

Tank 5 Quarterly Release Response Report Red Hill Bulk Fuel Storage Facility JBPHH, Oahu, Hawaii

DOH Facility ID No. 9-102271
DOH Release ID No. 140010

January 2020

Prepared by:



Commander
Navy Region Hawaii
Environmental Department, Code N45
850 Ticonderoga Street, Suite 110
JBPHH, Hawaii 96860-5101

Table of Contents

<i>Table of Contents</i>	i
<i>Executive Summary</i>	iii
<i>1.0 Introduction</i>	1
1.1 Statement of Purpose.....	1
1.2 Previous Reports	1
<i>2.0 Background</i>	2
2.1 Site Description	2
2.2 Facility Information.....	3
<i>3.0 Groundwater and Soil Vapor Monitoring</i>	3
3.1 Oil/Water Interface Measurements	3
3.2 Soil Vapor Monitoring	4
3.3 Groundwater Sampling and Analysis.....	4
3.4 Drinking Water Sampling	5
<i>4.0 Continued Groundwater and Soil Vapor Monitoring</i>	5
<i>5.0 Continued Drinking Water Sampling</i>	5
<i>6.0 Planned Future Release Response Actions</i>	5
<i>7.0 Public Notification</i>	6
<i>8.0 Conclusions and Recommendations</i>	6
<i>9.0 References</i>	7

Appendix A – Oil/Water Interface Measurements, January 2014 through October 2019

Appendix B – Soil Vapor Sampling Results through October 2019

Appendix C – Public Notification

This page intentionally left blank

Executive Summary

Navy Region Hawaii (NRH) prepared this Quarterly Release Response Report in accordance with the State of Hawaii Department of Health (DOH) Underground Storage Tank (UST) Technical Guidance Manual (DOH, 2000) and in response to the DOH release response letters dated February 12, 2014 and February 26, 2014 for the Red Hill Bulk Fuel Storage Facility (Facility). The objective of this report is to describe the actions taken by the Navy between October and December 2019 in response to the fuel reportedly released from Tank 5 in January 2014.

Soil vapor and groundwater samples continue to be collected from locations inside the Red Hill tunnel system. Groundwater samples are also collected from locations outside the Red Hill tunnel system.

The Navy continues to perform work to ensure the drinking water around the Facility remains safe. Future release response actions include determining the feasibility of alternatives for investigating and remediating releases from the Facility and continuing efforts to monitor and characterize the flow of groundwater around the Facility.

This page intentionally left blank

1.0 Introduction

As required by Hawaii Administrative Rules 11-280.1-65.2, Release Response Reporting, this Quarterly Release Response Report presents the following information:

- 1) All release response actions taken pursuant to subchapter 6 after the last reported date;
- 2) A plan for future release response actions to be taken; and
- 3) Information required pursuant to section 11-280.1-65.1.

This report presents a summary of the release response activities performed October 1 through December 31, 2019 at the Red Hill Bulk Fuel Storage Facility (hereinafter referred to as “the Facility”) located at Joint Base Pearl Harbor-Hickam (JBPHH), Oahu, Hawaii.

1.1 Statement of Purpose

Release response actions were performed to address a fuel release observed in Tank 5.

1.2 Previous Reports

The following documents were previously submitted to DOH:

- Release confirmation information for Tank 5 as Navy Region Hawaii (NRH) letter 5090 Ser N45/044 dated January 23, 2014
- Initial Release Response Report, enclosed with NRH letter 5090 Ser N45/320 dated April 24, 2014
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/563 dated July 22, 2014
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/929 dated November 10, 2014
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/121 dated January 21, 2015
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/322 dated April 20, 2015
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/573 dated July 17, 2015
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/812 dated October 16, 2015
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0411 dated January 13, 2016
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0508 dated April 13, 2016

-
- Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0583 dated July 28, 2016
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0658 dated October 24, 2016
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0422 dated January 27, 2017
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0489 dated April 24, 2017
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0552 dated July 24, 2017
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0627 dated October 23, 2017
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0410 dated January 19, 2018
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0492 dated April 19, 2018
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0553 dated July 18, 2018
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0630 dated October 16, 2018
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0403 dated January 11, 2019
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0403 dated April 15, 2019
 - Quarterly Release Response Report enclosed with NRH letter 5090 Ser N45/0590 dated July 12, 2019
 - Quarterly Release Response Report enclosed with NRH letter dated October 9, 2019

2.0 Background

The following sections provide a description of the site and information on the Facility.

2.1 Site Description

The Facility is located on federal government land (zoned a mix of F1- Military and Federal and P-1 Restricted Preservation districts) in south-central Oahu, approximately 2.5 miles northeast of Pearl Harbor. It is located on a low ridge on the western edge of the Koolau Mountain Range that divides Halawa Valley from Moanalua Valley. The Facility occupies 144 acres of land and

the majority of the ground surface of the site lies at an elevation of approximately 200 to 500 feet above mean sea level (msl) (AECOM Technical Services, Inc., 2018).

The Facility is bordered on the southwest by residential neighborhoods and the United States (U.S.) Coast Guard reservation, on the southeast by residential neighborhoods in Moanalua Valley, and on the northeast by preservation land. The Facility is bordered on the north by Halawa Correctional Facility and Halawa Industrial Park, which includes private businesses and a former bus facility. A quarry is located less than a quarter mile away to the northwest.

2.2 Facility Information

The Facility contains eighteen (18) active and two (2) inactive bulk fuel field-constructed underground storage tanks (USTs), which are operated by Naval Supply Systems Command (NAVSUP) Fleet Logistics Center (FLC) Pearl Harbor (formerly Fleet and Industrial Supply Center). The Facility was constructed by the U.S. Government in the early 1940s. Twenty (20) USTs and a series of tunnels were constructed to supply fuel to the Navy. Each UST has a capacity of approximately 12.5 million gallons. The Facility is located approximately 100 feet above the basal aquifer. The USTs currently contain Jet Fuel Propellant No. 5 (JP-5), North Atlantic Treaty Organization (NATO)-grade F-24 jet fuel, or Marine Diesel Fuel (F-76). Tank 5 was used to store Jet Fuel Propellant No. 8 (JP-8).

Four (4) groundwater monitoring wells (wells RHMW01, RHMW02, RHMW03, and RHMW05) are located within the lower access tunnel, and one (1) sampling point (RHMW2254-01) is located at Red Hill Shaft. Sampling point RHMW2254-01 is located inside the infiltration gallery of the Department of the Navy (Navy) Supply Well 2254-01.

Eleven (11) groundwater monitoring wells (RHMW04, RHMW06, RHMW07, RHMW08, RHMW09, RHMW10, RHMW11, RHMW14, RHMW15, OWDFMW01, and HDMW2253-03) are located outside of the Facility tunnel system. Well OWDFMW01 is located at the former Oily Waste Disposal Facility, near Adit 3, and wells RHMW11 and HDMW2253-03 are located at the Halawa Correctional Facility (outside the Red Hill Facility).

3.0 Groundwater and Soil Vapor Monitoring

The following sections describe activities that were performed to monitor the groundwater and soil vapor beneath Tank 5 from October 1 through December 31, 2019.

3.1 Oil/Water Interface Measurements

The water level was gauged and measured for the presence of light non-aqueous phase liquids (LNAPLs) using an interface meter. The interface meter was lowered into the groundwater monitoring wells located within the lower access tunnel to determine the depth of water to the nearest 0.01 foot, and the existence of any immiscible layers (LNAPL).

Oil/water interface measurements were taken at groundwater monitoring wells RHMW01, RHMW02, RHMW03, and RHMW05 in October 2019. No LNAPL was observed. Following the oil/water interface measurements, transducers were installed in the monitoring wells for a water level survey. No oil/water interface measurements were taken in November and December due to the presence of the transducers.

A summary of interface measurements through October 2019 is presented in Appendix A.

3.2 Soil Vapor Monitoring

Soil vapor samples were collected and analyzed in the field for volatile organic compound (VOC) concentrations using a photo-ionization detector (PID). Soil vapor monitoring points (SVMPs) were given a SV prefix, followed by the associated tank number, and then the location under the tank: “S” for shallow or front of the UST, “M” for mid depth or middle of the UST, and “D” for deep or outer edge of the UST.

A conservative approach to assess the integrity of the associated tank system is to measure if VOC concentrations exceed 280,000 parts per billion by volume (ppbv) in soil vapor monitoring probes beneath tanks containing jet fuels (JP-5 or F-24), or 14,000 ppbv in soil vapor monitoring probes beneath tanks containing marine diesel fuel (F-76) (TEC, 2010). These values are 50 percent of the calculated vapor concentration from fuel-saturated water.

Soil vapor monitoring was performed at all active and accessible tanks in October, November, and December 2019. Soil vapor VOC concentrations at Tank 5 were below the action level of 280,000 ppbv during all three monitoring events. During the same monitoring events, soil vapor VOC concentrations at all other active and accessible tanks were below the action levels, with no consistent trend.

Soil vapor sampling results from January 2014 through October 2019 are presented in Appendix B. The results for November and December 2019 are being reviewed and will be submitted under separate cover.

3.3 Groundwater Sampling and Analysis

Groundwater samples were collected from 13 conventional monitoring locations and 3 multilevel monitoring locations within the Red Hill groundwater monitoring network in October 2019. Groundwater samples were collected from sampling point RHMW2254-01 located at Red Hill Shaft, 11 monitoring wells within the Facility boundary (wells RHMW01 through RHMW10 and OWDFMW01), RHMW11, RHMW14, RHMW15, and the Halawa Deep Monitor Well (HDMW2253-03), which are located outside of the Facility. The multilevel monitoring locations, RHMW11, RHMW14, and RHMW15, are located outside of the Facility.

A groundwater monitoring report, which summarizes sampling activities and laboratory analytical results, will be submitted under separate cover.

3.4 Drinking Water Sampling

Drinking water samples were collected from the Red Hill Shaft post-treatment regulatory compliance sampling point (360-011, Tap Outside Chlorine Building) on December 18, 2019. Samples were analyzed for Lead, JP-8/F-24, and contaminants listed in the Transition Plan.

U.S. Environmental Protection Agency (EPA) Methods 524.2 (VOCs), 525.2 (SVOCs), 8015B (JP-8/F-24 and TPH-o), and 200.8 (Lead) were used and all analyses were conducted by labs certified by the DOH State Laboratories Division.

The sample results were not available at the completion of this report. A summary of the drinking water sampling results will be submitted under separate cover.

4.0 Continued Groundwater and Soil Vapor Monitoring

Continued monitoring of the groundwater and soil vapor will be conducted as follows:

- Oil/water interface measurements – quarterly
- Soil vapor sampling – monthly
- Groundwater sampling and analysis – quarterly

Monitoring results will be submitted to DOH for each sampling event.

5.0 Continued Drinking Water Sampling

Drinking water sampling will continue on a quarterly schedule in accordance with the approved Transition Plan. Samples will be taken at the entry point to the distribution system (360-011 Tap Outside Chlorine Building) and analyzed using the following analytical methods:

- VOCs – EPA 524.2
- SVOCs – EPA 525.2
- Gas Chromatography for JP-8/F-24 – EPA 8015
- Lead – EPA 200.8

6.0 Planned Future Release Response Actions

The Navy and DLA negotiated with the EPA and DOH (the “Regulatory Agencies”) release response actions that will be pursued. Future release response actions include determining the feasibility of alternatives for investigating and remediating releases from the Facility and continuing efforts to monitor and characterize the flow of groundwater around the Facility. A revised Work Plan/Scope of Work that describes the future release response actions was submitted pursuant to the Red Hill Administrative Order on Consent to the Regulatory Agencies in November 2016. Conditional approval was received from the Regulatory Agencies in December 2016.

The following documents were submitted for regulatory review:

- Monitoring Well Installation Work Plan Addendum No. 1 in January 2017
- Sampling and Analysis Plan in January 2017
- Existing Data Summary and Evaluation Report in March 2017
- Groundwater Flow Model Progress Report 01 in April 2017
- Sampling and Analysis Plan, Revision 01 in April 2017
- Data Gap Analysis Report in April 2017
- Monitoring Well Installation Work Plan Addendum No. 2 in August 2017
- Groundwater Flow Model Progress Report 02 in August 2017
- Groundwater Flow Model Progress Report 03 in December 2017
- Sentinel Well Network Development Plan in December 2017
- Risk Based Decision Criteria Development Plan in December 2017
- Technical Memorandum, Testing and Verification of Packer Integrity at RHMW11 in February 2018
- Seismic Profiling to Map Hydrostratigraphy in the Red Hill Area in March 2018
- Groundwater Flow Model Progress Report 04 in April 2018
- Conceptual Site Model Report and Groundwater Protection and Evaluation Considerations Report in July 2018
- Groundwater Flow Model Progress Report 05 in August 2018
- Groundwater Flow Model Progress Report 06 in December 2018
- Groundwater Flow Model Progress Report 07 in April 2019
- Conceptual Site Model Report Revision 01 in June 2019
- Groundwater Flow Model Progress Report 08 in August 2019
- Groundwater Flow Model Progress Report 09 in December 2019

Approval by the Regulatory Agencies of the documents will guide future release response actions.

