FIRST FIVE-YEAR REVIEW REPORT FOR
EPA SAFE DRINKING WATER ACT ADMINISTRATIVE ORDER 2 (AO2)
DECISION TO MODIFY PROHIBITION ON LIVE FIRING AND USE OF PYROTECHNICS
JOINT BASE CAPE COD, BARNSTABLE COUNTY, MASSACHUSETTS

Prepared by

U.S. Environmental Protection Agency
Region 1
Boston, Massachusetts

Olson, Bryan Digitally signed by Olson, Bryan
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Bryan Olson, Director **Date**
Superfund and Emergency Management Division

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
DD	Decision Document
EMC	Environmental Management Commission
EPA	United States Environmental Protection Agency
EPR	Enhanced Performance Round
EPS	Environmental Performance Standard
FYR	Five-Year Review
IAGWSP	Impact Area Groundwater Study Program
IC	Institutional Controls
JBCC	Joint Base Cape Cod
LUC	Land Use Control
MANG	Massachusetts Army National Guard
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mg/kg	milligram per kilogram
MMR	Massachusetts Military Reservation
MASC	Maximum Allowable Soil Concentrations
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGB	National Guard Bureau
NPL	National Priorities List
O&M	Operation and Maintenance
OMMP	Operations, Maintenance and Monitoring Plan
OU	Operable Unit
PAN	Percussion Activated Neutralizer
Pb	Lead
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RDX	Royal Demolition eXplosive
ROD	Record of Decision
RPM	Remedial Project Manager
SAC	EMC Science Advisory Council
SAR	Small Arms Range
Sb	Antimony
SDWA	Safe Drinking Water Act
SIT	Stationary Infantry Target
SSA	Sole Source Aquifer
TBC	To be considered
UCL	Upper Concentration Limit
ug/L	micrograms per liter
UXO	Unexploded Ordnance
XRF	X-ray Fluorescence

I. INTRODUCTION

Joint Base Cape Cod (JBCC) (formerly known as the Massachusetts Military Reservation (MMR)) is a 22,000-acre facility located on Cape Cod, in the townships of Bourne, Falmouth, Mashpee and Sandwich in Barnstable County, Massachusetts. The land within the Base is owned by the Commonwealth of Massachusetts and leased to the federal government. Operations at JBCC have included those conducted by the Massachusetts Army National Guard (MANG). Approximately 14,000 acres of JBCC constitutes the Training Range and Impact Area. Overall, JBCC is a relatively wooded area on the Upper Cape that is largely undeveloped, but fringed with highways, homes, and other development. The predominant land uses surrounding JBCC are residential and/or commercial.

In 1982, groundwater beneath the Base was designated by the U.S. Environmental Protection Agency (EPA) as the Cape Cod Sole Source Aquifer under Section 1424(e) of the Safe Drinking Water Act (SDWA), 42 U.S.C. 300 *et. seq.* (47 FR 30282). In 1997, due to concerns about actual and potential military contaminant impacts to the Sole Source Aquifer, EPA issued two Administrative Orders (AOs) under the SDWA (SDWA I-97-1019 (AO1) to the Respondent National Guard Bureau (NGB) & SDWA I-97-1030 (AO2) to the Respondents NGB and MANG). In the two Administrative Orders, EPA determined that the contaminants present in or likely to enter the underground source of drinking water may present an imminent and substantial endangerment to the health of persons pursuant to the SDWA, and that the Respondents had caused or contributed to the endangerment. AO1 required the NGB to investigate the nature and extent of contamination at and emanating from the Training Range and Impact Area at the Base.

AO2 required, among other things, the suspension at or near the Training Range and Impact Area of the following: all firing of lead ammunition or other "live" ammunition at small arms ranges; all artillery firing using high explosives; all mortar firing using high explosives; all planned demolition of ordnance or explosives except for unexploded ordnance (UXO) clearance activities; all use of artillery and mortar propellants in non-live firing of munitions; all use of pyrotechnics; and all burning of propellant or propellant bags. Additionally, AO2 required the removal of lead munitions from all berms at all small arms ranges, and the clearance of unexploded ordnance.

Prior to AO2, training activities at the Base had included:

1) Artillery firing and mortar firing into the Impact Area from gun and mortar firing points located within and/or near the Training Range;
2) Burning of excess propellant bags at firing ranges and gun and mortar locations;
3) Detonation practice for explosives at two demolition ranges near the Training Range and Impact Area;
4) Detonation of UXO found in and near the Impact Area, including detonation of high explosive mortar rounds; and
5) Small arms firing at several ranges in the Training Range and Impact Area involving the use of small caliber munitions.

Under Paragraph 125 of AO2, the Respondents are permitted to petition EPA to modify the Order. On July 23, 2007, after receiving a modification request from MANG and reviewing the available data,

EPA, and the Commonwealth of Massachusetts' Environmental Management Commission (EMC)[1] approved a pilot program to use lead ammunition on the small arms range identified as Tango (T) Range. This approval allowed MANG to conduct a pilot project of firing of lead ammunition at T Range with a STAPP™ environmental bullet capture (EBC) system. In July 2007, EPA modified AO2 by adding Appendix B, which authorized limited firing of lead ammunition at T Range through December 2008 and required the MANG to submit to EPA a final report after the conclusion of that pilot project. In January 2009, EPA further modified AO2 by adding Appendix C, which extended the authorization to fire lead ammunition at T Range through December 2009 and to allow firing of lead ammunition at two additional small arms ranges, Juliet (J) and Kilo (K) with the STAPP™ EBC system. Subsequent annual authorizations to fire lead at these ranges continued through December 2016.

On August 31, 2016, MANG petitioned EPA to modify the Scope of Work to AO2 to: 1) end the prohibition of "All firing of lead ammunition or other 'live' ammunition at small arms ranges at or near the Training Range and Impact Area" and "All use of pyrotechnics at or near the Training Range and Impact Area," 2) terminate the pilot project at T, J and K Ranges, 3) approve the Pilot Period Final Report for T, J and K Ranges, and 4) recognize the EMC as the oversight body for small arms range training and pyrotechnic use.

On May 15, 2017, EPA, in response to the August 31, 2016 MANG petition, modified the AO2 Scope of Work to allow firing of lead ammunition or other "live" ammunition at J, K and T Ranges and at other small arms ranges at or near the Training Range and Impact Area, and use of pyrotechnics M116A1 Hand Grenade Simulator, the M69 Hand Grenade Simulator with M228 fuse, the Percussion Activated Neutralizer (PAN) and other pyrotechnics at or near the Training Range and Impact Area to the extent the MANG received continued approval and oversight from EMC in accordance with approved Environmental Performance Standards ("EPS")[2] (the "2017 Decision"). Since 2017, live firing with lead ammunition has only occurred at J, K, T and Echo (E) Ranges.

