Air Force Civil Engineer Center

FORMER
WILLIAMS AIR FORCE BASE

Site ST012

Former Liquid Fuel Storage Area

BCT Conference Call

21 March 2019

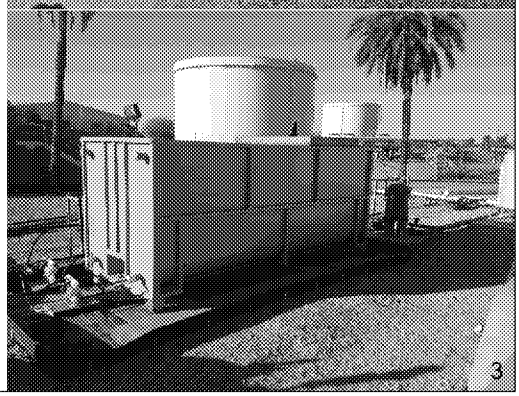
ED_005025_00011023-00001

Site ST012 Outline

- Summary of activities since Feb BCT call
- Update on SVE system (JP-4 equivalent of methane)
- LNAPL monitoring/removal update
- Pilot study extraction/injection update
- Path forward

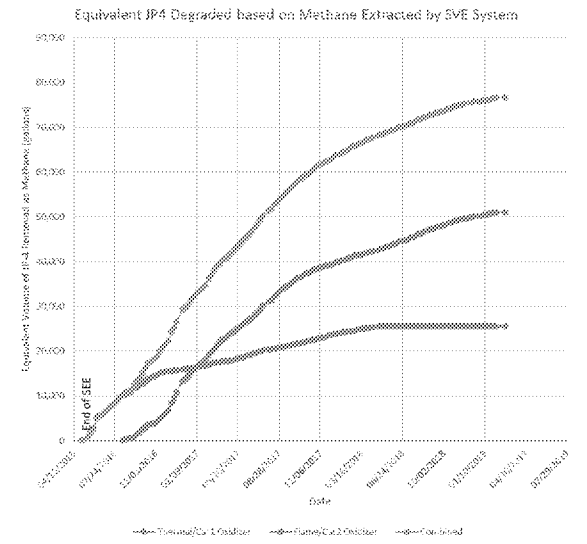
Site ST012 Activities Since February

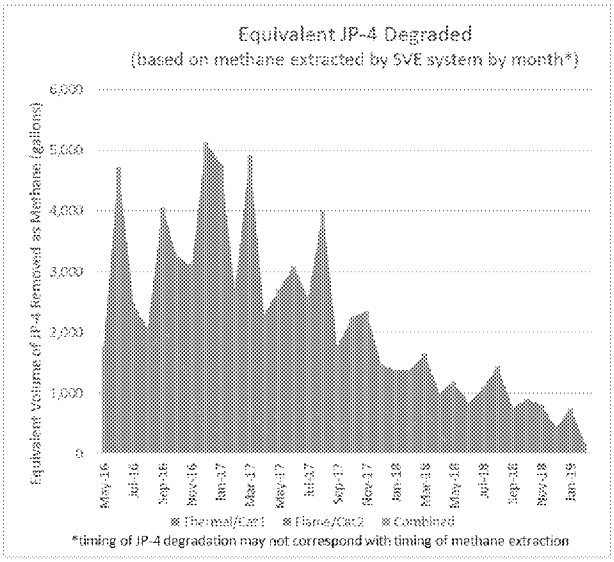
- Continued SVE operation
- Continued LNAPL screening in accessible wells
- Operation of Extraction and Treatment
  - Pump repairs
    - UWBZ27, moved pneumatic from UWBZ22
    - LSZ38, discharge pipe
    - CZ21, UWBZ21, UWBZ22 currently down
  - GAC backwash conducted
- Sodium sulfate injections (detail on later slides)
- SVE changed over to catalytic oxidizer moved from ST035 (started operation on 26 Feb 2019)



JP-4 Degradation Based on Methane Removed with SVE (through 1 Mar)

