MAXEY FLATS DISPOSAL SITE
ANNUAL REPORT
2020

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Energy and Environment Cabinet
Department for Environmental Protection
Division of Waste Management
Superfund Branch

Maxey Flats Disposal Site
2597 Maxey Flat Road
Hillsboro, KY 41049
606-783-8680

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1.0 Introduction

The Commonwealth of Kentucky (Commonwealth) is submitting this annual report for the Maxey Flats Disposal Site (MFDS) as described in Section 1.7.4 of the Quality Assurance Project Plan (QAPP), Sub Appendix D1 of the Performance Standard Verification Plan [(PSVP), Appendix D of the Institutional Control Work Plan (ICWP)]. Included in this report is a summary of the environmental data collected during 2020, annual concentration averages compared to regulatory limits, laboratory qualifications, annual dose calculations, and multiple physical condition evaluations. All reporting will be submitted to the Region 4 U. S. Environmental Protection Agency (EPA) in an approved electronic format.

1.1 Description

The MFDS is a remediated commercial low-level radioactive waste (LLRW) disposal facility owned and monitored by the Commonwealth. The MFDS includes the original commercial operations area of 280-acres, a 430-acre buffer zone acquired during the Initial Remedial Phase (IRP), and an additional 231 acres acquired during the Final Closure Period (FCP) to facilitate construction of the final cap. A survey was conducted during FCP to consolidate the properties into one deed. The property boundary, shown in Figure 1, was marked every one hundred feet with fiberglass survey markers.

The MFDS is located in the Knobs physiographic region of the Appalachian Plateau of northeast Kentucky, an area characterized by relatively flat topped ridges and hills. The disposal area is located on a spur of the Maxey Flat, one of the larger flat-topped ridges in the region. This spur is bounded by steep grades on the west, east, and south, with approximately 350 feet to the adjacent valley bottoms. Land in the area surrounding the MFDS is primarily mixed hardwood forest and open farmland. The area is sparsely populated, mostly undeveloped, and will likely remain this way.

The Maxey Flats Disposal Site lies in a tectonically stable region of North America with few exposed faults and relatively infrequent earthquakes. The rock units exposed in the area surrounding the MFDS consist of shale, siltstone, and sandstone ranging in age from the Silurian to the Mississippian (320 to 430 million years). In the MFDS area, the rock units dip 25 feet per mile (.3 degrees); regionally they dip 30 to 50 feet per mile to the east.

The residents of Maxey Flats have been served by public water supply since 1985. Before the public water supply was available, the water source for the area was shallow wells dug in the soil or weathered shale of the Nancy Member. These wells were not very productive; supplying approximately 25 to 50 gallons per day. Most investigators have considered this water supply to be a perched water table. Residents often supplemented household water usage with rainwater cisterns.

Vertical migration of groundwater between geological strata in this area is limited by low permeability shale layers, which act as aquitards. Therefore, contamination from the disposal area generally migrates

horizontally through the fractured siltstone layers toward the sandstone outcroppings on the adjacent slopes and into the bottom soil layers on these hillsides.

Both Drip Springs Creek located to the west, and No Name Creek located to east of the disposal area flow into Rock Lick Creek, which is southwest of the disposal area. Rock Lick Creek flows into Fox Creek approximately 2 miles southwest of the MFDS. Fox Creek then flows into the Licking River, approximately 6.5 miles west of the MFDS. The Licking River empties in to the Ohio River near Cincinnati, Ohio, which is 100 miles northwest of site.

