 33294058)
- Pensky-Martens Propane Heated Unit (no S/N available)
- Pensky-Martens Electronic Heat, Model 74537 (S/N: 10BC-11)
- SETA PM-93, Model 35000-0 Flashpoint Analyzer (S/N: 1058665)
- O.I. Analytical CNSolution 3100 Cyanide Analyzer (S/N: 302831499)
- Meile Professional Laboratory Dishwasher G7893
- Aquacounter AQV-300 Volumetric Karl Fischer Titrator (S/N: P421008-7)

Metals Department

- Perkin-Elmer NexION 300X Inductively Coupled Plasma Mass Spectrometer (S/N: 81XN3081201)
- Varian 720-ES ICP-OES with Varian SPS 3 Autosampler (S/N: EL06033903)
- CETAC M-7600 Mercury Analyzer (S/N: US19270021R) with ASX-280 Autosampler (S/N: 032065A280)
- CETAC M-8000 Low Level Mercury Analyzer (S/N: US20037010) with ASX-260 Autosampler (S/N: 071317A260)
- MARSX Digestion Microwave (S/N: XM3209)
- Hanna Instruments HI 93703 Turbidity Meter (S/N: 453093)

Organics Department

Extractions

- CEM Corporation MARSX Extraction Microwave with 40-position turntable (S/N: MD3921)
- Horizon Technology SPE-1000XL Plus SS Hexane Extractable Materials Analyzer (S/N: 00-007)

GC/MS Volatiles

- Hewlett-Packard 5890 Series II Gas Chromatograph with Electronic Pressure Control and a 5972GCD Mass Selective Detector coupled with a Tekmar Atomx Purge and Trap with built in Water and Soil Autosampler Instrument S/N: US16110004. Instrument Name: TRIXIE.
- Hewlett-Packard 5890 Series II Gas Chromatograph with Electronic Pressure Control and a 5972A Mass Selective Detector coupled with a Tekmar LSC-2000 Purge and Trap Concentrator and an Archon (EST Model 8100) water and soil autosampling system. Instrument S/N: 3307A00304. Instrument Name: CASSIE.
- Hewlett-Packard 5890 Series II Gas Chromatograph with 5972 Mass Selective Detector coupled with an EST Econ Evolution Purge and Trap Concentrator S/N EV319081810 and a CENTURION water and soil autosampling system. MS Instrument S/N: 3341A00932. Instrument Name: JACOB.
- Hewlett-Packard GCD Series Gas Chromatograph with Electronic Pressure Control and an EID coupled with an EST Encon Evolution Purge and Trap Concentrator S/N: EV483062413 and a CENTURION water and soil autosampling system. Instrument S/N: LR 47359C. Instrument Name: OTIS.

GC Volatiles

- Varian 3300 Gas Chromatograph with O.I. 430 Photo Ionization Detector coupled with a Tekmar LSC-2000 Purge and Trap Concentrator equipped with a Dynatech PTA-30 W/S water and soil autosampling system. Instrument S/N: 4026. Instrument Name: MYRTLE.
- Varian 3400 Gas Chromatograph with dual Varian Flame Ionization Detectors. Instrument S/N: 2066. Instrument Name: HOMER.
- Varian 3400 Gas Chromatograph with Varian Flame Ionization Detectors (S/N: 3520)
- Varian 3800/2280 Gas Chromatograph (S/N: 12347). Instrument Name: MURDOCK

GC/MS Semi-Volatiles

- Agilent 6890GC S/N: CN10709042Gas Chromatograph with Electronic Pressure Control equipped with 5975B Mass Selective Detector S/N: US65115534 and 7683 Automatic Injector S/N: CN23126486. Instrument Name: FIDO.
- Hewlett-Packard Series II Gas Chromatograph with Electronic Pressure Control equipped with 6890 Mass Selective Detector and 6890 Series Injector. Instrument Name: HAWG.
- Hewlett-Packard 5890 Series II Gas Chromatograph with 5971A Mass Selective Detector and an HP 7673 Controller and Injector. MS S/N: 3188A03554 GC S/N: 3310A47628. Instrument Name: EDWARD

GC Semi-Volatiles

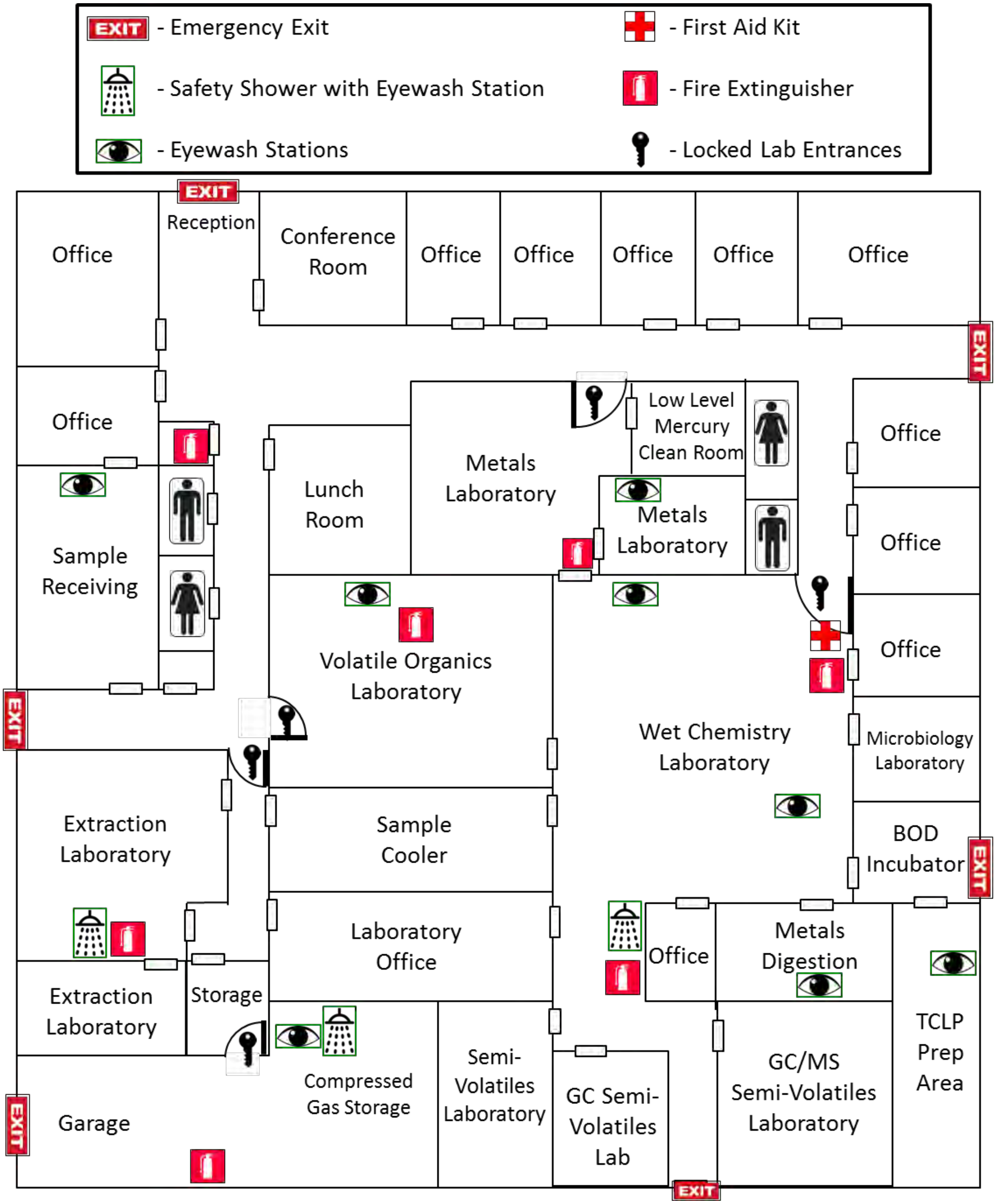
- Hewlett-Packard 5890A Gas Chromatograph with dual Split/Splitless injectors and dual Flame Ionization Detectors equipped with a 7673A Automatic Injector. Instrument S/N: 2843A19951. Instrument Name: FRANK.
- Hewlett-Packard 5890A Gas Chromatograph with dual Split/Splitless injectors, an Electron Capture Detector and a 7673A Automatic Injector. Instrument S/N: 2443A04016. Instrument Name: NORTON.
- Hewlett-Packard 5890A Gas Chromatograph with a Universal Injector and a Flame Ionization Detector and an Electron Capture Detector equipped with a 7673A Automatic Injector. Instrument S/N: 87082702. Instrument Name: BACCHUS.
- Varian 3400 Gas Chromatograph with Flame Ionization Detector. Instrument S/N: 15921. Instrument Name: GUS.
- Agilent HPLC 1050 with Diode Array Detector. Instrument S/N: 2840A00296. Instrument Name: ODIN.
- Agilent 6890 Gas Chromatograph (S/N: US00026897) with Electron Capture Detector (S/N: U2188) equipped with a 7683 autosampler injector and tray. Instrument Name: FREYA.
- Thermo Fisher 1300 Gas Chromatograph (S/N: 720000407). Instrument Name: EVE

Air Quality Department

- Olympus BH-2 (BHSP) Polarized Light Microscope
- Olympus CH-2 (BHSP) Phased Contrast Microscope
- Four (4) SKC personal air sampling pumps
- DC-Lite DryCal calibrator
- High Volume air sampling pump
- Bacharach electronic gas analyzer for carbon monoxide
- Bacharach electronic gases meter

Appendix V

Laboratory Layout



Appendix VI

Organization Chart*

TRACE
ANALYTICAL LABORATORIES, INC.

Organizational Chart

*A detailed Organization Chart can be found at Trace document DOC-13.

ATTACHMENT E

STATISTICAL EVALUATION PROGRAM

ATTACHMENT E

STATISTICAL EVALUATION PROGRAM
FOR
PHARMACIA & UPJOHN COMPANY, LLC
HAZARDOUS WASTE FACILITY
OPERATING LICENSE

Application MID: 000820381

prepared for

PHARMACIA & UPJOHN COMPANY, LLC
PORTAGE ROAD FACILITY
KALAMAZOO, MICHIGAN

prepared by

Mr. Michael Stoline, Ph.D.

for

AMERICAN HYDROGEOLOGY CORPORATION
6869 SOUTH SPRINKLE ROAD
PORTAGE, MICHIGAN 49002

August 24, 2012

Revised by Mr. R. Douglas Workman, Ph.D.

June 13, 2022

REPORT

TABLE OF CONTENTS

1.0 INTRODUCTION

This Statistical Evaluation Program (SEP) describes the methodology to be used for the statistical evaluation of Corrective Action Detection (CAD) monitoring wells at the Pharmacia & Upjohn Company, LLC (P&U) Hazardous Waste Facility in Kalamazoo, Michigan. This program was developed in accordance with the P&U Hazardous Waste Management Facility Operating License (Operating License) and recommendations provided in the U.S. EPA guidance documents entitled *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Interim Final Guidance* (February 1989) and *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Final Guidance* (July 1992).

1.1 Purpose of the SEP

The purpose of the SEP is to evaluate if storage and/or treatment activities at the hazardous waste facility have impacted downgradient groundwater quality. Groundwater monitoring data will be collected on a biannual basis from the site to obtain data to make this evaluation.

The specific details outlining the collection of biannual monitoring data from the Corrective Action Detection (CAD) wells located at the facility are described in the facility Groundwater Sampling and Analysis Plan (GSAP) of the Operating License. In the GSAP it is stated that: “The wells in the Corrective Action Detection (CAD) network surrounding the P&U property were selected to verify that no detections of constituents of concern have occurred in both the upper and lower aquifers beyond the boundaries of the Corrective Action regulated units.”

In the GSAP it further states that: “Eighteen CAD monitoring wells were selected for the purpose of detecting statistically-based changes of constituent concentrations in the two aquifers present beneath the facility.” It is further stated in this section that: “The CAD wells are situated along the perimeter of areas of manufacturing and material storage to allow for detection of a potential release of constituents from areas within the facility.”

The GSAP also states: “Two upper aquifer and two lower aquifer wells were selected as background wells”. The purpose of the background wells is: “to establish and verify upgradient concentrations of constituents in the groundwater beneath the facility”. The data collected from these upgradient wells will be used to: “alert P&U to the presence of organic and inorganic contamination that may migrate onto the P&U facility from off-site sources”.

1.2 Downgradient Wells

The GSAP designates wells MW-104, MW-142, MW-149, MW-152, MW-153, and MW-158 as downgradient wells for the lower aquifer, and wells MW-17, MW-101A, MW-108R, MW-109R, MW-110, MW-133, MW-141, and MW-161R as downgradient wells for the upper aquifer.

As referenced in Section 2.1, monitor wells MW-17 and MW-101A were designated as CAD wells and were first sampled during the Fourth Quarter of 2000.

The “R” designations refer to replacement wells. Well MW-108 has been replaced by MW-108R and well MW-109 has been replaced with MW-109R. Since the installation of wells MW-108 and

MW-109 in 1990, these wells frequently failed to possess sufficient groundwater to allow for sampling. Due to this condition, these two wells were replaced with monitor wells MW-108R and MW-109R in October 2000. The replacement wells are located within a few feet of the original wells and are slightly deeper to permit continuous sampling.

It is assumed that groundwater samples collected from the replacement wells will be representative of samples collected from the pre-existing wells and will provide a continuous record of the groundwater quality at these locations. Specifically, it is assumed that the groundwater samples collected from the replacement wells MW-108R and MW-109R will provide water quality data representative of that collected from MW-108 and MW-109.

Downgradient wells will be monitored biannually as part of the groundwater monitoring program. If trends or changing conditions are documented in groundwater within either aquifer downgradient of the hazardous waste facility, P&U may petition the State of Michigan to install additional downgradient wells for incorporation into future evaluations.

1.3 Upgradient Wells

The GSAP section of the Operating License designates wells MW-112 and MW-116 as upgradient wells for the lower aquifer, and wells MW-111 and MW-115A as upgradient wells for the upper aquifer.

As referenced in Section 2.1, monitor wells MW-112 and MW-116 were designated as CAD wells in October 2003 and October 2000, respectively. The sampling history for MW-112 includes the Second Quarter of 1992 and Fourth Quarter of 2003 through the present. The sampling history for MW-116 includes the Second Quarter of 1992 and Fourth Quarter of 2000 through the present.

Upgradient wells will be monitored biannually as part of the groundwater monitoring program. If trends or changing conditions are documented in groundwater within either aquifer upgradient of the hazardous waste facility, P&U may petition the State of Michigan to install additional upgradient wells within the affected aquifer for incorporation into future evaluations.

1.4 Use of Historic Intrawell Background Data as A Control

Quarterly groundwater monitoring data have been collected continuously at the site beginning in 1992. As of the end of the 2021 Fourth Quarter sampling, 119 quarterly monitoring events have been conducted at the site. Due to absence of groundwater in some of the monitor wells and modifications to the CAD network, individual wells possess from 74 to 119 data sets in this period.

As discussed in Sections 2.0 and Section 5.0, due to the differing groundwater chemistry between CAD monitoring wells, it was determined that naturally occurring parameters in downgradient monitoring wells should be evaluated using historic intrawell background data.

It is proposed that the accumulated data collected in the period 1992 – 2021 will be used to construct an intrawell set of background data for each downgradient and upgradient well in each of the two aquifers at the site. This background data will be referred to as the 1992 – 2021 background monitoring data in this SEP. The background data in this SEP specifically will consist of the 119 monitoring events conducted at the site starting with the 1992 Second Quarter sampling and ending with the 2021 Fourth Quarter sampling.

Monitoring data for each upgradient and downgradient well at the site starting with the 2022 First Quarter sampling will be evaluated by comparison to the historic intrawell 1992 – 2021 background monitoring data collected at the individual well.

1.5 Monitoring Data Evaluation Methods

Monitoring data for the CAD groundwater monitoring parameters will be evaluated for evidence of statistically significant increases and/or decreases by comparing the current levels to intrawell background data for each CAD downgradient monitor well. Upper and lower aquifer wells will be evaluated separately throughout the SEP.

Monitoring data for each upgradient well will also be evaluated. The purpose of the upgradient well evaluations is to provide a control for downgradient evaluations, although no statistical comparisons are recommended to compare upgradient and downgradient concentration levels.

Section 2.0 of the SEP contains a description of the development and characteristics of the intrawell background groundwater monitoring data at the site. Section 3.0 contains the description of the classification of the parameters into three groups of parameters for the purpose of statistical evaluation.

Section 4.0 contains the statistical and graphical evaluations applied to the “foreground” data for each of the three groups of parameters.

Sections 5.0 – 7.0 contain the statistical and graphical procedures which will be used to evaluate increases and/or decreases in concentrations of monitoring parameters at the wells as well as the basis for selection of these statistical procedures and quadruplicate re-sampling procedures.

