RAMBOLL

ENVIRONMENT
& HEALTH

Ms. Wanda Washington
FOCUS
PO Box 28
Tallevast, FL 34270

November 1, 2020

Re: Review of AECOM's 2019 and 2020 Remedial Action Status Report for the Groundwater Recovery and Treatment System, Tallevast Site, Florida

Dear Ms. Washington,

At your request I have reviewed the two latest *Remedial Action Status Report[s] for Groundwater Recovery and Treatment System* (AECOM; 2019 and 2020) for the Tallevast Site. These reports describe the past and then-current ground water conditions beneath and around the Lockheed Martin Corporation (LMC) facility on Tallevast Road in Sarasota County, Florida (the "Site"), and cover the operating/reporting periods of September 2018 through August 2019 (AECOM, 2019), and September 2019 through August 2020 (AECOM, 2020). The ground water in aquifers beneath Site and surrounding areas has been undergoing remediation by pumping/treatment to remove contaminants (principally 1,4 Dioxane and certain chlorinated volatile organic compounds, or CVOCs) that were previously released from the LMC facility by a predecessor operator. Having completed my review of these reports, I would offer the following observations and recommendations.

I start by noting that the pump/treat remediation system has now been operating for more than six years. Consistent with normal protocols in analogous state and federal remedial programs, therefore, this is an appropriate time for the stakeholders to assess the effectiveness of the selected remedy in meeting the cleanup goals envisioned in the approved Remedial Action Plan (RAP), and whether any adjustments to the remedial approach are warranted.

Overall, the ground water recovery and treatment system being operated by AECOM for LMC continues to perform within the operating parameters contained in the approved RAP for the Site. By this statement I mean that ground water continues to be recovered and the treatment system is successfully removing contaminants from the water (approximately 37 lbs were removed in the 2020 reporting period) before it is disposed to the ground water reinjection systems, or to the county sewer.

Additionally, the overall levels of individual contaminants in the aquifers beneath the Site and adjoining properties continues to very gradually

Ramboll
10150 Highland Manor Drive
Suite 440
Tampa, FL 33610
USA

T +1 813 628 4325
F +1 813 628 4983
https://ramboll.com

decline. Unlike in the earliest years of operation, when concentrations declined quite rapidly in most areas, however, the more recent improvement in ground water quality towards meeting the specified cleanup goals has been much slower, particularly in areas beneath and nearest the LMC facility.[1] This asymptotic pattern is normal and expected, and demonstrates that these types of remediation systems are not particularly efficient in removing contaminants in the latter stages of a remediation project, when diffusion from finer grained sediments in the aquifer zone becomes a more dominant and limiting process.

The contamination at this site is defined as an overall plume within individual aquifer units (i.e. an areas where contaminants are at concentrations above ground water cleanup standards), and more specific plumes which characterize individual contaminants of concern (COC) in a particular aquifer unit. For example, TCE is one of the primary COCs and it can be found in multiple aquifer units and so Lockheed characterizes a TCE-plume for each unit where it is found. Although the overall levels of contaminants in ground water have been decreasing with remediation, some of the COC and aquifer specific plumes are not decreasing in some areas; and in one area southeast of the LMC facility, the 1,4 Dioxane plume appears to be moving horizontally to the extent that it extends beyond Lockheed's defined capture zone – the area under the influence of its pump and treat system. Over the next few paragraphs, I will describe where plume movement and clean-up are behaving as Lockheed has previously predicted, and where they are not.

First, in the shallowest water-table aquifer (the USAS), ground water cleanup has progressed most rapidly, in a manner similar to that predicted in the original RAP and the pump/treat system is effectively reducing the concentrations of contaminants in most areas. This is likely due in part to the fact that the entire shallow aquifer is directly flushed by 8-12 inches of clean water from seasonal rainfall infiltration each year, which helps to enhance the flushing process. In some of the USAS extraction areas cleanup has been successful to the point that AECOM (2019) recommended ending pumping in certain wells in the Upper Shallow Aquifer System (USAS) along the highway bordering the Sarasota airport property and on the LMC property.[2] As the cleanup of ground water in the USAS has progressed, however, a gradual slow-down in the rate of decline of contaminant concentrations has been observed, consistent with the normal asymptotic trends these types of remedial systems usually experience. The pumping remedy has been less successful in reducing the overall plume footprint of the contaminants in excess of cleanup goals in ground water, due in part to the aforementioned asymptotic behavior as concentrations reach the lower concentration levels reflected in these goals.

