



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

November 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 actively 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 historical 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 involved actively 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. Northrop Grumman is implementing the last phase of soil cleanup, which 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 implement an annual well monitoring program.

Department Site Reassessment 2003-2006

The Department initiated a Site Reassessment investigation in 2003 to evaluate the threat historical releases of contaminants at the site may 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 intermittent detections of TCE, all 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.

Private Well Sampling 2018-Present

In response to renewed concerns regarding TCE groundwater contamination associated with the Litton site, the Department conducted 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. Department staff collected samples from a total of 191 private drinking water wells and 16 homes that receive water from shared wells in late 2018 and early 2019.

Northrop Grumman took over the domestic well sampling program beginning in March 2019, under Department oversight. Northrop Grumman has conducted quarterly sampling events in March, June, and September 2019. An additional one-time sampling event was conducted in May 2019 for wells not previously evaluated at that time. To date, samples have been collected at 353 domestic well locations since the sampling program was initiated in late 2018. Six (6) locations have reported TCE detections above the MCL, and treatment systems have been installed by Northrop Grumman. An additional 74 locations have exhibited detectable concentrations of TCE below the MCL. These 74 locations are being sampled by Northrop Grumman on a quarterly basis for a one-year period, and will continue to be sampled annually after that in order to monitor TCE levels. The next quarterly event is planned for December 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 consisted 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 is expanding this extraction system from one on-site well to nine on-site and two off-site wells on the airport property. The two off-site wells were connected to the on-site groundwater treatment system in August 2019 and are operational. Connection of the additional on-site wells and enhancing the existing on-site treatment system is in process. Northrop Grumman anticipates the work will be completed in the first quarter 2020.

Within the deeper regional Ozark aquifer, Northrop Grumman has operated since 2014 a separate extraction and treatment interim remedial measure consisting of one extraction well. 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 remedial system with two additional on-site extraction wells. This work is in process, and Northrop Grumman anticipates the new wells will be operational in the fourth quarter 2019.

Northrop Grumman is conducting a detailed technical evaluation of the entire groundwater extraction system. Numerous pilot studies 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 potentially 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 assessment that includes soil vapor and shallow groundwater sampling on and off the Litton property. Between April 2017 and July 2019, Northrop Grumman collected soil gas samples at approximately 175 locations both on and off the Site. Locations off the site include the general area of the former terminal at the airport to the west of the Site, residential property to the south, and public rights-of-way (i.e., public roadways) extending several miles to the north, east, south, northeast, and southeast of the Site. Concentrations of contaminants identified in soil vapor were very low to non-detectable in all off-site locations, with the exception of the public rights-of-way immediately south of the site on Kearney Blvd and in eastern parking lot areas near the former airport terminal building. Sampling locations in immediate proximity to the former airport terminal were very low to non-detectable. None of the sampling results collected since April 2017 suggest a current impact to indoor air quality within occupied commercial or residential structures. Northrop Grumman will conduct additional sampling at the airport property to further the evaluations.

Northrop Grumman's vapor intrusion investigation on residential property south of the site in March 2019

included soil gas, sub-slab and indoor air sampling at two private properties. VOCs were not detected in the indoor air or sub-slab samples. Low levels of VOCs were detected in soil gas; however, the concentrations were below health-based action levels.

- 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/m³. 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. Among samples collected in the toured portions of the cave, the maximum TCE concentration was 88 µg/m³, 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 (PAM) samples were collected during 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.

Representatives of Fantastic Caverns implemented measures in 2018 and 2019 to reduce TCE concentrations in air within the tourist portions of the cave. These measures have included drilling boreholes into the lower unoccupied portions of the cave system to allow for ventilation. Fan powered ventilation of select boreholes was initiated by Fantastic Caverns in 2019. Data presented to the Department by Fantastic Caverns suggests the borehole ventilation efforts have been successful in reducing TCE concentrations in air within the tourist portions of the cave to non-detect or nearly non-detect levels. Continued borehole ventilation and sampling is planned by Fantastic Caverns to maintain the TCE mitigation measures.

- Future Actions: Northrop Grumman will further delineate potential groundwater migration pathways via geophysics and drilling activities. These efforts will include installation of monitoring wells both on and off the Site in the Springfield and Ozark aquifers. These activities are underway and will continue into 2020. Northrop Grumman also plans to continue interim remedial actions, including groundwater extraction and treatment from the Springfield and Ozark aquifers. Enhancement of the groundwater treatment systems for both aquifers is in process.

Northrop Grumman will collect additional soil vapor data on the airport property and will continue to collect groundwater samples from private drinking water wells as part of the on-going domestic well sampling program.

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 hosted an informational public meeting on Thursday, March 14, 2019. Information presented at the meeting included 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. Presentations from that meeting can be found on the Department Litton website at <https://dnr.mo.gov/env/hwp/sfund/LittonSystems/>.

The Department will host another public meeting and open house on Thursday, November 7, 2019, from 4:00 pm to 8:00 pm at the Relics Event Center, 2015 W. Battlefield Road, Springfield. An open house is scheduled for 4-6 pm, with presentations at 6 pm. A question and answer session and additional open house time will follow the presentations. Department staff, Department of Health and Senior Services, and Northrop Grumman will give updates on activities at the Litton site. Information on the investigations at the Electro-Pac site also will be provided.

