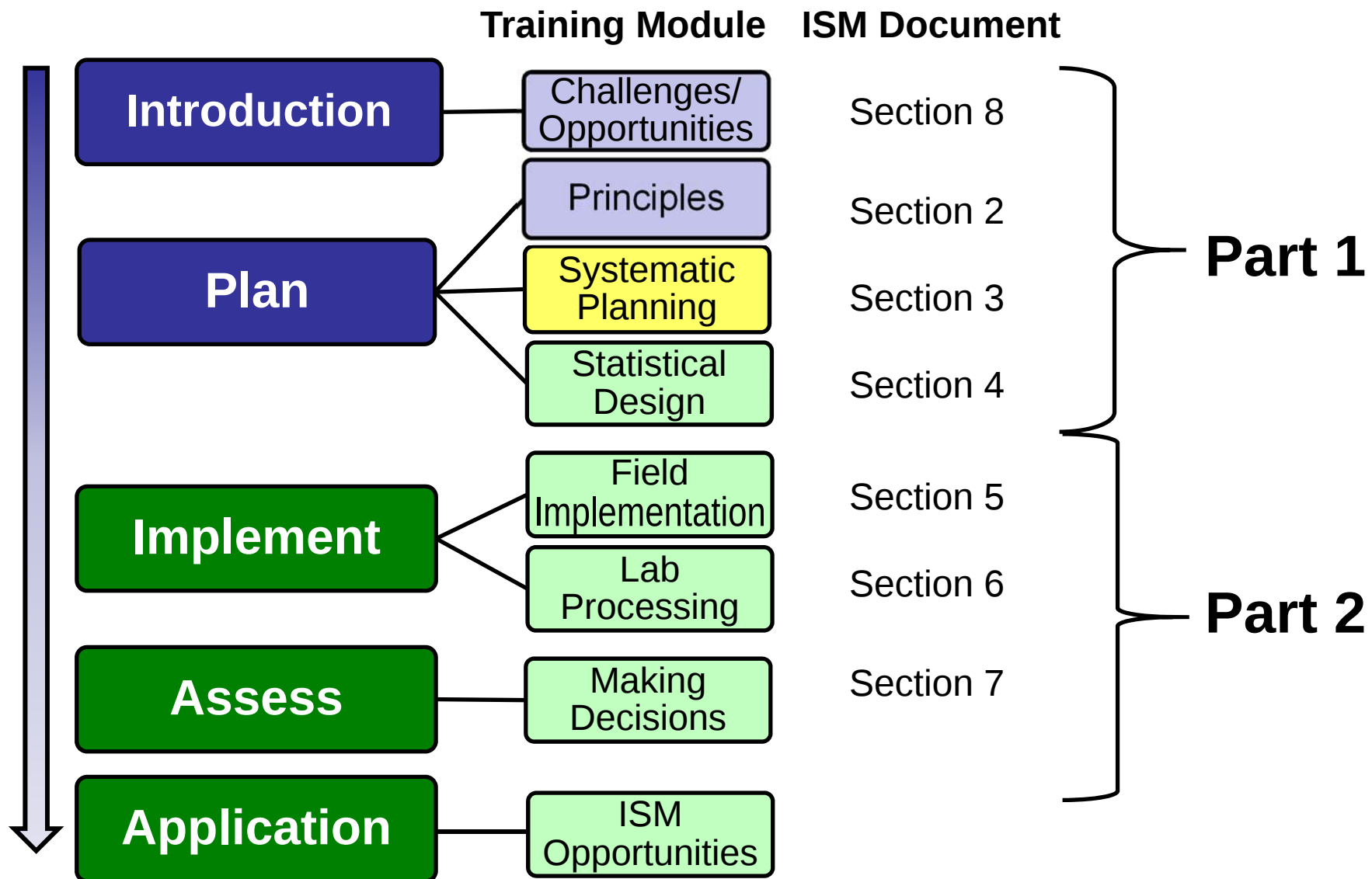


ISM Document and Training Roadmap

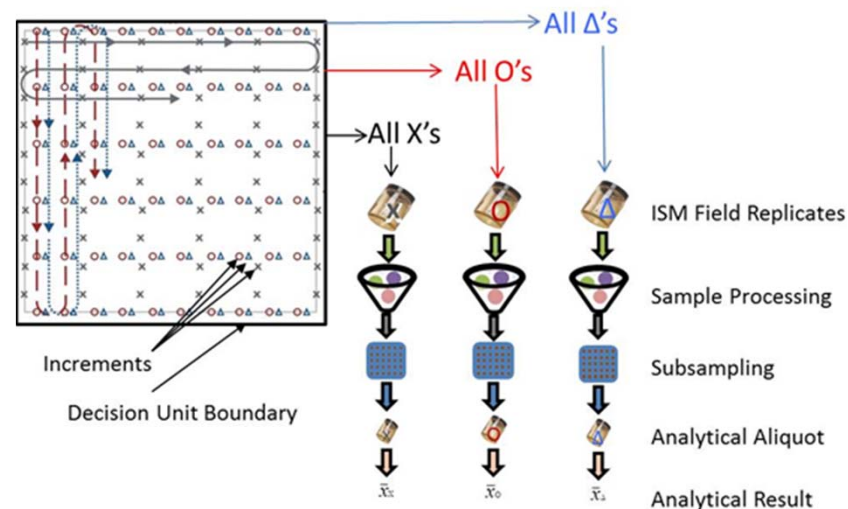


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Systematic Planning Learning Objectives

Learn how to:

- ▶ Conduct systematic planning steps important to ISM
 - Conceptual Site Model (CSM)
 - Risk pathways and contaminants of concern
 - Project objectives (Sampling and Data Quality Objectives (DOQs))
- ▶ Determine Decision Units (DUs)
 - Information used to develop DUs
 - Why DUs are important
 - Types of DUs
 - Real world examples (i.e., case studies)