Site ST012 SVE System Equivalent JP-4 Degradation Based on Methane Removed

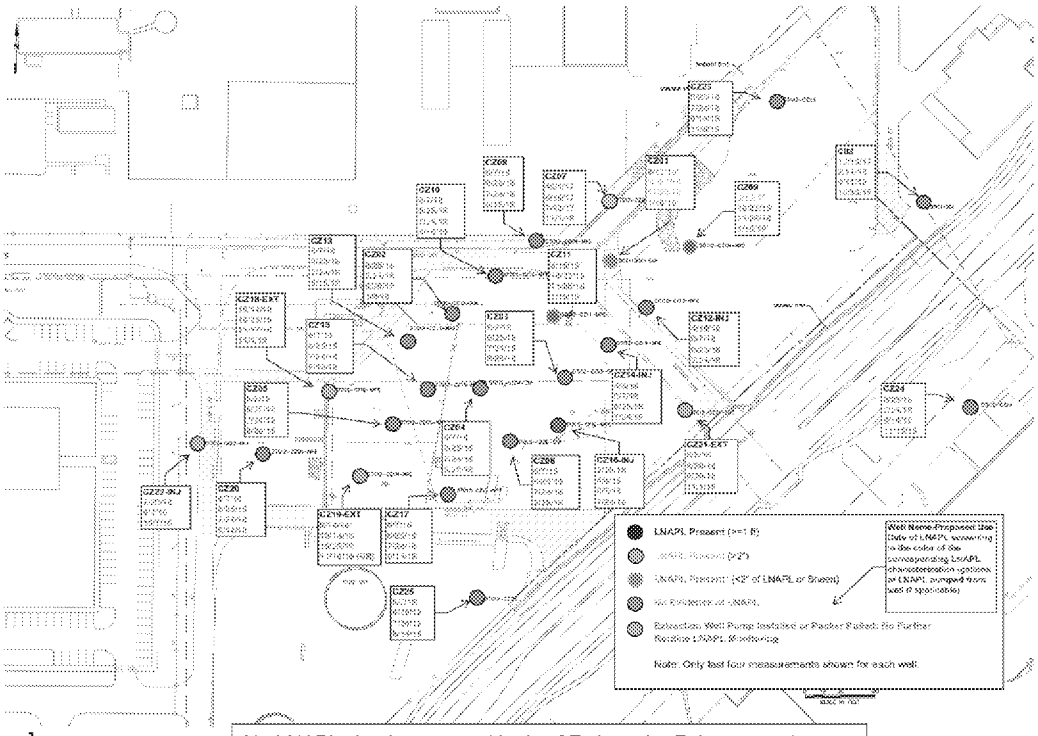




- Estimated JP-4 degradation as methane is in addition to JP-4 removal reported for SVE
- Thermal/Cat1 oxidizer changed from SVE to groundwater treatment end of Apr
- Flame oxidizer treating combined SVE and air stripper intermittently since 12 Nov 2018
- Flame oxidizer replaced by catalytic oxidizer (Cat2) 7 Feb to 26 Feb 2019
- Most recent equivalent JP-4 degraded affected by oxidizer downtime for change

LNAPL Monitoring Update (through 14 Mar)

LNAPL Monitoring/Removal Status
Cobble Zone



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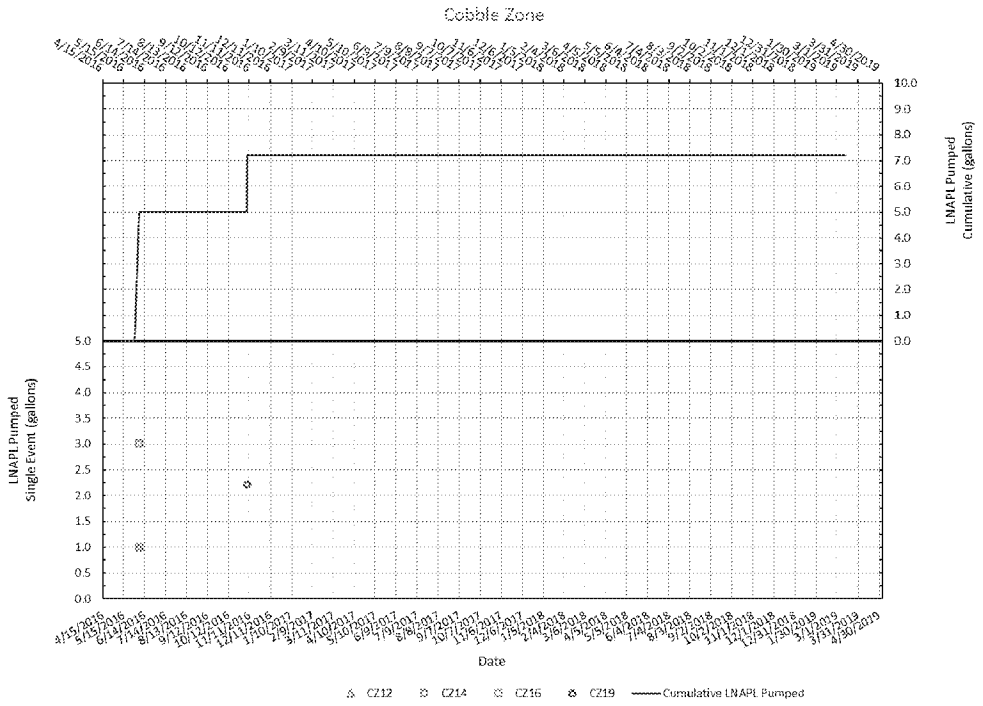
No LNAPL checks occurred in the CZ since the February update

