Trap and Skeet Range 17 (T&S)
Army BRAC Program

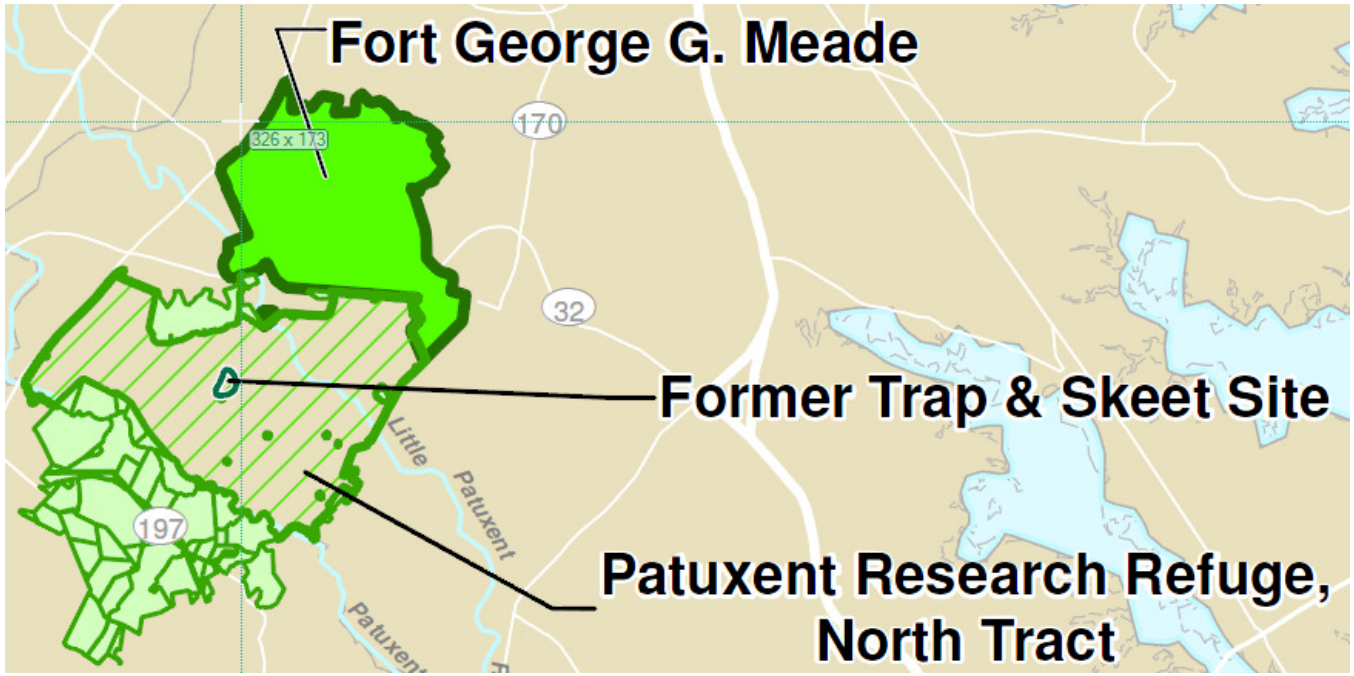
Multi-Incremental Sampling
Project Summary

Presented by:

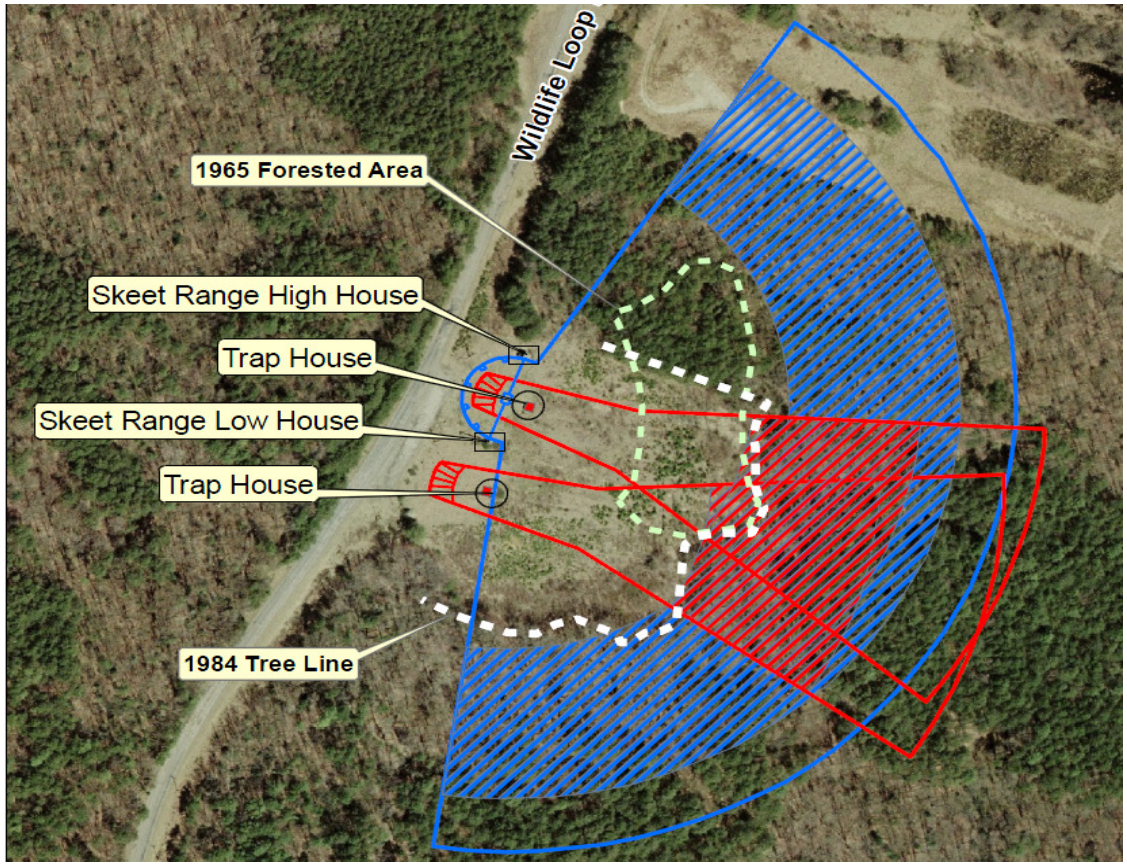
Bill Eaton
URS Corporation

Friday, March 20, 2014

Site Location



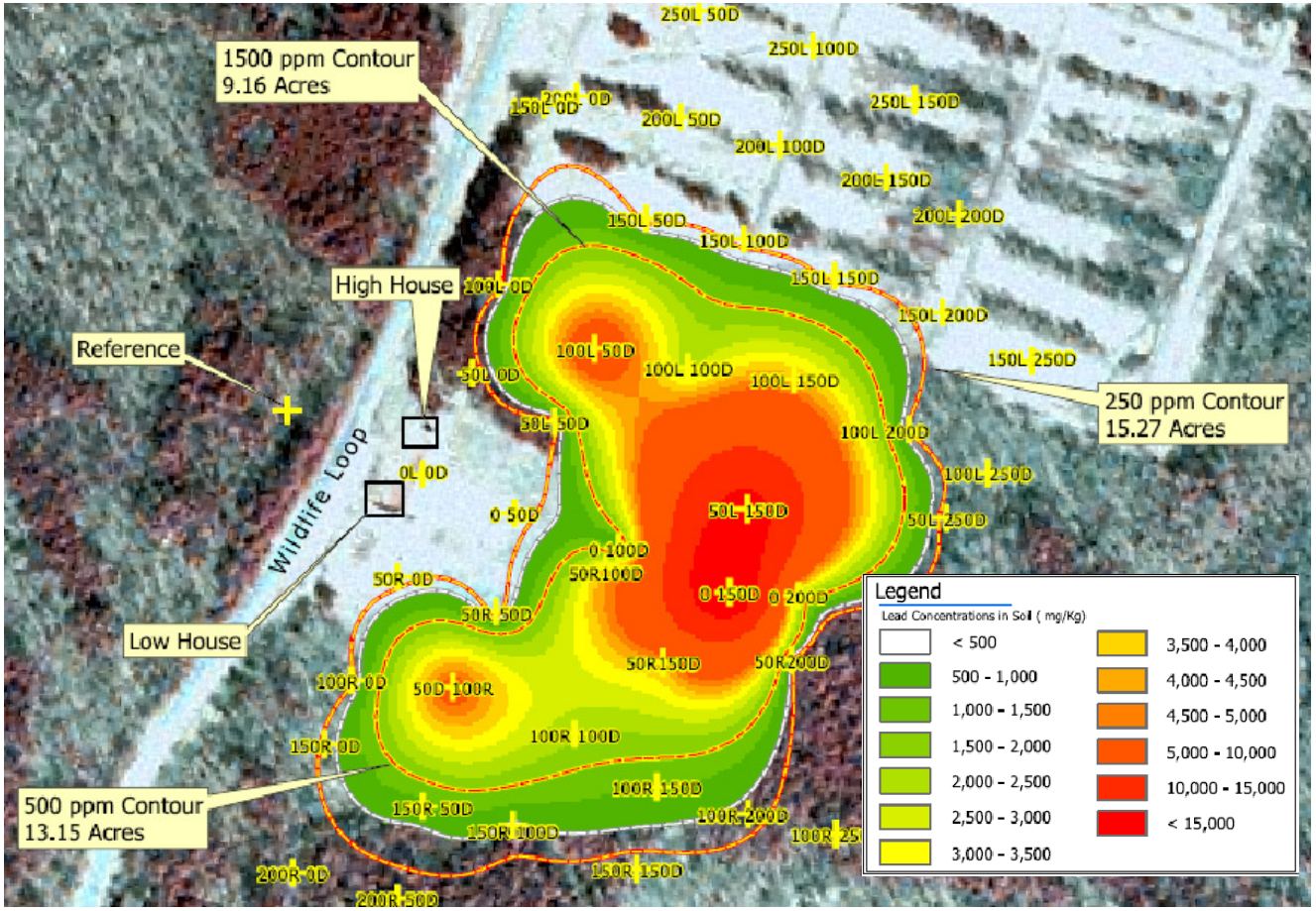
Site Configuration



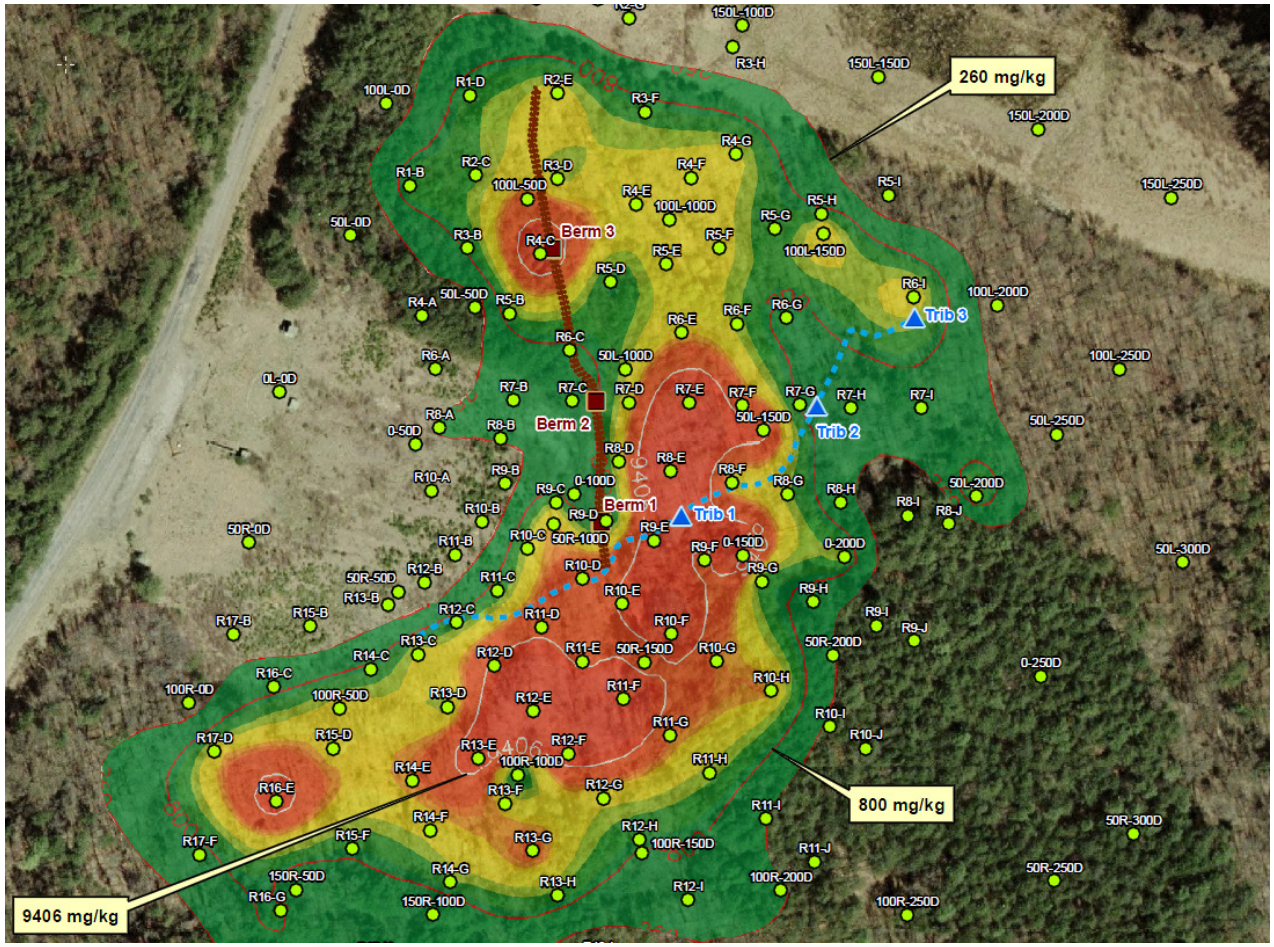
T&S Investigative History

