738 Upper Mountain Road Removal Site

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USEPA Region 02

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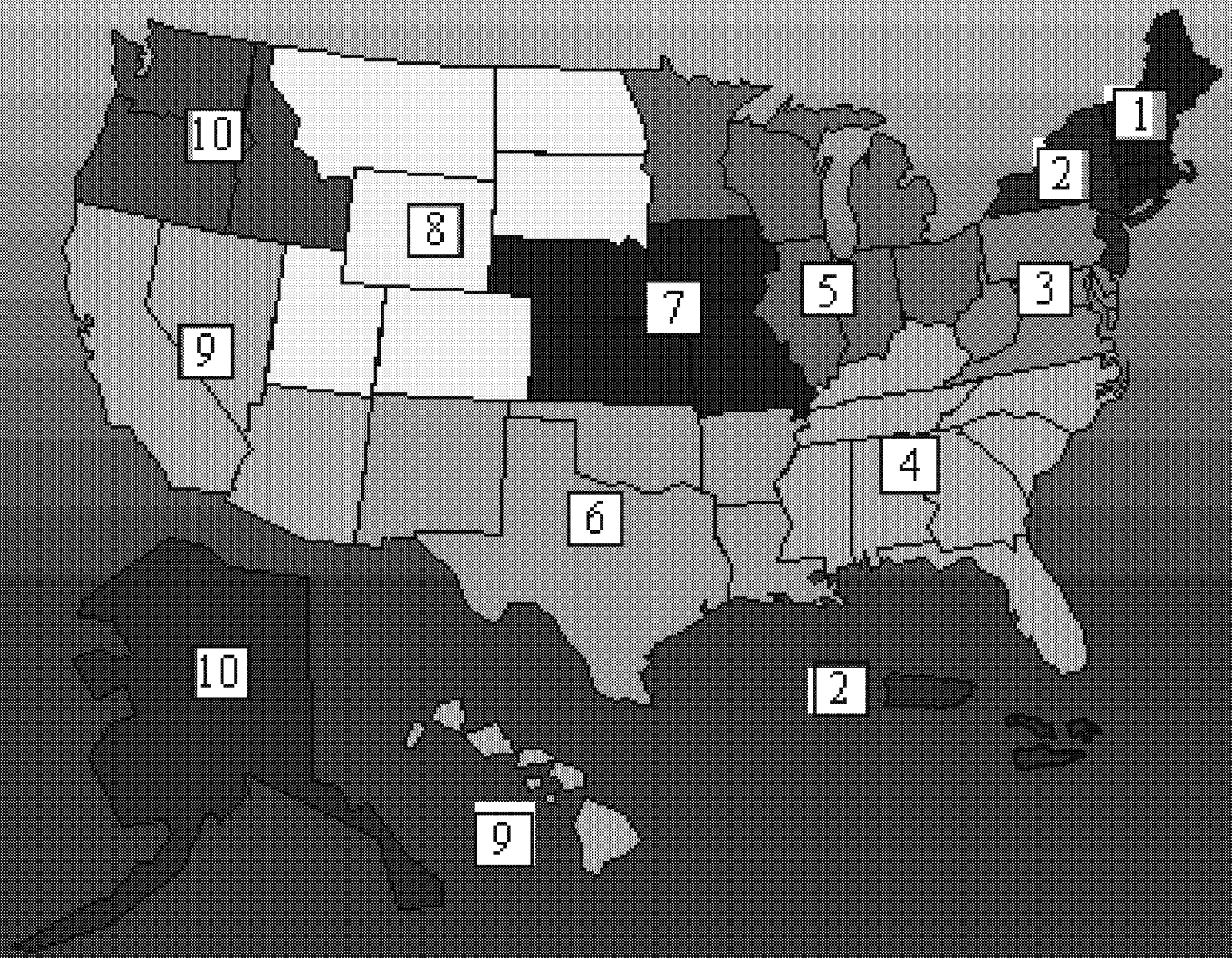
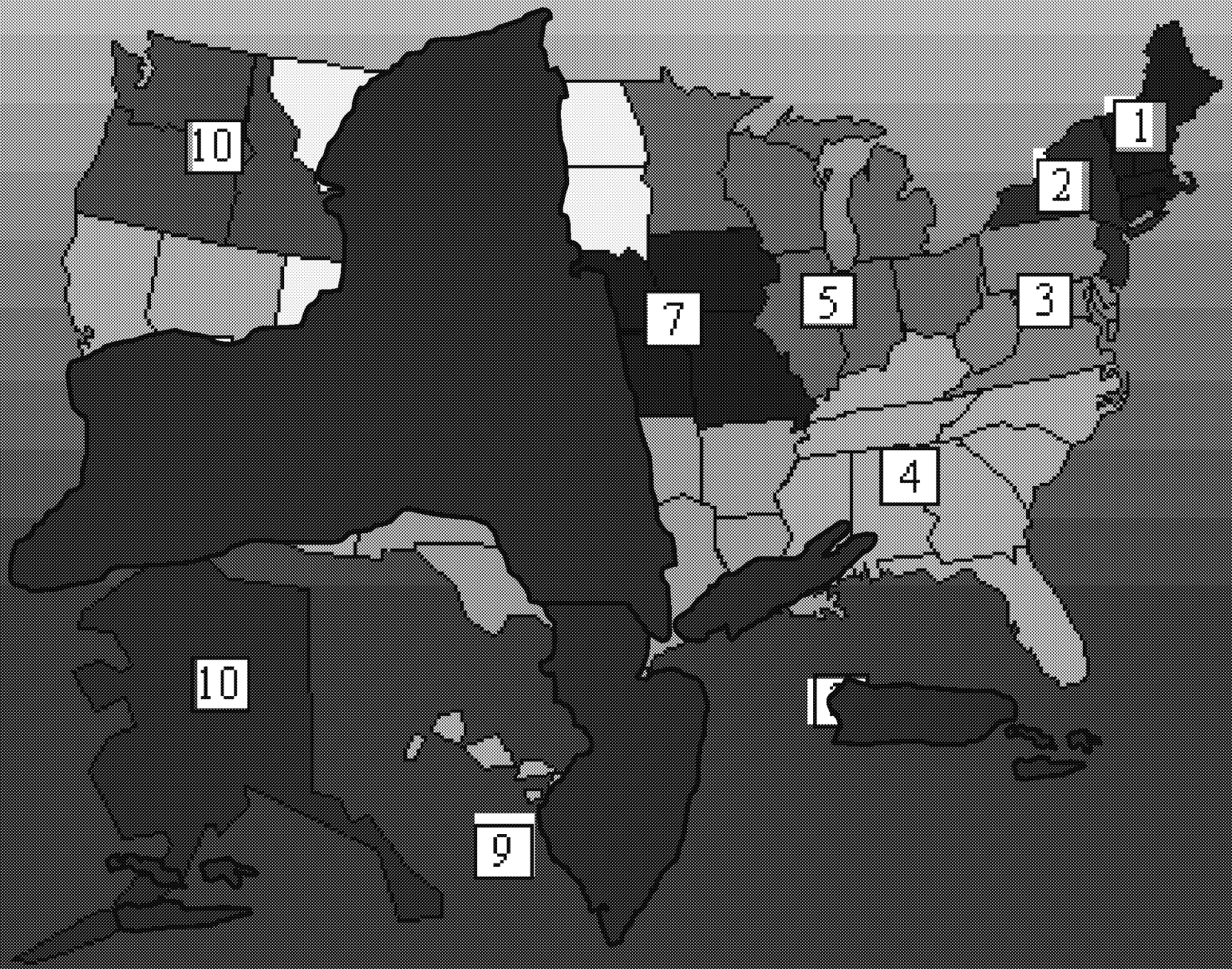
USEPA Environmental Response Team—West

October 21, 2019

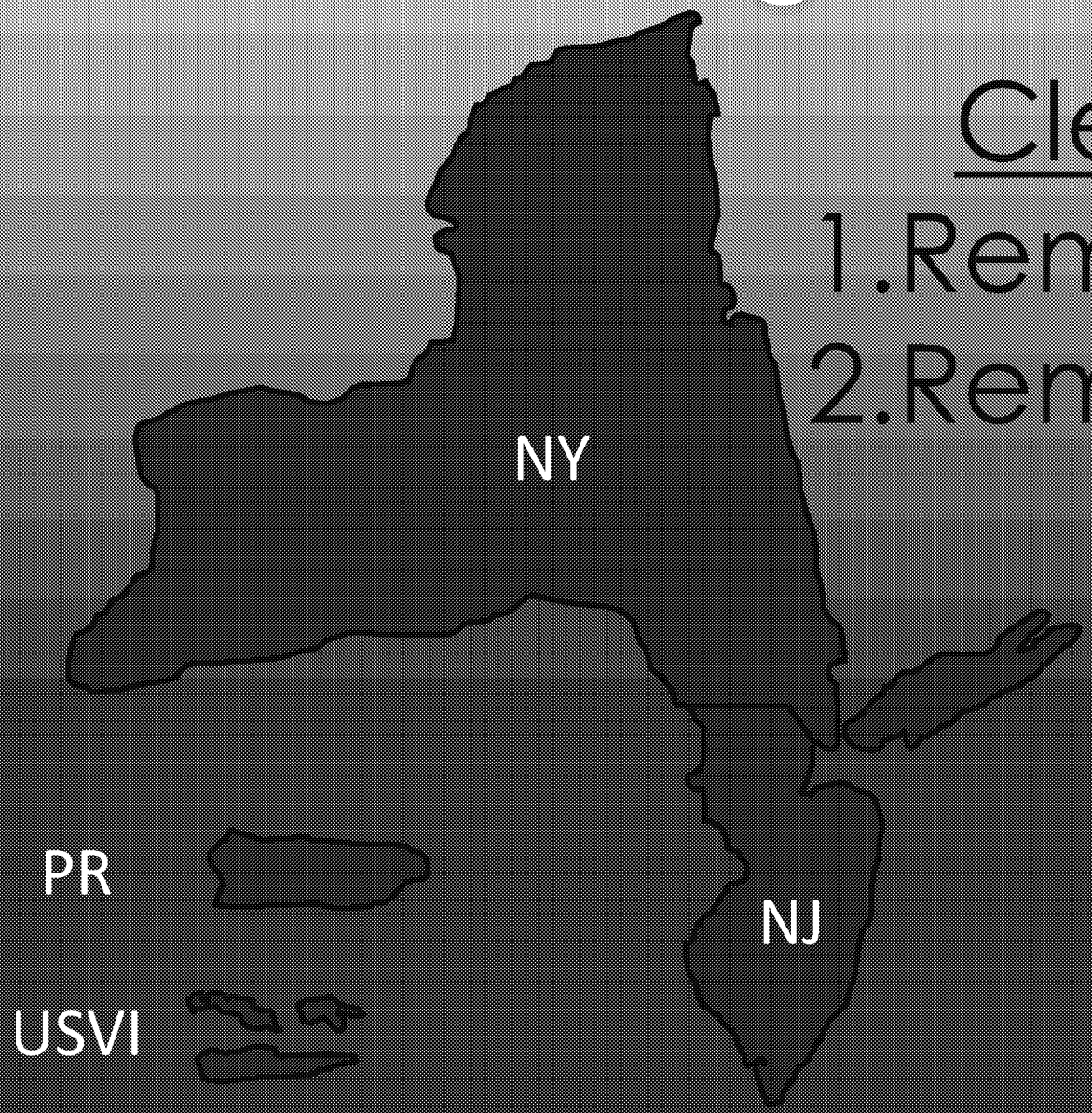
Who we are?



Who we are?



Region 2



Clean up:

1.Removal–OSC

2.Remedial–RPM

Special Teams

Environmental Response Team (ERT)

Consequence Management Advisory Team (CMAT)

Radiological Emergency Response Team (RERT)

National (NCERT)

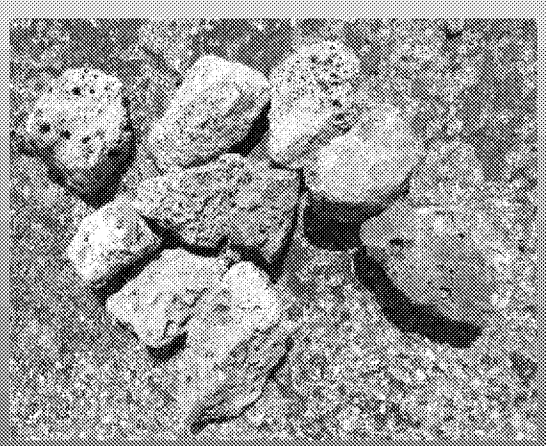
Site:
738 UMR

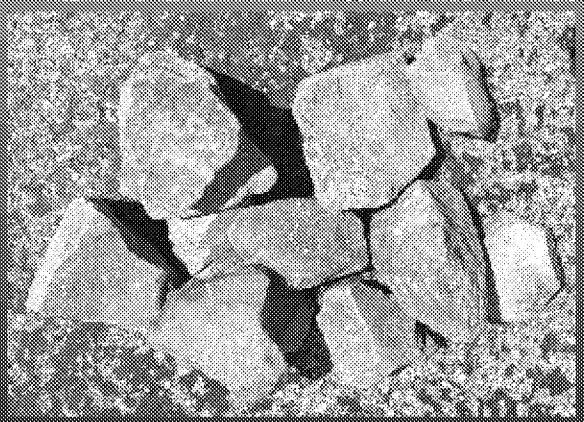
History

- In July 1985, members of the Radiological Survey Activities (RASA) Group at Oak Ridge National Laboratory (ORNL) performed a radiological survey of the Site for the U.S. Department of Energy (DOE), which documented a maximum gamma exposure rate of 710 microroentgens per hour (µR/hr). Biased surface soil samples collected during the survey indicated the presence of Radium-226 (Uranium-238, and Thorium-232 at the Site.
  - In general, background gamma is roughly 10-20 µR/hr
  - Roughly about 50 times background
  - Rule of thumb: EPA starts investigating at roughly 3 times background

- During a reconnaissance performed by the New York State Department of Health (NYSDOH) and the New York State Department of Conservation (NYSDEC) on July 9, 2013, screening activities showed radiation levels at 300 µR/hr with a hand-held pressurized ion chamber. The background readings for this Site were approximately 10 µR/hr.
  - Readings from the State were 30 times background

Contaminant: "Slag"





Radioactive Rock or "Slag" was used as fill dirt for roadways and parking lots throughout the Niagara Falls region

Units: So Confusing!

