MISSION SUPPORT AND TEST SERVICES LLC

DOE/NV/03624--1274

NEVADA NATIONAL SECURITY SITE

E-TUNNEL WASTEWATER DISCHARGE PERMIT

QUARTERLY MONITORING REPORT AND ANNUAL SUMMARY REPORT

WATER POLLUTION CONTROL PERMIT NEV 96021

FOURTH QUARTER AND CALENDAR YEAR 2021

January 2022

Prepared for:

U.S. Department of Energy

National Nuclear Security Administration

Nevada Field Office

Prepared by:

Mission Support and Test Services, LLC

Las Vegas, Nevada

This work was done by Mission Support and Test Services, LLC, under Contract No. DE-NA0003624 with the U.S. Department of Energy. DOE/NV/03624--1274

DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Available for sale to the public, in paper, from:

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Road
Alexandria, VA 22312
Telephone: (800) 553-6847
Fax: (703) 605-6900
E-mail: info@ntis.gov; customerservice@ntis.gov
Downloadable (no charge) at: https://classic.ntis.gov/search/

Available electronically (no charge) at: http://www.osti.gov

Available, in paper, for a processing fee to the U.S. Department of Energy and its contractors from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Telephone: (865) 576-8401
Fax: (865) 576-5728
E-mail: reports@osti.gov

MISSION SUPPORT AND TEST SERVICES LLC

DOE/NV/03624--1274

NEVADA NATIONAL SECURITY SITE

E-TUNNEL WASTEWATER DISCHARGE PERMIT

QUARTERLY MONITORING REPORT AND ANNUAL SUMMARY REPORT

WATER POLLUTION CONTROL PERMIT NEV 96021

FOURTH QUARTER AND CALENDAR YEAR 2021

January 2022

Prepared for:

U.S. Department of Energy

National Nuclear Security Administration

Nevada Field Office

Prepared by:

Mission Support and Test Services, LLC

Las Vegas, Nevada

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

bgs	below ground surface
EPA	U.S. Environmental Protection Agency
ETDS	E-Tunnel Wastewater Disposal System
ft	foot (feet)
L/day	liter(s) per day
L/min	liter(s) per minute
µS/cm	microsiemen(s) per centimeter
m	meter(s)
mg/L	milligram(s) per liter
NDEP	Nevada Division of Environmental Protection
pCi/L	picocurie(s) per liter
pH	hydrogen ion activity
QMR	Quarterly Monitoring Report
SU	standard unit(s)
TDMS	Tunnel Discharge Monitoring Station
WPC	Water Pollution Control

THIS PAGE INTENTIONALLY LEFT BLANK

E-TUNNEL WASTEWATER DISCHARGE PERMIT QUARTERLY MONITORING REPORT (QMR) FOR FOURTH QUARTER 2021 AND ANNUAL SUMMARY REPORT FOR CALENDAR YEAR 2021

1.0 INTRODUCTION

Monitoring and sampling activities are performed at the E-Tunnel Wastewater Disposal System (ETDS) according to the requirements of Water Pollution Control (WPC) Permit NEV 96021, Revision 1, which is effective October 1, 2013. Although the end date of the WPC permit is September 30, 2018, the Nevada Division of Environmental Protection (NDEP), in a letter dated September 21, 2018, provided guidance that indicated the WPC Permit NEV 96021, Revision 1, is in effect until NDEP notifies the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office otherwise.

This QMR includes the results of monthly inspections and monitoring for October, November, and December 2021. Monthly inspections and monitoring were conducted on October 13, November 16, and December 21, 2021. Inspections include a visual assessment of the berms, ponding, water levels relative to the overflow pipes, tunneling or burrowing into the berms, soil conditions on and around the berms, erosion or sloughing of the slopes of the berms, seeps at the toe of the berms, deep-rooting botanicals on the berms, and fencing. Monthly monitoring includes measurements of the instantaneous flow rate, hydrogen ion activity (pH), and specific conductance of the ETDS discharge.

Annual sample results of the effluent water from the ETDS are also included in this report. The effluent sample was collected on October 13, 2021, and analyzed for the parameters listed in Table 1-B of Permit NEV 96021.

In addition, Permit NEV 96021 requires the collection and analysis of representative groundwater samples from Well ER 12-1 every 24 months. Groundwater samples were not collected in 2021 and will be next collected in 2022. The results will be reported in the annual report for 2022.

2.0 MONTHLY MONITORING

E-Tunnel has a continuously flowing groundwater discharge that flows through the Tunnel Discharge Monitoring Station (TDMS). Flow measurements and a sample for measuring the water parameters of pH and specific conductance are collected monthly directly from the TDMS. The flow rate is determined by measuring the time it takes to fill a known volume. The fill time is measured three times, and the average is calculated. The calculated flow rate is presented in Table 1.

The effluent water is analyzed in the field to determine pH and specific conductance using a YSI 1030 pH and conductivity meter. The meter's specific conductivity sensor is calibrated before use in the field using a 1,000-microsiemens per centimeter (µS/cm) calibration standard. The meter's pH sensor is also calibrated using various standard pH solutions. Standard pH solutions (pH 7 and pH 10) are used to calibrate the instrument. The instrument is also checked against the standards at the end of the shift to check for instrument drift. The pH and specific conductance of the monthly samples from E-Tunnel did not exceed permissible limits (Table 2).

The effluent flow from E-Tunnel ranged between 28.4 and 29.6 liters per minute (L/min). The pH ranged between 7.3 and 7.4 standard units (SU), and the specific conductivity ranged between 356 and 369 µS/cm. All of these results are congruent with past observations. The results of the monthly monitoring are included in Table 1 and Table 2.

Table 1. Flow Rate and Total Volume (Permit NEV 96021, Part I.B.5)

Measurement/Calculation	October 2021	November 2021	December 2021
Average Flow Rate (L/min)	29.6	28.4	28.4
Days in Month	31	30	31
Daily Flow Rate (L/day)	42,600	41,000	40,900
Total Monthly Volume (liters)	1,320,000	1,230,000	1,270,000

Table 2. Indicator Parameters (Permit NEV 96021, Part I.B.6)

Parameter	Permissible Limit	October 2021	November 2021	December 2021
pH (SU)	Between 6.0 and 9.0 SU	7.3	7.3	7.4
Specific Conductance (µS/cm)	≤1,500 µS/cm	356	357	369

3.0 MONTHLY INSPECTIONS

Monthly inspections include a visual assessment of ponding, deep-rooting botanicals on the berms, tunneling or burrowing into the berms, fencing, and structural integrity of the ETDS.

Ponds 4, 5 and 6a are not currently receiving flow and are dry. Pond 6b continues to receive water from the transfer pipe and appears full with plants growing at both ends of the pond, and there remains a slow trickle into Pond 6c. Pond 6c shows signs of water flowing at the upstream end with plants growing, while the downstream end is dry with no plants growing. As water flow from Pond 6b continues, an accumulation of water and new growth is expected throughout Pond 6c.

The berms are in good condition; no sloughing or erosion was noted. No seeps were noted at the toe of any berm. The structural integrity of the ETDS remains in good condition an no corrective actions are required. In late September the road was bladed and repairs were made to the perimeter wire rope fence in early October.

The results of the monthly inspections are summarized in Table 3 through Table 7. Monthly rainfall quantities are presented in Table 8.

Table 3. Ponding (Permit NEV 96021, Part I.B.10.a)

Pond	October 2021	November 2021	December 2021
Pond 4	Dry	Dry	Dry
Pond 5	Dry	Dry	Dry
Pond 6a	Dry	Dry	Dry
Pond 6b	Filling	Filling	Filling
Pond 6c	Dry	Dry	Dry

Table 4. Deep-Rooting Botanicals in Earthen Embankments (Permit NEV 96021, Part I.B.10.b)

Pond	October 2021	November 2021	December 2021
Pond 4	No	No	No
Pond 5	No	No	No
Pond 6a	No	No	No
Pond 6b	Yes	Yes	Yes
Pond 6c	Yes	Yes	Yes

Table 5. Tunneling or Burrowing into Earthen Embankments (Permit NEV 96021, Part I.B.10.c)

Pond	October 2021	November 2021	December 2021
Pond 4	No	No	No
Pond 5	No	No	No
Pond 6a	No	No	No
Pond 6b	No	No	No
Pond 6c	No	No	No

Table 6. Perimeter Fencing (Permit NEV 96021, Part I.B.10.d)

	October 2021	November 2021	December 2021
Physical Condition	Good	Good	Good

Table 7. ETDS Structural Integrity (Permit NEV 96021, Part I.B.10.e)

	October 2021	November 2021	December 2021
Physical Condition	Good	Good	Good

Table 8. Precipitation Data (Permit NEV 96021, Part I.A.7)

	October 2021	November 2021	December 2021
Total Precipitation (inches)	0.87	0.00	3.04

4.0 ANNUAL DISCHARGE SAMPLE RESULTS

The annual sample of the effluent water was collected directly from the TDMS on October 13, 2021. The sample was preserved according to U.S. Environmental Protection Agency (EPA) methods and sent to a Nevada-Certified Laboratory for analysis of the parameters listed in Table 1-B of Permit NEV 96021.

The sample results show that all parameters were below the thresholds and permissible limits listed in Table 1-B of Permit NEV 96021. The results are presented in Table 9. Results that were below detection limits are identified and reported at the detection level with a “U” following the result. Results that were above the detection limit and below the reporting limit were estimated and marked with a “J” following the result.

Graphs of the data are presented in Figure 1 through Figure 20. The analyses show that all parameters have been within thresholds and permissible limits for the last six years.

Prior to 2017, gross alpha values were reported, as opposed to adjusted gross alpha values where the alpha concentrations are adjusted by the removal of the uranium activity. Subtracting uranium and radon from the gross alpha activity is specified in the EPA Drinking Water Requirements Radionuclides Rule and the E-Tunnel Wastewater Disposal System and Monitoring Well ER 12-1 Operations and Maintenance Plan, Nevada National Security Site, August 2017. Values for both gross alpha and adjusted gross alpha are included in Table 9.