- EPA & USFWS (2004)
  - Primarily metals and Polycyclic Aromatic Hydrocarbons (PAHs)
- URS (2010)
  - Lead, arsenic, antimony and lead shot
- MDE (2010) requested expanded investigation
  - Nitroglycerin (NG) and PAHs
- URS (March, 2014)
  - Draft Final RF/FS addressing metals, NG and PAHs

EPA & USFWS (2004) Lead Findings



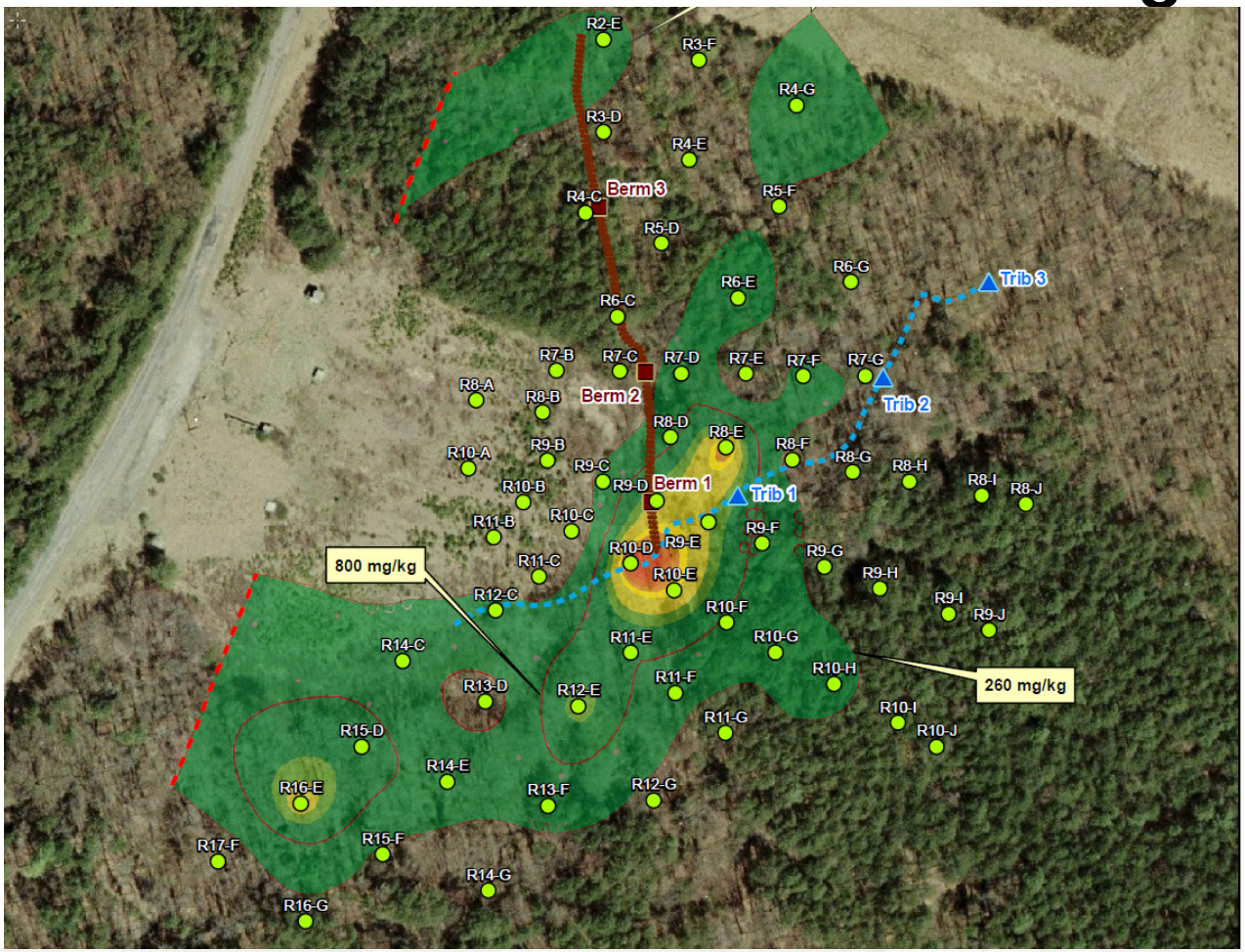
URS (2010)
Lead: 0 to 3 Inches bgs



Soil Lead Concentrations (mg/kg)

