BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

In the Matter of: HUDSON OIL REFINERY SUPERFUND SITE, Land O'Lakes, Inc., Petitioner.	CERCLA § 106(b) Petition No. 15-01 Unilateral Administrative Order U.S. EPA Region 6 CERCLA Docket No. 06-16-08

AFFIDAVIT OF B. TOD DELANEY
IN SUPPLEMENT TO THE DECLARATION OF D. KEITH BAUGHER

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STATE OF NEW JERSEY)
) ss.
COUNTY OF MORRIS)

B. Tod Delaney, being first duly sworn upon oath, states as follows:

I am over twenty-one (21) years of age, have personal knowledge of the matters referred to hereinafter, and am competent to testify thereto.

Role, Qualifications and Restatement of Opinions

1. I have been retained as an expert witness to replace D. Keith Baugher, who prepared a Declaration on behalf of Land O'Lakes, Inc. ("Land O'Lakes") in this matter, but who suffered a stroke and was unable to continue and finalize his work or sign his Declaration prior to or after the filing of Land O'Lakes' Petition for Reimbursement (the "Petition") in this matter[1] on August 18, 2015. Mr. Baugher was retained to serve as an expert witness on refinery operations and opine on how chemical constituents that the United States Environmental Protection Agency ("EPA") required Land O'Lakes to cleanup under the 2009 Unilateral Administrative Order ("UAO") are attributable to historical refinery operations at the Hudson Refinery Oil Superfund Site ("Site"). (Declaration of D. Keith Baugher, Exhibit 4 to the Petition hereinafter referred to as "Baugher 2015" or "Baugher Dec."). Mr. Baugher's Declaration (Exhibit 4 to the Petition) is attached hereto as Exhibit 1 and incorporated herein. His assignment was to provide refinery operational background to demonstrate (1) the application of the petroleum exclusion to the Site in order to show that Land O'Lakes is not liable under CERCLA Section 107(a) for costs that Land O'Lakes is seeking reimbursement, and (2) that

[1] *In the Matter of Hudson Oil Refinery Superfund Site*, Before the Environmental Appeals Board, United States Environmental Protection Agency, CERCLA 106(b) Petition No. 15-01, CERCLA Docket No. 06-16-08.

EPA's selection of the ordered response was arbitrary and capricious or otherwise not in accordance with the law (Baugher 2015). My engagement as a substitute expert in this matter was to review and perform an independent evaluation of historical operations on and near the Site, review required activities under the UAO, Site data, and Mr. Baugher's as filed unfinished Declaration. My overall purpose was to determine whether I could support or adopt Mr. Baugher's findings and opinions as well as consider any additional areas relevant to his assignment in order to provide a Supplemental Affidavit as a substitute/replacement expert for Mr. Baugher in support of the Petition.

2. I am the President of First Environment, Inc. ("First Environment"), an environmental engineering and consulting firm with corporate headquarters at 91 Fulton Street in Boonton, New Jersey. I am a Professional Engineer licensed in 15 states and a Board Certified member of the American Academy of Environmental Engineers and Scientists.

3. My educational background includes earning a Bachelor of Science Degree in 1968 and a Master of Science degree in 1972, both in Chemical Engineering, from the University of New Mexico, and a Ph.D. degree in Environmental Health Engineering from the University of Texas in 1976. I also received a Master's Degree in Business Administration from Pepperdine University.

4. I have practiced in the fields of environmental engineering, pollution prevention and hazardous waste management for more than 30 years, with specific emphasis on forensic environmental engineering, site investigations, industrial audits, remedial design, remedial construction, hazardous waste treatment and disposal practices, environmental management systems, strategic planning, air pollution control, and the applications of control and

treatment technologies. I am familiar with a wide variety of industrial operations and processes including, but not limited to, petroleum refineries, petroleum storage and distribution facilities, manufactured gas plants, industrial dry cleaning, aircraft, automotive and electronics manufacturing, and chemical manufacturing facilities. Through my work in these fields, I have developed a thorough understanding of the historic standards of care and state-of-the-art storage, handling, and disposal practices associated with industrial operations during the course of the 20th Century to the present.

