Characterizing Munitions Constituents from Artillery and Small Arms Ranges

Institute of Public Health
Surface Water and Wastewater Program
E2S2 Conference 9-12 May 2011

Approved for Public Release

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAY 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Characterizing Munitions Constituents from Artillery and Small Arms Ranges	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Public Health Command (Provisional),Institute of Public Health,5158 Blackhawk Road ,Aberdeen Proving Ground,MD,21010-5403**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**18**	

Background

- Conducted assessments of Army training and testing ranges in U.S.
  - Determined if munitions constituents of concern (MCOC) are elevated at range boundaries
  - Assessed potential impact of elevated MCOC on ecological or human receptors off-range
- 13 installations
  - 24 small arms sample locations
  - 48 impact area sample locations

Predicted MCOC

Artillery Impact Areas

- Explosives
  - RDX
  - TNT
  - 2, 4-DNT,
  - 2,6-DNT
- Perchlorate
- Metals

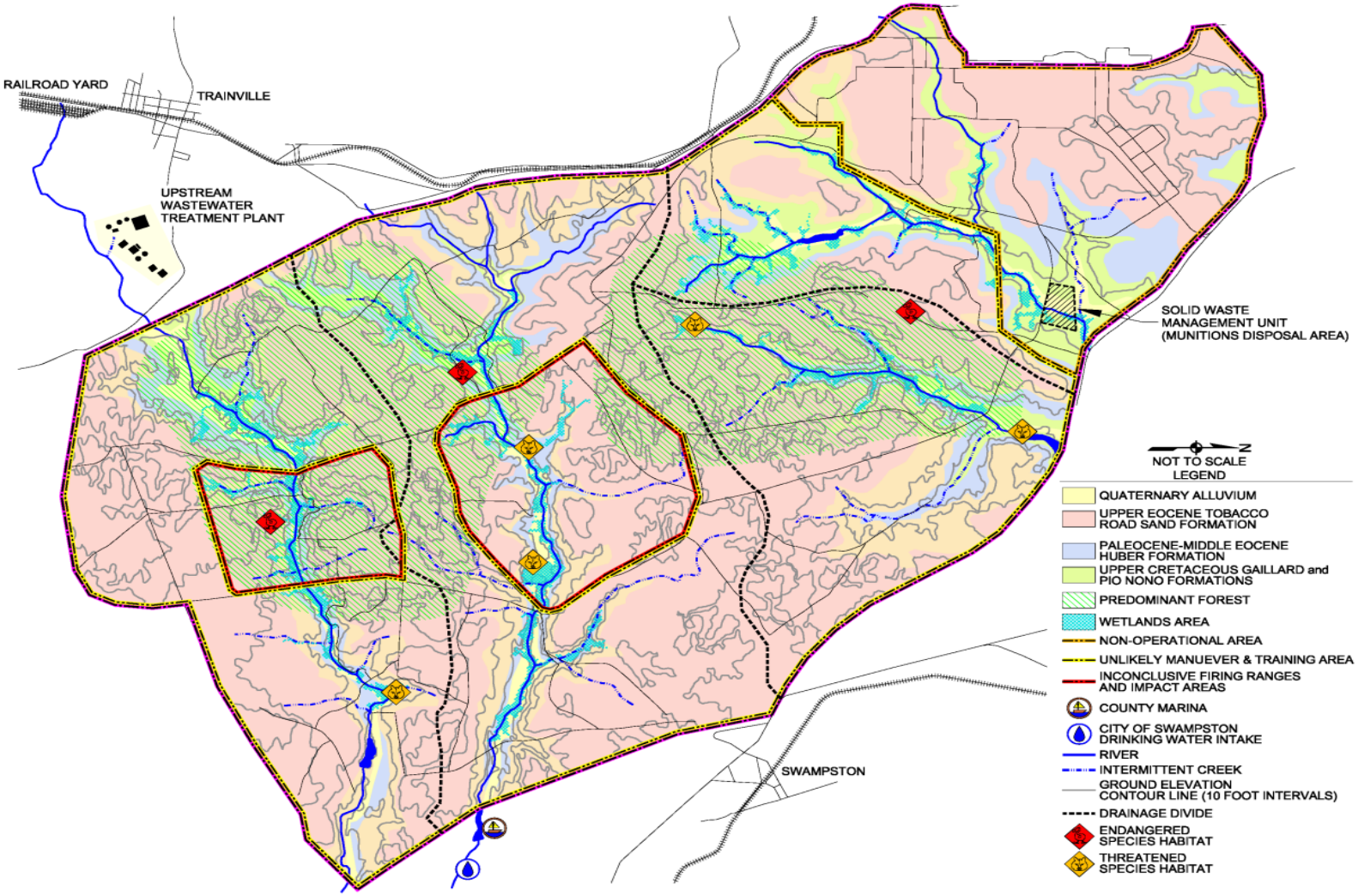
Small Arms Ranges

- Metals
  - Copper (Cu)
  - Lead (Pb)
  - Zinc (Zn)
  - Antimony (Sb)

MCOC Sampling Process

- 1st -determine if sampling necessary
  - MCOC source
  - Pathway
    (surface water system)
  - Receptor
- 2nd - sample to measure MCOC at range boundary and reference (background)

Example Surface Water System Conceptual Site Model



Sample Collection Strategy

- Surface water drainage pathways
  - Upstream/downstream of ranges
  - Wet/dry seasons
  - Clear /storm conditions
  - Composite or grab sample
- Both surface water and sediment collected

Data Results

- Compare data averages statistically
  - Upstream (background)
  - Downstream (range boundary)

- Types of MCOC found above background:
  - Explosives: RDX
  - Metals: Sb, Cu, Pb, Zn

