Management of Multiple Groundwater Contaminant Plumes Extending beyond Property Boundaries at the Young - Rainey STAR Center (Science, Technology, and Research Center) – 15623

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ABSTRACT

The US DOE Pinellas Plant—now known as the Young - Rainey STAR Center, located in Largo, Florida—manufactured components for nuclear weapons from 1956 to 1995. During decades of operations, chlorinated solvents were released from a drum storage area and from underground piping at multiple points adjacent to and beneath a 4.5-hectare (11-acre) building. Two groundwater contaminant plumes associated with contaminant sources beneath the building have been identified, delineated, and are being monitored. During a focused delineation campaign in 2008 to better define the plume boundaries prior to municipal construction projects in the area, the plumes were determined to extend beyond the site boundaries, beneath the adjacent roadway easements, and beneath four adjacent privately owned properties. US DOE has performed a number of activities in response to the discovery of the offsite contaminant plumes, including performing a high-resolution delineation of contaminant plumes; coordinating with local municipalities to complete two linear construction projects requiring dewatering in the vicinity of the plumes; performing risk assessment, risk management, risk communication, and community relations tasks associated with the project; coordinating with state regulators to identify a risk-based corrective action regulatory approach; and coordinating with impacted property owners to develop and implement institutional controls.

During the replacement of a 1.2-meter (48-inch) municipal potable water line directly over the contaminant plume area, US DOE (1) constructed infrastructure to receive and treat dewatering effluent at a rate of 20 gallons per minute around the clock for 6 weeks, and (2) conducted breathing-zone air monitoring during excavation of a 3.0-meter (10-foot) deep trench. This degree of diligence was necessary to ensure and document that no site workers were exposed to chlorinated solvent vapors during the construction process, and that a large volume of potentially contaminated groundwater was properly treated and dispositioned. US DOE also took aggressive actions to proactively address claims regarding loss of property value on two properties associated with the groundwater contamination, which resulted in a teaming arrangement with each party for future management of the ongoing corrective actions.

INTRODUCTION

Upon discovery of offsite migration of groundwater contamination that originated beneath Building 100 on the former Pinellas Plant, US DOE promptly completed the required notification to the Florida Department of Environmental Protection (FDEP) and the voluntary notification to the owners of properties located hydraulically downgradient from the contaminant plume. Following notifications to all stakeholders, US DOE worked closely with each party to keep

them informed as to potential health risks, hazard controls, and the proposed corrective actions. Subsequent delineation efforts led the investigation across the road right-of-way and three land parcels south of the site. A similar effort to the east identified a separate groundwater contaminant plume across another road right-of-way and the adjacent property to the east (Fig. 1).

