LMS/PIN/N01058-17.0

Pinellas County, Florida, Site Long-Term Surveillance and Maintenance Plan

September 2024

U.S. DEPARTMENT OF ENERGY | Legacy Management

This document has been designed for online viewing.

Contents

Figures

Tables

Appendixes

Abbreviations

CFR	*Code of Federal Regulations*
CMIP	Corrective Measures Implementation Plan
COPC	contaminant of potential concern
CTL	cleanup target level
DOE	U.S. Department of Energy
DRC	Declaration of Restrictive Covenant
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
FAC	*Florida Administrative Code*
FDEP	Florida Department of Environmental Protection
FS	*Florida Statutes*
ft	feet
ft/day	feet per day
GEMS	Geospatial Environmental Mapping System
HSWA	Hazardous and Solid Waste Amendments
IC	institutional control
JSA	job safety analysis
LM	Office of Legacy Management
LMS	Legacy Management Support
LTS&M	long-term surveillance and maintenance
LTS&M Plan	Long-Term Surveillance and Maintenance Plan
MCL	maximum contaminant level
mg/L	milligrams per liter
MOA	memorandum of agreement
PCIC	Pinellas County Industrial Council
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
ROW	right-of-way
SRCO	Site Rehabilitation Completion Order
STAR Center	Young - Rainey Science, Technology, and Research Center
SWMU	solid-waste management unit
WWNA	Wastewater Neutralization Area

1.0 Introduction

This Long-Term Surveillance and Maintenance (LTS&M) Plan documents the planning process and requirements for the long-term care, or legacy management, of the U.S. Department of Energy (DOE) Pinellas County, Florida, Site (hereafter Pinellas Site) located in Largo, Florida.

The DOE Office of Legacy Management (LM) is responsible for environmental restoration under a Hazardous and Solid Waste Amendments (HSWA) corrective action permit for the Pinellas Site, which is enforced by the Florida Department of Environmental Protection (FDEP) in accordance with the Resource Conservation and Recovery Act (RCRA) (Title 42 *United States Code* 6901 et seq. [42 USC 6901 et seq.]).

1.1 Location

The Pinellas Site is located in Pinellas County at the intersection of Bryan Dairy Road and Belcher Road (Figure 1). The facility lies in the northeast quarter of Section 13, Township 30 South, Range 15 East, and has a physical address of 7887 Bryan Dairy Road, Largo, Florida 33777.

1.2 Site Description

The Pinellas Site is home to the Young - Rainey Science, Technology, and Research (STAR) Center, which is owned and operated by the Pinellas County Industrial Development Authority and managed by the county's Economic Development Department. The STAR Center is a thriving industrial park with a focus on technology companies, housing more than 20 businesses and 1700 employees.

Administration of DOE activities at the facility remains the responsibility of LM. The Legacy Management Support (LMS) contractor provides technical support to LM for remedial actions and closure of all active solid-waste management units (SWMUs) onsite.

1.3 Site History

The Pinellas Plant was constructed in the mid-1950s as part of a nationwide nuclear weapons research, development, and production complex. The facility, while owned by DOE, primarily manufactured non-nuclear weapons parts, including radioisotope-powered thermoelectric generators, thermal batteries, specialty capacitors, crystal resonators, neutron detectors, lightning-arrestor connectors, and vacuum-switch tubes.

As a result of historical waste disposal practices and leaks during DOE operations, portions of the subsurface and the shallow surficial aquifer were contaminated with organic solvents and metals.

The Pinellas Plant ceased operations in 1994 and DOE sold the facility to the Pinellas County Industrial Council in 1995. The sales contract included clauses to ensure continued compliance with federal, state, and local regulations while DOE remediated the site.

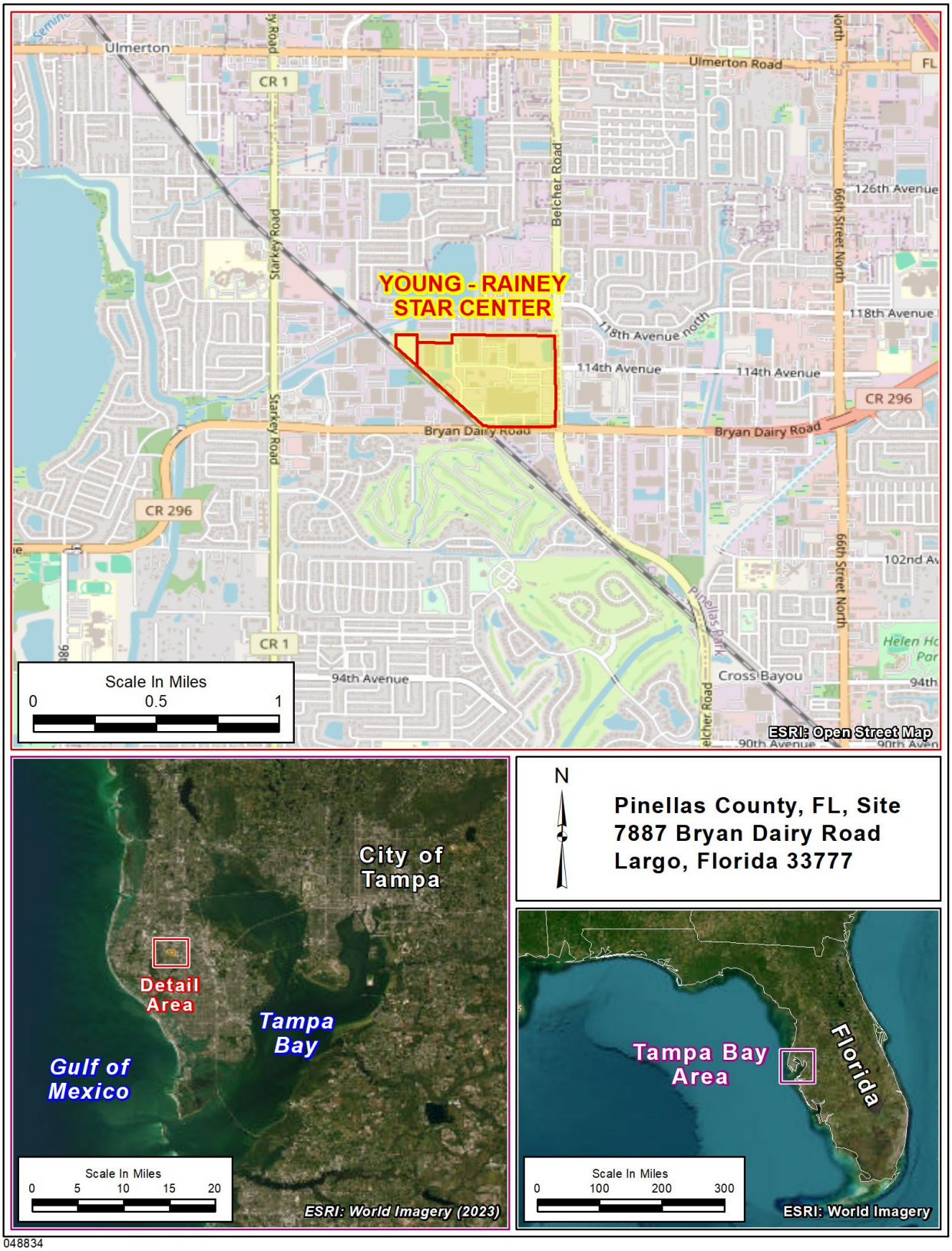

Figure 1. Young - Rainey STAR Center Location

The contaminated areas are designated as SWMUs. A total of 17 SWMUs were identified and investigated at the site. Fifteen SWMUs were identified during the original RCRA Facility Assessment and two additional SWMUs were identified later. A listing of all the SWMUs and current status is included in Appendix A.

- During the RCRA Facility Investigation (RFI) DOE recommended, and the U.S. Environmental Protection Agency (EPA) Region IV and FDEP approved, no further action decisions for 12 of these SWMUs.
- Another SWMU, the West Fenceline Area was remediated and closed with No Further Action in 1997.
- Two of the SWMUs, the Northeast Site and the Wastewater Neutralization Area, were conditionally closed in July 2016.
- The two remaining SWMUs—the Old Drum Storage Area and the Industrial Drain Leaks-Building 100—have contamination in the surficial aquifer groundwater at levels that exceed cleanup standards. These two SWMUs are collectively known as the Building 100 Area.

The 4.5 Acre Site was not considered a SWMU under the permit because it was not owned by DOE. It was remediated as a voluntary cleanup under a remediation agreement between DOE and FDEP. The 4.5 Acre Site was closed with no conditions in September 2019.

Details on the major SWMUs, including the Northeast Site, the Wastewater Neutralization Area, and Building 100 Area, and the 4.5 Acre site, can be found in Section 3.0 and Appendix B.

1.4 Regulatory Setting

In 1987, the EPA performed a RCRA Facility Assessment (RFA) (EPA 1988) at the site to gather information on potential releases of hazardous materials. In February 1990, EPA issued a HSWA permit to DOE. The permit required DOE to investigate and perform remediation activities in areas contaminated by hazardous materials resulting from DOE operations.

In 2000, the State of Florida received HSWA authorization from EPA, and FDEP issued a new HSWA permit to DOE in 2002. Groundwater standards for the Pinellas site are the applicable FDEP cleanup target levels.

FDEP global Risk-Based Corrective Action (RBCA) regulations were codified in 2005, under *Florida Administrative Code* Section 62-780 (FAC 62-780). The purpose of this regulation is to apply the default cleanup target levels provided in Section 62–777 statewide. In 2007, FDEP issued a revised HSWA permit to the Pinellas site, which incorporated the global RBCA regulations. The current 10-year HSWA permit, reissued in 2021, expires on January 10, 2032.

The RCRA HSWA permit requires investigation and, if necessary, remediation of releases of any hazardous waste or hazardous constituents from any SWMU at the facility. Specific conditions of the permit detail the duties of the permittee, including mitigating future releases to the environment; properly operating and maintaining facilities and treatment systems; providing information, records, and reports in a reasonable time frame and as specified in the permit; and allowing inspections by FDEP or an authorized representative of the agency.

Specific conditions also include the 24-hour reporting requirements for an imminent or existing hazard to human health or the environment. The remaining portions of the permit describe various plans, implementation and reporting requirements, modifications, approvals, and dispute-resolution processes.

