The Changing Landscape of Chemical Toxicity Values and Possible Impacts to DoD Legacy Site Cleanup

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Emerging Contaminants (ECs)

- Are chemicals or materials of interest that are characterized by:
  - a perceived or real threat to human health or environment, and
  - there is no currently published health standard or there is an existing health standard, but *the standard is evolving or being re-evaluated*.

Source: "Initiation of Emerging Contaminants Characterization and Response Actions for Protection of Human Health" Issue Paper (ECOS & DoD Sustainability Workgroup, 2008)

DoD's Scan, Watch, Action Process: Identifying, Prioritizing & Pursuing Risk Management

Over -the- horizon

EC News

Review literature, periodicals, regulatory communications, etc.

Possible DoD impacts

Phase I Assessment

Monitor events; Conduct Phase I qualitative impact assessment; Manage obvious risks.

Probable high DoD impacts

Phase II Assessment

Conduct Phase II quantitative impact assessment; Develop & rank risk management options (RMOs); Implement approved RMOs; Track implementation and reduce high risks; Revisit list annually for risk reduction progress and triggers for listing

Risk Management Options to ECGC

Approved RMOs become Risk Management Actions (RMAs)

Trichloroethylene Final Sept. 2011

- Kidney cancer in workers basis of cancer toxicity values, adjusted to include liver and non-Hodgkins lymphoma
  - Mutagenic mode of action adjustment applicable only for kidney cancer
- Current drinking water regulation of 5 µg/L used for most cleanups

Risk-Based Screening Levels*		
	Res. Water (µg/L)	Air (µg/m^3)
Non-Cancer Hazard of 1	3.4	2
10^{-6} Cancer Risk	0.65	0.59

*Using EPA Regional Screening Level Calculator

Tetrachloroethylene

- 1998 initiated
- Nat'l Academy Review Feb 2006
- June 2008 external review version released
- If present, common source was dry cleaning facilities

Risk-Based Screening Levels*			
	Res. Soil (mg/kg)	Res. Water Use (µg/L)	Indoor Air (µg/m^3)
Current	0.55	0.11	0.41
New (draft '08)	0.293	0.179	0.122
Sources of current toxicity values include EPA IRIS, ATSDR and CalEPA. Lowest RSL target risk = 10^{-6}.			

*Using EPA Regional Screening Level Calculator

Other Chemicals of DoD Interest Undergoing IRIS Reassessment

- 1,4-Dioxane
- Dioxin
- RDX
- Arsenic
- Benzo(a)pyrene
- Relative potency factors for PAHs

Shooting Trap and Skeet as Gunnery Training Component

Students, Using Shotguns Specially Mounted on Turrets, Learn How to Operate the Turrets as they Fire at Clay Pigeons Released from 40-foot High Towers

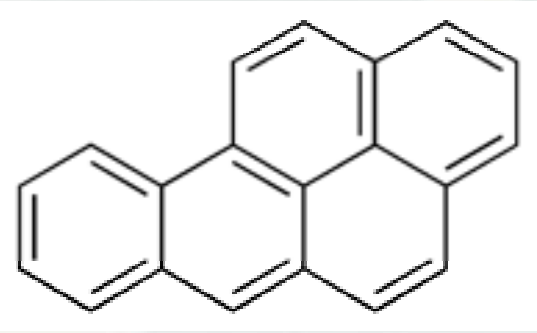
Photos provided by: Kingman Army Airfield Historical Society

Target Composition

- Clay and binder; ~30% composition is coal tar pitch especially during 1940s
  - ►Provided the right balance between surviving throw and shattering when hit with shot
- Less toxic and more degradable targets now being manufactured
  - ►Petroleum pitch, soy etc
    - PAHs ~ 75% lower in petroleum pitch than coal tar pitch

