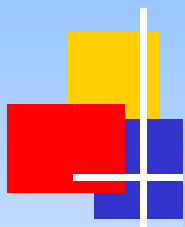


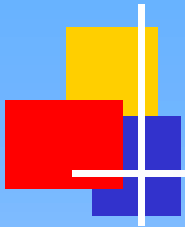
Accelerating Cleanup at a Former Nuclear Weapons Production Facility Utilizing Innovative Technologies



David S. Ingle
U.S. Department of Energy
Site Manager

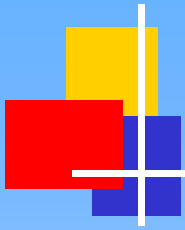
Pinellas Environmental
Restoration Project





Young-Rainey STAR Center





Remediation Goal

Expeditious and cost-effective cleanup of groundwater and soil contamination utilizing innovative treatment technologies





Young-Rainey STAR Center Background and History

- Located in Pinellas County, Florida
- Operated by DOE from 1957 through 1997
- Manufactured components for nuclear weapons
- Sold by DOE to Pinellas County Industry Council in 1995
- DOE operations ended (except for environmental restoration activities) in 1997
- Pinellas STAR Center established 1997; now known as the Young-Rainey STAR Center

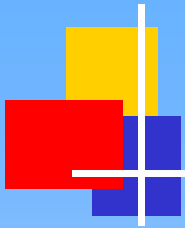




Young-Rainey STAR Center Background and History (continued)

- Operation and ownership of the Pinellas STAR Center transferred to Pinellas County Board of Commissioners in 1998
- 98% of space now leased
- 20+ tenants with approximately 1,500 personnel



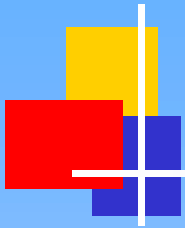


Drivers

Federal/State Authority

- EPA performed a RCRA Facility Assessment in 1987 to gather information on potential releases of hazardous materials
- 17 sites (Solid Waste Management Units or SWMUs) identified that may have environmental contamination as a result of past activities
- EPA issued a Hazardous and Solid Waste Amendment (HSWA) permit in 1990 enabling DOE to investigate and perform remediation activities at suspected sites



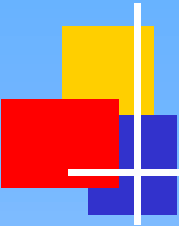


Drivers (continued)

Federal/State Authority (continued)

- DOE recommended and EPA and Florida Department of Environmental Protection (FDEP) approved 13 of 17 SWMUs for no further action
- State of Florida authorized HSWA programs in November 2000
- State of Florida issued new HSWA permit January 2002





Young-Rainey STAR Center Accelerated Cleanup Plan

Letter of Intent between DOE and FDEP

■ Objectives

- Accelerate cleanup time frames
- Establish cleanup priorities

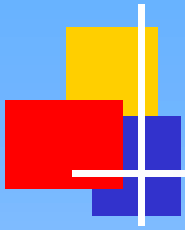
■ Ten key commitments

- Brownfields
- Innovative technologies

■ Results

- Accelerates completion of cleanup
- Transition site to long-term surveillance and monitoring



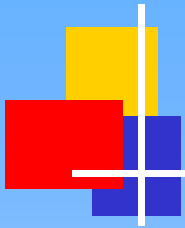


Letter of Intent

DOE and FDEP will

- Explore utilizing Brownfields approach for remaining cleanup activities
 - Consistent with current and planned use of facilities
 - Identification of institutional controls
 - Risk-based corrective action (RBCA) standards
 - Potential financial incentives for STAR Center
- Utilize innovative technologies
 - Practicable
 - Protective of environment
 - Achieve demonstrable risk reduction
 - Reasonable cost

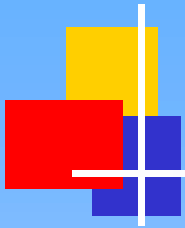




Brownfields Program

- Initial discussion with FDEP and Pinellas County staff (summer 2002)
- Extensive background research activities (summer/fall 2002)
- DOE management grants approval to move forward (winter 2002)
- Obtain Pinellas County approval (spring 2003)
- Initiate action to have STAR Center designated as Brownfields Site (summer 2003)
- Coordinate with FDEP and Pinellas County to develop Brownfields Site Rehabilitation Agreement (fall 2003)





Innovative Technologies

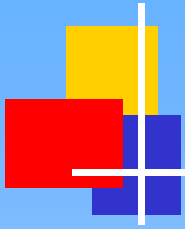
■ Current

- Electrical resistive heating (full field application)
- Steam-enhanced extraction (full field application)
- Enhanced bioremediation (pilot study)

■ Historical

- Rotary steam stripping (pilot study)
- In situ anaerobic bioremediation (pilot study)
- Air sparging utilizing horizontal wells (full field application)
- Biosparging utilizing horizontal wells (full field application)

