In the United States Court of Federal Claims

Consl. Ct. No. 06-141 C
Filed: January 6, 2017*

SHELL OIL COMPANY, ATLANTIC RICHFIELD COMPANY, TEXACO INC., and UNION OIL COMPANY OF CALIFORNIA, Plaintiffs, v. THE UNITED STATES, Defendant.	Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 *et seq.*; Damages Caused By Breach Of Contract; Federal Rules of Evidence ("FRE") 702 (Experts); Remand.

Michael William Kirk, Cooper & Kirk, PLLC, Washington, D. C., Counsel for Plaintiffs.

Stephen Carl Tosini, United States Department of Justice, Civil Division, Washington, D.C., Counsel for the Government.

MEMORANDUM OPINION AND FINAL ORDER ON REMAND REGARDING BREACH OF CONTRACT DAMAGES

BRADEN, *Judge*.

This case was filed almost a decade ago, after the United States ("the Government") reneged on contractual promises made during World War II to American oil companies that voluntarily agreed to "work night and day," without regard to shareholder obligations, to increase the production of military aviation gas. In 2014, the United States Court of Appeals for the Federal Circuit held the Government was liable for a breach of contract, but instructed this court to ascertain whether that breach caused damages and, if so, the amount. After affording the parties additional discovery and an evidentiary hearing, the court has determined that the above captioned oil companies collectively are entitled to $99,590,847.32, including $30,991,111.02 in interest which the U.S. taxpayers could have avoided paying, if the Government had lived up to its obligations, instead of wasting years in litigation.

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* On December 30, 2016, the court forwarded a sealed copy of this Memorandum Opinion And Final Order On Remand Regarding Breach Of Contract Damages to the parties to note any citation or editorial errors requiring correction. On January 4, 2017, the above captioned oil companies submitted proposed editorial changes. The court has incorporated those changes and corrected or clarified certain portions herein. The Government did not submit any changes.

To facilitate review of this Memorandum Opinion and Final Order On Remand Regarding Breach Of Contract Damages, the court has provided the following outline:

COURT EXHIBIT C

Plaintiffs' Damages Exhibit 1
Plaintiffs' Damages Exhibit 2
Plaintiffs' Damages Exhibit 3
Plaintiffs' Damages Exhibit 4
Plaintiffs' Damages Exhibit 5

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I. THE CRITICAL ROLE ASSUMED BY THE OIL COMPANIES DURING WORLD WAR II TO INCREASE PRODUCTION OF MILITARY AVIATION GASOLINE AND RELATED ACID WASTE DISPOSAL ISSUES (1940–1946).[1]

In August 1940, the Reconstruction Finance Corporation ("RFC") established the Defense Supplies Corporation ("DSC") to buy, sell, and produce 100 octane military aviation gasoline ("avgas") and make loans to private companies to construct avgas production facilities. DX 1054 (Dr. Brigham) at 18, 44. On August 16, 1940, the DSC was authorized to spend $50 million to purchase avgas for resale to the United States Army and Navy. PX 1298 (9/27/40 letter from RFC to Secretary of Navy).[2]

On March 11, 1941, the Lend-Lease Act was enacted to provide military supplies and equipment to Great Britain and other nations, at war with Germany, as well as to the Republic of

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[1] The historical background of this protracted litigation most recently was discussed in: *Shell Oil Co. v. United States*, 751 F.3d 1282, 1285–88 (Fed. Cir. 2014) and in new evidence adduced at an evidentiary hearing on breach of contract damages that took place on February 16, 17, and 19, 2016, in Washington, D.C. (TR 1-642), during which Plaintiffs' Exhibits (PX 1–1308) and the Government's Exhibits (DX 1–1056) were introduced. The court has admitted all of these exhibits, except for certain portions of PX 17, and the entirety of PX 612 and PX 613. Court Exhibit A (The Record on Remand) at 32; *see also* Court Exhibit B (Evidentiary Rulings Regarding Admissibility Of Exhibits And Written Direct Testimony).

At that February 2016 evidentiary hearing, the Government proffered two historical experts to supplement the record that the appellate court considered in 2014. Dr. Jay L. Brigham holds a Ph.D. in United States history from the University of California, Riverside and an M.A. degree in United States history from the University of Maryland, College Park DX 1054 (Dr. Brigham) at 1. His dissertation concerned the electrification of the United States in the early twentieth century. DX 1054 (Dr. Brigham) at 1. His M.A. thesis focused on American Isolationism in the years preceding World War II. DX 1054 (Dr. Brigham) at 1. Since 1997, he has worked at a public history and public policy firm known as Morgan, Angel & Associates. DX 1054 at 1. Dr. Brigham was proffered by the Government as an expert on twentieth-century United States history, focusing particularly on economics and World War II. TR at 280.

Dr. Rochelle Bookspan holds a B.A. degree in History from Ohio State University; a M.A. degree in American History from the University of Arizona; a M.A. degree in City Planning from the University of Pennsylvania; and a Ph.D. in History from the University of California, Santa Barbara. DX 1055 (Dr. Bookspan) at 2. She is as an independent consulting historian and, in the past, has operated the consulting company of PHR Environmental Consultants, Inc. DX 1055 (Dr. Bookspan) at 3. Dr. Bookspan was proffered by the Government as an expert in the "history of the petrochemical industry and its practices" before and during World War II. TR at 367.

The court has determined that Dr. Brigham and Dr. Bookspan are experts in their respective fields and qualified to testify as such. *See* FRE 702.

[2] This fact conflicts with the Government's expert testimony that the DSC was not authorized to purchase avgas until at least January 1, 1943. DX 1054 (Dr. Brigham) at 46.

China, at war with Japan. *See* An Act To Promote The Defense Of The United States, Pub L. No. 77-11, ch. 11, § 3, 55 Stat. 31, 31 (1941) (authorizing the Government to provide military supplies and equipment to "any country whose defense the President deems vital to defense of the United States"); *see also* H.R. Rept. No. 77-18, pt. 1, at 6–7 (1941) (same); H.R. Rept. No. 78-188, pt. 1, at 3–4 (1943) (reporting two years after the enactment of the Lend-Lease Act that the Government provided approximately $8.9 billion of military aid to 43 countries, including Great Britain, the Republic of China, and the Soviet Union).

In July 1941, the Office of the Petroleum Coordinator ("OPC") sent telegrams to refining companies to ascertain their interest in and ability to increase the production of avgas. DX 1054 (Dr. Brigham) at 19. Among those that responded were four refineries in Southern California: the Shell Oil Company ("Shell"); Atlantic Richfield Company ("Richfield"); the Texas Company (a predecessor to Texaco, Inc.) ("Texaco"); and Union Oil Company of California ("Union"), collectively referred to in this opinion as "the Oil Companies". DX 1054 (Dr. Brigham) at 19.

In November 1941, the RFC, the Army, the Navy, and the OPC delegated authority to the DSC to purchase military avgas to be resold to the Army and Navy; the price, however, would be set by the OPC. DX 1054 at 45 (Dr. Brigham). Extensive negotiations about the price of avgas ensued. DX 1054 (Dr. Brigham) at 20–39.

On December 8, 1941, the United States declared war on Japan. On December 11, 1941, the United States declared war on Germany.

On January 6, 1942, the DSC was authorized to make advance payments to several oil refineries to purchase 100-octane aviation gasoline. PX 1308 (1/6/42 letter from Federal Loan Agency to the DSC).[3] In January 1942, President Roosevelt created the War Production Board ("WPB"), the government agency responsible for allocating materials to all domestic industries involved in war production. DX 1054 (Dr. Brigham) at 41.

[3] The fact that the DSC was authorized to make payments to the Oil Companies for avgas on January 6, 1942 also contradicts the Government's expert testimony that the DSC was not authorized to purchase avgas until at least January 1, 1943. DX 1054 (Dr. Brigham) at 46.

Beginning on January 17, 1942, the DSC entered into contracts with Shell,[4] Richfield,[5] Texaco,[6] and Union[7] requiring each oil refinery "to work night and day" to expand their facilities to increase the production of avgas required in the war effort ("the Avgas Contracts").

Each of the Avgas Contracts included a Taxes Clause that provided:

> *Buyer shall pay . . . any* new or additional taxes, fees, or *charges*, other than income, excess profits, or corporate franchise taxes, *which Seller may be required by any* municipal, state, or *federal law in the United States* or any foreign country *to* collect or *pay by reason of the production, manufacture, sale or delivery of the commodities delivered hereunder*.

PX 3 at JA016 (emphasis added).[8]

In June 1942, a former Shell employee, Eli McColl, who had been employed by the Oil Companies for several years to dispose of refinery waste as an independent contractor, was informed by Riverside County officials that no additional disposal activities could be undertaken, without their approval. DX 1054 (Dr. Brigham) at 17. In response, Eli McColl relocated disposal activities to a new area in Orange County to accommodate the increase in oil refinery waste anticipated by the production of increased avgas required by the Avgas Contracts. DX 1054 (Dr. Brigham) at 17. On June 8, 1942, Eli McColl received a permit from the City of Fullerton, California, to use this new area for the disposal of oil refinery waste ("the McColl Site"). DX 1054 (Dr. Brigham) at 17. On June 23, 1942, Eli McColl signed a contract with Shell to dispose of at least 50,000 barrels of "acid sludge, alkylate acid, and [pressure-distillate] acid sludge" at the

[4] On April 10, 1942, Shell entered into a contract to sell avgas to the DSC. PX 3. On May 1, 1943, Shell entered into a second contract to sell avgas to the DSC. PX 7.

[5] On February 3, 1942, Richfield entered into a contract to sell avgas to the DSC. PX 2. On February 20, 1943, Richfield entered into a second contract to sell avgas to the DSC. PX 10. In addition, DSC agreed to advance Richfield a portion of the cost to build a "full size fluid catalytic cracker." DX 1054 (Dr. Brigham) at 26–27.

[6] On January 17, 1942, Texaco entered into a contract to sell avgas to the DSC. PX 1. On February 8, 1943, Texaco entered into a second contract to sell avgas to the DSC. PX 8.

[7] On December 31, 1942, Union entered into a contract with DSC to sell avgas. PX 5. On May 1, 1943, Union Oil entered into a second contract to sell avgas to the DSC. PX 6.

[8] Although there were minor differences in the text of the individual contracts with the Oil Companies, the United States Court of Appeals for the Federal Circuit has determined they were "insignificant." *Shell Oil*, 751 F.3d at 1290–91.

McColl Site until June 30, 1943. DX 19 (Shell/McColl Contract) at 1. Performance was to commence on July 1, 1942. PX 1130 (July 7, 1942 letter from Shell Legal Department).[9]

In December 1942, the OPC was renamed the Petroleum Administrator For War (the "PAW"). DX 1054 (Dr. Brigham) at 18. The PAW was responsible for setting the price at which avgas was sold to the DSC under the Avgas Contracts. DX 1054 (Dr. Brigham) at 20.

On December 19, 1942, the Army, Navy, DSC, and PAW agreed that the War and Navy Departments would advance the DSC $100 million to purchase 100-octane aviation gasoline, as well as to pay for certain oil refining company expenses, including the cost of building new facilities to refine avgas; this agreement became effective on January 1, 1943. DX 1054 (Dr. Brigham) at 46–47.

As the following table demonstrates, the Oil Companies significantly increased avgas production during the war:

Table 1.1 Production of High Octane Aviation Gasoline (Barrels)

Refinery	Yearly Total				Total for WWII
	1942	1943	1944	1945	
Richfield	1,044,000	2,597,000	4,516,000	4,029,000	12,186,000
Shell	1,405,000	2,940,000	6,107,000	4,878,000	15,330,000
Texas	741,000	983,000	2,138,000	2,874,000	6,736,000
Union	396,000	585,000	2,317,000	2,596,000	5,894,000

Source: WMR-2-0635 through WMR-2-0637.

PX 901 (Mr. Kipp Ex.).

World War II ended on September 2, 1945, with the formal surrender of Japan.

On April 29, 1946, Eli McColl received notice from Shell that the June 23, 1942 disposal contract would be terminated on June 30, 1946. PX 1191 (5/2/46 letter from Eli McColl to Shell acknowledging receipt of April 29, 1946 termination letter) at 1. On September 6, 1946, the McColl Site closed and Eli McColl's waste disposal permit expired. PX 701 (5/9/51 letter from Eli McColl to City of Fullerton reporting that his disposal permit expired on September 6, 1946) at 11.

II. THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT LITIGATION (1991–2005).

In 1991, forty-five years after the McColl Site was closed, the Government and the State of California filed an action in the United States District Court for the Central District of California

[9] In late 1943, Union Oil and Richfield joined Shell in disposing acid waste at the McColl Site. TR (Dr. Bookspan) at 377, 382. Texaco, however, did not dispose of acid waste at the McColl Site until late 1944. *See Shell Oil*, 751 F.3d at 1288.

("District Court") against the Oil Companies for violating the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9604–75 ("CERCLA"), seeking to recover "substantial response costs [incurred in the] attempts to clean up the McColl Site." *See United States v. Shell Oil Co.*, 13 F. Supp. 2d 1018, 1019–20 (C.D. Cal. 1998). This case concerned three types of waste: acid sludge from the production of benzol; acid sludge from the production of other petroleum products (including avgas); and "spent alkylation acid." *Id.* at 1023–24.

On August 11, 1998, the District Court issued a Final Opinion, determining that:

> (1) 100 percent of the benzol-related sludge at the McColl Site is attributable to the [DSC] (2) 100 percent of the non-benzol sludge at the McColl Site is attributable to the avgas program and (3) the [DSC] is wholly liable for all sludge at the McColl Site that is attributable to the avgas program. . . . [Therefore,] 100 percent allocation of liability to the [DSC] and zero percent allocation of liability to the Oil Companies.

Id. at 1030.

On February 11, 2002, the United States Court of Appeals for the Ninth Circuit reversed the District Court's determination that the DSC was an "arranger" for the non-benzol wastes. *See United States v. Shell Oil Co.*, 281 F.3d 812, 815 (9th Cir. 2002). On March 28, 2002, the Oil Companies and the Government filed petitions for rehearing.

On June 28, 2002, the United States Court of Appeals for the Ninth Circuit denied both petitions, withdrew the February 11, 2002 Opinion, and held that

> We reverse the holding of the district court that the [DSC] is liable for the non-benzol waste cleanup costs as an arranger under § 9607(a)(3). Because the [DSC] is not liable as an arranger, the question of allocation of liability for the non-benzol waste between the [DSC] and the Oil Companies under § 9613(f)(1) is moot. . . . We affirm the holding of the district court that 100% of the cleanup costs for the benzol waste should be allocated to the [DSC].

United States v. Shell Oil Co., 294 F.3d 1045, 1048–49 (9th Cir. 2002).[10]

On August 12, 2003, the Oil Companies and the Government stipulated that the Government's share of responsibility for response costs under CERCLA for the benzol sludge deposited at the McColl Site was 6.25%. Joint Request For Status Conference, *Shell Oil Co.*, No. CV-91-00589 BRO (C.D. Cal. Aug. 12, 2003), ECF No. 507.

[10] On January 13, 2003, the United States Supreme Court denied the Oil Companies' joint petition for a writ of certiorari. *See Shell Oil Co. v. United States*, 537 U.S. 1147 (2003).

On July 16, 2004 the Government filed a Motion to Dismiss the Oil Companies' breach of contract counterclaims, arguing that the District Court lacked subject matter jurisdiction. On December 14, 2004, the District Court granted the Government's Motion To Dismiss the Oil Companies' breach of contract counterclaims. *See* Min. Order, *United States v. Shell Oil Co.*, No. CV-91-0589 BRO (C.D. Cal. Dec. 14, 2004), ECF No. 525.

On June 30, 2005 the District Court transferred the Oil Companies' breach of contract counterclaims to the United States Court of Federal Claims. *See* Transfer Order, *Shell Oil Co. v. United States*, No. 05-704 (Fed. Cl. June 30, 2005).[11]

III. THE BREACH OF CONTRACT LITIGATION (2005 TO THE PRESENT).

A. Initial Proceedings Before The United States Court Of Federal Claims (2005–2009).

On July 28, 2005, the Oil Companies filed an Amended Complaint in the United States Court of Federal Claims. On September 22, 2005, however, the Oil Companies voluntarily dismissed the July 28, 2005 Amended Complaint. *See* Notice, *Shell Oil Co. v. United States*, No. 05-704 (Fed. Cl. Sept. 22, 2005). On November 23, 2005, the Oil Companies filed a claim with the General Services Administration ("GSA"), seeking $66,283,698.40 in response costs under Section 113(a) of the Contract Settlement Act of 1944. On February 15, 2006, the GSA informed the Oil Companies that they had "no basis for recovery."

On February 24, 2006, the Oil Companies filed a Complaint in the United States Court of Federal Claims alleging that the Avgas Contracts with the DSC required reimbursement for 100% of the response costs, subject to the CERCLA litigation. ECF No. 1 ¶¶ 23–27. This case was assigned to the Honorable Loren Smith.

On March 31, 2009, the United States Court of Federal Claims granted summary judgment for the Oil Companies and awarded $84,536,763.65 to the Oil Companies, *i.e.*, 100% of the CERCLA response costs plus statutory interest through June 30, 2008. *See Shell v. United States*, 86 Fed. Cl. 470, 475 (2009). Therein, the parties were ordered to calculate any remaining costs

[11] As a result of the United States Court of Appeals for the Ninth Circuit's affirmance of the District Court's CERCLA determination regarding the benzol waste, the Government was held liable to the State of California for response costs incurred at the McColl Site because of the benzol waste. *See Shell Co.*, 294 F.3d at 1062 ("We affirm the holding of the district court that 100% of the cleanup costs for the benzol waste should be allocated to the United States."). On July, 10, 2009, the State of California resolved its CERCLA cost recovery claim against the Government for the period of October 1990 through June 2008. *See* Partial Consent Decree, *Shell Oil Co. v. United States*, CV-91-00589 BRO (C.D. Cal. July 10, 2009), ECF No. 619 ¶ 4(a). On March 16, 2012, the State of California also resolved an additional CERCLA cost recovery claim against the Government for the period of July 2008 through June 2011. *See* Partial Consent Decree, *Shell Oil Co.*, CV-91-00589 BRO (C.D. Cal. Mar. 16, 2012), ECF No. 622 ¶ 4(a).

On December 6, 2013, the parties filed a Joint Status Report regarding the remaining claims in the CERCLA litigation. *Shell Oil Co.*, CV-91-00589 BRO (C.D. Cal. Dec. 6, 2013), ECF No. 630.

from July 1, 2008 to the present and provide a final proposed order to the court. *Id.* On October 30, 2009, a final judgment was entered granting $87,344,345.70 to the Oil Companies. ECF No. 53. On December 10, 2009, the Government filed a Rule of the United States Court of Federal Claims ("RCFC") 60(b) Motion For Relief From Judgment And Recusal to vacate the court's October 30, 2009 judgment, because Judge Smith's wife owned stock in Chevron Corporation, the parent company of Texaco and Union. ECF No. 61.

B. The First Appeal To The United States Court Of Appeals For The Federal Circuit (2009–2010).

On December 28, 2009, the Government filed an appeal to the United States Court of Appeals for the Federal Circuit. ECF No. 62. On May 19, 2010, the case was remanded, so that Judge Smith could consider the Government's December 10, 2009 RCFC 60(b) Motion. ECF No. 73.

C. The First Remand To The United States Court Of Federal Claims (2010).

On May 27, 2010, Judge Smith issued an Order severing Texaco and Union from the case and vacating the court's March 31, 2009 Opinion and October 30, 2009 final judgment. ECF No. 74. On August 4, 2010, the court entered judgment granting the remaining Oil Companies $68,849,505.88. ECF No. 80.

D. The Second Appeal To The United States Court Of Appeals For The Federal Circuit (2010–2012)

On September 17, 2010, the Government again filed an appeal to the United States Court of Appeals for the Federal Circuit. ECF No. 82. On March 7, 2012, Judge Smith's August 4, 2010 judgment was vacated and remanded with instructions that the case be reassigned to a different judge. *See Shell Oil Co. v. United States*, 672 F.3d 1283, 1294 (Fed. Cir. 2012).

E. The Second Remand To The United States Court Of Federal Claims (2012–2013).

On remand, the Honorable Thomas C. Wheeler was assigned this case. On January 14, 2013, the court granted summary judgment in favor of the Government, determining that CERCLA response costs were not subject to the Taxes Clause of the Avgas Contracts. *See Shell Oil Co. v. United States*, 108 Fed. Cl. 422, 425 (2013) ("The 'Taxes' [C]lause in [the Oil Companies'] contracts does not trump the California courts' CERCLA result.")

F. The Third Appeal To The United States Court Of Appeals For The Federal Circuit (2014).

On April 28, 2014, the United States Court of Appeals for the Federal Circuit reversed the January 14, 2013 summary judgment decision, holding that the Taxes Clause required the Government to reimburse the Oil Companies for "CERCLA costs arising from avgas production."

Shell Oil, 751 F.3d at 1296. This case again was remanded to the United States Court of Federal Claims,

> [t]o determine how much acid waste at the McColl Site was "by reason of" the avgas contracts.

Id. at 1303.

G. The Third Remand To The United States Court Of Federal Claims (2014 To The Present).

On September 11, 2014, the undersigned judge was assigned to adjudicate this case on remand. ECF No. 118. On November 12, 2014, the court entered a Scheduling Order, setting the close of additional discovery requested by the parties for August 15, 2015. ECF No. 121.

On March 12, 2015, the court convened a telephone status conference to discuss the Government's new request for discovery of the Oil Companies' environmental liability insurance. ECF No. 128. On March 23, 2015, the court entered a Scheduling Order, setting deadlines for the Oil Companies to file a Motion For A Protective Order and for the Government to file a Response. ECF No. 123.

On April 10, 2015, the Oil Companies filed a Motion For A Protective Order, Motion For Partial Summary Judgment, and A Memorandum In Support seeking to prevent discovery of the Oil Companies' insurance policies and any coverage settlements. ECF No 129, 130.

On May 15, 2015, the Government filed an Opposition To [The Oil Companies]' Motion For Protective Order And For Partial Summary Judgment. ECF No. 135. On that same day, the Government also filed a Cross-Motion For Partial Summary Judgment against Shell and Richfield, arguing that they recovered pending cleanup remediation costs from their insurers. ECF No. 135.

On August 27, 2015, the court scheduled an evidentiary hearing on the remand for the week of February 17, 2016, at the United States Court of Federal Claims in Washington, D.C. ECF No. 151.

On September 3, 2015, the Government filed a Motion For Leave To Amend the February 25, 2008 Answer to assert new affirmative defenses and counterclaims, based upon the Special Plea in Fraud, 28 U.S.C. § 2514, and the antifraud provision of the Contract Settlement Act of 1944, 41 U.S.C § 119. ECF No. 153.

On October 30, 2015, the court issued a Memorandum Opinion And Order granting the Oil Companies' April 10, 2015 Motion For Partial Summary Judgment, determining that Government's insurance offset was an affirmative defense that had to be asserted no later than February 25, 2008, when the Government filed an Answer. *See Shell Oil Co. v. United States*, 123 Fed. Cl. 707, 720 (2015). In addition, the court determined that the Government was now barred from engaging in discovery about the Oil Companies' insurance policies. *Id.* at 727–28. Consequently, the court denied the Oil Companies' April 10, 2015 Motion For A Protective Order, as moot. *Id*. The court also denied the Government's May 15, 2015 Cross-Motion For Summary Judgment and denied the Government's September 3, 2015 Motion, because allowing the

Government to amend the February 25, 2008 Answer to assert fraud counterclaims many years after the onset of the litigation would "substantially change[] the theory on which the case has been proceeding." *Id.* at 727 (quoting *Cencast Services, L.P. v. United States*, 729 F.3d 1352, 1364 (Fed. Cir. 2013)).

On November 17, 2015, the Oil Companies filed a Motion *In Limine* To Exclude Evidence Relating To Insurance Proceeds And The Testimony Of The Government's Insurance Expert, because the Government insisted it still intended to call an expert witness to testify about the insurance settlements and make a proffer regarding Richfield and Shell's "recovery of amounts subject to the claim at issue here." ECF No. 164 at 2. On December 4, 2015, the Government filed a Response. ECF No. 165. On December 11, 2015, the Oil Companies submitted a Reply. ECF No. 167. On December 14, 2015, the court granted the Oil Companies' Motion *In Limine.* ECF No. 168. On December 16, 2015, the court issued an additional scheduling order, setting the close of discovery for January 26, 2016. ECF No. 170.

On January 8, 2016, the Oil Companies filed a Witness List and Exhibit List. ECF No. 172–73. On January 11, 2016, the Oil Companies filed a Motion To Compel Responses To The Oil Companies' December 24, 2015 Final Set Of Discovery Requests. ECF No. 174. On January 13, 2016, the court convened a conference to resolve the Oil Companies' January 11, 2016 Motion To Compel and issued an Order denying that motion, because the response time for the documents requested by the Oil Companies' December 24, 2015 Final Set Of Discovery Requests exceeded the January 26, 2016 date for close of discovery. ECF No. 175.

On January 29, 2016, the Government filed a Memorandum Of Contentions Of Fact And Law, an Exhibit List, and a Witness List. ECF Nos. 176–78. On February 5, 2016, the Oil Companies filed Notice Of Amended Exhibit List to include six additional trial exhibits (ECF No. 179), and filed Notices Of The Written Direct Testimony Of Edmond F. Bourke and The Written Direct Testimony Of Gregory G. Kipp, PE. ECF Nos. 179–81.

On February 10, 2016, the Government filed a Notice Of Objections To The February 5, 2016 Written Testimony of Oil Companies' experts, Mr. Kipp and Mr. Bourke, arguing that, it was improper for them to render opinions based on the Stipulations and Proposed Findings of Fact from earlier stages in the litigation and to discuss the written report of a Government "may-call" witness. ECF No. 183. On February 11, 2016, the Oil Companies filed Notice Of Amended Exhibit List to correct a discrepancy in the January 8, 2016 Exhibit List. ECF No. 184. That same day, the Government filed Notices Of The Direct Testimony Of Dr. Jay Brigham, Ph.D., the Direct Testimony Of Dr. Allen Medine, Ph.D., and the Direct Testimony Of Dr. James Kittrell, Ph.D. ECF Nos. 185–87. On February 12, 2016, the Government also filed Notice Of Direct Testimony Of Dr. Shelley Bookspan, Ph.D. ECF No. 188. On February 15, 2016, the Oil Companies filed a Response to the Government's February 10, 2016 Objections. ECF No. 189.

On February 16–19, 2016, the court convened an evidentiary proceeding on causation and breach of contract damages in Washington, D.C. TR 1–642.[12]

On February 26, 2016, the court convened a conference to discuss the post hearing briefing schedule that was entered on March 1, 2016. ECF No. 194.

On March 23, 2016, the Government filed Objections To The Oil Companies' February 17, 2016 Exhibit List. ECF No. 201.

On April 8, 2016, the Oil Companies filed Proposed Findings Of Fact And Conclusions Of Law, and a Post Trial Damages Brief ("Pl. DBr."). ECF No. 202. On April 15, 2016, Kenneth J. Sheehan, Esq.. filed a Notice Of Appearance on behalf of the American Fuel & Petrochemical Manufacturers ("AFPM"). ECF No. 203. On that same day, AFPM filed a Motion For Leave To File Amicus Brief ("Amicus Br."), that the court granted on April 18, 2016. ECF No. 204.

On April 22, 2016, the Oil Companies filed a Response to the Government's March 23, 2016 Objection. ECF No. 207.

