

**FOURTH EXPLANATION OF SIGNIFICANT DIFFERENCES  
FORMER LUCENT TECHNOLOGIES RICHMOND WORKS FACILITY  
RICHMOND, VIRGINIA**

**I. INTRODUCTION**

With this Fourth Explanation of Significant Differences (“ESD”) the Environmental Protection Agency (“EPA”) is modifying the selected corrective measure for the former Lucent Technologies Richmond Works facility (“Facility” or “Site”); summarizes the information that supports the modifications, and affirms that the selected corrective measure, as modified, is consistent with the criteria EPA uses to evaluate corrective measures under the RCRA Corrective Action Program.

On January 22, 2020, EPA issued a draft ESD in which it announced proposed modifications to the selected corrective measures for the Facility. Consistent with public participation provisions under RCRA, EPA requested comments from the public on the proposed modifications. The commencement of a thirty (30)-day public comment period was announced in the Richmond Times Dispatch on January 22, 2020 and on the EPA Region III website. The public comment period ended on February 21, 2020. EPA received no comments on the proposed modifications. Therefore, the final modifications to the selected corrective measure remain unchanged from those proposed.

This ESD documents that EPA is allowing for source material removal supplemented with contingent treatment of “hot-spots” using In-situ Chemical Oxidation (“ISCO”) injections, biological treatment or other appropriate technologies in select locations where necessary (collectively, Additional Corrective Measures) as part of the selected corrective measure to protect human health and the environment at the Facility. In addition, EPA is adding 1,4-dioxane and vinyl chloride to the list of Site related contaminants of concern (“COCs”) and establishing 4.6 micrograms per liter (“µg/L”) and 2.0 µg/L respectively, as the cleanup goal for those contaminants in groundwater. This ESD and the documents supporting its issuance will become part of the Administrative Record for the Facility, which is located at the EPA Region III RCRA Records Center, 1650 Arch Street, Philadelphia, Pennsylvania.

**II. SUMMARY OF SITE HISTORY, CONTAMINATION AND THE SELECTED REMEDY**

The Facility is located on approximately 120 acres in eastern Henrico County, about five miles east of Richmond, Virginia. The Facility was constructed in approximately 1972 by Western Electric Co., a division of American Telephone & Telegraph (“AT&T”). AT&T manufactured printed circuit boards at the Facility and, during its manufacturing operations, used and stored chlorinated solvents at the Facility.

In 1986, during the repair of a fire main, AT&T discovered releases of chlorinated solvents. The soil surrounding the fire main was excavated, pipes were replaced and a sump in the former solvent recovery area of the plant was repaired. In 1989, the large-scale storage and use of methylene chloride (“MEC”) and 1,1,1 trichloroethane (“1,1,1-TCA”) at the Facility was

discontinued when it was discovered that those contaminants were in the shallow groundwater table.

Subsequently, on June 28, 1991, EPA issued a Record of Decision (“RCRA ROD”) for the Facility requiring, among other things, the installation, operation and maintenance of a groundwater treatment system. The RCRA ROD also establishes the following clean-up goals for the contaminants in groundwater at the Facility:

<u>Contaminant</u>	<u>Clean-up Goal (micrograms/liter)</u>
1,1,1-trichloroethane (“1,1,1-TCA”)	200.0
1,1-dichloroethylene (“1,1-DCE”)	7.0
methylene chloride (“MEC”)	5.0
1,1-dichloroethane (“1,1-DCA”)	0.4 (modified to 4.0 in 1992)

On February 13, 1992 and again on December 11, 1992, EPA issued an Explanation of Significant Differences (“1992 ESDs”) to the RCRA ROD, documenting, among other things, a change to the cleanup goal for 1,1-DCA, from 0.4 µg/L to 4.0 µg/L.

In 1996, AT&T assigned the assets of the Facility to Lucent Technologies, Inc. (“Lucent”), a newly-formed, wholly-owned subsidiary of AT&T. In September 24, 1996, EPA under the authority of Section 3008(h) of the Resource Conservation and Recovery Act (“RCRA”), 42 U.S.C. Section 6928(h), issued an Initial Administrative Order (“1996 Order”), which became final on October 24, 1996, to Lucent requiring Lucent to complete the construction of the groundwater remediation system, as specified in the RCRA ROD and as modified by the 1992 ESDs, and to operate and maintain the groundwater remediation system.

While Lucent remained the named Respondent under the 1996 Order, and, therefore, was responsible for complying with all terms and conditions of the 1996 Order, sometime in 1996, Lucent sold the Facility to Viasystems Technologies Corporation (“Viasystems”). Viasystems ceased manufacturing operations at the Facility in June 2001. The Facility property remained idle for several years and on August 23, 2006, Viasystems sold the Facility to Laburnum Investments, LLC, a subsidiary of Forest City Commercial Construction Group (“Forest City”), for redevelopment into the White Oak Village Shopping Center. As part of the Site development, Forest City subdivided the Facility property and sold parcels to individual retail/development entities. This change in property use prompted EPA to issue an ESD on May 16, 2011 (“2011 ESD”) to require land and groundwater use restrictions and provide for access. The corrective measures selected by EPA in the RCRA ROD, as modified by the 1992 ESDs and the 2011 ESD are hereinafter collectively referred to as the Selected Corrective Measures.