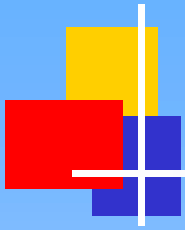




Northeast Site NAPL Area A

- Steam-Enhanced Extraction (SEE)
- Electrical Resistive Heating (ERH)

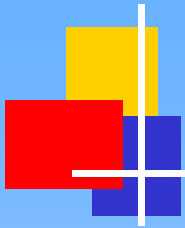




Site Characteristics

- Volatile organic compounds and total petroleum hydrocarbons from surface to 35 ft below ground surface
- Water table 2 to 5 ft below ground surface; significant fluctuations
- Moderately permeable sand unit to 30 ft below ground surface underlain by Hawthorn Group clay aquitard; upper 5 ft of clay part focus of remediation
- Surface footprint approximately 10,000 ft²
- Treatment volume approximately 14,000 yd³

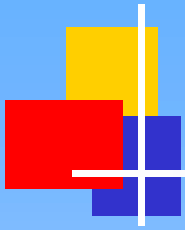




Cleanup Goals

NAPL Component	Ground Water ($\mu\text{g}/\text{L}$)	Soil ($\mu\text{g}/\text{kg}$)
Tetrachloroethene	11,000	20,400
<i>cis</i> -1,2-Dichloroethene	50,000	71,000
Methylene chloride	20,000	227,000
Toluene	5,500	15,000
Total petroleum hydrocarbons	50,000	2,500,000

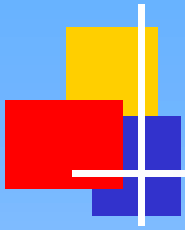




Operational Targets

- Achieve and maintain minimum temperature of 84 °C for entire treatment volume
- Operate system for 18 weeks or until indicator parameters are met

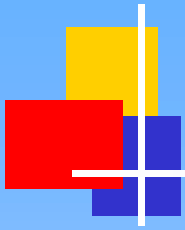




Remedial Approach

- Employ combination of steam-enhanced extraction and electrical resistive heating
- Use aggressive liquid and vapor extraction to recover contaminants and maintain hydraulic and pneumatic control
- Inject air intermittently to enhance volatilization and stimulate in situ oxidation



