Preliminary

# *Preliminary Analysis of Soil Data:* Distribution of Exide's Lead Emissions in Soil

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# Purpose of This Soil Data Analysis

- Show the distribution of Exide's lead in the soil around the facility
  - How much is there?
  - How far does it reach?
- Use the information about distribution of Exide's lead to design cleanup plan
- Document Exide's responsibility for lead contamination to recover the cleanup costs

<u>Note</u>: These analyses are not used to assess risks to human health and the environment

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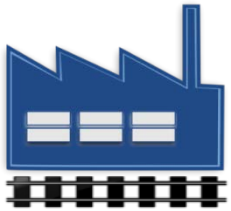
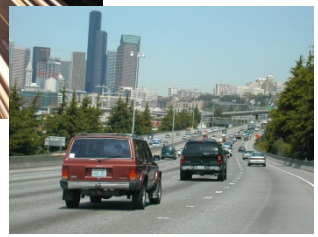
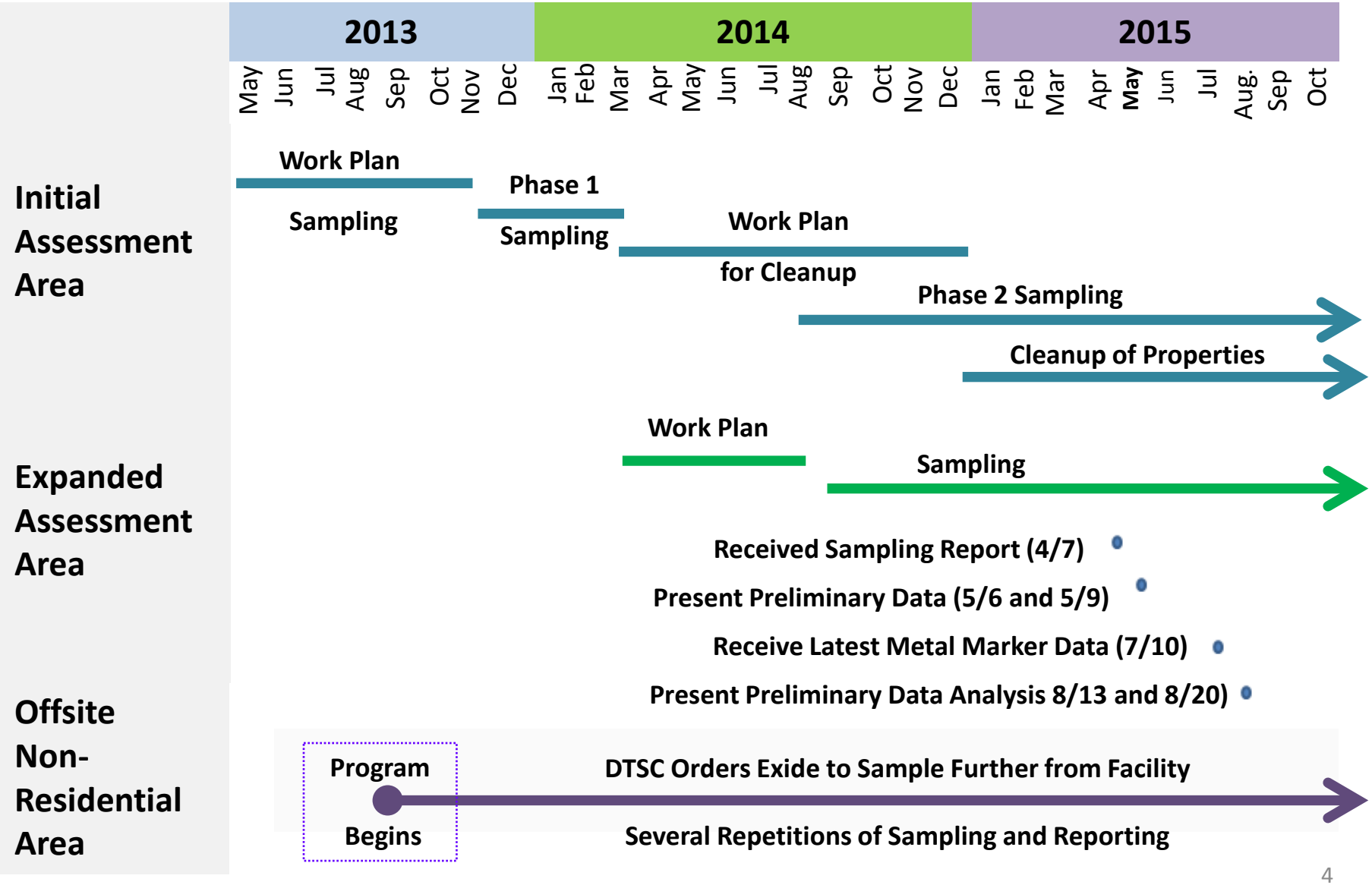
# Why Do We Want to Show What Lead Came From Exide?