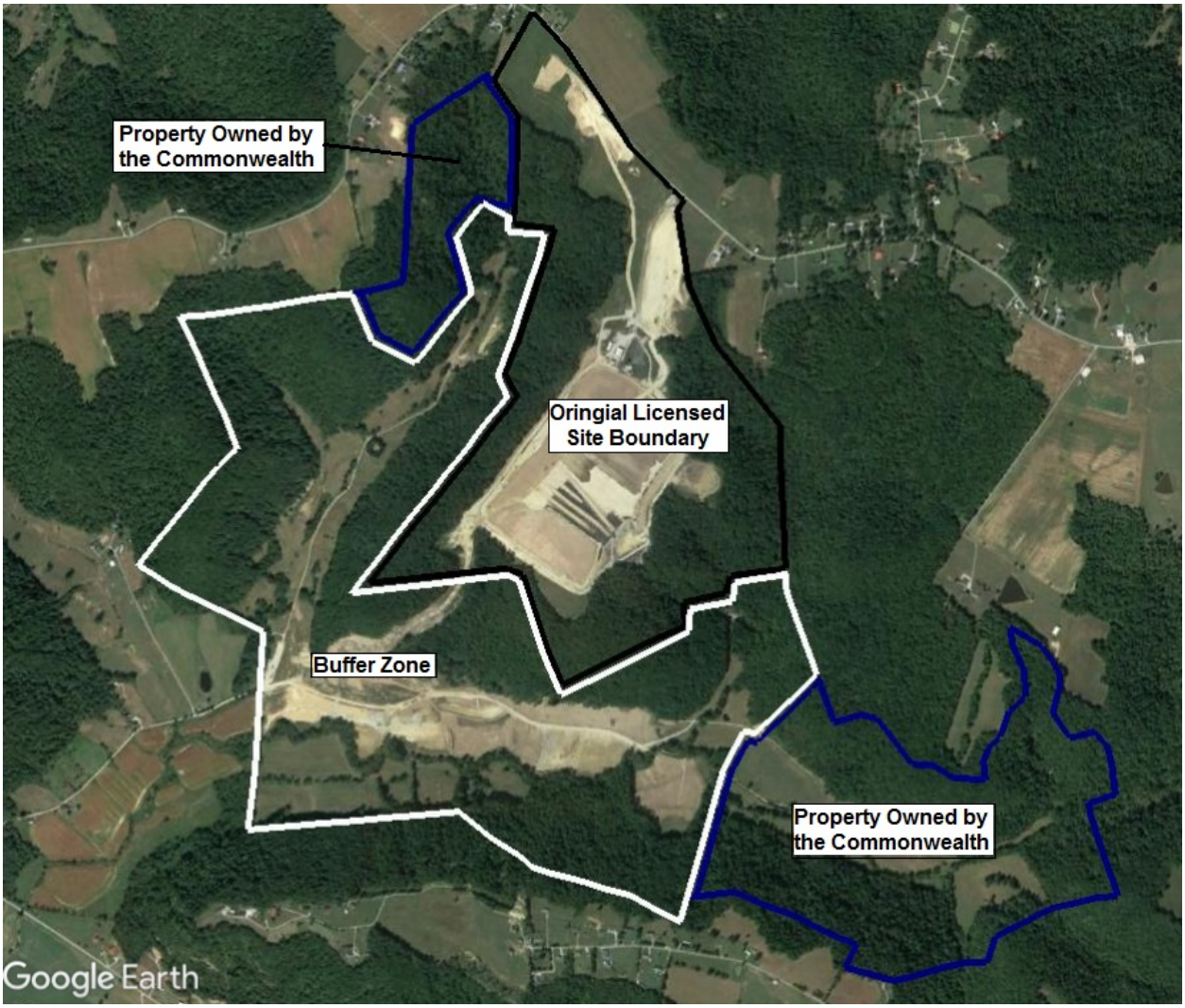

Figure 1: Maxey Flats Disposal Site Property Boundaries

1.2 Site History

In 1962, the Commonwealth was the first state to be granted Agreement State status by the Atomic Energy Commission, which established regulatory authority for managing low-level radioactive materials within the state. The Commonwealth then issued a radioactive materials license to the Nuclear Engineering Company (NECO) to dispose of LLRW at the MFDS. This made the MFDS the first low level nuclear waste disposal facility in the country.

The MFDS operated commercially from 1963 to 1977, disposing of approximately 4.8 million cubic feet of solid LLRW from hundreds of publicly and privately owned facilities. The waste contained approximately 2.4 million curies of by-product material, 533,000 pounds (lbs.) of source material, and 950 lbs. of special nuclear material. Solid waste forms included clothing, paper, glassware, used equipment, shielding materials, and animal carcasses, all in containers constructed of various materials including cardboard boxes, wooden boxes, and steel drums. Liquid waste was accepted from 1963 to 1972 under a license amendment requiring solidification and placement in special trenches designated for liquids.

During commercial operations, waste was disposed of in 46 unlined trenches. Waste designated as “high specific activity” was placed in special “hot wells”. A typical disposal trench was 30 feet deep with varying lengths and widths. Accumulated waste was covered by 3 to 10 feet of soil. This method of waste placement created an unstable waste matrix in the trenches that left the landfill susceptible to recurrent subsidence events and stormwater infiltration. Beginning in 1972, leachate was pumped from the trenches to prevent overflow. From 1973 to 1986, an evaporator facility was operated on site to reduce the volume of accumulated leachate. Over 6,000,000 gallons of leachate was treated, producing over 100,000 gallons of concentrates, which were solidified and disposed of in six additional noncommercial trenches from 1979 to1990.

In 1977, it was determined that trench leachate was migrating off site through subsurface geology. NECO was ordered by the Commonwealth to cease the receipt and burial of radioactive waste. To ensure proper closure and long term stewardship, NECO’s license and financial liability were transferred back to the Commonwealth, as required under Kentucky administrative regulations.

From 1983 to 1986, the Commonwealth pursued placement of the MFDS on the National Priorities List (NPL). In 1986, after comprehensive investigation, the EPA listed the Site on the NPL under the Superfund Program. The EPA issued a Record of Decision (ROD) in 1991, detailing remedial actions (RAs) and prescribing the four phases of the remedy: the Initial Closure Period which was renamed in the Consent Decree (CD) as the Initial Remedial Phase (IRP); the Interim Maintenance Period (IMP); the Final Closure Period (FCP), and the Institutional Control Period (ICP). The remedy selected by the EPA was natural stabilization during the IRP and IMP, to allow the wastes in the trenches to subside naturally to a stable condition prior to installation of a final, engineered cap. Natural stabilization was anticipated to occur over a period of 30 to 100 years. The finalized CD was signed and became effective in 1996.

The IRP began in 1998 with the solidification and on site disposal of over 900,000 gallons of leachate from the burial trenches. Leachate was solidified and placed in a concrete bunker within the restricted area. Upon cessation of the trench dewatering effort, an interim 52-acre exposed polypropylene geomembrane cap was constructed over the entire disposal area to replace previous, aging geomembranes. This interim cap prevented water infiltration and allowed for the monitoring of trench stabilization. It was at this time

the Commonwealth acquired additional buffer zone properties and filed deed restrictions on the properties.

