California EPA Waste Classification

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Dept Toxic Substances Control
Cal/EPA

Cal/EPA Toxicity Criteria: Extraction Tests

- TCLP: Regulatory Limits
- Waste Extraction Test (WET):
  Soluble Threshold Limit Concentrations (STLCs)

Cal/EPA Other Toxicity Criteria

- Calculated oral toxicity
- Calculated dermal toxicity
- Calculated inhalation toxicity
- Fish toxicity < 500 mg/L
- Listed carcinogens > 100 ppm

TCLP vs WET

- Acetate buffer vs. Citrate buffer
- 18 hrs vs. 48 hrs
- Liquid:solid - 20:1 vs 10:1

Cal/EPA Extraction Studies

Which extraction test best simulates extraction with municipal solid waste leachate?

Study Design

- 1. Compare WET, TCLP, SPLP, and leachate extraction
- 2. Determine extraction over 48-84 days with 10% replacement

Extraction Study

Wastes

- mine tailings (As, Pb)
- composite of burnt or catalyst wastes (Ag, Co, Sb, Zn)

Extraction Study

Wastes, cont.

- composite of water precipitated wastes (Be, Cd, Cr, Mo, Ni, V)
- composite of metallic wastes (Be, Co, Cr, Mo, Ni, V)
- composite of misc wastes (Ag, As, Ba, Be, Cd, Cr, Cu, Mo, Ni, Se, Tl, V)

Extraction Study

Extraction Fluids

- citrate (WET) protocol
- acetate (TCLP) protocol
- Synthetic Precipitation Leaching Procedure (SPLP) solution
- Ukiah landfill leachate

Results and Discussion

- Comparisons among MSWL, WET, TCLP, and SPLP

Study Conclusions

- Regulated elements fall in two categories

Category 1

- Beryllium (Be)
- Chromium (Cr III)
- Copper (Cu)
- Nickel (Ni)
- Zinc (Zn)
- Cadmium (Cd)
- Cobalt (Co)
- Lead (Pb)

Category 1

- TCLP better than WET or SPLP at simulating leachate extraction

Category 2

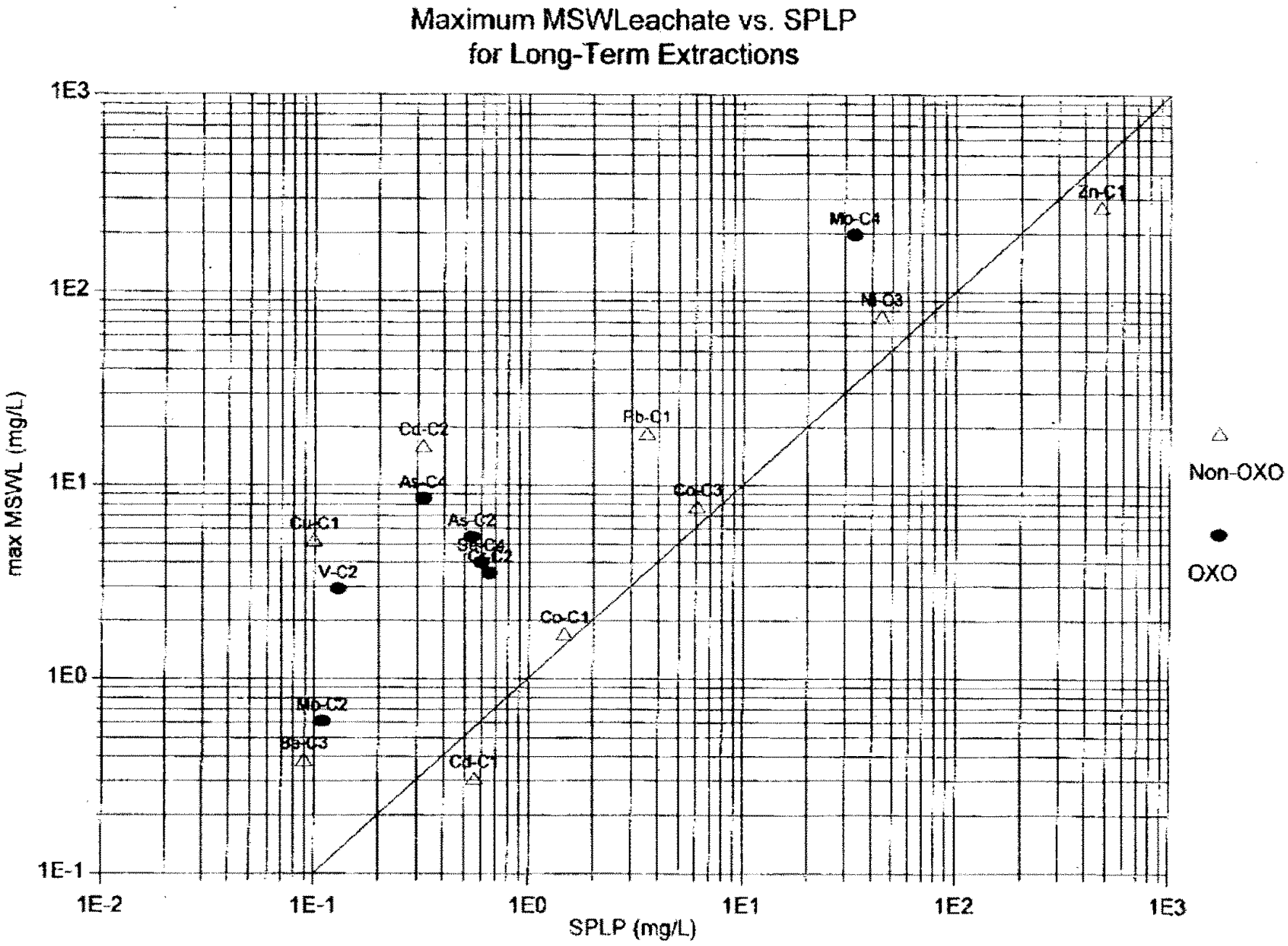
- Antimony
- Arsenic
- Molybdenum
- Selenium
- Vanadium