In 2013, EPA terminated the 1996 Order and replaced it with an Administrative Order on Consent, U.S. EPA Docket No. RCRA-03-2013-0105CA (“2013 Order”). The 2013 Order named LSI Corporation (see below) and Alcatel-Lucent USA, Inc (“Alcatel”) as Respondents and required the Respondents to have property owners at the new White Oak Village Shopping

Center execute and record environmental covenants.

### **Operation & Maintenance (“O&M”) of the Groundwater Remediation System**

In February 2001, Lucent created a new company named Agere Systems Inc. (“Agere”). While Lucent was responsible to EPA for complying with all terms and conditions of the 1996 Order, Agere contractually agreed to perform the operation and maintenance of the groundwater remediation system on behalf of Lucent. On April 2, 2007, Agere was acquired by LSI Logic to form a new merged company, LSI Corporation (“LSI”). As part of this acquisition, LSI agreed to continue the operation and maintenance of the groundwater remediation system on behalf of Lucent. LSI was acquired by Avago Technologies in May 2014. Effective February 1, 2016 Avago Technologies acquired Broadcom Corporation to form a new company Broadcom Limited. In April 2018 Broadcom Limited was redomiciled in the United States as Broadcom Inc. (“Broadcom”). LSI, currently owned by Broadcom, and Alcatel, maintain responsibility under the 2013 Order for operating the groundwater remediation system under the oversight of EPA and the Virginia Department of Environmental Quality (“VDEQ”).

### **III. DESCRIPTION OF FOURTH SIGNIFICANT DIFFERENCES AND THE BASIS FOR CURRENT CHANGES TO THE SELECTED CORRECTIVE MEASURE**

This ESD modifies the Selected Corrective Measures to allow for source removal and contingent treatment of “hot spots” followed by shut down of the groundwater remediation system and transitioning to Monitored Natural Attenuation (“MNA”) as the long-term remedy if supported by groundwater monitoring data. In addition, EPA is adding 1,4-dioxane and vinyl chloride to the list of Site related COCs and establishing 4.6 µg/L and 2.0 µg/L as the cleanup goal for those contaminants in groundwater.

#### **1. Source Material Removal with Contingent Treatment of “Hot Spots” and Long-Term Monitoring**

In 2017 and 2018 further soil investigations were performed at the Site to identify areas of vadose zone soil impacts remaining in the subsurface that may be contributing to the mass transfer of contaminants to groundwater or release and a resultant ongoing degradation of groundwater quality.

The 2017 and 2018 investigations identified 1,1,1-trichloroethane (“TCA”), methylene chloride (“MEC”), and 1,4 dioxane at substantially elevated concentrations in the vadose zone near the locations of former factory buildings 51 & 33 and the former Richmond Works tank farm (“tank farm”). Because these constituents are not degradation products, but instead were present in chemicals used in the former manufacturing process and found close to historical manufacturing activities, these high concentrations indicate historical releases and a primary source of impacts to groundwater rather than a result of matrix effects (discussed below).

Despite the operation of the groundwater remediation system for over 20 years, the amount of contamination remaining in the aquifer over the last 16 years has remained largely stable, even though the groundwater remediation system has removed an average of 80 kg of contamination during each 2-year reporting period, since 2009 and mass removal efficiency (kg removed/million gallons pumped) has increased at least two-fold since 2013. The residual mass may be attributable to matrix effects and the movement of volatile organic compound (“VOC”) mass from the vadose zone soil beneath the former factory buildings and tank farm into groundwater, leading to a continuing degradation of groundwater quality.

The “matrix effect” is the tendency for a clay layer, such as the one present at the Site, to act as a “sponge” that traps groundwater contamination when the top elevation of significantly contaminated groundwater rises during wet seasons. The clay layer can then release the contaminants back into groundwater that contacts the clay the next time the water table rises. This is termed a “matrix effect” because the soil matrix is re-contaminating groundwater that did not result directly from a spill or release at the surface. A clay layer is uniformly present to approximately 15 to 20 feet below ground surface throughout the Site.

The data provided by the 2017 and 2018 investigations show that there is a significant amount of vadose zone soil located beneath the factory buildings and tank farm that is contaminated with VOCs. EPA has determined that those contaminated soils are contributing to the ongoing degradation of the groundwater quality at the Facility and that their removal supplemented with contingent treatment of “hot spots” using ISCO injections, biological treatment or other appropriate technologies in select locations where necessary, will likely accelerate the groundwater restoration process. Specifically, EPA anticipates that once the soils are removed, the VOC contamination will decrease over time through natural degradation processes supported with contingent “hot spot” treatment. The approximate location of the source material removal is shown on Figure 1.

