OU1 Soil Sampling Technical Memorandum – Residential Criteria Area Delineation

Kerr-McGee Chemical Corp – Navassa Superfund Site

Navassa, North Carolina

EPA ID #NCD980557805

Prepared for:

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Trustee of the Multistate Environmental Response Trust

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Environmental Challenges
BUSINESS SOLUTIONS®

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Acronyms and Abbreviations

BaP	benzo(a)pyrene
bgs	below ground surface
EPA	United States Environmental Protection Agency
HHRA	Human Health Risk Assessment
mg/kg	milligram per kilogram
NC DEQ	North Carolina Department of Environmental Quality
MDL	method detection limit
ND	non-detect
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	polynuclear aromatic hydrocarbon
PCP	pentachlorophenol
pg/g	picogram per gram
ppt	parts per trillion
QA/QC	Quality Assurance/Quality Control
RPF	relative potency factor
RSL	regional screening level
SESD	Science and Ecosystem Support Division
SRI	Supplemental Remedial Investigation
TCDD	2,3,7,8-tetrachlorodibenzo-*p*-dioxin
TEF	toxic equivalency (or equivalence) factor
TEQ	toxic equivalent concentration
WHO	World Health Organization

1.0 INTRODUCTION

This Technical Memorandum provides sampling results for about 19 acres of the Kerr-McGee Chemical Corp – Navassa Superfund Site, located in Navassa, North Carolina [U.S. Environmental Protection Agency (EPA) ID# NCD980557805], referred to herein as the Site, that meet EPA and North Carolina Department of Environmental Quality (NC DEQ) criteria for unrestricted use with no institutional controls. The site investigation was conducted at the Site in August 2020. This Technical Memorandum is being submitted by EarthCon Consultants of North Carolina, P.C. on behalf of Greenfield Environmental Multistate Trust LLC, not individually but solely in its representative capacity as Trustee of the Multistate Environmental Response Trust (the Multistate Trust).

The Site operated as a creosote-based wood treating facility from 1936 to 1974. The Site location is shown on Figure 1. A Site plan showing the property boundary, Process Area, Wood Storage Areas, and other prominent Site features is provided as Figure 2. Previous investigations have indicated that soil, groundwater, and sediment at the Site were impacted by historical operations at the facility. The objective of the 2020 soil investigation was to collect additional data to refine the remedial/risk management decisions for Operable Unit 1 (OU1).

In an October 2019 Proposed Plan, the EPA designated OU1 as 21.6-acres (EPA, 2019), which includes the approximate 19-acre area discussed in this memorandum and 2.9-acre boundary area to the east. In 2020, the EPA and NC DEQ decided to evaluate OU1 for residential land use based on input from the Town of Navassa. The Multistate Trust conducted an evaluation of residential risk in May 2020. In this evaluation, the historical sampling results were compared to the benzo(a)pyrene toxic equivalent (BaP TEQ) concentration that serves as the threshold for unacceptable risk to human health under residential land use assumptions. Based on this evaluation, the EPA, NC DEQ and Multistate Trust developed the OU1/OU2 Revised Soil Sampling Work Plan (Work Plan), which was approved on August 3, 2020 (EarthCon, 2020).

The sampling strategy divided the 19-acre area into parcels with a maximum size of 1/4-acre and required surface soil samples from the parcels where there was no data. In July 2020, the EPA, NC DEQ and the Multistate Trust agreed to include analysis of the soil samples for pentachlorophenol (PCP) and for dioxins/furans (a common impurity associated with PCP) out of an abundance of caution and to ensure adequate characterization of these constituents. The EPA and NC DEQ provided PCP and dioxin TEQ concentration thresholds because these constituents were not identified as chemicals of concern for Site soils in either the April 2019 Human Health Risk Assessment (HHRA) or the August 2019 HHRA Addendum (EarthCon, 2019a and 2019b).

The EPA and NC DEQ developed the thresholds provided below to determine which parcels meet both the EPA no action criteria and the NC DEQ unrestricted use criteria under North Carolina General Statute § 143B-279.9(b)(1):

- BaP TEQ at 11 milligrams per kilogram (mg/kg) which corresponds to the residential Regional Screening Level (RSL) calculated at a target cancer risk level of 1E-04 or one in 10,000 (EPA, 2020a).

- PCP at 100 mg/kg which corresponds to the residential RSL calculated at a target cancer risk level of 1E-04.

- Dioxin TEQ at 50 picogram per gram (pg/g) or parts per trillion (ppt), which corresponds to a non-cancer target hazard index of 1 for a potential future resident.

2.0 SITE OVERVIEW

The 19-acre OU1 area was divided into 91 parcels with a maximum size of 1/4-acre using Thiessen polygon methodology and the historical soil sample locations (Figure 3). There were 57 parcels with an existing surface soil sample and 34 parcels without a surface soil sample. The following sampling strategy was implemented for the 91 parcels:

- **Parcels with BaP TEQ less than 5.5 mg/kg** – Per EPA and NC DEQ guidance, no further evaluation was required for the 48 parcels with BaP TEQ concentrations less than 5.5 mg/kg (which is 1/2 of the 11 mg/kg threshold described above).

- **Parcels without a surface soil sample** –5-point composite surface soil samples were collected from these 34 parcels.

- **Parcels with BaP TEQ Greater than 5.5 but less than 11 mg/kg** – 5-point composite surface soil samples were collected from these 7 parcels.

- **Parcels with BaP TEQ Greater than 11 mg/kg** – There are two parcels with historical data that exceed the threshold for unacceptable risk for residential use. These two parcels (TB-05 and SS-108) are designated as part of OU2. A separate technical memo will transmit the 2020 sampling results for OU2.

3.0 DATA COLLECTION ACTIVITIES

This section provides a summary of the data collection activities conducted during August 2020. The activities included collection of composite surface soil samples from 41 parcels in OU1. The field and laboratory activities were performed in accordance with the EPA and NC DEQ approved Work Plan (EarthCon, 2020) and the most recent EPA Region 4 Laboratory Services and Applied Science Division (LSASD) operating procedures (EPA, 2020b).

3.1 Field Activities

Soil sampling was conducted from August 5 to 8, 2020. The field forms and a photographic log are provided in Appendices A and B, respectively.

A total of 41 composite surface soil samples were collected from OU1 at locations shown on Figure 3. The composite samples included one aliquot from the center of the parcel, along with four aliquots collected in each of the four compass directions (N, S, E, W). The aliquots are labeled as follows: center is “A”, north is “B”, east is “C”, south is “D”, and west is “E”. Distance between aliquots is dependent upon parcel size. Soil could not be collected from aliquot location CS-53-A (due to the presence of gravel) or aliquot location CS-TB07-E (due to the presence of concrete). Therefore, surface soil samples CS-53 and CS-TB07 were 4-point composites.

The composite surface soil samples were collected at a depth of 0 to 1-foot below ground surface (bgs).

3.2 Laboratory Analysis

The composite surface soil samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) by SW-846 Method 8270D, PCP by SW-846 Method 8270D selective ion monitoring (SIM), and dioxins/furans by SW-846 Method 8290A. The laboratory reports are provided in Appendix C.

The laboratory data packages were submitted to EcoChem for data validation. A Level III (EPA Stage 2A) validation of 90 percent of the data and a Level IV validation (EPA Stage 4) of 10 percent of the laboratory data were performed as described in the 2015 Supplemental Remedial Investigation (SRI) Quality Assurance Plan (CH2M Hill, 2015). The validation reports are provided in Appendix D.

3.3 Data Quality Evaluation

The following field quality assurance/quality control (QA/QC) samples were collected during the field events:

- Field duplicates were collected at a rate of 1 per 10 samples.
- Matrix spike/matrix spike duplicates were collected at a rate of 1 per 20 samples.
- Field blanks were collected at a rate of one per week.
- Equipment blanks were collected at a rate of one blank per reusable equipment. (stainless steel trowels, hand augers, etc.) per media, per 20 samples collected; or one per week, whichever was more frequent.

Results of the QA/QC samples are provided in Appendix E. The results of the field QA/QC samples indicate that the quality of the analytical data is acceptable.

3.4 Toxicity Equivalent Calculations – BaP

Surface soil data for carcinogenic PAHs were converted to BaP TEQ using BaP as the index PAH (EPA, 1993). This conversion was conducted because these carcinogenic PAHs all act by the same mechanism as BaP. BaP TEQ values were calculated by computing the sum across congeners of the product of congener-specific concentration and its Relative Potency Factor (RPF) (EPA, 2010):

$$\text{BaP TEQ} = \sum (C_i \times RPF_i)$$

RPFs are available and were used for the following carcinogenic PAHs: BaP, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The RPFs[1] and resultant BaP TEQ concentrations are presented in Table 1.

