2019 Secretary of Defense Environmental Awards
Environmental Restoration
Fiscal Years 2017-2018
Defense Logistics Agency
Defense Supply Center Richmond

Introduction

The Defense Supply Center Richmond, located along the I-95 corridor in Chesterfield County, Virginia, is a consistent and dependable supplier of quality goods and services to those defending freedom around the world.

Defense Supply Center Richmond is the home of DLA Aviation, the aviation demand and supply chain manager for the Defense Logistics Agency. DLA Aviation serves within the Department of Defense (DoD) supply chain as the primary source of supply for nearly 1.2 million repair parts and operating supply items in support of all fixed- and rotor-wing aircraft, including spares for engines on fighters, bombers, transports and helicopters; all airframe and landing gear parts; flight safety equipment; and propeller systems. These items support more than 2,200 major weapons systems used throughout the DoD.

With over 600 acres and approximately 80 warehousing, utility and administrative buildings totaling more than 4.5 million square feet, Defense Supply Center Richmond is host to a number of other DoD, Federal and State organizations. The largest of these tenants are DLA Distribution Richmond, Virginia; DLA Disposition Services Richmond, Virginia; and the Virginia Army National Guard. DLA Aviation and the installation's tenant organizations employ more than 3,000 civilians, service members, and contractor personnel whose mission is to provide critical material support across the DoD and other Federal agencies.

Environmental Restoration Background

In 1987, the Defense Supply Center Richmond was included on the National Priorities List (NPL) of the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as "Superfund"). In 1990, Defense Supply Center Richmond; the U.S. Environmental Protection Agency (US EPA); and the Commonwealth of Virginia entered into a Federal Facilities Agreement (FFA), which directs restoration activities at the site. The FFA designated DLA as the lead agency responsible for the evaluation, selection and implementation of necessary, feasible, and reasonable response actions to ensure protection of human health and the environment. DLA Installation Operations Richmond oversees restoration and remedial activities on Defense Supply Center Richmond. DLA Installation Operations Richmond coordinates restoration activities with the US EPA, Virginia's Department of Environmental Quality (VADEQ) and DLA Installation Operations staff through monthly meetings of the Tier 1 Restoration Planning Team.

Thirteen operable units (OUs), which consist of both soil and groundwater affected by past site operations, are located on the installation. Investigations have been ongoing at these OUs since the mid-1980s. The complex properties of the local alluvial sediments coupled with the entrenched dense volatile contaminants, make environmental restoration especially

challenging. Heavy organic clays retard and sequester contaminants, making them difficult to assess, contact, and remediate over time. Despite these obstacles, DLA Installation Operations Richmond managed to reduce contamination and resultant risks by designing and using unique remediation technologies that take advantage of the innate physical and chemical properties of the soils.

Recent years have brought about more focused studies and the construction of successful long-term sustainable remedies on the installation. DLA Installation Operations Richmond, by working with the US EPA and the VADEQ, has obtained signed Records of Decision (RODs) for all of its sites. These RODs document the agreed upon remedies and outline the support for choosing these remedies. Defense Supply Center Richmond moved forward executing these solutions with dynamic and innovative remedial actions. Rather than addressing the individual OUs as independent undertakings, DLA Installation Operations Richmond focuses on addressing contamination from a holistic approach. This approach ensures larger issues are tackled in the right priority, preventing or eliminating the persistent sources of long-term liabilities. For transparency's sake, the Defense Supply Center Richmond's Management Action Plan (MAP) clearly lists the priorities. This plan details the history and context of the studies conducted as a clear and concise reference for employees, regulators, and stakeholders. It also helps all concerned understand the budget formulation and program planning process.

While the installation has made substantial progress in the remediation of all of its OUs, in this reporting period DLA focused on the groundwater Operable Units. OU-6, located in the central portion of the installation, consists of impacted groundwater underneath and down gradient of three source areas:

- An open storage area, designated separately as OU-1, was the site of numerous spills from storage activities and a recoupment operation. Additionally, three separate Malathion spills occurred here in years past.
- The former landfill area, designated separately as OU-2, is a 13-acre tract of land where a ravine used to dispose of bulk liquid chemicals, construction debris and scrap metal was located. The ravine has since been filled in; however, much of the contamination remains in place.
- The vehicle maintenance operation for the National Guard, designated separately as OU-3, included a degreasing area, a disposal area for sludge produced during wastewater treatment and several underground storage tanks.