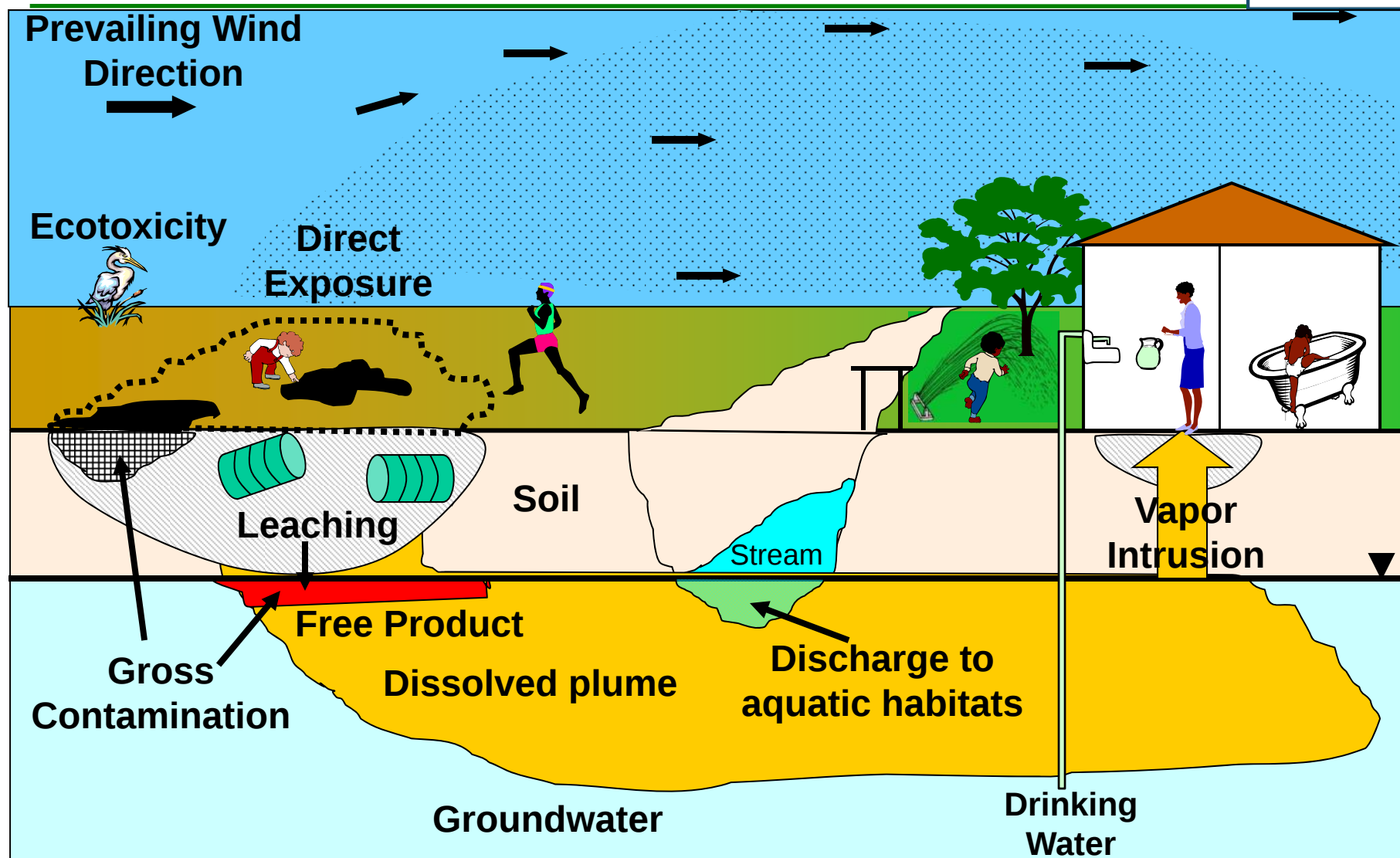
No Data Quality Objective (DQO)/Decision Units? **Bad Data!**

- ▶ Designating Decision Units (DUs) – arguably most important aspect of ISM from a regulatory perspective
 - Selection of DUs determines
 - Where samples are being collected
 - How many
 - DU selection determines whether the data are able to satisfy the project objectives, both sampling objectives and data quality objectives

Systematic Planning and Implementation

- ▶ Develop Conceptual Site Model (CSM)
- ▶ Identify contaminants and project objectives
- ▶ Identify data needed and how it will be used
- ▶ **Define Decision Units (DUs)** Key Step of ISM
- ▶ Develop decision statements
- ▶ Collect samples to characterize DUs
- ▶ Evaluate data

Conceptual Site Model (CSM)



Data/Information Needs

- ▶ What receptors and pathways are being evaluated?
- ▶ What are your sampling objectives?
- ▶ Are there multiple sampling objectives that must be met?
- ▶ What is the scale of decision making?
- ▶ What population parameter is of interest?

***The key is the volume over which
the mean should be estimated.***

Example Sampling Objectives

- ▶ Estimate the mean concentration of contaminants in a pre-determined volume of soil (i.e., DU)
- ▶ Delineate the extent of contamination above screening levels
- ▶ Estimate the potential risk to receptors posed by the soil contamination
- ▶ Evaluate background metals concentrations in soil
- ▶ Confirmation sampling following remediation

Designating Decision Units (DUs)

- ▶ Information used to develop DUs
- ▶ Why DUs are so important
- ▶ Types of DUs
- ▶ Examples



Stakeholder Agreement

Decision Units (DUs)

The volume of soil where samples are to be collected and decisions made based on the resulting data.

Source Areas

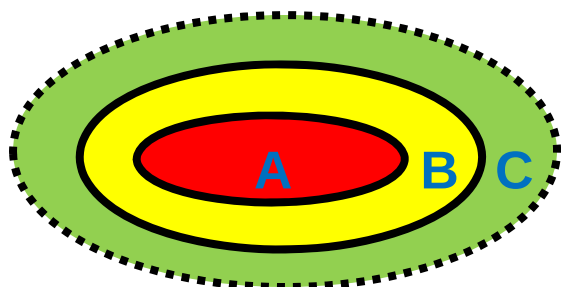


Exposure Areas



Size, shape and type of DU are an outcome of systematic planning and depend on site specific data quality objectives.

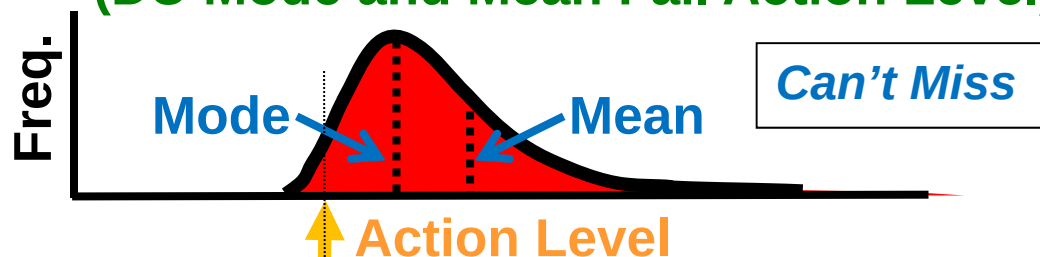
Why ISM Is Important



Example Soil Plume Map

Concentrations can vary several orders of magnitude within a DU at the scale of a discrete sample

Area A. Heavy Contamination
(DU Mode and Mean Fail Action Level)



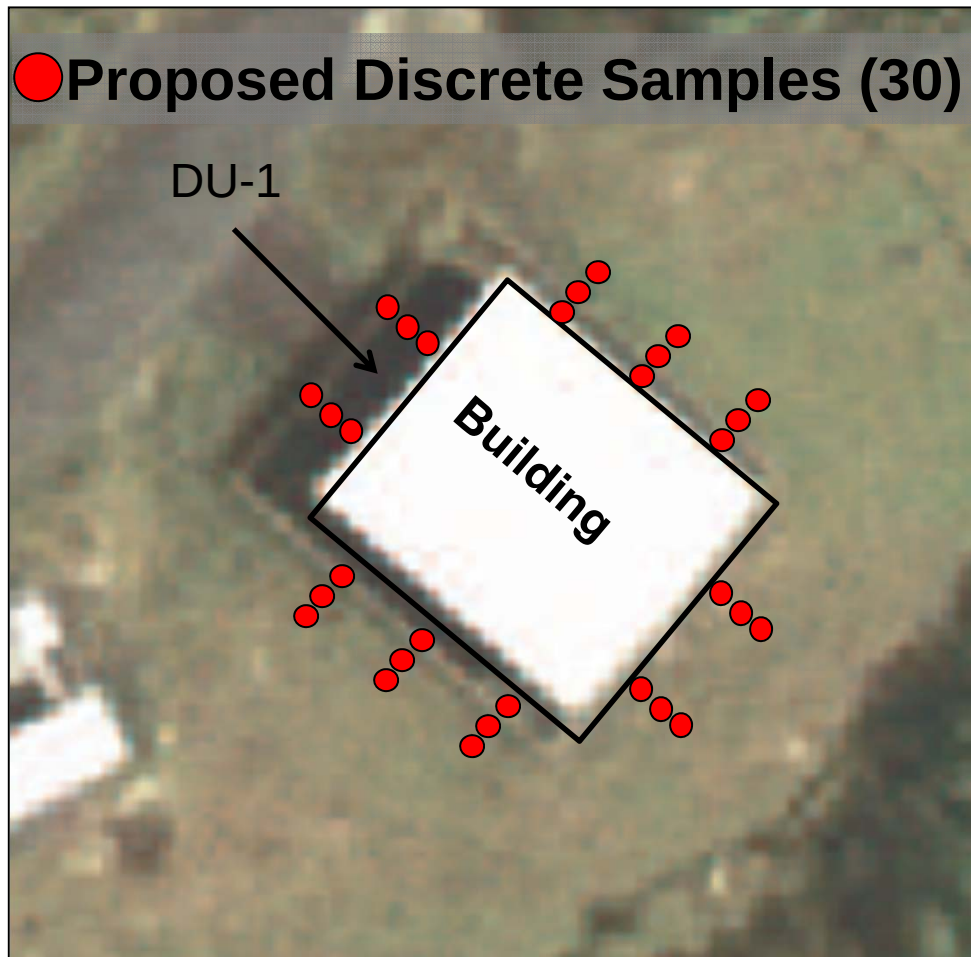
Area B. Moderate Contamination
(DU Mean Fails Action Level)



