



*Consulting Engineers
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March 21, 2017
PBW Project No. 1358

VIA EMAIL

Ms. Maureen Hatfield
MC-127
VCP-CA Section, Remediation Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Re: DNAPL Recovery Activities Report
Union Pacific Railroad Houston Wood Preserving Works Facility
4910 Liberty Road Facility, Houston, Texas
Post-Closure Care Permit No. HW-50343; Industrial SWR No. 31547

Dear Ms. Hatfield:

Pastor, Behling & Wheeler, LLC (PBW), on behalf of Union Pacific Railroad Company, is providing this summary report for the dense non-aqueous phase liquid (DNAPL) recovery activities conducted at the Houston Wood Preserving Works Facility (the Site). As detailed in the PBW letter dated February 5, 2013, PBW proposed to conduct a 24-month DNAPL recovery pilot test at the Site consisting of monthly manual DNAPL recovery. Following the 24-month testing period, the DNAPL recovery efforts have continued following the same procedures. Monthly recovery efforts have now been conducted for four years. The following monitoring wells are included in the DNAPL recovery:

Well Name	Zone
MW-57A	A-TZ
MW-78A	A-TZ
MW-12B	B-TZ
MW-32B	B-CZ
MW-41B	B-TZ
MW-57B	B-CZ
MW-70B	B-CZ
MW-75B	B-CZ
MW-23C	C-TZ
MW-34C/MW-34CR	C-TZ
MW-44C	C-TZ
MW-45C	C-TZ
MW-46C	C-TZ

Figure 1 shows the location of the DNAPL recovery wells.

The DNAPL procedures consists of measuring the depth to groundwater surface, the depth to the groundwater/DNAPL interface, and the total depth of the well relative to the top of well casing prior to

DNAPL recovery. Using a peristaltic pump or submersible pump, DNAPL is pumped from the bottom of the well until groundwater returned in the pump discharge. The volume of recovered DNAPL is estimated from each well based on the volume pumped, and the well is gauged to measure the total depth of the well and depth to residual DNAPL following pumping. Recovered DNAPL is temporarily stored at the Containment Storage Area. The most recent waste manifests for the recovered DNAPL and groundwater are provided in Attachment A.

A summary of the DNAPL recovery measurements for the DNAPL activities from February 2013 through February 2017 is provided on Table 1. A graph of DNAPL thicknesses prior to each monthly recovery efforts over time is presented on Figure 2. Observations from the recovery activities, with emphasis on the last six months of the pilot test, are provided below:

- A-TZ Wells: Initially, MW-57A was the only well completed in the A-TZ Unit that contained DNAPL. For MW-57A, DNAPL thickness decreased from 4.78 feet in February 2013 to less than 1 foot thick from October 2013 through January 2015. DNAPL thicknesses have steadily decreased since January 2015 from 0.39 feet to not detected since August 2015. Following installation of MW-78A in May 2014 in the Englewood Intermodal Yard and detection of DNAPL in the well, MW-78A was incorporated into the recovery program starting in early November 2014. DNAPL thickness in MW-78A was measured at 4.06 feet (late January 2015), increased to 5.38 feet (late February 2015), and has steadily decreased to 2.42 feet (February 2017).
- B-TZ/B-CZ Wells: At the beginning of the recovery activities, monitoring wells with the thickest DNAPL measurements included MW-12B and MW-41B on the west side of the Site (Figure 1). DNAPL thicknesses increased following the February 2013 recovery event in MW-12B (May 2013) and in MW-41B (June 2013). However, DNAPL thickness in well MW-12B gradually decreased from 8.18 feet in May 2013 to 0.11 feet thick in August 2015, with a slight increase to 0.65 feet from August 2015 to February 2016. Over the last six months, the DNAPL thickness in MW-12B has fluctuated between 0.28 feet (November 2016) to 0.51 feet (August 2016 and February 2017). DNAPL thickness in MW-41B during the first months of the recovery activities increased to 10.26 feet (August 2013). Measured thickness through May 2014 fluctuated, then began a steady decrease over time (with a slight increase in January to May 2015 and then began decreasing again). Over the past six months, DNAPL thickness in MW-41B has decreased from 4.72 feet (August 2016) to 4.3 feet (February 2017) (Figure 2).

Monitoring well MW-32B had a DNAPL thickness of 6.23 feet at the beginning of the recovery activities in February 2013. During the first 12 months, DNAPL thicknesses in the well generally decreased to less than two-feet thick by September 2013. Over the past six months, the DNAPL thickness in this well has been relatively stable ranging in thickness from 0.31 feet (August 2016) to 0.49 feet (September and November 2016, and February 2017).

DNAPL thickness in well MW-57B decreased from 1.28 feet thick in July 2013 to less than measurable (DNAPL noted on end of probe) thickness in January 2014 through early October 2014. Over the last six months, DNAPL in MW-57B has not been detected.

Wells MW-70B and MW-75B had measurable DNAPL at 1.61 feet and 3.1 feet, respectively, at the beginning of the recovery activities (February 2013). During the first 12 months, DNAPL thicknesses in these wells generally decreased to less than one-foot thick, then increased to just over one foot thick in these two wells in early October 2014. Over the past six months, DNAPL thickness in MW-70B have remained relatively stable ranging from 0.42 feet to 0.64 feet thick. DNAPL thickness in MW-75B has shown a slight increase from 0.51 (August 2016) to 0.94 feet

(February 2017) over the past six months, but has remained within the historical range measured in the well.

