

**IN THE UNITED STATES DISTRICT COURT
DISTRICT OF KANSAS**

Raytheon Aircraft Company,

Plaintiff,

v.

Case No. 05-2328-JWL

United States of America,

Defendant.

MEMORANDUM AND ORDER

This is an environmental case filed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq., concerning trichlorethylene (TCE) contamination at the Tri-County Public Airport Site in Herington, Kansas. The primary dispute in this case lies between the two parties who are potentially liable for the contamination—Raytheon Aircraft Company, an entity that incurred response costs cleaning up the Site on the grounds that it assumed the environmental liabilities of its predecessor Beech Aircraft Corporation, who occupied the Site in the 1950s and undisputedly used TCE in its operations, and the United States for the actions of the Army Air Force, who operated an Army Airfield at the Site in the early 1940s and, according to Raytheon, used TCE in its operations. The remainder of the dispute lies between the United States on behalf of the Environmental Protection Agency (EPA), who has also incurred response costs cleaning up the Site, and Raytheon, the entity from which the EPA seeks to recover its response costs. Thus, Raytheon alleges claims against the United States (based on the Army's status as an alleged co-PRP at the Site) for cost recovery under section 107(a) of CERCLA and for contribution under

sections 107(a) and 113(f) of CERCLA. The United States alleges counterclaims against Raytheon for cost recovery under sections 107(a)(2) and 107(a)(4)(A) of CERCLA (based on costs incurred by EPA) and for contribution under section 113(f) of CERCLA.

In April 2008, a ten-day trial to the court was held on the parties' claims. The court has thoroughly considered the evidence and arguments presented at trial and now issues its findings of fact and conclusions of law pursuant to Federal Rule of Civil Procedure 52(a).¹ For the reasons set forth fully below, the court is not persuaded that the United States owned or operated the Site at the time TCE was released to the environment and, thus, the court enters judgment in favor of the United States on Raytheon's claims.² With respect to the United States' counterclaim for cost recovery, the court is persuaded that Beech released TCE to the environment during its operations at the Site and that the United States has incurred response costs not inconsistent with the National Contingency Plan. The court, then, enters judgment in favor of the United States on its claim for cost recovery.

Findings of Fact

I. Site Background

¹The court, in preparing its findings of fact and conclusions of law, has reviewed the entire trial transcript and each of the exhibits admitted into evidence. To the extent a particular exhibit or portion of a witness's testimony is not discussed herein, the court has determined that such evidence would not materially affect the court's disposition of the issues.

²The court, then, moots Raytheon's pending motion to submit its attorneys' fee entries for in camera review (doc. 582).

The Site is located in Morris County, Kansas, approximately 7 miles northeast of the City of Herington, Kansas. Prior to 1942, the Site was utilized solely for agriculture purposes. From 1942 through 1945, the United States constructed and operated Herington Army Airfield (HAAF) at the Site for the Army Air Force's (hereinafter "Army") processing of military aircraft and crews during World War II. There were four hangars at HAAF during World War II. The four hangars were located adjacent to the tarmac, which ran in a north-south direction. Hangar 1 was the northernmost hangar and sat perpendicular to the tarmac. Hangars 2, 3 and 4 (with Hangar 4 as the southernmost hangar) faced the tarmac. In addition to the hangars, tarmac and runways, a number of buildings exist at HAAF and were utilized as part of the Army's operations, including an engineering building and a spark plug cleaning building (also known as Building 514).

In 1948, the United States quitclaimed the property to the City of Herington and the City renamed the Site the Tri-County Public Airport, leasing portions of the property to commercial tenants, including Beech Aircraft Corporation (Beech). From 1950 through 1959, Beech leased a portion of the Site (including the four hangars, tarmac, runways and a number of buildings) for use in disassembling military aircraft, producing jettisonable fuel tanks and steel shipping containers for those fuel tanks, and assembling military aircraft starter generators. The parties have stipulated for purposes of this case that Raytheon is the legal successor in interest to Beech and, accordingly, that Raytheon is responsible for any CERCLA liability of Beech arising out of Beech's activities at the Site.

While other commercial and industrial tenants have occupied the Site since Beech's

operations, it is undisputed that the activities of these tenants have no bearing on the issues in this case.

II. Environmental Investigations and Cleanup of Site

In 1994, the United States Army Corps of Engineers (the Corps), pursuant to the Defense Environmental Restoration Program for Formerly Used Defense Sites (FUDS), began investigating possible contamination at the Site in light of knowledge that a substantial fuel spill occurred at the Site during World War II. Toward that end, the Corps contracted with Burns and McDonnell, an environmental consulting firm, to investigate possible contamination at the Site. In its initial site investigation, Burns and McDonnell discovered not only contaminants resulting from the fuel spill but also discovered trichloroethylene (TCE) in groundwater samples. TCE is a chlorinated solvent typically used as a degreasing agent for metal parts.

Based on Burns and McDonnell's recommendation, the Corps contacted the Kansas Department of Health and the Environment (KDHE) to inform KDHE about the discovery of TCE in groundwater at the Site. In 1996, KDHE, through a cooperative agreement with the Environmental Protection Agency (EPA), conducted a preliminary assessment to confirm the presence of TCE in groundwater at the Site, to identify potential source areas and to begin investigating surface water, soil and water pathways. KDHE concluded that the groundwater beneath the site had been contaminated with TCE and its degradation compounds (cis-1, 2-DCE and vinyl chloride) and that multiple contamination sources existed at the site.

In September 1996, the Corps notified KDHE that it would not undertake any further

action with respect to TCE contamination at the Site because no evidence existed suggesting that the Army utilized TCE in any respect during its operations at the Site. Thereafter, the KDHE requested that the Corps provide additional information to support its assertion that TCE was not utilized during the Army's operations at the Site. Upon receipt of that information, KDHE prepared a report on the use of chlorinated solvents at Army Air Fields in Kansas and, in that report, found that TCE was "likely used in vapor degreasing at Liberal AAF and may have been used at Herington AAF as well."³ KDHE forwarded its report to the Corps, urging the Corps to authorize an additional study to evaluate the possibility that the use of TCE was widespread in Kansas air fields and recommending that the Corps, until the completion of the study, treat TCE as a potential DOD contaminant at all World War II FUDS in Kansas. The Corps rejected those suggestions, indicating to KDHE that those suggestions were inconsistent with the Corps' own research, which the Corps described in some detail. KDHE's report was forwarded to EPA in October 1997.