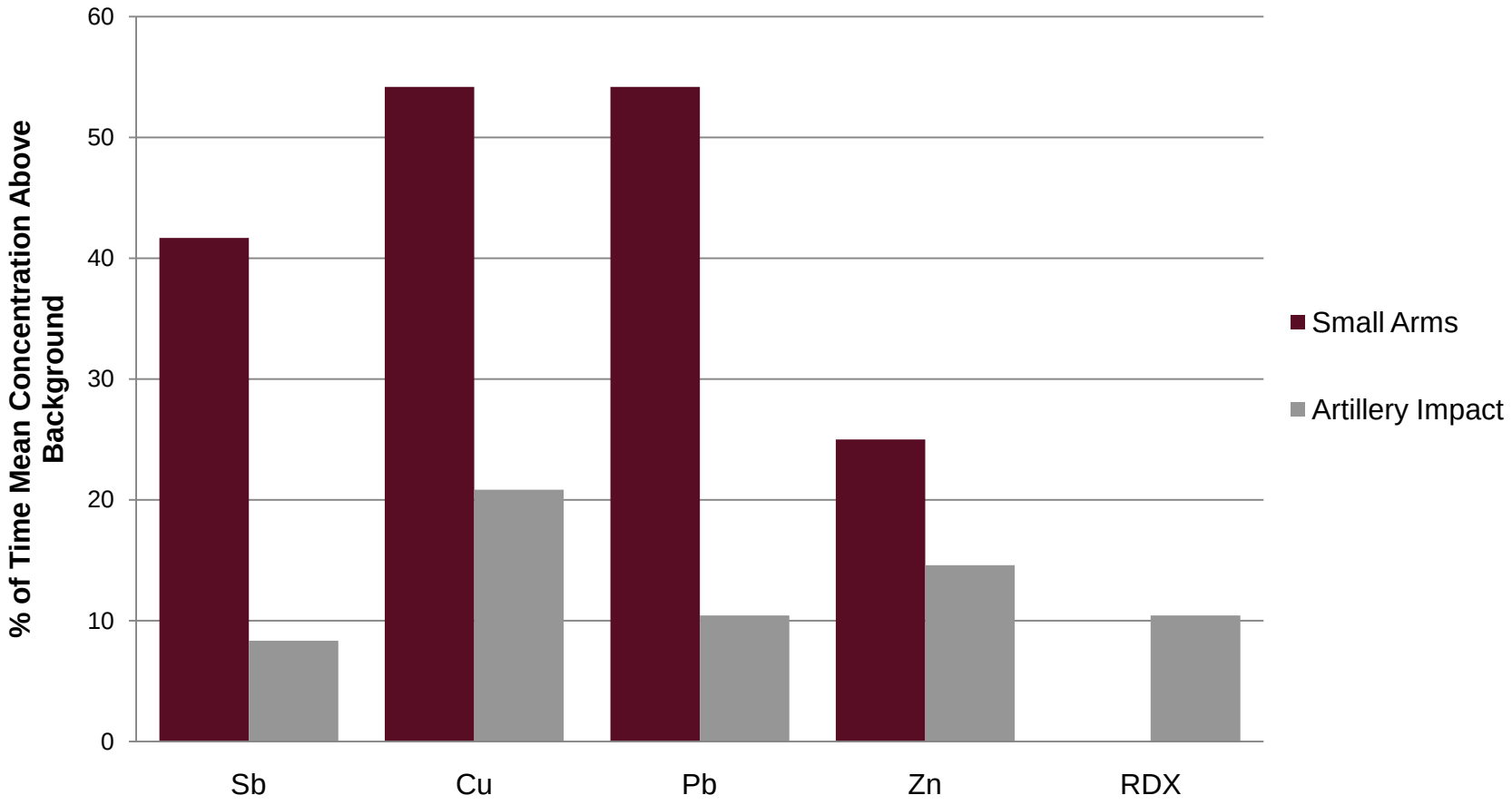
Data Evaluation Method

- Screening value (SV) chosen
  - Department of Defense Range and Munitions Use Subcommittee Workgroup (RMUS)
  - EPA and State standards
- 95% upper confidence level of the mean compared to SLs
- Determine if potential risk