7.0 Public Notification

The Navy provided notification to the public through the following document:

- Fact Sheet of October 15, 2019

A copy of this document is included as Appendix C.

8.0 Conclusions and Recommendations

Results of groundwater sampling and analysis and drinking water sampling and analysis indicate the release of JP-8 from Tank 5 has not impacted the Red Hill Shaft.

Additional release response actions have been negotiated with the EPA and DOH to protect the drinking water sources near the Facility.

The next quarterly release response report will be submitted in April 2020 and will cover the release response actions completed between January and March 2020.

9.0 References

AECOM Technical Services, Inc., 2018, Final First Quarter 2018 – Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, Prepared for Department of the Navy, Naval Facilities Engineering Command, Hawaii, JBPHH, Hawaii, July 2018.

DOH, 2000, Technical Guidance Manual for Underground Storage Tank Closure and Release Response, Environmental Management Division, Solid and Hazardous Waste Branch, Underground Storage Tank Section, March 2000.

DOH, 2013, Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan, Office of Hazard Evaluation and Emergency Response, Interim Final, March 2013.

DOH, 2017, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Environmental Management Division, Fall 2017.

Hawaii Administrative Rules, Title 11, Chapter 280.1, Underground Storage Tanks, July 2018.

TEC, 2007, Final Technical Report, Red Hill Bulk Fuel Storage Facility, Prepared for Department of the Navy, Commander Naval Facilities Engineering Command, Pacific, Pearl Harbor, Hawaii, August 2007.

TEC, 2008, Final Groundwater Protection Plan, Red Hill Fuel Storage Facility, prepared for Navy Region Hawaii, Pearl Harbor, Hawaii, January 2008, revised December 2009 and August 2014.

TEC, 2010, Final Soil Vapor Sampling Monitoring Analysis Letter Report, February 1, 2010.

Appendix A
Oil/Water Interface Measurements
January 2014 through October 2019

Red Hill Oil/Water Interface Measurements - October 2012 through October 2019

Date (m-yy)	RHMW01			RHMW02			RHMW03			RHMW05		
	Elevation = 102.27 ft. ₁			Elevation = 104.76 ft. ₁			Elevation = 121.06 ft. ₁			Elevation = 101.55 ft. ₁		
	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL
Oct-12	84.19	18.08	0	86.81	17.95	0	103.50	17.56	0	83.72	17.83	0
Nov-12	84.23	18.04	0	86.85	17.91	0	103.10	17.96	0	83.70	17.85	0
Dec-12	84.21	18.06	0	86.87	17.89	0	103.14	17.92	0	83.70	17.85	0
Jan-13	84.05	18.22	0	86.87	17.89	0	103.14	17.92	0	83.70	17.85	0
Feb-13	84.04	18.23	0	86.62	18.14	0	102.87	18.19	0	83.43	18.12	0
Mar-13	83.82	18.45	0	86.48	18.28	0	102.75	18.31	0	83.19	18.36	0
Apr-13	83.84	18.43	0	86.50	18.26	0	102.78	18.28	0	83.41	18.14	0
May-13	84.03	18.24	0	86.69	18.07	0	102.95	18.11	0	83.41	18.14	0
Jun-13	84.22	18.05	0	86.86	17.90	0	103.12	17.94	0	83.66	17.89	0
Jul-13	84.29	17.98	0	86.96	17.80	0	103.23	17.83	0	83.85	17.70	0
Aug-13	84.66	17.61	0	86.28	18.48	0	103.50	17.56	0	84.09	17.46	0
Sep-13	84.57	17.70	0	87.20	17.56	0	103.43	17.63	0	84.00	17.55	0
Oct-13	84.47	17.80	0	87.08	17.68	0	103.31	17.75	0	83.80	17.75	0
Nov-13	84.26	18.01	0	86.91	17.85	0	103.16	17.90	0	83.70	17.85	0
Dec-13	84.09	18.18	0	86.72	18.04	0	103.00	18.06	0	83.72	17.83	0
Jan-14	83.56	18.71	0	86.25	18.51	0	102.52	18.54	0	82.94	18.61	0
Feb-14	84.49	17.78	0	86.16	18.60	0	102.47	18.59	0	82.83	18.72	0
Feb-14	83.54	18.73	0	86.24	18.52	0	102.47	18.59	0	82.97	18.58	0
Mar-14	83.76	18.51	0	86.42	18.34	0	102.65	18.41	0	83.18	18.37	0
Apr-14	83.93	18.34	0	86.58	18.18	0	102.80	18.26	0	83.27	18.28	0
May-14	83.91	18.36	0	86.60	18.16	0	102.85	18.21	0	83.31	18.24	0
Jun-14	84.06	18.21	0	86.72	18.04	0	103.99	17.07	0	83.54	18.01	0
Jul-14	84.13	18.14	0	86.80	17.96	0	102.98	18.08	0	83.49	18.06	0
Aug-14	84.01	18.26	0	86.65	18.11	0	102.87	18.19	0	83.04	18.51	0
Sep-14	84.64	17.63	0	87.27	17.49	0	103.51	17.55	0	84.10	17.45	0
Oct-14	83.79	18.48	0	86.51	18.25	0	102.78	18.28	0	83.21	18.34	0
Nov-14	83.87	18.40	0	86.56	18.20	0	102.78	18.28	0	83.35	18.20	0
Dec-14	83.67	18.60	0	86.37	18.39	0	102.64	18.42	0	83.05	18.50	0
Jan-15	83.63	18.64	0	86.35	18.41	0	102.63	18.43	0	83.03	18.52	0
Feb-15	83.68	18.59	0	86.28	18.48	0	102.52	18.54	0	83.06	18.49	0
Mar-15	83.83	18.44	0	86.04	18.72	0	102.79	18.27	0	83.24	18.31	0
Apr-15	84.33	17.94	0	86.97	17.79	0	103.18	17.88	0	83.72	17.83	0
May-15	84.29	17.98	0	86.97	17.79	0	103.24	17.82	0	83.95	17.60	0

Notes:

1 - Elevations were updated based on the *Groundwater Flow Direction/Gradient and Tier 3 Risk Assessment Re-evaluation Letter Report, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii, Contract #N47408-04-D-8514, Task Order 54, dated April 15, 2010.*

DTW (TOC) - depth to water from top of well casing

LNAPL - light non-aqueous phase liquid thickness attributed to the Red Hill Bulk Fuel Storage Facility (Note: No measurable LNAPL to date)

SWL - static water level

2 - Measurements collected from October 2012 - August 2015 are taken by ESI, Inc., measurements taken from September 2015 on are taken by Element Environmental (E2).

Red Hill Oil/Water Interface Measurements - October 2012 through October 2019

Date (m-yy)	RHMW01			RHMW02			RHMW03			RHMW05		
	Elevation = 102.27 ft. ₁			Elevation = 104.76 ft. ₁			Elevation = 121.06 ft. ₁			Elevation = 101.55 ft. ₁		
	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL
Jun-15	84.58	17.69	0	87.28	17.48	0	103.57	17.49	0	83.75	17.80	0
Jul-15	84.58	17.69	0	87.24	17.52	0	103.44	17.62	0	83.76	17.79	0
Aug-15	84.44	17.83	0	87.13	17.63	0	103.41	17.65	0	83.69	17.86	0
Sep-15	84.26	18.01	0	86.94	17.82	0	103.21	17.85	0	83.63	17.92	0
Oct-15	84.00	18.27	0	86.38	18.38	0	103.38	17.68	0	Obstructed	NA	NA
Nov-15	84.25	18.02	0	86.93	17.83	0	103.24	17.82	0	84.62 ₃	16.93	0
Dec-15	83.76	18.51	0	86.36	18.40	0	102.56	18.50	0	83.18	18.37	0
Jan-16	83.31	18.96	0	85.97	18.79	0	102.21	18.85	0	Obstructed	NA	NA
Feb-16	83.17	19.10	0	85.81	18.95	0	102.10	18.96	0	Obstructed	NA	NA
Mar-16	82.89	19.38	0	85.60	19.16	0	101.82	19.24	0	82.26	19.29	0
Apr-16	82.97	19.30	0	85.63	19.13	0	101.91	19.15	0	82.31	19.24	0
May-16	83.14	19.13	0	85.81	18.95	0	102.03	19.03	0	82.50	19.05	0
Jun-16	83.16	19.11	0	85.77	18.99	0	102.03	19.03	0	82.54	19.01	0
Jul-16	83.32	18.95	0	85.99	18.77	0	102.31	18.75	0	82.63	18.92	0
Aug-16	83.27	19.00	0	85.96	18.80	0	102.20	18.86	0	82.63	18.92	0
Sep-16	83.13	19.14	0	85.74	19.02	0	102.06	19.00	0	82.44	19.11	0
Oct-16	83.01	19.26	0	85.69	19.07	0	101.95	19.11	0	82.39	19.16	0
Nov-16	82.92	19.35	0	85.56	19.20	0	101.82	19.24	0	82.24	19.31	0
Dec-16	82.67	19.60	0	85.36	19.40	0	101.61	19.45	0	82.01	19.54	0
Jan-17	82.45	19.82	0	85.13	19.63	0	101.46	19.60	0	82.04	19.51	0
Feb-17	82.37	19.90	0	85.01	19.75	0	101.31	19.75	0	81.72	19.83	0
Mar-17	82.49	19.78	0	85.19	19.57	0	101.45	19.61	0	81.84	19.71	0
Apr-17	82.59	19.68	0	85.25	19.51	0	101.50	19.56	0	81.94	19.61	0
May-17	82.45	19.82	0	85.13	19.63	0	101.39	19.67	0	81.80	19.75	0
Jun-17	82.94	19.33	0	85.59	19.17	0	101.89	19.17	0	82.30	19.25	0
Jul-17	83.43	18.84	0	86.50	18.26	0	Obstructed ₄	NA	NA	82.81	18.74	0
Mar-18 ₅	83.56	18.71	0	86.24	18.52	0	102.55	18.51	0	82.89	18.66	0
Apr-18	83.47	18.80	0	86.14	18.62	0	102.38	18.68	0	82.86	18.69	0
May-18	83.61	18.66	0	86.29	18.47	0	102.56	18.50	0	82.97	18.58	0

Notes:

1 - Elevations were updated based on the *Groundwater Flow Direction/Gradient and Tier 3 Risk Assessment Re-evaluation Letter Report, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii, Contract #N47408-04-D-8514, Task Order 54, dated April 15, 2010.*

DTW (TOC) - depth to water from top of well casing

LNAPL - light non-aqueous phase liquid thickness attributed to the Red Hill Bulk Fuel Storage Facility (Note: No measurable LNAPL to date)

SWL - static water level

2 - Measurements collected from October 2012 - August 2015 are taken by ESI, Inc., measurements taken from September 2015 on are taken by Element.

3 - Dedicated groundwater pump was obstructing the path of the interface meter probe. Depth measured was based on the elevation of water when pump was removed from the monitoring well (RHMW05).

4 - Monitoring well was modified by another contractor following June 2017 fuel product monitoring event. Could not remove the new PVC well casing cap to access well - no measurement was taken.

5 - Monitoring was not conducted by E2 between July 2017 - February 2018 due to an ongoing synoptic study conducted by AECOM.