5. I have first-hand experience with petroleum refining. I was employed by Exxon (now ExxonMobil Corporation) as a project engineer in the mid- to late-1970s. My assignments included the evaluation of process systems to upgrade efficiencies, implement pollution prevention and improve energy conservation at Exxon's former Bayway Refinery in Linden, New Jersey. In addition, I conducted tasks related to environmental site assessments and performed environmental testing of the air, soil and groundwater at the facility. Further, I worked as an environmental process engineer at refineries owned by Pennzoil and Shell. In the past several years, I was an expert witness at trial in a natural resource damages suit involving Exxon's former Bayway and Bayonne refineries in New Jersey and brought under New Jersey's Spill Compensation and Control Act. I am currently an expert in a matter involving a former petroleum refinery along Newtown Creek in New York City which has involved extensive review of refining processes and waste generation.

6. I have directed hundreds of environmental site investigations and remediation projects at industrial facilities. These efforts have included the development of sampling plans, the performance of remedial site investigations, the implementation of feasibility studies, the evaluation of cleanup alternatives, the design and operation of treatment systems, and the

supervision and management of cleanup programs. My professional experience includes the design, development, and management of programs for investigation and control of contaminants in the air, water, and soil. I have developed and executed extensive field data collection programs, remedial strategies for regulatory compliance, and preliminary and final designs of selected remedial options. My experience includes evaluation of data for purposes of source identification.

7. I have also worked closely with facilities subject to the Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. and the regulations promulgated thereunder ("RCRA") such as the former Hudson Refinery. I am familiar with the refinery waste streams that received RCRA listing under the regulations. I have consulted with clients subject to both the generator and the treatment, storage and disposal requirements of RCRA including permitting, treatment and storage operations, and corrective action investigation and cleanup work at these facilities. I routinely assist clients with the RCRA identification and classification of hazardous wastes subject to Subtitle C of the RCRA statute.

7. In addition to my work under RCRA, I also have significant experience working on sites subject to the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9601 et seq. and the regulations promulgated thereunder ("CERCLA"). I have worked with virtually all aspects of the CERCLA process, including the performance of preliminary assessments and site investigations, the ranking of sites on the National Priorities List ("NPL") using the Hazard Ranking System ("HRS"), the performance of remedial investigations and feasibility studies, the development of documentation and data that support remedial decisions in various Record of Decision documents and the performance of remedial design work and remedial actions. I have worked with the National Contingency Plan ("NCP")

as guidance in developing the administrative record for several sites and for developing Community Involvement Plans ("CIPs"). I have also supported numerous litigants in prosecuting and defending CERCLA cost recovery and contribution claims in Federal court cases and mediations. I have experience evaluating the applicability of the petroleum exclusion under CERCLA.

8. I have conducted a Site visit and met with fact witnesses Mick Gaskins, Forrest Fuqua, Al Williams, and Glen Wright. I also reviewed their Affidavits filed in this matter and had the opportunity to ask questions regarding their operational experience of the refinery. I carefully reviewed the unsigned Declaration of D. Keith Baugher presented as Exhibit 4 to the Petition. I also reviewed the Affidavits of others, including Paul Boehm, David Brady, Tarek Saba, and Jay Vandeven. Following this extensive review and performance of work, I found agreement with Mr. Baugher's findings and opinions with some limited noted exceptions. Accordingly, I adopt and incorporate the work and opinions of Mr. Baugher as my own, as well as his supporting figures and tables, with certain added supplemental findings, clarifications and opinions presented in this Affidavit. For reference and convenience, I restate and adopt Mr. Baugher's Opinions with explanatory footnotes and edits, as follows:

Opinion 1. In February 1977, Midland sold to Hudson an operating and well maintained refinery.

Opinion 2. Hudson's nearly six years of refinery operations eliminated any crude oil, feedstocks, products, chemicals, additives and by-products sold and transferred by Midland to Hudson in February 1977 because of the sheer number of turnover cycles created from the 19,000 barrels per day ("B/D") of refinery throughput.

Opinion 3. RCRA became effective for refineries soon after Midland sold the Site to Hudson. All of the RCRA Listed Hazardous Waste streams at the Hudson Refinery - DAF float (K048), Slop oil emulsion solids (K049), Heat exchanger sludge (K050), API separator sludge (K051), Leaded gasoline tank bottoms (K052), Crude tank sediment (K169), Clarified slurry tank sediment (K170), Spent hydrofining catalyst (K171) and Spent hydrotreating catalyst (K172) - were either placed in the Hudson LTU or removed prior to the 2009 UAO and disposed of as part of the response to the

Final Consent Decree (FCD), EPA Emergency Removal Action (ERA) or the Non-time Critical Removal Action (NTCRA).[2]

Opinion 4. The Contaminants of Concern (COCs) identified in the 2007 Record of Decision (ROD) and the "visual contamination" that the EPA directed Land O'Lakes to excavate and remove from the refinery processing and tankage areas are attributable to leaks or spills of crude oil or refined petroleum products during the almost 70 years that the refinery occupied the Site or attributable to third party activities.