Section 8.0 describes procedures and circumstances for changing or modifying the SEP.

Section 9.0 describes the reporting procedures to be followed as part of the SEP.

2.0 ESTABLISHMENT OF BACKGROUND CONCENTRATIONS FOR INTRAWELL EVALUATIONS

Background parameter concentrations or detection limit standards for each of the CAD groundwater monitoring events are presented in the GSAP. The CAD monitoring wells and CAD groundwater monitoring parameters are listed in Tables 4 and 5 of the GSAP.

A historic intrawell background set of monitoring data was used to establish background concentrations as described in Section 2.1. The characteristics of this intrawell background data set are used in Section 3.0 to classify each parameter into one of three groups of parameters in each aquifer.

2.1 Historic Intrawell Background Data

Historic intrawell background data is comprised of a maximum of 119 consecutive quarterly sampling events of monitoring data that have been collected at each well during the period starting with the 1992 Second Quarter sampling data and ending with the 2021 Fourth Quarter sampling data. Some wells have a shorter sampling history due either to dry well occurrences or being newly designated as a CAD well.

Tables A and B contain background data collection summaries of the quarterly sampling events collected at each well currently designated as a CAD well starting with the 1992 Second Quarter and ending with the 2021 Fourth Quarter sampling data. Table A contains the background data collection summary for the six lower aquifer downgradient wells (MW-104, MW-142, MW-149, MW-152, MW-153, and MW-158) and the two lower aquifer upgradient wells (MW-112 and MW-116). Table B contains the quarterly background data collection summary for the eight upper aquifer downgradient wells: (MW-17, MW-101A, MW-108R, MW-109R, MW-110, MW-133, MW-141, and MW-161R) and the two upper aquifer upgradient wells (MW-111 and MW-115A).

Table A: **Quarterly Data Collection Summary For The Lower Aquifer Wells For The Background Period:**

1992 Second Quarter - 2021 Fourth Quarter

	Year																			
Lower	**1992**			**1993**				**1994**				**1995**				**1996**				**Well**
Aquifer	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-152	N	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	N	N	N	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	x	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U
MW-116	x	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U

	Year																				
Lower	**1997**				**1998**				**1999**				**2000**				**2001**				**Well**
Aquifer	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U
MW-116	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	x	x	x	x	x	U

	Year																				
Lower	**2002**				**2003**				**2004**				**2005**				**2006**				**Well**
Aquifer	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	d	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	N	N	N	N	N	N	N	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-116	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

Table A: Quarterly Data Collection Summary For The Lower Aquifer Wells For The Background Period:

1992 Second Quarter - 2021 Fourth Quarter

	Year																				
Lower Aquifer	2007				2008				2009				2010				2011				Well Type
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	NS	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-116	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Lower Aquifer	2012				2013				2014				2015				2016				Well Type
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-116	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Lower Aquifer	2017				2018				2019				2020				2021				Well Type
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	NS	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-116	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

Data Code	Description	Well Type Code
x	data collected and available	U = upgradient background well
d	dry well encountered in sampling	D = downgradient background well
N	not part of the CAD network	
NS	CAD well could not be sampled	

Table B: Quarterly Data Collection Summary For The Upper Aquifer Wells For The Background Period:

1992 Second Quarter - 2021 Fourth Quarter

	Year																			
Upper	**1992**			**1993**				**1994**				**1995**				**1996**				**Well**
Aquifer	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-17	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D
MW-101A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	D
MW-108R	N	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	d	d	x	d	d	D
MW-110	x	x	x	x	x	x	x	d	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	d	x	x	x	x	x	x	x	x	x	x	x	x	x	d	d	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	N	N	N	N	N	N	N	N	N	N	N	N	x	x	x	x	x	x	x	D
MW-111	N	x	d	x	x	x	x	d	x	x	d	x	x	d	d	x	x	x	d	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Upper	**1997**				**1998**				**1999**				**2000**				**2001**				**Well**
Aquifer	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-17	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	x	x	x	x	x	D
MW-101A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	x	x	x	x	x	D
MW-108R	d	x	x	x	x	d	d	d	d	d	d	d	x	d	d	x	x	x	x	x	D
MW-109R	d	x	x	x	x	x	d	d	d	x	d	d	d	d	d	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	x	x	x	x	x	d	x	x	x	x	d	x	x	x	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	d	d	d	d	x	x	x	x	x	x	d	x	x	x	x	x	d	d	d	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Upper	**2002**				**2003**				**2004**				**2005**				**2006**				**Well**
Aquifer	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**Type**
MW-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-101A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-108R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	x	x	x	x	x	d	x	x	x	x	x	x	x	d	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	d	x	d	d	d	x	d	d	d	d	d	d	x	d	d	d	x	d	d	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

Table B: Quarterly Data Collection Summary For The Upper Aquifer Wells For The Background Period:

1992 Second Quarter - 2021 Fourth Quarter

	Year																				
Upper Aquifer	**2007**				**2008**				**2009**				**2010**				**2011**				**Well Type**
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-101A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-108R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	d	x	x	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Upper Aquifer	**2012**				**2013**				**2014**				**2015**				**2016**				**Well Type**
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-101A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-108R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year																				
Upper Aquifer	**2017**				**2018**				**2019**				**2020**				**2021**				**Well Type**
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
MW-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-101A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-108R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	NS	NS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

Data Code	**Description**
x	data collected and available
d	dry well encountered in sampling
N	not part of the CAD network
NS	CAD well could not be sampled

Well Type Code

U = upgradient background well

D = downgradient background well

2.2 Background Intrawell Sample Sizes

Tables A and B are used to determine the number of samples available for background calculation for each CAD well over the 1992 – 2021 period for the lower and upper aquifers, respectively.

The numbers of samples for calculation of background are tabulated in Table C for each of the 18 wells and are observed to range from 74 to 119 samples. Background data were collected from the two downgradient wells, MW-17 and MW-101A, beginning with the Fourth Quarter 2000 sampling. The sampling has yielded a total of 85 data values for background calculations for each of these two wells. Background data were collected at the upgradient well, MW-116, in the Second Quarter sampling of 1992, and regularly since the Fourth Quarter sampling in 2000. The sampling has yielded a total of 86 data values for background calculations for the MW-116 well. Background data were collected at the upgradient well, MW-112, in the Second Quarter sampling of 1992 and regularly since the Fourth Quarter sampling in 2003. The sampling has yielded a total of 74 data values for background calculations for the MW-112 well.

Table C: Number of Samples For Calculation Of Background By Well For The Background Period:

1992 Second Quarter – 2021 Fourth Quarter

Lower Aquifer Wells	Number of Samples For Calculation Of Background	Upper Aquifer Wells	Number of Samples For Calculation Of Background
Downgradient		**Downgradient**	
MW-104	119	MW-17	85
MW-142	119	MW-101A	85
MW-149	117	MW-108R	108
MW-152	118	MW-109R	106
MW-153	118	MW-110	118
MW-158	116	MW-133	110
		MW-141	119
		MW-161R	107
Upgradient		**Upgradient**	
MW-112	74	MW-111	88
MW-116	86	MW-115A	119

3.0 CLASSIFICATION AND FREQUENCY OF SAMPLING OF SITEPARAMETERS

The site parameters and frequency of monitoring are listed in Table 5 of the GSAP. Each parameter is classified into one of the three categories: Organic Parameters, Inorganic Parameters, and Field Parameters.

3.1 Classification and Frequency of Sampling of Organic Parameters

There are 11 parameters classified as Organic Parameters. They are listed in Table 5 of the GSAP and below in Table D.

Historic Intrawell Organic Parameter Data

Sampling data were regularly collected from each CAD well during the 1992 – 2021 background period for Organic Parameters according to the quarterly data collection summary listed in Tables A and B. There has been one detection (above the detection limit) of one of these eleven Organic Parameters over the 1992 – 2021 background period. This occurred in the 2020 Fourth Quarter sampling of MW-112. This well is designated as up-gradient. None of the eleven Organic Parameters have been detected (above the detection limit) in any of the downgradient or upgradient wells in either aquifer over the entire 1992 – 2021 background period.

Frequency of Sampling of Organic Parameters

The frequency of groundwater sampling and analysis for the eleven Organic Parameters is given in Table 5 of the GSAP and in Table D below. The GSAP specifies that four of the Organic Parameters are to be analyzed and evaluated on a biannual basis starting in 2023 as specified in Table D below. The GSAP specifies that an additional seven Organic Parameters are to be analyzed and evaluated on an annual basis only (in conjunction with the biannual sampling event in Quarter Two), as specified in Table D below.

Table D: Eleven Organic Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
Acetone	Biannual (Quarters 2 and 4)
t-Butanol	Annual (Quarter 2 only)
Chlorobenzene	Annual (Quarter 2 only)
Ethylbenzene	Annual (Quarter 2 only)
Hexane	Annual (Quarter 2 only)
Methylene chloride	Biannual (Quarters 2 and 4)
Methyl cyclopentane	Annual (Quarter 2 only)
Methyl t-butyl ether	Annual (Quarter 2 only)
Tetrahydrofuran	Biannual (Quarters 2 and 4)
Toluene	Biannual (Quarters 2 and 4)
Xylenes	Annual (Quarter 2 only)

Comparison of Organic Parameters to Detection Limits

As described in Section 5.0, each Organic Parameter will be evaluated by comparison to the detection limit used in the groundwater chemistry measurement process. A statistically significant increase at an upgradient or downgradient CAD well will be noted if at least one of the four biannually-evaluated Organic Parameters or seven annually-evaluated Organic Parameters listed in Table D is reported above the individual parameter's detection limit.

3.2 Classification and Frequency of Sampling of Field Parameters

Three site parameters are classified as Field Parameters and are listed on Table 5 of the GSAP and below in Table E. These three Field Parameters are pH, specific conductance, and temperature.

Field (Conventional) Parameters are defined in this SEP as those parameters which are detected in more than 50% of the samples from all CAD monitor wells within an aquifer over the entire 1992 – 2021 background period. The parameters, pH, specific conductance, and temperature, were observed to satisfy this requirement over the 1992 – 2021 background period. Historic intrawell background data will not be statistically analyzed for the Field Parameters.

Frequency of Sampling of Field Parameters

Table 5 of the GSAP specifies that the three Field Parameters are to be sampled on a biannual basis beginning in 2023, as shown in Table E below.

Table E: Field Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
pH	Biannual
Specific Conductance	Biannual
Temperature	Biannual

3.3 Classification and Frequency of Sampling of Inorganic Parameters

Three site parameters were classified as Inorganic Parameters in Table 5 of the GSAP and are given in Table F below. The three Inorganic Parameters are dissolved chromium, copper, and zinc.

Inorganic Parameters (Infrequently Detected Inorganic Parameters) are defined in this SEP as those parameters which are detected in fewer than 50% of the samples from all CAD monitoring wells within an aquifer over the entire 1992 – 2021 background period. Determinations of the Inorganic Parameters were made individually for each of the CAD wells incorporating data collected in the background period defined in Section 2.1 as the 1992 Second Quarter through the 2021 Fourth Quarter. The parameters chromium, copper, and zinc were detected in fewer than

50% of the samples over the 1992 – 2021 background sampling period in both the upper and lower aquifers at the site.

Frequency of Sampling of Inorganic Parameters

The GSAP specifies that the single Inorganic Parameter chromium is to be sampled and evaluated on a biannual basis beginning in 2023 and that two of the Inorganic Parameters, copper and zinc, are to be sampled and evaluated on an annual basis only (in conjunction with the regular biannual sampling in Quarter Two).

The Inorganic Parameters' frequencies of sampling are listed below in Table F.

Table F: Three Inorganic Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
Chromium	Biannual (Quarters 2 and 4)
Copper	Annual (Quarter 2 only)
Zinc	Annual (Quarter 2 only)

Non-Parametric Upper Tolerance Interval Limits Based on Background Data

As described in Section 7.0, a Non-Parametric Tolerance Interval statistical method will be used to evaluate the three Inorganic Parameters due to the high level of censoring (proportion of data falling below the detection limit). This method requires large numbers of background samples to ensure a reasonable Type I (false positive) error rate. Therefore, beginning with the 2022 First Quarter sampling, Inorganic Parameters at each well will be compared to the maximum historic intrawell parameter value observed at the well in the 1992 – 2021 background period.

Table G contains a tabulation of the maximal parameter values detected in the 1992 – 2021 background samples for each of the Inorganic Parameters at each CAD well. These maximal tolerance interval (TI) values will be used as the non-parametric Upper TI limits, as described in Section 7.0. Each Upper TI value tabulated in Table G is based on a total of 119 possible samples from the 1992 – 2021 background data.

According to the SEP protocol, four separate re-samples were collected from MW-108R on November 15, 2018. No chromium exceedances were found in any of the four re-samples and each of the four chromium re-sampled results were reported as non-detect (<0.025 mg/L). In accordance with the SEP (August 24, 2012), the foreground chromium concentration at MW-108R is consistent with background and is not classified as a statistically significant increase.

Five of the Upper TI values reported in Table G were revised in 2017 as part of a statistical review of the 2012 SEP and 2012 – 2016 foreground data. At that time, the 14 data sets from the Third Quarter 2012 to Fourth Quarter 2016 foreground data from each of the 18 CAD wells were incorporated into the intrawell background data set. The Upper TI for copper at MW-108R in the upper aquifer and the Upper TI values for zinc at MW-142, MW-149, MW-152, and MW-158 in the lower aquifer slightly increased.

The revised Upper TI values were based on identification of maximum detected concentrations already in the background data set which had not previously been used to update the Upper TI values. The Upper TI value of copper for MW-108R was increased from 0.05 mg/L to 0.06 mg/L. The groundwater sample collected on April 15–16, 2003, had a copper concentration of 0.06 mg/L.

The Upper TI values of zinc for four wells in the lower aquifer were increased based on the detections in the January 2000 samples as follows:

MW-142 increased from 0.02 mg/L to 0.03 mg/L
MW-149 increased from 0.01 mg/L to 0.03 mg/L
MW-152 increased from 0.06 mg/L to 0.08 mg/L
MW-158 increased from 0.03 mg/L to 0.04 mg/L

Detections of slightly lower concentrations of zinc were reported in the previous (October 1999) data set for all four of these wells. Additionally, at least one detection of zinc was reported prior to October 1999 in MW-149, 152, and 158.

Table G: **Non-Parametric Upper Tolerance Interval (Upper TI) Limits For The Infrequently Detected Inorganic Parameters For The Background Period:**

1992 Second Quarter – 2021 Fourth Quarter

Lower Aquifer

Well	Well Type	Chromium (mg/L)	Copper (mg/L)	Zinc (mg/L)
MW-104	D	<0.025	<0.02	0.03
MW-112	U	<0.025	<0.02	0.15
MW-116	U	<0.025	<0.02	<0.02
MW-142	D	<0.025	0.05	0.03
MW-149	D	<0.025	0.02	0.03
MW-152	D	<0.025	0.02	0.08
MW-153	D	<0.025	<0.02	0.02
MW-158	D	<0.025	<0.02	0.04

Upper Aquifer

Well	Well Type	Chromium (mg/L)	Copper (mg/L)	Zinc (mg/L)
MW-17	D	<0.025	<0.02	0.03
MW-101A	D	<0.025	<0.02	0.07
MW-108R	D	<0.025	0.06	0.19
MW-109R	D	<0.025	0.072	0.13
MW-110	D	<0.025	0.03	0.05
MW-111	U	<0.025	<0.02	0.90
MW-115A	U	<0.025	<0.02	0.03
MW-133	D	<0.025	<0.02	0.14
MW-141	D	<0.025	<0.02	1.09
MW-161R	D	<0.025	0.02	0.07

Well Type Code:

D = Downgradient
U = Upgradient

4.0 STATISTICAL EVALUATIONS APPLIED TO THE FOREGROUND DATA

Foreground Data

In accordance with this SEP, all new data collected from CAD wells at the facility (which may be affected by the facility), beginning with the First Quarter 2022 sampling, will be referred to as the "foreground data". The foreground data for the 2022 quarters will be evaluated on a quarterly basis and the foreground data starting with the 2023 biannual sampling will be evaluated on a biannual basis.

Statistical Evaluation of the Organic Parameters

An exceedance occurs if any quarterly or biannually-evaluated foreground Organic Parameter or any annually-evaluated foreground Organic Parameter is detected above the applicable detection limit. Details describing the statistical evaluation of the Organic Parameters are given in Section 5.0.

Graphical Evaluation of the Field Parameters

Foreground concentrations of Field Parameters in downgradient and upgradient wells will be evaluated and compared to intrawell background concentrations using graphical procedures. Details describing the graphical evaluation of the Field Parameters are given in Section 6.0.

