Range Sustainment: Assessing Marine Corps Operational Small Arms Ranges (SARs)

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Report Documentation Page

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Presentation Outline

- Introduction to the REVA Program
- SAR Protocol Development
- SAR Protocol
- Case Study
- Lessons Learned

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Range Environment Vulnerability Program (REVA)

- Marine Corps' methodology for assessing off-range environmental impacts from its operational training ranges
- DoD Instruction 4715.14:
  - Determine whether a release or substantial threat of a release of munitions constituents (historical and current) from an operational range poses an unacceptable risk to human health or the environment
  - Identify management practices to maintain (or increase) capacity and/or capability of the operational range
- Re-assess operational ranges on 5-year cycles

REVA Process

- Installation site visit and data collection
- Baseline environmental range assessment and fate and transport modeling
  - Primary (Indicator) MCs:
    - TNT, RDX, HMX, perchlorate, lead
- Environmental sampling (as appropriate)
- REVA report and recommendations
  - Establish baseline environmental range conditions
  - Range BMPs
  - CERCLA response (if demonstrated off-range release)

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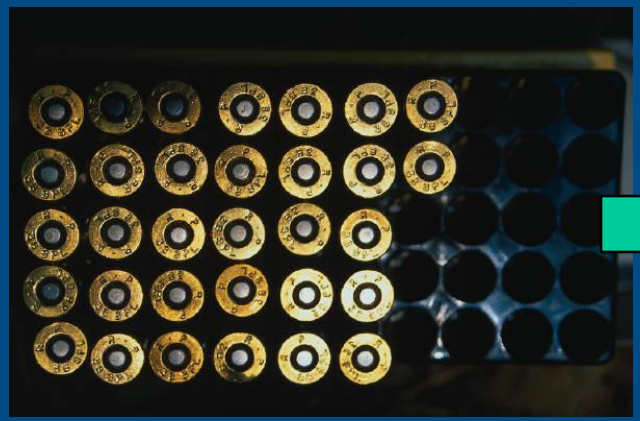
Small Arms Range Assessment Protocol

- REVA Munitions Constituent (MC) Indicator compound is lead
- Lead is the most prevalent potentially hazardous compound in Small Arms Ammunition (by weight)
- Fate and transport of lead based entirely on site-specific geochemical parameters



Factors Affecting Lead Migration

pH of Water

Quantity of lead

Depth to Groundwater

Slope

Precipitation

Vegetation

% Organic Material

pH of Soil

Maintenance

Soil Type

One factor is not necessarily more important than the other factors

Qualitative vs. Quantitative Assessment

- 100's of active SARs across the Marine Corps installations
- 100's site-specific geochemical samples would be required to quantitatively assess (model) all SARs
- Methodology to ***prioritize*** ranges based on factors affecting potential lead migration
  - Range Use and Design
  - Environmental and Physical Conditions
  - Location of Potential Receptors

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- Introduction to the REVA Program
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SAR Protocol

- Purpose: **prioritize** SARs qualitatively to determine which ranges should be address quantitatively
- Each Criteria given numerical rating based on potential to affect lead migration (range from 1 to 5)

  1 = low potential 3 = medium potential 5 = high potential
- Broken out into 7 tables
  - Range Use (Table 1)
  - Surface Water and Groundwater Pathways (Tables 2 and 3)
  - Surface Water and Groundwater Receptors (Tables 4 and 5)
  - Environmental Evaluation (Table 6)
  - Guidelines for Recommendations (Table 7)