The current HSWA permit is available on the DOE public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

2.0 Purpose and Scope

This LTS&M Plan explains how DOE will fulfill its obligation to manage long-term residual hazards at the site. Long-term surveillance and maintenance (LTS&M) tasks at the site include conducting long-term monitoring; meeting all regulatory requirements; conducting maintenance, inspection, and enforcement of the land and groundwater use restrictions and other ICs; ensuring the continued operation, inspection, and maintenance of engineered controls; identifying and implementing actions to optimize remedies and LTS&M activities; and preventing human and environmental exposure to potentially contaminated effluent from possible future dewatering activities in the vicinity of the groundwater contaminant plumes.

3.0 Overview of Remedial Action History

This section presents an overview of the most recent remedial action history for the major SWMUs at the site, including Building 100, the Northeast Site, and the Wastewater Neutralization Area, plus the same for the 4.5 Acre Site. More detailed background information for these four areas is included in Appendix B.

3.1 Building 100 Area

The Building 100 Area represents the only remaining active SMWUs and is made up of two SWMUs: the Industrial Drain Leaks/Building 100 (PIN12) and the Old Drum Storage Site (PIN06) (Figure 2).

Building 100 covers approximately 11 acres and is near the southeast corner of the STAR Center (Figure 2). This building housed the majority of the laboratory and production facilities during DOE ownership of the facility. Building 100 contained drain systems used for health physics, chemical, sanitary, and storm water wastes. Leaks from these drain systems caused some of the contamination at the Building 100 Area. The drain systems were flushed, grouted, and abandoned by 1997, and some of the chemical drain systems were replaced by an above-ground system that currently is in use (DOE 1997).

The Old Drum Storage Site is located at the northwest corner of the Building 100 Area and is the former location of a concrete storage pad. This area was equipped with a drain and containment system and was used to store hazardous waste. The waste stored at this location included methylene chloride, ignitable liquids, arsenic, and calcium chromate solids. Empty drums containing residual waste solvents also were stored in this area.

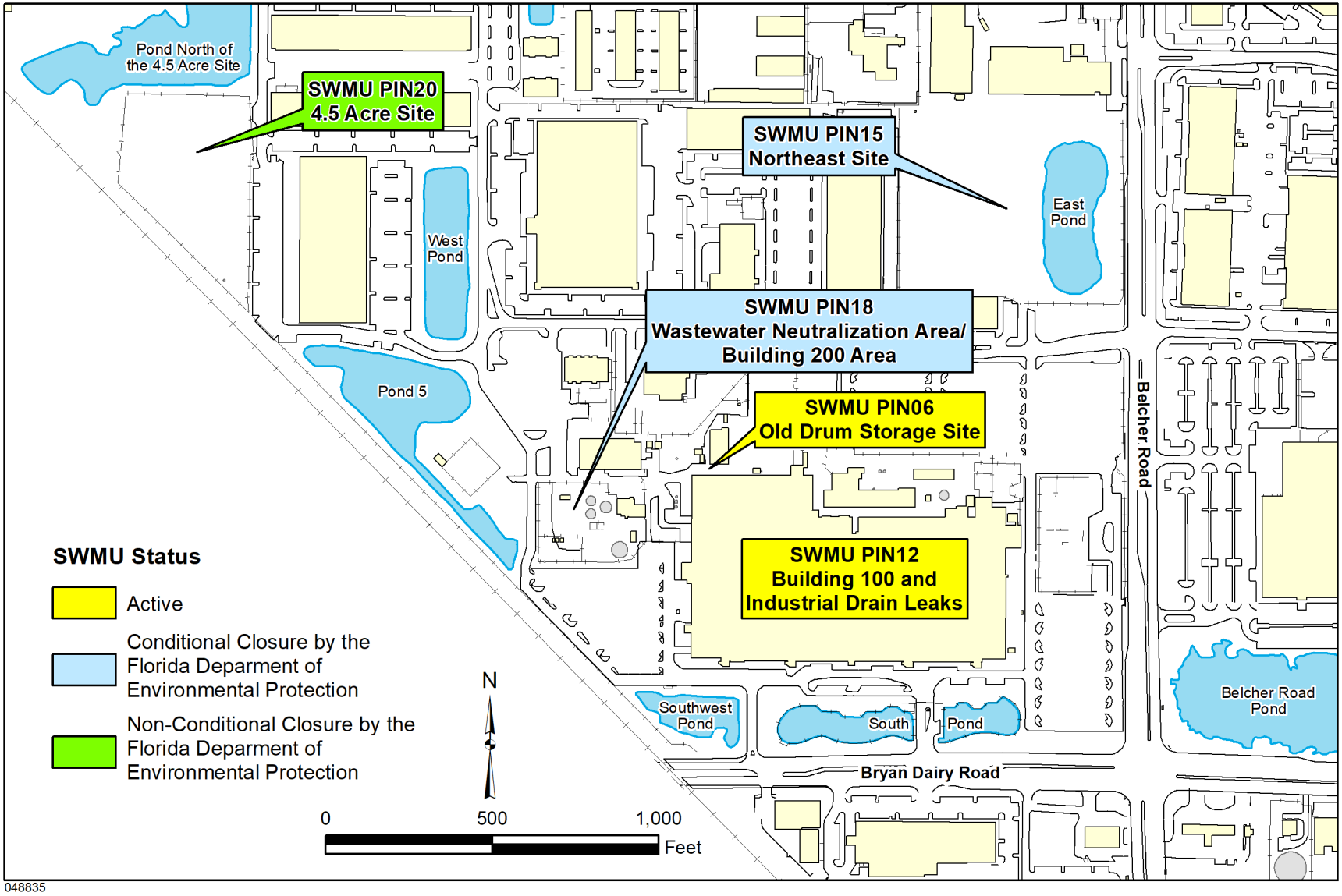

Figure 2. Location of STAR Center Major Solid Waste Management Units (SWMUs)

Several remedial actions were completed for Building 100. These remedial actions are more fully described in Appendix B.

Groundwater contamination at the Building 100 Area resulted from historical leaks of underground drain lines located beneath the building and from leaks or spills at the former drum storage pad near the northwest corner of the building. A groundwater extraction and treatment system operated at the Building 100 Area from 1997 to 2005. This system extracted contaminated groundwater through two recovery wells adjacent to the building and treated it with an air-stripper treatment system. Studies conducted in 2005 showed that the treatment system did not contribute significantly to plume containment or mass removal and it was shut down. By 2012, additional monitoring identified that the groundwater plume extended offsite, with one leg of the plume extending to the south and one to the east. To address this contamination, DOE has used enhanced biodegradation to treat the volatile organic compounds (VOCs) in the contaminated groundwater plume, including the south and east plumes. Injection of emulsified soybean oil was conducted on the STAR Center property in 2014, on the offsite properties in 2015, and beneath the building in November 2015. Additional onsite and offsite bioinjection activities were completed in 2016, 2017, and 2019, and monitoring is ongoing. To date, these activities are successfully reducing VOCs in the groundwater and additional bioinjections may be conducted if data indicate a need.

DOE's priority is to minimize or eliminate the potential for human exposure to contaminated groundwater using physical controls and ICs and to maintain plume stability by repeating enhanced in situ bioremediation as needed.

3.2 Northeast Site

The Northeast Site is located in the northeast corner of the STAR Center (Figure 2). In the late 1960s, before construction of the East Pond in 1968, drums of waste and construction debris were disposed of in the swampy area in the northeast corner of the Pinellas Plant. In 1986, an expansion of the East Pond was initiated to create additional storm water retention capacity, but excavation activities ceased when contamination was detected directly west of the pond. EPA identified the Northeast Site as a SWMU (PIN15) (EPA 1992).

Several remedial actions were completed for the Northeast Site. These remedial actions are more fully described in Appendix B.

DOE submitted the *Site Rehabilitation Completion Report with No Further Action Proposal for the Northeast Site* (DOE 2013) to FDEP in May 2013. That document proposed a risk-based closure for the Northeast Site under the State's RBCA regulations. FDEP tentatively approved that document pending finalization of ICs. An IC in the form of a Declaration of Restrictive Covenant (DRC) was finalized in September 2015. FDEP executed a Conditional SRCO for the Northeast Site on July 27, 2016, stating that no further action is required once all existing monitoring wells were plugged and abandoned. The specified wells were abandoned in June 2016, as approved by FDEP in anticipation of the Conditional Site Rehabilitation Completion Order (SRCO). The SRCO is included on the DOE public webpage at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

3.3 WWNA

The WWNA/Building 200 Area (PIN18) includes the STAR Center's Industrial Wastewater Neutralization Facility, the area south of the facility (including the parking lot) and Building 200 (Figure 2). In April 1993, the WWNA and the Building 200 Area were identified as potential SWMUs, and an RFA was conducted (EPA 1994). The RFA recommended that the WWNA and Building 200 be considered one SWMU. RFI field activities began in September 1994 and included soil characterization, monitoring well installation, and groundwater sampling. Arsenic was identified as the major contaminant of potential concern (COPC). Trichloroethene and vinyl chloride were detected at low concentrations in groundwater and were subsequently dismissed as COPCs once their concentrations decreased below cleanup levels.

Several remedial actions were completed for the WWNA. These remedial actions are more fully described in Appendix B.

A DRC was completed in September 2015. FDEP executed an SRCO for the WWNA on July 27, 2016, stating that no further action is required once all existing monitoring wells are plugged and abandoned. The specified wells were abandoned in June 2016, as approved by FDEP in anticipation of the Conditional SRCO. The SRCO is included on the DOE public webpage at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

3.4 4.5 Acre Site

The 4.5 Acre Site (PIN20) is a former part of the Pinellas Plant west of the STAR Center (Figure 2). This parcel, located adjacent to the northwest property boundary of the STAR Center, was owned by DOE from 1957 to 1972, when it was sold to a private landowner. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents.

The 4.5 Acre Site was not considered a SWMU under the permit because it was not owned by DOE. It was remediated as a voluntary cleanup under a remediation agreement between DOE and FDEP. This agreement was signed in 2001 and allowed DOE to arrange access to the property until cleanup of contaminated groundwater in the surficial aquifer is complete. Because the 4.5 Acre Site is privately owned, regulatory enforcement was managed by FDEP under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), but enforced consistent with RBCA regulations.

After several remedial actions which are described in Appendix B, post-active remediation monitoring was conducted until reductions in COPC concentrations to below the standard cleanup target levels (CTLs) in groundwater at the 4.5 Acre Site were achieved.