Table 9. Annual Discharge Sample Results

Parameter (Units)	Permissible Limit	10/18/2016	10/23/2017	10/09/2018	09/11/2019	10/14/2020	10/13/2021
Gross Alpha (pCi/L)	N/A	11.7	11.3	15.3	14.1	9.2	8.5
Adjusted Gross Alpha (pCi/L)	35.1	N/A	9.7	11.8	10.7	5.8	5.5
Gross Beta (pCi/L)	101	18.7	25.3	23.0	21.7	25.7	19.1
Tritium (pCi/L)	1,000,000	331,000	313,000	277,000	268,000	281,000	253,000
Cadmium (mg/L)	0.045	0.005 U	0.005 U	0.005 U	0.005 U	0.0002 U	0.0002 U
Chloride (mg/L)	360	9.8	8.8	8.8	8.7	8.4	8.4
Chromium (mg/L)	0.09	0.01 U	0.01 U	0.005 U	0.01 U	0.006 U	0.006 U
Copper (mg/L)	1.2	0.01 U	0.01 U	0.01 U	0.01 U	0.003 U	0.003 U
Fluoride (mg/L)	3.6	0.14	0.17	0.20	0.19	0.19	0.25
Iron (mg/L)	5.0	1.6	2.9	2.2	0.8	1.4	0.92
Lead (mg/L)	0.014	0.003 U	0.003 U	0.001	0.003	0.0009	0.0007
Magnesium (mg/L)	135	0.9	1.1	0.9	0.8	0.7	0.69
Manganese (mg/L)	0.25	0.018	0.034	0.025	0.010	0.016	0.010
Mercury (mg/L)	0.0018	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0001 U	0.00007 J
Nitrate Nitrogen (mg/L)	9.0	0.24	0.32	0.33	0.29	0.29	0.27
Selenium (mg/L)	0.045	0.005 U	0.006	0.005 U	0.005 U	0.0007 U	0.0007 U
Sulfate (mg/L)	450	17.0	16.0	16.0	16.0	14.0	14.0
Zinc (mg/L)	4.5	0.03	0.03	0.03	0.01	0.015 J	0.010 J