3.5 Toxicity Equivalent Calculations – Dioxin/Furan

The concentration of dioxins/furans were evaluated on a TEQ basis using the 2005 World Health Organization (WHO) mammalian toxic equivalency factors (TEFs) for the 17 congeners present in dioxin/furan mixtures (7 dioxins and 10 furans) (Van den Berg et al., 2006 and EPA, 2010). The TEFs are based on the toxicity of individual congeners relative to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). For each dioxin and furan congener, the detected concentration, or the MDL if the congener was ND, was multiplied by its corresponding TEF to calculate a toxicity-weighted concentration. The sample concentration of dioxin TEQ was then calculated by summing the toxicity-weighted concentrations. Dioxin (TCDD) TEQ values were calculated by computing the sum across congeners of the product of a congener-specific concentration and its TEF as shown below.

$$\text{TCDD TEQ} = \sum (C_i \times TEF_i)$$

TCDD TEQ values were compared to EPA's target dioxin TEQ of 50 pg/g or ppt[2]. The TEFs and resultant TCDD TEQ concentrations are presented in Table 2.

4.0 ANALYTICAL RESULTS

Analytical results from the August 2020 soil sampling event are provided in Tables 1 and 2 and described in the following sections. None of the composite soil samples have a BaP TEQ, PCP, or dioxin (TCDD) TEQ concentration that exceeds the threshold for either EPA's unacceptable

[1] The TEFs shown on Table 1 are the EPA 2010 RPFs.

[2] Calculated based on default residential exposure parameters and a target noncancer hazard index of 1 in accordance with EPA guidance for the development of site-specific risk-based cleanup levels at Superfund sites (https://www.epa.gov/superfund/risk-assessment-dioxin-superfund-sites).

risk to human health under residential land use assumptions or the NC DEQ unrestricted use criteria under North Carolina General Statute § 143B-279.9(b)(1).

4.1 PAH Results

The PAH results and BaP TEQ calculations are provided in Table 1. The BaP TEQ values, which ranged from 0.08 to 8.32 mg/kg, were compared to EPA's residential RSL at a target cancer risk level of 1E-04 of 11 mg/kg for BaP.

4.2 Pentachlorophenol Results

The PCP results are provided in Table 1. PCP was detected in only one sample at an estimated concentration of 0.0679 mg/kg. The PCP results were compared to EPA's residential RSL established at a 1E-04 target cancer risk level of 100 mg/kg.

4.3 Dioxin/Furan Results

The dioxin/furan results and TCDD TEQ calculations are provided in Table 2. The TCDD TEQ values ranged from 0.75 to 34.02 pg/g or ppt. These values were compared to EPA's screening criteria for TCDD TEQ concentration of 50 ppt protective of human health based on a residential land use.

5.0 EXTENT OF OU1 MEETING CRITERIA FOR NO ACTION AND NO INSTITUTIONAL CONTROLS

The results of the 2020 soil sampling investigation combined with sampling results from previous Site investigations identified 89 parcels in which surface soils do not pose an unacceptable risk to future residential receptors. As noted in Section 2.0, two of the 91 parcels evaluated (TB-05 and SS-108) had BaP TEQ concentrations greater than 11 mg/kg. These parcels do not meet the OU1 criteria and will be designated as part of OU2. To achieve contiguous areas for OU1 and OU2, parcel TB-07 along with portions of parcels CS-51, CS-53, CS-52[3], CS-55, SB-127, SB-148, SS-109, TB-04, TB-27 and TWSB24 will also be included in OU2. The resulting contiguous area for OU1, including the boundary area to the east, is shown in Figure 4.

6.0 REFERENCES

CH2M Hill, 2015. Supplemental Remedial Investigation Work Plan, Kerr-McGee Chemical Corporation Site – Navassa, NC, CH2M Hill, September 2015.

[3] Composite aliquot locations CS-52-A, CS-52-B, and CS-52-E will be included in OU2

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EPA, 2020b. Field Branches Quality System and Technical Procedures, Region 4: Laboratory and Field Operations. Standard Operating Procedures available online: https://www.epa.gov/quality/quality-system-and-technical-procedures-lsasd-field-branches.

Van den Berg, et al., 2006. The 2005 World Health Organization reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 2(93):223-241.

TABLES

Table 1: Summary of PCP, PAH and BaP TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, NC

Compound	CAS Number	CS-22 8/5/20	CS-23 8/5/20	CS-24 8/5/20	CS-25 8/5/20	CS-26 8/5/20	CS-27 8/6/20	CS-28 8/6/20	CS-29 8/6/20	CS-30 8/6/20	CS-31 8/6/20	CS-32 8/6/20	CS-33 8/6/20
Pentachlorophenol (mg/kg)	87-86-5	<0.018	<0.017	<0.019	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.019	<0.018
PAH Results (mg/kg)													
1-Methylnaphthalene	90-12-0	<0.018	<0.018	<0.019	<0.019	<0.018	<0.018	<0.180	<0.018	<0.019	<0.018	<0.019	<0.018
2-Methylnaphthalene	91-57-6	0.0247 J	<0.018	0.0216 J	<0.019	<0.018	<0.018	<0.180	<0.018	<0.019	<0.018	<0.019	<0.018
Acenaphthene	83-32-9	0.0737 J	0.0288 J	0.0751 J	<0.020	<0.019	0.0384 J	0.0602 J	<0.019	<0.020	0.0361 J	0.0696 J	0.0385 J
Acenaphthylene	208-96-8	1.05	0.283	0.872	0.300	0.161 J	0.61	0.734	0.0417 J	0.0564 J	0.445	0.628	0.544
Anthracene	120-12-7	2.80	0.500	1.60	0.596	0.352	1.06	1.35	0.0622 J	0.102 J	1.24	1.83	1.22
Benzo(a)anthracene	56-55-3	1.96	0.278	2.06 J	0.832	0.545	1.81	1.45	0.0518 J	0.134 J	0.909	0.739	1.34
Benzo(a)pyrene	50-32-8	1.84	0.375	1.97	1.18	0.453	1.54	1.47	0.0430 J	0.156 J	1.11	0.777	1.09
Benzo(b)fluoranthene	205-99-2	5.62	1.16	4.53	2.84	1.67	4.15	4.34	0.137 J	0.439	2.57	2.38	3.46
Benzo(g,h,i)perylene	191-24-2	1.39	0.357	1.18	0.724	0.342	1.01	0.898	0.0306 J	0.105 J	0.758	0.599	0.846
Benzo(k)fluoranthene	207-08-9	1.31	0.304	1.23	0.955	0.549	1.28	1.26	0.0512 J	0.144 J	0.852	0.637	0.962
Chrysene	218-01-9	2.86	0.536	2.38 J	1.49	1.14	2.90	2.92	0.0886 J	0.237	1.52	1.27	2.20
Dibenzo(a,h)anthracene	53-70-3	0.561	0.125 J	0.454	0.211	0.0849 J	0.37	0.355	<0.022	0.0289 J	0.197	0.219	0.334
Fluoranthene	206-44-0	4.88	0.572	3.00 J	1.45	1.79	5.47	6.25	0.0915 J	0.228	2.06	1.39	3.33
Fluorene	86-73-7	0.157 J	0.0479 J	0.149 J	0.0344 J	0.0281 J	0.0909 J	0.121 J	<0.019	<0.020	0.061 J	0.109 J	0.0814 J
Indeno(1,2,3-cd)pyrene	193-39-5	2.28	0.642	1.88	1.04	0.488	1.68	1.54	0.0485 J	0.139 J	0.957	1.09	1.49
Naphthalene	91-20-3	0.0276 J	<0.018	0.0251 J	<0.019	<0.018	<0.018	<0.018	<0.018	<0.019	<0.018	<0.019	<0.018
Phenanthrene	85-01-8	0.653	0.0530 J	0.176 J	0.0614 J	0.106 J	0.491	0.918	<0.018	<0.019	0.118 J	0.169 J	0.284
Pyrene	129-00-0	4.19	0.656	3.12 J	2.23	2.12	5.02	5.64	0.152 J	0.311	3.49	1.60	3.08
BaP TEQ calculations	**TEF[2]**												
Benzo(a)pyrene	1	1.84	0.375	1.97	1.18	0.453	1.54	1.47	0.043	0.156	1.11	0.777	1.09
Benzo(a)anthracene	0.1	0.196	0.0278	0.206	0.0832	0.0545	0.181	0.145	0.00518	0.0134	0.0909	0.0739	0.134
Benzo(b)fluoranthene	0.1	0.562	0.116	0.453	0.284	0.167	0.415	0.434	0.0137	0.0439	0.257	0.238	0.346
Benzo(k)fluoranthene	0.01	0.0131	0.00304	0.0123	0.00955	0.00549	0.0128	0.0126	0.000512	0.00144	0.00852	0.00637	0.00962
Chrysene	0.001	0.00286	0.000536	0.00238	0.00149	0.00114	0.0029	0.00292	0.0000886	0.000237	0.00152	0.00127	0.0022
Dibenzo(a,h)anthracene	1	0.561	0.125	0.454	0.211	0.0849	0.37	0.355	0.011	0.0289	0.197	0.219	0.334
Indeno(1,2,3-cd)pyrene	0.1	0.228	0.0642	0.188	0.104	0.0488	0.168	0.154	0.00485	0.0139	0.0957	0.109	0.149
BaP TEQ[1] (mg/kg)		3.40	0.71	3.29	1.87	0.81	2.69	2.57	0.08	0.26	1.76	1.42	2.06