On September 16, 2019, FDEP issued a SRCO for No Further Action at the 4.5 Acre Site. The order stated that DOE has satisfied the site rehabilitation requirements for the 4.5 Acre Site and is released from any further obligation to conduct site rehabilitation.

The SRCO is included on the DOE public webpage at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

4.0 Site Conditions

4.1 Site Hydrology

The STAR Center is on the western coastal plain of the Florida Peninsula. The subsurface at the STAR Center comprises three distinct hydrogeologic units. These hydrogeologic units, in descending order, are the undifferentiated surficial deposits (the surficial aquifer), an intermediate confining unit (the Hawthorn Group), and a lower limestone unit (the Upper Floridan aquifer).

The uppermost (i.e., most recent) deposits are known as the surficial sediments and are composed predominately of fine sand with varying amounts of silt and clay. At the STAR Center, the surficial sediments range in thickness from about 25 to 40 feet (ft). At the Building 100 Area, the surficial sediments have been observed up to 40 ft thick. At the base of the surficial aquifer, there is a discontinuous layer of clayey sand that represents the transition zone between the surficial sediments and the underlying Hawthorn Group (Hawthorn). The saturated portion of the surficial sediments is known as the surficial aquifer. At the STAR Center, no groundwater is obtained from the surficial aquifer for drinking or irrigation because of the poor yield of the aquifer and poor quality of the water.

The surficial aquifer at the STAR Center acts as a two-layer hydraulic system due to a fine, discontinuous, clayey sand lens, of variable thickness and shell content, that has been observed in the middle portion (vertically) of the surficial deposits. The tendency of water levels in wells screened in the shallow portion of the surficial aquifer to differ from those in wells screened in the underlying deep surficial aquifer indicates a horizontal-to-vertical anisotropy with regard to the aquifer's hydraulic conductivity. On the basis of such observations, a representative vertical hydraulic conductivity for the aquifer is expected to be about 0.1 to 0.01 of the horizontal value. Aquifer testing indicates that the horizontal hydraulic conductivity for the surficial aquifer ranges from 0.1 to 3 feet per day (ft/day) at the site and averages about 1 ft/day (DOE 1991). Groundwater movement between the shallow and deep portions of the surficial aquifer is primarily controlled by the amount of recharge from rainfall.

The Hawthorn underlies the surficial sediments and is about 70 ft thick. It is an aquitard that separates the surficial aquifer from the underlying Upper Floridan aquifer. A weathered limestone and dense clay layer is often present at the top of the Hawthorn. This layer is typically less than 3 ft thick and is laterally discontinuous. Silty, sandy, phosphatic clay of variable thickness underlies the silty clay and limestone. Below that, dry clay with up to 50% carbonate inclusions and fissile layers is present. The hydraulic conductivity of the Hawthorn is several orders of magnitude lower than that of either the surficial or Floridan aquifers (DOE 1991). Measurements in 2007 (DOE 2007) indicated a hydraulic conductivity of about 0.0002 ft/day. Studies have concluded that surficial aquifer contamination was very unlikely to affect the underlying Floridan aquifer (DOE 1991).

Static water level measurements are taken semiannually at all accessible wells, piezometers, and ponds at the STAR Center. The five site ponds are artificial and exist for the purpose of collecting storm water runoff from parking lots and buildings and are in hydraulic communication with the shallow surficial aquifer.

The depth to groundwater typically ranges from about 2 to 5 ft below land surface but can be near land surface following significant rainfall events. Groundwater and surface-water elevations are used to construct groundwater contour maps of the site.

At Building 100, shallow groundwater flows to the southeast under a very slight gradient. This flow pattern has remained consistent for many years. The estimated hydraulic gradient is approximately 0.002 feet per foot. Calculations using the approximations mentioned above indicate that groundwater flow beneath the building is estimated to be about 2 to 3 feet per year. However, a pumping test conducted in 2009 near the southern property boundary of the Building 100 Area resulted in an estimated hydraulic conductivity value of about 7 ft/day; this higher value may indicate that significant preferential flow pathways exist in this area.

4.2 Site Contaminant Distribution

4.2.1 Contaminants of Potential Concern

Table 1 lists the COPCs and their CTLs. The COPCs listed in Table 1 were determined from a review of site data and regulatory documents for the STAR Center and the 4.5 Acre Site as described in the *Historical Review and Evaluation of Contaminants of Potential Concern* (DOE 2003). Arsenic was added as a COPC for the Building 100 Area and 4.5 Acre Site in 2005, but sampling for arsenic was discontinued in 2008 because concentrations were all below the CTL. A limited amount of radiological material was used during operations at the Pinellas Plant. A comprehensive sitewide sampling for tritium during the RFI in 1990 and 1991 demonstrated that concentrations were below applicable standards, so tritium was eliminated as a contaminant of concern for all SWMUs.

Plume delineation conducted east of Building 100 in May and June 2011 showed that 1,4-dioxane is present both onsite and offsite at concentrations above its CTL. As a result, FDEP requested in August 2011 that 1,4-dioxane be added as a COPC for the Building 100 Area (Table 1).

Table 1. Contaminants of Potential Concern and CTLs

COPC	FDEP CTLs in Groundwater (µg/L) (onsite/offsite)[a]
Building 100 Area	
Trichloroethene	30/3.0
1,1-Dichloroethene	70/7.0
cis-1,2-Dichloroethene	700/70
trans-1,2-Dichloroethene	1000/100
Vinyl chloride	10/1.0
1,4-Dioxane	32/3.2

Note:
[a] Onsite CTLs are poor groundwater quality CTLs.

Abbreviation:
µg/L = micrograms per liter

While older documents for the Pinellas Site have compared groundwater contaminant concentrations to drinking water standards (i.e., maximum contaminant level [MCLs]), those standards are not the applicable default CTLs for evaluating site remediation under RBCA regulations. A comprehensive review of background data for the site indicated that aluminum and iron levels in the shallow groundwater at the site are naturally elevated and exceed the State of Florida Secondary Drinking Water Standards (FAC 62-550). Specifically, the average background concentration of 1.1 milligrams per liter (mg/L) for aluminum exceeds the 0.2 mg/L secondary standard, and the average background concentration for iron (9.3 mg/L) exceeds the 0.3 mg/L secondary standard. The ambient shallow groundwater in the area is therefore designated as "poor quality" as defined in FAC 62-780.200(35). Thus, the applicable groundwater CTLs are those for groundwater of "low yield/poor quality" provided in Table 1 of FAC 62-777. These CTL values are higher than the MCL values for site COPCs by a factor of 10. The FDEP has allowed use of the poor water quality CTLs onsite but requires that the default CTLs apply to offsite areas.

4.2.2 Groundwater Contaminant Plume

Contaminant plume maps for the Building 100 Area are included in the annual groundwater report. The interpreted plume footprint includes wells in which any individual COPC exceeded its CTL (Table 1). The annual groundwater reports can be found on the DOE public webpage at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

5.0 Long-Term Surveillance and Maintenance

5.1 Surveillance and Maintenance Implementation

This LTS&M Plan implements long-term components of remedies selected for the STAR Center. The purpose of the LTS&M Plan is to meet the general objectives listed in Section 2.0, "Purpose and Scope."

DOE will maintain protection of human health and the environment at the STAR Center through a combination of activities, including conducting regular inspections and land use reviews; conducting environmental monitoring, sampling, and other site operations and maintenance activities; and maintaining ICs and regulatory compliance.

5.2 Site Inspections and Land Use Reviews

DOE performs routine surveillance and maintenance of the assets, remedies, and ICs under DOE control. A facility map (Figure 3) that shows the location of the SWMUs, the monitoring wells, and the locations of the offsite impacted properties will be used for the land use review.