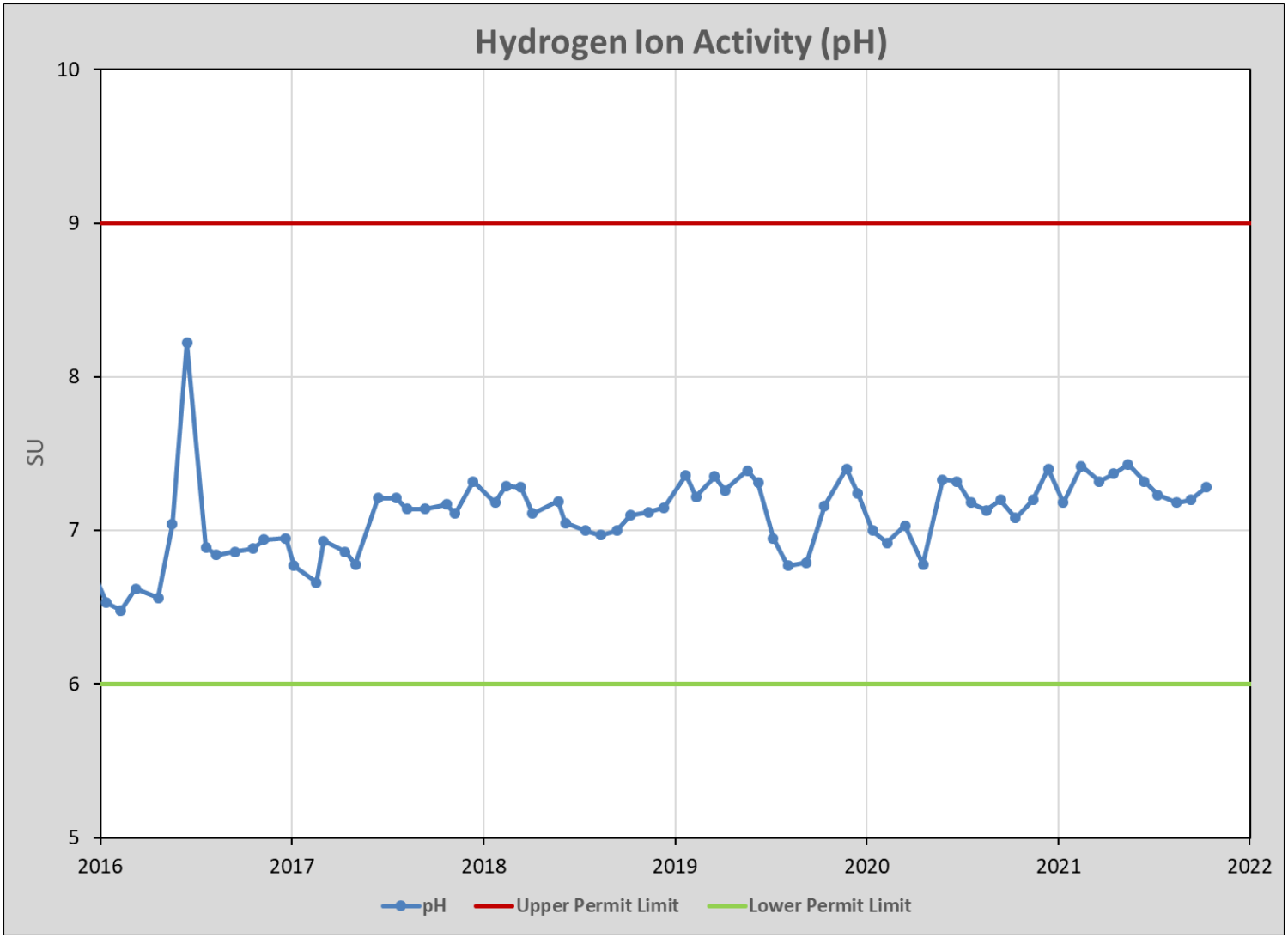

Figure 1. Hydrogen Ion Activity (pH) Annual Discharge Sample Results

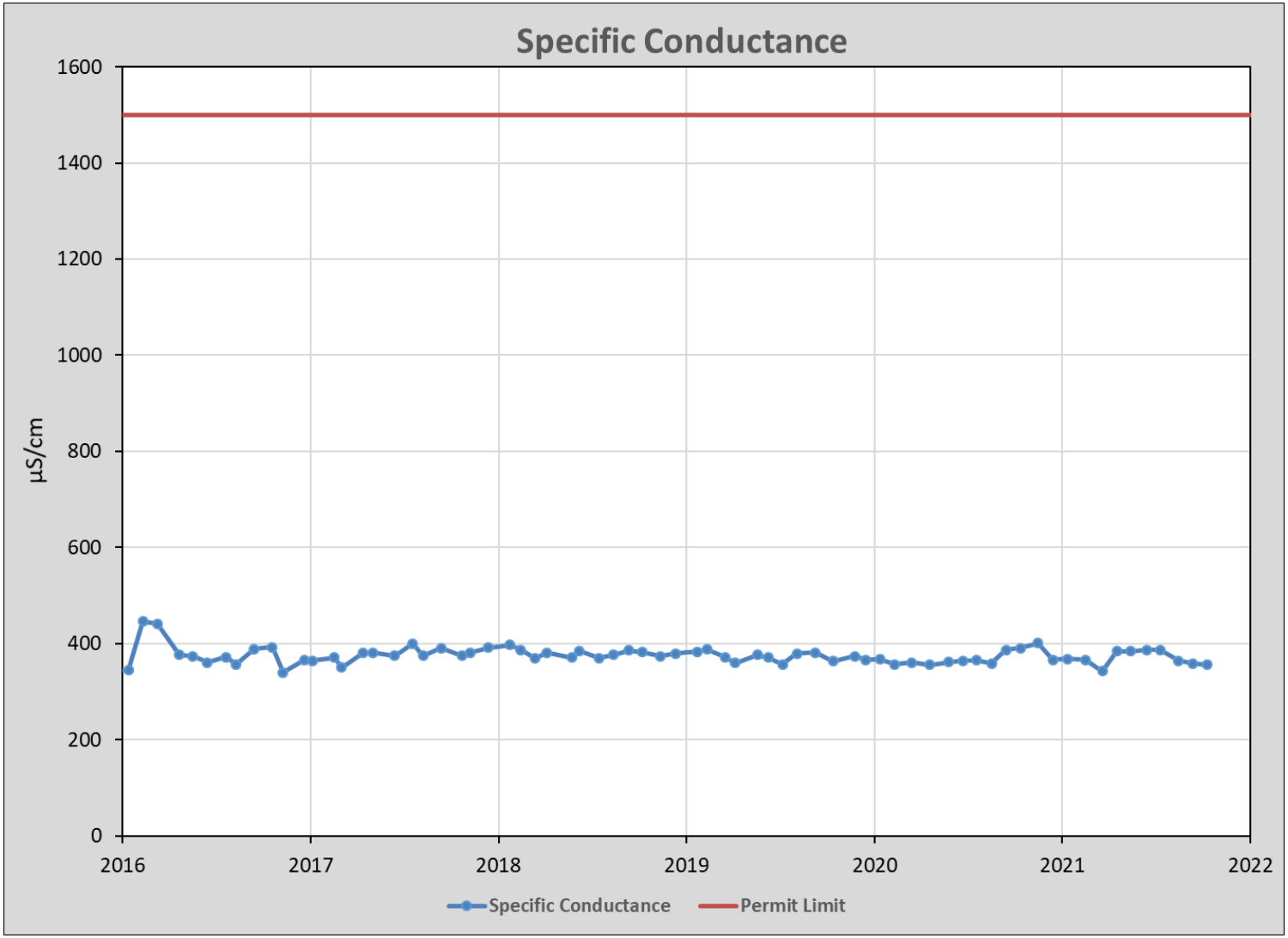

Figure 2. Specific Conductance Annual Discharge Sample Results

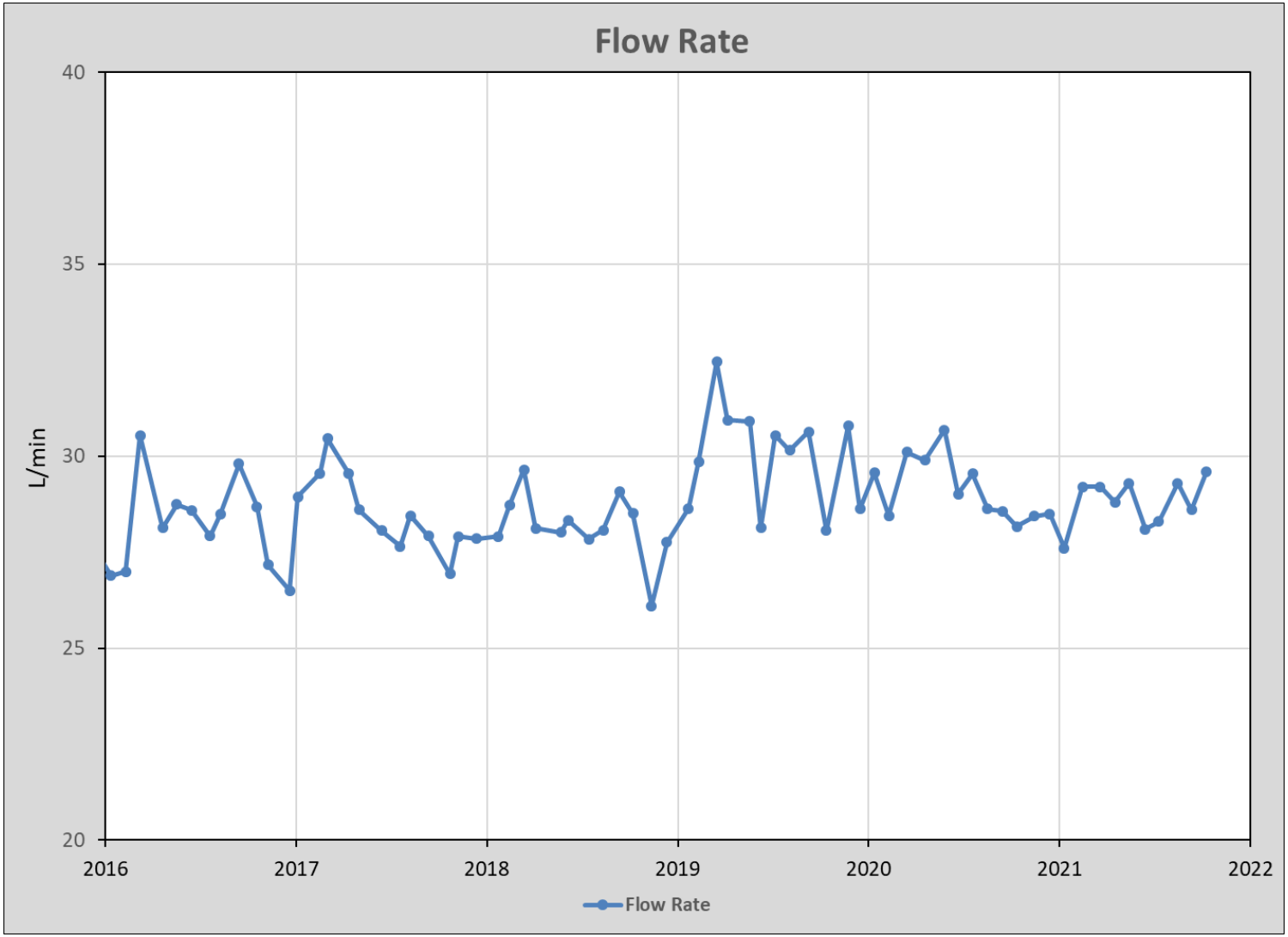

Figure 3. Instantaneous Flow Rate Annual Discharge Sample Results

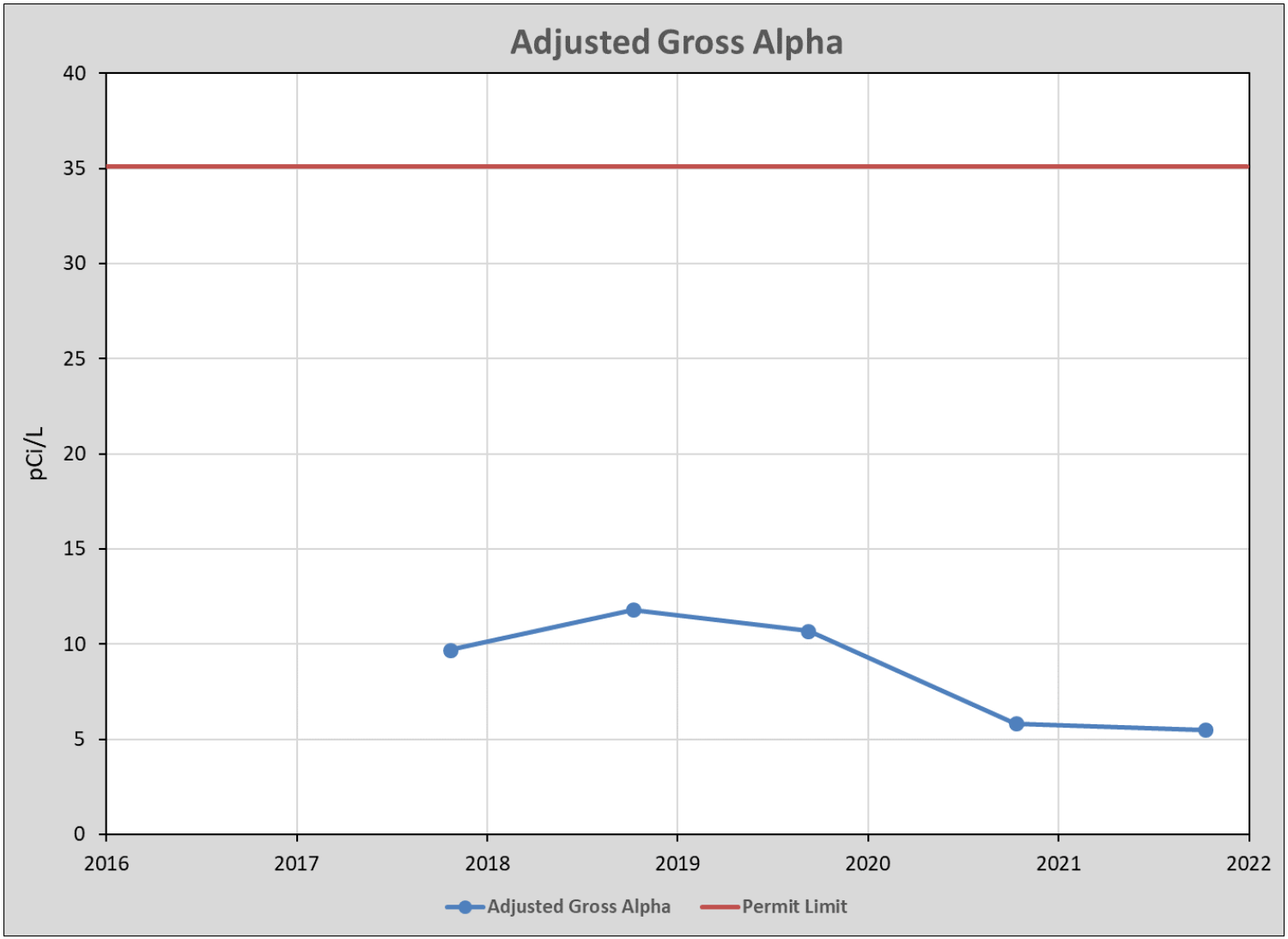

Figure 4. Adjusted Gross Alpha Annual Discharge Sample Results

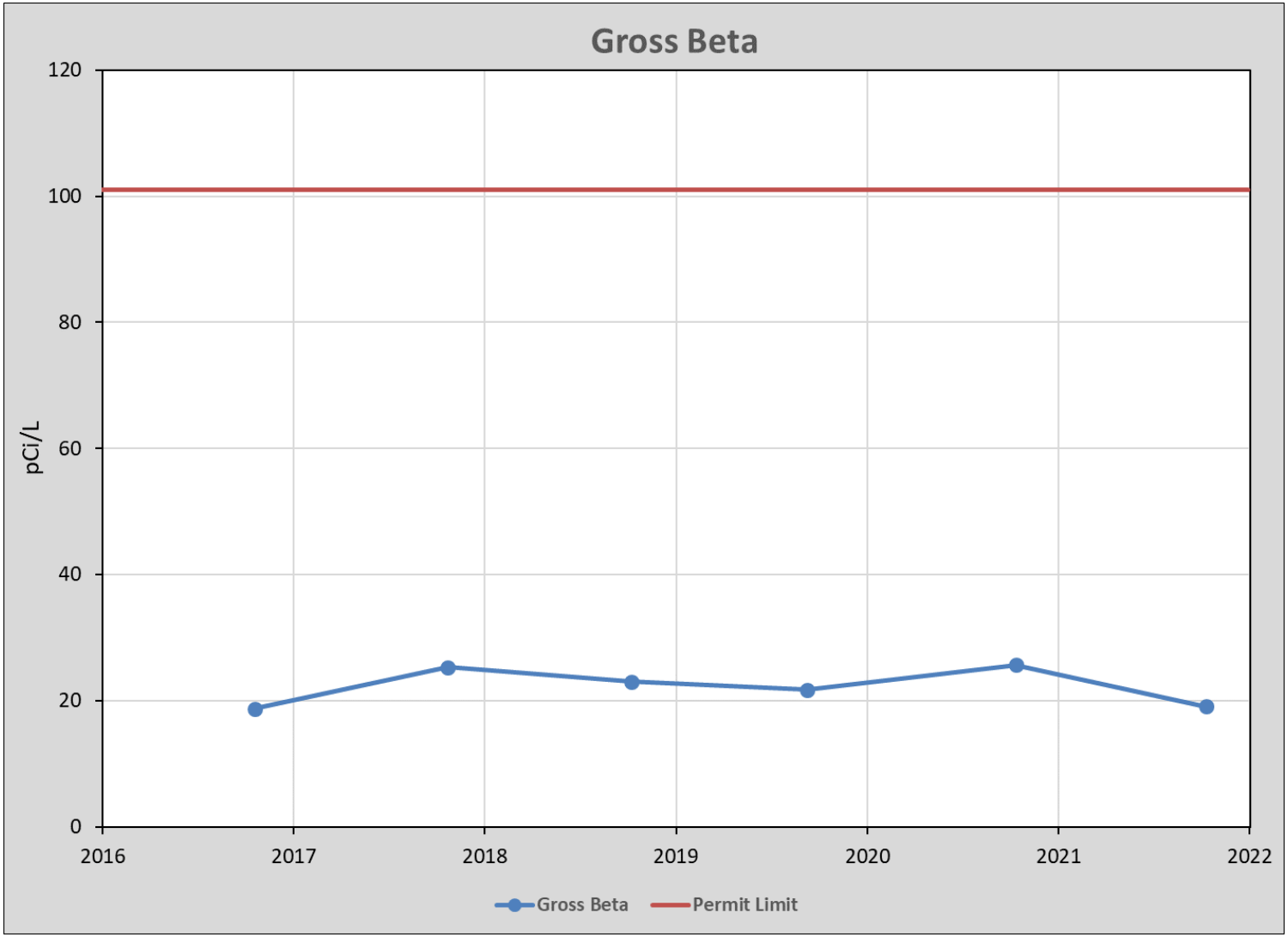

Figure 5. Gross Beta Annual Discharge Sample Results

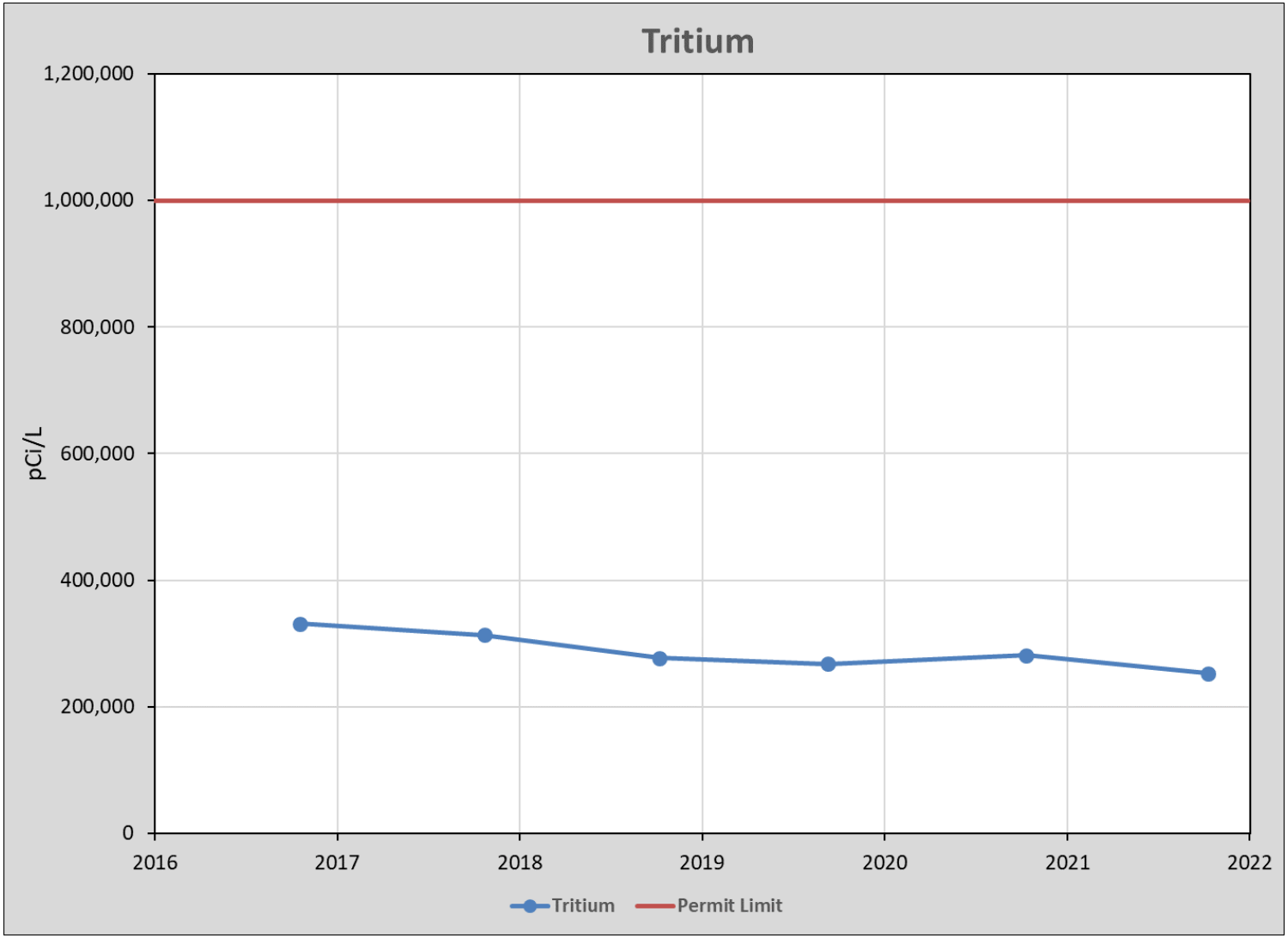