The EPS are a list of requirements, or standards for performance, that guide both military and other users in the protection of Camp Edwards' natural and cultural resources and the groundwater beneath the Training Range and Impact Area. The EPS are based on existing federal and state regulations. In some cases, the protections offered by the EPS are more stringent than those offered by other regulations. These standards apply to the Upper Cape Water Supply Reserve within the Camp Edwards Training Area. The EPS 19 "Range Performance Standards" specifically applies to the small arms ranges.

The 2017 Decision, which only relates to the small arms ranges identified above, was expressly limited in scope. The 2017 Decision states that the authorizations in the 2017 Decision do not extend to any other type of ammunition or training device, other than those set forth in the AO2 Scope of Work, as modified in 2007, 2009 and 2017.

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[1] The EMC was established in 2002 by the Commonwealth of Massachusetts to ensure the permanent protection of the drinking water supply and wildlife habitat of the Upper Cape Water Supply Reserve (the Reserve) (which encompasses the area of the Sole Source Aquifer within the Base). The EMC is comprised of the commissioners of the Department of Fish and Game, the Department of Environmental Protection (MassDEP), and the Department of Conservation and Recreation. Per the statute establishing the EMC (Chapter 47 of the Acts of 2002), the EMC oversees compliance with, and enforcement of, the Environmental Performance Standards to protect the resources in the Reserve.

[2] Environmental Performance Standards are a set of standards specifically created through the Massachusetts Environmental Policy Act, MGL c. 30, §§ 61 through 62L, and overseen by the EMC to protect the resources in the Reserve.

One component of EPA's 2017 Decision provided for subsequent review of the 2017 Decision as appropriate, but in no event less often than every five years. The purpose of this five-year review ("Review") is to revisit the appropriateness of the 2017 Decision in providing adequate protection of public health. As stated in the 2017 Decision, the scope of this Review includes, but is not limited to the following questions: are the ranges operating as designed (*i.e.*, monitoring or maintenance); have any of the cleanup standards changed since the 2017 Decision; and is there any new information that would warrant modifying or withdrawing the 2017 Decision. The methods, findings, and conclusions of the Review are documented in this report along with recommendations to address any issues found during the review.

The sites addressed in this Review are E, J, and K small arms ranges ("SARs") where, between 2017 and 2022, lead ammunition is or was fired, the T SAR where lead ammunition was used only until November 2017, and Lima (L) Range, where the M781 40mm Practice Grenade Training Round is fired. In addition, this review includes an evaluation of the use of the M116A1 Hand Grenade Simulator, M69 Hand Grenade Simulator with M228 fuse, and the PAN that have been authorized for use by EPA.

Separate and distinct from this Review of the 2017 Decision, EPA has issued a Sole Source Aquifer project review draft determination (SSA draft determination) for the MANG's proposal to construct a Multi-purpose Machine Gun (MPMG) Range at JBCC. The proposed MPMG Range would be constructed at the KD (East and West) Range at JBCC. KD East and West were not subject to this Review of the 2017 Decision. Section 4.3.2 of the SSA draft determination provides details on the distinctions between this Review of the 2017 Decision and the SSA draft determination.

The Review was led by Jane Dolan, Remedial Project Manager, of the Federal Facilities & Housatonic River Section in the U.S. EPA Region 1's Superfund and Emergency Management Division. Participants in the Review included Leonard Pinaud, EMC Executive Director/Environmental Officer. EPA Region 1 initiated this Review in early 2022.

Site Background

The SARs addressed in this Review are relatively flat areas of cleared vegetation which allow for easy acquisition of downrange targets. Potential sources of SAR contaminants include propellant-related compounds deposited on the soil surface in the vicinity of firing lines and projectile-related compounds deposited on the soil surface at, and in the vicinity of, range backstops.

The SARs were historically used for a variety of small arms training, including pistols, rifles, shotguns, sub-machine guns and machine guns. The SARs are located around the Impact Area with firing generally towards the Impact Area. Typical components of most SARs include one or more firing lines, a range floor, target arrays, and an earthen impact berm. The impact berms usually include the berm face frequently containing bullet pockets and a trough at the base of the berm. The types of small arms ammunition historically used at the ranges included 5.56-millimeter (mm) ball, 9 mm, .30 caliber, .45 caliber, .50 caliber, 7.62 mm ball and tracer rounds.

The types of SARs at JBCC can be divided into three categories: operational and active, operational but inactive and non-operational ranges. Operational and active ranges are ranges where firing is currently permitted and an Operations, Maintenance and Monitoring Plan ("OMMP") is in place, as required by AO2 and the EPS, and overseen by the EMC under the terms of the 2017 Decision. The SARs included

in this Review are currently classified as operational and active (E and T Ranges) and operational but inactive (J and K Ranges). L Range is an active practice grenade launcher range.

STAPP™ EBC systems were constructed at T Range in 2006 and at J and K Ranges in 2008. The systems consisted of a composite lumber frame filled with granular rubber placed on top of a bottom-liner inside the composite frame to a depth of 18 inches. The granular rubber was then capped with a patented self-sealing membrane. The lead alloy bullets passed through the top cover and were captured in the granulated rubber layer. This system was designed to capture and contain fired bullets. The system also minimized potential airborne lead and runoff. The system included an internal water collection reservoir to capture any water that infiltrated the STAPP™ EBC system. Lead rifle ammunition is no longer authorized for use at Camp Edwards. For this reason, J and K Ranges with their associated STAPP™ EBC systems were no longer required, and the systems were dismantled in fall 2020. The T Range STAPP™ EBC system was dismantled in November 2017 and the range was modernized to support firing of copper ammunition in 2021.

E Range became operational and active in September 2019 under the oversight of the EMC. E Range, a dual-purpose range, is a Combat Pistol/Military Police Qualification Course. 9mm (copper jacketed lead) pistol ammunition is fired at pop-up targets and stationary targets. The ammunition passes through the targets and strikes an earthen backstop berm. The backstop berm is utilized as the primary projectile capture area. Single individual target frontal berms are the capture location for extreme low shot projectiles. The backstop berm was constructed of native material, landscape fabric as a demarcation line covered by 18-24 inches of sand, and finally by 8 inches of topsoil that slows projectiles and allows for vegetation and slope stabilization.

L Range was originally developed as an infiltration course in the 1940s and used as such into the 1950s. In the mid to late 1970s, the area was used as a M79 and M203 grenade launcher familiarization range using high explosive grenades. In the late 1980s to 1994, the L Range was used as an M203 grenade launcher range using high explosive grenades. L Range was re-activated as a practice grenade range and became operational and active in 2012 under the oversight of the EMC and EPA. L Range is used to train and test individual soldiers on the skills necessary to engage and defeat stationary target emplacements with the M203 40mm grenade launcher. The grenade launcher fires a M781 40mm Practice Grenade Training Round that is a projectile composed of a hollow plastic “windshield” filled with Day-Glo-Orange marking powder. The range has four self-contained stations and is 30-meters wide by 400-meters long. The stations consist of firing positions and targets of various types and distances, ranging from 100 to 350 meters.

