



## Litton Systems Inc. Site 4811 West Kearney Street, Springfield, MO Greene County

March 2019

### Site Description

The former Litton Systems Inc. site is located at 4811 West Kearney Street in Springfield on approximately 70 acres of land just east of the Springfield-Branson National Airport. Litton Systems Inc. began manufacturing printed circuit boards in the 1960s and closed in 2007. The facility was demolished in 2008, and the site is now a vacant lot with only the concrete building slab remaining. The site is owned by Northrop Grumman Corporation Guidance and Electronics Company Inc., a subsidiary of Northrop Grumman Corporation that acquired the site from Litton Systems Inc. in 2001. Northrop Grumman is investigating and remediating the site. The Department is overseeing this cleanup through its Superfund Cooperative Program, an alternative for contaminated sites that otherwise would be referred to the U.S. Environmental Protection Agency (EPA).

### Description of Contamination

During the course of operation, the facility generated wastes containing metals, predominantly copper, and volatile organic compounds (VOCs), predominantly trichloroethylene (TCE). Until the early 1980s, the facility managed wastes in a series of on-site waste management units consisting of shallow lagoons, and waste piles and pits. The historic waste management units did not fully contain the materials; investigations of surrounding soils, shallow groundwater, deep groundwater and vapor intrusion have been conducted to determine the extent of potential on-site and off-site contamination.

The area in and around Springfield has an extensive network of voids, caverns and sinkholes in the shallow bedrock, and springs that surface at various points. This “karst” geology provides selective pathways for contamination to potentially travel farther than in soil or saturated groundwater zones. In karst geology, groundwater contaminant plumes are difficult to delineate because they often do not follow a predictable pattern. The Department conducted a number of dye trace studies that showed materials traveled distances from 0.4 to 6.3 miles, and additional investigations are ongoing.

### Investigation and Cleanup Activities

The Department has been actively involved with the site since 1979 and conducted several on-site and off-site pre-remedial investigations and site assessments between 1989 and 1993. From 1980 to 1988, the Department conducted investigations that documented the presence of metals and VOC contamination, including TCE, on site.

- Inspection and closure of waste management units: Department staff inspected the facility in 1979 and observed plating waste overflowing from a lagoon into an on-site sinkhole. VOCs, including TCE, were detected in samples of water from the lagoon. This raised concerns that the plating waste could travel through the karst system, including sinkholes, on and near the property, resulting in possible groundwater contamination adversely affecting nearby springs and private wells. In 1980, the Missouri Clean Water Commission ordered Litton to connect to Springfield’s sewer system and cease off-site discharges. By 1982, the on-site waste management units were closed, and Litton was connected to the Springfield Municipal Sewer System.
- Soil Investigations: The Department completed a Preliminary Assessment Superfund investigation in 1985 and a Site Inspection in 1988 that included soil sampling and analysis. Sample results showed the presence of copper, chromium, lead, arsenic, silver, nickel, and VOCs above background and health-based screening levels in soil on the Litton site.

From 1994 to 2001, Litton conducted Phase I (site-wide summary) and Phase II (soils) Investigations. These investigations were performed to delineate contaminant distribution in soils associated with the former waste management units. From 2001 to 2006, Northrop Grumman continued remedial investigations to determine the extent of contamination in soil and groundwater. These series of Remedial Investigations documented VOCs, predominantly TCE, and metals contamination in soil at the site.

- Soil Remediation: From 1994 to 2001, the Department oversaw Litton's on-site investigations and remediation activities. On-site areas with copper-contaminated soils from waste management units were consolidated and then capped in place or disposed off-site at an approved facility.

Northrop Grumman excavated copper-impacted soil from the subfloor footprint of the former building slab and initiated a full-scale in-situ chemical reduction and enhanced in-situ bioremediation mixing program to remediate residual TCE in the soil below the building subfloor footprint slab.

A combination of treatment methods, electrical resistance heating and in-situ chemical reaction/enhanced in-situ bioremediation soil mixing and injection, have been used successfully to treat and reduce levels of on-site VOCs in soils and, in some areas, TCE in soil below the groundwater to meet soil cleanup standards. The last phase of soil cleanup is underway and includes remediating subfloor contamination under the foundation of the former building complex and a former sanitary lagoon on airport property to the west.