Figure 6. Tritium Annual Discharge Sample Results

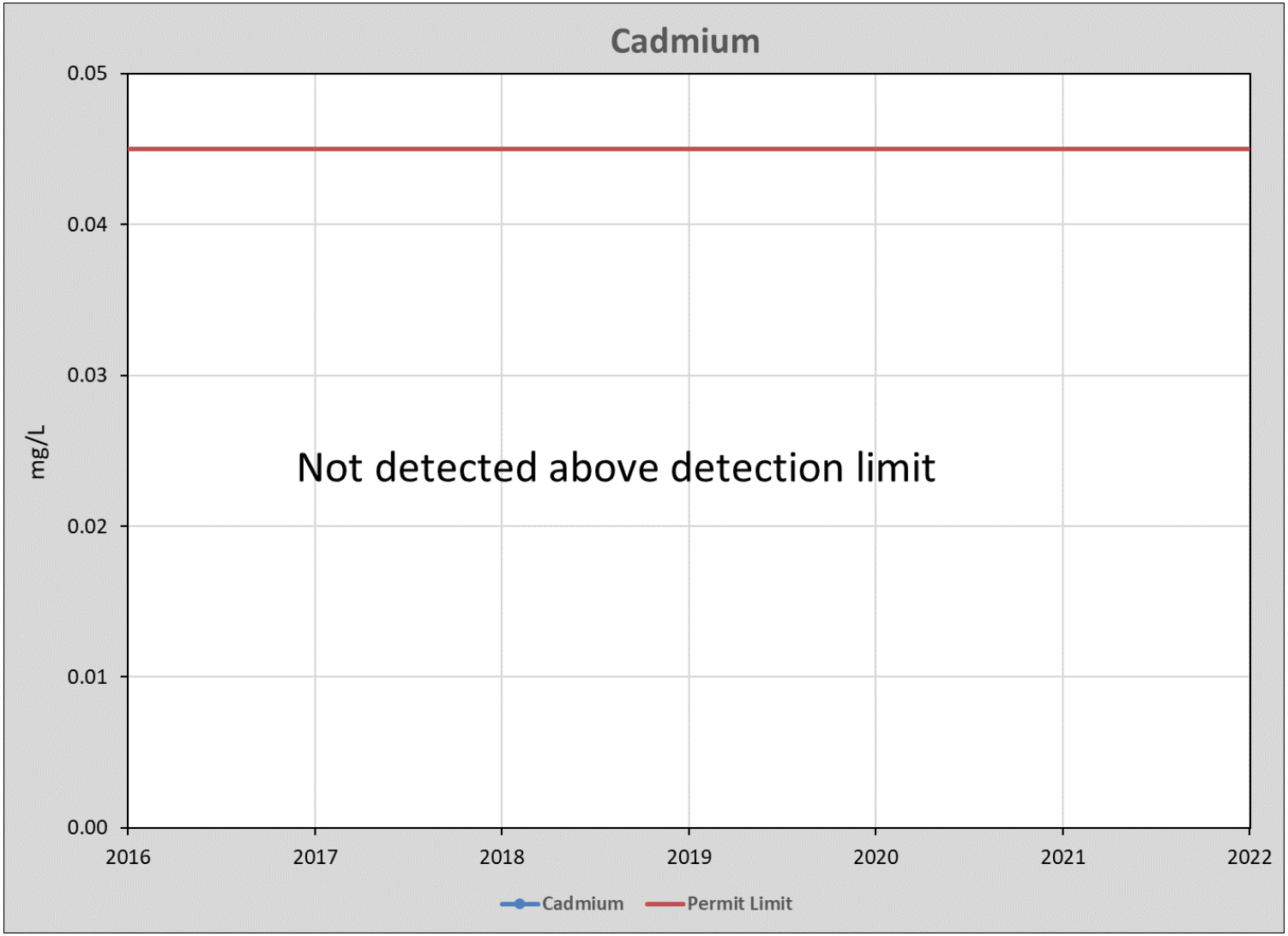

Figure 7. Cadmium Annual Discharge Sample Results

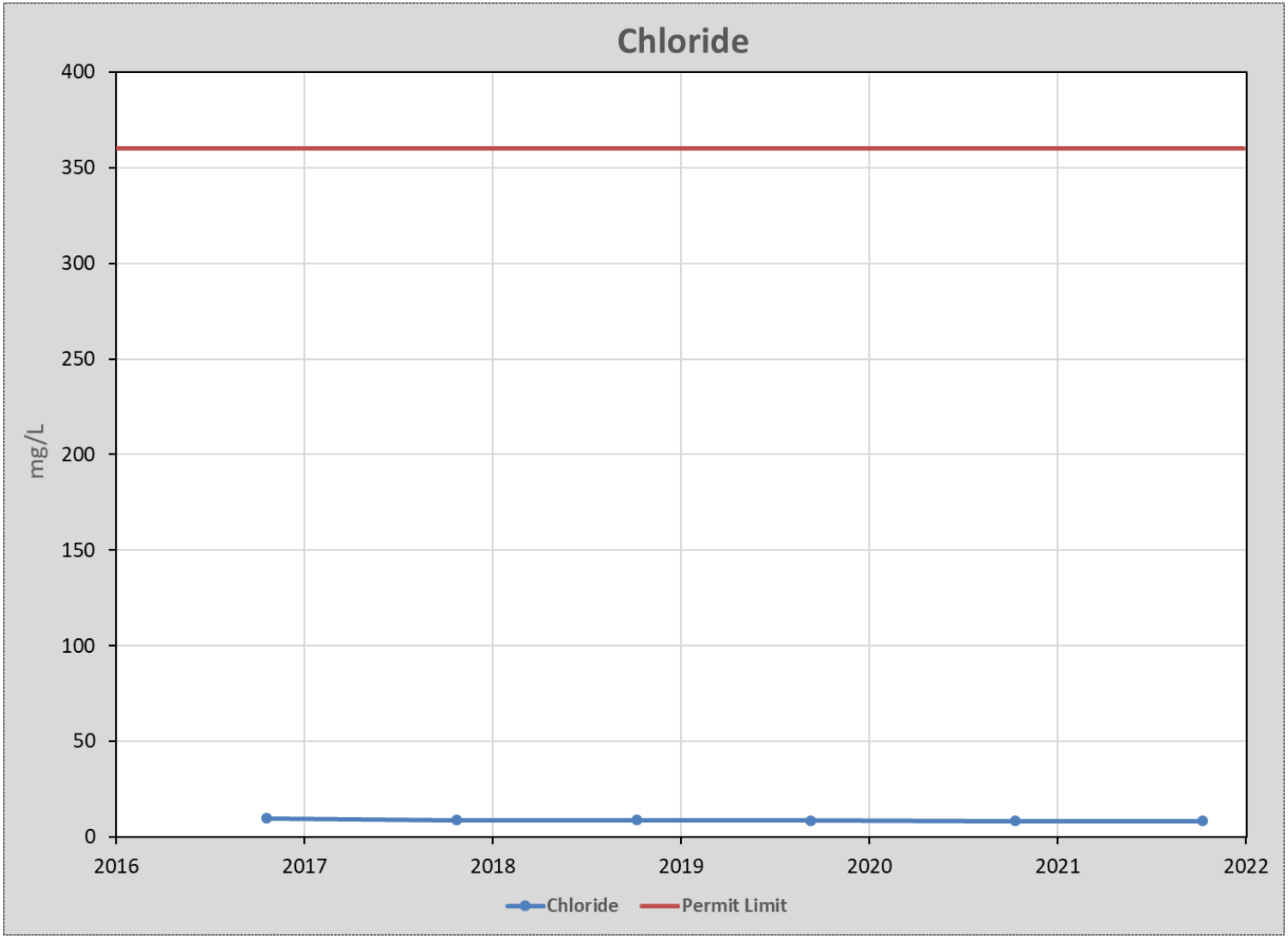

Figure 8. Chloride Annual Discharge Sample Results

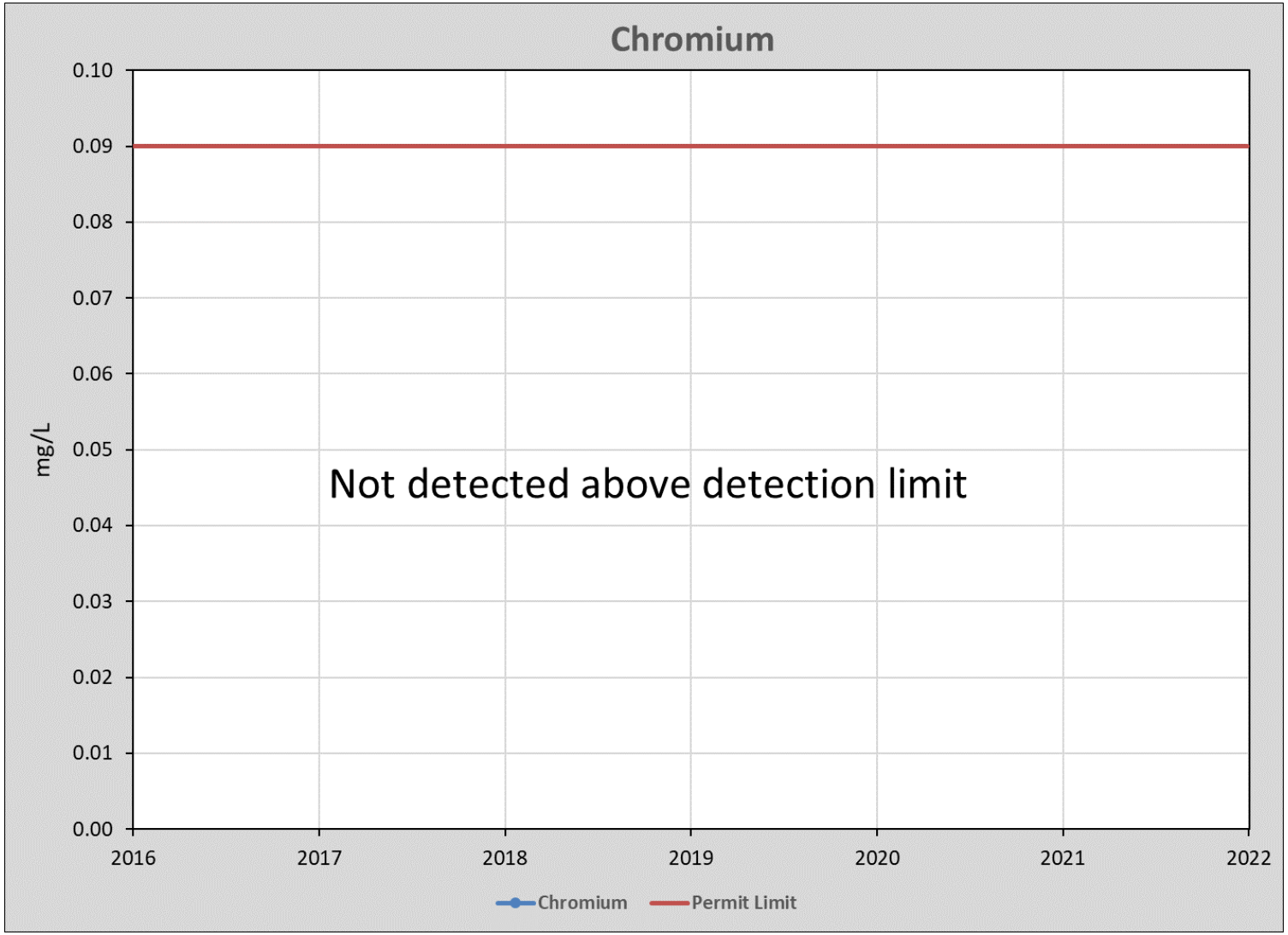

Figure 9. Chromium Annual Discharge Sample Results

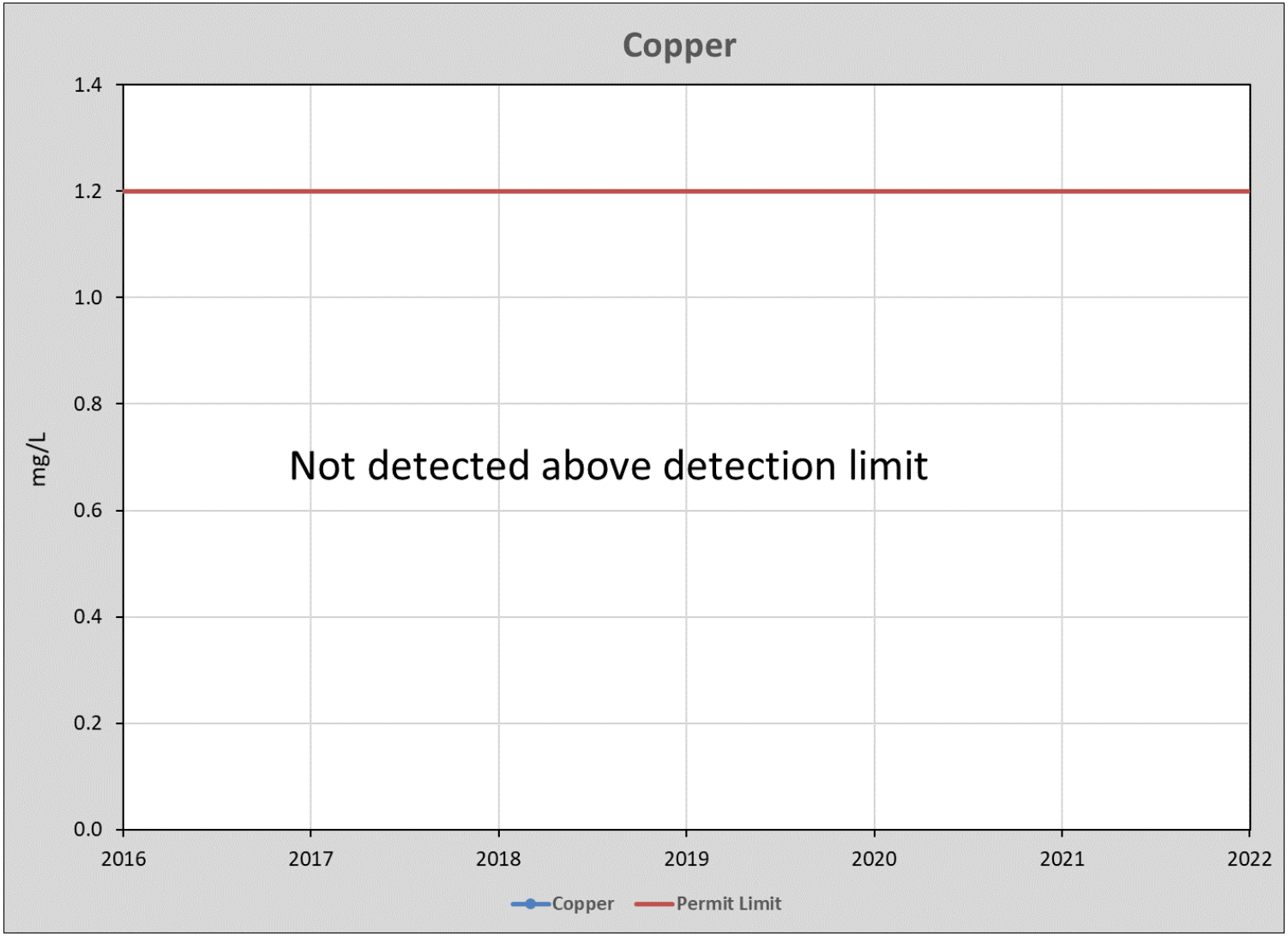

Figure 10. Copper Annual Discharge Sample Results

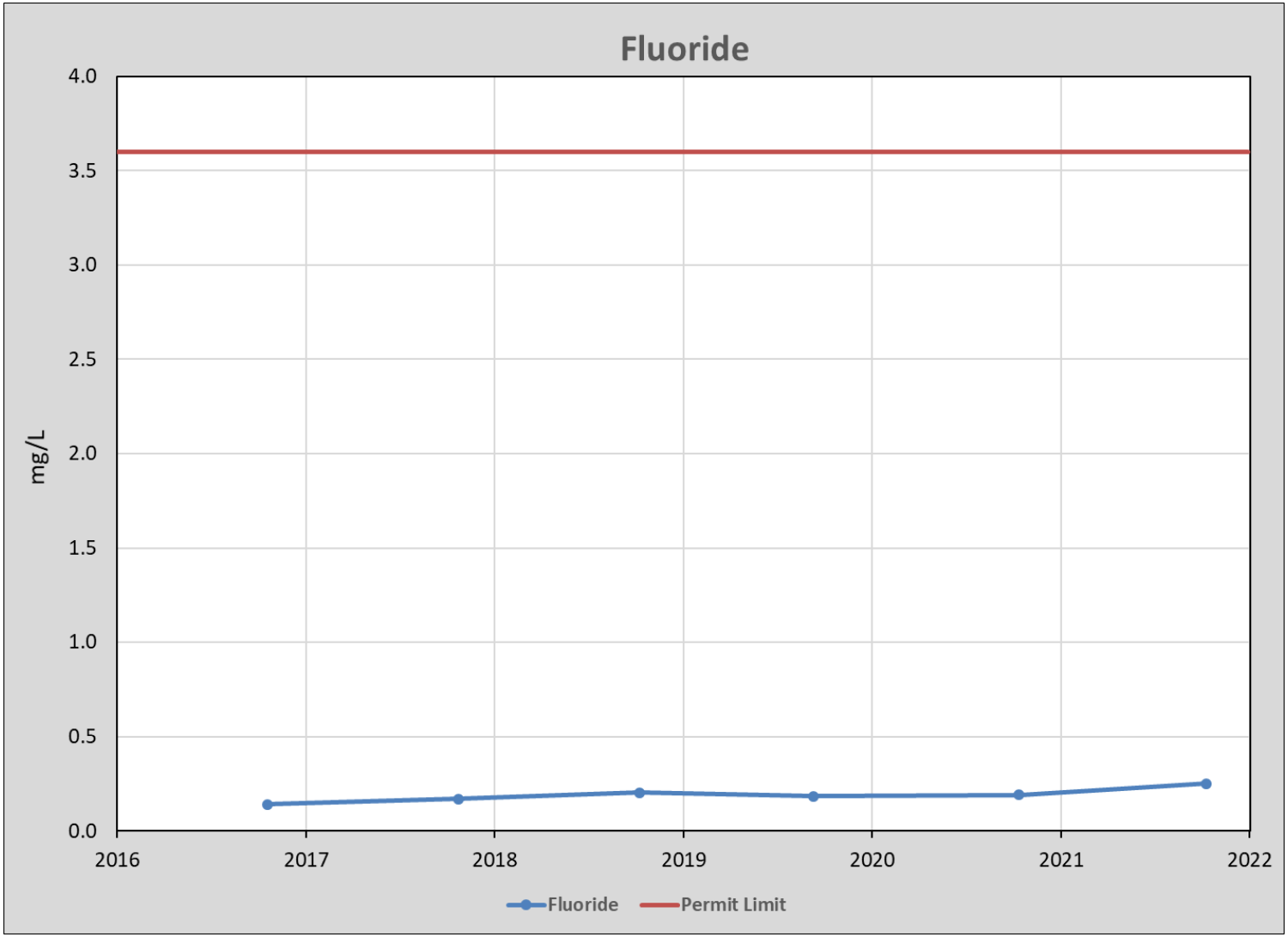

Figure 11. Fluoride Annual Discharge Sample Results

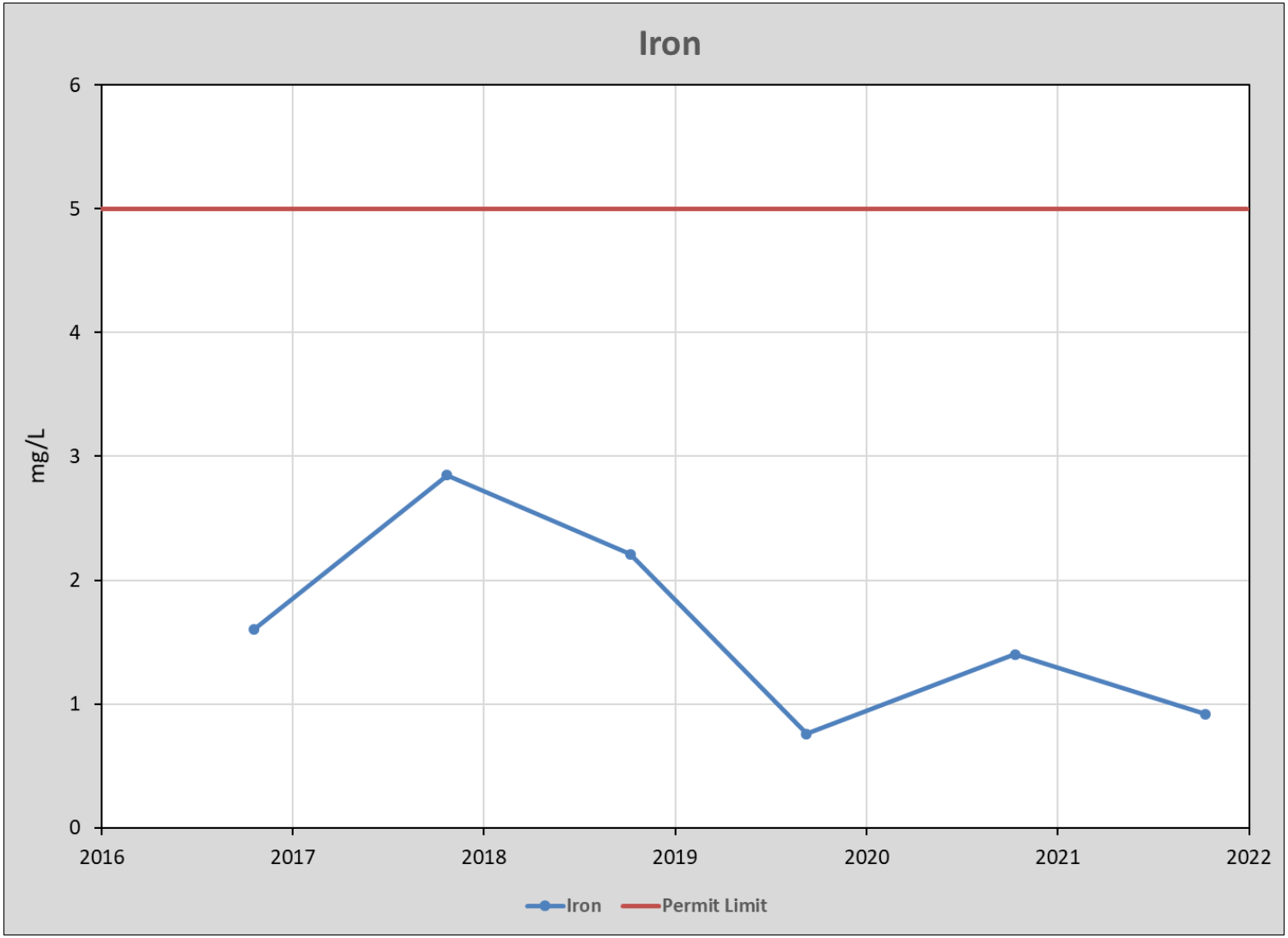