II. SUMMARY OF THE 2017 DECISION

As described above, in the 2017 Decision, EPA modified the AO2 Scope of Work to allow, at or near the Training Range and Impact Area, firing of lead ammunition or other “live” ammunition at specific small arms ranges and use of specific pyrotechnics. EPA conditioned the 2017 Decision on, among other things, MANG receiving continued approval and oversight from EMC in accordance with the EPS, and on MANG requesting and receiving the funds necessary to ensure compliance with the approved OMMPs. EPA’s 2017 Decision was made after a public comment period, and was based on such factors as:

1) Soil cleanup having been completed at all SARs per the EPA Decision Documents (DD) for the SARs;

2) That no Action Levels for soil specified in the OMMP had been exceeded at J, K or T Ranges during the 9-year pilot period leading up to the 2017 decision;
3) That the resumption of lead ammunition training at J, K and T Ranges under the controls established in the pilot had not led to detections of lead in groundwater exceeding the OMMP action level during the same 9-year pilot period; and
4) That a long-term groundwater monitoring program was implemented to verify that the ranges are not a source of groundwater contamination.

In addition, EPA determined that potential impacts from pyrotechnic use could be minimized with proper controls.

The only small arms ranges where lead ammunition firing occurred since the 2017 Decision are the J, K, T and E Ranges. During that period, L Range, which was also assessed in the Review, was used as a grenade launcher range using the M781, 40mm practice grenade. The grenade contains a hollow plastic "windshield" which is filled with Day-Glo-Orange marking powder. L Range is used to support small arms marksmanship training.

OMMPs are currently in place for E, T, and L Ranges and contain best management practices. Monitoring at J and K Ranges were transitioned to the Impact Area Groundwater Study Program (IAGWSP)[3] in 2023 since these ranges are currently classified as operational but inactive.

Basis for Taking Action

Potential sources of SAR contaminants include primers and propellant-related compounds deposited on the soil surface in the vicinity of firing lines and projectile-related compounds deposited on the soil surface at, and in the vicinity of, range backstops.

- Primers used in small arms range projectiles include lead styphnate and antimony sulfide.
- Propellant-related compounds consist, in part, of a suite of semi-volatile organic compounds produced by the combustion of small caliber ammunition propellants.
- Projectile-related residues consist mainly of the metallic constituents of various alloys used in the manufacturing of small caliber rounds.

Lead compounds (including lead-antimony alloys) are the primary constituents of most lead bullet small arms ammunition. Lead may comprise more than 50 percent of the weight of certain small arms ammunition. Certain additional metals, including antimony, may be present to increase projectile hardness. Copper is often used as a jacket around the projectile's lead core. Tungsten ammunition was also used at certain small arms ranges during the time from 2000-2006.

The Training Range and Impact Area lies directly over the Sagamore Lens, the most productive part of the Cape Cod Sole Source Aquifer. The Training Range and Impact Area is a major groundwater recharge area, located above what may be the apex of the Sagamore Lens. Groundwater flows radially in all directions from the Training Range and Impact Area.

[3] The Army National Guard's Impact Area Groundwater Study Program (IAGWSP) at Camp Edwards located on JBCC began in 1997 when the EPA issued Administrative Orders AO1 and AO2. Working under the oversight of EPA and the MassDEP, the IAGWSP is investigating and remediating groundwater contamination and its sources at Camp Edwards, as well as areas off-base.

Response Actions at E, J, K, T and L Ranges

In response to AO2, MANG implemented a berm maintenance program in 1998 to remove the maximum amount of lead munitions from SAR berm soils, and to minimize the possibility of lead fines (particles too small for physical removal) migrating toward groundwater. The lead fines were addressed by the chemical fixation of leachable lead to concentrations less than the project performance criteria of 5.0 mg/L by the *ex-situ* or *in-situ* application of MAECTITE® (a proprietary liquid reagent containing reactive phosphates and sulfates). Approximately 17,788 cubic yards of berm soils containing bullet fragments, including those at E, J, and K ranges, were removed from the subject ranges and taken to a central location for screening and chemical fixation of leachable lead (*i.e.*, *ex-situ* processing). An estimated 1,200 cubic yard mixture of gravel, bullets, bullet fragments, and bullet jacketing was removed from berm soils and managed for recycling. *In-situ* processing was performed on 5,380 cubic yards of berm soils at some ranges, including J and K, based upon the pre-excavation and/or post-excavation sample data and range specific processing plans. Berms were re-constructed using *ex-situ* processed range soils.

In 2006, MANG performed a berm maintenance project to address concerns and findings related to the use of tungsten-containing bullets which had been fired at certain small arms ranges at JBCC from 2000-2006. Following an initial range evaluation and field screening program, soil excavation and removal actions were implemented at the ranges, including J, K and T Ranges. A total of approximately 4,615 cubic yards of soil was excavated from the impacted ranges and disposed of off-site in compliance with local, state, and federal environmental regulations. (Tungsten ammunition has been eliminated from military use and has not been used at JBCC since February 2006 when concerns were raised regarding the migration of tungsten into groundwater. It is not on the EMC Approved Munitions List at JBCC).

In 2007, MANG performed a soil excavation action at the firing line at T Range to remove elevated nitroglycerin levels. Nitroglycerin contaminated soil excavated from T Range was disposed of off-site in compliance with local, state, and federal environmental regulations. In September 2008, soil removal actions were conducted at the J and K Ranges to remove elevated nitroglycerin levels. J, K, and T Ranges were rebuilt to prepare for use under the EPA and the EMC pilot test of the STAPP™ EBC systems. The T Range backstop berm was rebuilt with soil from T Range berms taken out of service and with additional soil from within the Training Ranges area. J and K Range backstop berms were reconfigured and were rebuilt with existing on-site range berm soil.

Between 2009 and 2011, surface soil removal actions were performed by MANG at several ranges, including the backsides of berms at J and K Ranges, to remove lead projectiles and elevated levels of lead in soil detected during previous range investigations. Excavation was focused on bullet fall-out areas and where soils had lead concentrations greater than 300 mg/kg (the MassDEP soil cleanup standard at the time). Over 4,000 cubic yards of soil was excavated, screened, and disposed of off-site.

The remedy selected by EPA in a 2015 SAR DD was long-term monitoring of groundwater with land use controls to protect monitoring wells and additional action to address residual soil contamination that pose a risk of leaching to groundwater at certain ranges. The overall results of groundwater sampling evaluations conducted to support the remedy selection indicated that, at that time, lead, copper, and antimony in groundwater at the SARs subject to the 2015 SAR DD were not detected above action levels, and that the risks of future groundwater impacts from migration of soil contaminants to groundwater had been reduced because of soil removal actions and range maintenance activities. Therefore, as EPA stated in the 2015 SAR DD, EPA determined that long-term groundwater monitoring

would continue as a requirement under the 2015 SAR DD at certain areas including J, K and T Ranges, and no groundwater remediation was needed. However, No Further Action was required at E Range due to no exceedances of soil action levels documented at the site. The 2015 SAR DD explicitly explained that EPA's determination was related to preventing future unacceptable threats to the groundwater aquifer from the Site.

