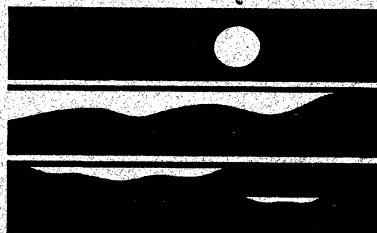


Natural Background Soil Metals Concentrations in Washington State

Toxics Cleanup Program
Department of Ecology



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

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Natural Background Soil Metals Concentrations

in

Washington State

by

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TABLE OF CONTENTS

ACKNOWLEDGMENTS.....	viii
EXECUTIVE SUMMARY.....	1
I. OVERVIEW.....	1-1
Introduction.....	1-1
What Does "Natural Background" Mean?.....	1-1
Why is this Study Important?.....	1-1
What are the Requirements for Background in the Model Toxics Control Act?.....	1-2
How are Background Values Used?.....	1-2
Background Soils Metals - Other Studies.....	1-2
United States Geological Survey.....	1-3
Washington.....	1-3
Michigan.....	1-3
New Jersey.....	1-4
Ontario, Canada.....	1-4
II. SOIL	
What is Soil and How is it Formed?.....	2-1
Factors Affecting Soils Formation.....	2-1
Washington Soils.....	2-1
Effect of Soil and Geologic Diversity on Background.....	2-1
Summary.....	2-2
III. STUDY DESIGN	
Objective.....	3-1
Approach.....	3-1
IV. SAMPLING	
Soos Creek Basin, King County.....	4-1
Statewide Natural Background Assessment.....	4-1
Vertical Profile Samples.....	4-6
Equipment Decontamination.....	4-6
V. ANALYSIS	
Laboratory Analytical Procedures.....	5-1
Grain Size.....	5-1

Table of Contents - cont'd.

VI.	STUDY RESULTS	
	Data Analysis.....	6-1
	Calculation of Background Values.....	6-1
	What is the 90th Percentile Value?.....	6-1
	Why is this Important?.....	6-1
	90th Percentile Comparison.....	6-1
	Background Values: Washington and Other States.....	6-3
VII.	ANALYSIS OF REGIONAL VARIATION.....	7-1
	Overview.....	7-1
	Data Sets.....	7-1
	Aluminum.....	7-2
	Arsenic.....	7-2
	Beryllium.....	7-2
	Cadmium.....	7-2
	Chromium.....	7-3
	Copper.....	7-3
	Iron.....	7-3
	Lead.....	7-3
	Manganese.....	7-3
	Nickel.....	7-3
	Zinc.....	7-4
	Other Elements.....	7-4
	Antimony.....	7-4
	Selenium.....	7-4
	Silver.....	7-4
	Thallium.....	7-4
	Why are the West Side Background Values Higher?.....	7-4
	Geologic Diversity.....	7-5
VIII.	USE AND APPLICATION OF BACKGROUND VALUES	
	Site-Specific or Area Studies of Natural Background.....	8-1
	Use of the Statewide and Regional Values.....	8-1
	Other Areas.....	8-1
	Application of Background Values.....	8-1
	Alternative Procedures.....	8-2
IX.	SCATTER PLOTS, DISTRIBUTION GRAPHS, AND CONCENTRATION MAPS	
	Summary.....	9-1

Table of Contents - cont'd.

X.	DATA TABLES	
	Data Retrieval.....	10-1
	Interpreting the Data Tables.....	10-1
	Latitude & Longitude.....	10-1
	Site Codes.....	10-1
	Number Column.....	10-2
XI.	MTCASat CALCULATIONS & SUMMARY STATISTICS.....	11-1
	Calculation of Background Values.....	11-1
XII.	DATA QUALITY INFORMATION.....	12-1
	Data Quality Assurance and Quality Control (QA/QC).....	12-1
	Sample Splits, Duplicates, and Reference Samples.....	12-1
	Laboratory Precision and Accuracy.....	12-2
	Data Quality Results.....	12-2
	Analytical Effects - Arsenic.....	12-2
	Quality Assurance Memos.....	12-2
XIII.	REFERENCES.....	13-1

LIST OF FIGURES

Figure 1: Soils Regions of Washington State.....	3-2
Figure 2: Soil sampling locations in Washington State.....	4-2
Figure 3: Basic soil sampling scheme, statewide investigation.....	4-4
Figure 4: Soil sampling preparation, background soil metals project.....	4-5
Figure 5: Statewide 90th percentile values.....	6-2
Figure 6: Sample Populations.....	6-4
Figure 7: Al, Fe Comparison of West-East 90th Percentile Values.....	6-5
Figure 8: Be, Cd, Hg Comparison of West-East 90th Percentile Values.....	6-5
Figure 9: As, Cr, Cu, Ni, Pb Comparison of West-Eat 90th Percentile Values.....	6-5
Figure 10: Background Value Comparison.....	6-6
Figure 11: Aluminum Regional Analysis.....	7-6
Figure 12: Arsenic Regional Analysis.....	7-7
Figure 13: Beryllium Regional Analysis.....	7-8
Figure 14: Cadmium Regional Analysis.....	7-9
Figure 15: Chromium Regional Analysis.....	7-10
Figure 16: Copper Regional Analysis.....	7-11
Figure 17: Iron Regional Analysis.....	7-12
Figure 18: Lead Regional Analysis.....	7-13
Figure 19: Manganese Regional Analysis.....	7-14
Figure 20: Mercury Regional Analysis.....	7-15
Figure 21: Nickel Regional Analysis.....	7-16
Figure 22: Zinc Regional Analysis.....	7-17
Figure 23: Aluminum X,Y SCATTER PLOT.....	9-2
Figure 24: Statewide Aluminum Concentration Map.....	
Figure 25: Arsenic X,Y SCATTER PLOT.....	9-4
Figure 26: Statewide Arsenic Concentration Map.....	
Figure 27: Beryllium X,Y SCATTER PLOT.....	9-6
Figure 28: Statewide Beryllium Concentration Map.....	
Figure 29: Cadmium X,Y SCATTER PLOT.....	9-8
Figure 30: Statewide Cadmium Concentration Map.....	
Figure 31: Chromium X,Y SCATTER PLOT.....	9-10
Figure 32: Statewide Chromium Concentration Map.....	
Figure 33: Copper X,Y SCATTER PLOT.....	9-12
Figure 33: Statewide Copper Concentration Map.....	
Figure 35: Iron X,Y SCATTER PLOT.....	9-14
Figure 36: Statewide Iron Concentration Map.....	
Figure 37: Lead X,Y SCATTER PLOT.....	9-16
Figure 38: Statewide Lead Concentration Map.....	
Figure 39: Manganese X,Y SCATTER PLOT.....	9-18
Figure 40: Statewide Manganese Concentration Map.....	
Figure 41: Mercury X,Y SCATTER PLOT.....	9-20
Figure 42: Statewide Mercury Concentration Map.....	

List of Figures - cont'd.

Figure 43: Nickel X,Y SCATTER PLOT.....	9-22
Figure 44: Statewide Nickel Concentration Map.....	
Figure 45: Zinc X,Y SCATTER PLOT.....	9-24
Figure 46: Statewide Zinc Concentration Map.....	
Figure 47: 90th Percentile Values - Other Elements.....	9-26
Figure 48: Mean Relative Percent Difference.....	12-3
Figure 49: Puget Sound Basin Arsenic AA vs ICP Analysis.....	12-7
Figure 50: Spokane Basin Arsenic AA vs ICP Analysis.....	12-8
Figure 51: Clark County Arsenic AA vs ICP Analysis.....	12-9
Figure 52: Yakima Basin Arsenic AA vs ICP Analysis.....	12-10

LIST OF TABLES

Table 1: Statewide and Regional 90th Percentile Values.....	1
Table 2: Anticipated Users of the Background Soils Information.....	1-2
Table 3: Soil and Regional Geologic Descriptions.....	3-3
Table 4: Background Soil Metals Sampling Summary.....	4-3
Table 5: Laboratory Analytical Methods Summary.....	5-2
Table 6: Statewide 90th Percentile Values.....	6-2
Table 7: Comparison of 90th Percentile Values.....	6-4
Table 8: Comparison of West/East 90th Percentile Values.....	6-5
Table 9: Comparison of Washington Background Values to Other States.....	6-6
Table 10: Data Subdivisions.....	7-1
Table 11: Aluminum 90th Percentile and Lognormal Mean Values, West and East Data.....	7-2
Table 12: Counties Encompassed by Background Values.....	8-1
Table 13: 90th Percentile Values.....	8-3
Table 14: Site Code Definitions.....	10-1
Table 15: Site Code Suffix Definitions.....	10-2
Table 16: Background Soil Metals Study Chronology.....	10-2
Table 17: Background Values Summary Statistics.....	11-2
Table 18: Sample Splits, Duplicates, and Reference Samples.....	12-1
Table 19: Relative Percent Difference Summary Statistics.....	12-3
Table 20: Relative Percent Differences, Sample Splits, Duplicates, and Reference Samples.....	12-4

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Executive Summary

This report contains information on the natural background concentrations of metals in surficial soil throughout Washington State. The objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington. The results of this study represent the culmination of a seven-year effort by Ecology (Toxics Cleanup Program) and its co-sponsor, the USGS Water Resources Division (Tacoma Office).

Upon the completion of a small pilot project (Big Soos Creek Drainage Basin, King County, 1987), Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see Figure 1). Twelve of these 24 regions were then selected for a statewide assessment of Washington. These 12 regions were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most cleanup sites are located. Soil samples were then collected from the predominant soil series in each of the 12 regions, with a total of 490 soil samples collected from 166 locations throughout Washington. An effort was made to collect samples from undisturbed or undeveloped areas. Samples were collected from the "A," "B," and "C" soil horizons at each sampling location (ground surface to a depth of 3 ft.). Each sample was analyzed for total metals content.

The results of this study found that the soil metals concentrations in Western Washington were on average slightly higher than Eastern Washington. The population, climate, and vegetation of Western Washington are thought to be the primary reasons for this variation. The variation in west-to-east data are more pronounced when the 90th percentile values are compared (see Table 1 below). The one exception was arsenic, whose east-side 90th percentile value was 13% higher than the west. Statewide and regional 90th percentile values are presented in Table 1 below.

Table 1: Statewide & Regional 90th Percentile Values¹

	Al	As ²	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
State Wide	37,200	7	2	1	42	36	42,100	17	1,100	0.07	38	86
Puget Sound	32,600	7	0.6	1	48	36	58,700	24	1,200	0.07	48	85
Clark County	52,300	6	2	1	27	34	36,100	17	1,500	0.04	21	96
Yakima Basin	33,400	5	2	1	38	27	51,500	11	1,100	0.05	46	79
Spokane Basin	21,400	9	0.8	1	18	22	25,000	15	700	0.02	16	66

¹ All Values = mg/kg and represent total-recoverable analysis.

² Graphite furnace atomic absorption (GFAA) analysis.

I. OVERVIEW

Introduction

This report contains the results of a study of natural background soil metals concentrations in Washington State. In this study, 490 soil samples were collected from 166 sites throughout Washington. This study was conducted by the United States Geological Survey (USGS) in cooperation with the Department of Ecology, Toxics Cleanup Program.

What Does "Natural Background" Mean?

"Natural background" is defined in the Model Toxics Control Act (MTCA) (Ch 173-340-200 WAC) as the "...concentration of hazardous substance consistently present in the environment which has not been influenced by localized human activities. For example, several metals occur naturally in the bedrock and soil of Washington State due solely to the geologic processes that formed these materials and the concentration of these metals would be considered natural background. Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global use of these hazardous substances. These low concentrations would be considered natural background. Similarly, concentrations of various radionuclides which are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background."

Why is this Study Important?

The advent of hazardous and toxic waste regulation in the United States has prompted a need for both the regulatory and industrial community to better understand the natural concentrations of certain elements in the environment. Consequently, many states, including Washington, have now begun to assess the natural concentration of metals in soils throughout their prospective regions. This study is important in that it represents a true benchmark of the natural background soil metals concentrations in Washington State. These data can be compared against data from known or suspected sites of environmental contamination. More informed decisions on site investigations, cleanup actions, and remedy selections can now be made as a result of the information from this study.

What are the Requirements for Background in the Model Toxics Control Act?

The requirements for determining natural background are given in Ch 173-340-708 (11) WAC of Washington's MTCA. Two types of background values may be determined--"area" and "natural." The derivation of natural background requires the collection of at least ten (10) samples, while the derivation of area background requires at least twenty (20) samples. Samples must be collected from areas that have the same basic characteristics as the medium of concern at the site. Samples must also be collected in areas that "...have not been influenced by releases from the site, and, in the case of natural background concentrations, have not been influenced by releases from other localized

human activities." Statistical methods and detailed guidance on how to derive background values are presented in the publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). A computer software program known as "MTCASat" (July 1993) can also be used to derive background values. Copies of the *Statistical Guidance for Site Managers* and MTCASat can be obtained through the Ecology publications office (phone 206 407-7472).