Notes:
BaP - benzo(a)pyrene
MDL - method detection limit
PAH - polynuclear aromatic hydrocarbon
PCP - pentachlorophenol
mg/kg - milligram per kilogram
J - estimated concentration
RPF - relative potency factor
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
1) For non-detects, 1/2 the MDL is used to calculate the TEQ
2) The TEFs are EPA 2010 relative potency factors (RPFs)

Table 1: Summary of PCP, PAH and BaP TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, NC

Compound	CAS Number	CS-34 8/6/20	CS-35 8/6/20	CS-36 8/6/20	CS-37 8/6/20	CS-38 8/6/20	CS-39 8/6/20	CS-40 8/7/20	CS-41 8/7/20	CS-42 8/7/20	CS-43 8/7/20	CS-44 8/7/20
Pentachlorophenol (mg/kg)	87-86-5	<0.017	<0.018	<0.021	<0.020	<0.019	<0.018	<0.018	<0.019	<0.020	<0.018	<0.019
PAH Results (mg/kg)												
1-Methylnaphthalene	90-12-0	<0.018	0.0181 J	0.0269 J	<0.021	<0.019	<0.018	<0.018	0.0214 J	<0.020	<0.019	<0.019
2-Methylnaphthalene	91-57-6	<0.018	0.0262 J	0.0295 J	<0.021	<0.019	<0.018	<0.018	0.0293 J	0.0242 J	<0.019	<0.019
Acenaphthene	83-32-9	0.0514 J	0.0949 J	0.182 J	0.0585 J	<0.020	0.0252 J	0.0293 J	<0.020	<0.021	<0.020	<0.020
Acenaphthylene	208-96-8	0.389	1.17	1.46	0.598 J	0.172 J	0.195	0.361	0.247	0.200	0.266	0.276
Anthracene	120-12-7	0.621	2.94	3.13	1.3	0.185 J	0.220	0.653	0.472	0.333	0.472	0.501
Benzo(a)anthracene	56-55-3	0.734	2.73	5.33	3.62	0.151 J	0.151 J	0.986	0.379	0.382	0.708	0.679
Benzo(a)pyrene	50-32-8	0.696	2.58	3.17	4.1	0.152 J	0.169 J	1.57	0.351	0.377	0.725	0.604
Benzo(b)fluoranthene	205-99-2	2.24	8.12	12.3	9.81	0.519	0.522	3.67	0.946	0.968	1.88	1.53
Benzo(g,h,i)perylene	191-24-2	0.511	1.70	1.92	1.89	0.102 J	0.151 J	0.894	0.293	0.251	0.488	0.356
Benzo(k)fluoranthene	207-08-9	0.546	2.06	2.52	3.31	0.133 J	0.131 J	1.23	0.276	0.316	0.601	0.518
Chrysene	218-01-9	1.39	4.16	8.12	4.44	0.263	0.249	1.68	0.538	0.588	1.10	1.07
Dibenzo(a,h)anthracene	53-70-3	0.194	0.689	0.816	0.313	0.0365 J	0.0512 J	0.285	0.072 J	0.0698 J	0.133 J	0.0936 J
Fluoranthene	206-44-0	2.70	6.24	15.1	5.1	0.272	0.258	1.41	0.539	0.720	0.836	1.33
Fluorene	86-73-7	0.0890 J	0.185	0.317	0.113 J	0.0358 J	0.0466 J	0.0502 J	0.0421 J	0.0382 J	0.0412 J	0.0431 J
Indeno(1,2,3-cd)pyrene	193-39-5	0.923	2.79	3.12	2.89	0.200	0.276	1.33	0.379	0.347	0.650	0.474
Naphthalene	91-20-3	<0.018	0.0316 J	0.0313 J	<0.021	<0.019	<0.018	<0.018	0.0257 J	0.0204 J	<0.019	<0.019
Phenanthrene	85-01-8	0.774	0.808	1.53	0.355 J	<0.019	0.0233 J	0.0819 J	0.0951 J	0.103 J	0.0708 J	0.082 J
Pyrene	129-00-0	2.13	6.48	12.9	7.07	0.461	0.313	2.27	0.672	0.830	1.14	1.65
BaP TEQ calculations	**TEF[2]**											
Benzo(a)pyrene	1	0.696	2.58	3.17	4.1	0.152	0.169	1.57	0.351	0.377	0.725	0.604
Benzo(a)anthracene	0.1	0.0734	0.273	0.533	0.362	0.0151	0.0151	0.0986	0.0379	0.0382	0.0708	0.0679
Benzo(b)fluoranthene	0.1	0.224	0.812	1.23	0.981	0.0519	0.0522	0.367	0.0946	0.0968	0.188	0.153
Benzo(k)fluoranthene	0.01	0.00546	0.0206	0.0252	0.0331	0.00133	0.00131	0.0123	0.00276	0.00316	0.00601	0.00518
Chrysene	0.001	0.00139	0.00416	0.00812	0.00444	0.000263	0.000249	0.00168	0.000538	0.000588	0.0011	0.00107
Dibenzo(a,h)anthracene	1	0.194	0.689	0.816	0.313	0.0365	0.0512	0.285	0.072	0.0698	0.133	0.0936
Indeno(1,2,3-cd)pyrene	0.1	0.0923	0.279	0.312	0.289	0.02	0.0276	0.133	0.0379	0.0347	0.065	0.0474
BaP TEQ[1] (mg/kg)		1.29	4.66	6.09	6.08	0.28	0.32	2.47	0.60	0.62	1.19	0.97

Notes:
BaP - benzo(a)pyrene
MDL - method detection limit
PAH - polynuclear aromatic hydrocarbon
PCP - pentachlorophenol
mg/kg - milligram per kilogram
J - estimated concentration
RPF - relative potency factor
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
1) For non-detects, 1/2 the MDL is used to calculate the TEQ
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Table 1: Summary of PCP, PAH and BaP TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, NC