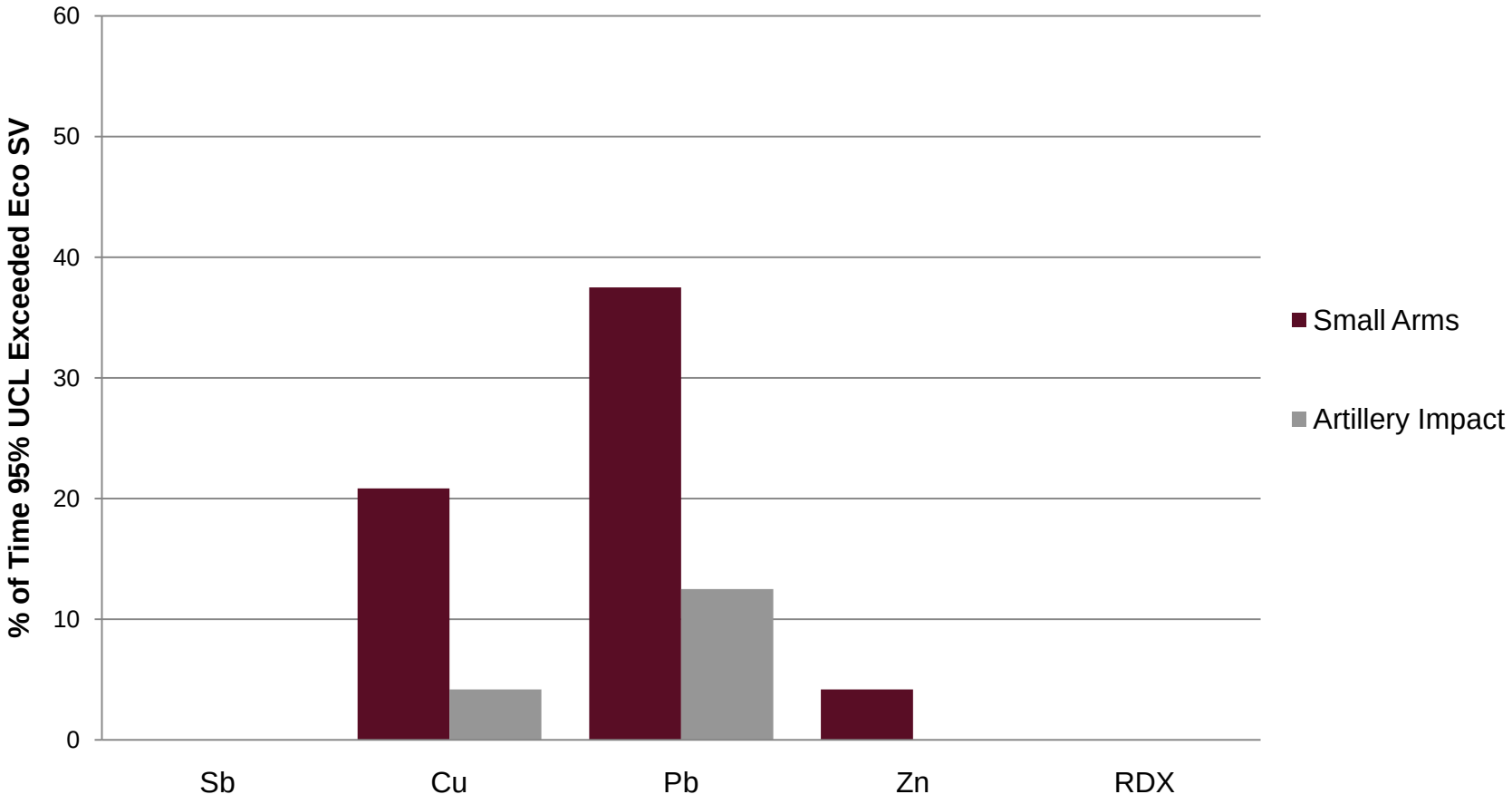
Range of Ecological and Human SVs Used in the Analysis

MCOC	Human	Ecological	
	Potable Water (ppb)	Water (ppb)	Sediment (ppm)
Sb	14 - 15	5.6 - 160	2 - 12
Cu	1300 - 1500	0.9 - 24	16 - 34
Pb	15	0.08 – 13	31 - 47
Zn	9100 - 11000	7.8 - 304	120 - 150
RDX	0.61 - 2	190	0.013

