Marine Recruit Depot Parris Island Weapons and Field Training Battalion Range Sustainability

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Outline

- Background
- Sustainability Strategies
  - Engineering solutions
  - Evaluating risks
    - Chemical monitoring with risk thresholds
    - Biological monitoring with risk thresholds
    - Predictive modeling
  - Ecological offsets

Background

- Marine Corps Recruit Depot Parris Island (MCRDPI)
- Located in Beaufort County, South Carolina
- Covers approximately 8,050 acres
  - 3,275 acres are dry land, 4,775 acres are tidal marsh and creeks
- Primary mission: **“We make Marines!”**
  - Serves as one of the Marine Corps' two boot camps
  - Trains all male recruits east of the Mississippi and all female recruits nationwide
  - 13 week training program:
    - Phase 1: Basic Learning
    - Phase 2: Rifle Training
    - Phase 3: Field Training

Background

- Four Known Distance Ranges and one Unknown Distance Range firing into tidal wetland
- Two pistol ranges firing into river
- First range established in 1918, three ranges established by 1929
- Previous studies conducted
  - Agency for Toxic Substances and Disease Registry (ATSDR) – 1995
    - Determine the safe seafood consumption rate
      - Recreational harvesters (adults, including pregnant women) could eat as much as two - 4 ounce meals per week as often as 50 weeks per year.
  - US Army Corps of Engineers – 1997
    - To determine if metals were present and at what concentration and distribution
    - Metals were found throughout the marsh, and in biota, muscles.
      - Levels not expected to pose a risk.

Scope of Study

- Prepare a Munitions Deposition Analysis for the MCRDPI WFTBN Ranges
- In conjunction with the University of South Carolina and Georgia Tech, sample 50 locations in the WFTBN impact area (tidal marsh) and background location
  - Sampled for
    - Simultaneously extracted metals and acid volatile sulfides ratio (SEM/AVS)
    - Total Organic Carbon (TOC)
    - Bulk Density and Grain Size
    - Bulk Metals using Portable XRF (provided by USCB)
- Characterize the sediments and prepare a Munitions Impact Analysis
- Develop a Range Sustainability Action Plan

Sampling Results

- Some areas of the WFTBN have been adversely impacted by range operations.
  - Impacts tend to be located in the central part of the impact area,
    - Which is also where the highest concentrations of projectiles were found.
  - Several locations along the shoreline of the Broad River also show evidence of impacts.
    - Where the pistol ranges fire
  - The majority of the sample locations with elevated concentrations of metals occur in the intertidal marsh rather than in the tidal channels.
- Impacts are localized and pose no risk to human and limited risk to ecological receptors.
  - Offsite transport of sediment-associated metals is likely to be limited to the areas within or adjacent to the tidal channels, or along the Broad River shoreline.

Range Sustainability Action Plan

- Evaluated range sustainability alternatives for:
  - Sediment management strategies
  - Engineering technologies
  - Best management practices

Engineering Technologies

– Evaluated viability of the following technologies based on anticipated firing load for 202k Plus Up
  - Shock absorbing concrete/rubber block
  - Soil impact berms
  - Steel total containment bullet entrapment

Shock-Absorbing Concrete (SACON)

- Consists of a low- to medium-density fiber-reinforced formed concrete
- Best suited for low volume shooting ranges.
  - Requires regular maintenance and block rearrangement for an even saturation of projectiles within the blocks.

Not a viable option for the high volume WFTBN rifle ranges.

Suitable for use as separation wall between shooting ranges or as baffle above soil berm.

Rubber Blocks

- Primarily chopped rubber placed on top of a structure similar to a soil berm.
- Mainly used for low-volume shooting at close distances
- Should be mined every 80,000 rounds per lane, on average, to prevent ricochet and fire hazards.
- When rubber traps are mined, special safety precautions are necessary for disposal of the hazardous materials

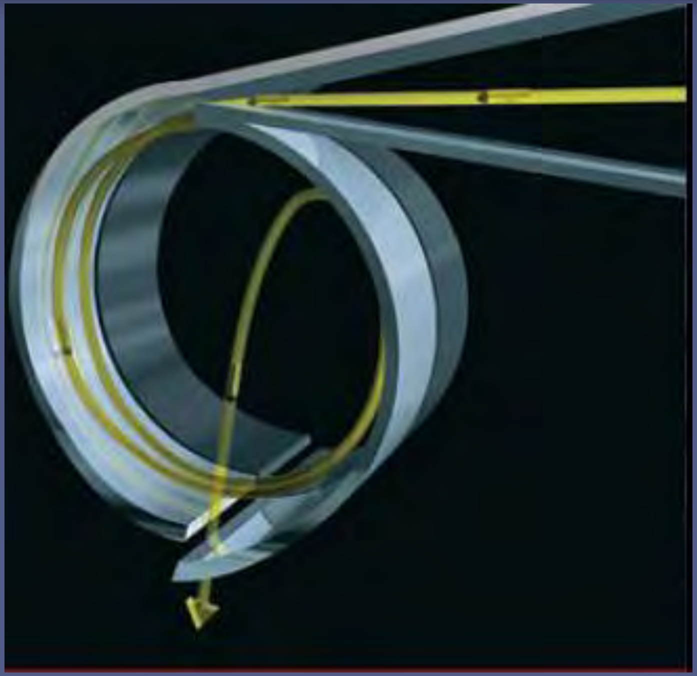
Because of the high volume of shooting at WFTBN rifle ranges and the potential safety risks, rubber blocks are not a viable option.

