

**2017 Secretary of Defense Environmental Awards
Environmental Restoration
Fiscal Years 2015-2016
Defense Logistics Agency
Defense Supply Center Richmond**

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Introduction

The Defense Supply Center Richmond, located along the I-95 corridor in Chesterfield County, Virginia, has been a consistent and dependable supplier of quality goods and services to those defending freedom around the world since its activation in 1942.

Defense Supply Center Richmond is the home of DLA Aviation, the aviation demand and supply manager for the Defense Logistics Agency, located in Fort Belvoir, Virginia.. 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 2,000 major weapons systems utilized 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 Distribution Mapping; and the Virginia Army National Guard Vehicle Maintenance Shop. 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, DLA, 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 Support at Richmond oversees restoration and remedial activities on Defense Supply Center Richmond. DLA Installation Support at Richmond coordinates restoration activities with the US EPA, Virginia's Department of Environmental Quality (VADEQ) and DLA Installation Support Staff through quarterly meetings of the Restoration Planning Team.

Thirteen operable units (OUs), which consist of both soil and groundwater affected by past site operations, have been identified 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 Support at Richmond managed to reduce contamination and resultant risks by designing and utilizing 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 Support at Richmond by working with the US EPA and the VADEQ has obtained signed Records of Decision (RODs) for all its sites. These RODs document the negotiated remediation actions. Over the past two fiscal years, Defense Supply Center Richmond has progressed with executing these solutions with dynamic and innovative remedial actions. Rather than addressing the individual OUs as independent undertakings, the Center has focused 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.

The installation has made substantial progress in the remediation of all of its OUs. OU-6, located in the central portion of the installation, consists of impacted groundwater underneath and down gradient of a former landfill, an open storage area, and a vehicle maintenance operation. Three OUs are a source for OU-6.

- An open storage area, designated separately as OU-1, was the site of numerous spills from storage activities and a recouplement 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 Monitored Natural Attenuation and Land Use Controls.

OU-7 is the contaminated groundwater found in three separate plumes resulting from past firefighter training activities. DLA Installation Support at 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 Support at Richmond implemented 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-5 is acid neutralization pits and associated contaminated soils. OU-5 requires No Further Action. OU-8 is the groundwater contaminated by the acid neutralization pits 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, but not excluded to, *in situ* bioremediation if certain triggering criteria occur. During routine sampling, and follow up data gap sampling, DLA Installation Support at Richmond discovered the OU-8 spread beyond the existing array of monitoring wells and towards the installation boundary triggering the contingency remedy of *in situ* bioremediation through an Explanation of Significant Differences (ESD). DLA Installation Support at 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 Support at 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). Through careful and diligent coordination with off-site stakeholders, including the United States Army 99th Regional Support Command and the Virginia Department of Transportation, DLA Installation Support at Richmond successfully characterized the full extent of contaminated groundwater.

To keep its neighbors and the public informed of remediation actions, Defense Supply Center Richmond established a monthly Restoration Advisory Board (RAB), which consists of community members, a DLA Installation Support at 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. The Defense Supply Center 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. In addition to the RAB quarterly meetings, DLA Installation Support at Richmond has provided periodic updates to the Bensley Community, local residents whose properties have been impacted by contaminated groundwater from OU-8, to ensure they are fully aware of the current status of activities surrounding the cleanup activities and to provide opportunities for answers to any questions that may arise. DLA Installation Support at Richmond provided these updates through mailings, door-to-door notification deliveries, and a meeting of the Bensley Civic Association. Lastly, in April of 2014 with follow up stories in 2015, the Richmond Times Dispatch published an article highlighting the history, accomplishments and status of the restoration program on Defense Supply Center Richmond.

Environmental Restoration Program Summary

DLA Installation Support at 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 Support at 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 Support at Richmond prescribed an analytic decision-making process to evaluate prudent courses of action when an implemented remedy is not performing adequately. First, DLA Installation Support at Richmond evaluates techniques to optimize the current remedial technology. 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 Support at Richmond has replaced several ineffective highly engineered remedial technologies with more passive less energy consumptive remediation solutions. Recently, an inefficient 'Pump and Treat' system was replaced by an 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 the DLA Installation Support at Richmond has the means to evaluate the new technology from the baseline.

DLA Installation Support at 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 Support at Richmond's Restoration Planning Team consists of DLA, US EPA, VADEQ as well as Chesterfield County Environmental Engineering and the Virginia Department of Health. 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. The execution of this partnership, established in the FFA, also fosters trust and understanding of desired outcomes and requirements of each stakeholder.

Environmental Restoration Program Accomplishments

One of the costliest recurring tasks from year-to-year is the sampling of groundwater monitoring wells at OU-6, OU-7 and OU-8. During the award period, DLA Installation Support at Richmond analyzed the value of each well that we sample on a recurring basis and compared results from that well over the last 5 years and determined how information from that well ultimately influences our understanding of the behavior of groundwater. In some cases, the sample results from monitoring wells that offer little to no value with respect to plume behavior were also being used to monitor potential risk and sampling will continue. In a number of cases however, we were able to reduce, with concurrence from EPA and VADEQ, the frequency with which we sample each of these wells or eliminate sampling altogether. The results of this optimization yielded an impressive savings of over \$650,000 over a three-year period beginning in 2015.