Overall progress in the USAS notwithstanding, a persistent area of contamination by CVOCs and 1,4 Dioxane remains in this shallow aquifer on the private properties extending 600-800 feet east of the LMC facility. Concentrations of TCE and 1,4 Dioxane (principal contaminants released from the LMC facility) have actually increased in one monitoring well (MW 28) in this area in this area since remediation began circa 2014, suggesting that the pumping , particularly from the shallow horizontal collection drains just southeast of this well may be drawing contaminants that originated from the LMC property towards this area. In a second nearby monitoring well (MW 27),

[1] See for example the COC Concentration vs Time Charts in Appendix F of AECOM, 2020.
[2] The identified wells in these areas were turned off in 2019, and follow-up testing into 2020 demonstrated that there was little to no significant rebound of contaminants to levels above the ground water cleanup goals.

concentrations initially declined, but in recent years have again increased or remained relatively constant at levels well in-excess-of cleanup goals. The recent trends in these two wells have been somewhat surprising in-light-of the continued pumping and natural flushing of the USAS from rainfall infiltration and the progress seen elsewhere, and suggests that the current extraction of ground water in this area is not operating at an optimal efficiency. Alternatively, there may be a more significant and recalcitrant area of contamination in the aquifer in the area just east of the LMC facility not well defined by the current monitoring system.

Currently there are relatively few monitoring wells east of the LMC facility in this area to help answer these questions. Additional (perhaps 2-3) shallow (USAS) monitoring wells in this area are warranted, along with a more accelerated monitoring of ground water, to devise a program to get this remediation back on track. Before any more permanent USAS monitoring wells are constructed, however, it may be more efficient to first sample groundwater with a series of hydropunch probes to measure water quality at the top and lower half of the water table zone in this area. This could help refine the current understanding of the nature and extent of this contamination. Based on these investigative findings, some reconfiguration and/or enhancement of the remediation system may be warranted; e.g. by converting MW27 and 28 into direct extraction wells to increase the extent and rate of recovery of water from this area, or by direct treatment of the groundwater insitu (see discussion below).

Another surprising finding in the AECOM reports was the detection of 1,4-Dioxane in the USAS (PZ-USAS-19) in an area southeast of the LMC property that lies outside the previously understood region of contamination (see Figure 5-1 in AECOM, 2019) as well as Lockheed's defined capture zone. Initial concentrations detected in this piezometer in 2019 were about 5 μg/L, and then increased to around 10-13 μg/L in 2020. It is unclear whether this represents current migration from the broader region of Site-related contamination located east-southeast of the LMC property that is not being effectively captured by the pumping system, or is simply a prior, historic region of contamination that was only recently revealed by the ongoing monitoring.

In its 2019 report AECOM described plans to increase the pumping of water from two recovery wells (Nos. 2103 and 2104) located to the north of this area in an effort to address this recently discovered contamination and ensure it is captured by the USAS groundwater recovery system (see AECOM, 2019; pg. 5-9 for a more detailed discussion of the specific measures that were contemplated). This plan was later implemented, and the results reported in AECOM, 2020. To summarize, the increased pumping was successful in expanding the capture zone of the remediation system, but not to the extent needed to encompass the entire identified 1,4 Dioxane plume. Piezometer PZ-USAS-19 (and immediately surrounding areas) remains outside the currently estimated capture zone boundary.