Table 1 – Range Use and Range Management

Table 1: Range Use and Range Management (*Source)* Element (These definitions only apply for the purposes of the Assessment Protocol.)			
Criteria	**Evaluation Characteristics**	**Score Criteria**	**Site Score**
Duration of Range Use	Length of time the range has been used	5 if usage > 30 years 3 if usage is 10 to 30 years 1 if usage < 10 years	
Bullet-Capturing Technology	The presence and duration of bullet-capturing technologiesCompare the duration of the range use to the duration of bullet-capturing technologies.	If [range usage duration = bullet capture duration], then apply a **negative** score so that the [range usage duration + bullet capture duration] = 1 If [range usage duration – bullet capture duration] = 10 to 30 years, then apply a **negative** score so that the [range use duration + bullet capture duration] = 3 0 if [range usage duration – bullet capture duration] > 30 years	
MC Loading Rates	The amount and types of small arms ammunition expended on the rangeEstimate the MC loading by using a time weighted average of MC loading rates	5 if MC loading > 1000 pounds/year 3 if MC loading = 100 to 1000 pounds/year 1 if MC loading < 100 pounds/year	
Range Maintenance	Frequency of any range maintenance activities involving the removal of lead from the ranges	5 if lead is removed less than every three years 3 if lead is removed more than every three years but less than annually 1 if lead is removed at least annually	
Source Element Score			
Notes:			

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Source Element Score			
Notes:			

Duration of Use:

Usage < 10 yrs = 1 pt

Usage >10 yrs but <30 yrs = 3 pts

Usage > 30 yrs = 5 pts

Table 1 – Range Use and Range Management Criteria

- Duration of Range Use
- Bullet Capture Technology
  - Reduce Range Use Score with bullet capture technology
- MC/Lead Loading Rates: based on lbs lead/yr
- Range Maintenance

Table 2/3 – Surface Water and Groundwater Pathway Characteristics Criteria

- pH of Water/Soil
- Precipitation
- Slope of Range
- Vegetation
- Soil Type /Runoff Conditions
- Runoff Erosion Engineering Controls
  - Reduce Overall Score if Current Engineering Control are in place

Table 4/5 – Surface Water or Groundwater Receptors Criteria

Purpose: to identify potential off-range receptors

- Drinking Water Usage
- Agricultural or Other Beneficial Usage
  - E.g. Recreational Use
- Threatened or Endangered Species Habitat

Table 6 – Relative Environmental Concern

- Sum all the scores of Surface Water pathway (Tables 1, 2, and 4) and Groundwater pathway (Tables 1, 3, and 5)

Table 6: Relative Environmental Concern Evaluation		
Surface Water		
Element	**Table**	**Score**
Range Use and Range Management (Source)	1	
Surface Water Pathways	2	
Surface Water Receptors	4	
Sum of Surface Water Element Scores		
Groundwater		
Element	**Table**	**Score**
Range Use and Range Management (Source)	1	
Groundwater Pathways	3	
Groundwater Receptors	5	
Sum of Groundwater Element Scores		

Potential Data Sources

- Installation Reports (MMRP, IRP, ISR, Master Plans etc.)
- Range Standard Operating Procedures
- RFMSS or other range loading data
- Archive Search Reports
- U.S. Geological Survey Data and Reports
- U.S. Department of Agriculture
- Aerial Photographs

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- Introduction to the REVA Program
- SAR Protocol Development
- SAR Protocol
- ***Case Study*** → **4 Ranges**, **4 Installation**, **3 Climates**
- Lessons Learned

Range 1: Desert Environment
(with off-site receptors)

- Known Distance Pistol Range
- No bullet trap present or other capture technology
- Currently 101 lbs lead per year
- Little to no vegetation (creosote bushes)
- Low precipitation rates
- Gravelly sand

Range 2: Desert Environment
(no off-site receptors)

- Known Distance Rifle Range
- No bullet trap present or other capture technology
- Between 4,700 to 8,000 lbs of lead per year
- Little to no vegetation (creosote bushes)
- Low precipitation rates
- Sands and gravels

Range 3: Temperate Environment

- Known Distance Pistol Range
- Bullet Trap in Place
- Between 1,200 to 1,500 lbs of lead per year
- Grasses, shrubs and trees
- High precipitation rates
- Sandy clay
- Very acidic soils

Range 4: Tropical Environment

- Known Distance Rifle Range
- No Bullet Capture Technology in place
- Approximately 3,300 lbs of lead per year
- Eroded bullet pockets, with grass surrounding
- Moderate precipitation rates
- Clay or Rock

Table 1: Range Use and Range Management

Criteria	Range 1	Range 2	Range 3	Range 4
Duration of Range Use	5	5	5	5
Bullet-Capture Technology	0	0	0	0
MC (lead) Loading Rates	3	5	5	5
Range Maintenance	5	5	5	5
	13	15	15	15