- Exide is required to clean up lead contamination from their operations
- There are other potential sources of lead in urban environments with industrial activity
- These and other types of analyses help hold Exide accountable and may identify others responsible for lead contamination

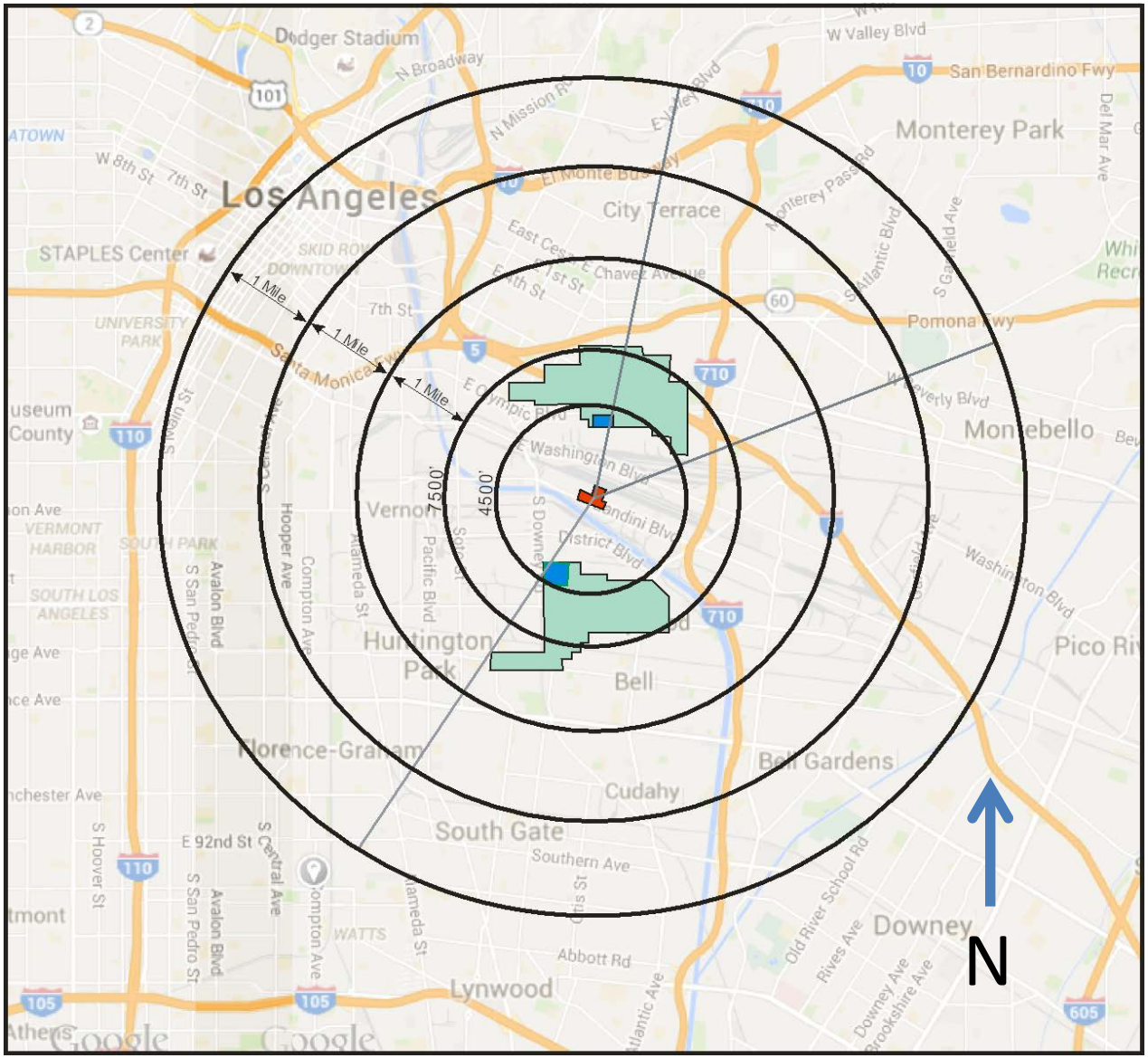




# Timelines


2013
2014
2015
May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug. Sep Oct
Initial Assessment Area
Work Plan
Sampling
Phase 1
Sampling
Work Plan
for Cleanup
Phase 2 Sampling
Cleanup of Properties
Expanded Assessment Area
Work Plan
Sampling
Received Sampling Report (4/7)
Present Preliminary Data (5/6 and 5/9)
Receive Latest Metal Marker Data (7/10)
Present Preliminary Data Analysis 8/13 and 8/20)
Offsite Non-Residential Area
Program
Begins
DTSC Orders Exide to Sample Further from Facility
Several Repetitions of Sampling and Reporting

# Map of Sampling Areas




Initial Assessment Area Soils (Residential)

Expanded Area Soils (Residential)

Off-Site Non-Residential Soil Sampling ~4.5 Miles

Sampling Transects Dominant Wind Directions

# Summary of Samples Used for Preliminary Analysis

**INTIAL ASSESSMENT AREA**

- Samples from total of 184 out of 219 Properties were used for the Evaluation