During the IMP, which began in 2003, the Commonwealth continued environmental monitoring, cap maintenance, and evaluation of trench stabilization under established radiological controls. Primary focuses of the IMP were monitoring and evaluation of 83 trench sump leachate levels and cap subsidence monitoring, with subsidence being the key factor in evaluating trench stabilization.

On November 16, 2012, the EPA approved the MFDS Trench Stabilization Criteria Evaluation submitted by the Commonwealth, which indicated that natural stabilization at the site was substantially complete. This action occurred approximately 35 years after the Commonwealth stopped waste from being accepted at the facility, and signified entry of the MFDS into the FCP. The Commonwealth selected a supervising contractor (AECOM) to complete the remedial design and oversee the activities of Remedial Construction Services, L.P. (RECON) and the Walker Company, who were hired to implement the FCP RA. The remedial actions included:

- **Sump Abandonment**. Closure and sealing of all sumps and monitoring wells on the cap.
- **Final Cap Construction**. Construction of a multi-layered cap constructed with geogrid reinforcement, HDPE geomembrane, drainage layer, geosynthetic clay layer, and a vegetative soil cap to mediate any future differential settlement, eliminate water infiltration into the trenches, and allow for precipitation to percolate through the soil, evaporate, and drain from the cap to surface water control features.
- **Surface Water and Erosion Control**. Construction of two new detention basins in the valleys below to the west and south, and construction of a perimeter stormwater collection system around the final cap to deliver surface water to the detention basins.

The Certification of Completion of the FCP RA is pending EPA review and approval of the Institutional Control Work Plan. The EPA issued approval to implement the ICWP Sampling and Analysis Plan effective January 1, 2020. The Commonwealth will perform the general Operations and Maintenance (O&M) requirements in the ICWP including inspections of the cap, perimeter roadway, stormwater drainage system, and erosion surveys and document any potential impacts until the ICWP is approved. If impacts exceed the standards of the ICWP PSVP, repairs will be performed and documented following the same procedures and methods in the IMP PSVP and O&M Plan. Following EPA issuance of the FCP RA Certification of Completion, the ICWP will be followed for 100 years.

1.3 Scope of Work

The remediation at the MFDS was completed as defined by the Consent Decree (Civil Action Number 95-98) signed by EPA, Settling Private Parties, and the Commonwealth. As defined in the CD, the Balance of the Remedial Phase (BoRP) ends with the Certificate of Completion of the FCP. All responsibility for the MFDS after the BoRP will be held by the Commonwealth. This includes all monitoring, maintenance, and reporting activities outlined in the ICWP, which follows the criteria described in the Record of Decision (ROD) for the duration of the 100 year Institutional Control Period and site control in perpetuity.

The following IC Work Plan monitoring and maintenance activities are summarized in this report. The supporting documentation is included in appendices:

- Surface and groundwater contamination monitoring
    - Climatological data
    - Data collection, analysis, evaluation, and quality assurance
- Adjacent slope erosion monitoring
    - Mass material movement
    - East, west, and south drain erosion inspections and surveys
- Vegetative cap monitoring
    - Subsidence monitoring
    - Perimeter drainage system maintenance
    - Vegetation
- Contaminated liquid storage and disposal
- General site maintenance

2.0 Contamination Monitoring

Tritium is the indicator isotope used to evaluated contamination at the MFDS. This isotope was one of the most abundant waste forms disposed of at the site during commercial operations. It is very mobile in the environment and is easily detected with the appropriate analysis equipment. All regulatory screening and action levels At the MFDS are based on the concentration of this isotope.

Tritium is as mobile as water, therefore it is appropriate to document the climatological conditions at the MFDS annually. There are three rain gauge locations associated with the MFDS. They are located at Stormwater Management Feature 1 [(SWMF-1), the location previously referred to as the East Detention Basin (EDB) which was changed for IC purposes to SWMF-1], sampling location 102D, and outside the main office building. The official annual rainfall data for the MFDS is collected at SWMF-1. The main office rain gauge is used for official rainfall totals in the event of a rain gauge malfunction or failure at SWMF-1. The data from the rain gauge at 102D is collected and maintained exclusively by the USGS and serves as a reference to site data. The measured rainfall at the SWMF-1 gauge during 2020 was 50.83 inches. This is 3.93 inches more than the 20th century Kentucky Climate Division 4 average of 46.90 inches, as reported by the NOAA National Climatic Data Center. It is also important to note that the heaviest rain events in 2020 were less than 2.5 inches in a 24 hour period, as compared to a 2 year rain event of 2.8 inches in 24 hours. Because environmental tritium activity and trending is indelibly linked to rainfall, the annual precipitation data appears along with tritium data in Appendix A: 2020 MFDS Tritium Data.xlsx.

2.1 Surface Water Monitoring

Surface water sample collection at the MFDS is divided into two classifications: perennial surface and drainage channel waters. Both classifications are influenced by the surface water runoff from the cap and have unique regulatory screening/action levels. All the IMP locations are represented in the IC sampling plan, but involved some changes in collection procedure and locations. These changes were implemented to reduce the number of samples collected annually, while maintaining representation of conditions at these locations. Surface water sampling locations are indicated in Figure 2.

