

REVA: A Case Study at a Marine Corps Installation

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Outline

- Overall Program
- REVA Process
- REVA Case Study
- Next Steps
- Acknowledgements



Program Goals

- Assess the potential for munitions constituents (MC) to migrate off operational ranges and identify potential impacts (human health and the environment)
- Provide information for Range Management Plans
- Enhance Service's stewardship and outreach programs
- Assist Senior leadership decision making to improve sustainable range management



Primary Program Drivers

- DODD 3200.15
- DODD 4715.11
- DODI 4715.14
- OSD Policy on Required Actions Related to Perchlorate (26 Jan 2006) – in revision
- EPA Perchlorate Memo (8 January 2009)



REVA Process

- Conduct Site Visit / Data Collection
- Develop Conceptual Site Model (CSM)
- Perform Small Arms Range Assessments
- Prepare and employ screening-level fate and transport modeling, if applicable
- Conduct further assessment / field work, if applicable
- Document conclusions



REVA Case Study



Independent Environmental Engineers, Scientists and Consultants

**MALCOLM
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Data Collection

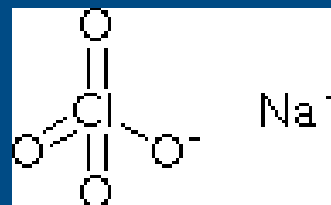
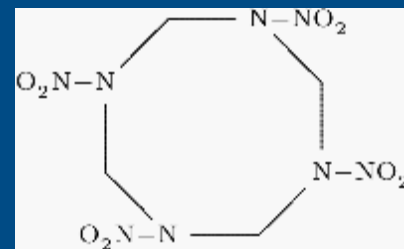
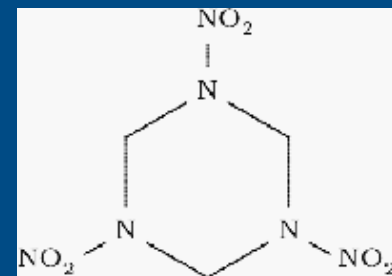
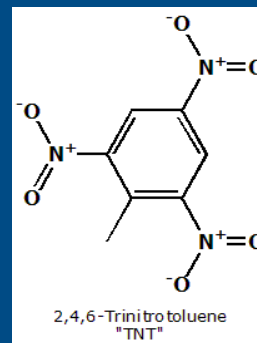
- Total of 47 ranges / training areas assessed
 - Live fire training areas
 - Artillery firing areas
 - Mortar firing positions
 - Maneuver areas
 - Small arms ranges
 - Explosive Ordnance Disposal range

- Of the 47 ranges, three areas were identified for modeling
 - A Impact Area
 - B Impact Area
 - C Impact Area



Basic MC Loading Assumptions

- Expenditure data, where available
- Indicator MC include TNT, RDX, HMX, Perchlorate, and Lead
- Main filler of the munitions considered majority of loading
- MC loading estimated for the entire time the range was operational
- MC Loading areas based upon discussions with range control, GIS/mapping data and target locations