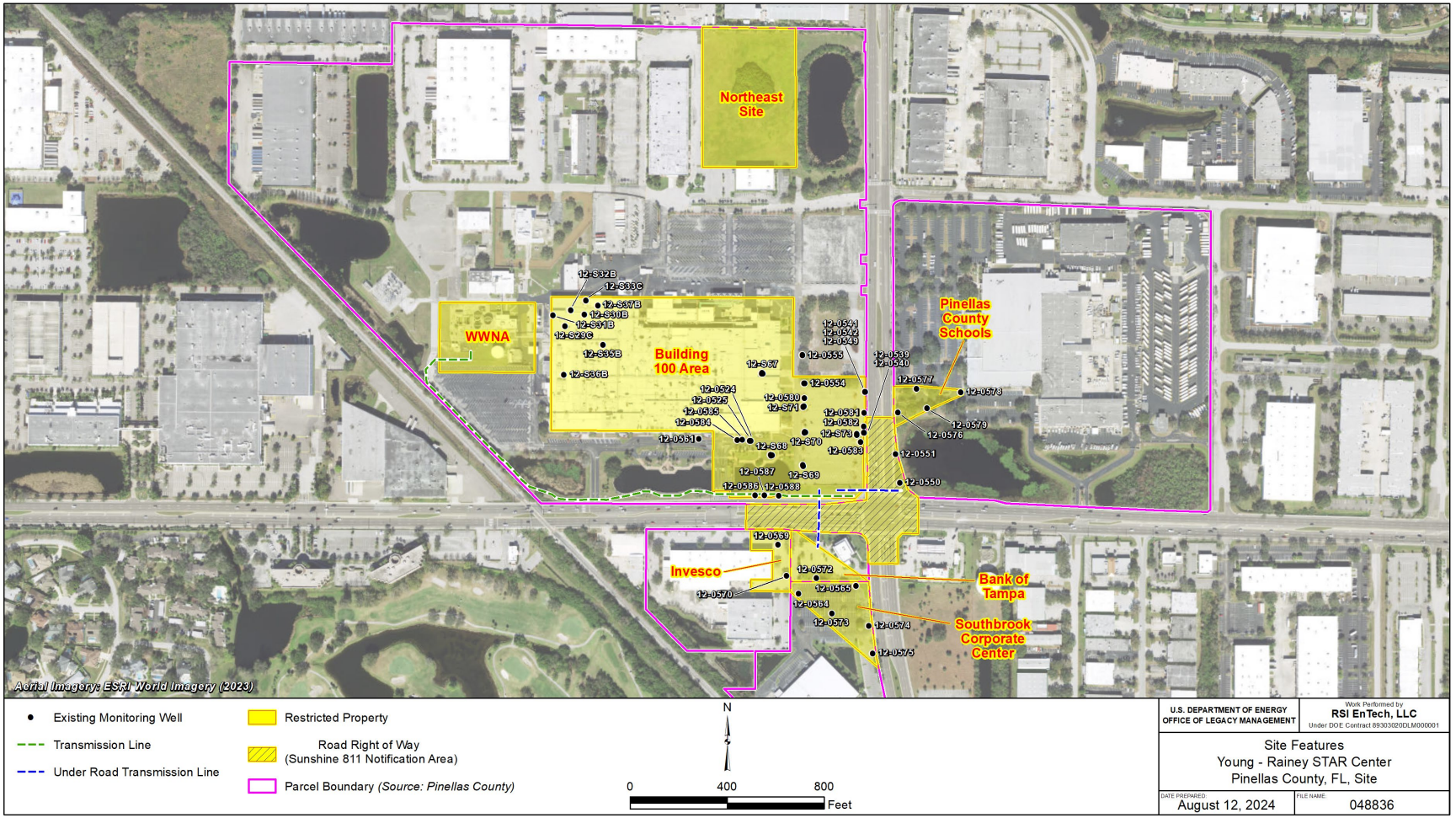

Figure 3. Facility Map

5.2.1 Annual Land Use Review

DOE conducts an annual land use review to confirm that land use remains in compliance with the terms of the easement or agreement and the associated restrictions for each property. This review is performed as a best management practice and includes contacting the property owners by phone or email to maintain annual contact with the representatives responsible for IC and land use matters. This annual contact is used to maintain awareness of the ICs by reviewing the requirements and restrictions with each property representative. The physical locations addressed by ICs will also be observed during the land use review. DOE will also evaluate whether the ICs remain effective in protecting human health and the environment and will take appropriate action if evidence indicates the controls are not effective. DOE also performs recurring (typically weekly) inspections of the site.

5.2.2 Engineering Control Maintenance Inspection

The annual inspection of the Building 100's engineering control (the building's concrete floor) is required by the DRC between Pinellas County and FDEP. DOE assists the STAR Center with this inspection. The engineering control and requirements are described in the engineering control maintenance plan for the Building 100 Area, which is included as Exhibit C to the DRC. The DRCs are discussed in Section 6.0.

5.2.3 Annual Monitoring Well Inspection

All monitoring wells, the inactive recovery well (discussed in Appendix B), horizontal well vaults, piezometers, and staff gauges at the STAR Center are inspected annually.

The interior and exterior conditions of each well and vaults are checked. The inspectors check the well access, identification tag or label, cover, lock, concrete pad, location, and other conditions, and describe any well damage or changes to the well that require maintenance or repair. In addition, site controls on access to the wells (see Section 5.3) will be inspected as part of the well inspection process.

Wells where issues requiring repair are identified, will be repaired within a 2-week period, as feasible. Well repairs will be documented in the annual groundwater reports that are submitted to FDEP.

5.3 Routine Site Maintenance and Operations

Site maintenance will consist of activities such as DOE-owned infrastructure maintenance and repair. Monitoring wells, horizontal wells, and the inactive recovery well are inspected annually for security and maintenance items. DOE's inactive, underground water transmission lines were inspected in 2024 with a camera (both 6-inch diameter lines) and a pressure test (2-inch diameter line) and found to be in good condition.

The Building 100 Area monitoring wells are located both inside and outside the building. The wells are secured with locks or bolt-down covers.

5.4 Environmental Monitoring

Semiannual groundwater monitoring is conducted in the spring and fall, typically in March and September. Samples are analyzed for the COPCs listed in Section 4.2.1. Results are used to evaluate the performance of these remedial actions for Building 100. The details of the environmental monitoring program for the Building 100 Area are outlined in the annual groundwater monitoring reports which are available on the DOE public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

5.5 Reporting

DOE prepares and submits an annual Building 100 Area monitoring report to FDEP. This report provides results of recent (spring and fall) groundwater monitoring activities, an interpretation of the analytical data, results of well inspections, results of the latest groundwater model evaluation, optimization of the monitoring program, and a summary of ongoing and projected work. The annual reports are available on the DOE Public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

DOE also prepares a land use inspection report which documents the results of the annual land use review and includes photographs and observations or findings.

6.0 Institutional Controls for the Pinellas Site

ICs are nonengineered instruments, such as administrative and legal controls, that help to minimize the potential for exposure to contamination or protect the integrity of a response action, or both.

FDEP requires ICs to be in place for all impacted properties associated with the groundwater contaminant source before granting a conditional closure. The State of Florida's preferred legal instrument for ICs is a restrictive covenant, documented as a DRC, which is a two-party agreement between FDEP and the property owner, clarifying FDEP's enforcement authority regarding corrective actions under the HSWA permit.

These DRCs are an agreement between the landowners and FDEP to ensure continued protection of human health and the environment and to provide access to FDEP for future inspection of the properties.

Because DOE does not own any of the properties affected by the groundwater contamination and is not party to the DRCs between FDEP and landowners, DOE entered into separate ICs (e.g., easements, access agreements, memoranda of agreement [MOAs]) with the landowners to enforce similar groundwater-use controls to those in the state's DRCs to better control DOE's liability.

Table 2 summarizes the FDEP DRCs that are in place for each impacted property and the associated grantors.

Table 2. FDEP DRCs

FDEP DRC Summary and Recording Information			
Property	**FDEP DRC**	**Grantor/Grantee**	**Book/Page**
STAR Center	Northeast Site DRC	Grantor: Pinellas County Grantee: FDEP	Book: 18926 Pages: 880–888
	B100 DRC	Grantor: Pinellas County Grantee: FDEP	Book: 18926 Pages: 850–869
	WWNA DRC	Grantor: Pinellas County Grantee: FDEP	Book: 18926 Pages: 870–879
Invesco (formerly BCH-1)	DRC	Grantor: BCH-1 Ltd. Grantee: FDEP	Book: 18785 Pages: 1080–1087
Bank of Tampa	DRC	Grantor: Bank of Tampa Grantee: FDEP	Book: 18439 Page: 570
Walter Pownall Services Center—Pinellas County Schools	DRC	Grantor: Pinellas County Schools Grantee: FDEP	Book: 18470 Pages: 1180–1187
Southbrook Corporate Center	DRC	Grantor: Southbrook Corporate Center Grantee: FDEP	Book: 22125 Page: 1618

DOE ICs are in the form of easements and covenants to restrict use, access agreements, or MOAs. Table 3 summarizes the easements and agreements that DOE maintains with each impacted property owner.

Table 3. DOE Easements and Agreements

DOE IC Summary and Recording Information			
Property	**DOE IC**	**Grantor/Grantee**	**Book/Page**
STAR Center	MOA	Grantor: Pinellas County Grantee: DOE	Signed 2015
Invesco	Easement and Covenant to Restrict Use	Grantor: Invesco Grantee: DOE	Book: 18091 Pages: 1964–1971
Bank of Tampa	Easement and Covenant to Restrict Use	Grantor: Bank of Tampa Grantee: DOE	Book: 18091 Pages: 1972–1979
Southbrook Corporate Center	Easement and Covenant to Restrict Use	Grantor: Southbrook Corporate Center Grantee: DOE	Book: 21139 Pages: 1659–1672
Pinellas County Schools	Access Agreement	Grantor: Pinellas County Schools Grantee: DOE	Renewed October 1, 2021

According to the DRCs, any dewatering activities on the restricted properties require a plan approved by FDEP. DOE is responsible for managing groundwater withdrawn from the restricted areas. Some restricted areas also require management of the soil if removed.

The IC documents are available on the DOE public webpage at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

The Belcher Road and Bryan Dairy Road rights-of-way (ROWs) require a mechanism that is acceptable to both FDEP and DOE to control access to the underlying contaminated groundwater. DOE joined the Florida Sunshine 811 “Call Before You Dig” program and activated the account in October 2021. Membership in this program serves as DOE’s de facto IC

for these ROWs near the STAR Center property. Receiving Sunshine 811 tickets provides LM with a process to protect human health and the environment and its under-road groundwater transmission lines when subsurface work in the ROWs could intersect groundwater potentially contaminated by former DOE operations at the Pinellas site.

7.0 Information Management

7.1 Data Management

The LMS contractor is responsible for managing and maintaining the environmental monitoring data and geospatial data in compliance with LM requirements. The data are produced mainly from groundwater sampling events.

Data are accessible at https://gems.lm.doe.gov/#site=PIN through the Geospatial Environmental Mapping System (GEMS). GEMS was designed to provide dynamic mapping and environmental monitoring data display tools for sites managed by the LM. The information made available and the environmental data display tools developed for GEMS are the result of input from various stakeholders including DOE and contractor staff, regulatory agencies, and members of the public. Spatial data are also available in GEMS, such as physical features and roads and nonphysical features such as the site boundary.

7.2 Records Management

The retention of records and dissemination of information over the long term is a critical aspect of legacy management. Records are managed consistent with legal and regulatory requirements and complies with the U.S. Office of Management and Budget, National Archives and Records Administration (NARA), and DOE guidance. LM manages records at the LM Business Center at Morgantown, West Virginia, a National Archives and Records Administration-certified facility for the storage of federal records.

8.0 Safety and Health

Health and safety procedures for LM activities at the site are consistent with DOE orders, regulations, applicable codes, and standards. The LM Integrated Safety Management System process serves as the basis for the LMS contractor's health and safety programs. For the purposes of integrated safety management, the definition of safety encompasses safety, health, and environmental protection, including pollution prevention and waste minimization.

Contractors and subcontractors performing work for LM at the Pinellas Site are required to comply with the LMS contractor's site specific health and safety plan. Work activities are controlled through the job safety analysis (JSA) process using the Integrated Safety Management System's five core functions for work planning and control to define the scope of work for a specific work activity, analyze the hazards identified with the activity, and develop and implement controls and protective equipment to mitigate those hazards. Work activities are performed within the controls of the JSA, and personnel are requested to provide feedback and

suggestions for continual improvements during the work process. Project personnel are required to review and understand the JSA prior to the start of work and add any additional identified hazards or concerns to the JSA, thereby integrating safety management into the workplace.

9.0 References

42 USC 6901 et seq. "Resource Conservation and Recovery Act," *United States Code*.

DOE (U.S. Department of Energy), 1991. *RCRA Facility Investigation Report, Pinellas Plant*, Environmental Restoration Program, Albuquerque Operations Field Office, Albuquerque, New Mexico, September.