- Total Number of Sample Locations = 2,286
- Total Number of Samples = 10,848

**EXPANDED ASSESSMENT AREA**

- Samples from 146 Properties were used for the Evaluation
- Total Number of Sample Locations = 1,742
- Total Number of Samples = 8,695

**OFF-SITE NON-RESIDENTIAL SOIL SAMPLING**

- Total Number of Sample Locations = 116
- Total Number of Samples = 351

**Total Number of Sample Locations used– 4,144**

**Total Number of Samples used - 19,894**

*Samples Received as recently as **July 10, 2015** were included in the Preliminary Analysis*

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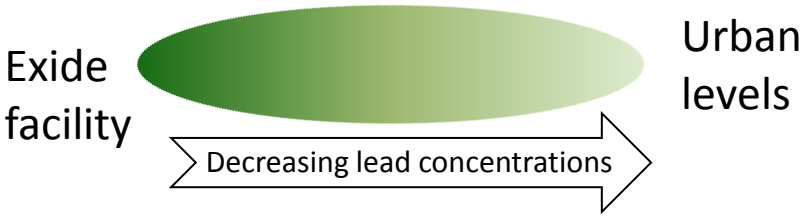
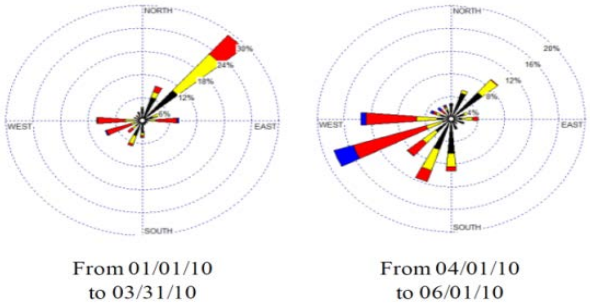
# The Analyses Look for Patterns of Lead Concentrations

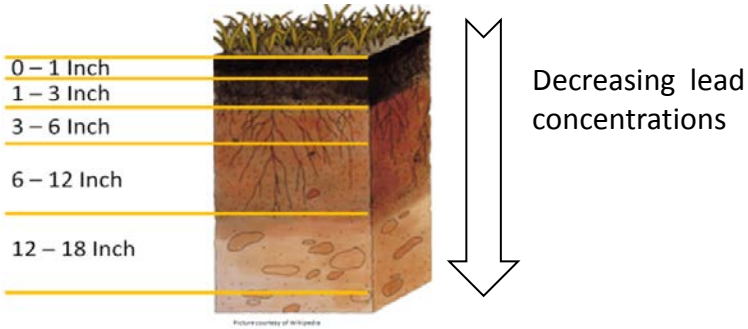
- Higher concentrations closer to the facility




- Higher concentrations in downwind directions




- Higher concentrations closer to the surface of the soil



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# Multiple Methods Used for Analyses to Build Confidence in Results

- Standard exploratory data analyses (descriptive statistics, graphing)
- Statistical tests of difference between near-facility levels and more distant levels
- Analysis of marker metals