- Groundwater Investigations: Groundwater movement in the shallow aquifer at the site is generally north-northeast. In addition, a major joint system, defined as a group of fractures in rock, exists, trending northwest-southeast toward a drainage channel and sinkhole on the airport property located along the western boundary of the site property. Area-wide dye traces suggest a hydraulic connection between the observed contaminated wells and springs and groundwater near the site.

#### EPA and Department Investigations 1980 - 1988

In 1980 and 1981, EPA sampling of lagoon waters and monitoring wells documented VOC contamination in groundwater at the site. The Department's subsequent investigations between 1980 and 1988 documented VOCs in area springs and in two private wells. One of the wells contained TCE, but the level was below the Maximum Contaminant Level (MCL) for TCE of 5 ug/L or parts per billion. MCLs are standards set by the EPA to protect public health by limiting the levels of contaminants in public drinking water supplies. Sampling documented TCE in wells, and TCE and copper in springs and wells located east of the Litton site.

#### Litton and Northrop Grumman Investigations 2001 - Present

Results from Litton's Phase I and Phase II Investigations showed the shallow Springfield Plateau Aquifer had been impacted by metals and VOCs from the site at levels above their respective MCLs, and that the deeper Ozark Aquifer had been impacted by VOCs at levels above the MCLs. Between 2001 and 2006, Northrop Grumman continued Remedial Investigations to determine the extent of contamination in soil and groundwater at and near the property.

Northrop Grumman has been conducting shallow and deep groundwater monitoring for TCE since the early 2000s, installing a network of over 80 monitoring and recovery wells to determine the extent of the groundwater contamination and conduct remediation. Northrop Grumman continues to sample these wells on an annual basis.

#### Department Site Reassessment 2003-2006

The Department initiated a Site Reassessment investigation in 2003 to evaluate the threat historic releases of contaminants at the site pose to human health and the environment. These activities included sampling and analysis of water, sediment and air samples from springs and a cave (Fantastic Caverns) north and east of the site, and water samples from private and public drinking water wells located within four miles of the site, primarily to the north and east. The Department's 2006 Site Reassessment report documented that VOCs and metals, predominately TCE and copper, were found within four miles north and east of the Litton site. The Department did not identify any other significant sites contributing to contamination.

Of the more than 70 private drinking water wells sampled in 2004-2005 during the Site Reassessment, 13 showed detectable levels of TCE, and one well showed TCE slightly above the MCL. Water from this well is treated with a carbon filtration system that was installed by Northrop Grumman in November 2004.

Of the six public wells that have been sampled, only one has had detections of TCE. The Country Squire Village well, located 1.5 miles east of the Litton site, has had two detections of TCE, both below the MCL.

This well is now on quarterly monitoring. A total of 10 springs were sampled as part of the Site Reassessment with TCE detections documented in four of those springs.

#### Department Private Well Sampling 2018-2019

In response to renewed concerns regarding TCE groundwater contamination associated with the Litton site, the Department is conducting extensive private drinking water well sampling within an initial focus area around the site. This initial focus area was established within one to 4.5 miles of the Litton site based on dye trace studies documenting groundwater flow data. The Department has received 480 requests for sampling from citizens with private wells in the area. On November 15 and 19, December 3-4 and 20, 2018, and January 8-9, 2019, Department staff collected samples from a total of 191 private drinking water wells and 16 homes that receive water from shared wells. Of the total 191 wells sampled, 178 wells were within the initial focus area and 13 wells were from outlier areas.

Four wells had detections of TCE above the MCL. One of those wells is the same one identified in 2004 that already has a carbon filtration system installed. Two of the wells are located just south of the site within city limits. Northrop Grumman provided bottled water to the home owners as soon as laboratory results were reported, and installed carbon filtration systems at both homes on December 21, 2018. The fourth well had detections of TCE above the MCL during the January 2019 sampling event and is located in the same area as the original well above the MCL from 2004. Northrop Grumman provided bottled water to the home owners until a carbon filtration system was installed on January 17, 2019. Northrop Grumman is conducting regular monitoring of these carbon filtration systems to ensure they are removing TCE contamination.