LNAPL Monitoring/Removal Status
Cobble Zone



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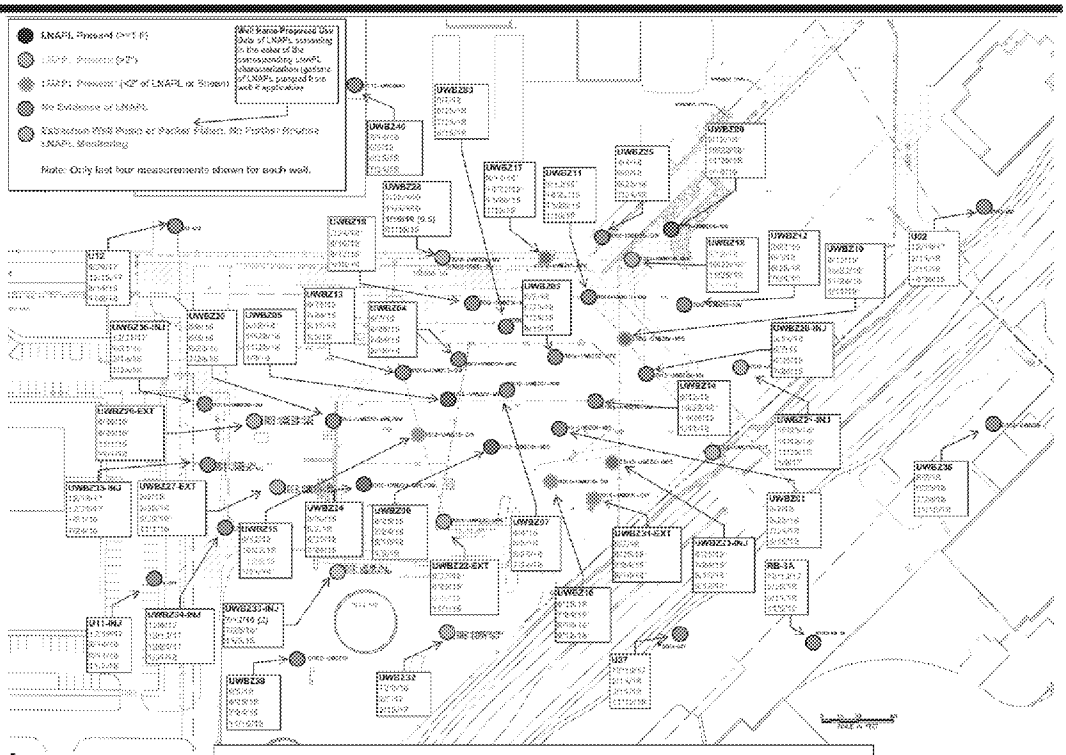
ERC modified this slide. The pumping events were missing from the figure

LNAPL Monitoring/Removal Status
Upper Water Bearing Zone



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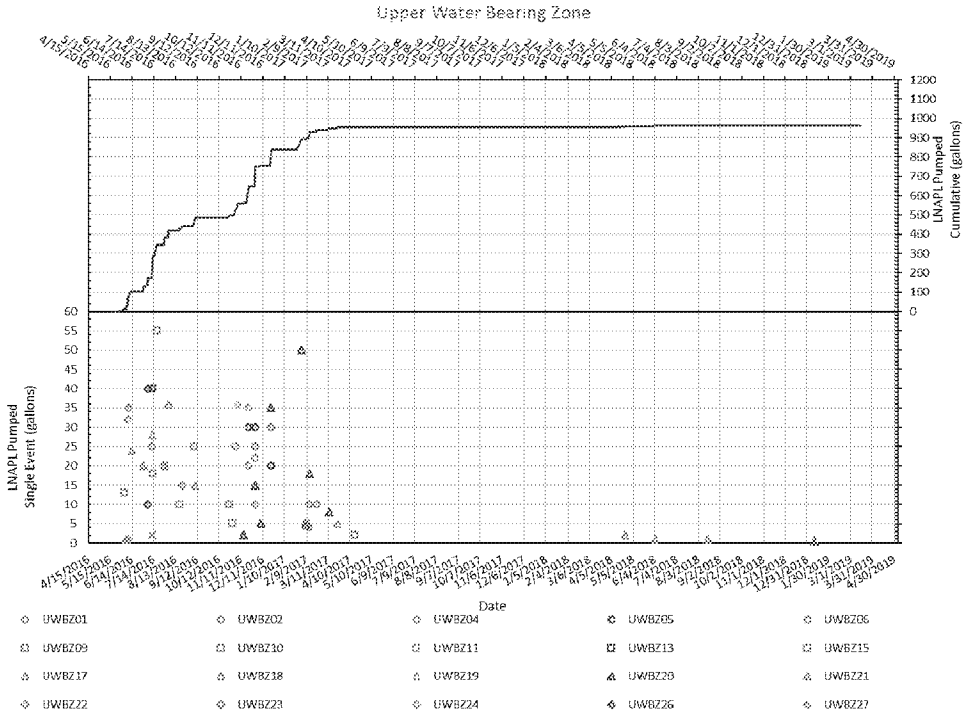
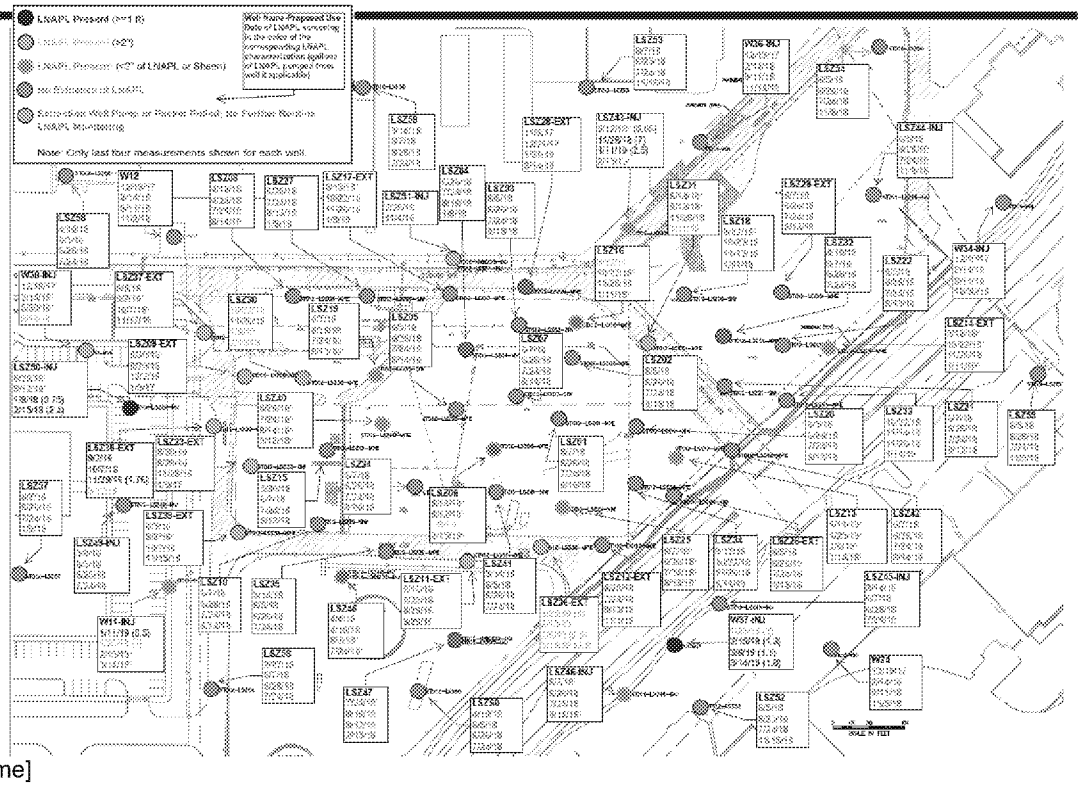
No LNAPL checks occurred in the UWBZ since the February update

