Vapor Intrusion Mitigation Beneath an Occupied Industrial Building at the Young – Rainey Science, Technology, and Research Center Largo, Florida – 17463

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ABSTRACT

Groundwater contamination, consisting of chlorinated solvents, was identified in the southeastern portion of the Pinellas Site in Largo, Florida. The contamination is beneath Building 100, an 11-acre building that housed manufacturing facilities during US Department of Energy (DOE) operations at the site. Because the building was constructed in phases over a period of decades, it is comprised of approximately 20 different buildings, each with a separate foundation, all of which are now connected under a single roof.

Based on the results of a pilot test that indicated the presence of volatile organic compounds beneath the floor slab and, in the absence of state regulations or guidance, DOE elected to proactively address the potential for release of these compounds into the facility by designing and installing a vapor intrusion (VI) mitigation system. To ventilate vapors from beneath the building, piping was installed from beneath the concrete floor slab through the roof, and negative pressure was created using electric blowers. The system design was complicated by foundation walls supporting each of the various sections of Building 100 and by special requirements due to the sensitive nature of the tenant's manufacturing activities and the heightened need for security. This paper addresses significant aspects of the design and construction of a VI mitigation system beneath a large, occupied industrial production facility, including technical, logistical, and environmental challenges; community relations; and regulatory relations.

INTRODUCTION

This paper describes the process for planning, designing, and constructing, a vapor intrusion (VI) mitigation system at a site in Largo, Florida, where weapons components for the nation's nuclear weapons program were developed and manufactured. Operations for DOE at the former Pinellas Plant, now known as the Young - Rainey Science, Technology, and Research (STAR) Center (Figure 1), ceased in 1997. Subsequently, DOE and the Pinellas County, Florida, government jointly redeveloped the site for commercial use.

Building 100 covers an area of approximately 11 acres and was the main production facility at the Pinellas Plant. Trichloroethene was released into the subsurface