In that same time frame, EPA issued section 104(e) requests for information to the Corps and to Raytheon. In its November 1997 response to EPA's section 104(e) requests, Raytheon admitted that it utilized TCE in two vapor degreasers at the Site, one in Hangar 1 and one in

³Vapor degreasers are used primarily for removing grease from metal parts. Vapor degreasers are containers that hold liquid solvent (typically TCE) in a reservoir at the bottom of the container. The solvent is then heated to boiling and the vapors from the boiling solvent rise to the upper portion of the degreaser where there is a cold zone created by the use of circulated cold water. The cold zone causes the vapors to cool and condense. The metal that is being degreased is then placed into the cold zone where the vapors will condense onto the metal and, as it drips off, will dissolve the oil and grease on the metal.

Hangar 4, and that TCE was stored in drums in a building to the northwest of Hangar 1. The Corps, in its response to EPA's section 104(e) requests, denied any use of TCE by the Army at the Site during its operations.

In late 1997, EPA initiated an Expanded Site Inspection/Remedial Investigation (ESI/RI) and contracted with Ecology and Environment, Inc. (E&E) to perform that assignment. The purposes of the ESI/RI were to determine the nature and extent of TCE contamination at the Site, to document on-site concentrations of TCE and its degradation compounds, and to determine from which of the identified potential source areas a release of TCE had occurred and establish attribution of the documented groundwater contamination to the source areas. As part of the ESI/RI, E&E performed field work including the collection of soil and groundwater samples and also conducted interviews with various individuals at the Site and analyzed Raytheon's and the Corps' responses to EPA's section 104(e) requests. The final report of the ESI/RI, Exhibit 1166, was issued in June 1999 and it concluded, based on concentration levels of TCE in soil and groundwater samples, that three primary source areas were present at the Site—the west side of Hangar 4 and to the southeast of Hangar 4; to the northwest of Hangar 1; and to the north of Hangar 1 where a potential drum burial site was discovered. The ESI concluded that TCE contamination at Hangars 1 and 4 was likely the result of the vapor degreasers operated by Beech at those locations.

In 2000, EPA proposed the site for listing on the National Priorities List (NPL), the prioritized list of hazardous waste sites identified for cleanup by EPA. It is undisputed that the Site was never placed on the NPL because the State of Kansas withheld its consent to the listing.

In any event, the Agency for Toxic Substances and Disease Registry (ATSDR) is authorized by statute to conduct public health assessments at all sites proposed to the NPL. Accordingly, ATSDR conducted a public health assessment at the site wherein it evaluated the affect of the TCE contamination on the health of the public.

In March 2000, Raytheon entered into an Administrative Order on Consent with EPA to install whole-house water treatment systems for those 23 residences utilizing private water wells containing levels of TCE above EPA's maximum contaminant level for TCE and to perform area water well sampling on a periodic basis for several years. In December 2000, Raytheon entered into a Consent Order with KDHE to perform a remedial investigation and feasibility study for the purpose of developing and evaluating remedial response alternatives. In 2002, the KDHE asked Raytheon to excavate a large area north of Hangar 1. Raytheon opposed excavation and offered recommendations for in-situ remediation of the Site (methods to treat the soil without removing it). Raytheon and KDHE were unable to reach an agreement concerning remediation and KDHE then turned the issue over to EPA.

In 2003, EPA performed an engineering evaluation and cost analysis (EE/CA) report regarding removal action alternatives at the Site. Raytheon participated in the public comment period and again opposed excavation and urged methods of in-situ remediation. In September 2004, EPA issued Raytheon a Unilateral Administrative Order (UAO) requiring Raytheon to excavate the area north of Hangar 1, including the areas where the finger building or Hangar 1 annex were located and the area where Building 514 (the Corps' spark plug building) was located. Raytheon hired Shaw Environmental to oversee the UAO work. Ultimately, the

excavated area was 16-feet deep and the size of a football field. The excavation was complete in October 2005 and, in November 2005, Shaw submitted to EPA its Hangar 1 Removal Action Report. Thereafter, the EPA issued a Notice of Completion.

Since the 1990s, Raytheon has consistently asserted that the Army used TCE at HAAF during World War II and released TCE to the environment during its operations such that the Army is responsible for the costs incurred by Raytheon in cleaning up the Site.

III. Army Operations at the Site

HAAF was constructed beginning in 1942 and activated in early 1943 as part of a large and quick expansion of the American military in the early 1940s. The primary mission of HAAF was the processing and staging of heavy bombers and very heavy bombers and their crews for overseas deployment. The first heavy bombers—B-17 and B-24 aircraft—arrived at HAAF in May 1943 and, during the first year of operations, HAAF processed B-17s and B-24s exclusively. Beginning in May 1944, very heavy bombers, B-29s, began to arrive at HAAF. The B-29 bomber was essential to winning the War in the Pacific theater because it was a long-range bomber—it was able to carry large bomb loads from the United States to the mainland of Japan without needing to refuel. The last B-29 bombers left HAAF in September 1945 and, by that time, the War had ended in both theaters and the base was decommissioned soon thereafter.

The B-29s that were processed at HAAF arrived new from Boeing manufacturing plants

or from modification centers.⁴ The planes were then inspected and, if necessary, repaired.⁵ B-29 pilots would also conduct test flights on each plane before deployment, permitting the pilot to get acquainted with the aircraft prior to combat and ensure that it was functioning properly in all respects. Additional inspections and repairs then occurred as necessary. The Army used Hangar 1 as the “subdepot” hangar and it contained the manufacturing and repair shops for more specialized maintenance activities. Hangar 4 was utilized for less-specialized maintenance activities, including production line maintenance.