Coal Tar Pitch

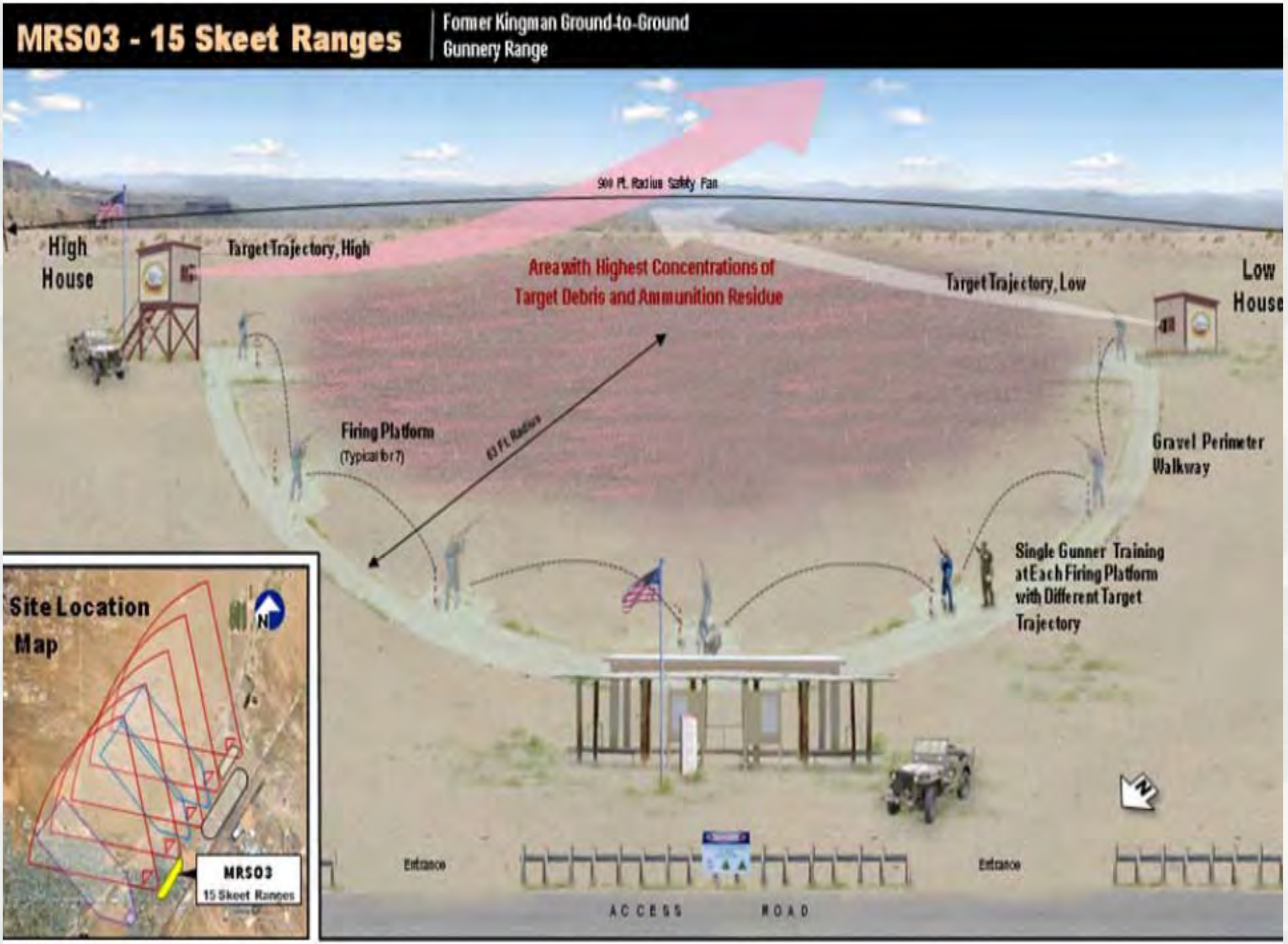
- Coal tar pitch is a complex mixture of organic compounds
- Polycyclic aromatic hydrocarbons (PAHs) chemical class of most concern due to toxicity
- Benzo(a)pyrene most studied
  - ►Carcinogen
- Low soil screening level; 15 µg/kg