On May 23, 2016, the Government filed Proposed Findings Of Fact And Conclusions Of Law. ECF No. 210 ("Gov't DBr."). On May 25, 2016, the Government filed a Notice of Additional Authority citing *Northrup-Grumman Computing Systems, Inc. v. United States*, 823 F.3d 1364 (Fed. Cir. 2016), for the proposition that each of the Oil Companies had to establish the amount of damages sustained from the Government's breach of the Avgas Contracts. ECF No. 211.

On June 10, 2016, the Oil Companies filed a Reply to the Government's May 23, 2016 Post-Trial Brief. ECF No. 212 ("Pl. Reply Br."). ECF No. 212.

On October 18, 2016, the Oil Companies filed a Motion To Supplement The Record to include a complete copy of the 1993 Environmental Protection Agency ("EPA") Record of Decision ("ROD") that included all tables and figures. ECF No. 214.[13]

On November 21, 2016, the court convened closing oral arguments at the United States Court of Federal Claims. ECF No. 218 (11/21/16 TR 1–81).

On December 2, 2016, the Oil Companies filed a Supplemental Response To The Court's Questions During Oral Argument ("Pl. Supp."). ECF No. 219. On December 9, 2016, the

[12] On February 17, 2016, the Oil Companies filed a comprehensive List of Exhibits that the court admitted into evidence. ECF No. 190. On February 19, 2016, the Government filed an Amended Exhibit List to include written direct examinations of the Government's expert witnesses that the court also admitted into evidence. ECF No. 191.

[13] The text of the 1993 ROD offered by both parties as evidence, *i.e.*, PX 517 and DX 208, did not include the attached figures and tables. The court grants the Oil Companies' October 18, 2016 Motion To Supplement The Record to include the tables and figures.

Government filed a Response ("Gov't Resp. To Supp."). ECF No. 220. On December 16, 2016, the Oil Companies filed a Reply. ("Pl. Supp. Reply") ECF No. 222.

IV. DISCUSSION.

A. Jurisdiction.

The United States Court of Federal Claims has jurisdiction, pursuant to the Tucker Act, 28 U.S.C. § 1491, "to render judgment upon any claim against the United States founded either upon the Constitution, or any Act of Congress or any regulation of an executive department, or upon any express or implied contract with the United States, or for liquidated or unliquidated damages in cases not sounding in tort." 28 U.S.C. § 1491(a)(1). The Tucker Act, however, is "a jurisdictional statute; it does not create any substantive right enforceable against the United States for money damages. . . . [T]he Act merely confers jurisdiction upon [the United States Court of Federal Claims] whenever the substantive right exists." *United States v. Testan*, 424 U.S. 392, 398 (1976).

To pursue a substantive right under the Tucker Act, a plaintiff must identify and plead an independent contractual relationship, constitutional provision, federal statute, and/or executive agency regulation that provides a substantive right to money damages. *See Todd v. United States*, 386 F.3d 1091, 1094 (Fed. Cir. 2004) ("[J]urisdiction under the Tucker Act requires the litigant to identify a substantive right for money damages against the United States separate from the Tucker Act[.]"); *see also Fisher v. United States*, 402 F.3d 1167, 1172 (Fed. Cir. 2005) (*en banc*) ("The Tucker Act . . . does not create a substantive cause of action; . . . a plaintiff must identify a separate source of substantive law that creates the right to money damages. . . . [T]hat source must be 'money-mandating.'") (citations omitted). Specifically, a plaintiff must demonstrate that the source of substantive law upon which he relies "can fairly be interpreted as mandating compensation by the Federal Government." *United States v. Mitchell*, 463 U.S. 206, 216 (1983) (quoting *Testan*, 424 U.S. at 400). And, the plaintiff bears the burden of establishing jurisdiction by a preponderance of the evidence. *See Reynolds v. Army & Air Force Exch. Serv.*, 846 F.2d 746, 748 (Fed. Cir. 1988) ("[O]nce the [trial] court's subject matter jurisdiction [is] put in question . . . [the plaintiff] bears the burden of establishing subject matter jurisdiction by a preponderance of the evidence.").

The February 24, 2006 Complaint alleges that the Oil Companies entered into Avgas Contracts that were breached by the Government. Compl. ¶¶ 27, 29. As such, the court has jurisdiction to adjudicate the Oil Companies' claims.

B. Standing.

The United States Supreme Court has held that "the question of standing is whether the litigant is entitled to have the court decide the merits of the dispute or of particular issues." *Warth v. Seldin*, 422 U.S. 490, 498 (1975). Standing must be determined "as of the commencement of suit." *Lujan v. Defs. of Wildlife*, 504 U.S. 555, 570 n.5 (1992). The party invoking federal jurisdiction bears the burden of establishing standing. *Id.* at 560–61. Specifically, "a plaintiff must show [that] it has suffered an 'injury in fact' that is . . . concrete and particularized and . . . actual or imminent, not conjectural or hypothetical; . . . the injury is fairly traceable to the

challenged action of the defendant; and . . . it is likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." *Friends of the Earth, Inc. v. Laidlaw Envtl. Serv., Inc.*, 528 U.S. 167, 180–81 (2000).

The February 24, 2006 Complaint alleges that the Oil Companies suffered an "injury in fact" that is "concrete," "particularized," and "fairly traceable" to the Government's breach of the Avgas Contracts. Compl. ¶¶ 27, 29. The injury sustained by the Oil Companies can be redressed by a monetary award.

For these reasons, the court has determined that the Oil Companies have standing to seek an adjudication of the claims alleged in the February 24, 2006 Complaint.

C. Evidence Adduced At The Remand Proceeding.[14]

The specific instructions of the United States Court of Appeals for the Federal Circuit to the United States Court of Federal Claims, on the *third* remand, was

> [t]o determine how much acid waste at the McColl Site was 'by reason of' the [A]vgas Contracts.

Shell Oil, 751 F.3d at 1303.

1. Crude Oil Was Processed Into Aviation Gasoline And Other Petroleum By-Products, Both Of Which Resulted In "Acid Waste."

The first step in the remand analysis requires understanding that crude oil was processed into avgas and other petroleum by-products, both of which resulted in "acid waste."[15]

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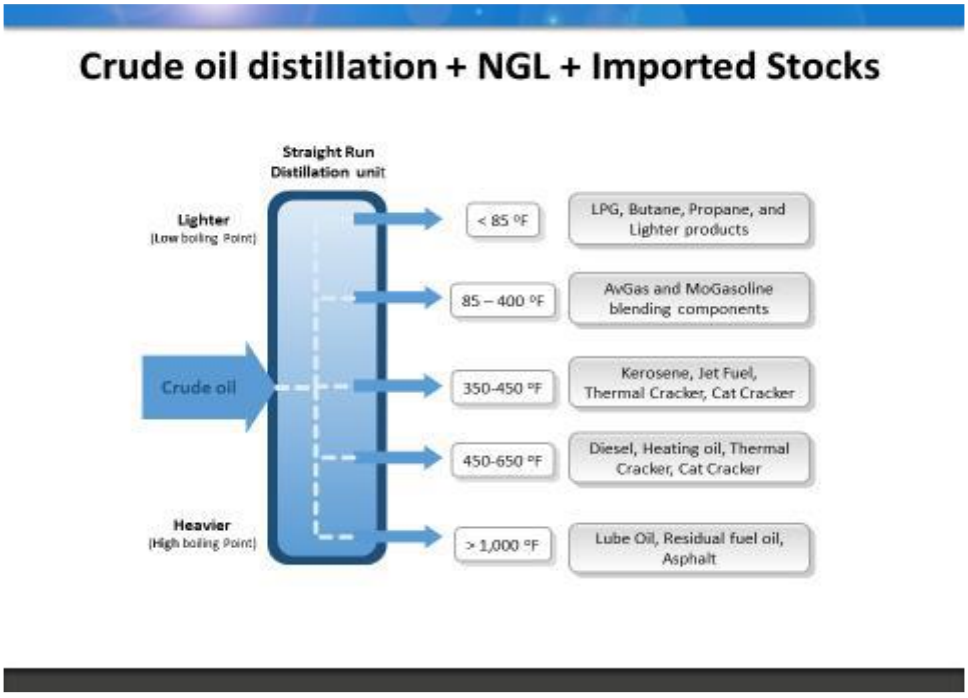
[14] Court Exhibit A, attached to this Memorandum Opinion and Final Order, provides a comprehensive list of all witness testimony and documents admitted into evidence in the remand proceeding. Court Exhibit B provides Evidentiary Rulings Regarding Admissibility of Exhibits and Written Direct Testimony.

[15] Both parties proffered expert petroleum engineers to testify about these issues to supplement the record that the appellate court considered in 2014.

The Oil Companies' expert petroleum engineer was Gregory G. Kipp. Mr. Kipp is a Professional Engineer and General Manager of Geomega, Inc., an environmental consulting firm. PX 17 (Mr. Kipp) at 1. In 1996, Mr. Kipp received a B.S. in Geological Engineering from the University of Minnesota and, in 2009, a M.S. in Geological Engineering from the South Dakota School of Mines. PX 17 (Mr. Kipp) at A014. He also had over 20 years of experience specializing in environmental geochemistry, hydrology, and contaminant transport. PX 17 (Mr. Kipp) at 1. Mr. Kipp's work included "evaluating the sources and causes of contaminant releases," requiring an "intimate knowledge of the processes that led to the releases and how those processes have changed[.]" PX 17 (Mr. Kipp) at 1. Mr. Kipp was proffered as an expert in: geology; geochemistry; environmental chemistry; industrial process chemistry; engineering; and World

When crude oil arrives at a refinery it is sent to a distillation tower, where it is subjected to extreme heat that breaks down crude oil into constituent hydrocarbons—the heaviest of which settle near the bottom of the tower, while the lighter hydrocarbons rise to the top, according to their boiling points. PX 17 (Mr. Kipp) at 6–7; DX 1053 (Dr. Kittrell) at 17–18. As hydrocarbons rise in the distillation tower, they are cooled, condensed, and then removed from the tower. DX 1053 (Dr. Kittrell) at 18. Those that are not further processed are known as "straight run" distillates. DX 1053 (Dr. Kittrell) at 18.



DX 1053(Dr. Kittrell) at 18, Figure 1.

Hydrocarbons that reached a boiling between 100° F to 295° F were used to make avgas. DX 1053 (Dr. Kittrell) 18. But, other petroleum by-products, such as kerosene and heating oil, also could be converted into the lighter hydrocarbons and used in avgas production through a

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War II oil refinery operations. TR at 110. The Government objected to Mr. Kipp being offered as an expert in World War II oil refinery operations. TR at 116.

The Government's expert petroleum engineer was James R. Kittrell, Ph.D. Dr. Kittrell received a B.S. in Chemical Engineering from Oklahoma State University, and a M.S. and Ph.D. in Chemical Engineering from the University of Wisconsin, where he continued post-doctoral studies. DX 1053 (Dr. Kittrell) at 67. Dr. Kittrell currently is the President of KSE, Inc., a firm in the business of invention, development, and licensing of new technology, primarily for application in the petroleum, chemical, and environmental industries and holds over 50 U.S. patents. DX 1053 (Dr. Kittrell) at 67. The Government proffered Dr. James Kittrell as an expert in: chemical engineering; petroleum refinery operations; historical refinery operations from 1920 to the present; refinery waste management; and environmental remediation. TR at 497–98.

The court has determined that Mr. Kipp and Dr. Kittrell are both experts in their respective fields and qualified to testify as such. *See* FRE 702.

process known as "cracking." PX 17 (Mr. Kipp) at 8. "Cracking" was the preferred method of manufacturing avgas "base stock," one of the principal ingredients in avgas. PX 17 (Mr. Kipp) at 9; DX 1053 (Dr. Kittrell) at 38 ("100-octane aviation gasoline was a blend of components, the first of which would be an aviation base stock."). There are two types of cracking.

Thermal cracking is a heat and pressure process that was used prior to World War II. PX 17 (Mr. Kipp) at 8. Thermal cracking resulted in a petroleum by-product known as "pressure distillate." DX 1053 (Dr. Kittrell) at 18–19; PX 17 (Mr. Kipp) at 63. Pressure distillates can be further distilled into lighter hydrocarbons or fractions with a boiling point of 100° F to 295° F that can be used to produce avgas. DX 1053 (Dr. Kittrell) at 18. Fractions with a 100° F to 400° F boiling point can be used to manufacture motor gasoline. DX 1053 (Dr. Kittrell) at 18.

By 1942, a more advanced process known as "catalytic cracking" was developed that used a catalyst to cause a chemical reaction transforming heavier hydrocarbons into components of avgas. PX 17 (Mr. Kipp) at 8. Catalytic cracking allowed refineries to produce greater quantities of lighter hydrocarbons and increase avgas production. DX 1053 (Dr. Kittrell) at 21 ("The performance of the [catalytic crackers] was so superior to thermal crackers that many refineries installed [catalytic cracking] units during WWII, during the 1942-1945 time period."). This technology was an "important contributor to high octane avgas." DX 1053 (Dr. Kittrell) at 21.

Thermal and catalytic cracking, however, were not the only way to produce avgas from crude oil. Another process used 98% fresh sulfuric acid as a catalyst in a device known as an alkylation unit, that yielded alkylate—a "critical" component of avgas, generally comprising 25%–40% of avgas. PX 17 (Mr. Kipp) at 8–9; DX 1053 (Dr. Kittrell) at 39; TR (Dr. Kittrell) at 500. This process resulted in a "dramatic increase in the amount of 100 octane avgas that could be produced, without any increase in the amount of crude oil that was processed." DX 1053 (Dr. Kittrell at 39). The sulfuric acid used during the alkylation process, however, became diluted as impurities were emulsified and could not be separated from the acid, resulting in a waste product known as spent alkylation acid, that had a 89%–90% acid content. PX 17 (Mr. Kipp) at 9–10; DX 1053 (Dr. Kittrell) at 39–40. Spent alkylation acid was not suitable for further alkylation, without reprocessing, but could be reused to "acid treat" distillates to remove impurities and unwanted sulfur compounds. DX 1053 (Dr. Kittrell) at 19 ("[M]any [p]ressure [d]istillate products require[d] further [acid] treatment to improve color and odor, and to remove sulfur compounds and olefin compounds[.]"). In addition, spent alkylation acid could be used to produce other non-avgas petroleum by-products. PX 17 (Mr. Kipp) at 10–11 ("Acid treatment was also regularly used in the creation of products other than avgas."). After spent alkylation acid was used for acid treatment, the result was "acid sludge," a waste product with a 35%–65% acid content that had no further petroleum refining use, but could be used to manufacture fertilizer or burned as fuel. PX 17 (Mr. Kipp) at 10–11; DX 1053 (Dr. Kittrell) at 22–23. In the alternative, it required disposal. DX 1053 (Dr. Kittrell) at 23.

Since both of the parties' petroleum engineering experts essentially agreed on how crude oil was processed into avgas and other petroleum by-products, the court has adopted their findings.

2. Spent Alkylation Acid And Acid Sludge Are Components Of "Acid Waste" And Both Were Disposed Of At The McColl Site.

The second step in the remand analysis requires understanding that both spent alkylation acid and acid sludge are components of "acid waste" and were disposed of at the McColl Site.

a. The Opinion Of The Oil Companies' Petroleum Engineering Expert.

i. Spent Alkylation Acid Was Disposed Of At The McColl Site.

Catalytic cracking produced an avgas base that then was subjected to alkylation, using 98% sulfuric acid, but this process resulted in a component of acid waste, known as spent alkylation acid. PX 17 (Mr. Kipp) at 29. As avgas production increased, however, a proportionally higher output of spent alkylation acid resulted. PX 17 at 29–30 (Mr. Kipp). For example, in 1941, Shell generated 36,421 barrels of spent alkylation acid; in 1944, when avgas production was at its highest, Shell generated 203,147 barrels of spent alkylation acid or a 458% increase. PX 17 (Mr. Kipp) at 29.

Therefore, on June 20, 1942, the Stauffer Chemical Company ("Stauffer") applied for permission from the OPC to construct a new 200-ton-per-day spent alkylation acid reprocessing facility in Dominguez, California. PX 1129 (Stauffer letter to OPC) at 1. Stauffer explained that, because of increased avgas production, Shell would have "an excess of alkylation waste acid on January 1, 1943, and a very large excess by September 1943." PX 1129 at 1–2. Shell sent a letter in support of Stauffer's application, reporting that production of avgas under its contract with the DSC would generate spent alkylation acid of "approximately 100 tons per day," but that disposal would be "physically very difficult." PX 1132 (9/26/42 Shell letter to OPC in support of Stauffer) at 1; PX 1123 (4/28/42 Shell memo reflecting that "the volume of surplus spent alkylation acid will be so great that [disposal] will be extremely difficult") at 1.

By late 1943, Stauffer opened plants in Dominguez, California, and in Torrance, California, but the Stauffer II plant did not open until December 9, 1944.[16] PX 17 (Mr. Kipp) at 31–32. Unfortunately, the Stauffer II plant immediately had operational issues. PX 1165 (7/11/44 Stauffer Board Minutes discussing problems with Stauffer II). In addition, the General Chemical Company plant in El Segundo, California ("the El Segundo plant") increased reprocessing, but did not operate at full capacity until mid-1944. PX 1158 (1/6/44 WPB Memo reporting that the El Segundo plant would be completed on April 1, 1944). In addition, the Oil Companies' spent alkylation acid storage tanks were full by December, 1944. PX 11 at Stip. 373 ("The storage capacity for all the [Oil Companies] as of December 27, 1944, was full."); PX 1175 (Jan. 1945 WPB Report reflecting that all of the Oil Companies' storage tanks were full).

[16] Texaco also asked permission to build a reprocessing plant in 1943, but permission was denied. PX 1140 (3/23/43 WPB letter denying Texaco's request to build a reprocessing plant); PX 1144 (5/19/43 Texaco Letter to WPB concerning denial of request).

Although the Oil Companies used as much spent alkylation acid as possible to acid treat non-avgas petroleum by-products, they still were left with an "unprecedented" amount of spent alkylation acid that could not be reprocessed or stored by the existing facilities in Southern California at that time. PX 17 (Mr. Kipp) at 30–36, 84–85, 88. Therefore, without sufficient reprocessing or storage facilities, the Oil Companies turned to the McColl Site to dispose of excess spent alkylation acid. PX 17 (Mr. Kipp) at 88.

To determine the amount of spent alkylation acid that was disposed of at the McColl Site, Mr. Kipp used January and February 1945 Government survey reports,[17] containing the "Spent Alkylation Situation Forecast" for Southern California. PX 17 (Mr. Kipp) at 87 (citing PX 1175 (Jan. 1945 Skinner Report); PX 1178 (Feb. 1945 Skinner Report)). Next, Mr. Kipp estimated: (1) the daily amount of excess spent alkylation acid produced by the Oil Companies from November 1944 to April 10, 1945 (PX 906–Mr. Kipp Ex.);[18] (2) the capacity in Southern California to reprocess spent alkylation acid during that same period (PX 908–Mr. Kipp Ex.);[19] and (3) the Oil Companies' storage capacities for spent alkylation acid.[20]

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[17] These reports were prepared with the assistance of a WPB employee, Paul Skinner, and are known as the "Skinner Reports." PX 17 (Mr. Kipp) at 87.

[18] Because the Skinner Reports did not include data for November and December 1944, Mr. Kipp assumed that the Oil Companies would have had the same amount of spent alkylation, acid in those months, as they did in January, 1945. PX 17 (Mr. Kipp) at 89. Mr. Kipp's calculations took account of spent alkylation acid produced by the Standard Oil Company: this company did not dispose of acid waste at the McColl Site, but the spent alkylation acid it generated took up reprocessing capacity. PX 17 (Mr. Kipp) at 89.

[19] Because the Stauffer II plant did not open until December 9, 1944 and immediately had operational problems, Mr. Kipp estimated that Stauffer II had much less acid reprocessing capacity from February 1945 to April 10, 1945 than was forecasted in the Skinner Reports. PX 17 (Mr. Kipp) at 91–92. Therefore, Mr. Kipp estimated that Stauffer II had a capacity of 60 tons/day during March 1945, instead of the 100 tons/day forecast by the Skinner Reports. PX 17 (Mr. Kipp) at 92

[20] Mr. Kipp also assumed that the Oil Companies' storage tanks were empty during November 1944, because the Skinner Reports did not report on storage data. PX 17 (Mr. Kipp) at 93. But, Mr. Kipp estimated that the storage tanks were full by December of 1944, based on stipulations entered into by the parties and a January 1945 Skinner Report. PX 17 (Mr. Kipp) at 93 (citing PX 11 at Stip. 373 ("The storage capacity for all the [Oil Companies] as of December 27, 1944, was full."); PX 1175 (Jan. 1945 Skinner Report)). On April 11, 1945, the Wilshire Oil Company's spent alkylation acid storage tank also came online in Los Angeles, California, making 15,000 tons of storage available to the Oil Companies and creating sufficient capacity to handle excess spent alkylation acid afterwards. PX 17 (Mr. Kipp) at 93; PX 1187 (4/6/45 Shell Contract with Wilshire for storage of "dilute [sulfuric] acid . . . resulting from [Shell's] alkylation plant operations").

The amount of excess "spent alkylation acid" that Mr. Kipp estimated was disposed of at the McColl Site from November 1944 through April 10, 1945 is set forth in the following chart:

Los Angeles Refineries Spent Alkylation Acid Available for Reprocessing - Late 1944 through Early 1945

Revised Table 4.5 Total Spent Alkylation Acid Sent to McColl Site (Tons of Pure Acid)

	Description	November	December	January	February	March	April 1-10*	Method of Calculation
20	Reprocessing capacity shortage (tons/day)	133	59	33	125	137	101	Subtract line 13 from line 5
21	Days in relevant month	30	31	31	28	31	10	Calendar days in the month
22	Reprocessing capacity shortage (tons/month)	3,990	1,823	1,023	3,500	4,247	1,010	Multiply line 20 by line 21
23	Storage available (tons/month)	4,900	910	0	750	450	0	Subtract storage used from total storage [d]
24	Storage used (tons/month)	3,990	910	0	300	450	0	Assume available storage used before disposal
25	Sent to McColl	0	913	1,023	3,200	3,797	1,010	Subtract storage used from reprocessing capacity shortage
26	Special disposal to clear Union new acid tank				1,700			Line 17
27	**Total Sent to McColl per Month**	0	913	1,023	4,900	3,797	1,010	Add lines 25 and 26
28	**Grand Total Sent to McColl (tons)**						**11,643**	Add values in line 27

Calculated value

* Stipulation 371 states that the Wilshire tank was in service April 11, 1945 alleviating storage problems for spent alkylation acid.

[d] Shell added 750 tons storage in February (2,650 tons in PX1178 minus 1,900 tons storage in PX1175). 2,200 tons used on 2/21/45. Assume remaining 450 tons used by end of following month.

PX 910 (Mr. Kipp Ex.).

As shown above, Mr. Kipp estimated that a total of 11,643 tons of "spent alkylation acid" was deposited at the McColl Site from November 1944 through April 10, 1945. PX 17 (Mr. Kipp) at 95. Mr. Kipp then converted tons into pounds and pounds into barrels, to ascertain that approximately 45,480 barrels of "spent alkylation acid" was disposed of at the McColl Site by the Oil Companies, other than Shell,[21] from November 1944 through April 10, 1945. PX 17 (Mr. Kipp) at 87–96, 103.

Los Angeles Refineries Spent Alkylation Acid Available for Reprocessing - Late 1944 through Early 1945

Revised Table 4.6 Barrels of Spent Alkylation Acid Sent to McColl Site

	Description	Value	Units	Method of Calculation
29	Tons of spent alkylation acid sent to McColl (100% H_2SO_4)	11,643	tons	Table 4.5
30	Pounds of spent alkylation acid sent to McColl (100% H_2SO_4)	23,286,000	lbs	2,000 lbs/ton
31	Pounds of pure acid per spent alkylation acid barrel	512	lbs	Shell Operating Report 1945
32	**Barrels of spent alkylation acid sent to McColl**	**45,480**	**bbl**	Divide line 30 by line 31

Calculated value

PX 911 (Mr. Kipp Ex.)

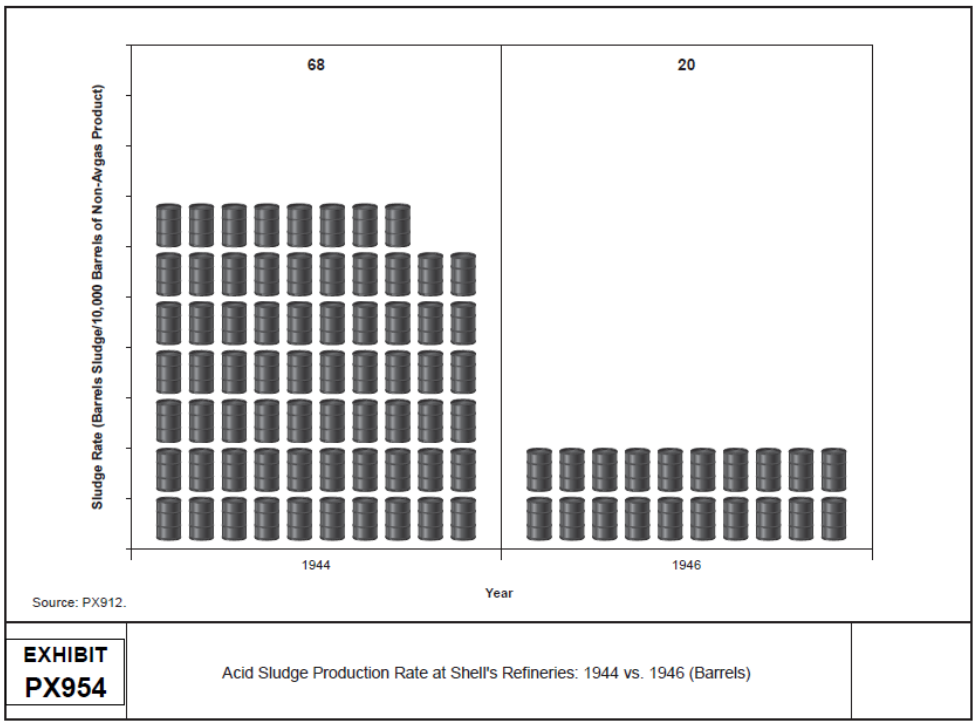
ii. Acid Sludge Was Disposed Of At The McColl Site.

As the Oil Companies increased throughput from 1942 until late 1944 to increase avgas production, they also produced more non-avgas petroleum by-products. PX 17 (Mr. Kipp) at 43. When these by-products were acid treated with spent alkylation acid, the resulting waste product was "acid sludge," a "thicker, viscous, and ultimately solid matter." PX 17 (Mr. Kipp) at 39. The relationship between increased avgas production and increased acid sludge can be "demonstrated empirically," by comparing Shell's acid sludge production in 1944, the peak of avgas production, with 1946, when Shell was no longer producing large amounts of avgas. PX 17 (Mr. Kipp) at 44. For example, in 1944, Shell produced 68 barrels of acid sludge for every 10,000 barrels of non-

[21] During this time, Shell was able to reprocess all of its spent alkylation acid at Stauffer's Dominguez plants. PX 17 (Mr. Kipp) at 103.

avgas by-product produced. PX 17 (Mr. Kipp) at 45; PX 1104 (1944 Shell Operating Report) at 38, 133. In 1946, however, Shell produced only 20 barrels of acid sludge for every 10,000 barrels of non-avgas by-products produced. PX 17 (Mr. Kipp) at 45; PX 1104 (1946 Shell Operating Report) at 313, 395.