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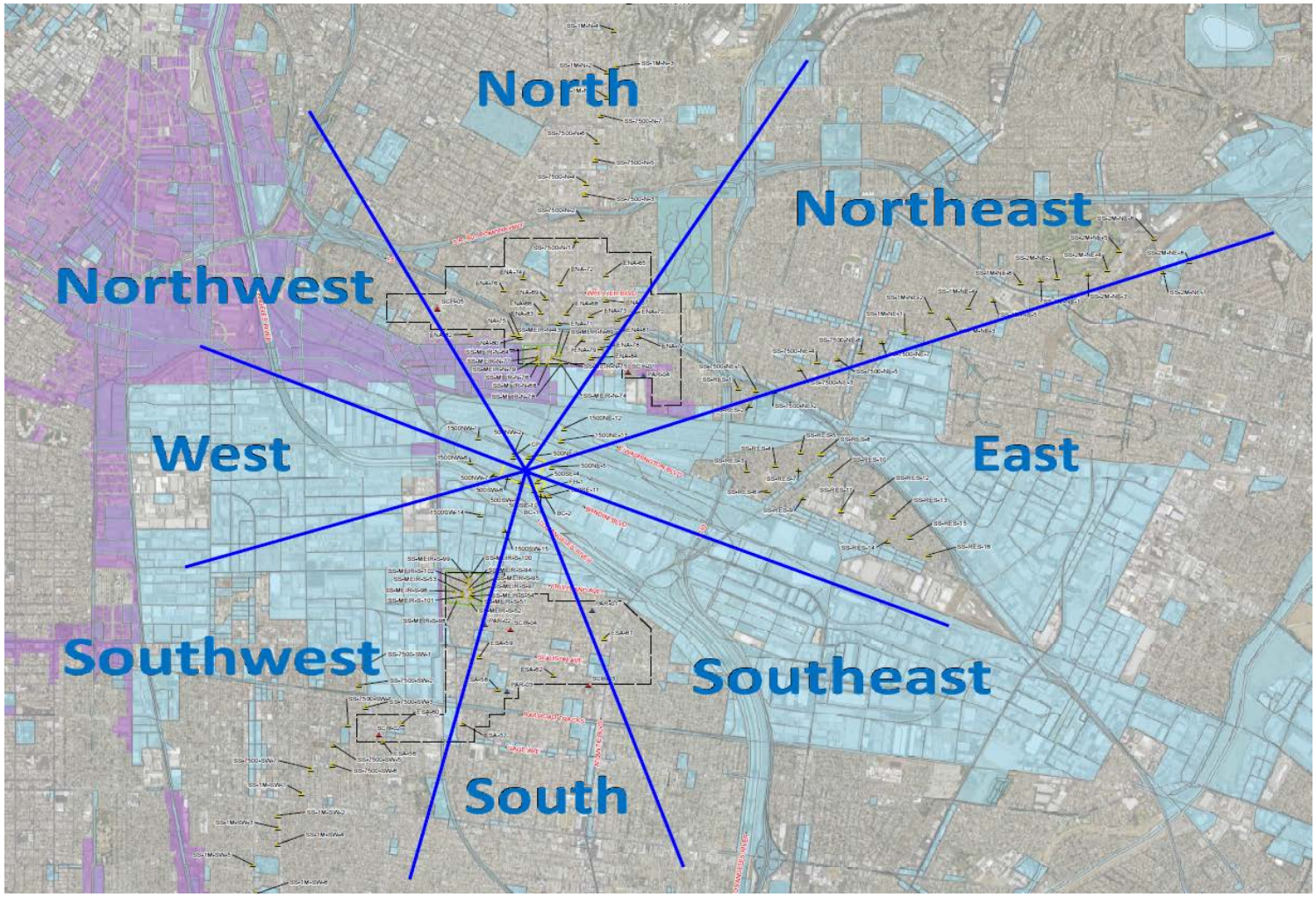
# Analyze Data in Groups Based on Direction from Exide Facility