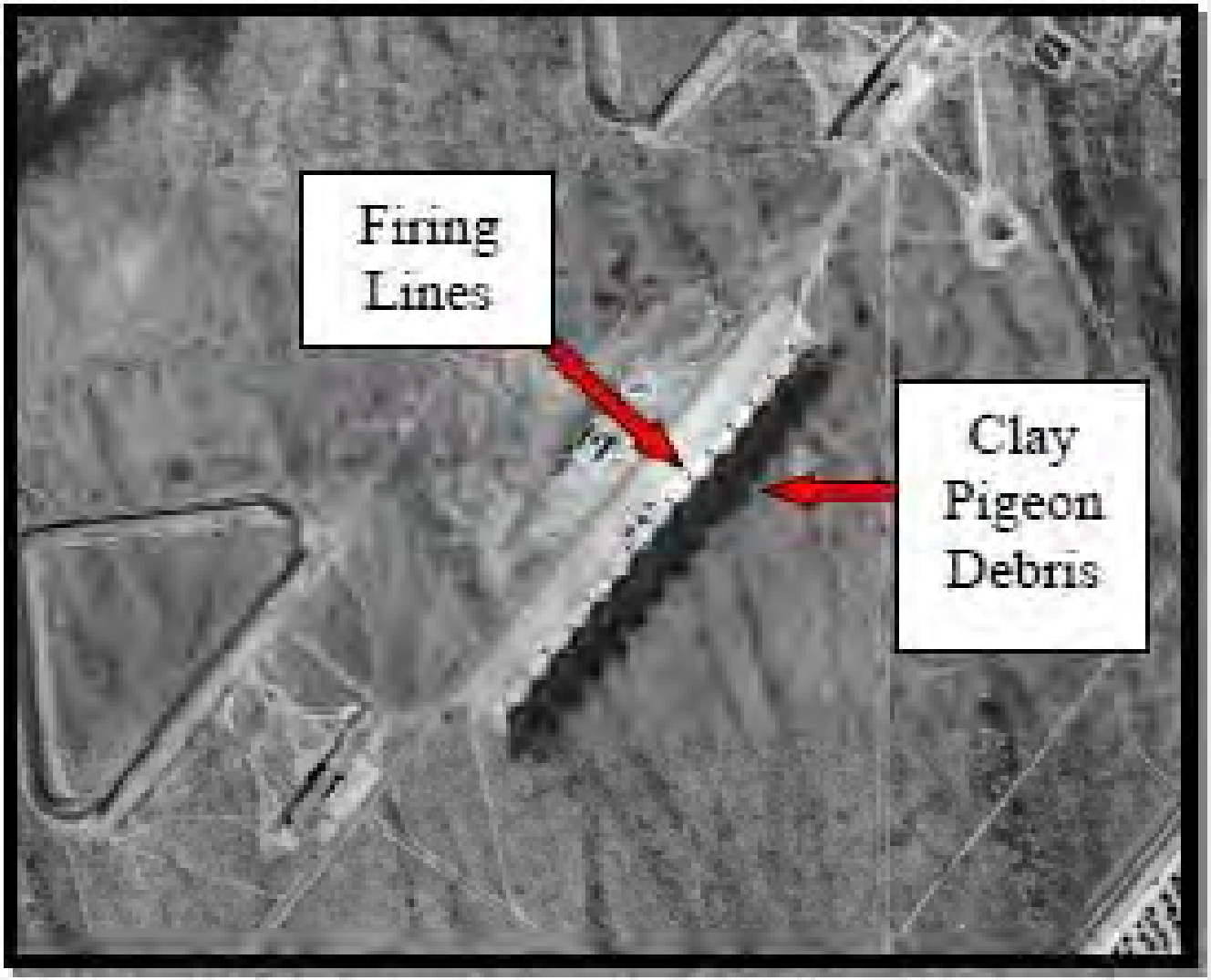


Source: EPA Regional Screening Level

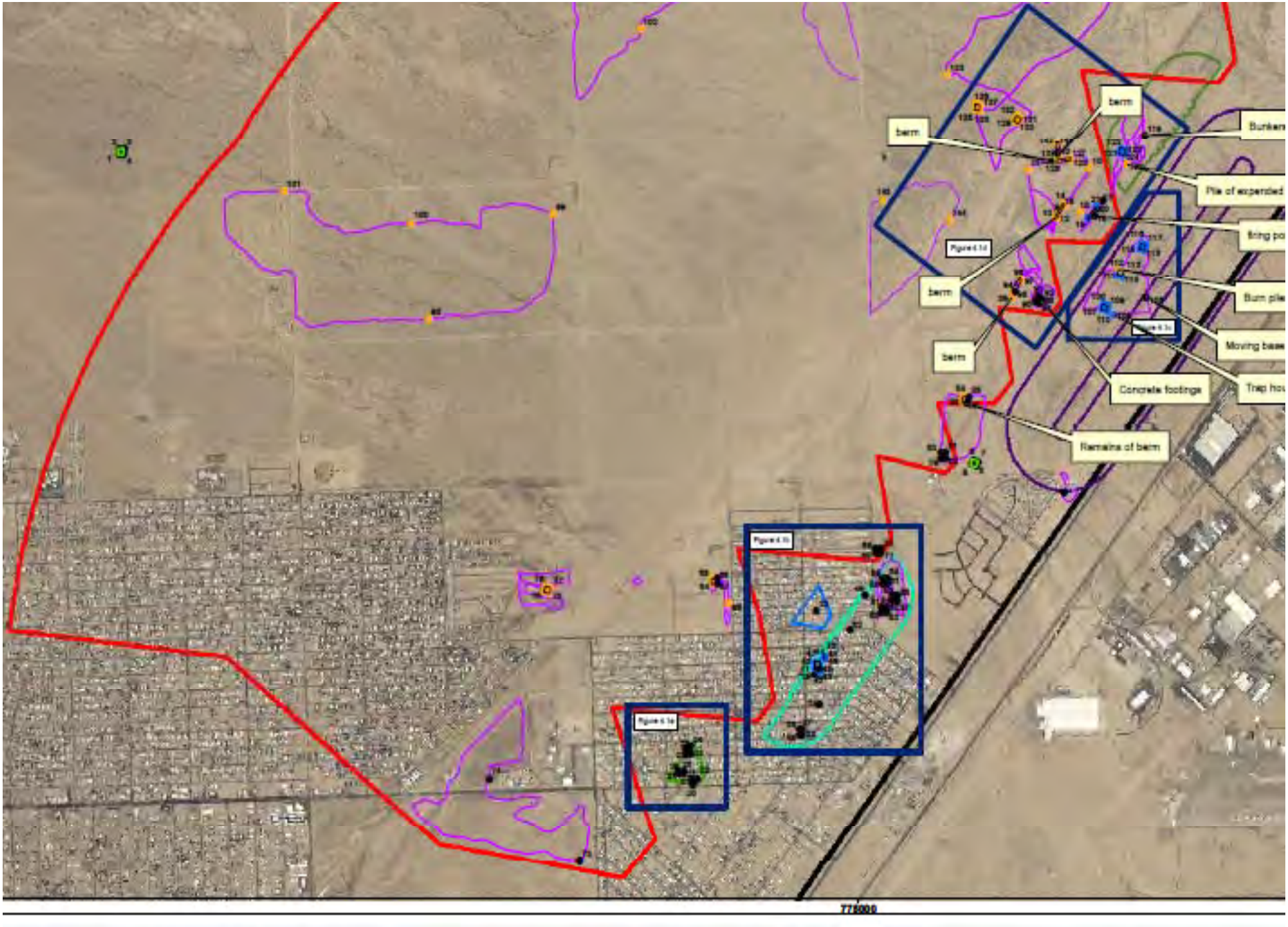
Investigation Strategies

- Conceptual Site Model – consider past and subsequent site use
- PAHs in clay pigeons not highly mobile
  - ▶ Soil/sediment will be media of primary concern
- Consider ambient sources
  - ▶ Roadways
  - ▶ Runoff from surface sealant
  - ▶ Forensics may add value at some sites


MRS03 - 15 Skeet Ranges
Former Kingman Ground-to-Ground Gunnery Range
900 Ft. Radius Safety Fan
High House
Target Trajectory, High
Area with Highest Concentrations of Target Debris and Ammunition Residue
Target Trajectory, Low
Low House
Firing Platform
(Typical for 7)
63 Ft. Radius
Gravel Perimeter Walkway
Single Gunner Training at Each Firing Platform with Different Target Trajectory
Site Location Map
N
MRS03
15 Skeet Ranges
Entrance
Entrance
ACCESS ROAD