Opinion 5. I am unaware of a source of arsenic associated with the refining of the crude oil at the Site which could explain the elevated arsenic levels measured in soil in a few locations in the processing and tankage areas.[3]

Opinion 6. The largest excavation required by the ROD involved the removal of approximately 32,863 cubic yards ("CY") of soil and coke fines from the Coke Pond and the Coke Pond Expansion Area (Brady Affidavit). Approximately 5,596 CY of the 32,863 CY removed was petroleum coke fines, a product refined from crude at this and many other US refineries.

Opinion 7. The 27,267 CY of soil removed from areas surrounding the Coke Pond (an area referred to as the Coke Pond Expansion) was required because of EPA-designated "visual contamination". This material was attributable to leaks and spills of petroleum products from pipes and tanks and unrelated to the coke fines. My conclusion is that all this material was petroleum excluded under CERCLA.

Opinion 8. Lead, Benzo(a)pyrene (BaP), and "visual contamination" that the EPA RPM directed Land O' Lakes to excavate and remove from SAOC-1, SAOC-2, SAOC-3, and SAOC-4 are attributable to leaks or spills of crude oil and petroleum products during the years that the refinery occupied the Hudson Site or third party activities. This material was either subject to the petroleum exclusion or the costs incurred to address it are divisible *or are attributable to third parties.*[4]

Opinion 9. The ROD required only one excavation in SAOC-7 in the North Refinery tank field, south of Tanks 100 and 101. The contaminants in this area are attributable to spills and leaks of

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[2] Midland sold the refinery to Hudson in 1977; regulations implementing RCRA were not effective until 1980. Placement of listed RCRA wastes in the Hudson LTU or their removal from the Site occurred in the post-Midland era. I note also that Mr. Baugher interchanged the names of K171 and K172 wastes. I amend Mr. Baugher's Opinion 3 with the provisions that: (a) spent hydrotreating catalyst is K171 waste, and (b) spent hydrofining catalyst is K172 waste. "Hydrofining" is shorthand for "hydrorefining," which is included in the formal name for K172 waste listed for regulation in EPA's Final Rule issued August 6, 1998 adding several petroleum process wastes to those first listed for regulation in 1980. ("K172 … Spent Hydrorefining catalyst from petroleum refining operations, including guard beds used to desulfurize feeds to other catalytic reactors (this listing does not include inert support media)" [63 FR 42185])

[3] While Mr. Baugher was unaware of a source of arsenic derived from light, sweet crude that could explain the elevated levels detected in a few processing and tankage areas, I have identified two potential sources related to petroleum refining and two potential sources unrelated to refining. They are presented under the Arsenic Subsection of the Supplemental Findings, Clarifications, and Opinions Section.

[4] I added the last phrase "or are attributable to third parties."

petroleum products from tanks and their associated piping and are subject to CERCLA's petroleum exclusion.

Opinion 10. EPA mischaracterized tar like materials encountered during the investigation and excavation of the Site as "Coke Tar." This mischaracterized "coke tar" is, in reality, crude oil or a petroleum product. It is not the RCRA listed waste K087. K087 requires the use of coal and was never produced during the operation of the refinery on the Site.

Opinion 11. The mischaracterized "coke tar" and "visual contamination" that the EPA RPM directed Land O' Lakes to excavate and remove from the "Coke Tar Area" are attributable to leaks or spills of crude oil and petroleum products during the years that the refinery occupied the Site. All this material is subject to the CERCLA petroleum exclusion.

Opinion 12. Material identified by the EPA RPM as "Coke Tar" and visual contamination north of Tank 97 and next to State Highway 33 (an area designated as "AA-1") was crude oil which is attributable to leaks from the pipelines which transferred crude to Tanks 96 and 97. All this material was subject to the CERCLA petroleum exclusion.