Figure 12. Iron Annual Discharge Sample Results

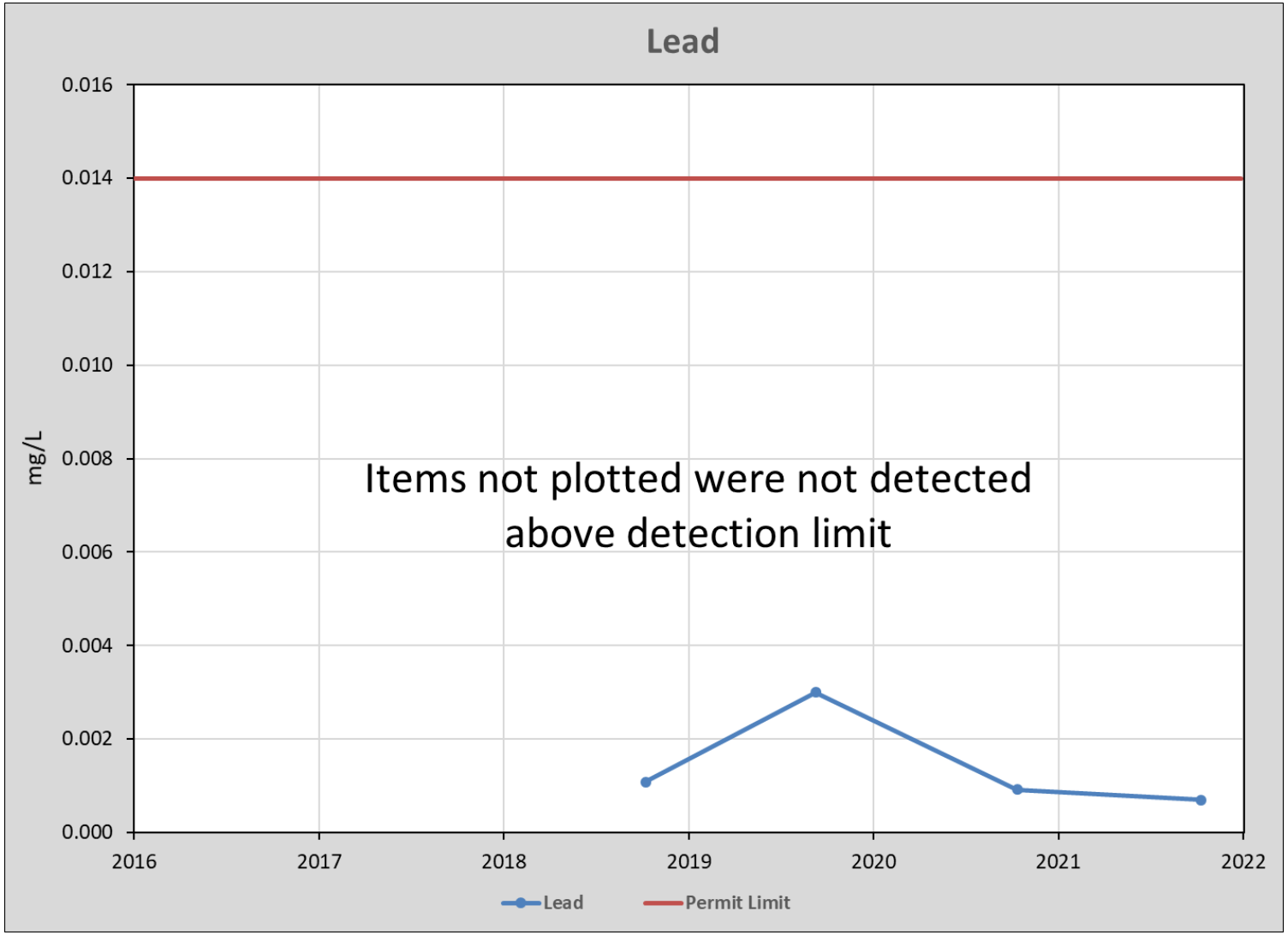

Figure 13. Lead Annual Discharge Sample Results

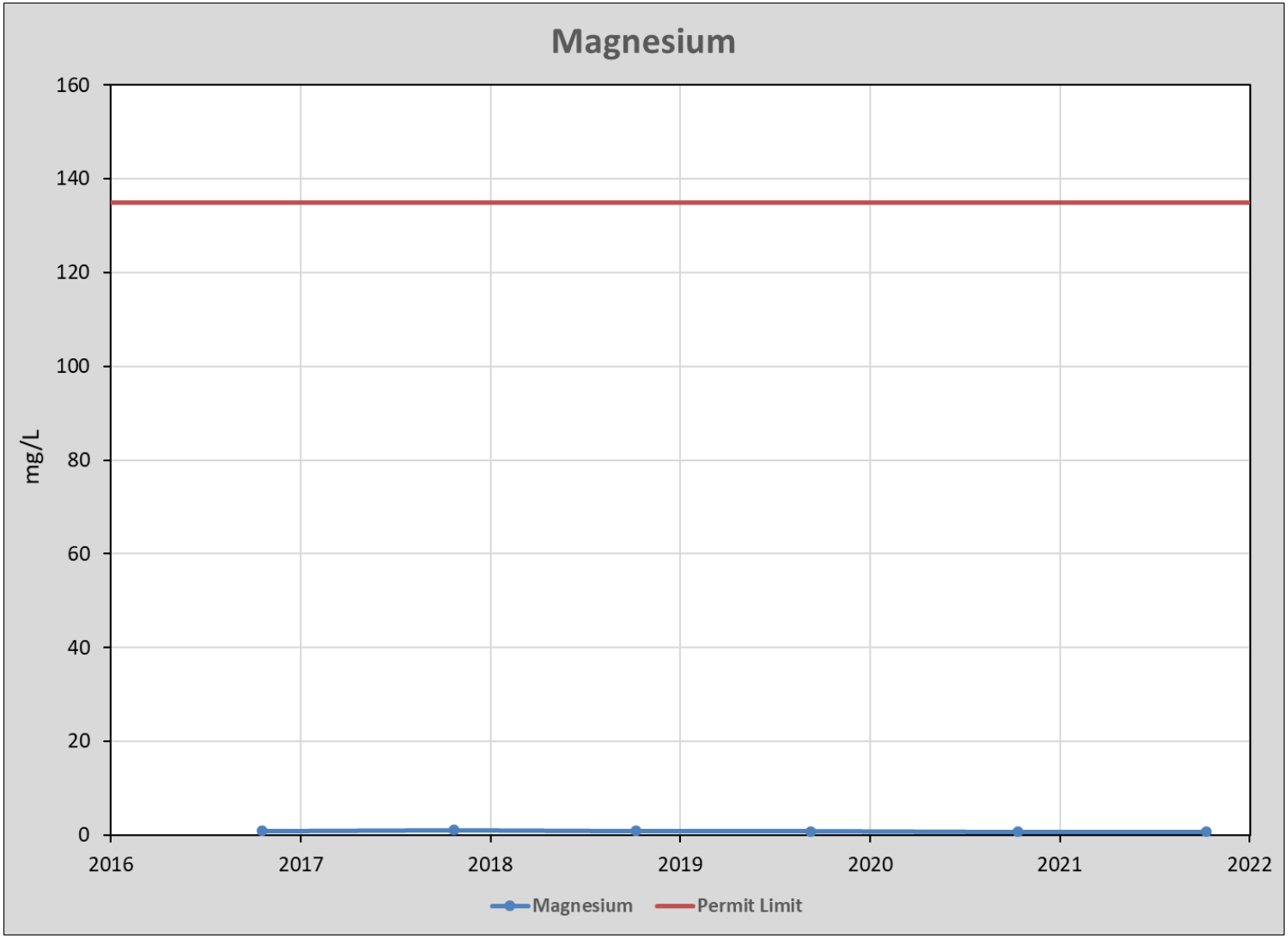

Figure 14. Magnesium Annual Discharge Sample Results

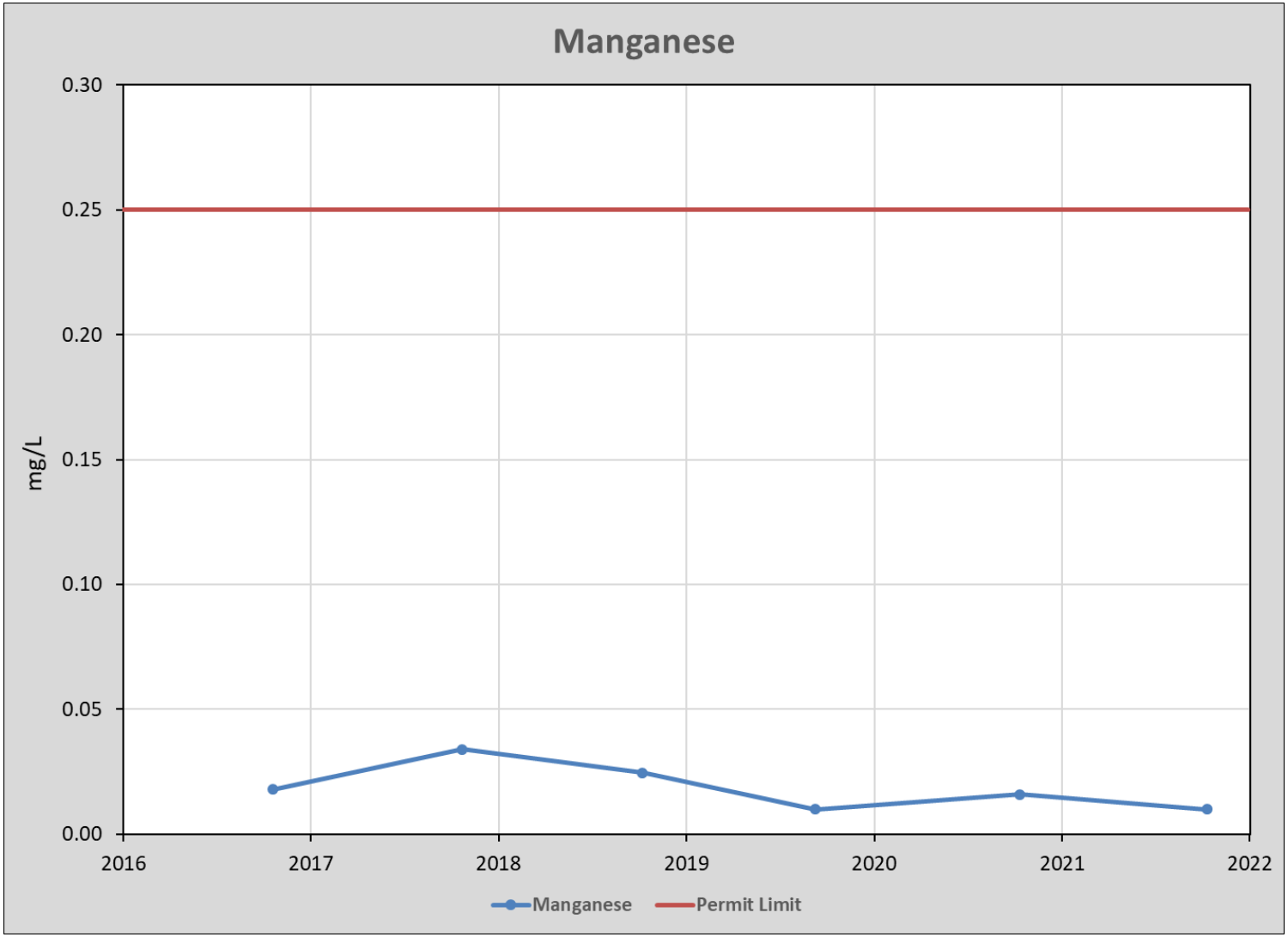

Figure 15. Manganese Annual Discharge Sample Results

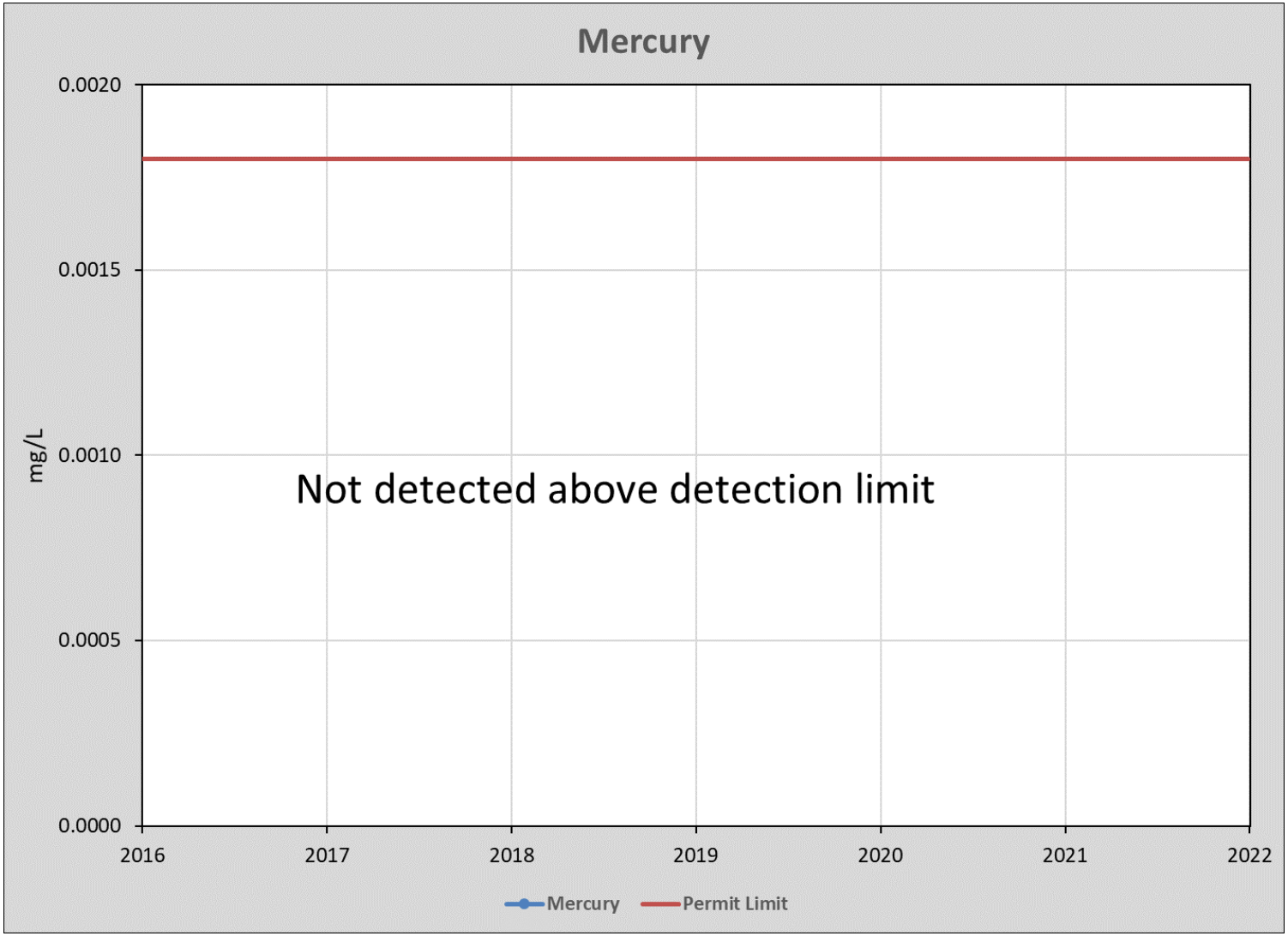

Figure 16. Mercury Annual Discharge Sample Results

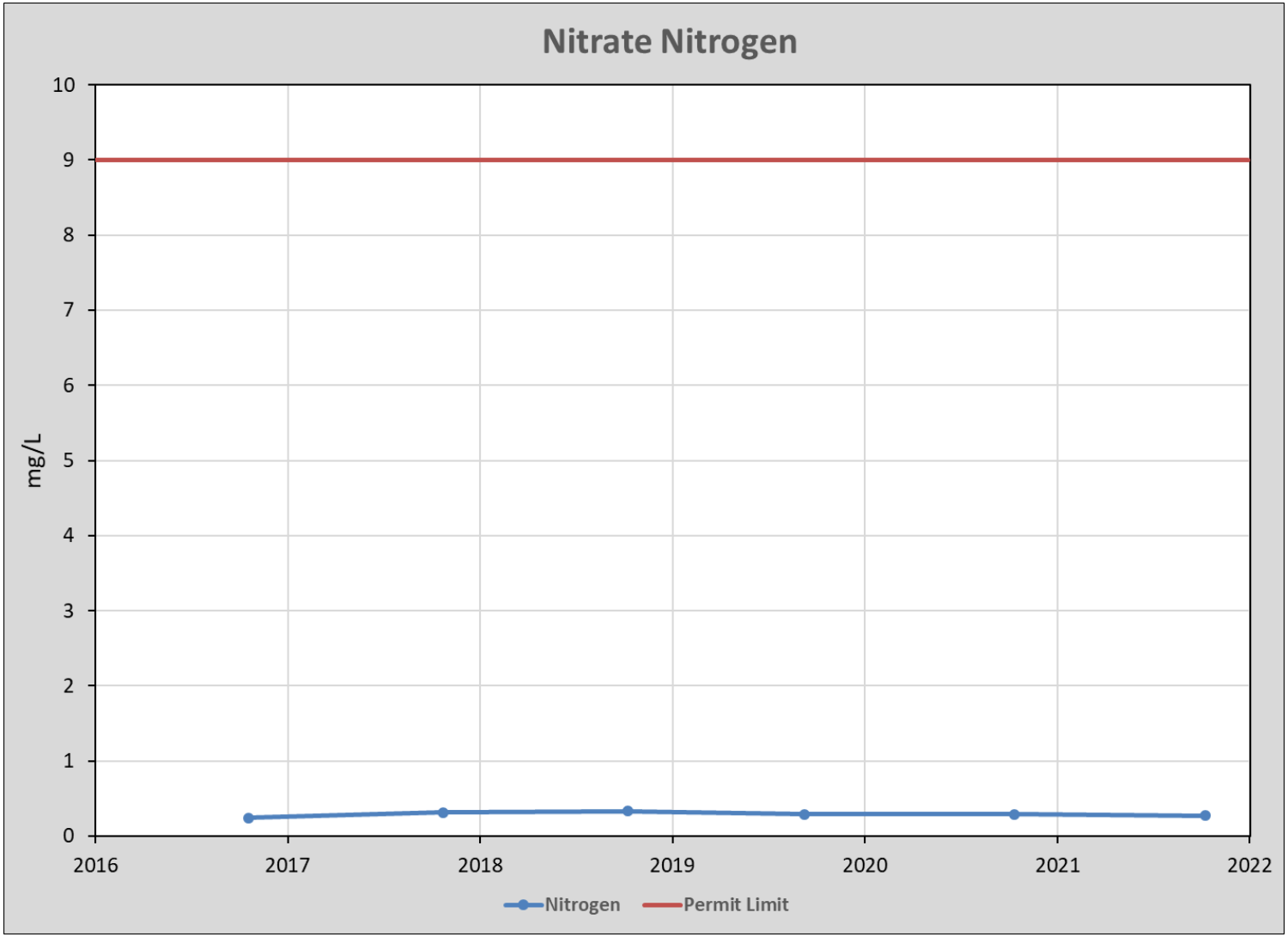

Figure 17. Nitrate Nitrogen Annual Discharge Sample Results