Soil

- pCi/g--true value of contamination in soil
- cpm--estimating how much contamination from a detector

Emit

- µR/hr --estimating the amount of radiation in air (exposure)
- mrem/hr --estimating how much radiation the body receives (dose)

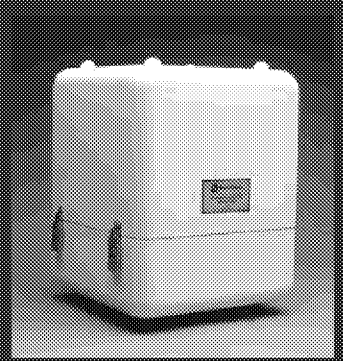
Units: So Confusing!

- pCi/g
- cpm

Quantitative Measurements

- µR/hr
- mrem/hr

Qualitative Measurements



Static Measurement
Ex. Scalar Mode

Scan Measurement
Ex. Rate mode

Units: So Confusing!

- pCi/g

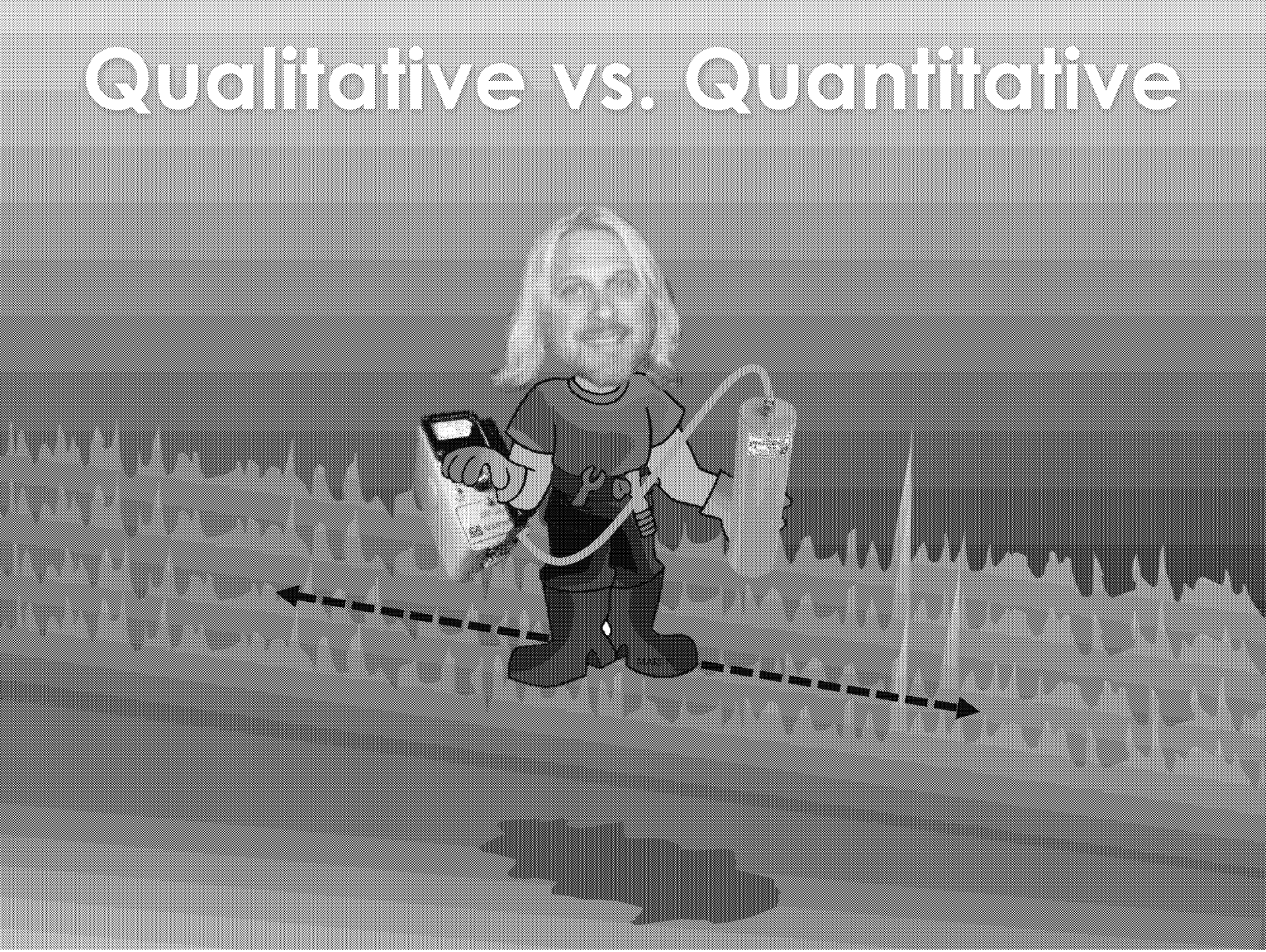
Quantitative Measurements