Red Hill Oil/Water Interface Measurements - October 2012 through October 2019

Date (m-yy)	RHMW01			RHMW02			RHMW03			RHMW05		
	Elevation = 102.27 ft. ¹			Elevation = 104.76 ft. ¹			Elevation = 121.06 ft. ¹			Elevation = 101.55 ft. ¹		
	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL	DTW (TOC) ₂	SWL	LNAPL
Jun-18	83.63	18.64	0	86.34	18.42	0	102.57	18.49	0	82.99	18.56	0
Jul-18	83.55	18.72	0	86.33	18.43	0	102.58	18.48	0	82.90	18.65	0
Aug-18	Obstructed ₆	NA	NA	86.32	18.44	0	102.58	18.48	0	Obstructed ₆	NA	NA
Oct-18	82.64	19.63	0	85.34	19.42	0	101.58	19.48	0	81.99	19.56	0
Jan-19	82.30	19.97	0	84.96	19.80	0	101.22	19.84	0	81.66	19.89	0
Apr-19	82.45	19.82	0	85.18	19.58	0	101.41	19.65	0	81.88	19.67	0
Jul-19	82.67	19.60	0	85.34	19.42	0	101.57	19.49	0	82.06	19.49	0
Oct-19	83.15	19.12	0	85.84	18.92	0	102.19	18.87	0	82.09	19.46	0

Notes:

1 - Elevations were updated based on the *Groundwater Flow Direction/Gradient and Tier 3 Risk Assessment Re-evaluation Letter Report, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Hawaii, Contract #N47408-04-D-8514, Task Order 54, dated April 15, 2010.*

DTW (TOC) - depth to water from top of well casing

LNAPL - light non-aqueous phase liquid thickness attributed to the Red Hill Bulk Fuel Storage Facility (Note: No measurable LNAPL to date)

SWL - static water level

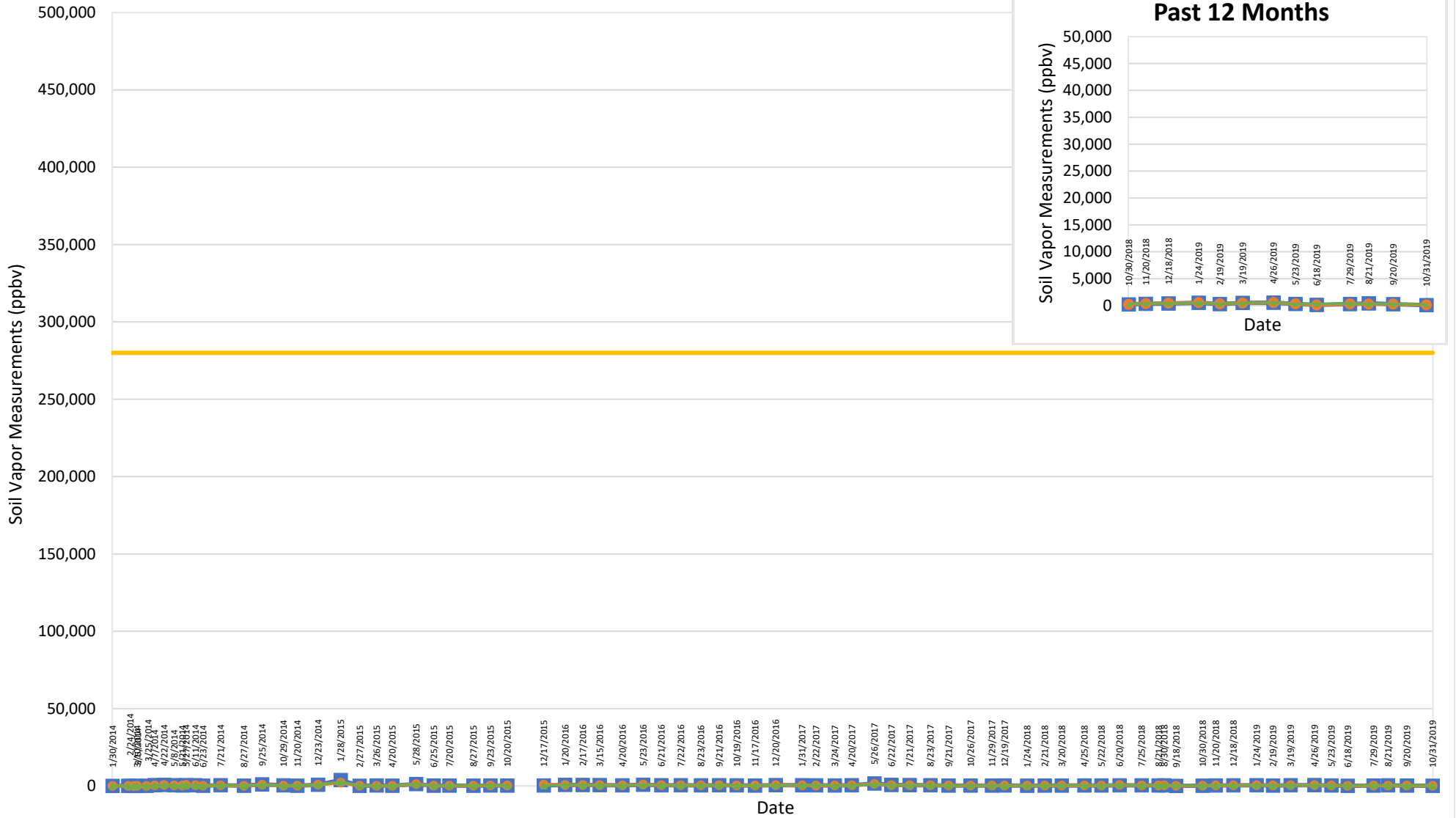
2 - Measurements collected from October 2012 - August 2015 are taken by ESI, Inc., measurements taken from September 2015 on are taken by Element.

6 - Transducers, installed within the groundwater monitoring well as part of another contract, obstructed the path of the interface meter probe - no measurement was taken.

Appendix B
Soil Vapor Sampling Results through October 2019

Figure 1
Soil Vapor Measurements - SV02 (F-24)

SV02 S SV02 M SV02 D Action Level (280,000 ppbv)

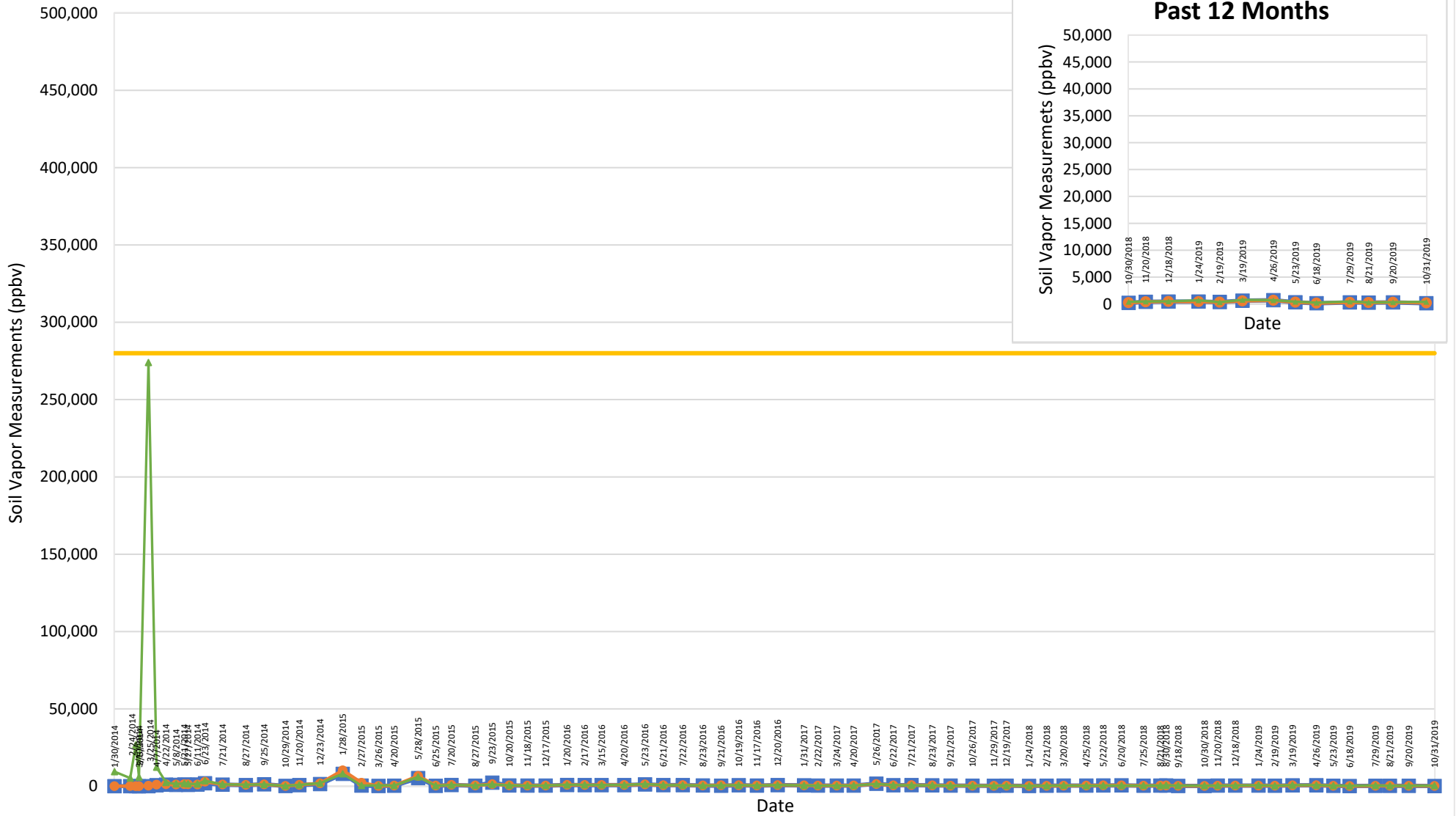


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 2
Soil Vapor Measurements - SV03 (F-24)

SV03 S SV03 M SV03 D Action Level (280,000 ppbv)

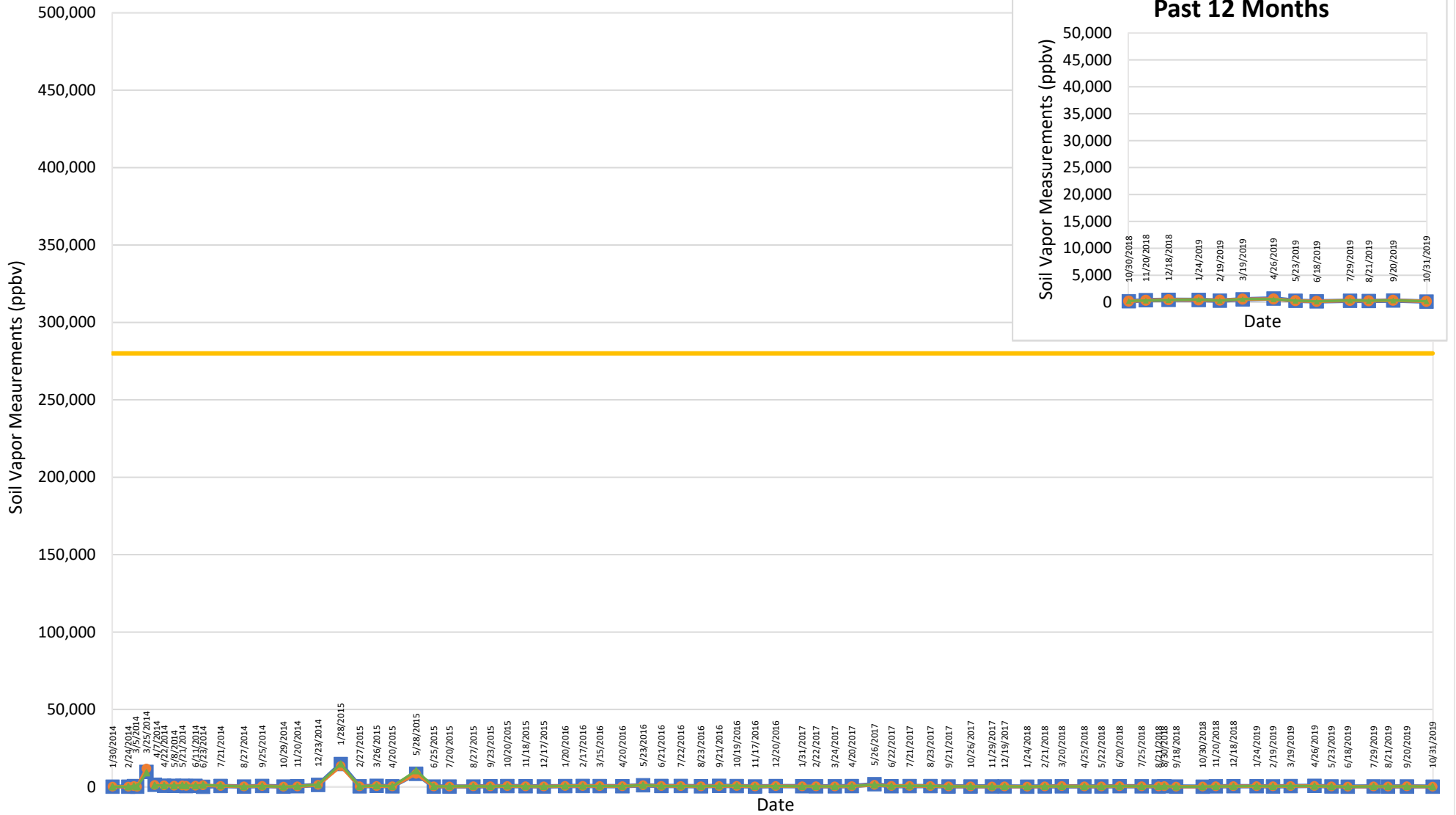


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 3
Soil Vapor Measurements - SV04 (F-24)

SV04 S SV04 M SV04 D Action Level (280,000 ppbv)