DOE (U.S. Department of Energy), 1997. *Pinellas Plant Environmental Baseline Report*, prepared by Lockheed Martin Specialty Components Inc. for U.S. Department of Energy, Pinellas Area Office, June.

DOE (U.S. Department of Energy), 2003. Y*oung - Rainey STAR Center, Pinellas Environmental Restoration Project, Historical Review and Evaluation of Contaminants of Potential Concern*, GJO-2002-359-TAC, February.

DOE (U.S. Department of Energy), 2007. *4.5 Acre Site Source Characterization Data Report*, DOE−LM/1549−2007, Office of Legacy Management, December.

DOE (U.S. Department of Energy), 2013. *Site Rehabilitation Completion Report with No Further Action Proposal for the Northeast Site*, LMS/PIN/N01778, Office of Legacy Management, May.

EPA (U.S. Environmental Protection Agency), 1988. *RCRA Facility Assessment Department of Energy—Fl6 890 090 008*, June.

EPA (U.S. Environmental Protection Agency), 1992. Letter to DOE, Gerald W. Johnson, Approval of Pinellas Site Remedial Facility Investigation Report, April.

EPA (U.S. Environmental Protection Agency), 1994. *RCRA Facility Assessment Report, WWNA/Building 200 Area*, March.

FAC 62-550. "Drinking Water Standards, Monitoring, and Reporting," *Florida Administrative Code*.

FAC 62-777. "Contaminant Cleanup Target Levels," *Florida Administrative Code*.

FAC 62-780. "Contaminated Site Cleanup Criteria," *Florida Administrative Code*.

Appendix A

SWMU Information

Pinellas SWMU Table			
SWMU No.	**SWMU Name**	**Identification Time Period**	**Status**
PIN 02	West Pond	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 03	Spray Irrigation Site	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 04	Metallic Anomaly	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 05	Trench Site	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 06	Old Drum Storage Site	1990 RFA	Currently active
PIN 07	Pistol Range	1990 RFA	1993 RFI—No Further Action based on removal of lead soil
PIN 08	Closed Fire Department Training Tank	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 09	Incinerator Site	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 10	Incinerator Ditch	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 11	Diesel Fuel Spill	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 12	Industrial Drain Leaks—Building 100	1990 RFA	Currently active
PIN 13	Southwest Ditch	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 14	Current Fire Department Training Tank	1990 RFA	1991 RFI—No Further Action based on additional investigation
PIN 15	Northeast Site	1990 RFA	July 2016—SRCO: No Further Action with controls
PIN 16	Building 500 Spill Site	1992 RFI	1991 RFI—No Further Action based on additional investigation
PIN 17	West Fenceline Area	1992 RFA	1997 Remediated and No Further Action
PIN 18	WWNA	1993 RFA	July 2016—SRCO: No Further Action with controls

Note:
PIN 01 was not a SWMU, it was the location of sampling for collection of background information.

Abbreviations:
RCRA = Resource Conservation and Recovery Act
RFA = RCRA Facility Assessment
RFI = RCRA Facility Investigation
SRCO = Site Rehabilitation Completion Order
SWMU = solid-waste management unit
WWNA = Wastewater Neutralization Area

Appendix B

Remedial Action Background Information

This appendix presents background and detailed remedial action history for the three major SWMUs (Building 100, Northeast Site, and Wastewater Neutralization Area [WWNA]) and the 4.5 Acre Site. The 4.5 Acre Site was not considered a SWMU under the permit because it was not owned by the U.S. Department of Energy (DOE). It was remediated as a voluntary cleanup under a remediation agreement between DOE and the Florida Department of Environmental Protection (FDEP).

Building 100

The Building 100 Area is made up of two solid-waste management unit (SWMUs): the Industrial Drain Leaks/Building 100 (PIN12) and the Old Drum Storage Site (PIN06). Building 100 covers approximately 11 acres, and is near the southeast corner of the Young - Rainey Science, Technology, and Research (STAR) Center. This building is the most notable feature of the STAR Center, having housed the majority of the laboratory and production facilities during DOE ownership of the facility. Building 100 contained individual drain systems used for health physics, chemical, sanitary, and storm water wastes. Leaks from these drain systems caused some of the contamination at the Building 100 Area. The drain systems were flushed, grouted, and abandoned by 1997, and some of the chemical drain systems were replaced by an above-ground system that currently is in use (DOE 1997b).

The Old Drum Storage Site is located at the northwest corner of the Building 100 Area and is the former location of a concrete storage pad. This area was equipped with a drain and containment system and was used to store hazardous waste. The waste stored at this location included methylene chloride, ignitable liquids, arsenic, and calcium chromate solids. Empty drums containing residual waste solvents also were stored in this area.

The contaminants of potential concern (COPCs) for the Building 100 Area are trichloroethene (TCE), *cis*-1,2-dichloroethene (cDCE), *trans*-1,2-dichloroethene, 1,1-dichloroethene, vinyl chloride (VC), and arsenic. Arsenic is no longer monitored because concentrations do not exceed the 100 micrograms per liter (µg/L) poor water quality cleanup target levels (CTLs). The highest contaminant concentrations detected in groundwater are in the northwest area of the building.

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was conducted in 1991 at the Pinellas Plant to fulfill the requirements of the Hazardous and Solid Waste Amendments (HSWA) permit, and an RFI report was produced in 1991 (DOE 1991b). A subsequent RFI report addendum was completed in March 1992. Based on the findings in these two documents, in accordance with the HSWA permit, the U.S. Environmental Protection Agency (EPA) notified DOE of the requirement for a Corrective Measures Study (CMS) for the Old Drum Storage Site and the Industrial Drain Leaks/Building 100 SWMUs.

The CMS report (DOE 1994) for the Industrial Drain Leaks/Building 100 and the Old Drum Storage Site proposed remediation of these two SWMUs together (collectively referred to as the Building 100 Area). The report was submitted to EPA and was subsequently approved on June 9, 1994. FDEP approved the CMS report on January 18, 1995.

The CMS report concluded that pump-and-treat with the recovered groundwater sent to the Northeast Site treatment system was the preferred corrective measure for the Building 100 Area. This conclusion was based on shallow monitoring well data that suggested contamination was

confined to shallow groundwater at the northwest corner of the building. The *Building 100 Area Corrective Measures Implementation Plan* (DOE 1996a) describes the installation, operations, and monitoring of two recovery wells at the northwest corner of the building in 1995.

These recovery wells, PIN12-RW01 and PIN12-RW02, extracted groundwater and pumped the water through secondary containment piping to the Northeast Site treatment system for pretreatment, air stripping, and discharge to the STAR Center's Industrial Wastewater Neutralization Facility (IWNF) before transfer to the POTW.

Subsequent to recovery well installation, additional investigations were conducted by installing monitoring wells at multiple depths both outside the building and through the floor of the building. In 1996, these investigations were summarized in the *Building 100 Area Subsurface Investigation, Phases I, II, and III* (DOE 1996c) and the *Building 100 Area Data Report* (DOE 1996b). Results of these investigations indicated that significant contaminant concentrations were present at shallow, intermediate, and deep depths in the surficial aquifer under the building and that low levels of contamination were present at the south and east sides of the building. The *Building 100 Area Data Report* made the following recommendations:

- Continue operating the two recovery wells installed under the CMS/Corrective Measures Implementation Plan (CMS/CMIP)
- Conduct additional characterization under the building and east of the building
- Perform additional contaminant transport modeling
- Evaluate the potential for occurrence of dense nonaqueous phase liquid (NAPL)

The recommendations were addressed in the Building 100 Area CMIP Addendum (DOE 1998). The Northeast Site treatment system was decommissioned in April 2004 before thermal NAPL remediation at NAPL Area B, so a smaller air stripper treatment system was installed at the Northeast Site to treat the groundwater recovered via the two Building 100 Area recovery wells.

A pilot test study was conducted in 2003 to determine the effectiveness of biological enhancement for this site. Results of the pilot test, although positive, did not result in significant elimination of VC in low-concentration areas.

The *Building 100 Area Corrective Measures Study Report Addendum* was finalized in July 2006 (DOE 2006). The document concluded that DOE's original remediation objective of meeting maximum contaminant levels (MCLs) throughout the contaminant plume did not appear to be reasonable. At that time, it appeared that containment of the contaminant plume had been achieved, and it was determined that human health and the environment were protected.

The document proposed that institutional controls (ICs) be placed on the site property to prevent inappropriate groundwater use and the MCLs for site-related COPCs be applied as groundwater cleanup goals outside the IC boundary. Because the two existing groundwater recovery wells did not contribute significantly to either contaminant plume containment or mass removal, DOE also proposed shutting down these wells and the associated treatment system. Operation of these recovery wells and treatment system was terminated on August 21, 2006, with the approval of FDEP.

An interim remedial action plan *Interim Remedial Action Plan for Groundwater Pumping at the Building 100 Area* (DOE 2009e) was submitted to FDEP in March 2009 and approved in July 2009. The plan detailed the use of groundwater pumping to collect hydraulic information for a feasibility study to identify the most appropriate groundwater plume management technology for the Building 100 Area. One recovery well (12-RW03) was installed south of Building 100 and operated from July 2009 through May 2011. The contaminated groundwater captured by this well was transported to an onsite air stripper for treatment and subsequently discharged to the STAR Center's IWNF.

Pinellas County Utilities and Pinellas County Public Works initiated major utility line and road construction efforts, respectively, along both Bryan Dairy and Belcher Roads, that started in July 2011. When DOE was informed of this upcoming work in 2007, DOE installed new monitoring wells in this area in October 2007 and in January and February, 2008, to further define the plume. This investigation confirmed that the plume was offsite south of Bryan Dairy Road, on the county right-of-way. DOE performed the required notification to FDEP regarding the offsite plume.

Additional delineation confirmed that the contaminant plume extends south of Bryan Dairy Road onto the properties at 8040 Bryan Dairy Road, 10980 Belcher Road, and 10950 Belcher Road. The required offsite plume notifications for these properties were submitted to FDEP. Permanent monitoring wells were installed in the offsite areas in May 2011 to monitor the stability of the plume.

Additional delineation of the eastern plume at the Building 100 Area was conducted in 2011 and 2012. This work identified a contaminant plume extending from under the eastern edge of Building 100, past the eastern STAR Center property boundary under Belcher Road, and onto the property at 11111 Belcher Road. DOE performed the required notification to FDEP regarding the offsite plume. Elevated concentrations of 1,4-dioxane were measured during this work and, as a result, that compound was added as a COPC for the Building 100 Area.