How are Background Values Used?

Background values are often compared against a separate data set for regulatory or investigative purposes. Separate data sets can include data from site investigations, waste streams (sewage, sludge, incinerator ash, fill material), and other background studies. Once the data sets are compared, a decision is then made about whether the foreground data set exceeds the true range of values from the background data set. This decision is typically made using statistics or other mathematical procedures. A summary of potential users for the information from this study is given in Table 2 below.

Table 2: Anticipated Uses of the Background Soils Information

Task	Anticipated Users
Defining Background	Owner/operator of any site that does not want to complete a site-specific background study per MTCA requirements (using this data may be more cost-effective for smaller sites)
Risk Assessments	Toxicologists and other Scientists
Screening Data for Contamination	Ecology staff & Consultants
Analyzing Waste Streams	Generators of hazardous and solid waste, incinerator ash, fill material, and sewage sludge
Designing Investigative Studies	Consultants
Regulatory Compliance	Federal Programs including RCRA and Superfund, state biosolids and sewage sludge programs, health departments
Research	Universities and other organizations
General Information	Public, Attorneys, etc.

Background Soil Metals - Other Studies

The intent of this section is to provide some brief information on what other states and organizations have done regarding background investigations. It is hoped that this information can be used primarily for comparative purposes.

United States Geological Survey (USGS)

Schacklette and Boerngen (1984) of the USGS initiated one of the first studies of elements in soil throughout the United States. In their paper, Schacklette and Boerngen state that at the beginning of the study (1961), "...few data were available on the abundance of elements in surficial materials of the United States as a whole." They also went on to state that "...most of the early reports discussed only the elements that were of economic importance to mining or agriculture in a metallogenic area or State..." Thus, Shacklette designed a study to "...give estimates of the range of elemental abundance in surficial materials that were unaltered or very little unaltered from their natural condition." This led to the collection of soil samples from 1,318 sampling locations across the United States at depths of approximately 20 cm.

Washington

Increased awareness of environmental affairs and concern over industrial pollution in the United States has led to more need to understand the natural concentrations of certain elements in the environment. This trend has taken hold in Washington State, as noted by the 1989 PTI Environmental Services study entitled *Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State*. This study (performed by PTI for the Department of Ecology), was designed to identify "...the concentrations of high-priority contaminants that are representative of background (or ambient) conditions in the water, soil, and air of Washington state." The information from this study was ultimately used in the development of cleanup standards for the Model Toxics Control Act (MTCA).

The advent of hazardous waste regulation and cleanup of sites contaminated with toxic wastes in the United States has also prompted the need to understand the natural concentration of elements in the environment on a site-specific basis. A good example of this is the April 1993 study conducted by the United States Department of Energy for the Hanford Nuclear Reservation. This study involved the collection of over 180 soil samples at 14 locations throughout the Hanford site. Information from this study will ultimately be used in the environmental remediation and restoration effort at the Hanford site.

Similar site-specific investigations into background metals concentrations have been conducted at the Asarco Smelter Superfund site in Tacoma and the former Dupont Works site in Dupont. For the Asarco study, 25 samples were collected from McChord Air Force Base to determine the background concentrations of inorganics in soil (ICF & Ecology, April 1993). The natural or "ambient" concentration of arsenic in soil in and around the Asarco Smelter has been a high-priority item for several years now. A number of samples have also been collected to assess the natural concentration of mercury and other inorganic constituents at the Dupont site.

Michigan

The Michigan Department of Natural Resources (MDNR) completed a study of natural background soil metals concentrations in September 1988. An update to this study was completed in April 1991.

The background data from Michigan's study was originally intended for comparison against data from hazardous waste site closures (RCRA); however, the data set has been widely distributed and is currently being used at Michigan toxic waste cleanup sites as well. In Michigan, natural background values are generated by calculating the mean plus three standard deviations. For more information on the Michigan study, contact Dave Slayton, Senior Geologist, Geotechnical Unit, MDNR Waste Management Division at (517) 373-8012.

New Jersey

The New Jersey Department of Environmental Protection has published information available on the concentrations of metals and organics in soil at background locations throughout the state (ref: "A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey", New Jersey DEP, September, 1993). In this study, 80 soil samples were collected from 46 of the most common soil types found in New Jersey. Background concentrations are given according to five land use categories: urban, suburban, rural, golf course, and farm. Statistical or regulatory requirements for determining background are not given in the report; however, 90th percentile values are given for each land use category.

Ontario, Canada

A detailed and comprehensive assessment of background concentrations for both metals and organics in soil is given in Ontario's report entitled *Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow* (Ontario Ministry of Environment and Energy, December, 1993). Data on background soil metals concentrations have been compiled using the 98th percentile or Ontario Target Range (OTR₉₈). The 98th percentile was selected because it represents the mean plus two standard deviations of a normally distributed population. Ontario has also decided to divide background concentrations into ten land use categories, ranging from old urban residential to rural agricultural (data is currently available for only two land use categories: old urban and rural parkland). For more information, contact Lee Hoffman, PhD Toxicologist, Hazardous Contaminants Branch, at (416) 323-5118.

II. SOIL

What is Soil and How is it Formed?

There are several accepted definitions of soil. A simplistic definition for soil is "...that part of the regolith that can support rooted plants" (Flint, 1977). The term "regolith" literally means "blanket rock" and is defined as the unconsolidated portion of the earth's crust that overlies bedrock. Bushnell (1944) defined soil as a "...natural part of the earth's surface, being characterized by layers parallel to the surface resulting from modification of parent materials by physical, chemical, and biological processes operating under varying conditions during varying periods of time." Soil formation normally can be attributed to five factors: parent material, climate, topography, soil biota (i.e., vegetative cover), and time (Jenny, 1941).

Factors Affecting Soils Formation

The formation of soils is thought to be a weathering process (Thornes, 1979). Reiche (1950) and Keller (1957) defined weathering as "...the response of materials within the lithosphere to conditions at or near its contact with the atmosphere, the hydrosphere, and the biosphere." According to Jenny (1941), the formation and development of soils is controlled by five factors: parent material, climate, topography, soil biota (vegetation), and time. According to Flint (1971), "...the greatest differences among soils now forming are related to climate and vegetation." Specifically, changes in vegetation and soil weathering characteristics correspond to changes in climate and temperature. This trend can be observed across North America. For example, in the dry southwest, the warmer climate evaporates water more quickly, precipitating Ca^{2+} as a carbonate into the "B" soil horizon, producing alkaline conditions. Conversely, in the wet and cold northeast, soluble cations such as Ca^{2+} are transported readily into the soil horizon. The differences in climate and weathering processes in North America form the basis for two primary soil subdivisions: pedocals (calcium-rich, dryer climates) and pedalfers (higher amounts of clay and iron in the "B" horizon, wetter climates).

Washington Soils

The State of Washington is a geologically diverse land mass encompassing over 60,000 square miles. Geologic events over the last 200 million years have brought together several separated subcontinents into what is now Washington. Alt and Hyndman (1984) have since reclassified the State of Washington into six main geologic regions: Olympic Peninsula, Puget Sound Basin, Willapa Hills, Cascade Volcanics and North Cascades, Columbia Plateau, and Okanogan Subcontinent/Kootenay Arc areas.

Effect of Soil and Geologic Diversity on Background

For the purposes of this study, it was recognized that Washington is a geologically diverse state and that determination of background elements in surficial soils could be viewed with skepticism. However, it should again be noted that the formation and development of soils is a process that is

governed primarily by factors other than "geologic diversity;" i.e., the formation of soil is a weathering process affected largely by climate and vegetation. Thornbury (1969) illustrates this point by giving credit to two men, Dokuchaiev of Russia and Hilgard of America. Both of these men felt that given similar topographic, climatic, and vegetative conditions, the soil profile would "...essentially be the same, regardless of variability in parent material." Thus, "geologic diversity" or "variability of parent rock material" may in some cases have minimal impact on the development and the elemental composition of soils. However, Thornbury (1969) also conceded that the thinking on the role of parent material is changing; i.e., "...no pedologist today would maintain that under similar environmental conditions a soil profile developed upon granite would ever be the same as that on limestone."

Summary

This study was designed to measure the background concentrations of metals in soil throughout Washington State. The effects of soil, climate, vegetation and geologic diversity and influences were recognized factors in the conception of this study; however, the definition and measurement of natural background was given top priority. Consequently, the true effects of soils, climate, and geologic diversity upon the results of this study have not been rigorously investigated. Ecology is hopeful that further research on the data from this study will be initiated at some future date.

III. STUDY DESIGN

Objective

The primary objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington State. In order to meet this objective, the Department of Ecology entered into a joint funding agreement with the USGS Tacoma Office to study the ambient concentrations of metals in soils at a series of sites throughout Washington.

Approach

In order to meet the study objective, a small-to-large approach was taken in this study; i.e., a small test site was first investigated and larger areas were gradually added into the scope of work. Thus, the first site to be investigated was a small site in Western Washington known as the Big Soos Creek Drainage basin. This site, which occupies 15 to 30 square miles in southeast King County, was used for the collection of 41 samples at 18 separate locations at depths up to five (5) feet (1987).

Upon completion of the Soos Creek study, the State of Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see **Figure 1**). Each of these regions was selected by the USGS Water Resources Division. A decision was then made to select 12 of the 24 regions for a statewide natural background soil metals assessment of Washington. The predominant soil series within each of these 12 regions were then sampled (see **Table 3**). A decision was also made to focus additional sampling on the four large urban areas within these 12 regions: Puget Sound Basin, Clark County, Yakima, and the Spokane Basin. The 12 statewide regions and four major urban areas were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most toxic waste sites are located.

Figure 1: Soil Regions of Washington State

(See Table 3 for Regional Description)

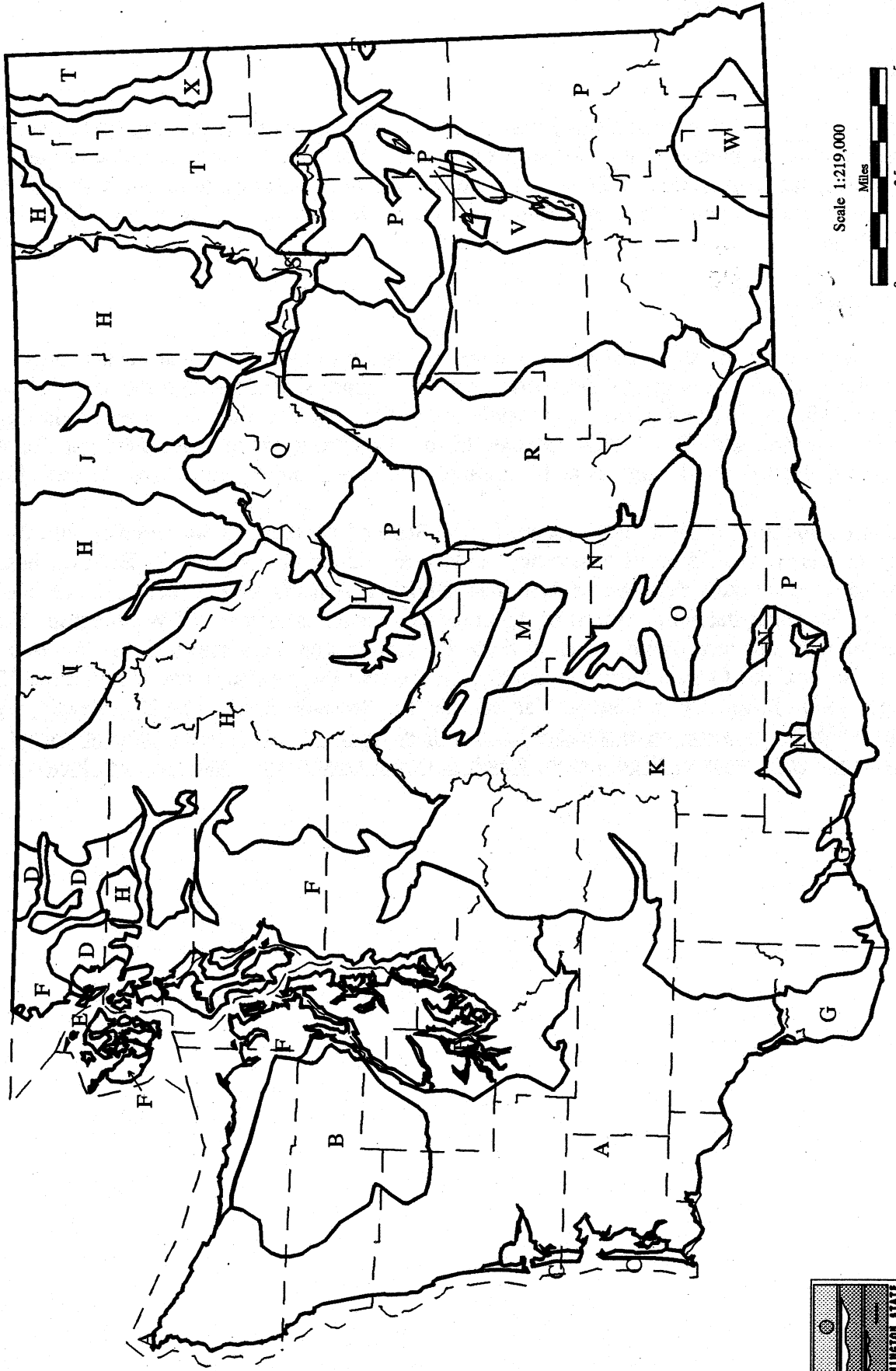


Table 3: Soil and Regional Geologic Descriptions, Statewide Natural Background Study.¹

