

Lockheed Martin's Plan for Reducing Chlorinated Benzene Compounds

For the past several years, Lockheed Martin has been investigating groundwater plumes in Blocks E and F that are contaminated with chlorinated benzene compounds. Chlorinated benzene compounds were historically used together with polychlorinated biphenyls (PCBs) in electric transformer oils. During soil and groundwater sampling and analysis, Lockheed Martin tracked the sources of the chlorinated benzene compounds to the area under the former D-Building slab where three electric transformer rooms were located. Unlike PCBs, chlorinated benzene compounds tend to be more mobile in groundwater, and over time they separated from the PCBs, formed a groundwater plume, and began moving through the Block E subsurface into Block F towards Dark Head Cove.

The sources of the chlorinated benzene compounds will be eliminated during removal of the D-Building foundation slab and contaminated soil that is currently ongoing and will be completed this fall. The soil in the areas beneath the location of the three transformer rooms will be excavated to depths of up to twenty feet, and the excavated soil will be disposed of at an approved and licensed out-of-state waste receiving facility.

Lockheed Martin Proposes to Expand Dump Road Area (DRA) Treatment

In May, Lockheed Martin submitted a report to the Maryland Department of the Environment recommending expansion of its groundwater treatment in the Dump Road Area of

Public comment periods will be open from August 1 – 31 for two documents, which are available at the website links below and at the Essex public library. No public meetings are planned as both documents represent minor changes in the cleanup approach. For Middle River, Groundwater Response Action Plan Addendum Number 5 – Blocks E and F, Revision 1 can be found here: <https://www.lockheedmartin.com/en-us/who-we-are/eesh/remediation/middle-river.html>

Martin State Airport. The feasibility study proposes that Lockheed Martin install additional extraction wells in areas inland from the current near-shore wells, to collect and treat groundwater from areas with high concentrations of contaminants, also known as "Source Areas." Under the proposed plan, Lockheed Martin will extract groundwater from new extraction wells positioned in Source Areas 6, 7, and 8, which are groundwater treatment facility and Taxiway Tango. (See graphic on page 3.) These extraction wells will remove groundwater and will supplement treatment from the sixteen existing extraction wells. At a fourth area (Source Area 5), located on the

the Glenn L. Martin Airport runway and at a greater distance from the treatment facility, Lockheed Martin has recommended use of *in situ* (in place) bioremediation. The company is already using bioremediation to clean up shallow groundwater plumes at the Middle River Complex. In bioremediation, a mixture of water

and lactate produced from sugars such as corn or beets is injected into the ground to stimulate existing and naturally

Over time, the chlorinated benzene compounds remaining in the underlying groundwater plumes will

Martin will continue to regularly monitor the plumes by collecting groundwater and surface water samples. If monitoring indicates natural attenuation is not successfully breaking down remaining contaminants, then pumping wells may be installed in the plume and connected to the groundwater treatment system that Lockheed Martin has constructed to remove and treat chlorinated solvents, such as trichloroethene, in groundwater from eastern Blocks E and F. (See map on page 6.)

Since the chlorinated benzene compounds plumes were

Dark Head Cove surface water to ensure the plume has not carried the compounds into the waterbody. Over the last four years, none of the compounds have been detected in the Cove. If chlorinated benzene compounds

could trigger installation of pumping wells to remove any chlorinated benzene product that has not broken down or otherwise been captured for treatment.

Earlier this year, Lockheed Martin submitted a Groundwater Remedial Action Plan (RAP) Addendum to the Maryland Department of the Environment (MDE), seeking approval of its plan for addressing the chlorinated benzene compounds. MDE approved the addendum on April 19, 2021. Because this is an addendum to an approved plan, a public meeting is not required. However, Lockheed Martin has scheduled a public comment period for August 1 through August 31

may review the RAP addendum at:
www.lockheedmartin.com/middleriver

occurring bacteria that consume and break down contaminants.