Raytheon contends that the Army utilized TCE at HAAF in connection with the maintenance activities performed there. The basis for Raytheon’s claim is essentially twofold. First, Raytheon asserts that it is reasonable to infer that the Army used TCE at HAAF because sufficient supplies of TCE were available to the Army as a whole during World War II, TCE was

⁴After the planes rolled out of the manufacturing plants, they were sent directly to modification centers where they received the latest modifications that had been developed. From that point, the planes were either sent to processing centers such as HAAF or, in some instances, to a training base and then to a processing center. Planes arriving at HAAF from modification centers typically had less than 15 hours of flying time on them. Planes arriving at HAAF from training bases in all likelihood had between 100 and 125 hours of flying time on them. Based on testimony by HAAF veterans that will be discussed in more detail below, the court concludes that the majority of B-29s processed at HAAF had very few flight hours and came directly from modification centers.

⁵As explained by both Floyd Barnes, a veteran stationed at HAAF during the B-29 processing period, and Michael Looney, one of Raytheon’s experts, the engine of the B-29 initially required numerous repairs and replacements because the aircraft went into production without any testing or development in light of the immediate need for the aircraft in the Pacific theater. Thus, the initial B-29s were fairly “sloppy” planes and any “bugs” in the design and installation of the aircraft and its parts were repaired after-the-fact as opposed to prior to production.

the Army's "solvent of choice" during World War II and the B-29 project was a high priority during the War. In other words, Raytheon asks the court to infer the use of TCE by the Army at HAAF based on evidence that the Army used TCE as a degreaser during World War II and evidence that the B-29 was a high-priority project warranting the use of the most effective degreaser available. Second, Raytheon relies on eyewitness testimony and other evidence specifically linking the use of TCE to HAAF during World War II. The court addresses both aspects of Raytheon's claim below and, ultimately, is not persuaded that the Army used TCE at HAAF during its operations at the Site.

Raytheon presents a third category of evidence in an effort to demonstrate that the Army used TCE at HAAF. Specifically, Raytheon, through its expert Peter Mesard, presented evidence concerning the composition of the contaminant plume and the relatively shallow subsurface degradation of TCE purporting to show that TCE must have been released at the Site before Beech began its operations at the Site. The court addresses (and, ultimately, rejects) this evidence below in connection with Beech's operations.

A. Supply and Regulation of TCE during World War II

The court begins, then, with a closer look at Raytheon's contention that TCE was widely used by and readily available to the Army during World War II. Both parties presented expert testimony on this issue. Richard Doherty, an environmental engineer who has studied the historical use in the United States of TCE and other chlorinated solvents, testified on behalf of Raytheon. Dr. Jay Brigham, an historian specializing in 20th Century American History,

including World War II and the wartime economy, testified on behalf of the United States. Mr. Doherty opined that TCE was widely available to the military, including the Army, during World War II and that the Army enjoyed adequate supplies—even, at times, a surplus—of TCE during the War.⁶ Dr. Brigham, in contrast, opined that while the Army received the TCE it needed during World War II, the heavy regulation of TCE during the War necessitated that the Army limit its use of TCE to depots performing the highest level of maintenance. On this issue, as will be explained, the court is ultimately persuaded by the testimony of Dr. Brigham, whom the court found highly credible and able to provide both a compelling historical context for the vast documentary evidence concerning the allocation of TCE during the wartime economy as well as an informed independent analysis of those documents.⁷

As explained by Dr. Brigham, the United States government during World War II heavily regulated the distribution of a variety of goods that were required for the war effort, including chemicals such as TCE. In 1940, the executive branch authorized the Army/Navy Munitions

⁶Mr. Doherty also opined, based in large part on his opinion that the Army enjoyed a surplus of TCE during World War II, that TCE was more likely than not used at HAAF during World War II. The United States objected to this opinion on the grounds that Mr. Doherty lacked the proper foundation to offer it. The court retained that objection under advisement and now overrules the objection. While the foundation for the opinion is admittedly thin, the court has considered the testimony but is ultimately not persuaded by that testimony in any event.

⁷The testimony of Mr. Doherty, on the other hand, did not transcend the mere recitation of excerpts from certain documents—namely, those documents that, in isolation, appear to suggest a surplus of TCE available to the Army. In other words, perhaps because his education and experience lie primarily in environmental engineering rather than history, Mr. Doherty was unable to provide the court with the requisite historical context underlying the documents concerning the use and allocation of TCE during the wartime economy.

Board to institute a preference or priority system to ensure that those industries, businesses or contractors who were engaged in the production of essential wartime materiel (e.g., planes, tanks, engines) received what they needed to accomplish that production. Eventually, the priority system was managed by the Office of Production Management (OPM). Pursuant to that system, each industry, business or contractor desiring a particular good received a priority ranking with respect to that particular good and then placed orders for goods (orders that were often inflated by the industry or business in the hopes it would receive the necessary amount) with the OPM. The OPM then fulfilled those orders by priority rankings. Ultimately, the priority system became cumbersome and ineffective in its goal of taking the economy to its full potential in terms of production. Those entities with higher priority rankings absorbed nearly all the available essential goods, leaving entities with lower priority rankings without the requisite goods for wartime production. The production of wartime materiel suffered as a result.

In January 1942, the War Production Board (WPB) was created as the successor to the OPM and, over time, the WPB began issuing allocation orders that replaced the priority system. Unlike the priority system, the allocation system ensured that each industry, business and contractor involved in the production of materiel considered essential to the war effort received some portion of available goods necessary for that production. The allocation system was highly successful and, ultimately, the American wartime economy outfitted the American military with everything that it needed to fight and win the war. In fact, as Dr. Brigham testified, the United States' wartime economy and its industrial output of war armaments, as much as any other factor, resulted in the Allies winning the War.

Under the allocation system, the distribution of TCE was heavily regulated and the lion's share of available TCE was allocated to indirect military and civilian use. Indirect military use refers to a defense contractor under contract with the federal government to produce materiel for the war—airplanes, tanks, guns, ammunition and related component parts—who utilized TCE for metal degreasing. Direct military use, by contrast, refers to use by the various branches of the military. According to Dr. Brigham, the decision to allocate the vast majority of TCE for indirect military use reflects the federal government's understanding that an emphasis on the manufacture of war goods was essential to the overall war effort. Indeed, throughout 1944 until the end of the war (coinciding with the time period when B-29s were processed at HAAF), the allocation of TCE was most stringent and was earmarked almost exclusively for indirect military use.