Area C. Low Contamination
(DU Mode and Mean Pass Action Level)



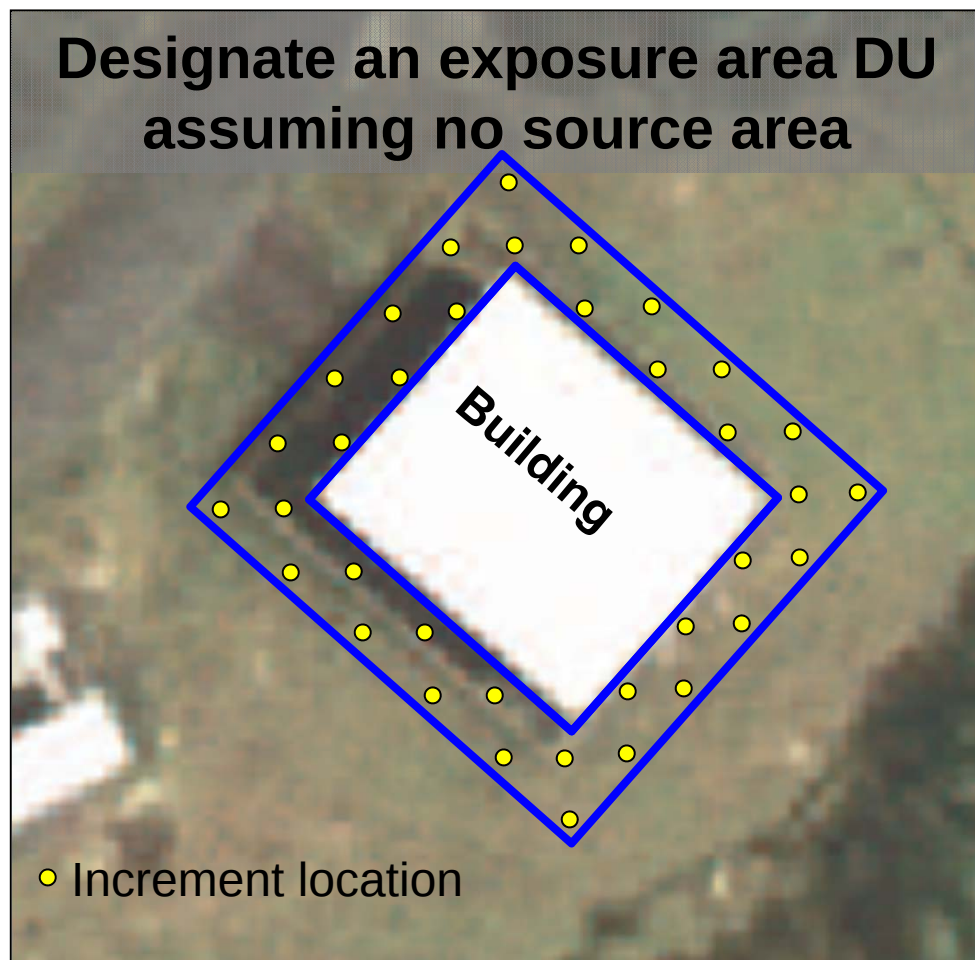
Traditional Site Investigation Approach



► Potential Concerns

- Inadequate number of sample points to define outward boundaries
- High risk of False Negatives and False Positives
- Confusion over single point “hot spots”
- Cost of 30 analyses
- Sample points should be randomly located for estimation of exposure point concentration (EPC)

ISM Approach (Option 1)



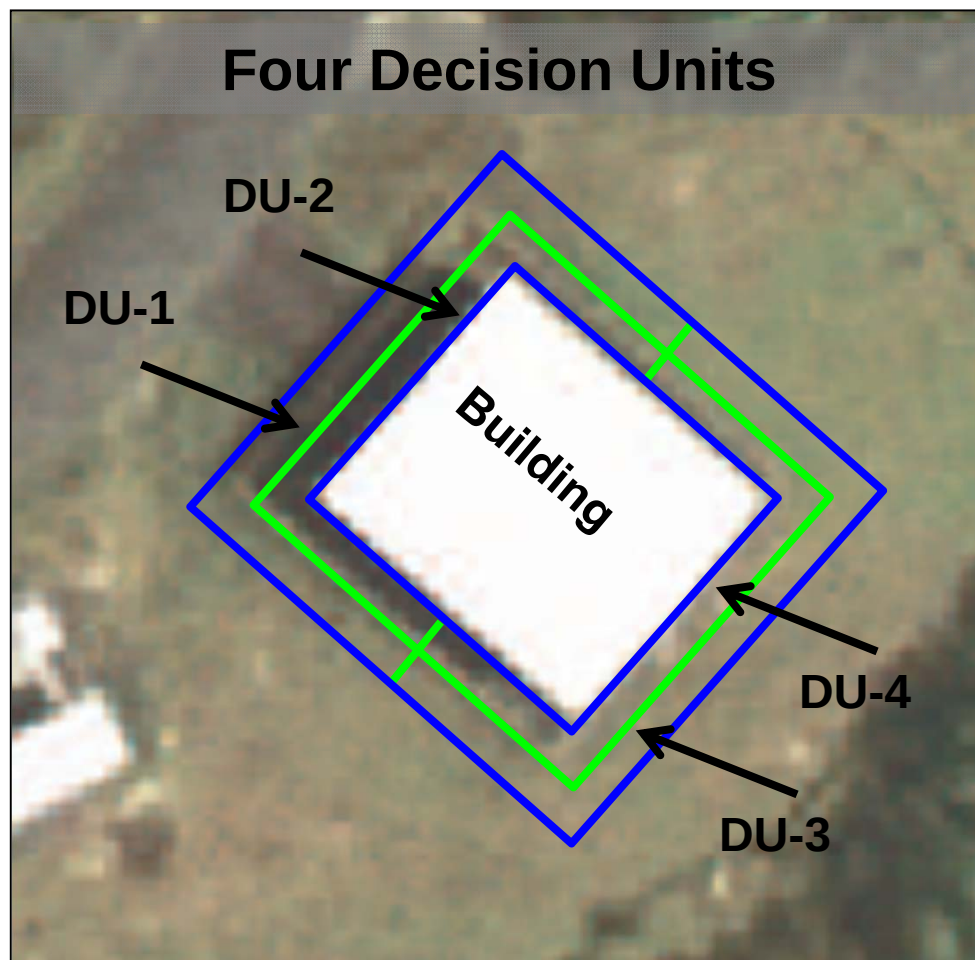
► Advantages

- More representative
- Risk evaluation objective identified up front
- Increments randomly and evenly spaced to minimize size of hot spot missed
- Quick and cheap if minimal contamination suspected

► Disadvantages

- Additional sampling required if DU fails

ISM Approach (Option 2)



► Advantages

- Addresses both source area and perimeter as well as directional variability if an exceedance is found
- Best approach to minimize additional sampling
- Will minimize remediation volumes if DU exceeds screening level
- If increments are collected using cores, vertical delineation is easily done with stacked DUs

Suspected Lead Paint and Pesticides Around House and in Yard



Source Area DU:
perimeter of
house

**Exposure Area
DU:** remainder
of the yard

Do lead or pesticides exceed action levels around the house or in the yard?