To assess the impact of the operation of the L (grenade) Range on groundwater, in 2008, a robotics technology demonstration was conducted at the L Range to evaluate the effectiveness of using remotely operated equipment to safely remove unexploded ordnance ("UXO") to facilitate soil sampling. The robotics technology demonstration was performed over the entire L Range floor where the former targets were located, and therefore, where there was the greatest probability of finding UXO. A total of 53 potentially high explosive grenades and more than 12,000 pounds of munitions debris were recovered from the range floor during this robotic effort. Approximately 2,000 cubic yards of soil contaminated with explosives (1,3,5-trinitro-1,3,5-triazine, or Royal Demolition eXplosive ("RDX")) was excavated, treated using alkaline hydrolysis, and placed back on the range. Results from post-excavation sampling indicated no detections of RDX in the soil. However, RDX was identified as a contaminant in groundwater.

A September 2010 L Range DD concluded that no further action was necessary regarding the source associated with the L Range. Soil contamination and most of the UXO at the L Range were adequately removed during the response action of soil excavation and treatment in 2009/2010. Post-excavation soil samples collected at the range revealed no detections of explosives compounds. The selected site remedy was Monitored Natural Attenuation and land use controls (LUCs) for groundwater to address the RDX contamination, and no further action for source areas.

Status of Implementation of the 2017 Decision

In its 2017 Decision, EPA modified AO2's Scope of Work to allow firing of lead ammunition or other "live" ammunition at J, K and T Ranges and at other small arms ranges at and near the Training Range and Impact Area, and use of pyrotechnics M116A1 Hand Grenade Simulator, M69 Hand Grenade Simulator with M228 fuse, and the PAN, and other pyrotechnics at or near the Training Range and Impact Area to the extent MANG receives continued approval and oversight from EMC in accordance with the Environmental Performance Standards.

Specific requirements associated with the 2017 Decision included the following:

- The authorization was conditioned upon continued compliance by MANG with all conditions established by the EMC;
- The authorization was conditioned upon MANG requesting and receiving the funds necessary to ensure compliance with the approved OMMPs;
- The authorization did not extend to any other ammunition or training device;
- The proposed use of this ammunition or training device would be authorized only to the extent it does not interfere with the completion of investigation and cleanup activities; and
- The decision would be reviewed as appropriate, but in no event less often than every five years.

The purpose of the review would be to revisit the appropriateness of the 2017 Decision in providing adequate protection of public health. The scope of the review would include but would not be limited to the following questions: are the ranges operating as designed (*i.e.*, monitoring or maintenance); have any of the cleanup standards changed since this decision; and is there any new information that would warrant modifying or withdrawing this decision. If appropriate, additional actions (including, if necessary, reopening the 2017 Decision) may be required because of these reviews.

OMMPs were in place for T, E and L Ranges. Monitoring at J and K Ranges (where OMMPs had been in place while they were operational and active) was transitioned to the IAGWSP in 2023 since these ranges are currently defined as operational but inactive. Long-term monitoring of environmental media was performed during the review period by the MANG under the oversight of the EMC in accordance with the EPSs.

Modifications made to OMMP requirements since 2017 include modification of the Range Inspection Forms, addition of analytical parameters to the monitoring program, and the cessation of stand-alone annual monitoring reports. EMC continues to perform independent range inspections and review completed range inspection forms and monitoring records. The STAPP^{TM} EBC systems at J, K and T Ranges were removed during this first review period and firing is not currently conducted at J and K Ranges. The T Range was modernized to support firing of the EPR copper projectiles in 2021. For purposes of this Review, the operation and monitoring of the T Range considered was only through 2020, after which it was modernized to support an EPR range.

III. PROGRESS SINCE THE LAST REVIEW

This is the first Five-year Review of the EPA AO2 decision to modify the prohibition on live firing of lead ammunition and use of pyrotechnics at specific small arms ranges at the JBCC Training Range and Impact Area.

IV. FIVE-YEAR REVIEW PROCESS

Data Review

J, K and T Ranges

The most recent OMMP for the J, K and T Ranges was approved in 2015. (T Range was redeveloped as an EPR (copper) zeroing range in 2021. All T Range sampling data for 2021 is for the reconfigured copper range and represents initial baseline conditions for the EPR range, so the data considered for this five-year review for T Range is from 2017-2020). Surface soil and groundwater samples were collected annually from J, K and T Ranges over this five-year review period and analyzed for lead, copper, and antimony in accordance with the OMMP. Soil sample results for these ranges show no exceedances of the Action Levels specified in the OMMP for these metals. Groundwater sample results for lead, copper and antimony have consistently been detected below the Action Levels specified in the OMMP, except for the October 2021 sampling event which resulted in elevated method detection limits and reporting limits for lead and antimony, thus confounding the interpretation of results for these groundwater samples in that sampling event. It is not possible to evaluate if there are positive detects at values between the action level and the reporting limit because of the accuracy limitations of the test.

Porewater samples have been collected annually from lysimeters on J, K and T Ranges over this five-year review period and analyzed for lead, copper, and antimony. Antimony has almost always consistently been detected in porewater above the OMMP Action Levels.

Contaminant	Surface Soil Action Level (mg/kg)	Porewater Action Level (ug/L)	Groundwater Action Level (ug/L)
Lead	3,000	15	7.5
Copper	10,000	1,300	650
Antimony	300	6	3

mg/kg – milligram per kilogram or parts per million (ppm)
ug/L- micrograms per liter or parts per billion (ppb)
Surface soil Action Levels are set using selected soil Upper Concentration Limits (UCLs) from the Massachusetts Contingency Plan (MCP).
Porewater Action Levels are based on the Safe Drinking Water Act Groundwater Maximum Contaminant Level (MCL).
Groundwater Action Levels are set equal to one half of the MCL.

Figures locating the sampling locations on the respective ranges and data obtained over this five-year review period can be found in the annual MANG State of the Reservation reports (MANG, 2018; MANG, 2019; MANG, 2020; MANG, 2021).

The assessment of results of porewater samples is unclear due to the variable method detection limits and reporting limits by the testing laboratories. Low detection limits (0.20 ug/L) and reporting limits (2.0 ug/L) with SW846 Method 6020A have been achievable for antimony as reported for samples analyzed in 2019 but these limits have not been consistently met by the MANG year to year. Groundwater and porewater samples collected in April 2020 were filtered and analyzed by SW846 Method 6020A to report the dissolved concentrations of metals. Dilution of the samples for metals analysis resulted in elevated detection limits (2.0 ug/L) and reporting limits (5.0 ug/L) for antimony. These same detection limits and reporting limits were documented for 2018 samples. Groundwater and porewater samples collected in 2021 were analyzed by SW846 Method 6010C which also resulted in higher detection limits and reporting limits for antimony (5.2 ug/L and 12 ug/L, respectively) and for lead (2.7 ug/L and 9 ug/L). Detection limits of 0.5 ug/L and reporting limits of 1.0 ug/L have been achievable for lead. Except for the 2021 data for lead where elevated reporting limits confound the results, concentrations of lead and copper in porewater samples collected from the lysimeters on these ranges have consistently been below the Action Levels and have remained at relatively the same concentrations since testing began. Concentrations of antimony detected from lysimeters on these ranges have generally exceeded the reporting limit of 12, so the test has been accurate for the levels of antimony detected.