MC Loading

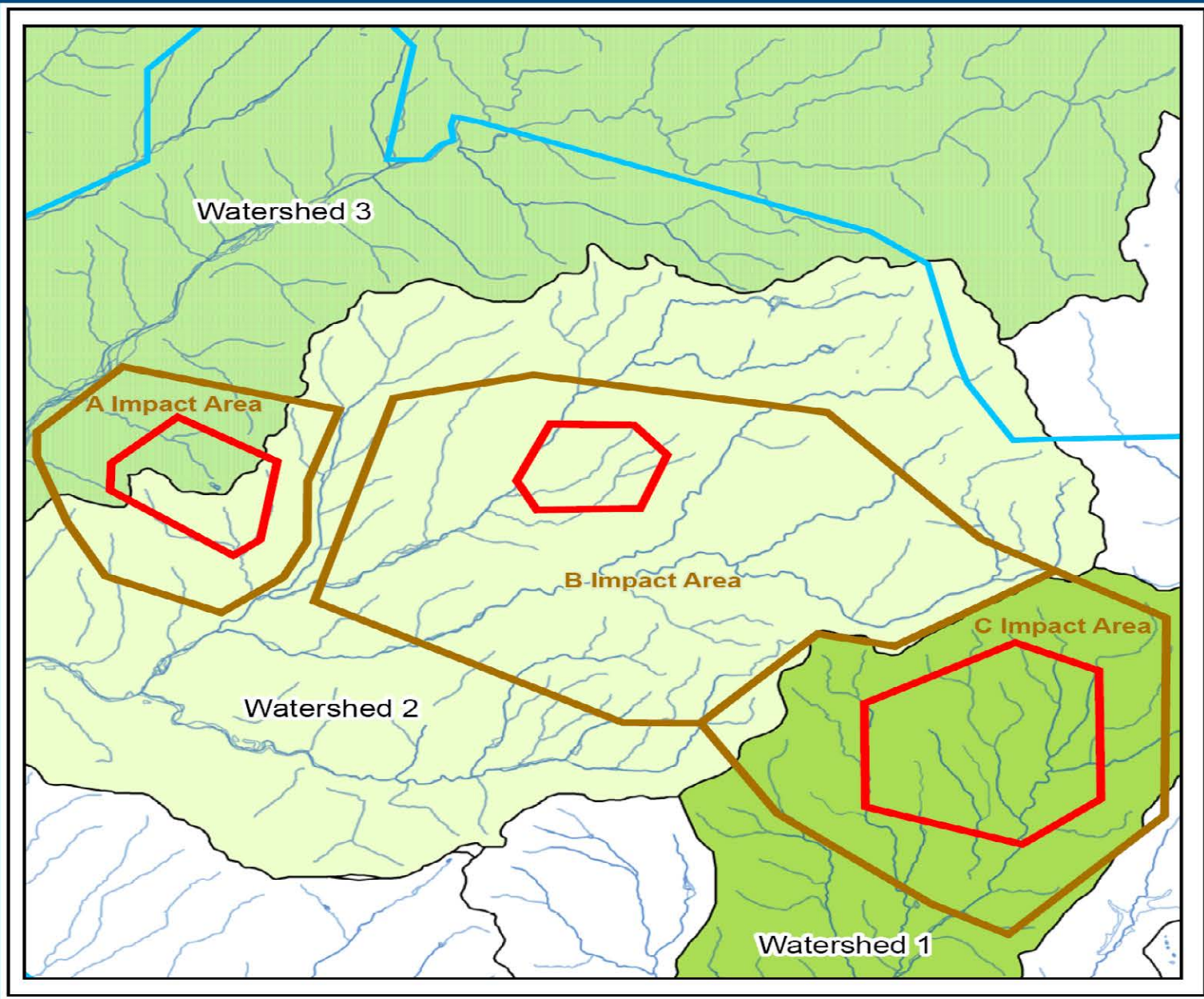
- A Impact Area
 - 1938-Present
 - TNT, RDX, HMX, Perchlorate
- B Impact Area
 - 1938-Present
 - TNT, RDX, HMX, Perchlorate
- C Impact Area
 - 1938-Present
 - TNT, RDX, HMX, Perchlorate



Conceptual Site Model

- Varying topography and slope
- 3 MC loading areas located in 3 different hydrologic watersheds
- 22 inches of precipitation yearly average
- Surface water recharges groundwater
- Groundwater aquifer (up to 30 ft bgs) provides water supply
- Receptors
 - Human – groundwater water supply
 - Ecological – surface water streams





Overview of Screening-Level Surface Water Analysis

*MC Mass from
Soil to Surface Water*

*Surface Water Runoff
Estimate*

*= “Edge of MC Loading Area”
MC Concentration in
Surface Water*

X Down Gradient Mixing Factor

*Compare to
REVA
Trigger Values*

*= “Mixed”
MC Concentration in
Surface Water*



Overview of Screening-Level Groundwater Analysis

$$\frac{\text{MC Mass}}{\text{Infiltration}} = \text{Concentration of Infiltrating water}$$

Compare to
REVA
Trigger Values

Unsaturated Zone Modeling
(VS2DTi or VLEACH) $\xrightarrow{\text{Vertical movement of MC from surface to GW}}$ Does MC concentration reach water table above REVA trigger values ?