As reflected in Exhibit 258, a January 3, 1944 memorandum issued by the Chemicals Division Requirements Committee of the WPB concerning anticipated TCE supply requirements for the calendar year 1944, the WPB anticipated that in excess of 90 percent of available TCE would be allocated for metals degreasing in connection with indirect military use. By contrast, this memorandum reflects that the WPB anticipated that the Army would receive a very small amount of TCE—approximately 3500 gallons per month. Consistent with the amounts anticipated by the WPB in January 1944, Exhibit 1022, a WPB progress report for the week ending October 14, 1944, reflects that, in fact, 97 percent of available TCE was allocated for metals degreasing in plants holding contracts for war production. Similarly, Exhibit 1024, a December 6, 1944 memorandum from the Chemicals Bureau of the WPB, reflects that nearly all available TCE

remains earmarked for indirect military use. Finally, Exhibit 1032, a September 21, 1945 draft proposed by the WPB concerning the history of TCE use during World War II, reflects a heavy demand for TCE during the war as a metals degreaser for use in degreasing machines found on production lines in manufacturing plants making war materiel, such as airplanes, tanks, guns and ammunition. That draft also reflects that "a large field use for the same purpose developed by the various military branches, particularly the Air Corps."

B. Use of TCE by the Army during World War II

As reflected in Exhibit 1032, the Army certainly received TCE during the war and, like manufacturing plants, used that TCE as a metals degreaser in degreasing machines. The effect of the allocation system on the overall distribution of TCE, however, forced the Army, in turn, to regulate where its allocated share of TCE would be used. By way of background, by early 1942 it became evident that some systematic process of handling the immense number of planes rolling out of American factories was necessary and the Army's system of maintenance was reorganized. Maintenance activities were performed at either depots or subdepots and, within that dichotomy, a four-level echelon system of maintenance was put in place. Fourth echelon maintenance, the highest and most sophisticated level of maintenance, included complete engine overhauls and restoration of worn or damaged aircraft. Third echelon maintenance involved repairs to and replacement of aircraft parts and equipment.

Pursuant to Army regulations and technical orders in place at the time HAAF was processing B-29s, fourth echelon maintenance was performed only at depots. Ex. 1010; 1014.

The highest level of maintenance performed at a subdepot was third echelon maintenance. Ex. 1013. These limits on the levels of maintenance performed at subdepots was confirmed by HAAF veterans and it is undisputed that HAAF was a subdepot.⁸ As Major Goddard testified, fourth echelon maintenance was performed only at the regional depot facilities that existed in the United States at that time and fourth echelon maintenance, unlike the lower echelons of maintenance, required the use of several special types of solvents due to the nature of the work. Exhibit 254,⁹ an Army technical order dated November 12, 1942 concerning the cleaning and maintenance of aircraft parts, discusses the use of TCE in connection with vapor cleaning and, due to the cost of TCE, expressly limits vapor cleaning to “depots and such stations as are specifically authorized by . . . Wright Field . . . to employ this method of cleaning.” There is no evidence in the record that this restriction was lifted at any time prior to or during the period when HAAF was processing B-29s and there is no evidence that HAAF ever requested or received authorization to employ TCE vapor cleaning in connection with aircraft maintenance.¹⁰

⁸During the cross-examination of Dr. Brigham, Raytheon attempted to show, through the use of Exhibit 194, that TCE was, in fact, used at subdepots. Exhibit 194 is a November 1997 letter from a lawyer at EPA to a lawyer with the Department of Justice in preparation for an upcoming meeting with the Army Corps of Engineers to discuss the potential use of TCE at Strother Field, a subdepot in Kansas. Contrary to Raytheon’s suggestion at trial, the document does not indicate that TCE was used at Strother Field. Rather, it simply indicates that fourth echelon maintenance may have occurred at Strother Field and, if so, the use of TCE would be consistent with such maintenance activities. This exhibit, then, in no way supports an inference that TCE was used at HAAF in the absence of evidence that fourth echelon maintenance was performed at HAAF.

⁹The document constituting Exhibit 254 is also in evidence as Exhibit 1012.

¹⁰The technical order reflected in Exhibit 254 was amended in April 1944 but that amendment is not in the record. It is unlikely, however, that the missing amendment would

Moreover, Dr. Brigham testified that while he presumed TCE could be used in other contexts, the only context in which he had seen the use of TCE in his review of relevant materials was in connection with vapor degreasing. Even Exhibit 1032 indicates that the “large field use” developed by the Army for TCE was limited—at least during the period when B-29s were processed at HAAF—to the use of TCE in degreasing machines.

Raytheon contends, in response to this evidence, that HAAF was performing fourth echelon maintenance such that it is reasonable to infer that TCE was used at HAAF. In support of its argument, Raytheon relies primarily on one particular unit history discussing “overhauls” at HAAF.¹¹ A unit history is a monthly report issued from various units stationed at HAAF. The unit history highlighted by Raytheon, Exhibit 168, states, in pertinent part, as follows:

Because of the high proficiency of the personnel of the 6th Heavy Bombardment Processing Headquarters, no aircraft accidents, which required 3rd Echelon

have lifted the restriction of TCE to depots using vapor degreasers. As explained by Dr. Brigham, TCE was still in short supply in April 1944 and continued to be in short supply through the end of that calendar year.

¹¹Raytheon relies to a lesser extent on Exhibit 166, a March 19, 1943 unit history from HAAF reflecting a “suggested outline of organization of departments” for the base, including, by way of example, an electroplating department and other evidence suggesting an “engine build up” department. Raytheon contends that electroplating required the use of TCE and that engine build-up refers to engine overhauls that, in turn, constituted fourth echelon work requiring the use of TCE. No evidence was presented that electroplating occurred at HAAF or that an electroplating department ever materialized once the base was opened and, in fact, Major Goddard testified that electroplating was not done at HAAF. Moreover, engine build-up is simply not the same as an engine overhaul. As explained by Colonel Burt Bickerstaff, a veteran stationed at HAAF during the B-29 processing period and the Director of Aircraft Maintenance for the base, engines shipped to HAAF did not arrive with all component parts in place and, in engine build-up, Army personnel installed those components on the engines.

maintenance, occurred [sic] during this time and the facilities of Sub-Depot Engineering were primarily utilized in the repair and overhaul of aircraft parts. All personnel were awaiting the opportunity to show their ability to accomplish 3rd Echelon work. This ambition was realized when, approximately six months after activation, the Sub-Sept began the repair and overhaul of aircraft, including such work as center section structural repair and complete DIR of heavy bombardment aircraft.