DOE evaluated the effect that the Building 100 Area contaminant plume might have upon water line installation and road construction activities along the east and south sides of the STAR Center and chose to capture and treat groundwater collected and discharged by the County's dewatering contractor during waterline replacement and road construction activities (DOE 2008b). DOE began treating this water in July 2011, and treatment ended in January 2012. The extracted groundwater was transported to an onsite air stripper for treatment, and the treated water was discharged to the STAR Center's IWNF and subsequently discharged to the POTW. DOE also notified STAR Center personnel and Pinellas County Utilities regarding the discovery and potential discharge of 1,4-dioxane, which is not readily removed by air stripping. Routine monitoring of the treated effluent indicated that 1,4-dioxane concentrations were acceptable for discharge to Pinellas County Utilities.

The *Building 100 Area Site Assessment Report* (DOE 2012) summarizes the results of the plume delineation work conducted at the Building 100 Area and the adjacent private properties from 2007 to 2012. The action proposed in this document was to conduct plume stability monitoring of both the onsite and offsite plumes, and plume stability monitoring began with the March 2013 sampling event.

The sources of contamination at the Building 100 Area are leaks from drain lines that once ran beneath Building 100 (their exact locations are not known) and spills from the drum storage pad which had been at the northwest corner of Building 100. The extent of characterization beneath the building is limited, but historical information and groundwater monitoring results indicate that there might still be multiple source areas beneath the building. No source removal has been conducted because it is technically impracticable to access the subsurface for characterization or treatment beneath the occupied 11-acre building. Groundwater extraction and ex situ treatment activities were conducted from 1997 to 2006 using two recovery wells located near the northwest corner of Building 100. This action removed significant amounts of contaminants locally, but contaminant concentrations in monitoring wells located in the northwest and central parts of the building suggest that there may be non-aqueous phase TCE in the subsurface.

After the fourth plume stability monitoring event in September 2014, DOE determined that contaminant concentrations in the south plume were increasing and that remediation to treat both the south and east plumes should be implemented. The *Interim Corrective Measure Work Plan for Source and Plume Treatment at the Building 100 Area* (DOE 2014) was submitted to FDEP on October 2, 2014. The objective of this work was to enhance contaminant biodegradation in (1) the dissolved-phase contaminant plumes downgradient from the building on the STAR Center property, (2) the dissolved-phase contaminant plumes located on the offsite properties, and (3) the contaminant source areas and the high-concentration dissolved-phase contaminant plumes beneath the building.

The first phase of this work was conducted on the STAR Center property in October and November 2014 by injecting emulsified soybean oil and *Dehalococcoides mccartyi* in the southeastern portion of the property (i.e., the downgradient portions of the plumes) and near the northwest corner of Building 100 (upgradient from a likely contaminant source area). The second phase of this work was conducted by injecting these same amendments on three offsite properties in February 2015. With the implementation of enhanced bioremediation at the Building 100 Area, plume stability monitoring was suspended and replaced with performance monitoring of the remediation project.

The third phase of this work, amendment injection beneath the building, was implemented in summer and fall 2015. Eight horizontal wells (four stacked pairs) were installed beneath the building in July through September 2015. Amendment injection beneath the building then took place using the horizontal wells in November 2015.

A fourth enhanced bioremediation event, both beneath Building 100 and in the downgradient onsite and offsite areas, took place in January through March, 2017 (DOE 2016).

In September 2017, recovery wells 12-RW01 and 12-RW02 were abandoned in accordance with the requirements of the Southwest Florida Water Management District. All plumbing and piping were removed from the recovery well vaults in June 2018, and the remaining empty vaults are now property of the STAR Center.

Ongoing Building 100 Area monitoring in 2019 indicated that additional groundwater treatment was needed. The *Pinellas County, Florida, Site, Second Addendum to the Interim Corrective Measure Work Plan for Source and Plume Treatment at the Building 100 Area* (DOE 2019a)

describes the approach for implementing this treatment (i.e., in situ bioremediation). The work was conducted from August 2019 through December 2019 (DOE 2020).

Northeast Site

The Northeast Site is in the northeast corner of the STAR Center. In the late 1960s, before construction of the East Pond in 1968, drums of waste and construction debris were disposed of in the swampy area in the northeast corner of the Pinellas Plant. In 1986, an expansion of the East Pond was initiated to create additional storm water retention capacity, but excavation activities ceased when contamination was detected directly west of the pond. EPA identified the Northeast Site as a SWMU (PIN15) (EPA 1992). The *Interim Corrective Measures Study Northeast Site* (DOE 1991a) was developed and submitted to EPA, and approval of that document was received in October 1991.

An interim groundwater recovery system for the Northeast Site was installed and operation commenced in January 1992. The groundwater treatment system, as initially installed, consisted of four recovery wells equipped with pneumatic recovery pumps, a holding tank, centrifugal transfer pumps, and approximately 2500 feet (ft) of transfer and secondary containment piping. Recovered groundwater was transferred to the 4.5 Acre Site for treatment. During 1993, DOE proposed a reconfigured system for the site consisting of four shallow and three deep recovery wells. After EPA approved the upgrade, the system was reconfigured and became operational on March 1, 1994.

Between August and October 1995 a portion of the Northeast Site was excavated to remove debris, drums of waste, and other materials that could inhibit future corrective measures. Location of the areas of excavation was based primarily on the results of a geophysical survey and knowledge of existing utility locations. Detailed descriptions of the debris removal activities were submitted to EPA and FDEP as part of the *Northeast Site Interim Measures Quarterly Progress Report* (DOE 1996e).

In 1996, DOE submitted the *Northeast Site Corrective Measures Implementation Plan* (DOE 1996d) to EPA Region 4 and FDEP, and this plan was approved by both regulatory agencies in 1997. As part of the Northeast Site CMS and CMIP, a pump-and-treat system (in conjunction with a subsurface hydrogeologic barrier wall) was identified as the best available technology. The pump-and-treat system included a pretreatment system for iron removal, an air stripper unit, and a tank for holding treated groundwater before discharge to the STAR Center IWNF before transfer to the Publicly Owned Treatment Works (POTW). The treatment system was constructed in early 1997 and became operational by July 1997, processing groundwater from seven Northeast Site recovery wells and two Building 100 Area recovery wells.

The recovery well network evolved over time as some of the older wells were abandoned and new wells installed. The pump-and-treat system operated until April 2004. At that time, the system was decommissioned in preparation for a NAPL remediation project. The above-ground portion of the pump-and-treat system was removed and the recovery wells were abandoned in place.

During 1997, anaerobic bioremediation and rotary steam stripping pilot tests were conducted in the northern and southern portions of the Northeast Site, respectively. These tests were designed

by the Innovative Treatment Remediation Demonstration group of regulatory and industry members to evaluate remedial options at the STAR Center.

NAPLs were identified in a few monitoring and recovery wells in 1998. An *Interim Measures Work Plan for Remediation of Non-Aqueous Phase Liquids at the Northeast Site* (DOE 2001a) was submitted to FDEP in late November 2001. The purpose of this document was to present the plan to remediate NAPLs at two areas (NAPL Areas A and B) of the Northeast Site using a thermal remediation method. FDEP approved this document on January 10, 2002.

Construction of the NAPL Area A treatment system began in late May 2002, system startup occurred on September 26, 2002, and treatment was completed on February 28, 2003. The *Northeast Site Area A NAPL Remediation Final Report* (DOE 2003b) describes the thermal remediation of Area A.

Construction of the NAPL Area B treatment system began in July 2004 and was completed in early August 2005. Operations began on August 16, 2005. NAPL treatment was completed on August 29, 2006. The *Final Report Northeast Site Area B NAPL Remediation Project at the Young - Rainey STAR Center, Largo, Pinellas County, Florida* (DOE 2007b) describes Area B remediation.

Monitoring wells were installed at the former NAPL areas to monitor the remaining dissolved-phase plumes. Groundwater samples from a few of the wells installed at the Northeast Site continued to show high concentrations of contaminants. Soil samples were collected from 12 soil borings in August 2007 to evaluate the potential for contaminant source remaining in the subsurface at these locations. Results indicated high contaminant concentrations in soil at most of these borings, so a second phase of sampling was conducted in March and April 2008, during which samples were collected from 45 soil borings. An additional 10 borings were sampled in May and 11 more were sampled in June. These 78 soil borings defined 2 areas containing a source of contamination.

DOE prepared the *Interim Remedial Action for Source Removal at the Northeast Site Final Report* (DOE 2009d) for the soil excavation using a large-diameter auger (LDA) and offsite disposal of soil in accordance with Risk-Based Corrective Action (RBCA) regulations and submitted the document to FDEP in August 2008. This plan was approved on August 22, 2008. The objective of this interim remedial action was to remove the source of contamination at the site. An engineering design was developed, and a source removal subcontract was awarded in 2008. Source removal in the form of LDA excavation began on January 14, 2009, and was completed on May 22, 2009. Some 243 large-diameter and 352 small-diameter borings were completed. Approximately 8387 cubic yards of soil were excavated; of this total, 4667 cubic yards were removed as clean overburden and 3720 cubic yards of contaminated soils were removed, characterized for waste disposal, and disposed of as nonhazardous waste at a RCRA Subtitle D landfill.

As a follow-up to the LDA work, emulsified soybean oil and *Dehalococcoides mccartyi* were injected into the subsurface at 75 points at the site in January and February 2010. The *Injection of Emulsified Soybean Oil at the Northeast Site and 4.5 Acre Site* (DOE 2010) was prepared to describe the work involved in this task. This project resulted in a significant decrease in

contaminant mass and concentration around the former contaminant source areas and in the downgradient contaminant plume.

With completion of the LDA project to remove the contaminant source material and the follow-up enhanced bioremediation around the previous source areas to treat any residual contaminants located outside the excavation areas, DOE proceeded to close the site under the FDEP's RBCA rules (FAC Chapter 62-780.680). The *Closure Monitoring Plan for the Northeast Site and 4.5 Acre Site* (DOE 2009a) describes the closure monitoring that is necessary under RBCA, according to the requirements for post active remediation monitoring (FAC 62-780.750). Closure monitoring was initiated with the September 2009 sampling event and completed with the September 2012 sampling event. COPCs concentrations decreased significantly over this period.