Statistical Evaluation of the Inorganic Parameters

A statistical evaluation method will be used to determine if a foreground sample concentration of an Inorganic Parameter is to be reported as a statistically significant increase.

An exceedance occurs if any of three Inorganic Parameters is detected above the applicable Non-Parametric Upper TI Limit given in Table G. Details describing the statistical evaluation of the Inorganic Parameters are given in Section 7.0.

5.0 STATISTICAL EVALUATION OF THE ORGANIC PARAMETERS

The eleven Organic Parameters listed in Table D were analyzed during the 1992 – 2021 background sampling period at the site.

Biannual Sampling Statistical Evaluation of Organic Parameters

Foreground concentrations of the four biannually-evaluated Organic Parameters listed in Table D will be evaluated by comparison to the detection limit used in the groundwater chemistry measurement process. A statistically significant increase at an upgradient or downgradient CAD well will be noted if at least one of the four biannually-evaluated Organic Parameters listed in Table D is reported above the individual parameter's detection limit.

If each of the four foreground concentrations of the biannually-evaluated Organic Parameters is reported below the detection limit, then concentrations at the well will be considered not in exceedance and, therefore, compliant. However, if at least one of the four foreground concentrations of the biannually-evaluated Organic Parameters equals or exceeds its detection limit, the Organic Parameter concentration at the well will be deemed as higher than background. The well will then be re-sampled in quadruplicate as soon as practical for the detected Organic Parameter in that well to confirm the exceedance.

Annual Sampling Statistical Evaluation of Organic Parameters

Foreground concentrations of the seven annually-evaluated Organic Parameters listed in Table D will be evaluated by comparison to the detection limit used in the groundwater chemistry measurement process. A statistically significant increase at an upgradient or downgradient CAD well will be noted if at least one of the seven annually-evaluated Organic Parameters listed in Table D is reported above the individual parameter's detection limit.

If each of the seven foreground concentrations of the annually-evaluated Organic Parameters is reported below the detection limit, then concentrations at the CAD well will be considered not in exceedance, and therefore, compliant. However, if at least one of the seven foreground concentrations of the annually-evaluated Organic Parameters equals or exceeds its detection limit, the Organic Parameter concentration at the well will be deemed as higher than background. The well will then be re-sampled in quadruplicate as soon as practical for the detected Organic Parameter in that well to confirm the exceedance.

Quadruplicate Re-Sampling Procedure for Biannual and Annual Evaluations

The analytic results of the quadruplicate re-sampling will be evaluated as soon as practical.

If any Organic Parameter from the quadruplicate re-sampling exceeds a detection limit, foreground concentrations of the individual parameter in the affected CAD well will be declared an exceedance. In this event, procedures in accordance with Part VI of the Operating License will be performed.

However, it may be demonstrated that a source other than the facility caused the observed exceedance in the Organic Parameter concentration by using procedures described in the Operating License. If it is determined that the facility is not the source of the detected parameter, P&U will propose to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) one of the following:

(1) exclude the subject Organic Parameter at the affected CAD well from statistical evaluation until the non-facility influence no longer exists, or

(2) removal of the affected well from the CAD network and substitution of another suitable non-affected monitor well into the CAD network.

6.0 GRAPHICAL EVALUATION OF THE FIELD PARAMETERS

The procedures to be used to evaluate the Field Parameters, pH, specific conductance, and temperature, are graphical procedures. A graph will be produced after each quarterly sampling event including all three Field Parameters for each of the 18 CAD wells. Each graph produced will include all data from the 1992 – 2021 background period and all foreground data collected after the 2021 Fourth Quarter sampling including the most recent quarterly or biannual data collected at the well. The method of evaluation is inspection of the graphs for excessively large values of pH, conductivity, and temperature and for excessively small values of pH and temperature only.

Quarterly listings of the Field Parameters, pH, specific conductance, and temperature (Centigrade), from 1992 to 2021 are given in Appendices A, B, and C, respectively. It is noted that temperatures were reported in Fahrenheit degrees for all quarterly listings up to and including the Third Quarter of 1999. All quarterly temperatures were reported in Centigrade degrees starting with the Fourth Quarter of 1999. For consistency, all quarterly Fahrenheit temperatures are reported in Centigrade degrees in the Appendix C listings.

7.0 STATISTICAL EVALUATION OF THE INORGANIC PARAMETERS

Foreground concentrations of the Inorganic Parameters (identified in Section 3.0) will be compared to historic intrawell background concentrations using Non-Parametric Upper Tolerance Interval (TI) Limits.

Non-parametric TIs are recommended in the U.S. EPA Guidance (July 1992; p. 54) for use in evaluating groundwater monitoring data when “the assumptions of normality and lognormality cannot be justified, especially when a significant portion of the samples are non-detect”. According to U.S. EPA guidance, non-parametric intervals are sensitive to the actual magnitudes of the concentrations. Because non-parametric TIs may be established as the maximum detected concentration in background, they allow for an accurate representation of background when high levels of censoring are present in background data sets.

The choice of the use of the non-parametric TIs for the analysis of the Inorganic Parameters is the result of the high number of non-detect data observed in the background data for these parameters, as noted in Section 3.3.

Establishment of Non-Parametric Upper Tolerance Interval Limits for Inorganic Parameters

Non-parametric upper TIs have been established based on the historic 1992 –2021 intrawell background data for each Inorganic Parameter in each downgradient and upgradient CAD monitoring well at the facility.

Table G in Section 3.3 contains a tabulation of the maximal parameter values detected in the 1992 – 2021 background samples for all Inorganic Parameters at each well. These maximal tolerance interval (Upper TI) values will be used as the non-parametric upper tolerance interval limits. For Inorganic Parameters detected above current detection limits in the 1992 – 2021 intrawell background data, the Upper TI value in Table G is the maximum detected concentration in the 1992 – 2021 intrawell background history. For Inorganic Parameters not detected above current detection limits in the 1992 – 2021 intrawell background data set, the Upper TI is the detection limit itself.

Each Upper TI value tabulated in Table G is based on a possible total of 119 possible samples from the 1992 – 2021 background data set. U.S. EPA Guidance (July 1992; p. 76) recommends that a minimum of eight samples be used to characterize background concentrations. Statistical evaluation of the Inorganic Parameters for each of the eighteen wells listed in Table C may continue because at least eight background samples are available from each well.

Statistical Evaluation Procedure using the Non-Parametric Upper Tolerance Interval

Foreground data for each Inorganic Parameter in an individual well will be evaluated by comparing detected concentrations to the maximal detected concentration Upper TI limit observed in the 1992 – 2021 period for the well. The following notation is introduced:

x_i = individual foreground concentration at sampling event i

Upper TI = maximum concentration over the entire1992 – 2021 background period, which is tabulated in Table G

Foreground Concentrations Consistent with the 1992 – 2021 Background Concentrations

If the foreground concentration of a particular Inorganic Parameter in a well is less than the Upper TI:

$x_i <$ Upper TI,

or if the foreground concentration is below the detection limit (regardless of the detection limit employed), it will be considered consistent with background.

Foreground Concentrations in Exceedance of the 1992 – 2021 Background Concentrations

If a foreground concentration of a particular Inorganic Parameter in a well exceeds the Upper TI:

$x_i >$ Upper TI,

it will be classified as greater than background concentrations and the concentration will be classified as a statistically significant increase or an exceedance.

Implementation of the Non-Parametric Tolerance Interval Evaluation Method

The Upper TI values in Table G will be used for all evaluations of the Inorganic Parameters for all foreground data collected beginning with the 2022 First Quarter. Foreground Inorganic Parameter data will be compared to the maximal historic intrawell parameter value (Upper TI) observed at the well in the 1992 – 2021 background period.

The non-parametric tolerance interval evaluation method will be utilized for the chromium Inorganic Parameter on a quarterly basis for 2022 data and on a biannual-basis beginning with 2023 data. Copper and zinc inorganic parameters will be evaluated on an annual basis (at the Second Quarter sampling only) as listed in Table F.

Quadruplicate Re-Sampling Procedure

The analytic results of the quadruplicate re-sampling will be evaluated as soon as practical.

If an exceedance of the Upper TI limit occurs for any Inorganic Parameter, samples will be collected in quadruplicate from the well as soon as practical to confirm the exceedance for the parameter. If at least three of the subsequent detected concentrations fall below the Upper TI value, foreground concentrations will be considered consistent with background. However, if two or more of the subsequent detected concentrations exceed the Upper TI value, foreground concentrations of the individual Inorganic Parameter in the affected well will be considered significantly greater than background and the steps in accordance with Part VI of the Operating License will be performed.

8.0 PROCEDURES FOR MAKING CHANGES TO THE SEP

P&U may submit a petition to the EGLE to re-evaluate and modify, as necessary, the statistical procedures included in the 2022 SEP resulting from documented evidence of changes in the groundwater chemistry at the site.

P&U may review any new and improved statistical methods as they are developed, and propose modifications to the SEP accordingly, upon approval by the EGLE. In addition, P&U may request a modification of the CAD groundwater parameters monitored at the site from the EGLE. Finally, P&U may request from the EGLE that new site CAD wells be added or existing site CAD wells be deleted from the SEP.

9.0 REPORTING PROCEDURES

The statistical evaluation of the groundwater sampling analytical results from the CAD wells will be performed and documented in biannual statistical reports after 2022. The EGLE will receive notifications of exceedances as specified in the Operating License. These biannual reports and the Annual Statistical Summary Report will be submitted to the EGLE as attachments to the Annual Groundwater Monitoring Report.

9.1 Protocol for Biannual Reports

The quarterly monitoring data collected at each of the CAD wells in the 1992 – 2021 period will be used as an intrawell background for each round of data collected at each CAD well starting with the First Quarter 2022 sampling. This set of background intrawell data will be used as a background for all quarterly, biannual, or annual monitoring data collected at the CAD well beginning with the First Quarter 2022.

Quarterly reports will be produced for the quarterly sampling period starting with the First Quarter 2022 sampling and biannual reports will be produced once the quarterly sample events are replaced with biannual sampling in 2023. The same background intrawell data sets will be used as the background control at each individual CAD well and parameter for a minimum of four years (2022 – 2025).

The background intrawell data will not be updated as new data are collected between 2022 and 2025.

A thorough statistical review will be completed after the Fourth Quarter 2025 sampling. Consideration will be given to updating the background data used for intrawell evaluations with the 2022 – 2025 monitoring data. A thorough statistical review will subsequently be completed every four years if there are no major changes in the data and consideration will be given to updating the background data used for intrawell evaluations.

10.0 REFERENCES

U.S. Environmental Protection Agency (U.S. EPA) (1992; July) *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance*. Office of Solid Waste, Permits & State Programs Division.

U.S. EPA (1989; April) *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Interim Final Guidance*. Office of Solid Waste, Permits & State Programs Division.

11.0 APPENDIX SECTION

Appendix A – pH Parameter Data Listings by Well: 1992 – 2021
Appendix B – Specific Conductance Parameter Data Listings by Well: 1992 – 2021
Appendix C – Temperature Parameter Data Listings by Well: 1992 – 2021

Appendix A

pH Parameter Data Listings by Well: 1992 – 2021

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Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	8.60	7.99	7.23	7.89	8.15	8.43	7.80	8.16	----	7.70	7.34	7.76
MW-108R	7.47	6.98	7.30	6.83	7.54	7.77	7.25	----	7.30	7.10	6.39	6.86
MW-109R	7.47	7.68	7.03	7.07	8.68	7.39	7.52	----	7.10	7.40	6.67	6.99
MW-110	8.54	7.23	7.69	7.10	7.90	7.93	7.63	----	----	7.50	6.75	7.30
MW-111		6.91	----	6.42	7.98	7.56	6.79	----	----	7.20	7.11	----
MW-112	7.57	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.70	7.74	----	7.58	8.77	7.91	7.61	----	7.97	7.60	7.16	7.59
MW-116	8.72	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.86	7.63	----	7.38	8.75	7.71	7.98	----	8.45	7.80	7.27	7.47
MW-141	7.28	7.14	7.33	6.82	8.12	8.14	8.95	7.53	----	7.60	6.71	7.11
MW-142	7.66	7.62	7.63	7.64	8.44	8.97	8.04	8.04	----	7.90	7.42	7.76
MW-149	7.96	7.78	8.34	8.22	8.59	8.56	7.58	----	8.56	7.90	7.35	7.75
MW-152	----	8.42	7.95	8.26	9.06	9.09	8.59	----	8.77	7.80	7.10	7.70
MW-153	7.15	7.40	7.55	7.10	8.08	8.40	7.81	----	7.42	7.60	6.90	7.39
MW-158	----	----	----	7.49	8.42	8.60	7.74	8.37	----	7.80	7.31	7.01
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----

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Well ID	1/18-19/95	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	7.89	----	7.87	7.83	----	7.50	----	----	7.92	8.18	7.33	7.47
MW-108R	6.98	----	7.04	6.99	----	7.40	----	6.50	----	6.79	6.31	7.11
MW-109R	6.70	----	7.22	7.41	----	----	----	----	----	7.28	----	----
MW-110	7.58	----	7.60	7.30	----	7.10	----	7.08	----	7.49	8.02	6.96
MW-111	7.41	----	7.37	----	----	----	----	6.86	----	6.91	7.09	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.76	----	7.75	7.81	----	7.30	----	7.38	----	7.43	7.62	7.37
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.75	----	7.83	7.40	----	7.40	----	----	7.77	----	----	7.26
MW-141	----	7.24	7.31	----	7.20	7.40	----	7.44	----	7.54	7.04	6.70
MW-142	----	7.81	7.97	----	7.82	8.20	----	8.07	----	8.17	10.05	7.20
MW-149	8.18	----	8.10	7.90	----	7.70	----	----	8.08	8.16	8.09	6.27
MW-152	7.71	----	7.87	----	7.59	----	8.30	7.63	----	7.73	5.65	7.20
MW-153	7.41	----	7.73	----	7.58	7.40	----	7.71	----	7.84	7.25	7.30
MW-158	7.50	----	7.81	----	7.45	7.90	----	----	7.51	7.82	7.49	7.32
MW-161R	----	----	7.40	7.51	----	7.30	----	7.47	----	7.49	6.59	7.22

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Well ID	1/23-24/97	4/22-24/97	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	8.19	7.65	7.41	7.89	7.97	7.90	8.07	7.85	7.77	----	7.41	7.43
MW-108R	----	7.21	6.93	7.28	6.70	6.65	----	----	----	----	----	----
MW-109R	----	7.37	7.22	7.84	6.65	7.34	----	----	----	----	6.87	----
MW-110	7.61	7.36	7.14	7.55	7.56	7.43	7.98	8.23	----	7.28	6.97	7.30
MW-111	----	----	----	----	7.46	7.27	6.40	6.58	6.62	----	6.52	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.65	7.34	7.27	7.49	7.62	7.65	7.39	7.68	7.42	----	7.40	7.29
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.70	7.70	7.60	7.57	7.70	7.73	7.59	----	7.07	----	7.22	7.40
MW-141	7.33	6.74	7.22	7.47	7.36	7.16	7.18	6.86	6.73	----	7.12	7.18
MW-142	7.90	7.31	7.57	7.92	8.12	8.06	8.23	7.72	7.94	----	7.29	7.80
MW-149	9.80	8.98	8.41	8.87	8.65	8.42	7.80	8.18	8.71	----	7.72	7.52
MW-152	7.52	7.41	7.35	7.67	7.89	7.51	8.05	7.94	7.68	----	7.37	7.26
MW-153	7.63	7.46	7.46	7.69	7.64	7.55	7.79	7.90	7.38	----	7.29	7.16
MW-158	7.77	7.43	7.52	7.92	7.88	7.69	7.75	7.61	7.61	----	7.22	7.33
MW-161R	7.36	7.12	7.01	7.43	7.36	7.22	6.90	7.43	7.10	----	6.95	6.85

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Well ID	10/12-14/99	1/18-21/00	4/19-21/00	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01
MW-17	----	----	----	----	6.84	7.00	----	6.90	----	----	7.01	----
MW-101A	----	----	----	----	7.06	7.04	----	6.99	----	----	6.70	----
MW-104	7.47	7.59	7.55	7.35	7.60	7.72	----	7.40	----	----	7.05	----
MW-108R	----	6.38	----	----	6.91	7.12	7.07	7.06	----	----	6.87	----
MW-109R	----	----	----	----	7.42	7.38	----	7.76	----	7.60	7.18	----
MW-110	7.23	7.41	7.28	7.57	7.72	8.05	----	7.43	----	----	7.65	----
MW-111	6.78	6.70	6.90	6.88	6.75	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.33	7.50	7.46	7.69	7.59	7.82	----	7.66	7.31	----	7.30	----
MW-116	----	----	----	----	8.00	8.14	----	8.05	----	----	7.82	----
MW-133	7.28	----	7.62	7.62	7.31	7.57	----	7.67	----	----	7.25	----
MW-141	7.02	7.26	7.15	7.07	7.25	7.36	----	7.37	----	6.98	7.02	----
MW-142	7.45	7.56	7.61	7.40	7.63	7.83	----	7.63	----	----	7.43	----
MW-149	7.53	7.75	8.77	8.00	7.62	7.80	----	8.34	----	----	9.15	----
MW-152	7.40	7.48	7.42	7.71	7.41	7.60	----	7.29	----	----	6.95	----
MW-153	7.21	7.41	7.16	7.52	7.12	7.41	----	7.22	----	----	6.88	----
MW-158	7.37	7.52	7.44	7.36	7.54	7.71	----	7.54	----	----	6.97	----
MW-161R	6.93	7.22	7.14	6.81	7.05	7.21	----	7.13	----	7.05	6.77	7.12