A total of 39 wells supplying water to 47 homes had detections of TCE below the MCL. Northrop Grumman will sample these 39 wells and homes served by the wells on a quarterly basis for a period of one year to ensure TCE concentrations do not exceed the MCL over time. If TCE is detected above the MCL during any sampling event, Northrop Grumman will install a carbon filtration system. If TCE continues to be detected below the MCL during any of the quarterly sampling events, sampling will continue thereafter on an annual basis. The first quarterly sampling will occur in April 2019. The Department did not detect TCE in the remaining 148 wells or 8 homes that receive water from shared wells. The site sampling map on the last page of this fact sheet shows results from the Department private well sampling events.

The next round of sampling will be conducted by Northrop Grumman, with Department oversight, in early March 2019 to resample wells with detections of TCE below the MCL that were first sampled on January 8 or 9, 2019 and to sample additional wells requested by homeowners within the initial focus area.

Previous private well sampling investigations for the Litton site focused on those located outside Springfield city limits, because it was assumed residents and businesses within city limits were supplied by the city's public drinking water. In addition, the Department's database of private wells does not document wells immediately adjacent to the site; however, some wells may have been drilled before well registration was required. The city of Springfield reported that the majority of businesses and residential homes located along Kearney Street are supplied by the city's public drinking water. However, some residential properties are located too far off Kearney Street for the city water lines to have been run when they were installed. The Department coordinated with the city to identify any residents within city limits near the site that are not on city water so that sampling can be conducted.

Department staff contacted approximately 280 homeowners who live outside the initial focus area to explain that the need for additional sampling would be assessed after results from the preliminary round have been analyzed. TCE was not detected in the 13 samples collected from outlier areas to the north, northeast, and west of the focus area. Based on the results from these recent sampling events, TCE contamination appears to be concentrated in areas north-northeast, east, and directly south of the site. The initial focus area will be expanded to the south and southeast to include potential wells within city limits near the site. In addition, priority will be given to contacting the estimated 150 property owners that are located within the focus area near wells with TCE detections who have not contacted the Department to request sampling. If these additional property owners grant access for sampling, Northrop Grumman will conduct this sampling with Department oversight in April 2019.

- Groundwater Remediation: In 1994, Litton initiated an interim remedial measure of on-site extraction and treatment of Springfield Aquifer groundwater to inhibit off-site migration of the impacted shallow groundwater. This remedial measure consists of one on-site extraction well still in place today. Monitoring of perimeter wells

has shown a steady decline in TCE levels in most of the wells. Northrop Grumman plans to expand this extraction system from one on-site well to nine on-site and two off-site wells, which includes work tunneling beneath Aviation Blvd from the site to airport property. This work will be completed by Fall 2019.

Within the deeper regional Ozark aquifer, Northrop Grumman has operated a separate extraction and treatment interim remedial measure consisting of one extraction well since 2014. TCE levels in the deep groundwater aquifer have been reduced significantly since the interim remedial measure started. Northrop Grumman also plans to expand this Ozark aquifer system with one additional on-site extraction well.

Northrop Grumman is conducting a detailed technical evaluation of the entire groundwater extraction system. Numerous pilot studies also have been conducted by Northrop Grumman to support the preparation of a feasibility study, which will evaluate various remediation alternatives and propose a final remedy for groundwater.

- Vapor Intrusion Investigation: Vapor intrusion refers to vapors associated with volatile chemicals in soil or groundwater migrating into enclosed and confined spaces such as buildings, voids, caves, mines, etc. A typical vapor intrusion investigation starts at the source and extends outward. Samples generally are collected for a minimum of four quarters to account for temperature and other seasonal conditions that can affect the movement of soil contaminant vapor and determine subsequent vapor sampling locations and depths.

Northrop Grumman is conducting an ongoing vapor intrusion assessment that includes soil gas and shallow groundwater sampling on and off the Litton property. In April 2017, Northrop Grumman installed and sampled 10 soil gas wells (about 4 and 10 feet in depth) at locations along the site perimeter to the west, east and south. Soil gas data from the 10 soil gas wells sampled in April 2017 did not show any detections of TCE. In December 2017-January 2018, Northrop Grumman installed 16 shallow groundwater monitoring wells (about 20 feet in depth) also located along the site perimeter near the soil gas wells. Analytical results of shallow groundwater sampling conducted in January 2018 showed two of the four wells that contained water had detections of TCE above the MCL. April 2018 analytical results from 12 of the 16 groundwater wells that contained water, show detections of TCE and breakdown products in 9 wells, 6 of which contain TCE above the MCL. Data from sampling in the third and fourth quarters of 2018 is generally consistent with these data from April 2018. Northrop Grumman will be conducting additional soil gas sampling in Spring 2019 outside Litton property boundaries to the west and south. In addition, slab and indoor air sampling will be conducted at private property south of the site.