- As long as lead loading greater than 1,000 lbs per year, range receives score of 5 (most ranges assessed)
- Few differences between ranges in Table 1
- Few Ranges with continual maintenance (> once/five years)

Table 2: Surface Water Pathways Characteristics

Criteria	Range 1	Range 2	Range 3	Range 4
pH of Water	1	1	1-3	1
Precipitation	1	1	5	3
Slope of Range	5	5	5	5
Vegetation	5	5	1	3
Soil Type/Runoff Conditions	1	1	3	5
Runoff/Erosion Control	-5	-5	-10	0
	8	8	5-7	17

- Erosion Control and run-on/run-off control is an important criteria
- Vegetation has significant impact on score
- pH of water is generally not significant

Table 3: Groundwater Pathways Characteristics

Criteria	Range 1	Range 2	Range 3	Range 4
Depth to Groundwater	1	0	3	3
Precipitation	1	1	5	3
pH of Water	1	1	1-5	1-5
pH of Soil	1	1	5	1
Soil Type/ Infiltration	5	5	3	1
Clay Content in Soil	5	5	3	1
	14	13	20-24	10-14

- No methodology to decrease rating at ranges with best management practices in place (bullet-traps)
- Depth to groundwater in desert climates is significant on score
- Soil type is double counted in this table
- Acidic soil and groundwater plays important role

Table 4: Surface Water Receptors

Criteria	Range 1	Range 2	Range 3	Range 4
Drinking Water Usage	2	2	2	2
Agricultural or Other Beneficial Usage	1	1	3	1
Sensitive Species Habitat and Threatened or Endangered Species	5	1	5	5
	8	4	10	8

- Generally, no surface water drinking water sources located nearby
- No methodology to differentiate between ranges with potential off-range receptors and without potential off-range receptors

Table 5: Groundwater Receptors

Criteria	Range 1	Range 2	Range 3	Range 4
Wells Identified as Potable Water Sources	2	2	2	2
Wells Identified for Agricultural or Other Beneficial Usage	1	1	1	1
Sensitive Species Habitat and Threatened or Endangered Species	1	1	1	1
	4	4	4	4

- Few noted down-gradient receptors for groundwater
- Several ranges had sampling data from previous investigations (MMRP or IRP) to help determine if lead was an issue

Table 6: Relative Environmental Concern

Element	Range 1	Range 2	Range 3	Range 4
Surface Water				
Range Use (Table 1)	13	15	15	15
SW Pathway (Table 2)	8	2	5-7	17
SW Receptor (Table 4)	8	4	10	8
	29	27	30-32	40
Groundwater				
Range Use (Table 1)	13	15	15	15
SW Pathway (Table 3)	14	13	20-24	10-14
SW Receptor (Table 5)	4	4	4	4
	31*	32*	39-43	29-33

* - decreased ranking to minimal from moderate due to lack of potential groundwater receptors

Table 7: Best Management Practices

Ranking	Ranges	Recommended Action
High (50-65)		Action required. 1. Sample appropriate media (groundwater, surface water, and/or soil). 2. Implement BMPs.
Medium (30-50)	Range 4 SW [40] Range 3 GW [39-43] Range 3 SW [30-32] Range 4 GW [29-33]	1. Implement BMPs. 2. Consider sampling appropriate media (groundwater, surface water, and/or soil).
Minimal (0-29)	Range 4 GW [29-33] Range 1 SW [29], GW [31*] Range 2 SW [27], GW [32*]	1. No further action needed. 2. Consider implementing BMPs.

* - decreased ranking to minimal from moderate due to lack of potential groundwater receptors

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- ***Lessons Learned***

Lessons Learned

- Data from the installation, government agencies, public, and private sources are readily available to complete this qualitative assessment
- Tables are quick and easy to prepare
- Cost savings compared to sampling or modeling
- Climate/environment have an impact on the rankings (some professional judgment between installations is required)
- Determination of complete/incomplete pathways is important, but may not be reflect in the scoring

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Questions

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