During the award period, DLA Installation Support at Richmond finalized the Remedial Design for OU-6 and implemented the remedy. In 2015, approximately 54,000 gallons of edible oil substrate and lactic acid was injected into the source zone of contamination through injection wells located in seven different transects targeting both the upper and lower water bearing units. The edible oil substrate provides fodder for microbes to naturally biochemically reduce chlorinated volatile organic compound concentrations in the area. In 2016, an additional injections 14,000 gallons of edible oil substrate were injected. Injections occurred primarily in source areas but also in down-gradient areas to accelerate off-site contaminant concentration reduction. DLA holds an environmental easement to allow restoration activities to occur on an adjoining property. Acceleration of off-site cleanup allows for future optimization of restoration funds for remediation as opposed to renewal of easements and enforcement of off-site deed restrictions.

During the award period, DLA Installation Support at Richmond extended the reach of the designed remedy for OU-7 to target down gradient and off-site contamination, some of it on private lands. DLA Installation Support at Richmond injected an additional 20,000 gallons of Emulsified Vegetable Oil and Lactic Acid into three transects that were not originally included in the 2013 Remedial Design and Remedial Action. These new transects included two areas located at the installation fence line and one area on an adjoining piece of private property. DLA Installation Support at Richmond obtained a Right-Of-Entry agreement with the landowner prior to off-site work occurring. The goal of these injections was to accelerate down gradient and off-site contamination cleanup to relieve DLA Installation Support at Richmond and the off-site property owner of land use controls that would otherwise become necessary and costly. The effort allows for the optimization of future restoration funds towards effective cleanup instead of managing off-site contamination that would require costly land use agreements and deed restrictions.

OU-8 presents its own unique challenges. Naturally occurring preferential pathways influence the aquifer in the area to behave inconsistently with the Conceptual Site Model initially developed in 2005. In 2014 and 2015, DLA Installation Support at Richmond installed sentry wells, which then produced samples with results above cleanup levels creating concerns about the definition of the northern boundary. The existence of an elementary school to the north of the OU-8 amplified these concerns. A team effort between EPA, VADEQ, DLA, the local school district, the 99th Regional Support Command and supporting agencies, led to accelerated field activities that provided answers to pressing questions in an extremely expeditious manner and turned a situation that could have otherwise become a negative public story for DLA into an extremely positive outcome. The team obtained answers and filled in the missing pieces to the conceptual site model for OU-8. Groundwater flow within OU-8 outpaces the selected remedy of *in situ* bioremediation. While the results for the injections completed to date are promising (the larger contaminant plumes showed an overall decrease of impacted area of 65% through the award period) an enhancement to this design was required. To influence groundwater flow in OU-8, DLA Installation Support at Richmond with concurrence from EPA and VADEQ implemented two long-term pump tests. Specifically, a design for better managing the source area for OU-8 was developed and recently implemented. This design consists of a network of three extraction wells and four injections wells. This system is different from traditional pump and treat systems in that it will also be continuously injecting substrate for bioremediation with the treated groundwater. The desired outcome will be a much smaller plume that is contained

well within the installation's boundary and will restrict the area into which contamination is permitted to flow. The constant flushing of the contaminated source area will also accelerate the overall cleanup. This system design, based on a similar system implemented at Fort Drum, New York, has proven to be effective.

Judging Criteria

Program Management. During the award period, DLA Installation Support at Richmond showed tremendous improvement by implementing low-cost sustainable remedies at its high-risk restoration sites. These remedies replaced highly engineered inefficient strategies that were providing ineffective risk reduction. By eliminating these systems, the installation was able to save on operation and maintenance contracts totaling over \$700,000 per year. DLA Installation Support at Richmond also shifted its focus from managing contamination to addressing and managing source areas. By attacking the contamination at its source, the overall life expectancy of these sites is greatly reduced.

The Environmental Restoration Program is an integral part of DLA Installation Support at 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 more effectively focus their efforts toward supporting the warfighter.

Technical Merit. Through on-site testing and development, DLA Installation Support at Richmond successfully implemented cost effective and innovative remediation techniques. DLA Installation Support at 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 resulted 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. 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.

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 restoration of its contaminated sites. Additionally DLA Installation Support at Richmond routinely meets with regulatory stakeholders at both the state and Federal level to ensure the program maintains forward momentum and to streamline the solution for any problems that may arise during restoration efforts.

Impact/Outcomes. DLA Installation Support at Richmond completes annual inspections of the Land Use Controls at each OU and operates a Long-Term Monitoring program that ensures implemented selected remedies are operating according to intended designs and that expected milestones are reached and maintained.