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Well ID	10/23-25/01	12/19/01	1/21-23/02	3/22/02	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02
MW-17	7.01	----	6.95	----	----	7.01	----	----	6.65	----	6.58	----
MW-101A	6.95	----	6.88	----	----	6.99	----	----	6.65	----	6.46	----
MW-104	7.50	----	7.81	----	----	7.82	----	----	7.52	7.24	7.32	7.57
MW-108R	7.06	----	7.24	----	----	7.24	----	----	6.96	----	6.09	----
MW-109R	7.68	----	7.28	7.58	----	7.50	----	----	7.18	----	6.92	7.12
MW-110	7.59	----	7.93	----	----	7.89	----	----	7.60	----	7.80	----
MW-111	7.15	----	----	----	----	7.31	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.60	----	7.63	----	----	7.80	----	----	7.52	----	7.10	----
MW-116	8.02	----	8.06	----	----	8.17	----	----	7.80	----	7.55	----
MW-133	7.52	----	7.78	----	----	7.72	----	----	7.49	----	7.04	----
MW-141	7.29	----	7.45	----	----	7.40	----	----	7.22	----	6.89	----
MW-142	7.84	----	7.82	----	----	7.74	----	----	7.59	----	7.37	----
MW-149	8.50	----	8.09	----	8.08	----	7.70	8.02	7.78	7.71	7.80	7.92
MW-152	7.59	----	7.47	----	----	7.74	----	----	7.33	----	7.16	----
MW-153	7.56	----	7.54	----	----	7.68	----	----	7.19	----	7.08	----
MW-158	7.70	----	7.70	----	----	7.78	----	----	7.41	----	7.23	----
MW-161R	7.23	7.12	7.14	----	----	7.29	----	----	6.95	6.76	6.65	6.89

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Well ID	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	4/19-23/04
MW-17	7.69	----	6.70	----	6.72	----	7.04	----	----	6.83	----	6.81
MW-101A	7.62	----	6.48	----	6.53	----	6.80	----	----	6.87	----	6.79
MW-104	8.30	7.62	7.23	7.46	7.58	7.77	7.76	7.65	----	7.73	7.63	7.81
MW-108R	7.26	----	6.18	6.38	6.26	----	6.53	----	6.56	6.68	6.70	6.94
MW-109R	7.95	7.28	7.24	----	7.14	----	7.43	7.44	----	7.12	7.26	7.24
MW-110	8.17	----	7.12	----	7.87	----	7.78	----	----	7.38	----	7.39
MW-111	----	----	6.84	----	----	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	7.45	----	----	7.32	----	7.64
MW-115A	8.12	----	7.22	----	7.36	----	7.56	----	----	7.52	----	7.59
MW-116	8.52	----	7.43	----	7.72	----	8.05	----	----	8.07	----	8.09
MW-133	7.76	----	7.24	----	7.28	----	----	----	----	7.85	----	7.81
MW-141	7.42	----	6.87	----	6.95	----	7.28	----	----	7.38	----	7.36
MW-142	7.76	----	7.27	----	7.41	----	7.73	----	----	7.82	----	7.88
MW-149	8.59	9.71	8.88	8.39	----	----	7.54	7.78	----	7.85	----	7.63
MW-152	8.16	----	7.07	----	7.26	----	7.53	----	----	7.52	----	7.48
MW-153	8.06	----	7.06	----	7.23	----	7.51	----	----	7.55	----	7.46
MW-158	7.38	----	7.24	----	7.10	----	7.64	----	----	7.64	----	7.60
MW-161R	7.73	6.98	6.71	6.46	6.86	7.16	7.04	7.10	----	7.21	7.08	7.01

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Well ID	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05	9/9/05
MW-17	----	7.06	----	6.83	----	----	6.87	----	6.79	----	6.76	----
MW-101A	----	6.79	----	6.77	----	----	6.80	----	6.84	----	6.82	----
MW-104	7.79	7.58	7.76	7.72	7.84	----	7.51	7.65	7.67	7.62	7.69	7.69
MW-108R	----	7.15	----	6.85	----	----	6.95	----	6.83	----	6.76	----
MW-109R	7.42	7.56	7.19	7.15	7.37	----	7.33	7.35	7.34	7.46	7.46	7.37
MW-110	----	7.47	----	7.32	----	----	7.27	----	7.46	----	7.32	----
MW-111	----	----	----	----	----	----	7.15	----	----	----	----	----
MW-112	----	7.60	----	7.44	----	----	7.33	----	7.34	----	7.34	----
MW-115A	----	7.88	----	7.54	----	----	7.40	----	7.48	----	7.60	----
MW-116	----	8.20	----	8.07	----	----	7.88	----	7.99	----	7.98	----
MW-133	----	7.13	----	7.49	----	----	7.84	----	7.42	----	7.57	----
MW-141	----	7.34	----	7.37	----	----	7.22	----	7.36	----	7.33	----
MW-142	----	7.73	----	7.84	----	----	7.64	----	7.78	----	7.79	----
MW-149	7.66	7.57	7.66	7.68	----	7.72	7.62	7.69	7.71	7.47	7.70	7.70
MW-152	----	7.28	7.46	7.53	----	----	7.40	----	7.43	----	7.50	----
MW-153	----	7.45	----	7.54	7.64	----	7.58	7.48	7.43	7.44	7.52	----
MW-158	----	7.53	----	7.59	----	----	7.45	----	7.50	7.44	7.48	7.68
MW-161R	7.21	7.06	7.01	7.19	7.19	----	7.06	7.15	7.08	6.89	7.16	7.23

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Well ID	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07	4/16-18/07
MW-17	6.88	----	6.90	----	6.83	----	6.89	----	6.79	----	6.83	6.92
MW-101A	6.80	----	6.92	----	6.88	----	6.88	----	6.95	----	6.83	6.97
MW-104	7.84	7.48	7.89	7.72	7.78	7.72	7.80	7.78	8.01	----	7.90	7.92
MW-108R	6.89	----	6.73	----	6.81	----	6.83	----	6.66	----	6.71	6.81
MW-109R	7.41	7.21	7.48	7.29	7.27	7.34	7.24	7.01	7.21	7.12	7.21	7.25
MW-110	7.49	----	7.56	----	7.34	----	7.46	----	7.26	----	7.25	7.52
MW-111	----	----	7.40	----	----	----	----	----	7.25	----	7.58	7.35
MW-112	7.45	----	7.46	----	7.51	----	7.47	----	7.52	----	7.46	7.55
MW-115A	7.50	----	7.53	----	7.56	----	7.69	----	7.70	----	7.51	7.63
MW-116	8.06	----	8.09	----	7.73	----	8.09	----	8.18	----	7.96	8.04
MW-133	----	----	7.69	----	7.87	----	7.66	----	7.70	----	7.99	8.20
MW-141	7.34	----	7.35	----	7.19	----	7.33	----	7.55	----	7.46	7.51
MW-142	7.96	----	7.78	----	7.64	7.78	7.86	7.82	8.05	----	7.98	7.96
MW-149	7.79	7.37	7.70	7.81	7.73	7.75	7.66	7.73	8.00	7.77	7.83	7.91
MW-152	7.56	----	7.55	----	7.52	----	7.54	----	7.71	----	7.62	7.53
MW-153	7.58	7.27	7.70	7.49	7.57	7.55	7.59	7.58	7.58	----	7.70	7.27
MW-158	7.68	7.40	7.53	7.69	7.56	7.65	7.68	7.63	7.76	----	7.81	7.65
MW-161R	7.17	----	7.18	----	7.30	----	7.12	----	7.39	----	7.32	7.40

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Well ID	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09	11/6/09
MW-17	6.94	----	6.84	6.80	6.77	7.24	7.01	7.05	7.07	7.15	----	7.09
MW-101A	6.97	----	6.84	7.00	6.75	7.04	6.92	6.95	6.90	6.93	6.83	----
MW-104	8.00	----	7.80	7.86	7.74	7.99	7.76	8.00	8.00	7.99	7.89	----
MW-108R	6.88	----	6.79	6.72	6.69	7.12	6.83	6.82	6.93	6.98	6.79	----
MW-109R	7.08	----	7.12	7.10	7.12	7.69	7.33	7.50	7.55	7.60	7.39	----
MW-110	7.48	----	7.38	7.46	7.36	7.69	7.39	7.68	7.90	7.75	7.63	----
MW-111	7.45	----	6.95	7.21	7.19	7.36	6.99	7.10	7.30	7.40	7.28	----
MW-112	7.50	----	7.45	7.61	7.49	7.70	7.45	7.59	7.71	7.60	7.48	----
MW-115A	7.78	----	7.62	7.59	7.47	7.75	7.50	7.67	7.73	7.57	7.62	----
MW-116	8.19	----	7.98	8.10	7.90	8.12	7.87	8.13	8.18	8.03	8.02	----
MW-133	7.75	----	7.48	7.55	7.73	7.73	7.52	8.06	7.98	7.78	7.75	----
MW-141	7.51	----	7.36	7.15	7.24	7.44	7.36	7.34	7.38	7.30	7.41	----
MW-142	8.06	7.65	7.90	7.68	7.82	7.90	7.72	7.97	7.96	7.69	7.86	----
MW-149	7.95	----	7.74	7.44	7.66	8.00	7.75	7.95	7.94	7.94	7.83	----
MW-152	7.74	----	7.61	7.47	7.39	7.81	7.44	7.71	7.63	7.76	7.59	----
MW-153	7.75	----	7.58	7.68	7.49	7.85	7.49	7.70	7.67	7.64	7.55	----
MW-158	7.79	7.30	7.60	7.47	7.60	7.91	7.58	7.83	7.74	7.81	7.68	----
MW-161R	7.25	----	7.21	7.06	7.18	7.42	7.27	7.26	7.25	7.03	7.18	----

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Well ID	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12	7/18-23/12
MW-17	7.09	7.17	7.23	7.29	7.24	7.51	7.14	7.05	----	7.13	7.16	7.64
MW-101A	6.88	6.97	7.03	7.10	7.09	7.30	7.13	7.08	----	7.19	7.19	6.67
MW-104	8.06	8.07	8.08	8.06	8.01	8.27	8.02	7.80	----	7.58	7.89	7.26
MW-108R	6.85	6.95	6.93	7.05	7.06	7.15	----	6.99	----	7.12	6.98	7.25
MW-109R	7.35	7.54	7.56	7.40	7.32	7.94	7.50	7.44	7.39	7.52	7.49	7.07
MW-110	7.83	7.84	7.84	7.90	7.98	8.35	7.75	7.89	----	7.95	7.70	8.83
MW-111	7.55	7.37	7.40	7.35	----	7.33	7.19	7.15	----	7.14	7.20	6.83
MW-112	7.66	7.70	7.64	7.69	7.62	7.85	7.53	7.51	----	7.62	7.44	7.21
MW-115A	7.60	7.81	7.89	7.88	7.62	7.91	7.78	7.75	----	7.63	7.53	7.18
MW-116	8.16	8.25	8.23	8.17	8.06	8.38	8.10	8.00	----	8.04	7.91	7.45
MW-133	7.71	7.99	7.84	7.59	7.65	8.16	7.67	7.70	----	8.26	7.83	7.67
MW-141	7.35	7.54	7.64	7.61	7.52	7.68	7.49	7.41	----	7.45	7.41	6.83
MW-142	7.89	8.02	7.88	7.79	7.79	7.98	7.81	7.65	----	7.88	7.63	7.28
MW-149	7.86	8.09	8.00	7.96	7.98	8.39	----	8.04	----	7.97	7.90	7.31
MW-152	7.74	7.82	7.79	7.60	7.77	7.94	7.85	7.68	----	7.69	7.38	7.15
MW-153	7.68	7.65	7.71	7.67	7.71	7.79	7.61	7.44	----	7.62	7.40	7.87
MW-158	7.77	7.83	7.65	7.65	7.69	8.05	7.42	7.82	----	7.71	7.34	9.15
MW-161R	7.29	7.35	7.37	7.37	7.32	7.40	7.44	7.48	----	7.41	7.37	6.78

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Well ID	10/22-30/12	1/25-29/13	4/17-23/13	7/15-17/13	10/21-24/13	1/31-2/6/14	4/24-5/1/14	7/21-24/14	10/20-23/14	1/20-29/15	4/21-24/15	7/22-27/15
MW-17	7.27	7.08	7.30	7.65	7.52	7.81	7.34	7.37	7.36	7.29	7.19	7.27
MW-101A	7.20	6.91	7.17	7.27	7.31	7.24	7.01	7.19	6.74	7.13	6.92	7.15
MW-104	7.93	7.43	7.86	8.05	8.08	7.74	7.60	7.85	7.16	7.81	7.64	7.83
MW-108R	7.14	7.14	7.01	7.08	7.04	7.17	6.75	7.01	6.94	6.87	6.77	6.91
MW-109R	7.56	7.19	7.58	7.65	7.50	7.45	7.86	7.47	7.46	7.38	7.25	7.55
MW-110	8.08	8.06	7.92	7.80	7.88	7.53	7.68	7.79	7.74	7.67	7.45	7.60
MW-111	7.16	7.24	7.15	7.18	7.22	7.59	7.13	7.29	7.16	7.30	7.22	7.08
MW-112	7.75	7.29	7.55	7.80	7.77	7.51	7.51	7.67	7.67	7.44	7.40	7.54
MW-115A	7.80	7.32	7.61	7.82	7.99	7.46	7.52	7.69	7.70	7.52	7.33	7.63
MW-116	8.19	7.56	8.04	8.24	8.20	8.04	7.83	8.05	7.93	7.89	7.86	7.93
MW-133	7.72	7.25	8.10	7.87	7.60	7.74	7.44	7.48	7.49	7.70	7.40	7.66
MW-141	7.41	6.98	6.86	7.60	7.43	7.46	7.32	7.11	6.50	7.32	7.18	7.41
MW-142	7.94	7.35	7.30	8.19	7.78	7.67	7.71	7.33	6.62	7.77	7.68	7.90
MW-149	8.10	8.02	7.92	8.08	8.04	7.55	7.87	7.84	7.93	7.86	7.70	7.80
MW-152	7.76	7.74	7.70	7.79	7.71	7.41	7.40	7.64	6.90	7.51	7.35	7.45
MW-153	7.75	7.73	7.68	7.74	7.75	7.42	7.30	7.57	7.56	7.45	7.26	7.44
MW-158	7.89	7.23	7.71	7.86	7.86	7.61	7.56	7.69	7.77	7.67	7.45	7.66
MW-161R	7.44	6.98	7.38	7.52	7.46	7.35	7.25	7.48	7.42	7.32	7.15	7.38

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Well ID	10/21-26/15	1/20-27/16	4/25-28/16	7/19-26/16	0/24-11/1/16	1/9-12/17	4/17-24/17	7/17-25/17	10/17-23/17	1/16-22/18	4/9-12/18	7/11-18/18
MW-17	7.22	7.35	7.26	7.30	7.35	7.22	7.19	7.17	7.26	7.21	7.25	7.34
MW-101A	6.84	7.02	7.12	7.21	7.32	7.17	7.22	7.06	7.20	7.00	7.21	7.13
MW-104	7.19	7.58	7.80	7.82	7.88	7.65	7.85	7.62	7.73	7.65	7.84	7.60
MW-108R	6.74	6.84	6.76	6.85	7.02	6.93	6.84	6.95	6.99	7.04	7.04	7.17
MW-109R	6.98	7.22	7.51	7.49	7.61	7.50	7.36	7.49	7.34	7.57	7.57	7.63
MW-110	7.15	7.40	7.57	7.59	7.76	7.70	7.84	7.52	7.60	7.61	7.98	7.85
MW-111	6.93	6.67	7.10	7.02	7.20	7.25	7.25	6.99	7.07	6.94	7.25	7.18
MW-112	7.10	7.40	7.52	7.49	7.57	7.52	7.45	7.40	7.55	7.41	7.65	7.54
MW-115A	7.12	7.45	7.57	7.56	7.75	7.64	7.56	7.48	7.66	7.44	7.63	7.14
MW-116	7.38	7.75	7.90	7.96	7.98	7.89	7.75	7.82	7.94	7.86	8.00	7.29
MW-133	7.33	7.09	7.83	7.66	7.70	7.62	7.82	----	----	7.51	7.79	7.72
MW-141	6.95	7.25	7.33	7.55	7.54	7.43	7.47	7.35	7.30	7.30	7.43	7.51
MW-142	7.34	7.64	7.86	7.85	7.86	7.72	7.75	7.58	7.69	7.74	7.76	7.84
MW-149	7.18	7.61	7.86	7.98	7.88	7.78	7.69	7.70	7.55	7.87	8.05	8.15
MW-152	7.05	7.30	7.39	7.53	7.49	7.58	7.30	7.41	7.55	7.59	7.63	7.57
MW-153	6.85	6.85	7.42	7.36	7.48	7.44	7.53	7.34	7.36	7.30	7.43	7.36
MW-158	7.27	7.35	7.66	7.63	7.73	7.53	7.53	7.45	7.56	7.53	7.63	7.68
MW-161R	7.19	7.28	7.29	7.39	7.48	7.33	7.40	7.27	7.14	7.43	7.31	7.37