Opinion 13. When leaded gasoline is spilled or leaked, the gasoline quickly evaporates leaving behind tetraethyl lead (TEL). It is not unusual at an old refinery site, like the Site, to find elevated lead levels in the soil in the areas where leaded gasoline has spilled or leaked. In the absence of evidence of elevated levels of lead in the area of the TEL storage facilities (there being no other sources of lead at the Site), it is my opinion that all but one of the elevated soil lead levels in the South Refinery processing and tankage areas were the result of leaded gasoline spills or leaks. All such materials are subject to the CERCLA petroleum exclusion.[5]

Opinion 14. The Lockheed Report incorrectly identified various pools of water shown in aerial photographs taken of the refinery as pools of "hazardous substances" from leaking tanks. The EPA's decision to use Lockheed's incorrect analysis as part of the basis for the ROD and UAO issued to Land O' Lakes was arbitrary and capricious.

Supplemental Findings, Clarifications and Opinions

9. With some overlap, Baugher's opinions fall under five substantive categories, which I further discuss to some extent in subsections as follows:

- Midland's maintenance of the refinery and Hudson's turnover (Opinions 1 and 2)
- RCRA waste streams (Opinion 3) and non-generation of K087 waste (Opinion 10)
- Leaks and spills covered by the petroleum exclusion (Opinions 4, 6, 7, 8, 9, 11, 12 and 13)
- Source of arsenic (Opinion 5)
- Faulty aerial photographic analysis (Opinion 14)

[5] The one elevated soil lead level that does not appear to be a result of leaded gasoline spills or leaks was located northeast of Tank 31 (storing platformate) in SAOC-2. Paul Boehm concludes that the lead result for the sample in this area was an outlier, and I concur.

Midland's Maintenance of the Refinery and Hudson's Turnover

10. As Mr. Baugher indicated, Midland sold to Hudson a well-maintained and operating refinery. Like Mr. Baugher, I performed calculations and analysis with respect to throughput and turnover cycles. Appendix A presents an explanation of my calculations. Based on turnover cycles driven by production and sales and given turnarounds performed for maintenance and repairs,[6] it is my opinion that Hudson's almost six years of operations virtually eliminated any petroleum, chemicals, or by-products sold or transferred by Midland to Hudson.

RCRA Hazardous Waste Streams and Non-Generation of K087 Waste

11. Based on my review of documentation, I agree with Mr. Baugher that the RCRA Petroleum Refinery Wastes from Specific Sources (K048, K049, K050, K051, K052, K169, K170, K171 and K172 wastes) generated at the refinery were either placed in the Hudson LTU or removed prior to the UAO and disposed of as either part of the required work under the FCD, EPA ERA or the NTCRA. As discussed below, however, none of those wastes were listed RCRA wastes while Midland owned or operated the Site. In fact, K048 – K052 wastes were not listed until more than two years after Midland's sale of the refinery to Hudson, and K169 –K172 wastes were not listed until about 20 years after such sale. Unsurprisingly, the presence of K169 – K172 wastes at the Site, if they were generated at all, is undocumented since their designation occurred several years after completion of the response under the FCD.

12. Midland never generated the above-referenced K Wastes because the RCRA regulations governing such hazardous wastes (Petroleum Refining Wastes from Specific Sources) were not in force and cannot be applied retroactively to such waste-generating activities. The U.S. Congress enacted RCRA in 1976, but EPA did not promulgate implementing hazardous waste regulations until 1980. Midland sold the Site to Hudson in February 1977, three years before EPA promulgated RCRA regulations on K wastes and other hazardous wastes in 1980. (Baugher Dec. ¶ 44). Prior to the implementation of RCRA, Midland used "oil service contractors with vacuum trucks to collect API separator sludge and tanks bottoms for off-site disposal or sale to recyclers." (Fuqua Aff. ¶74). When RCRA regulations for K Wastes became effective, Hudson placed K

[6] *See, e.g.*, Affidavit of Forrest Fuqua, ¶ 85 (Petition Ex. 12); Affidavit of Mick Gaskins, ¶¶ 51-64 (Petition Ex. 13); Affidavit of Louis Al Williams, ¶¶ 80-89 (Petition Ex. 16); Affidavit of Glen Wright ¶¶ 106-124 (Petition Ex. 20).

Wastes in the Hudson LTU or sent them offsite. (See Hudson's RCRA Part A and Part B Applications (EPAFOIA0011193 and [Part B not Bates Stamped]). In addition, Hudson-generated RCRA wastes were placed in the Hudson LTU as part of action under the FCD completed in 1994, and later, some amounts of remaining Hudson RCRA wastes were placed in an EPA-constructed LTU on the Site as part of the ERA in 1998 and the NTCRA in 2002-2003. (Baugher Dec. ¶45).