- C-TZ Wells: Similar to the other wells tested, DNAPL thicknesses in the C-TZ wells MW-44C, MW-45C, and MW-46C significantly decreased over the first two months of testing, with some sporadic increases from May through August 2013 (Figure 2). From December 2013 through early October 2014, C-TZ wells MW-44C, MW-45C, and MW-46C showed increasing DNAPL thicknesses with the largest increase at MW-44C increasing about 1.57 feet. Since August 2015, no DNAPL has been detected in MW-45C. Over the past six months, the DNAPL thickness in MW44C has over all decreased from 1.31 feet (September 2016) to 0.79 feet (February 2017). There has been a slight increase in measured DNAPL thickness during the past six months at MW-46C from 0.33 feet (August 2016) to 0.51 feet (February 2017). Well MW-34C was gauged in October 2013, and no DNAPL was measured in the well (the well historically had DNAPL sporadically present). In May 2014, replacement well MW-34CR was installed and is now gauged as part of the recovery program. However, no DNAPL has been detected in the well.

Monitoring well MW-23C was added to the pilot test program in early November 2014. The initial DNAPL thickness in the well in November 2014 was 2.09 feet. Through October 2016, the DNAPL thickness has steadily decreased to less than one foot in the well. Since October 2016, there has been a slight increase in DNAPL thickness in MW-23C over the past four events from 0.82 feet (October 2016) to 1.06 feet (February 2017).

- DNAPL Recovery: From February 2013 through February 2017, an estimated 369 gallons of creosote DNAPL have been recovered, with monthly DNAPL recovery volumes increased after the January 2015 event (changed pumping techniques). Over the past six months, recovery has been approximately 8 to 9 gallons per month (Table 1).

With the on-going monthly DNAPL recovery activities, the overall trend in DNAPL thicknesses over the past six months has been decreasing in the wells with a significant DNAPL thickness (MW-41B and MW-78A) or relatively stable for the wells with less than a foot of measurable DNAPL thickness. Based on the observations over the past six months, the current recovery procedures are achieving the response action objective of removing the readily recoverable DNAPL from the wells as well as reducing the overall thicknesses. Therefore, there are no proposed changes to the recovery activities at this time.

If you have any questions or need additional information, please feel free to call me at (512) 671-3434 or Mr. Geoffrey Reeder of UPRR at (281) 350-7197.

Sincerely,

PASTOR, BEHLING & WHEELER, LLC



Eric C. Matzner, P.G.
Associate Hydrogeologist

cc: Waste Program Manager, TCEQ Region 12, Houston
Mr. Geoffrey Reeder, P.G., UPRR – Spring, TX