As the following chart shows, Shell produced proportionally more acid sludge in 1944 than it did in 1946:



PX 954 (Mr. Kipp Ex.).

To produce more revenues and reduce the need for disposal, Shell reprocessed as much acid sludge into fertilizer as possible. PX 930 (Mr. Kipp exhibit showing acid sludge sent from Shell refineries to Shell Point fertilizer facility); PX 1157 (1943 Sulfuric Acid Report reflecting that "P.D. [Pressure Distillate] Acid Sludge" was sent to Shell Chemical's Ammonium Sulfate Plant to be converted into fertilizer) at A01037; PX 1104 (1944 Shell Operating Report) at 133; PX 1104 (1945 Shell Operating Report) at 264.[22]

Because of its toxicity, however, acid sludge needed to be transported by rail in specialized tank cars. But, these tank cars were tightly regulated during the war by the WPB. PX 17 (Mr. Kipp) at 48–49. As Eli McColl testified in May 1942, "[w]e cannot ship [acid sludge] from Los Angeles to San Francisco anymore," because "the [G]overnment will not allow us to use the tank

[22] Union Oil also reprocessed acid sludge at a General Chemical reprocessing plant at El Segundo, California. PX 1113 at 4 (Dec. 1941 Sulfuric Acid Survey Table); PX 1131 at 17 (8/8/42 PAW Sulfuric Acid Survey); PX 1157 (12/11/43 Sulfuric Acid Report) at A01045.

cars for that purpose." PX 1126 (5/6/42 Transcript Of San Jose District Disposal Permit Hearing) at LEV00846.

Acid sludge also could be burned as a heat source, but it was an inefficient fuel. PX 1105 (4/3/39 Shell Memo reflecting that acid sludge had only limited utility as a fuel source).[23] Burning acid sludge, however, caused the emission of sulfur dioxide and odorous fumes.[24]

Because not all of the acid sludge could be used to make fertilizer or burned, the Oil Companies disposed of acid sludge at the McColl Site as follows:

- Shell began to dispose of acid sludge at the McColl Site during the second half of 1942. PX 17 (Mr. Kipp) at 118; PX 1103 (1942 Shell Operating Report reflecting that Shell sent 2,030 barrels of sludge to disposal from Wilmington and 98,310 barrels of sludge to disposal from Dominguez).[25] Shell also disposed of acid sludge in 1943, in 1944, and in 1945. PX 1103 (1943 Shell Operating Report reflecting that Shell sent 7,825 barrels of acid sludge from Wilmington and 104,542 barrels from Dominguez at 808); PX 1104 (1944 Shell Operating Report reflecting that Shell sent 17,194 barrels of acid sludge from Wilmington and 48,825 barrels from Dominguez) at 133; PX 1104 (1945 Shell Operating Report reflecting that Shell sent 180 barrels from Wilmington and 1,222 barrels from Dominguez) at 264.

- The Texas Company did not dispose of acid sludge at the McColl Site until early 1945, because it was burned until late 1944. PX 17 (Mr. Kipp) at 116; PX 1113 (Dec. 1941 PAW report stating that the Texas Company "Burned" acid sludge); PX 1131 (8/8/42 OPC report stating that that the Texas Company burned acid sludge); PX 1157 (12/14/43 Smith Report stating that the Texas Company's acid sludge was "Burned at Refinery") at 1046; TR (Dr. Bookspan) 381; DX 92 (Minutes of a 1957 meeting between the Oil Companies, reporting that Texaco disposed of

[23] Richfield burned some of its acid sludge prior to 1944. PX 1113 (Dec. 1941 Sulfuric Acid Survey table showing that Richfield burned some of its sludge) at 2; PX 1157 (12/11/43 Richard C. Smith Sulfuric Acid Report to WPB that Richfield burned its acid sludge at the refinery) at A01045. Texaco burned all of its acid sludge until late 1944. PX 1113 (Dec. 1941 Sulfuric Acid Survey Table showing that Texaco burned all of its acid sludge) at 4; PX 1131(8/8/42 PAW Sulfuric Acid Survey showing that Texaco burned all of its acid sludge) at 17.

[24] PX 1107 (8/11/39 Shell memo reporting that the burning of acid sludge at Shell's Dominguez refinery was "creating a menace through the discharge of large amounts of sulfur dioxide"); PX 1126 (5/6/1942 Transcript of San Jose District Disposal Permit Hearing) at LEV00843–4 (stating that burning of sludge "produced an odor").

[25] Because the McColl Site did not accept sludge from Shell until at least July 1, 1942, it is likely that no more than 50% of Shell's 1942 acid sludge was sent to the McColl Site. DX 19 (Shell/McColl Contract); PX 1130 (7/7/42 letter from Shell Legal Department reflecting that performance of disposal contract was to begin July 1, 1942).

approximately 5,000 barrels or roughly 1% of the acid sludge at the McColl Site, but does not state when).

- Union did not dispose of acid sludge at the McColl Site until "late 1943," because it was reprocessed either at General Chemical or Shell Point. PX 1113 (Jan. 1942 Union response to Government Sulfuric Acid Survey stating that acid sludge was "given away"); PX 1228 (10/5/42 Union Memorandum discussing quality of acid sludge delivered to General Chemical for reprocessing); PX 1157 (12/8/43 Smith Report reflecting the disposal of 450 tons of acid sludge) at A01044.

- Richfield did not dispose of acid sludge at the McColl Site until "late 1943." TR at 377 (Dr. Bookspan). Richfield burned some "acid sludge," and also used a site in Gardena, California for disposal from 1940 to July 1943. TR at 377 **(**Dr. Bookspan); PX 1113 (Dec. 1941 Sulfuric Acid Survey Table) at 2; PX 1131 (8/8/42 PAW Sulfuric Acid Survey) at 17; PX 1157 (12/11/43 Sulfuric Acid Report) at A01045.

b. The Opinion Of The Government's Petroleum Engineering Expert.

i. Little Or No Spent Alkylation Acid Was Disposed Of At The McColl Site.

Dr. Kittrell agreed with Mr. Kipp that "spent alkylation acid increased during WWII" and "as the production of avgas was ramped up during the war, the production of spent alkylation acid increased proportionately." DX 1053 (Dr. Kittrell) at 11, 42. But, Dr. Kittrell testified that spent alkylation acid was not disposed of at the McColl Site from 1943–1945, because he found no Shell records or Avgas Gasoline Subcommittee reports confirming that activity and rail cars were available from December 1944 to April 10, 1945 that could have transported spent alkylation acid for further processing. DX 1053 (Dr. Kittrell) at 12, 48. Dr. Kittrell, however, conceded that spent alkylation acid was used to treat straight run and pressure distillates, so that some spent alkylation acid may have remained in the "substantial sludge production of the acid treatment of distillates" and was disposed of at the McColl Site. DX 1053 (Dr. Kittrell) at 13. But, "little or no spent alkylation acid" ever reached the McColl Site. DX 1053 (Dr. Kittrell) at 11.

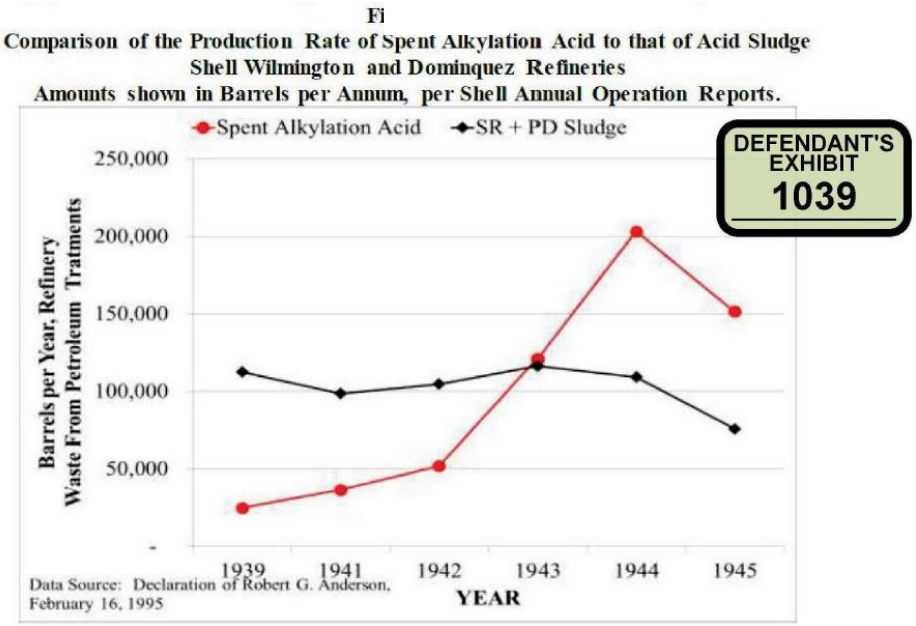
ii. Acid Sludge Was Disposed Of At The McColl Site.

In Dr. Kittrell's opinion, almost all of the acid sludge at the McColl Site was "created by" the acid treatment of pressure distillate and straight run distillate "to improve their properties for use in refinery products other than avgas." DX 1053 (Dr. Kittrell) at 14, 28.[26] The increase in avgas production, however, did not cause an increase in non-avgas products, such as motor

[26] Dr. Kittrell testified that the amount of acid sludge generated from acid treating of pressure distillate or straight run distillate decreased from 1942 to 1945. DX 1053 (Dr. Kittrell) at 27–28 (citing PX 1103 (Shell Operating Report 1943) at 808; PX 1104 (1944 Shell Operating Report) at 133; PX 1104 (1945 Shell Operating Report) at 164).

gasoline, that required acid treating and resulted in acid sludge. DX 1053 (Dr. Kittrell) at 43-44. This is so, because avgas was manufactured, not only using crude oil, but also other petroleum products shipped to refineries, such as "blend sources, including natural gasoline, blend stocks, intermediate feedstocks, and petroleum fractions[.]" DX 1053 (Dr. Kittrell) at 44. In addition, "around 1940," Shell developed a new process that pre-treated feedstock that was used for gasoline and did not create sludge. DX 1053 (Dr. Kittrell) at 12. In addition, from 1943 through August 1945, hydrogenation replaced acid treatment for the purification of non-avgas products, resulting in no sludge waste. DX 1053 (Dr. Kittrell) at 12.[27] This explains why as avgas production increased, particularly in 1943 and 1945, crude oil throughput did not increase proportionately. DX 1053 (Dr. Kittrell) at 45. And, it explains why as avgas production and spent alkylation acid increased, acid sludge production did not, but remained constant and declined by the end of the war. DX 1053 (Dr. Kittrell) at 6–7, 45.

Although the Avgas Contracts led to an increase in the production of spent alkylation acid, as the following chart shows, "[t]he [acid] sludge that was formed in the Oil Companies Refineries was equal in amount and quality to that which would have been formed had [the DSC] purchased no avgas during the time period." DX 1053 (Dr. Kittrell) at 47.



DX 1039.[28]

[27] But, later in his direct testimony, Dr. Kittrell admitted that, although Shell installed a hydrogenation unit in 1944, it appears not to have produced "cat cracked stock that was hydrogenated" until 1945. DX 1053 (Dr. Kittrell) at 13 (citing PX 1104 (1945 Shell Operating Report) at 195).

[28] DX 1039 is based on data from: (1) PX 1103 (Shell Operating Reports 1939–1943); PX 1104 (Shell Operating Reports 1944–1947); and (2) PX 604 (3/31/97 Decl. of Robert G. Anderson

Finally, Dr. Kittrell testified that the amount of acid sludge attributable to the Avgas Contracts and disposed of at the McColl Site can be calculated by tracking the amount of "red oil." DX 1053 (Dr. Kittrell) at 40, 42. Roughly 5% to 10% of spent alkylation acid used to make avgas contained red oil. DX 1053 (Dr. Kittrell) at 53. To calculate the amount of red oil at the McColl Site, Dr. Kittrell first determined the total number of barrels of avgas produced by the Oil Companies under the DSC contracts. DX 1053 (Dr. Kittrell) at 51. DX 1025 (table summarizing purchases of 100 octane avgas by the DSC). Then, he applied each of the Oil Companies internal formulas for producing avgas[29] to calculate how many tons of red oil were used in alkylation during avgas production. Based on the 72,600 cubic yards of sludge that EPA reported was found at the McColl Site, Dr. Kittrell estimated that at best only 0.95% of the acid sludge at the McColl Site can be attributed to the use of spent alkylation acid. DX 1053 (Dr. Kittrell) at 13, 42.

c. The Court's Findings

To ascertain whether both spent alkylation acid and acid sludge were disposed of at the McColl Site, the court defers to the May 15, 1996 EPA Superfund Record of Decision ("ROD") as the best and most reliable evidence of the fact that "[d]uring the operation of the [McColl] disposal site, various oil refining companies disposed of refinery waste, predominantly spent *sulfuric acid catalyst*." DX 269 (1996 EPA Superfund ROD) at Part I, § B (emphasis added). Clearly, this was a reference to the fact that spent alkylation acid was used to produce avgas. DX 269 (1996 EPA Superfund ROD) at Part I, § B; PX 513 (Jan. 1992 EPA Report stating that, "The [McColl Site] was used from 1942-1946 for the disposal of acidic sludges resulting from the *alkylation* ***and*** *product-treating processes* used in the refining of aviation gasoline" (emphasis and bold added)) at 2; PX 706 (9/21/1990 Dep. of John McColl stating that "watery" acid waste, *i.e.*, spent alkylation acid, was disposed of at the McColl Site) at 29; PX 1173 (12/11/44 Minutes of Aviation Gasoline Advisory Committee reporting that, "on the West Coast sometimes spent alkylation acid is [disposed of] in a pit as a means of disposal."); DX 19 (6/23/42 Shell/McColl Contract reflecting that Eli McColl was expected to accept at least 50,000 barrels of "alkylate acid"

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reflecting "amount of used acid sent to disposal by Shell's Wilmington and Dominguez refineries");

But, Dr. Kittrell excluded from DX 1039, the amount of acid sludge from which recoverable oil could be removed, because "[u]sing the [amount of sludge *plus* the amount of sludge from which recoverable oil could be removed] would raise the acid sludge numbers, but not change the dissimilarity between the two trends. DX 1053 (Dr. Kittrell) at 46 n. 35. As a result, Dr. Kittrell's chart does not show the actual production of sludge.

[29] For the avgas formulations for Richfield, Dr. Kittrell relied on PX 1115 (Jan., 1942 Richfield cost report) at 49; PX 1248 (12/10/44 PAW Report on avgas production) at 74; and PX 1259 (7/10/44 PAW Report on avgas production). For Texaco, Dr. Kittrell relied on PX 1248 (12/10/44 PAW Report on avgas production) at 79 and PX 1259 (7/10/44 PAW Report) at 24. For Union, Dr. Kittrell relied on PX 1143 (May 1945 Union Oil cost report), as well as PX 1248 (12/10/44 PAW Report on avgas production) at 81 and PX 1259 (7/10/44 PAW Report) at 27.

and "acid sludge" from Shell).[30] PX 517 (6/30/93 EPA ROD) ("[f]rom 1942 through 1946, approximately 72,600 cubic yards of *waste sludge* was disposed of into the 12 Ramparts and Los Coyotes sumps at the McColl Site.") at Part II, § 2 (emphasis added). Therefore, regardless of Dr. Kittrell's views to the contrary, spent alkylation acid was disposed of by the Oil Companies at the McColl Site.

For these reasons, the court finds that both spent alkylation acid and acid sludge are components of acid waste that were disposed of at the McColl Site by the Oil Companies.

3. The McColl Site.

The third step in the remand analysis requires understanding the physical properties of the McColl Site, how both types of acid waste were disposed of at the McColl Site, and the EPA's election and cost of remediation.[31]

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[30] PX 518 (2/1/94 Environmental Solutions Phase V Final Report, McColl Site Treatability Study) at 1 (stating that contamination was due "to disposal, in pits, of spent sulfuric acid sludge from the production of aviation fuel"); PX 527 (10/31/96 GeoSyntec Consultants & Parsons Engineering Science Report to EPA) at 5 (stating that "sulfuric-based *alkylation* sludge[]" was disposed of at McColl) (emphasis added)).

[31] Both parties proffered environmental engineering experts to supplement the record that the appellate court considered in 2014. The Oil Companies proffered Edmond F. Bourke as an expert in environmental engineering, the assessment of hazardous waste sites, and the design, implementation and maintenance of remedies for hazardous waste sites. TR 392. Mr. Bourke holds an undergraduate degree from San Diego State University in Applied Arts and Sciences, with a specialty in Environmental Design, and is the Founder and President of C2 REM, Inc., ("C2 REM") an environmental management company. PX 18 (Mr. Bourke) at 2. Since 2002, C2 REM has supervised operations, maintenance, and monitoring at the McColl Site. PX 18 (Mr. Bourke) at 1. Another company, McAuley, LCX, is responsible for site security. PX 18 (Mr. Bourke) at 2. As of November 2015, these companies received a combined $4,982,759.64 from the Oil Companies. PX 18 (Mr. Bourke) at 1.

Although Mr. Bourke was not a chemical engineer nor a geologist, he has 30 years of "hands-on" practical experience, gained "an understanding and working knowledge" of the chemical properties of waste materials, and has worked on dozens of Superfund remediation projects. PX 18 (Mr. Bourke) at 2–3. As a result, he has been approved by the EPA as a Project Coordinator. PX18 (Mr. Bourke) at 1. The projects where Mr. Bourke has worked include: the remediation of the Del Amo Superfund site in Los Angeles, involving the construction of a cover system to remediate contamination from World War II disposal of benzene; and the remediation of the OII Superfund in Monterey Park, California, involving the construction of a cover system to control acidic waste. PX 18 (Mr. Bourke) at 3.

The Government objected to Mr. Bourke being offered as an expert in environmental engineering. TR 403. In particular, the Government argued that Mr. Bourke's groundwater remediation testimony should not be afforded any weight, because he is not a Certified California Civil Engineer and is not qualified to propose a remediation for the McColl Site, because under

California law, "[a]ll civil (including structural and geotechnical) engineering plans, calculations, specifications, and reports . . . s*hall be prepared by, or under the responsible charge of*, a licensed civil engineer." *See* CALIFORNIA BUSINESS AND PROFESSIONAL CODE ("CBPC") § 6735. In addition, Mr. Bourke may not have taken organic chemistry or differential equations college classes, which, according to the Government, is important because of differential equations "underpins all engineering specialties," and remediation of the McColl Site involves organic chemistry. Gov't DBr. at 60. But, the Government conceded at trial that Mr. Bourke is an "engineering contractor." TR at 402.

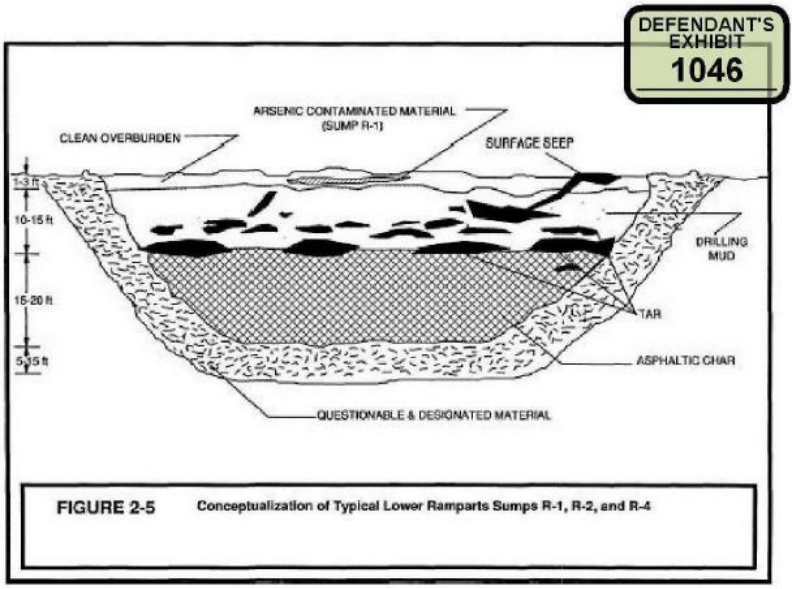
The Government proffered Dr. Allen J. Medine as an expert in environmental engineering, environmental chemistry, and hazardous waste management. TR 308. Dr. Medine holds a Ph.D. in Environmental Engineering from Utah State University, a M.S. in Civil and Sanitary Engineering from the University of California, Berkeley, and a B.S. from the University of Illinois. DX 1056 at 5. He is a registered Civil Engineer in California and a registered Professional Engineer in Colorado. DX 1056 at 5. Dr. Medine's water quality and environmental management experience includes: analytical evaluation of trace chemicals in water; the design of industrial waste treatment facilities; cost evaluations; and "restoration of damaged ecosystems." DX 1056 at 6. In addition, he has served as a Project Manager and Senior Environmental Engineer at waste sites and has personal experience with acid spill cleanup and studied spills and discharges of acid at twenty sites. DX 1056 at 6–7. Dr. Medine is not an expert in petroleum engineering or avgas production. TR (Dr. Medine) at 313. Dr. Medine has never visited the McColl Site. TR (Dr. Medine) at 313. Dr. Medine has, however, previously analyzed petroleum wastes in the laboratory setting while working as the technical director of Eneseco's Rocky Mountain Analytical Division. TR (Dr. Medine) at 316.

The court has determined that Mr. Bourke and Dr. Medine are experts and qualified to testify in their respective fields. *See* FRE 702.

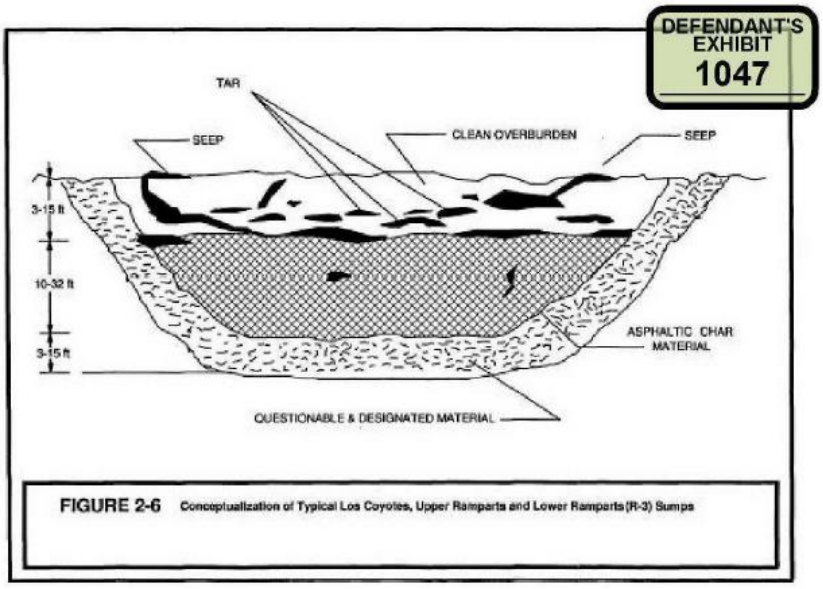
a. The Physical Properties Of The McColl Site.

The McColl Site consists of two parcels of land: an eastern parcel ("the Ramparts parcel") and a western parcel ("the Los Coyotes parcel"). PX 18 (Mr. Bourke) at 7; DX 1056 (Dr. Medine) at 8. Each parcel contained 6 pits, known as "sumps," into which acid waste from the Oil Companies was disposed from June 23, 1942 until September 6, 1946, the date of closure. PX 18 (Mr. Bourke) at 7; DX 1056 (Dr. Medine) at 8.

Typical sumps at the Ramparts and the Los Coyotes parcels are depicted below:



DX 1046 (Dr. Medine) Figure 4.



DX 1047 (Dr. Medine) Figure 5.

Each sump contained a bottom layer of char that is a "black, friable material similar to coal or asphaltic cement." PX 18 (Mr. Bourke) at 11; DX 1056 (Dr. Medine) at 9. Char is formed by acid waste that solidifies by chemical reactions over time. PX 527 at 9, 11 (10/31/96 Report by GeoSyntec & Parsons Engineering Science for EPA).[32] Char is very acidic[33] and releases sulfur dioxide and volatile organic compounds ("VOCs"), such as benzene and tetrahydrothiophene ("THT"), when exposed to the atmosphere. PX 18 (Mr. Bourke) at 12 (citing PX517 (6/30/93 EPA ROD) at Part II, § 7.0); DX 1056 (Dr. Medine) at 15. Char comprised the majority of the acid waste at the McColl Site. DX 277 (2002 C2 REM Annual Report re McColl Site) at 9 ("The majority of the waste has been characterized as a hard, black char with low pH.").

Each sump also contained tar. PX 18 (Mr. Bourke) at 12; DX 1056 (Dr. Medine) at 9. Tar is an intermediate product formed by the same chemical reactions that transforms acid sludge into char. PX 527 (10/31/96 Report by GeoSyntec & Parsons Engineering Science For EPA) at 11 ("The flowable tar material is suspected as being an intermediate product of the reaction mechanisms occurring at the site."). Unlike char, tar waste is fluid and can migrate through the soil. PX 517 (6/30/93 EPA ROD) at Part II, § 7.0.

Three sumps located on the eastern Ramparts Parcel also contained drilling muds. PX 18 (Mr. Bourke) at 13 (citing PX 517 (6/30/93 EPA ROD) at Part II, § 2.0). Drilling muds have the consistency of soft clay. PX 517 (6/30/93 EPA ROD) at Part II, § 7.0. Drilling muds were deposited at these sites in the 1950s and 1960s to cover up the sumps and reduce harmful odors. PX 18 (Mr. Bourke) at 9; TR (Dr. Medine) at 318. Drilling muds alone, however, would not have required remediation, but did at the McColl Site, because of contaminant concentration. TR (Dr. Medine) at 320.

Each of the sumps also contained contaminated soils consisting of underlying and cover soils mixed with acid waste. PX 18 (Mr. Bourke) at 14. Arsenic-contaminated soil was also

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[32] A 1996 report prepared for the EPA concerning the chemical conditions at the McColl Site summarized these reactions as follows:

> Three reaction types have been proposed for conversion of the original waste into char: (i) acid-catalyzed polymerization and polycondensation of organic material, (ii) acid-catalyzed polymerization and polycondensation of organic material, accelerated by acidified clay and reaction with clay, and (iii) acid-catalyzed polymerization and polycondensation of organic material, accelerated by auto-oxidation. These reactions are irreversible under existing conditions at the site.

PX 527 (10/31/96 Report by GeoSyntec & Parsons Engineering Science For EPA) at 11.

[33] Acidity and basicity is measured on the pH scale: a pH range of 1 to 6 is considered acidic, pH 7 is neutral, and pH 8 to14 is considered basic. TR (Dr. Medine) at 332. The pH levels at McColl were below 1 in certain samples, *i.e.*, highly acidic. TR (Dr. Medine) at 333. There also were samples with a pH approaching a level of 8. TR (Dr. Medine) at 333. The average pH level at the Los Coyotes sumps was approximately 2; and the average pH level of the Rampart sumps was 3. TR (Dr. Medine) at 334.

present, but only at one sump. PX 517 (6/30/93 EPA ROD) at Part II, §§ 2.0, 7.0. PX 18 (Mr. Bourke) at 14.

The average area of each sump was approximately 15,000 square feet (100 feet x 150 feet), 180,000 square feet for all 12 sumps. PX 510 (2/15/83 Radian Corp. Technical Memorandum for EPA), at 1-1, 3-6, 4-3; PX 18 (Mr. Bourke) at 52. Each sump was approximately 20 feet deep with a slope on each side. PX 512 (2/12/91 Environ Solutions Inc. McColl Report) at 2-7; PX 18 (Mr. Bourke) at 52. The Ramparts 1 sump and the Los Coyotes 1 sump were significantly larger with areas of 27,022 square feet[34] and 28,128 square feet,[35] respectively. PX 510 (2/15/83 Radian Corp. Technical Memorandum for EPA) at 3–7.[36]

b. "Contaminants Of Concern" At The McColl Site.