13. I note further that EPA made listing determinations for certain refinery hazardous wastes as K Wastes in two regulatory actions more than 15 years apart. In 1980, EPA listed K048, K049, K050, K051 and K052 wastes. (45 FR 33084 at 33123 May 19, 1980 [Final Rule]) Those wastes were/are sludges which arise either from the treatment of wastewater generated during refining operations [K048, K049, or K051] or from the cleanup of equipment/storage tanks used in the refinery [K050 or K052]. (US EPA, May 2, 1980 Background Document, 671).[7] In 1998, EPA listed certain other refinery hazardous waste streams as K169, K170, K171, and K172 wastes. (63 FR 42110 August 6, 1998 [Final Rule]).[8]

14. As can be seen from the above summaries on EPA's actions on the listing of petroleum refining wastes from specific sources, the waste code "K087" does not appear. That is because K087 waste is derived from coal operations; in no way is K087 waste derived from or associated with petroleum refining. K087 waste was listed as a coal-derived hazardous waste on July 16, 1980. (45 FR 47832 at 834 designating "Decanter tank tar sludge from coking operations" as K087 waste from the coking industry). Phenol and naphthalene were the hazardous constituents for which K087 waste was listed. (45 FR 47832 at 834) A close reading of EPA's Background Document covering the listing of K087 waste reveals that such waste is derived only from operations involving the distillation of coal:

> "Coke, the residue from the destructive distillation of **coal**, serves as both a fuel and as a reducing agent in the making of iron and steel. Some coke plants recover by-products given off or created during the coke production process, and the recovery of by-products generates the sludge which is listed in this document. There are 66 by-product coke plants,

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[7] The wastes were/are listed for chromium and/or lead. Lead "comes predominantly from the use of tetraethyl lead in the blending of leaded products," and chromium "comes predominantly from cooling tower blowdown that uses a chromium base corrosion inhibitor." (US EPA, May 2, 1980 Background Document, 679-680)

[8] K170 Waste was listed for benzo (a)pyrene and other polyaromatic hydrocarbons; K171 and K172 wastes were listed for benzene and arsenic. (63 FR 42110 at 186) See also 60 FR 57747, November 20, 1995 (Proposed Rule) wherein EPA proposed listings for residuals in accordance with a consent decree between the Environmental Defense Fund and EPA approved December 9, 1994 and stemming from a lawsuit filed in 1989 (EDF v. Browner; Civ. No. 89-0598 D.D.C.) over failure to meet statutory deadlines.

which generate an estimated 72,300 tons/yr of decanter tank tar-sludge. During the recovery of chemicals in the by-product coke production process, tar separates by condensation from coke oven gas and drains to a decanter tank. Recoverable oil fractions are decanted off the top and the tar sludge settles to the bottom.

Approximately 97% of this tar-sludge is elemental carbon. The remaining 3% consists of condensed tar materials. These condensed tar materials contain the waste constituents of concern namely phenolic compounds and naphthalene, which are formed as a result of the destructive distillation of **coal**."

(Listing Background Document – Coking in US EPA Background Document on Listing of Hazardous Wastes [Phase IB], July 7, 1980) [9] (emphasis added)

15. No K087 waste was ever generated at the Site, nor was the generation of such waste even possible there. Tar stills are shown on 1924 and 1931 Sanborn Maps, but these stills were used in the petroleum refining process. A vacuum/visbreaker unit installed in 1956.[10] generated bottoms sometimes referred to as tar, but these bottoms were "stored and sold as heavy residual fuel." (Fuqua Aff. ¶ 80). In 1969, a coker unit was constructed to replace the visbreaker unit, after which the refinery no longer produced residual fuel for sale as this stream was used as a feed for the coker to produce petroleum coke sold as a separate product. (Fuqua Aff. ¶ 81; Fact Witness Joint Ex. 130 [FF00528 at 540]). Coke fines in the coke pond were residuals from delayed coking of petroleum residuum at the refinery, as explained by Baugher and Vandeven. (Baugher Dec. ¶¶ 31 and 52; Vandeven Aff. ¶ 41 referring to Williams and Wright Affidavits) In 1976, 1978 and 1981, coke fines were dredged from the coke pond and sold as fuel. (Baugher Dec. ¶54). Coke fines removed from the Site pursuant to the UAO are/were subject to CERCLA's Petroleum Exclusion. The description of any Site contamination as "Coke Tar" and subject to RCRA as a listed waste was incorrect.