- >9,406
- 5,000–9,406
- 4,500–5,000
- 4,000–4,500
- 3,500–4,000
- 3,000–3,500
- 2,500–3,000
- 2,000–2,500
- 1,500–2,000
- 1,000–1,500
- 260–1,000
- 0–260

URS (2010)
Lead: 3 to 6 Inches bgs



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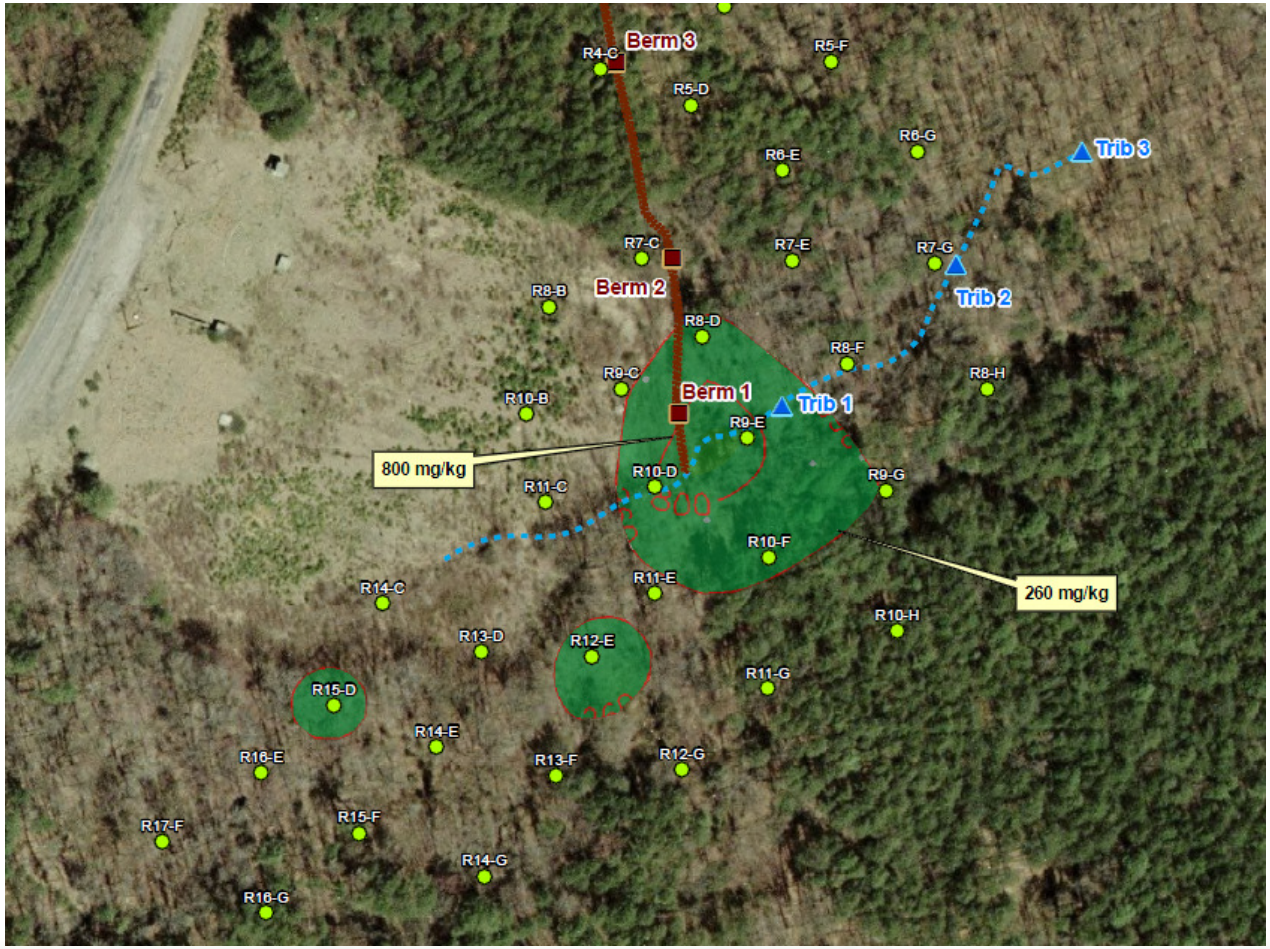
URS (2010)
Lead: 6 to 12 Inches bgs



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- 0-260

URS (2010)
Lead: 9 to 12 Inches bgs

Soil Lead Concentrations (mg/kg)

- >9,406
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- 4,500–5,000
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- 2,000–2,500
- 1,500–2,000
- 1,000–1,500
- 260-1,000
- 0-260

URS PAHs and NG Investigation

- Followed the Incremental Sampling Methodology (ISM)

ISM

- ISM is a structured composite sampling AND processing protocol that reduces that reduces data variability and provides a reasonably unbiased estimate of mean contaminant concentrations in a volume of soil targeted for sampling.
- ISM provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil (typically 30–100 increments) that are combined, processed, and subsampled according to specific protocols.