I also note that the full extent of this newly discovered 1,4 Dioxane contamination at PZ-USAS-19 is currently unknown, as this piezometer was already contaminated when first tested in 2019, and concentrations have since increased year-over-year. There are no monitoring points beyond this piezometer to bound this plume, and the dashed plume boundary depicted on Figure 12A of AECOM, 2020 is simply an educated, but unsubstantiated guess. Without an understanding of the full extent of this plume, there can be no assurance that the pumping system is controlling it. An additional (2-3) locations southeast of PZ-USAS-19 should be sampled with a hydropunch

sampler at the top and lower half of the water table zone, and ground water tested for Dioxane/CVOCs, to ensure the full extent and nature of this new area of contamination is fully understood.[3] Only then can a definitive assessment of the capture system security/performance be performed. Furthermore, there are other monitoring points in this same area (PZ-USAS- 15, 16, 17, 18 and 20) that are not being tested for water quality, although they are depicted as being within the broader plume area. Data from these piezometers is important to understand the nature, spatial extent, and origin of contamination in this area. These five monitoring points should also be tested for 1,4 Dioxane and CVOCs. Given that this recent discovery may reflect a "Hole" in the current capture system's containment, there is a level of urgency to this work such that the testing should proceed outside the normal operational monitoring program.

The deeper LSAS and AF Gravel formations have continued to show a gradual decline in concentrations, but overall progress here has been slower as compared to the USAS. The AF Gravel, in-particular, continues to show significantly elevated concentrations of CVOCs in the area beneath the LMC property with only a slow to minimal decline in concentrations over the past 4 years. Similarly, several areas of persistent contamination in the LSAS aquifer remain beneath the LMC property and on properties to the east, south and southwest. These observations may suggest more recalcitrant regions of contamination are embedded in these aquifers or overlying/separating confining units that pumping is only very slowly degrading, and/or the flow of clean water through these aquifers is naturally limited by the low permeability of overlying confining units. I think both factors are likely. Given that the flow of water through this area is naturally limited by the geometry and permeability of the aquifers and surrounding confining units, I think it is unlikely that increased pumping would be effective in accelerating the cleanup of these units. Other, more direct treatment approaches such as are discussed below should be considered.

While pumping of the LSAS and AF Gravel beneath the LMC facility should continue to contain and very gradually reduce concentrations of COCs, the data and charts in these two latest reports demonstrate the recovery of COCs in these deeper zones, as well as the USAS to the east (discussed above) have become quite asymptotic at concentration well above applicable cleanup goals. When faced with this condition on other like projects, I have seen examples where considerable progress towards accelerating or reinvigorating the cleanup of these same types of chemicals was achieved through the introduction of chemical oxidizer solutions (e.g. potassium permanganate) into the affected ground water systems. This has typically been done by draining oxidizer solutions into strategically located monitoring wells around the recalcitrant "hotspot" areas, while the pumping continues to remove the contaminants from the aquifers more broadly. While I recall there has been some limited hotspot pilot tests of this type of oxidizer technology directly beneath the LMC facility, I don't believe it has been more broadly assessed for cleanup of deeper aquifers or beyond the known source areas. Given experience I have previously observed in an analogous project setting, this technology could be an effective, relatively low-cost enhancement of the current remedial approach at Tallevast (which currently relies on pumping alone), applied to recalcitrant areas of the AF, LSAS and USAS formations to reinvigorate the progress of ground water cleanup. I would recommend LMC and FDEP consider this as part of

[3] Additional sampling points may be necessary, depending on the finding of this initial investigation.

their ongoing review of the project performance and milestones. If there is interest in this regard, I would be happy to introduce them my other client's project management representatives to discuss their potentially relevant experience.

Lastly, I would encourage LMC and FDEP to engage the community in evaluating changes to the remedial action system so that community concerns and potential impacts can be fully discussed and evaluated as part of the decision-making process. I am happy to continue to engage with you and LMC in this process if the community feels it is providing the independent technical assistance it needs in evaluating progress in fulfilling the goals of LMC's Consent Order with the FDEP.

If you have any questions regarding these thoughts and comments, I would be happy to discuss them with you further.

Very truly yours,

Robert L Powell, PhD, PE
Principal