Leaks and Spills Covered by the Petroleum Exclusion

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[9] A Federal Register Notice issued some 11 years later on July 26, 1991 confirms that K087 waste is derived from the distillation of coal, not petroleum refining. ("Pursuant to section 3001 of subtitle C of RCRA, EPA proposes to list as hazardous seven wastes generated from the production, recovery, and refining of coke by-products produced from coal. Three wastes generated by this industry (EPA Hazardous Waste No. K035 …, EPA Hazardous Waste No. K060 ..., and EPA Hazardous Waste No. K087 – Decanter tank tar sludge from coking operations) currently are listed as hazardous wastes." (56 FR 35758 at 759)).

[10] Fact Witness Joint Ex. 130 [FF00528 at 540].

16. Leaks and spills of crude oil or refined petroleum products from stills, tanks and piping were the sources of material in the following areas remediated under the UAO: the Coke Pond Expansion Area; the Coke Tar Area; SAOC-1, SOAC-2, SAOC-3, SAOC-4 and SAOC-7.[11] For sake of easy reference, I lump these areas under two broad categories of principal usage as follows:

- the South Refinery Process Area including the Coke Pond Expansion Area; the Coke Tar Area; SAOC-3 and SAOC-4; and
- Petroleum Storage and/or Railroad Areas SAOC-1, SAOC-2 and SAOC-7.

Key figures prepared by other experts that provide a foundation of the UAO resulting in remediation of areas impacted by historical leaks and spills of petroleum are:

- Vandeven 2015 Affidavit Figures 13A and 13B (showing areas affected by FCD activities and areas addressed under the UAO);
- Brady 2015 Affidavit Attachment O (Refinery Piping figure prepared by Enviro Clean); and
- Baugher Figures 12, 13, 14 and 18 (showing an overlay of UAO excavation boundaries on Sanborn Maps and on an aerial photograph of the South Refinery main process and storage areas).

17. To support my opinion that leaks and spills of crude or refined petroleum products were sources of material subject to the Petroleum Exclusion in these areas, I have developed my own Figure 1 (attached) and highlight some key points from Baugher as follows:

A series of crude stills and other distillation/condensing/processing units were located within the South Refinery Process Areas SAOC-3 and SAOC-4 (both part of the Coke Pond Expansion because of "visual contamination") from approximately 1917. (Baugher 2015 ¶ 56; Vandeven Aff. ¶40). Buried piping was left in place when these units were dismantled prior to

[11] Quench water and wash water entraining coke fines from the petroleum coker was also a source of materials excavated from the Coke Pond and Coke Pond Expansion Area. (Baugher Dec. ¶ 31).

World War II and replaced with more efficient units. (Baugher 2015 ¶ 57). The pipes left in the ground had transported crude in process, and it was typical for idled pipes to be left in place full of crude and capped. (Baugher 2015 ¶ 59). Galvanic corrosion of unprotected piping results in holes and leaks over time. (Baugher 2015 ¶ 59). Analysis of photographs taken during the UAO response and Sanborn maps reveals that the buried piping left in place and connecting various stills, condensers and tanks prior to World War II had leaked. (Baugher 2015 ¶ 60 and Baugher Figure 15 [from Brady Aff.] showing "Visual contamination from 'Rat's Nest' of Leaking Buried Piping under Former Crude Stills").

"Visual contamination" (a term used by EPA in the ROD) in the South Refinery Process Area is also attributable to leaks from Tanks 36, 64 and 65 including associated piping. (Baugher 2015 ¶ 63). Those tanks stored heavy residuum or No. 6 Fuel Oil.[12] Tank 36 was a large AST that underwent significant repairs in 1980. (Fuqua Aff. ¶ 62). Heavy fuel oil around Tank 36 was a target of remediation under the FCD. (Fuqua Aff. ¶ 175).

Figure 1 presents some photographs of leaks of petroleum from tanks and/or piping geospatially located across the South Refinery Process Area and referenced to a 1938 Sanborn Map overlaid with piping locations from Brady. These photographs taken during the Remedial Action performed under the UAO, supplement those presented by Baugher. (See Brady Aff., describing conditions encountered with its Attachment B for figures with reference points for photo locations, Attachment F for photos themselves and Attachment O for a piping map).