DOE submitted the *Site Rehabilitation Completion Report with No Further Action Proposal for the Northeast Site* (DOE 2013b) to FDEP in May 2013. That document proposed a risk-based closure for the Northeast Site under the State's RBCA regulations. FDEP tentatively approved that document pending finalization of ICs. An IC in the form of a Declaration of Restricted Covenant (DRC) was finalized in September 2015. FDEP executed a Conditional Site Rehabilitation Completion Order (SRCO) for the Northeast Site on July 27, 2016, stating that no further action is required once all existing monitoring wells are plugged and abandoned. The specified wells were abandoned in June 2016, as approved by FDEP in anticipation of the Conditional SRCO. The SRCO is available on the DOE public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

WWNA

The WWNA/Building 200 Area (PIN18) includes the STAR Center's IWNF, the area south of the facility (including the parking lot), and Building 200. In April 1993, the WWNA and the Building 200 Area were identified as potential SWMUs, and an RFA was conducted (EPA 1994). The RFA recommended that the WWNA and Building 200 be considered one SWMU. RFI field activities began in September 1994 and included soil characterization, monitoring well installation, and groundwater sampling. Arsenic was identified as the major COPC. TCE and VC were detected at low concentrations in groundwater and were subsequently dismissed as COPCs once their concentrations decreased below cleanup levels.

A CMS/CMIP report (DOE 1997a) was completed for this SWMU. The recommended remediation alternative for the WWNA/Building 200 Area was groundwater recovery with the Building 100 Area wells and an additional recovery well located in the WWNA. The CMIP recommended that the recovery well in the WWNA/Building 200 Area withdraw surficial aquifer groundwater directly from the arsenic plume, thereby reducing contaminant mass and preventing contaminant migration. It also recommended that the recovered water be discharged directly to the STAR Center's IWNF.

DOE conducted extensive sampling and analysis of soil in an effort to locate the source of arsenic contamination. Elevated levels of arsenic were identified at several locations and at various depths within the SWMU. A treatability study was conducted to determine the leachability of arsenic from the soil into the groundwater. The study concluded that arsenic leachability from the soil was very limited, as demonstrated by a measured average soil/water

distribution coefficient of 63 liters per kilogram. DOE then conducted a statistical evaluation of arsenic soil data that resulted in the proposal to excavate two areas where the highest concentrations of arsenic were identified.

This proposal was approved by FDEP in September 1999. An excavation plan was developed to address logistics, sampling and analytical concerns, and waste management issues regarding the generation of contaminated media. That document and the statistical evaluation are included in the WWNA/Building 200 CMIP Addendum (DOE 2000). Excavation of the two areas was completed in early October 1999. Subsequently, the existing recovery well was abandoned and two recovery wells were installed to continue plume control in the area. In addition, a third recovery well was created in 2003 by converting the monitoring well with the highest arsenic concentration (PIN18-0501) to a recovery well.

On December 20, 2005, DOE received concurrence from FDEP to shut down the groundwater recovery system and begin monitoring to determine a closure approach through FDEP's RBCA regulations, promulgated by the Florida Legislature in 2003. The 1-year RBCA closure monitoring program specified by FDEP began in October 2005 and was completed in October 2006.

A No Further Action with Controls proposal (DOE 2007c) was submitted to FDEP on March 14, 2007, and FDEP approved the document on May 24, 2007.

After the No Further Action with Controls proposal was submitted, FDEP expressed concern about arsenic exceeding the residential standard in shallow soils (less than 2 ft deep). The goal of the 1999 soil excavation was to remove the areas containing the highest arsenic concentrations so that the remaining soils met the industrial CTL of 12 milligrams per kilogram. Soils containing arsenic concentrations above the residential CTL of 2.1 milligrams per kilogram were left in place because site use is solely industrial. In response to FDEP's concerns, DOE determined that the best course of action was to identify the area where the residential arsenic standard is exceeded and apply ICs that prohibit future residential development in this area and also ensure that excavated soil is disposed of properly.

A DRC was completed in September 2015. FDEP executed an SRCO for the WWNA on July 27, 2016, stating that no further action is required once all existing monitoring wells are plugged and abandoned. The specified wells were abandoned in June 2016, as approved by FDEP in anticipation of the Conditional SRCO. The DRC and SRCO are available on the DOE public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

4.5 Acre Site

The 4.5 Acre Site (PIN20) is adjacent to the northwest property boundary of the STAR Center. During a 1984 investigation of past waste disposal practices at the Pinellas Plant, DOE determined that drummed waste had been buried at the 4.5 Acre Site in about 1962 (DOE 1987). In 1985, the U.S. Geological Survey conducted an electromagnetometer survey to ascertain whether drums were present in the subsurface at the 4.5 Acre Site, and this survey identified two areas that could contain buried metallic objects. A more detailed survey conducted in 1985 by HAZTECH using a proton magnetometer confirmed the results of the U.S. Geological Survey study and also identified a few other small areas of potential buried metallic objects (HAZTECH 1985). A subsequent

excavation by HAZTECH in June 1985 removed 83 drums from the subsurface; 34 drums were partially or completely full when removed, 16 drums were completely empty, and the remaining 33 drums were found crushed and empty (HAZTECH 1985).

The sources of contamination at the 4.5 Acre Site are releases from the drums of waste that were buried in pits in about 1962. The COPCs are TCE, cDCE, *trans*-1,2-dichloroethene, VC, benzene, and arsenic. Arsenic is no longer monitored because concentrations do not exceed the 100 µg/L poor water quality CTL.

Following drum removal, the first remedial action implemented at the 4.5 Acre Site was groundwater pumping, with extracted groundwater being discharged directly to the Pinellas Plant's IWNF (DOE 1987). This system used seven recovery wells (R001 through R007) that were screened in the lower half of the surficial aquifer, starting at 15–18 ft below land surface (bls) and extending to near the bottom of the surficial aquifer at 25–28 ft bls. This system began operation in December 1988 but was shut down temporarily in January 1989 because contaminant concentrations in the discharged water exceeded permit limits. An air stripper was added to the system to treat the water prior to discharge, and this system operated from May 1990 to July 1997.

This groundwater recovery system effectively decreased the extent of the contaminant plume and significantly reduced contaminant concentrations in groundwater (by orders of magnitude at many locations). The air stripper treated approximately 11,125 pounds of volatile organic compounds (VOCs) during its operation, but this amount includes an unknown but likely significant amount of VOCs in groundwater recovered from another part of the Pinellas Plant, the Northeast Site. Operation of this system was discontinued because the rate of contaminant mass recovery had decreased, and it was believed that a more aggressive remediation system was necessary to remove the remaining contaminant mass.

The second remedial action, dual-phase extraction, operated from August 1997 to August 1999 (DOE 1995). This system consisted of 22 wells that extracted groundwater and vapor from the subsurface. These wells were screened over the entire saturated thickness of the surficial aquifer, starting at approximately 5 ft bls. Each well had a vacuum extraction tube installed to approximately 22 ft bls. The system removed approximately 185 pounds of VOCs from the subsurface during its 2 years of operation. Operation of this system was discontinued because contaminant removal rates were lower than expected.

The third remedial action, biosparging, operated from September 1999 to May 2003 (DOE 1999 and 2001b). The purpose of this action was to inject air into the subsurface to convert aquifer conditions from reducing and anaerobic to oxidizing and aerobic to facilitate contaminant biodegradation. The biosparge system consisted of three horizontal wells at 24 ft bls, one through the southwestern contaminated area and two through the eastern contaminated area, connected to blowers at the surface. Biosparge performance evaluations (DOE 2003c) conducted in 2002 and 2003 indicated that the system had not been effective at reducing contaminant concentrations for two main reasons: (1) the small particle size of the aquifer matrix resulted in air channeling through preferential pathways, limiting air contact with most of the matrix; and (2) high oxygen demand in the subsurface prevented attainment of aerobic conditions within a realistic time frame. Biosparge operations were discontinued in May 2003. The three horizontal wells were abandoned in August 2005 by grouting the entire length of each well.

The fourth remedial action was a pump-and-treat system, started in April 2004, to control the contaminant plume located near the western site boundary until a final site remedy could be determined (DOE 2003a). The system consisted of three recovery wells, each with a 20-ft screened interval, located along the western side of the site. Recovered groundwater was sent to an onsite, shallow tray air stripper for treatment. In December 2005, FDEP approved the cessation of this action and the initiation of a 2-year monitoring period to evaluate the potential for closing the site under RBCA.

Upon treatment system shutdown in December 2005, DOE began a 2-year closure monitoring program as required by FDEP to confirm the stability of the groundwater contaminant plume, in accordance with RBCA rules. Groundwater concentrations for the previous few years had shown a stable or declining trend at most monitoring locations. However, during the first year of closure monitoring, an increasing trend in levels of TCE, dichloroethene, and VC concentrations was observed in several wells and in particular in two wells located approximately 60 ft from the southwest property boundary.

On the basis of these results, DOE decided to conduct a detailed characterization of soil in the area of high groundwater contaminant concentrations to determine whether a contaminant source remained in the subsurface. During the summer of 2007, 1172 soil samples were collected from 138 soil borings. Results from analysis of the soil samples indicated that a source of contamination remained at two areas of the site. The results were reported in the *4.5 Acre Site Source Characterization Data Report* (DOE 2007a).

In April 2008, DOE completed a Feasibility Study that evaluated the available contaminant source removal technologies (DOE 2008a). The preferred option for source removal at the 4.5 Acre Site was determined to be soil excavation using an LDA and offsite disposal of soil. In a letter dated May 17, 2008, FDEP stated "the report is acceptable for its intended purpose" and "the preferred option for source removal of soil excavation using large diameter auger and offsite disposal is acceptable to the Department." According to consultation with FDEP, the main regulatory program applicable to this remedial action (source removal) is Global RBCA promulgated under FAC 62-780. DOE prepared the *Interim Remedial Action for Source Removal at the 4.5 Acre Site Final Report* (DOE 2009c) for the soil excavation in accordance with the RBCA regulations and submitted the document to FDEP in July 2008. This plan was approved on August 19, 2008. The objective of the interim remedial action was to remove the source of contamination at the site.

LDA operations commenced at the 4.5 Acre Site on March 31, 2009, and were completed on May 27, 2009. There were 221 large-diameter and 325 small-diameter borings completed. Approximately 7035 cubic yards of soil were excavated; of this total, 4464 cubic yards were removed as clean overburden and 2571 cubic yards of contaminated soil were removed, characterized for waste disposal, and disposed of as nonhazardous waste at a RCRA Subtitle D landfill. Additional information regarding the 4.5 Acre Site LDA work can be found in the *Data Report for Overburden Soil at the Northeast Site and the 4.5 Acre Site* (DOE 2009b) and the *Interim Remedial Action for Source Removal at the 4.5 Acre Site Final Report* (DOE 2009c).