Chuck Trione, Project Manager for Martin State Airport, said, “We have always planned to expand our groundwater treatment system to include source area treatment, if warranted, in addition to the current wells protecting Frog Mortar Creek. The system was designed and built with a groundwater treatment capacity of 100

contaminant source areas.”

As installed, the Dump Road Area groundwater treatment system includes a series of extraction wells placed along the shoreline of Frog Mortar Creek. These existing extraction wells function as a barrier that has effectively intercepted and collected contaminated groundwater moving from the Dump Road Area toward Frog Mortar Creek since late 2017. The captured groundwater is cleaned in the treatment facility before being released to Frog Mortar Creek through submerged diffusers. (See story page 5.) Extending the extraction system to treat Source Areas 6, 7, and 8, and the addition of bioremediation of Source Area 5, are major steps towards cleaning up sources of groundwater contamination to ensure improved water quality in Frog Mortar Creek.

Update On Per- and Polyfuoroalk



had both been sampled earlier. These substances are a large group of man-made chemicals that have been used in a variety of industries since the 1940s to manufacture commercial products, including Class B aqueous

eight PFAS substances Lockheed Martin sampled for, the U.S. Environmental Protection Agency (EPA) has established human health advisory levels of 70 parts

screening levels for PFOA and PFOS of 40 ppt each.

Middle River Complex

PFAS could potentially have been used at the Middle River Complex during historical plating operations and

voluntarily sampled groundwater at the site for PFAS in October 2019. Background, upgradient, potential sources, and downgradient groundwater samples were taken from 41 existing monitoring wells. A total of 11

and at downgradient locations near Dark Head Cove. An additional 30 samples were collected site-wide to assess former metal plating areas and at downgradient locations near Cow Pen Creek.

The Middle River Complex sampling revealed that low-level PFAS concentrations are present in 40 of the 41 locations sampled. However, none of the samples exceeded

PFOS, either individually or combined. Combined PFOA and PFOS concentrations in the 40 locations ranged from 0.83 ppt to 62 ppt. PFOS concentrations detected in

screening level guidance of 40 ppt, at 42 and 47ppt.

Martin State Airport

While PFOA and PFOS were historically used in

historically, they have been replaced with other PFAS

decades. The history and types of AFFF used at Martin State Airport is unknown, although the U.S. Air Force began using PFOA- and PFOS-containing foam in the

U.S. Air Force has been reducing the use of certain PFAS-containing AFFF during training exercises since 2015. Historical use of AFFF at the multiple facilities on the

civilian side of Martin State Airport is unknown, although its use at civilian airports elsewhere has been common. An accidental release of AFFF at the Lockheed Martin corporate aircraft hangar was reported to the Maryland Department of the Environment in 2012 and cleaned up at that time.

In February and March 2020, to evaluate groundwater and surface water on areas used historically by Lockheed Martin predecessor companies at Martin State Airport (MSA), Lockheed Martin voluntarily sampled existing groundwater wells and nearby ponds and drainage channels. In the Dump Road Area, groundwater was sampled in 20 wells and surface water was sampled in two ponds. At Greater Strawberry Point, water samples from eight wells and from two drainage channels were analyzed. All samples were analyzed for eight PFAS compounds. A follow-up investigation of groundwater and surface water was undertaken in June and July 2020 and included collection of groundwater samples from 28 locations and four surface water samples. In September 2019 and again in June 2020, water samples from the groundwater treatment facility in the Dump Road Area were also tested for PFAS, and PFAS are now routinely monitored in the intake water and treated water at the facility. PFAS were not detected in the treated water being discharged to Frog Mortar Creek.

Dump Road Area

The June-July 2020 investigation focused on testing wells in areas where PFAS were detected in the Dump Road Area in the February-March 2020 sampling event. PFOA and PFOS were found in all 16 of the wells tested. PFOA exceeded the 40 ppt EPA groundwater screening level in 14 of the wells, located near the north and south ends of the Dump Road Area. PFOS exceeded the 40 ppt EPA groundwater screening level in nine of the 16 wells, located near the north and south ends of the Dump Road Area.