Contaminants of Concern ("COCs")[37] are chemicals that pose a risk to human health and the environment. DX 1056 (Dr. Medine) at 19. At the McColl Site, the COCs found in the soil, groundwater, and air include: sulfur dioxide; arsenic; benzene; tetrahydrothiophenes ("THTs"); and metals (aluminum, beryllium, cadmium, manganese, nickel, and vanadium). PX 18 (Mr. Bourke) at 15–23; PX 517 (6/30/93 EPA ROD) at Part II, § 4.0 ("[T]he principal threats at the Site [include] benzene, sulfur dioxide, and arsenic."). Sulfuric acid was not considered as a COC, but

[34] The Ramparts 1 sump contained 581,000 cubic feet of waste (area of 27,022 square feet x depth of 21.5 feet). PX 510 (2/15/83 Radian Corp. Technical Memorandum for EPA) at 3-9. This 581,000 cubic feet of acid waste yields approximately 21,518 cubic yards of waste (581,000 cubic feet/27 cubic feet per cubic yard).

[35] The Los Coyotes 1 sump contained 85,644.8 cubic feet of waste or 6,875.7 cubic yards. PX 510 (2/15/83 Radian Corp. Technical Memorandum for EPA) at 3-9.

[36] The McColl Site was opened for operation on July 1, 1942, but the record does not include documents showing how many sumps existed or the order in which they were dug and filled. The Oil Companies cite the April 11, 1984 EPA ROD that states "[i]n 1942 Eli McColl had 12 pits constructed." PX 511 (4/11/84 EPA ROD re McColl) at § II; PX 18 (Mr. Bourke) at 51; PX 1009 (1947 aerial photo showing 12 pits).

The Government insists that one sump at a time was excavated and filled, before a second sump was excavated, based on the inconclusive testimony of Eli McColl's son about events that took place forty-eight years earlier. PX 706 (9/21/90 John McColl Dep.) at 58. Although the record is not definitive, the court has determined that the preponderance of evidence weighs in favor of the EPA's conclusion that 12 sumps were dug and in existence in 1942. PX 511 (4/11/84 EPA ROD re McColl) at § II.

[37] Contaminants of Concern also are referred to in the record as "constituents of concern" or "chemicals of concern." *See, e.g.*, PX 18 (Mr. Bourke referring to COCs as "chemicals of concern") at 14; DX 277 (C2 REM Report referring to COCs as "constituents of concern") at 9–10.

was "a substance that contributes to the chemical conditions within the sumps;" and "may be dangerous [to humans] upon exposure." DX 1056 (Dr. Medine) at 19.

Sulfur dioxide is formed by a chemical reaction that separates sulfate (SO_4) into water (H_2O) and sulfur dioxide (SO_2). PX 18 (Mr. Bourke) at 18. Sulfuric acid was present both in the spent alkylation acid and the acid sludge[38] and was the source of "almost *all*" the sulfate molecules that broke down to form sulfur dioxide. PX 18 (Mr. Bourke) at 18.

In addition, metals naturally present at the site became COCs when they were dissolved by the sulfuric acid and "mobilized." PX 18 (Mr. Bourke) at 20. After being mobilized, the metals migrated through the soil and contaminated water in the perched aquifers. PX 18 (Mr. Bourke) at 20 (citing PX521 (ICF Technology Inc. Nov. 1995 Baseline Risk Assessment for McColl Superfund Site) at §11 at 7-4); DX 1056 (Dr. Medine) at 30. In addition, arsenic naturally found in the soil at the McColl Site also was mobilized by the sulfuric acid. PX 18 (Mr. Bourke) at 21–22.

Benzene also was present in the soil at the McColl Site, because of the disposal of benzol sludge but, typically, microorganisms living in soil break the benzene down into a "harmless by-product." PX 18 (Mr. Bourke) at 17. At the McColl Site, however, these microorganisms were killed by the sulfuric acid in the acid waste, so they were unable to break down the benzene. PX 18 (Mr. Bourke) at 17; TR (Dr. Medine) at 335.

The Government's expert, Dr. Medine testified that remediation was required, because of the presence of "benzene, THT, sulfur dioxide, and arsenic, among other contaminants, *rather than sulfuric acid*." DX 1056 (Dr. Medine) at 26 (emphasis added); DX 1053 (Dr. Kittrell) at 14. Benzene and THT also were considered COCs, because of the existence of a complex mix of carbon molecules and organic sulfates found in acid sludge. DX 1056 (Dr. Medine) at 28–29. "Leaching of contaminants from the petroleum wastes [present in the acid sludge, however,] would have occurred regardless of the presence of sulfuric acid. Hydrocarbons soluble in water, including, for example, aromatics (benzene), aliphatics, phenols, cresols would interact with precipitation and surface water runoff to result in contaminant migration." DX 1056 (Dr. Medine) at 29. Likewise, THT was a COC, because of the fractions used in Straight Run (SR) Distillate and Pressure Distillate (PD) processes that lead to the creation of acid sludge. DX 1056 (Dr. Medine) at 28.

Dr. Medine conceded that sulfur dioxide could be formed by the decomposition of organic sulfates, within the acid sludge, as a result of reactions that took place in the alkylation unit, where sulfuric acid reacted with conjunct polymers formed from olefins known as "Red Oils." DX 1056 (Dr. Medine) at 26. And, Dr. Medine agreed that sulfuric acid present in the acid waste advanced chemical reactions that mobilized metals and arsenics naturally present in the soil, leading to a threat of groundwater contamination. DX 1056 (Dr. Medine) at 27. But, considering the potential eight to one ratio of acid sludge to spent alkylation acid, any potential spent alkylation acid

[38] Dr. Medine agreed that acid sludge was "very complex in nature due to the variety of reactions among petroleum components and concentrated sulfuric acid." DX 1056 (Dr. Medine) at 13.

disposed of at the McColl Site would have added to the size of the sumps, but would not have materially altered the chemical reaction conditions within each sump. DX 1056 (Dr. Medine) at 27, 32. Although the spent alkylation acid was of a higher acid strength then the acid sludge (87%–90% strength as compared to 35%–65% strength), both were still "extremely acidic" and the greater amount of acid sludge correspondingly led to a greater amount of sulfur dioxide release. DX 1056 (Dr. Medine) at 27.

The components of the acid sludge, "including high acidity, high organic carbon, metals, organic sulfates, and sulfate, and the associated degradation of organic sulfates to sulfur dioxide, [were] the most significant contributor to the site risks." DX 1056 (Dr. Medine) at 28. To the extent that the acid sludge resulted in char formation, the presence of spent alkylation acid in the sumps also would increase char formation. DX 1056 (Dr. Medine) at 31.

Finally, Dr. Medine testified that, if only spent alkylation acid was disposed of at the McColl Site, remediation, although necessary, would have been reduced in cost. Based on his experience with past acid spills, Dr. Medine estimated that over time the spent alkylation acid would come into contact with naturally occurring neutralizing elements in the subsurface soil and water. DX 1056 (Dr. Medine) at 33; TR (Dr. Medine) at 361. This data indicated that spent alkylation acid had only a limited effect on the subsurface, as the pH levels were "near neutral." DX 1056 (Dr. Medine) at 34. This data collected also demonstrated the continued existence of high pH neutralizing capacity (alkalinity) within the subsurface. DX 1056 (Dr. Medine) at 34 (citing DX 261, DX 262). If only spent alkylation acid was disposed of in the 1940s, subsurface migration and neutralization would reduce the cost of remediation required seventy years later. DX 1056 (Dr. Medine) at 34.

c. The Remediation Solution[39] Elected By The Environmental Protection Agency For The McColl Site.

Because sulfur dioxide (SO_2) was found both in the soil and air at the McColl Site, the EPA elected a remediation solution using a cover system to prevent both hazardous emission and water infiltration. PX 524 (3/4/96 GeoSyntec & Parsons Engineering Science Report) at 1–2, 7–2. PX 517 (6/30/93 EPA ROD re McColl Site) at Part I, § 4.2. In addition, sub-surface barriers ("slurry walls") were constructed to prevent lateral migration of the COCs, together with a reinforced earthen slope to protect the stability of the cover system. PX 517 (re same) at Part I, § 4.2. This remediation solution also included the construction of water infiltration controls and periodic monitoring of groundwater. PX 18 (Mr. Bourke) at 30–31; DX 1056 (Dr. Medine) at 4 ("[I]f sulfur dioxide and benzene were removed, the remedy would likely be different . . . excavation could

[39] Although prior court decisions refer to the costs incurred by the Oil Companies to address the environmental issues at the McColl Site, as "recovery costs," the solution elected by the EPA more accurately is described as remediation. Section 9601 of CERCLA provides that: "(24) The terms *"remedy" or "remedial action"* means those actions consistent with *permanent remedy taken instead of or in addition to removal actions*[.]". 42 U.S.C. § 9601 (emphasis added).

have been implemented to remove and destroy contaminants rather than leave them in place with a containment facility."); DX 1056 (Dr. Medine) at 26–27 (same).

D. All Of The Acid Waste Disposed Of At The McColl Site Was "By Reason Of" The Avgas Contracts.

1. The Relevant Causation Standard.

To obtain breach of contract damages, the plaintiff bears the burden of establishing: "(1) a valid contract between the parties; (2) an obligation or duty arising out of the contract; (3) a breach of that duty; and (4) damages *caused by* the breach." *San Carlos Irrigation & Drainage Dist. v. United States*, 877 F.2d 957, 959 (Fed. Cir. 1989) (emphasis added). Since the United States Court of Appeals for the Federal Circuit has held that the Government breached the Avgas Contracts, the court now must determine whether the damages claimed by the Oil Companies were caused by that breach. To satisfy this fourth element, the plaintiff also must show that: "(1) the damages were reasonably foreseeable by the breaching party at the time of contracting; (2) the breach is a substantial causal factor in the damages; and (3) the damages are shown with reasonable certainty." *Indiana Michigan Power Co. v. United States*, 422 F.3d 1369, 1373 (Fed. Cir. 2005).

2. In 1942, It Was Reasonably Foreseeable To The Government That The Taxes Clause Of The Avgas Contracts Could Be Invoked In the Future To Compensate The Oil Companies For "New Charges" Required To Remediate Acid Waste At The McColl Site.

In 1926, the Oil Companies formed the Refiners Committee On Waste Disposal to ascertain how to arrange for the long term disposal of acid waste from their refineries in the Southern California. DX 5 at ¶¶ 45, 47; DX 67 (Sept. 1930 Oil Bulletin "Committees' Investigators Trace Chief Cause For Complaints To Incomplete Combustion of "Acid Tar" At Refineries; Now Being Remedied By Installation Of Special Equipment"); DX 76 (10/2/34 Minutes of Committee Of Refinery Odors); DX 1055 (Dr. Bookspan) at 6. To handle and dispose of acid waste produced by their refining processes, the Oil Companies contracted with several companies, such as the trucking company owned by Eli McColl. DX 1054 (Dr. Brigham) at 15–16; DX 1055 (Dr. Bookspan) at 5–6.

In April 1942, the DSC entered into contracts with the Oil Companies to purchase avgas and resell it to the Army and Navy. *See Shell Oil Co. v. United States*, 751 F.3d at 1286. Each contract included the Taxes Clause was required by the Oil Companies and agreed to by the Government, anticipating the fact that "new . . . charges . . . may be required by . . . federal law." PX 1 (1/17/42 Contract between DSC and Texaco) at JA159; PX 2 (2/3/42 Contract between DSC and Richfield) at JA112; PX 3 (4/10/42 Contract between DSC and Shell) at JA16; PX 5 (12/31/42 Contract between DSC and Union) at JA61. This contractual provision was agreed to by both DSC and PAW officials, because as former oil company executives and/or top employees they were very aware of the relationship between the increased production of avgas, resulting acid

waste, increasing environmental problems,[40] and the cost of disposal. DX 1054 (Dr. Brigham) at 18–19.

In addition, the fact that the price of avgas under the Avgas Contracts was set at a 6%–7% profit margin over the "base price" evidences that the Government was aware that the Oil Companies had to *maximize revenues from all non-avgas petroleum by-products* or be at risk of having to ask the Government to increase their profit margins, that consequently would raise the price of avgas. Since it was expensive to dispose of acid waste, the Oil Companies also were required to make every effort to recycle and reuse both spent alkylation acid *and* acid sludge to keep the costs of avgas production down. PX 1126 (5/6/42 testimony of Eli McColl that disposal was considered a "last resort"). The Government was successful in containing the price of avgas, but this resulted in the manufacture and sale of increased non-avgas petroleum by-products that substantially increased the amount of both spent alkylation acid and acid sludge, requiring disposal.

For these reasons, the court has determined that, in 1942, it was reasonably foreseeable to the Government that the Taxes Clause could be invoked in the future to compensate the Oil Companies for "new charges" required to remediate acid waste at the McColl Site.

3. The Requirements Of The Avgas Contracts Were A "Substantial Causal" Factor In The Remediation Of Acid Waste At The McColl Site.

The United States Court of Appeals for the Federal Circuit remanded this case to United States Court of Federal Claims to determine how much of the acid waste disposed of at the McColl Site was "by reason of the [A]vgas [C]ontracts." *Shell Oil*, 751 F.3d at 1303. In *Burrage v. United States,* 134 S. Ct. 881 (2014), the United States Supreme Court observed that "[i]n common talk . . . the phrase, 'by reason of,' requires at least a showing of 'but for' causation.'" *Id.* at 889. In *Energy Northwest v. United States*, 641 F.3d 1300 (Fed. Cir. 2011), our appellate court restated that a plaintiff seeking damages for a breach of contract "must submit a hypothetical model establishing what its costs would have been [to a reasonable certainty] in the absence of breach . . . by comparing this hypothetical 'but for' scenario with the [plaintiff's] actual conduct[.]" *Id.* at 1305, 1307; *see also Yankee Atomic Electric Co. v. United States,* 536 F.3d 1268, 1273 (Fed. Cir. 2008) ("Without record evidence about [the plaintiff's] condition with full Government performance, the [United States Court of Federal Claims] could not perform the necessary comparison between the breach and non-breach worlds and thus could not accurately assess the [the plaintiff's] damages.").

According to the Government, the "evidence is abundantly clear" that the Oil Companies would not have shut down their refineries [but for the Avgas Contracts], and instead would have conducted "normal refinery operations," resulting in the production of non-avgas products and acid sludge. Gov't DBr. at 51. ("[The Oil Companies] merely would have continued their

[40] At this time, one of the disposal sites used by Oil Companies was the Thomas Ranch, but it was reaching capacity and a local ordinance was being considered that would ban all future "sludge dumping." DX 1054 (Dr. Brigham) at 16–17.

decades' long practice of [disposing of] acid sludge into pits in the ground, regardless of the existence of the avgas contract[.]"). Therefore, the Government argued that, "under the correct but-for analysis, the operative question to ask is whether the refineries would have shut down[,] but for the avgas contracts." Gov't DBr. at 62. This "operative question," however, ignores the relevance of the Government's obligations in the Avgas Contracts and misstates the but-for causation standard that does not require the Oil Companies to establish that spent alkylation acid and/or acid sludge would not have been produced "but for" the Avgas Contracts --- but instead, how much acid waste disposed of at the McColl Site was caused by the increased avgas production and need to maximize the manufacture and sale of non-avgas petroleum by-products --- required by the terms of the Avgas Contracts.

Recognizing this problem, the Government took a different tack in its closing argument, asserting that 1941 is the appropriate "but-for" year in which to examine the non-breach world, because that year reflects "normal" refinery operations before the Avgas Contracts were signed. 11/21/2016 TR at 65. But, by early 1940, the Oil Companies already began to increase the production of military avgas. PX 1298 (9/27/40 letter from the head of the RFC reflecting that on August 16, 1940, President Roosevelt authorized the DSC to allocate $50 million to purchase 100 octane-aviation gasoline and that the DSC had "been ready since [August 29, 1940] to buy the gasoline" for resale to the Army and Navy). And, shortly afterward, the Lend-Lease Act was signed in March, 1941, whereby the Government increased supplying other countries with essential war materials, such as avgas. In 1945, however, the war ended and the Avgas Contracts expired in 1946. PX 1104 (1945 Shell Operating Report stating that "Cancellation of Government contracts at the end of the war necessitated broad changes in the refinery operating program[.]") at 159; PX 17 (Mr. Kipp) at 44 ("avgas production plummeted in 1946 to pre-Contract levels."

For these reasons, the court has determined that 1946 is the appropriate year to measure the amount of acid waste that would have been sent to the McColl Site in a non-breach world. But, none of the Oil Companies disposed of acid waste at the McColl Site in 1946.[41] Before determining causation, the court also decided to consider the relevance of the following new evidence *not previously considered by the United States Court of Appeals for the Federal Circuit.*

In November 1941, the OPC conducted a nationwide survey of refineries' sulfuric acid usage to prepare for the "large required expansion of alkylation processes" associated with increased avgas production. PX 1112 at 1. The survey asked: "If consumption [of sulfuric acid] is to be increased, what provisions will be made for *securing additional acid* ***and*** *for handling resultant [acid] sludge?*" PX 1112 at Sheet 3 (emphasis and bold added). This evidences that the Government expected that "additional acid" *i.e.*, spent alkylation acid resulting from the production of avgas and its use to acid treat non-avgas petroleum products, would result in acid sludge and require disposal. In December 1941, Shell informed OPC that it anticipated additional alkylation facilities at its Dominguez Refinery, but cautioned that "[d]isposal of sludge has not been arranged." PX 1114 (Refinery Sulfuric Acid Survey Responses) at 0622FL. On January 9,

[41] The record reflects that Shell did not dispose of *any* of the acid sludge that it generated in 1946, after the war was over and the Avgas Contracts expired. PX 1104 (1946 Shell Operating Report) at 302, 395. Instead, acid sludge produced in 1946 was sent for reprocessing via tank cars or pipelines. PX 1104 (1946 Shell Operating Report) at 302, 395.

1942, Shell advised the OPC that it would dispose of acid sludge at its refineries "by contractor." PX 1113 (1/9/42 OPC Table Summarizing Refinery Sulfuric Acid Survey Responses) at 3. As such, before the Avgas Contracts were executed, the Government knew and expected that the increased production of avgas required thereunder would entail disposal of both types of acid waste. Although the Government may not have known the specific place of disposal would be the McColl Site, the Government was aware that disposal likely would take place at a location in the Southern California area, as had been the case since at least the 1930s.

The record also reflects that *some* of the avgas that Shell produced from January 1943, to May 1943 was sold to non-DSC customers. PX 1148 (8/20/43 DSC letter reflecting the percentage of avgas Shell sold to non-DSC customers decreased from 13.2% in January 1943 to 3.6% in May 1943). The record, however, does not establish that any of the spent alkylation acid that resulted from the sale of this avgas was disposed of at the McColl Site at this time. PX 1103 (1943 Shell Operating Report reflecting that Shell's spent alkylation acid was sent to reprocessing facilities) at 686. The record, however, reflects that for the entire year 1943, Shell disposed of 112,367 barrels of sludge at the McColl Site, an unknown amount of which could be attributed to non-DSC customers. PX 1103 at 686.

Divided by 27 cubic feet per cubic yard →

112,367	barrels of acid sludge			
x 42	gallons per barrel			
x .13	cubic feet of acid sludge			
613,524	cubic feet of acid sludge	=	22,723.1	cubic yards of acid sludge

The total remediation cost for 72,600 cubic yards at the McColl Site was $64,219,514.46 or $884.57 per yard. Thus, assuming that *all* of that sludge was associated with non-contract avgas and *all* of Shell's 1943 sludge was disposed of at McColl Site, $20,100,092.76 could be considered as a deduction from Shell's damages, together with associated interest.

But, the record also reflects that Shell only sold 13.2% of its avgas to non-DSC customers in January 1943, and this amount decreased by roughly 10% by May 1943. PX 1148 (8/20/43 DSC Letter). And, the DSC "continue[d] to urge Shell to reduce further its direct [*i.e.*, non-DSC] sales." PX 1148. Therefore, what the record evidences is that Shell produced a total of 2,940,000 barrels of avgas in 1943. PX 1189 (1945 Report To WPB summarizing avgas production for the entire war).

Assuming that Shell uniformly reduced non-DSC avgas sales by 2.4% each month and produced avgas at a uniform monthly rate, beginning in January 1943, Shell would have sold 105,840 barrels of non-DSC avgas in 1943, as summarized in the following table:

1943 Shell Monthly Non-DSC Avgas Sales			
Month	**Barrels Produced**	**Non-DSC Barrel Percentage**	**Non-DSC Barrels**
Jan. 1943	245,000	13.20%	32,340
Feb. 1943	245,000	11%	26,460
Mar. 1943	245,000	8%	20,580
Apr. 1943	245,000	6.00%	14,700
May 1943	245,000	3.60%	8,820
June 1943	245,000	1.200%	2,940
July 1943	245,000	0	0
Aug. 1943	245,000	0	0
Sept. 1943	245,000	0	0
Oct. 1943	245,000	0	0
Nov. 1943	245,000	0	0
Dec. 1943	245,000	0	0
Total	**2,940,000**		105,840

The 105,840 barrels of non-DSC avgas represents 3.6% of the total 2,940,000 barrels of the avgas that Shell produced in 1943. Assuming that 3.6% of that avgas also generated 3.6% of the sludge produced in 1943, a total of 818 cubic yards of sludge nominally could be attributed to Shell's 1943 non-DSC avgas sales. At $884.75 per yard, this yields $723,578.26.

But the remediation solution elected by the EPA utilized a closure system for each of the 12 sumps that did not differentiate between spent alkylation acid or acid sludge disposed of by the Oil Companies at the McColl Site. In other words, *the cost to remediate* acid waste at the McColl Site, resulting from the increased production of avgas, under the Avgas Contracts, was the *same* whether it was composed of spent alkylation acid or acid sludge, or a combination of both, or acid sludge generated from non-DSC avgas sales. PX 517 (EPA 6/30/93 ROD re McColl Site) at Part I, § 4.2. As the Government's expert environmental engineer testified, the remediation solution elected by the EPA was based on the entire McColl Site, so "it matters little if you remove any one COC[.]" DX 1056 (Dr. Medine) at 26; TR (Dr. Medine) at 327 ("The remedy is designed to address *all* of the contaminants of concern, not just the primary ones.") (emphasis added). The bottom line is "[t]he uncertainty in the migration of any one of the COCs . . . dictates that the site be managed as a single entity." DX 1056 (Dr. Medine) at 26.

For these reasons, the court has determined that the Avgas Contracts were a "substantial causal" factor in the remediation of the acid waste at the McColl Site and "but for" the Government's breach of the Avgas Contracts, the Government would have been required to pay all of the environmental remediation costs at the McColl Site, because of the solution elected by the EPA. Therefore, the Oil Companies are entitled to damages reflecting all of the costs they paid to remediate the McColl Site. *See Indiana Michigan Power Co. v. United States*, 422 F.3d 1369,

1373 (Fed. Cir. 2005) **(**"The remedy for breach of contract is damages sufficient to place the injured party in as good a position as it would have been had the breaching party fully performed.").

4. The Breach of Contract Damages Have Been Established With "Reasonable Certainty."

a. The Oil Companies' Proffer And Argument.

The Oil Companies proffered the following evidence to establish the environmental remediation costs incurred were established with "reasonable certainty:"

(1) PX 12 – October 13, 1999 Stipulation entered into during the CERCLA litigation before the United States District Court for the Central District of California ("PX 12").

(2) PX 14 – July 11, 2008 Defendant's Responses To Plaintiffs' Proposed Findings Of Uncontroverted Fact submitted to the United States Court of Federal Claims ("PX 14").

(3) PX 15 – September 7, 2012 Defendant's Response To Plaintiffs' Proposed Findings Of Uncontroverted Fact submitted to the United States Court of Federal Claims.

(4) PX 101–03 – Declarations of Edmond F. Bourke, President of C2 REM. PX 101 (9/6/2008 Bourke Decl.); PX 102 (July, 2010 Bourke Decl.); PX 103 (6/26/2016 Bourke Decl.).

(5) PX 104–264 – Invoices submitted by C2 REM to the Oil Companies from November 11, 2002 to January 6, 2016. PX 104–221 (C2 REM Invoices for the McColl Site from November 11, 2002 to May 31, 2012); PX 222–63 (C2 REM Invoices from July 9, 2012 to Nov. 30, 2015); and

(6) PX 271–83 – Payments to McAuley, LCX from June 24, 2003 to May 1, 2015.

On October 13, 1999, the Oil Companies and the Government stipulated that the Oil Companies incurred $64,219,514.46 in remediation costs through October 31, 1998. PX 12 at JA610. The $64,219,514.46 included $18,000,000 that the Oil Companies had paid to the Government and to the State of the California, pursuant to a December 12, 1994 Consent Decree entered by the United States District Court for the Central District of California. PX 14 at ¶14. The remaining $46,219,514.46 balance was paid by the Oil Companies on or before November 1, 1997, when the EPA concluded that "construction had been completed according to specifications and the remediation had been successfully implemented." PX 14 at ¶15. The $64,219,514.46 amount stipulated to on October 13, 1999 excluded any interest. PX 12 at JA610.

The Oil Companies claim that they are also entitled to a simple annual interest rate of 2.5 percent on both the initial $18,000,000 December 12, 1994 payment and on the stipulated $64,219,514.46 for remediation costs, under the Contract Settlement Act,

41 U.S.C. § 106(f) (repealed 2011).[42] The Oil Companies claim 2.5% interest on $18,000,000 from January 1, 1995 through October 31, 1997, or a total interest payment of $1,275,000. Plaintiffs' Damages Exhibit ("Pl. Dm. Ex.") 5.[43] Since the Government did not dispute that the Oil Companies paid an additional $46,219,514.46 by November 1, 1997 for remediation costs, the Oil Companies also claim 2.5% interest on the $64,219,514.46 total stipulated amount, from November 1, 1997 through November 30, 2015, or an additional interest payment of $29,032,573.22. Pl. Damages Ex. 5; *see also* PX 14 at ¶15.

The Oil Companies do not claim any damages incurred between November 1, 1998 and August 2002, other than statutory interest, because, during this time, the EPA supervised all

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[42] Section 106(f) of the Contract Settlement Act ("CSA") of 1944 provides that,

> *Each contracting agency shall allow and pay interest on the amount due and unpaid from time to time on any termination claim under a prime contract at the rate of 2 ½ per centum per annum for the period beginning thirty days after the date fixed for termination and ending with the date of final payment*, except that (1) if the prime contractor unreasonably delays the settlement of his claim, interest shall not accrue for the period of such delay, (2) if interest for the period after termination on any advance payment or loan, made or guaranteed by the Government, has been waived for the benefit of the contractor, the amount of the interest so waived allocable to the terminated contract or the terminated part of the contract shall be deducted from the interest otherwise payable hereunder, and (3) if after delivery of findings by a contracting agency, the contractor appeals or sues as provided in section 113 of this title, interest shall not accrue after the thirtieth day following the delivery of the findings on any amount allowed by such findings, unless such amount is increased upon such appeal or suit. In approving, ratifying, authorizing, or making termination settlements with subcontractors, each contracting agency shall allow interest on the termination claim of the subcontractor on the same basis and subject to the same conditions as are applicable to a prime contractor.