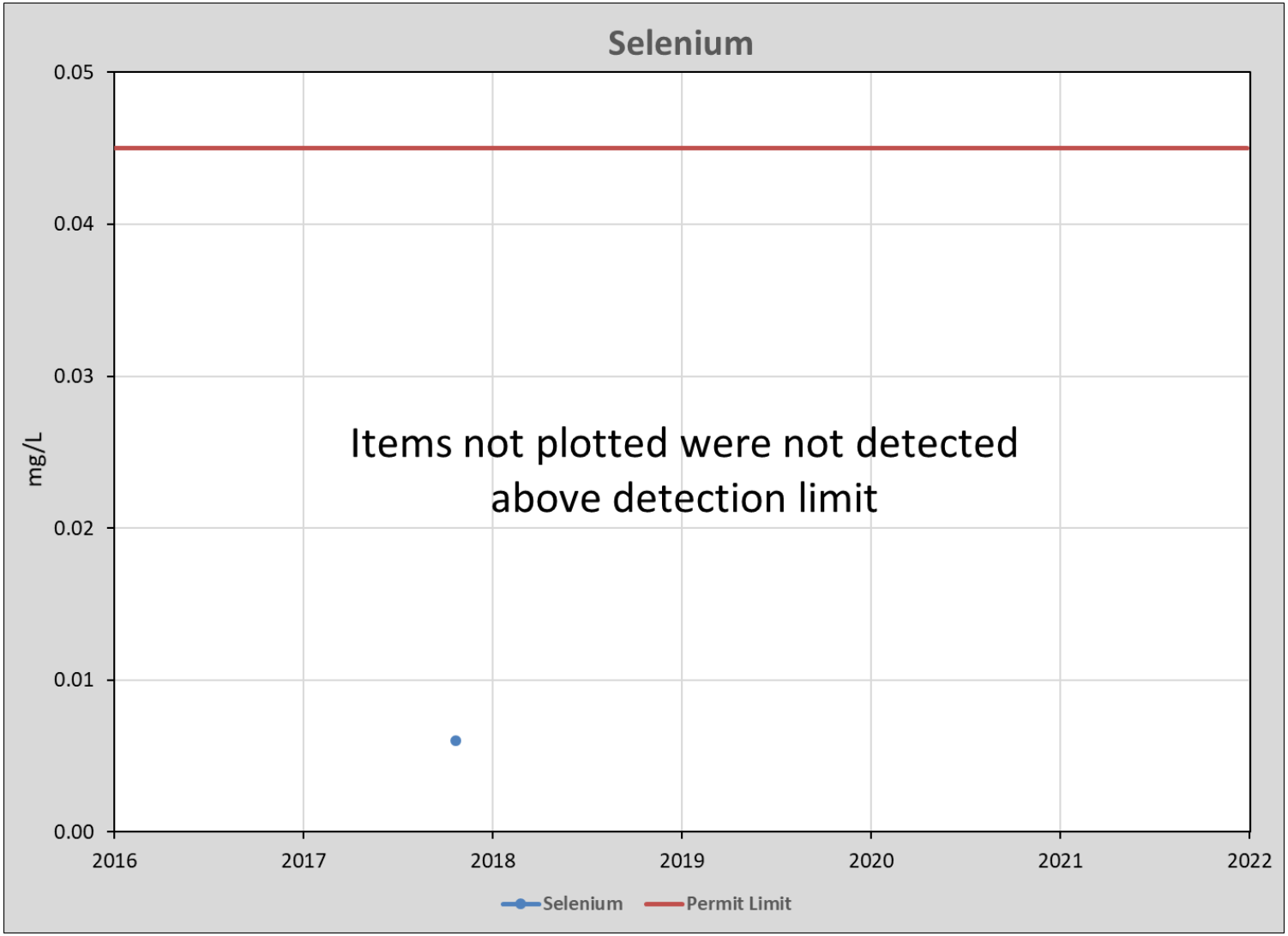

Figure 18. Selenium Annual Discharge Sample Results

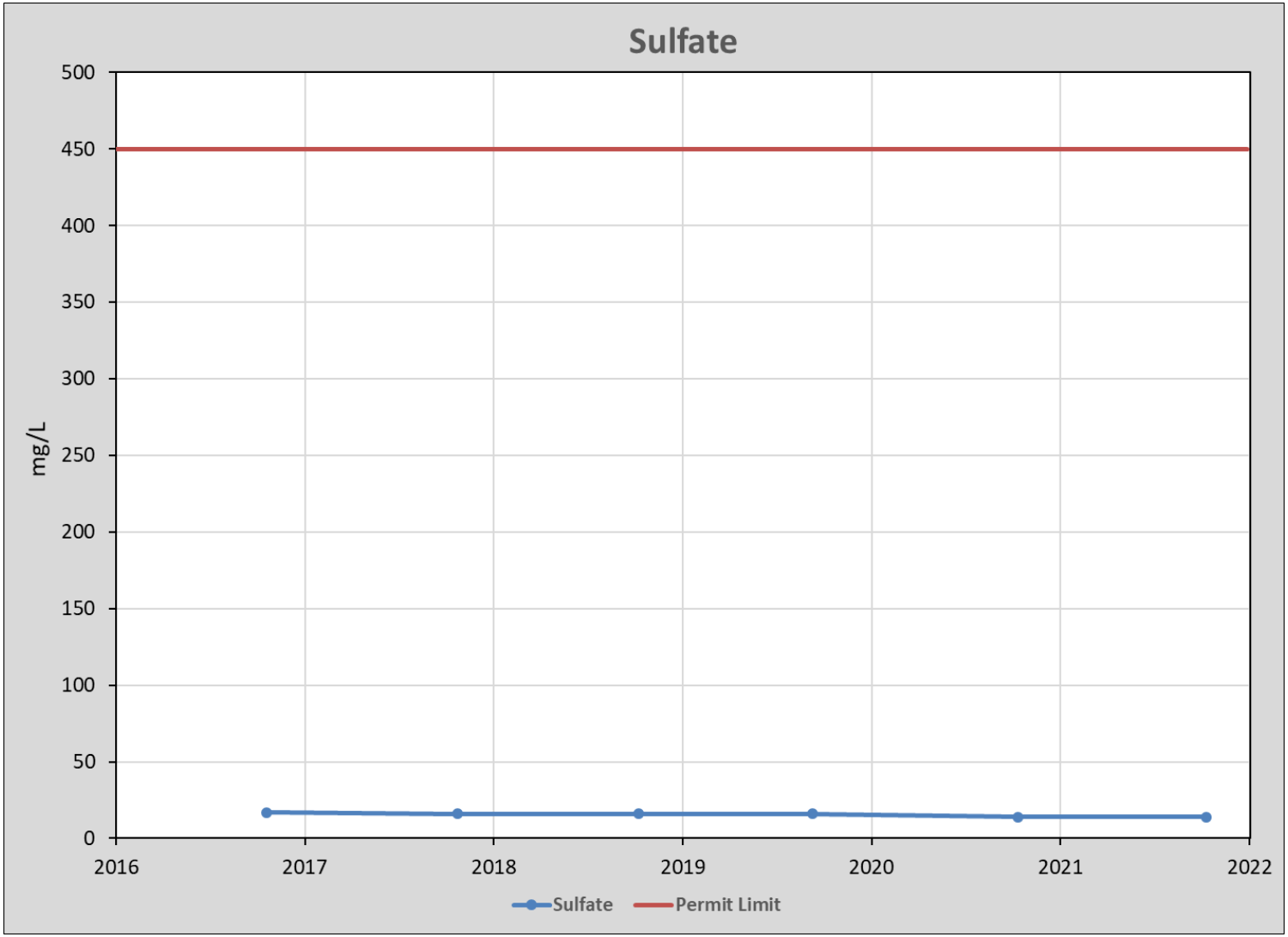

Figure 19. Sulfate Annual Discharge Sample Results

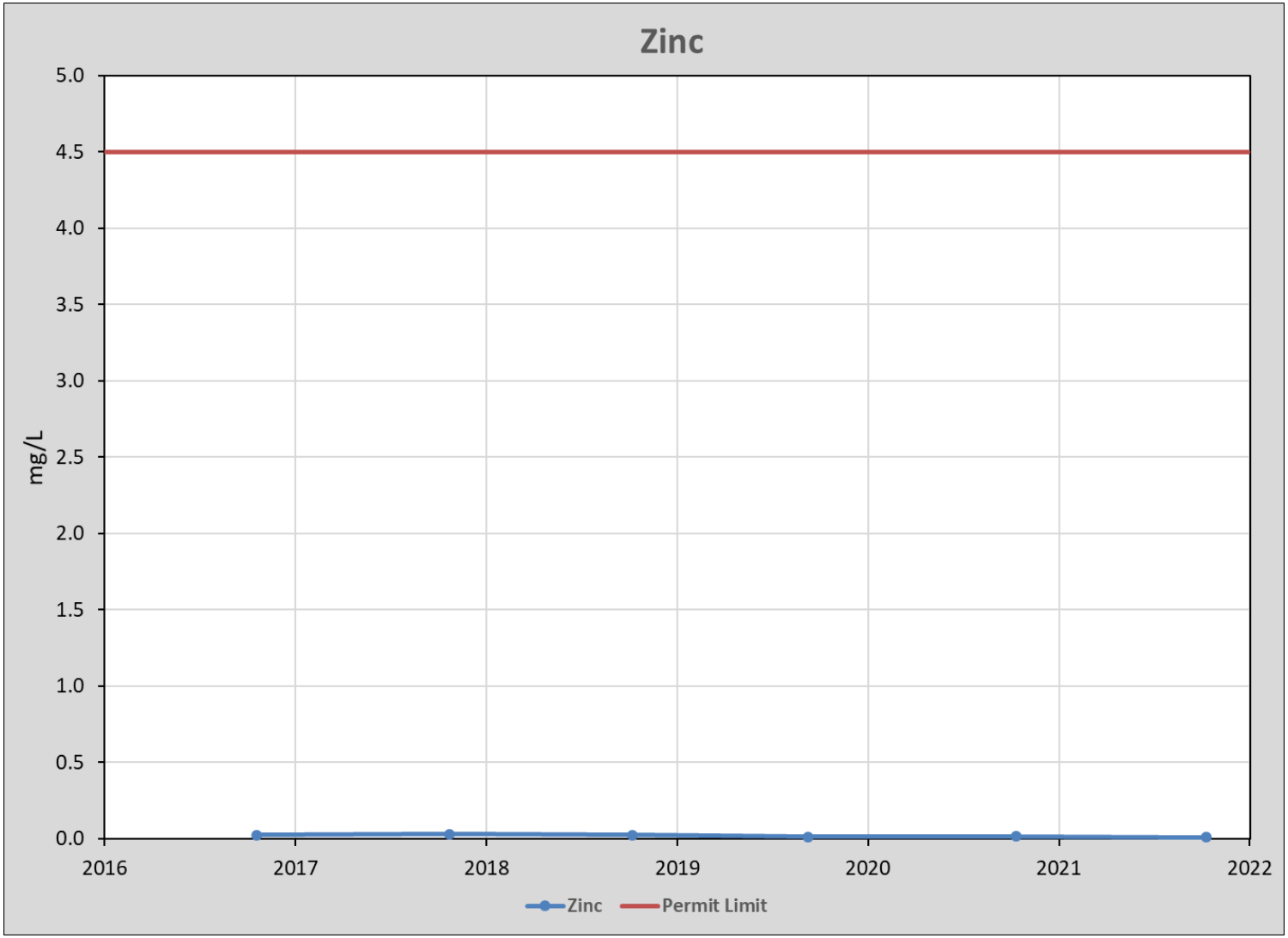

Figure 20**. Zinc Annual Discharge Sample Results**

5.0 WELL ER 12-1 GROUNDWATER SAMPLE RESULTS

Well ER 12-1 is located approximately 2.1 kilometers (1.3 miles) east-southeast of the U12e tunnel complex where nine underground nuclear tests were conducted. Some of these tests were conducted in a groundwater lens that is perched a maximum of 600 meters (m) (1,969 feet [ft]) above the regional groundwater table. Well ER 12-1 is also located 460 m (1,509 ft) east of the U12e tunnel effluent ponds. These unlined earthen ponds contain tritiated water accumulated from the discharge of perched groundwater draining from the U12e tunnel complex. Water in these ponds evaporate to the air or infiltrate to the soils directly below them.

The water level measurement was 463 m (1,519.89 ft) below ground surface (bgs) on April 17, 2017. Permit NEV 96021 requires the collection and analysis of representative groundwater samples from Well ER 12-1 every 24 months. Groundwater samples were collected from Well ER 12-1 on August 18, 2020. Groundwater samples were not collected in 2021 and will be collected in 2022. The results will be reported in the annual report for 2022.

Certification Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system and those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Reed J. Poderis

Digitally signed by Reed J. Poderis
Date: 2022.01.25 20:47:02 -08'00'

Signature and Date

THIS PAGE INTENTIONALLY LEFT BLANK