	Location & Soils Description	Soil Series & Geologic Origin
A	Southwest Washington (Willapa Hills). Developed mainly in continental and marine sedimentary beds along the Pacific Coast (Pringle, 1986). All soils sampled in this Region were developed on upland marine sediments.	Willapa: developed on marine terraces that were cut into marine sediments. Zenker: weathered sandstones. Melbourne: material weathered from marine-deposited siltstone, shale, and fine-grained sandstone.
C	Pacific Coast (Long Beach, Westport, Grays Harbor). Beach sands and "dune lands", i.e. excessively drained ridges formed in fine beach sands.	Netarts: upland areas. Yaquina: basin-like areas between sand dunes (Pringle, 1986).
D	Northern Skagit and Whatcom Counties, Mt. Baker Area. Developed in older sedimentary rocks on the west side of the Cascades (Poulson, 1953).	Cathcart: sandstones and shales. Heisler: glacial moraines in high mountain valleys west of Mt. Baker. Schmorbrush: arkosic sandstone and mountain-side drift material or talus rubble - Nooksack River valley.
F	Puget Sound Basin. Glacial Deposits (till, alluvium, etc.).	Everett: glacial outwash. Spanaway: glacial outwash + volcanic ash.
G	Vancouver-Clark County area. Alluvium derived from a variety of sources.	Lauren: mixed alluvium from Columbia River terraces 50 - 100 ft. above the present river elevation. Wind River: mixed alluvium 150 - 500 ft. above the present river elevation. Sauvie: alluvial bottom lands along the Columbia River. Dollar: terrace deposits. Gee: rolling hills on eroded terraces.
J	Unconsolidated deposits in the Okanogan River Valley.	Colville: mixed alluvium from igneous rocks and volcanic ash. Pouge: terrace deposits, underlain by gravelly sandstones that were deposited as glacial outwash. Cashmere: glacial outwash and more recent alluvium (Lenfesty, 1990)
L	Developed primarily from older sedimentary rocks in the Wenatchee River Valley.	Burch: older alluvium derived from sandstone.
M	Unconsolidated loess and alluvium of the Ellensburg Basin.	Renslow & Selah: loess with caliche layers, underlain by gravel and valley fill. Naches: older valley fill. Reeser: formed over cemented gravels. Wenas: stream bottom material from weathered basalt.
O	Yakima River valley.	Shano & Warden: loess underlain by glaciolacustrine sediments ("Touchet" beds). Weirman: mixed alluvium from flood plains
P	Lincoln-Douglas County area. Thick loess deposits.	Walla & Athena: loess + volcanic ash.
R	Central Columbia Basin. Unconsolidated wind-blown and alluvial material.	Quincy: eolian sands. Shano: loess + volcanic ash. Taunton: wind-worked alluvium.
U	Spokane River Valley.	Marble: wind-worked sandy outwash. Spingdale: outwash mantled with volcanic ash and loess. Ewall & Spens: glacial outwash.

¹ Note: the information in this table was taken from a report prepared by Kenneth C. Ames of the U.S. Geological Survey ("Concentrations of Metals in Soils From Selected Regions in the State of Washington". Draft report, subject to revisions).

IV. SAMPLING

All soil samples were collected by personnel from the USGS Water Resources Division. The Department of Ecology participated in sampling activities at a few locations. All sampling activities took place between June 1987 and January 1993. A brief description of each sampling area and sampling methodology is included in the summaries below. A summary of all sampling activities is presented in Table 4.

Soos Creek Basin, King County

Sixty (60) samples were collected during June 1987 from a 15.9 mi² area immediately north of the Big and Little Soos Creeks confluence. Five (5) sampling sites were located in the Big Soos Creek subbasin and another four (4) were located in the Little Soos Creek subbasin. One shallow sample (0.5 ft.) was collected from these nine locations. Three (3) streambed sediment sampling sites were also located in these subbasins.

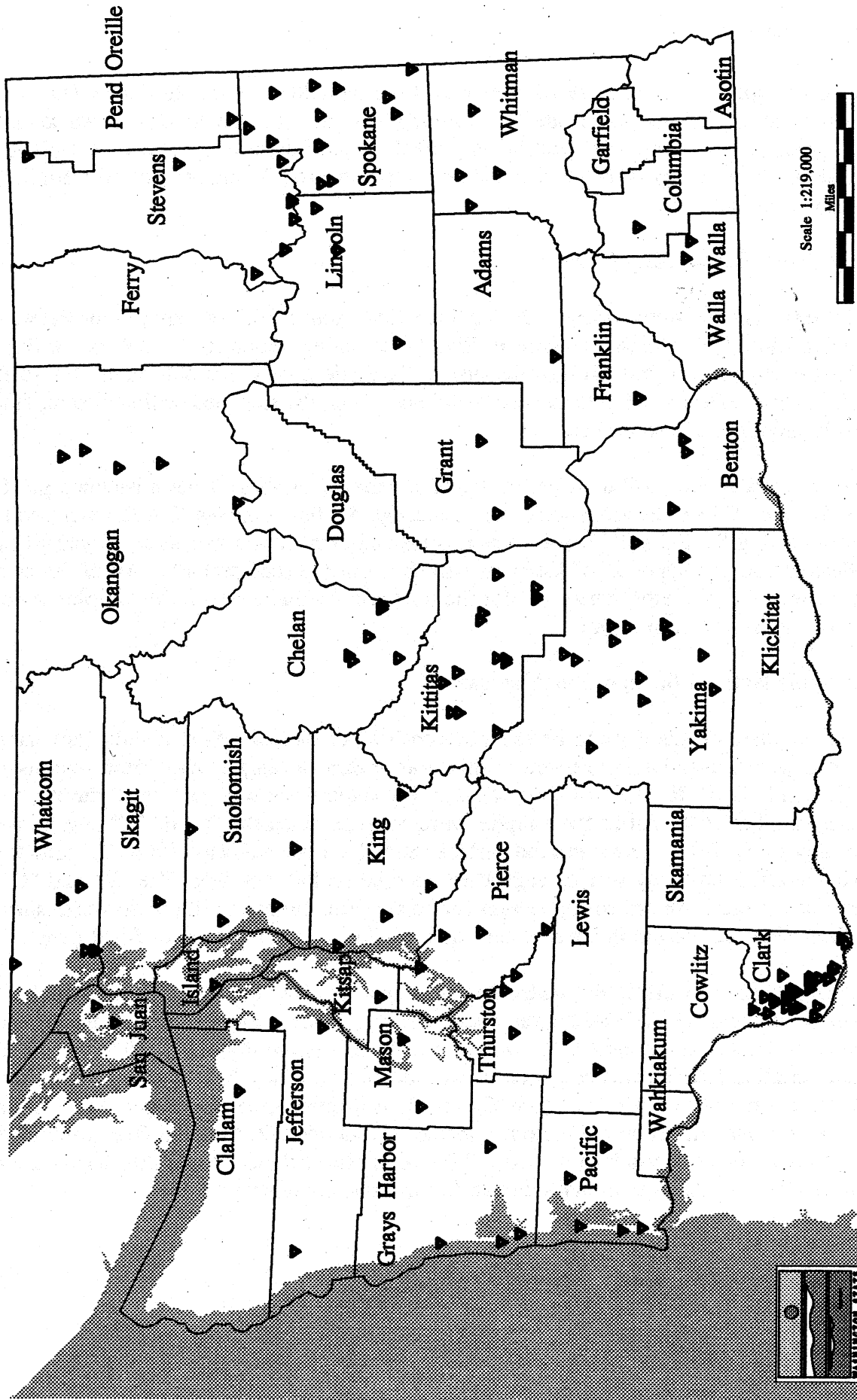
Deeper samples (i.e., 5-7 ft.) were collected at selected locations from a backhoe pit. Samples from the "B" and "C" soil horizons were then collected. Shallow samples (0.5 ft.) were collected after first removing the top 1-2" of soil, which contained plant debris and litter. Streambed samples were collected from the upper 1" of locations with fine-grained sand and silt. All of the samples were then sieved for laboratory analysis. For the total-recoverable method, the samples were sieved to particles sizes less than 2 mm.

Statewide Natural Background Assessment

The first phase of this work to be initiated consisted of the collection of sixty (60) samples from the 12 main geologic and urban regions within Washington (5 samples each from regions A, C, D, F, G, J, L, M, O, P, R, U, see Figure 2). The 12-region work was performed during July, August, and September 1990. All of the samples were collected from the "B" or "C" soil horizons that are typically found 2-3 ft. below ground surface. Samples were collected from this zone to minimize the potential effect posed by surface vegetative material on the sampling. The "B" and "C" soil horizons were also selected for sample collection for comparison purposes with toxic waste sites since many of these sites are located in areas where the topsoil has been removed or filled over.

The next phase of work in the statewide assessment involved the collection of samples from the four main urban areas within Washington: Clark County, Yakima Basin, Spokane Basin, and Puget Sound Basin. At each sampling location a shovel was used to dig a 2-ft. wide by 2-ft. deep hole. Each sampling location was consisted of five test pits; i.e., a 2 X 2 ft. test pit was dug at the center and each corner of a 1-acre plot (see Figure 3). A stainless-steel soil auger was then used to collect 1-2 liters of material from the bottom 6 inches of each test pit. Material from each of the five holes was sieved down to particles less than 19.0 mm in size and placed in a 20-liter plastic bucket. The soil samples were then thoroughly mixed to form one composite sample.

Figure 2: Soil Sampling Locations in Washington State



Scale 1:219,000

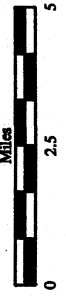


Table 4: Background Soil Metals Sampling Summary

Study	No. of Samples Collected	Sampling Locations	Sample Depths (in.)	Number of Samples Collected per Location	Sampling Procedures	Date
Soos Creek	41	18	up to 60	1-3	Pilot project for natural background study. One shallow sample (0.5 ft.) collected from 9 locations + 3 streambed sediment samples. Deeper samples (5-7 ft.) collected from backhoe pits.	1987
Twelve Region	60	60	20-34	1 (composite of 5 locations within a 1 acre area).	Samples collected from 12 geologically distinct regions in Washington (5 samples per region for a total of 60). Only surficial samples are collected: 2 ft. x 2 ft. test pit dug at the center and each corner of a 1 acre plot, see Figure: (five sampling test pits total). Stainless-steel augur used to collect 1-2 liters of soil from the bottom 6 inches of each test pit. Material from each test pit sieved to < 19.0 mm particle size and thoroughly mixed (compited) in a 20 liter plastic bucket. Soil is then sieved to less than 2 mm at Manchester Laboratory.	1990
Clark ¹ County	81	21	24-36	5 from Vertical Profile "A" 13 from Vertical Profile "B"	Two types of samples collected, surficial (see above description) and "vertical profile". Vertical profile samples were collected from a hand-dug test pit approximately 5-6 ft. deep. An effort is made to sample the "A", "B", and "C" soil horizons. Vertical profile samples were <u>not</u> composited. Two types of vertical profile sampling techniques were used. In Version "A", 5 samples were collected at vertical intervals (samples are collected by standing in the test pit and trowling soil from the "A", "B", and "C" soil horizons). In Version "B", 13 samples are collected; 5 samples are collected from the "center" hand-dug test pit and an additional 8 are collected from 4 sampling locations near the test pit (each corner of a 1-acre plot, 2 samples per location).	1991
Yakima ² Basin	107	22	24-36	5 from surficial, 5 or 13 from vertical profile.	Surficial (five samples collected from a 1 acre plot with a stainless-steel soil augur, 2 ft. depth) and vertical profile (5 or 13 samples collected from a hand-dug test pit, 5-6 ft. deep) samples collected. All samples field-sieved to < 19 mm.	1991
Spokane Basin ³	79	22	24-36	Same as above.	Same as above.	1992
Puget Sound Basin ⁴	122	23	24-36	Same as above.	Same as above.	1993
Total	490	166				

¹ Five (5) samples from Region "G" added for background calculations. ² Ten (10) samples (total) from Regions "M" and "O" added for background calculations. ³ Five (5) samples from Region "U" added for background calculations. ⁴ Five samples from Region "F" added for background calculations.