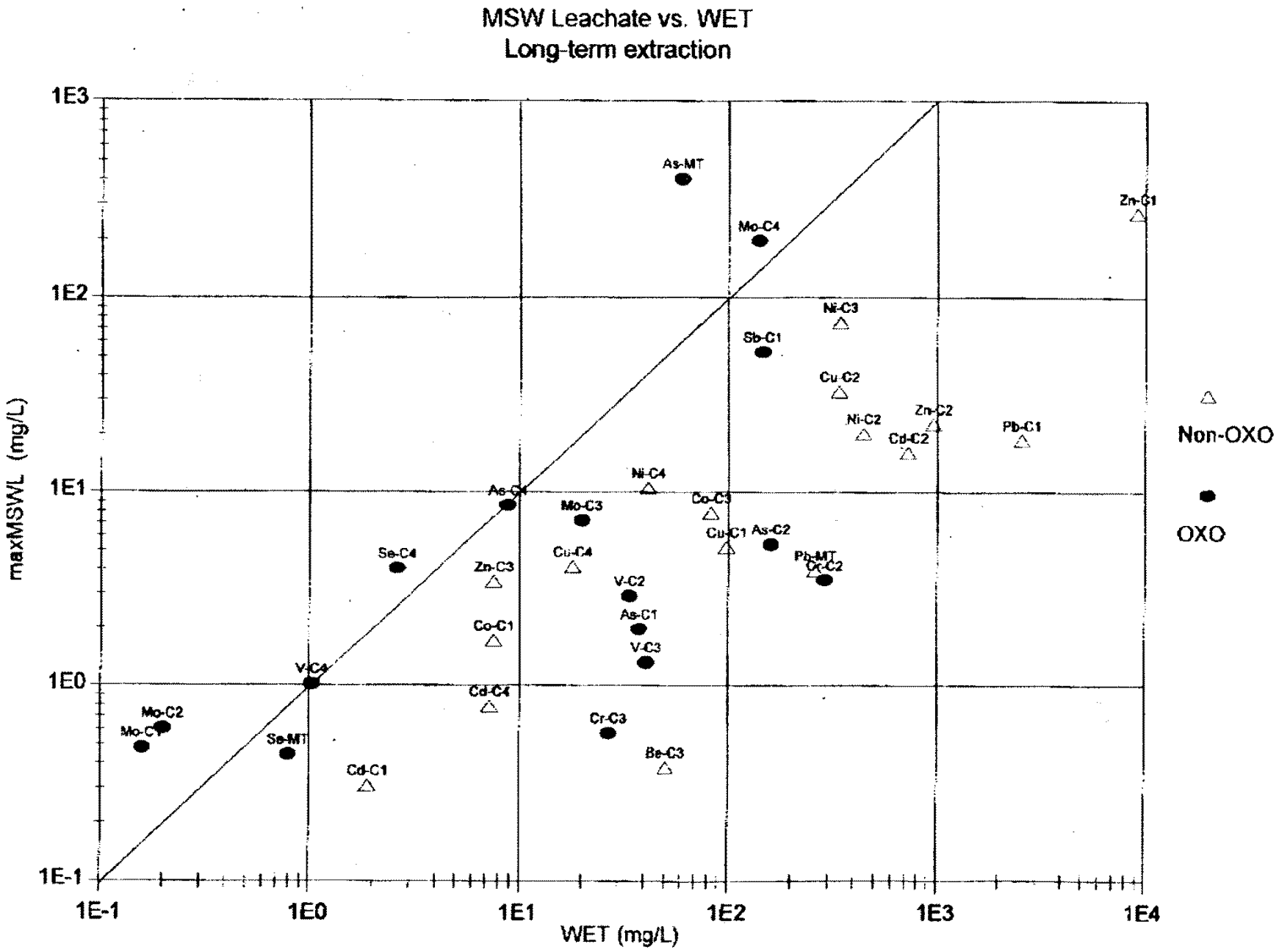
Category 2

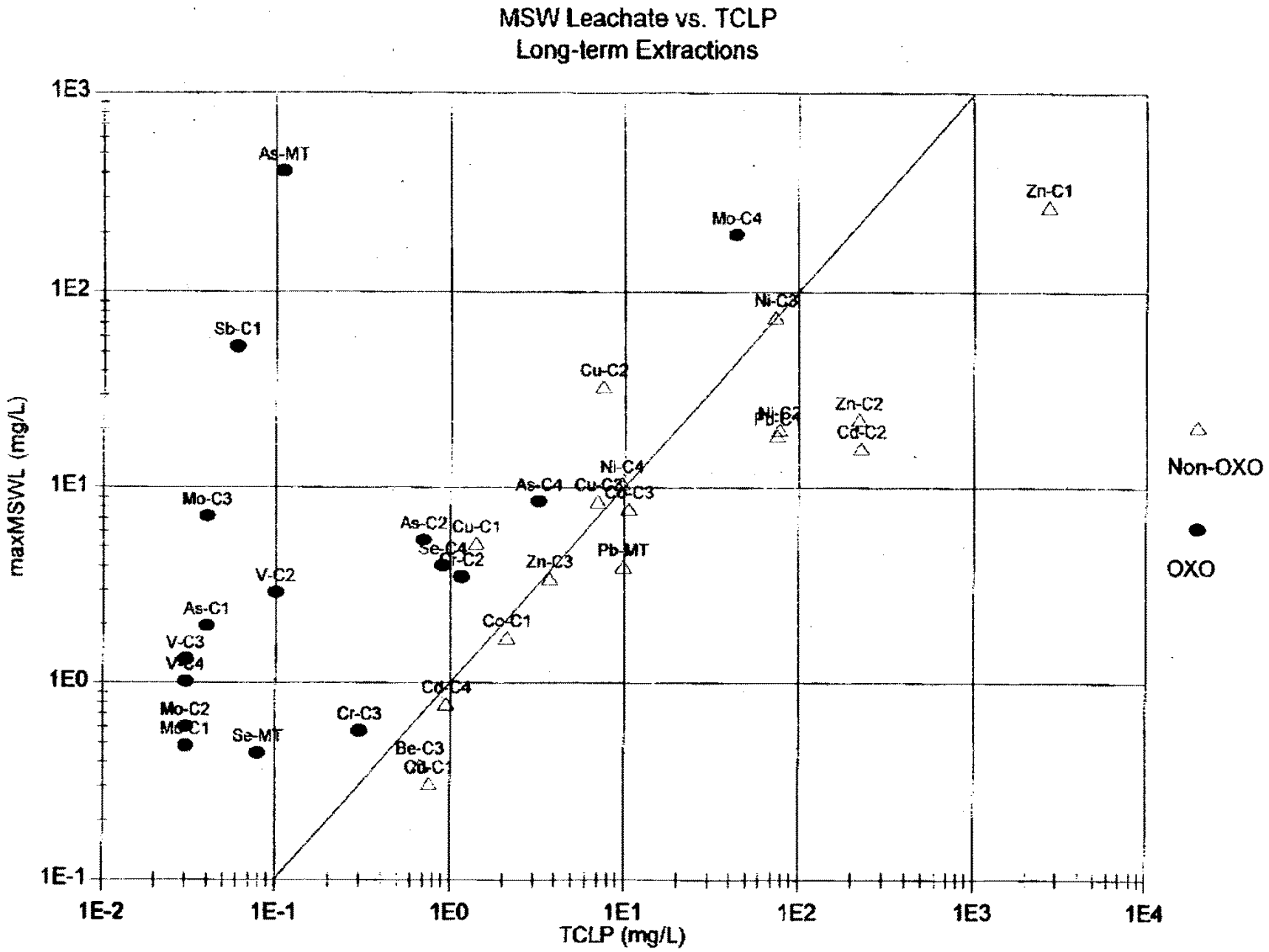
- No test consistently predicted leachate extraction, but WET better than TCLP or SPLP