41 U.S.C. § 106(f) (repealed 2011) (emphasis added).

In 2011, the CSA was repealed and replaced by An Act To Enact Certain Laws Relating To Public Contracts, Pub. L. 111–350, 124 Stat. 3677. The 2011 Act contained a savings clause providing that, "[t]he laws . . . are repealed except for *rights and duties that matured*, penalties that were incurred, and proceedings that were begun before the date of enactment of this Act." Pub. L. No. 111–350, § 7(b), 124 Stat. 3677, 3855 (2011) (emphasis added). Consequently, the Oil Companies may still recover for interest on the environmental remediation costs they have incurred, as the Oil Companies right to be reimbursed for environmental remediation costs under the Avgas Contracts matured prior to 2011.

[43] Plaintiff's Damages Exhibits 1–5, attached hereto as Court Exhibit C, summarize the amount of statutory interest that has accrued, on the initial $18 million December 13, 1994 payment and the subsequent October 13, 1999 $64,219,514.46 stipulated remediation cost figure, divided among the Oil Companies.

operations, maintenance, and monitoring work at the McColl Site. Pl DBr. at 125–26 (citing DX 275 (2000 & 2001 McColl Superfund Site Annual Reports) at ES-1).

In June 2002, the Oil Companies retained C2 REM to supervise future operations, maintenance, and monitoring ("OM&M") work at the McColl Site. PX 18 (Mr. Bourke) at 72. C2 REM submitted its first invoice to Shell on November 11, 2002. PX 104 (C2 REM Invoice). From November 11, 2002 to June 30, 2012, the Oil Companies incurred $2,935,846.26 that was paid to C2 REM, in addition to $348,316.68 in interest on those payments. Pl. Dam. Exs. 1–4; PX 104–221 (C2 REM Invoices). From July 1, 2012 to November 30, 2015, the Oil Companies incurred an additional $1,105,975.58 that was paid to C2 REM in addition to $293,208.51 in interest on those payments. Pl. Dam. Exs. 1–4; PX 223–263 (C2 REM Invoices) PX 300–301 (tables summarizing amounts paid to C2 REM and accrued interest).

Beginning in 2003, the Oil Companies also paid McAuley, LCX an annual lump sum of $20,000 to provide surface maintenance and site security for the McColl Site. PX 18 at 72 (Bourke Direct); TR at 408 (Bourke).[44] From June 24, 2003 to June 30, 2012, the Oil Companies also incurred $198,000.00 paid to McAuley, LCX, in addition to $22,733.38 in interest on that amount. Pl. Dam. Exs. 1–4; PX 271–80 (Records of Payment to McAuley, LCX). From July 1, 2012 to November 30, 2015, the Oil Companies paid an additional $59,400.00 to McAuley, LCX, and $19,279.23 in interest was accrued on those costs. Pl. Dam. Exs. 1–4; PX 281–83 (records of payment to McAuley, LCX); PX 303–04 (tables summarizing costs paid to McAuley, LCX and accrued interest).

In sum, the Oil Companies claim that they are entitled to:

(1) $64,219,514.46 in total remediation costs, including $18 million paid on December 12, 1994 and an additional $46,219,514.46 paid by November 1, 1997.

(2) $37,500 in interest each month on the $18 million paid on December 12, 1994, from January 1, 1995 to October 31, 1997, for a total of $1,275,000;

(3) $133,790.66 in in interest each month on the $64,219,514.46 total remediation costs, from November 1, 1997 to November 30, 2015, for a total of $29,032,573.22;

(4) $4,683,347.03 in costs with interest paid to C2 REM; and

(5) $299,412.61 in costs with interest paid to McAuley, LCX.

In sum, the Oil Companies claim a total of $99,509,847.32 in breach of contract damages, including accrued interest. Pl. DBr. at 170.

[44] One percent of the amount McAuley received was paid by another refining company, ConocoPhillips, and is not claimed as damages by the Oil Companies. Pl. DBr. at 126.

The Oil Companies have divided the damages payable to each Plaintiff, as summarized in the following table:

Plaintiff	Percent of Damages	Damages
Shell	58.58 percent	$58,292,868.56
Union	18.94 percent	$18,847,165.08
Atlantic Richfield	18.94 percent	$18,847,165.08
Texaco	3.54 percent	$3,522,648.60

Pl. DBr. at 170.[45]

b. The Government's Response.

The Government responds that the Oil Companies failed to prove damages to a degree of "reasonable certainty" and instead seek damages that are merely "speculative." Gov't DBr. at 65. The United States Court of Appeals for the Federal Circuit's third remand permitted the Government to "challeng[e]" the amount of damages owed, and consequently, the Oil Companies were required to submit evidence of damages. Gov't DBr. at 65 (citing *Shell Oil Co.*, 751 F.3d at 1303). The Stipulation relied on by the Oil Companies to establish their pre-November 1, 1999 damages is inadmissible. Gov't DBr. at 66; *see also* PX 12 at JA610 (10/13/99 Stipulation that the Government could owe the Oil Companies $64,219,514.46 for remediation costs, if the United States District Court for the Central District of California's Final Judgment Order was affirmed on appeal). Because the Stipulation is inadmissible, the Oil Companies have provided no evidence of damages. Gov't DBr. at 66.

Second, the Oil Companies failed to establish how any particular "charge" was incurred by each of the Oil Companies "by reason" of the Avgas Contracts. Gov't DBr. at 67. For example, Shell did not dispose of any spent alkylation acid, but did dispose of acid sludge during the relevant period. Gov't DBr. at 67.

Third, the Oil Companies' division of the remediation costs is an assignment of contractual rights, violating the Anti-Assignment Act.[46] Gov't DBr. at 3–4, 67. Nothing in the Avgas

[45] The amount paid and interest due for each Oil Company is also summarized in Pl. Dam. Exs. 1–5, attached hereto as Court Exhibit C.

[46] Section 3727(b) of the Anti-Assignment Act provides,

> (b) An assignment [of a claim against the federal government] may be made only after a claim is allowed, the amount of the claim is decided, and a warrant for payment of the claim has been issued. The assignment shall specify the warrant, must be made freely, and must be attested to by 2 witnesses. The person making the assignment shall acknowledge it before an official who may acknowledge a deed, and the official shall certify the assignment. The certificate shall state that the official completely explained

Contracts authorizes an assignment of rights and the Oil Companies may not assign their respective recovery rights to each other. Gov't DBr. at 67.

Fourth, the Oil Companies failed to proffer the "best evidence" of allocating actual damages incurred by reason of the DSC avgas production and the production of all other products. Gov't DBr. at 67.

Finally, the United States Court of Appeals for the Federal Circuit's recent decision *Northrop-Grumman Computing Sys., Inc. v. United States*, 823 F.3d 1364, 1368 (Fed. Cir. 2016), requires that the Oil Companies establish how much of the costs were allocated to each company and the Oil Companies failed to meet this burden. Gov't Notice of Supplemental Authority, ECF No. 211, at 2; Gov't Supp. Resp. at 1–2.

c. The Oil Companies' Reply.

The Oil Companies reply that the October 13, 1999 Stipulation in the CERCLA litigation (PX 12 at JA 610) is a judicial admission that is both admissible and binding on the parties. Pl. Reply Br. at 49. In any event, the Stipulation has been incorporated by the Government's subsequent admissions in this case that are admissible and binding on the Government. Pl. Reply Br. at 49 (citing PX 13–15).

As to the Oil Companies allocation, Mr. Bourke, President of C2 REM and issuer of the invoices to the Oil Companies, testified that the Oil Companies have "have allocated the costs they have incurred in the following manner: Shell (58.58 percent); Union (18.94 percent); Richfield (18.94 percent); and Texaco (3.54 percent)." Pl. Reply Br. at 50 (citing PX 18 (Mr. Bourke) at 76). The Government has presented no evidence that the Oil Companies did not properly divide the costs among themselves. Pl. Reply Br. at 51. And, the Oil Companies have not violated the Anti-Assignment Act, because they have not assigned anything. Pl. Reply Br. at 51.

In specific response to the Government's argument that Oil Companies have not allocated their damages between those costs incurred by reason of the production of avgas and those incurred by reason of the production of other products, the Oil Companies repeat that *all* costs were incurred "by reason" of the production of avgas, due to the nature of avgas production and the remediation solution elected by the EPA. Pl. Reply Br. at 52.

Finally, *Northrop-Grumman* did not hold that plaintiffs must prove how damages suffered by a group of plaintiffs should be allocated among them. Pl. Supp. Reply at 1. Instead, the United States Court of Appeals for the Federal Circuit held that, where "[t]he undisputed facts show that [the plaintiff] has suffered no harm," the plaintiff cannot recover damages based on harm suffered by a party not before the court. *See Northrop-Grumman*, 823 F.3d at 1368. In this case, the Oil Companies submitted evidence of the costs of environmental remediation incurred and paid by the reason of the Government's breach of the Taxes Clause of the Avgas Contracts. Finally, the

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> the assignment when it was acknowledged. An assignment under this subsection is valid for any purpose.

31 U.S.C. § 3727.

Government cites no precedent suggesting that an award of lump-sum damages to a group of plaintiffs is prohibited. Pl. Supp. Reply at 1.

d. The Court's Resolution.

With respect to the Government's argument that the Oil Companies relied on inadmissible evidence to establish their pre-1999 damages, the court has ruled today that the October 13, 1999 Stipulation (PX 12 at JA 610), although not a binding admission, is relevant, admissible, and reliable evidence. Court Exhibit B, Court Rulings Regarding Admissibility of Exhibits And Direct Testimony at 5.

With respect to the Government's argument that the Oil Companies failed properly to allocate damages among themselves, as a matter of law, damages in a breach of contract action must be established to a "reasonable certainty," but need not be established with "absolute exactness or mathematical precision." *See San Carlos Irr. & Drainage Dist. v. United States*, 111 F.3d 1557, 1563 (Fed. Cir. 1997) ("[W]here responsibility for damages is clear, it is not essential that the amount thereof be ascertainable with absolute exactness or mathematical precision[.]" (citation omitted)). To require individual Oil Companies to track how each barrel of spent alkylation acid or acid sludge affected the cost of a remediation solution implemented decades ago would require "absolute exactness or mathematical precision." The remediation solution elected by the EPA was to be accomplished by a cover system built over each of the twelve sumps with slurry walls. PX 524 (3/4/96 GeoSyntec Consultants Report discussing cover system solution for the McColl Site) at 1–2, 7–2. As such, the cost of remediation was the same regardless of the percentage of spent alkylation acid, acid sludge, other COCs deposited in each sump, or origins of the acid waste.

With respect to the Government's argument about the Anti-Assignment Act, the Oil Companies did not assign their rights to receive reimbursement for the Government's breach of the Avgas Contracts to any third parties. Instead the Oil Companies presented evidence of how they determined the percentage of damages that each of the Oil Companies were owed based on the payments of remediation made.

With respect to the Government's "best evidence" argument, the agreement among the Oil Companies as to the appropriate amount each company should pay for the required environmental remediation is relevant, admissible, and reliable evidence of how reimbursement by way of damages should be made.

Finally, *Northrop-Grumman* concerned whether a plaintiff could recover damages for breach of contract, after it privately assigned rights under a contract to third parties, in exchange for payment in an equivalent amount of plaintiff's anticipated profits under the contract. *See* 823 F.3d at 1366–67. Since the plaintiff in that case received payment from an assignee that was equivalent to expected profits under the contract, the plaintiff could not establish that it was in a "financially worse position," because of the Government's breach. *Id.* at 1368. In other words, the plaintiff in that case did not suffer any compensable harm. In this case, however, the Oil Companies did not assign any of their rights under the Avgas Contracts. And, even if *Northrup-Grumman* stood for the principle that a group of plaintiffs must establish damages "particular to

each plaintiff," the Oil Companies have met that burden, through their record of payments, as reflected in testimony of Mr. Bourke.

V. CONCLUSION.

For these reasons, the court has determined that all of the of the acid waste disposed of at the McColl Site was "by reason of" the Avgas Contracts, and that the Plaintiffs in this case have established, with reasonably certainty, damages for the Government's breach of the Avgas Contracts in the amount of $99,509,847.32, including interest, for the period of December 12, 1994 to November 13, 2015.

The court also has determined that the $99,509,847.32 is to be reflected in separate judgments to be entered and payable to each Plaintiff in the following amount as designated:

Shell Oil Company	$58,292,868.56
Union Oil Company of California	$18,847,165.08
Atlantic Richfield Company	$18,847,165.08
Texaco, Inc.	$ 3,522,648.60

IT IS SO ORDERED.

s/ Susan G. Braden
SUSAN G. BRADEN
Judge

COURT EXHIBIT A

COURT EXHIBIT A: THE RECORD ON REMAND

The record on remand includes the following:

I. Trial Testimony.

The testimony admitted during the three-day evidentiary hearing held at the United States Court of Federal Claims on February 16, 17, and 19, 2016. *See* Trial Volume 1 (Mar. 4, 2016), ECF No. 196; Trial Volume 2 (Mar. 8, 2016), ECF No. 198; Trial Volume 3 (Mar. 8, 2016), ECF No. 200.

II. Exhibits.

The parties also moved into evidence, without objection, the following exhibits. *See* Plaintiffs' List of Exhibits Moved Into Evidence (Feb. 17, 2016), ECF No. 190; Defendant's Exhibit List (Feb. 19, 2016), ECF No. 191; Plaintiffs' Motion to Supplement the Record (Oct. 18, 2016), ECF No. 214. After the evidentiary hearing, the Court required the parties to submit, by March 23, 2016, "any objections to the admissibility of any exhibits introduced during trial." *See* Scheduling Order (Mar. 1, 2016), ECF No. 194. Neither party objected to the admissibility of these exhibits; thus, any objection is waived, and the following exhibits are admitted into evidence:

A. Plaintiffs' Exhibits.

PX1	Texas Avgas Contract (Jan. 17, 1942)
PX2	Richfield Avgas Contract (Feb. 3, 1942)
PX3	Shell Avgas Contract (Apr. 10, 1942)
PX4	Tidewater Avgas Contract (June 10, 1942)
PX5	Union Avgas Contract (Dec. 31, 1942)
PX6	Union Avgas Contract (May 1, 1943)
PX7	Shell Avgas Contract (May 1, 1943)
PX8	Texas Avgas Contract (Feb. 8, 1943)
PX9	Tidewater Avgas Contract (Feb. 18, 1943)
PX10	Richfield Avgas Contract (Feb. 20, 1943)
PX16	Def.'s Resp. to Pls.' First Set of Requests for Admission, *Shell Oil Co. et al. v. United States* (Dec. 9, 2015) (No. 06-141C)

PX17	Portions of the Written Direct Testimony of Gregory G. Kipp, *Shell Oil Co. v. United States* (Feb. 5, 2016) (No. 06-141C) to which the Government has not objected in Defendant's Objections to Plaintiffs' Written Testimony, at 5–10 and 15–16 (Feb. 10, 2016), ECF No. 183 (*i.e.*, all but portions of pages 4, 9, 10, 12, 14, 15, 27–29, 32–34, 40, 41, 48, 49, 51, 56, 58–60, 69, 73–76, 84–87, 92, 93, 95, 101, 102, 104, 115–17, and 122).
PX18	Portions of the Written Direct Testimony of Edmond F. Bourke, *Shell Oil Co. v. United States* (Feb. 5, 2016) (No. 06-141C) to which the Government has not objected in Defendant's Objections to Plaintiffs' Written Testimony, at 5–10 and 15–16 (Feb. 10, 2016), ECF No. 183 (*i.e.*, all but portions of pages 5, 10, 23, 48, 49, 72–74, and 76).
PX101	Decl. of Edmond F. Bourke, *Shell Oil Co. et al. v. United States* (June 20, 2008)
PX102	Decl. of Edmond Bourke, *Shell Oil Co. et al. v. United States* (July 2010)
PX104–264	C2REM Invoices for McColl Site OM&M Costs (2002–2015)
PX271–83	Annual Payments to McAuley for M&S Costs, C2REM (2002–2015)
PX299	C2REM Costs Incurred from July 1, 2012 to Nov. 30, 2015 (Jan. 8, 2016)
PX300	Interests on C2REM Costs Paid Between July 1, 2012 & Nov. 30, 2015 (Jan. 8, 2016)
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PX302	McAuley Costs Incurred from July 1, 2012 to Nov. 30, 2015 (Jan. 8, 2016)
PX303	Interest on McAuley Costs Paid Between July 1, 2012 and Nov. 30, 2015 (Jan. 8, 2016)
PX304	New Interest Accrued on McAuley Costs Paid Prior to July 1, 2012 (Jan. 8, 2016)
PX510	McColl Phase II: Physical & Chemical Characterization & Distribution of the Waste at the McColl Site, Radian Corp. (Feb. 15, 1983)
PX511	EPA Superfund Record of Decision: McColl (Apr. 11, 1984)
PX512	Selective Excavation Treatment & RCRA Equivalent Closure Report, Environ (Feb. 12, 1991)
PX513	Technology Evaluation Report, USEPA (Jan. 1992)
PX514	Baseline Public Health Evaluation, IFC Technology (May 1992)
PX515	Baseline Public Health Evaluation, IFC Technology Inc. & Clement Int'l Protection Agency (May 1992)

PX516	Demonstration of a Trial Excavation at the McColl Superfund Site, USEPA (Oct. 1992)
PX517	Record of Decision: McColl, USEPA (June 30, 1993)
PX517A	[Complete] Record of Decision: McColl, USEPA (June 30, 1993)
PX518	Phase V Final Report, McColl Superfund Site Treatability Study, Environmental Solutions (Feb. 1, 1994)
PX519	Final Remedial Investigation Report, Groundwater Operable Unit, Environ (Dec. 29, 1995)
PX520	Full-Scale Treatability Study Report Draft, McColl Site Group (May 1995)
PX521	Baseline Risk Assessment for the McColl Superfund Site, ICF Technology, Inc. (Nov. 1995)
PX522	Fate & Transp. of Tetrahydrothiophenes at the McColl Site, McColl Site Group (Dec. 18, 1995)
PX523	Feasibility Study Report Groundwater Operable Unit, USEPA (Feb. 7, 1996)
PX524	Draft Integrated Conceptual Design Report, GeoSyntec & Parsons Engineering Science (Mar. 4, 1996)
PX525	1996 Record of Decision, USEPA (May 9, 1996)
PX526	EPA Superfund Record of Decision: McColl, USEPA (May 15, 1996)
PX527	Final Material Compatibility Laboratory Testing Report, GeoSyntec & Parsons Engineering Science (Oct. 31, 1996)
PX528	OM&M Plan McColl Superfund Site, Parsons (Oct. 15, 1997)
PX529	Remedial Action Report McColl Superfund Site, Parsons (Apr. 1998)
PX530	Superfund Closeout Report, Parsons (June 30, 1998)
PX531	EPA Superfund Explanation of Significant Differences: McColl (Sept. 1, 2005)
PX534	Letter from Refiner's Committee on Waste Disposal to Towler (July 5, 1956)
PX537	Aerial Photo (1981)
PX544	Aerial Photo (2012)
PX701	Decl. of John McColl, *Shell Oil Co. v. Accident & Casualty Ins. Co., et al.*, No. 278953 (Super. Ct. Cal. Sept. 25, 1987)
PX704	Deposition of Bruce Dunbar, *United States v. Shell Oil Co.*, No. 91-0589-RJK (Aug. 18, 1992)

PX706	Deposition of John McColl, *Protective Nat'l Ins. Co. of Omaha v. Union Oil Co.*, No. C-514-463 (Sept. 21, 1990), supplemented to include additional pages as stated in Defendant's Objections to Plaintiffs' Exhibits, at 10 (Mar. 23, 2016), ECF No. 201
PX707	Deposition of James V. Willacy, *United States v. Shell Oil Co.*, No. 91-0589-RJK (Aug. 20, 1992), supplemented to include additional pages as stated in Defendant's Objections to Plaintiffs' Exhibits, at 10 (Mar. 23, 2016), ECF No. 201
PX802	Methods of Mixing Sludge, George Pfau & C. A. Barrere (June 1931)
PX803	Sludge Conversion Process Improves Refinery Acid Recovery, F. J. Bartholomew (1933)
PX805	Burning Various Types of Oil Refinery Fuels, A. L. Wilson (1939)
PX808	Patent US2368063 (Jan. 23, 1945)
PX809	Chemical Refining of Petroleum, Vladimir Kalichevsky & Bert Allen Stagner (1942)
PX811	A History of the Petroleum Administration for War, John W. Frey & H. Chandler Ide (1946)
PX812	Petroleum Refinery Engineering, W. L. Nelson (1949)
PX814	Analysis of Sulfuric Acid & Acid Sludges from Petroleum Processes, F. T. Weiss et al. (1953)
PX816	Sulfuric Acid Use and Handling, Fasullo (1965)
PX817	Groundwater, R. Allen Freeze & John A. Cherry (1979)
PX818	Statistical Methods 8th ed., George G. Snedecor & William G. Cochran (1989)
PX820	Decomposition of Spent Alkylation Sulfuric Acid to Produce Sulfur Dioxide & Water, Stephen Sung et al. (1993)
PX822	Analytic Element Modeling of Ground-Water Flow & High Performance Computing, USEPA (May 2000)
PX823	Acid Runaways in a Sulfuric Acid Alkylation Unit, Liolios (Nov. 2001)
PX830	Corrosion & Fouling in Sulfuric Acid Alkylation Units, Jeff Caton et al. (Sept. 2008)
PX831	Handbook of Petroleum Processing, David S. Jones & Peter A. Pujadó (2008)
PX833	SULFURIC ACID 93% Material Safety Data Sheet, Rhodia (Jan. 2009)
PX836	Light Alkylate Naphtha (petroleum), USEPA (2015)

PX841	Patent US1954488 (Apr. 10, 1934)
PX851	Patent US2399805 (May 7, 1946)
PX852	Patent US2404452 (July 23, 1946)
PX901	Expert Report Table 1.1 Production of High Octane Aviation Gasoline (Barrels), Gregory G. Kipp (Oct. 19, 2015)
PX902	Expert Report Table 1.2 Increase in Avgas Production Over 1942 Levels, Gregory G. Kipp (Oct. 19, 2015)
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PX904	Revised Table 3.1 Destination of Acid Sludge and Spent Alkylation Acid at Shell's Refineries (Barrels), Gregory G. Kipp (Oct. 19, 2015)
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PX907	Expert Report Table 4.2 Net Available Capacity at General Chemical After Reprocessing Standard's Spent Alkylation Acid (Tons of Pure Acid/Day), Gregory G. Kipp (Oct. 19, 2015)
PX908	Expert Report Table 4.3 Acid Reprocessing Capacity of Los Angeles Chemical Companies, Gregory G. Kipp (Oct. 19, 2015)
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PX912	Expert Report Table 5 Acid Sludge Productions Rate at Shell's Refineries: 1944 vs. 1946 (Barrels), Gregory G. Kipp (Oct. 19, 2015)
PX913	Expert Report Revised Table 6 Sulfuric Acid Usage at the Continuous Acid Treater, Gregory G. Kipp (Oct. 19, 2015)
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PX916	Expert Report Revised Figure 3 Comparison of Spent Alkylation Acid Generated and Avgas Produced, Gregory G. Kipp (Oct. 19, 2015)
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PX1236	Acid Recovery Facilities for the Texas Company 100 Octane Plant at Wilmington, California, Griswold (Mar. 17, 1943)
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PX1270	Sulfuric Acid for the Los Angeles Area, Reuter (May 7, 1945)
PX1273	Minutes of Meeting, Avgas Subcomm. (May 23, 1945)
PX1275	Minutes of Meeting, Dist. 5 Avgas Subcomm. (July 18, 1945)
PX1279	Incorporated Wilmington and Dominguez Refineries Operating Report for Year 1946, Shell Oil Co. (1946)
PX1282	Memorandum to File, Bretizus (Nov. 25, 1953)
PX1284	Incorporated Wilmington and Dominguez Refineries Operating Report Year 1945, Shell Oil Co. (Apr. 28, 2005)

PX1298	Letter from Jesse H. Jones to E.R. Stettinius, Jr. (Sept. 27, 1940)
PX1307	Memo from Bruce K. Brown to Ralph K. Davies re 100 Octane Aviation Gasoline New Plants Program (Dec. 12, 1941)
PX1308	Letter from Jesse H. Jones to H.A. Mulligan (Jan. 6, 1942)

B. <u>Defendant's Exhibits.</u>

DX1	Declaration of C. Satterfield with attachments (CERCLA) (01/05/1995)
DX2	Declaration of R. Anderson with attachments (CERCLA) (02/16/1995)
DX3	Shatterfield Report II - CERCLA (03/14/1997)
DX4	Declaration of R. Anderson with attachments (CERCLA) (03/31/1997)
DX5	Findings of fact and conclusions of law in Western Properties Serv. Corp. v. Shell Oil (C.D. Cali. Mar. 31, 1999) (03/01/1999)
DX6	Complaint, Ct. No. 06-141C (Fed. Cl.) (02/24/2006)
DX7	Plaintiff's Opposition to Motion to Dismiss and Cross Motion for Partial Summary Judgment in *Shell Oil Co. v. United States* (Ct. Fed. Cl. June 30, 2006) (06/30/2006)
DX8	Plaintiff's Reply ISO Cross Motion for Partial Summary Judgment in Shell Oil Co. v. United States (Ct. Fed. Cl. Sept. 1, 2006) (09/01/2006)
DX9	Reply Brief of Appellants, Shell Oil Co., *et al.* in *Western Properties Servs. Corp. v. Shell Oil Co.* , 2002 WL 32302276 (9th Cir. 2002). (11/09/2010)
DX10	Pl.'s Resp. to Def.'s 1st Set Of Requests For Admission and Interrogatories, dated March 16, 2015 (03/16/2015)
DX11	Pl.'s Resp. to Def.'s 2d Set of Interrogs., dated Apr. 27, 2015 (04/27/2015)
DX12	*Exxon Mobil Corp. v. United States*, C.A. Nos. H-10-2386, H-11- 1814, 2015 WL 3513949 (S.D. Tex. June 4, 2015) (06/04/2015)
DX13	Pl.'s Resp. to Def.'s 4th Set of Discovery., dated Oct. 1, 2015 (10/01/2015)
DX14	Plaintiffs' Supp Respose to 2d Set of Interrogatories (10/29/2015)
DX15	Plaintiffs' responses to Defendant's Fifth set of Discovery Requests in Shell Oil Co. v. United States (Ct. Fed. Cl.) (11/24/2015)
DX16	Contract between Defense Supplies Corporation and The Texas Company, Jan. 17, 1942 (01/17/1942)
DX17	Contract between Defense Supplies Corporation and Shell Oil Company, Inc., Apr. 10, 1942 (04/10/1942)