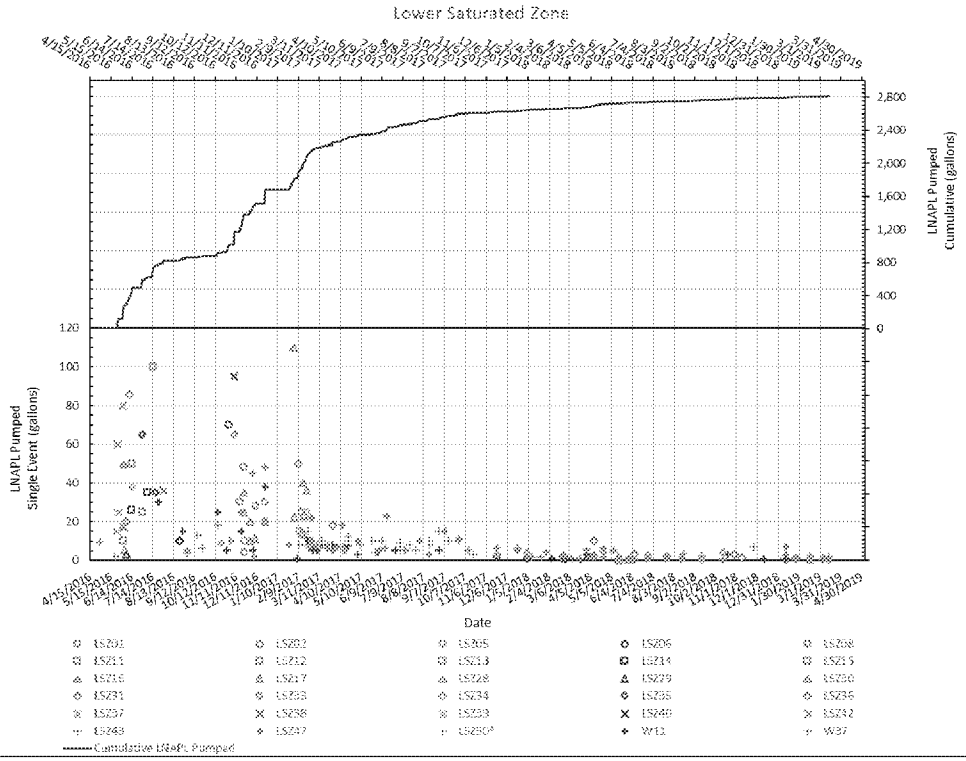
LNAPL Monitoring/Removal Status
Upper Water Bearing Zone