At the request of the EMC, testing for chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen in surface soil, groundwater, and porewater samples has been conducted since October 2019 to help determine whether these substances can cause metals to be mobile in soil. Sampling results from 2019 to 2022 for these substances show no significant changes in concentration. The EMC Science Advisory Council[4] (SAC) Ad Hoc Committee voiced no concern for the sampling results regarding metals mobility; however, the

[4] The SAC advises the Environmental Management Commission on technical issues related to the oversight of the northern 15,000 acres of Joint Base Cape Cod.

MANG is continuing to monitor these substances at the request of the EMC to track concentration trends for a comparison over time to SAR metals concentrations.

E Range

The E Range design and OMMP were approved of by the EMC in 2017. E Range became operational and active in September 2019. Groundwater and surface soil samples were collected from the range in October 2019, April 2020, and October 2021 in accordance with the approved OMMP and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen. There were no Action Level exceedances reported for samples from these monitoring events. Like the results reported for the other ranges, the method detection limits and method reporting limits for the October 2021 sampling event analyzed using Method 6010C were elevated, thus confounding the interpretation of results for groundwater samples from the 2021 sampling event. One cannot evaluate if there are positive detects at values between the action level and the reporting limit.

L Range

In October 2018 porewater samples were collected from L Range and analyzed for lead, copper, and antimony in accordance with the 2013 approved OMMP. No exceedances of Action Levels were reported. In October 2019, April 2020, and October 2021, porewater and surface soil samples were collected from L Range and analyzed for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen, where appropriate for the media being sampled. There were no Action Level exceedances reported during the sampling events. Method detection limits and reporting limits for the October 2021 sampling event were elevated. One cannot evaluate if there are positive detects at values between the action level and the reporting limit.

M781, 40mm Practice Grenades

EPA and EMC authorized use of the M781, 40mm practice grenade for use at the L Range in November 2012. Approximately 5,000 were used from 2017-2022.

Other items, including pyrotechnic devices, have been used within the Training Range and Impact Area during the review period and include the following:

- M116A1 Hand Grenade Simulator - EPA and EMC authorized use of the M116A1 Hand Grenade Simulator in March 2010. Approximately 825 M116A1 Hand Grenade Simulators were used from 2017-2022. These simulators are approved for use by EMC on all Camp Edwards training areas.
- M69 Hand Grenade Simulator with M288 fuse - EPA and EMC authorized use of the M69 Hand Grenade with M228 fuse in May 2013. Camp Edwards developed a Standard Operating Procedure and Course Management Plan for the M69 Hand Grenade Simulator, approved by the EMC in 2014. The plan allows for maximum effective use of the M69 Hand Grenade Simulator with the M288 Fuse in the Camp Edwards training areas and on the Hand Grenade Qualification Course while abiding by training and environmental guidelines. Use of the M69 Hand Grenade

Simulator began in September 2014. Approximately 1,000 M69 Hand Grenade Simulators with the M288 fuse were used from 2017-2021.

- Percussion Activated Neutralizer (PAN) – EPA authorized use of the Percussion Activated Neutralizer (PAN) in June 2016 and EMC authorized its use in August 2016. No PAN devices have been used at Camp Edwards over this five-year review period.
- Other pyrotechnics have been used during the review period in quantities and locations as approved of by EMC on a case-by-case basis, and in accordance with the relevant Standard Operating Procedures, OMMPs, and EPS.

Site Inspection

EPA conducted an inspection of the ranges on November 4, 2022, to document current conditions. In attendance were Jane Dolan/EPA, Leonard Pinaud/EMC, Mike Ciaranca/JBCC Environmental and Readiness Center, and Major James Gerardi/Officer-In-Charge Range Control/Camp Edwards. Observations included:

1) The soil backstop berms at J and K Ranges were moderately vegetated because of re-seeding which took place after the STAPP™ EBC systems at J and K Ranges were removed in October/November 2020. No firing has taken place at the ranges since that time. The lysimeters were in place except for LYJRNG003 which was destroyed during the STAPP™ EBC system removal project;
2) Soldiers were zeroing their weapons at T Range at the time of the inspection and were firing copper projectiles into a soil backstop berm. The T Range STAPP™ EBC system was removed in November 2017 and the target berm and firing lines were moved 25 meters north of the former positions as part of range modernization efforts which took place between the Fall of 2020 and May 2021. No firing of lead bullets has occurred at the T Range since November 2017;
3) Soldiers were firing their weapons at E Range at the time of the inspection. Bullet trajectories were apparent in the Dura-Bloc™ , which was placed along the top of the Stationary Infantry Target (SIT) vaults to protect the target lifting mechanism. Dura-Bloc™ is a rubber composite block designed to encapsulate ammunition up to 7.62 caliber. Bullet holes representing low shots were evident in the sand-filled structures placed at the foot of the SITs. These structures were generally in good shape, but some were noticeably sagging. Fragments of copper-jacketed lead bullets were present in the backstop berm in well-defined bullet pockets. The remainder of the backstop berm and range floor were vegetated, and no standing water was present; and
4) The lysimeters at L Range were missing their PVC caps at the time of the inspection. The hay bales and netting placed at the northwestern edge of the range had recently been replaced with concrete jersey barriers to prevent practice grenades from leaving the range. The range floor was vegetated and predominantly free of rocks and debris, including intact and partially intact rounds, and windshields.

Operations and Maintenance Records Review

MANG conducts periodic inspections of the ranges in accordance with the OMMPs to ensure that pollution prevention equipment remains in place and is in good working order and to ensure that environmental conditions on the ranges are not degrading.

EPA conducted a review of the range operations and maintenance records on November 10, 2022, and based upon this review, it appears that pre- and post-firing inspections and detailed inspections are being conducted by MANG in accordance with the OMMPs and that these forms are generally satisfactorily completed. Recommendations for improving operations, maintenance, monitoring, and reporting are provided in the Other Findings section below. In addition, EMC continues to conduct periodic inspections of the ranges as evidenced by the inspection log provided to EPA as part of this five-year review.

V. 2017 DECISION ASSESSMENT

The 2017 Decision required that MANG meet specific conditions and that EPA perform a review of the 2017 Decision with evaluation of 4 specific questions.

Specific Conditions:

--Has there been continued compliance with all conditions established by the EMC?