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Well ID	10/22-25/18	11/15/18	1/11-18/19	4/24-26/19	7/23-30/19	10/24-28/19	1/14-20/20	4/24-28/20	7/9-14/20	10/21-23/20	12/8/20	1/6-11/21
MW-17	7.10	----	7.27	7.12	7.06	7.09	7.35	7.17	7.37	7.36	----	7.17
MW-101A	7.21	----	7.28	7.29	7.09	7.09	7.15	7.38	7.29	7.58	----	7.20
MW-104	7.78	----	7.87	7.87	7.61	7.61	7.34	7.64	7.64	8.12	----	7.79
MW-108R	7.12	7.10	7.02	7.04	6.88	6.85	7.50	6.42	7.16	7.18	----	6.94
MW-109R	7.61	----	7.47	7.48	7.29	7.35	7.88	7.51	7.71	7.34	----	7.34
MW-110	7.89	----	7.77	7.74	7.53	7.75	7.40	8.18	8.16	7.86	----	7.91
MW-111	6.97	----	7.52	7.21	6.89	7.41	6.75	7.46	7.37	7.56	----	8.06
MW-112	7.76	----	7.57	7.61	7.39	7.50	7.65	7.62	7.47	7.68	7.70	7.45
MW-115A	7.77	----	7.68	7.53	7.36	7.52	7.47	7.75	7.46	7.73	----	7.62
MW-116	8.13	----	8.08	7.94	7.70	7.83	7.68	7.77	7.97	8.07	----	7.95
MW-133	7.73	----	7.77	7.66	7.17	7.11	8.20	7.61	7.33	7.48	----	7.65
MW-141	7.55	----	7.44	7.45	7.27	7.40	7.35	7.27	7.48	7.75	----	7.40
MW-142	7.96	----	7.88	7.86	7.71	7.71	7.24	7.23	8.04	8.19	----	7.61
MW-149	8.15	----	7.71	7.50	7.58	7.33	7.62	8.11	8.12	8.05	----	7.81
MW-152	7.70	----	7.63	7.54	7.38	7.59	7.14	7.59	7.64	7.41	----	7.59
MW-153	7.53	----	7.46	7.36	7.13	7.45	7.14	6.93	7.34	7.29	----	7.37
MW-158	7.77	----	7.78	7.62	7.45	7.55	7.58	7.42	7.67	7.73	----	7.58
MW-161R	7.51	----	7.46	7.30	7.17	7.32	7.33	7.24	7.49	7.13	----	7.38

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Well ID	4/21-26/21	7/14-28/21	10/20-27/21
MW-17	7.07	7.20	7.47
MW-101A	7.15	7.32	7.35
MW-104	7.75	7.81	7.66
MW-108R	6.78	6.85	7.15
MW-109R	7.31	7.45	7.61
MW-110	7.93	7.89	8.11
MW-111	7.90	7.89	7.43
MW-112	7.57	7.49	7.69
MW-115A	7.43	7.57	7.89
MW-116	7.79	7.89	8.23
MW-133	7.57	7.59	7.90
MW-141	7.28	7.45	7.60
MW-142	7.68	7.73	7.87
MW-149	7.86	7.85	8.08
MW-152	7.45	7.44	7.64
MW-153	7.19	7.29	----
MW-158	7.53	7.57	7.82
MW-161R	7.39	7.41	7.61

Appendix B

Conductivity Data Listings by Parameter and Well: 1992 – 2021

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	630	598	574	600	544	506	502	527	----	585	715	628
MW-108R	1,490	1,567	1,425	1,461	978	1,125	1,537	----	2,017	2,140	2,180	1,970
MW-109R	1,359	734	812	1,038	505	908	1,320	----	1,372	959	1,690	1,561
MW-110	1,012	793	502	616	634	662	1,007	----	----	988	2,020	2,880
MW-111	----	908	----	981	738	728	748	----	----	925	926	----
MW-112	766	----	----	----	----	----	----	----	----	----	----	----
MW-115A	603	522	500	599	568	450	537	----	595	638	703	584
MW-116	308	----	----	----	----	----	----	----	----	----	----	----
MW-133	700	384	----	625	550	502	520	----	671	570	580	634
MW-141	1,182	957	946	942	938	928	1,120	1,030	----	970	1,130	1,019
MW-142	581	437	426	456	407	429	418	388	----	431	543	466
MW-149	480	475	329	495	650	477	365	----	460	501	582	482
MW-152	----	985	730	981	872	761	879	----	725	941	1,236	917
MW-153	795	939	661	906	736	742	684	----	694	652	428	669
MW-158	----	----	----	553	474	604	532	503	----	510	634	518
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	1/18-19/95	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	648	----	581	567	----	542	----	----	651	477	484	587
MW-108R	2,183	----	2,310	2,630	----	2,510	----	3,180	----	2,660	2,780	2,180
MW-109R	213	----	2,300	2,450	----	----	----	----	----	1,990	----	----
MW-110	1,905	----	1,040	1,260	----	1,908	----	1,347	----	1,067	1,042	1,317
MW-111	1,273	----	1,090	----	----	----	----	895	----	888	758	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	635	----	645	590	----	568	----	438	----	568	539	613
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	711	----	661	516	----	759	----	----	649	----	----	604
MW-141	----	1,037	1,013	----	1,010	900	----	699	----	844	872	1,028
MW-142	----	478	462	----	477	390	----	331	----	416	394	489
MW-149	537	----	599	552	----	505	----	----	550	923	570	577
MW-152	1,088	----	1,040	----	985	----	800	717	----	881	915	1,131
MW-153	676	----	618	----	611	905	----	399	----	489	485	613
MW-158	568	----	553	----	575	490	----	----	580	483	540	676
MW-161R	----	----	885	805	----	823	----	697	----	768	764	836

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	1/23-24/97	4/22-24/97	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	479	543	496	415	496	483	481	454	507	----	557	590
MW-108R	----	1,620	2,330	1,980	429	----	----	----	----	----	----	----
MW-109R	----	1,220	1,398	885	310	1,013	----	----	----	----	1,142	----
MW-110	1,162	1,259	1,348	938	1,219	822	1,302	1,212	----	1,142	1,058	1,160
MW-111	----	----	----	----	981	344	658	593	829	----	661	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	583	652	557	498	683	602	536	584	689	----	548	586
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	572	638	510	484	677	524	543	----	652	----	568	571
MW-141	968	1,529	713	823	1,148	1,111	1,064	1,140	1,363	----	865	925
MW-142	438	515	497	420	508	499	510	512	483	----	455	470
MW-149	1,023	482	470	395	935	524	513	470	500	----	552	555
MW-152	992	1,124	1,138	879	1,143	1,084	982	978	961	----	820	889
MW-153	509	603	581	485	589	563	572	568	567	----	558	626
MW-158	549	658	606	504	596	569	562	558	552	----	543	603
MW-161R	761	1,206	1,023	847	1,052	896	1,096	922	909	----	1,105	1,240

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Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	10/12-14/99	1/18-21/00	4/19-21/00	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01
MW-17	----	----	----	----	2,410	1,647	----	2,430	----	----	1,935	----
MW-101A	----	----	----	----	2,430	1,960	----	2,320	----	----	2,440	----
MW-104	495	669	668	618	603	453	----	509	----	----	467	----
MW-108R	----	3,900	----	----	2,290	2,360	1,917	1,823	----	----	1,752	----
MW-109R	----	----	----	----	1,090	2,540	----	1,755	----	1,199	1,492	----
MW-110	828	1,217	1,102	1,022	950	792	----	999	----	----	1,028	----
MW-111	676	920	837	702	848	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	479	665	638	482	691	622	----	624	602	----	597	----
MW-116	----	----	----	----	352	319	----	352	----	----	347	----
MW-133	475	----	658	480	682	635	----	660	----	----	677	----
MW-141	767	1,036	1,032	1,010	1,114	934	----	914	----	1,053	1,111	----
MW-142	378	495	491	497	491	432	----	488	----	----	491	----
MW-149	417	940	724	441	559	762	----	833	----	----	618	----
MW-152	679	954	891	742	1,005	813	----	1,050	----	----	876	----
MW-153	469	614	745	475	622	552	----	609	----	----	607	----
MW-158	480	666	667	592	589	534	----	593	----	----	571	----
MW-161R	1,198	1,101	1,391	1,812	1,086	1,093	----	1,142	----	1,058	1,263	1,037

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Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	10/23-25/01	12/19/01	1/21-23/02	3/22/02	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02
MW-17	1,453	----	1,856	----	----	2,320	----	----	2,950	----	2,470	----
MW-101A	2,189	----	1,680	----	----	2,570	----	----	2,460	----	2,940	----
MW-104	401	----	338	----	----	428	----	----	441	422	425	388
MW-108R	1,810	----	1,250	----	----	1,454	----	----	2,830	----	3,650	----
MW-109R	809	----	2,992	2,800	----	2,420	----	----	1,708	----	4,110	5,080
MW-110	971	----	800	----	----	914	----	----	871	----	864	----
MW-111	709	----	----	----	----	639	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	501	----	573	----	----	675	----	----	581	----	583	----
MW-116	311	----	314	----	----	331	----	----	338	----	308	----
MW-133	579	----	515	----	----	569	----	----	540	----	581	----
MW-141	905	----	705	----	----	890	----	----	962	----	1,068	----
MW-142	439	----	397	----	----	447	----	----	454	----	441	----
MW-149	445	----	3,580	----	859	----	662	691	510	665	741	539
MW-152	742	----	774	----	----	786	----	----	755	----	787	----
MW-153	488	----	462	----	----	591	----	----	604	----	555	----
MW-158	472	----	450	----	----	541	----	----	571	----	550	----
MW-161R	823	780	790	----	----	1,276	----	----	1,714	1,636	1,499	997

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Well ID	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	3/23/04
MW-17	1,512	----	2,810	----	1,988	----	1,995	----	----	955	----	----
MW-101A	1,769	----	2,900	----	2,720	----	2,510	----	----	981	----	----
MW-104	357	488	446	376	390	445	436	485	----	345	463	----
MW-108R	3,380	----	3,420	3,340	3,290	----	3,240	----	2,290	2,310	2,410	----
MW-109R	4,230	3,930	2,690	----	2,540	----	1,531	1,204	----	1,289	4,270	----
MW-110	746	----	1,020	----	790	----	952	----	----	679	----	----
MW-111	----	----	794	----	----	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	565	----	----	435	----	----
MW-115A	509	----	695	----	620	----	604	----	----	443	----	----
MW-116	265	----	327	----	312	----	329	----	----	272	----	----
MW-133	533	----	669	----	547	----	----	----	----	526	----	----
MW-141	708	----	990	----	895	----	961	----	----	593	----	----
MW-142	375	----	467	----	422	----	455	----	----	363	----	----
MW-149	3,100	3,800	2,370	897	----	----	600	674	----	496	----	518
MW-152	550	----	850	----	901	----	867	----	----	555	----	----
MW-153	464	----	588	----	555	----	600	----	----	422	----	----
MW-158	466	----	628	----	588	----	646	----	----	476	----	----
MW-161R	852	1,170	1,140	1,240	1,064	1,080	1,286	938	----	794	1,223	----

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Well ID	4/19-23/04	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05
MW-17	3,570	----	877	----	2,580	----	----	1,789	----	1,212	----	1,163
MW-101A	2,770	----	1,594	----	2,680	----	----	1,452	----	1,002	----	808
MW-104	457	400	453	449	429	361	----	430	493	412	336	182
MW-108R	1,748	----	935	----	1,599	----	----	1,360	----	999	----	1,297
MW-109R	4,880	2,650	960	2,960	3,460	1,635	----	1,788	1,726	1,280	947	1,318
MW-110	1,254	----	788	----	1,776	----	----	818	----	805	----	957
MW-111	----	----	----	----	----	----	----	472	----	----	----	----
MW-112	669	----	640	----	588	----	----	441	----	635	----	520
MW-115A	702	----	610	----	555	----	----	430	----	642	----	495
MW-116	344	----	365	----	310	----	----	267	----	352	----	323
MW-133	715	----	644	----	584	----	----	504	----	486	----	394
MW-141	922	----	758	----	905	----	----	587	----	584	----	562
MW-142	482	----	439	----	442	----	----	345	----	182	----	361
MW-149	535	497	470	552	513	----	578	420	833	629	477	532
MW-152	946	----	974	1,374	989	----	----	643	----	721	----	665
MW-153	603	----	511	----	547	480	----	570	608	510	424	470
MW-158	702	----	517	----	616	----	----	421	----	605	420	502
MW-161R	1,514	940	774	1,569	1,112	896	----	690	876	837	514	572

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Well ID	9/9/05	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07
MW-17	----	1,502	----	2,340	----	2,650	----	3,000	----	1,201	----	1,442
MW-101A	----	1,492	----	1,280	----	3,120	----	328	----	815	----	1,378
MW-104	608	452	516	453	349	506	470	494	447	285	----	459
MW-108R	----	1,697	----	2,420	----	2,500	----	2,430	----	1,296	----	1,663
MW-109R	2,880	2,840	1,095	1,192	1,391	3,440	3,430	3,900	3,490	980	3,180	1,490
MW-110	----	1,007	----	898	----	1,769	----	1,633	----	740	----	684
MW-111	----	----	----	821	----	----	----	----	----	453	----	663
MW-112	----	570	----	559	----	605	----	622	----	375	----	633
MW-115A	----	545	----	609	----	679	----	611	----	359	----	642
MW-116	----	371	----	368	----	297	----	376	----	273	----	421
MW-133	----	----	----	643	----	638	----	564	----	343	----	644
MW-141	----	817	----	813	----	943	----	896	----	451	----	794
MW-142	----	443	----	436	----	474	426	427	425	273	----	435
MW-149	810	613	487	563	400	585	494	530	500	296	580	495
MW-152	----	850	----	1,045	----	1,099	----	970	----	498	----	864
MW-153	----	568	663	535	401	602	530	607	530	442	----	562
MW-158	840	625	654	656	434	696	619	692	591	362	----	588
MW-161R	1,115	797	----	875	----	882	----	854	----	555	----	736

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Well ID	4/16-18/07	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09
MW-17	3,220	2,520	----	3,280	3,500	3,610	2,520	2,110	2,500	2,390	2,390	----
MW-101A	1,873	2,520	----	3,290	3,190	3,650	3,300	2,450	3,760	3,360	1,146	3,280
MW-104	437	500	----	450	524	486	545	499	428	410	365	467
MW-108R	1,880	1,975	----	2,660	2,950	2,900	2,740	2,680	4,390	4,240	4,640	5,040
MW-109R	3,230	3,310	----	3,580	3,030	2,940	2,270	1,674	1,950	1,893	1,776	1,834
MW-110	701	957	----	1,380	1,019	1,093	1,270	601	918	1,189	968	1,230
MW-111	563	620	----	617	724	598	712	1,340	1,150	804	587	747
MW-112	505	643	----	633	713	650	772	560	642	655	543	680
MW-115A	580	625	----	638	769	787	877	494	646	674	560	674
MW-116	344	438	----	430	478	457	544	366	445	453	403	478
MW-133	545	634	----	664	748	784	668	645	695	718	613	660
MW-141	674	821	----	986	1,186	1,278	1,265	1,118	1,305	1,034	792	945
MW-142	360	424	406	424	517	582	695	770	688	646	580	664
MW-149	4,010	1,029	----	903	989	770	762	647	610	634	535	589
MW-152	744	734	----	841	830	1,324	1,013	793	877	876	810	1,052
MW-153	500	586	----	611	689	730	748	636	678	745	587	854
MW-158	531	650	609	642	673	594	642	712	662	660	553	746
MW-161R	730	859	----	1,129	882	783	959	941	930	1,061	840	921