TABLES

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-12B				MW-23C				MW-32B				MW-33BR				MW-34C/MW-34CR (July 2014)			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	9.06	39.87	5.93	2.5	NM	NM	NM	---	6.01	30.06	6.23	2	3.72	ND	0	---	NM	NM	NM	---
4/3/2013	9.41	39.95	5.85	1	NM	NM	NM	---	4.86	33.61	2.68	1	4.02	PoP	0	---	NM	NM	NM	---
4/22/2013	8.61	31.64	14.16	0.5*	NM	NM	NM	---	5.62	36.08	0.21	0.25	3.63	ND	0	---	NM	NM	NM	---
5/30/2013	8.47	37.62	8.18	1.5*	NM	NM	NM	---	5.86	32.21	4.08	2	3.59	ND	0	---	NM	NM	NM	---
6/29/2013	9.62	38.22	7.58	1.5	NM	NM	NM	---	6.79	33.59	2.7	1.5	6.07	ND	0	---	NM	NM	NM	---
7/22/2013	11.16	39.04	6.76	1	NM	NM	NM	---	7.14	33.91	2.38	1.5	9.68	ND	0	---	NM	NM	NM	---
8/26/2013	11.31	39.61	6.19	1	NM	NM	NM	---	7.48	33.83	2.46	1	9.86	ND	0	---	NM	NM	NM	---
9/27/2013	11.17	40.63	5.17	1	NM	NM	NM	---	7.23	34.39	1.9	1	9.57	ND	0	---	NM	NM	NM	---
10/31/2013	11.09	43.71	2.09	1	NM	NM	NM	---	7.16	34.96	1.33	0.53	9.32	ND	0	---	21.63	NM	NM	---
11/27/2013	11.17	44.06	1.74	1	NM	NM	NM	---	7.29	35.03	1.26	0.53	9.16	ND	0	---	NM	NM	NM	---
12/31/2013	11.02	44.62	1.18	1	NM	NM	NM	---	7.16	35.16	1.13	0.5	8.97	ND	0	---	NM	NM	NM	---
1/30/2014	11.34	45.12	0.68	1	NM	NM	NM	---	6.72	34.82	1.47	0.53	7.41	ND	0	---	NM	NM	NM	---
3/3/2014	11.17	44.32	1.48	1	NM	NM	NM	---	6.53	34.52	1.77	0.53	7.16	ND	0	---	NM	NM	NM	---
3/31/2014	11.03	44.53	1.27	1	NM	NM	NM	---	6.29	34.21	2.08	0.53	7.04	ND	0	---	NM	NM	NM	---
4/30/2014	10.92	44.26	1.54	1	NM	NM	NM	---	6.42	34.67	1.62	0.53	6.88	ND	0	---	NM	NM	NM	---
5/27/2014	10.81	44.34	1.46	1	NM	NM	NM	---	6.36	34.72	1.57	0.53	6.72	ND	0	---	NM	NM	NM	---
6/26/2014	10.72	44.61	1.19	1	NM	NM	NM	---	6.21	34.61	1.68	0.53	6.52	ND	0	---	NM	NM	NM	---
7/31/2014	10.13	44.96	0.84	1	NM	NM	NM	---	6.06	34.33	1.96	0.25	6.29	ND	0	---	19.06	ND	0	---
8/27/2014	10.26	45.12	0.68	1	NM	NM	NM	---	6.18	34.98	1.31	0.25	6.47	ND	0	---	18.96	ND	0	---
10/3/2014	10.17	44.91	0.89	1	NM	NM	NM	---	6.06	34.72	1.57	0.25	6.32	ND	0	---	18.81	ND	0	---
11/3/2014	10.29	44.97	0.83	1	22.51	70.71	2.09	0.25	6.18	34.91	1.38	0.25	NM	NM	NM	---	19.06	ND	0	---
11/24/2014	10.27	44.99	0.81	1	22.56	70.92	1.88	0.5	6.21	35.16	1.13	0.5	NM	NM	NM	---	19.11	ND	0	---
12/22/2014	10.23	44.71	1.09	1	22.47	70.81	1.99	0.5	6.14	35.02	1.27	0.75	NM	NM	NM	---	19.06	ND	0	---
1/29/2015	10.16	44.96	0.84	1	22.26	71.04	1.76	0.5	5.71	35.29	1	0.75	NM	NM	NM	---	18.79	ND	0	---
2/26/2015	10.12	44.96	0.84	1.5	22.06	71.09	1.71	0.5	6.02	35.29	1	1	NM	NM	NM	---	18.71	ND	0	---
3/26/2015	9.96	45.21	0.59	1.5	22.17	71.12	1.68	0.25	5.46	35.36	0.93	1	NM	NM	NM	---	18.67	ND	0	---
4/27/2015	9.89	45.37	0.43	1.5	22.23	71.06	1.74	0.5	5.21	35.29	1	1	NM	NM	NM	---	18.79	ND	0	---
5/26/2015	9.72	45.61	0.19	2	22.17	71.14	1.66	0.5	5.07	35.46	0.83	1	NM	NM	NM	---	18.63	ND	0	---
7/6/2015	7.12	45.96	0.24	2	19.01	71.39	1.41	0.5	4.06	35.66	0.63	1	NM	NM	NM	---	17.29	ND	0	---
8/3/2015	7.26	46.09	0.11	2	19.16	71.46	1.34	0.75	4.29	35.71	0.58	1	NM	NM	NM	---	17.21	ND	0	---
8/27/2015	8.09	46.01	0.19	1	20.34	71.51	1.29	0.75	5.05	35.77	0.52	1	NM	NM	NM	---	18.46	ND	0	---
10/5/2015	7.12	45.86	0.34	1	19.02	71.57	1.23	0.5	4.31	35.96	0.33	1	NM	NM	NM	---	17.29	ND	0	---
11/5/2015	6.86	45.81	0.39	1	18.59	71.59	1.21	0.5	4.02	35.91	0.38	1	NM	NM	NM	---	16.78	ND	0	---
12/3/2015	6.46	45.79	0.41	1	18.33	71.67	1.13	0.5	3.92	35.96	0.33	1	NM	NM	NM	---	16.44	ND	0	---
12/28/2015	6.23	45.62	0.58	1.25	23.21	71.61	1.19	0.75	3.73	35.91	0.38	1	NM	NM	NM	---	16.16	ND	0	---
2/3/2016	6.04	45.55	0.65	1.5	17.96	71.64	1.16	0.5	3.61	35.87	0.42	1	NM	NM	NM	---	15.98	ND	0	---
3/3/2016	5.96	45.61	0.59	1.5	17.92	71.71	1.09	0.5	3.51	35.91	0.38	1	NM	NM	NM	---	15.98	ND	0	---
3/31/2016	6.06	45.72	0.48	1.5	17.86	71.79	1.01	0.5	3.56	35.92	0.37	1	NM	NM	NM	---	15.98	ND	0	---
5/3/2016	6.13	45.66	0.54	1	NM	NM	NM	---	3.67	35.87	0.53	0.5	NM	NM	NM	---	15.79	ND	0	---
6/2/2016	6.21	45.61	0.59	1	22.9	71.51	1.29	0.5	3.74	35.92	0.48	0.5	NM	NM	NM	---	15.97	ND	0	---
7/8/2016	6.29	45.72	0.48	1	23.09	71.52	1.28	0.25	3.91	35.96	0.44	0.5	NM	NM	NM	---	16.06	ND	0	---
8/3/2016	6.34	45.77	0.43	1	23.16	71.66	1.14	0.25	4.03	35.49	0.91	0.5	NM	NM	NM	---	16.17	ND	0	---
8/30/2016	6.47	45.69	0.51	1	23.31	71.61	1.19	0.5	4.22	36.09	0.31	0.5	NM	NM	NM	---	16.31	ND	0	---
9/30/2016	6.59	45.81	0.39	1	23.39	71.81	0.99	0.5	4.33	35.91	0.49	0.5	NM	NM	NM	---	16.42	ND	0	---
11/3/2016	6.64	45.92	0.28	1	23.41	71.98	0.82	0.5	4.47	35.99	0.41	0.5	NM	NM	NM	---	16.51	ND	0	---
11/30/2016	6.86	45.86	0.34	0.5	23.59	71.91	0.89	0.75	4.62	35.91	0.49	0.5	NM	NM	NM	---	16.72	ND	0	---
1/4/2017	7.02	45.81	0.39	0.5	23.74	71.82	0.98	0.75	4.83	36.02	0.38	0.25	NM	NM	NM	---	16.94	ND	0	---
2/7/2017	6.97	45.69	0.51	0.5	23.67	71.74	1.06	0.75	4.81	35.91	0.49	0.25	NM	NM	NM	---	16.91	ND	0	---
Total DNAPL Pumped (gal)				54.75				14				36.49				0				0

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNALP Extracted

MW-12B- TD Measured at 46.2 instead of 45.8, August 28, 2015.