In addition to investigations on the Litton Site, Northrop Grumman conducted a soil vapor investigation along highway rights-of-way north of the Litton site. The investigation included sampling along six miles of county road within easements owned by Greene County and the city of Springfield. The sampling did not include work on private property. The investigation evaluated the presence of TCE in shallow soil vapor across a wide geographic area. The initial round of sampling in April 2018 at 77 locations found minimal detections of TCE at only two locations; both were below levels of concern. To account for variation in temperature and moisture, Northrop Grumman conducted a second round of soil vapor sampling at 30 locations in November 2018. TCE was not detected in any samples; vinyl chloride, a breakdown product of TCE, was detected at only two locations; both were below levels of concern. The locations for this sampling effort were selected as the most likely areas for potential soil vapor occurrences. Based on the results from the two rounds of soil vapor sampling, there appears to be no need for sub-slab vapor or indoor air monitoring for occupied structures within this sampling area. The Department will continue to evaluate all vapor intrusion sampling data related to the Litton site to determine if any additional area-wide soil vapor sampling is needed.

- Fantastic Caverns Investigation: The Department first conducted air sampling in Fantastic Caverns in April 2004 during the Litton Site Reassessment investigation. TCE was detected in a sample collected at the second bridge feature in the cavern. Air sampling was again conducted in February and November 2005. TCE was not detected in cave air in February, however it was detected in November 2005, again under the second bridge. At the time, the TCE concentrations were all below the health-based action level.

The Department conducted air sampling in Fantastic Caverns again in 2016 as part of a wider statewide investigation of air quality in toured caves near known sources of VOC contamination. Between April 2016 and November 2017, the Department conducted 14 air sampling events in Fantastic Caverns. The current EPA TCE action level for occupational exposure for a typical 8-hour work day is 6 µg/m<sup>3</sup>. TCE concentrations above the EPA action level were measured at nine of the 11 tour route sampling locations during at least one sampling event over the course of the investigation. The maximum concentration of TCE measured in cave air was 2,300

µg/m<sup>3</sup> measured in the Lower Passage Floor area of the cave below the Second Bridge. The Lower Passage is an area of the cave connected with, and adjacent to, the regularly toured portion of the cave, but is not normally accessed by the public. Among samples collected in the toured portions of the cave, the maximum TCE concentration was 88 µg/m<sup>3</sup>, measured at the Sink Hole feature on July 13, 2017. These sampling results were all from stationary eight-hour time-integrated air samples.

Stationary eight-hour time-integrated samples collected from specific locations in the cave are not representative of actual exposure patterns experienced by the public or tour guide staff since cave tours only spend brief periods of time at each cave feature. Therefore, personal air monitoring samples (PAM) were collected on seven sampling events to better estimate TCE exposure for tour guides. TCE was detected in the PAM samples during six of the seven sampling events, but never at concentrations exceeding the EPA action level. The highest PAM sample result for TCE was 4.3 µg/m<sup>3</sup> measured on Oct. 11, 2017.

- **Future Actions:** Northrop Grumman will be documenting the completion of soil remediation activities at the subfloor and the former sanitary lagoon. In addition, the company will conduct further delineation of potential groundwater migration pathways via geophysics and drilling activities. Northrop Grumman also plans to apply additional interim remedial measure actions and to conduct pilot studies designed to aggressively treat residual groundwater impacts near source areas and along preferential groundwater flow paths. Enhancement of the groundwater treatment systems for both aquifers is also under development.

Northrop Grumman will continue to collect additional samples from private drinking water wells and springs in the area in 2019 to further define TCE contamination. In addition, private wells with detections of TCE and the Country Squire Village public well will be monitored on a regular basis to ensure TCE levels do not exceed the MCL.

## Agency Actions Taken

In October 1991, the Department proposed placing the Litton site on the Missouri Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites. Litton appealed and agreed to clean up the site to avoid the listing. In July 1993, Litton signed a Consent Agreement with the Department to conduct on-site investigation and remediation. Following EPA's Site Inspection Prioritization in 1993 and subsequent Hazard Ranking System computation, EPA deferred proposing the Litton Systems site for placement on the National Priorities List because the Department and Litton entered into an agreement for cleanup.