2.1.1 Perennial Surface Water

Perennial Surface Water (PSW) is monitored at five locations in three streams that receive surface water runoff from the MFDS and one location separate from MFDS surface water runoff influence.

Sample locations 106, 122C, and 103E are monitored using automated composite samplers that collect four daily aliquots into a weekly composite. This is a change from IMP monitoring that specified a four aliquot daily composite. The Commonwealth believes this change does not affect the representativeness of the conditions at these locations for evaluating annual tritium concentration averages.

Location 122A represents a background sample. The collection frequency for IC was changed at this location from a daily four aliquot composite to a weekly grab. The annual tritium concentration average at this location can be used for background subtraction in evaluating data at the MFDS.

Sample results for PSW locations are compared to the drinking water standard of 20 pCi/mL. A 10 pCi/mL screening level was established to assess the annual average tritium concentration at each location. During 2020, 514 of 524 possible PSW samples were collected for tritium analysis with no anomalous data reported. The annual average tritium concentration at all PSW sampling locations were below the screening level of 10 pCi/mL. The annual average tritium concentrations for all PSW locations for 2016-2020 is provided in Table 1.

Location 102D is stationed outside the MFDS property boundary after the confluence of all streams influenced by MFDS runoff, and serves as the final compliance point. A four aliquot composite sample is collected daily at this location using an automated composite sampler. This sampling method remains unchanged from the IMP methodology. As prescribed by Sub Appendix D3 (Radiological Dose Calculation) of the IC PSVP, Location 102D is used to calculate compliance with the 4 mrem annual average dose equivalent for tritium (equivalent to 20 pCi/mL) at a location that could reasonably serve as a public drinking water source. The annual average for 102D was 0.28 pCi/mL, which demonstrated compliance with this conservative standard; no further calculations were necessary.

2.1.2 Drainage Channel Water

Drainage Channel Water (DCW) is monitored in the west, south, and east drainage systems, which receive intermittent surface water flow from the vegetative cap. These locations are monitored using automated composite samplers.

Sampling protocol for IC at location 144 remained unchanged from the IMP method; a four aliquot composite sample is collected daily.

The diversion of surface water from the new vegetative cap to the south and west drainage channels necessitated the construction of two new storm water controls: Storm Water Management Features 2 and 3 (SWMF-2 and SWMF-3).The IMP sampling locations 143 and 107C were removed from IC sampling and are now represented by SWMF-2 and SWMF-3 respectively. The IMP sampling location referred to as the East Detention Basin (EDB) was changed for IC to SWMF-1.

Sample results for DCW locations are compared to the 25 mrem/year Total Effective Dose Equivalent (TEDE) standard, an annual average screening level of 62.5 pCi/mL , and an annual average action level of 125 pCi/mL. In 2020, 521 of an expected 525 samples were collected at the DCW locations for tritium analysis. The four uncollected samples were the results of frozen or dry conditions at sample location 144. No location exceeded the 62.5 pCi/mL annual average screening level, but because the tritium concentration is very low at the SWMFs an increase to 10 pCI/mL at those locations would be reported to the EPA. The annual average tritium concentrations for all DCW locations for 2016-2020 is provided in Table 1.

Surface Water Annual Average Tritium Concentrations (pCi/mL)

	Perennial Surface Water					Drainage Channel Water			
	122A	**106**	**122C**	**103E**	**102D**	**C107**	**143**	**EDB**	**144**
2016	-0.02	4.05	0.61	0.50	0.39	15.86	0.10	0.18	55.73
2017	0.02	2.57	0.47	0.42	0.36	7.86	0.49	0.48	34.45
2018	0.02	2.58	0.49	0.52	0.39	8.81	0.68	0.92	29.33
2019	-0.04	2.91	0.50	0.67	0.37	16.07	1.11	1.69	37.03
ICWP Sampling Plan						**SWMF-3**	**SWMF-2**	**SWMF-1**	
2020	**0.05**	**2.84**	**0.50**	**0.68**	**0.28**	**8.65**	**0.93**	**1.87**	**40.65**