DX18	Contract between Defense Supplies Corporation and Tidewater Assoc. Oil Co., June 10, 1942 (06/10/1942)
DX19	Shell-McColl Contracts - 1942-1944 (06/23/1942)
DX20	Agreement between the Army, Navy, DSC, and PAW (12/19/1942)
DX21	Contract between Defense Supplies Corporation and Union Oil Company, Dec. 31. 1942 (12/31/1942)
DX22	Contract between Defense Supplies Corporation and Richfield Oil Corporation, Feb. 3, 1942 (02/03/1943)
DX23	Contract between Defense Supplies Corporation and The Texas Company, Feb. 8, 1943 (02/08/1943)
DX24	Contract between Defense Supplies – Richfield (Watson Refinery – Second Contract), 2/20/1943, "Revised 2/16/1943 (02/16/1943)
DX25	Contract between Defense Supplies Corporation and Tidewater (02/18/1943)
DX26	Contract between Defense Supplies Corporation and Richfield Oil Corporation, Feb. 20, 1943, revised 3/23/43 (03/23/1943)
DX27	Gray Trucking - Shell Contract -1933 (02/27/1943)
DX28	Contract between Defense Supplies Corporation and Union Oil Company, revised July 29, 1943 (07/29/1943)
DX29	Contract between Defense Supplies Corporation and Shell Oil Company, Inc., revised January 1, 1944 (01/01/1944)
DX30	"Shell Oil Company, Wilmington and Dominguez Refineries, Operating Report, Year 1939 (12/31/1939)
DX31	Shell Oil Company,Wilmington and Dominguez Refineries, Operating Report, Year 1940 (excerpt) (01/01/1941)
DX32	Shell Oil Company, Wilmington and Dominguez Refineries, Operating Report, Year 1941 (01/01/1942)
DX33	Richfield Operations Report (09/14/1942)
DX34	Shell Oil Co., Wilmington and Dominguez Refineries, Operating Report, 1942 (1905)
DX35	Shell Oil Company, Wilmington and Dominguez Refineries, Operating Report, Year 1943 (1905)
DX36	Wilmington and Dominguez Refineries Operating Report, 1944 (1905)
DX37	Shell Oil Company, Wilmington and Dominguez Refineries Operating Report, 1945 (1905)
DX38	Shell Oil Company, Wilmington and Dominguez Refineries Operating Report, 1946 (04/04/1947)
DX39	Richfield Annual Report 1939

DX40	Richfield Annual Report 1940
DX41	Shell Union Oil Corp., Annual Report For the Year Ended, December 31, 1941
DX42	Richfield Annual Report 1941
DX43	Richfield Annual Report 1942
DX44	Richfield Annual Report 1943
DX45	Richfield Annual Report - 1944 Shell Oil Company, Incorporated, Wilmington and
DX46	The Texas Co. Annual Report 1943
DX47	Richfield Annual Report 1945
DX48	Richfield Annual Report 1946
DX49	The Texas Company, 1946 Annual Report
DX50	The Texas Company and Subsidiary Companies, *Annual Report, 1950*
DX51	Richfield Oil Company, *Annual Report for 1950*
DX52	*The Oil and Gas Journal , Refineries Operating In the United States - 1938 (05/31/1938)*
DX53	Refineries Operating In the United States - 1943 (03/25/1943)
DX54	*The Oil and Gas Journal , Refineries Operating In the United States - 1945 (03/31/1945)*
DX55	Refinery Sulphuric Acid Survey, Douglas Oil & Refinery Co. (01/14/1942)
DX56	Refinery Sulphuric Acid Survey, The Texas Company - Los Angeles Works (12/09/1941)
DX57	Refinery Sulphuric Acid Survey, Wilmington Refinery (Shell) (12/15/1941)
DX58	Refinery Sulphuric Acid Survey, Martinez Refinery (Shell) (12/15/1941)
DX59	Refining Committee District 5 Sulfuric Acid Survey (01/07/1942)
DX60	Refinery Sulfuric Acid Survey, Petroleum Coordinator for War, Refining Committee—District 5 (01/09/1942)
DX61	Refining Committee - District 5, Refinery Sulfuric Acid Survey (01/09/1942)

DX62	"Sulfuric Acid Survey, Estimated Requirements of Petroleum Refiners 1942," compiled by Office of Petroleum Coordinator for War, Refining Division, Construction Section (08/08/1942)
DX63	E.L. Hildebrand, *The Oil and Gas Journal* , "Handling Sulfuric Acid Sludges"
DX64	Memorandum for A.W. Raine Re: Amounts and Concentration of Separated Sludge Acid Available for Recovery (06/29/1923)
DX65	J.B. Rather, National Petroleum News , "Acid Sludge Disposal Remains Unsolved Problem to Refining Plants" (02/22/1928)
DX66	*Refiner and Natural Gasoline Manufacturer*, "Burning Acid Sludge" (08/01/1931)
DX67	H. Wade, Oil Bulletin, " Air Pollution at Long Beach" (09/01/1930)
DX68	A. Anderson, *Refiner and Natural Gasoline Manufacturer*, "Recent Acid Sludge Burner Research" (03/01/1932)
DX69	Shell Oil Co., Gray Trucking Co. Contract Docs (1933-1935)
DX70	Nuisance Letter - 1932 (05/11/1932)
DX71	Minutes of refiners' committee on waste disposal (07/12/1932)
DX72	B. Stagner, Refiner and Natural Gasoline Manufacturer , "Sulfur Dioxide and Fresh Sulfuric Acide From Refinery Acid Sludge" (02/01/1936)
DX73	Gray Trucking Nuisance Petitions - 1936 (08/31/1936)
DX74	*Westminster Gazette*, "Health Officer Says Fumes Are Deadly" (09/24/1936)
DX75	Minutes of committee on refinery odors (10/02/1934)
DX76	Gray Trucking Nuisance Letter - 1936 (11/04/1936)
DX77	June 1938 Advertisement in Petroleum World, cited in Bookspan Report at 12. (06/01/1938)
DX78	Acid Sludge Memorandum from L. Rosenstein to C. deBruyn (05/08/1939)
DX79	J. Hill, *Industrial and Engineering Chemistry*, "Waste Problems in the Petroleum Industry" (11/01/1939)
DX80	Gray Trucking Nuisance Report - 1940 (06/20/1940)
DX81	Shell Letter from Supt. Of Watson Refinery to Coyle and Sullivan re: Sludge (11/13/1941)
DX82	Newspaper articles re Thomas Ranch (1942)

DX83	M-3 Permit Case No. 210 - Rubbish Dump, San Jose District - Testimony and supporting documents (05/06/1942)
DX84	News report and fish and game reports re: illegal dumping/overflows (1941-1943)
DX85	L. Burroughs, *Petroleum Refiner* , "Disposal of Refinery Wastes" (07/01/1946)
DX86	Shell dumping request - 1948 (12/02/1948)
DX87	Memo from J. Partia to R. King re: petroleum industries' waste (03/02/1949)
DX88	intentionally omitted
DX89	Letter from E. McColl to N. Hiltscher (05/09/1951)
DX90	McColl 1951 Dumping Letter (09/25/1951)
DX91	Memo to file by D. Bretisus re: Shell Dominguez plant (11/25/1953)
DX92	Minutes of area refineries meeting re: Nuisance Acid Sludge (07/11/1957)
DX93	Internal Union Oil memo from J. Sherborne to H. Ellis re: refinery acid sludge disposal in Fullerton sumps (08/16/1957)
DX94	Letter from P. Merkus, Shell Oil refinery manager, to various oil companies re: rehab of acid sludge disposal ponds by E. McColl (08/22/1957)
DX95	Letter to T. Edwards re: oil companies' plan to loan money to E. McColl (with attached correspodence and meeting minutes) (08/23/1957)
DX96	Declaration of John McColl, July 29, 1987, Shell Oil Co. vs. Accident and Casualty Insurance Company, et al . (07/29/1987)
DX97	Declaration of John McColl with exhibits, July 29, 1987, Shell Oil Co. vs. Accident and Casualty Insurance Company, et al. (07/29/1987)
DX98	Image of 1,200 and 2,400 Barrel Agistators, ca. 1916, source: Bacon, R.F.; and Hamor, W.A., The American Petroleum Institute, Volume II (1916)
DX99	C. Ellis, "Process for Making Motor Fuel," U.S. Patent 1,318,061 (10/17/1919)
DX100	intentionally omitted
DX101	C. Kettering, *National Petroleum News*, "Automotive Developments Held Back by Lack of True Anti-Knock Fuels" (04/30/1930)
DX102	A. Claydon, *National Petroleum News*, "Automobile Engineers to Rate Knocking by Octane Number" (06/04/1930)
DX103	G. Vaughn, *The Oil and Gas Journal*, "Fuel Problems in Aviation Engines" (09/25/1930)
DX104	W. Ziegenhain, *The Oil and Gas Journal* "Many 1932 Model Cars Will Need Gasoline of Higher Octane Number" (12/24/1931)

DX105	C. Wilson, *The Oil and Gas Journal*, "Car Manufacturers Want Higher Octanes" (04/28/1932)
DX106	*The Oil and Gas Journal*, "New Airplanes Demand 100 Octane Number Motor Fuel for Starting," (07/04/1935)
DX107	Letter from J. Doolittle to Bureau of Aeronautics (10/23/1935)
DX108	*National Petroleum News*, "Air Corps Buys 900,000 Gallons of Super-Fuel in 1935" (01/08/1936)
DX109	*National Petroleum News*, "Royal Dutch Shell Operations In U.S. Profitable in 1935 (04/15/1936)
DX110	H. Ralph, *The Oil and Gas Journal*, "Three Industries Cooperate to Advance Aviation" (05/20/1937)
DX111	*American Petroleum Institute Quarterly*, "3,000 Oil Men Discuss Industry at Institute's Eighteenth Annual Meeting" (partial) (01/01/1938)
DX112	Dubbscracking advertisement, *Petroleum World* (06/01/1938)
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DX114	intentionally omitted
DX115	J. Collins, *Petroleum World*, "Now—Desulphurizaton Without Sludge" (01/01/1940)
DX116	*National Petroleum News* , "Defense Plan Begins to Shape Up," "Ickes Studies War-Oil Plan," "See Aviation 'Gas' Civil Demand Rise," and "Fueling of Warplane Fleet Studied By Defense Group" (06/12/1940)
DX117	Memorandum re District 5 Products Sold to Federal Government 1942-45
DX118	Letter from Shell to Petroleum Coordinator for National Defense re: avgas production, capacity, properties, and compositions (07/25/1941)
DX119	Letter from Texas Company to Subcommittee on Aviation Gasoline re: avgas Questionnaires (10/03/1941)
DX120	D.W. Wilson, Memorandum for the Files re: 100 octane aviation gasoline (10/06/1941)
DX121	Letter from W. Gary, Director of Refining, to A. Fraser, Shell Oil, re: potential increase in avgas production (11/04/1941)
DX122	D.W. Wilson, Memorandum of Conference re: Union Oil production of toluene and 100 octane avgas (11/17/1941)
DX123	Excerpt from transcript of Conference of Petroleum Industry Committee Chairmen re: alkylation royalty rates (10/20/1941)
DX124	Letter from W.H. Geis, Union Oil, to W. Gary, OPC, re: expected 100 octange avgas production (12/16/1941)
DX125	Letter from H. Sinclair, Richfield Oil, to DSC re: erection of additional refinery facilities in Watson, California (01/05/1942)

DX126	Letter from M. Halpern, Texas Company, to W. Gary, OPC, re: estimated costs of 100 octane avgas (01/06/1942)
DX127	Letter from E. Isom, Richfield Oil, to W. Gary, OPC, re: 100 octane avgas prices (01/08/1942)
DX128	Letter from Chairman, Richfield Oil, to R. Davies, Deputy Petroleum Coordinator for National Defense, re: proposal to erect additional facilities to manufacture avgas (01/13/1942)
DX129	Letter from M. Halpern, Texas Company, to W. Gary, OPC, re: estimated costs of 100 octane avgas production (01/13/1942)
DX130	Memo to file by B. Brown, G. Parkhurst, and W. Gary re: Sinclair and Richfield avgas contract negotiations (01/26/1942)
DX131	Internal OPC memo from D. Wilson to W. Gary re: Richfield Price Negotiations (02/03/1942)
DX132	Internal OPC memo from D. Wilson to W. Gary re: proposed Union Oil avgas plant (02/04/1942)
DX133	Letter from R. Taylor, Union Oil, to H. Ickes, Petroleum Coordinator for National Defense, re: submitted avgas contract (02/05/1942)
DX134	Memo from B. Brown re: avgas supply and capacity (03/06/1942)
DX135	Internal OPC memo from D. Wilson to W. Gary re: conference with Shell Oil re: 100 octane avgas (04/08/1942)
DX136	100-Octane Aviation Gasoline Cost Analysis and Breakdown prepared by Shell Oil for DSC (04/08/1942)
DX137	Avgas Price Negotiation Memo by B. Brown, D. Wilson, and G. Parkhurst of OPC - 1942 (04/22/1942)
DX138	Letter from R. Herndon, Texas Company, to R. Cragin, OPC, re: Navy Department avgas contracts (06/09/1942)
DX139	Letter from R. Isom, Richfield Oil, to R. Davies, Department of Interior, re: proposal for supplying 100 octane avgas (06/24/1942)
DX140	Internal OPC memo from G. Parkhurst to B. Brown re: proposed Richfield Oil avgas expansion (06/25/1942)
DX141	Letter from W. Stewart, Union Oil, to B. Brown, OPC, re: Union's preference to negotiate directly with Army and Navy (08/19/1942)
DX142	Various Reports on Refining and Refined Products, PAW District 5 (1942)
DX143	Internal OPC memo from G. Parkhurst to B. Brown re: 100 octane avgas Richfield Oil (09/01/1942)
DX144	Letter from R. Gragin to G. Parkhurst re: Army and Navy base prices for 100 octane avgas (10/15/1942)
DX145	Letter from R. Taylor, Union Oil, to R. Davies, Deputy Petroleum Coordinator for War, proposing Executive Order (with attachment) (10/16/1942)
DX146	Letter from M. Halpern, Texas Company, to E. Cumming, OPC, re: proposal to consturct additional avgas facilities (12/05/1942)

DX147	Letter from W. Stewart, Union Oil, to G. Parkhurst, Office of Petroleum Adminstration for War, re: avgas contract terms (12/22/1942)
DX148	PAW District 5 Summary Report (11/19/1942)
DX149	Internal OPC memo from B. Brown to R. Davies re: avgas discusisons with Sinclair Refining Co. (02/03/1943)
DX150	Shell Oil Co. table re: value of current 1942-43 contracts (02/17/1943)
DX151	Letter from M. Halpern, Texas Company, to G. Parkhurst, PAW, re: 100 octane avgas (05/19/1943)
DX152	PAW memo re: Richfield Oil price negotiation (05/24/1943)
DX153	Internal OPC memo from G. Skerritt to K. Stone re: DSC avgas purchase, Jan./Feb. 1943 (06/19/1943)
DX154	Aviation Gasoline Subcommittee Meeting Minutes- 8.10.43 (08/10/1943)
DX155	Letter from Union Oil to Paymaster General of Navy re: avgas contract deliveries in August 1943 (09/03/1943)
DX156	Memo of recommendation from G. Parkhurst, PAW, re: Union Oil avgas contract (09/13/1943)
DX157	Various requests for PAW exceptions, 1943-45 (10/09/1943)
DX158	Letter from V. Stapleton, Akylation Subcommittee Chairman, to R. Follis, District 5 Technial Subcommittee, re: District 5 acid (circa 10/9/1943)
DX159	Aviation Gasoline Subcommittee Meeting Minutes 10.19.43 (10/19/1943)
DX160	Letter from R. Follis, District 5 avgas subcommittee chairman, to V. Stapleton, Texas Co., re: sulfuric acid for alyklation district 5 (10/22/1943)
DX161	W. Tidwell & B. O'Callaghan, Monograph: The Role of DSC in the Wartime Aviation Gasoline Program (05/01/1905)
DX162	"General Summary—Sulfuric Acid Reports," November 29, 1943-December 14, 1943; Exhibit Smith-4, 8-1080, Defendant's Exhibit 280 (1943)
DX163	Various acid reports from R. Smith to P. Blakemore (1943)
DX164	PAW May-June Petroleum Supply Program (circa 1943)
DX165	Refinery Committee District 5 Minutes (01/20/1944)
DX166	PAW press release re: Peacetime Uses (04/06/1944)
DX167	PAW press release re: rumors of over abundance of motor fuel (04/13/1944)
DX168	Letter from R. Follins, District 5 Avgas Subcommittee, to R. Cragin, PAW, re: efficient use of sulfuric acid (04/24/1944)

DX169	PAW press release re: Motor Gas (05/26/1944)
DX170	Agreement Extending and Modifying The Aviation Gasoline Reimbursement Plant+C166 and the Four-Party Purchase Agreement (07/01/1944)
DX171	Letter from M. Halpern, Texas Company, to G. Parkhurst, PAW, re: historical avgas data (08/18/1944)
DX172	District 5 Avgas Subcommittee Meeting Minutes (09/20/1944)
DX173	District 5 Avgas Subcommittee Meeting Minutes (09/20/1944)
DX174	Memo from H. Stiles to F. Jayne re: unit prices for 100 octane avgas 1935-41 (12/12/1944)
DX175	Avgas subcommittee meeting minutes (12/27/1944)
DX176	*Science Newsletter,* "Better Postwar Cars" (01/27/1945)
DX177	Avgas subcommittee meeting minutes (02/21/1945)
DX178	Detail of Petroleum demand data - PAW District 5, Statistical Section (02/17/1945)
DX179	District 5 avgas subcommittee meeting minutes (02/21/1945)
DX180	Various letters from district 5 to PAW (1945)
DX181	Shell Wilshire Agreement (04/06/1945)
DX182	District 5 avgas subcommittee meeting minutes (04/11/1945)
DX183	Statements of Tank Car Shipments from District 5 to District 1 and District 3 (1943)
DX184	District 5 avgas subcommittee meeting minutes (05/23/1945)
DX185	District 5 avgas subcommittee meeting minutes (07/18/1945)
DX186	Letter from P. Byrne, PAW, to M. Yonker, District 5, re: sulfuric acid (07/19/1945)
DX187	Telegram from P. Davies, PAW, to all refiners re: end of war (08/15/1945)
DX188	Telegram from A. Frame, director of refining, to H. Gallagher, district 5 director, re: end of war (08/18/1945)
DX189	E.L. Hildebrand, *The Oil and Gas Journal*, "Handling Sulfuric Acid Sludges" (09/30/1948)
DX190	Advertisement, *Torrace* (CA) *Herald*, September 20, 1945 (09/20/1945)

DX191	E.F. Lindsley, Scientific American , "Fuels Rated By Performance" (03/01/1946)
DX192	A.P. Frame, "Postwar Effects of Refinery Wartime Construction," *Oil and Gas Journal* (03/30/1946)
DX193	J. Carmical, "New Oil Processes Benefit Motorists," New York Times , Apri 21, 1946 (04/21/1946)
DX194	B. Pierce, New York Times , "Shortages Restrict Production of the Fuel Which New Cars Are Designed to Use" (12/22/1946)
DX195	V. Biske, Institute of Petroleum Review , "Acid Sludge Disposal" (1947 circa)
DX196	*New York Times* , "Unfilled Backlog for Autos Grows: Record Production this Year Will Not Satisfy Demand" (03/14/1948)
DX197	*New York Times* , "Output Held High in Auto Industry" (07/17/1949)
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DX199	*Science News Letter*, "Car Industry Looks Ahead" (01/28/1950)
DX200	*Shell News*, "Wilmington Refinery to Serve the West" (03/01/1950)
DX201	Octane Number Data (Blade 1955) (1955)
DX202	E. Welty and F. Taylor, The Black Bonanza, The Fabulous Life and Times of the Union Oil Company of California (excerpt) (1958)
DX203	C. Jones, From the Rio Grande to the Artic, The Story of the Richfield Oil Corp. (excerpt) (1972)
DX204	M. Gladstone, L.A. Times , "Gas Seeping Into Mobile Home Park" (12/09/1982)
DX205	Texaco Website, 1901-2014 timeline (12/11/2015)
DX206	McColl pre-SARA Record of Decision (ROD) (04/11/1984)
DX207	*L.A. Times*, "State Orders Cleanup of Old Gardena Dump Site" (07/09/1992)
DX208	McColl Source Record of Decision (ROD) (06/30/1993)
DX209	J. Gary & G. Handwerk, Petroleum Refining Technology and Economics (3d ed) (excerpt) (1994)
DX210	HF alkylation description and block diagram
DX211	McColl Groundwater Record of Decision (ROD) (05/15/1996)
DX212	S. Howarth, A Century of Oil, The "Shell" Transport and Trading Company, 1897-1997 (excerpt) (1997)

DX213	EPA, “McColl Superfund Site -- Five-Year Review Complete” (06/01/2008)
DX214	Octane History Chart (03/12/2013)
DX215	U.S. Energy Info Administration, “Alkylation is an important source for octane in gasoline,” available at http://www.eia.gov/todayinenergy/detail.cfm? id=9971 (10/08/2015)
DX216	Shell Oil Co., “Post-war expansion,” available at http://www.shell.com/global/aboutshell/who-we-are/ourhistory/post-war-expansion.html (12/04/2015)
DX217	California Energy Comm'n, “California Oil Refinery History,” available at http://energyalmanac.ca.gov/petroleum/refinery_history.html (12/14/2015)
DX218	Shell Oil Co., “Shell in Carson Southern California, About Carson,” available at http://www.shell.us/about-us/projects-andlocations/shell-in-carson-southern-california/about-carson.html (12/14/2015)
DX219	EPA Overview of Ralph Gray Trucking Co. superfund site (12/28/2015)
DX220	Appendix C, Brownfield Property Listing
DX221	1940 California road map (1940 circa)
DX222	Snedecor & Cochran, Statistical Methods , Chapter 10: Correlation (8th ed.1989) (1989)
DX223	Excerpts of record in *Western Properties Servs. Corp. v. Shell Oil Co* . (9th Cir.)
DX224	EDR Aerial Photo Decade Package, McColl Superfund site in Fullerton, California (Undated)
DX225	V. Kalichevsky & B. Stagner, Chemical Refining of Petroleum, “Chapter III: Sulfuric Acid Sludge and Hydrogen Sulfide; Recovery and Manufacture of Sulfuric Acid” (revised ed.) (1942)
DX226	Spent alkylation acid situation forecast, Q1 1945 (1945)
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DX230	Aerial photograph 1963 (1963)
DX231	Aerial photographs 1968-1981 (1968-1981)
DX232	EPA Report, “Trace Elements Associated with Oil Shale and its Processing” (05/01/1977)

DX233	Radian Corp., Technical Memo: "McColl Phase II, Physical and Chemical Characterization and Distribution of the Waste at the McColl Site" (submitted to California Department of Health Services) (02/15/1983)
DX234	L. Streebin et al., U.S. Department of Commerce, "Land Treatment of Petroleum Refinery Sludges" (11/01/1984)
DX235	EPA Superfund Record of Decision (ROD) McColl site (04/11/1984)
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DX237	CH2M Hill, McColl Site Field Report for EPA (10/09/1987)
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DX239	W. Cullen & K. Reimer, "Arsenic Speciation in the Environment" (07/12/1988)
DX240	B. Puri & K. Irgolic, "Determination of arsenic in crude petroleum and liquid hydrocarbons" (09/27/1989)
DX241	Aerial photo (1990)
DX242	Environmental Solutions, Inc., McColl Superfund Site: Selective Excavation Treatment and RCRA Equivalent Closure Report (02/12/1991)
DX243	Clement Int'l Corp., Addendum to the Baseline Public Health Evaluation for McColl Superfund Site (prepared for EPA) (07/01/1992)
DX244	Clement Int'l Corp., Baseline Public Health Evaluation for McColl Superfund Site (prepared for EPA) (05/01/1992)
DX245	EPA Demonstration of a Trial Excavation at the McColl Superfund Site, Applications Analysis Report (10/01/1992)
DX246	ICF Technology Inc., Public Health Evaluation of Remedial Alternatives at McColl Superfund Site, Vol. 1 (prepared for EPA) (05/01/1992)
DX247	ICF Technology Inc., Public Health Evaluation of Remedial Alternatives at McColl Superfund Site, Vol. 2 attachments (prepared for EPA) (05/01/1992)
DX248	E. Calabrese & P. Kostecki, Principles and Practices for Petroleum Contaminated Soils , "Chapter 9: Mathematical Hydrocarbon Fate Modeling in Soil Systems" (1993)
DX249	S. Sung et al., Ind. Eng. Chem. Res. , "Decomposition of Spent Alkylation Sulfuric Acid to Produce Sulfur Dioxide and Water" (08/02/1993)
DX250	EPA Superfund Record of Decision (ROD) McColl site (06/30/1993)
DX251	Aerial photographs 1994-2005 (1994-2005)
DX252	McColl Superfund Site Treatability Study, Phase V Final Report (prepared for EPA) (02/01/1994)
DX253	McColl site aerial photographs 1995-1998 (1995-1998)

DX254	Environ Corporation, Fate and Transport of Tetrahydrothiophenes at the McColl Site (12/18/1995)
DX255	Environ Corporation, Quarterly Groundwater Monitoring Report Q1 Sampling Period (1994) at McColl Site (03/02/1995)
DX256	ICF Technology, Inc., Final Baseline Risk Assessment for McColl Superfund Site Groundwater Operable Unit (prepared for EPA) (11/01/1995)
DX257	Environ Corporation, Quarterly Groundwater Monitoring Report Q2 Sampling Period (1995) at McColl Site (prepared for EPA) (04/27/1995)
DX258	Environ Corporation, Quarterly Groundwater Monitoring Report Q3 Sampling Period (1995) at McColl Site (prepared for EPA) (07/27/1995)
DX259	F. Manning & R. Thompson, Oilfield Processing Volume Two: Crude Oil , "Chapter 2: Characterization of Crude Oils" (Undated)
DX260	Memo from M. Rorty, ICF Technology Inc., to M. Wolfram, EPA; re: period and regional aquifer wells, McColl groundwater (06/14/1995)
DX261	Environ Corporation, Final Remedial Investigation Report Groundwater Operable Unit at McColl Site (prepared for EPA) (12/29/1995)
DX262	Environ Corporation, Final Remedial Investigation Report Groundwater Operable Unit at McColl Site - Appendicies (prepared for EPA) (12/29/1995)
DX263	Environ Corporation, Final Remedial Investigation Report Groundwater Operable Unit at McColl Site - Overize figures (prepared for EPA) (12/29/1995)
DX264	Environ Corporation, Final Remedial Investigation Report Groundwater Operable Unit at McColl Site - Additional oversize figures (prepared for EPA) (12/29/1995)
DX265	The McColl Site Group, Task 4 Full-Scale Treatability Study Report Draft for McColl Site (prepared for EPA) (05/01/1995)
DX266	GeoSyntec Consultants, Task 13.4 Final Material Compatibility Laboratory Testing Report for McColl Superfund Site (prepared for EPA) (10/31/1996)
DX267	EPA Feasibility Study Report Groundwater Operable Unit at McColl Site (02/07/1996)
DX268	GeoSyntec Consultants, Task 14.2 Draft Integrated Conceptual Design Report for McColl Superfund Site (prepared for EPA) (03/04/1996)
DX269	EPA Superfund Record of Decision (ROD) McColl site (05/15/1996)
DX270	Parsons Engineering Science, Operations and Maintenance Plan at the McColl Superfund Site (prepared for EPA) (10/15/1997)
DX271	EPA Superfund Closeout Report for McColl Superfund Site (06/20/1998)
DX272	Parsons Engineering Science, Remedial Action Report at the McColl Superfund Site (prepared for EPA) (04/01/1998)
DX273	J. Matschullat, The Science of the Total Environment , "Arsenic in the geosphere - a review" (2000)
DX274	Montgomery Watson Harza, McColl Superfund Site Five-Year Review Report (prepared for U.S. Army Corps of Engineers) (11/01/2002)
DX275	Montgomery Watson Harza, McColl Superfund Site Annual Reports 2000 & 2001 (prepared for U.S. Army Corps of Engineers) (10/01/2002)