15

Former Pesticide Mixing Area (0.5 acres)

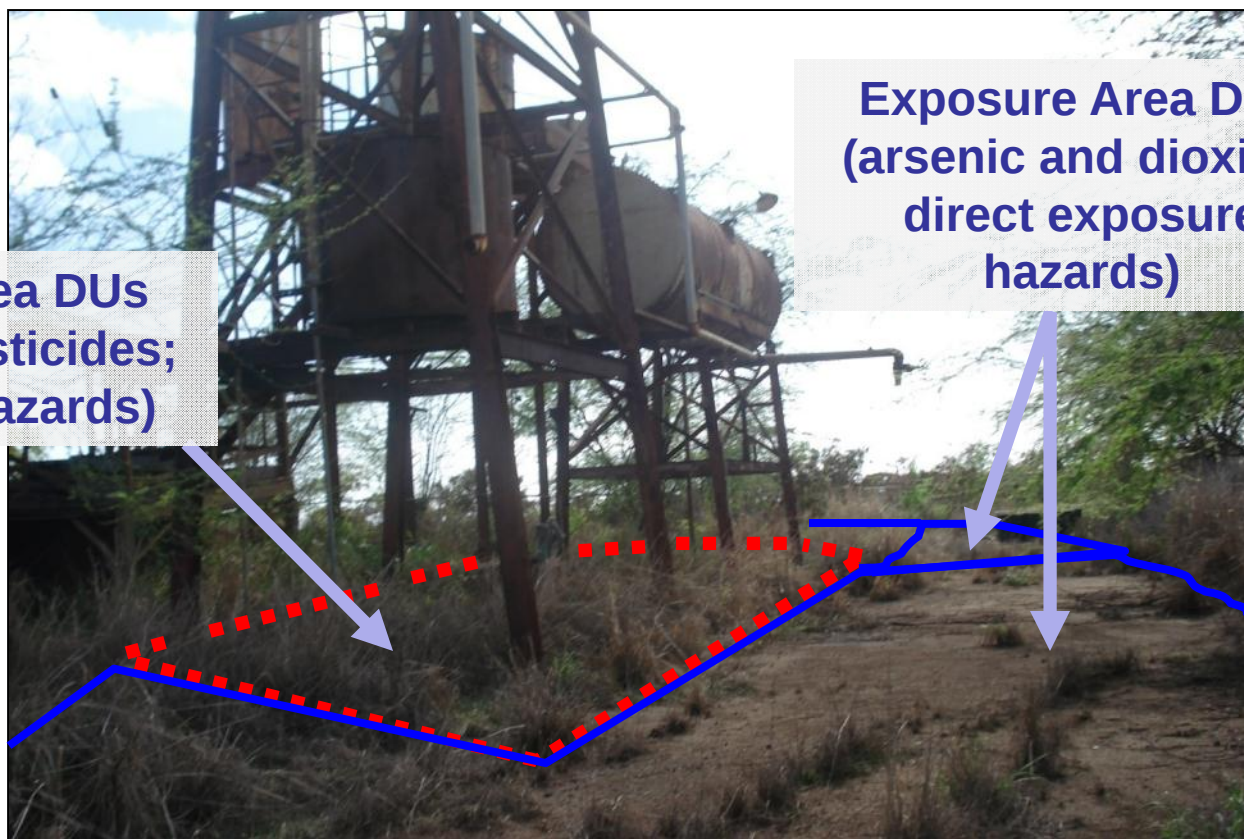


**Suspected heavy contamination with arsenic,
dioxins (from PCP) and leachable pesticides**

Source Area and Exposure Area DU Designation

Source Area DUs
(triazine pesticides;
leaching hazards)

Exposure Area DUs
(arsenic and dioxins;
direct exposure
hazards)



Primary objective is to delineate the source area and the extent of contamination.

Former Pesticide Mixing Area



Source Area DUs: Heavy contamination + leaching



Exposure Area DUs: Maximum 5,000 ft²

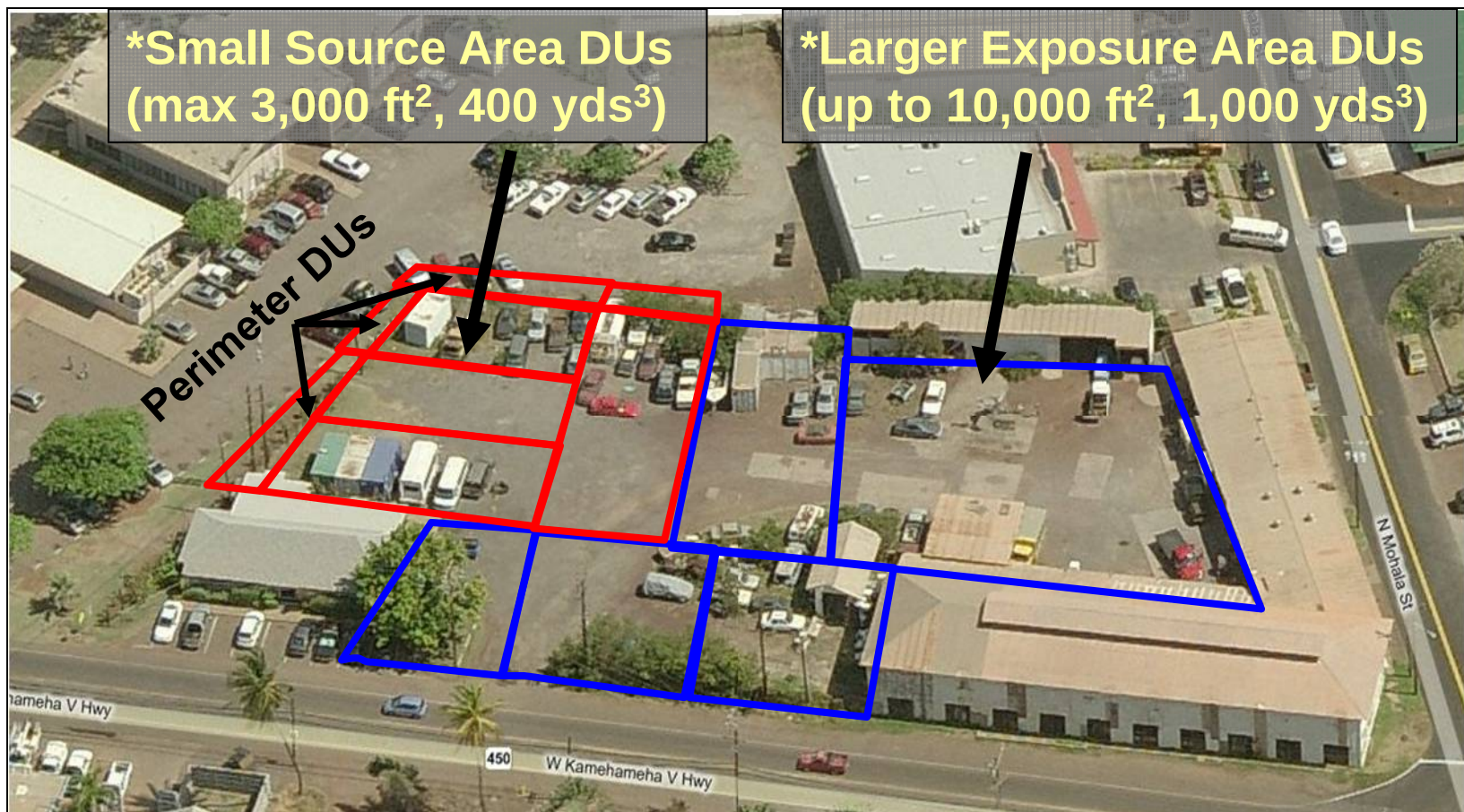
Former Power Plant Proposed Community Center