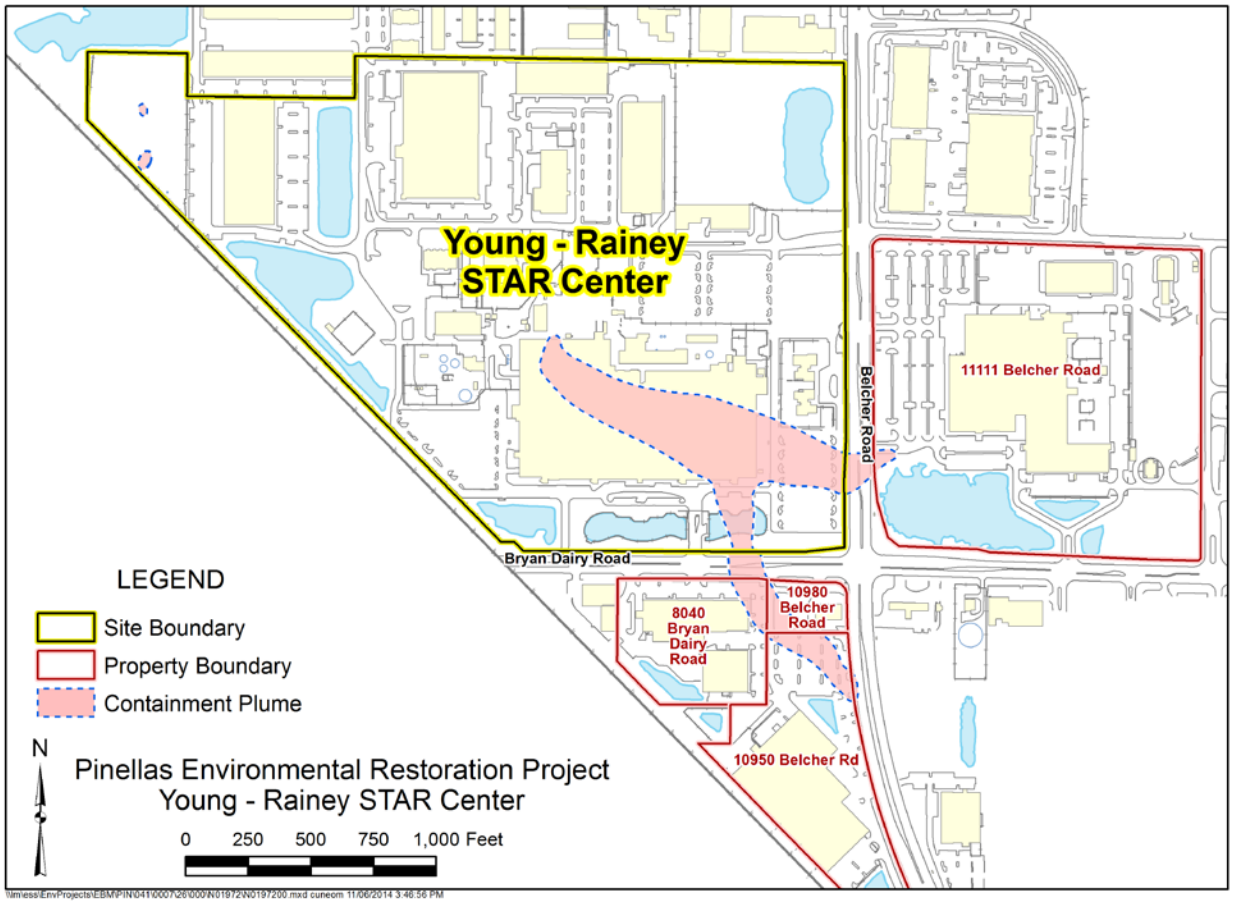

Fig. 1. This map illustrates the location of the groundwater contaminant plume**.**

US DOE's management of the site consisted of three major aspects: (1) physical management of the groundwater plumes during two municipal construction projects that occurred in close proximity to the plumes, (2) regulatory compliance, and (3) community relations, as discussed in the following sections.

METHODS

Groundwater Plume Management

Upon learning that municipal construction projects involving dewatering had the potential to impact, or be impacted by, groundwater contamination, US DOE performed a dewatering evaluation [1] to identify potential impacts and determine options for mitigation of those impacts. The potential impacts identified were as follows: (1) risk of worker exposure to

groundwater contaminants, (2) loss of plume control, (3) improper management of contaminated water, and (4) future claims against the property owners, contractors, and government due to human exposure.

The options identified for risk mitigation were as follows:

- No action
- US DOE monitors the effluent and has a contingency plan in place for effluent disposal
- US DOE manages the effluent, with the assumption that it is contaminated
- US DOE installs the dewatering system and manages the effluent
- US DOE installs and operates the dewatering system and manages the effluent

These options are described in more detail in Table I.

TABLE I. Summary of Belcher and Bryan Dairy Road Dewatering Options

Option	County Worker Risk	Regulatory Risk	Contingency Plan(s)	Cost	Other Considerations
1—No Action	Likely to be low based on existing groundwater data, but will be unverified; no information to refute potential future worker claims; county may refuse to accept this option without funding to use a contractor trained for hazardous materials handling.	Storm sewer disposal criteria will probably be met, but no data available to verify. Probably no real risk to storm water system, but perception could be otherwise.	None.	No cost for construction activities; potential other costs in future.	Easy to implement; high risk for future US DOE liabilities.
2—US DOE Monitors Effluent; Potential Contingency Plan in Place for Effluent Disposal	Probably low based on existing groundwater data. Monitoring of effluent as it is recovered could be used to determine potential exposures and whether personal protective equipment will be required (there will be a time lag before analyses obtained).	Effluent would be sampled as disposed of in storm sewer. If results indicate disposal criteria are not met, contingency action would be required. Improper disposal of water exceeding criteria could occur before analytical results are obtained. Penalties of some sort could result. Minimizes amount of water to be treated.	Contingency plan for water treatment if regulatory criteria exceeded; contingency plan for worker exposure if breathing zone monitoring exceeds threshold.	Analytical costs only. Potential contingency infrastructure: $ 141,000.	Likely requires a new permit for disposal of untreated water in the storm sewer system or other permission from the county.

3—US DOE Manages Effluent; Effluent Assumed to be Contaminated	Probably low based on existing groundwater data. Risks during construction and operation are controlled through monitoring. Monitoring of pretreatment effluent could be used to determine potential exposures, though results would be obtained after the fact.	All effluent would be treated and monitoring would ensure that Industrial Wastewater Neutralization Facility (IWNF) disposal criteria are met. May result in treatment of more water than necessary.	Contingency plan for worker exposure if breathing zone monitoring exceeds threshold.	$236,000	IWNF will not allow disposal without treatment; disposal elsewhere would require a new permit.
4—US DOE Installs System and Manages Effluent	Eliminates risk associated with construction. Operation risks probably low based on existing groundwater data; controlled through monitoring. Monitoring of pretreatment effluent could be used to determine potential exposures, though results would be obtained after the fact.	All effluent would be treated and monitoring would ensure that IWNF disposal criteria are met. May result in treatment of more water than necessary.	Contingency plan for worker exposure if breathing zone monitoring exceeds threshold.	$326,000	US DOE can exercise greater control over plume; would require much coordination with county and road construction contractor.
5—US DOE Installs and Operates System and Manages Effluent	Eliminates all potential exposures of Pinellas County contractor to contaminated water.	All effluent would be treated and monitoring would ensure that IWNF disposal criteria are met. May result in treatment of more water than necessary.	Not required for Pinellas County contractor.	$614,000	Requires coordination with county and road construction contractor.