DX276	EPA First 5-Year Review Report at McColl Superfund Site (09/30/2002)
DX277	C2REM, 2002 Operations, Maintenance & Monitoring Annual Report at McColl Superfund Site (prepared for McColl Site Group) (05/01/2003)
DX278	C2REM, Draft 2003 Operations, Maintenance & Monitoring Annual Report at McColl Superfund Site (prepared for McColl Site Group) (02/06/2004)
DX279	EPA Superfund Explanation of Significant Differences at McColl Site (09/01/2005)
DX280	C2REM, Draft 2004 Operations, Maintenance & Monitoring Annual Report at McColl Superfund Site (prepared for EPA) (02/01/2005)
DX281	C2REM, Final 2005 Operations, Maintenance & Monitoring Annual Report at McColl Superfund Site (prepared for EPA) (03/01/2006)
DX282	C. Duyck et al., Spectrochimica Acta Part B , "The determination of trace elements in crude oil and its heavy fractions by atomic spectrometry" (05/03/2007)
DX283	U.S. Army Corps of Engineers, Final Second 5-Year Review Report for McColl Superfund Site (prepared for EPA) (09/25/2007)
DX284	C2REM, 2007 Operations, Maintenance & Monitoring Annual Report at McColl Superfund Site (prepared for EPA) (04/01/2008)
DX285	Aerial photographs 2009-2010 (2009-2010)
DX286	C. Reimann et al., Applied Geochemistry , "Arsenic distribution in the environment: The effects of scale" (04/18/2009)
DX287	Alberta Research Council, Final Report: Potential Release of Heavy Metals and Mercury from the UOG Industry into the Ambient Environment - Literature Review (prepared for Petroleum Technology Alliance Canada) (10/16/2009)
DX288	Aerial photograph 2012 (2012)
DX289	U.S. Army Corps of Engineers, Third 5-Year Review Report for McColl Superfund Site (approved by EPA) (09/28/2012)
DX290	G. Hu et al., Journal of Hazardous Materials , "Recent developments in the treatment of oily sludge from petroleum industry" (07/29/2013)
DX291	J. Speight, The Chemistry and Technology of Petroleum (5th ed) (excerpt) (Undated)
DX292	Kalichevsky, Petroleum Refining With Chemicals (1956)
DX293	Shell Annual Report (03/08/1951)
DX294	Large Gasoline Order for Planes (10/05/1932)
DX295	Refineries Operating In United States (1941) (03/27/1941)
DX296	Refineries Operating In United States (1942) (03/24/1942)

DX297	General Summary - Sulfuric Acid Reports (11/29/1943)
DX298	NARA Folder - District 5 PAW Directive of 9/29/43 - Reports (circa 1943)
DX299	Skerrit to Stone - DSC Purchases 100 Octane, January and February 1943 (06/19/1943)
DX300	*Petroleum World , Petroleum Administrator Orders Cur In Civilian Gasoline Consumption (11/01/1943)*
DX301	NARA Folder - Detail of Demand Data Reported to US Bureau of Mines (1943-1945)
DX302	NARA Folder - Docs of the Stat. Com. Of Dist. 5 1942-1945 (1942-1945)
DX303	NARA Folder - Records Related To The Storage And Supply Of Petroleum Products for the Navy 1943-1945 (1943-1945)
DX304	PAW Comparison Of Estimated With Actual Demand, Refinery Operations and Crude Production (circa 1945)
DX305	NARA Folder - PAW District 5 Reports on Refining and Refined Products
DX306	Oil Industry Says It Can Meet Military Demands For Gasoline (09/27/1950)
DX307	Inspector's Report (10/26/1958)
DX308	Gas Seeing Into Mobile Home Park (12/09/1982)
DX 1000	Bookspan Table 1
DX 1001	Bookspan Table 2
DX 1002	Bookspan Table 3
DX 1003	Bookspan Table 4
DX 1004	Bookspan Figure 1
DX 1005	Bookspan Figure 2
DX 1006	Brigham Table One
DX 1007	Brigham Table Two
DX 1008	Brigham Table Three
DX 1009	Brigham Table Four

DX 1010	Brigham Table Five
DX 1011	Brigham Table Six
DX 1012	Brigham Table Seven
DX 1013	Brigham Figure Three (One)
DX 1014	Brigham Figure Two
DX 1015	Brigham Table Eight
DX 1016	Brigham Figure Three
DX 1017	Brigham Appendix One
DX 1018	Kittrell Initial Report Image of 1,200 and 2,400 Barrel Agitators ca. 1016
DX 1019	Kittrell Initial Report Figure 1
DX 1020	Kittrell Initial Report Figure 2
DX 1021	Kittrell Initial Report Figure 3
DX 1022	Kittrell Initial Report Figure 4
DX 1023	Kittrell Initial Report Figure 5
DX 1024	Kittrell Initial Report Table 1
DX 1025	Kittrell Initial Report Table 2
DX 1026	Kittrell Initial Report Table 3
DX 1027	Kittrell Initial Report Table 4
DX 1028	Kittrell Initial Report Table 5
DX 1029	Kittrell Initial Report Table 6
DX 1030	Kittrell Initial Report Table 7
DX 1031	Kittrell Initial Report Table 8

DX 1032	Kittrell Initial Report Table 9
DX 1033	Kittrell Initial Report Table 10
DX 1034	Kittrell Initial Report Table 11
DX 1035	Kittrell Rebuttal Report Figure 1
DX 1036	Kittrell Rebuttal Report Figure 2
DX 1037	Kittrell Rebuttal Report Figure 3
DX 1038	Kittrell Rebuttal Report Table 1
DX 1039	Kittrell Rebuttal Report Figure 4
DX 1040	Kittrell Rebuttal Report Table 2
DX 1041	Kittrell Rebuttal Report Table 3
DX 1042	Kittrell Rebuttal Report Table 4
DX 1043	Medine Figure 1
DX 1044	Medine Figure 2
DX 1045	Medine Figure 3
DX 1046	Medine Figure 4
DX 1047	Medine Figure 5
DX 1048	Medine Table 1
DX 1049	Medine Table 2
DX 1050	Medine Table 3
DX 1051	Medine Table 4
DX 1052	Medine Table 5
DX 1053	Dr. James Kittrell, Ph. D. Direct Testimony

DX 1054	Dr. Jay Brigham, Ph. D. Direct Testimony
DX 1055	Dr. Shelley Bookspan, Ph. D. Direct Testimony
DX 1056	Dr. Alan Medine, Ph. D. Direct Testimony

In addition, on December 21, 2016, the Government moved to enter the following exhibit, cited by the Government's expert James R. Kittrell, Ph.D., into evidence.

PX1259	Ultimate Production of Aviation Grade Gasoline On Completion Of Presently Approved Facilities (July 10, 1944). .

The Government objected, in whole or in part, to the admissibility of certain Exhibits introduced by Plaintiffs. *See* Defendant's Objections to Plaintiffs' Written Testimony (Feb. 10, 2016), ECF No. 183, and Defendant's Objections to Plaintiffs' Exhibits (Mar. 23, 2016), ECF No. 201. Plaintiffs responded by arguing that those exhibits were all admissible into evidence in their entirety, *see* Plaintiffs' Post-Trial Proposed Findings of Fact and Memorandum of Law 150–70 (Apr. 8, 2016), ECF No. 202; Plaintiffs' Response to Defendant's Objections to Plaintiffs' Exhibits (Apr. 22, 2016), ECF No. 207; Plaintiffs' Response to Defendant's Objections to the Written Testimony of Plaintiffs' Experts (Feb. 15, 2016), ECF No. 189.

The following Exhibits have been deemed admissible and part of the record

PX11	CERCLA Stipulations
PX12	Judgment and Stipulation as to pre-October 31, 1998 costs incurred (Oct. 13, 1999)
PX13	Def.'s Resp. to Pls.' Proposed Findings of Uncontroverted Fact, *Shell Oil Co. v. United States* (Aug. 11, 2006) (No. 06-141C)
PX14	Def.'s Resp. to Pls.' Proposed Findings of Uncontroverted Fact, *Shell Oil Co. v. United States* (July 11, 2008) (No. 06-141C)
PX15	United States, 2012 Gov't Responses to Pls.' Proposed Findings of Uncontroverted Fact (Sept. 7, 2012)
PX18	The Government objected to portions of Written Direct Testimony of Edmond F. Bourke, *Shell Oil Co. v. United States* (Feb. 5, 2016) (No. 06-141C), as identified in Defendant's Objections to Plaintiffs' Written Testimony, at 5-10 and 15-16 (Feb. 10, 2016), ECF No. 183
PX103	Decl. of Edmond F. Bourke, *Shell Oil Co. et al. v. United States* (June 26, 2012)
PX297	Total Costs Incurred, With Interest (Jan. 8, 2016)
PX298	Additional Interest on Pre-October 31, 1998 Costs (Jan. 8, 2016)

PX605	Transcript of CERCLA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 17, 1998)
PX606	Transcript of CERCLA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 18, 1998)
PX607	Transcript of CERLCA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 19, 1998)
PX609	Transcript of CERCLA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 20, 1998)
PX610	Transcript of CERCLA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 23, 1998)
PX611	Transcript of CERCLA Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Feb. 24, 1998)

The following have been deemed inadmissible.

PX17	Portions of Written Direct Testimony of Gregory G. Kipp, as identified in Defendant's Objections to Plaintiffs' Written Testimony, at 1718 (Feb. 10, 2016), ECF No. 183.
PX612	The Oil Companies' Post-Trial Br. for the Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Mar. 31, 1998) (No. 91-0589)
PX613	United States' Post-Trial Br. for the Allocation Trial, *United States v. Shell Oil Co.*, No. 91-589-RJK (Apr. 2, 1998) (No. 91-0589)

COURT EXHIBIT B

COURT EXHIBIT B: EVIDENTIARY RULINGS REGARDING ADMISSIBILITY OF EXHIBITS AND WRITTEN DIRECT TESTIMONY

I. BACKGROUND.

The Government objects, in whole or in part, to the admissibility of certain Exhibits introduced by the Oil Companies. On February 10, 2016, the Government filed Objections To Plaintiffs' Written Direct Testimony. ECF No. 183 ("Gov't Test. Obj."). On February 15, 2016, the Oil Companies filed a Response. ECF No. 189. ("Pl. Resp."). On February 25, 2016, the Government filed a Reply. ECF No. 192 ("Gov't Reply").

On March 23, 2016, the Government filed Objections To Plaintiffs' Exhibits. ECF No. 201 ("Gov't Ex. Obj."). On April 8, 2016, the Oil Companies responded to the Government's March 23, 2016 Objections in the Plaintiffs' Post-Trial Proposed Findings of Fact And Memorandum Of Law. ECF No. 202 ("Pl. DBr."); *see also* Plaintiffs' Response To Defendant's Objections To Plaintiffs' Exhibits, ECF 207 (stating that "[t]o avoid repetitive briefing" the Oil Companies wished to rely upon their post-trial brief as a response to the Government's objections to exhibits).

II. DISCUSSION.

A. Stipulations And Trial Testimony In *United States v. Shell Oil Company, et al.*, No. Civ. 91-0589 (C.D. Cal.)—PX 11, PX 605, PX 606, PX 607, PX 609, PX 610, PX 611.

1. The Government's Argument.

The Government argues that the stipulations (PX 11)[1] that the parties agreed to in, and the argument and sworn trial testimony from the CERCLA litigation, *United States v. Shell Oil Company, et al.*, No. Civ. 91-0589 (C.D. Cal.) (PX 605, PX 606, PX 609, PX 610, and PX 611),[2]

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[1] PX 11 contains several documents:
(A) the June 23, 1995 Stipulated Facts Of The Parties Relating To Pending Motions For Summary Judgment And Related Motions in *United States v. Shell Oil Company, et al.*, No. Civ. 91-0589 (C.D. Cal.) ("the CERCLA case"). PX 11 at JA377–475.
(B) the July 31, 1995 Supplemental Stipulated Facts Of The Parties Relating To Pending Motions For Summary Judgment And Related Motion in the CERCLA Case. PX 11 at JA476–78;
(C) the December 11, 1997 Preliminary Draft Pretrial Order in the CERCLA case. PX 11 at JA479–88; and
(D) the December 11, 1997 Supplemental Stipulated Facts Of The Parties Relating To Pending Trial To Allocate Response Costs Between The Oil Companies And The United States in the CECLA case PX 11 at JA489–550.

[2] PX 605 is a February 17, 1998 Transcript of the CERCLA Motions in Limine and Opening Statements.
PX 606 is a February 18, 1998 Transcript of CERCLA trial testimony.

are not relevant and otherwise not admissible, in the case pending before the United States Court of Federal Claims. Gov't Ex Obj. at 1–3. "It is axiomatic that, for a stipulation to bind the parties in different litigation, it 'must explicitly express this intent[.]'" Gov't Ex. Obj. at 2–3 (citing RESTATEMENT (SECOND) OF JUDGMENTS § 27 cmt. (e) (2016)). The parties agreed that the CERCLA stipulations were intended solely for summary judgment and trial. Gov't Ex. Obj. at 2 (citing PX 11 at JA380, 476, 489). And, because the CERCLA stipulations (PX 11) are inadmissible, the CERCLA trial testimony and argument (PX 605, PX 606, PX 607, PX 609, PX 610, and PX 611), based on the stipulations, are inadmissible as well. Gov't Ex. Obj. at 1.

2. The Oil Companies' Response.

The Oil Companies respond that the Government's objections that the CERCLA stipulations are not binding in this case are belied by Government's prior representation to the court that the stipulations are "*binding fact[s] on the parties.*" 12/18/2012 TR at 57 (Hearing On Cross-Motions For Summary Judgment) ECF No. 111 at 57. Therefore, the doctrine of judicial estoppel is applicable. *See Data Gen. Corp. v. Johnson*, 78 F.3d 1556, 1565 (Fed. Cir. 1996) (holding that "where a party successfully urges a particular position in a legal proceeding, it is estopped from taking a contrary position in a subsequent proceeding where its interests have changed"). In the alternative, the CERCLA stipulations are binding "judicial admissions," because they are formal concessions that "have the effect of withdrawing a fact from issue." Pl. DBr. at 152, 164 (citing *Christian Legal Soc'y v. Martinez*, 561 U.S. 661, 677–78 (2010) (holding that facts stipulated at the summary-judgment stage were binding "judicial admissions")). In addition, the parties agreed that the CERCLA stipulations were binding and "true for purposes of this litigation." PX 11 at JA491 (Dec. 11, 1997 CERCLA Stipulation Amendments). And, the breach of contract claims are a continuation of the CERCLA litigation. Pl. DBr. at 164. In any event, the CERCLA Stipulations are admissible evidence, even if they are not binding, because they are prior

PX 607 is a February 19, 1998 Transcript of CERCLA trial testimony.
PX 609 is a February 20, 1998 Transcript of CERCLA trial testimony.
PX 610 is a February 23, 1998 Transcript of CERCLA trial testimony.
PX 611 is a February 24, 1998 Transcript of CERCLA trial testimony.

statements of a party-opponent and are public records. Pl. DBr. at 165; *see* FRE 801(d)(2)[3] and FRE 803(8)[4]).

3. The Court's Resolution.

Plaintiff argues that the CERCLA stipulations are binding on the parties, because they are judicial admissions, *i.e.*, a "formal waiver of proof that relieves an opposing party from having to prove the admitted fact and bars the party who made the admission from disputing it." BLACK'S LAW DICTIONARY 49 (7th ed. 1999); *see also* 32 CORPUS JURIS SECUNDUM, EVIDENCE § 550 (2016) ("[A] stipulation constitutes a judicial admission of the fact in issue."). But, the "duration of [a stipulation's] effect, no less than its scope, depends, after all, on the intent of the parties." 9 WIGMORE, EVIDENCE 3d Ed. § 2593 at 594 (1940). In PX 11, the parties specifically stated that the stipulations were "for purposes of the summary judgment and other motions [then] currently pending before the [district] [c]ourt" and "purposes of this litigation." PX 11 at JA380, JA491. Although the pending case before the court includes the same parties and related facts, it is not the same litigation in which the CERCLA stipulations were made. The Oil Companies voluntarily dismissed the breach of contract counterclaim filed in the United States District Court of Central California and filed a new Complaint in the United States Court of Federal Claims. *See Shell Oil Co. v. United States*, 751 F.3d 1282, 1289 (Fed. Cir. 2014) ("The [Oil Companies] voluntarily

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[3] Rule 801(d)(2) of the Federal Rules of Evidence ("FRE") provides that:

> [a] statement that meets the following conditions is not hearsay: . . . The statement is offered against an opposing party and . . .
> (A) was made by the party in an individual or representative capacity;
> (B) is one the party manifested that it adopted or believed to be true;
> (C) was made by a person whom the party authorized to make a statement on the subject;
> (D) was made by the party's agent or employee on a matter within the scope of that relationship and while it existed; or
> (E) was made by the party's coconspirator during and in furtherance of the conspiracy.

FRE 801(d)(2).

[4] FRE 803(8) provides that:

> The following are not excluded by the rule against hearsay, regardless of whether the declarant is available as a witness . . .
> (8) Public Records. A record or statement of a public office if:
> (A) it sets out:
> (i) the office's activities;
> (ii) a matter observed while under a legal duty to report, but not including, in a criminal case, a matter observed by law-enforcement personnel; or
> (iii) in a civil case or against the government in a criminal case, factual findings from a legally authorized investigation; and
> (B) the opponent does not show that the source of information or other circumstances indicate a lack of trustworthiness.

FRE 803(8).

dismissed the transferred Complaint without prejudice, exhausted their administrative remedies with the General Services Administration . . . and filed a *new* Complaint in the Court of Federal Claims, seeking reimbursement for the CERCLA costs."(emphasis added)). Therefore, as a matter of law, the CERCLA stipulations are not binding on the parties or the court in this case.

But, judicial admissions in one case may be evidentiary admissions in another case. *See Higgins v. Mississippi*, 217 F.3d 951, 954–55 (7th Cir. 2000) ("[A] judicial admission binds only in the litigation in which it is made. . . . In any other suit . . . it operates merely as an evidentiary admission."). As a matter of law, evidentiary admissions are not binding, but are admissible and the factfinder is "free to weigh [them] against the other evidence adduced at trial." *See Paice LLC v. Toyota Motor Corp.*, 504 F.3d 1293, 1312 (Fed. Cir. 2007); *see also Tzu Wei Chen Food Co., Ltd. v. Chia-Chi Enters., Inc.*, No. 94-1527, 1995 WL 714589 at *4 (Fed. Cir. 1995) ("[E]vidential admissions are not binding; instead, they merely constitute admissible evidence to be considered in combination with all other relevant evidence.").

For these reasons, the court has determined that the CERCLA stipulations (PX 11) are relevant,[5] and are admissible evidentiary admissions, and reliable evidence of the underlying amount of damages at issue. Likewise, the trial testimony (PX 605, PX 606, PX 607, PX 609, PX 610, and PX 611) is admissible as a public record. *See* FRE 803(8).

B. Stipulation In CERCLA Litigation As To Pre-October 31, 1998 Costs Incurred And The Declaration Of Edmond F. Burke—PX 12, PX 103.

1. The Government's Argument.

PX 12 reflects that parties entered into an agreement in the CERCLA litigation "to allow a final appealable judgment . . . in the [United States District Court for the Central District of California.]" Gov't Ex. Obj. at 3 (citing PX 12 at 6). This agreement provided that, "in the event that the Orders are not affirmed in full, the Parties shall again negotiate in good faith to attempt to reach a stipulated payment for response costs." PX 12 at 6. The United States Court of Appeals for the Ninth Circuit, however, reversed the district court's judgment, terminating the agreement. Gov't Ex. Obj. at 3. As such, PX 12 and the part of PX 103 (Edmond F. Bourke Decl.) that repeats PX 12 is not relevant in this case. Gov't Ex. Obj. at 3.

In addition, PX 12 and 103 are not admissible under FRE 408(a),[6] that "adopts a rule excluding factual admissions made in the course of settlement negotiations." Gov't Ex. Obj. at 4 (quoting *Eid v. Saint-Gobain Abrasives, Inc.*, 377 F. App'x 438, 445 (6th Cir. 2010)).

[5] FRE 401 provides: "Evidence is relevant if: (a) it has any tendency to make a fact more or less probable than it would be without the evidence; and (b) the fact is of consequence in determining the action." FRE 401.

[6] FRE 408 provides:

2. The Oil Companies' Response.

PX 12 is "a stipulation, not a settlement offer" that, "the Government . . . adopted . . . during the 2008 summary judgment proceedings before this [c]ourt." Pl. DBr. at 165–66 (citing PX 14 at ¶ 13). PX 103 is also not a settlement offer, but a declaration of the Oil Companies' expert Edmond Bourke that provides a summary of interest due on costs incurred and stipulated in PX 12. PX 103 at JA 668.

3. The Court's Resolution.

PX 12 is a stipulation that "constitutes a judicial admission of the fact in issue." 32 CORPUS JURIS SECUNDUM, Evidence § 550. But, a judicial admission binds the parties "only in the litigation in which it is made. . . . In any other suit . . . it operates merely as an evidentiary admission." *Higgins*, 217 F.3d at 954–55 (internal citations omitted). Although evidentiary admissions are not binding, they are admissible evidence. *See Paice LLC*, 504 F.3d at 1312 (attorney's statement that was an "*evidential* admission" could be weighed by factfinder against other evidence adduced at trial); *see also Tzu Wei Chen Food Co., Ltd.*, No. 94-1527, 1995 WL 714589 at *4 ("[E]vidential admissions are not binding; instead, they merely constitute admissible evidence to be considered in combination with all other relevant evidence.").

For these reasons, the court has determined that PX 12 is an evidentiary admission of the pre-November 1, 1998 costs incurred and is relevant, admissible, and reliable evidence. PX 103 is also admissible.

> (a) Prohibited Uses. Evidence of the following is not admissible--on behalf of any party--either to prove or disprove the validity or amount of a disputed claim or to impeach by a prior inconsistent statement or a contradiction:
> (1) furnishing, promising, or offering--or accepting, promising to accept, or offering to accept--a valuable consideration in compromising or attempting to compromise the claim; and
> (2) conduct or a statement made during compromise negotiations about the claim--except when offered in a criminal case and when the negotiations related to a claim by a public office in the exercise of its regulatory, investigative, or enforcement authority.
> (b) Exceptions. The court may admit this evidence for another purpose, such as proving a witness's bias or prejudice, negating a contention of undue delay, or proving an effort to obstruct a criminal investigation or prosecution.

FRE 408.

C. The Government's Responses To Proposed Findings Of Fact In Support Of Summary Judgment In The United States Court Of Federal Claims—PX 13, PX 14, PX 15.

1. The Government's Argument.

PX 13, PX 14, and PX 15 are the Government's responses to the Oil Companies' proposed findings of fact in support of the June 30, 2006, June 20, 2008, and June 29, 2012 Motions For Summary Judgment in the United States Court of Federal Claims, but are inadmissible, because the court never issued a Rules of the United States Court of Federal ("RCFC") 56(g) order.[7] Gov't Ex. Obj. at 4–8. RCFC 56 allows the court to consider proposed facts as "undisputed *for purposes of the motion*." Gov't Ex. Obj. at 4 (quoting RCFC 56(e)(2) (emphasis added)). If summary judgment is denied, however, RCFC 56(g) allows the court to "enter an order stating any material fact . . . that is not genuinely in dispute and treating the fact as established *in the case*." Gov't Ex. Obj. at 5 (quoting RCFC 56(g) (emphasis added)). The practice of not deeming facts, proposed under RCFC 56, as evidence for purposes of trial encourages summary judgment and, thus, comports with the RCFC 1 goal of fostering "the just, speedy, and inexpensive determination of . . . action[s] and proceeding[s]." Gov't Ex. Obj. at 7 (quoting RCFC 1). In this case, the court did not adopt the Oil Companies' proposed facts when the motion for summary judgment was denied and did not enter a RCFC 56(g) order, "thereby leaving all issues related to damages open." Gov't Ex. Obj. at 7. Instead, the court observed that the issue of whether all or some of the Plaintiff's CERCLA liability was incurred "by reason of" their avgas production was a "blank slate." Gov't Ex. Obj. at 7 (quoting *Shell Oil Co. v. United States*, 108 Fed. Cl. 422, 447 (2013)).

In addition, the United States Court of Appeals for the Federal Circuit has held that "the prior CERCLA litigation does not preclude the Government from challenging the amount of acid waste attributable to the avgas contracts." Gov't Ex. Obj. at 7 (quoting *Shell Oil*, 751 F.3d at 1303). Therefore, in keeping with the mandate, the court set a trial for damages. Gov't Ex. Obj. at 8.

2. The Oil Companies' Response.

The Oil Companies respond that the Government's responses to the proposed findings of fact are binding judicial admissions. Pl. DBr. at 152 (citing *Reliable Contracting Grp., LLC v. Department of Veterans Affairs*, 779 F.3d 1329, 1334 (Fed. Cir. 2015) ("[J]udicial admissions . . . 'have the effect of withdrawing a fact from issue and dispensing wholly with the need for proof of the fact[.]'"). The test is whether the admission was "clear, deliberate, and unambiguous." *Centillion Data Sys., LLC v. Qwest Commc'ns Int'l, Inc.*, 547 F. App'x 980, 985 (Fed. Cir. 2013). The United States Supreme Court has held that joint stipulations submitted by the parties on summary judgment are "judicial admission[s]" and added that "[t]he power of the court to act in

[7] PX 13 is an August 11, 2006 Defendant's Responses To Plaintiffs' Proposed Findings Of Uncontroverted Fact.

PX 14 is a July 11, 2008 Defendant's Responses To Plaintiffs' Proposed Findings Of Uncontroverted Fact.

PX 15 is a September 7, 2012 Defendant's Responses To Plaintiffs' Proposed Findings Of Uncontroverted Fact.

the disposition of *a trial* upon facts conceded by counsel is as plain as its power to act upon the evidence produced." *Christian Legal Soc'y*, 561 U.S. at 677–78 (holding that a joint stipulation withdraws facts from issue). Therefore, judicial admissions "may not be controverted *at trial* or on appeal of the same case," including "admissions . . . in motions for summary judgment." 30B WRIGHT, MILLER & GRAHAM, FEDERAL PRACTICE & PROCEDURE § 7026 (2014 ed.).

In this case, the Government had weeks, if not months, to consider its responses to the Oil Companies' proposed findings of uncontroverted facts. Pl. DBr. at 154. Moreover, the Government was on notice that when it admitted facts during summary judgment, they may be deemed "established in the action." Pl. DBr. at 156 (citing RCFC 56(d)(1)). In addition, the cases cited by the Government are not precedential. Pl. DBr. at 156.[8]

RCFC 56(g) and its predecessors provide that admissions made at summary judgment are binding throughout the entire litigation. Pl DBr. at 157. RCFC 56(g) clarifies that the court has the power to enter an order to that effect, but does not state that, in the absence of such an order, a party will not be bound by its formal admissions of fact. Pl. DBr. at 157. Neither Judge Wheeler nor the Federal Circuit suggested that the Government's prior judicial admissions in this case are not binding. Pl. DBr. at 157–58. Instead, the United States Court of Appeals for the Federal Circuit held that the "prior CERCLA litigation does not preclude the Government from challenging the amount of acid waste attributable to the avgas contracts." Pl. DBr. at 158 (quoting *Shell*, 751 F.3d at 1303). And, the Government did so at the evidentiary hearing in this case.

In the alternative, the Government's admissions are admissible. Pl. DBr. at 158. Although the Government argues that the proposed findings of fact are irrelevant under FRE 401, because they were filed in connection with summary judgment, the Government fails to cite any precedent in support. Pl. DBr. at 159. The Government's response to the Oil Company's proposed findings of fact at the summary judgment stage are instead admissible as statements of party-opponents and as public records. Pl. DBr. at 159–60 (citing FRE 801(d)(2) and FRE 803(8)).