FIGURE 3: SURFICIAL SOIL SAMPLING SCHEME: 2 X 2 FT. TEST PIT HAND-DUG AT THE CENTER AND EACH CORNER OF A ONE ACRE PLOT. STAINLESS STEEL SOIL AUGER USED TO COLLECT 1-2 LITERS OF SOIL FROM THE BOTTOM 6" OF EACH HOLE. ALL 5 SAMPLES WERE THEN COMPOSITED TO FORM ONE SAMPLE.

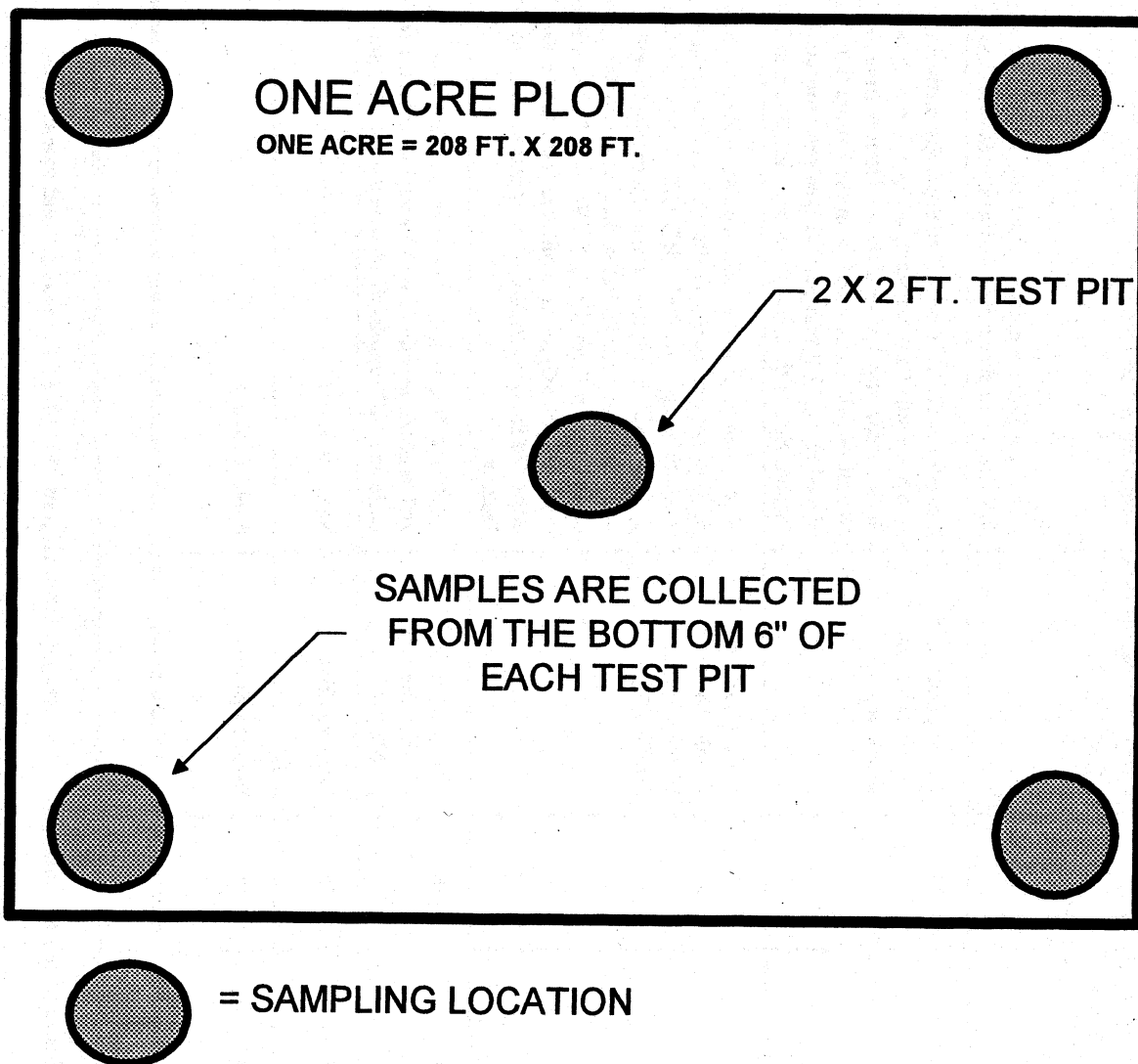
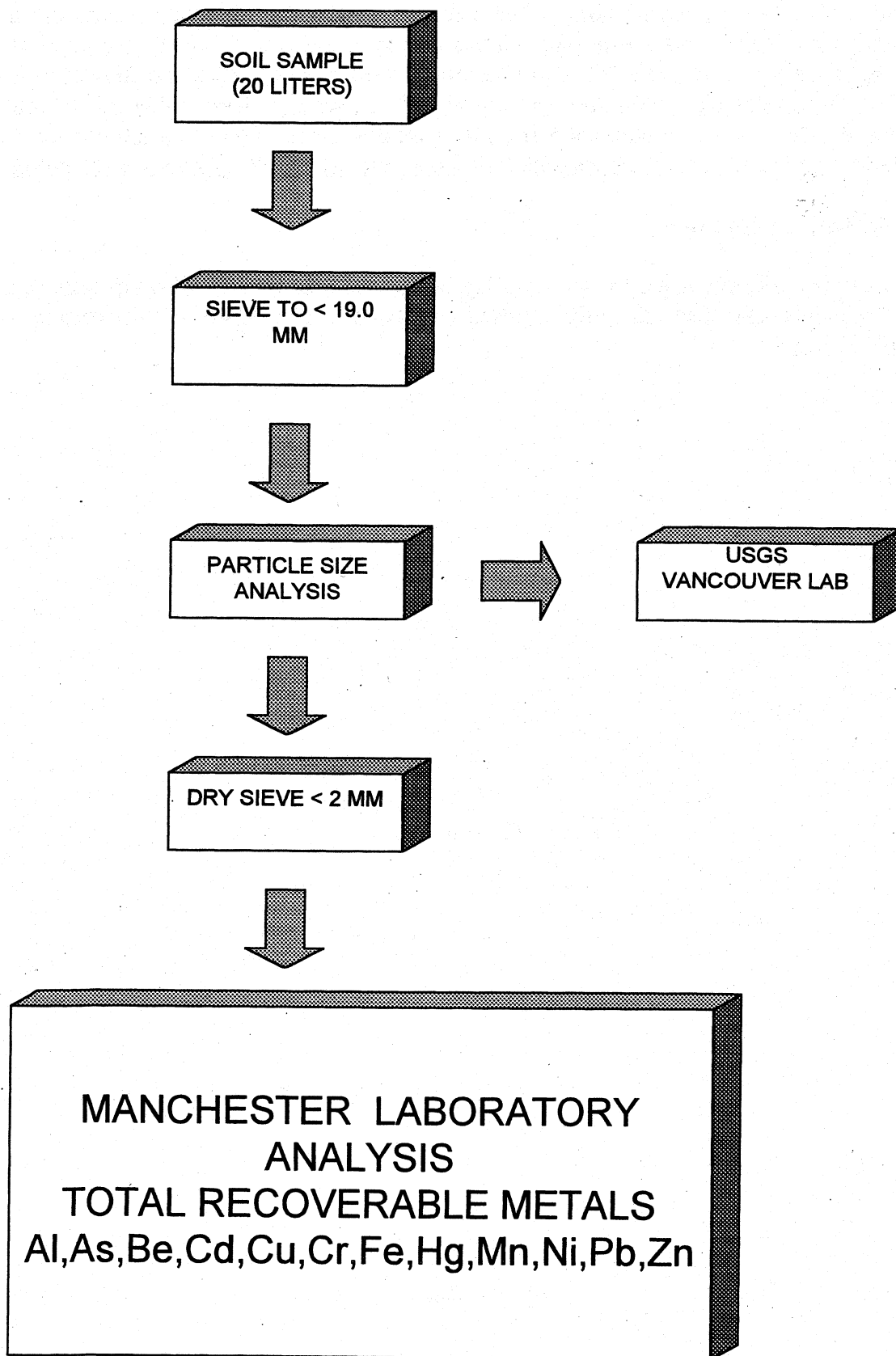


FIGURE 4: SOIL SAMPLE PREPARATION, BACKGROUND SOIL METALS PROJECT



Vertical Profile Samples

A second sampling procedure, known as "vertical profile" sampling, was also used in the statewide assessment study. Vertical profile samples were collected using the following procedure: a hand-dug hole located at the center of a 1-acre plot was completed to a depth of 5-6 ft.. Samples were then collected from the "A", "B", and "C" soil horizons. Two types of vertical profiles were used. In version "A", 5 samples were collected. In version "B", 13 samples were collected--5 from the center hand-dug hole and an additional 8 from four locations near the hole (each corner of a 1-acre plot; 2 samples per location). Samples collected from vertical profile locations were not composited.

Equipment Decontamination

Before and after collecting samples, all sampling equipment was washed with tap water and detergent (Alconox) and then sequentially rinsed with tap water, a 60/40 acetone/hexane solution, and deionized water.

V. ANALYSIS

Laboratory Analytical Procedures

All of the soil metals data presented in this report except for mercury, was generated by use of the "total recoverable" laboratory method; i.e., EPA Method 3050, Acid Digestion of Sediments, Sludges, and Soils. In this method, a representative (1-2 gram wet weight) sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid or hydrochloric acid. EPA Method 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), is then used for analysis after the samples are digested and solubilized. This method measures element-emitted light by optical spectrometry (EPA SW-846, Test Method for Evaluating Solid Waste, Volume 1A, 1986). Mercury analysis was performed by using EPA Method 7471, Manual Cold-Vapor Technique. This technique is based on the atomic absorption of radiation at the 253.7-nm wavelength by mercury vapor. Because of the ability to produce lower detection limits, atomic absorption methods were also used to analyze arsenic and selenium (EPA Methods 7060 and 7740). A summary of all laboratory analytical methods is given in Table 5.

Grain Size

All of the samples sent to Manchester Laboratory were sieved to sizes less than 2 mm prior to analysis. This practice is consistent with Ch. 173-340-740 (7) WAC of the MTCA; i.e., compliance with soil cleanup levels shall be based on total analysis of the soil fraction less than 2 mm in size.

Table 5: Laboratory Analytical Methods Summary

Parameter	Test	Laboratory Methods	Laboratory
Metals ¹	Total Recoverable Metals	Samples are prepared using Method 3050 Acid Digestion of Sludges, Sediments, and Soils. Analysis is performed using EPA 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP).	Manchester
Metals ¹	Total-Total Metals	At least 95 percent of the solid material is digested using hydrochloric, nitric, hydrofluoric, and perchloric acids. Material is then solubilized and analyzed using ICP & AA techniques.	USGS Denver, Colorado (Arvada)
As	Graphite Furnace Atomic Absorption (GFAA)	EPA 7060 & 7740	Manchester
Hg	Cold Vapor	EPA 7471 Manual Cold-Vapor Technique	Manchester

¹ Al, As, Be, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn

VI. STUDY RESULTS

Data Analysis

Since more than one sample was collected at many sampling locations, a decision was made to simply average all of the measured values per location, including sample splits and duplicates. For each of the twelve elements, one value is reported per sampling location. Thus, a sample population of 166 was used for the calculation of natural background values (166 sampling locations). One-half the detection limit value was also used for non-detect values, per MTCA specifications (Ch 173-340-708 (11)(e) WAC).

Calculation of Background Values

Ecology's MTCASat program (MTCASat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) was used to calculate 90th percentile values for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. Statewide and area or regional natural background values were calculated for Clark County, Puget Sound, Yakima, and Spokane. Statewide 90th percentile values are given in Table 6 and Figure 5.

What is the 90th Percentile Value?

The 90th percentile is a value that 10% of a given data set will exceed (90th = 90% data below, 10% data above). Another way of thinking about the 90th percentile is you have a one-in-ten chance of having a sample that exceeds the specified concentration.

Why is this important?

Ecology uses the 90th percentile as the default value for background calculations. The 90th percentile value was selected as a result of Monte Carlo simulations of lognormal and normally distributed data (ref: *Statistical Guidance for Site Managers*). The 90th percentile is a conservative value; i.e., 10% of the data will exceed it. For example, in a normal distribution or bell-shaped curve, the 90th percentile is equal to 1.28 standard deviations from the mean. In the same distribution, the 95th percentile is equal to 1.96 standard deviations and the 99th percentile is equal to 3.0 standard deviations. Background values in some states such as Michigan, and in Ontario (Canada) are based on 99th and 98th percentile values (in a normal distribution, the 99th percentile = mean + 3 standard deviations, the 97.5 percentile = mean + 2 standard deviations).