The agreed upon remedy for OU-6 focuses on *in situ* bioremediation, coupled with Long Term Monitored Natural Attenuation and Land Use Controls. In 2015 and 2016, DLA Installation Operations Richmond initiated this remedy and installed forty-one new injection wells in nine separate transects and injected more than 50,000 gallons of Emulsified Vegetable Oil substrate into these wells to stimulate naturally occurring bacterial growth, which in turn provided a means for the breakdown of the contaminants of concern.

OU-7 is the contaminated groundwater found in three separate plumes resulting from past firefighter training activities. DLA Installation Operations Richmond manages the pits themselves separately as OU-4. The remedy for OU-7 consists of *in situ* bioremediation, coupled with Land Use Controls and Long Term Monitored Natural Attenuation. In 2013, DLA

Installation Operations Richmond initiated this remedy and installed twenty-three new injection wells in eight separate transects and injected more than 22,300 gallons of Emulsified Vegetable Oil substrate into these wells to stimulate naturally occurring bacterial growth, which in turn provided a means for the breakdown of the contaminants of concern.

OU-8 is the groundwater contaminated by the acid neutralization pits, considered separately as OU-5, associated with past industrial metal working operations. OU-8 was on a track towards Long Term Monitored Natural Attenuation coupled with Land Use Controls per the Record of Decision. The ROD includes a contingency remedy such as, *in situ* bioremediation if certain triggering criteria occur. During routine sampling, and follow-up data gap sampling, DLA Installation Operations Richmond discovered OU-8 spread beyond the existing array of monitoring wells and towards the installation boundary triggering the contingency remedy of *in situ* bioremediation. The contingency remedy is officially added through an Explanation of Significant Differences (ESD) signed in 2011. DLA Installation Operations Richmond put the remedy into place in 2013 by installing fifteen injection wells and injecting over 15,500 gallons of Emulsified Vegetable Oil substrate and lactic acid. In addition, DLA Installation Operations Richmond conducted a substantial amount of sampling, analysis and investigation to define the plume boundaries, to determine risk to potential receptors, and to revise the Conceptual Site Model (CSM). Naturally occurring preferential pathways influence the aquifer in the area to behave inconsistently with the Conceptual Site Model initially developed in 2005. DLA Installation Operations Richmond installed new sentry wells in 2012, which then produced samples with results above cleanup levels creating concerns about the definition of the northern boundary. The presence of a residential community and an elementary school to the north of the OU-8 amplified these concerns. Through careful and diligent coordination with off-site stakeholders, including the United States Army 99th Regional Support Command, Chesterfield County Schools and the Virginia Department of Transportation, DLA Installation Operations Richmond successfully characterized the full extent of contaminated groundwater.

To keep its neighbors and the public informed of remediation actions, DLA Installation Operations Richmond established a monthly Restoration Advisory Board (RAB), which consists of community members, a DLA Installation Operations Richmond co-chair, a US EPA representative, and a VADEQ representative. The RAB's primary objectives are to inform the community on the restoration activities at Defense Supply Center Richmond and to obtain community input regarding these activities and the proposed remedies for the OUs. DLA Installation Operations Richmond decreased the frequency of RAB meetings from monthly to quarterly because of its effectiveness in educating the public. The community co-chair stated, "We hold Defense Supply Center Richmond to be good stewards of the land and water on and surrounding Defense Supply Center Richmond." The Community Involvement Plan (CIP) is updated with input from interested citizens of the surrounding community.

Environmental Restoration Program Summary

DLA Installation Operations Richmond's Environmental Restoration Program for the Defense Supply Center Richmond strives to attain timely and cost effective risk reduction. To accomplish this goal, we work to ensure that our selected remedies are performing as designed and will achieve cleanup goals and a "response complete" status in a reasonable time frame. To

accomplish this, DLA Installation Operations Richmond periodically assesses the performance of a given remedy against clearly established metrics.

These metrics may include decreases in contaminant concentration or mass flux and changes in groundwater geochemical conditions or similar environmental parameters. When the remedy is performing as designed, the cleanup goals should be met within the design's time frame. Failure to meet the performance metrics suggests that the remedy is not performing as designed and alternative courses of action should be considered.