According to Joseph Novak of the Army Corps of Engineers, "DIR" is an acronym for "depot inspection and repair," which refers to the sending of aircraft parts to a depot for inspection and overhaul or repair and then sending those parts back into the field.

The court is not persuaded that HAAF was performing fourth echelon maintenance during World War II and finds the testimony of various war veterans highly credible on this issue. Both Colonel Burt Bickerstaff, a HAAF veteran and the Director of Aircraft Maintenance for the base during the B-29 processing period, and Major George Goddard, a HAAF veteran and a maintenance supervisor at the base during the B-29 processing period, testified that the highest level of maintenance performed at HAAF was third echelon maintenance and that all fourth echelon work was performed at Tinker Field in Oklahoma City. Both men also testified that engine overhauls (described by Colonel Bickerstaff as completely tearing down an engine and putting in new parts) constituted fourth echelon work and that all overhauls were done in Oklahoma City. Colonel Bickerstaff explained that engine overhauls were not performed at HAAF because the engines were too complicated and overhauls required high quality control. Similarly, Major Goddard testified that HAAF had neither the tools nor the skills necessary to perform engine overhauls. Dr. Theodore Bashkow, another veteran stationed at HAAF during the B-29 processing period, also testified that the tearing down or rebuilding of engines was

simply "too much" for HAAF and that HAAF lacked the facilities to perform such work.

With respect to Exhibit 168, the court is not convinced that the author intended to suggest that fourth echelon engine overhauls occurred at HAAF. Significantly, the author writes that personnel were awaiting "the opportunity to show their ability to accomplish 3rd echelon work" and that "this ambition" was realized when the subdepot "began the repair and overhaul of aircraft." The fact that the author refers to the "overhaul of aircraft" as third echelon work indicates that the author is not describing fourth echelon engine overhauls. Moreover, when confronted in his deposition with Exhibit 168 and, more specifically, the language contained therein referencing "overhaul of aircraft" at HAAF, Major Goddard took great exception to the author's use of the term "overhaul":

I'm just questioning the ability of the man who wrote this to understand what he was writing because there was certainly not, in my mind, a capability of complete overhauling.

* * * *

I believe that this reference to "overhaul" is not correct. That is not the term that is used for third echelon maintenance. It's a term that is used for fourth echelon maintenance. And, to my knowledge, Herington Air Base never performed fourth echelon maintenance on aircraft or parts.

The court credits Major Goddard's construction of Exhibit 168 and is not persuaded that this document evidences the performance of engine overhauls or fourth echelon work at HAAF. In addition, no other unit histories presented at trial reflect the need for TCE at HAAF, the use of TCE at HAAF or the performance of any fourth echelon maintenance activity at HAAF that would require the use of TCE.

Raytheon also contends that the echelon system did not apply to the B-29 (or, stated another way, that the B-29 program was exempt from the echelon system) such that even if the Army was not conducting fourth echelon work at HAAF, it nonetheless could have and would have received TCE for use in connection with B-29 maintenance. In support of this argument, Raytheon relies on its Exhibit 295, a document entitled "The Maintenance of Army Aircraft in the United States, 1939-1945." That document, which sets forth the Army's general policies and procedures concerning aircraft maintenance during World War II, including the echelon system, bears an issue date of August 1946 and was authored primarily by Capt. Robert W. Ackerman of the Material Section of the Army Historical Office. The document presents a historical study of aircraft maintenance during the War. In the introduction portion of that voluminous document, the author notes that "the maintenance of the comparatively new B-29 and of gliders, since special problems were involved, is not discussed here." From that isolated sentence, Raytheon contends that the B-29 was exempt from the echelon system. The court is not persuaded. As Dr. Brigham testified, the document simply does not suggest that the B-29 was somehow exempt from the echelon system. Rather, it suggests only that any maintenance procedures or policies specific to the B-29 were not considered or discussed for purposes of the study—a study that focused on the B-17, a much simpler aircraft than the B-29.

Nonetheless, if even the court were to assume that the B-29 was exempt from the echelon system, the court is not persuaded that the limited maintenance activities conducted on B-29s at HAAF would have warranted the use of TCE. The B-29s processed at HAAF came directly from the Boeing plants in Wichita and Seattle or from modification centers. They were, as

succinctly described by Floyd Barnes, a veteran stationed at HAAF during the B-29 processing period, "brand new." Because the planes were new, Army personnel at HAAF did not clean aircraft engines prior to inspecting the aircraft on arrival. Colonel Bickerstaff estimated that the engines of the B-29s at HAAF had only 10 to 15 hours on them. Both he and Mr. Barnes agreed that "very little cleaning" was required in connection with the B-29s at HAAF.¹² To the extent those engines required cleaning, the court is not persuaded that that task would have required the use of TCE. In fact, Raytheon's own expert endorsed simple soap and water over solvents for cleaning engines. In that regard, Michael Looney, a former volunteer and flight engineer for the Commemorative Air Force who helped restore and maintain FiFi, a B-29 obtained by the Commemorative Air Force in 1971, testified that, in his contemporaneous experience, while a B-29 engine would typically be cleaned before an inspection, that cleaning was more often accomplished with use of a soap solution rather than a solvent.

With respect to the cleaning of exhaust stains after test flights, Colonel Bickerstaff testified that "soap and water would take that off" and he did not recall using any specific product to remove those stains. Similarly, Major Goddard testified that if an aircraft part had oil or grease on it during routine maintenance, the part was simply wiped with a rag without the need for a cleaner or solvent. As aptly summarized by Major Goddard:

And we had new airplanes, so—new airplanes were not like old airplanes being covered with dirt and grime. New airplanes were shiny. And the engines were not dirty like old cruddy engines. The engines were, well, in many cases, less than 25

¹²Moreover, as explained below, the veterans testified that to the extent any cleaning required the use of a solvent, they used a petroleum-based solvent.

hours. They don't get dirty in 25 hours. There will be a few leaks and so forth from improperly tightened clamps or something, but it's not in the same category with what I would call dirty.