1943 Aerial Photograph showing MRS03 – 15 Skeet Range


berm
berm
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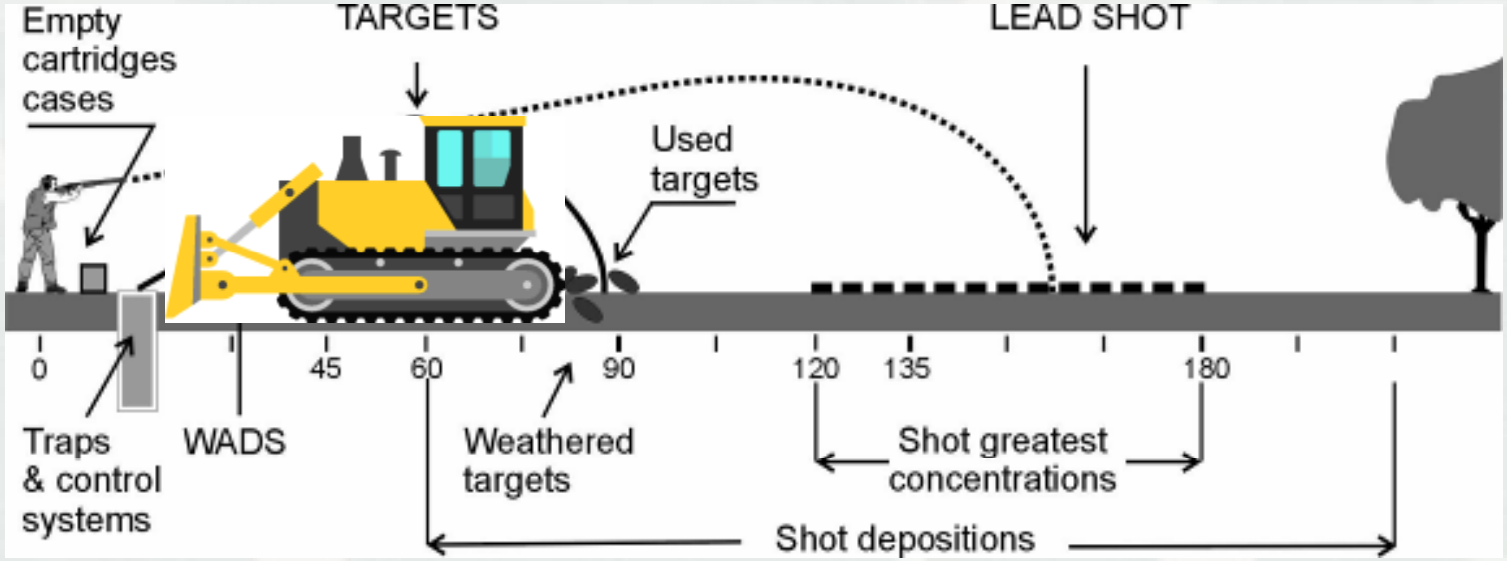
Concrete footings
Remains of berm
775000

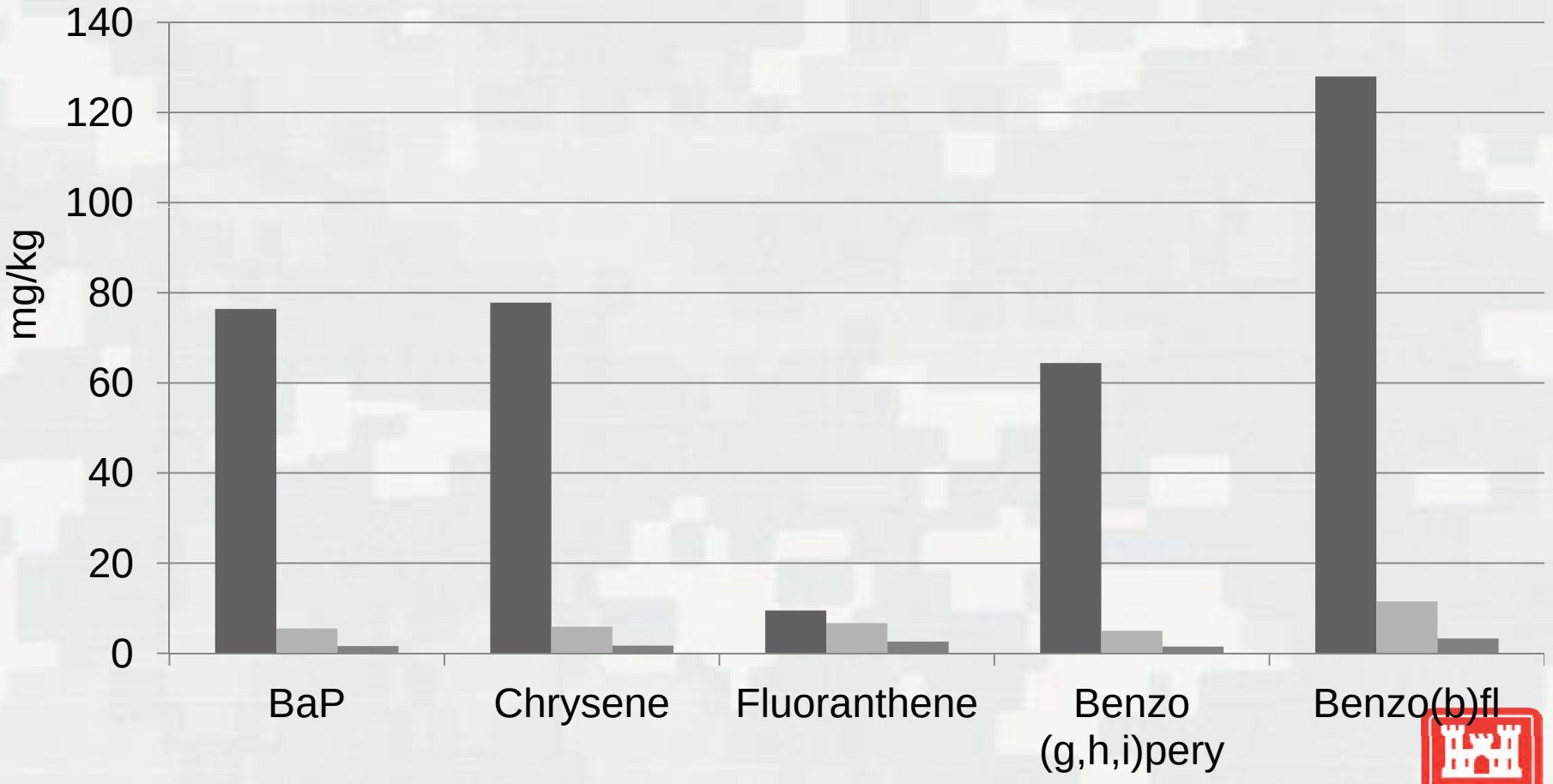
Conceptual Model (cont.)