The Department entered into a Consent Decree with Northrop Grumman in March 2010 to perform remedial actions on-site and beyond the Litton property boundary. This Consent Decree replaced the 1993 Consent Agreement with Litton.

The Department will host an informational public meeting on Thursday, March 14, 2019, from 6:30 to 8:30 pm at the Ozark Empire Fairgrounds and Event Center in the Center Hall, 3001 N. Grant Ave., Springfield. Information presented at the meeting will include a brief history of the Litton site, a summary of environmental remediation and sampling efforts in the area, an overview of plans for future work, activities on property belonging to Fantastic Caverns, and a discussion of trichloroethylene, the primary site contaminant. An open forum and availability session will follow the presentations. The public will have an opportunity to ask questions and provide comments about the site. Participants also will be able to submit written comments, questions, and concerns.

The Department also anticipates hosting another public meeting in 2020 to present a Proposed Plan for the recommended remedy for deep groundwater within the Ozark Aquifer. The public meeting will be an opportunity for the Department to share additional information with the community about details of the final cleanup plan at the Litton site and to request public feedback on the Proposed Plan for a deep groundwater remedy. The meeting will be scheduled after further testing is completed, adjustments are made to improve the interim remedial measure and final components are developed as part of the Ozark Aquifer deep groundwater Remedial Investigation and Feasibility Study being prepared by Northrop Grumman.

## For More Information

For additional information regarding the site, contact Christopher Dudenhoeffer or Wane Roberts, Missouri Department of Natural Resources, at 573-751-4187 or by email at [christopher.dudenhoeffer@dnr.mo.gov](mailto:christopher.dudenhoeffer@dnr.mo.gov) or [wane.roberts@dnr.mo.gov](mailto:wane.roberts@dnr.mo.gov). The Department updates this fact sheet periodically, and it can be found on the Department's website at: <https://dnr.mo.gov/env/hwp/sfund/docs/litton-factsheet.pdf>.

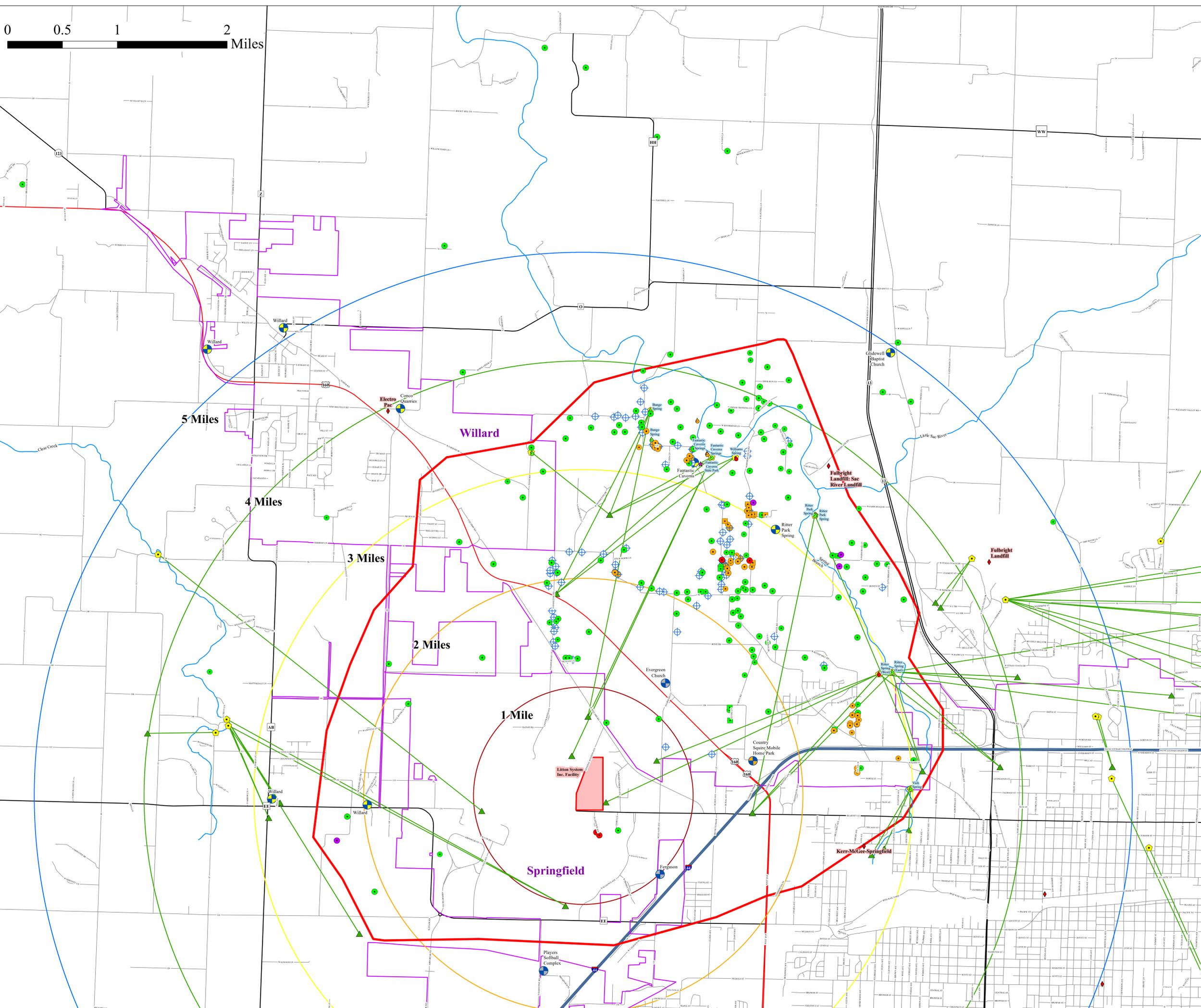
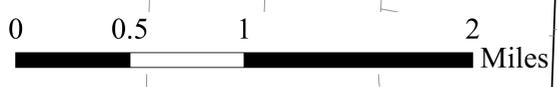
Residents living inside the focus area, depicted on the sampling map on the following page, and who get their drinking water from private wells may request free drinking-water sampling for TCE and other Volatile Organic Compounds by calling 573-751-4187. For health-related questions about TCE, contact the Missouri Department of Health and Senior Services at 573-751-6102.