Primary objective is to identify and delineate source area and extent of contamination that exceeds action levels.

100'

Former Power Plant Decision Unit Designation



***Assuming 3' depth**

100'

Really Big Decision Units (DU)!

(400-acre former sugarcane field)

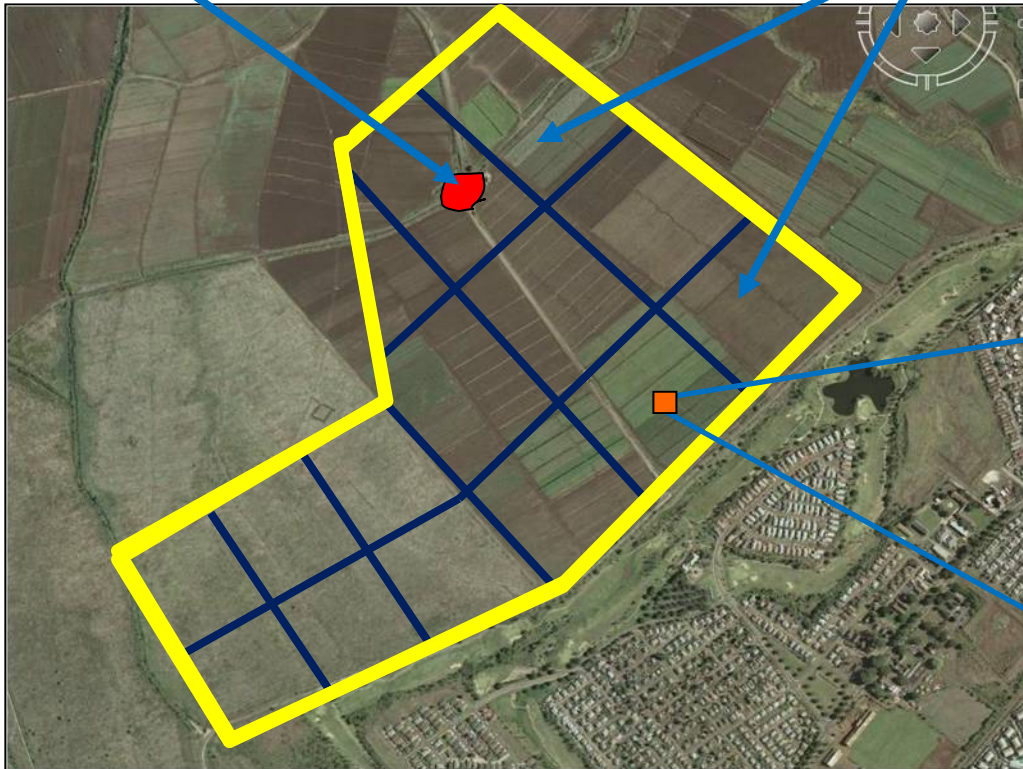
Source Area DU
(investigated separately)

Initial Screening DU

- Residual pesticide levels?
- OK for residential development?

Lot-Scale Resolution

- Hypothetical lots
- 5,000 ft² Exposure Area
- May also be required



Primary objective is to determine if property can be developed for residential use.

Really Small Decision Units???

What about the Sandbox!?

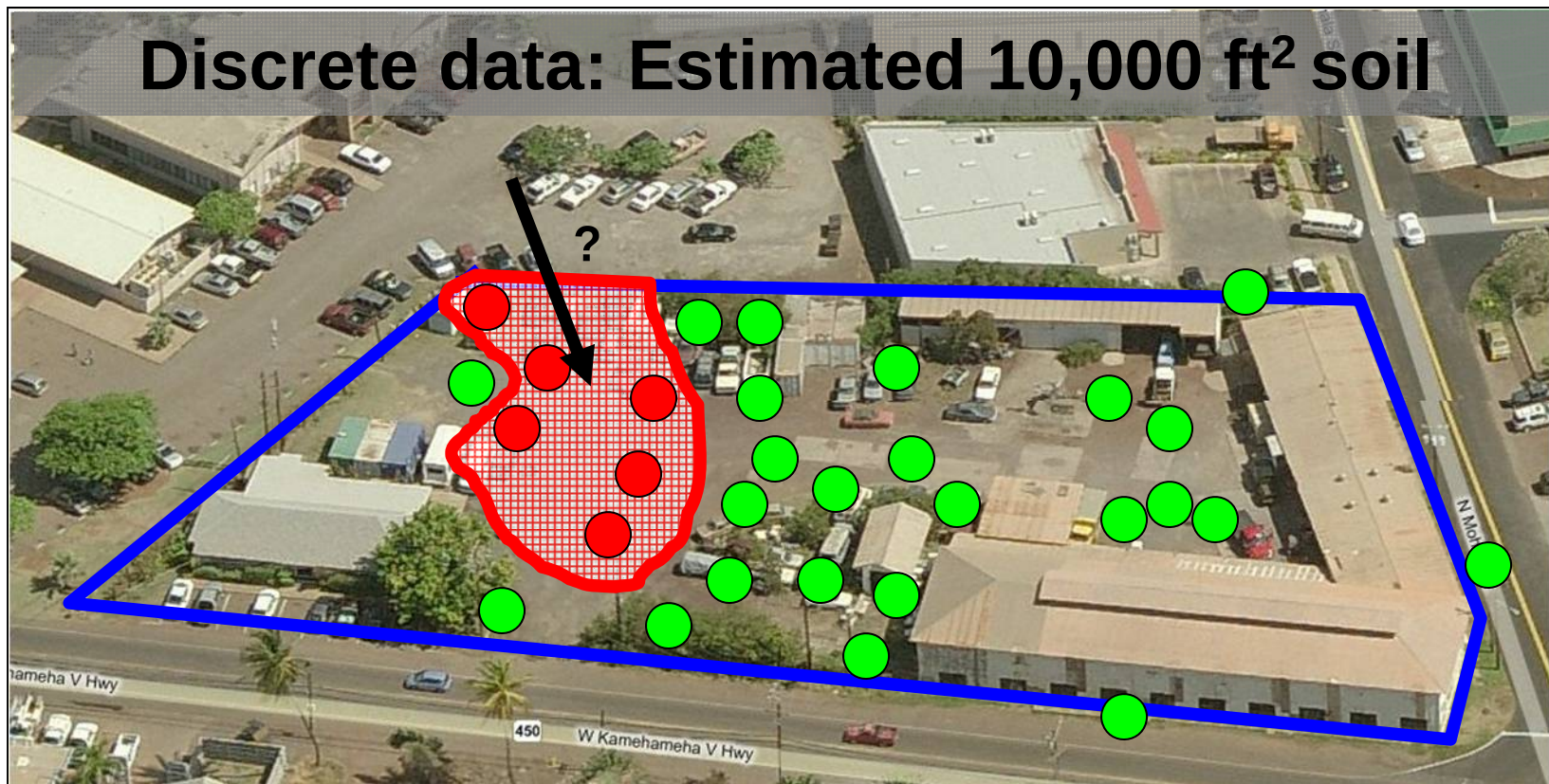


- ▶ Yard-size DUs are most often appropriate
- ▶ If acute hazards or intense exposure are being evaluated, smaller DUs may be necessary
 - Not typical
- ▶ Investigate known or suspected source areas separately
 - Remember: As sampling objectives change, so must the sampling design