DLA Installation Operations Richmond prescribed an analytic decision-making process to evaluate prudent courses of action when an implemented remedy is not performing adequately. First, DLA Installation Operations Richmond evaluates techniques to improve the current remedial technology through optimization. Optimization begins with a review of system performance and design and an analysis of the root causes of sub-optimum performance, followed by design or operational changes intended to overcome the adverse, site-specific conditions. If the current technology proves technically non-feasible, which has occurred in practice many times, selection of a substitute technology or approach is evaluated. DLA Installation Operations Richmond has replaced several ineffective highly engineered remedial technologies with more passive less energy consumptive remediation solutions. Recently, two inefficient 'Pump and Treat' systems were replaced by *in-situ* bioremediation technology that augments the natural attenuation processes already lessening contamination in place. Once the ineffective technology is replaced, the performance goals and expectations are revised so that DLA Installation Operations Richmond has the means to evaluate the new technology from the baseline.

DLA Installation Operations Richmond uses the Triad approach to managing its restoration program. Triad consists of three elements: systematic project planning (SPP), dynamic work strategies, and innovative rapid sampling and analytical technologies. The data obtained through this approach is then considered by the Restoration Planning Team in its decision making process. DLA Installation Operations Richmond's Restoration Planning Team is a Tier I team and consists of DLA, US EPA, Region III, VADEQ as well as Chesterfield County Environmental Engineering and the Virginia Department of Health. Technical and Contractor support is offered by the United States Army Corps of Engineers, Baltimore District. For simplicity, they will be collectively referred to as the team. Through these interactions, concurrence with an action is maintained throughout and buy-in is achieved every step of the way. The consistent communication and sharing of data also eliminates much of the review time and questions that may otherwise arise. This partnership, established in the FFA, also fosters trust and understanding of desired outcomes and requirements of each stakeholder.

Environmental Restoration Program Accomplishments

Building 151 houses a vehicle maintenance operation for the Virginia Army National Guard. It is located over one of the more concentrated trichloroethylene plumes in OU-6. During the risk assessment conducted in 2013, we determined there was an unacceptable future risk to industrial workers in that building stemming from a buildup of contaminant vapors emanating from the plume underneath the building's foundation. The ROD addresses this risk by prescribing periodic sampling to monitor if and when these vapors began to enter into the

breathable air space inside the building. The first such sampling conducted in 2016 revealed that while the air inside the building was clean, the concentrations underneath the buildings slab were more than double those detected in 2013. During the reporting period, the team took steps to protect the personnel in that building by designing and installing a Sub Slab Depressurization System (SSDS) to apply a vacuum underneath the foundation of the building removing the vapors that had already collected and preventing a repeat of any buildup. The results of that installation show a complete radius of influence achieved for the entire area of concern underneath the building. While the effort is by no means large on the scale of cleanup work completed, it is significant because the building may continue to be used for its intended purpose for the foreseeable future with no impact to the workforce from the proximal contamination underneath.

During the reporting period, the team designed and implemented the second round of injections within Operable Unit 7 with new injection locations and a new injection substrate. In this round, the team selected Lactoil® which is more soluble, distributes through the aquifer more readily and lasts longer once there without sacrificing any of remedial power found in emulsified vegetable oil, indeed it creates an improved reductive environment over traditional emulsified vegetable oil. Seventeen of the previously installed injections wells were used for this round based on the current plume configuration. Additionally, the team installed twelve new injection wells both expanding the existing transects and adding points to plume areas that responded poorly to the first round of injections (due to a tight geology). These new wells were constructed using 4 inch stainless steel which is larger in size and more durable in construction compared to the 2 inch Poly Vinyl Chloride (PVC) wells used previously. These new wells allow for repeated injections in future years. The team injected 90,000 gallons of Lactoil® diluted to the appropriate concentration into twelve transects across the most concentrated plume areas on the site. The team also injected an additional 2,000 gallons of Lactic Acid into two down gradient transects on the site to address lower concentration areas approaching the boundary of the installation.

OU-8 presents its own unique challenges. During the reporting period, the team implemented a pilot study which would work in concert with the selected contingency remedy of *in situ* bioremediation. During the design phase for this system, the team discovered a previously unknown source of contamination. A significant amount of contaminant mass was discovered underneath the northern portion of Building 65 which had housed the original industrial activities that generated the contamination. With this added information at the team's disposal, we were able to design a series of extraction wells and injection wells that would draw contaminated down gradient groundwater out, clean it, and inject it back into the ground up gradient of the source area. This approach avoids the common failure of pump and treat systems where in a plume becomes asymptomatic due to dewatering and rebound occurs when thesystem is shut off and groundwater rises back to its equilibrium state. Instead the injected groundwater is forced through the source zone flushing contamination towards the extraction points for faster cleanup. One can imagine the challenges in implementing this system when the source area is underneath a warehouse. The team was able to find drillers with rigs capable of entering into the tight space within the warehouse to install the injection wells with no interruption to mission activities. The resulting system works in concert with the selected contingency remedy because carbon substrate can be added to the pristine groundwater injected back into the ground. During the reporting period, this Bioenhanced Directed Groundwater Recirculation (BDGR) system