MW-23C- Added 5 feet to TOC due to capping after 2/3/2016

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-41B				MW-44C				MW-45C				MW-46C				MW-57A			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	8.91	41.1	3.71	3	18.96	62.95	7.85	1	21.26	69.9	0.7	0.25	21.07	71.3	1.6	0.25	10.56	22.12	4.78	0.5
4/3/2013	9.37	41.6	3.21	1.5	19.34	70.47	0.33	0.25*	21.39	70.39	0.21	0.25*	20.61	72.36	0.54	0.25*	10.32	24.79	2.11	0.5
4/22/2013	8.62	41.6	3.21	0.5*	18.62	70.64	0.16	0.25*	21.03	70.47	0.13	0.25*	20.61	72.61	0.29	0.25*	10.71	25.85	1.05	0.5
5/30/2013	8.73	34.16	10.65	2	18.43	70.01	0.79	0.25*	21.16	70.25	0.35	0.25*	20.59	71.61	1.29	0.25*	10.63	24.16	2.74	0.5
6/29/2013	9.72	37.12	7.69	2	19.34	70.32	0.48	0.25	21.93	70.32	0.28	0.25*	21.09	72.34	0.56	0.25*	12.16	23.82	3.08	2
7/22/2013	10.31	39.29	5.52	1.5	20.36	70.26	0.54	0.25	22.72	70.39	0.21	0.25*	21.96	72.16	0.74	0.25*	13.21	23.05	3.85	2
8/26/2013	10.09	34.55	10.26	2.5	20.62	70.39	0.41	0.25	22.86	70.31	0.29	0.25	22.23	72.32	0.58	0.25	12.91	25.32	1.58	1
9/27/2013	9.63	37.29	7.52	2	20.39	70.61	0.19	0.25	22.66	70.17	0.43	0.25	22.09	72.09	0.81	0.25	12.72	25.71	1.19	0.75
10/31/2013	9.52	38.16	6.65	2	20.17	70.75	0.05	0.07	22.59	70.42	0.18	0.13	22.41	72.34	0.56	0.2	12.72	25.92	0.98	1
11/27/2013	9.57	38.39	6.42	2	20.09	70.78	0.02	---	22.52	70.49	0.11	---	22.31	72.47	0.43	0.07	12.61	25.98	0.92	1
12/31/2013	9.42	39.36	5.45	2	20.01	70.8	PoP	---	22.39	70.46	0.14	---	22.03	72.53	0.37	0.07	12.46	26.09	0.81	1
1/30/2014	9.06	39.17	5.64	2	19.67	70.42	0.38	0.25	22.13	70.35	0.25	---	21.81	72.55	0.35	0.07	11.79	26.15	0.75	0.25
3/3/2014	8.62	38.06	6.75	2	19.29	70.17	0.63	0.25	21.86	70.09	0.51	---	21.57	72.05	0.85	0.25	11.02	26.25	0.65	0.25
3/31/2014	8.52	37.74	7.07	2	19.17	70.02	0.78	0.25	21.71	69.63	0.97	0.25	21.43	72.12	0.78	0.13	10.83	26.41	0.49	0.25
4/30/2014	8.36	37.21	7.6	2	19.02	69.81	0.99	0.25	21.59	69.74	0.86	0.25	21.27	71.81	1.09	0.25	10.71	26.31	0.59	0.25
5/27/2014	8.26	37.29	7.52	2	18.92	69.71	1.09	---	21.52	69.67	0.93	0.25	21.34	71.71	1.19	0.25	10.74	26.16	0.74	0.25
6/26/2014	8.02	37.47	7.34	2	18.81	69.52	1.28	0.25	21.59	69.77	0.83	0.25	21.17	71.6	1.3	0.25	10.61	26.29	0.61	0.25
7/31/2014	8.21	37.92	6.89	2	18.66	69.37	1.43	0.25	21.21	69.96	0.64	0.25	20.39	71.43	1.47	0.25	10.35	26.18	0.72	0.25
8/27/2014	8.07	38.29	6.52	1.5	18.53	69.47	1.33	0.25	21.13	70.12	0.48	0.25	20.22	71.61	1.29	0.25	10.22	26.26	0.64	0.25
10/3/2014	8.02	38.13	6.68	2	18.41	69.23	1.57	0.25	20.13	70.41	0.19	0.25	20.14	71.39	1.51	0.25	10.09	26.04	0.86	0.25
11/3/2014	8.22	38.29	6.52	2	18.52	69.37	1.43	0.25	20.29	70.36	0.24	0.25	20.27	71.47	1.43	0.25	10.17	26.16	0.74	0.25
11/24/2014	8.27	38.47	6.34	2	18.57	69.49	1.31	0.5	20.34	70.48	0.12	0.25	20.38	71.53	1.37	0.5	10.13	26.29	0.61	0.25