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Well ID	11/6/09	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12
MW-17	2,500	1,711	1,657	1,913	1,700	1,841	1,320	2,270	5,650	----	6,800	5,640
MW-101A	----	3,420	3,620	3,520	3,220	2,690	2,770	3,080	3,220	----	3,010	3,130
MW-104	----	413	367	495	447	461	405	379	462	----	417	413
MW-108R	----	4,340	4,540	4,000	3,890	3,870	3,000	3,140	3,330	----	3,200	3,080
MW-109R	----	1,694	1,398	1,697	2,600	1,950	1,710	2,000	2,240	1,995	1,589	1,641
MW-110	----	998	760	807	1,005	1,040	593	779	910	----	764	560
MW-111	----	718	582	763	661	----	735	590	817	----	1,054	830
MW-112	----	613	568	718	665	710	712	536	725	----	625	624
MW-115A	----	604	618	718	672	711	739	529	749	----	639	693
MW-116	----	420	379	477	431	479	486	363	484	----	418	419
MW-133	----	640	634	647	678	740	709	584	711	----	749	611
MW-141	----	962	866	930	799	1,048	1,068	928	1,182	----	975	734
MW-142	----	645	563	710	694	880	816	512	698	----	575	572
MW-149	----	535	463	573	539	588	580	----	595	----	484	481
MW-152	----	643	570	734	681	772	581	758	773	----	800	595
MW-153	----	587	585	740	708	772	651	835	895	----	815	738
MW-158	----	689	560	798	715	860	633	560	661	----	572	600
MW-161R	----	794	635	922	791	888	959	673	861	----	768	773

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Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	7/18-23/12	10/22-30/12	1/25-29/13	4/17-23/13	7/15-17/13	10/21-24/13	1/31-2/6/14	4/24-5/1/14	7/21-24/14	10/20-23/14	1/20-29/15	4/21-24/15
MW-17	4,070	7,820	11,240	8,740	3,770	4,270	3,366	3,165	2,800	3,330	3,210	3,170
MW-101A	1,142	2,860	3,084	3,040	3,640	3,400	3,159	2,810	2,840	2,077	1,823	1,758
MW-104	292	547	551	560	609	577	716	704	763	707	620	540
MW-108R	3,850	5,250	4,830	3,450	4,590	4,900	4,174	4,340	6,470	6,540	5,850	4,900
MW-109R	847	2,630	2,568	1,442	1,875	1,584	1,504	2,230	1,990	1,848	1,390	1,626
MW-110	749	1,030	1,095	749	767	940	883	841	772	1,670	1,270	764
MW-111	580	1,062	958	780	1,564	1,198	1,171	826	710	814	666	588
MW-112	503	778	743	665	773	689	933	804	808	750	735	693
MW-115A	430	868	746	714	887	696	693	853	837	828	766	714
MW-116	314	511	479	445	501	449	425	515	523	492	462	435
MW-133	886	901	740	825	682	695	677	842	814	804	770	718
MW-141	548	1,303	1,266	1,413	1,237	1,120	1,221	974	1,013	831	994	1,227
MW-142	295	658	617	706	640	629	904	769	705	714	656	804
MW-149	257	569	542	498	560	499	592	558	584	533	520	499
MW-152	655	968	870	796	869	805	946	695	935	986	844	754
MW-153	893	958	824	754	869	815	1,012	980	980	886	835	768
MW-158	707	710	690	607	707	627	894	808	772	690	687	660
MW-161R	493	951	935	820	1,147	1,164	1,511	1,304	1,072	917	924	856

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	7/22-27/15	10/21-26/15	1/20-27/16	4/25-28/16	7/19-26/16	0/24-11/1/16	1/9-12/17	4/17-24/17	7/17-25/17	10/17-23/17	1/16-22/18	4/9-12/18
MW-17	3,320	3,155	2,981	2,680	3,090	1,659	2,550	1,695	1,580	2,860	1,653	1,777
MW-101A	2,630	2,224	2,117	1,610	1,826	1,242	2,540	1,449	1,610	2,320	1,872	1,650
MW-104	638	624	600	491	591	490	597	434	473	649	526	556
MW-108R	7,650	10,290	7,306	8,220	10,290	4,090	7,400	7,360	5,560	9,540	5,520	4,720
MW-109R	1,796	1,842	1,840	1,370	1,658	1,315	1,645	1,167	1,300	2,790	1,419	1,318
MW-110	1,080	1,362	1,460	874	982	865	733	669	1,296	1,415	1,139	1,594
MW-111	680	683	684	542	564	598	640	546	537	741	677	599
MW-112	858	858	842	763	851	781	773	687	752	907	741	723
MW-115A	793	860	802	773	858	757	786	624	805	917	756	721
MW-116	529	517	511	478	515	483	488	364	468	528	461	446
MW-133	720	890	836	737	740	728	834	635	----	----	774	711
MW-141	1,372	1,224	1,296	1,058	833	682	834	624	723	910	776	837
MW-142	731	723	704	626	710	592	653	487	563	704	592	604
MW-149	520	568	559	499	570	534	598	572	544	760	578	798
MW-152	1,040	843	850	704	904	846	814	729	928	934	764	759
MW-153	1,073	996	1,080	892	1,050	913	860	640	1,052	1,178	869	887
MW-158	857	835	777	670	770	741	764	633	693	900	738	679
MW-161R	1,127	1,189	1,199	1,045	1,118	851	1,049	799	847	1,194	913	966

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	7/11-18/18	10/22-25/18	11/15/18	1/11-18/19	4/24-26/19	7/23-30/19	10/24-28/19	1/14-20/20	4/24-28/20	7/9-14/20	10/21-23/20	12/8/20
MW-17	1,663	3,080	----	3,010	2,530	1,782	1,361	1,410	2,753	2,365	2,346	----
MW-101A	1,797	2,400	----	1,334	1,581	1,392	1,379	1,373	1,333	1,089	1,501	----
MW-104	605	619	----	428	480	522	437	668	365	357	575	----
MW-108R	3,650	6,460	7,480	6,180	6,230	4,780	3,320	3,808	6,336	6,391	12,218	----
MW-109R	1,267	2,140	----	1,651	1,618	1,728	1,165	2,567	2,040	1,931	3,032	----
MW-110	412	2,240	----	1,651	1,217	791	954	968	680	781	2,502	----
MW-111	232	597	----	502	464	471	443	632	354	286	538	----
MW-112	338	927	----	734	723	764	741	885	742	598	972	975
MW-115A	374	908	----	869	770	856	574	781	696	529	867	----
MW-116	220	526	----	504	419	550	380	626	346	299	520	----
MW-133	672	839	----	974	762	716	719	915	593	800	903	----
MW-141	797	1,103	----	1,105	935	860	778	731	877	698	1,050	----
MW-142	601	759	----	733	641	668	659	667	505	482	714	----
MW-149	245	704	----	608	810	542	487	1,315	4,065	382	595	----
MW-152	780	991	----	952	863	892	755	813	692	579	977	----
MW-153	936	1,236	----	1,140	1,010	1,062	888	766	876	727	1,255	----
MW-158	650	757	----	768	675	795	726	766	654	617	871	----
MW-161R	904	1,093	----	1,069	1,006	1,040	920	1,051	947	897	1,183	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	1/6-11/21	4/21-26/21	7/14-28/21	10/20-27/21
MW-17	2,708	2,074	2,417	2,628
MW-101A	1,417	1,491	1,392	341
MW-104	567	576	558	317
MW-108R	11,470	12,130	13,405	11,170
MW-109R	2,490	3,677	2,400	3,289
MW-110	3,346	1,415	762	1,909
MW-111	472	441	477	501
MW-112	980	960	966	894
MW-115A	929	987	840	739
MW-116	508	509	503	455
MW-133	960	985	794	755
MW-141	1,032	886	862	786
MW-142	744	748	748	689
MW-149	2,049	777	715	537
MW-152	968	953	975	868
MW-153	1,210	1,225	1,228	----
MW-158	846	849	605	760
MW-161R	1,195	1,267	1,280	1,241

Appendix C

Temperature (°C) Data Listings by Well: 1992 – 2021

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	10.0	14.1	12.7	13.2	13.0	17.9	12.1	11.8	----	11.7	12.8	13.6
MW-108R	8.4	19.4	13.0	11.5	11.1	14.6	10.1	----	10.5	10.2	14.2	12.4
MW-109R	11.0	14.0	9.2	8.3	9.6	11.8	10.8	----	8.5	10.7	13.9	11.9
MW-110	11.4	13.3	13.1	12.9	10.0	11.8	11.3	----	----	11.0	15.5	12.8
MW-111	----	14.6	----	10.0	7.5	12.0	15.1	----	----	10.8	15.3	----
MW-112	17.8	----	----	----	----	----	----	----	----	----	----	----
MW-115A	14.9	10.6	11.2	12.4	7.1	19.8	7.4	----	9.8	10.1	10.3	12.3
MW-116	17.8	----	----	----	----	----	----	----	----	----	----	----
MW-133	14.3	14.1	----	0.8	8.3	18.9	12.8	----	-0.7	3.1	24.6	16.3
MW-141	9.7	10.8	10.1	9.9	8.9	10.0	8.4	9.1	----	8.1	8.6	10.1
MW-142	11.7	11.1	9.9	9.8	9.3	10.0	8.7	8.8	----	8.3	9.0	10.5
MW-149	17.3	12.0	10.1	10.4	9.9	15.5	9.6	----	7.3	9.5	10.4	11.1
MW-152	----	11.9	10.2	10.4	10.0	15.4	9.4	----	8.9	8.9	10.0	11.0
MW-153	15.0	11.4	10.4	9.8	9.5	11.4	8.9	----	7.5	8.7	10.8	10.7
MW-158	----	----	----	11.5	10.7	12.2	9.7	9.6	----	9.4	10.4	11.4
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	1/18-19/95	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	10.6	----	10.7	10.8	----	14.7	----	----	10.9	10.2	10.0	9.9
MW-108R	8.4	----	9.4	10.8	----	12.3	----	8.6	----	10.4	11.9	10.2
MW-109R	6.8	----	8.7	14.1	----	----	----	----	----	8.9	----	----
MW-110	9.8	----	10.2	11.8	----	13.8	----	9.3	----	11.2	11.4	10.1
MW-111	8.6	----	7.3	----	----	----	----	11.1	----	4.2	12.5	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	11.9	----	10.6	8.2	----	13.3	----	5.7	----	2.2	3.5	10.7
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	0.8	----	4.6	19.1	----	20.1	----	----	1.1	----	----	14.1
MW-141	----	7.1	7.6	----	7.3	9.8	----	6.2	----	7.3	8.7	11.2
MW-142	----	7.2	7.5	----	7.6	10.0	----	6.8	----	6.9	8.5	11.6
MW-149	8.2	----	8.8	9.0	----	12.4	----	----	4.7	8.1	8.9	12.2
MW-152	7.7	----	8.4	----	8.8	----	11.8	7.8	----	7.9	8.1	8.1
MW-153	7.2	----	8.0	----	8.7	11.8	----	7.2	----	7.6	7.8	7.4
MW-158	7.9	----	9.0	----	8.9	11.1	----	----	7.8	10.6	10.1	10.3
MW-161R	----	----	9.8	10.1	----	12.6	----	7.5	----	9.7	9.7	11.4

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	1/23-24/97	4/22-24/97	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	12.0	12.7	13.4	12.4	9.9	12.8	15.5	13.0	10.8	----	12.4	16.2
MW-108R	----	9.9	14.6	11.4	3.2	15.7	----	----	----	----	----	----
MW-109R	----	13.4	20.5	11.0	5.0	13.7	----	----	----	----	12.7	----
MW-110	11.9	11.8	14.3	12.4	10.0	12.9	17.0	12.1	----	12.7	14.4	17.2
MW-111	----	----	----	----	4.7	11.4	15.9	14.1	8.8	----	14.1	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	3.9	5.6	9.6	16.7	4.9	9.0	21.3	20.4	19.1	----	11.4	22.4
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	2.7	6.6	19.8	17.3	3.3	11.4	25.1	----	10.0	----	10.2	23.4
MW-141	9.4	9.6	10.6	9.3	6.8	10.5	12.8	9.6	9.6	----	10.7	11.0
MW-142	8.0	9.4	10.8	9.8	6.4	11.0	11.3	10.0	9.7	----	11.1	10.9
MW-149	10.1	12.3	14.5	11.5	9.8	12.1	15.4	11.3	9.9	----	11.5	15.0
MW-152	9.2	11.7	15.0	11.2	5.8	12.6	14.5	11.6	9.8	----	12.3	13.9
MW-153	9.7	10.0	14.2	10.1	8.8	11.9	14.2	10.3	8.9	----	11.9	12.0
MW-158	11.1	12.2	13.0	11.3	9.6	12.0	13.1	11.5	10.7	----	12.7	13.3
MW-161R	10.0	10.9	11.9	10.8	8.1	11.1	12.2	10.7	10.1	----	11.6	13.6

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	10/12-14/99	1/18-21/00	4/19-21/00	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01
MW-17	----	----	----	----	15.3	13.3	----	15.6	----	----	16.3	----
MW-101A	----	----	----	----	12.8	9.7	----	13.1	----	----	14.1	----
MW-104	12.1	9.3	11.1	14.0	12.3	10.2	----	12.5	----	----	13.0	----
MW-108R	----	1.4	----	----	13.2	6.2	10.7	11.8	----	----	16.2	----
MW-109R	----	----	----	----	13.2	11.1	----	12.8	----	13.3	14.3	----
MW-110	13.0	6.4	11.2	14.4	12.3	6.4	----	11.0	----	----	12.2	----
MW-111	17.6	8.6	7.1	18.3	19.0	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	17.5	11.6	10.6	20.7	17.6	4.5	----	8.7	10.7	----	21.1	----
MW-116	----	----	----	----	14.7	8.6	----	10.5	----	----	15.0	----
MW-133	18.7	----	10.2	20.9	17.3	8.4	----	6.8	----	----	20.2	----
MW-141	9.8	8.1	9.8	11.3	10.6	8.3	----	10.9	----	10.7	10.4	----
MW-142	10.5	9.5	9.6	10.7	10.7	6.9	----	11.0	----	----	10.6	----
MW-149	11.3	10.2	10.6	13.2	12.8	9.6	----	12.1	----	----	17.6	----
MW-152	11.5	9.7	11.5	12.6	11.7	8.5	----	12.4	----	----	12.8	----
MW-153	10.3	9.3	10.8	11.1	10.9	7.9	----	11.5	----	----	12.2	----
MW-158	11.2	9.6	10.5	14.2	11.8	8.8	----	12.0	----	----	12.9	----
MW-161R	11.4	8.7	11.4	12.8	11.4	9.4	----	11.6	----	12.3	11.8	12.2

CAD Groundwater Monitoring - Temperature
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Well ID	10/23-25/01	12/19/01	1/21-23/02	3/22/02	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02
MW-17	15.6	----	13.5	----	----	16.0	----	----	18.0	----	14.9	----
MW-101A	13.6	----	11.5	----	----	12.0	----	----	13.2	----	12.2	----
MW-104	12.6	----	11.3	----	----	11.4	----	----	13.6	13.9	11.7	10.9
MW-108R	14.2	----	9.9	----	----	12.3	----	----	14.2	----	13.1	----
MW-109R	14.1	----	13.7	11.5	----	13.3	----	----	13.7	----	12.9	12.3
MW-110	12.3	----	9.9	----	----	10.9	----	----	14.1	----	12.3	----
MW-111	15.7	----	----	----	----	11.7	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	16.4	----	13.4	----	----	13.7	----	----	12.1	----	15.2	----
MW-116	13.9	----	11.6	----	----	12.7	----	----	12.8	----	13.5	----
MW-133	17.2	----	3.5	----	----	9.0	----	----	19.6	----	21.4	----
MW-141	9.3	----	10.3	----	----	10.0	----	----	10.7	----	9.8	----
MW-142	9.9	----	10.1	----	----	10.4	----	----	11.0	----	10.2	----
MW-149	13.6	----	10.6	----	10.1	----	11.5	12.9	13.2	13.2	11.2	10.1
MW-152	10.6	----	11.3	----	----	11.3	----	----	13.0	----	12.0	----
MW-153	9.9	----	10.5	----	----	10.2	----	----	11.4	----	10.7	----
MW-158	10.9	----	11.2	----	----	12.4	----	----	13.6	----	11.3	----
MW-161R	12.2	10.9	11.3	----	----	12.6	----	----	14.6	13.8	11.7	10.9