Why DUs (and ISM) are Important (Discrete Sample Data)

● >Action Level

● ≤Action Level



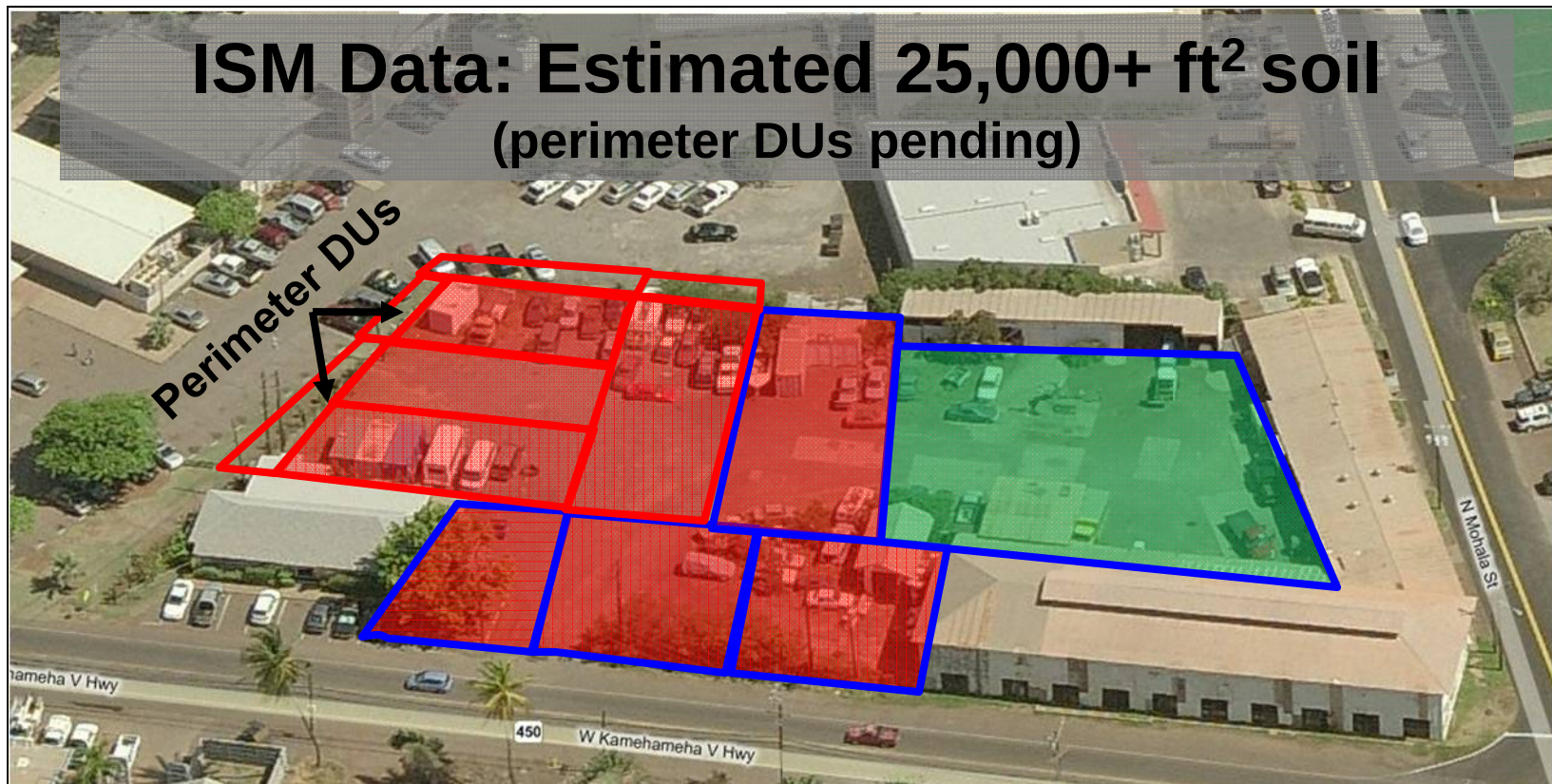
PCB sample aliquot = 30 grams (one spoonful of soil)

100'

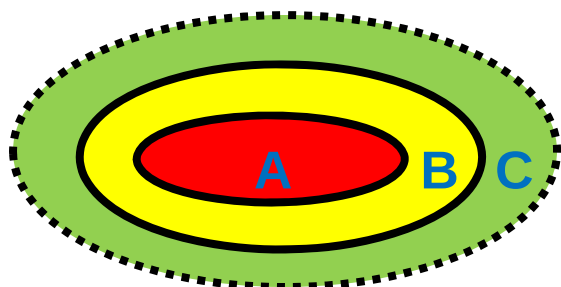
Why DUs (and ISM) are Important (ISM Sample Data)

■ > Action Levels

■ ≤ Action Levels



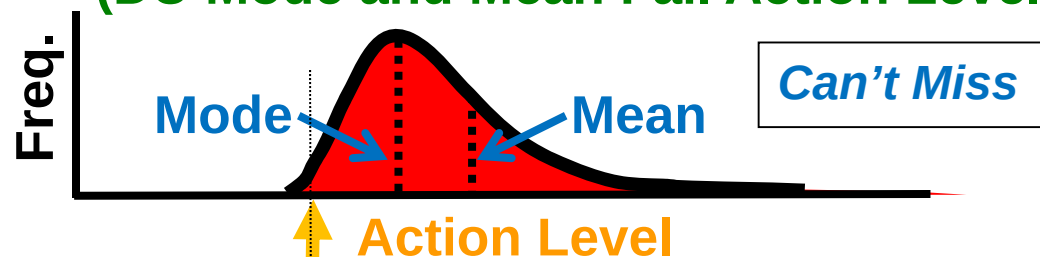
Why ISM Is Important



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Concentrations can vary several orders of magnitude within a DU at the scale of a discrete sample

Area A. Heavy Contamination
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(DU Mean Fails Action Level)

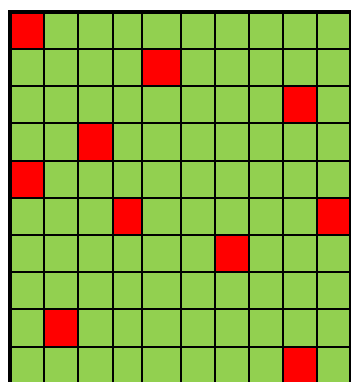


Area C. Low Contamination
(DU Mode and Mean Pass Action Level)