Compound	CAS Number	CS-45 8/7/20	CS-46 8/7/20	CS-47 8/7/20	CS-48 8/8/20	CS-49 8/8/20	CS-50 8/7/20	CS-51 8/7/20	CS-52 8/8/20	CS-53 8/25/20	CS-54 8/7/20	CS-55 8/7/20	CS-RISB02 8/5/20
Pentachlorophenol (mg/kg)	87-86-5	<0.018	0.0679 J	<0.019	<0.013	<0.012	<0.0096	<0.011	<0.010	<0.0098	<0.019	<0.0096	<0.018
PAH Results (mg/kg)													
1-Methylnaphthalene	90-12-0	0.0524 J	<0.020	<0.019	<0.025	<0.024	0.0296 J	0.0307 J	<0.020	<0.020	<0.019	0.0388 J	<0.018
2-Methylnaphthalene	91-57-6	0.0549 J	<0.020	<0.019	<0.025	<0.024	0.0396 J	0.0387 J	<0.020	<0.020	<0.019	0.0339 J	<0.018
Acenaphthene	83-32-9	0.159 J	0.0821 J	0.024 J	0.0271 J	<0.026	<0.020	<0.023	0.0224 J	<0.021	<0.020	0.244	0.0476 J
Acenaphthylene	208-96-8	1.86	0.946	0.242	0.217 J	0.0876 J	0.167 J	0.210 J	0.306	0.0681 J	0.112 J	0.284	0.576
Anthracene	120-12-7	3.18	2.52	0.756	0.346	0.0940 J	0.346	0.311	0.499	0.160 J	0.219	0.867	1.04
Benzo(a)anthracene	56-55-3	4.73	3.73	0.420	0.644	0.0561 J	0.558	0.452	0.596	0.158 J	0.0690 J	1.07	1.11
Benzo(a)pyrene	50-32-8	5.03	2.61	0.547	0.470	0.0505 J	0.357	0.372	0.800	0.122 J	0.0850 J	0.640	1.18
Benzo(b)fluoranthene	205-99-2	12.9	7.08	1.69	1.28	0.138 J	0.861	0.795	1.19	0.294	0.335	0.846	3.30
Benzo(g,h,i)perylene	191-24-2	3.02	1.42	0.450	0.265	0.0406 J	0.272	0.264	0.394	0.0920 J	0.0946 J	0.255	0.834
Benzo(k)fluoranthene	207-08-9	2.64	2.12	0.577	0.397	0.0434 J	0.276	0.263	0.396	0.0795 J	0.0842 J	0.263	0.917
Chrysene	218-01-9	8.34	4.33	0.761	1.06	0.0937 J	0.668	0.555	0.796	0.192 J	0.133 J	1.21	2.20
Dibenzo(a,h)anthracene	53-70-3	0.919	0.457	0.131 J	0.0811 J	<0.030	0.0742 J	0.0694 J	0.099 J	<0.025	<0.023	0.071 J	0.324
Fluoranthene	206-44-0	14.9	5.98	0.501	1.95 J	0.0914 J	0.845	0.691	0.625	0.255	0.107 J	3.31	2.84
Fluorene	86-73-7	0.303	0.163 J	0.0362 J	0.0563 J	<0.026	0.0361 J	0.0583 J	0.0659 J	<0.021	0.0288 J	0.380	0.0955 J
Indeno(1,2,3-cd)pyrene	193-39-5	5.69	2.13	0.687	0.363	0.0524 J	0.323	0.318	0.470	0.123 J	0.0918 J	0.291	1.43
Naphthalene	91-20-3	0.0614 J	<0.020	<0.019	<0.025	<0.024	0.0454 J	0.0406 J	<0.020	<0.020	<0.019	0.0261 J	<0.018
Phenanthrene	85-01-8	2.60	0.537	0.0884 J	0.157 J	<0.024	0.180 J	0.188 J	0.0652 J	0.0516 J	0.0273 J	3.11	0.229
Pyrene	129-00-0	13.7	9.60	1.21	2.19	0.123 J	0.952	0.788	1.05	0.260	0.132 J	3.37	2.50
BaP TEQ calculations	**TEF[2]**												
Benzo(a)pyrene	1	5.03	2.61	0.547	0.47	0.0505	0.357	0.372	0.8	0.122	0.085	0.64	1.18
Benzo(a)anthracene	0.1	0.473	0.373	0.042	0.0644	0.00561	0.0558	0.0452	0.0596	0.0158	0.0069	0.107	0.111
Benzo(b)fluoranthene	0.1	1.29	0.708	0.169	0.128	0.0138	0.0861	0.0795	0.119	0.0294	0.0335	0.0846	0.33
Benzo(k)fluoranthene	0.01	0.0264	0.0212	0.00577	0.00397	0.000434	0.00276	0.00263	0.00396	0.000795	0.000842	0.00263	0.00917
Chrysene	0.001	0.00834	0.00433	0.000761	0.00106	0.0000937	0.000668	0.000555	0.000796	0.000192	0.000133	0.00121	0.0022
Dibenzo(a,h)anthracene	1	0.919	0.457	0.131	0.0811	0.015	0.0742	0.0694	0.099	0.125	0.0115	0.071	0.324
Indeno(1,2,3-cd)pyrene	0.1	0.569	0.213	0.0687	0.0363	0.00524	0.0323	0.0318	0.047	0.0123	0.00918	0.0291	0.143
BaP TEQ[1] (mg/kg)		8.32	4.39	0.96	0.78	0.09	0.61	0.60	1.13	0.31	0.15	0.94	2.10

Notes:
BaP - benzo(a)pyrene
MDL - method detection limit
PAH - polynuclear aromatic hydrocarbon
PCP - pentachlorophenol
mg/kg - milligram per kilogram
J - estimated concentration
RPF - relative potency factor
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
1) For non-detects, 1/2 the MDL is used to calculate the TEQ
2) The TEFs are EPA 2010 relative potency factors (RPFs)

Table 1: Summary of PCP, PAH and BaP TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, NC

Compound	CAS Number	CS-SB-125 8/5/20	CS-SS-101 8/5/20	CS-SS-104 8/5/20	CS-SS-106 8/6/20	CS-SS-109 8/6/20	CS-TB07 8/6/20
Pentachlorophenol (mg/kg)	87-86-5	<0.018	<0.018	<0.019	<0.020	<0.021	<0.020
PAH Results (mg/kg)							
1-Methylnaphthalene	90-12-0	<0.018	<0.018	<0.019	<0.020	<0.022	0.11 J
2-Methylnaphthalene	91-57-6	<0.018	0.0216 J	0.0269 J	<0.020	<0.022	0.169 J
Acenaphthene	83-32-9	<0.019	0.0657 J	0.0455 J	0.0352 J	0.0487 J	0.223
Acenaphthylene	208-96-8	0.172 J	0.772	0.599	0.454	0.561	2.06
Anthracene	120-12-7	0.310	1.91	1.16	0.716	1.25	3.64
Benzo(a)anthracene	56-55-3	0.546	2.23	1.78	1.27	1.75	3.82
Benzo(a)pyrene	50-32-8	0.497	1.51	1.77	0.936	1.32	4.58
Benzo(b)fluoranthene	205-99-2	1.61	6.45	4.10	2.87	3.84	9.89
Benzo(g,h,i)perylene	191-24-2	0.322	0.969	1.04	0.606	0.912	2.72
Benzo(k)fluoranthene	207-08-9	0.504	1.23	1.17	0.865	1.05	2.24
Chrysene	218-01-9	1.05	3.10	2.45	1.78	2.09	4.35
Dibenzo(a,h)anthracene	53-70-3	0.0809 J	0.405	0.455	0.224	0.372	0.969
Fluoranthene	206-44-0	1.57	7.47	2.78	3.14	3.07	5.13
Fluorene	86-73-7	0.0223 J	0.127 J	0.0924 J	0.0798 J	0.100 J	0.312
Indeno(1,2,3-cd)pyrene	193-39-5	0.444	1.70	1.78	1.10	1.62	3.86
Naphthalene	91-20-3	<0.018	0.0283 J	0.0293 J	<0.020	0.0262 J	0.159 J
Phenanthrene	85-01-8	0.199	0.825	0.288	0.291	0.274	0.607
Pyrene	129-00-0	1.61	6.12	3.23	3.09	3.50	5.59
BaP TEQ calculations	**TEF[2]**						
Benzo(a)pyrene	1	0.497	1.51	1.77	0.936	1.32	4.58
Benzo(a)anthracene	0.1	0.0546	0.223	0.178	0.127	0.175	0.382
Benzo(b)fluoranthene	0.1	0.161	0.645	0.41	0.287	0.384	0.989
Benzo(k)fluoranthene	0.01	0.00504	0.0123	0.0117	0.00865	0.0105	0.0224
Chrysene	0.001	0.00105	0.0031	0.00245	0.00178	0.00209	0.00435
Dibenzo(a,h)anthracene	1	0.0809	0.405	0.455	0.224	0.372	0.969
Indeno(1,2,3-cd)pyrene	0.1	0.0444	0.17	0.178	0.11	0.162	0.386
BaP TEQ[1] (mg/kg)		0.84	2.97	3.01	1.69	2.43	7.33

Notes:
BaP - benzo(a)pyrene
MDL - method detection limit
PAH - polynuclear aromatic hydrocarbon
PCP - pentachlorophenol
mg/kg - milligram per kilogram
J - estimated concentration
RPF - relative potency factor
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
1) For non-detects, 1/2 the MDL is used to calculate the TEQ
2) The TEFs are EPA 2010 relative potency factors (RPFs)

Prepared by: MAB 09/17/20
Checked by: CDN 09/17/20

Table 2: Summary of Dioxin/Furan and TCDD TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, North Carolina