Soil Impact Berm

- Soil berms are the most basic and commonly employed type of entrapment technology on small arms ranges
  - Must be periodically mined to prevent saturation and bullet ricochet and to reduce the potential for lead migration.
  - Maintenance requires down-time and lead sifting
    - The associated O&M costs can be significant

Soil berms are a potential viable option for the high firing rates at MCRDPI and are being further evaluated.

Steel Bullet Traps



- Deceleration-type trap
  - After projectiles pass through the entry funnel, they slide into the chamber where they safely spin along the circular steel path until their energy is dissipated.

Steel bullet traps are a potential viable option for the high firing rates at MCRDPI and are being further evaluated.

Challenges

- Impact to wetlands
  - Does the past 90+ years of impact and future increased loading of munitions under 202k Plus Up warrant the installation of engineering controls?
- Ricochet issue with steel bullet entrapment systems
  - 29 Palms

Engineering Solutions
Pros and Cons

Description	Soil Impact Berm	Steel Entrapment System
Total Estimated Capital Cost	$12,232,000	$16,392,000
Annual Estimated O&M Costs	$4,508,000/year	$668,000
Wetland Impact Area	4.37 acres	0
Down Time for Construction	3 months/range	8 months/range
Down Time for O&M	2 weeks/range/year	3 days/range/year
Complexity	Earthwork is a proven technology.	Relatively new technology. May encounter some complications.
Lifespan	Unlimited life span if maintained properly	15 to 20-year life span

Range Sustainability - Risk Evaluation Alternatives

- Approaches to Evaluating Risk
  - Chemical monitoring with risk thresholds
  - Biological monitoring with risk thresholds
  - Predictive modeling

Risk Evaluation Alternative – Chemical Monitoring with Risk Thresholds

- Monitoring of metals concentrations in sediment porewater over time
- Porewater analysis
  - Provides more information about bioavailability than bulk sediment chemistry
  - Compare concentration to literature based value to determine impacts on benthic invertebrates
  - Use data to calculate potential for impacts to upper trophic level receptors
  - Include reference locations

Risk Evaluation Alternative – Biological Monitoring with Risk Thresholds

- Benthic community analyses (animal surveys)
  - Enables changes in community structure to be observed over time
- Tissue residue analysis (e.g., fish, shellfish)
  - Using literature values and desktop models, enables assessment of impact to animals accumulating metals and to those that prey on them
  - Direct ecological measures that integrate effects of all contaminants
  - Reference locations are critical

Risk Evaluation Alternative – Predictive Modeling

- Challenge is to predict increases in metals concentrations and availability over time
- Data not available to begin to model future changes with any confidence (need data collected over time)
- Setting is very dynamic with many variables
- As part of chemical or biological monitoring, data could be collected to support modeling in the future
- When might modeling be useful?
  - Under a scenario where monitoring indicates that impacts are occurring (how much worse is it going to get?)

Sustainability Strategies – Ecological Offsets

- The potential level of ecosystem service impact associated with identified risks or impacts can be quantified
- When engineering solutions are not possible, are not complete, or have a disproportionate cost to benefit, offsetting ecosystem services can be scaled and created
  - Habitat Equivalency Analysis

Ecosystem Service Debit +

Ecosystem Service Credit =

Sustainable Range Operations

What to Do Now? (+ and -)

Alternative	Positives	Negatives	Cost
Engineering Controls	Proactive and certain	Some environmental impact with construction; continuing O&M	H
Chemical Monitoring	Provides information on change over time	With an exceedance of benchmarks, actual impact still not well understood	L
Biological Monitoring	Provides information on change over time. Direct ecological measure	Requires suitable reference locations; Communities are naturally variable	L
Predictive Modeling	Predictions can support action and avoid impacts	Impacts may occur before they are identified; the model is complex	M
Ecological Offsets	Provides for no net loss of ecosystem services; Demonstrate sustainability	Require leadership and demonstration that engineering solution are not cost effective. Not applicable to human health risks.	M

Best Management Practices

- Maintaining ground/vegetative cover
- Stormwater management
- Chemically/physically immobilizing lead
- Continuing to collect spent rounds and recycle brass
- Documentation
    - SOPs & Management Plans

Path Forward

- Additional sampling to further characterize risk
  - More sediment sampling in focused areas
  - Sediment porewater sampling
  - Biota sampling
    - Mummichug, oyster, blue crab, snail, and fiddler crab.

Questions?

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