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	3/23/04
MW-17	13.3	----	17.3	----	16.5	----	16.6	----	----	12.7	----	----
MW-101A	11.2	----	13.1	----	12.5	----	11.8	----	----	9.9	----	----
MW-104	9.5	13.5	12.8	13.8	12.4	11.9	11.1	10.4	----	9.5	10.9	----
MW-108R	8.3	----	16.4	16.6	14.9	----	14.1	----	8.5	8.9	11.6	----
MW-109R	12.3	13.8	14.0	----	13.0	----	12.5	12.0	----	10.6	12.8	----
MW-110	6.8	----	15.4	----	14.6	----	13.5	----	----	8.3	----	----
MW-111	----	----	18.1	----	----	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	13.9	----	----	14.5	----	----
MW-115A	15.8	----	13.9	----	12.0	----	15.3	----	----	12.6	----	----
MW-116	12.0	----	11.7	----	13.0	----	12.8	----	----	10.2	----	----
MW-133	2.6	----	7.4	----	24.3	----	----	----	----	1.7	----	----
MW-141	7.5	----	10.7	----	10.0	----	9.5	----	----	7.2	----	----
MW-142	9.3	----	10.8	----	10.4	----	9.8	----	----	7.8	----	----
MW-149	8.8	10.9	14.0	16.2	----	----	10.5	9.5	----	8.0	----	9.8
MW-152	10.7	----	13.8	----	12.7	----	11.6	----	----	10.1	----	----
MW-153	9.7	----	11.4	----	11.5	----	10.4	----	----	8.0	----	----
MW-158	8.8	----	12.3	----	12.8	----	11.4	----	----	8.2	----	----
MW-161R	10.2	13.4	13.7	15.6	14.6	13.0	11.6	10.6	----	8.1	11.2	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
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Well ID	4/19-23/04	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05
MW-17	16.1	----	17.8	----	14.6	----	----	12.7	----	15.2	----	19.3
MW-101A	12.0	----	13.3	----	11.8	----	----	10.0	----	11.9	----	14.6
MW-104	11.3	11.6	13.1	13.4	11.2	12.2	----	9.0	11.5	11.4	12.6	14.5
MW-108R	14.2	----	14.3	----	12.3	----	----	11.2	----	14.0	----	15.4
MW-109R	13.1	12.9	14.5	14.3	12.8	14.4	----	12.1	12.2	13.5	14.6	15.8
MW-110	11.4	----	13.0	----	11.0	----	----	9.9	----	11.6	----	12.9
MW-111	----	----	----	----	----	----	----	7.0	----	----	----	----
MW-112	15.0	----	16.9	----	14.5	----	----	13.3	----	14.7	----	16.5
MW-115A	14.2	----	13.3	----	13.3	----	----	12.6	----	13.9	----	11.9
MW-116	11.5	----	13.9	----	13.3	----	----	11.9	----	11.9	----	13.4
MW-133	6.3	----	19.3	----	19.8	----	----	2.2	----	6.3	----	19.0
MW-141	10.1	----	10.8	----	10.1	----	----	9.4	----	10.4	----	11.4
MW-142	10.4	----	11.7	----	10.4	----	----	9.0	----	10.7	----	12.3
MW-149	11.3	13.0	11.5	12.9	11.3	----	9.9	9.7	11.7	11.5	13.2	13.9
MW-152	11.3	----	14.5	13.7	11.5	----	----	9.2	----	11.2	----	14.2
MW-153	10.5	----	12.7	----	10.6	11.4	----	8.8	10.8	10.6	11.9	12.7
MW-158	11.5	----	13.4	----	11.4	----	----	8.5	----	11.5	12.3	13.1
MW-161R	12.5	14.0	14.9	15.0	11.8	12.0	----	9.5	11.6	12.2	13.7	14.0

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan

Well ID	9/9/05	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07
MW-17	----	15.0	----	13.1	----	19.4	----	19.0	----	16.0	----	15.6
MW-101A	----	11.5	----	10.6	----	12.5	----	14.2	----	12.7	----	11.7
MW-104	12.4	11.7	10.0	10.0	10.1	11.9	13.8	12.8	12.6	12.7	----	10.5
MW-108R	----	12.1	----	12.6	----	15.2	----	14.4	----	13.6	----	13.2
MW-109R	13.9	12.3	11.3	11.8	10.4	13.1	14.7	14.3	13.7	13.3	14.8	13.0
MW-110	----	11.0	----	10.1	----	13.1	----	13.1	----	12.6	----	12.0
MW-111	----	----	----	9.0	----	----	----	----	----	15.7	----	9.6
MW-112	----	13.9	----	13.0	----	16.2	----	15.4	----	14.4	----	13.2
MW-115A	----	12.6	----	14.9	----	14.6	----	11.9	----	14.4	----	16.0
MW-116	----	13.2	----	11.5	----	13.2	----	13.3	----	14.1	----	12.6
MW-133	----	----	----	8.9	----	7.1	----	17.3	----	23.7	----	5.4
MW-141	----	9.6	----	9.4	----	12.3	----	11.0	----	11.1	----	10.5
MW-142	----	10.0	----	9.0	----	12.6	12.6	11.8	11.9	11.3	----	10.3
MW-149	12.8	10.9	9.3	9.3	10.1	11.7	14.4	13.3	13.4	12.5	13.4	11.2
MW-152	----	11.6	----	10.4	----	11.9	----	13.6	----	12.5	----	11.3
MW-153	----	10.8	9.2	9.5	9.1	10.8	13.5	12.9	11.8	11.3	----	10.4
MW-158	12.5	10.5	8.3	9.4	9.7	12.9	13.1	12.7	12.4	11.6	----	9.4
MW-161R	11.7	11.3	----	9.0	----	11.0	----	11.5	----	11.5	----	10.3

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	4/16-18/07	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09
MW-17	17.3	17.0	----	15.6	14.7	15.7	16.9	20.1	16.5	17.1	18.0	----
MW-101A	13.5	13.3	----	11.9	11.2	12.2	13.1	14.1	12.3	14.0	14.5	13.5
MW-104	13.4	12.9	----	11.5	10.8	11.9	13.1	13.5	11.2	13.4	13.9	13.2
MW-108R	14.9	13.7	----	13.4	12.9	13.6	13.0	16.4	14.6	14.5	14.6	14.6
MW-109R	14.5	14.1	----	12.9	13.6	13.6	14.6	16.0	13.8	14.4	15.6	14.4
MW-110	13.6	15.8	----	12.7	9.9	11.9	13.0	19.0	10.5	11.9	14.7	13.5
MW-111	11.8	14.6	----	15.6	10.8	9.1	14.5	NA	11.9	10.3	14.7	16.7
MW-112	15.1	14.4	----	13.1	12.5	13.6	14.9	NA	14.3	14.7	15.4	15.0
MW-115A	17.2	15.1	----	13.3	14.7	15.4	16.4	13.5	12.8	15.6	16.3	14.8
MW-116	13.8	13.3	----	13.4	12.9	13.6	13.8	NA	14.4	14.2	14.4	15.0
MW-133	6.0	18.9	----	22.7	10.1	5.1	17.6	22.1	3.4	5.6	19.1	16.4
MW-141	11.7	11.2	----	10.2	10.8	10.7	10.9	12.1	11.0	12.2	11.9	11.5
MW-142	11.9	11.7	12.1	10.5	10.7	10.8	11.2	12.7	11.1	12.6	12.5	12.2
MW-149	12.9	13.1	----	11.4	10.8	11.5	12.9	13.5	11.3	12.7	14.9	13.1
MW-152	13.2	13.3	----	11.8	12.2	11.9	12.7	15.0	12.7	13.6	14.7	13.3
MW-153	12.3	12.3	----	11.0	9.4	11.1	12.0	14.0	11.0	12.5	13.6	12.6
MW-158	12.4	12.7	12.1	10.2	9.0	10.7	12.4	12.7	10.9	12.5	13.1	11.7
MW-161R	12.1	12.0	----	10.6	10.7	10.4	11.0	12.6	11.1	12.3	13.0	12.9

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	11/6/09	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12
MW-17	15.0	16.7	15.8	16.5	15.2	14.1	17.1	16.8	15.1	----	16.8	17.1
MW-101A	----	13.4	12.7	13.7	12.2	11.4	14.2	13.6	12.2	----	14.0	14.1
MW-104	----	12.5	12.1	12.7	11.6	10.5	13.5	12.6	11.6	----	11.3	13.4
MW-108R	----	14.4	13.3	12.9	13.2	13.0	15.2	14.8	12.9	----	15.2	14.8
MW-109R	----	14.0	13.7	14.4	12.9	12.4	15.6	14.4	12.9	15.0	13.5	14.7
MW-110	----	11.0	12.0	14.4	12.2	9.8	12.4	14.3	12.2	----	13.0	13.4
MW-111	----	10.2	11.2	16.3	15.5	----	12.0	14.9	15.4	----	12.6	12.9
MW-112	----	14.3	13.8	14.7	13.6	12.4	15.4	14.9	13.0	----	14.7	15.6
MW-115A	----	14.0	14.6	15.1	13.4	13.9	17.5	14.9	12.9	----	16.2	17.2
MW-116	----	14.9	14.6	12.9	14.2	11.5	14.4	12.7	13.4	----	14.5	14.6
MW-133	----	13.7	8.2	19.9	20.8	11.0	8.7	27.0	17.7	----	3.1	14.9
MW-141	----	11.6	10.5	11.2	10.6	8.8	12.9	11.0	10.3	----	12.6	12.3
MW-142	----	11.4	10.7	11.6	11.4	9.9	12.9	11.4	10.8	----	12.1	12.3
MW-149	----	12.4	11.9	13.6	11.8	10.1	13.6	----	11.7	----	12.6	13.0
MW-152	----	12.8	12.3	12.8	11.5	9.0	12.9	12.8	11.6	----	13.3	13.3
MW-153	----	11.9	11.1	11.9	11.1	10.0	13.1	12.5	11.5	----	12.5	13.0
MW-158	----	9.3	11.4	12.6	11.3	9.2	12.2	11.9	10.8	----	12.4	12.6
MW-161R	----	12.7	11.9	12.2	12.1	10.9	14.4	12.8	12.1	----	13.8	14.1

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	7/18-23/12	10/22-30/12	1/25-29/13	4/17-23/13	7/15-17/13	10/21-24/13	1/31-2/6/14	4/24-5/1/14	7/21-24/14	10/20-23/14	1/20-29/15	4/21-24/15
MW-17	18.3	16.5	14.8	16.5	19.9	15.2	11.1	18.0	18.5	17.6	18.8	19.2
MW-101A	13.0	11.4	11.2	12.6	13.8	12.0	9.7	11.6	14.0	11.3	12.9	13.3
MW-104	11.9	11.4	10.8	11.7	12.7	11.6	8.9	11.2	12.8	10.7	12.7	12.9
MW-108R	15.7	13.6	13.0	13.4	13.2	13.1	10.9	14.4	13.3	13.2	14.8	14.2
MW-109R	14.2	12.7	10.0	12.7	13.6	12.6	9.5	14.4	13.7	12.7	14.0	14.0
MW-110	15.2	13.7	10.2	11.8	13.4	11.9	8.5	11.6	13.0	11.9	12.7	12.3
MW-111	17.5	17.7	8.3	9.6	16.1	15.2	3.3	9.8	14.2	14.7	12.5	10.7
MW-112	15.1	14.3	13.3	13.7	15.8	14.0	11.1	13.6	14.7	13.9	14.8	14.9
MW-115A	15.3	13.8	15.0	14.9	15.4	12.3	11.5	13.6	14.6	12.8	14.7	15.2
MW-116	13.2	14.1	12.3	12.0	13.3	13.1	11.9	12.3	12.7	13.2	14.7	14.1
MW-133	25.6	23.1	8.1	4.5	25.1	22.8	8.7	4.1	23.4	20.7	10.7	6.7
MW-141	10.8	10.4	10.7	10.6	11.4	10.4	8.5	10.0	10.0	9.5	12.6	12.0
MW-142	11.2	10.7	10.5	10.5	11.8	10.7	7.9	10.2	10.6	9.9	12.5	12.3
MW-149	12.6	11.4	10.7	12.2	13.1	11.6	9.5	11.9	14.5	12.2	12.5	12.8
MW-152	12.0	11.7	10.8	11.5	13.0	11.3	8.4	12.6	12.4	10.6	12.9	13.1
MW-153	14.4	11.4	10.2	11.4	13.0	11.2	7.3	10.8	12.5	11.5	12.5	12.7
MW-158	14.5	11.6	11.3	12.6	14.2	11.9	8.8	11.6	13.9	12.5	13.8	13.8
MW-161R	13.6	12.7	12.0	12.7	13.9	12.9	11.0	12.5	13.6	13.2	14.3	14.7

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	7/22-27/15	10/21-26/15	1/20-27/16	4/25-28/16	7/19-26/16	0/24-11/1/16	1/9-12/17	4/17-24/17	7/17-25/17	10/17-23/17	1/16-22/18	4/9-12/18
MW-17	20.3	16.7	15.8	17.5	18.8	16.2	15.8	16.1	17.1	18.9	17.9	18.0
MW-101A	14.2	11.7	10.7	13.0	13.6	12.4	11.2	12.5	12.5	14.9	14.1	15.4
MW-104	13.7	11.3	10.4	12.4	12.9	11.9	11.1	11.6	12.0	14.5	13.3	14.3
MW-108R	15.1	12.9	11.8	14.0	15.1	13.2	13.1	13.2	14.8	16.5	13.3	15.3
MW-109R	14.5	12.0	11.0	13.0	14.0	12.3	12.2	12.4	14.2	15.3	12.9	15.4
MW-110	13.8	12.3	9.8	11.7	14.5	12.7	11.4	12.1	13.6	16.0	12.8	13.9
MW-111	16.1	15.8	9.7	11.5	15.5	16.1	10.2	10.9	13.9	18.5	11.9	12.6
MW-112	15.8	13.4	12.6	14.0	15.3	13.2	12.0	13.2	13.7	16.0	15.2	15.6
MW-115A	15.7	12.4	11.9	14.7	16.0	13.3	12.3	13.8	14.3	17.1	16.5	17.1
MW-116	14.0	13.3	12.2	13.7	13.8	13.3	12.2	13.7	13.4	16.3	14.9	16.4
MW-133	24.3	20.4	8.3	8.1	25.3	19.7	10.0	7.0	----	----	13.2	8.9
MW-141	12.4	9.8	9.5	11.0	11.7	10.7	10.2	11.0	10.3	13.0	12.4	10.0
MW-142	12.8	10.3	9.6	11.2	12.2	11.0	10.2	11.2	10.9	13.5	12.4	10.1
MW-149	13.8	11.2	9.8	12.2	13.4	11.3	10.9	11.8	13.2	14.6	11.2	14.7
MW-152	13.7	11.8	10.9	13.2	13.7	11.6	10.9	11.8	12.2	14.3	11.5	13.4
MW-153	13.2	10.8	9.0	12.0	12.6	11.1	10.4	11.6	11.5	13.8	12.9	13.8
MW-158	14.4	11.8	10.6	13.5	14.0	12.3	11.7	12.6	13.4	15.5	12.6	14.8
MW-161R	15.0	12.8	12.0	13.8	14.5	13.2	12.8	13.4	13.6	16.1	13.2	15.9

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	7/11-18/18	10/22-25/18	11/15/18	1/11-18/19	4/24-26/19	7/23-30/19	10/24-28/19	1/14-20/20	4/24-28/20	7/9-14/20	10/21-23/20	12/8/20
MW-17	17.0	16.1	----	15.7	16.5	17.0	15.9	11.0	15.9	16.5	15.4	----
MW-101A	14.7	13.3	----	10.9	13.2	13.9	12.6	11.1	12.5	13.3	12.2	----
MW-104	13.9	12.7	----	10.7	12.3	13.3	11.7	11.1	12.2	13.0	11.7	----
MW-108R	13.4	14.0	12.6	13.7	14.1	14.9	13.6	10.4	12.9	13.9	13.4	----
MW-109R	13.5	13.5	----	13.7	14.4	14.5	13.4	10.2	13.1	14.5	12.4	----
MW-110	12.4	12.6	----	9.5	12.9	13.5	13.0	10.1	11.4	12.3	12.0	----
MW-111	14.1	15.1	----	8.8	12.6	15.1	15.4	11.0	11.3	15.8	14.6	----
MW-112	13.6	13.5	----	13.0	13.8	14.2	12.7	11.1	13.0	14.1	12.5	11.5
MW-115A	14.4	15.2	----	13.8	14.8	15.3	14.4	12.1	12.8	14.5	13.8	----
MW-116	13.1	14.3	----	14.5	17.7	14.1	14.2	11.5	13.2	13.5	13.6	----
MW-133	26.0	22.0	----	9.9	7.9	25.8	20.2	12.0	6.9	21.1	20.2	----
MW-141	10.4	11.3	----	11.0	11.8	11.3	11.1	11.2	10.2	10.5	10.1	----
MW-142	11.1	11.8	----	11.0	12.3	12.0	11.5	11.3	10.5	11.1	10.4	----
MW-149	13.2	12.8	----	10.8	13.1	14.4	12.4	10.8	13.0	13.4	12.1	----
MW-152	12.6	12.9	----	12.1	12.6	13.1	12.3	10.2	11.0	12.6	11.4	----
MW-153	11.7	12.2	----	11.8	12.3	12.8	12.0	11.8	10.8	11.4	10.8	----
MW-158	13.9	13.5	----	11.7	13.3	14.3	12.9	12.5	12.2	13.7	12.9	----
MW-161R	16.3	14.2	----	13.8	14.3	15.0	13.8	11.1	12.9	13.4	13.2	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
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Well ID	1/6-11/21	4/21-26/21	7/14-28/21	10/20-27/21
MW-17	14.3	15.1	16.4	14.6
MW-101A	11.0	11.9	12.7	12.3
MW-104	11.0	11.9	12.3	11.7
MW-108R	11.6	12.5	13.8	13.0
MW-109R	12.3	12.5	14.1	12.5
MW-110	10.3	12.8	14.4	12.6
MW-111	3.9	18.4	16.7	16.2
MW-112	11.7	12.8	13.5	12.5
MW-115A	12.8	14.3	14.7	12.6
MW-116	11.1	12.6	12.8	13.3
MW-133	10.6	7.3	16.5	17.2
MW-141	10.0	10.2	10.8	9.9
MW-142	10.0	10.3	11.3	10.1
MW-149	10.5	12.6	14.0	11.7
MW-152	10.9	11.2	13.1	11.6
MW-153	10.2	11.0	12.3	----
MW-158	11.0	12.1	15.1	12.5
MW-161R	12.4	12.9	13.6	12.5