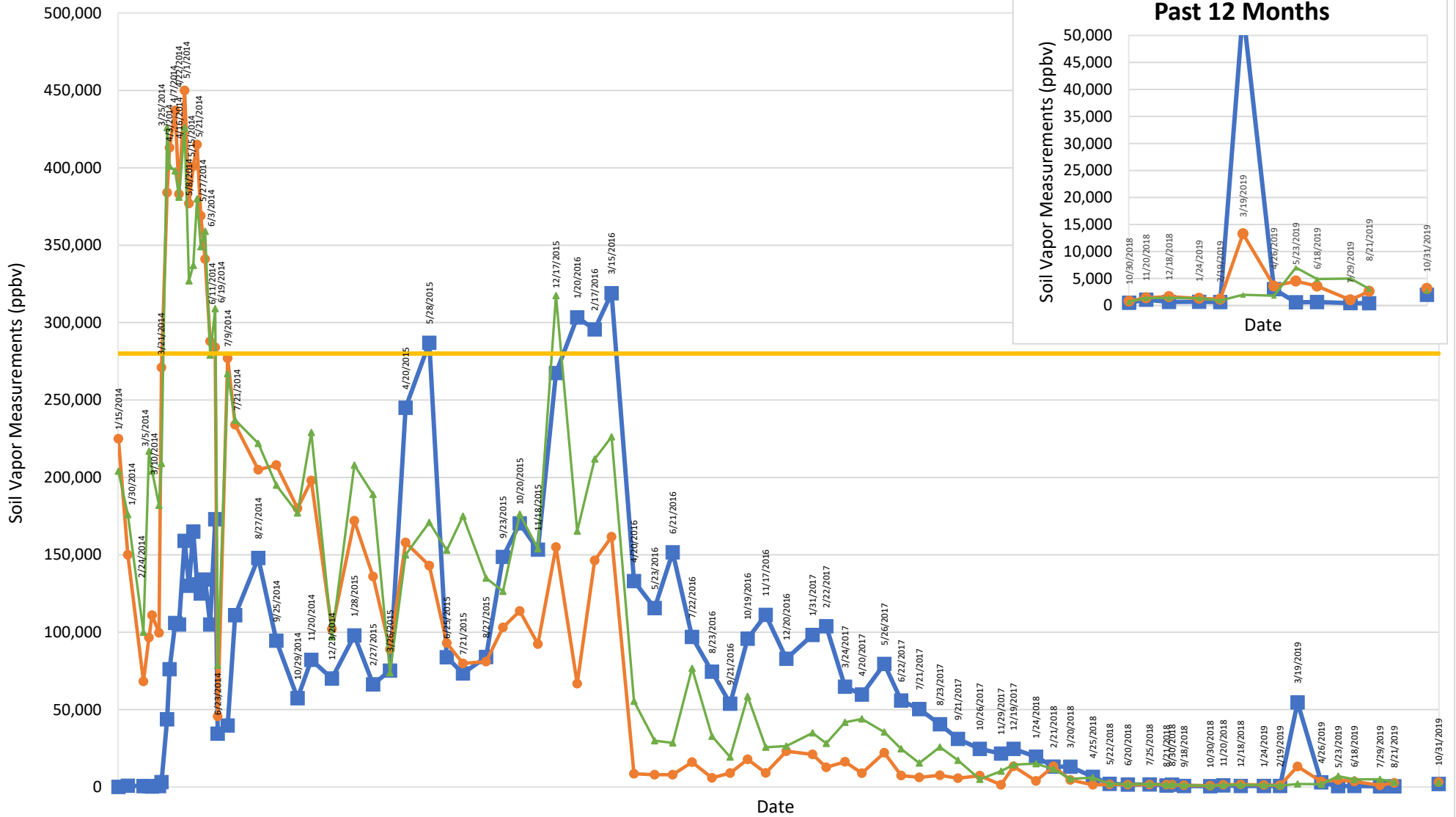


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 4
Soil Vapor Measurements - SV05 (F-24)

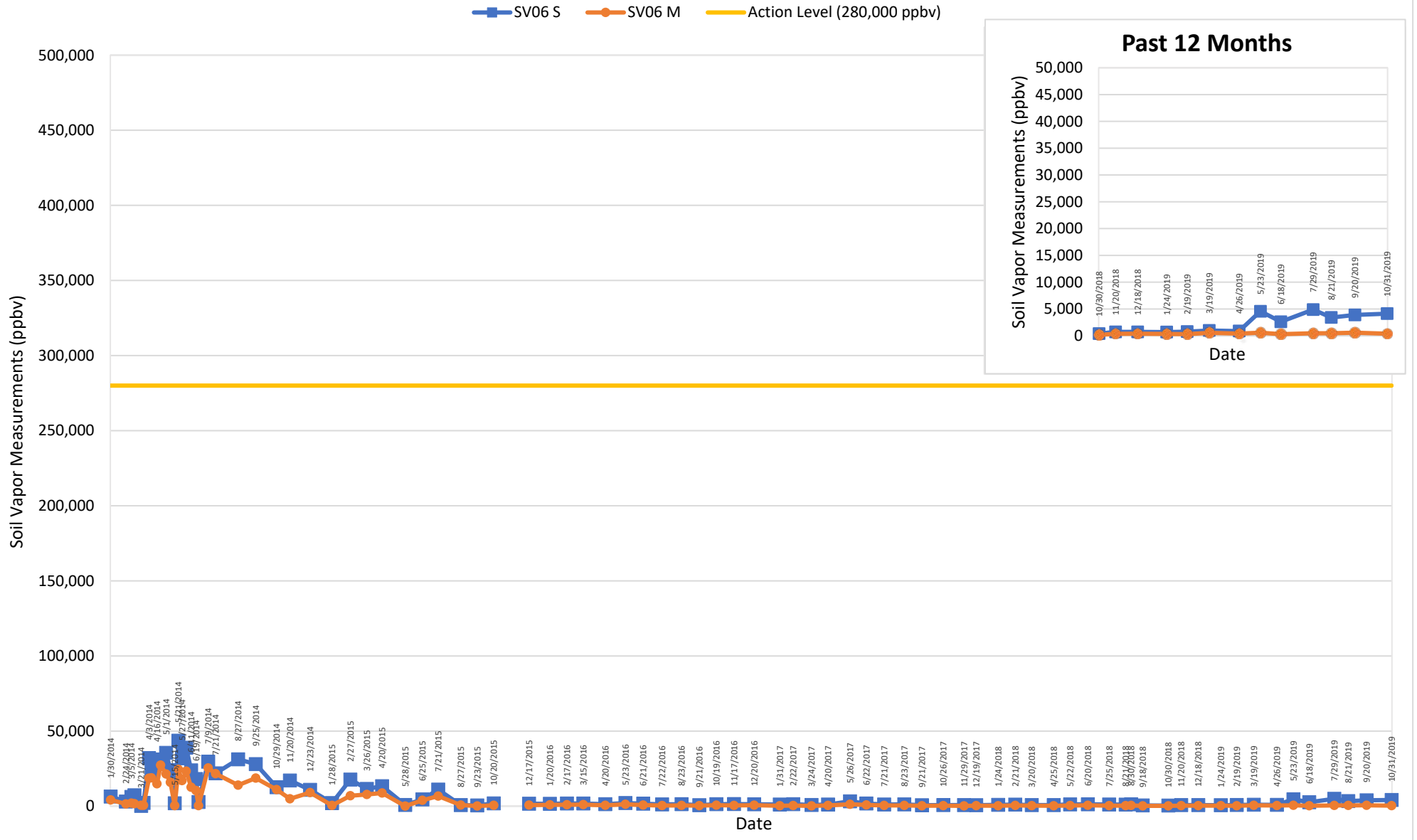
SV05 S SV05 M SV05 D Action Level (280,000 ppbv)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 5
Soil Vapor Measurements - SV06 (F-24)

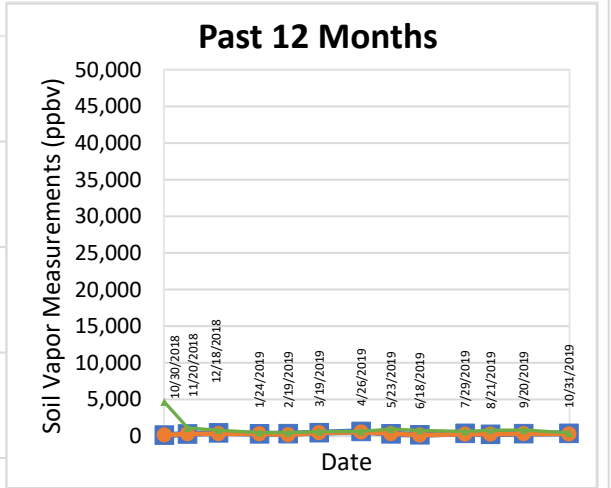
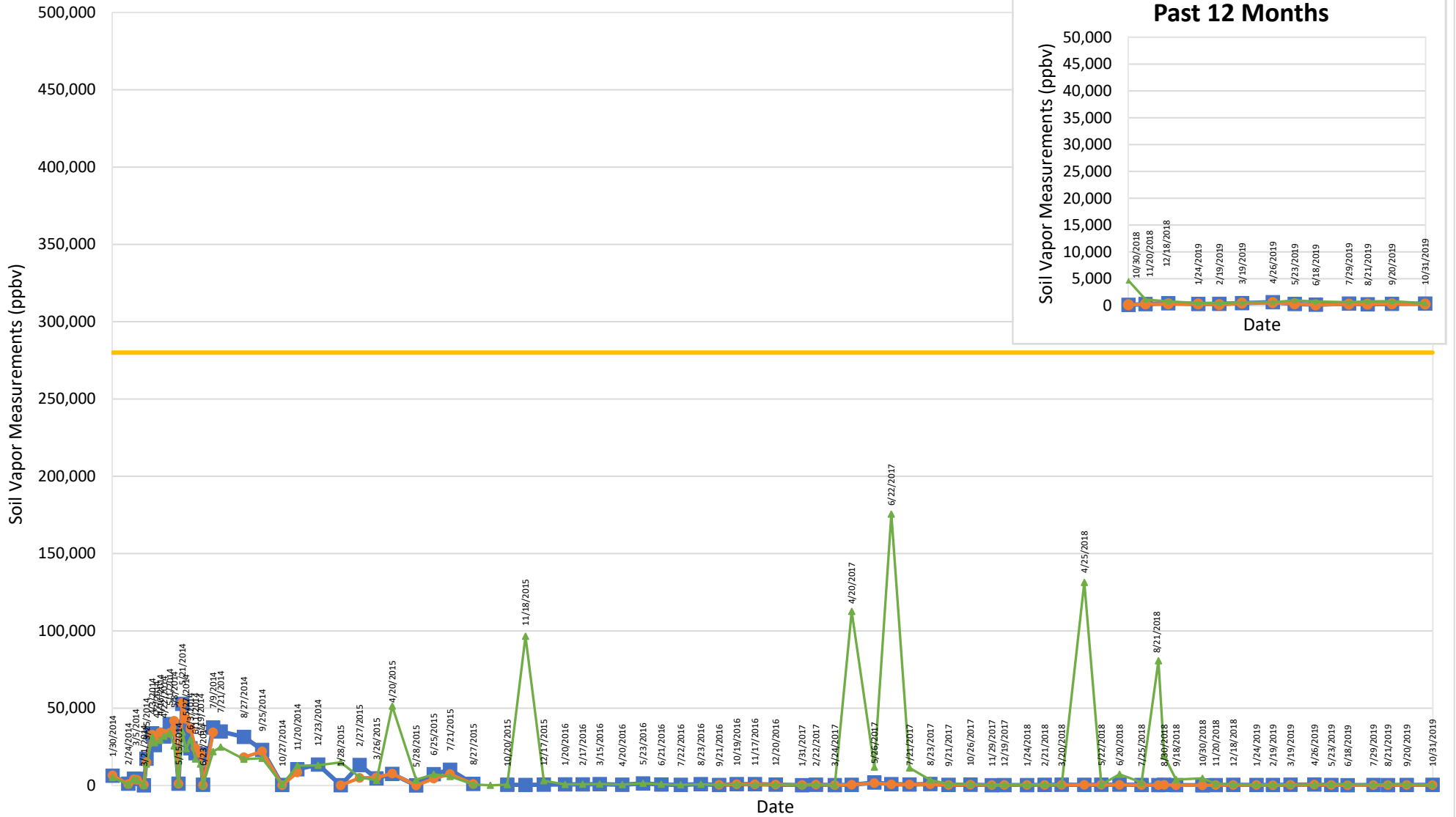


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 6
Soil Vapor Measurements - SV07 (JP-5)

SV07 S SV07 M SV07 D Action Level (280,000 ppbv)