The State of the Reservation reports contain a description of the EPS Violations History. These violations included two violations of the General Performance Standard and one violation of EPS 19. MANG reported on March 31, 2022, that unauthorized use of yellow and white smoke grenades occurred outside of the approved non-standard training plan. White smoke grenades were not approved for use and yellow smoke grenades were used in an unapproved location. Corrective actions were implemented and are described next to the description of the violation in the State of the Reservation reports. MANG reported on September 17, 2019, that three L600 M119 whistling booby trap simulators were used. These simulators were not on the approved munitions list and were not authorized for use by the EMC. Corrective actions were implemented and are described next to the description of the violation. MANG reported on February 18, 2021, that firing of 17,000 5.56 copper-only rounds occurred on E Range, a violation of EPS 19. Corrective actions were implemented and are described next to the description of the violation. EPA has not initiated compliance actions against the MANG regarding any of these violations during this review period since they were adequately addressed by the EMC.

--Has MANG requested and received the funds necessary to ensure compliance with the approved OMMPs?

During this review period EPA has not identified any significant deficiencies in the funding received by MANG necessary to ensure compliance with the approved OMMPs.

--Has MANG complied with the condition that the 2017 Decision authorization not be extended to any other ammunition or training device?

Consistent with the 2017 Decision, the MANG did not extend training since 2017 to any range, or any other type of ammunition or training device, other than those set forth in the AO2 Scope of Work, as modified in 2007, 2009 and 2017 (other than those noted in the violations addressed above).

--Has the 2017 Decision's authorization of ammunition or training devices interfered with the completion of investigation or cleanup activities?

Operations at the small arms ranges subject to this review did not interfere with the investigations and cleanup ongoing at JBCC under the AOs.

Monitoring at J and K Ranges (where OMMPs had been in place while they were operational and active) was transitioned to the IAGWSP in 2023 since these ranges are currently defined as operational but inactive. Long-term monitoring of environmental media was performed during the review period by MANG under the oversight of the EMC in accordance with the EPS.

Data collected from soil, porewater and groundwater samples collected from E, J, K, T and L Ranges were compared to Action Levels specified in the OMMPs. The OMMPs were prepared to satisfy the requirements of EPA's AO2 and the EMC EPSs to employ "maximum feasible use" of pollution prevention technologies by:

- Implementing a system of range upgrades and Best Management Practices (BMPs) that will - either sever potential migration and exposure pathways or monitor environmental conditions to confirm that pathways remain incomplete and
- Implementing a "contain, maintain, and monitor" approach to SAR BMPs that will include redundant methods to prevent pollution (*e.g.*, bullet containment, pH monitoring, and when needed, pH management, erosion control) and methods to assess the effectiveness (*e.g.*, inspections, sampling) of each system in each environmental media (*e.g.*, soil, groundwater).

Over the Five-Year Review (FYR) review period the selected approach included:

- Managing metals at their source through containment;
- Monitoring potential migration pathways, such as surface soil, porewater, and groundwater to evaluate whether contaminants are being transported in environmental media; and
- Implementing several other monitoring and maintenance BMPs to sustain the conditions that limit metals mobility (*e.g.*, monitoring the condition of the bullet containment system), maintaining healthy vegetation on range areas to prevent soil erosion, maintaining windbreaks to limit windborne metals transport, and monitoring.

QUESTION A: Are the ranges operating as designed (*i.e.*, monitoring or maintenance)?

Yes. The remedy selected in the 2015 SAR DD was long-term monitoring under the OMMPs for the J, K, and T Ranges and no further action for E Range. The 2010 DD for the L Range specifies additional requirements for monitoring the explosives plumes. An OMMP was subsequently developed for E Range when it became an active range in 2019. The range monitoring and maintenance requirements for E, T, and L Ranges are described in the OMMPs. Note that after the FYR period monitoring of J and K ranges were transitioned to the IAGWSP in 2023 because of their revised status as operational and inactive. The goal of the monitoring during the FYR review period was to determine when range maintenance activities were needed to protect the environment and promote range sustainability.

Specific OMMP requirements related to the range inspection BMP were:

1. Conducting range inspections (pre-firing inspection) each time a range is used for live firing;
2. Conducting range inspections (post-firing inspection) after each time the range is used to document the post-firing conditions;
3. Completing a Training Facility Utilization Report at the end of each training day; and

4. Conducting detailed range inspections within 2 business days of significant storm events.

Specific OMMP requirements related to the environmental monitoring BMP include:

1. Collecting soil, porewater and groundwater samples annually from the range floor and backstop berms, lysimeters and monitoring wells with analysis for specified parameters;
2. Forwarding unvalidated (*i.e.*, draft) data to the regulatory agencies within 48 hours of receipt by the MANG (not counting holidays and weekends). Comparing results to the Action Levels presented in the OMMPs and noting any concentrations exceeding the action levels in the results submittal. Proposing a plan for resampling, if needed to confirm an exceedance, pending data validation. Forwarding validated data to the regulatory agencies as soon as feasible within 7 days of receipt (not counting holidays and weekends);
3. Re-sampling of soils, if needed, within 1 month of receiving the original validated laboratory data, unless additional time is needed to secure funding and award contracts, at which time the regulatory agencies will be notified of the delay within 2 business days. Resampling with an X-ray Fluorescence (XRF) field instrument with applicable detection limits may be proposed as an alternative to supplement the soil sampling and laboratory analysis; and
4. Re-sampling of porewater and groundwater, if needed, within 14 days of receiving the original validated laboratory data, unless additional time is needed to secure funding and award contracts, at which time the regulatory agencies will be notified of the delay within 2 business days.

MANG sampled SAR surface soil, porewater and groundwater annually for antimony, copper, lead, chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, and alkalinity. The sample results were used to track the accumulation of metals from the projectiles and those constituents that may make these metals more mobile in soil to determine when range maintenance is needed to reduce metals concentrations. Based on the results of this soil, porewater and groundwater monitoring the MANG, in consultation with EPA and/or EMC, conducted certain investigations to evaluate causes of identified metals exceeding established Action Levels and to address any observed trends of increasing anion, chloride, sulfate, calcium, magnesium, phosphate, potassium, and sodium, concentration that were determined to potentially mobilize SAR metals. Under the Order and the OMMP EPA and/or EMC are also able to require maintenance to be done or that the range be shut down based on exceedances of soil or groundwater standards. Maintenance actions taken are discussed below where applicable. No range shutdowns were required.

During the five-year review period for this document, samples were collected, analyzed, validated and results reported in accordance with the OMMPs. Action Levels for surface soil throughout the review period and currently are lead (3,000 mg/kg), antimony (300 mg/kg) and copper (10,000 mg/kg). Soil monitoring results were compared to the Action Levels. An exceedance of an Action Level could trigger the removal of surface and subsurface soil in the applicable area to eliminate or mitigate the potential for migration of the metal to porewater or groundwater. No soil removals were necessary in accordance with the OMMP during the review period 2017 – 2022 because no Action Levels were exceeded for soil samples. Soils and subsurface soils surrounding the lysimeters where porewater samples exceeded the Action Level for antimony were sampled. All soil results were non-detect or background for antimony. No soil removal actions were necessary per the OMMP and after consultation with the EMC. As a result of the porewater detections and non-detects in soil, the EMC requested a column leaching study for lead and antimony by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) from MANG to assist in answering questions related to the fate and transport of lead and antimony in JBCC SAR soils. According to the MANG, the results from the 2021 CRREL column leaching study showed

that past amendment additions to the JBCC soil berms for sequestering metals, like lime (pH adjustment) and phosphate (lead immobilization), likely caused the observed increase in antimony concentrations. No amendment additions occurred during this FYR period.