- cpm
- µR/hr
- mrem/hr

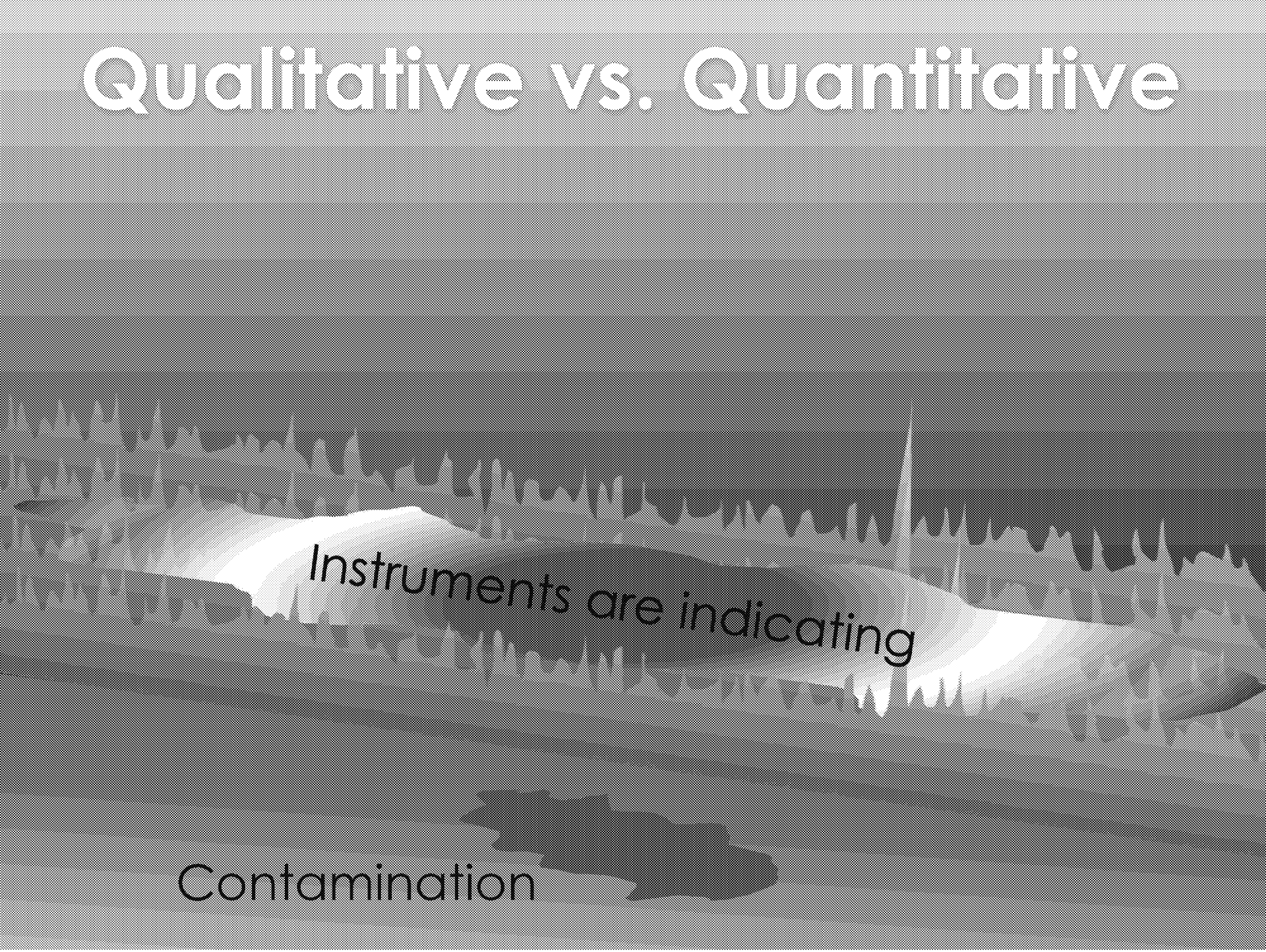
Qualitative Measurements

Base the removal eligibility off of <u>Quantitative</u> Data

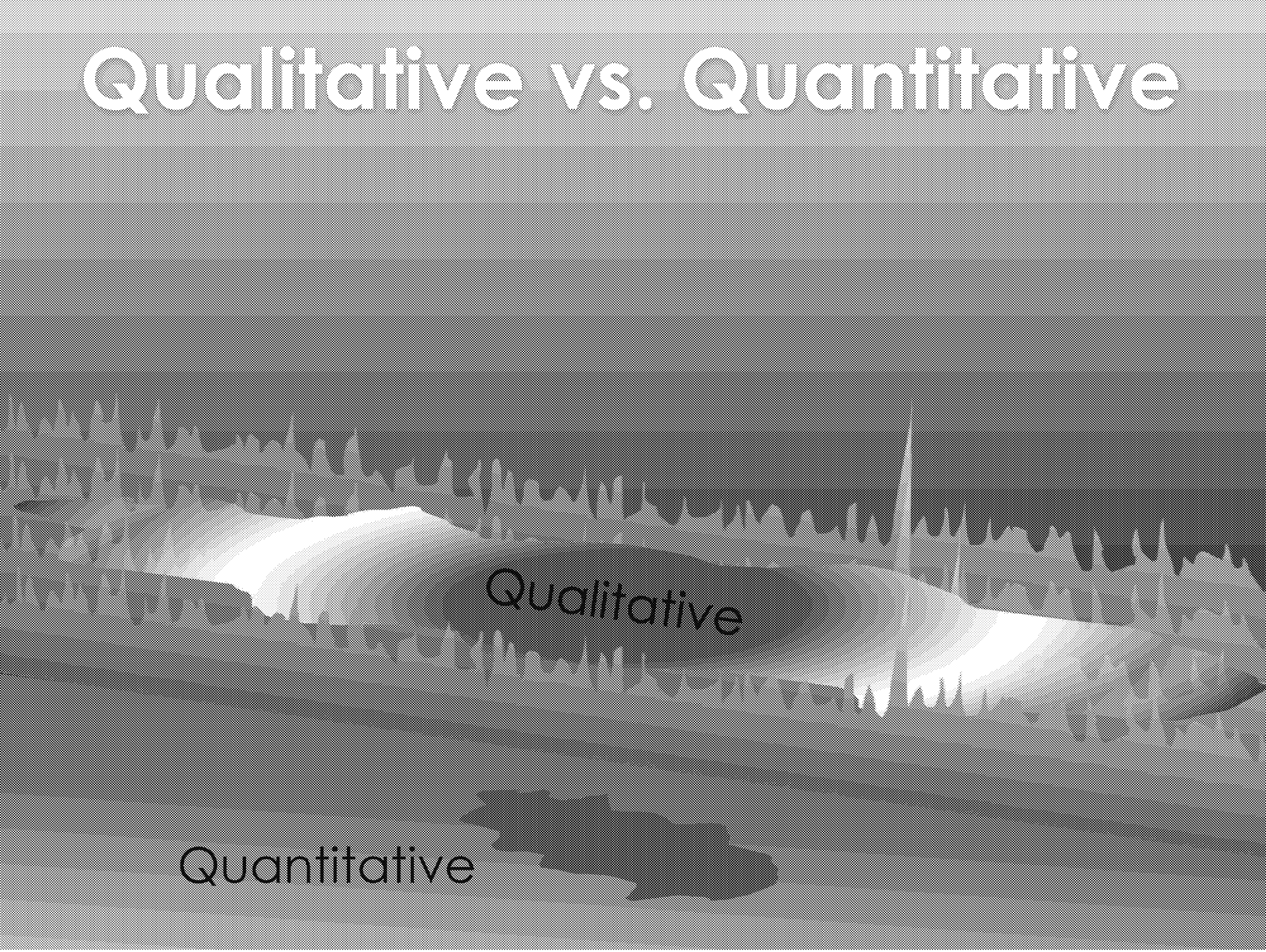
Qualitative vs. Quantitative



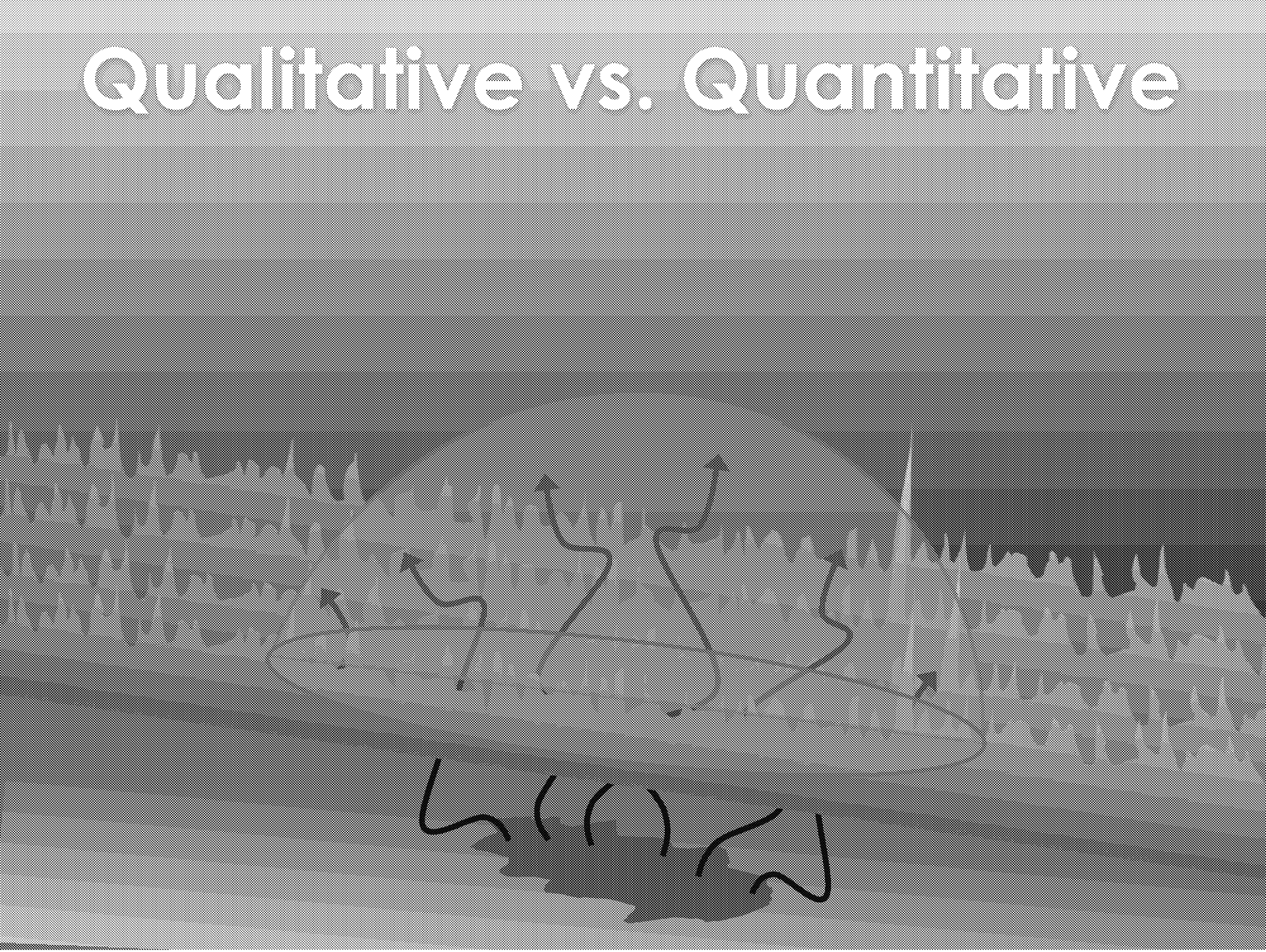
Qualitative vs. Quantitative



Qualitative vs. Quantitative



Qualitative vs. Quantitative



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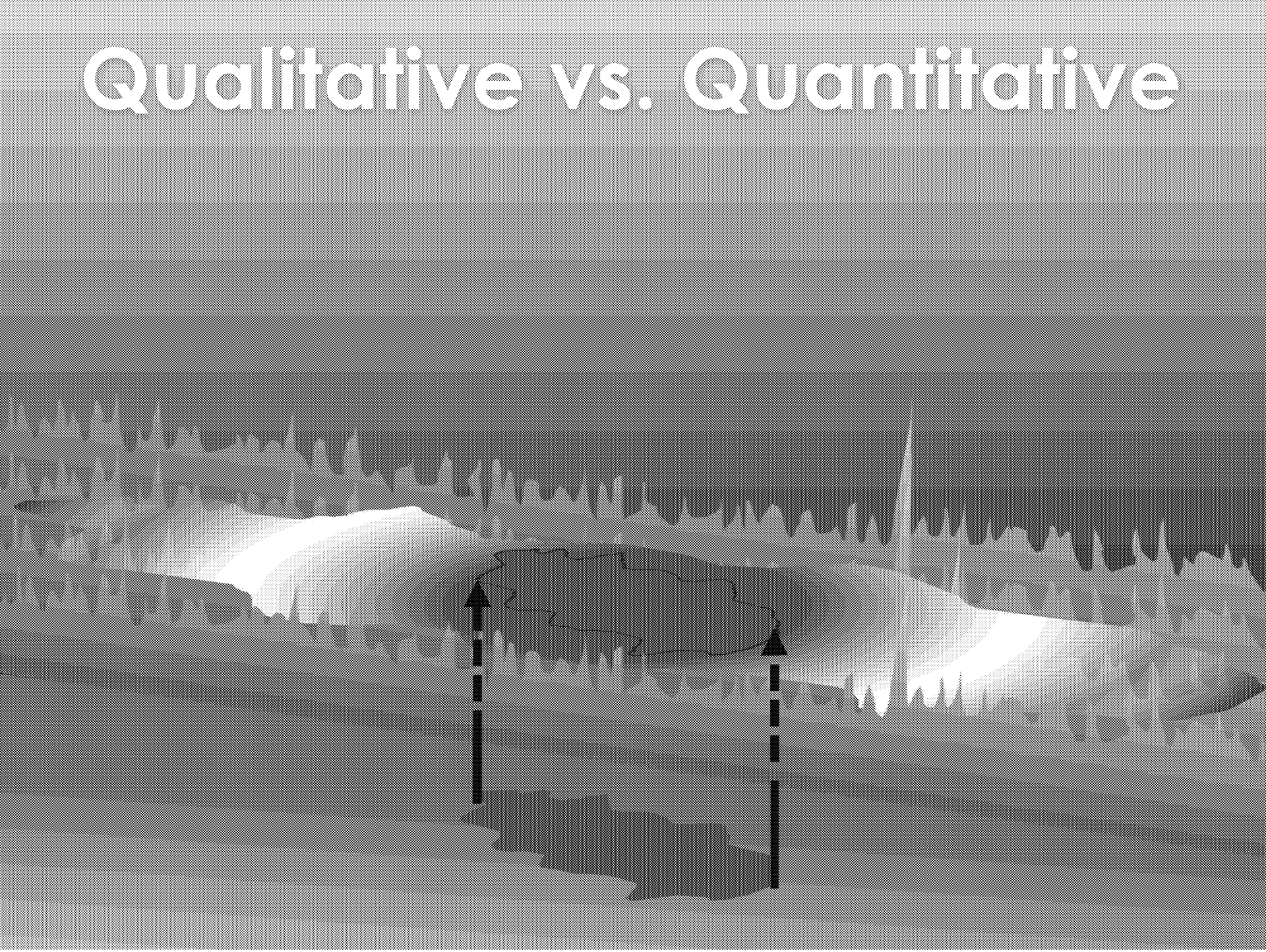
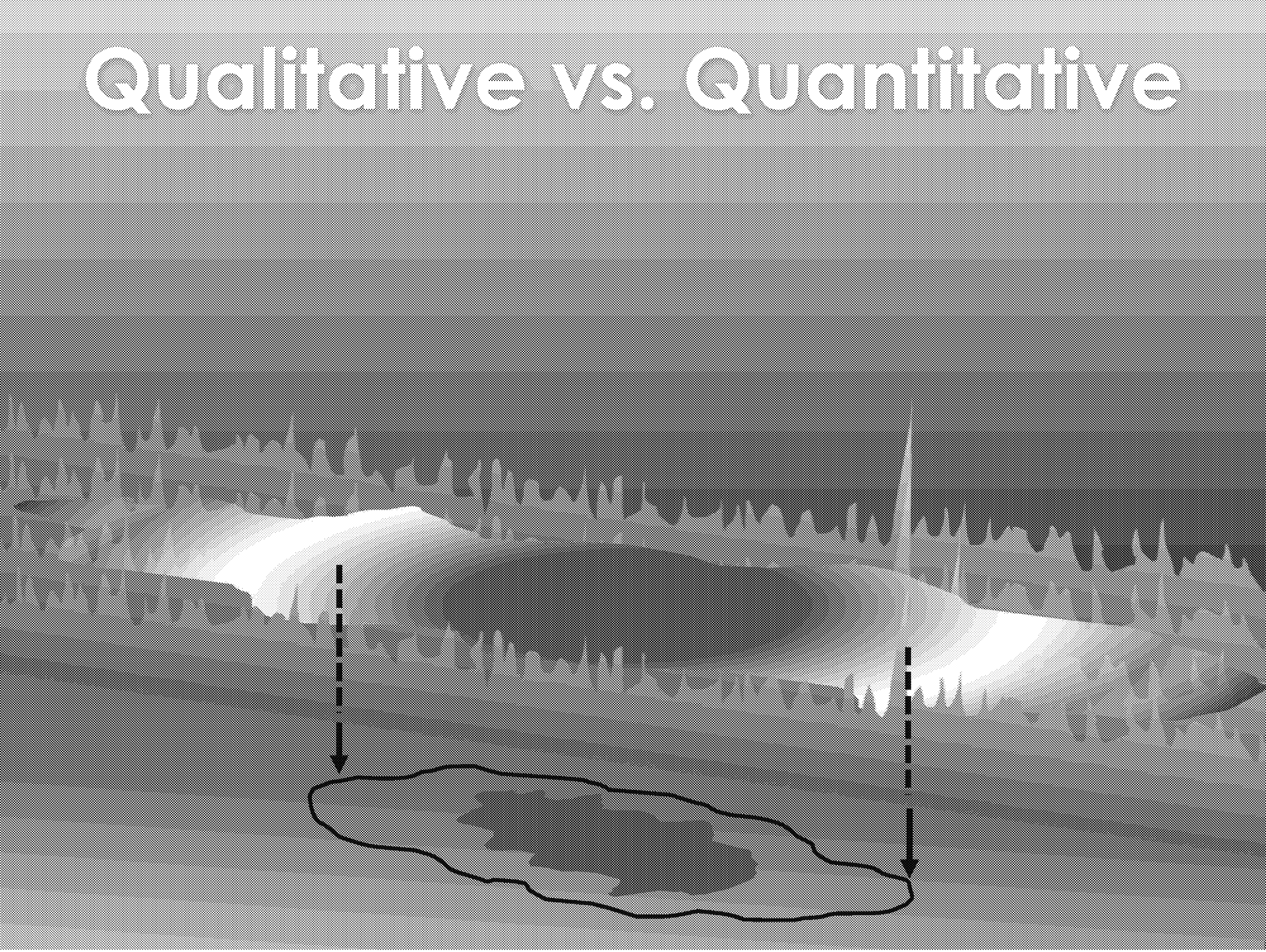
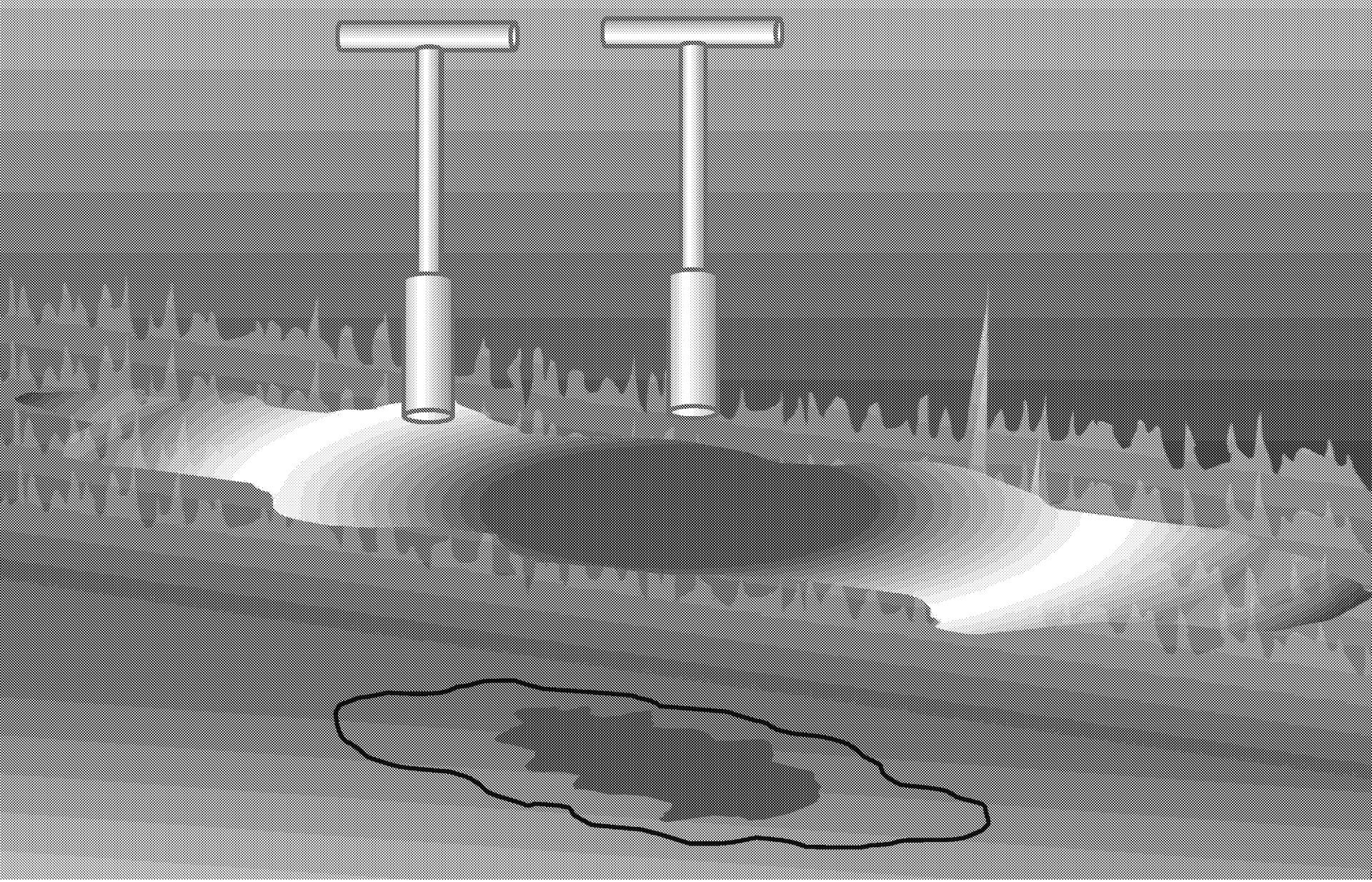