ITRC, 2012. Technical and Regulatory Guidance, Incremental Sampling Methodology.

ISM

- Is ISM always necessary?
  - No
  - i.e., for a homogenously distributed parameter a single discrete sample may suffice
- Does ISM always produce better results?
  - No, such as when:
  - A ‘hot spot’ drives unnecessary remediation
  - A ‘hot spot’ is missed

Hot Spot Drives Unnecessary Remediation

DU with 64 Increments

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

Hypothetical results:

- Mean Soil Arsenic Concentration: 326 mg/kg
- Risk exceeds 1E-04
- Decision: Remediate DU
- Oops: About 94 percent of the DU is actually uncontaminated

URS

ARMY STRONG.

Missed Hot Spot

DU with 64 Increments

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

Hypothetical results:

- Mean Soil Arsenic Concentration: 1.5 mg/kg
- Risk less than 1E-06
- Decision: Do not remediate DU
- Oops: Red increment locations are very contaminated

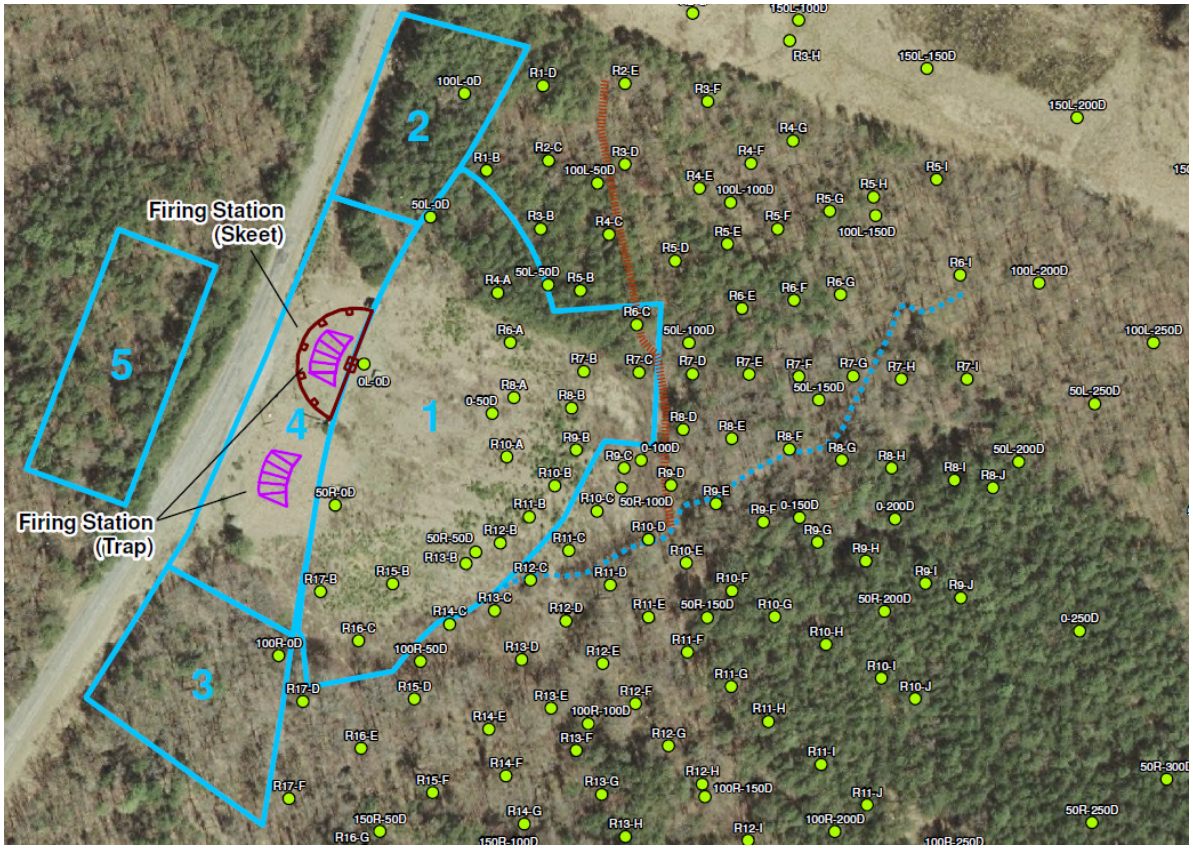
Why ISM for T&S PAHs and NG?