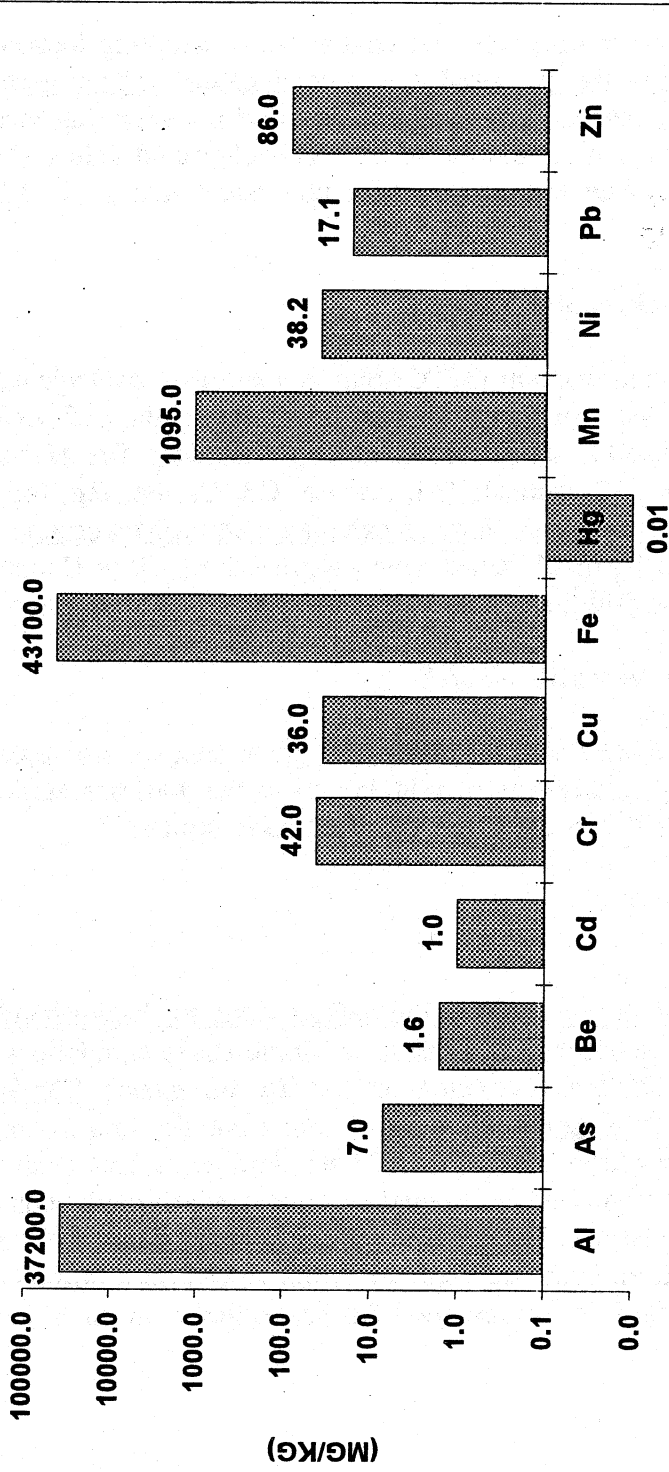
TABLE 6: STATEWIDE 90th PERCENTILE VALUES

SAMPLE POPULATION (n) = 166

Al	As	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
37200.0	7.0	1.6	1.0	42.0	36.0	43100.0	0.01	1095.0	38.2	17.1	86.0

All Values = mg/kg

FIGURE 5: STATEWIDE 90th PERCENTILE VALUES



Note: See Figure 47 for Ag, Ba, Ca, Co, Mg, Na, Sb, Se, Ti, & V 90th Percentile Values

90th Percentile Comparison

A summary comparison of 90th percentile values is given in **Table 7**. The sample population for each regional group is given in **Table 7** and **Figure 6**. When comparing 90th percentile values between data sets, the following observations were made:

- ▶ Five of the 13 maximum 90th percentile values came from one data set, Group "W" (Al, Cr, Cu, Hg, Ni). This occurrence is probably due to the smaller sample population (15) of Group "W" (note: Group "W" is comprised of Regions "A", "C", and "D" and encompasses that area outside of the Puget Sound Basin and Clark County regions),
- ▶ Conversely, seven of the minimum 90th percentile values came from one data set, Spokane Basin (Al, Cr, Cu, Fe, Hg, Ni, Zn). Additionally, when compared against other data sets, the Spokane data tended to have the least amount of variation from maximum to minimum values.
- ▶ The west-side 90th percentile values are on average 1.5 times higher than the east-side values (see **Table 8** and **Figures 7-9**). The lone exception to this was the east-side 90th percentile value for arsenic, which was 15% higher than the west-side value. The extremities in climate, vegetation, and geology between Western and Eastern Washington are thought to be the primary reasons for variations in the west/east 90th percentile values.

Background Values: Washington and Other States

A comparison of Washington's 90th percentile values to those from other states or other background studies is presented in **Table 9** and **Figure 10**. This comparison found that the background values identified in Washington are very similar to those detected in other states or other studies.

TABLE 7: COMPARISON OF 90th PERCENTILE VALUES

	n	Al	As AA	As ICP	Ba	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
GROUP "W"	15	62,905	8.47	N/A	0.75	0.10	78.46	52.85	49,170	0.13	691.75	54.19	10.87	85.56
PUGET SOUND	45	32,581	7.30	22.80	0.61	0.77	48.15	36.36	36,128	0.07	1,146.00	38.19	16.83	85.06
CLARK COUNTY	26	52,276	5.81	60.80	2.07	0.93	26.57	34.43	58,665	0.04	1,511.00	21.04	24.02	95.52
WEST (ALL)	86	45,735	6.37	46.21	1.51	1.20	47.40	43.23	50,125	0.08	1,337.27	44.20	20.42	98.39
STATEWIDE	166	37,206	6.99	41.81	1.44	0.99	41.88	36.01	43,106	0.07	1,094.85	38.19	17.09	85.82
EAST (ALL)	80	28,299	7.61	36.17	1.27	0.81	31.88	28.40	36,644	0.04	836.00	24.54	13.10	80.91
YAKIMA BASIN	32	33,379	5.13	41.79	1.57	0.93	38.27	26.47	51,451	0.05	1,104.84	45.89	11.00	78.71
SPOKANE BASIN	27	21,376	9.34	20.83	0.84	0.72	17.81	21.61	25,026	0.02	663.48	16.19	14.91	66.40
GROUP "E"	21	25,591	5.76	N/A	0.61	N/A	37.80	28.42	29,631	0.02	526.59	22.41	9.85	67.47

ALL VALUES = MG/KG

FIGURE 6: SAMPLE POPULATIONS (n)

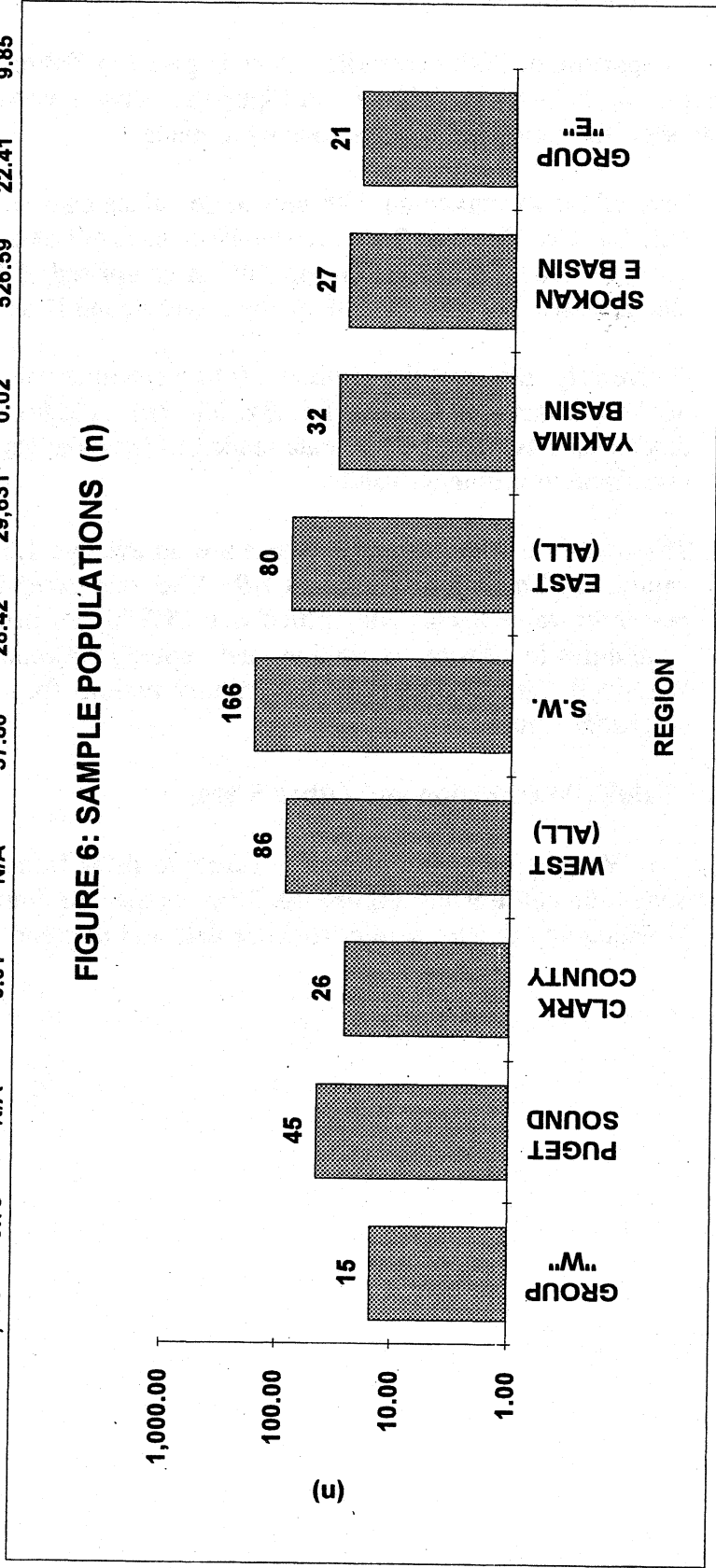


TABLE 8: COMPARISON OF WEST/EAST 90th PERCENTILE VALUES

	Al	As	Be	Cd	Ct	Cu	Fe	Hg	Mn	Ni	Pb	Zn
WEST (ALL)	45,735.00	6.37	1.51	1.20	47.40	43.23	50,125.00	0.08	1,337.27	44.20	20.42	98.39
EAST (ALL)	28,299.00	7.31	1.27	0.81	31.88	28.40	36,644.00	0.04	836.00	24.54	13.10	80.91
RATIO W:E	1.62		1.19	1.48		1.52	1.37	2.00	1.60	1.80	1.56	1.22
MEAN RATIO	1.53											