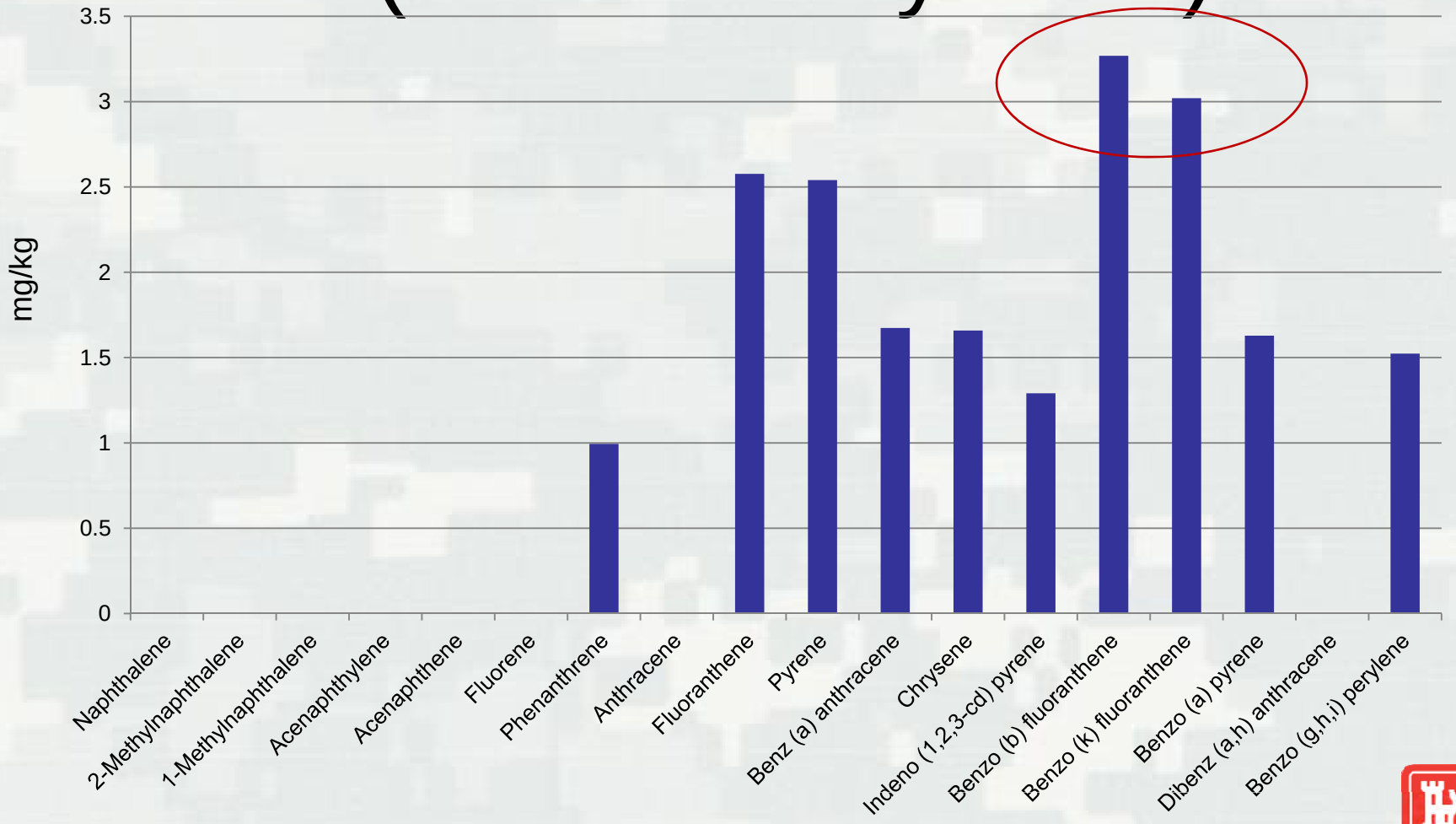
Flight paths of different materials resulting from clay target shooting (in meters, 1 m = 3.28 feet).

* ITRC, 2005

Select PAHs from Sampled Areas



Detected PAHs (Low Density Area)



Emerging Contaminant Issue

- Benzo(a)pyrene under reevaluation by EPA IRIS program
- Another EPA NCEA document: "Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures"
  - ►EPA Science Advisory Board review complete
  - ►RPF approach retained but updated by new data/science

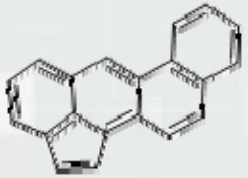
Carcinogenic PAHs and Relative Potency Factors

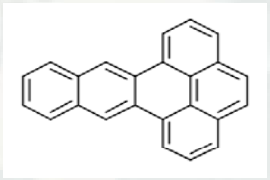
	Current RPF	Draft RPF	Δ
Benzo(a)pyrene	1	1	
Benz(a)anthracene	0.1	0.2	2x
Benzo(b)fluoranthene	0.1	0.8	8x
Benzo(k)Fluoranthene	0.01	0.03	3x
Chrysene	0.001	0.1	100x
Dibenz(a,h)anthracene	1	10	10x
Indeno(1,2,3-c,d)pyrene	0.1	0.07	