Table 1

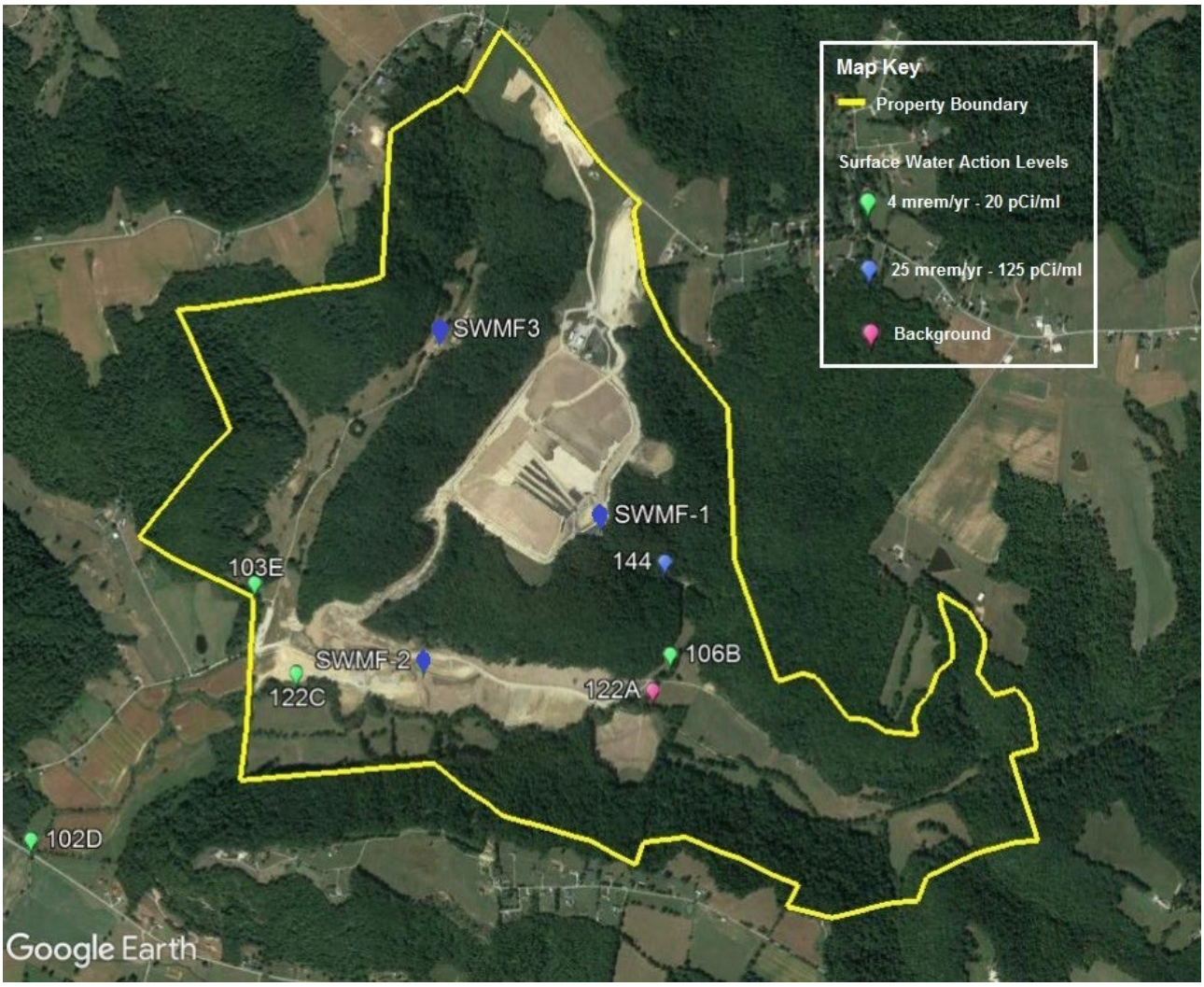

Figure 2: Surface Water Sampling Locations/Screening Levels

2.2 Groundwater Monitoring

Groundwater monitoring at the MFDS is conducted through the sampling and evaluation of alluvial wells in the buffer zone and five perimeter monitoring wells located just west of the cap perimeter drain.

There are twelve alluvial wells in the buffer zone (Figure 3), of which five are sampled regularly.

The west perimeter wells are maintained for water level monitoring, a requirement of the IC Work Plan, and the wells are sampled to satisfy a tritium monitoring requirement in the Radioactive Materials License (RML).

Sample results for all groundwater locations are contained in Appendix A: *2020 MFDS Tritium Data.xlsx.* Water level monitoring tables for alluvial and perimeter wells are contained in Appendix B: *MFDS Well Conditions 2020.*

2.2.1 Alluvial Well Monitoring

The Commonwealth has restricted public access in the buffer zone by removing the county road right-of-way through the buffer zone and installing a secure gate at the property boundary. Daily surveillance by MFDS staff further precludes lengthy public occupancy. For these reasons, the alluvial wells are not considered a reasonable public drinking water source and do not represent a potential radiological dose to the public.

Alluvial well (AW) samples were collected for tritium analysis as outlined in the IC PSVP and the 2007 EPA Five Year Review sampling amendment. Results from the eleven samples collected from five different wells was consistent with historical data. Sample results for all AW locations are presented in Table 2. The maximum tritium concentration was 2.39 pCi/mL from the 2nd quarter sample at AW-7. Comparison of this maximum value to 50 percent of the 20 pCi/mL applicable or relevant and appropriate requirement (ARAR) specified by the 2007 EPA Five Year Review sampling amendment indicated no additional analyses were required.