ALL VALUES = MG/KG

FIGURE 7: Al, Fe COMPARISON

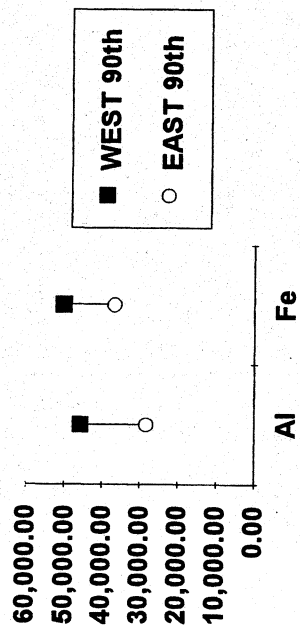


FIGURE 8: Be, Cd, Hg COMPARISON

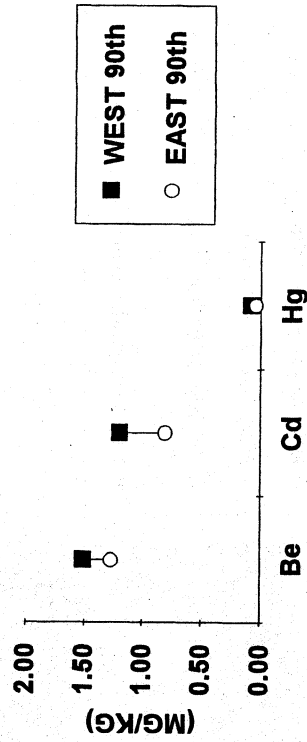
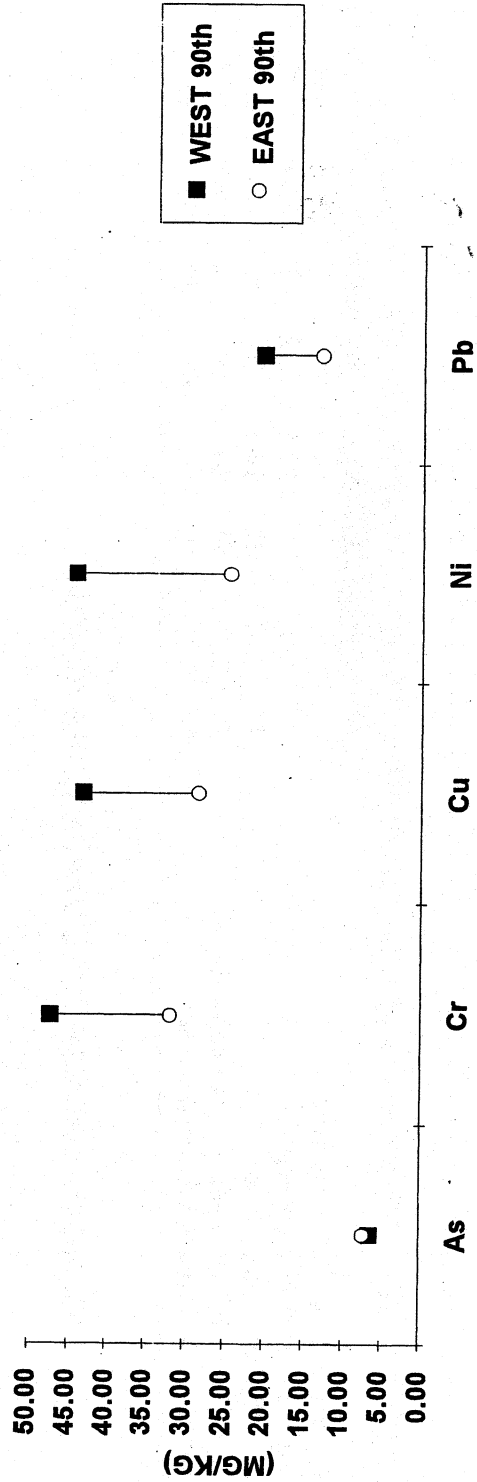


FIGURE 9: As, Cr, Cu, Ni, Pb COMPARISON

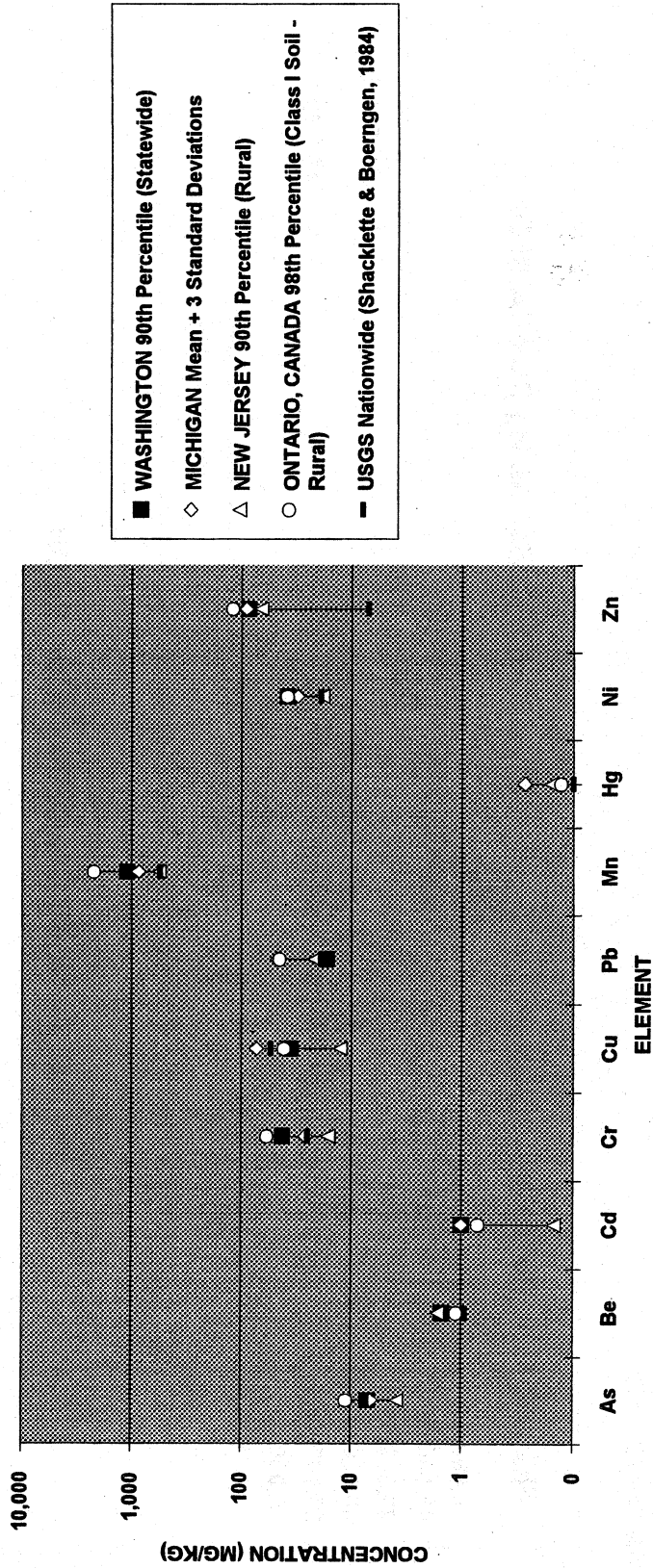


*NA = VALUE NOT AVAILABLE

TABLE 9: COMPARISON OF WASHINGTON BACKGROUND VALUES TO OTHER STATES (MG/KG)

	As	Be	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn
WASHINGTON 90th Percentile (Statewide)	7	1.5	1	41.8	36	17	1095	0.07	38.2	85.8
MICHIGAN Mean + 3 Standard Deviations	7	*NA	1	26.2	72.2	47	855.8	0.27	30.9	90.3
NEW JERSEY 90th Percentile (Rural)	4	1.63	0.15	16.5	12.8	22	561	0.16	18.7	65.9
ONTARIO, CANADA 98th Percentile (Class I Soil - Rural)	11	1.1	0.71	58	41	45	2,200	0.13	38	120
USGS Nationwide (Shacklette & Boermgen, 1984)	7	0.92	*NA	25	54	19	550	0.1	19	7

FIGURE 10: BACKGROUND VALUE COMPARISON



VII. ANALYSIS OF REGIONAL VARIATION

Overview

Due to time, budget, and resources, a highly sophisticated statistical analysis of the variation in data between regions was not performed. Routine comparative methods were instead employed to analyze the data. Due to the significant variation in climate, soils, geology, vegetation, population, etc. throughout Washington, the decision was made to simply compare the following values from each data set: (a) 90th percentile; (b) maximum and minimum; and (c) median (see Figures 11-22). A brief discussion on the observations made per element is also included in this section.

Data Sets

For comparison purposes, the data were subdivided into nine basic groups (see Table 10 below). Sampling data from Puget Sound, Yakima Basin, Clark County, and Spokane Basin comprise four groups. Three additional groups were created by pooling data into west, east, and statewide groups. The Cascade Mountain Range was used as a dividing line for the west/east data groups. Group "W" contains that data independent of the Puget Sound and Clark County data sets. Group "E" contains that data independent of the Yakima and Spokane Basins data sets.

Table 10: Data Subdivisions

Data Group	Sample Population	Definition
Group "W"	15	Whatcom and Skagit Counties, Pacific Coast (Grays Harbor, Lewis, and Pacific Counties).
Puget Sound	45	Snohomish, King, Pierce, Thurston, Mason, Jefferson, Island, San Juan, and Clallam Counties.
Clark County	26	Clark County
West (All)	86	All sampling locations west of the Cascade Mountain Range
Statewide	166	All statewide sampling locations
East (All)	80	All sampling locations east of the Cascade Mountain Range
Yakima Basin	32	Yakima, Kittitas, Chelan, and Grant Counties
Spokane Basin	27	Spokane, Lincoln, and Pend Oreille Counties
Group "E"	21	Benton, Spokane, Lincoln, Adams, Okanogan, and Whitman Counties

Aluminum

A notable west-east trend was observed in the aluminum data set (see Figure 24). Both the 90th percentile and lognormal mean values for west-side are nearly twice as high as the east side data (see Table 11 below). The reason for this is unknown; however, it is suspected that the wet west-side climate is probably a significant factor (i.e., the formation of bauxite). Higher aluminum concentrations (greater than 40,000 mg/kg) were detected in Whatcom County (Mt. Baker), along the Pacific Coast (Pacific County) and the Clark County Vancouver area. Significantly lower aluminum values (less than 20,000 mg/kg) were detected in the Spokane Basin (see Figure 11).

Table 11: Aluminum 90th Percentile and Lognormal Mean Values - West and East Data

Value	West (n = 86)	East (n = 80)
90th Percentile	45,700	28,300
Lognormal Mean	25,500	18,200

All Values = mg/kg n = sample population

Arsenic

The statewide distribution of arsenic in soil was remarkably uniform throughout the state (between 1 - 10 mg/kg, see Figures 12 and 26). Specifically, there was very little variation in the median and 90th percentile values for each data set (see Figure 9). One possible reason for nominal variation in the arsenic data set is the used of atomic absorption analytical methods, which is considered to be more reliable for arsenic at lower concentrations (as opposed to ICP methods). Arsenic was the only element whose 90th percentile value was higher in Eastern Washington. Higher arsenic values (greater than 50 mg/kg) were detected in the Tacoma vicinity (Pt. Defiance Park)--probably due to fallout from the Asarco Smelter. Higher values were also detected in the Yakima Basin, which may be due to the extensive use of arsenic-based pesticides.

Beryllium

The variation in the statewide distribution of beryllium was somewhat unusual. Specifically, higher values (greater than 1 mg/kg) were observed only in the Vancouver area and Central Washington (Yakima and Ellensburg). The Clark County beryllium data are also unique in that the data are normally distributed and the 90th percentile value, 2.1 mg/kg, was notably higher than all other data sets (see Figure 13).

Cadmium

The statewide distribution of cadmium was relatively uniform, with approximately 40% (61 out of 165 values) of the data set at or below detection limits (less than 0.2 or 0.8 mg/kg, see Figures 14 and 30).

Chromium

A significant west-east variation was noted in the chromium data set. An examination of the statewide chromium concentration map (see **Figure 32**) finds that the west-side values are notably higher than the east. Higher chromium values were detected in the Mt. Baker area (Region "D;" Northern Skagit and Whatcom Counties). The reason for the detection of higher chromium values in this area is not known. However, the difference between west to east 90th percentile values (47.4 vs. 31.9 mg/kg) is not considered to be important from a cleanup perspective since the MTCA Method A soil cleanup level for chromium, 100 mg/kg, is over twice the statewide or area background values.

Copper

A slight west-east trend was observed in the copper data set. Specifically, there is a noticeable lack of higher values (greater than 40 mg/kg) in the Spokane Basin region. However, there is a fairly constant distribution (10-100 mg/kg) in copper from Yakima to Seattle (see **Figure 33**).

Iron

Very little variation was observed in the iron data set. Examination of the X,Y scatter plot (see **Figure 35**) reveals a straight-line set of values between 1,000 and 100,000 mg/kg. However, there was some variation in the iron data for Clark County, as noted by the detection of the maximum 90th percentile value (58,700 mg/kg) in this region.

Lead

The lead data set is unique in that it appears to mimic statewide population trends; i.e., higher values were detected in more densely populated regions (Seattle, Vancouver, Yakima, and Spokane, see **Figure 38**). Higher lead values in more densely populated areas may be due to fallout from automobile exhaust. However, an examination of the X,Y scatter plot finds that nearly all the lead values tended to fall between 2 and 20 mg/kg (see **Figure 37**).

Manganese

The variation in the manganese data set was relatively nominal with nearly all values falling between 100 and 1,000 mg/kg. The one exception was the Clark County data set, which was normally distributed with a median value of 510 mg/kg (max value observed, see **Figure 19**). Higher manganese concentrations (greater than 1,000 mg/kg) were observed in the Vancouver, Yakima, and the Seattle-Tacoma-Olympia corridor.

Nickel

A noticeable west-east trend was observed in the nickel data set. Values greater than 20 mg/kg were not detected east of Yakima (see **Figure 44**).

Zinc

Very little variation was observed in the statewide zinc data set. Nearly all the values fell between 10 and 100 mg/kg (see Figures 45 & 46).

Other Elements

Background data were also compiled for ten other elements: antimony (Sb), barium (Ba), calcium (Ca), cobalt (Co), magnesium (Mg), sodium (Na), selenium (Se), titanium (Ti), thallium (Tl), and vanadium (V). The Ba, Ca, Co, Mg, Na, Ti, and V data were collected only in the Spokane Basin area, and the data for Ag, Sb, Se is limited since these elements were normally not detected above laboratory detection limits. Because of these two factors, an assessment of the regional variation for these elements was not completed. A brief summary of the 90th percentile values for these elements is given in Figure 47.