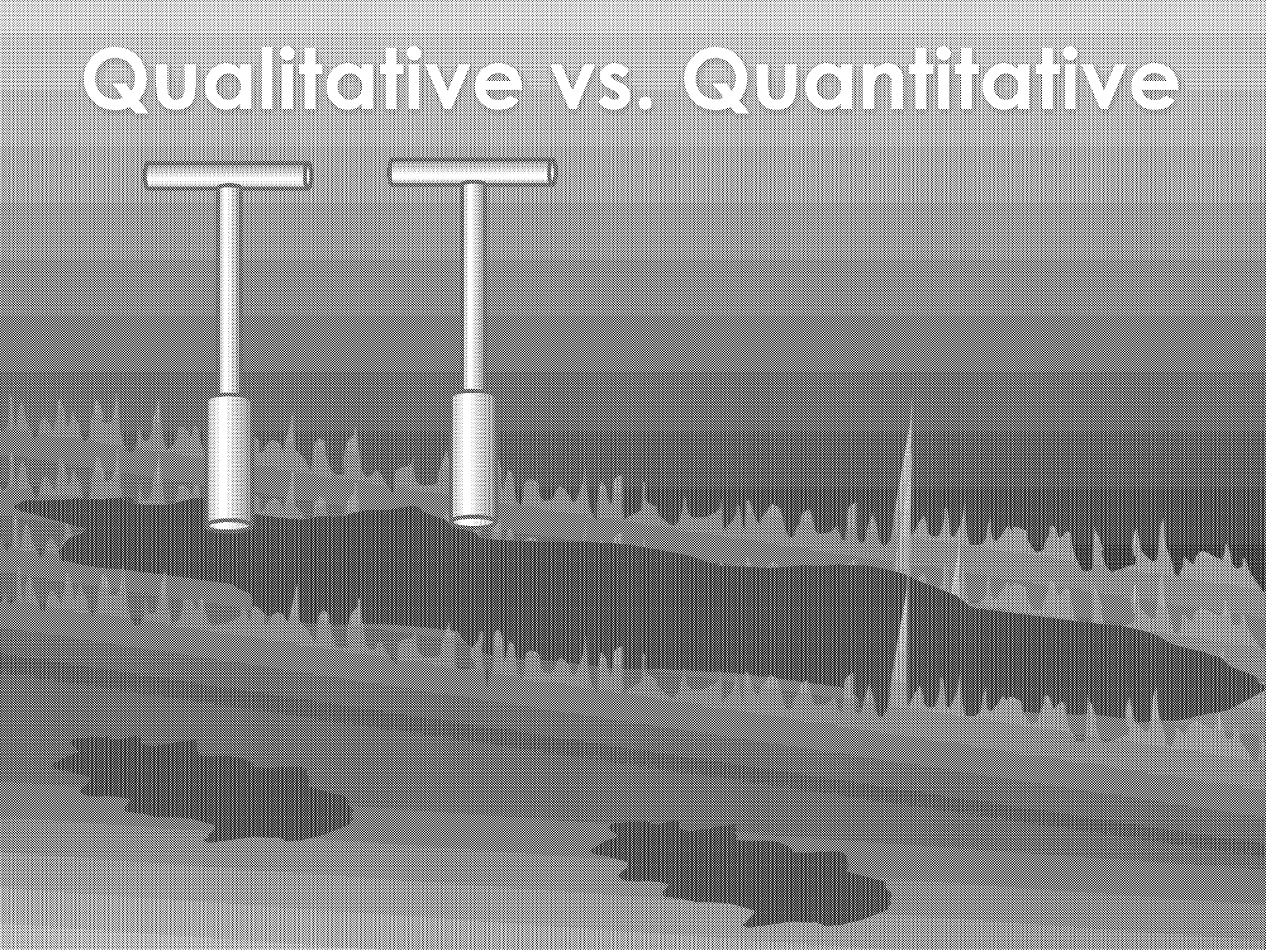
Qualitative vs. Quantitative



Qualitative vs. Quantitative



Qualitative vs. Quantitative



EPA Site Assessment

- The NYSDEC and NYSDOH referred the Site to EPA on July 21, 2013 for further assessment.
- From September 2013 through May 2014, the EPA Region 2 Pre-Remedial Section (PRS) initiated a preliminary assessment (PA) and site inspection (SI) to assess whether the Site posed a threat to human health and the environment.

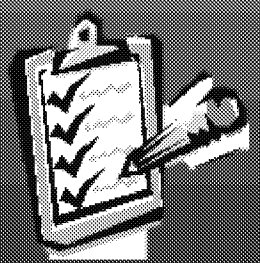
How does it work?

Immediate Threat?
Emergence aspect?

Removal

Remedial

Pre-Remedial



Meet the
National Priority List?

No

Yes

Removal

Remedial

EPA Site Assessment

- Based on the PA and SI results, a Hazardous Ranking System (HRS) score was calculated. The calculated HRS score for the Site was less than 28.5 and, as a result, the Site did not qualify for inclusion on the NPL. In May 2015, the Site was referred to the Emergency and Remedial Response Division, now the Superfund and Emergency Management Division (SEMD), Removal Action Branch (RAB) for a determination as to whether the Site warranted a CERCLA removal action.
- Initially, 738 Upper Mountain Road was deemed ineligible for a removal action based on information at the time. However, after EPA OSC and ERT Health Physicist assessed the three other radiological site, the same assessment criteria was applied to 738 UMR Site.

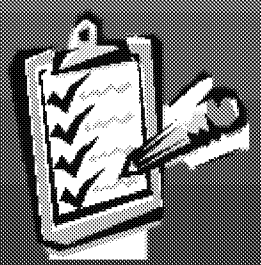
738 UMR

Immediate Threat?
Emergence aspect?

Removal

Remedial

Pre-Remedial



Meet the
National Priority List?

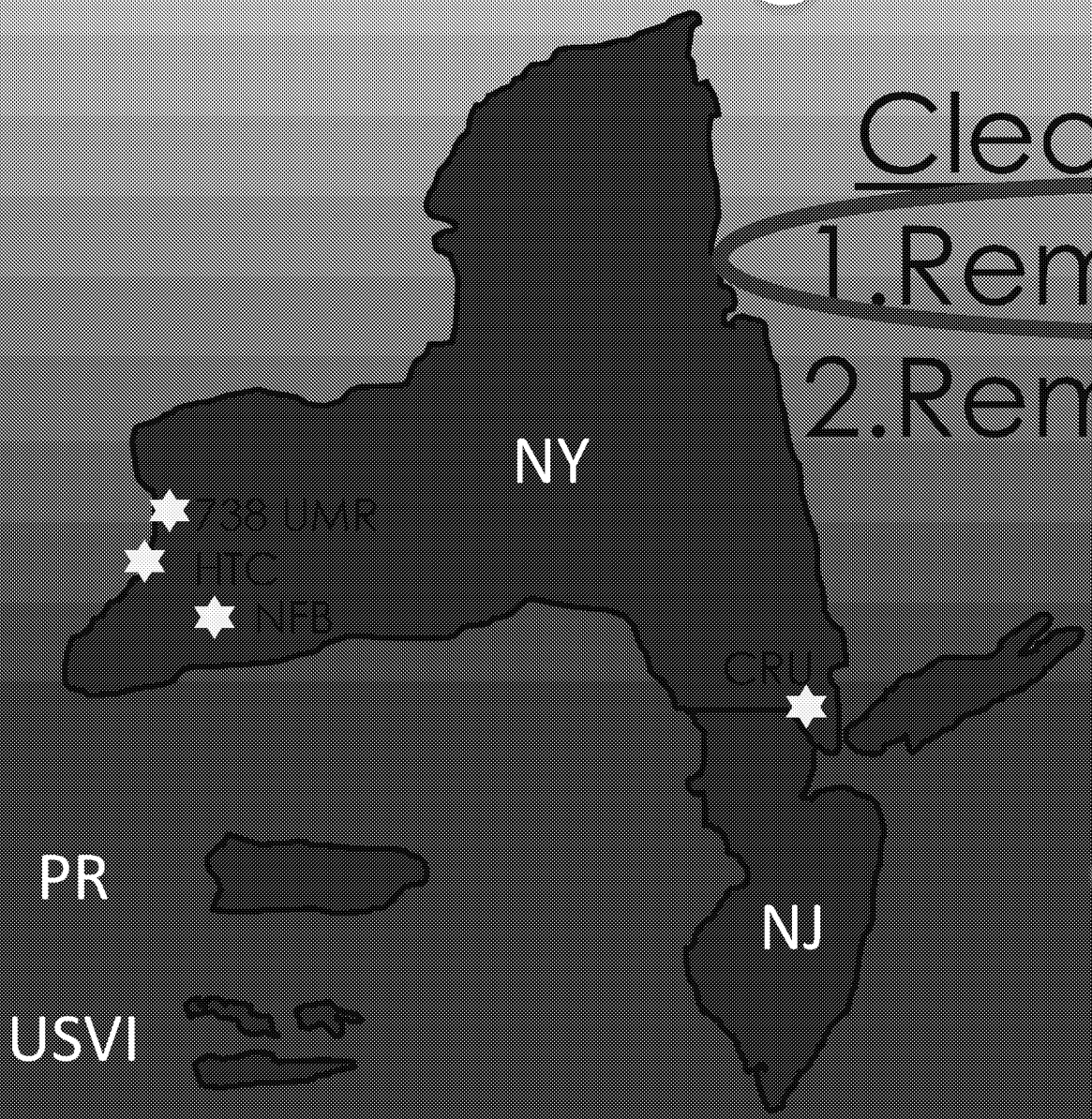
No

Yes

Removal

Remedial

Region 2



Clean up:

1.Removal–OSC

2.Remedial–RPM

Pre-Remedial Data:

Removal Assessment Process

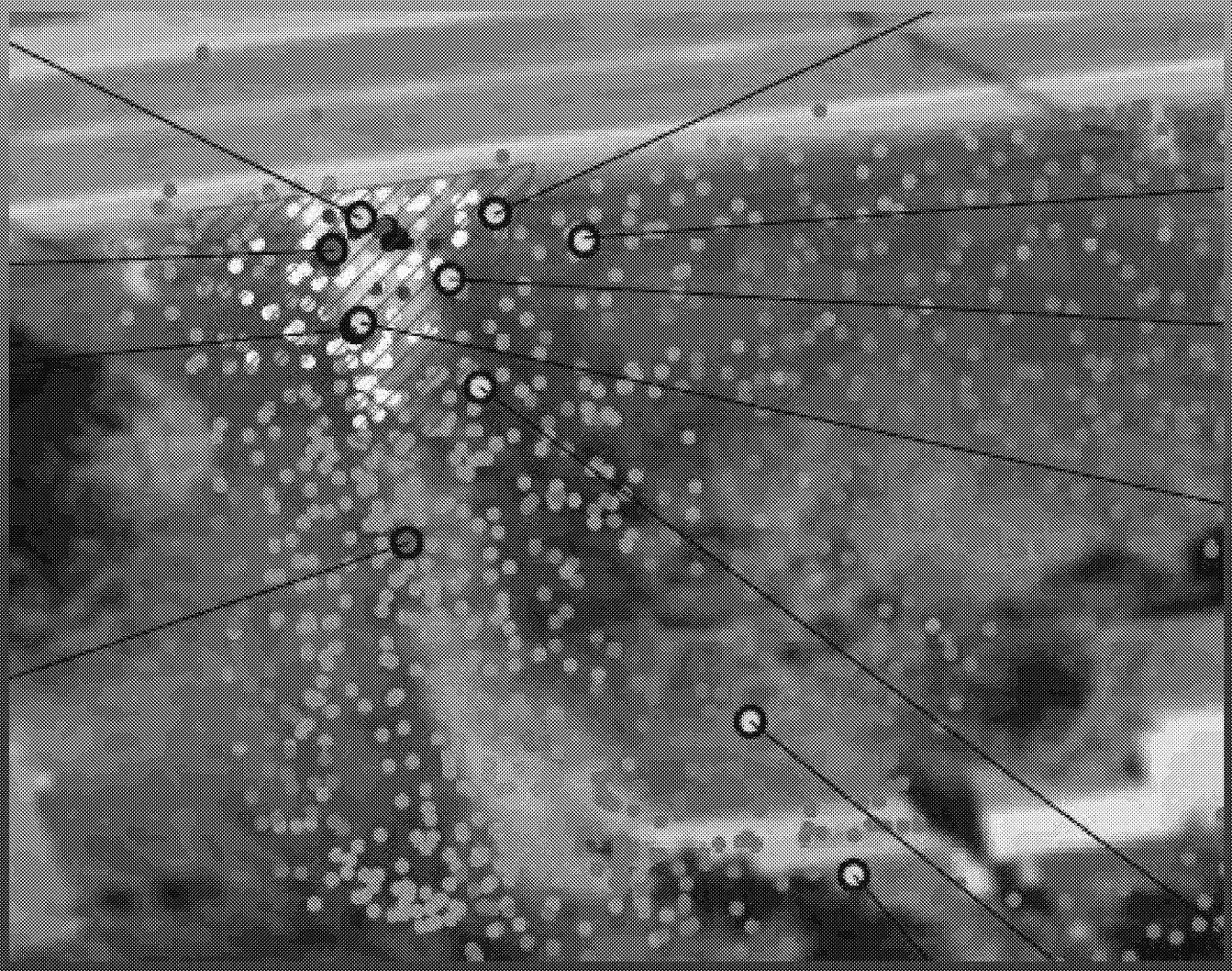
- Ground Truthing:
  - How far does it extend past the property
  - Depth of contamination
  - Radon/Thoron measurements
- Verified the contaminant(s)

Removal Assessment:

Specifying Site Boundary

Removal Scan

Additional Sampling Locations



Contaminant of Concern vs. Highest Values

Radioisotope	Analytical Data
	pCi/g
Actinium-228 (Ac-228)	NA
Bismuth-212 (Bi-212)	244.51
Cesium-137 (Cs-137)	0.489
Lead-212 (Pb-212)	232.95
Potassium-40 (K-40)	29.895
Protactinium-234M	32.995
Radium-226* (Ra-226)	36.575
Radium-228 (Ra-228)	221.46
Thallium-208 (Tl-208)	78.922
Thorium-228 (Th-228)	323.85
Thorium-234 (Th-234)	22.436
Uranium-235 (U-235)	2.401
Thorium-228 (Th-228)	74.7
Thorium-230 (Th-230)	12.2
Thorium-232 (Th-232)	59.1
U-233/234	23.5
U-235/236	1.68
Uranium-238 (U-238)	24.2

Ra-226* (21 days ingrowth)
Yellow Highlight indicates the highest concentration in the Th-232 decay chain
Pink Highlight indicates the highest concentration in the U-238 decay chain

Is this contamination?