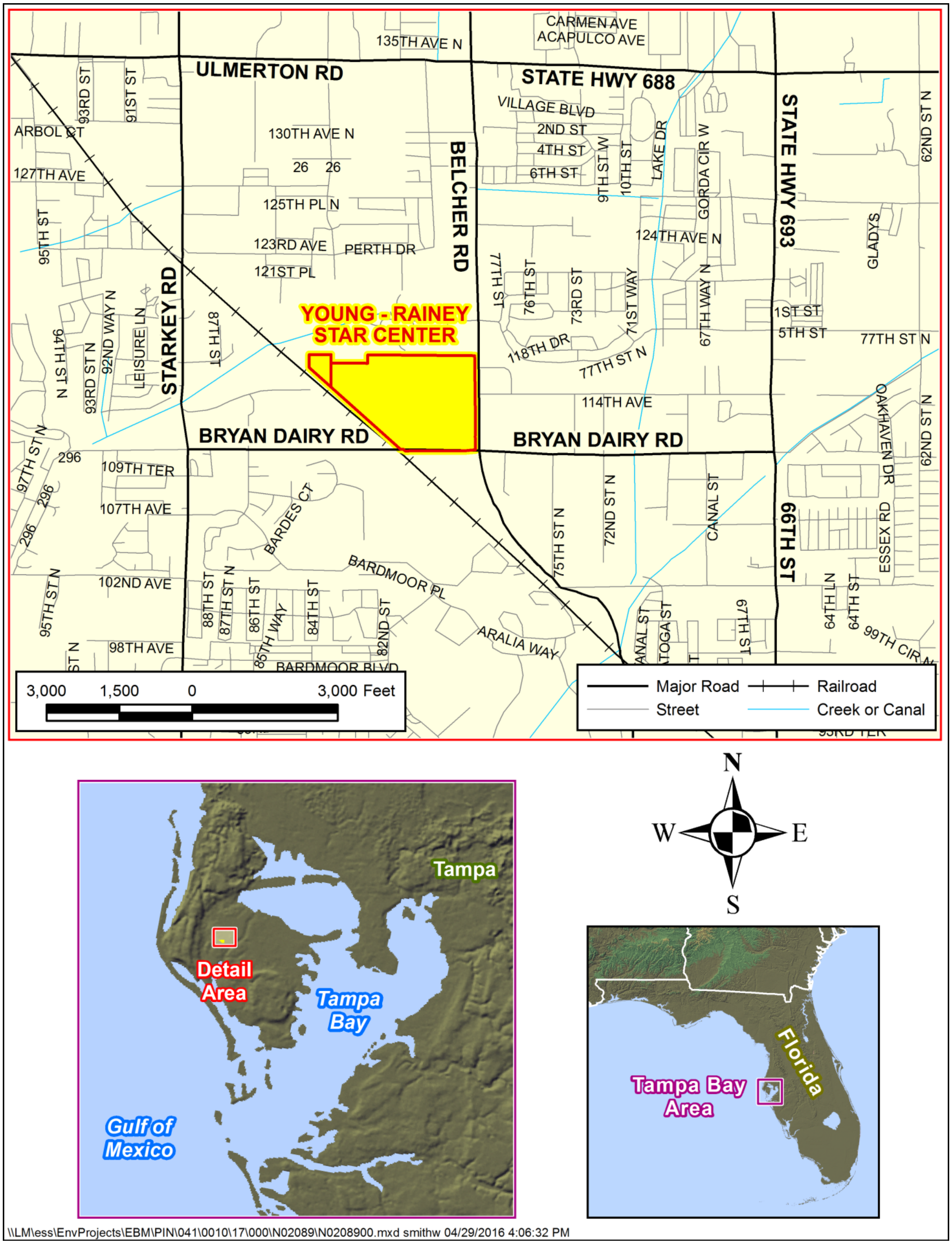

Figure 1. Location of the Young - Rainey STAR Center.

through leaks from a liquid-waste drain system that ran beneath the building. Currently the building is an industrial production facility.

In accordance with US Environmental Protection Agency (USEPA) Office of Solid Waste and Emergency Response's *Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* [1], DOE evaluated the potential for volatile organic compound vapors to migrate into the building, and any associated human exposure.

A short-term pilot test to evaluate the potential for intrusion of contaminant vapors into the building was conducted in early 2015. The pilot test results indicated that, under worst case assumptions, there was a potential for vapor intrusion in the northwest portion of the building. The pilot test locations of concern are shown in Figure 2. In the absence of state regulations or guidance, DOE elected to proactively address the potential risk of vapor intrusion by designing and installing a VI mitigation system.