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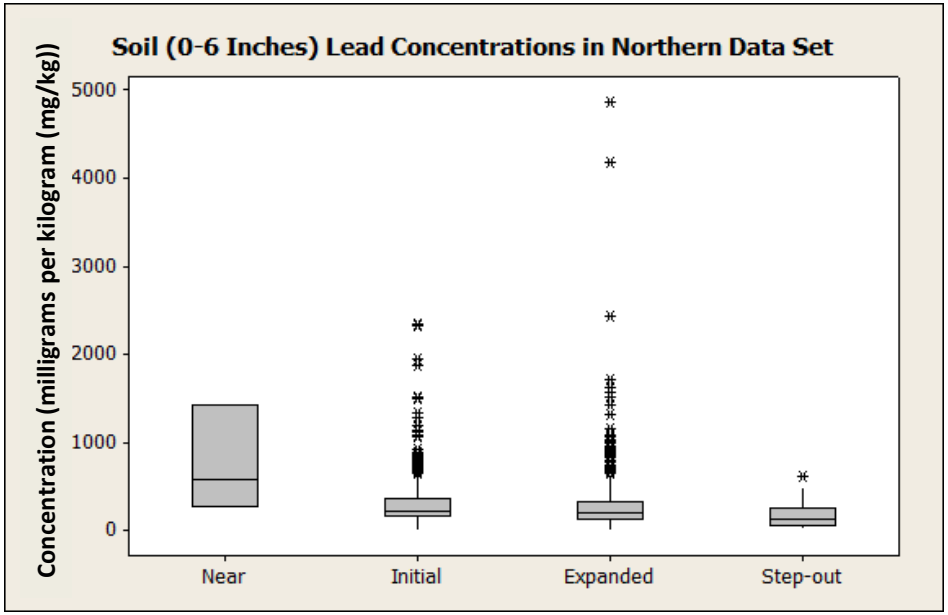
# Exploratory Data Analysis:

## For example – Northern Data Set

### Descriptive Statistics

| Data Group | No. of Data Points | Mean (mg/kg) | Median (mg/kg) | Range (mg/kg) |
|---|---|---|---|---|
| Near | 3 | 764 | 585 | 273 – 1,433 |
| Initial Area | 885 | 294 | 229 | 11 – 2,338 |
| Expanded Area | 758 | 291 | 202 | 13 – 4,858 |
| Step-out | 21 | 181 | 135 | 26 - 612 |

### Boxplot



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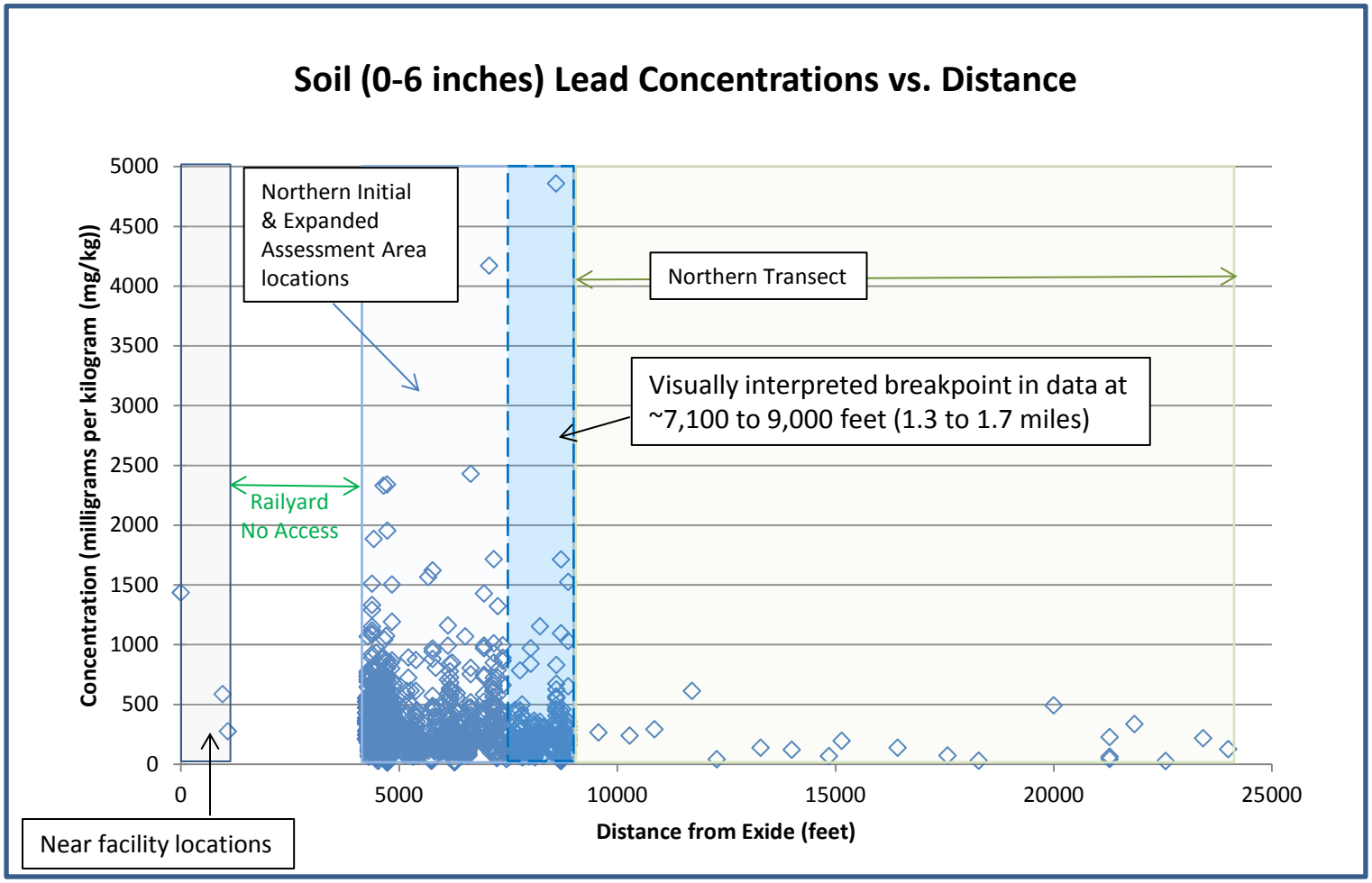
# Exploratory Data Analysis:

## Example Scatterplot – Northern Data Set



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# Statistically Compare Amounts of Lead Closer to and Farther From Facility

- Similar to graphical approach shown on previous slide
- Compares mean concentrations from data group closer to facility vs. data group farther from facility
  - At some distance, amount of lead in soil closer to the facility will be higher than amount of lead in soil farther from facility

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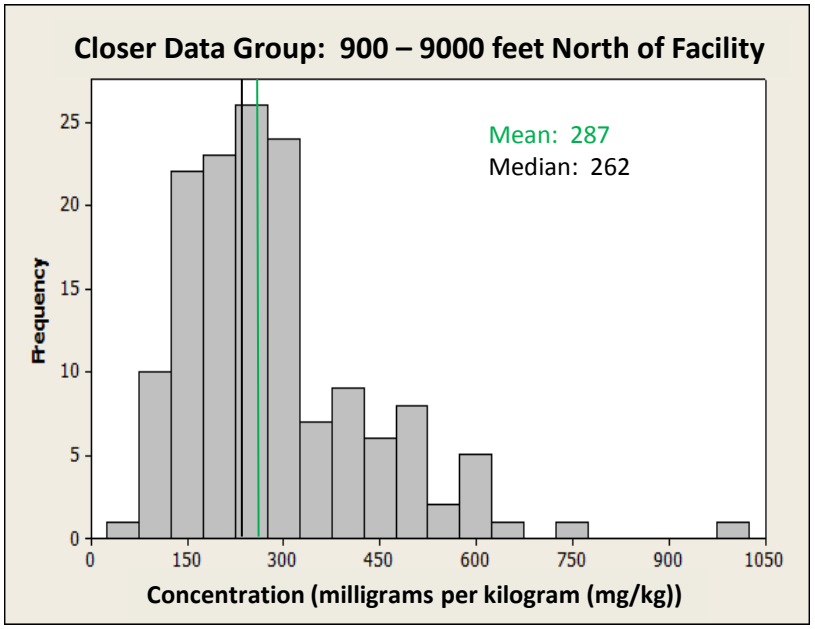
# Statistical Comparison:

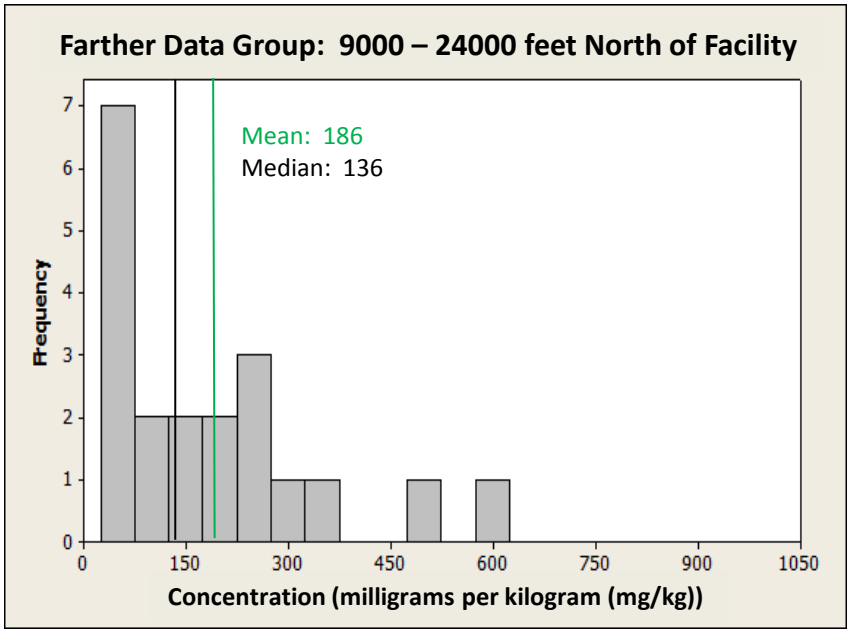
## For example – Northern Data Set

**Finding:** Breakpoint in soil lead concentrations between 7,000 and 9,000 feet (1.3 to 1.7 miles)

Inside Preliminary Estimate of Area of Influence from Exide Emissions




Outside Preliminary Estimate of Area of Influence from Exide Emissions



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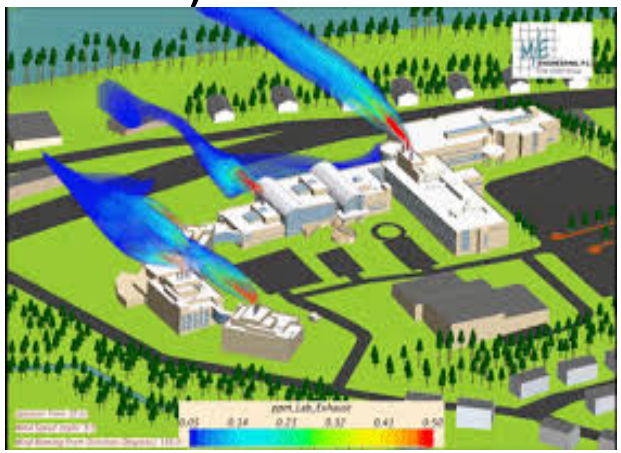
# Emissions from Secondary Lead Smelters Include Other Metals

- Commonly associated metals:
  - Antimony (about 5% of “hard lead”)
  - Arsenic
  - Cadmium
  - Copper
  - Nickel
  - Zinc



- To support evaluation, performed additional analyses for metals on previously collected samples

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# Summary of Findings for Marker Metals

| Metal | Associated with secondary smelters? | Common to other sources? | Concentration pattern with distance (Fits conceptual site model of Exide emissions?) | Near facility data? | Strength as indicator of Exide distribution |
|---|---|---|---|---|---|
| **Antimony** | **Yes, "antimonial lead"** | **No** | **Strong decreasing trend** | **Yes** | **Very strong** |
| Cadmium | Yes | Yes | Strong decreasing trend | Yes | Strong |
| Copper | Yes | Yes | Apparent decreasing trend (variability in data) | No | May be strong (additional data needed) |
| Zinc | Yes | Yes | Apparent decreasing trend (variability in data) | No | May be strong (additional data needed) |
| Arsenic | Yes | Yes | Limited variation with distance | Yes | Weak |
| Nickel | Yes | Yes | Limited variation with distance | No | Weak |

This table summarizes the characteristics that make a given metal useful as an indicator of Exide's distribution.

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# Summary of Preliminary Findings

- Lead concentrations decrease farther from the facility
- We can show a distance where lead concentrations reflect urban lead levels
- Using several data evaluation methods, preliminary estimates of distribution of Exide's emissions:
  - Multiple lines of evidence that Exide's lead emissions may extend to a distance of 1.3 to 1.7 miles from the facility
  - The distance appears to vary depending on the direction
- County's data evaluation method showed similar results
- Further refinement of distance is needed
  - Data collection to fill data gaps