Antimony

Approximately 10% of the data set (50 samples) exceed laboratory detection limits (ICP analysis @ 3 mg/kg). Based on this data, a 90th percentile value of 5 mg/kg was calculated for Sb.

Selenium

The ICP data for selenium were not assessed because the standard detection limits used were too high (5 - 15 mg/kg). Only 14 selenium samples exceeded atomic absorption (AA) analytical detection limits. Of these 14, only two were given a laboratory code of "J," which means that the analyte was positively identified. The remaining 12 were assigned a laboratory code of "P," which means that the analyte was detected above the instrument detection limit but below the established minimum quantitation limit. Based on those samples exceeding AA detection limits, a 90th percentile value of 0.78 mg/kg was estimated for selenium.

Silver

Less than 10% of the data set (33 samples) exceeded laboratory detection limits (0.3 mg/kg). Based on this data, a 90th percentile value of 0.61 mg/kg was calculated.

Thallium

Values above the laboratory detection limit (5 mg/kg) were not detected.

Why are the West-Side Background Values Higher?

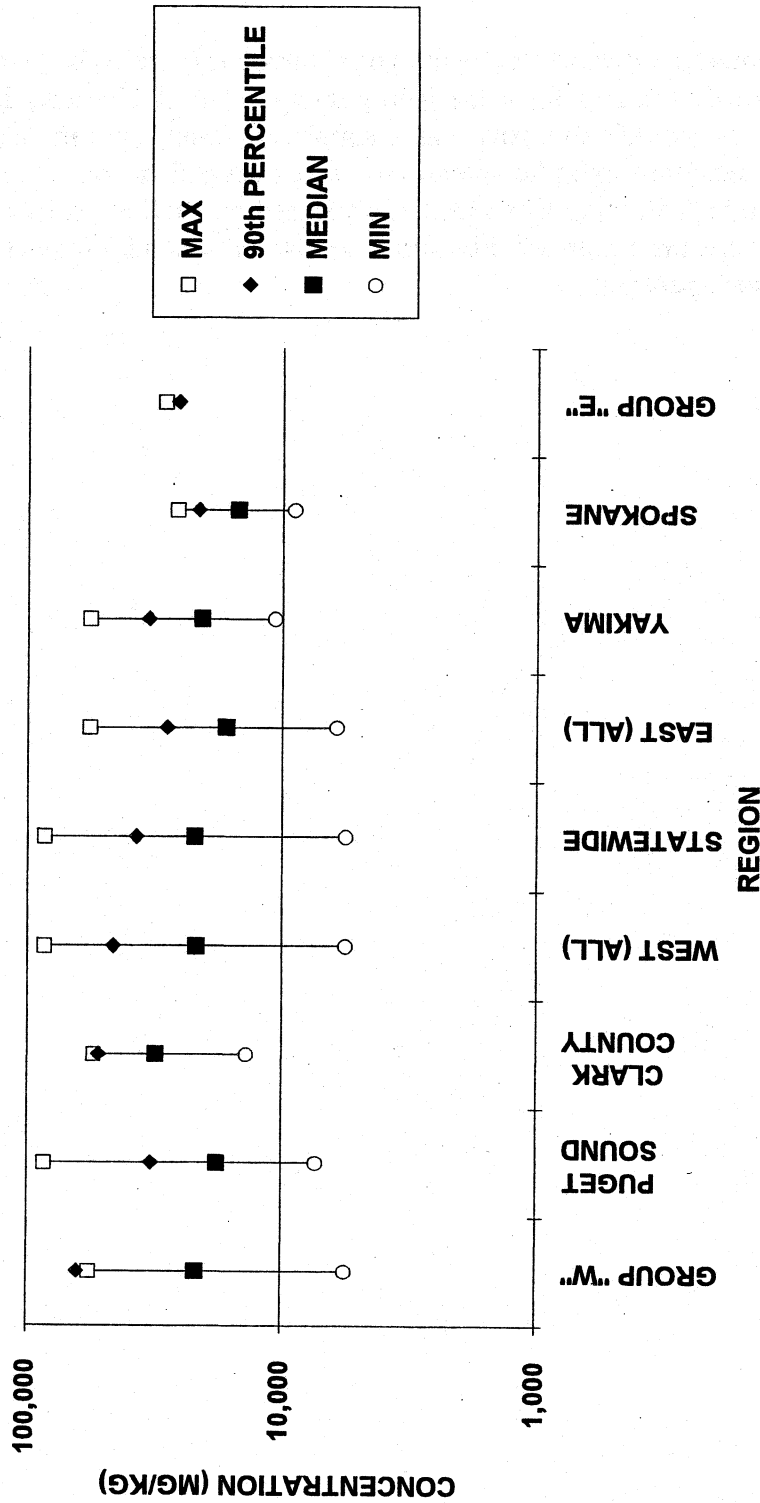
The formation of soils is to a large degree a weathering phenomenon that is heavily influenced by climate and vegetation. Thus, the wet climate and dense vegetation of Western Washington has undoubtedly been a significant factor in the formation of west-side soils. Conversely, the much

dryer climate and sparser vegetative pattern in Eastern Washington has likely produced a different type of soil.

Geologic Diversity

The actual effect of Washington's diverse geologic makeup upon this study is thought to be somewhat nominal. Specifically, nearly all of the data points for the 12 elements fall within one order of magnitude. Thus, if geologic diversity was a significant issue, then the argument could conceivably be made that the data should be spread out across several orders of magnitude. However, it should also be kept in mind that this study focused on surficial soils only. Thus, it may not be appropriate to compare the results of this study against the potential impact of geologic diversity upon the entire soil spectrum.

FIGURE 11: ALUMINUM REGIONAL ANALYSIS

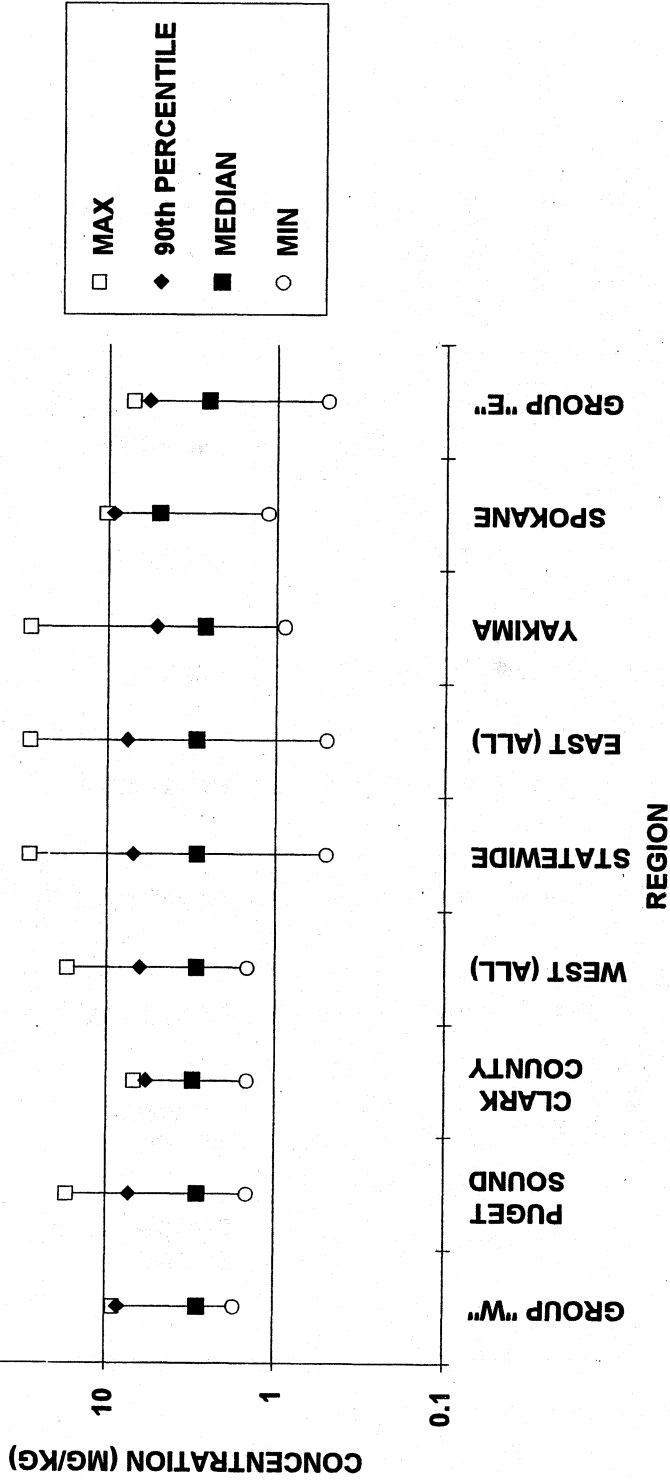


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	56,550	84,900	54,550	84,900	84,900	56,550	56,550	25,850	29,000
90th PERCENTILE	62,985	32,981	52,276	45,735	37,286	25,299	33,379	21,376	25,591
MEDIAN	21,700	17,900	31,192	21,760	21,956	16,600	20,800	15,000	14,800
MIN	5,670	7,390	13,750	5,670	5,670	6,140	10,650	8,933	6,140

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 12: ARSENIC REGIONAL ANALYSIS

NOTE: CHART BASED ON *GFAA ANALYSIS

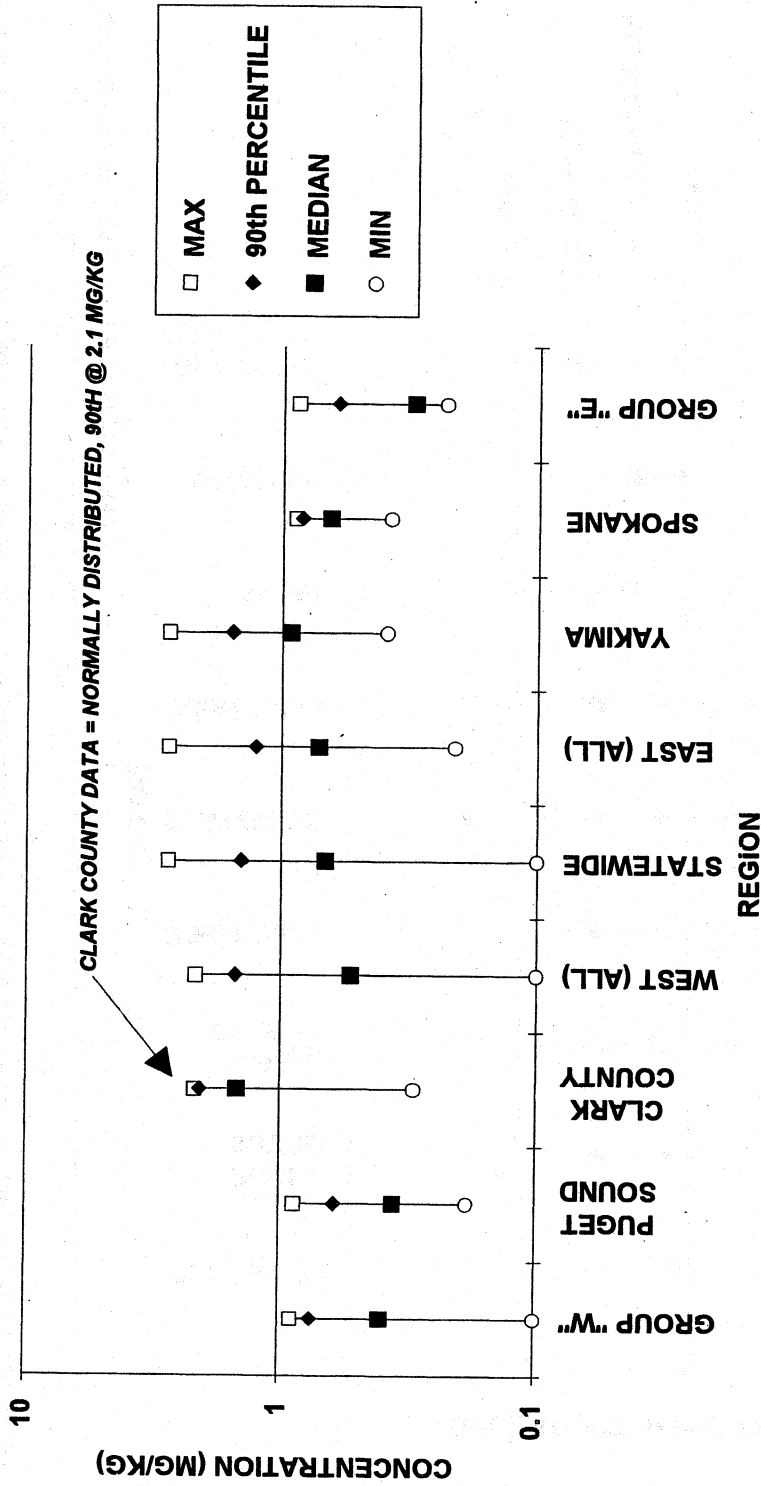


*GFAA = GRAPHITE FURNACE ATOMIC ABSORPTION

ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19
90th PERCENTILE	8.47	7.30	5.81	9.37	6.99	7.61	5.13	5.34	5.76
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