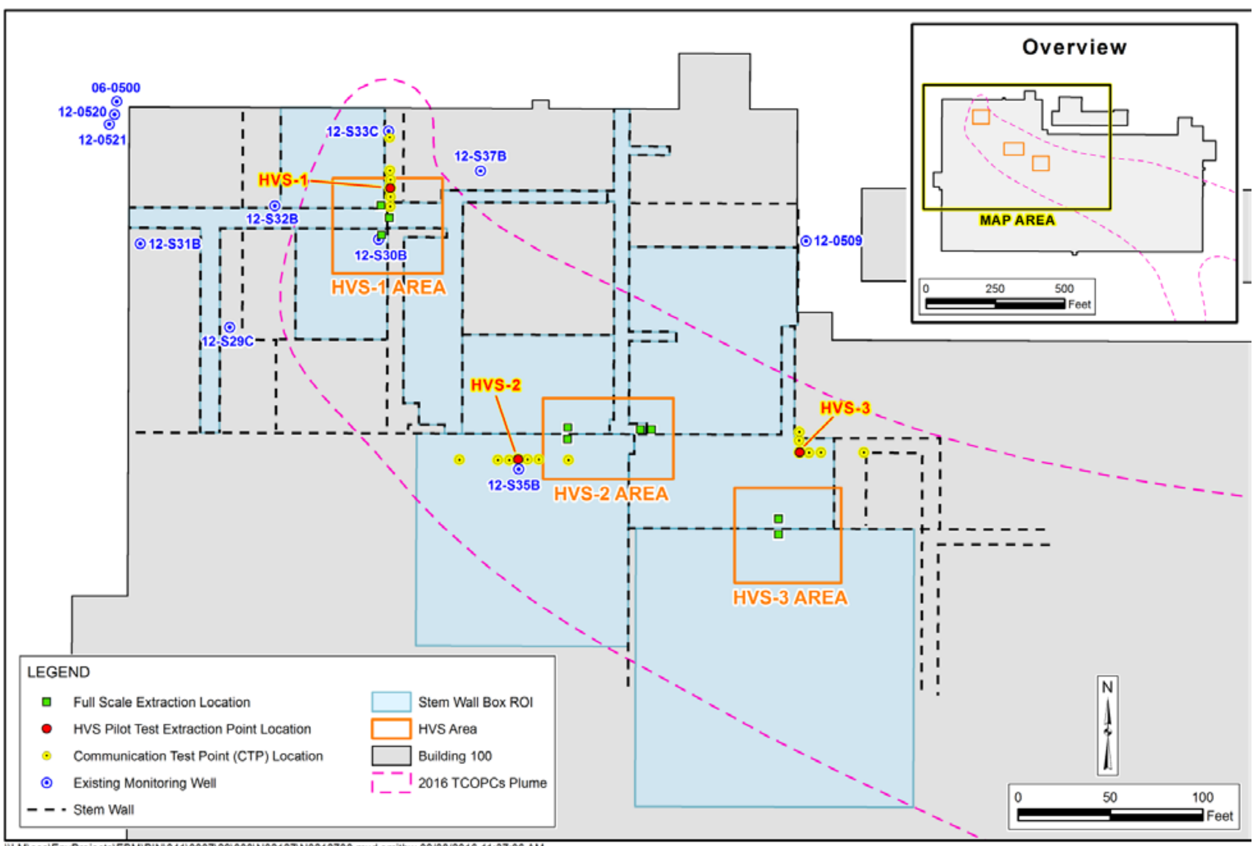

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Figure 2. Location of the pilot tests, the full-scale VI mitigation system, and the foundation (stem) walls beneath the building.

DESIGN

The general technical approach to ventilate vapors from beneath the building was to install piping which extends from beneath the concrete floor slab through the roof, and to create negative pressure by using electric blowers on the roof.

The construction of Building 100 began in 1956 and the building was expanded approximately 20 times from 1960 through 1984. The system design was complicated by the potential presence of subsurface foundation walls supporting each of the various sections of Building 100; these foundation walls would limit the radius of influence at each vapor extraction point. One of the initial challenges for identifying foundation wall locations was to find and decipher building design drawings from the 1960s and 1970s. Once the locations of the foundation walls were identified, the system designers had to choose extraction points that would optimize the area of influence for vapor extraction. At each of four areas where piping would penetrate the floor slab, additional vapor extraction points through foundation walls were added. As shown in Figure 2, three foundation walls were penetrated at the HVS-1 area, one foundation wall was penetrated at each of two separate parts of the HVS-2 area, and one foundation wall was penetrated at the HVS-3 area. Figure 3 shows the two vapor extraction points at the east side of the HVS-2 area, one of which penetrates a foundation wall.

Limitations on where various VI mitigation system components could be located were imposed by the property owner and the tenant. The tenant has sensitive operations in several areas of the building. Multiple iterations of discussions, site visits, and preliminary system location drawings were necessary to complete the design. For example, it was initially proposed that one of the extraction systems be located in a main hallway, but that was rejected because the work would have caused too much disruption to tenant activities, and the system was moved to an alternative location.

The potential for methane underneath the floor slab also complicated the design. Emulsified soybean oil was injected beneath the building about a year before system installation began, which could have led to the generation of methane gas beneath the slab. The design relied on explosion-proof blowers and three rounds of sub-slab methane sampling, which were conducted before construction began.