- Three approaches for setting an action limit:
  - Applicable or Relevant and Appropriate Requirements (ARARs)
  - Dose Based Modeling
  - Risk Based Modeling

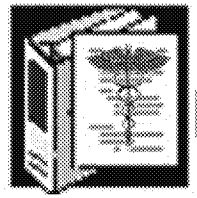
Our Risk Approach

- Internal Risk
  - Inhalation—soil (i.e. pCi/g units)
  - Ingestion—soil (i.e. pCi/g units)
  - Absorption
  - Injection
- External Risk
  - Exposure—gamma (i.e. μR/hr)
  - Dose—gamma (i.e. mrem/hr)

Break?

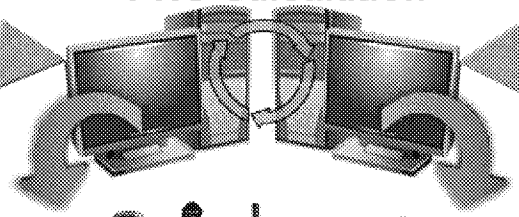
PRG Overview

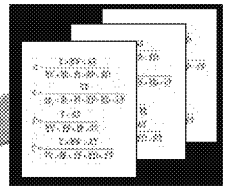
Preliminary Remediation Goals for Radionuclies (PRG)



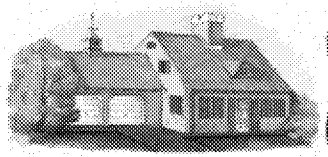
Slope Factors

PRG Calculation

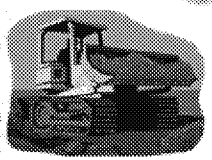




PRG Equations

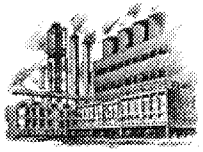


Resident

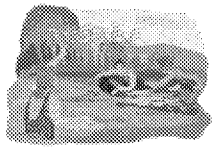


Construction Worker

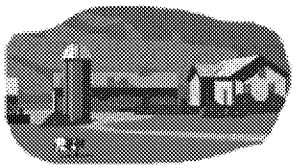
Outdoor Worker



Indoor Worker



Recreator



Farmer

Resident

- **Soil**: *ingestion*, *inhalation*, *external*, *ingestion of produce*
- **Fish**: *consumption*
- **Tap Water**: *ingestion*, *inhalation*, *immersion*, *ingestion of produce*
- **Air**: *inhalation*, *submersion*
- **Soil Screening Levels** (for protection of groundwater)

Construction Worker

- **Soil**: *ingestion*, *inhalation*, *external*
- **Air**: *inhalation*, *submersion*

Outdoor Worker

- **Soil**: *ingestion*, *inhalation*, *external*
- **Air**: *inhalation*, *submersion*

Indoor Worker

- **Soil**: *ingestion*, *inhalation*, *external*
- **Air**: *inhalation*, *submersion*

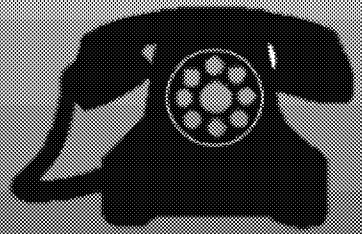
Recreator

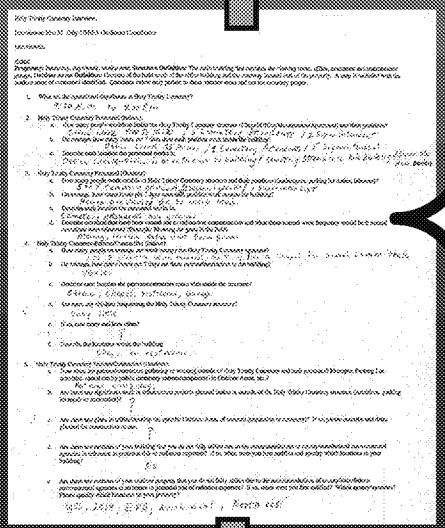
- **Soil/Sediment**: *ingestion*, *inhalation*, *external*
- **Surface Water**: *ingestion*, *immersion*
- **Air**: *inhalation*, *submersion*
- **Biota**: *game*

Farmer

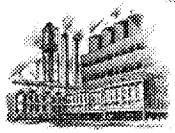
- **Soil**: *ingestion*, *inhalation*, *external*, *consumption of produce*
- **Air**: *inhalation*, *submersion*
- **Tap Water**: *ingestion*, *inhalation*, *immersion*, *consumption of produce*
- **Biota**: *poultry*, *eggs*, *beef*, *milk*, *swine*, *fish*

How to choose?

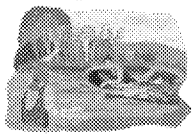




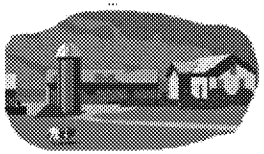
Resident



Indoor Worker

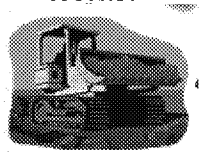


Recreator



Farmer

Outdoor Worker



Construction Worker

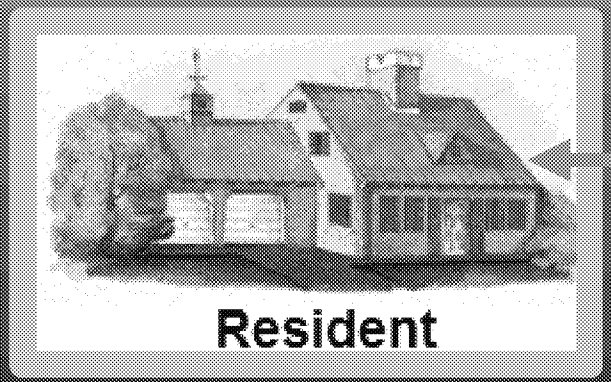
1 Minimal

2 Realistic

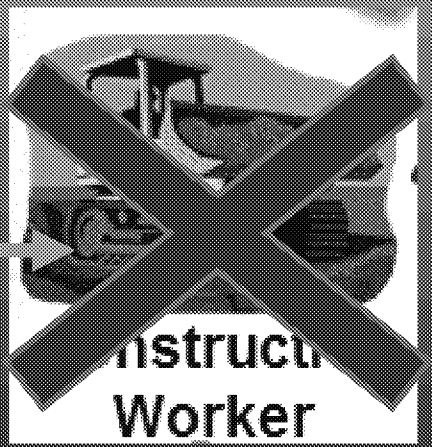
3 Maximum

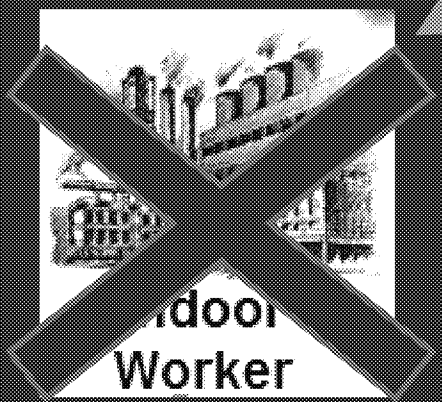
Test out all receptors!

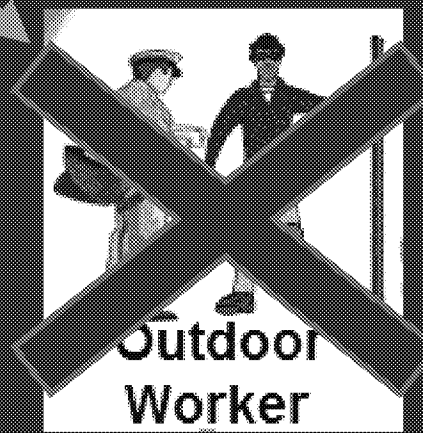
Remember this report is only for one receptor!



Which other receptors are present at your site with the greatest risk?



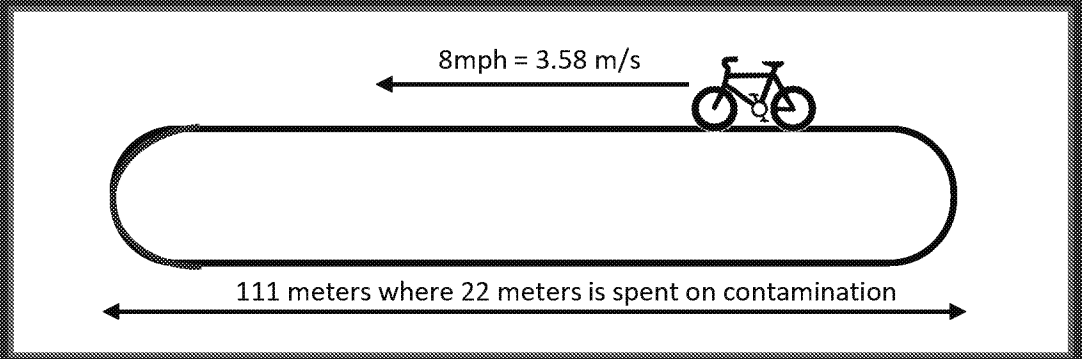




Residential

	Scenarios	mins/day	hours/day	days/year
Child	Child waiting for Bus	30	0.5	180
	Child Playing during School Year (3 hours after school of play)	72	0.6	180
	Child Playing during Summer (5 hours of play)	120	1	120
Adult	Adult Shoveling Snow	60	1	40
	Adult Mowing the Lawn	10	0.417	20
	Adult Landscaping	15	0.625	20
	Adult in Driveway (waiting with child for bus)	30	0.083	365

Child Scenarios of "Play"



Conclusion:

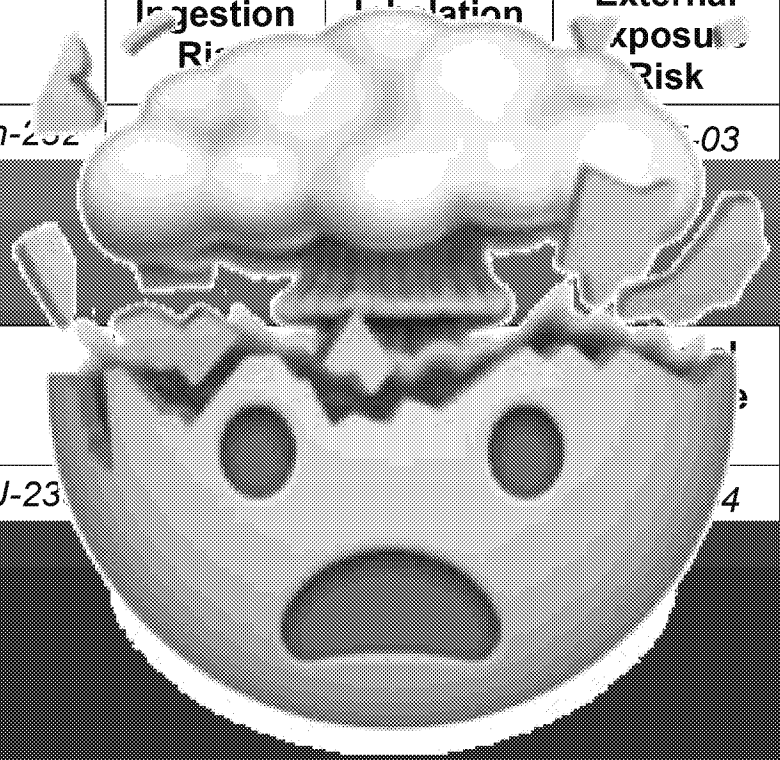
3 hours of play
- 72 mins on top of the contamination

5 hours of play
- 120 mins on top of the contamination

738 UMR Risk Output

Isotope	Ingestion Risk	Inhalation	External Exposure Risk	Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for Th-232			-03	-	6.46E-03

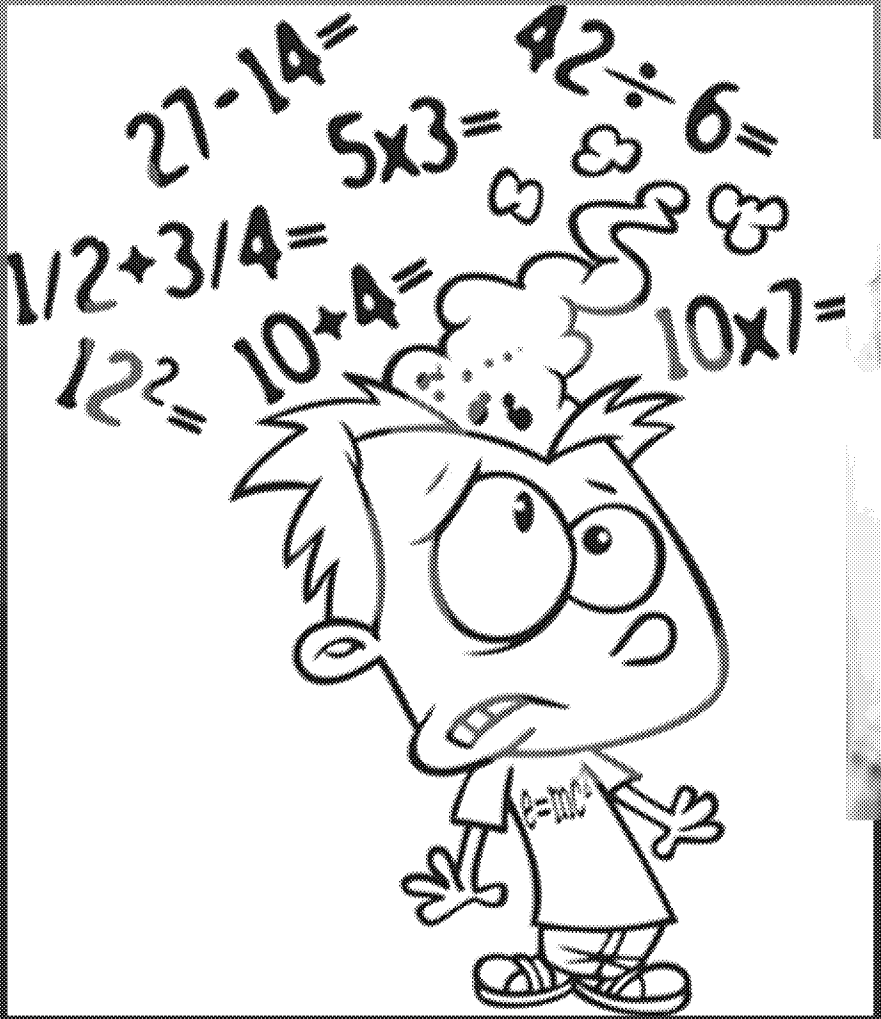
Isotope				Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for U-23			4	-	7.06E-04