Surface soil action levels for lead, copper, and antimony are set using selected soil Upper Concentration Limits (UCLs) from the Massachusetts Contingency Plan (MCP). Given that there may be significant uncertainty in modeling, surface soil Action Levels for lead, copper and antimony were set at MCP UCLs. Porewater and groundwater will continue to be sampled to confirm that SAR metals are not migrating such as to cause action level exceedances in groundwater.

Porewater Action Level numbers for lead, copper, and antimony are set at the groundwater MCL. Porewater is monitored as an early warning of the potential for groundwater impacts. Action Levels for porewater include lead (15 ug/L), antimony (6 ug/L) and copper (1,300 ug/L). Porewater monitoring results were compared to the Action Levels. An exceedance of an Action Level may trigger the removal of surface soil in the applicable lysimeter area in accordance with the OMMP to eliminate or mitigate the potential for migration of the metal to groundwater.

In the review requested by EMC, several potential causes of the elevated antimony detections in porewater were explored: 1. STAPP™ EBC system water reservoir leak resulting in metals possibly being released to the range floor (note that no such leaks have been detected); 2. legacy range soils that were used for berm and range construction at J, K and T Ranges; 3. phosphates added to range soils (1998-1999) as part of the berm maintenance project to immobilize lead in legacy soils, but which may have released antimony; 4. pH levels of soil and porewater which may have released legacy antimony. To address the issue of antimony and other metals movements through soils, the MANG, along with members of the EMC SAC Ad Hoc Committee added the sampling of substances that may cause metals to be mobile in soil. The first round of this amended sampling was completed in October 2019 and inclusion of these substances in subsequent sampling rounds continued. Sampling results from 2019 to 2022 for these substances show no significant changes in concentration. The EMC SAC voiced no concern for the sampling results regarding metals mobility; however, the MANG is continuing to monitor these substances at the request of the EMC to track concentration trends for a comparison over time to SAR metals concentrations.

As discussed above, at the request of EMC and the SAC, MANG funded a column leaching lab study conducted at the CRREL which concluded that antimony mobility was influenced by the past phosphate and calcium hydroxide (lime) addition used to help immobilize legacy lead in soils. Soil amendment by lime addition was halted at the direction of the EMC SAC in 2013. The SAC has advised the MANG and the EMC not to add soil amendments to the SARs and to continue to monitor for metals and for chloride, sulfate, calcium, magnesium, phosphate, potassium, sodium, pH, alkalinity, specific conductance, dissolved organic carbon and oxygen in surface soil, groundwater, and porewater samples to help determine whether these substances can cause metals to be mobile in soil.

Under the OMMPs, groundwater concentrations at or above the Action Levels may trigger the removal of surface and subsurface soil in the applicable area, a suspension of range use and reassessment of the pollution prevention program. Groundwater Action Levels for lead (7.5 ug/L), copper (650 ug/L) and antimony (3 ug/L) are set equal to one half of the MCL. Except for data from 2021 that was reported with elevated detection and reporting limits (one cannot evaluate if there were positive detects of antimony at values between the Action Level (6 ppb) and the Reporting Limit (12 ppb) because the laboratory instrument was not calibrated for measurements at the Action Level of 6 ppb), groundwater

concentrations of lead, antimony and copper were not detected at or above the Action Levels, so based on the sampling results, no suspension of range use or soil removal and replacement has been necessary during the five-year period addressed by this Review.

QUESTION B: Have any of the Action Levels changed since this decision?

No. Action Levels have not been revised during the review period. It is expected that range monitoring and maintenance will continue under the current or revised OMMPs. MANG is responsible for ensuring that LUCs are established, monitored, maintained, reported on, and enforced as part of the remedy to ensure the integrity of groundwater monitoring wells and other environmental sampling equipment at the SARs for the duration of the remedy selected in that DD. These actions are documented in annual LUC reports and in the State of the Reservation reports.

QUESTION C: Is there any new information that would warrant modifying or withdrawing this decision?

No. There has been no new information that has been identified that would warrant modifying or withdrawing EPA's 2017 Decision to modify the prohibition on live firing and use of pyrotechnics at the JBCC Training Range and Impact Area.

CONCLUSION

Based on the review and analysis described above, EPA has determined that EPA's 2017 Decision to modify the AO2 prohibition on live firing and use of pyrotechnics at JBCC is providing adequate protection of public health for the ranges evaluated in this review. This determination does not extend to any other ammunition, range, time period, or training device.

VI. ISSUES/RECOMMENDATIONS

No issues/recommendations were identified for E, J, K, T and L Ranges during this review period.

OTHER FINDINGS

In addition, the following are recommendations that were identified during this five-year review and may improve the effectiveness of the OMMPs:

- EPA recommends that each State of the Reservation report specifically include a statement as to whether the BMPs are functioning as intended for each of the ranges subject to this FYR, whether the assumptions used at the time of the BMP selection are still valid, whether new information indicates that previously selected BMPs are no longer protective of the environment or other BMPs/technologies not yet employed are available to reduce the release of contaminants to extent feasible, and whether any addendums or major revisions to the OMMPs were prepared during the year and provide the date of the most recent approved OMMPs. The report should also specifically address E Range OMMP requirements: recordation of the number of projectiles fired per lane; monthly examination of bullet pockets to determine if fragmentation is occurring; hand-excavation and screening of soil from bullet pockets to determine if fragmentation is occurring, and removal of projectiles from the soil backstop berm.

- EPA recommends that the Range Inspection forms be revised for clarity. Inclusion of photos or videos taken during the inspections may reduce some subjectivity. It is also recommended that range-specific forms be used, the Ammunition Use section of the form be revised to avoid confusion, and the form be better tailored to match the requirements of each range-specific OMMP.

- EPA recommends that the OMMPs be updated to revise the following requirement: "Forwarding unvalidated (*i.e*., draft) data to the regulatory agencies within 48 hours of receipt by the MANG (not counting holidays and weekends). Comparing results to the Action Levels presented in the OMMPs and noting any concentrations exceeding the Action Levels in the results submittal. Proposing a plan for resampling, if needed to confirm an exceedance, pending data validation. Forwarding validated data to the regulatory agencies as soon as feasible within 7 days of receipt (not counting holidays and weekends)."