- To better estimate the mean PAH concentrations associated with the ‘chunky’ heterogeneous PAH distribution
- To fulfill the expectation that munitions constituents (MC) such as NG are best assessed by ISM
- To reduce analytical costs
- *Good apriori knowledge of PAH and NG contamination locations, which is necessary to appropriately define the DUs.

Apriori Knowledge of Contamination Locations at T&S

- Visual Clues:
  - PAHs: Target Fragments
  - NG: Concrete Walkways at Firing Points Where NG Released
- Historic Operational Information
  - Shotgun firing and target throwing at trap and skeet ranges follows well-defined rules

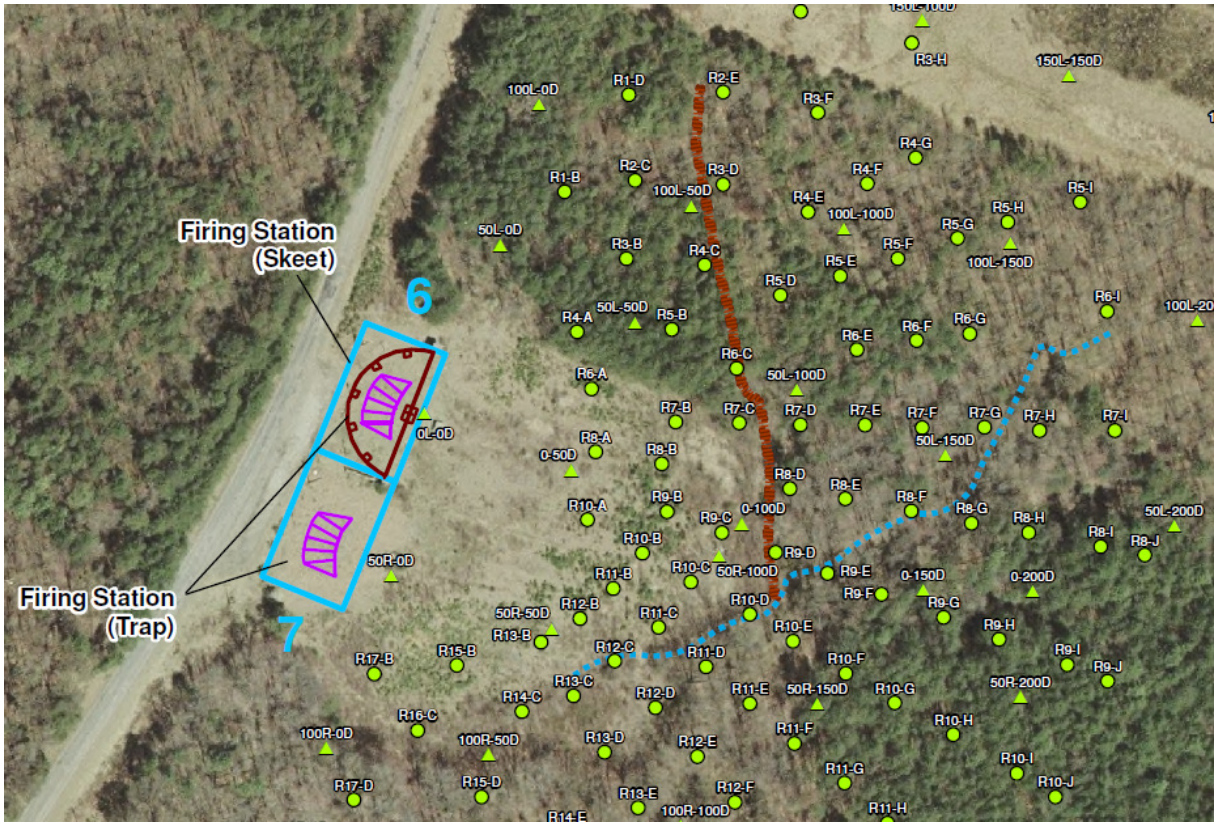
PAH DUs at T&S



DU1: H_0: Contaminated
DU2: H_0: Not Contaminated
DU3: H_0: Not Contaminated
DU4: H_0: Contaminated
DU5: H_0: Contaminated