## Site Location Aerial Map



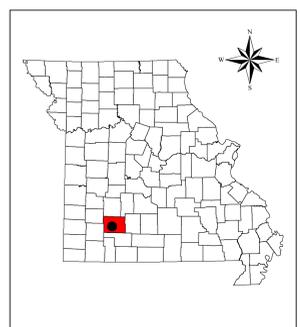
## Site Sampling Map (Next Page)

Litton Systems Inc.  
 Sampling Results  
 Springfield, Missouri  
 February 2019



- Legend**
- Private Well with TCE Above MCL, 2018 (4)
  - Private Well with TCE Below MCL in December and No Detect January, 2018 (4)
  - Residences with TCE Below MCL (8)
  - Private Well with TCE Below MCL, 2018 (47)
  - Residences where TCE Not Detected (7)
  - Private Well where TCE Not Detected, 2018 (156)
  - Private Well with TCE Above MCL, 2005 (1)
  - Private Well with TCE Below MCL, 2005 (12)
  - Private Well where TCE Not Detected, 2005 (66)
  - Spring with TCE Above MCL (2)
  - Spring with TCE Below MCL (3)
  - Spring where TCE Not Detected (7)
  - Sampled Public Wells
  - Currently Inactive Public Wells, No TCE Detected (4)
  - Active Public Well where TCE Not Detected (11)
  - Active Public Well with TCE Detect (1)
  - Hazardous Waste Sites
  - Fantastic Caverns Cave
  - Dye Injection Points
  - Dye Receiving Points
  - Inferred Dye Path
  - Major Rivers
  - Litton System Inc. Facility
  - Updated Focus Area
  - Litton System Inc. Facility Buffer
  - 1 Mile
  - 2 Miles
  - 3 Miles
  - 4 Miles
  - 5 Miles
  - Municipal Boundary

TCE = Trichloroethylene/Trichloroethene  
 MCL = Maximum Contaminant Level



Updated on: 2/25/2019 by David Nykodym. This map is located at M:\Superfund\Litton\LittonSamplingAreaInterest\_PublicMap.mxd  
 Scale: 1:18,000

Data Sources: Missouri Department of Transportation, Missouri Geologic Survey

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