EGLE

MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
MATERIALS MANAGEMENT DIVISION

SITE IDENTIFICATION FORM

You must save this file to your computer before completing the form
Required under authority of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Failure to submit this information may result in civil or criminal penalties

1. Reason for Submittal (Select only one)

☐	Obtaining an initial United States Environmental Protection Agency (EPA) Identification (ID) number, **as a new site or new owner,** for an on-going regulated activity that will continue for a period of time. **FEES DO NOT APPLY TO LIB ONLY SITES**. **1. Pay the $50 fee** on-line using MasterCard, VISA, or Discover Card at https://www.thepayplace.com/mi/deq/siteid. **2. E-mail the form,** with a copy of the fee receipt, to EGLE-MMD-Site-ID-Reporting@Michigan.gov; **or, Mail the form with check** payable to the **State of Michigan** to: Michigan Department of Environment, Great Lakes and Energy (EGLE), Cashier's Office–HWUC, P.O. Box 30657, Lansing, Michigan 48909-7741.
☐	Submitting a subsequent notification to change, update, or verify site information for an existing owner of a site with a previously issued Site ID number. E-mail to EGLE-MMD-Site-ID-Reporting@Michigan.gov
☐	* NOTIFYING that **SITE IS STILL IN BUSINESS AND NO LONGER GENERATING WASTE (end date required)** ________________ Authorized Signature________________________________ Date_______ * *E-mail completed pages 1-2 to* EGLE-MMD-Site-ID-Reporting@Michigan.gov
☐	*NOTIFYING that **SITE IS OUT OF BUSINESS AND NO LONGER GENERATING WASTE (end date required)** ________________ Authorized Signature________________________________ Date_______ ******E-mail completed pages 1-2 to* EGLE-MMD-Site-ID-Reporting@Michigan.gov
☐	Site was a TSD facility and/or generator of less than 1,000 kilograms (kg) of hazardous waste, less than 1 kg of acute hazardous waste, or 100 kg of acute hazardous waste spill cleanup in one or more months of the reporting year.
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities.
☑	Submitting a new or revised Part A Form.
☐	Submitting as a component of the Hazardous Waste Biennial Report.

2. Site EPA ID Number

M	I	D	0	0	0	8	2	0	3	8	1

3. Site Legal Name

PHARMACIA & UPJOHN COMPANY LLC

4. Site Specific Name

PHARMACIA & UPJOHN COMPANY LLC

Site ID 8 1

5. Site Location Address

Street Address 7171 Portage Road		
Street Address (room/suite/mail code)		
City, Town, or Village Kalamazoo		County Kalamazoo
State MI	Country United States	Zip Code 49001

6. Site Mailing Address ☐ **Same as Location Address**

Street Address 7000 Portage Road		
Street Address (room/suite/mail code)		
City, Town, or Village Kalamazoo		County Kalamazoo
State MI	Country United States	Zip Code 49001

7. Federal Tax ID # (required)

38-1123360

8. Site Land Type (check one)

Private	County	District	Federal	Tribal	Municipal	State	Other
☑	☐	☐	☐	☐	☐	☐	☐

9. North American Industry Classification System (NAICS) at least one 6-digit code REQUIRED

A 325412	B	C	D

10. Site Contact Information ☐ **Same as Location Address**

First Name Steve	MI	Last Name Maynard
Street Address 7000 Portage Road (PORT 91-106)		
City, Town, or Village Kalamazoo		
State MI	Country United States	Zip Code 49001
Email steve.maynard@pfizer.com		
Phone 269-833-9040	Ext	Fax

11. Name of Site's Legal Owner (Company or Individual) ☐ **Change in Ownership**

Approximate date became owner 01/01/1996 ☑ **Same as Site Mailing Address**

Full Name Pharmacia & Upjohn LLC		
Street Address		
City, Town, or Village		
State	Country	Zip Code
Email		
Phone	Ext	Fax

11(b) Name of Site's Legal Operator (Company or Individual) ☐ **Change in Operator**

Approximate date became operator____________ ☑ **Same as Site Specific Name/Address**

Full Name Pharmacia & Upjohn LLC		
Street Address		
City, Town, or Village		
State	Country	Zip Code
Email		
Phone	Ext	Fax

Hazardous Waste Activities (Please complete all questions)

12. Type of Regulated Waste Activity Date Activity Began 01/01/1996

☐ Y ☐ N	1. Generator of Hazardous Waste – If "Yes", mark only one of the following:	
☑	**Large Quantity Generator (LQG)**	-Generates, in any calendar month (includes quantities imported by importer site), 1,000 kg per month (mo) (2,200 pounds (lb)/mo) or more of non-acute hazardous waste; or -Generates, in any calendar month or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or -Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material
☐	**Small Quantity Generator (SQG)**	100 to 1,000 kg/mo (220 to 2,200 lb/mo) of non-acute hazardous waste, and no more than 1 kg (2.2 lb) of acute hazardous waste, and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material
☐	**Very Small Quantity Generator (VSQG)**	Less than, or equal to, 100 kg/mo (220 lb/mo) of non-acute hazardous waste
Please answer all questions		
☐ Y ☑ N	2. Short Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes" provide an explanation in the Comments Section.	
☑ Y ☐ N	3. Treater, Stores or Disposer of Hazardous Waste – Hazardous waste Part B permit is required for these activities	
☐ Y ☑ N	4. Receives Hazardous Waste from Off-site	
☐ Y ☑ N	5. Recycler of Hazardous Waste	
	☐ who stores prior to recycling ☐ who does not store prior to recycling	
☐ Y ☑ N	6. Exempt Boiler and/or Industrial Furnace – If "Yes", mark all that apply.	
	☐ Small Quantity On-site Burner Exemption	
	☐ Smelting, Melting, and Refining Furnace Exemption	

Waste Codes for Federally Regulated Hazardous Waste. Please list the waste codes of the Federal Hazardous Wastes handled at your site. List them in the order they are presented in the regulations (e.g., D001, D002, F007, U112). Use an additional page if more spaces are needed.

See Attached						

Waste Codes for State Regulated (non-Federal) Hazardous Waste. Please list the waste codes of the State Hazardous Wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

See Attached						

13. Additional Regulated Waste Activities

Other Waste Activities

☑ Y ☐ N	**Transporter of Hazardous Waste** – If "Yes", mark all that apply. **(May require permits or registration)**
	☑ Transporter
	☐ Transfer Facility (at your site)
☐ Y ☑ N	Commingle Waste
☐ Y ☑ N	Off Loads During Transportation
☑ Y ☐ N	Underground Injection Control
☐ Y ☑ N	United States Importer of Hazardous Waste
☐ Y ☑ N	Recognized Trader – If "Yes", mark all that apply
	☐ Importer
	☐ Exporter
☐ Y ☑ N	Importer/Exporter of Spent Lead-Acid Batteries (SLABs under R 299.9804) – If "Yes", mark all that apply.
	☐ Importer
	☐ Exporter

Universal Waste Activities

☑ Y ☐ N	Large Quantity Handler of Universal Waste (accumulate 5,000 kg or more) – If "Yes", mark all that apply. Note: Refer to state regulations to determine what is regulated.
	☑ Batteries
	☐ Pesticides
	☑ Thermostats
	☑ Mercury Switches
	☑ Mercury Thermometers
	☑ Devices containing elemental mercury
	☑ Electric Lamps
	☑ Pharmaceuticals
	☑ Consumer Electronics
	☐ Antifreeze as defined in R 299.9101
☐ Y ☑ N	Destination Facility of Universal Waste **(a hazardous waste permit may be required for this activity)**

Used Oil Activities

☐ Y ☑ N	Used Oil Transporter – If "Yes", mark all that apply.
	☐ Transporter
	☐ Transfer Facility (at your site)
☐ Y ☑ N	Used Oil Processor and/or Re-refiner – If "Yes," mark all that apply.
	☐ Processor Date Activity Began:
	☐ Re-refiner Date Activity Began:
☐ Y ☑ N	Off-Specification Used Oil Burner Date Activity Began:
☐ Y ☑ N	Used Oil Fuel Marketer – If "Yes", mark all that apply.
	☐ Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner Date Activity Began:
	☐ Marketer Who First Claims the Used Oil Meets the Specifications Date Activity Began:
☐ Y ☑ N	Used Oil Collection or Aggregation Point
☐ Y ☑ N	Collection Center or Aggregation Point that accepts DIY Used Oil

Liquid Industrial By-Product Activities

☐ Y ☑ N	Liquid Industrial By-Product Transporter – If "Yes", mark all that apply. **(requires Permit & Registration)**
	☐ Transporter Date Activity Began:
	☐ Transfer Facility (at your site) Date Activity Began:
☑ Y ☐ N	Transports Own Waste. Date Activity Began:
☑ Y ☐ N	Liquid Industrial Waste By-Product Generator. Date Activity Began:
☐ Y ☑ N	Liquid Industrial By-Product Designated Facility. Date Activity Began:

14. Eligible Academic Entities with Laboratories - Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to R 299.9315.

☐ Y ☑ N	Opting into, or currently operating under, R 299.9315, for the management of hazardous wastes in laboratories. If “Yes”, mark all that apply. NOTE: See the item-by-item instructions for definitions of types of eligible academic entities.
	☐ College or University
	☐ Teaching Hospital that is owned by, or has a formal written affiliation with, a college or university
	☐ Non-profit Institute that is owned by, or has a formal written affiliation with, a college or university
☐ Y ☑ N	Withdrawing from R 299.9315, for the management of hazardous wastes in laboratories.

15. Episodic Generation

☐ Y ☑ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category? If “Yes”, you must fill out the Addendum for Episodic Generator.

16. LQG Consolidation of VSQG Hazardous Waste

☑ Y ☐ N	Are you an LQG notifying of consolidating VSQG hazardous waste under the control of the same person pursuant to R 299.9307(6)? If “Yes”, you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

17. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (Required)

☐ Y ☑ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility
	☐ Central Accumulation Area (CAA)
	☐ Entire Facility
	Expected Closure date:
	Requesting new closure date:
	Date Closed:
☑ Y ☐ N	In compliance with the closure performance standards R 299.9307(1)(k)
☐ Y ☑ N	Not in compliance with the closure performance standards R 299.9307(1)(k)

18. Notification of Hazardous Secondary Material (HSM) Activity

☑ Y ☐ N	Are you notifying under R 299.9204(1) that you will begin managing, are managing, or will stop managing HSM under R 299.9204(1), R 299.9204(1)(aa – dd)? If “Yes”, you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.

19. Electronic Manifest Broker

☐ Y ☑ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

20. Comments (include item number for each comment)

21. Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.
Note: For the RCRA Hazardous Waste Part A Permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11).

Signature of legal owner, operator, or authorized representative DocuSigned by: David Breen CBB53461C18D425...	Date (mm/dd/yyyy) June 15, 2022
Printed Name (First, Middle Initial, Last) David Breen	Title Site Leader
Email David.Breen@pfizer.com	

Signature of legal owner, operator, or authorized representative	Date (mm/dd/yyyy)
Printed Name (First, Middle Initial, Last)	Title
Email	

Site ID M I D 0 0 0 8 2 0 3 8 1

ADDENDUM TO THE SITE IDENTIFICATION FORM
NOTIFICATION OF HAZARDOUS SECONDARY MATERIAL ACTIVITY

ONLY FILL OUT THIS FORM IF:

You are located in a State that allows you to manage excluded hazardous secondary material (HSM) under rule R 299.9204 (1)(aa - dd) of Part 111;

AND

a. You are or will be managing excluded HSM in compliance with rules R 299.9202 (6)(a – f), or R 299.9204 (1)(aa – dd) (or federal equivalent) or have stopped managing excluded HSM in compliance with the exclusion(s) and do not expect to manage any amount of excluded HSM under the exclusion(s) for at least one year. Do not include any information regarding your hazardous waste activities in this section. Note: if your facility was granted a solid waste variance under rules R 299.9202 (6)(a – f) prior to July 13, 2015, your management of HSM under rules R 299.9202 (6)(a – f) is grandfathered under the previous regulations and you are not required to notify for the HWM management activity excluded under rules R 299.9202 (6)(a – f).

Reason for Notification (include dates where requested)

Facility will begin managing excluded HSM as of_______________

Facility is still managing excluded HSM/re-notifying, as required, by March 1 of each even-numbered year.

Facility has stopped managing excluded HSM as of________ and is notifying as required.

Description of Excluded HSM Activity: Please list the appropriate codes (see Code List section of the instructions) and quantities, in short tons, to describe your excluded HSM activity ONLY (do not include any information regarding your hazardous wastes). Use additional pages if more space is needed.

Facility Code	**HSM Waste Codes**	**Est. Short Tons of Excluded HSM Managed Annually**	**Actual Short Tons of Excluded HSM Managed During the Most Recent Odd-numbered Year**	**Land-based Unit Code**
		See Attached		

Site ID M I D 0 0 0 8 2 0 3 8 1

ADDENDUM TO THE SITE IDENTIFICATION FORM
EPISODIC GENERATOR

ONLY fill out this form if:

You are an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves the generator to a higher generator category pursuant to R 299.9316. Note: Only one planned and one unplanned episodic event are allowed within one year. Otherwise, you must follow the requirements of the higher generator category. Use additional pages if more space is needed.

Type of Episodic Event

Planned (requires **30 day** prior notification) ☐ Excess chemical inventory removal ☐ Tank Cleanouts ☐ Short-term construction or demolition ☐ Equipment maintenance during plant shutdowns ☐ Other________________	**Unplanned** (requires notification within **72 hours**) ☐ Accidental Spills ☐ Production process upsets ☐ Product recalls ☐ "Acts of nature" (Tornado, hurricane, flood, etc.) ☐ Other__________________
Emergency Contact Phone	Emergency Contact Name
Beginning Date	End Date

Waste 1

Waste Description	Estimated Quantity (in pounds)

Federal and/or State Hazardous Waste Codes					

Waste 2

Waste Description	Estimated Quantity (in pounds)

Federal and/or State Hazardous Waste Codes					

Waste 3

Waste Description	Estimated Quantity (in pounds)

Federal and/or State Hazardous Waste Codes					

Site ID M I D 0 0 0 8 2 0 3 8 1

ADDENDUM TO THE SITE IDENTIFICATION FORM

LQG CONSOLIDATION OF VSQG HAZARDOUS WASTE

ONLY fill out this form if:

You are an LQG receiving hazardous waste from VSQGs under the control of the same person. Use additional pages if more space is needed.

VSQG 1

Site ID Number (if assigned) M I D 0 0 0 8 2 0 3 8 1	Name PHARMACIA & UPJOHN CO LLC	
Street Address 2605 E KILGORE RD SUITE 2		
City, Town, or Village Kalamazoo	State MI	Zip Code 49001
Contact Phone Number 269-833-9040	Contact Name Steve Maynard	
Email Steve.Maynard@pfizer.com		

VSQG 2

Site ID Number (if assigned)	Name	
Street Address		
City, Town, or Village	State	Zip Code
Contact Phone Number	Contact Name	
Email		

VSQG 3

Site ID Number (if assigned)	Name	
Street Address		
City, Town, or Village	State	Zip Code
Contact Phone Number	Contact Name	
Email		