extracted, cleaned and injected over 4,000,000 gallons of groundwater. The team also bolstered the vapor mitigation system that was previously installed in the warehouse adding an additional 4 extraction points with the goal in mind of protecting the workforce from any additional vapors that the pilot test may cause underneath the building itself. The team also designed and implemented a second round of injections adding 6 wells inside Building 65 in the source area and expanding the down gradient transect by 6 wells. Over 50,000 gallons of sodium lactate solution was injected underneath Building 65. Over 75,000 gallons of an Emulsified Vegetable Oil and Sodium Lactate solution were injected into the down gradient transects. The results of using this two pronged approach of in-*situ* bioremediation and groundwater recirculation have been impressive reducing the total area covered by the groundwater plume by over 70% since the maximum area was established in 2014.

Judging Criteria

Program Management. During the award period, DLA Installation Operations Richmond showed tremendous improvement and ingenuity. DLA Installation Operations Richmond also shifted its focus from managing and monitoring contamination and to addressing and managing source areas. By attacking the contamination at its source and accelerating cleanup, the overall life expectancy of contamination at these sites is greatly reduced.

The Environmental Restoration Program is an integral part of DLA Installation Operations Richmond's International Organization for Standardization 14001 externally registered Environmental Management System. This allows us to identify and effectively track program improvements and associated milestones. In addition, the installation restoration program manager worked diligently with the Center's community planner to integrate protective Land Use Controls (LUCs) into the installation's Master Plan which is transparent and easily understandable. This effective program management allows all employees of DLA Aviation and other tenant activities to focus their efforts toward supporting the warfighter.

Technical Merit. Through on-site testing and development, DLA Installation Operations Richmond successfully implemented cost effective and innovative remediation techniques. DLA Installation Operations Richmond uses the Triad approach to characterization, which allows for dynamic planning and field-based decision-making. All involved/impacted stakeholders are privy to nearly instantaneous vital field-based environmental sampling test results, which helps them make quick, well-informed decisions.

Orientation to Mission. The effectiveness of the implementation of the environmental restoration remedies will result in several acres of previously contaminated land being restored to a state where it can now be used to support the growing needs of the installation. Additionally, the green and sustainable remedies, like natural attenuation and bioremediation, were implemented as low profile actions, which promote military readiness and civil works missions. All aspects of Defense Supply Center Richmond's Installation Restoration Program are pursued in full compliance with all applicable Commonwealth of Virginia and Federal environmental regulations.

Transferability. A significant percentage of the remedies pursued within Defense Supply Center Richmond's Installation Restoration Program are natural and sustainable. They

involve the relatively non-technical use of sustainable native vegetation plantings, low-impact landscaping, and the injection of edible oil substrate or sugars. The simplicity of these proven, effective, low-cost remedies, and the ease of their sustainment, facilitates their continued use long into the future. The broadness of these remedies also allows for their adoption by other DoD facilities. The BDGR system can be adopted anywhere there is a concern with a growing contaminant plume or a need to accelerate cleanup efforts without resorting to ineffective pump and treat methods.

Stakeholder Interaction. Defense Supply Center Richmond's RAB has proven to be an effective means of involving our surrounding community, state and local organizations, as well as non-governmental organizations since 2002. Each informational meeting is open to the public, including individuals and businesses. The installation gives regular briefings detailing the ongoing projects at each of the relevant restoration sites. Throughout the past several years, the installation has achieved a friendly rapport with the local RAB members that allows for casual and transparent discussions regarding concerns and project status. We borrowed many lessons learned from the experience of others. The transparency offered by DLA during its interactions with the public has led to a level of trust on both sides of the fence. The public understands the challenges both technical and administrative that DLA must meet to address effective cleanup of its contaminated sites. Additionally the team routinely meets to ensure the program maintains forward momentum and to streamline the solution for any problems that may arise during restoration efforts.

Impact/Outcomes. Over the past 15 years DLA Installation Operations Richmond has turned an Installation Restoration Program that had received a great deal of negative press requiring allocation of resources to address negative publicity with both the regulatory agencies and the local community into a program that is able to focus its resources on the cleanup of these sites. The impact of having a community that works with us to understand the challenges and a regulatory environment that is vested in partnering with us to complete cleanup actions results in real cleanup results.