Compound	CAS Number	CS-22 8/5/20	CS-23 8/5/20	CS-24 8/5/20	CS-25 8/5/20	CS-26 8/5/20	CS-27 8/6/20	CS-28 8/6/20	CS-29 8/6/20	CS-30 8/6/20	CS-31 8/6/20	CS-32 8/6/20
Dioxins/Furans Results (pg/g)												
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	<0.105	<0.116	<0.109	<0.13	<0.1	<0.187	<0.171	<0.191	<0.196	<0.327	<0.151
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	1.18 J	0.779 J	0.433 J	<0.345	<0.175	<0.17	<0.272	<0.167	<0.4	<0.217	0.18 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	3.5	2.63 J	1.04 J	<0.802	<0.65	0.647 J	1.33 J	<0.401	<0.55	<0.654	<0.439
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	8.52	5.67	2.6 J	1.57 J	1.18 J	1.36 J	2.22 J	<0.419	0.854 J	0.94 J	<0.849
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	5.45	4.36	1.61 J	<1.25	0.864 J	0.913 J	1.49 J	<0.437	<0.762	1.19 J	0.824 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	282	197	91.2	55.6	66	45.5	108	5.78	21.1	32.8	35.1
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	2320	1580	928	525	346	335	935	292	318	521	326
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	<0.523	0.382 J	<0.204	<0.19	<0.0762	<0.129	0.228 J	<0.105	<0.144	<0.241	<0.109
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	<0.621	<0.416	<0.225	0.398 J	<0.128	<0.165	<0.142	<0.121	<0.218	<0.107	<0.187
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	2.5 J	2.13 J	1.12 J	<0.528	<0.399	0.537 J	<0.469	<0.122	<0.208	<0.368	<0.308
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	3.84	3.32	1.42 J	0.793 J	<0.371	<0.696	1.03 J	<0.14	<0.324	0.48 J	0.494 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	2.32 J	2.25 J	0.854 J	0.565 J	0.413 J	0.473 J	<0.429	<0.145	0.307 J	<0.362	0.306 J
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	60851-34-5	3.56	3.62	1.41 J	<0.76	0.596 J	<0.641	<0.719	<0.162	<0.416	<0.371	<0.43
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	<0.303	<0.343	<0.195	<0.188	<0.148	<0.157	<0.214	<0.171	<0.172	<0.193	<0.15
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	58.8	48.3	19.9	8.45	6.04	10.3	14.6	<0.421	3.33	4.33	6.58
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	4.7	4.62	1.14 J	<0.729	0.602 J	<0.555	0.935 J	<0.154	<0.247	<0.187	0.446 J
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0	160	115	46.5	19.1	16.1	21.5	44.8	<0.661	4.78 J	6.24	16.3
Dioxin/Furans TCDD Calculations	**TEF[1]**											
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	0.105	0.116	0.109	0.13	0.1	0.187	0.171	0.191	0.196	0.327	0.151
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	1.18	0.779	0.433	0.345	0.175	0.17	0.272	0.167	0.4	0.217	0.18
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.35	0.263	0.104	0.0802	0.065	0.0647	0.133	0.0401	0.055	0.0654	0.0439
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.852	0.567	0.26	0.157	0.118	0.136	0.222	0.0419	0.0854	0.094	0.0849
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.545	0.436	0.161	0.125	0.0864	0.0913	0.149	0.0437	0.0762	0.119	0.0824
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	2.82	1.97	0.912	0.556	0.66	0.455	1.08	0.0578	0.211	0.328	0.351
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	0.696	0.474	0.2784	0.1575	0.1038	0.1005	0.2805	0.0876	0.0954	0.1563	0.0978
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.0523	0.0382	0.0204	0.019	0.00762	0.0129	0.0228	0.0105	0.0144	0.0241	0.0109
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.01863	0.01248	0.00675	0.01194	0.00384	0.00495	0.00426	0.00363	0.00654	0.00321	0.00561
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.75	0.639	0.336	0.1584	0.1197	0.1611	0.1407	0.0366	0.0624	0.1104	0.0924
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.384	0.332	0.142	0.0793	0.0371	0.0696	0.103	0.014	0.0324	0.048	0.0494
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.232	0.225	0.0854	0.0565	0.0413	0.0473	0.0429	0.0145	0.0307	0.0362	0.0306
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	0.1	0.356	0.362	0.141	0.076	0.0596	0.0641	0.0719	0.0162	0.0416	0.0371	0.043
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.0303	0.0343	0.0195	0.0188	0.0148	0.0157	0.0214	0.0171	0.0172	0.0193	0.015
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	0.588	0.483	0.199	0.0845	0.0604	0.103	0.146	0.00421	0.0333	0.0433	0.0658
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	0.047	0.0462	0.0114	0.00729	0.00602	0.00555	0.00935	0.00154	0.00247	0.00187	0.00446
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	0.048	0.0345	0.01395	0.00573	0.00483	0.00645	0.01344	0.0001983	0.001434	0.001872	0.00489
TCDD TEQ (pg/g)		9.05	6.81	3.23	2.07	1.66	1.70	2.88	0.75	1.36	1.63	1.31

Notes:
pg/g - picogram per gram [or part per trillion (ppt)]
mg/kg - milligrams per kilogram
Non-detects are reported to the method detection limit (MDL)
(1) WHO (2005) TEFs
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
WHO - World Health Organization
J - estimated concentration
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Table 2: Summary of Dioxin/Furan and TCDD TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, North Carolina

Compound	CAS Number	CS-33 8/6/20	CS-34 8/6/20	CS-35 8/6/20	CS-36 8/6/20	CS-37 8/6/20	CS-38 8/6/20	CS-39 8/6/20	CS-40 8/7/20	CS-41 8/7/20	CS-42 8/7/20	CS-43 8/7/20
Dioxins/Furans Results (pg/g)												
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	<0.184	<0.172	0.115 J	<0.131	<0.147	<0.211	<0.166	<0.175	<0.259	<0.314	<0.471
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	0.312 J	<0.3	<0.407	0.577 J	<0.502	<0.197	0.235 J	<0.192	0.709 J	1.06 J	<0.815
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	1.02 J	<1.1	1.8 J	3.18	18.3	<0.257	<0.329	<0.409	<1.12	1.75 J	<0.539
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	2.26 J	2.54 J	4.21	7.94	24.9	0.579 J	0.717 J	<0.419	2.15 J	3.06	1.25 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	1.82 J	<1.58	3.11	5.77	11.4	0.683 J	0.727 J	<0.447	<1.45	2.5 J	1.08 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	85.6	100	158	320	2280	<6.8	17.3	11.9	59.7	73.8	29.5
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	653	750	1360	2280	10300	52.3	304	116	590	1070	313
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	<0.125	<0.205	<0.254	<0.0626	0.241 J	<0.0903	0.171 J	<0.0929	0.559	0.781	0.513 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	<0.134	0.24 J	0.407 J	<0.151	0.275 J	<0.149	0.228 J	<0.171	<0.708	1.16 J	0.523 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	<0.495	0.455 J	0.987 J	<0.635	<0.549	0.247 J	<0.285	<0.334	0.874 J	1.37 J	1.38 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	1.46 J	1.3 J	2.73	4.07	3.59	0.241 J	<0.276	0.386 J	1.24 J	1.55 J	0.923 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	0.681 J	0.577 J	1.25 J	1.68 J	1.45 J	<0.181	<0.358	<0.221	0.809 J	<1.2	0.814 J
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	60851-34-5	<1.05	<0.837	2.03 J	3.16	2.41 J	<0.397	0.342 J	<0.273	0.967 J	1.49 J	1.07 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	<0.116	<0.238	<0.3	<0.381	<0.483	<0.0994	<0.136	<0.177	<0.25	1.2 J	<0.311
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	18.6	17.4	34.7	62	84.4	1.85 J	1.87 J	3.24	8.14	10.8	19.4
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	1.62 J	1.74 J	3.46	6.82	7.63	0.195 J	<0.303	<0.155	<0.729	<1.22	<0.428
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0	47.3	49.4	109	193	369	2.37 J	<3.09	3.84 J	16.6	23.9	19.6