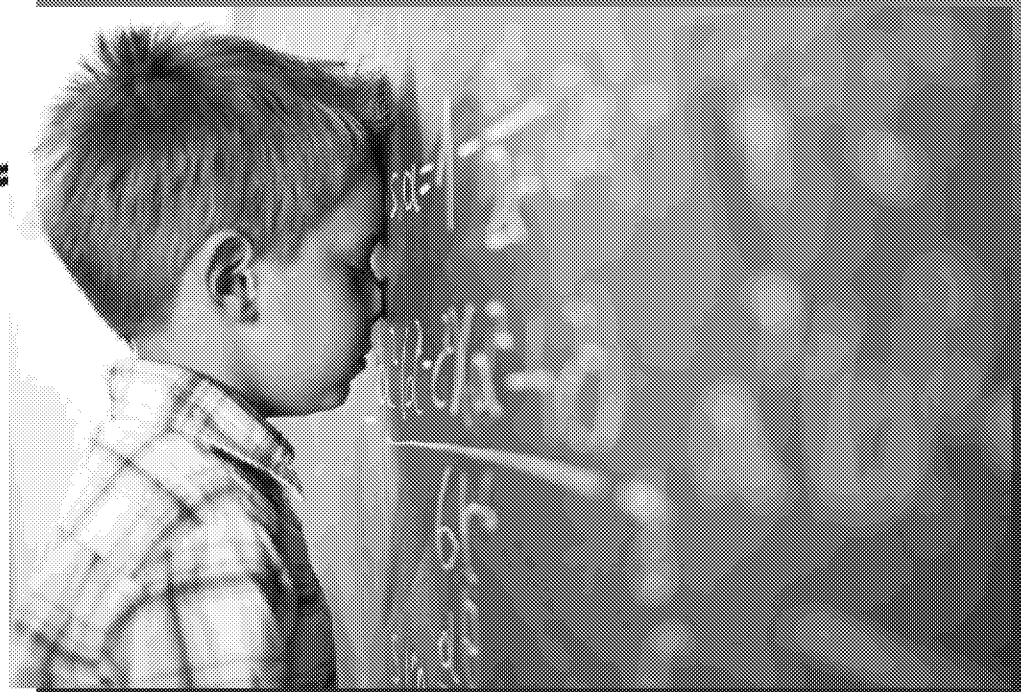


The acceptable risk was set to 1.0E-04

(Or you could think of it as 1 in 10,000 excess risk of developing cancer)

Time for some MATH!





738 UMR Risk Output

Isotope	Ingestion Risk	Inhalation Risk	External Exposure Risk	Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for Th-232	1.10E-03	5.77E-08	5.37E-03	-	**6.46E-03**

0.0.0.6.46 Greater than 0.0001? Yes!

3 2 1

Isotope	Ingestion Risk	Inhalation Risk	External Exposure Risk	Produce Consumption Risk	Total Risk
*Secular Equilibrium Risk for U-238	2.65E-04	4.08E-09	4.41E-04	-	**7.06E-04**

7.06E-04 = 0.000706 is greater than 0.0001

The acceptable risk was set to 1.0E-04= 0.0001

(Or you could think of it as 1 in 10,000 excess risk of developing cancer)

Ok, last slide on Math

LINGO!!!

Typically, we may switch back and forth on terms:

$$1.0E\text{-}04 = 1x10^{-4}$$

"E to the minus 4" or "ten to the minus 4"

738 UMR PRG Output

Site-Specific

Resident PRGs for Soil - Secular Equilibrium

Isotope	Ingestion PRG TR=0.0001 (pCi/g)	Inhalation PRG TR=0.0001 (pCi/g)	External Exposure PRG TR=0.0001 (pCi/g)	Produce Consumption PRG TR=0.0001 (pCi/g)	Total PRG TR=0.0001 (pCi/g)
**Secular Equilibrium PRG for Th-232*	*2.95E+01*	*2.98E+07*	*6.03E+00*	-	*5.01E+00*
**Secular Equilibrium PRG for U-238*	*1.38E+01*	*4.77E+07*	*8.29E+00*	-	*5.18E+00*

Removal Site Evaluation (RSE)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION II

DATE: DEC 14 2018

SUBJECT: Removal Site Evaluation for the 738 Upper Mountain Road Site, Lewiston, New York

FROM: Eric M. Daly, On-Scene Coordinator
Response Prevention Branch

TO: Joseph D. Rotola, Chief
Removal Action Branch

Introduction

The United States Environmental Protection Agency (EPA) Region II Removal Action Branch (RAB) was requested to conduct a Removal Site Evaluation (RSE) at the 738 Upper Mountain Road Site (Site) by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH).

In July 1985, members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) performed radiological surveys of properties throughout Niagara County. The results of the surveys were recorded in a November 1986 report, which specifically documented elevated gamma exposure rates at the driveway of the Site, among other sites in Niagara Falls and Lewiston, New York. The NYSDEC and NYSDOH referred 738 Upper Mountain Road to EPA on July 21, 2013 for further assessment.

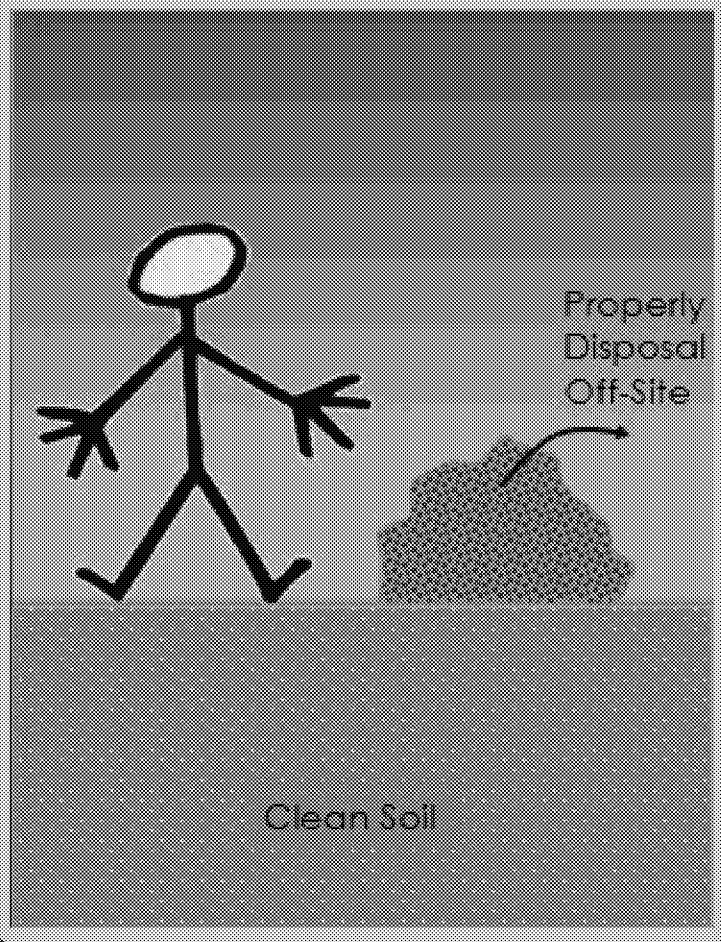
The EPA Pre-Remedial Section (PRS) screened the Site in December 2013 and as of May 2014 recommended a "No Further Remedial Action Planned" (NFRAP) determination. The NFRAP determination signifies that no additional remedial steps will be taken to list the Site on the National Priorities List (NPL) unless new information warranting further Superfund consideration or conditions not previously known to EPA regarding the Site are disclosed. The NYSDEC and NYSDOH requested RAB to assess the Site for a potential Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) removal action. In response to this, RAB initiated a RSE to determine Site eligibility.

It should be noted that a Removal Site Evaluation, dated 06/12/2018, previously determined that the Site did not warrant a CERCLA removal action. Due to an adjustment and recalculation of the PRG calculator, and the resultant increase in the calculated risk, it was determined that the Site does warrant a CERCLA removal action. This document supersedes the Removal Site Evaluation dated 06/12/2018.

We determined a need for removal… Now what?

The Site as is

Full/Partial Shielding



Removal

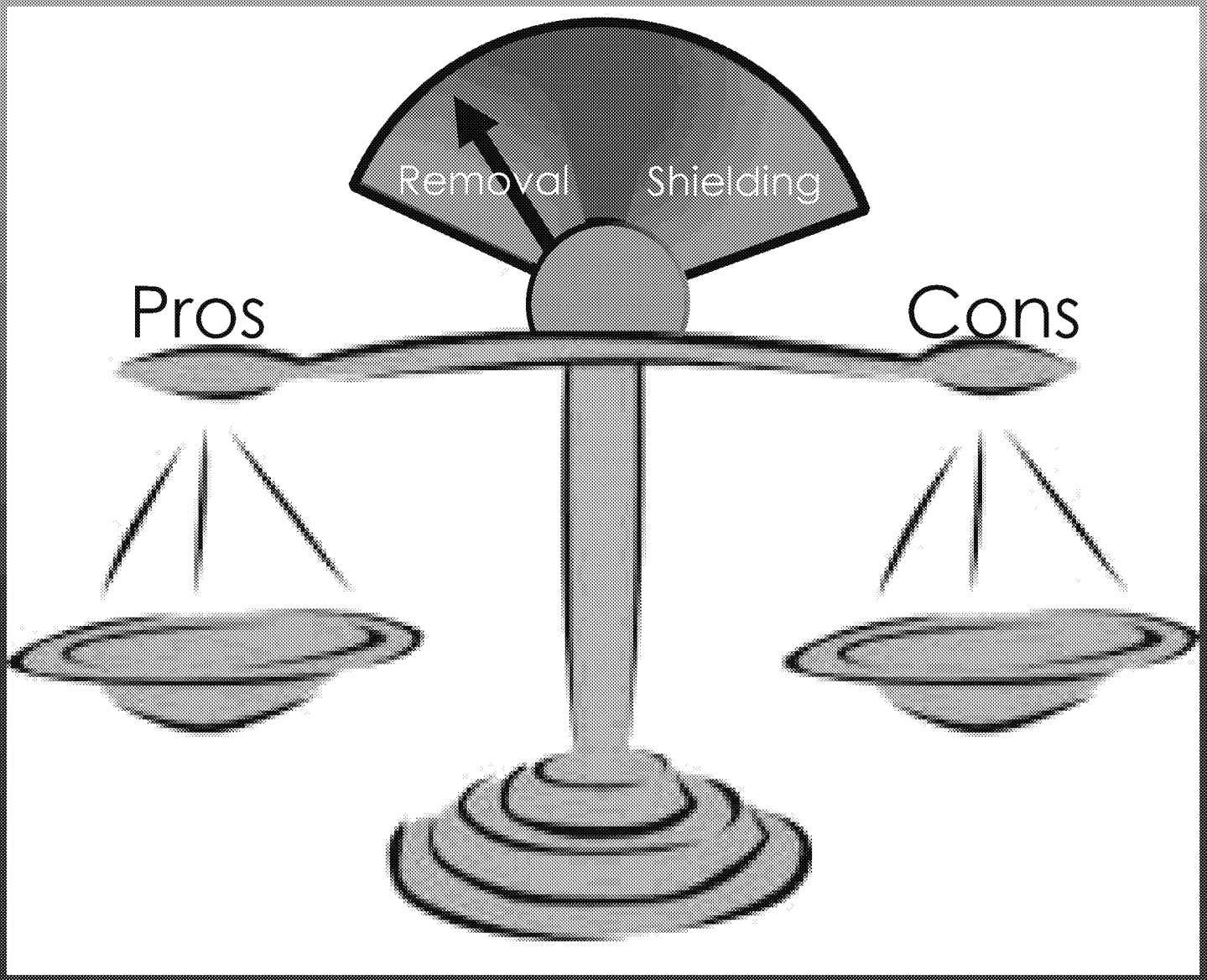
Full Removal

- Pros:
  - Once the contaminant is removed, the site is CLEAN
  - Positive public reception of EPA
  - Maybe able to do a combined removal especially with HTC
- Cons:
  - Need a better picture of the extent of contamination
  - Cost
  - Time / Interfere with business operations

Full/Partial Shielding

- Pros:
  - Variety of options
  - Less time / Cost maybe less depending on material
- Cons:
  - It's not "cleaned." May be a waste if determined later site doesn't meet remedial goals of 10^{-6}
  - Shielding will need to be maintained
  - Will add a height to ground
    - Tripping hazards, installation of ramps or stairs will all need to be considered
    - If you set shielding in ground, contaminated top layer of dirt will need to be removed anyway
  - Deed restrictions will be needed
  - Negative public perception

Full Removal!!!!