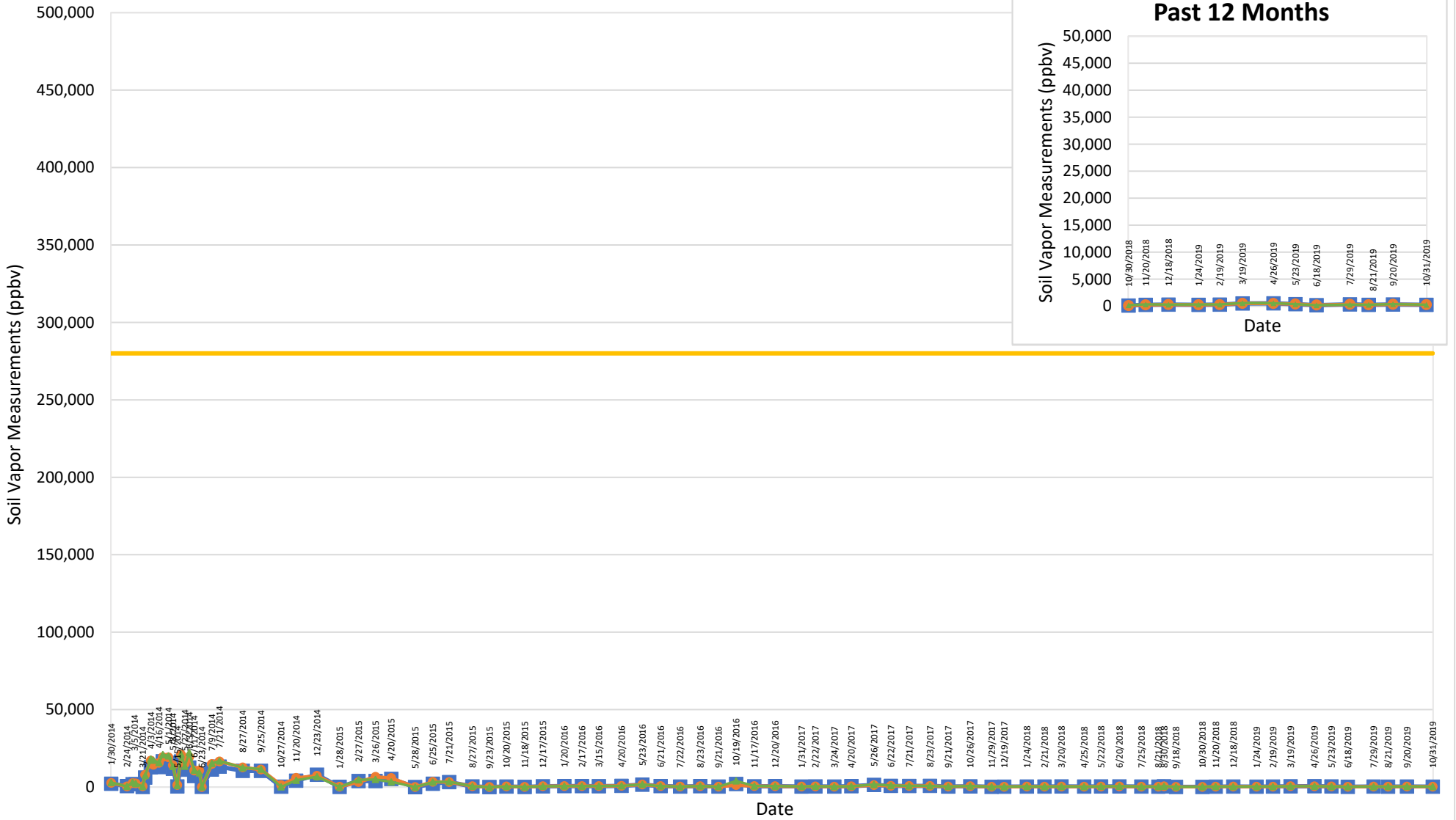


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 7
Soil Vapor Measurements - SV08 (JP-5)

SV08 S SV08 M SV08 D Action Level (280,000 ppbv)

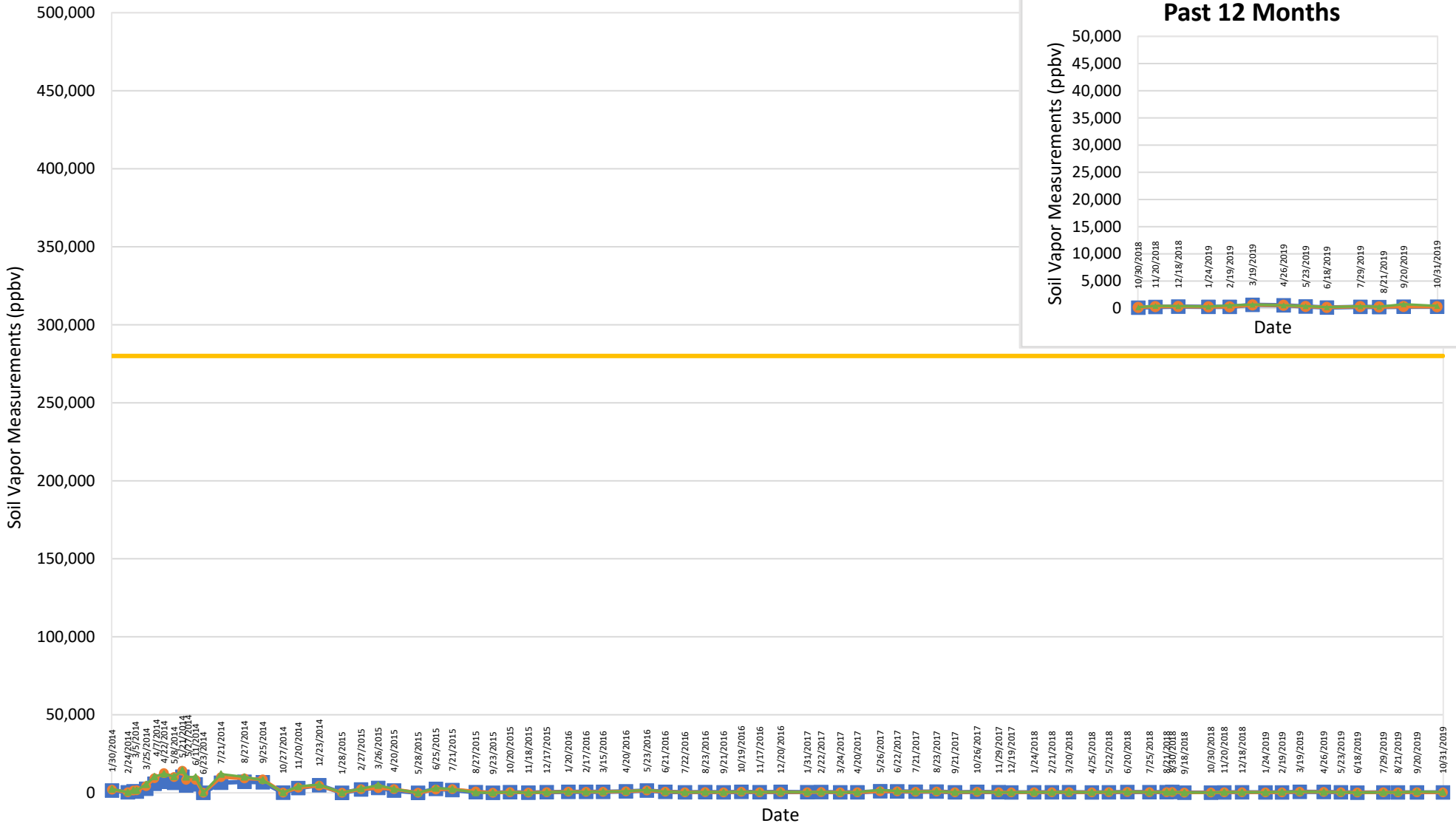


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 8
Soil Vapor Measurements - SV09 (JP-5)

SV09 S SV09 M SV09 D Action Level (280,000 ppbv)

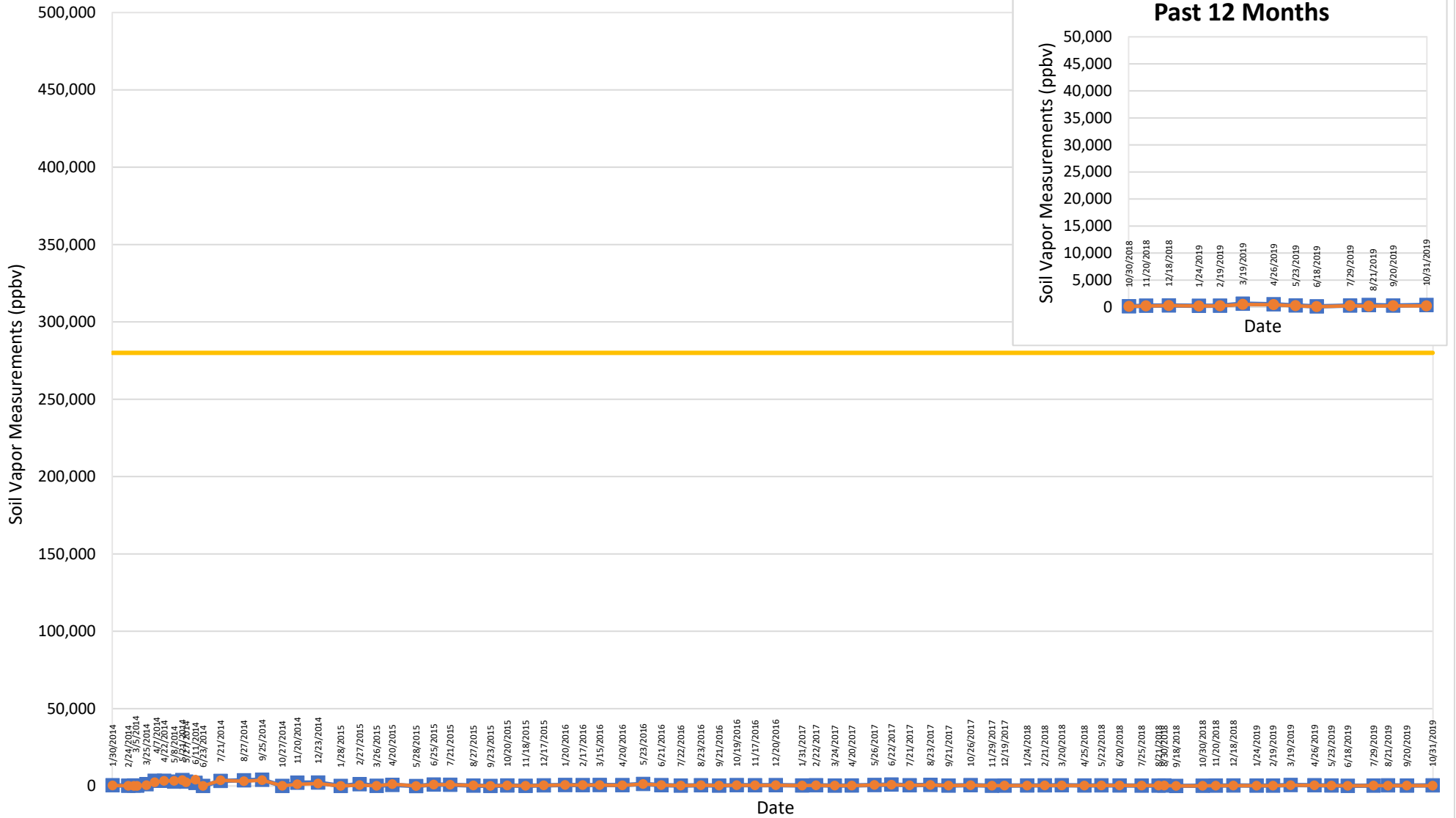


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 9
Soil Vapor Measurements - SV10 (JP-5)