Finally, with respect to the cleaning of spark plugs, Major Goddard testified that spark plugs required very little cleaning because they "don't get very dirty" in 25 hours. In fact, in the opinion of Major Goddard, the spark plugs that HAAF cleaned were already so clean that he believed "it was a waste of time" to clean them.

Raytheon spent a good deal of time and effort at trial demonstrating that the B-29 program was a high priority of the United States government during the war and that the Army preferred TCE as its "solvent of choice" for degreasing activities. Numerous witnesses testified about the high priority assigned to the B-29 program and Mr. Novak, among others, testified that TCE was the most efficient and effective degreaser available during World War II. Based on these facts, Raytheon urges the inference that HAAF—responsible for processing these high-priority planes and feeling pressure to do so quickly—would have received and utilized TCE for its degreasing needs.

The court is certainly persuaded that the B-29 program was a high priority of the federal government and that TCE was preferred by the Army as a degreasing agent. The priority assigned to that program, however, is reflected in the WPB's decision to allocate the vast majority of available TCE to defense contractors responsible for manufacturing the planes and component parts, thus ensuring that those planes continued to roll out of American factories as quickly as possible. The priority of the B-29 program and the preference for TCE as a degreasing agent is also reflected in the Army's decision to allocate its share of TCE to those

depots performing significant and sophisticated maintenance on B-29s. In other words, the priority assigned to the B-29 program and the undisputed effectiveness of TCE caused a processing center like HAAF to go without TCE during the war—TCE was provided to those contractors and depots that actually had a need for it (and utilized degreasing machines for which no TCE substitute existed) and was not provided to HAAF for the light cleaning required on new airplanes when soap and water was a sufficient substitute. Thus, even assuming, as testified by Mr. Doherty, that the Army had more than sufficient amounts of TCE to satisfy its needs, the court does not believe that HAAF needed TCE and there is no evidence to support the conclusion that the use of TCE at HAAF would have enabled HAAF to process B-29s more quickly or more efficiently. For these reasons, the court is unwilling to infer from the priority of the B-29 program, the Army's asserted preference for TCE as a degreasing agent or the general availability of TCE to the Army during the war that TCE was, in fact, used at HAAF.

Nonetheless, Raytheon urges that the use of TCE was required for certain maintenance activities performed at HAAF by virtue of Army technical orders. Exhibit 269 is an Army technical order dated September 10, 1945 regarding the cleaning of aircraft and, according to Raytheon, this technical order requires the use of TCE in connection with the removal of exhaust stains. The court has carefully reviewed that technical order and does not understand that document to require the use of TCE in connection with the removal of exhaust stains. At the very most, the document permits the use of TCE if available. In any event, that document was issued near the end of the War when, as explained by Dr. Brigham, the wartime allocation

system was coming to an end and the supply of TCE was becoming greater.¹³

Indeed, Exhibit 254, a prior technical order dated November 12, 1942, emphasized the use of aqueous cleaners such as soft soap whenever practical for the cleaning of aircraft and aircraft parts. This technical order also addresses the removal of exhaust stains and recommends the use of other cleaners, including kerosene (but, as explained above, not TCE, which was restricted to use in vapor cleaning at depots and “such stations as are specifically authorized by . . . Wright Field”) only when such stains are difficult to remove with the soft soap solution. While an additional technical order was issued in April 1944 and that technical order is not in the record, it is unlikely that this missing technical order would have amended the November 12, 1942 technical order’s emphasis on the use of aqueous cleaners where practical. As Dr. Brigham explained, TCE was still in short supply in April 1944 and continued to be in short supply through the end of that calendar year.

Finally, Raytheon directs the court to certain statements made by Burns and McDonnell and the ATSDR in connection with their investigations at the Site as evidence of the Army’s use of TCE at HAAF. In its Draft Site Investigation Report issued in March 1995, Burns and McDonnell stated that the TCE found in groundwater samples was “likely the result of DOD

¹³Similarly, Raytheon contends that Exhibit 443, a March 1945 handbook of instructions concerning oil coolers and control valves, requires the use of TCE in connection with the cleaning of copper oil coolers. While the handbook states that copper oil coolers “can be cleaned” with a cleaning solution containing TCE, the handbook expressly states that the cleaning solution is simply “recommended” by the Army. Thus, to the extent that the Army was cleaning copper oil coolers at HAAF during World War II (a fact that is disputed by the United States in any event), that fact would not compel the conclusion that the Army necessarily was using TCE at HAAF.

operations of the Site," a conclusion that Raytheon looks to as supporting its assertion that the Army used TCE at the Site. The court, however, attaches no significance to this statement or any other statements in the Draft Site Investigation Report indicating that TCE contamination occurred during the Army's occupancy of the Site. As explained by Tracy Cooley, a Burns and McDonnell manager who testified concerning the Site investigation, Burns and McDonnell was tasked with determining whether DOD activities adversely affected the Site and, in performing that task, it did not consider other sources (and, specifically, did not consider whether Raytheon might have been responsible) for the contamination and did not endeavor to ascertain whether any other person or entity might be responsible for the contamination. Moreover, Mr. Cooley testified that Burns and McDonnell had no information suggesting that the Army used TCE at HAAF.

For this reason, the court is also unwilling to draw the nefarious inference that Raytheon urges from the fact that the Corps directed Burns and McDonnell to remove the language from the draft report concerning DOD's responsibility and that, as a result, the Draft Final Site Investigation Report issued in May 1995 did not contain that language. The court believes it was entirely appropriate for the Corps to ask that the language be removed because Burns and McDonnell had no basis—aside from the fact that the Corps had operated at the Site in the past—to render the conclusion that TCE contamination was likely the result of DOD activities.¹⁴

¹⁴In a somewhat related vein, Raytheon takes the Corps to task in connection with the Corps' section 104(e) responses, pointing to those responses as additional evidence that the Corps was somehow hiding the ball with respect to the Army's TCE use at HAAF or as evidence that the Corps, in bad faith, was continuing to deny use of TCE without support for

Similarly, the final version of the public health assessment prepared by ATSDR stated by way of introduction that "Army personnel used TCE and other solvents to clean spark-plugs and degrease aircraft parts during maintenance operations." Just as it did with the Burns and McDonnell Draft Site Investigation Report, Raytheon looks to this document as additional evidence that the Army used TCE during its operations at the Site. As with the Draft Site Investigation Report, the court does not believe that the final version of the public health assessment has any probative value with respect to the Army's use of TCE at HAAF.