LNAPL Monitoring/Removal Status
Lower Saturated Zone



LNAPL Monitoring/Removal Status
Lower Saturated Zone



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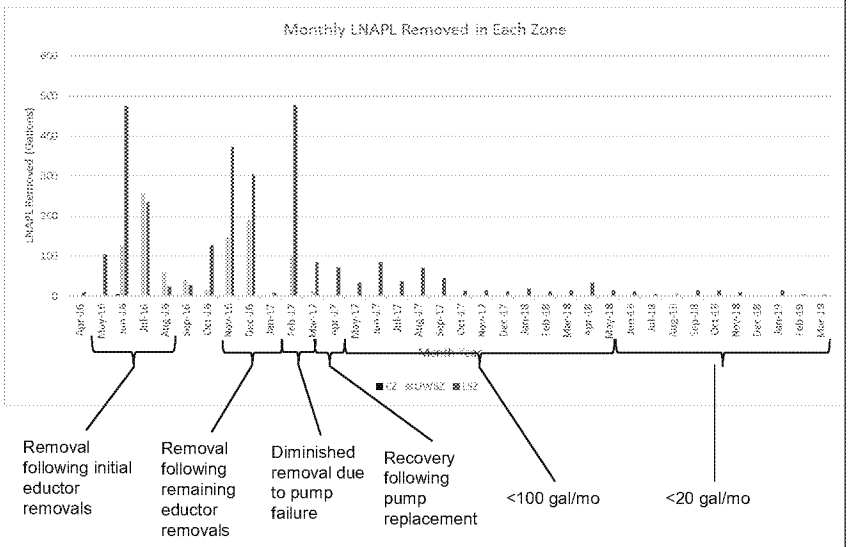
ST012 LNAPL Monitoring/Removal Summary

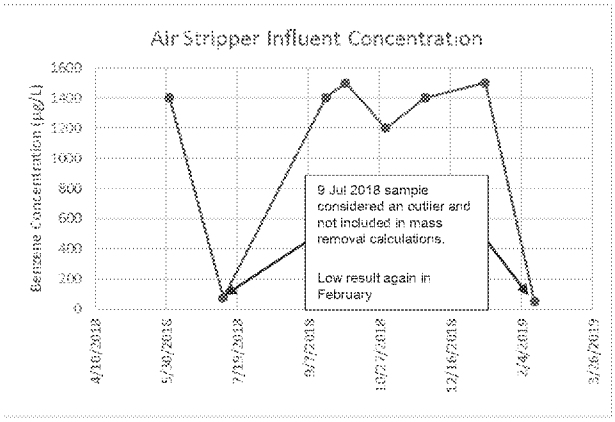
- CZ – 7 gallons of LNAPL removed. None since Nov 2016 (no checks performed)
- UWBZ - 963 gallons of LNAPL removed. None since Feb update (no checks performed)
- LSZ - 2,811 gallons of LNAPL removed. 8 gallons removed since Feb update (W37, LSZ30, LSZ36, LSZ50).

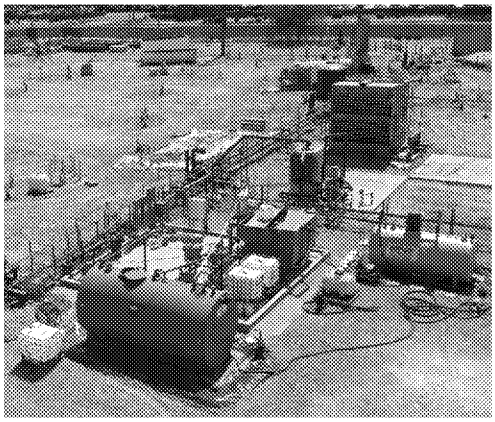


Pilot Study Injection/Extraction Update

Site ST012 Extraction System Performance

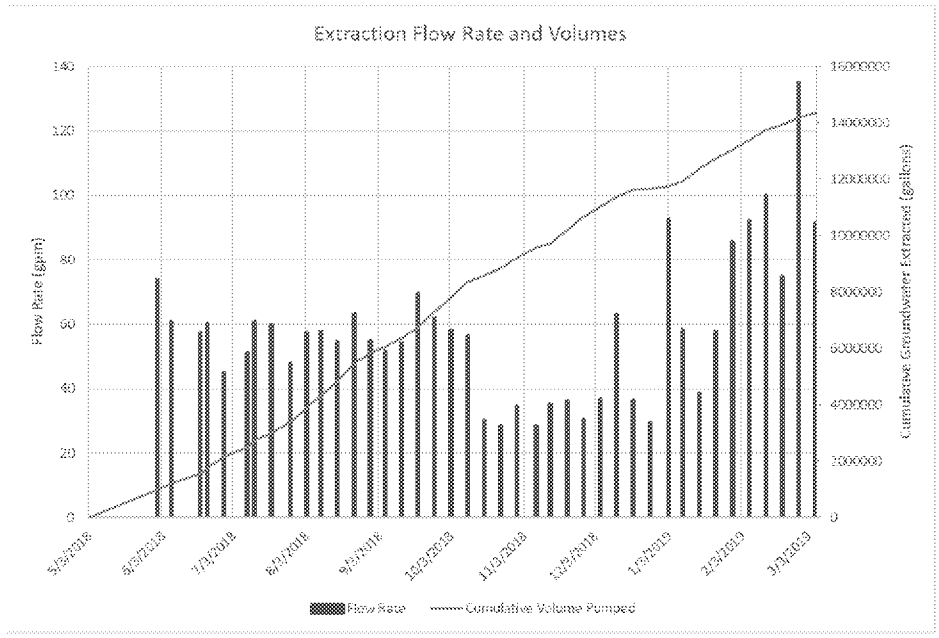
- No LNAPL has been recovered since extraction started up
- CZ21, UWBZ21, UWBZ22 currently down (driller scheduled on 27&28 Mar)
- Benzene air stripper influent stabilized at ~1,400 µg/L but then dropped in most recent sample