The Department anticipates hosting another public meeting in 2021 to present a Proposed Plan for the recommended final cleanup 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 Katherine Brookshire, Missouri Department of Natural Resources, at 573-751-4187 or by email at katherine.brookshire@dnr.mo.gov. The Department updates the Litton web page and this fact sheet periodically, and this information can be found on the Department's website at: <https://dnr.mo.gov/env/hwp/sfund/LittonSystems/>.

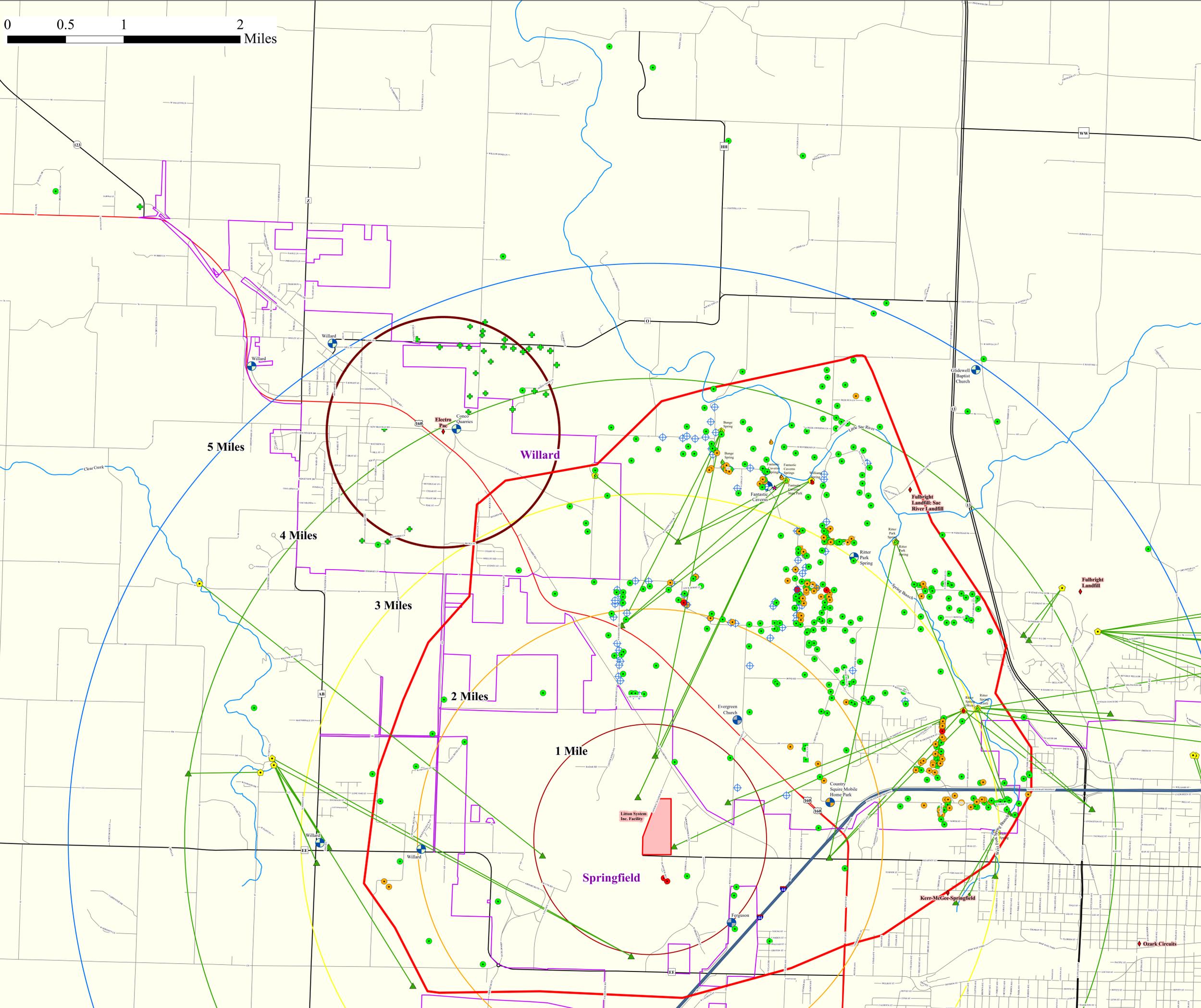
Residents living inside the focus area, depicted on the sampling map on the following page, and who get their drinking water from private wells may request free drinking-water sampling for TCE and other Volatile Organic Compounds by calling 573-751-4187. For health-related questions about TCE, contact 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
 October 2019



- Legend**
- Private Well Where TCE Not Detected, 2018-2019 (264)
 - Private Well with TCE Below MCL, 2018-2019 (67)
 - Private Well with TCE Above MCL, 2018-2019 (5)
 - Residences where TCE Not Detected, 2018-2019 (7)
 - Residences with TCE Below MCL, 2018-2019 (8)
 - Private Well with TCE Above MCL, 2005 (1)
 - Private Well with TCE Below MCL, 2005 (12)
 - Private Well where TCE Not Detected, 2005 (66)
 - ⊕ Electro Pac Private Well Sampling 2019, TCE Not Detected
 - 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: 10/18/2019 by David Nykodym. This map is located at M:\Superfund\Litton\Litton_PublicMap_Oct2019.mxd

Scale: 1:16,981
 Data Sources: Missouri Department of Transportation, Missouri Geologic Survey

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