Additional PAHs from 2010 RPF Assessment

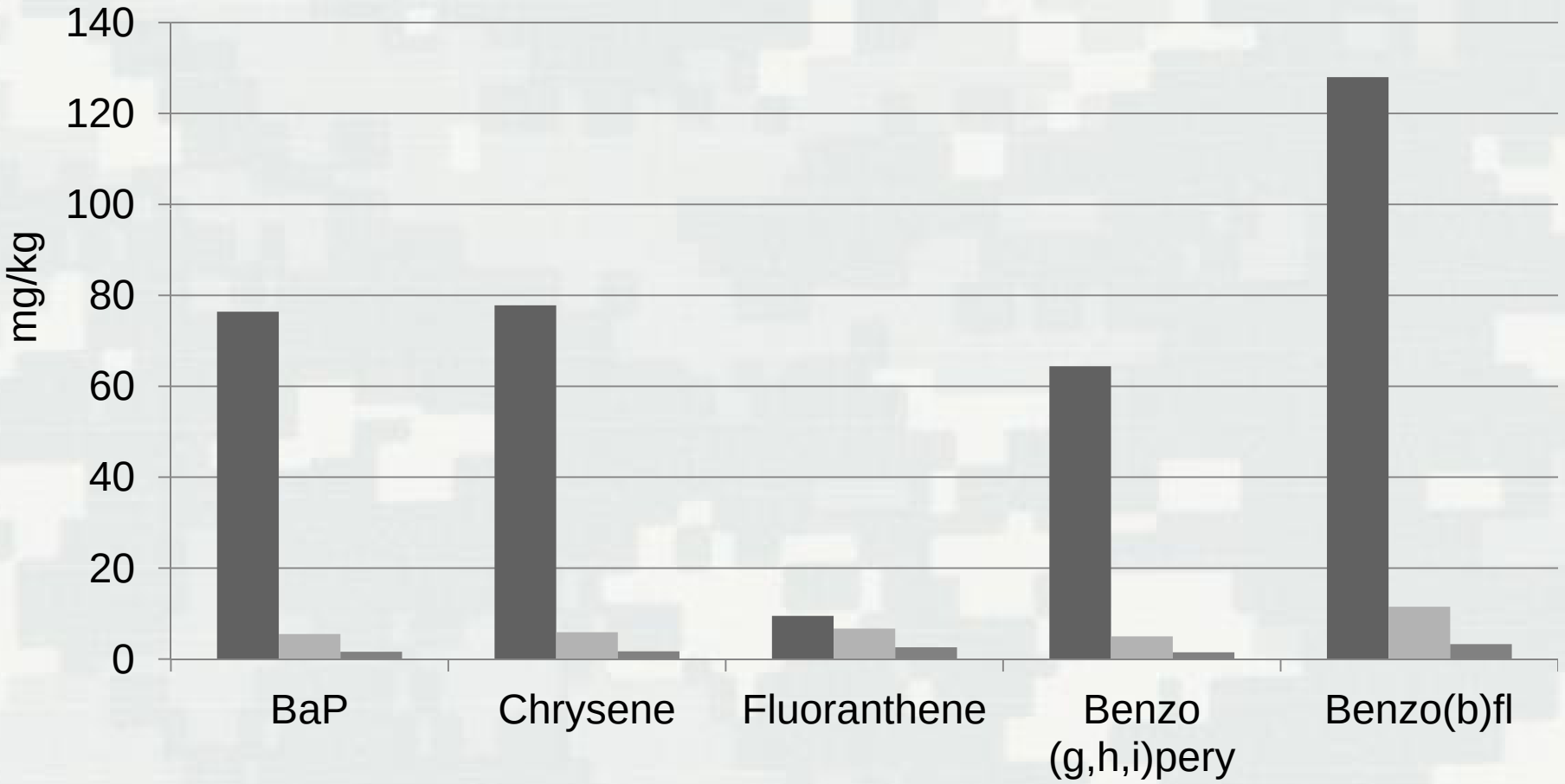
- Anthanthrene
- Benzo[g,h,i]perylene
- Benzo[j]fluoranthene
- Cyclopenta[c,d]pyrene
- Dibenzo[a,e]fluoranthene
- Dibenzo[a,e]pyrene
- Dibenzo[a,h]pyrene
- Dibenzo[a,i]pyrene
- Dibenzo[a,l]pyrene
- Fluoranthene

- Benz[b,c]aceanthrylene
- Benz[e]aceanthrylene
- Benz[j]aceanthrylene (60x)
- Benz[l]aceanthrylene
- Cyclopenta[d,e,f]chrysene
- Naphtho[2,3-e]pyrene