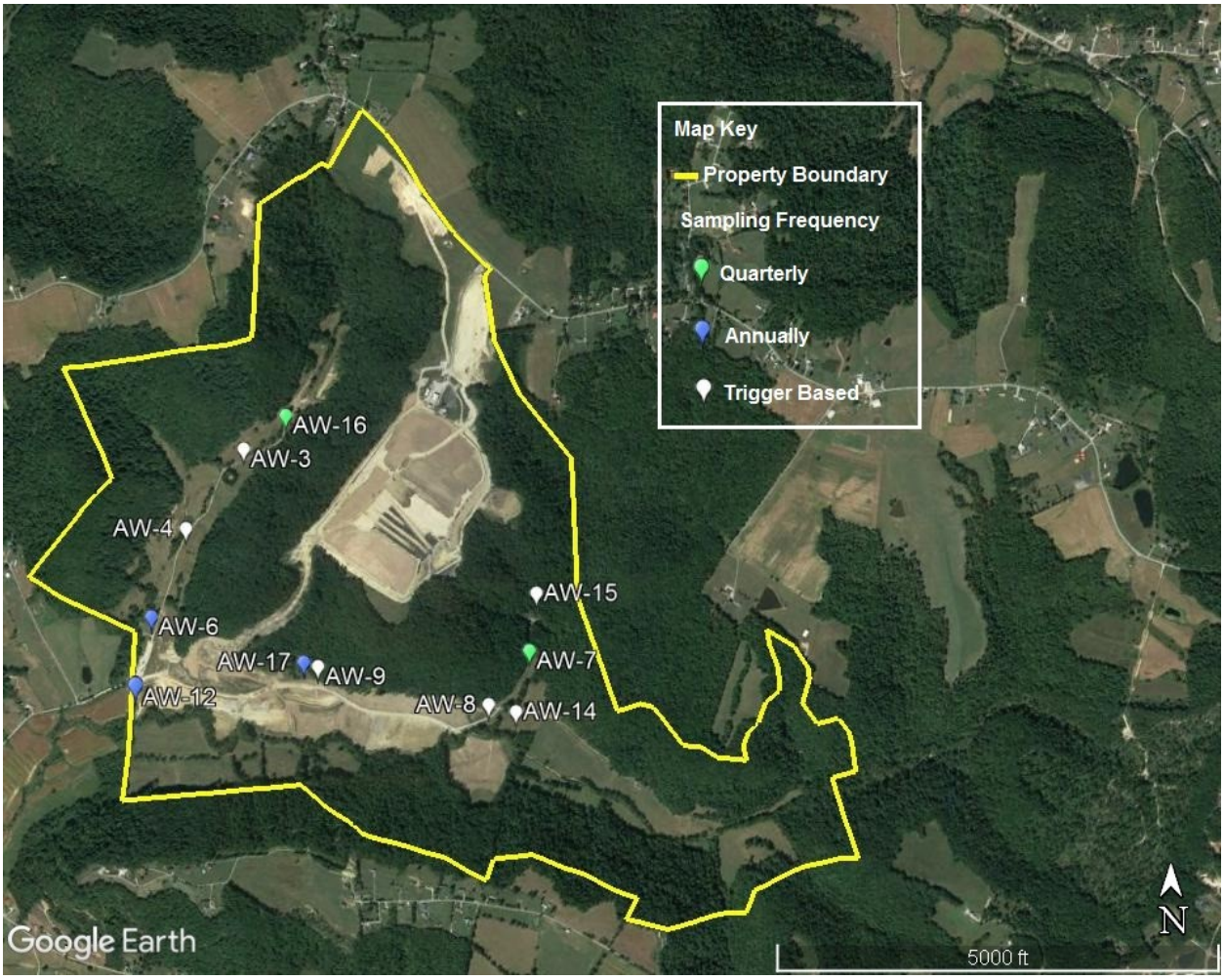

Figure 3: Groundwater Sampling Locations

2020 Alluvial Well Tritium Activity (pCi/mL)

AW-6	12/11/20	0.06
AW-7	3/27/20	2.26
	6/25/20	2.39
	9/24/20	2.30
	12/11/20	2.32
AW-12	12/11/20	0.20
AW-16	3/27/20	0.18
	6/25/20	0.22
	9/24/20	0.17
	12/11/20	0.25
AW-17	12/11/20	-0.03

Table 2

2.2.2 Perimeter Well Monitoring

Water levels in the west perimeter monitoring wells were measured quarterly in 2020. Levels were characteristic of recent data, including the near dry condition of N2B. The 2020 perimeter monitoring well water level measurements are presented in Table 3. Historical measurements are retained in Appendix B: *2020 MFDS West Perimeter Well Levels.xlsx* for comparative evaluation. Monitoring wells N2B, UK-1, FCP-1 were sampled on a semiannual schedule. Monitoring well N2B did not have sufficient volume for sampling in 2020. Tritium analysis results for the west perimeter monitoring wells can be found in Appendix A: *2020 MFDS Tritium Data.xlsx.*

2020 West Perimeter Monitoring Well Measurements

Well ID	Ground Elevation* (ft)	Ground to Water (ft) 3/27/19	Ground to Water (ft) 6/25/20	Ground to Water (ft) 9/24/20	Ground to Water (ft) 12/23/20
ESI-2	1047.50	**8.10**	**11.69**	**11.89**	**11.56**
ESI-4	1048.00	**12.15**	**12.30**	**12.39**	**12.79**
N2B	1044.50	**8.15**	**9.08**	**9.15**	**9.27**
UK-1	1046.10	**10.26**	**10.49**	**10.58**	**10.97**
FCP-1	1040.00	**12.08**	**12.39**	**12.69**	**12.62**

Table 3

2.3 Data Collection, Analysis, Evaluation, and Quality Assurance

The MFDS laboratory detects low levels of tritium in water using industry specific equipment and chemicals. A Tri-Carb 2910TR liquid scintillation analyzer manufactured by Perkin Elmer and Ultima Gold Low Level Tritium scintillation cocktail are used to detect ultra low levels of tritium in a wide range of water samples. In 2020, the minimum detectable activity (MDA) ranged from 0.32 - 0.38 pCi/mL with a typical efficiency of 0.38.