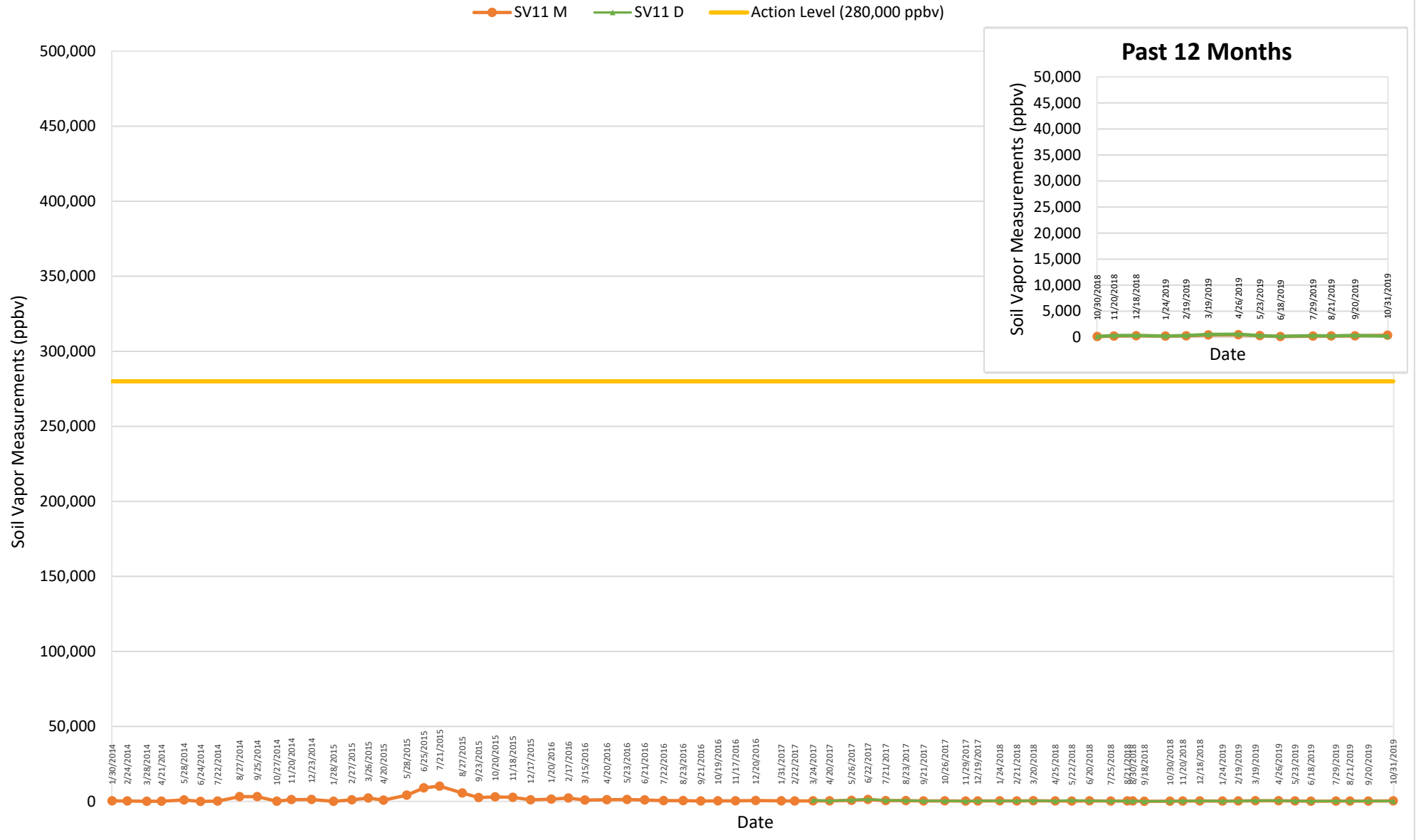
SV10 S SV10 M Action Level (280,000 ppbv)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 10
Soil Vapor Measurements - SV11 (JP-5)

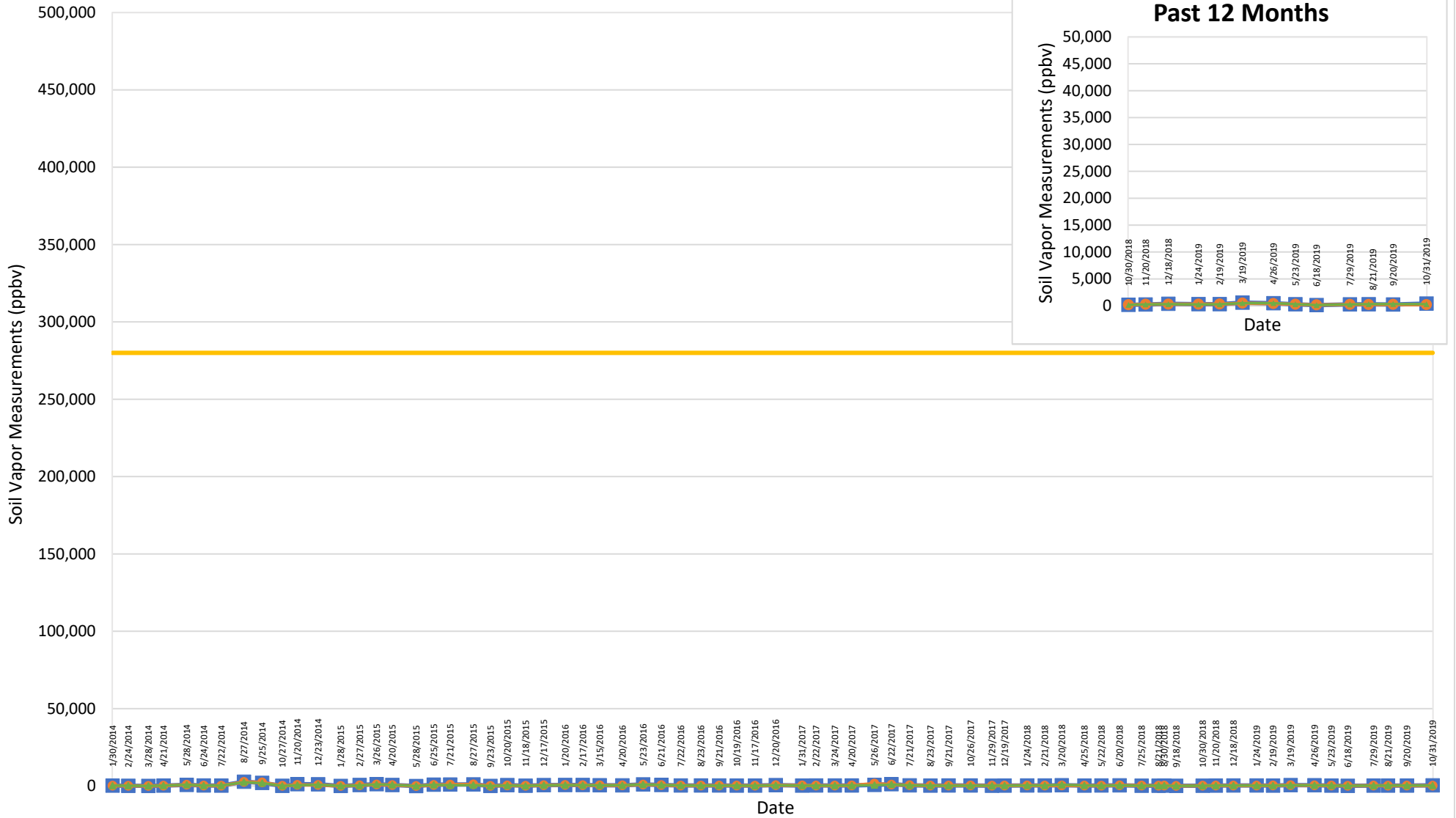


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 11
Soil Vapor Measurements - SV12 (JP-5)

SV12 S SV12 M SV12 D Action Level (280,000 ppbv)

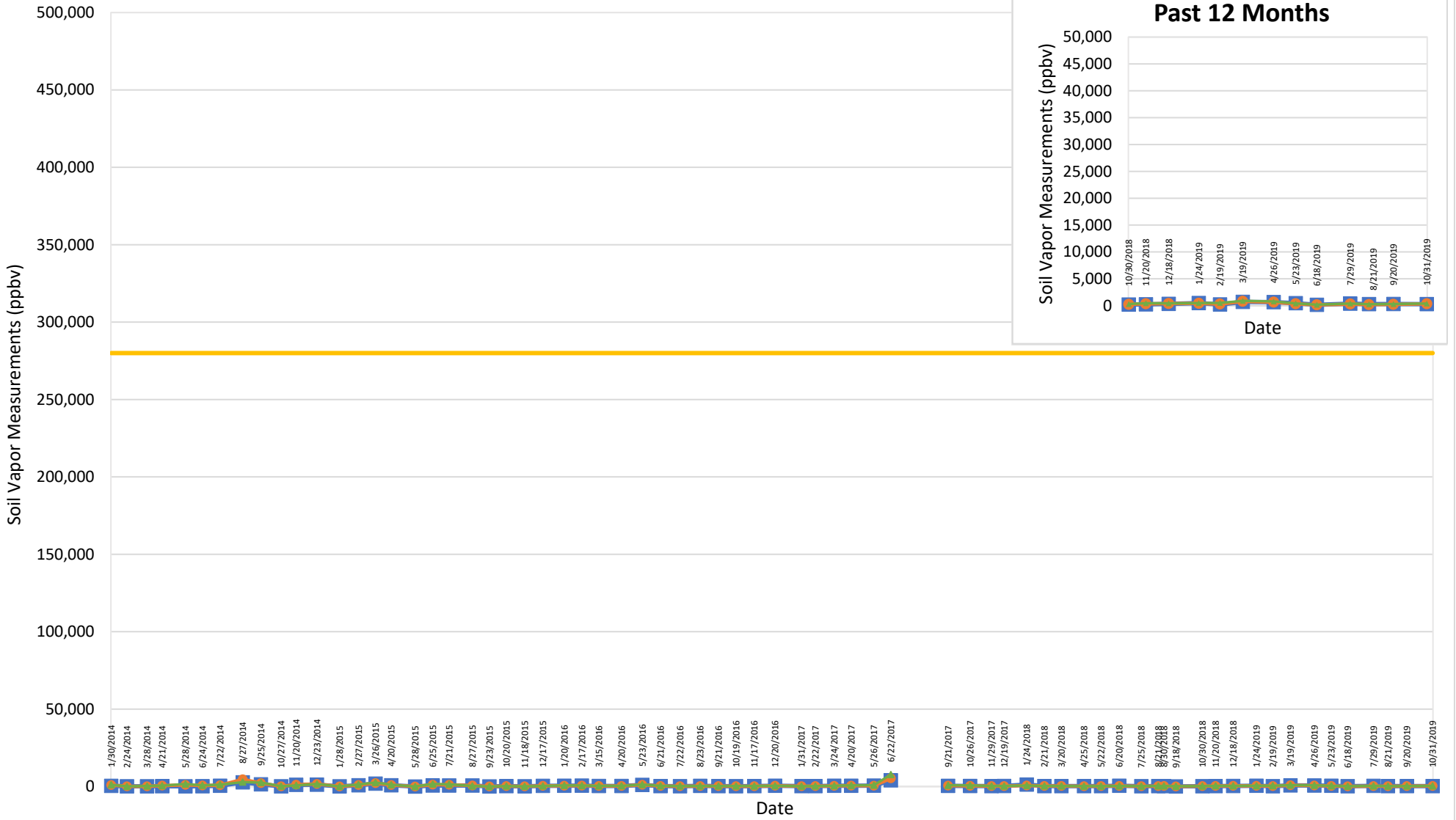


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 12
Soil Vapor Measurements - SV13 (JP-5)

SV13 S SV13 M SV13 D Action Level (280,000 ppbv)

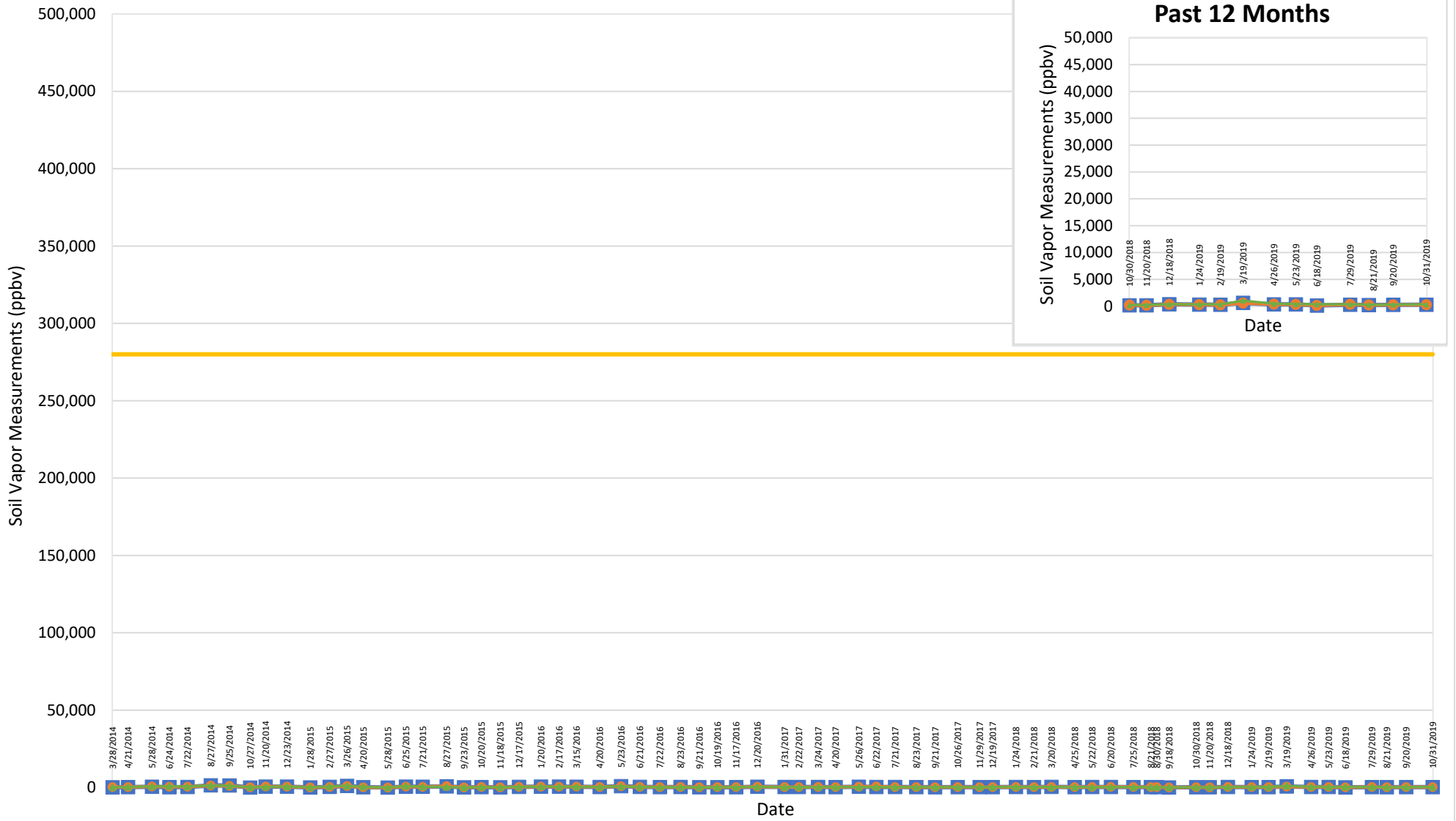


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 13
Soil Vapor Measurements - SV14 (JP-5)