Dioxin/Furans TCDD Calculations	**TEF[1]**											
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	0.184	0.172	0.115	0.131	0.147	0.211	0.166	0.175	0.259	0.314	0.471
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	0.312	0.3	0.407	0.577	0.502	0.197	0.235	0.192	0.709	1.06	0.815
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.102	0.11	0.18	0.318	1.83	0.0257	0.0329	0.0409	0.112	0.175	0.0539
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.226	0.254	0.421	0.794	2.49	0.0579	0.0717	0.0419	0.215	0.306	0.125
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.182	0.158	0.311	0.577	1.14	0.0683	0.0727	0.0447	0.145	0.25	0.108
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	0.856	1	1.58	3.2	22.8	0.068	0.173	0.119	0.597	0.738	0.295
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	0.1959	0.225	0.408	0.684	3.09	0.01569	0.0912	0.0348	0.177	0.321	0.0939
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.0125	0.0205	0.0254	0.00626	0.0241	0.00903	0.0171	0.00929	0.0559	0.0781	0.0513
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.00402	0.0072	0.01221	0.00453	0.00825	0.00447	0.00684	0.00513	0.02124	0.0348	0.01569
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.1485	0.1365	0.2961	0.1905	0.1647	0.0741	0.0855	0.1002	0.2622	0.411	0.414
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.146	0.13	0.273	0.407	0.359	0.0241	0.0276	0.0386	0.124	0.155	0.0923
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0681	0.0577	0.125	0.168	0.145	0.0181	0.0358	0.0221	0.0809	0.12	0.0814
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	0.1	0.105	0.0837	0.203	0.316	0.241	0.0397	0.0342	0.0273	0.0967	0.149	0.107
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.0116	0.0238	0.03	0.0381	0.0483	0.00994	0.0136	0.0177	0.025	0.12	0.0311
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	0.186	0.174	0.347	0.62	0.844	0.0185	0.0187	0.0324	0.0814	0.108	0.194
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	0.0162	0.0174	0.0346	0.0682	0.0763	0.00195	0.00303	0.00155	0.00729	0.0122	0.00428
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	0.01419	0.01482	0.0327	0.0579	0.1107	0.000711	0.000927	0.001152	0.00498	0.00717	0.00588
TCDD TEQ (pg/g)		2.77	2.88	4.80	8.16	34.02	0.84	1.09	0.90	2.97	4.36	2.96

Notes:
pg/g - picogram per gram [or part per trillion (ppt)]
mg/kg - milligrams per kilogram
Non-detects are reported to the method detection limit (MDL)
(1) WHO (2005) TEFs
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
WHO - World Health Organization
J - estimated concentration
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Table 2: Summary of Dioxin/Furan and TCDD TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, North Carolina

Compound	CAS Number	CS-44 8/7/20	CS-45 8/7/20	CS-46 8/7/20	CS-47 8/7/20	CS-48 8/8/20	CS-49 8/8/20	CS-50 8/7/20	CS-51 8/7/20	CS-52 8/8/20	CS-53 8/25/20	CS-54 8/7/20
Dioxins/Furans Results (pg/g)												
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	<0.184	<0.16	<0.171	<0.206	<0.222	<0.146	<0.232	<0.432	<0.155	<0.137	<0.143
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	<0.326	<1.8	1.6 J	0.361 J	<0.276	<0.193	0.367 J	<0.487	0.875 J	0.281 J	<0.233
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	0.574 J	9.54	6.86	0.532 J	<0.501	<0.259	<0.492	0.738 J	5.66	0.748 J	<0.395
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	<0.897	21.6	15	1.18 J	<0.849	<0.344	0.808 J	<1.47	14.2	1.39 J	0.521 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	1.14 J	17	12.9	0.981 J	<0.825	0.509 J	<0.739	<0.783	9.59	1.1 J	0.654 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	28.4	741	510	28.1	42.8 J	12.7	20.7	32.4	787	37.3	13.1
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	598	5320	3690	245	280 J	150	274	270	8650	352	132
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	0.288 J	0.466 J	<0.399	<0.34	<0.252	<0.182	<0.439	<0.307	<0.296	<0.669	<0.342
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	0.375 J	0.729 J	<0.644	0.404 J	<0.293	<0.132	0.427 J	0.646 J	0.285 J	0.587 J	<0.218
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	0.899 J	2.33 J	<1.4	0.741 J	<0.285	<0.137	0.677 J	<0.721	1.71 J	0.738 J	<0.319
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	<0.412	12.7	9.24	<0.568	0.292 J	<0.364	0.627 J	1.02 J	3.91	0.79 J	0.344 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	<0.424	6.03	4.41	0.592 J	0.246 J	<0.201	0.502 J	0.85 J	1.87 J	0.59 J	0.19 J
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	60851-34-5	0.759 J	9.54	6.65	0.797 J	0.501 J	0.267 J	0.482 J	<0.502	4.31	<0.461	<0.274
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	<0.172	<0.222	<0.224	<0.198	<0.247	<0.106	<0.132	<0.177	<0.62	<0.198	0.505 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	5.26	170	118	8.56	5.58	1.56 J	4.98	7.61	104	4.28	4.54
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	<0.141	18	13.3	<0.267	0.543 J	<0.0714	0.338 J	0.595 J	10.4	0.388 J	<0.229
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0	<5.31	480	354	11.7	18	2.46 J	6.08	11.1	498	9.01	6.14
Dioxin/Furans TCDD Calculations	**TEF[1]**											
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	0.184	0.16	0.171	0.206	0.222	0.146	0.232	0.432	0.155	0.137	0.143
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	0.326	1.8	1.6	0.361	0.276	0.193	0.367	0.487	0.875	0.281	0.233
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.0574	0.954	0.686	0.0532	0.0501	0.0259	0.0492	0.0738	0.566	0.0748	0.0395
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.0897	2.16	1.5	0.118	0.0849	0.0344	0.0808	0.147	1.42	0.139	0.0521
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.114	1.7	1.29	0.0981	0.0825	0.0509	0.0739	0.0783	0.959	0.11	0.0654
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	0.284	7.41	5.1	0.281	0.428	0.127	0.207	0.324	7.87	0.373	0.131
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	0.1794	1.596	1.107	0.0735	0.084	0.045	0.0822	0.081	2.595	0.1056	0.0396
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.0288	0.0466	0.0399	0.034	0.0252	0.0182	0.0439	0.0307	0.0296	0.0669	0.0342
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.01125	0.02187	0.01932	0.01212	0.00879	0.00396	0.01281	0.01938	0.00855	0.01761	0.00654
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.2697	0.699	0.42	0.2223	0.0855	0.0411	0.2031	0.2163	0.513	0.2214	0.0957
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0412	1.27	0.924	0.0568	0.0292	0.0364	0.0627	0.102	0.391	0.079	0.0344
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0424	0.603	0.441	0.0592	0.0246	0.0201	0.0502	0.085	0.187	0.059	0.019
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	0.1	0.0759	0.954	0.665	0.0797	0.0501	0.0267	0.0482	0.0502	0.431	0.0461	0.0274
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.0172	0.0222	0.0224	0.0198	0.0247	0.0106	0.0132	0.0177	0.062	0.0198	0.0505
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	0.0526	1.7	1.18	0.0856	0.0558	0.0156	0.0498	0.0761	1.04	0.0428	0.0454
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	0.00141	0.18	0.133	0.00267	0.00543	0.000714	0.00338	0.00595	0.104	0.00388	0.00229
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	0.001593	0.144	0.1062	0.00351	0.0054	0.000738	0.001824	0.00333	0.1494	0.002703	0.001842
TCDD TEQ (pg/g)		1.78	21.42	15.40	1.77	1.54	0.80	1.58	2.23	17.36	1.78	1.02

Notes:
pg/g - picogram per gram [or part per trillion (ppt)]
mg/kg - milligrams per kilogram
Non-detects are reported to the method detection limit (MDL)
(1) WHO (2005) TEFs
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
WHO - World Health Organization
J - estimated concentration
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin

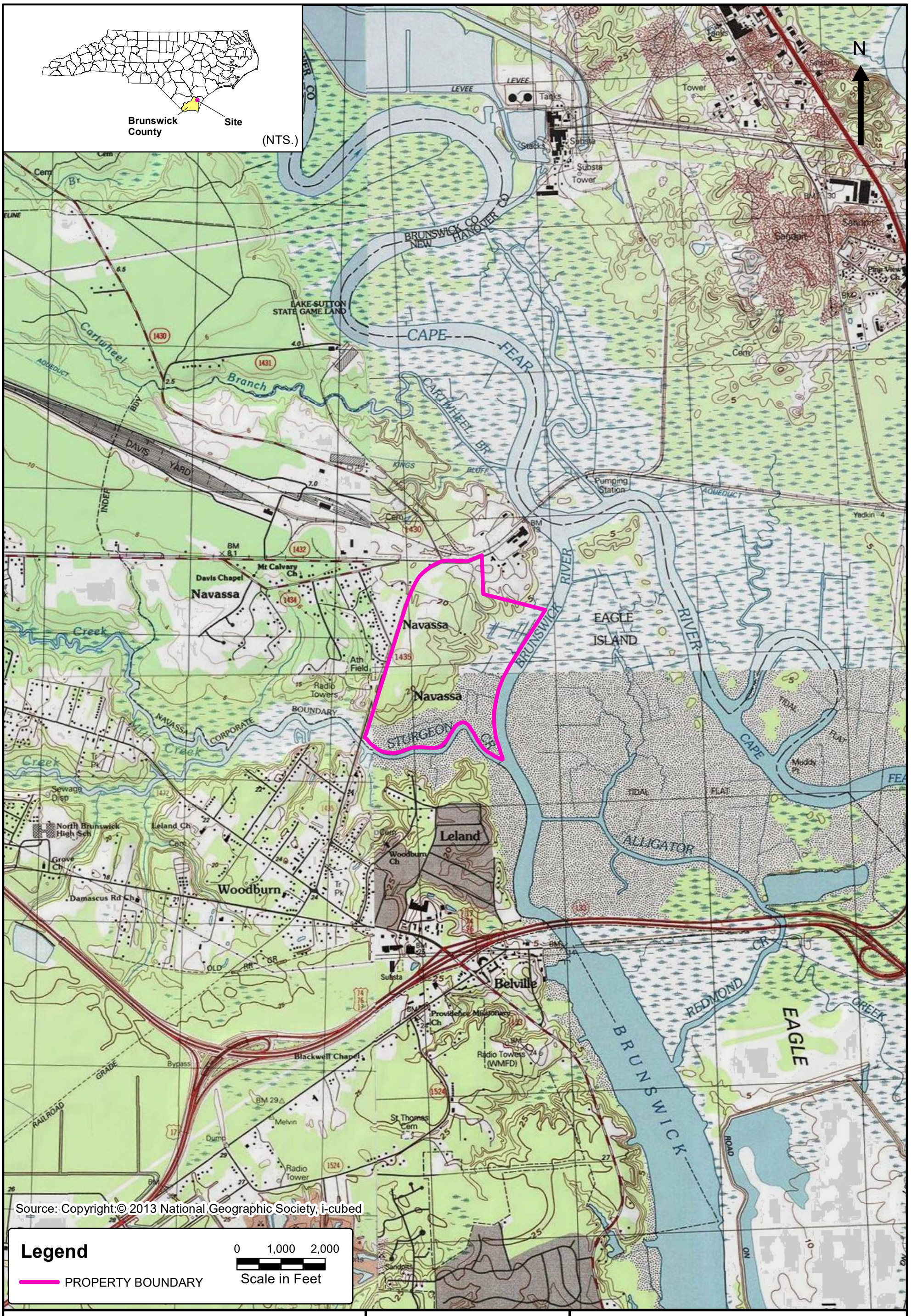
Table 2: Summary of Dioxin/Furan and TCDD TEQ Results
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, North Carolina

Compound	CAS Number	CS-55 8/7/20	CS-RISB02 8/5/20	CS-SB-125 8/5/20	CS-SS-101 8/5/20	CS-SS-104 8/5/20	CS-SS-106 8/6/20	CS-SS-109 8/6/20	CS-TB07 8/6/20
Dioxins/Furans Results (pg/g)									
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	<0.35	<0.112	<0.129	<0.165	<0.124	<0.225	<0.162	0.257 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	<0.173	<0.135	<0.187	0.379 J	0.764 J	<0.165	0.291 J	1.33 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	0.453 J	0.35 J	<0.562	1.61 J	3.37	<0.544	1.44 J	2.72 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	<0.616	1.2 J	1.67 J	3.95	10	1.19 J	<2.37	5.47
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	0.831 J	0.72 J	1.07 J	2.33 J	6.84	<0.814	2.02 J	4.25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	18.3	36.3	66.1	161	416	59.7	133	314
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	162	304	515	1610	3190	389	806	3030
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	0.304 J	<0.0788	<0.0761	0.313 J	<0.144	<0.174	<0.174	1.12
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	0.404 J	<0.104	<0.109	<0.32	0.307 J	0.186 J	<0.573	<1.13
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	0.618 J	0.301 J	<0.189	<0.686	0.766 J	<0.186	0.642 J	<1.61
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	0.537 J	0.863 J	0.862 J	2.77	4.62	<0.366	1.82 J	2.23 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	<0.351	<0.347	0.498 J	1.17 J	2.59 J	0.276 J	0.786 J	1.69 J
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	60851-34-5	<0.578	<0.517	0.763 J	<1.56	4.69	<0.37	0.787 J	1.61 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	<0.184	<0.117	<0.166	<0.219	<0.386	<0.157	<0.176	<0.234
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	8.73	9.95	17.3	30.8	132	5.17	17.2	24.9
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	<0.218	0.96 J	1.49 J	3.64	12.9	0.463 J	1.49 J	1.72 J
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0	<7.75	27	65.1	100	636	18	46.8	81.5
Dioxin/Furans TCDD Calculations	**TEF[1]**								
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	0.35	0.112	0.129	0.165	0.124	0.225	0.162	0.257
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	0.173	0.135	0.187	0.379	0.764	0.165	0.291	1.33
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.0453	0.035	0.0562	0.161	0.337	0.0544	0.144	0.272
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.0616	0.12	0.167	0.395	1	0.119	0.237	0.547
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.0831	0.072	0.107	0.233	0.684	0.0814	0.202	0.425
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	0.183	0.363	0.661	1.61	4.16	0.597	1.33	3.14
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	0.0486	0.0912	0.1545	0.483	0.957	0.1167	0.2418	0.909
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.0304	0.00788	0.00761	0.0313	0.0144	0.0174	0.0174	0.112
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.01212	0.00312	0.00327	0.0096	0.00921	0.00558	0.01719	0.0339
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.1854	0.0903	0.0567	0.2058	0.2298	0.0558	0.1926	0.483
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0537	0.0863	0.0862	0.277	0.462	0.0366	0.182	0.223
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0351	0.0347	0.0498	0.117	0.259	0.0276	0.0786	0.169
2,3,4,6,7,8-Hexchlorodibenzofuran (HxCDF)	0.1	0.0578	0.0517	0.0763	0.156	0.469	0.037	0.0787	0.161
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.0184	0.0117	0.0166	0.0219	0.0386	0.0157	0.0176	0.0234
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	0.0873	0.0995	0.173	0.308	1.32	0.0517	0.172	0.249
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	0.00218	0.0096	0.0149	0.0364	0.129	0.00463	0.0149	0.0172
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	0.002325	0.0081	0.01953	0.03	0.1908	0.0054	0.01404	0.02445
TCDD TEQ (pg/g)		1.43	1.33	1.97	4.62	11.15	1.62	3.39	8.38

Notes:
pg/g - picogram per gram [or part per trillion (ppt)]
mg/kg - milligrams per kilogram
Non-detects are reported to the method detection limit (MDL)
(1) WHO (2005) TEFs
TEF - toxic equivalency factor
TEQ - toxic equivalent concentration
WHO - World Health Organization
J - estimated concentration
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Prepared by: MAB 09/17/20
Checked by: CDN 09/17/20