The required precision for the data produced at the MFDS is defined in the ICWP, Sub Appendix D: QAPP, Section 1.5.5.1. It states the Relative Error Ratio (RER) for all duplicate samples will be less than three. Dade Moller was contracted in June of 2020 to perform third party data validation for the data produced in the MFDS laboratory. Data validations produced by Dade Moeller report the error ratio as Duplicate Error Ratio (DER), an interchangeable term with RER. An annual average RER for all duplicates of 0.28 was calculated for the MFDS data sent for third party validation. A representative Dade Moller data validation report and the excel file containing DER tables are included in Appendix A: *Maxey Flats Disposal Site Analytical Data 2020.*

The MFDS laboratory participates in a third party proficiency testing program as required in the ICWP, Sub Appendix D1: QAPP, Section 1.5.5 "Measurement Performance and Acceptance Criteria". Administered by Environmental Resource Associates, proficiency testing is performed semi-annually for tritium and annually for gross alpha and gross beta. The tritium results for 2020 were both within the accepted range. The gross alpha results were within the accepted range, while gross beta results were not. The laboratory manager evaluated the procedures and formulas, with no apparent grounds for gross beta failure. Copies of the 2020 ERA proficiency test results are included in Appendix A: *Maxey Flats Disposal Site Analytical Data 2020.*

3.0 Adjacent Slope Erosion Monitoring

One of the primary concerns to the security of the capped disposal area is hillside erosion that could retreat toward the FCP cap. Mass material movement monuments were installed around the south cap during FCP and are surveyed annually to detect movement near the cap Drainage channels are visually inspected quarterly and after severe rain events. Erosional cross-section area data is collected semi-annually by a licensed surveyor.

3.1 Mass Material Movement Monitoring

A mass material movement event occurred above Borrow Area 4 in the buffer zone as a result of FCP cap construction. This event required the installation of seven monuments above the landslide, below the perimeter of the south cap, to document any movement further up the slope. The latitude, longitude, and altitudes are collected annually by a licensed surveyor. These monuments have remained

very stable since installation. This data can be reviewed in Appendix D: Maxey Flats Disposal Site Erosion Monitoring 2020; *2020 MFDS SC Hillside Subsidence Monitoring.pdf*.

The landslide area above Borrow Area 4 is visually inspected semi-annually and following any severe weather event. These inspections show material movement within the slide, but movement further up the slope has not been observed. A large parking cone was secured at the apex of the slide and ribbons marked the width of the affected area during FCP. No material movement has been seen outside of the defined area.

3.2 Drainage Channel Inspections and Surveys

There are three primary drainage channels that receive targeted surface water flow from the vegetative cap: East Drainage Channel, West Drainage Channel, and South Drainage Channel. These drainage channels are visually inspected semi-annually and following any severe weather event. They are also surveyed by a licensed surveyor semi-annually. The vegetative FCP cap has dramatically reduced the released surface water flow to the East Drainage Channel, while increasing the surface water flow to the South and West Drainage Channels. Visual inspections have documented no erosional concerns in any drainage system since the completion of the final cap. The flow data at SWMF-1 supports this conclusion as the total flow at this location for 2020 was just over 10 million cubic feet, which was less than 15% of the annual flow during IMP. Flow data at the West and South Drainage Channel is incomplete for 2020. The solar power at these locations was upgraded during the year because of frequent power loss. When the new solar power did not resolve the power failures the new electronic transducer flow meters were replaced with the older bubbler models that require less power. The bubbler models have not failed since installation, but the flow data at these locations is unusable for data comparisons.

Cross-sectional surveys of the three drainage systems has proven more difficult than usual as the surveyor that routinely performed this service passed away unexpectedly in 2019. Curd Survey collected the baseline data for the three drainage systems, cap subsidence, and mass material movement monuments in 2017, and the data for the drainage systems again in 2018. Early in 2019, the staff at MFDS contacted Curd to perform all surveys, but were informed of the surveyor's passing. It took several months to find and approve another surveyor. D and L Land Surveying started data collection in November 2019; the surveyor contracted Lyme disease and did not deliver the survey result until April, 2020, which resulted in the Spring 2020 survey not being completed. The Fall 2020 survey was conducted per contract obligation in a timely manner. The D and L Land Surveying drainage system survey data has not shown any constancy and does not compare well to the previous data. More data is required to effectively evaluate the erosional conditions in the South and West Drainage Channels. The surveys for the Curd Survey baseline and D and L Land Surveying are included in Appendix D: Maxey Flats Disposal Site Erosion Monitoring 2020 for further review.

4.0 Vegetative Cap and Drainage

The MFDS FCP cap is a multi-layered cap constructed with geogrid reinforcement, HDPE geomembrane, drainage layer, geosynthetic clay layer, and vegetative soil cap. The cap perimeter drainage system includes a riprapped apron, vegetative swales, a concrete inverted crown road drain with catch basins and sub gradient piping, and three stormwater management features. Inspections of the vegetative cap and associated drainage features are completed monthly, semi-annually, and annually.

4.1 Cap Vegetation

The vegetative cover density of the cap has improved every year since construction completion in 2017. In the spring of 2020, the entire cap received its second application of agricultural lime as recommended by the County Extension Office after soil samples were analyzed. Annual fertilization of the entire cap will cease in 2021. Fertilizer and lime will be concentrated in areas with lower vegetative density only.