The highest PFAS groundwater concentrations were 2,300 ppt of PFOA and 7,800 ppt of PFOS in the same sample, taken near the south end of the Dump Road Area. The next highest PFAS concentrations were 3,000 ppt of PFOS and 680 ppt of PFOA in a well north of the Dump Road Area. Both pond surface water samples had low-levels of PFAS, with a maximum of 12 ppt PFOA. Notably, groundwater PFAS concentrations were higher in shallower wells than in intermediate depth wells. No deep wells were tested in June-July 2020 as no PFAS was detected in deep well samples collected in February-March 2020.

Greater Strawberry Point

In the June-July 2020 investigation, PFAS compounds, including PFOS and PFOA, were detected in eleven of the wells tested. PFOA was detected above the 40 ppt EPA groundwater screening level (at 66 ppt) in a well near the north end of the Greater Strawberry Point wooded area. PFOS was detected above the 40 ppt EPA groundwater screening level in three wells near the airport maintenance facility; the highest level detected was 170 ppt. All three surface water samples, collected from a channel and the airport stormwater detention basins, had similar low PFAS levels. The highest surface water concentrations were 21 ppt PFOA and 4.7 ppt PFOS.

Groundwater Treatment Facility

Process water in the groundwater treatment facility at MSA is sampled regularly. In June 2020, the sampling included and concentration of PFAS being processed at the facility. PFAS are regularly detected at concentrations above the 40 ppt EPA groundwater screening level in the treatment

What does this mean?

At this time, the Maryland Department of the Environment (MDE) does not have standards for PFAS compounds in groundwater to inform risk mitigation, and 40 ppt each for PFOA and PFOS to inform monitoring. These screening levels are used to determine if PFAS levels may warrant further investigation. Because the public is not drinking groundwater at the Middle River Complex or Martin State Airport, there is little-to-no risk for public exposure to PFAS-impacted groundwater. PFAS that are being captured by the groundwater treatment facility at Martin State Airport are being removed. Lockheed Martin is planning additional investigation of PFAS-impacted groundwater in the south end of the Dump Road Area in 2021. Groundwater in the south end of the Dump Road Area is not within the capture zone of the treatment facility extraction wells.

Both MDE and EPA do not have surface water standards for PFAS compounds. PFAS present in onsite groundwater may be discharging to nearby surface water bodies at low level concentrations. Assessing and monitoring PFAS

advisory levels is the current regulatory approach to mitigate PFAS impacts to the environment.

More information regarding PFAS at the Middle River Complex and Martin State Airport is available in a PFAS fact sheet found on the Lockheed Martin websites, [lockheedmartin.com/middleriver](https://www.lockheedmartin.com/middleriver) and www.lockheedmartin.com/martinstateairport

Frog Mortar Creek Surface Water Conditions

Lockheed Martin monitors surface water in Frog Mortar Creek six times per year: four times during the summer months of June, July, August and September, and again in the winter months of December and March. During each sampling event, 32 samples are collected near the western shore of Frog Mortar Creek, and four additional samples are collected from the eastern shore near Edwards Lane (June only). Prior to 2020, 44 samples were collected in each event, but this has been reduced based on the consistent improvement in Frog Mortar Creek contaminant concentrations since startup of Lockheed

Trichloroethene (TCE), a solvent commonly used in factory operations of Lockheed Martin heritage companies located in Middle River, is the primary contaminant being monitored, along with TCE breakdown products. TCE can break down over time into cis-1,2-dichloroethene and vinyl chloride. These chemicals, commonly called chlorinated volatile organic compounds (CVOCs), have been found in the Dump Road Area on Martin State Airport.

and treats the contaminated groundwater coming from the Dump Road Area before it reaches Frog Mortar Creek. An array of sixteen extraction wells located parallel to the creek in the Dump Road Area of the airport extracts groundwater and sends it to the treatment system. The groundwater treatment plant is located between Frog groundwater is treated to drinking water standards before being discharged to Frog Mortar Creek through three underwater diffusers near the airport shoreline.