FIGURES



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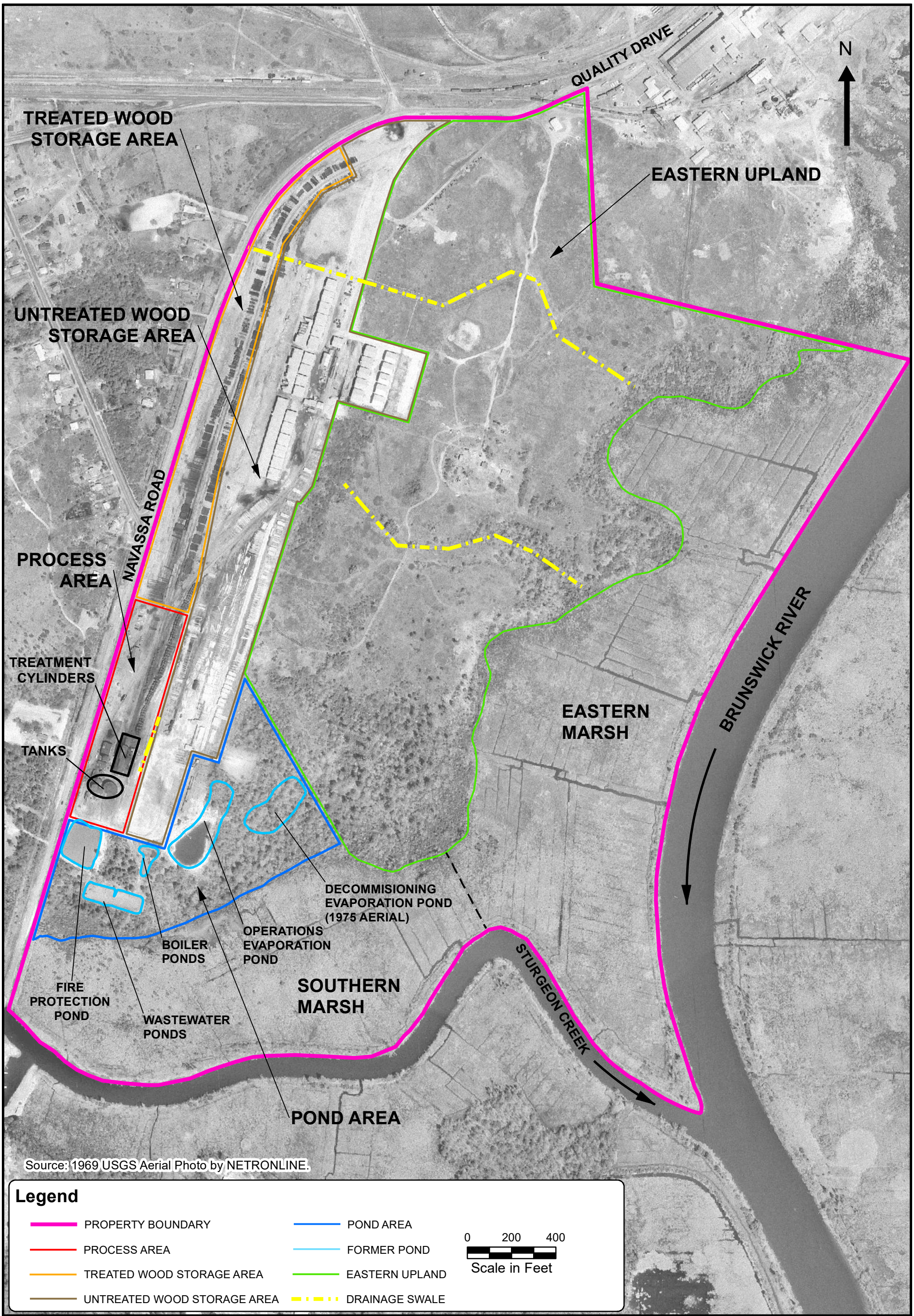
SITE LOCATION
OU1 Soil Sampling Technical Memorandum - Residential Criteria Area Delineation
Kerr-McGee Chemical Corp - Navassa Superfund Site Navassa, North Carolina

DRAWN	CHECKED	DATE	FIGURE
HVP	CDN	SEPT 2020	1



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HISTORICAL SITE PLAN

OU1 Soil Sampling Technical Memorandum - Residential Criteria Area Delineation

Kerr-McGee Chemical Corp - Navassa Superfund Site Navassa, North Carolina

DRAWN	CHECKED	DATE	FIGURE
HVP	CDN	SEPT 2020	2

PARCELS SAMPLED IN OPERABLE UNIT 1

PARCELS SAMPLED IN OPERABLE UNIT 2

N

CS-30
A
B
C
D
E

INSET (NTS)

Aerial Source: 1969 USGS Aerial Photo by NETRONLINE.

Legend

- 5.5 < BaP TEQ < 11 mg/Kg
- BaP TEQ < 5.5 mg/Kg
- POLYGON WITHOUT SAMPLE
- UNTREATED WOOD STORAGE AREA
- SAMPLE AREA BOUNDARY
- PROPERTY BOUNDARY
- TREATED WOOD STORAGE AREA
- BaP TEQ > RESIDENTIAL RSL
- SOIL ALIQUOT LOCATION
- SOIL BORING
- TERRESTRIAL SEDIMENT
- 2019 VERIFICATION SAMPLING LOCATION
- 2019 SURFACE SAMPLING LOCATION
- 2019 BOUNDARY SOIL BORING
- 2019 TRENCH SOIL BORING

BaP TEQ - Benzo(a)pyrene Toxic Equivalent (mg/kg)

BaP Residential RSL 10^{-4} = 11 mg/kg

mg/kg - MILLIGRAMS PER KILOGRAM

0 80 160
Scale in Feet

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COMPOSITE SAMPLE LOCATIONS
OU1 Soil Sampling Technical Memorandum - Residential Criteria Area Delineation
Kerr-McGee Chemical Corp - Navassa Superfund Site Navassa, North Carolina

DRAWN	CHECKED	DATE	FIGURE
HVP	CDN	SEPT 2020	3

S:\Premier\Projects\Greenfield Environmental Multistate Trust\KMCC Navassa NC Superfund Site\CAD GIS Data\EARTHCON_GIS\MXDs\OU1_Tech_Memo\Fig 3 Composite Sample Locations.mxd 9/15/2020 1:18:14 PM

OPERABLE UNIT 1 BOUNDARY

OPERABLE UNIT 2 BOUNDARY

BOUNDARY AREA

N

SB-119R/ SB-119 CS-23 CS-22 BRSB01 CS-24 CS-26 SB-120 CS-01 CS-19 CS-25 RISB01 CS-27 CS-28 CS-33 SB-144 CS-34 CS-29 CS-32 CS-20 CS-02 SB-121 SS-101 CS-30 CS-36 CS-35 CS-31 SB-122 RISB02 SB-145 CS-38 SB-123 CS-37 CS-18 CS-03 SS12 TB-01 SB-124 CS-39 CS-40 SB-125 CS-45 TB-02 SB-125R/ CS-SB-125 CS-41 SS-102 RISB03 SB-146 SS-103 CS-42 CS-46 CS-44 CS-21 CS-04 SS-104 CS-47 CS-43 RISB04 CS-48 SS-105 SB-147 SO033 TWSB25 SO034 CS-54 CS-50 TB-03 SS-106 SO040 SO035 SO036 SB-126 TB-04 CS-49 TB-05 SO039 SS-107 TB-06 SO038 CS-55 CS-51 TB-07 SO041 SS-109 SS-108 SO037 SO042 TWSB24 SB-127 CS-52 SO043 SS08 CS-53 SO048 CS-56 SO047 SO044 SB-128 SS-110 SB-148 BKSB04 SO046 TB-08 CS-57 SO045 TB-09 TB-10 CS-58 CS-05 SB-129 TB-11 SB-130 RISB05 CS-61 RISB07 CS-59 TB-12 TB-13 RISB06 SB-149 TWSB23 CS-60 CS-06 SS-111 TB-14 CS-62 RISB08 TB-16E SB-131 TB-15 SB-150 TB-16A TB-16 TB-16F TB-16B SS-112 TB-16H TB-16D SB-132 CS-63 TB-20 TB-17 CS-07 TB-19 TB-18 TB-16C SS-125 TB-21 TB-16G SD021R/ CS-SD021 TB-22 SD021 TWSB27 CS-65 SS-126 SS-113 CS-64 SS-114 TB-23 SB-151 RISB10 TB-24 RISB09 SB-133 SS-116 CS-66 SS-115 SS-117 SS-118 SB-136 CS-08 SB-134 CS-67 SS-119 SS-120 SB-135 SS-121 SS-122 CS-68 SB-152 TB-26 TB-25 SS-123 SS-124 CS-09 SB-153

Aerial Source: 1969 USGS Aerial Photo by NETRONLINE.

Legend

- EXCEEDS RESIDENTIAL CRITERIA
- MEETS RESIDENTIAL CRITERIA
- UNTREATED WOOD STORAGE AREA
- OPERABLE UNIT 1 AND 2 BOUNDARY
- PROPERTY BOUNDARY
- TREATED WOOD STORAGE AREA

BaP TEQ - Benzo(a)pyrene Toxic Equivalent (mg/kg)

BaP Residential RSL 10^{-4} = 11 mg/kg

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0 80 160
Scale in Feet

- SOIL ALIQUOT LOCATION
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OU1 BOUNDARY
OU1 Soil Sampling Technical Memorandum - Residential Criteria Area Delineation
Kerr-McGee Chemical Corp - Navassa Superfund Site
Navassa, North Carolina

DRAWN	CHECKED	DATE	FIGURE
HVP	CDN	SEPT 2020	4

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