Sources of Arsenic

18. Under the UAO, ten locations at the Site were remediated for arsenic. Of these locations, six were in SAOC-1, two were in SAOC-2, and two were in SAOC-4. I have identified two indicated historical sources of arsenic beyond natural background (addressed by Dr. Paul Boehm) that would account for arsenic contamination in areas SAOC-1 and SAOC-2. These potential sources are unrelated to refinery activities at the Site. The two sources are: (1) a former

[12] See SPCC 1974 (EPAFOIA0012738-50) cited as Footnote 10 in Baugher 2015 showing Tank 36 stored Top Crude, Tank 64 stored Tar, and Tank 65 stored No. 6 Fuel [out-of-service]. According to Fuqua, Tank 36 was a 55,000 barrel capacity wooden-structure AST that stored No. 6 Fuel Oil sold prior to 1969 and used as a feedstock for the Coker Unit after 1969. (Fuqua Aff. ¶ 62).

cotton gin operation located adjacent to southeast corner of the Site, and (2) railroad tracks running through the Site. My Figure 2 (attached) shows arsenic remedial design areas overlaid on a 1938 Sanborn Map showing refinery process units, storage tanks, railroads, and part of a cotton gin.

(Cotton Gin)

From at least 1913 until sometime between 1938 and 1961, a cotton gin was located adjacent to the southeast quadrant of the Site. (See Vandeven Aff. Sanborn Maps spanning 1913 to 1961 showing a cotton gin was owned or operated over the years by the Cushing Cotton Co., Jones Cotton Co, and J.H. Bellis Cotton Co.)[13] The cotton gin was located alongside the Santa Fe railroad and the ditch that runs along the railroad through the Site. Based on a review of the spatial extent of arsenic contamination, arsenic in two of the remediated areas in SAOC-1 and the two remediated areas in SAOC-2 was likely transported from the Cushing/Jones/Bellis cotton gin onto the Site by way of the drainage ditch east of the Santa Fe railroad shown on Figure 2.[14]

Arsenic was commonly used as an herbicide, pesticide and insecticide until the 1940s when it began being replaced with safer, more effective synthetic chemicals. In the 1940s, mechanical harvesting of cotton began being adopted along with defoliation or desiccation, which was applied along with mechanical harvesting to remove dry or unneeded leaves from the cotton plant. (Wakelyn et al. in Cotton Harvest Management 2001, 276). Arsenic acid was a commonly used cotton desiccant. (NAPCA 1969, 21). Because of the use of arsenic-based chemicals as pesticides, insecticides, and desiccants, cotton gins represent a source of arsenic pollution. (ATSDR 2009, 26 and NAPCA 1969, 23) "In addition to the operation of the cotton gin, the burning of trash from a cotton gin is also a source of arsenic pollution." (NAPCA 1969, 23). The use of arsenic in cotton

[13] The Sanborn Maps show only a portion of larger cotton seed oil operations that were located south of the Site and extended to the area shown adjacent to the southeast quadrant of the Site. According to an Oklahoma historic preservation survey, the Commonwealth Cottonseed Oil Company was founded in 1906 by John Hamilton (J.H.) Bellis. (OHPS 1985, 18-19) A cotton seed oil complex was built on sixty acres of land at the intersection of Pucket Ave and W Cherry St in Cushing, Oklahoma near the Santa Fe railroad tracks. (OHPS 1985, 18) This property is south of W Moses street adjacent to the Site. The Commonwealth Cottonseed Oil complex consisted of a number of buildings and employed and housed several hundred laborers. (OHPS 1985, 18) The oil produced at the complex was shipped to several factories across the United States as a replacement for lard in food products. (OHPS 1985, 18).

[14] Similarly, cotton gin or cotton seed oil operations to the south of the Site would have been sources of arsenic transported by the drainage ditch west of the Santa Fe railroad and remediated. Those operations, including those of the Commonwealth Cotton Oil Co and the Peoples Compress Co., are shown on additional Sanborn Maps. (See, Exhibits 2 and 3, for example, Sanborn Maps for 1917 and 1938 in EDR Inquiry 4455831.2, January 4, 2016 with maps spanning the period 1903 – 1961.)

growing and ginning has led to the documented contamination of groundwater as well as ecological damage in Texas. (Cohen 1989; Scanlon et al. 2005, 2; NAPCA 1969, 23).