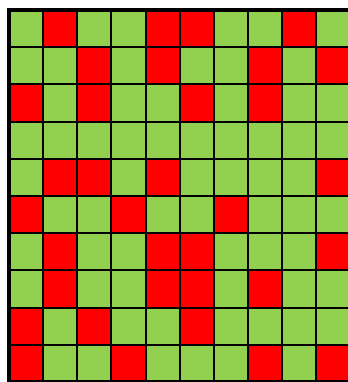


Why Discrete Samples Miss Contamination in the Field

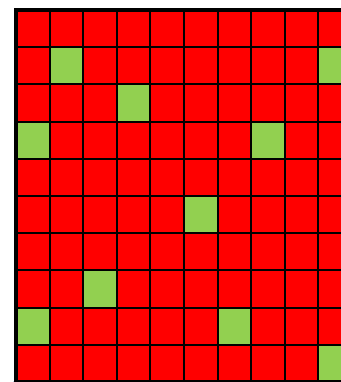
Area average PASSES
(Isolated False Positives)



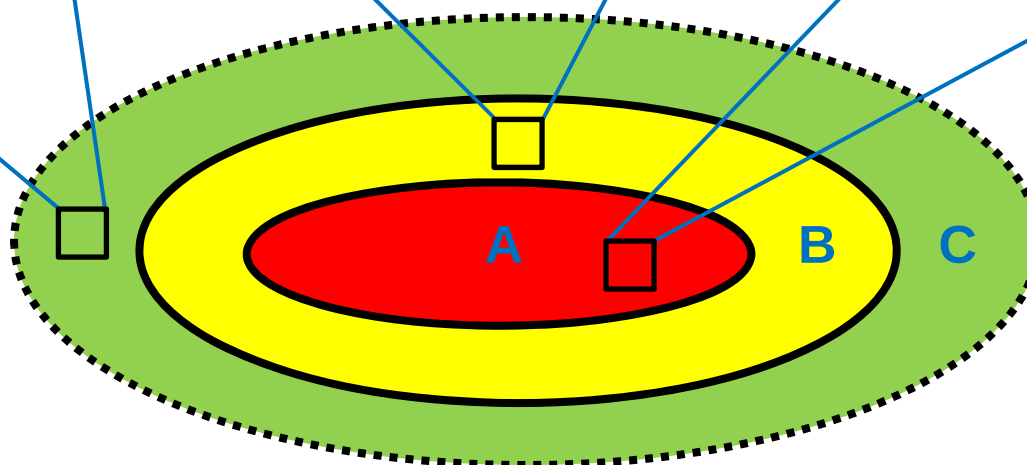
Area average FAILS
(Majority False Negatives)



Area average FAILS
(Isolated False Negatives)