H_0: Null Hypothesis

NG DUs at T&S

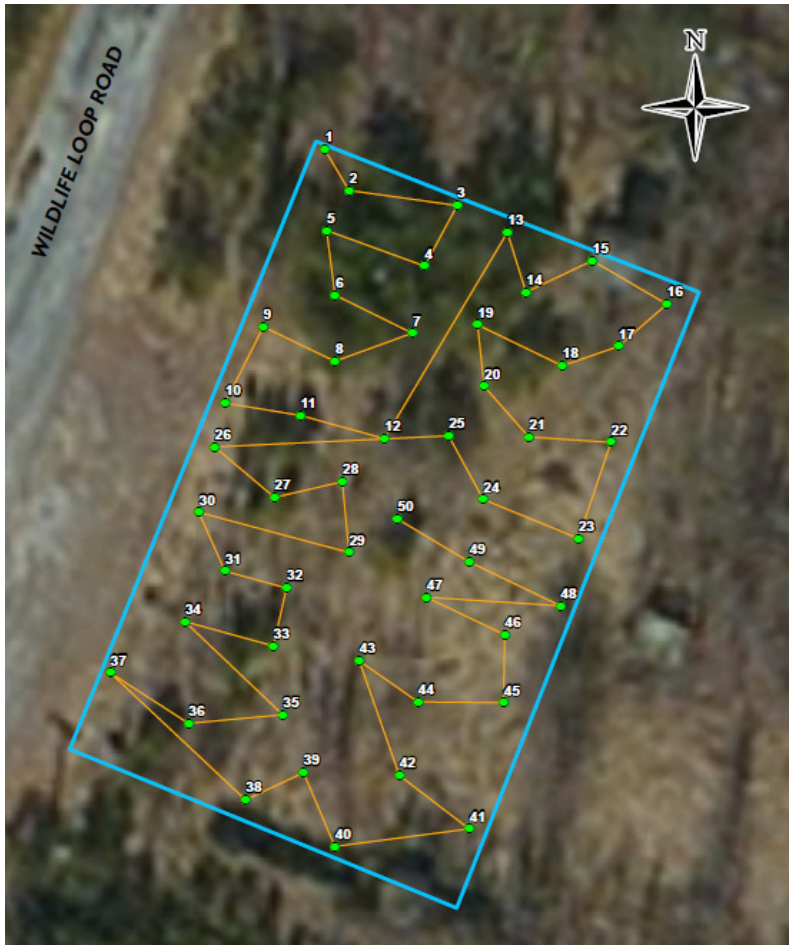


DU6: H_0: Most likely area of contamination but probably not contaminated

DU7: H_0: Most likely area of contamination but probably not contaminated

H_0: Null Hypothesis

DU6 Increments Locations



- The increments collection was similar for all of the other DUs

T&S Increments

DU	Interval (inches bgs)	Grand Total		
		Increments	Replicates (a)	Total Increments
1 (PAHs)	0-6	50	3	150
1 (PAHs)	6-12	50	3	150
2 (PAHs)	0-6	50	3	150
3 (PAHs)	0-6	50	3	150
4 (PAHs)	0-6	50	3	150
5 (PAHs)	0-6	50	3	150
6 (NG)	0-6	50	1	50
7 (NG)	0-6	50	1	50
		TOTAL:	**20**	**1000**

(a) Laboratory will produce a result for each replicate.

Laboratory Soil Sample Handling

- Air dried
- Sieved (2mm openings)
- Passing material ground in puck mill to pass 0.25mm
- Pulsed mill operation and temperature monitoring to minimize volatilization
- 30 increments of pulverized fraction collected for extraction/analysis

Soil Sample Analysis

- PAHs: Sample Method 8270C SIM
  - Sample is extracted and analyzed using gas chromatography/mass spectrometry (GC/MS) in the selective ion monitoring (SIM) mode
- Nitroglycerin: Sample Method 8330B
  - Sample is extracted and analyzed using high pressure liquid chromatography/ultraviolet (HPLC/UV) or HPLC/Mass Spectrometry (MS)

NG ISM Laboratory Results

Decision Unit / Interval	NG Concentration (mg/kg)
DU 6 (0 to 6")	4.8
DU 7 (0 to 6")	3.8

PAH ISM Laboratory Results

Decision Unit / Interval	PAH (total) Concentration (mg/kg)		
	Replicate A	Replicate B	Replicate C
DU 1 (0 to 6")	92	339	380
DU 1 (6 to 12")	27	54	48
DU 2 (0 to 6")	0.1	0.2	0.1
DU 3 (0 to 6")	0.4	0.2	0.2
DU 4 (0 to 6")	22	653	25
DU 5 (0 to 6")	0.3	0.2	0.2

Questions?

Army Points of Contact

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