(Railroad Tracks)

Railroad tracks are an additional potential source of arsenic contamination. The presence of arsenic contamination in SAOC-1 underneath and on the western side of the railroad track, an area where contamination from the cotton gin is unlikely to have been transported by way of the drainage ditch, is likely linked to the railroad track. Railroads are known sources of arsenic contamination:

> "The most commonly reported contamination along rail lines includes metals, pesticides (such as lead arsenate), and constituents of oil or fuel (petroleum products). These chemicals have been associated with normal railroad operations and are likely to be found anywhere along the line." (Joint Expert Witness Exh 110, 2 [Massachusetts Department of Environmental Protection (DEP) Best Management Practices (BMPs) for Controlling Exposure to Soil during the Development of Rail Trails *circa* 2003])

The Massachusetts DEP BMPs further state that it is not "…uncommon to find arsenic (up to ten times natural background levels present in the soil along a right-of-way…" (Joint Expert Witness Exh 110, 2). The document attributes this arsenic contamination to, among other things, arsenic herbicide use and arsenic-laced slag that would be used as fill for railroad beds. The majority of areas that were remediated for arsenic contamination are on or near the railroad tracks and the ditches running alongside the railroad. The spatial location of the arsenic contamination suggests that the railroad tracks represent a second source of arsenic contamination at the Site. (Figure 2)

(Arsenic in Leaked Petroleum)

The only arsenic contaminated areas remediated under the UAO that were likely not impacted by the cotton gin or railroad tracks are the two areas in SAOC-4, one area in SAOC-1 and one area in SAOC-2. Mr. Baugher stated that he was "unaware of a source of arsenic associated with the refining of the crude oil at the Site which could explain the elevated arsenic levels measured in soil in a few locations in the processing and tankage area." Mr. Baugher then, however, qualified his statement noting that "the light, sweet crude that was processed at the refinery contained very little arsenic" and that "the arsenic in the crude tends to concentrate in the residuum and petroleum coke." (Baugher 2015 Opinion 5, ¶51). Although the levels of arsenic

in most or all of the crude would have been low, it is possible that the refining process and ancillary oil storage could have accounted for arsenic levels excavated in SAOC-4, which levels align with the location of an old still adjacent to a crude distillation column (see Sanborn 1938; 1942 Refinery Map [Baugher Figure 1 or Fact Witness Joint Exh 4]; and Baugher Figure 13) and with three old aboveground storage tanks (ASTs) storing petroleum (Tanks 36, 65 and 66) adjacent to the coker pond (see Baugher Figures 1 and 18; Reed Shaw 1976 [Joint Fact Witness Exh 1]).[15] In addition, leaks associated with a large AST (Tank 27) storing crude in the southwestern portion of SAOC-1 and a large AST (Tank 96) storing crude northeastern portion of SAOC-2 may have been sources of arsenic.[16] In the balance, however, even if the above-listed tanks were sources of arsenic, the excavated soils containing arsenic were likely impacted by leaked or spilled petroleum, which is exempt from CERCLA under the Petroleum Exclusion.

Faulty Aerial Photographic Analysis

I do not disagree with Baugher's opinion on EPA's reliance on photographic analysis that was faulty. I have nothing further to add to Baugher's opinions with respect to photographic analysis.

[15] Tank 36 was a 55,000 barrel capacity wooden-structure AST that stored No. 6 Fuel Oil sold prior to 1969 and used as a feedstock for the coker unit after 1969. (Fuqua Aff. ¶62). Tanks 65 and 66 stored No. 6 Fuel Oil as well. (Wright Aff. ¶¶ 148 and 154; Reed Shaw 1976 [Joint Fact Witness Exh 1]; see also SPCC 1974 providing tank volumes and contents (EPAFOIA0012738-50) cited as Footnote 10 in Baugher 2015).

[16] Tank 96 stored crude oil from Mid-Continent. (Fuqua Aff. ¶¶44 and 46). Tank 27 also stored raw oil. (Reed Shaw 1976 [Joint Fact Witness Exh 1]). As stated in Baugher's Opinion 12, a pipeline supplying Tank 96 was also a source of leaked crude oil.

FURTHER AFFIANT SAYETH NOT.

B. Tod Delaney

Subscribed and sworn to before me
this 19 day of January, 2016.

Notary Public

MARGARET CULLEN
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Jan. 31, 2017

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