Saturated Zone Modeling
(Biochlor) $\xrightarrow{\text{Horizontal movement of MC in GW}}$ Does MC concentration reach receptor or range boundary above REVA trigger values ?



A Impact Area Modeling Results

- Surface water
 - MC predicted below REVA trigger values for all indicator MC
- Groundwater
 - MC predicted below REVA trigger values for all indicator MC



A & B Impact Areas Modeling Results

- Surface water
 - MC predicted above REVA trigger values for TNT and RDX off range
- Groundwater
 - MC predicted above REVA trigger values for TNT and RDX at estimated down gradient drinking water supply well locations



C Impact Area Modeling Results

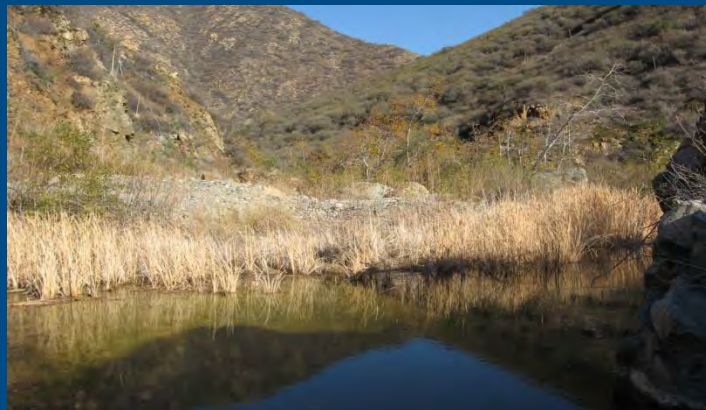
- Surface water
 - MC predicted above REVA trigger values for TNT and RDX off range
- Groundwater
 - MC predicted above REVA trigger values for TNT and RDX at estimated down gradient drinking water supply well locations



Further Assessment

Sampling Conducted in 2 Watersheds

- Surface water - sampled up to 4 off-range locations where road intersects streambeds
- Groundwater - sampled up to 7 drinking water supply wells
- Analytes included full explosives suites and lead



Watershed 1 Sampling Results

- Groundwater
 - Explosives - Non detect
 - Lead - Below Draft DoD Screening Values
- Surface Water
 - Explosives – Non detect
 - Lead - Below Draft DoD Screening Values after specific hardness was calculated



Watershed 2 Sampling Results

■ Groundwater

- Explosives - 2-nitrotoluene (2-NT) detected below Draft DoD Screening Values in original samples. Non detect in subsequent samples.
- Lead – Detected below Draft DoD Screening Values in original samples. Non detect in subsequent samples.

■ Surface Water

- Explosives - 2-NT, 3-NT detected below Draft DoD Screening Values. RDX detected below DoD Screening Values in original samples but non detect in subsequent samples.
- Lead - At the Draft DoD Screening Value after specific hardness was calculated.



Assessment Conclusion

- No current off range migration of MC posing an unacceptable risk to human health or the environment
- Detected MC concentrations decreased over sampling events
- Further actions may be evaluated to continue mitigating the possibility of MC migration



REVA Documentation

- Draft report developed
- Reviewed by outside 3rd party
- Draft Final (publicly releasable document)
 - 60 day courtesy review regulator notification period
 - Sent directly with cover letter to agencies identified by installation
- Final (publicly releasable document)
 - Posted on installation website



Next Steps

- Continue regular surface water monitoring
- Re-assess per DoDI beginning in 2014
- Evaluate best management practices to control MC migration within Watershed 2



Acknowledgements

- Headquarters Marine Corps
 - Ms. Jennifer Simmons
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 - Mr. Mike Caras
- USMC Installations



Questions?