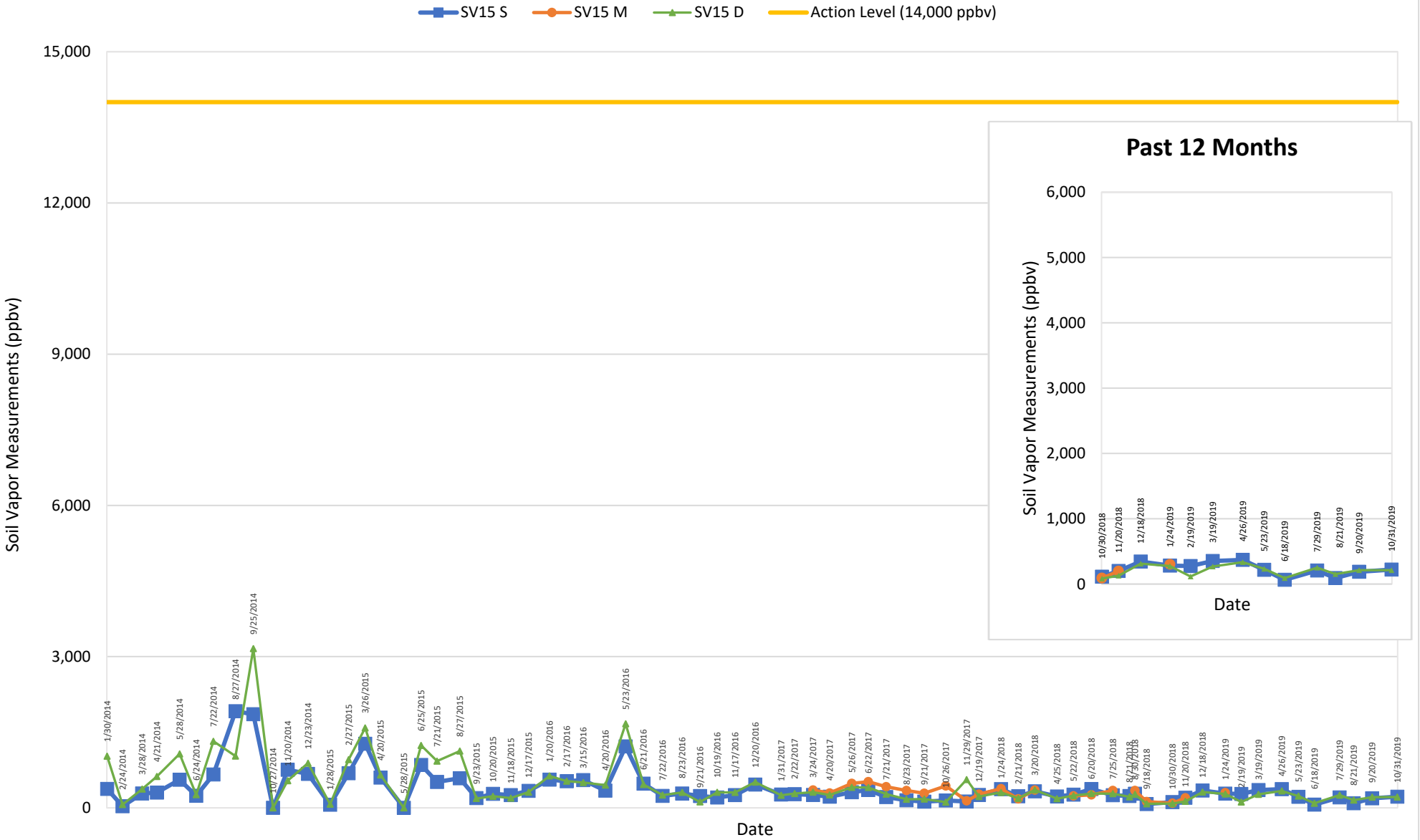
SV14 S SV14 M SV14 D Action Level (280,000 ppbv)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

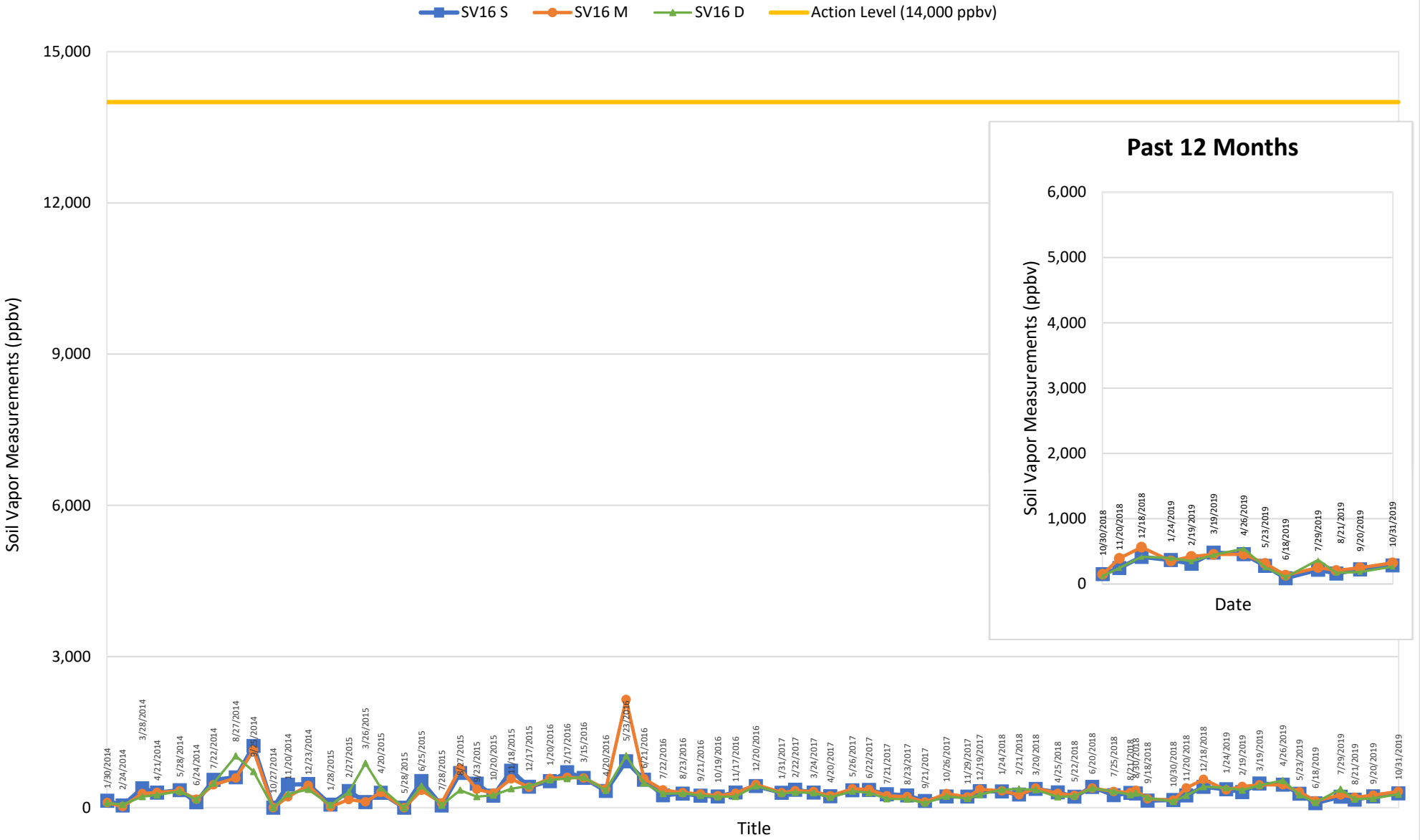
Figure 14
Soil Vapor Measurements - SV15 (F-76)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 15
Soil Vapor Measurements - SV16 (F-76)

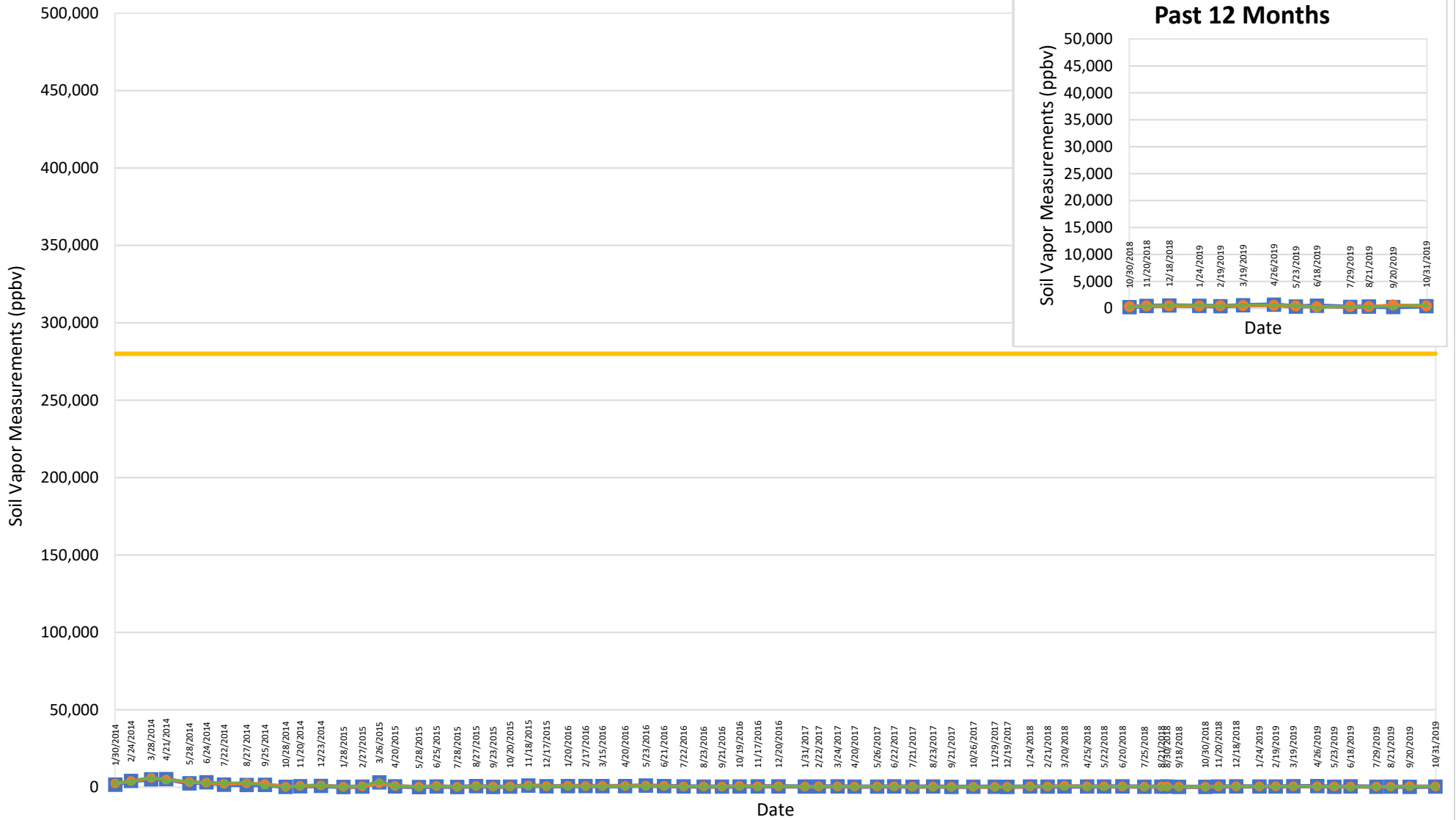


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 16
Soil Vapor Measurements - SV17 (JP-5)