Surface Water Mean Downstream Concentrations Above Background Concentrations



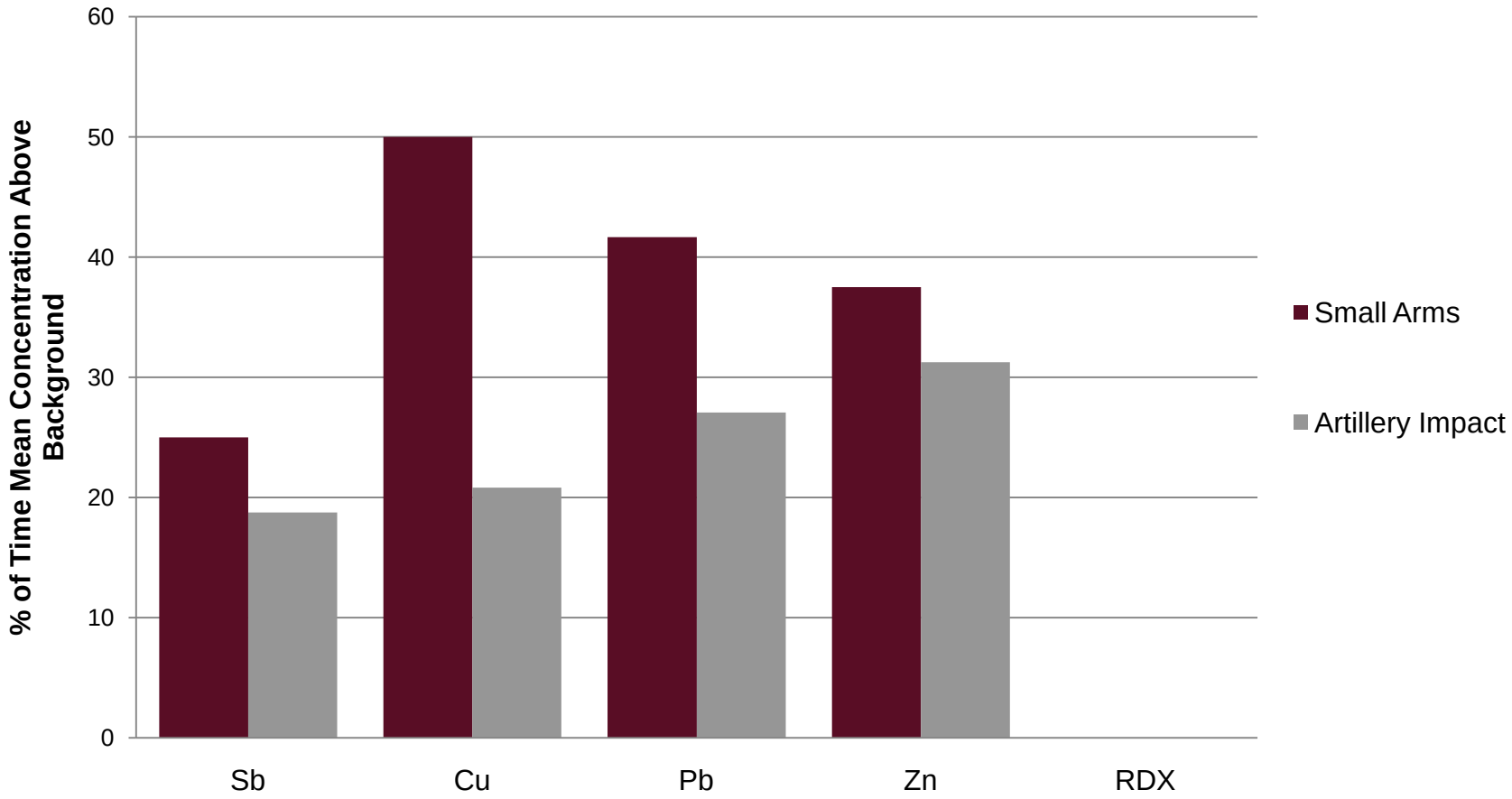
Surface Water 95% UCL of Mean Downstream Concentrations Exceed Ecological SVs