12/22/2014	8.16	38.39	6.42	2	18.51	69.31	1.49	0.5	20.31	70.41	0.19	0.25	20.37	71.42	1.48	0.5	10.06	26.34	0.56	0.25
1/29/2015	8.02	39.16	5.65	1.5	18.39	69.39	1.41	0.5	20.17	70.51	0.09	0.25	20.13	71.48	1.42	0.5	9.73	26.51	0.39	0.25
2/26/2015	7.92	39.06	5.75	2.5	18.42	69.51	1.29	0.5	20.11	70.59	0.01	---	20.09	71.38	1.52	0.5	9.87	26.42	0.48	0.25
3/26/2015	7.83	38.74	6.07	2.5	18.39	69.42	1.38	0.25	19.26	70.52	0.08	---	20.17	71.02	1.88	0.25	9.81	26.32	0.58	0.25
4/27/2015	8.02	38.61	6.20	3	18.29	69.52	1.28	0.5	20.17	70.48	0.12	0.25	20.22	71.56	1.34	1	9.82	26.47	0.43	0.5
5/26/2015	7.91	38.72	6.09	3	18.17	69.57	1.23	0.75	20.12	70.41	0.19	0.25	20.12	71.61	1.29	1	9.71	26.56	0.34	0.5
7/6/2015	6.03	38.96	5.85	2.5	16.29	69.86	0.94	0.5	18.07	70.49	0.11	0.25	18.17	71.93	0.97	0.75	7.41	26.82	0.08	TR*
8/3/2015	6.09	39.01	5.80	2.5	16.18	69.82	0.98	0.5	18.16	70.56	0.04	TR*	18.24	71.98	0.92	0.75	7.29	26.86	0.04	TR*
8/27/2015	7.39	39.14	5.67	2	17.46	69.74	1.06	0.25	19.03	70.54	0.06	TR*	19.39	72.03	0.87	0.5	8.11	26.90	0	TR*
10/5/2015	6.32	39.34	5.47	2	16.83	69.86	0.94	0.25	18.39	70.60	0	---	18.72	72.34	0.56	0.5	7.72	26.90	0	---
11/5/2015	6.01	39.51	5.30	2	16.62	69.79	1.01	0.25	17.96	70.60	0	---	18.51	72.26	0.64	0.5	7.39	26.90	0	---
12/3/2015	5.76	39.56	5.25	2	16.46	69.73	1.07	0.25	17.72	70.60	0	---	18.62	72.36	0.54	0.5	7.13	26.90	0	---
12/28/2015	5.62	39.63	5.18	2.25	16.32	69.77	1.03	0.25	17.62	70.60	0	---	18.42	72.31	0.59	0.5	NM	NM	NM	---
2/3/2016	5.32	39.72	5.09	3	16.17	69.74	1.06	0.25	17.42	70.60	0	---	18.29	72.46	0.44	0.25	NM	NM	NM	---
3/3/2016	5.17	39.81	5.00	3	16.12	69.79	1.01	0.25	17.39	70.60	0	---	18.23	72.49	0.41	0.25	NM	NM	NM	---
3/31/2016	5.26	39.77	5.04	3	16.06	69.71	1.09	0.25	17.33	70.6	0	---	18.24	72.54	0.36	0.25	NM	NM	NM	---
5/3/2016	5.52	39.96	4.85	3	16.27	69.59	1.21	0.25	17.47	70.6	0	---	18.39	72.39	0.51	0.25	NM	NM	NM	---
6/2/2016	5.67	40.07	4.74	3	16.38	69.63	1.17	0.25	17.52	70.6	0	---	18.43	72.43	0.47	0.25	7.26	26.9	0	---
7/8/2016	5.72	40.01	4.8	3	16.47	69.71	1.09	0.25	17.62	70.6	0	---	18.54	72.49	0.41	0.25	7.39	26.9	0	---
8/3/2016	5.79	40.09	4.72	3	16.59	69.7	1.1	0.25	17.69	70.6	0	---	18.51	72.53	0.37	0.25	7.46	26.9	0	---
8/30/2016	5.91	40.26	4.55	3	16.67	69.58	1.22	0.25	17.76	70.6	0	---	18.72	72.57	0.33	0.25	7.58	26.9	0	---
9/30/2016	6.06	40.13	4.68	3	16.79	69.49	1.31	0.5	17.86	70.6	0	---	18.83	72.46	0.44	0.25	7.69	26.9	0	---
11/3/2016	6.11	40.29	4.52	3	16.86	69.71	1.09	0.5	17.92	70.6	0	---	18.89	72.41	0.49	0.25	7.77	26.9	0	---
11/30/2016	6.26	40.42	4.39	3	17.03	69.94	0.86	0.75	18.09	70.6	0	---	19.12	72.32	0.58	0.25	7.92	26.9	0	---
1/4/2017	6.39	40.56	4.25	3	17.22	70.11	0.69	0.75	18.22	70.6	0	---	19.27	72.46	0.44	0.25	8.07	26.9	0	---
2/7/2017	6.44	40.51	4.3	3	17.29	70.01	0.79	0.5	18.17	70.6	0	---	19.19	72.39	0.51	0.25	8.18	26.9	0	---
Total DNAPL Pumped (gal)				111.25				15.82				5.63				16.04				15.5