As Robert Knowles of ATSDR testified, ATSDR prepared three versions of the public health assessment for the Site—an initial version to share with various state and federal agencies; a public comment version; and a final version. The initial release and public comment versions of the public health assessment for the Site did not contain any language concerning the Army's use of TCE at HAAF. That statement, Mr. Knowles explained, was included in the final version based on information submitted to ATSDR during the public comment period from IT Group, an environmental consulting group hired by Raytheon. Mr. Knowles also testified that ATSDR had no other information indicating the use of TCE by the Army. For this reason, the court also

that denial. In that regard, in submitting its responses to EPA's section 104(e) requests, the Corps did not identify the individuals who provided information in formulating the Corps' responses and did not identify the documents consulted in connection with its responses. While the court appreciates Raytheon's frustration at the Corps' incomplete responses, the fact remains that the Corps' ultimate response—that the Army did not use TCE at HAAF—was correct. For this same reason, the court rejects Raytheon's related suggestion that it was punished for providing honest answers concerning its use of vapor degreasers and TCE by having to bear the cost of cleanup while the Corps was rewarded for its steadfast refusals to admit responsibility.

refuses to draw any negative inference from the fact that EPA, upon receipt of the final version of the public health assessment, contacted ATSDR and asked the agency to either retract or modify the language concerning the Army's use of TCE at HAAF and, as a result, ATSDR entered a letter of correction indicating that the sentence should read: "Army personnel used solvents to clean spark-plugs and degrease aircraft parts during maintenance operations." The court believes that it was entirely appropriate for EPA to ask ATSDR to omit the language stating that the Army used TCE at the Site as ATSDR had no evidence demonstrating that the Army, in fact, had used TCE at the Site.

Similarly, Raytheon's counsel, in his closing argument, challenged the United States to demonstrate how the KDHE "got it wrong" in 1997 when it concluded, in its report on the use of chlorinated solvents at Army Air Fields in Kansas, that TCE was "likely used in vapor degreasing at Liberal AAF and may have been used at Herington AAF as well." As evidenced by that report, Exhibit 420, the KDHE's conclusion is based largely on the same evidence on which Raytheon's claims are based—that HAAF would have made every effort to obtain TCE because it is a highly effective degreaser. That logic, at least as to HAAF, was successfully discredited by the testimony of Dr. Brigham here. The KDHE also concluded that the Army's Airfield in Liberal used TCE based on an interview with an individual who was in charge of the second echelon shop at Liberal who stated that a vapor degreaser was used there. But, that individual was not subjected to cross-examination which, as occurred here with respect to Colonel Bickerstaff and Walter Rosendale (as explained below), might have exposed his statement as unreliable. Moreover, there is no evidence concerning whether or not Liberal had

special permission to utilize vapor degreasers or TCE and, in any event, the report indicates that the aircraft maintained at Liberal required more maintenance than the aircraft at HAAF because the aircraft at Liberal had significantly more flight hours on them. Therefore, even if TCE actually had been used at Liberal, the court does not infer that TCE was also used at HAAF. The KDHA also puts much stock in a statement from the individual who worked in the second echelon shop at Liberal that he had seen vapor degreasers at "many other airfields" that he traveled to during the war. The statement, however, does not even indicate whether the individual traveled to other airfields in Kansas let alone that he traveled to HAAF. Finally, the KDHE's conclusion that TCE may have been used at HAAF is based in part on a HAAF internal report indicating that rust-protective coating on guns should be degreased within existing "modern steam tanks." The KDHE simply assumes that the author of this phrase intended to reference "vapor degreasers" because steam is "heated water vapor." There is no persuasive evidence before the court, however, that a reference to "modern steam tanks" in fact means "vapor degreasers." For these reasons, the court is not persuaded by the KDHE's conclusion.

C. Raytheon's Evidence Specifically Linking TCE Use to HAAF during World War II

Raytheon points to three pieces of what it believes is direct evidence of TCE use by the Army at HAAF during World War II. The first is the testimony of Colonel Bickerstaff. Colonel Bickerstaff testified that the Army utilized a vapor degreaser at HAAF to clean spark plugs in Building 514. Although Colonel Bickerstaff did not recall the name of the solvent used in the machine he described as a vapor degreaser, it is undisputed that if, in fact, a vapor degreaser was

used at HAAF then that degreaser necessarily would have utilized TCE. Nonetheless, the court, for several reasons, is not persuaded that the Army used a vapor degreaser at HAAF. Colonel Bickerstaff, at the time of his preservation deposition, was seventy-nine years old and, as he himself candidly offered, he has “been at many bases over 21 years and did a lot of things and [he has] kind of lost track of what [he] did do.”

Moreover, the court is not convinced that the machine described by Colonel Bickerstaff was, in fact, a vapor degreaser. Rather, the description provided by Colonel Bickerstaff suggests that he was confusing two distinct methods of cleaning. He testified that the machine had a “small agitator to make the vapors rise,” but no other evidence at trial concerning vapor degreasers reflected that vapor degreasers utilized an agitator mechanism. In fact, Exhibit 262, a handbook of instructions concerning the reconditioning of ceramic aircraft spark plugs, describes the use of an agitator only in connection with the solvent method (as opposed to the vapor method) of cleaning spark plugs.¹⁵ In addition, Raytheon’s expert Mr. Doherty testified on cross-examination that the typical TCE vapor degreaser does not have an agitator.

Colonel Bickerstaff also testified that the machine was located inside a glass enclosure or underneath a glass top. No other evidence at trial concerning vapor degreasers reflected this design and, in fact, Mr. Doherty testified that he had never seen a vapor degreaser with a glass

¹⁵Other evidence was presented at trial suggesting that HAAF utilized the solvent method in cleaning spark plugs during World War II. Specifically, Mr. Novak testified that the spark plug cleaning building, as evidenced by a 1948 quitclaim deed for the property, had nonsparking fans and a “significant blower system to waft away any explosive environments,” indicating the use of flammable solvents in that building.

top or enclosure. Finally, the court believes that, consistent with the Army technical order expressly limiting the use of vapor cleaning to depots without authorization from Wright Field, HAAF would have needed permission to utilize the vapor degreaser and no authorization for that use appears in the record. For these reasons, coupled with Major Goddard's testimony that the spark plugs that were cleaned at HAAF were not particularly dirty in the first instance, the court is not persuaded that the Army would have used a TCE vapor degreaser at HAAF in connection with the cleaning of spark plugs during World War II.