Select PAHs from Sampled Areas

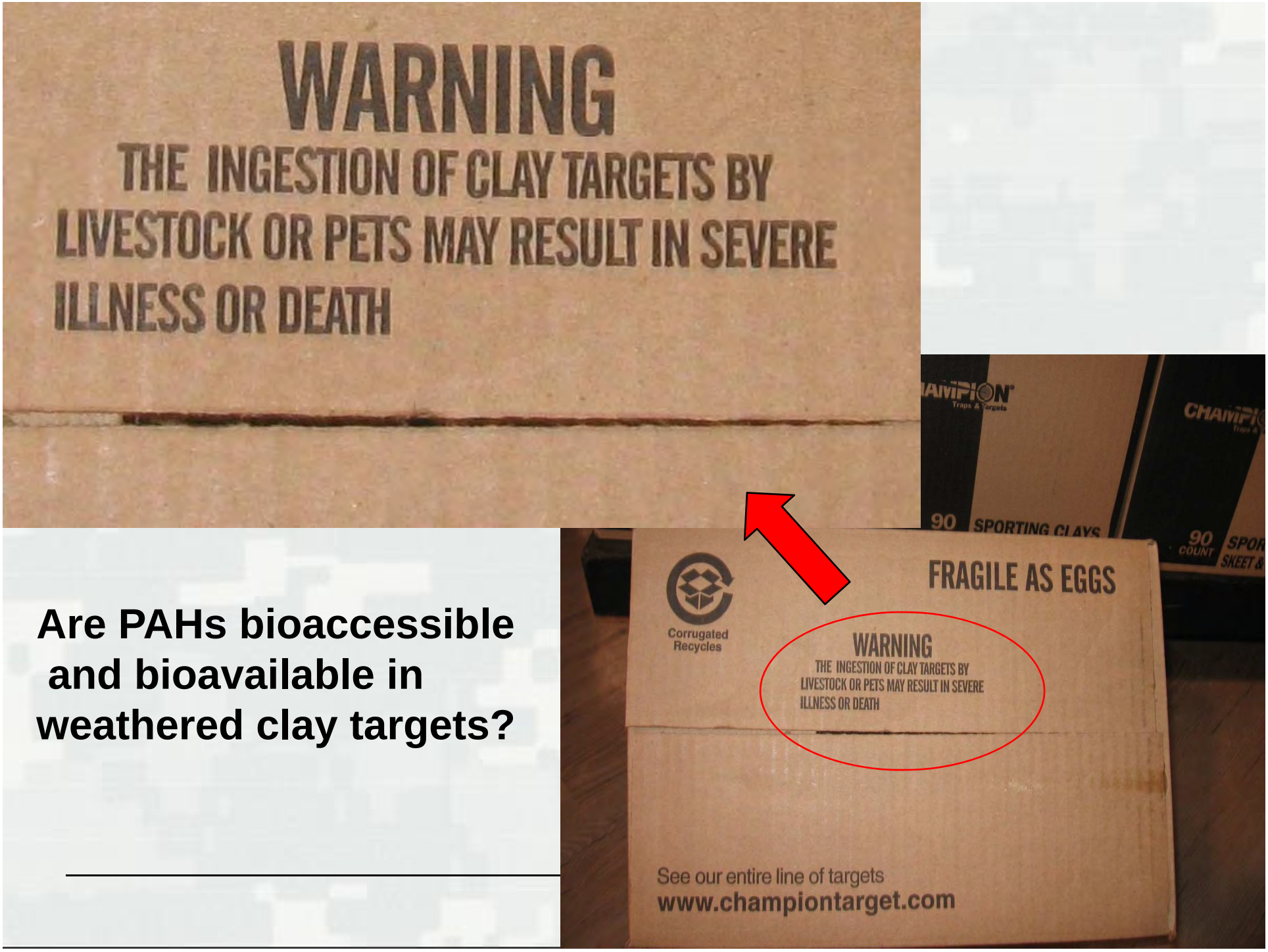


Potential Impacts

Analyte	High	Med	Low	Current RSL	Draft RSL	10^{-4} RSL	Bkg
BaP	76.4	5.5	1.6	0.015	0.015	1.5	0.014
Chrysene	77.8	5.9	1.7	15	0.15	15	0.012
Fluoran-thene	9.5	6.7	2.6		0.188	18.8	0.018
Benzo-(g,h,i)per ylene	64.4	5	1.5		1.67	167	0.032
Benzo(b) fluoran-thene	128	11.5	3.3	0.15	0.019	1.9	0.027

Investigation Strategies

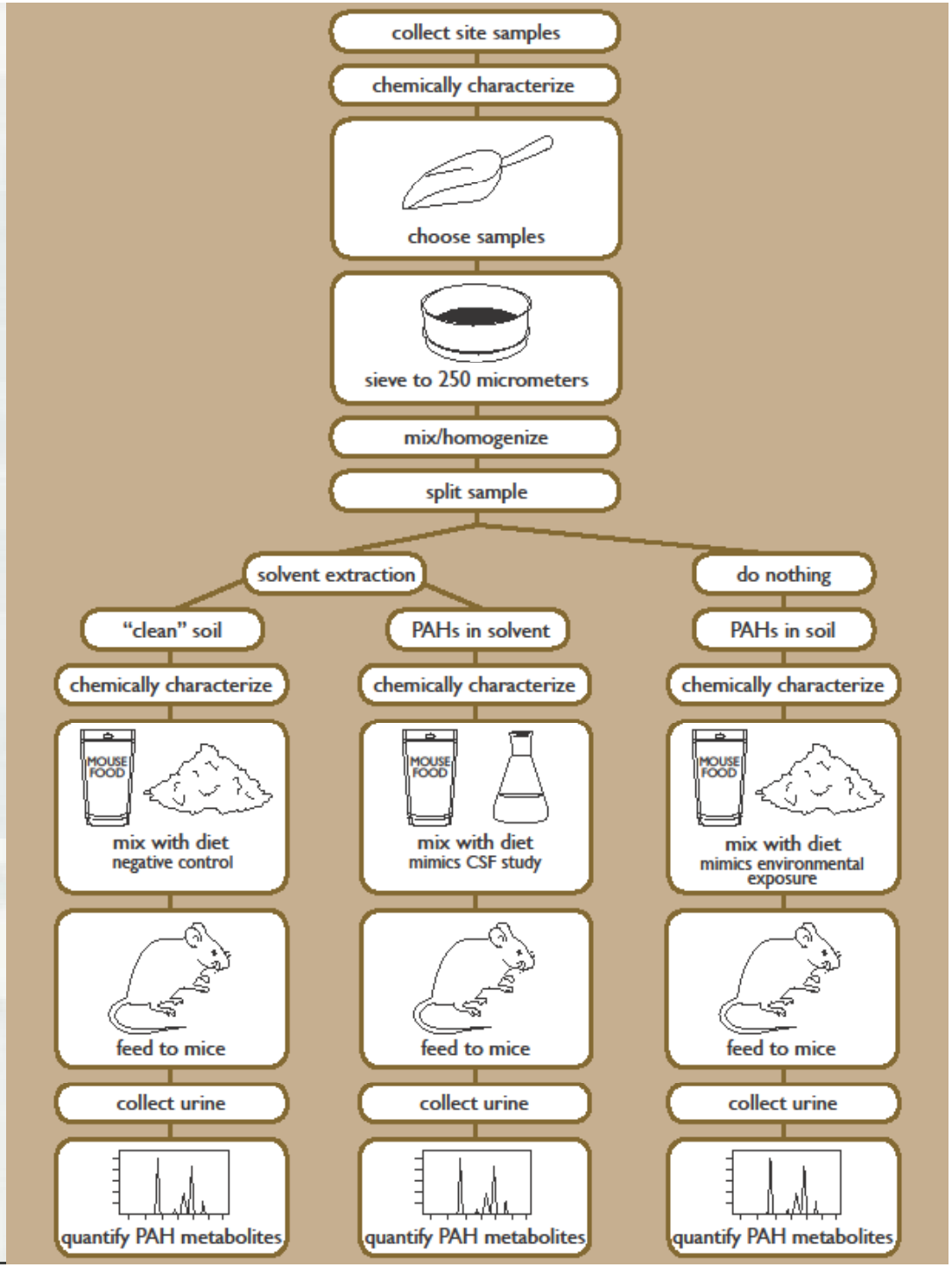
- Reduce uncertainty in CSM and in risk assessment; better informed decisions
  - Location/ size of fragments? Likelihood of exposure?
  - Are risk assessment assumptions valid and representative of exposure?
  - Fragment size
  - Relative bioavailability