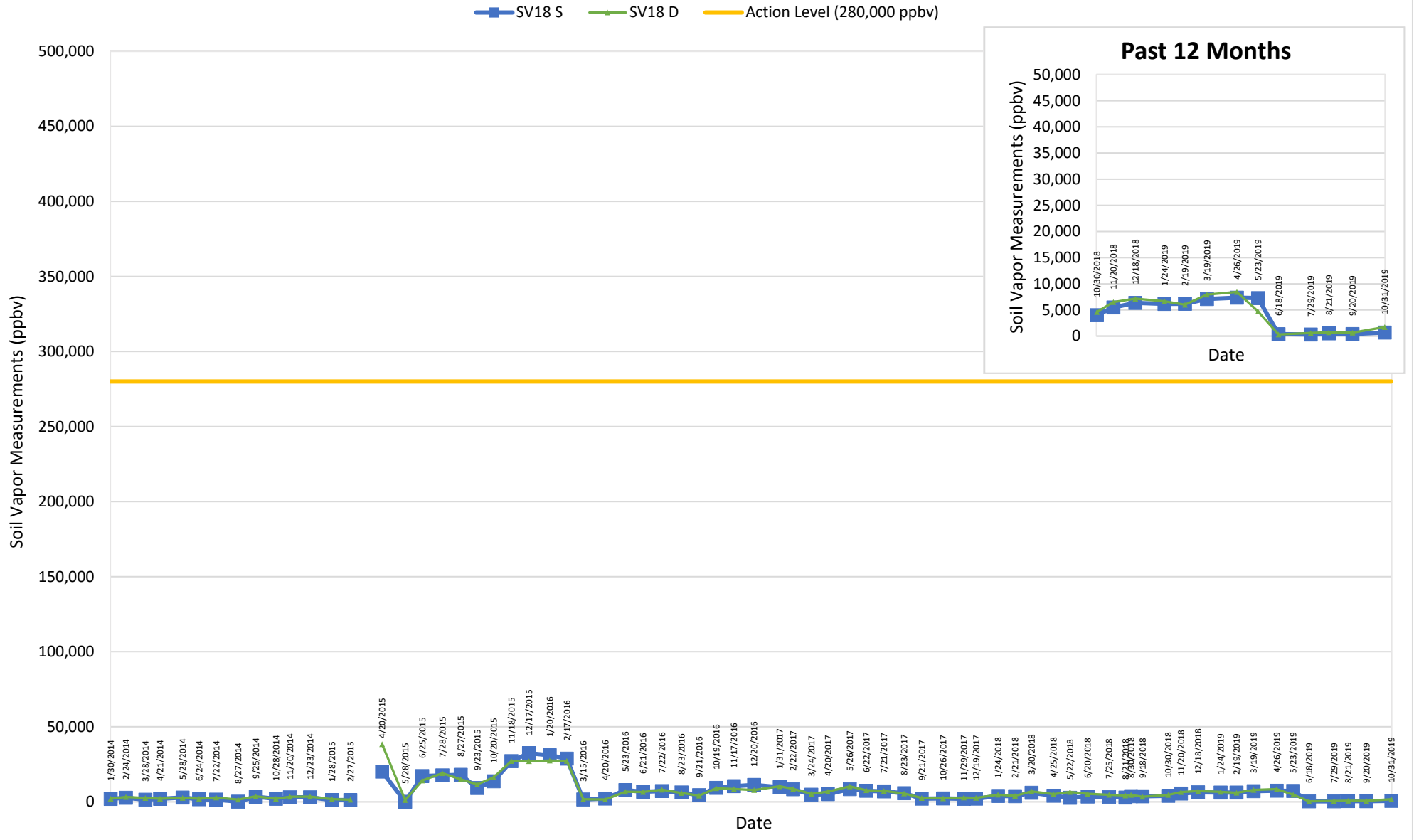
SV17 S SV17 M SV17 D Action Level (280,000 ppbv)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 17
Soil Vapor Measurements - SV18 (JP-5)

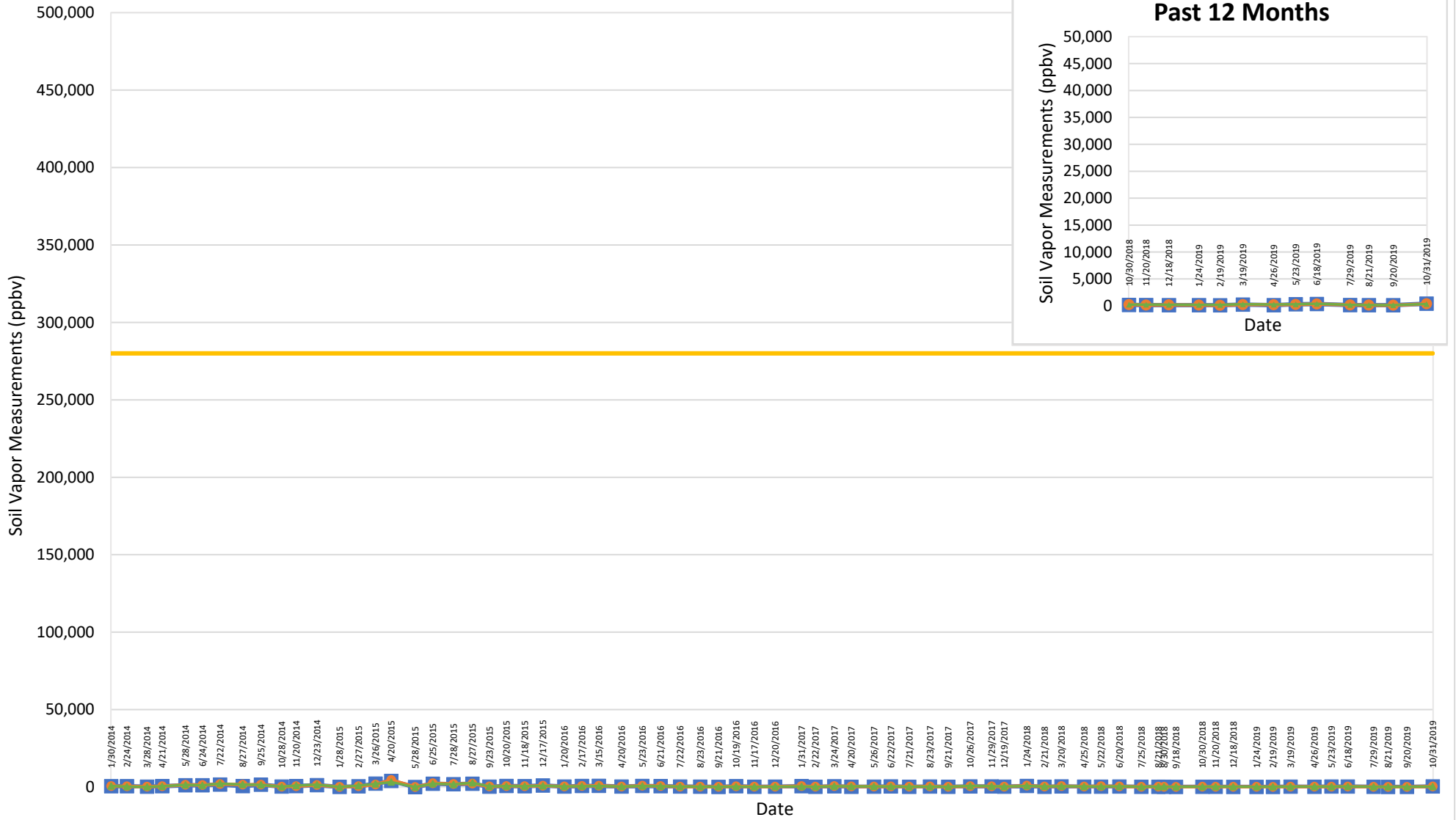


Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Figure 18
Soil Vapor Measurements - SV20 (JP-5)

SV20 S SV20 M SV20 D Action Level (280,000 ppbv)



Notes:
 ppbv: Parts Per Billion by Volume
 F-24: Jet Fuel, Fuel Number 24

JP-5: Jet Fuel, Propellant Number 5
 F-76: Marine Diesel, Fuel Number 76

Appendix C
Public Notification



NAVFAC
Naval Facilities Engineering Command



RED HILL BULK FUEL STORAGE FACILITY FACT SHEET

The Administrative Order on Consent (AOC) highlights our partnership

Signed in 2015, this partnership between the Environmental Protection Agency (EPA), State of Hawaii, the Navy and Defense Logistics Agency (DLA) is working.

Our partnership facilitates open and transparent conversation among all stakeholders. AOC documents are available to the public at the EPA and state Department of Health (DOH) websites. The latest document online is the Tank Upgrade Alternatives and Release Detection Decision Document.

The AOC is designed to ensure the safety of Oahu's water supply

"This agreement will ensure the safety of Oahu's drinking water supply, while allowing the Red Hill tanks to remain in use as a resource for our national defense," Jared Blumenfeld, EPA's Regional Administrator for the Pacific Southwest, said in a joint EPA-DOH press release announcing the AOC signing. *"EPA and the Department of Health will remain vigilant during this long-term effort to protect the public health and Hawaii's precious aquifers."*

"In order to address the challenges presented at Red Hill, the U.S. Navy, DLA, EPA and DOH have developed this AOC as a framework basis to deal with this complex challenge," Keith Kawaoka, DOH's Deputy Director of Environmental Health, said in the same release. *"The AOC establishes the process to make well-researched, well-planned and cost-effective improvements to protect the groundwater resources beneath and surrounding the Red Hill Bulk Fuel Storage Facility."*

The AOC document itself affirms that it was *"...negotiated in good faith and that (it) is fair, reasonable, protective of human health and the environment, and is in the public interest."*

This partnership has led to implementation of significant improvements at the Red Hill Facility, such as increased monitoring, enhanced release detection and other technological advances, and an expanded understanding of key environmental conditions, and even more improvements are in the works.

All AOC partners are committed to clean drinking water. For example, every quarter an EPA-certified lab tests the water; annually, a second sample is sent to a separate EPA-certified lab to corroborate test results and ensure the water is safe.

The Navy is listening to our DOH and EPA partners, as well as the public, and driving improvements to Red Hill to help protect our nation, Hawaii, and our drinking water

The Navy is pursuing technologies that will provide secondary containment of the fuel as established by Hawaii Administrative Rules.

Although this technology does not currently exist to allow a fiscally-responsible approach, Navy is committed to finding a solution for secondary containment, or it will remove the fuel from Red Hill in the 2045 timeframe.

Hawaii's best and brightest are helping. Navy engineering experts have already approached the University of Hawaii College of Engineering and Applied Research Lab to assist with a wide range of technical solutions.

The Navy will also continue to leverage the larger universe of technical expertise from academia, industry, and government to collaborate on development of advanced improvements.

The Navy will also determine the feasibility for potential construction of a water treatment plant or equivalent engineering controls and, by no later than 2022, will evaluate the cost and construction schedule.



RED HILL BULK FUEL STORAGE FACILITY FACT SHEET

DoD is Making a Substantial Investment to Protect the Environment

The Defense Department has spent \$162 million in just the last five years to modernize the Red Hill Facility to ensure the military and Hawaii National Guard have access to critical fuel while also keeping our drinking water safe. Over the next five years, the Navy and DLA anticipate spending another quarter of a billion dollars for added improvements.

Other Improvements already Completed, Ongoing and Planned to Protect the Environment and Our Drinking Water

The frequency of tank tightness testing is now done twice as often as the state requires.

The inventory of monitoring wells has increased from eight to 15, and eight more are planned by the end of 2021, which will bring the total number of monitoring wells to 23.

Recent field data has been incorporated into a new groundwater model that has improved our understanding of the aquifer.

The AOC partners are working with Honolulu Board of Water Supply and U.S. Geological Survey to further understand groundwater flow models.

Improvements to the tank Clean, Inspect and Repair (CIR) program have been made through implementation of EPA/DOH-approved procedures.

Higher standards for Tank Inspection, Repair and Maintenance (TIRM) procedures that were approved by the EPA and DOH in 2017 have been adopted.

A way to more rapidly drain the tanks and transfer fuel has been developed for use in the unlikely event of an emergency.

Experiments are being conducted to identify and test a coating material to provide additional protection.

A pilot study will test continuous soil vapor monitoring as a viable method for helping to detect fuel releases in real time.

Risk is being reduced by decommissioning small nozzles (i.e. piping between the bottom of each tank and the first isolation valve) during each CIR project.

Protecting Hawaii and Our Nation's Security

Russia's and China's militaries have become increasingly aggressive and Red Hill provides the Defense Department ready access to fuel for needed mission readiness of the U.S. Indo-Pacific Command.

Red Hill is also a vital fuel source for Hawaii during disasters and emergencies. Red Hill could supply fuel to the Daniel K. Inouye International Airport, Honolulu Harbor, Hawaiian Electric, and responding ships and aircraft.

Hawaii's isolation makes us dependent on shipping and air transport. The fuel from Red Hill helps ensure those transit lanes are secure.

Red Hill is more vital today than ever. Even during World War II, ADM Chester Nimitz said the war would have lasted two more years had the strategic fuel reserves on Oahu been destroyed in the Pearl Harbor attack.

Shared goals of EPA, State of Hawaii, DLA and Navy: *Protect our national security, our environment and our drinking water.*