Notes:

* - indicates DNAPL and groundwater mixture

--- No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNALP Extracted

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-57B				MW-70B				MW-75B				MW-78A				Approx DNAPL Recovered (gal)
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	
2/14/2013	28.56	41.41	1.54	0.25	6.57	34.09	1.61	0.25	10.01	34.1	3.1	0.25	NM	NM	NM	---	10.25
4/3/2013	28.09	42.36	0.59	0.25*	6.79	35.26	0.44	0.25	13.71	36.47	0.73	0.25	NM	NM	NM	---	5.5
4/22/2013	27.06	42.17	0.78	0.25	6.06	35.12	0.58	0.25	9.72	36.72	0.48	0.25	NM	NM	NM	---	3.25
5/30/2013	27.13	41.63	1.32	0.25	6.19	34.67	1.03	0.25	9.61	35.09	2.11	0.75	NM	NM	NM	---	8
6/29/2013	18.26	42.07	0.88	0.25	8.01	34.92	0.78	0.25*	10.61	35.61	1.59	0.75	NM	NM	NM	---	9
7/22/2013	16.34	41.67	1.28	0.75	8.22	34.07	1.63	0.25*	9.74	35.71	1.49	0.75	NM	NM	NM	---	8.5
8/26/2013	18.01	42.31	0.64	0.25	8.17	35.09	0.61	0.25	10.76	35.93	1.27	0.75	NM	NM	NM	---	7.5
9/27/2013	17.74	42.51	0.39	0.25	8.32	35.34	0.36	0.25	10.52	36.39	0.81	0.5	NM	NM	NM	---	6.5
10/31/2013	17.61	42.61	0.29	0.07	8.26	35.39	0.31	0.07	10.31	36.47	0.73	1	NM	NM	NM	---	6.07
11/27/2013	17.54	42.67	0.23	0.07	8.12	35.42	0.28	0.07	10.39	36.51	0.69	1	NM	NM	NM	---	5.74
12/31/2013	17.36	42.74	0.16	0.07	7.89	35.51	0.19	0.07	10.13	36.72	0.48	1	NM	NM	NM	---	5.71
1/30/2014	17.04	ND	PoP	---	7.84	35.06	0.64	0.07	12.62	36.49	0.71	0.75	NM	NM	NM	---	4.92
3/3/2014	16.51	ND	PoP	---	7.09	35.05	0.65	0.13	12.12	36.35	0.85	0.75	NM	NM	NM	---	5.16
3/31/2014	16.41	ND	PoP	---	6.87	35.17	0.53	0.07	12.01	36.27	0.93	0.75	NM	NM	NM	---	5.23
4/30/2014	16.29	ND	PoP	---	6.72	35.01	0.69	0.07	11.84	36.02	1.18	0.75	NM	NM	NM	---	5.35
5/27/2014	16.13	ND	PoP	---	6.64	34.86	0.84	0.07	11.71	35.79	1.41	0.75	NM	NM	NM	---	5.1
6/26/2014	16.02	ND	PoP	---	6.52	34.97	0.73	0.25	11.58	35.91	1.29	0.5	NM	NM	NM	---	5.28
7/31/2014	15.84	ND	PoP	---	6.26	34.76	0.94	0.25	11.32	35.82	1.38	0.5	NM	NM	NM	---	5
8/27/2014	15.71	ND	PoP	---	6.84	34.86	0.84	0.25	11.19	36.09	1.11	0.5	NM	NM	NM	---	4.5
10/3/2014	15.61	ND	PoP	---	6.71	34.61	1.09	0.25	11.09	36.01	1.19	0.5	NM	NM	NM	---	5
11/3/2014	NM	NM	NM	---	6.79	34.79	0.91	0.25	11.16	36.19	1.01	0.75	9.31	19.12	6.23	2.00	7.50
11/24/2014	NM	NM	NM	---	6.77	34.93	0.77	0.25	11.21	36.27	0.93	0.5	9.39	19.62	5.73	2.00	8.25
12/22/2014	NM	NM	NM	---	6.69	34.86	0.84	0.25	11.26	36.19	1.01	0.5	9.34	19.86	5.49	2.00	8.50
1/29/2015	NM	NM	NM	---	6.48	34.92	0.78	0.25	11.06	36.34	0.86	0.5	9.14	21.29	4.06	2.00	8.00
2/26/2015	NM	NM	NM	---	6.39	34.81	0.89	0.5	11.09	36.34	0.86	0.5	9.17	19.97	5.38	2.5	10.25
3/26/2015	NM	NM	NM	---	6.27	34.91	0.79	0.25	10.93	36.42	0.78	0.5	9.12	20.31	5.04	0.75	7.50
4/27/2015	NM	NM	NM	---	6.19	34.99	0.71	0.25	10.78	36.52	0.68	0.5	9.17	20.46	4.89	2	11.00
5/26/2015	NM	NM	NM	---	6.07	35.11	0.59	0.5	10.61	36.72	0.48	0.75	9.09	20.59	4.76	2.5	12.75
7/6/2015	NM	NM	NM	---	5.03	35.32	0.38	0.25	8.52	36.91	0.29	0.75	7.01	21.16	4.19	2	10.50
8/3/2015	12.32	ND	PoP	---	5.12	35.37	0.33	TR*	8.66	36.96	0.24	0.75	7.12	21.39	3.96	2.5	10.00
8/27/2015	13.04	ND	0.00	---	6.31	35.41	0.29	TR*	9.31	36.91	0.29	0.75	7.96	21.51	3.84	2	8.25
10/5/2015	12.62	ND	0.00	---	5.72	35.47	0.23	0.25	8.62	37.02	0.18	0.5	7.23	21.67	3.68	2	8.00
11/5/2015	12.27	ND	0.00	---	5.41	35.42	0.28	0.25	8.34	36.93	0.27	0.5	7.02	21.56	3.79	2	8.00
12/3/2015	12.02	ND	0.00	---	5.13	35.63	0.07	0.25	8.12	36.81	0.39	0.5	6.83	21.67	3.68	2	8.00
12/28/2015	NM	NM	NM	---	5.02	35.26	0.44	0.25	8.01	36.72	0.48	0.5	6.71	21.52	3.83	2.25	9.00
2/3/2016	NM	NM	NM	---	4.86	35.21	0.49	0.25	7.82	36.19	1.01	0.25	6.52	21.67	3.68	2	9.00
3/3/2016	NM	NM	NM	---	4.92	35.17	0.53	0.25	7.74	36.27	0.93	0.5	6.46	21.72	3.63	2	9.25
3/31/2016	NM	NM	NM	---	4.91	35.24	0.46	0.25	7.67	36.39	0.81	0.5	6.49	21.86	3.49	2	9.25
5/3/2016	NM	NM	NM	---	5.13	35.29	0.36	0.25	7.79	36.47	0.68	0.5	6.57	21.94	3.41	2	7.75
6/2/2016	12.32	ND	0.00	---	5.26	35.36	0.29	0.25	7.71	36.42	0.73	0.5	6.65	21.91	3.44	2	8.25
7/8/2016	12.44	ND	0.00	---	5.34	35.31	0.34	0.25	7.8	36.53	0.62	0.5	6.71	21.97	3.38	2	8.00
8/3/2016	12.52	ND	0.00	---	5.42	35.39	0.26	0.25	7.89	36.59	0.56	0.5	6.82	22.04	3.31	2	8.00
8/30/2016	12.67	ND	0.00	---	5.61	35.21	0.44	0.25	7.96	36.64	0.51	0.5	6.94	22.21	3.14	2	8.25
9/30/2016	12.81	ND	0.00	---	5.74	35.03	0.62	0.25	7.91	36.51	0.64	0.5	7.04	22.39	2.96	2	8.50
11/3/2016	12.92	ND	0.00	---	5.79	35.11	0.54	0.25	7.86	36.36	0.79	0.5	7.11	22.49	2.86	2	8.50
11/30/2016	13.16	ND	0.00	---	6.03	35.23	0.42	0.25	7.97	36.47	0.68	0.75	7.29	22.67	2.68	2	8.75
1/4/2017	13.24	ND	0.00	---	6.17	35.09	0.56	0.5	8.04	36.36	0.79	0.75	7.42	22.74	2.61	2	8.75
2/7/2017	13.29	ND	0.00	---	6.26	35.01	0.64	0.5	8.12	36.21	0.94	0.75	7.48	22.93	2.42	2.5	9.00
Total DNAPL Pumped (gal)				2.71				11.12				28.75				57	368.31