Write our Action Memo

Funding

RSE

History

Transportation

Disposal

Definitions

Risk

Action Memo Layout

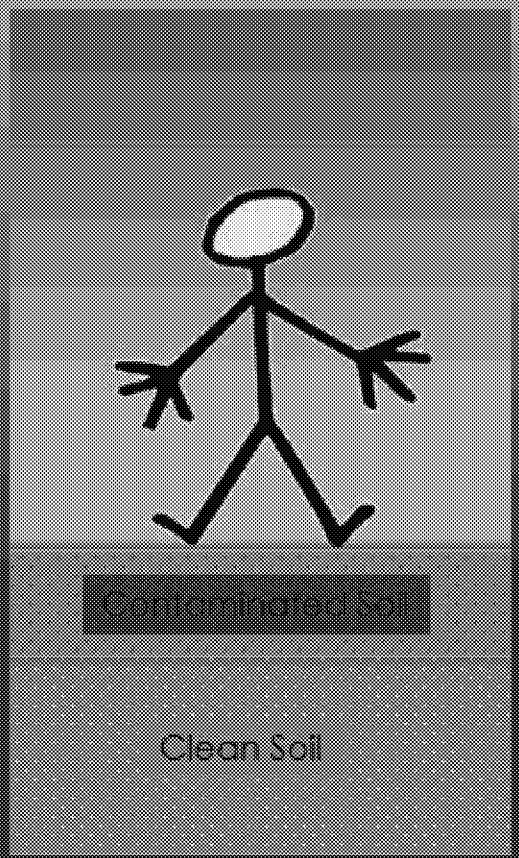
- Basic layout:
  - Background of the site
  - History
  - Terms
  - "Threat to Public Health or Welfare" and "Threat to Environment"
  - Proposed Action
  - Estimated Cost

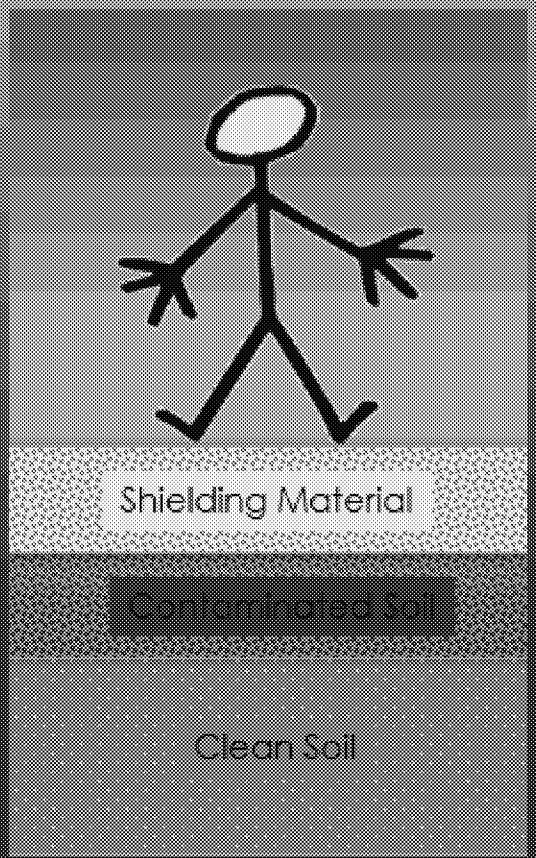
RSE

Proposed Statement of Work

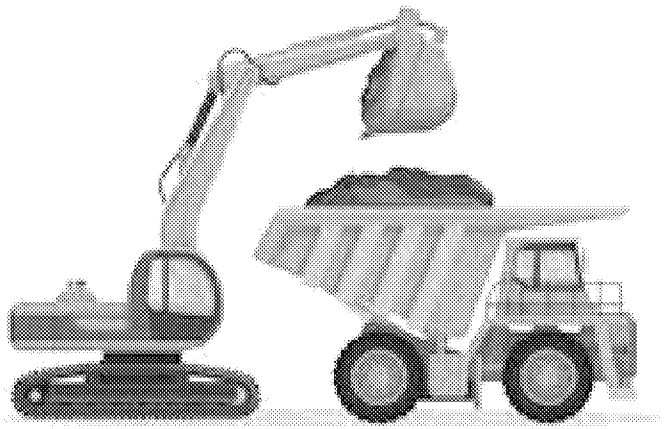
- Establish support facilities on the site property (vehicle parking area, staging areas for equipment, sanitation facilities, and foliage removal);
- Secure and restrict access to the work areas;
- Excavate approximately 102 cubic yards of radioactive material from the identified area of concern on the Site;
- Perform post-excavation gamma surveying, soil sampling, and analysis as per the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) plan;
- Off-Site disposal of hazardous waste and/or substances in compliance with the CERCLA Off-Site Disposal Rule, 40 C.F.R 300.440, and specific disposal acceptance criteria as per the approved radiological disposal facility; and
- Restore excavated area to pre-excavation condition with clean fill.

But, how do we do that?

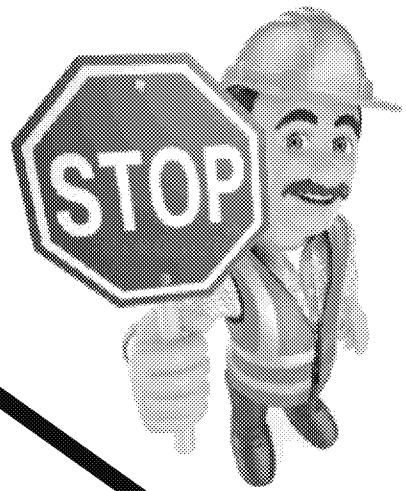


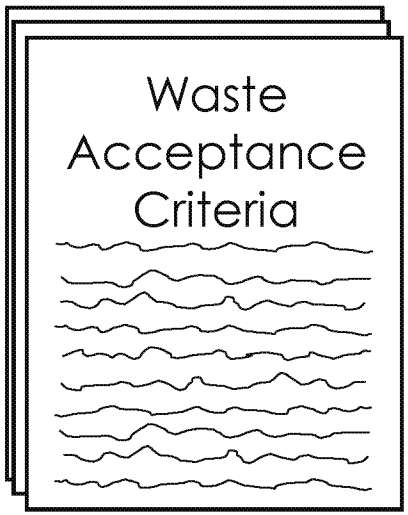


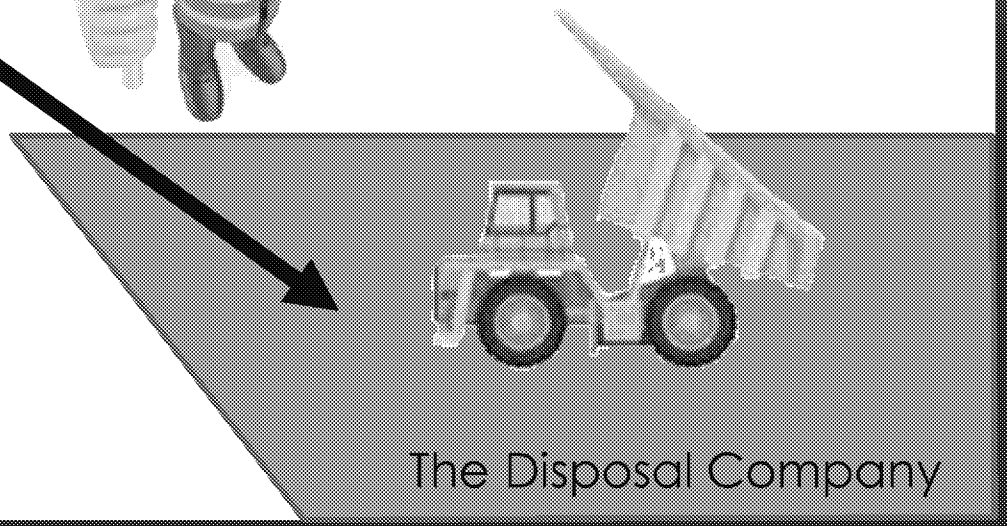
Disposal Operations



The Site: 738 UMR







The Disposal Company

Example WAC

2. Source Material Sum of Fractions (SOF) Formulas:

Natural Uranium + Thorium	Refined Uranium + Thorium	Depleted Uranium + Thorium
$\frac{Conc_{U\text{-}238}}{167\ pCi/g} + \frac{Conc_{Th\text{-}232}}{55\ pCi/g} \leq 1$	$\frac{Conc_{U\text{-}Total}}{333\ pCi/g} + \frac{Conc_{Th\text{-}Total}}{110\ pCi/g} \leq 1$	$\frac{Conc_{U\text{-}238}}{169\ pCi/g} + \frac{Conc_{Th\text{-}232}}{55\ pCi/g} \leq 1$

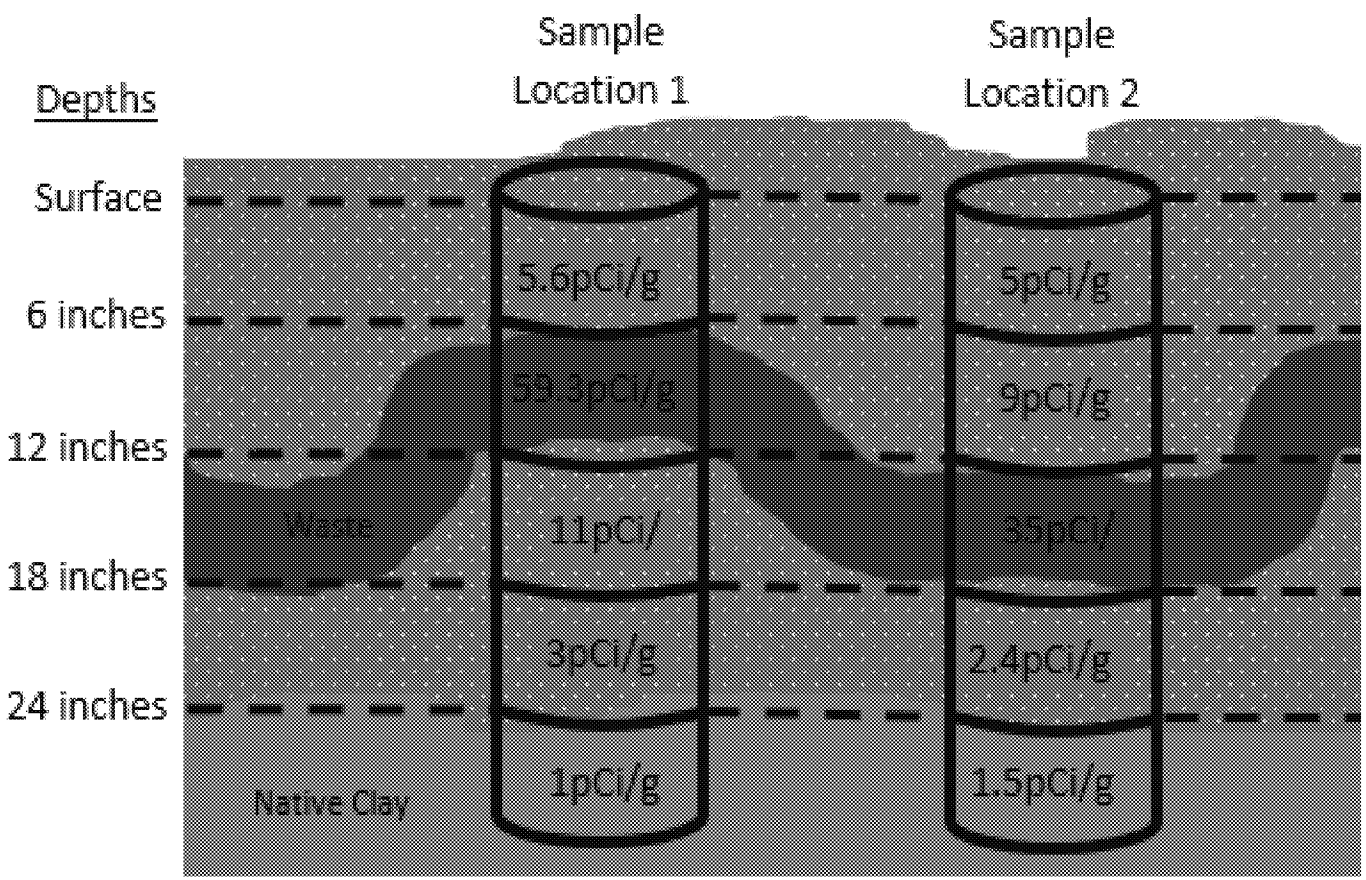
Notes:
1. *Unless otherwise noted, use parent nuclide in equations*
2. *Th-232 will routinely be considered to be in equilibrium with all progeny.*
3. *Total Uranium = U-234 + U-235 + U-238.*
4. *Total Thorium = Th-232 + Th-228*
5. *Refined Uranium refers to chemical forms where the equilibrium state of the uranium decay chain has been disrupted.*
6. *Depleted Uranium contains U-235 at < 0.71% by weight*

D. NORM/TENORM other than Source Material Dispersed in Soil or Other Media

1. Does the waste contain:	☑ Ra-226	☐ Pb-210	☐ K-40	☐ Other(s)
2. Waste Concentration (pCi/g):	46	N/A	N/A	N/A
3. WDI Site Disposal Limits: (Note 1)	*50*	*260*	*(Note 2)*	*(Note 3)*

Notes:
1. MDI may receive higher concentrations for treatment or blending. All treated waste intended for disposal at WDI must meet the limits shown in D.3.
2. K-40 may not be enriched beyond its natural concentration.
3. Contact WDI Waste Approvals.