During 2020, the IC inspection program did identify a depression on the cap that held water for an extended period of time. The depression was measured, filled with soil, leveled, seeded, and the location was documented with GPS. This condition and repair are documented in Appendix E: Maxey Flats Disposal Site Inspection Reports; *MFDS 05 2020 Monthly Insp.pdf*

4.2 Perimeter Drain

The perimeter drainage system was inspected monthly during 2020. No deficiencies were identified. Vegetative growth in the swales is sufficient to prevent erosion and the surface of the concrete inverted crown road drain is performing as designed. No cracks in the concrete exceeded the 1/8" limit in 2020. The integrity of the catch basins and sub gradient piping was satisfactory, excluding the occasional accumulation of leaves.

4.3 Stormwater Management Features

Woody vegetation was removed from all SWMFs before reaching the 1" diameter limit. SWMF-1 is lined with rip rap that shows no sign of deterioration or thinning. SWMFs 2 & 3 are lined with vegetation and require mowing to maintain the 12” height limit. Both SWMFs 2 & 3 have developed a near perennial flow that facilitates excessive growth in the central channels. Cutting of this vegetation can not be completed with on site equipment, so it has been completed by hand and is labor-intensive. The MFDS plans to purchase a sickle mower during 2021 that will reduce the time and labor required to keep the basin's vegetation below the 12" height criteria. Information about the flow at the SWMFs is available in Section 3.2 of this document.

4.4 Cap Subsidence Monitoring

Annual FCP cap subsidence monitoring is conducted by verifying the elevation of 34 monitoring points. These monitoring points duplicate the IMP areas of concern that were prone to subsidence. In 2020, the FCP cap subsidence survey was performed by D and L Land Surveying. A consistent shift of -0.05 was noted in the 2020 data across benchmarks and subsidence points. The change in the 2020 elevations is within the current margin of error for differential grade (<= 1 meter) GPS equipment. The FCP cap subsidence monitoring data is summarized in Table 4. The Fall 2020 survey is included in Appendix D: Maxey Flats Disposal Site Erosion Monitoring 2020 for further review.

FCP Cap Subsidence Comparison

Subsidence Point	Baseline 2018 Elevation (ft)	2019 Elevation (ft)	2020 Elevation (ft)	2019 Baseline Difference	2020 Baseline Difference
1	1065.54	1065.55	1065.46	0.01	-0.08
2	1069.70	1069.68	1069.66	-0.02	-0.04
3	1071.02	1071.96	1070.96	0.94	-0.06
4	1073.07	1073.05	1073.02	-0.02	-0.05
5	1064.15	1064.07	1064.01	-0.08	-0.14
6	1070.87	1070.84	1070.75	-0.03	-0.12
7	1072.18	1072.11	1072.05	-0.07	-0.13
8	1065.86	1065.89	1065.78	0.03	-0.08
9	1067.50	1067.54	1067.45	0.04	-0.05
10	1061.24	1061.28	1061.17	0.04	-0.07
11	1065.12	1065.11	1065.04	-0.01	-0.08
12	1065.40	1065.34	1065.38	-0.06	-0.02
13	1068.68	1068.69	1068.68	0.01	0.00
14	1067.90	1067.91	1067.83	0.01	-0.07
15	1063.64	1063.72	1063.59	0.08	-0.05
16	1062.65	1062.60	1062.56	-0.05	-0.09
17	1058.44	1058.47	1058.34	0.03	-0.10
18	1054.65	1054.59	1054.58	-0.06	-0.07
19	1053.42	1053.36	1053.27	-0.06	-0.15
20	1049.84	1049.71	1049.68	-0.13	-0.16
21	1046.30	1046.31	1046.28	0.01	-0.02
22	1043.05	1043.02	1042.95	-0.03	-0.10
23	1052.97	1052.99	1052.95	0.02	-0.02
24	1060.05	1059.95	1059.98	-0.10	-0.07
25	1056.12	1056.06	1055.99	-0.06	-0.13
26	1052.50	1052.45	1052.45	-0.05	-0.05
27	1050.11	1050.70	1049.99	0.59	-0.12
28	1070.83	1070.82	1070.77	-0.01	-0.06
29	1068.21	1068.11	1068.03	-0.10	-0.18
30	1073.22	1073.24	1073.15	0.02	-0.07
31	1068.50	1068.41	1068.41	-0.09	-0.09
32	1062.29	1062.27	1062.19	-0.02	-0.10
33	1073.15	1073.17	1073.10	0.02	-0.05
34	1073.44	1073.39	1073.33	-0.05	-0.11

Table 4

5.0 Contaminated Liquid and Solid Waste

All solid and liquid contaminated waste generated from laboratory, radiological, and maintenance activities is securely stored in the on-site radiological laboratory. Contaminated waste is transferred to 55 gallon drums to accumulate. Once a drum is full it is sealed and labeled. Drums will accumulate until space restraints require off-site disposal; no off-site disposal was required in 2020. Currently there are two sealed drums in the Radiological laboratory with space for two more drums. A copy of the 2020 Annual Low Level Radioactive Waste Report is located in Appendix C: *Maxey Flats Disposal Site Compliance Information 2020.*