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

FIGURES

EXPLANATION

- UPRR Property Boundary
- - - - - Fence
- - - - - Railroad
- ⊕ Monitoring Well Location
- ⊕ Monitoring Well Location used for DNAPL Recovery
- (0.84) In Well DNAPL Thickness (Ft)



Approx. Scale in Feet



Source:
Base map from ERM-Southwest, Inc APAR Addendum,
Fig 3-1, dated June 2004.

HWPW

**Englewood
Intermodal
Yard**



UNION PACIFIC RAILROAD CO.

HOUSTON WOOD PRESERVING WORKS

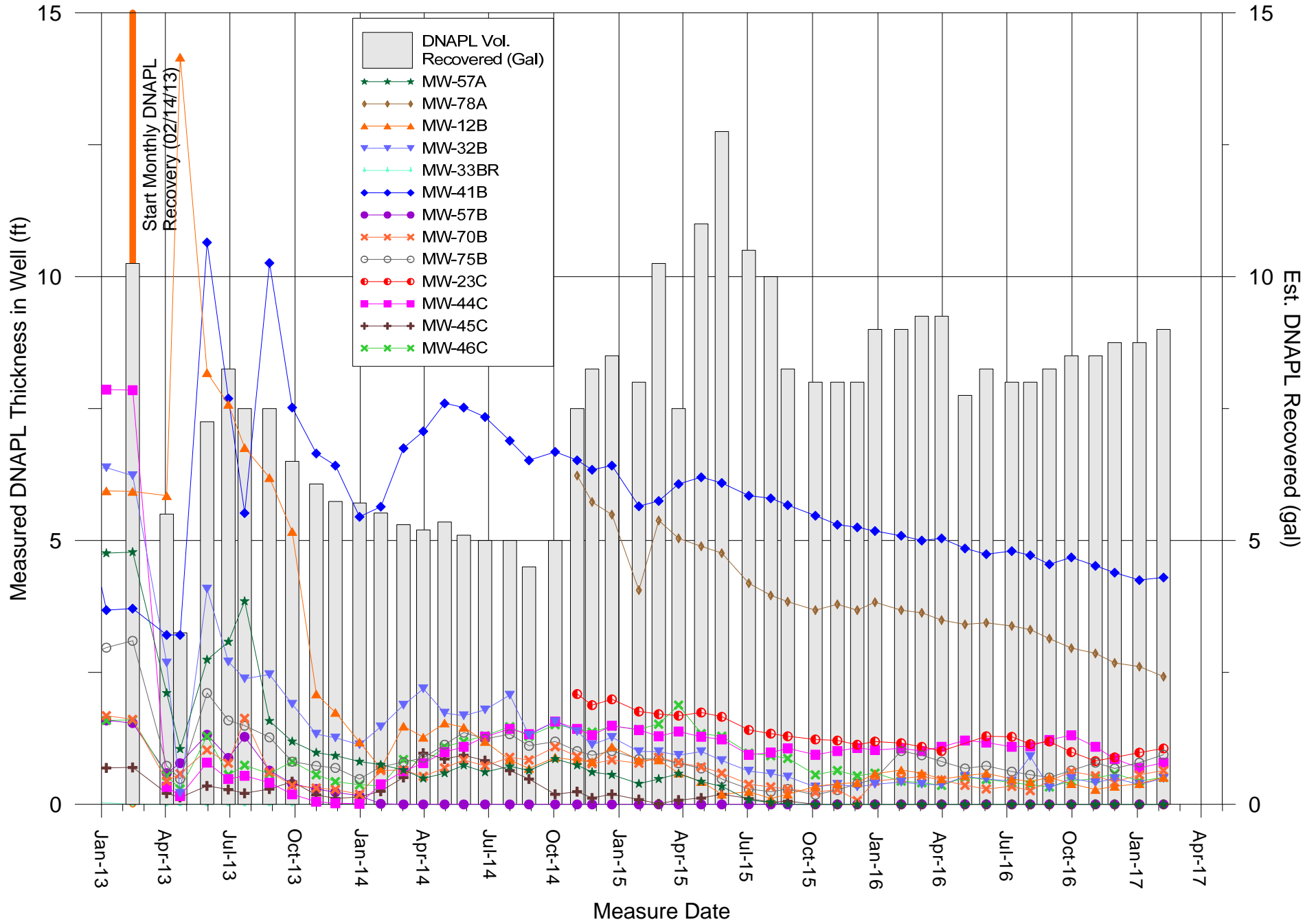
Figure 1

**IN-WELL DNAPL THICKNESS
FEBRUARY 2017**

PROJECT: 1358	BY: AJD	REVISIONS
DATE: MAR., 2017	CHECKED: ECM	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Figure 2
DNAPL Recovery Activities February 2013 - February 2017
UPRR Houston Wood Preserving Works