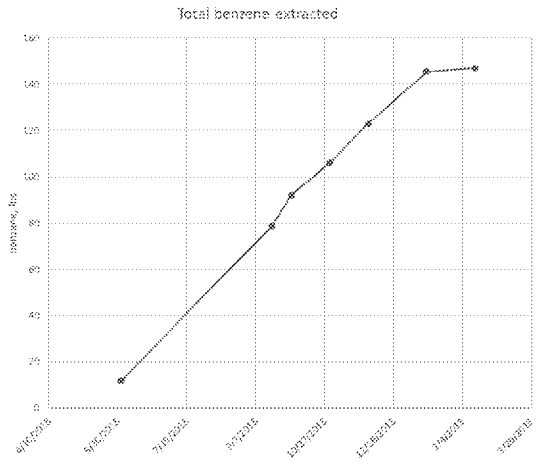
Site ST012 Extraction System Performance

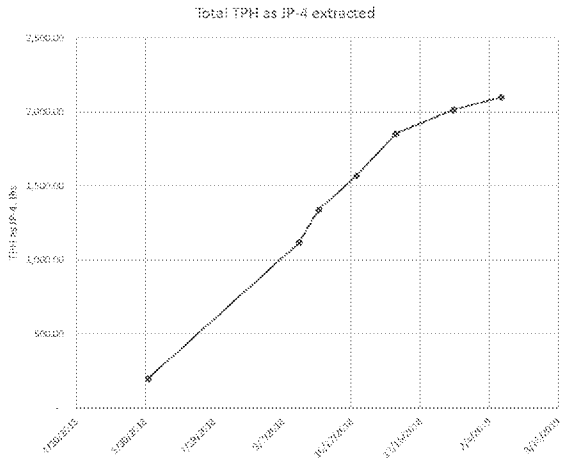
- **Overall Extraction Rates and Cumulative Volume Extracted**



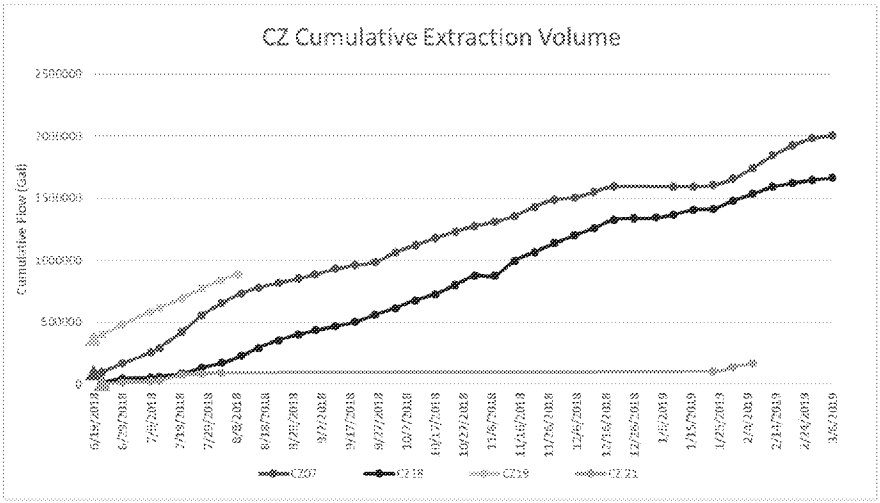
Site ST012 Extraction System Performance

- **Estimated Mass Removal by Extraction**
- **Recent lower mass extraction is due to reduced benzene influent concentration in February. February data point will be compared with future samples and may be removed from future calculations if appropriate.**