Frog Mortar Creek no longer warrant limiting swimming. In the swimming advisory established in 2012 and

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available on its website, the Maryland Department of the Environment (MDE) suggests that swimming in these waters be for no more than four hours a day, 70 days a year. MDE has posted signs in the waters off the airport shoreline providing advice to limit swimming in the advisory area. Since the groundwater treatment system began operating in 2017, Lockheed Martin has not detected CVOCs above swimming screening levels in summer surface water samples. CVOCs have not been detected in any samples taken at the southernmost end of the sampling area since 2018. March CVOC levels, including those from 2021, have historically been higher than the other months.

Remarking on the low levels of chlorinated volatile organic compounds that have been showing up over the three years since operation of the groundwater treatment system began,

talking to the Maryland Department of the Environment about the possibility of reducing the number of rounds of samples we take each year, and are recommending retaining the March sampling round, plus three summer

Mortar Creek shoreline.”

Dump Road Area Groundwater Treatment Facility is Successfully Containing Contaminated Groundwater

- Since December 2017, nearly 75 million gallons of groundwater treated
- Over 3,000 pounds of volatile organic compounds destroyed
- Over 900 pounds of petroleum-range organics destroyed
- Nearly 200 pounds of heavy metals removed
- Treated water discharge has complied with permit limits, except for one month in 2019

The Middle River Complex uses Tax Blocks to identify remediation areas.



Update On Block E Soil And Groundwater Cleanups

Block E Soil Cleanup Recently Begun

Lockheed Martin has received all the permits and approvals required to begin soil cleanup in Block E. Equipment began arriving at the site in mid-April 2021, and erosion controls were set in place later that month. Remediation began in the southwest corner of the foundation slab in early May.

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A soil nail wall has been installed to create a stable side wall for the excavation area. The western portion of the Block E work area is adjacent to Tilley Chemical, and

Temporary Closing of Chesapeake Park Plaza road scheduled for late September-early October 2021

As part of the Block E soil cleanup project, the storm drain system originally installed to service former D-Building is being removed, and will be replaced with a new system designed to manage stormwater for Block E after cleanup. New piping will route stormwater to existing outfalls on Dark Head Cove. This new piping will require trenching across Chesapeake Park Plaza road, and the road will be closed for approximately one month beginning in late September. At the same time that the new piping is being placed, the top foot of soil in the median strip of Chesapeake Park Plaza road south of Block E will be removed and replaced. This is an area where small quantities of polychlorinated biphenyls (PCBs) were noted in investigations. The road closing will be coordinated with Baltimore County, which must approve the temporary road closure.

Latest surface water sampling confirms that the water in Dark Head Cove and Cow Pen Creek is safe for swimming

Three times a year—spring, summer, and fall—Lockheed Martin samples the surface water in Dark Head Cove and Cow Pen Creek to determine if the water continues to be safe for swimming. Samples are tested for volatile organic compounds (including trichloroethene and chlorinated benzenes); the semi-volatile compound 1,4-dioxane; and polychlorinated biphenyls (PCBs) in Dark Head Cove because of their presence in Block E soil and groundwater. PCBs and 1,4-dioxane are sampled only in the spring. The water cleanliness standards that Lockheed Martin works to meet are set by the Maryland Department of the

criteria ensure that the surface water data are evaluated

swimming in the Cove or Creek.

In the three sampling events in 2020, no compounds were detected that exceeded either regulatory standards or the swimming limits; no PCBs or chlorinated benzene compounds were detected. Results in the most recent

round of sampling, completed in April, 2021, indicate very low concentrations of PCBs are present in most Dark Head Cove sampling locations; however, none of the contaminants exceeded the limits for swimming. No chlorinated benzene compounds were detected during the April 2021 event.

To ensure swimmer safety, samples are taken one foot most accurately measure what swimmers might encounter.

Update On Sediment Remediation

Dark Head Cove Carbon layer has reduced

than met the goals we set in our application to the U.S.