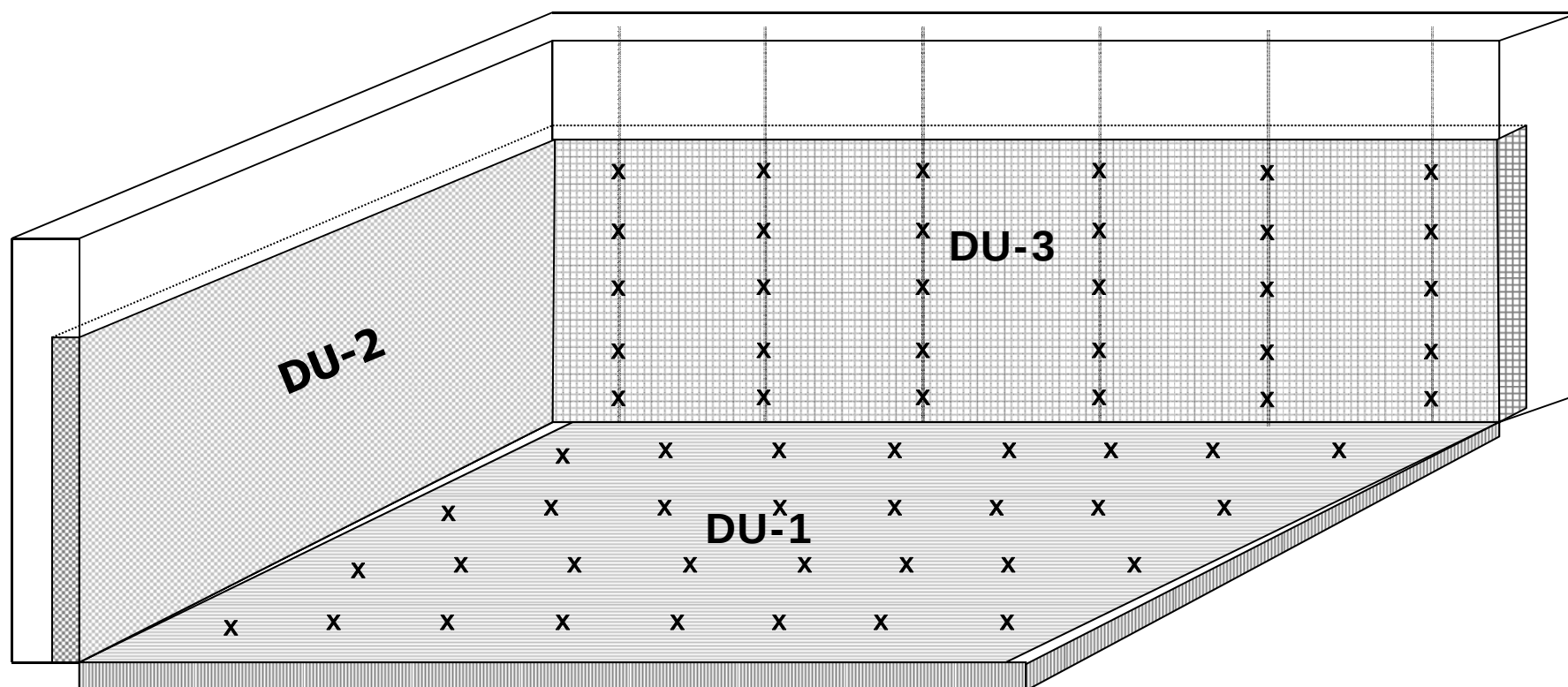
Above
Action
Level



Below
Action
Level

Excavation Decision Units

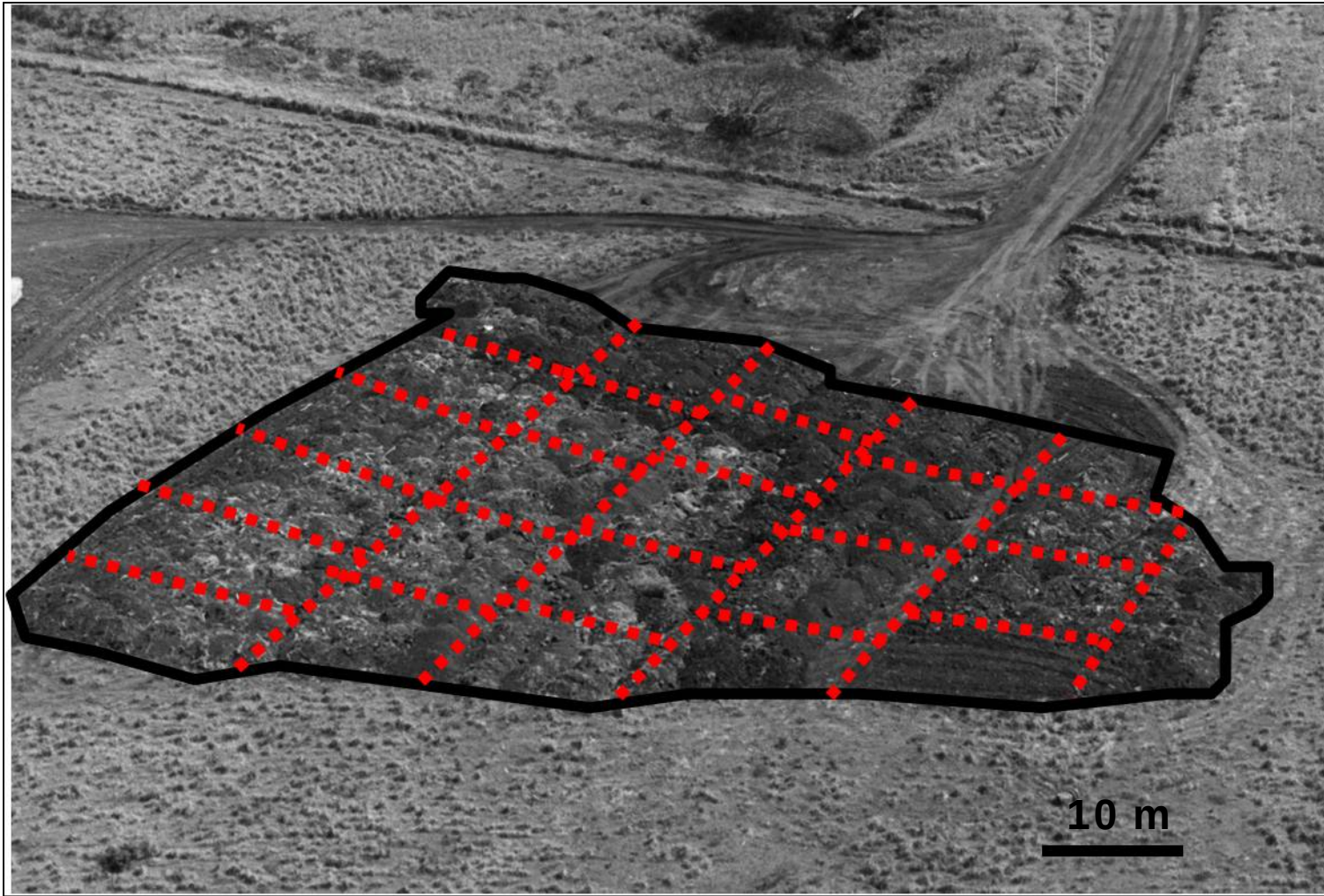
Floor and sides tested as separate DUs



X - Increment Sampling Locations

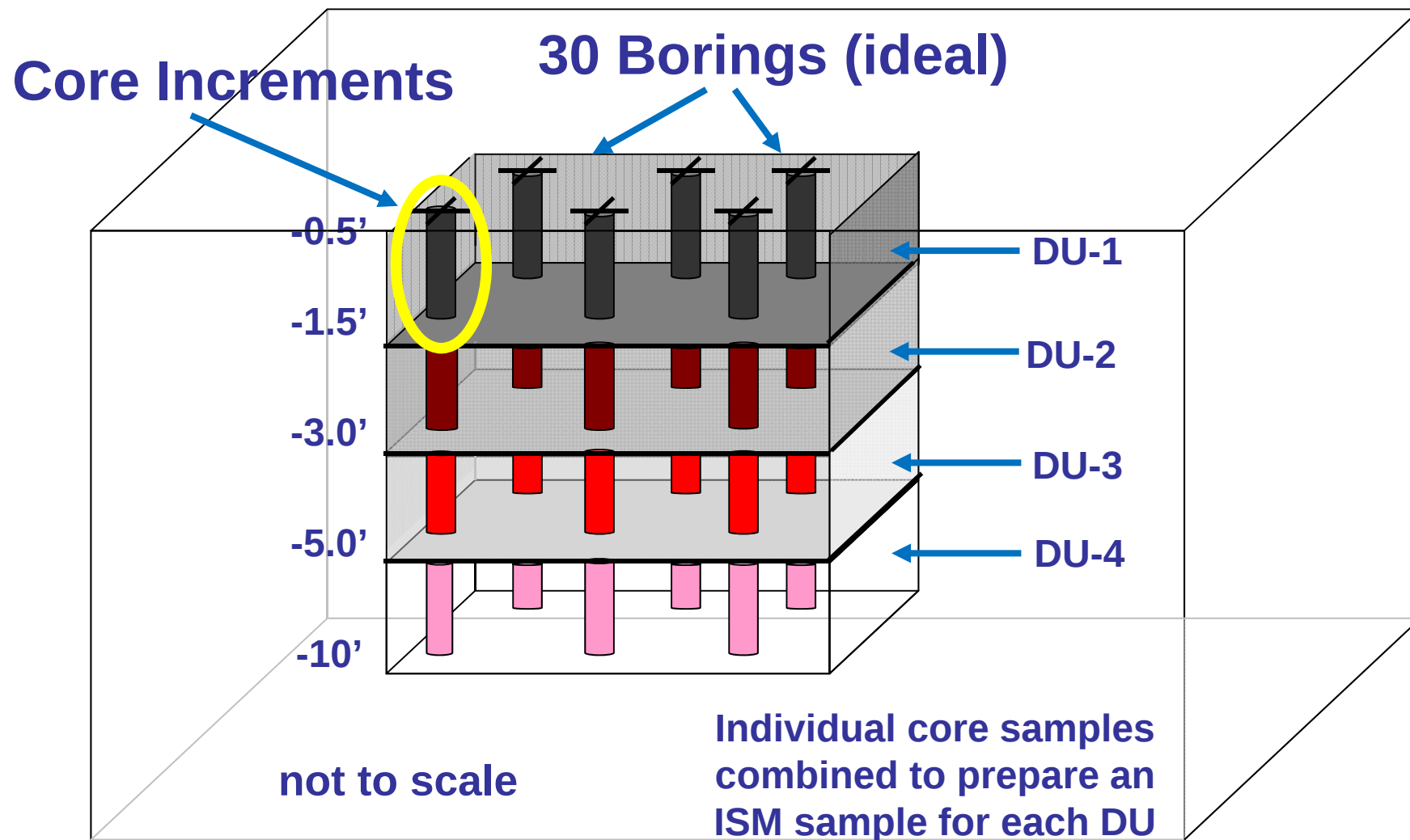
ITRC, ISM-1, Section 3.3.6 and Figure 3-11

Stockpile Decision Units



ITRC, ISM-1, Section 3.3.5 and Figure 3-10

Subsurface Decision Units



Decision Unit (DU) Highlights

- ▶ Determining DU size and location
 - Use all available information
 - Determine Data Quality Objectives
- ▶ Establish DUs with risk assessment and remedial goals in mind from the start
- ▶ Many random increments required (30 to 50+)
 - Capture the effects of heterogeneity
 - Characterize a DU

Decision Unit Highlights (continued)

- ▶ ISM samples
 - More efficient and cost effective method
 - Minimize the size of undetected hot spots
 - Represent larger volumes, i.e., DUs
- ▶ Tight grids of screening data can be useful to locate suspected source areas for better DU designation, if needed

Summary: Systematic Planning

► Conduct Systematic Planning

- It's important to develop a CSM before beginning a sampling design
- Be sure that your sampling design will achieve your sampling objectives
- Be certain that your sampling design will provide the kind of data necessary to fulfill the sampling objectives

► Decision Unit designation

- Make sure that all site information has been used to develop your DUs
- Be sure that your scale of decision making aligns with your sampling objectives

ISM Document and Training Roadmap