- EPA recommends that MANG follow adequate quality assurance/quality control plans to ensure the requirement for appropriately low method detection limits and reporting limits and communication to the lab so that they are consistently and timely achieved. Aqueous samples should have been re-collected and analyzed in accordance with the OMMP after the October 2021 sample results were received since one is not able to evaluate if there are positive detects of antimony at values between the Action Level (6 ppb) and the Reporting Limit (12 ppb). The OMMP stipulates that re-sampling should occur if there is an action level exceedance.

- The 2022 State of the Reservation report should note whether the EMC requested that the lysimeter at the Z target on L Range be sampled for constituents in the projectile. The L Range OMMP states that: The Z target lysimeter will be sampled once per year for constituents in the projectile if requested by the EMC after the first year of operation using an agreed upon analytical method.

- The 2022 State of the Reservation report should indicate if the previously proposed antimony speciation study recommended by the EMC SAC Ad Hoc Committee will be conducted. This work was to have been conducted in 2020 by a lab in California. The work, when complete, would help determine the type, or species, of antimony present in the soil, which could then lead to what the source of antimony may be on the ranges and if any management actions are needed.

- EPA recommends a quantitative rather than qualitative metric be established for the frequency of removal of projectiles from the backstop berm, at the east end of the side berms for the ranges subject to this Review, and at the SIT frontal berms at E Range. The BMP requirement is for aggressive projectile removal. Since bullet retrieval may not be tied to soil action level exceedances, EPA recommends a re-assessment of soil action levels currently used as trigger for action and additional investigations.

- EPA recommends consideration be given to installation of additional groundwater monitoring wells at E Range to augment the existing well.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Ranges: E, J, K, and T Small Arms Ranges and the L Grenade Launcher Range	*Protectiveness Statement* Protective
Protectiveness Statement: The 2017 Decision to modify the AO2 prohibition on live firing and use of pyrotechnics at certain ranges at Joint Base Cape Cod is providing adequate protection of public health for the ranges evaluated in this Review. This determination does not extend to any other range, ammunition, time period or type of training. EPA's determination that the 2017 Decision has provided adequate protection of public health is expressly limited to the facts and circumstances associated with the training activity authorized by the 2017 Decision during the Review period.	

VIII. NEXT REVIEW

The next five-year review report for the EPA 2017 Decision to modify the AO2 prohibition on live firing and use of pyrotechnics at Joint Base Cape Cod will be conducted no later than five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

EMC, 2022. Environmental Management Commission Inspections by Year 2017-2022. November 17, 2022

EPA, 1982. Cape Cod Aquifer Determination. 47 FR 30282

EPA, 1997a. *In the Matter of: Training Range and Impact Area Massachusetts Military Reservation*. Administrative Order for Response Action. 1997. EPA Docket # SDWA I-97-1019

EPA, 1997b. *In the Matter of: Training Range and Impact Area Massachusetts Military Reservation. Administrative Order for Response Action, as Modified. 1997. EPA Docket #* SDWA I-97-1030

EPA, 2007. EPA Region 1 Limited Authorization for Lead Ammunition Training Administrative Order SDWA 1-97- 1030, July 23, 2007

EPA, 2010. U.S. EPA Region 1 Decision Document L Range Operable Unit Camp Edwards Massachusetts Military Reservation Cape Cod, Massachusetts, September 2010

EPA, 2012. EPA's Proposed Authorization for M781 40mm Practice Round Training, SDWA 1-97-1030, November 19, 2012

EPA, 2015. U.S. EPA Region 1 Decision Document Small Arms Ranges Operable Unit Camp Edwards Joint Base Cod Cape Cod, Massachusetts, September 2015

EPA, 2016. EPA's Limited Authorization for Percussion Activated Neutralizer (PAN Training), June 1, 2016

EPA, 2017. EPA Final Response Massachusetts National Guard Request to Modify Prohibition on Live Firing and Use of Pyrotechnics, May 15, 2017

IAGWSP, 2012. *Summary of Investigations at T Range Technical Memo*, IAGWSP, April 5, 2012

MANG, 2007. Request to modify the Scope of Work ("SOW") to Administrative Order SDWA 1-97-1030 ("AO2") issued pursuant to Section 1431 (a) of the Safe Drinking Water Act with respect to the Massachusetts Military Reservation ("MMR"), June 13, 2007.

MANG, 2012. Pyrotechnic Simulator M116A1 Hand Grenade DODIC L601 STANDARD OPERATING PROCEDURES (SOP) Camp Edwards, Army National Guard Training Site, Massachusetts National Guard January 2012

MANG, 2013. Standard Operations Procedures (SOP) and Range Management Plan for Lima Range Grenade Launcher Range Camp Edwards, Army National Guard Training Site, Massachusetts National Guard, Final 9 September 2013

MANG, 2014. Standard Operating Procedures (SOP) and Course Management Plan for the Hand Grenade Qualification Course M69 with the M228 Fuse (DODIC G878) Camp Edwards, Army National Guard Training Site,
Massachusetts National Guard, Revised 25 September 2014

MANG, 2015. Best Management Practices and Operations, Maintenance and Monitoring Plan for Juliet, Kilo, and Tango Ranges at Camp Edwards, Massachusetts Revised 15 July 2015

MANG, 2016. Petition to Modify the Scope of Work of Administrative Order SDWA I-97-1030, August 31, 2016.

MANG 2017. Environmental Performance Standards for Massachusetts National Guard Properties at the Massachusetts Military Reservation, April 6, 2017 (as amended).

MANG, 2017. Best Management Practices and Operations, Maintenance and Monitoring Plan for Echo Range at Camp Edwards, Massachusetts 10 July 2017

MANG, 2018. State of the Reservation Report Training Year 2018 Camp Edwards Massachusetts National Guard
Environmental & Readiness Center

MANG, 2019. Final Annual State of the Reservation Report Training Year 2019, Camp Edwards Massachusetts National Guard Environmental & Readiness Center

MANG, 2020. Final State of the Reservation Report Training Year 2020, Camp Edwards Massachusetts National Guard Environmental & Readiness Center

MANG, 2021. Final State of the Reservation Report Training Year 2021, Camp Edwards Massachusetts National Guard Environmental & Readiness Center

MANG, Echo Range Live Fire Range Inspection (LFRI) Forms, Juliet Range LFRI Forms, Kilo Range LFRI Forms, Tango Range LFRI Forms, and Lima Range LFRI Forms 2017 – 2022. Hardcopies available for review at Camp Edwards Massachusetts National Guard Environmental & Readiness Center.

Tetra Tech, Inc., 2014. Final Small Arms Ranges Investigation Report Camp Edwards Massachusetts Military Reservation Cape Cod Massachusetts January 2014

USACE, 2021. Mobility of Lead and Antimony in Shooting Range Soils: Column Leaching Study U.S. Army Corps of Engineers Engineering Research and Development Center February 2021

USACE, 2022. Final Small Arms Ranges Soil Removal Activities Completion of Work Report Camp Edwards Joint Base Cape Cod, Cape Cod, Massachusetts, July 2022