3. The Court's Resolution

PX 13, PX 14, and PX 15 are the Government's Responses to the Plaintiffs' Proposed Findings of Fact, that were filed in response to three separate RCFC 56 Motions For Summary

[8] Gov't Ex. Obj. at 4–5 (citing *Brown v. Navarro*, 2012 WL 3987427, at *3 (N.D. Ill. Sept. 11, 2012); *Fisher v. Ciba Specialty Chemicals Corp.*, 2007 WL 2995525, at *9 (S.D. Ala. Oct. 11, 2007); *Chen v. Mayflower Transit, Inc.*, 2004 WL 2535258, at *3 (N.D. Ill. Sept. 23, 2004)). The only case that the Government cites from the United States Court of Federal Claims does not provide a categorical rule, and instead determined that a party's admissions in a proposed findings of fact "are *not necessarily* binding upon the parties or the Court at the trial to follow." *Bell BCI Co. v. United States*, 72 Fed. Cl. 164, 166 n.2 (2006) (emphasis added).

Judgment: a 2006 Motion For Partial Summary Judgment,[9] a 2008 Motion For Summary Judgment,[10] and a 2012 Motion For Summary Judgment.[11]

RCFC 56 provides that the court may consider facts not addressed or supported as undisputed, for purposes of a motion, but if the court does not grant summary judgment, the court nevertheless may enter an order stating that certain material facts have been established. *See* RCFC 56(e)(2), (g). In this case, the court granted summary judgment on these motions, in favor of the Oil Companies regarding the 2006 and 2008 Motions For Summary Judgment, and in favor of the Government on the 2012 Motion For Summary Judgment. But, all of these orders now are vacated. *See Shell Oil Co. v. United States*, 108 Fed. Cl. 422 (2013) (denying the Oil Companies' 2012 Motion For Summary Judgment), *rev'd and remanded,* 751 F.3d 1282 (Fed. Cir. 2014); *see also Shell Oil Co. v. United States*, 86 Fed. Cl. 470 (2009) (granting the Oil Companies' 2008 Motion For Summary Judgment), *vacated by* Order of May 27, 2010; *Shell Oil Co. v. United States*, 80 Fed. Cl. 411 (2008) (granting the Oil Companies' 2006 Motion for Partial Summary Judgment), *vacated by* Order of May 27, 2010.

The United States Supreme Court has held that stipulations jointly submitted at the summary judgment stage nevertheless are binding on appeal. *See Christian Legal Society*, 561 U.S. at 677. The Court's reasoning relied upon a "leading legal reference," the *Corpus Juris Secundum*, that provides:

> Where the parties agree on a statement of facts that will determine the case, and there is nothing in agreement expressly limiting its operation to the particular trial at which it is made, the stipulation is admissible in a later trial of the same case between the same parties, especially where it consists largely of matters of record. However, a stipulation of an agreed statement of facts, to be used in the trial of a cause, that "shall constitute the evidence in the trial of said cause," does not prevent the introduction of further evidence at a second trial.

83 CORPUS JURIS SECUNDUM STIPULATIONS § 92 (internal citations omitted).

The *Corpus* cites *Imhoff v. Whittle*, 84 S.W. 243 (Tex. Civ. App. 1904), as the source of this rule. In *Imhoff*, the parties stipulated to certain facts at trial, but the opinion of the trial court was reversed, and the case was remanded for another trial. *Id.* The appellate court determined that the previously stipulated facts were admissible, but not binding, in the remand trial, because "[t]here is no stipulation in the agreement to the effect that neither party should have the right, in

[9] *See Shell Oil Co. v. United States*, 80 Fed. Cl. 411 (2008) (granting the Oil Companies' 2006 Motion For Partial Summary Judgment), *vacated by* Order of May 27, 2010, ECF No. 74.

[10] *See Shell Oil Co. v. United States*, 86 Fed. Cl. 470 (2009) (granting the Oil Companies' 2008 Motion For Summary Judgment), *vacated by* Order of May 27, 2010, ECF No. 74.

[11] *See Shell Oil Co. v. United States*, 108 Fed. Cl. 422 (2013) (denying the Oil Companies' 2012 Motion For Summary Judgment), *rev'd and remanded*, 751 F.3d 1282 (Fed. Cir. 2014).

the event of a second trial, to introduce testimony to prove additional facts; nor do we believe that it was the purpose of the parties to deprive themselves of such right." *Id.*

In this case, the Government's Responses to Plaintiffs' Proposed Findings Of Fact were not "jointly submitted" nor contain any indication that the parties intended to be bound by the Proposed Findings Of Fact beyond the summary judgment stage. Proposed Findings Of Uncontroverted Fact (2006), ECF No. 11; Proposed Findings Of Uncontroverted Fact (2008), ECF No. 32; Proposed Findings Of Uncontroverted Fact (2012), ECF No. 95.

For these reasons, the court has determined that PX 13-15 are not binding, but are relevant, admissible, and reliable.

D. Demonstratives Alleging Total Costs—PX 297 and PX 298.

1. The Government's Argument.

The Government argues that PX 297 and PX 298 are inadmissible, because the Oil Companies did not lay a proper foundation with respect to these demonstratives showing pre-2002 costs. Gov't Ex. Obj. at 8. [12]

2. The Oil Companies' Response.

The Oil Companies respond that, when a moving party fails to cite authority, "the moving party's poorly developed argument is deemed waived." Pl. DBr. at 167 (citing *Puffer v. Allstate Ins. Co.*, 675 F.3d 709, 718 (7th Cir. 2012) **(**holding that a conclusory argument that was not developed before the district court was waived upon appeal)).

In any event, PX 297 and PX 298 are admissible charts under FRE 1006,[13] "so long as the proponents 'make the originals or duplicates available for examination or copying, or both, by other parties at a reasonable time and place.'" Pl. DBr. at 168 (citing FRE 1006).

3. The Court's Resolution.

FRE 1006 provides that "[t]he proponent may use a summary, chart, or calculation to prove the content of voluminous writings, recordings, or photographs that cannot be conveniently

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[12] The Government did not provide a specific citation to the FRE.

[13] FRE 1006 provides:

> The proponent may use a summary, chart, or calculation to prove the content of voluminous writings, recordings, or photographs that cannot be conveniently examined in court. The proponent must make the originals or duplicates available for examination or copying, or both, by other parties at a reasonable time and place. And the court may order the proponent to produce them in court.

FRE 1006.

examined in court." FRE 1006. PX 297 and PX 298 are demonstrative summary charts of the total costs incurred prior to 2002, plus interest that the Oil Companies claim as damages.

For these reasons, the court has determined that PX 297 and PX 298 are relevant and admissible.

E. Spreadsheet Dated 1998 Tallying "Shell Chemical Receipts Of Sludge"—PX 608.

1. The Government's Argument.

The Government argues that PX 608 lacks foundation, because it does not identify the source of the numbers cited in the spreadsheet. Gov't Ex. Obj. at 9.[14] In addition, "the only identifying mark, 'Peter R. Taft' refers to [the Oil Companies'] counsel in the district court CERCLA case." Gov't Ex. Obj. at 9 (citing *Shell Oil Co. v. United States*, 294 F.3d 1045, 1047 (9th Cir. 2002) (identifying "Peter R. Taft, Munger, Tulles & Olson LLP")).

2. The Oil Companies' Response.

The Oil Companies did not respond to the Government's objection.

3. The Court's Resolution.

Because the Government's objection to PX 608 was not opposed, the court has determined that PX 608 is not reliable.

F. CERCLA Litigation Post-Trial Briefs—PX 612 and PX 613.

1. The Government's Argument.

The Government argues that PX 612 and PX 613, post-trial briefs from the CERCLA case, are inadmissible. Gov't Ex. Obj. at 9 (quoting *Lockformer Co. v. PPG Indus., Inc.*, No. CIV.A. 99-C-6799, 2003 WL1563703, at *2 (N.D. Ill. Mar. 25, 2003) ("Judicial opinions and parties' own briefs are not evidence."), *aff'd*, 138 F. App'x 314 (Fed. Cir. 2005)).

2. The Oil Companies' Response.

The Oil Companies respond that the Government's CERCLA brief, PX 613, is admissible either as a judicial or evidentiary admission. Pl. DBr. at 169.[15] In the alternative, the Government's brief is admissible as a statement of party opponent. Pl. DBr. at 169–70 (citing

[14] The Government did not provide a specific citation to the FRE.

[15] PX 612 is the Oil Companies' CERCLA post-trial brief. The Oil Companies did not respond to the Government's objection regarding PX 612.

FRE 801(d)(2)). In addition, PX 613 is admissible as a public record. Pl. DBr. at 169 (citing FRE 803(8)).

3. The Court's Resolution.

The Oil Companies seek to introduce as evidence PX 613, the Government's Post-Trial Brief, in the 1998 CERCLA litigation. It is well established that trial court pleadings in one case may be admissible as nonbinding evidentiary admissions of that party in another case. *See* FRE 801(d)(2); *see also Massing v. Secretary of Dept. of Health and Human Services*, 19 Cl. Ct. 511, 515 (1990) ("[A]dmissions made in pleadings in prior litigation are admissible in evidence in a subsequent suit."). No rule, however, governs whether briefs are admissible as evidence.

Although evidence is relevant if it has "any tendency to make the existence of any fact that is of consequence more or less probable," the court may exclude relevant evidence, "if its probative value is substantially outweighed by a danger of . . . unfair prejudice[.]" FRE 403. Briefs filed in another case create a danger of unfair prejudice, because they are advocacy. *Cf. Dartez v. Owens-Illinois, Inc.*, 910 F.2d 1291, 1293 (5th Cir. 1990), *cert. denied*, 504 U.S. 955 (1992) ("Because . . . briefs are restricted to the facts in the record, characterizing a brief's summary of record facts as an admission 'is bound to be uncertain in the best of circumstances and dangerously misleading in most others.'") (citation omitted); *see also Kassel v. Gannett Co., Inc.*, 875 F.2d 935, 952 n. 17 ("[The United States Court of Appeals for the First Circuit] share[s] the reluctance of the [United States Court of Appeals for the] Fifth Circuit routinely to treat . . . briefs submitted by a party in one action as evidentiary admissions against that party in another action.").

For these reasons, the court has determined that PX 612 and PX 613 are not admitted into evidence.

G. The Government's Supplementation Request For The Depositions Of John McColl And James Willacy.

1. The Government's Argument.

The Government also designated pages 5, 27, 40, and 57–58 from the deposition transcript of John McColl (PX 706) and pages 95–98 from the deposition transcript of James Willacy, PX 707, as additional deposition page pursuant to RCFC 32(a)(6).[16] Gov't Ex. Obj. at 10.

2. The Oil Companies' Response.

The Oil Companies' did not respond to this request.

[16] RCFC 32(a)(6) provides: "If a party offers in evidence only part of a deposition, an adverse party may require the offeror to introduce other parts that in fairness should be considered with the part introduced, and any party may itself introduce any other parts."

3. Court's Resolution.

Because the Government's request was unopposed, the court has determined that PX 706 and PX 707 are supplemented to include the additional pages designated by the Government.[17] *See* Court Exhibit B.

H. The Court's Rulings Regarding The Government's February 10, 2016 Objections To Written Testimony.

Most of the evidentiary objections raised in the Government's February 10, 2016 Objections To Written Testimony have been addressed. Stipulations from the prior litigation are admissible evidence. Likewise, the Government's Responses to the Plaintiffs' Proposed Findings of Fact are admissible. Accordingly, the Oil Companies' experts may rely upon those stipulations and Responses to Proposed Findings of Fact in their direct testimony.

1. The Government's Argument Regarding Mr. Matthew Low's Report.

In support of portions of his expert opinion, the Oil Companies' expert Gregory G. Kipp relies on and discusses an expert report prepared by a "may call witness" for the Government, Matthew Low. Gov. Test. Obj. at 17. Mr. Low is an expert on allocation of response costs in CERCLA matters. Gov. Test. Obj. at 17. Mr. Low's Report was not proffered by the Government or the Oil Companies, and is hearsay. Gov. Test. Obj. at 17. Although an expert may rely on inadmissible evidence to support an opinion, he may do so only when "experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject." FRE 703. Therefore, Mr. Kipp can rely on Mr. Low's Report only if Mr. Kipp is an expert in a field that would reasonably rely on reports prepared by CERCLA experts. Gov. Test. Obj. at 17. Mr. Kipp is a geological engineer and geochemist, and does not present himself as an expert who would reasonably rely on reports prepared by those with CERCLA response cost expertise. Gov. Test. Obj. at 18.

2. The Oil Companies' Response.

The Oil Companies respond that "[e]xperts like Mr. Kipp routinely rely upon the analysis of other experts in the same or closely connected fields." Pl. Resp. at 20. Furthermore,

> [I]t is common in technical fields for an expert to base an opinion in part on what a different expert believes on the basis of expert knowledge not possessed by the first expert; and it is apparent from the wording of Rule 703 that there is no general requirement that the other expert testify as well.

Dura Auto. Sys. Of Indiana, Inc. v. CTS Corp., 285 F.3d 609, 613 (7th Cir. 2002). In short, Mr. Kipp may rely upon the otherwise inadmissible report of Mr. Low under FRE 703.

[17] These pages were attached as exhibits to the Government's March 23, 2016 Motion as ECF No. 201-1 (John McColl) and ECF No. 201-2 (James V. Willacy).

3. The Court's Resolution.

An expert may rely upon inadmissible evidence, if experts in the same field reasonably rely on those kinds of fact or data. *See* FRE 703.[18] The Oil Companies proffered Mr. Kipp as an expert in geology; geochemistry; environmental chemistry; industrial process chemistry; engineering; and World War II oil refinery operations. TR 110. Mr. Low was described by the Oil Companies as an expert in "cost allocation at historical waste sites" (Pl. Resp. at 20), and by the Government as an expert "on allocation of response costs in CERCLA matters." Gov. Test. Obj. at 17. The Oil Companies, however, have not demonstrated how an expert in geology; geochemistry; environmental chemistry; industrial process chemistry; engineering; and World War II oil refinery operations "reasonably rely upon" cost allocation expertise.

Therefore, the following portions of Mr. Kipp's Written Direct Testimony are therefore inadmissible:

- "[T]he Government's allocation expert has conceded that the sludge resulting from these processes is directly attributable to avgas production." PX 17 at 15–16.
- "As discussed, the Government's allocation expert has conceded that the sludge from treatment of avgas components is 'directly attributable' to avgas production." PX 17 at 41.
- "Mr. Low's analysis assumes that no significant amount of acid waste was dumped at McColl after the war." PX 17 at 83.

In addition, certain portions of Mr. Kipp's Written Direct Testimony titled "Response to Matthew Low's Calculation of Acid Sludge Dumped At the McColl Site Allegedly Generated By Non-DSC-Contract Avgas" are inadmissible. PX 17 at 113–115, 119–122. The court considers these portions of Mr. Kipp's expert testimony as not relevant, because the Government elected not to call Mr. Low as an expert at trial.

[18] FRE 703 states that:

> [a]n expert may base an opinion on facts or data in the case that the expert has been made aware of or personally observed. If experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject, they need not be admissible for the opinion to be admitted. But if the facts or data would otherwise be inadmissible, the proponent of the opinion may disclose them to the jury only if their probative value in helping the jury evaluate the opinion substantially outweighs their prejudicial effect.

FRE 703.

COURT EXHIBIT C

Plaintiffs' Damages Exhibit 1

Shell's Response Costs Plus Interest (58.58% of Costs)

Cost Category		Amount Incurred by All Four Oil Companies	Amount Incurred by Shell[1]	Source[2]
Pre-Nov. 1, 1998 response costs plus interest	Response Costs through Oct. 31, 1998	$64,219,514.46	$37,619,791.57	PFOF ¶ 424
	Total interest incurred on $64M costs	$30,307,573.22	$17,754,176.39	Proposed Court Exhibit 5
C2 REM costs plus interest	C2 REM costs incurred through June 30, 2012	$2,935,846.26	$1,719,818.74	PFOF ¶ 430(b)(iii); PX104 to PX221
	Interest earned on C2 REM costs, through June 30, 2012	$348,316.68	$204,043.91	PFOF ¶ 430(b)(iv); PX104 to PX220
	New C2 REM costs incurred from July 1, 2012 to Nov. 30, 2015	$1,105,975.58	$647,880.49	PX299; PX222 to PX263
	Interest on all C2 REM costs, from July 1, 2012 to Nov. 30, 2015	$293,208.51	$171,761.55	PX300 to PX301; PX104 to PX261
McAuley costs plus interest	McAuley costs incurred through June 30, 2012	$198,000.00	$115,988.40	PFOF ¶ 430(b)(iii); PX271 to PX280
	Interest earned on McAuley costs, through June 30, 2012	$22,733.38	$13,317.21	PFOF ¶ 430(b)(iv); PX271 to PX280
	New McAuley costs incurred from July 1, 2012 to Nov. 30, 2015	$59,400.00	$34,796.52	PX302; PX281 to PX283
	Interest on all McAuley costs, from July 1, 2012 to Nov. 30, 2015	$19,279.23	$11,293.77	PX303 to PX304; PX281 to PX283
TOTAL AMOUNT INCURRED		**$99,509.847.32**	**$58,292,868.56**	

FN 1. Shell incurred 58.58 percent of the response costs paid by the four Plaintiff Oil Companies. Plaintiffs' Post-Trial Proposed Findings of Fact & Memorandum of Law at ¶ 440 (Apr. 8, 2016), Doc. 202.
FN 2. "PFOF" refers to the proposed findings of fact in Plaintiffs' Post-Trial Brief and the evidence cited therein. All interest is calculated at the statutory simple interest rate of 2.5 percent. *See id.* at 149 n.8.

Plaintiffs' Damages Exhibit 2

Union's Response Costs Plus Interest (18.94% of Costs)

Cost Category		Amount Incurred by All Four Oil Companies	Amount Incurred by Union[1]	Source[2]
Pre-Nov. 1, 1998 response costs plus interest	Response Costs through Oct. 31, 1998	$64,219,514.46	$12,163,176.04	PFOF ¶ 424
	Total interest incurred on $64M costs	$30,307,573.22	$5,740,254.37	Proposed Court Exhibit 5
C2 REM costs plus interest	C2 REM costs incurred through June 30, 2012	$2,935,846.26	$556,049.28	PFOF ¶ 430(b)(iii); PX104 to PX221
	Interest earned on C2 REM costs, through June 30, 2012	$348,316.68	$65,971.18	PFOF ¶ 430(b)(iv); PX104 to PX220
	New C2 REM costs incurred from July 1, 2012 to Nov. 30, 2015	$1,105,975.58	$209,471.77	PX299; PX222 to PX263
	Interest on all C2 REM costs, from July 1, 2012 to Nov. 30, 2015	$293,208.51	$55,533.69	PX300 to PX301; PX104 to PX261
McAuley costs plus interest	McAuley costs incurred through June 30, 2012	$198,000.00	$37,501.20	PFOF ¶ 430(b)(iii); PX271 to PX280
	Interest earned on McAuley costs, through June 30, 2012	$22,733.38	$4,305.70	PFOF ¶ 430(b)(iv); PX271 to PX280
	New McAuley costs incurred from July 1, 2012 to Nov. 30, 2015	$59,400.00	$11,250.36	PX302; PX281 to PX283
	Interest on all McAuley costs, from July 1, 2012 to Nov. 30, 2015	$19,279.23	$3,651.49	PX303 to PX304; PX281 to PX283
TOTAL AMOUNT INCURRED		**$99,509.847.32**	**$18,847,165.08**	

FN 1. Union incurred 18.94 percent of the response costs paid by the four Plaintiff Oil Companies. Plaintiffs' Post-Trial Proposed Findings of Fact & Memorandum of Law at ¶ 440 (Apr. 8, 2016), Doc. 202.
FN 2. "PFOF" refers to the proposed findings of fact in Plaintiffs' Post-Trial Brief and the evidence cited therein. All interest is calculated at the statutory simple interest rate of 2.5 percent. *See id.* at 149 n.8.

Plaintiffs' Damages Exhibit 3

Atlantic Richfield's Response Costs Plus Interest (18.94% of Costs)

Cost Category		Amount Incurred by All Four Oil Companies	Amount Incurred by Atlantic Richfield[1]	Source[2]
Pre-Nov. 1, 1998 response costs plus interest	Response Costs through Oct. 31, 1998	$64,219,514.46	$12,163,176.04	PFOF ¶ 424
	Total interest incurred on $64M costs	$30,307,573.22	$5,740,254.37	Proposed Court Exhibit 5
C2 REM costs plus interest	C2 REM costs incurred through June 30, 2012	$2,935,846.26	$556,049.28	PFOF ¶ 430(b)(iii); PX104 to PX221
	Interest earned on C2 REM costs, through June 30, 2012	$348,316.68	$65,971.18	PFOF ¶ 430(b)(iv); PX104 to PX220
	New C2 REM costs incurred from July 1, 2012 to Nov. 30, 2015	$1,105,975.58	$209,471.77	PX299; PX222 to PX263
	Interest on all C2 REM costs, from July 1, 2012 to Nov. 30, 2015	$293,208.51	$55,533.69	PX300 to PX301; PX104 to PX261
McAuley costs plus interest	McAuley costs incurred through June 30, 2012	$198,000.00	$37,501.20	PFOF ¶ 430(b)(iii); PX271 to PX280
	Interest earned on McAuley costs, through June 30, 2012	$22,733.38	$4,305.70	PFOF ¶ 430(b)(iv); PX271 to PX280
	New McAuley costs incurred from July 1, 2012 to Nov. 30, 2015	$59,400.00	$11,250.36	PX302; PX281 to PX283
	Interest on all McAuley costs, from July 1, 2012 to Nov. 30, 2015	$19,279.23	$3,651.49	PX303 to PX304; PX281 to PX283
TOTAL AMOUNT INCURRED		**$99,509.847.32**	**$18,847,165.08**	

FN 1. Atlantic Richfield incurred 18.94 percent of the response costs paid by the four Plaintiff Oil Companies. Plaintiffs' Post-Trial Proposed Findings of Fact & Memorandum of Law at ¶ 440 (Apr. 8, 2016), Doc. 202.
FN 2. "PFOF" refers to the proposed findings of fact in Plaintiffs' Post-Trial Brief and the evidence cited therein. All interest is calculated at the statutory simple interest rate of 2.5 percent. *See id.* at 149 n.8.

Plaintiffs' Damages Exhibit 4

Texaco's Response Costs Plus Interest (3.54% of Costs)

Cost Category		Amount Incurred by All Four Oil Companies	Amount Incurred by Texaco[1]	Source[2]
Pre-Nov. 1, 1998 response costs plus interest	Response Costs through Oct. 31, 1998	$64,219,514.46	$2,273,370.81	PFOF ¶ 424
	Total interest incurred on $64M costs	$30,307,573.22	$1,072,888.09	Proposed Court Exhibit 5
C2 REM costs plus interest	C2 REM costs incurred through June 30, 2012	$2,935,846.26	$103,928.96	PFOF ¶ 430(b)(iii); PX104 to PX221
	Interest earned on C2 REM costs, through June 30, 2012	$348,316.68	$12,330.41	PFOF ¶ 430(b)(iv); PX104 to PX220
	New C2 REM costs incurred from July 1, 2012 to Nov. 30, 2015	$1,105,975.58	$39,151.54	PX299; PX222 to PX263
	Interest on all C2 REM costs, from July 1, 2012 to Nov. 30, 2015	$293,208.51	$10,379.58	PX300 to PX301; PX104 to PX261
McAuley costs plus interest	McAuley costs incurred through June 30, 2012	$198,000.00	$7,009.20	PFOF ¶ 430(b)(iii); PX271 to PX280
	Interest earned on McAuley costs, through June 30, 2012	$22,733.38	$804.76	PFOF ¶ 430(b)(iv); PX271 to PX280
	New McAuley costs incurred from July 1, 2012 to Nov. 30, 2015	$59,400.00	$2,102.76	PX302; PX281 to PX283
	Interest on all McAuley costs, from July 1, 2012 to Nov. 30, 2015	$19,279.23	$682.49	PX303 to PX304; PX281 to PX283
TOTAL AMOUNT INCURRED		**$99,509.847.32**	**$3,522,648.60**	

FN 1. Texaco incurred 3.54 percent of the response costs paid by the four Plaintiff Oil Companies. Plaintiffs' Post-Trial Proposed Findings of Fact & Memorandum of Law at ¶ 440 (Apr. 8, 2016), Doc. 202.
FN 2. "PFOF" refers to the proposed findings of fact in Plaintiffs' Post-Trial Brief and the evidence cited therein. All interest is calculated at the statutory simple interest rate of 2.5 percent. *See id.* at 149 n.8.

Plaintiffs' Damages Exhibit 5

Interest on Pre-November 1, 1998 Response Costs (Interest Accrued From Jan. 1, 1995 to Nov. 30, 2015)

- ***This Proposed Court Exhibit identifies all of the interest that has accrued on the $64,219,514.46 that the four Plaintiff Oil Companies paid through October 31, 1998.***
- ***The first segment of the chart calculates interest on the $18 million that was paid on or about December 12, 1994, with interest beginning to accrue on January 1, 1995.***
- ***The second segment calculates the interest on the full $64.2 million, all of which was paid by November 1, 1997. Thus interest for this segment begins to accrue on November 1, 1997.***
- ***The third segment sums the interest that accrued in each of the first two segments.***

	Jan. 1, 1995 to Oct. 31, 1997			Nov. 1, 1997 to Nov. 30, 2015			Total Interest, Jan. 1, 1995 to Nov. 30, 2015
	Total Costs Incurred	Months × Monthly Interest[1]	Interest	Total Costs Incurred	Months × Monthly Interest[2]	Interest	Total Interest
All Plaintiffs	**$18,000,000**	**34 × $37,500**	**$1,275,000**	**$64,219,514.46**	**217 × $133,790.66**	**$29,032,573.22**	**$30,307.573.22**
Shell (58.58%)	$10,544,400	34 × $21,968	$746,895	$37,619,791.57	217 × $78,374.57	$17,007,281.39	$17,754,176.39
Union (18.94%)	$3,409,200	34 × $7,103	$241,485	$12,163,176.04	217 × $25,339.95	$5,498,769.37	$5,740,254.37
Atlantic Richfield (18.94%)	$3,409,200	34 × $7,103	$241,485	$12,163,176.04	217 × $25,339.95	$5,498,769.37	$5,740,254.37
Texaco (3.54%)	$637,200	34 × $1,328	$45,135	$2,273,370.81	217 × $4,736.19	$1,027,753.09	$1,072,888.09

FN 1. The first $18,000,000 was paid on or about December 12, 1994, and interest began to accrue on January 1, 1995. Interest accrued at a rate of 2.5 percent annually, or $37,500 each month. Plaintiffs' Post-Trial Proposed Findings of Fact & Memorandum of Law at ¶ 430(a)(iii) (Apr. 8, 2016), Doc. 202. That interest is then apportioned pro-rata to the four Plaintiff Oil Companies according to the portion of response costs that they incurred. For example, 58.58 percent of the $37,500 is apportioned to Shell. Because the entire $64 million was paid by November 1, 1997, *see id.* ¶ 430(a)(iii), we have calculated interest on the initial $18 million from January 1, 1995 to October 31, 1997.
FN 2. The second step of this exhibit calculates interest on the entire approximately $64 million, with interest running from November 1, 1997 to November 30, 2015. The monthly interest rate for the $64 million is $133,690.66. That monthly interest rate is then apportioned pro-rata for each of the four Plaintiff Oil Companies.