Cumulative Extraction Volume and Analytical Data by Well - Cobble Zone



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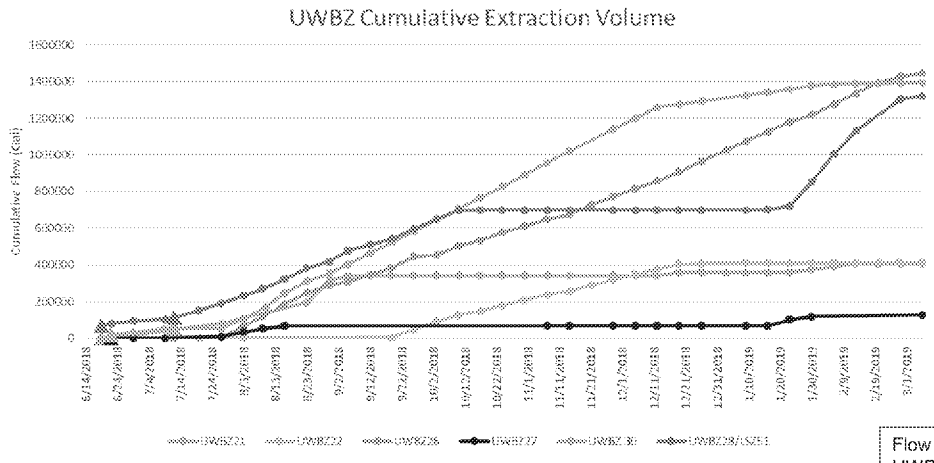
Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-CZ07	4/30/2018	230
	11/1/2018	600
	2/11/2019	410
ST012-CZ18	4/3/2018	1200
	11/1/2018	260
	2/11/2019	260
ST012-CZ19	5/9/2018	3.1
ST012-CZ21	4/12/2018	680

- Most recent baseline and operating (when available) benzene analytical result listed (Feb 2019 added)
- Individual well concentrations may be reduced with pumping

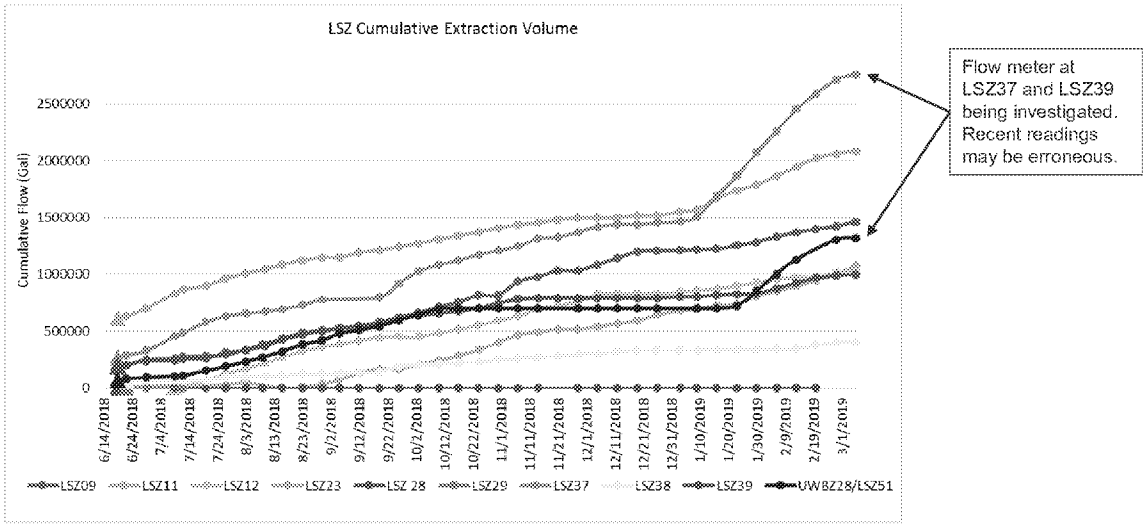
Cumulative Extraction Volume and Analytical Data by Well - Upper Water Bearing Zone



Flow estimated at UWBZ21 when cycle counter was not working

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-UWBZ21	8/9/2017	3400
ST012-UWBZ22	5/9/2018	1900
	2/11/2019	2800
ST012-UWBZ26	4/3/2018	3500
	4/3/2018	3700
	2/22/2019	2900
ST012-UWBZ27	4/3/2018	1500
	2/22/2019	460
ST012-UWBZ28/LSZ51	5/9/2018	1700
ST012-UWBZ30	5/9/2018	6000

Cumulative Extraction Volume and Analytical Data by Well - Lower Saturated Zone



Flow meter at LSZ37 and LSZ39 being investigated. Recent readings may be erroneous.

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Cumulative Extraction Volume and Analytical Data by Well - Lower Saturated Zone

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-LSZ09	4/3/2018	2100
	2/12/2019	1000
ST012-LSZ11	5/9/2018	2100
	2/12/2019	3500
ST012-LSZ12	5/9/2018	1400
	11/1/2018	420
	2/12/2019	470
ST012-LSZ23	4/3/2018	1600
	2/12/2019	790
ST012-LSZ28	12/1/2016	110
ST012-LSZ29	4/10/2018	2.1
ST012-LSZ37	4/12/2018	2700
	2/12/2019	460
ST012-LSZ38	4/3/2018	3000
	11/1/2018	1300
	2/12/2019	2100
ST012-LSZ39	4/12/2018	3100/5500
	2/12/2019	130
ST012-UWBZ28/LSZ51	5/9/2018	1700