Meeting the WAC

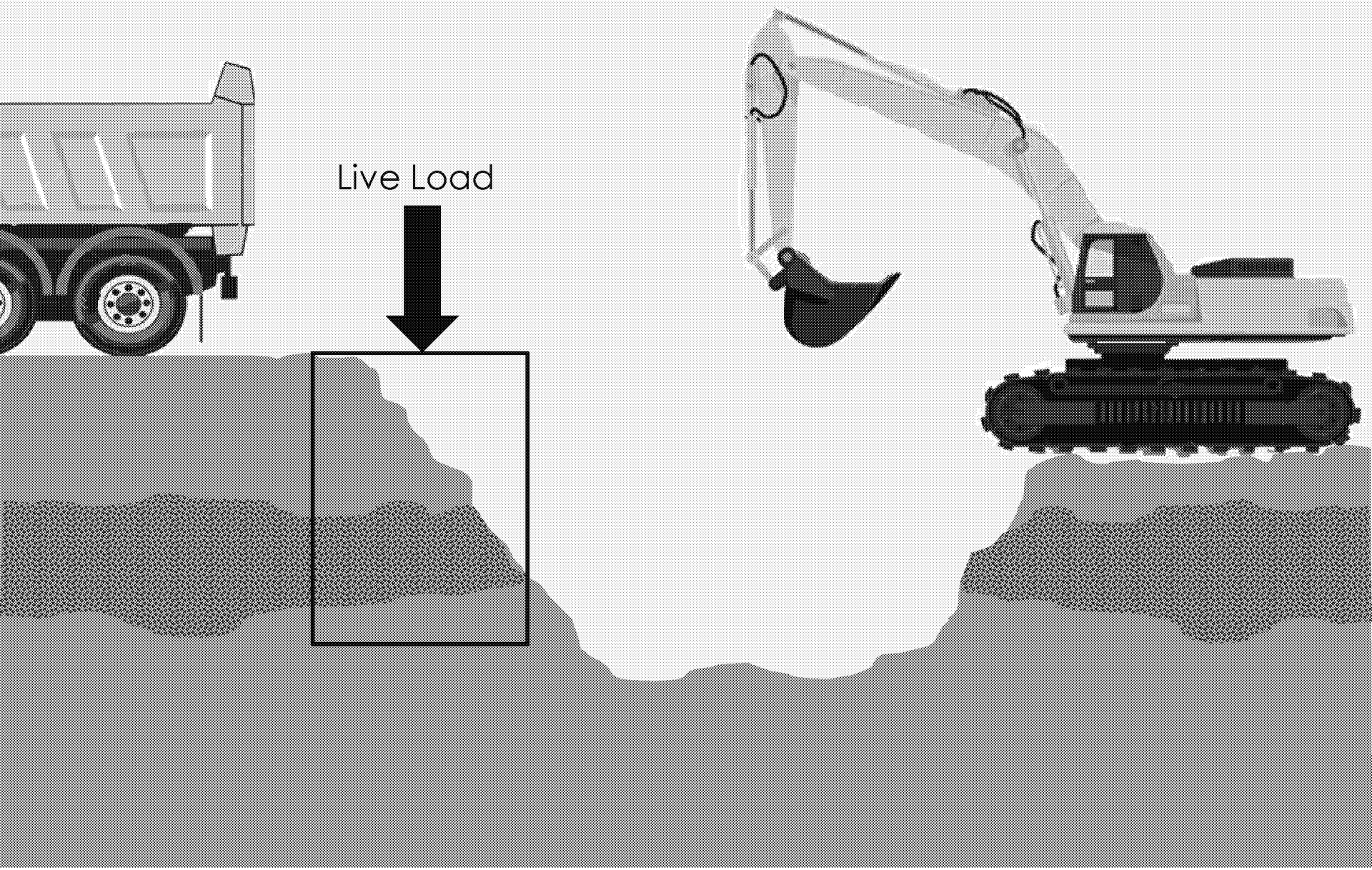


Soil including top soil, native soil, and or fill dirt in background levels

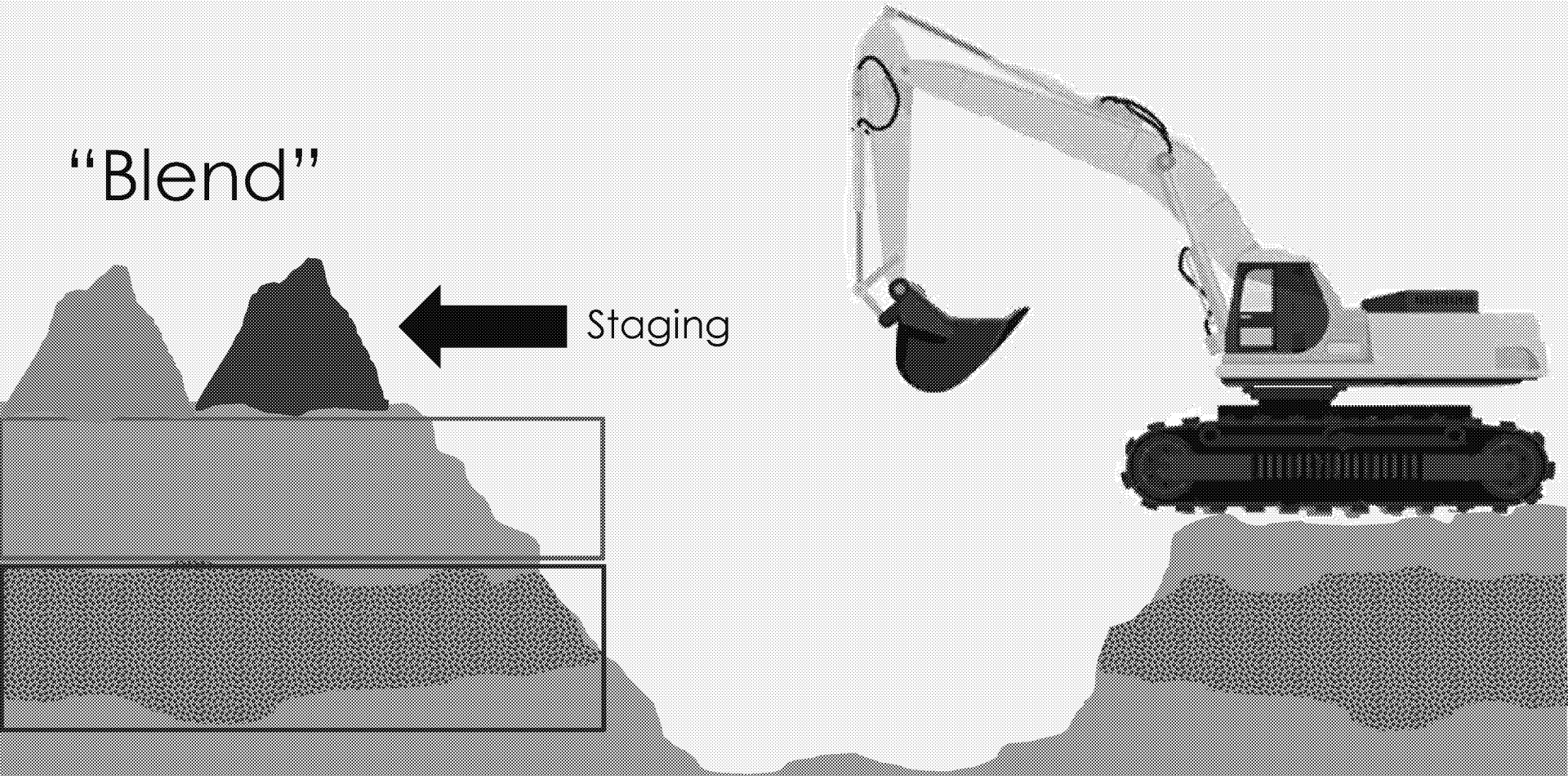
Waste / Contamination with elevated levels

Native Soil / Clay at background levels

Live Loading vs. Staging



Live Loading vs. Staging

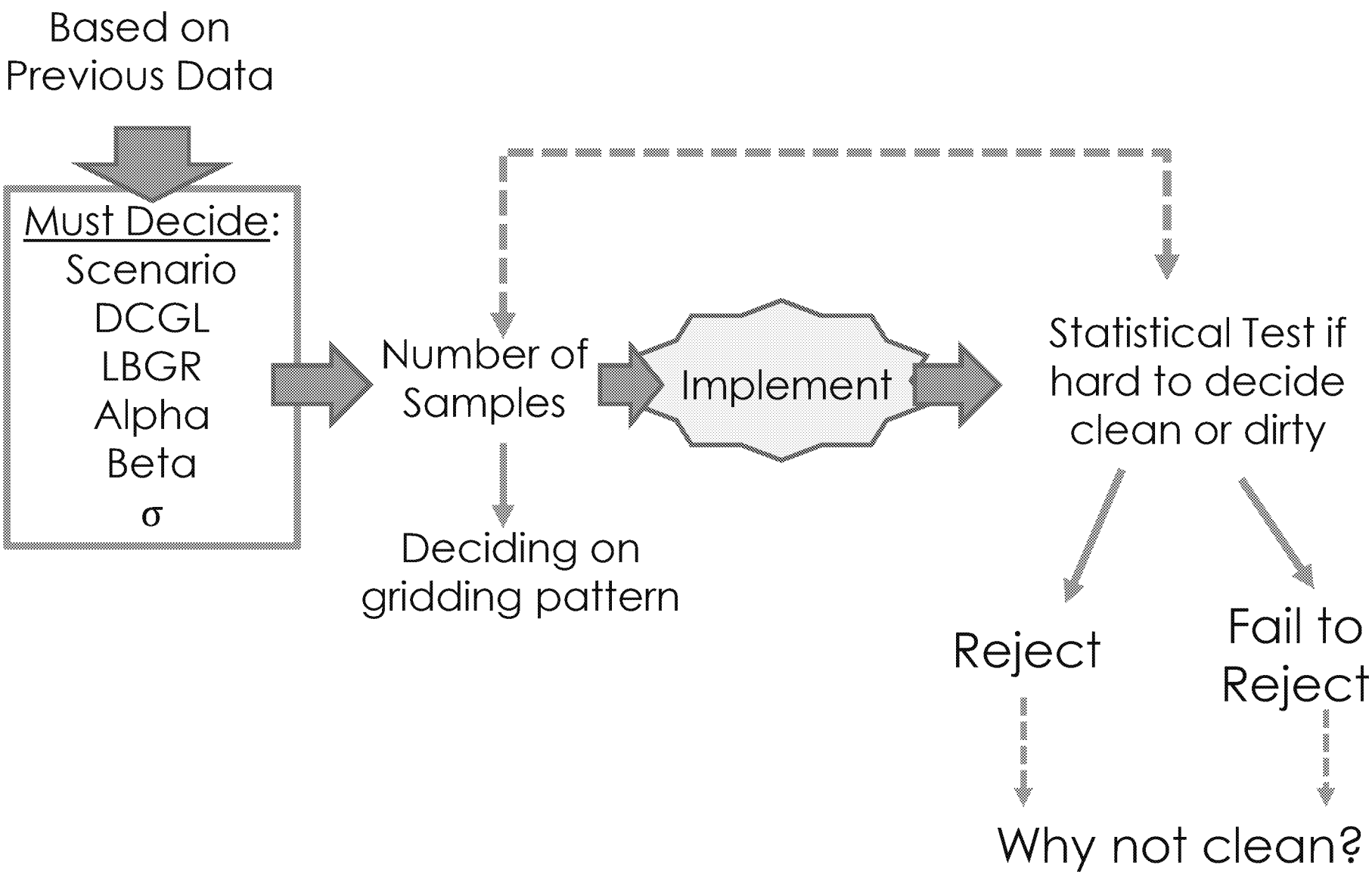


Major concern to consider: Logistics

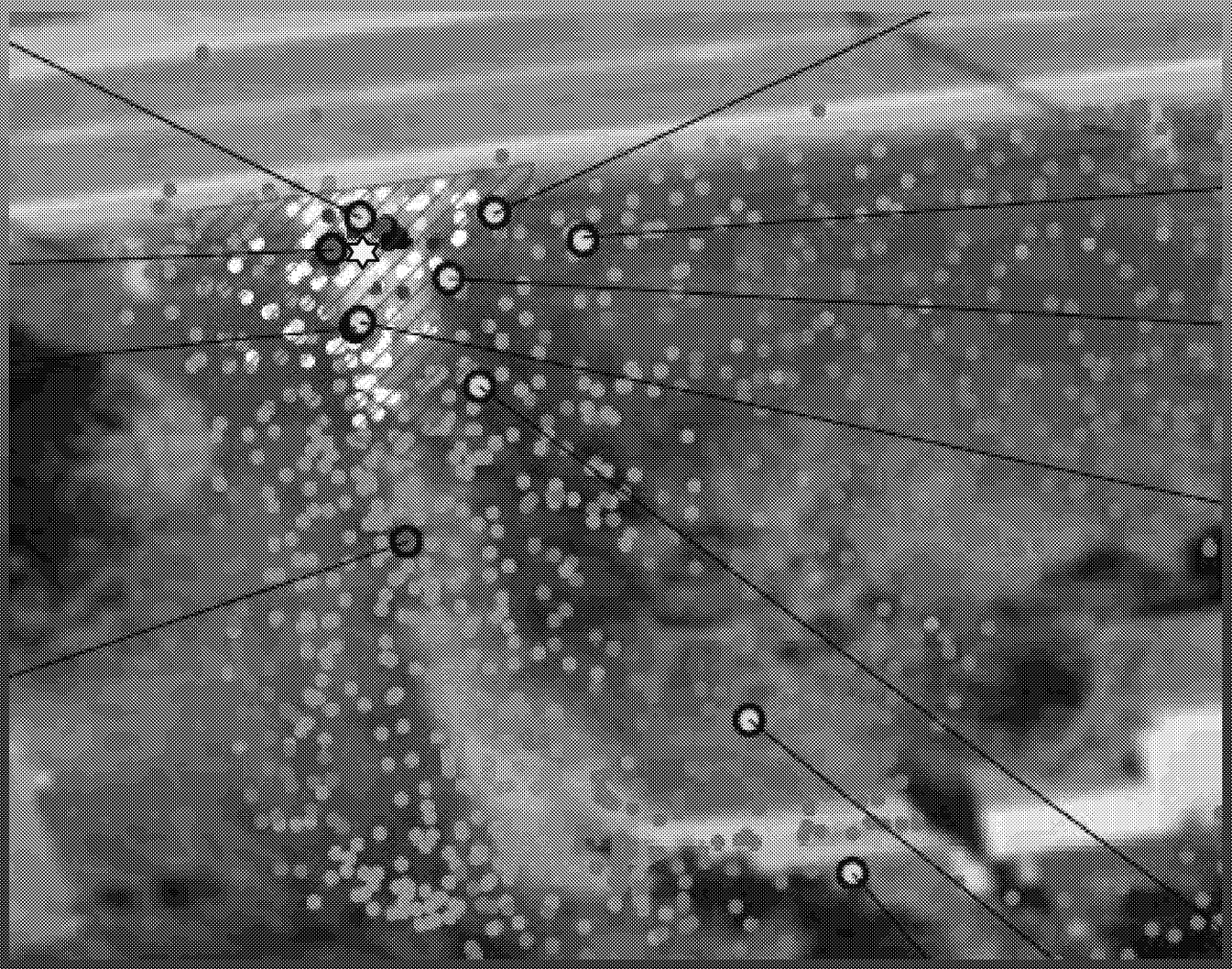
Process for determining clean / Post-Disposal

- How do we determine if site is clean?
- Go down to native (background)
- Gamma surveys
- Post excavation sampling
- Backfill with clean material—sampled
- Analytical
- MARSSIM process to determine if clean
- If not, area will be re-excavated

MARSSIM


Based on Previous Data
Must Decide:
Scenario
DCGL
LBGR
Alpha
Beta
σ
Number of Samples
Deciding on gridding pattern
Implement
Statistical Test if hard to decide clean or dirty
Reject
Fail to Reject
Why not clean?

Work this Week: Additional Sample Location



Work this Week: Property Boundary

Any Questions?