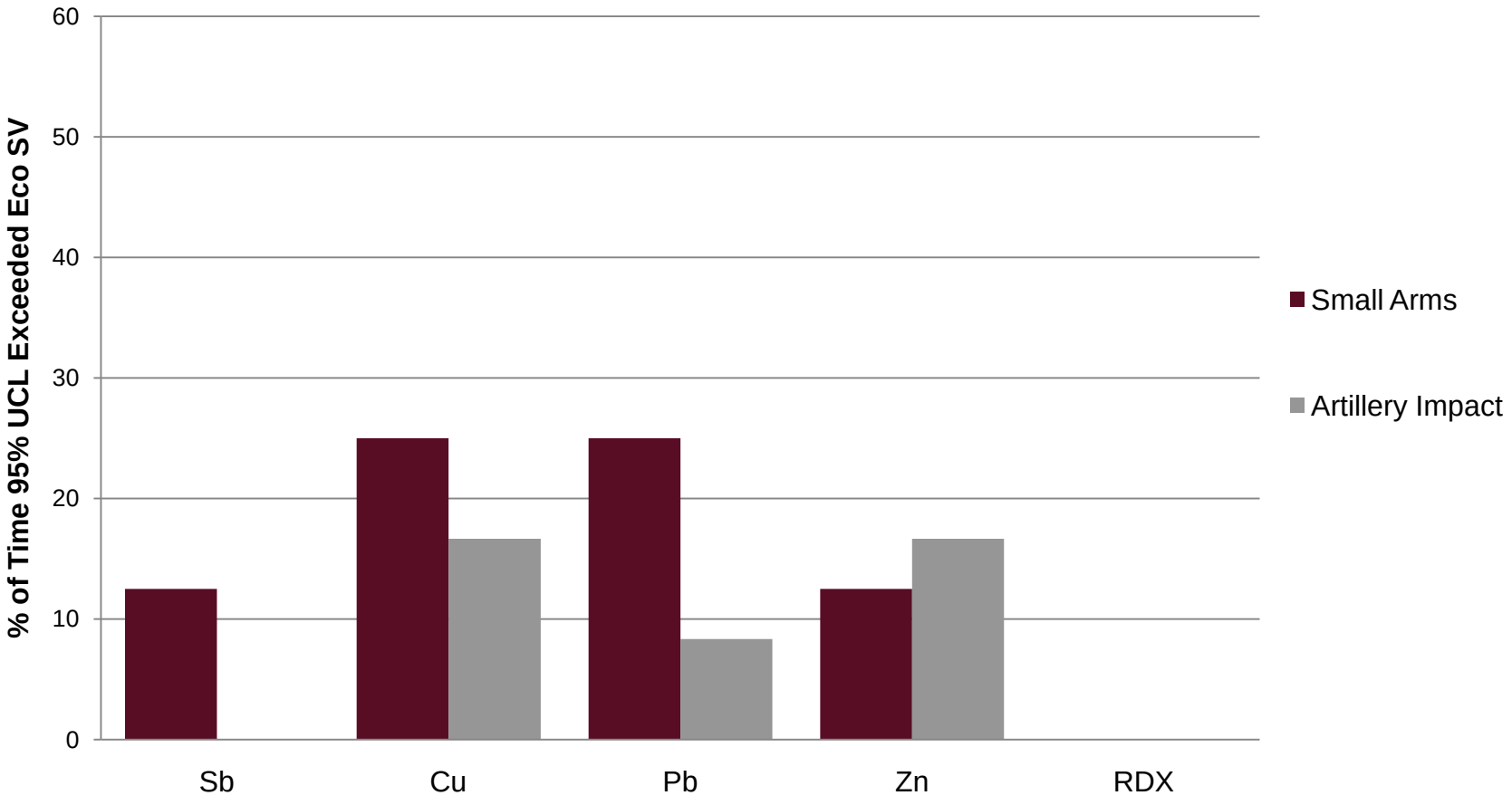
Summary – Surface Water

- Human SV exceedances
  - Pb - small arms range
- Ecological SV exceedances
  - Cu and Pb – both range types
  - Zn – small arms

Sediment Mean Downstream Concentrations Above Background Concentrations



Sediment 95% UCL of Mean Downstream Concentrations Exceed Ecological SVs



Summary – Sediment

- Pb and Cu – most often exceeded at small arms
- No explosives found at small arms or artillery impact areas

Range Data Summary

Artillery range

- No explosives elevated above SVs
- Metals elevated above SVs <20% of time
  - Surface water – Cu, Pb (Sb and Zn 0%)
  - Sediment – Cu, Pb, Zn (Sb 0%)

Small arms ranges

- No explosives
- Metals elevated above SVs <40% of time
  - Surface water
    - Sb and Zn <10%
    - Cu and Pb <40%
  - Sediment
    - Sb and Zn <15%
    - Cu and Pb <30%

Potential MCOC Impact

- Presence of MCOC above SV does not equate to negative effects occurring
  - bioavailability important
  - benthic macroinvertebrates used to assess stream health
- Ecological/Human health risk assessments may be completed to clarify whether a risk is present

Conclusions

- Explosives
  - not migrating from ranges at elevated levels
- Metals
  - more likely at small arms ranges at elevated levels
- Human health
  - not at unacceptable level of risk