Are PAHs bioaccessible and bioavailable in weathered clay targets?

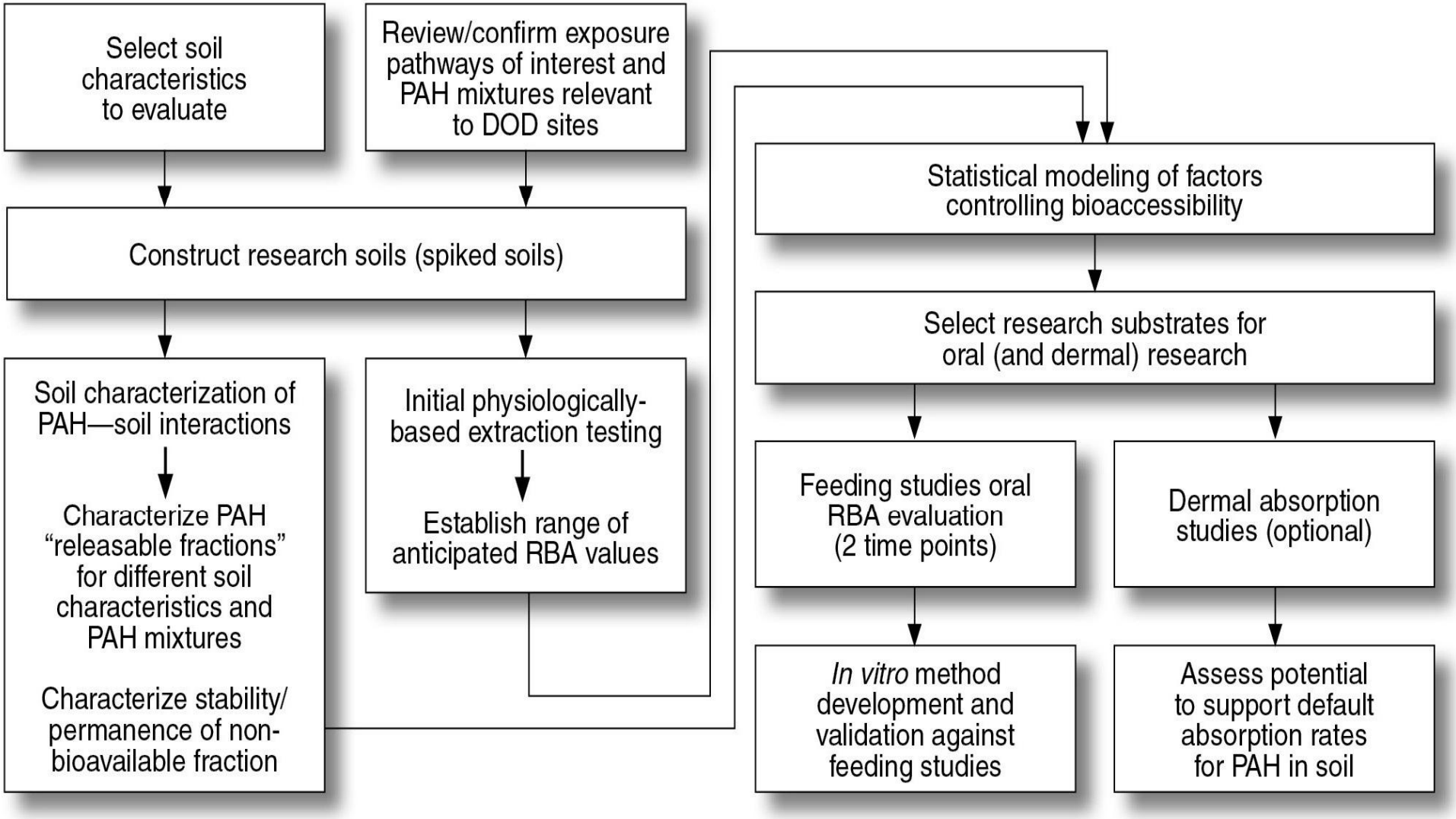
Risk Management Strategies

- Draft plan for relative bioavailability study planned for Formerly Used Defense Site in TX



DoD Funded Project

PAH Bioavailability from Soils—Schematic of Project Tasks



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