Significant utilities within the building also complicated the design process because the VI mitigation system piping had to be routed around them. The piping penetrated firewalls in a few locations inside the building, which necessitated additional care and coordination.

Figure 3. Photo showing system piping prior to backfilling.

STAKEHOLDER RELATIONS

The STAR Center is owned by Pinellas County and most of the space inside the building is leased to private companies, so DOE takes extraordinary measures to avoid disrupting tenant activities. Before the pilot test was conducted, a communications and coordination process with the owner and tenants was begun and continued for approximately two years through the construction of the VI mitigation system.

A memorandum of agreement identified the various future responsibilities of the property owner and DOE. The property owner owns the system after the installation was complete and is responsible for its operation and maintenance.

The Florida Department of Environmental Protection does not have specific guidance for the assessment of vapor intrusion. However, DOE chose to implement the action to mitigate the potential risk to ensure protection of human health.

CONSTRUCTION

Installation of the VI mitigation system began in early September 2016 and was completed in mid-November 2016. The installation entailed cutting through the floor slab at four locations, excavating the underlying soil, coring horizontally through six individual foundation walls, installing ventilation piping beneath the slab, backfilling and replacing the floor slab, installing ventilation piping up the interior walls, penetrating firewalls, penetrating and re-sealing the special roofing system at three locations, and installing electric blowers and associated controls to operate the system.

In response to the building tenant's requirement that Foreign Object Debris protocol be used, various dust and debris containment systems were implemented during certain phases of the project. During slab cutting, for example, a plastic tent with a negative-pressure air exhaust system was erected around the work area.

The system installation was made more complicated because the tenant's activities require heightened security measures. Much of the construction work had to be conducted during weekends and evenings. The necessity for evening and weekend work extended the work schedule beyond what it would have been if the work was done during standard business hours. Evening and weekend work required considerable coordination between multiple subcontractors. For example, a weekend slab cut consisted of setting up the tent, cutting the slab, excavating soil, coring through the foundation wall(s), installing piping, backfilling the excavation, pouring concrete, and allowing sufficient time for the concrete to dry so that the area could receive traffic by 6 am Monday morning.

The tenant required that all workers have a security escort within sight. This required multiple escorts at times; for example, workers cutting the slab needed an escort at the same time workers exiting the building to retrieve supplies also needed an escort.

The roof of the large building has a special roofing system, and the property owner required that a system-certified roofing subcontractor conduct the repairs for the roof penetrations. Likewise, the electrical subcontractor had to be approved by both the landlord and the tenant because of the necessity to access sensitive areas to install the electrical power and control system wiring.

CONCLUSION

Installation of a VI mitigation system in a functioning industrial production facility was fairly simple in concept, but involved significant complexities in practice. Due to the sensitive nature of the tenant's activities, extra steps and considerations were involved in the planning, design, stakeholder relations, staffing, and construction of the VI mitigation system. Many challenges were encountered in performing the work within the constraints imposed by the landlord and tenants. Specifically, much of the work had to be performed during second or third shift and weekends to avoid interfering with the tenant's production process. Concrete cutting, removal, soil excavation, piping installation, and new concrete placement and finishing had to be completed over weekends, and the concrete ready for pedestrian traffic by Monday morning. To avoid adverse impacts to sensitive electronics near the work areas, extraordinary efforts were made to control dust and debris, including encapsulating work zones in plastic enclosures with negative pressure and external air exhaust during concrete cutting and coring. All workers had to be within the line of sight of a security escort at all times within the tenant space. Stationary equipment in the work areas had to be covered with anti-static sheeting and workers had to wear anti-static smocks during overhead piping installation. The work was completed on schedule with no significant adverse impact to the tenant.

REFERENCES

1. Office of Solid Waste and Emergency Response (OSWER), 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air,* OSWER Publication 9200.2-154, 267 pp.