The second piece of direct evidence highlighted by Raytheon is the testimony of Walter Rosendale, a veteran stationed at HAAF for some period of time between 1943 and 1945. In response to leading questions from Raytheon's counsel (to which no contemporaneous objection was made) and at the specific suggestion by Raytheon's counsel that TCE was used to clean aircraft parts, Mr. Rosendale testified at some length that TCE was so used. A full reading of the designated excerpts from Mr. Rosendale's preservation deposition, however, readily reveals that Mr. Rosendale is a highly suggestible witness. Indeed, when counsel for the United States ultimately objected to the approach taken by Raytheon's counsel (i.e., leading questions suggesting that TCE was used by the Army), Mr. Rosendale essentially objected to the objection, asserting that he liked the approach taken by Raytheon's counsel because the events occurred nearly 55 years ago and, in essence, it was difficult for him to recollect those events independent of the questions posed by Raytheon's counsel. Indeed, when Mr. Rosendale was later asked by counsel for the United States how he knew that TCE was used by the Army at HAAF, Mr. Rosendale testified: "All I know—I don't know if it was TCE, but it was a cleaning solvent. And

I think that's all that was available in those days to the military. . . . But TCE, I don't remember it actually being used as, you know, the solvent. That's too many years ago." The court, then, declines to credit the testimony of Mr. Rosendale as to the Army's use of TCE at HAAF during World War II.

The third and final piece of direct evidence relied upon by Raytheon to support the conclusion that the Army used and released TCE at HAAF during World War II is the testimony of Mr. Novak on the subject of carbon tetrachloride (CTC) fire extinguishers. Mr. Novak testified that CTC fire extinguishers were present at HAAF during World War II and that, based on his reading of certain testimony, on at least one occasion a serviceman at HAAF emptied the contents of a CTC fire extinguisher to clean his overalls.¹⁶ Although Mr. Novak has no personal knowledge of whether CTC fire extinguishers during World War II contained TCE, he testified, based on his review of documents that he was shown at his deposition, that such fire extinguishers apparently contained TCE.

Exhibit 258, a document from the Chemicals Division Requirements Committee of the War Production Board concerning tentative supply requirements for 1944, certainly indicates that TCE served as a freezing point depressant in CTC fire extinguishers. As Mr. Brigham testified, however, TCE would be added to a CTC fire extinguisher to winterize that fire extinguisher when the outside temperature dropped to a certain point (he could not recall what

¹⁶While Mr. Novak did not identify the individual or individuals on whose testimony he was relying, the testimony of Mr. Barnes, presented at trial by deposition, could be construed to suggest that servicemen emptied CTC fire extinguishers to clean their overalls.

that temperature was). According to Mr. Brigham, then, CTC fire extinguishers contained TCE only “under certain conditions”—namely, if and when those fire extinguishers were winterized. There is no evidence in the record that any of the CTC fire extinguishers at HAAF were winterized. The court, then, is not persuaded that TCE was used by the Army at HAAF during World War II in connection with CTC fire extinguishers.¹⁷

An analysis of other evidence presented at trial further supports the court’s conclusion that Raytheon has not met its burden of establishing that the Army used TCE at HAAF during World War II. Without exception, none of the veterans who testified (except for Mr. Rosendale who, as explained above, was highly suggestible and later recanted his testimony) recalled the use of TCE at HAAF. Moreover, each of these veterans either had no recollection of the use of any solvents whatsoever or specifically recalled the use of a petroleum-based solvent for maintenance activities. Mr. Barnes, for example, testified that the consistency and clarity of the solvent that was used to remove Cosmoline from aircraft parts was “about like kerosene” and that this same solvent was used for the general cleaning of aircraft parts. Colonel Bickerstaff testified that Army personnel used air guns with atomizers to spray oil off aircraft engines and that the solvent used in the spray guns was a petroleum-based solvent “kind of like kerosene” and that it had “a very high flash point.” Mr. Novak testified that Stoddard solvent was a flammable, petroleum-based solvent, testimony that is corroborated by Exhibit 250, a War

¹⁷As explained by Colonel Bickerstaff, the CTC fire extinguishers were not pressurized and could be filled with CTC simply by removing a plug and pouring CTC into the chamber. There is simply no evidence that TCE was on hand at HAAF to be added to the fire extinguishers for winterization or that winterization was required.

Department Technical Manual describing Stoddard solvent as a “colorless, inflammable liquid distilled from petroleum.” The court is not persuaded, then, that the solvent described by the veterans as widely used at HAAF was TCE.¹⁸

For all the foregoing reasons, the court is not persuaded that the Army used TCE at HAAF during its operations at the Site.

III. Beech’s Operations at the Site

From 1950 through 1959, Beech leased a portion of the Site for use in disassembling military aircraft, producing jettisonable fuel tanks and steel shipping containers for those fuel tanks, and assembling military aircraft starter generators. It is undisputed that Beech, during the second-half of that decade, operated two large vapor degreasers that each utilized large quantities of TCE.

¹⁸At trial, the United States highlighted the lack of shipping records indicating that HAAF received TCE during World War II. Similarly, the United States attaches some significance to the undisputed fact that no records exist indicating the presence of a vapor degreaser at HAAF during World War II. The court assigns very little, if any, probative value to the absence of such records. Indeed, as highlighted by Raytheon, no shipping records were presented indicating that HAAF received Stoddard solvents but the court nonetheless believes that such solvents were used at HAAF. Raytheon, however, attempted to turn the argument of the United States on its head, suggesting that numerous records at HAAF were destroyed or otherwise unavailable and those “absent” records might suggest that HAAF received TCE during World War II. The court simply does not believe that any HAAF records would have reflected the use of TCE because, as explained above, the nature of the work performed at HAAF did not necessitate its use and, under the wartime allocation system, HAAF would have gone without TCE.