As a follow-up to the LDA work, emulsified soybean oil and the microorganism *Dehalococcoides mccartyi* were injected into the subsurface at 95 points at the site in February 2010. The *Injection of Emulsified Soybean Oil at the Northeast Site and 4.5 Acre Site* (DOE 2010) was prepared to

describe the work involved in this task. This project resulted in a significant decrease in contaminant mass and concentrations around the former contaminant source areas and should significantly reduce contaminant concentrations in the downgradient contaminant plume.

With (1) the completion of the LDA project to remove the contaminant source material and (2) the follow-up enhanced bioremediation around the previous source areas to treat any residual contaminants located outside the excavation areas, DOE is proceeding to close the site under the FDEP's RBCA rules (FAC 62-780.680). The *Closure Monitoring Plan for the Northeast Site and 4.5 Acre Site* (DOE 2009a) describes the closure monitoring that is necessary under RBCA, according to the requirements for Post Active Remediation Monitoring (FAC 62-780.750). FDEP approved this document in December 2009. Closure monitoring began in September 2009.

Routine monitoring at the site in March 2009 identified the presence of VC offsite in monitoring well PIN20-M035. DOE reported this discovery to FDEP and to the property owner in accordance with FDEP notification requirements. The last three times this well was sampled (September 2013, March 2014, and September 2016), the VC concentration was below the CTL of 1.0 µg/L.

In July 2013, DOE conducted an interim remedial action to enhance biodegradation of contaminants along the southwest property boundary, as described in the *Interim Remedial Action Plan for Emulsified Edible Oil Injection at the 4.5 Acre Site* (DOE 2013a). Additional enhanced bioremediation was conducted at the 4.5 Acre Site in October through December 2016 as described in Section 3.2.2 of this report. Post active remediation monitoring was conducted until reductions in COPC concentrations to below the standard CTLs in groundwater at the 4.5 Acre Site were achieved.

DOE submitted the *Site Rehabilitation Completion Report with No Further Action Proposal for the 4.5 Acre Site* (DOE 2019b) to FDEP in June 2019. The FDEP issued a Site Rehabilitation Completion Order on September 16, 2019, for No Further Action at the 4.5 Acre Site. The order stated that DOE has satisfied the site rehabilitation requirements for the 4.5 Acre Site and was released from any further obligation to conduct site rehabilitation at the site. The SRCO is available on the DOE public website at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Pinellas.

References

DOE (U.S. Department of Energy), 1987. *Interim Remedial Action Plan, Department of Energy, 4.5 Acre Site*, prepared by Soil and Material Engineers, Inc. (S&ME) for the U.S. Department of Energy.

DOE (U.S. Department of Energy), 1991a. *Interim Corrective Measures Study Northeast Site*, Pinellas Plan, Largo, Florida, May.

DOE (U.S. Department of Energy), 1991b. *RCRA Facility Investigation Report, Pinellas Plant*, Environmental Restoration Program, Albuquerque Operations Field Office, Albuquerque, New Mexico, September.

DOE (U.S. Department of Energy), 1994. *Corrective Measures Study Report – Industrial Drain Leaks Building 100 Area and Old Drum Storage Site, Pinellas Plant*, Environmental Restoration Program, Albuquerque Operations Field Office, Albuquerque, New Mexico, February.

DOE (U.S. Department of Energy), 1995. *4.5 Acre Site Remedial Action Plan Vol 1 and 2. e*, prepared by Lockheed Martin Specialty Components, Inc. for the U.S. Department of Energy. September.

DOE (U.S. Department of Energy), 1996a. *Building 100 Area Corrective Measures Implementation Plan*, March.

DOE (U.S. Department of Energy), 1996b. *Building 100 Area Data Report*, October 1993 to July 1996, November.

DOE (U.S. Department of Energy), 1996c. *Building 100 Area Subsurface Investigation, Phases I, II, and III,* Volumes 1 and 2, January.

DOE (U.S. Department of Energy), 1996d. *Northeast Site Corrective Measures Implementation Plan*, March.

DOE (U.S. Department of Energy), 1996e. *Northeast Site Interim Measures Quarterly Progress Report*, January.

DOE (U.S. Department of Energy), 1997a. *Corrective Measures Study Report/Corrective Measures Implementation Plan WWNA/Building 200*.

DOE (U.S. Department of Energy), 1997b. *Pinellas Plant Environmental Baseline Report*, prepared by Lockheed Martin Specialty Components Inc. for U.S. Department of Energy, Pinellas Area Office, June.

DOE (U.S. Department of Energy), 1998. *Building 100 Corrective Measures Study Implementation Plan Addendum*, April.

DOE (U.S. Department of Energy), 1999. *Interim Remedial Action Plan Addendum, Biosparging Design and Construction* Report, prepared by MACTEC-ERS, LLC, for the U.S. Department of Energy, March.

DOE (U.S. Department of Energy), 2000. *Wastewater Neutralization Area/Building 200 Area Corrective Measures Implementation Plan Addendum*, January.

DOE (U.S. Department of Energy), 2001a. *Interim Measures Work Plan for Remediation of Non-Aqueous Phase Liquids at the Northeast Site,* MAC-PIN 13.10.5-1, November.

DOE (U.S. Department of Energy), 2001b. *Remedial Action Plan for the Pinellas 4.5 Acre Site,* Office of Legacy Management, GJO-2-1-235-TAR, PIN 25.5.6. July.

DOE (U.S. Department of Energy), 2003a. *Interim Remedial Action Plan for Groundwater Recovery at the 4.5 Acre Site.* GJO-2003-480-TAC, GJO-PIN 25.5.6, Office of Legacy Management, August.

DOE (U.S. Department of Energy), 2003b. *Northeast Site Area A NAPL Remediation Final Report*, GJO−2003−482−TAC, September.

DOE (U.S. Department of Energy), 2003c. *Performance Evaluation for the Biosparging System at the 4.5 Acre Sire*, GJO-2003-426-TAC, GJO-PIN 25.5.1.1, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2006. *Building 100 Area Corrective Measures Study Report Addendum*, DOE-LM/GJ1241-2006, Office of Legacy Management, July.

DOE (U.S. Department of Energy), 2007a. *4.5 Acre Site Source Characterization Data Report*, DOE−LM/1549−2007, Office of Legacy Management, December.

DOE (U.S. Department of Energy), 2007b. *Final Report Northeast Site Area B NAPL Remediation Project at the Young - Rainey STAR Center, Largo, Pinellas County, Florida*, DOE-LM/1457-2007, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2007c. *Young - Rainey STAR Center, Wastewater Neutralization Area No Further Action With Controls Proposal*, DOE-LM/1419-2007, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2008a. *4.5 Acre Site Source Removal Feasibility Study*, DOE-LM/1606-2008, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2008b. *Dewatering Evaluation Report for Road Construction and Water Line Replacement Along Bryan Dairy and Belcher Roads*, DOE-LMS/PIN/NO1113, Office of Legacy Management, June.

DOE (U.S. Department of Energy), 2009a. *Closure Monitoring Plan for the Northeast Site and 4.5 Acre Site*, LMS/PIN/N01401, Office of Legacy Management, August.

DOE (U.S. Department of Energy), 2009b. *Data Report for Overburden Soil at the Northeast Site and the 4.5 Acre Site*, LMS/PIN/N01395, Office of Legacy Management, July.

DOE (U.S. Department of Energy), 2009c. *Interim Remedial Action for Source Removal at the 4.5 Acre Site Final Report*, LMS/PIN/N01359, Office of Legacy Management, September.

DOE (U.S. Department of Energy), 2009d. *Interim Remedial Action for Source Removal at the Northeast Site Final Report*, LMS/PIN/N01357, Office of Legacy Management, August.

DOE (U.S. Department of Energy), 2009e. *Interim Remedial Action Plan for Groundwater Pumping at the Building 100 Area*, LMS/PIN/N01318, Office of Legacy Management, July.

DOE (U.S. Department of Energy), 2010. *Injection of Emulsified Soybean Oil at the Northeast Site and 4.5 Acre Site*, LMS/PIN/N01494, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2012. *Building 100 Area Site Assessment Report*, LMS/PIN/N01747, Office of Legacy Management, August.

DOE (U.S. Department of Energy), 2013a. *Interim Remedial Action Plan for Emulsified Edible Oil Injection at the 4.5 Acre Site*, LMS/PIN/N01776, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2013b. *Site Rehabilitation Completion Report with No Further Action Proposal for the Northeast Site*, LMS/PIN/N01778, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2014. *Interim Corrective Measure Work Plan for Source and Plume Treatment at the Building 100 Area*, LMS/PIN/N01868, Office of Legacy Management, October.

DOE (U.S. Department of Energy), 2016. *Addendum to the Interim Corrective Measure Work Plan for Source and Plume Treatment at the Building 100 Area*, LMS/PIN/N02121, Office of Legacy Management, September.

DOE (U.S. Department of Energy), 2019a. *Pinellas County, Florida, Site, Second Addendum to the Interim Corrective Measure Work Plan for Source and Plume Treatment at the Building 100 Area*, LMS/PIN/N02301, Office of Legacy Management, July.

DOE (U.S. Department of Energy), 2019b. *Site Rehabilitation Completion Report with No Further Action Proposal for the 4.5 Acre Site*, LMS/PIN/N02300, Office of Legacy Management, June.

DOE (U.S. Department of Energy), 2020. *Pinellas County, Florida, Site, Building 100 Area Bioinjection Completion Report*, LMS/PIN/N02337, Office of Legacy Management, August.

EPA (U.S. Environmental Protection Agency), 1992. Gerald W. Johnson, letter to DOE (about Approval of Pinellas Site Remedial Facility Investigation Report), April.

EPA (U.S. Environmental Protection Agency), 1994. *RCRA Facility Assessment Report, WWNA/Building 200 Area*, March.

FAC 62-780. "Contaminated Site Cleanup Criteria," *Florida Administrative Code*.

HAZTECH, 1985. *Identification and Removal of Waste, Department of Energy Pinellas Plant, Largo, Florida*, prepared for General Electric Company Neutron Devices Department, September.