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Site ST012 Injection Progress

- **Injections continued in Feb-Mar**

Date	Volume (gallons)	Number of Bags of Sulfate Added	Calculated Na2SO4 Conc. g/L	Calculated SO4 Conc. g/L	Locations(% of volume if multiple locations)
2/18/2019	5,000	2	96	65	UWBZ36
2/27/2019	5,000	2	96	65	UWBZ36
2/28/2019	10,000	4	96	65	UWBZ34
3/5/2019	9,500	4	96	65	UWBZ34 (58%),W11(42%)
3/6/2019	6,000	2	96	65	UWBZ34 (50%),W11(50%)

- **Cold weather practical limit has been ~96 g/L of sodium sulfate (~65 g/L of sulfate). Expect to increase concentration soon.**
- **Initial injections in UWBZ33, UWBZ36 complete**
- **Multi-well injections started**
- **45 tons injected through 6 Mar 2019 (of 169 tons planned for Subphase 1 – 26%)**

Site ST012 Sulfate Field Screening

- **Estimated travel times (from work plan, App F figures)**
  - UWBZ33 to UWBZ22 (130 ft): up to 10 months
  - UWBZ33 to UWBZ27 (115 ft): up to 15 months
  - UWBZ36 to UWBZ26 (60 ft): 1-2 months
- **Model predicts sulfate concentrations would increase at extraction locations for several months before decreasing**
- **Sulfate field tests completed ~weekly in wells in proximity to injections**

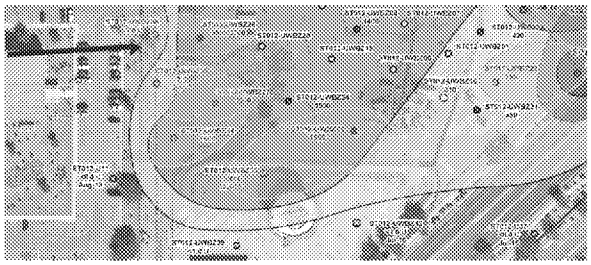
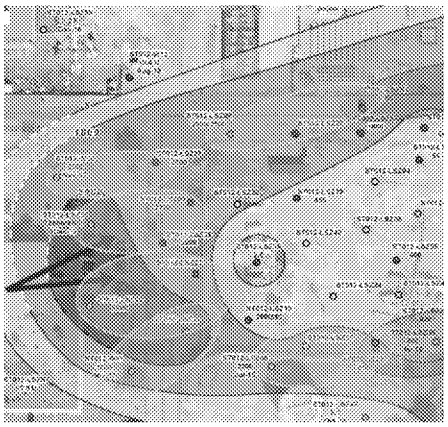
Site ST012 Sulfate Field Screening

Monitoring Points	Background Well	Date	Sample Result
UWBZ-33	UWBZ-22 (average pre-injection laboratory sulfate = 11 mg/L)	12/17/2018	*30*
		12/21/2018	*45*
		12/26/2018	146
		1/15/2019	45
		1/18/2019	40
		1/21/2019	38
		1/24/2019	41
		1/25/2019	250
		1/28/2019	10
		1/29/2019	35
		1/31/2019	89
		2/1/2019	57
		2/5/2019	37
		2/11/2019	37
		2/15/2019	36
		2/18/2019	40
		2/22/2019	pump down
		2/25/2019	pump down
		3/1/2019	pump down
		3/4/2019	pump down
		3/8/2019	pump down

Monitoring Points	Background Well	Date	Sample Result
UWBZ-33 UWBZ-34	UWBZ-27 (average pre-injection laboratory sulfate = 108 mg/L)	12/17/2018	*15*
		12/21/2018	*30*
		12/26/2018	>150
		1/15/2019	71
		1/18/2019	57
		1/21/2019	66
		1/24/2019	48
		1/25/2019	50
		1/28/2019	pump down
		1/29/2019	pump down
		1/31/2019	pump down
		2/1/2019	pump down
		2/5/2019	pump down
		2/11/2019	54
		2/15/2019	48
		2/18/2019	pump down
		2/22/2019	pump down
		2/25/2019	pump down
		3/1/2019	94
		3/4/2019	112
		3/8/2019	pump down

Monitoring Points	Background Well	Date	Sample Result
UWBZ-36	UWBZ-26 (average pre-injection sulfate = 3.6 mg/L)	1/31/2019	22
		2/1/2019	9
		2/5/2019	25
		2/11/2019	10
		2/15/2019	12
		2/18/2019	16
		2/22/2019	22
		2/25/2019	38
		3/1/2019	66
		3/4/2019	67
		3/8/2019	104

- **Increasing trends in UWBZ26 and UWBZ27.**

Site ST012 Path Forward Mar-Apr

- Continued SVE operation
- Troubleshoot well pumps (27&28 Mar)
- Pilot Study Implementation
  - Continue mixing sulfate batches and inject according to plan (FVM7) Mar – Apr (finishing injection of batches in UWBZ34 and W11 this week)
  - Next planned injection wells UWBZ35 and LSZ08 (simultaneous injections)