ATTACHMENT A
WASTE MANIFEST

Projects #: 0-0

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

EPA FORM 8700-22

1700546033

Order #: 149132

Form Approved, OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number TXD000820266 / 31547	2. Page of 12	3. Emergency Response Phone 877-577-2669	4. Manifest Tracking Number 003286818 GBF			
5. Generator's Name and Mailing Address Union Pacific Railroad 24125 Aldine Westfield Road, Spring, TX 77373 Generator's Phone: 281-350-7197 ATTN: Geoffrey Reeder				Generator's Site Address (if different than mailing address) UP Railroad Houston Wood Preserving Works 4910 Liberty Rd Houston, TX 77026				
6. Transporter 1 Company Name Stericycle Specialty Waste Solutions Inc				Ph#: 713-672-6100 State ID#: 88922 / H-1495		U.S. EPA ID Number MNS000110924		
7. Transporter 2 Company Name						U.S. EPA ID Number		
8. Designated Facility Name and Site Address Clean Harbors Deer Park, L.P. 2027 Independence Pkwy South LaPorte, TX 77571 Facility's Phone: 281-930-2300				State ID#: 50088		U.S. EPA ID Number TXD055141378		
GENERATOR	9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))		10. Containers No. Type		11. Total Quantity	12. Unit Wt/Vol	13. Waste Codes
	<input checked="" type="checkbox"/>	1. RQ, NA3082, Hazardous waste, liquid, n.o.s. (creosote), 9, PG III, ERG 171		001 DM		55	G	0918219H F034
		2.						
		3.						
		4.						
14. Special Handling Instructions and Additional Information Q1: Recovered creosote WR #10570 (PF:CH1269245) 55G								
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.								
Generator's/Officer's Printed/Typed Name X GEOFFREY REEDER Signature X Geoffrey Reeder Month Day Year 11 31 17								
16. International Shipments <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S. Port of entry/exit: Date leaving U.S.:								
17. Transporter Acknowledgment of Receipt of Materials Transporter 1 Printed/Typed Name Thomas Reel Signature Thomas Reel Month Day Year 11 31 17 Transporter 2 Printed/Typed Name Signature Month Day Year								
18. Discrepancy								
18a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection Manifest Reference Number:								
18b. Alternate Facility (or Generator) U.S. EPA ID Number								
Facility's Phone:								
18c. Signature of Alternate Facility (or Generator) Month Day Year								
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)								
1. 01: H040 2. 3. 4.								
20. Designated Facility Owner or Operator. Certification of receipt of hazardous materials covered by the manifest except as noted in item 18a. Printed/Typed Name A. Gohring Signature A. Gohring Month Day Year 12 17 17								

For Wastes Subject to the Treatment Standards Found in 40 CFR 268

Generator Name: Union Pacific Railroad

Manifest No: 003286818GBF

WMDS	WW / NWW	EPA Waste Codes / Underlying Hazardous Constituents	LDR Code
CH1269245	<input type="checkbox"/> / <input checked="" type="checkbox"/>	F034 /	E

A. Restricted Waste Meets Treatment Standards (40 CFR 268.7(a) (3))

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

B. Restricted Waste Treated To Treatment Standards (40 CFR 268.7(b) (1) and 268.7 (b) (2))

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Restricted Waste With Technology Based Treatment Standards (40 CFR 268.7(b) (4))

I certify under penalty of law that I personally have examined and am familiar with the treatment technology and operation of the treatment process used to support this certification and that based on my inquiry of those individuals immediately responsible for obtaining this information, I believe that the treatment process has been operated and maintained properly so as to comply with the treatment standards specified in 40 CFR 268.40, without impermissible dilution of the prohibited waste. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

D. Restricted Waste Decharacterized But Requires Treatment For UHC (40 CFR 268.9)

I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains Underlying Hazardous Constituents (UHC) that require further treatment to meet the universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

E. Restricted Waste Subject To Treatment (40 CFR 268.7(a) (2))

The restricted waste identified above must be treated to the applicable treatment standards in 40 CFR 268.40, or treated to comply with applicable prohibitions set forth in Part 268.32 or RCRA Section 3004(d). I have attached all supporting analytical data, where available.

F. Hazardous Debris Subject To Treatment (40 CFR 268.45)

This hazardous debris identified above must be treated to the alternative treatment standards in 40 CFR 268.45.

G. Restricted Waste Subject To A Variance or Extension (40 CFR 268.7(a) (4))

This restricted waste identified above is subject to a case by case exemption under 40 CFR 268.5, an exemption under 40 CFR 268.6 or a nationwide capacity variance under Subpart C of 40 CFR 268, and is not prohibited from land disposal. LDR prohibitions become effective on _____ (date) for this restricted waste. The corresponding treatment standard(s) are promulgated in 40 CFR 268.40. I have attached all supporting analytical data, where available.

H. Restricted Waste Managed In A "Lab Pack" (40 CFR 268.7(a) (9))

I certify under penalty of law that I personally have examined and am familiar with the waste and that the lab pack contains only waste that have been excluded under appendix IV to 40 CFR Part 268 and that this lab pack will be sent to a combustion facility in compliance with the alternative treatment standards for lab packs at 40 CFR 268.42(c). I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

I certify and warrant that the information that appears on this form, and appended documents, is true and correct. I have correctly indicated how my waste is to be managed in accordance with 40 CFR 268. My certification is based on personal examination of the information submitted, or is based on my inquiries of those individuals responsible for obtaining the information.

Authorized Signature X Scott P. Yeager Title MGR. ENVIRONMENTAL SITE Date 012317
REMEDATION

For Internal Use Only