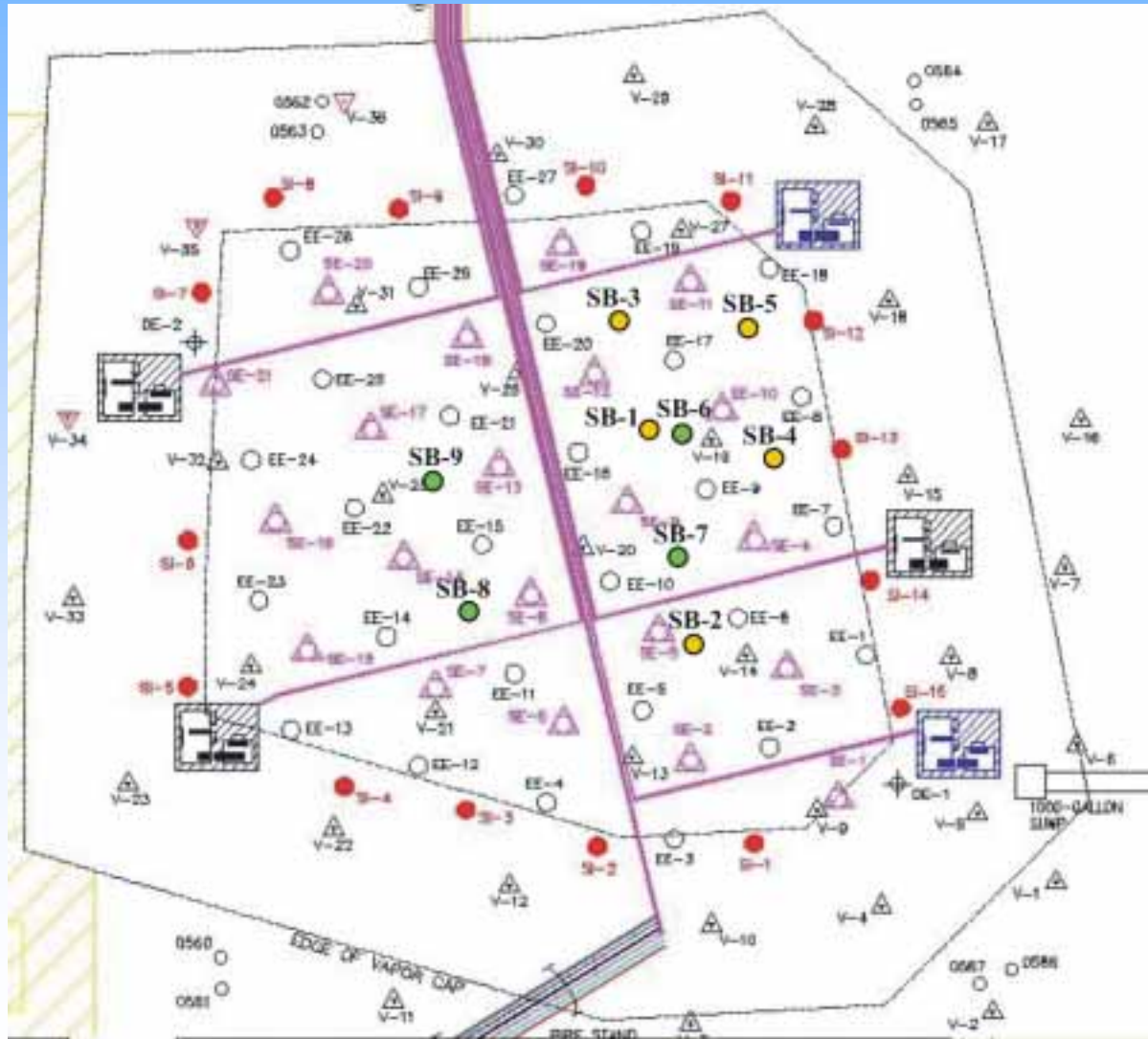


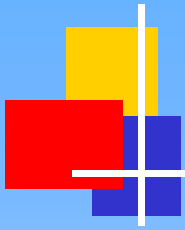
System Components

- 36 steam injection wells; steam provided by diesel fired 8,000 lb/hr steam generator
- 51 electrodes powered by five 200- to 250-kW units
 - 21 in upper sands
 - 30 in Hawthorn Group clay
- 28 extraction wells
- Well spacing approximately 15 to 20 ft



NAPL Area A at Northeast Site

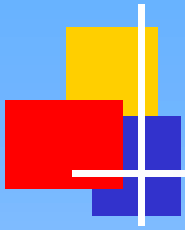




System Operation

- Ensure hydraulic and pneumatic controls before initiation of heating
- Steam injection at 22 to 30 ft near base of upper aquifer
- Resistive heating at 30 to 35 ft and in upper sands at 10 to 15 ft
- Water injected at low rate to prevent desiccation and maintain optimum current transfer

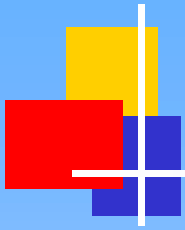




System Operation (continued)

- Majority of site heated to steam temperature in 4 to 6 weeks
- Pressure cycling induced after reaching target temperature; mass recovery increased significantly each time depressurization cycle conducted
- Mass removal diminished within 1 month of pressure cycling

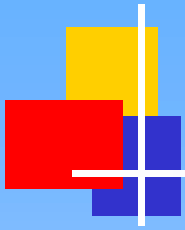




Chronology of System Operation

- October 1, 2002: electrical heating initiated in clay layer
 - + 3 weeks: steam injection in perimeter wells
 - Late October: steam and electrical heating of central and upper portions of site
 - + 4 to 6 weeks: pressure cycling initiated
- November 2002: mass removal rates diminish
- January 22, 2003: area with resin discovered; wells added and heat campaign extended
- January 31, 2003: began cool-down mode; continued heating of resin area
- February 17, 2003: treatment operations concluded

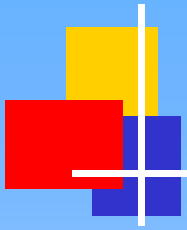




Preliminary Results

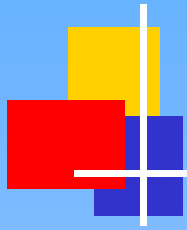
- Initial groundwater data reveal significant reduction in contaminant concentrations
- Additional sampling in 2003 to evaluate potential rebound
- Soil sampling initiated when subsurface temperatures less than 100 °C





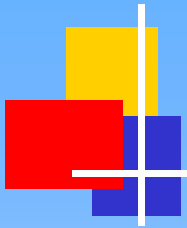
Overall View





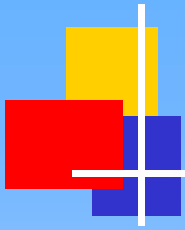
View of Treatment System





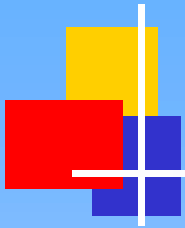
View of Pad





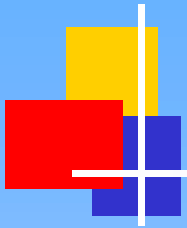
View of Pad





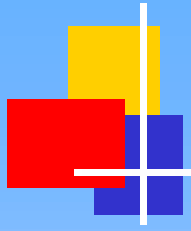
View of PDS Units





Recovered NAPL





Recovered NAPL





Pinellas Environmental Restoration Project

■ Point of Contact

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