DISCUSSION

Groundwater Plume Management

To address worker exposure to contaminated groundwater, US DOE performed a risk assessment based on exposure to vinyl chloride (VC). VC was used as a representative indicator chemical because it is the most mobile and widespread contaminant at the site. In addition, as a carcinogen, it is the contaminant of concern with the highest toxicity. Calculations showed that

VC concentrations in the groundwater closest to the areas requiring dewatering would not result in unacceptable risk. However, during construction, US DOE maintained a presence onsite to monitor the breathing zone in excavations and to document that no human exposures occurred.

To address potential loss of plume control, US DOE performed groundwater modeling to simulate the effect of short-term dewatering on groundwater movement in the vicinity of the construction activity. The results of the modeling were inconclusive due to uncertainties in the hydraulic parameters that control the mixing of waters from various locations. However, the available information regarding the distribution of contamination in the two layers of the surficial aquifer suggested that the mixing of uncontaminated water with any contaminated water pumped by wells would significantly reduce contaminant concentrations. This prediction was substantiated by the observation of a maximum concentration of 10 micrograms per liter VC in water samples of the dewatering effluent collected for laboratory analysis prior to treatment.

US DOE also selected Option 3 (Table 1), which involved leaving the dewatering to the municipality's construction contractor and taking responsibility for receiving and treating the dewatering effluent. Accommodating the receipt and treatment of the effluent required the installation of a 701-meter (2,300-foot) underground water transmission pipeline from the southeastern corner of the site to a water treatment area in the central part of the site, upgrades to the water treatment system, a portable pumping station, two pairs of temporary surge/settling tanks, and two underground pipelines beneath the two adjacent roadways to transfer potentially contaminated water back onsite for treatment. The water was treated in a shallow-tray air stripper to meet discharge standards of the public-owned treatment works. This system was designed to operate around the clock with 100-percent component redundancy to ensure that system failure would not cause construction delays for the municipality. The system performed as planned, treating dewatering effluent at a rate of up to 76 liters per minute (20 gallons per minute) continuously for 6 weeks.

The potential for future claims by construction workers was addressed during construction by performing field monitoring and inspection to document that no exposures occurred. This effort was also supported by the documentation of a maximum VC concentration of 10 micrograms per liter in untreated effluent.

METHODS

Regulatory Compliance

US DOE negotiated with FDEP to implement a risk-based corrective action approach for the Building 100 Area. This approach involved developing a plume stability monitoring plan for the two offsite plumes and implementing institutional controls for both the STAR Center and the offsite properties, with the ultimate objective of attaining a conditional risk-based closure.

DISCUSSION

Regulatory Compliance

The institutional control preferred by FDEP is a restrictive covenant, which is a two-party agreement between FDEP and the property owner that clarifies FDEP's enforcement authority. US DOE has taken the lead to coordinate between each property owner and FDEP and assist the property owner in preparing the restrictive covenant for their property. To date, restrictive covenants have been completed for two properties and are near completion for two others.

US DOE also proactively addressed development of a plume stability monitoring plan to demonstrate that both plumes are no longer expanding, which is a requirement for a risk-based closure under Florida rules. After 2 years of monitoring the plumes, it appears that the plumes are not entirely stable, which led US DOE to proceed with a more proactive approach for plume control. Specifically, an enhanced bioremediation project was completed to accelerate naturally occurring biological degradation of the groundwater contaminants. This activity consisted of injecting emulsified vegetable oil and a microbial culture to augment the indigenous bacteria that are known to degrade VC to ethene. This process has been performed on four other occasions around the facility, with contaminant concentrations at two of the locations approaching groundwater cleanup standards. Additional enhanced bioremediation events are planned for the impacted offsite properties, as well as for the inferred source areas beneath Building 100 via permanent horizontal wells.

METHODS

Community Relations

DOE has aggressively worked with the regulators, the stakeholders, and the community to establish trust and cooperation in working together toward environmental restoration and beneficial reuse.

DISCUSSION

Community Relations

Owners of two of the impacted offsite properties filed damage claims based on the presence of contaminated groundwater on their property, contending that this situation resulted in loss of property value. US DOE responded by reaching out and ultimately settling the claims, as well as forming a teaming arrangement to mutually manage the terms of future corrective actions. US DOE has also developed an excellent relationship with each of the other property owners by maintaining good communication, providing accurate data, and addressing other requests in a timely manner.

CONCLUSIONS

US DOE aggressively responded to the discovery of offsite contamination originating on the

former Pinellas Plant property and actively engaged the owners of the impacted offsite properties to develop teaming relationships for mutually managing the responsibilities associated with corrective actions. All parties stand to benefit from the cooperative approach toward the mutual goals of environmental restoration and beneficial reuse.

REFERENCES

1. US DOE (US Department of Energy), 2008. *Dewatering Evaluation Report for Road Construction and Water Line Replacement Along Belcher and Bryan Dairy Roads*, LMS/PIN/N01113, June.