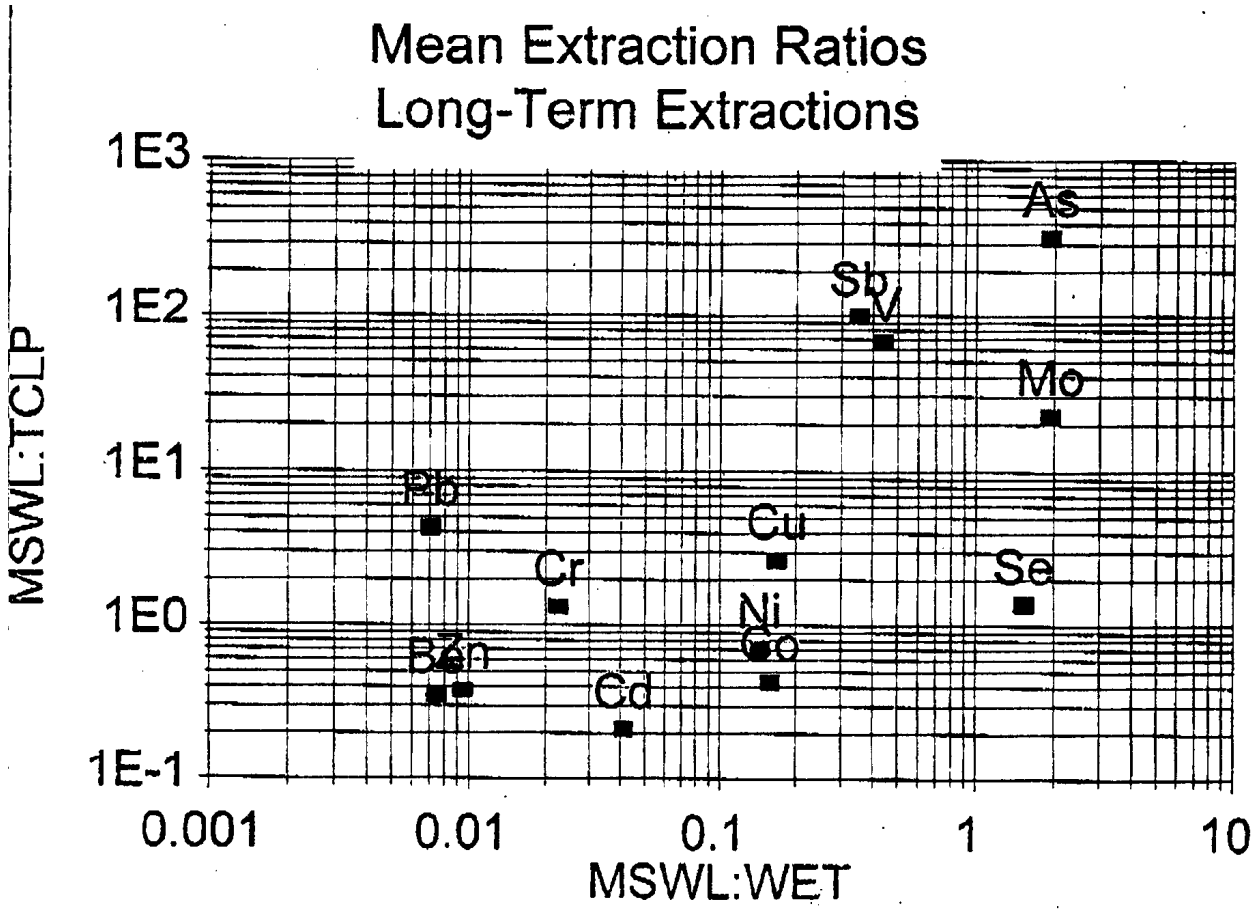
NAS Report

- “Risk-Based Waste Classification in California”
- April, 1999


Maximum MSWLeachate vs. SPLP
for Long-Term Extractions
max MSWL (mg/L)
SPLP (mg/L)
1E3
1E2
1E1
1E0
1E-1
1E-2
1E-1
1E0
1E1
1E2
1E3
Zn-C1
Mo-C4
Ni-C3
Pb-C1
Cd-C2
As-C4
Co-C3
As-C2
Cu-C1
V-C2
Co-C1
Mo-C2
Ba-C3
Cd-C1
Non-OXO
OXO


MSW Leachate vs. WET
Long-term extraction
maxMSWL (mg/L)
WET (mg/L)
1E3
1E2
1E1
1E0
1E-1
1E-1
1E0
1E1
1E2
1E3
1E4
As-MT
Mo-C4
Zn-C1
Ni-C3
Sb-C1
Cu-C2
Zn-C2
Ni-C2
Cd-C2
Pb-C1
Ni-C4
As-C4
Co-C3
Mo-C3
Cu-C1
As-C2
Se-C4
Cu-C4
Pb-MT
Cr-C2
Zn-C3
V-C2
As-C1
Co-C1
V-C3
V-C4
Cd-C4
Mo-C2
Mo-C1
Cr-C3
Se-MT
Be-C3
Cd-C1
Non-OXO
OXO


MSW Leachate vs. TCLP
Long-term Extractions
maxMSWL (mg/L)
TCLP (mg/L)
1E3
1E2
1E1
1E0
1E-1
1E-2
1E-1
1E0
1E1
1E2
1E3
1E4
As-MT
Sb-C1
Mo-C3
V-C2
As-C1
V-C3
V-C4
Mo-C2
Mo-C1
Se-MT
Cr-C3
Be-C3
Co-C1
Co-C4
As-C2
Cu-C1
Se-C4
Cr-C2
Zn-C3
Co-C1
As-C4
Cu-C2
Ni-C4
Co-C3
Pb-MT
Cu-C2
Mo-C4
Ni-C3
Pb-C4
Zn-C2
Co-C2
Zn-C1
Non-OXO
OXO


Mean Extraction Ratios
Long-Term Extractions
MSWL:TCLP
1E3
1E2
1E1
1E0
1E-1
0.001
0.01
0.1
1
10
MSWL:WET
As
Sb
V
Mo
Pb
Cu
Cr
Se
Ni
Co
Zn
Cd

NAS Recommendations

- Work with stakeholders and EPA to address shortcomings of TCLP and WET

NAS Recommendations

- Use extraction study data in probabilistic modeling

NAS Recommendations

- Incorporate groundwater pathway into multimedia model