This ESD modifies the Selected Corrective Measures to allow for source material removal supplemented with contingent “hot spot” treatment and long-term monitoring. Once source material removal and any necessary “hot spot” treatment are completed, the groundwater treatment system will be shut down and EPA will evaluate groundwater monitoring data to determine whether the current groundwater treatment system is no longer needed to achieve the Clean-up Goals at all Points of Compliance. If data shows that contaminant concentrations in the groundwater plume remain stable or are decreasing, the Selected Corrective Measures as modified by this ESD will allow for the groundwater treatment system to remain shut-down provided that 1) monitoring be performed on a quarterly basis for one year (4 events), then semi-annually for one year (2 events), and then annual monitoring until the Clean-up Goals have been met at all Points of Compliance and 2) the Contingency Plan, described in III.2., directly below, be implemented.

## **2. Contingency Plan for Treatment of “Hot Spots”**

In 2015 EPA approved a workplan to temporarily shut down the groundwater treatment

system (“Shut-Down Test”) to: (1) evaluate plume stability and mass flux/discharge under non-pumping conditions (2) perform remedial pilot testing and collect geochemical data to evaluate alternative remedial technologies, with respect to current cleanup levels, to pump and treat, including MNA and ISCO injections; and, (3) assess drinking water receptors downgradient of the Site and potential future exposure risk under non-pumping conditions.

In the event that unexpectedly fast contaminant migration occurred through preferential pathways or zones of higher permeability during the Shut-Down Test, EPA required a Contingency Plan be implemented to prevent contaminants of concern from reaching receptors at unacceptable concentrations. The Contingency Plan established Groundwater Contingency Values for perimeter wells. If groundwater data indicated that a groundwater sample collected from a perimeter well exceeded the Groundwater Contingency Value at specified points in the system, contingent actions, including re-sampling, re-activation of the groundwater remediation system, biological treatment and/or ISCO injections, were required.

With this ESD the Contingency Plan approved for the 2015 Shut-Down Test will remain in effect until the Cleanup Goals at all Points of Compliance are met. For a detailed description of the Contingency Plan please see the “Additional Work Plan, Former Lucent Richmond Works Facility, 4500 Laburnum Avenue, Richmond, Virginia” dated December 2015, included in the Administrative Record for this ESD.

### **3. Addition of 1,4-Dioxane and Vinyl Chloride as Contaminants of Concern and Establishment of Groundwater Cleanup Levels**

In the early 2000s, EPA became aware that 1,4-dioxane, an organic compound used as a stabilizer in organic solvents and degreasers was often present at sites, such as this one, where chlorinated VOCs were released into the environment. Routine groundwater sampling performed at the Site has consistently demonstrated the presence of 1,4-dioxane above the EPA Region 3 Risk Screening Level (“RSL”) of 0.46 µg/L in several extraction wells, perimeter monitoring wells, and down gradient monitoring wells, with concentrations as high as 352 µg/L from a sample collected in the source material area.

As stated in Section II, the RCRA ROD and 1992 ESDs established groundwater cleanup goals for four COCs. The cleanup levels were based on the Federal Maximum Contaminant Level (“MCL”), or if no MCL existed for the contaminant, a risk-based numerical value for tap water. Since that time, VDEQ has established groundwater screening levels under its Voluntary Remediation Program, (“VRP”). As a result of this new information, EPA is adding 1,4-dioxane to the list of groundwater COCs and establishing a cleanup goal of 4.6 µg/L, which is the VRP Tier II Residential Groundwater Screening Level (“Tier II Level”) for 1,4-dioxane. Tier II Levels are based on published, media-specific values, derived using conservative default assumptions.

The routine groundwater sampling performed at the Site has also demonstrated the presence of vinyl chloride, a breakdown product of 1,1-DCE, above its MCL of 2.0 µg/L. As a

result of this trend, EPA is adding vinyl chloride to the list of groundwater COCs and establishing a cleanup goal of 2.0 µg/L for vinyl chloride.

#### **IV. SUPPORT AGENCY REVIEW**

VDEQ has been consulted regarding the modifications to the Selected Corrective Measures for the Facility as described above and concurs with this ESD.

#### **V. AFFIRMATION OF DECLARATION**

Given that this ESD allows for the implementation of source removal and contingent “hot spot” treatment where necessary with the ultimate transition to MNA, EPA and the VDEQ believe that the remedy remains appropriate and protective of human health and the environment.

#### **VI. AUTHORITY**

EPA is issuing this ESD under the authority of the Solid Waste Disposal Act, as amended by RCRA, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901 to 6992k.

3.5.20

Date



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<b>SITE:</b> FORMER LUCENT RICHMOND WORKS		
<b>DATE:</b> 11/15/2019	<b>SCALE:</b> 1" = 250'	<b>PROJ.:</b> 6480199002
<b>DR:</b> D. Young	<b>CHK:</b> S. Knox	
<b>LOCATION:</b> \\dhm-fs1\projects\Comm-Ind\Projects\Clients G to L\LSI Richmond\6480181003 Start Jan 2018\07_CADD and GIS\Additional Soil Assessment		

<b>TITLE:</b> LSI EXCAVATION
<b>ADDRESS:</b> 4500 S. Laburnum Ave., Richmond, VA

**Figure:**  
**1**