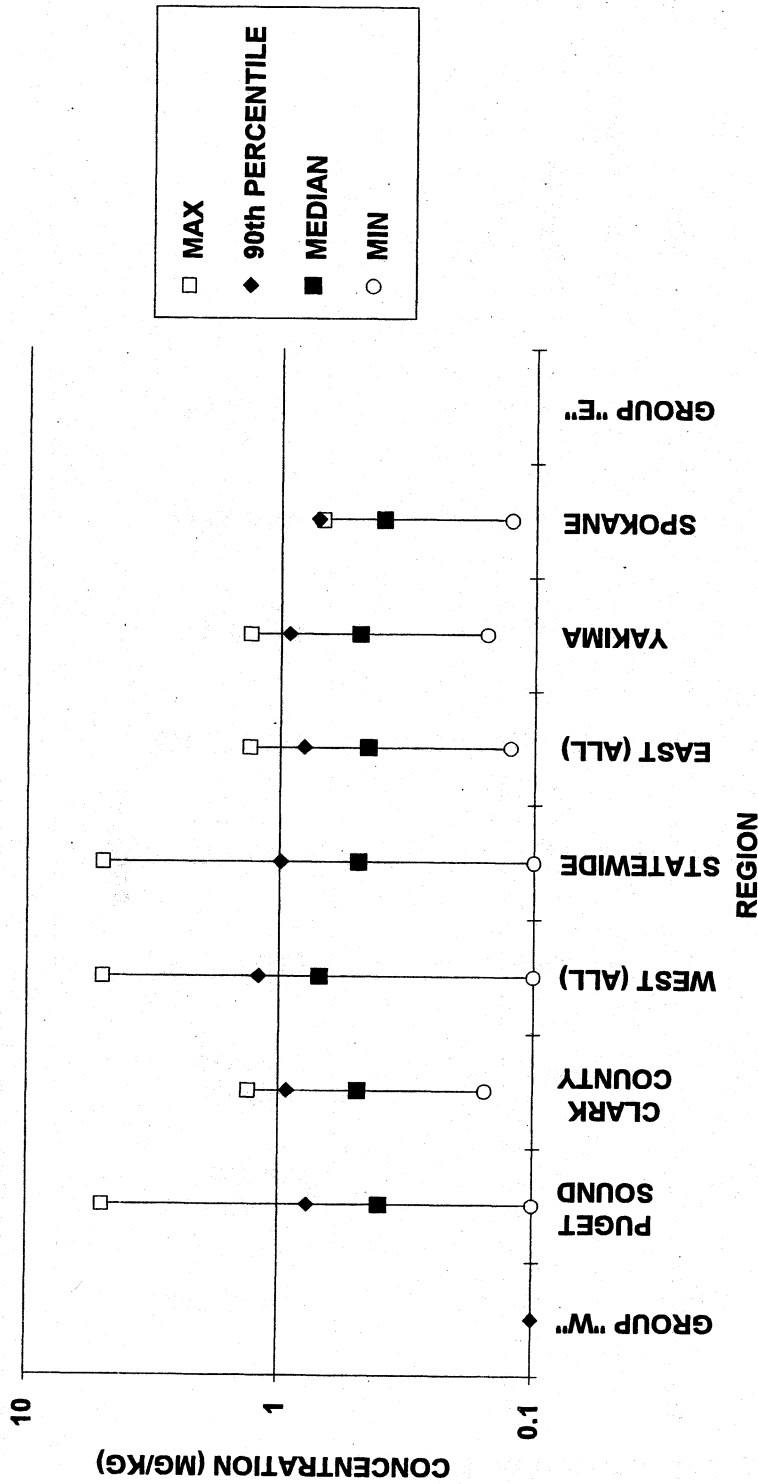
FIGURE 13: BERYLLIUM REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.89	0.875	2.155	2.155	2.79	2.79	2.79	2.79	2.79
90th PERCENTILE	0.75	0.61	2.07	1.51	1.44	1.27	1.57	1.27	1.57
MEDIAN	0.4	0.358	1.479	0.53	0.67	0.72	0.84	0.655	0.655
MIN	0.1	0.185	0.3	0.1	0.1	0.21	0.39	0.37775	0.23

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

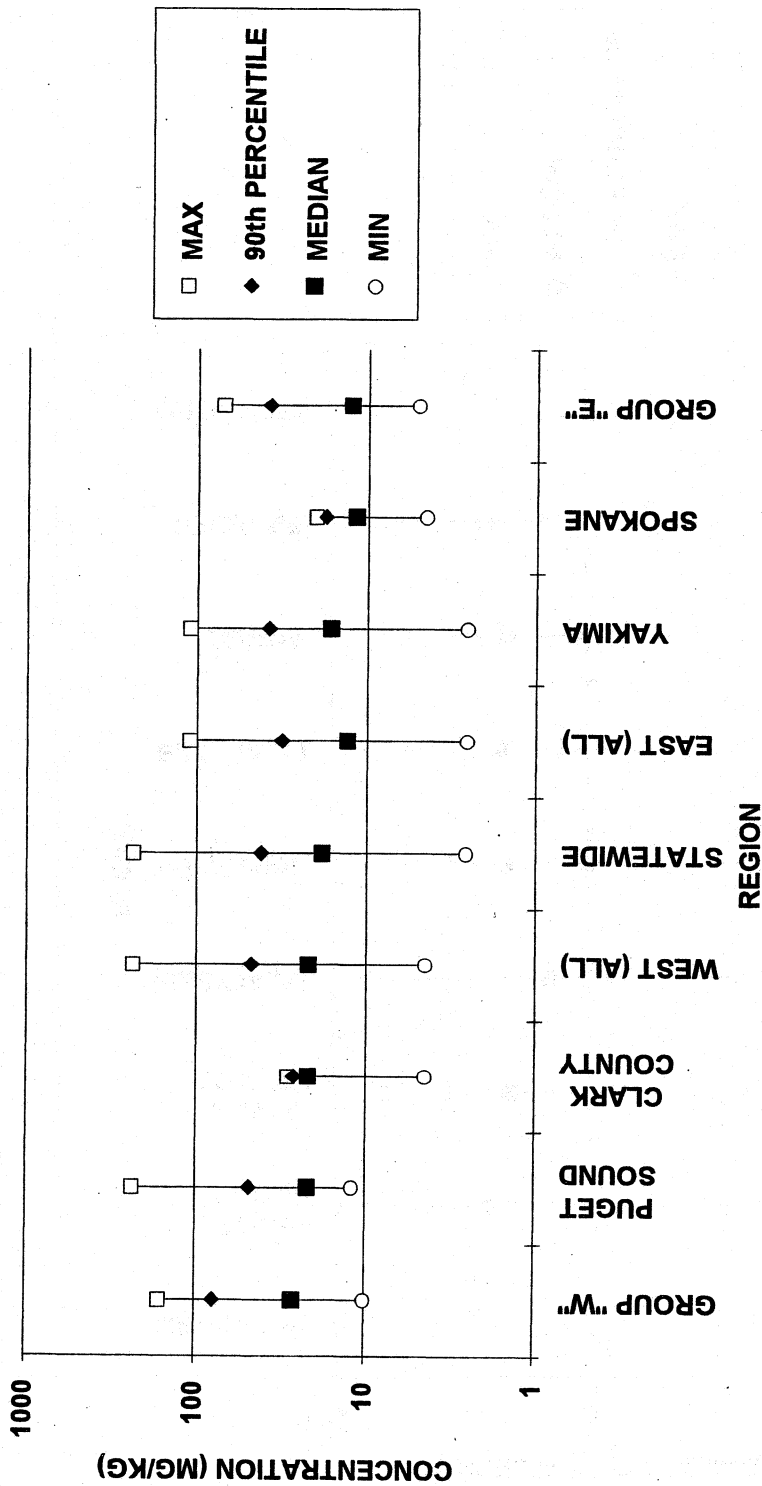
FIGURE 14: CADMIUM REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	N/A	5	5	1.32	5	5	1.32	0.685	N/A
90th PERCENTILE	0.1	0.77	0.93	0.93	1.2	0.87	0.93	0.72	N/A
MEDIAN	N/A	0.4	0.49	0.49	0.7	0.45	0.49	0.395	N/A
MIN	N/A	0.1	0.155	0.155	0.1	0.125	0.155	0.125	N/A

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = DENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

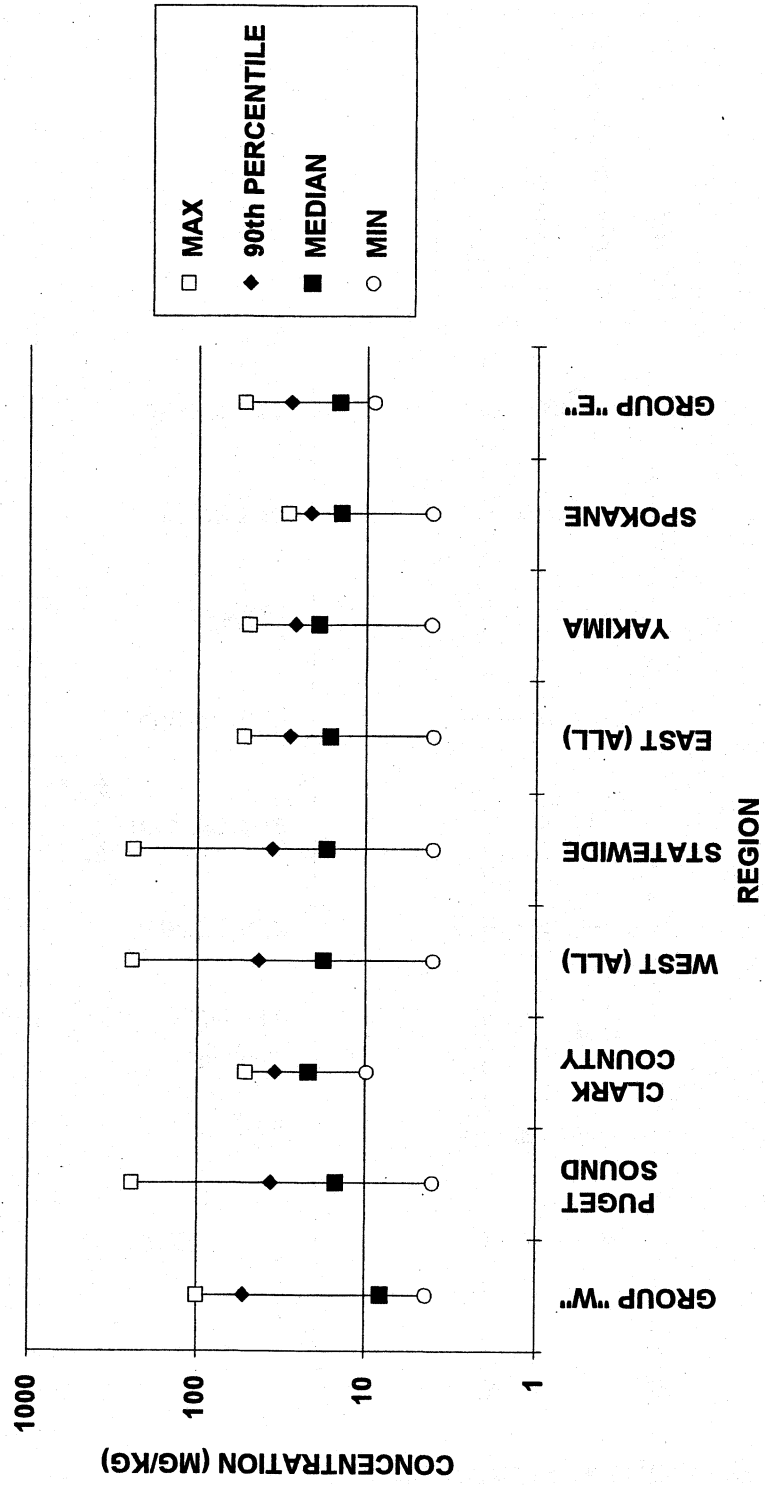
FIGURE 15: CHROMIUM REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	163	235	28.83	235	235	110.3	110.3	20.25	71.3
90th PERCENTILE	73.46	49.15	26.57	47.4	47.85	31.88	38.27	17.81	37.8
MEDIAN	26.7	22	21.99	22	18.42	13.15	16.42	11.78	12.6
MIN	10.1	12	4.42	4.42	2.56	2.55	2.55	4.5	5

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

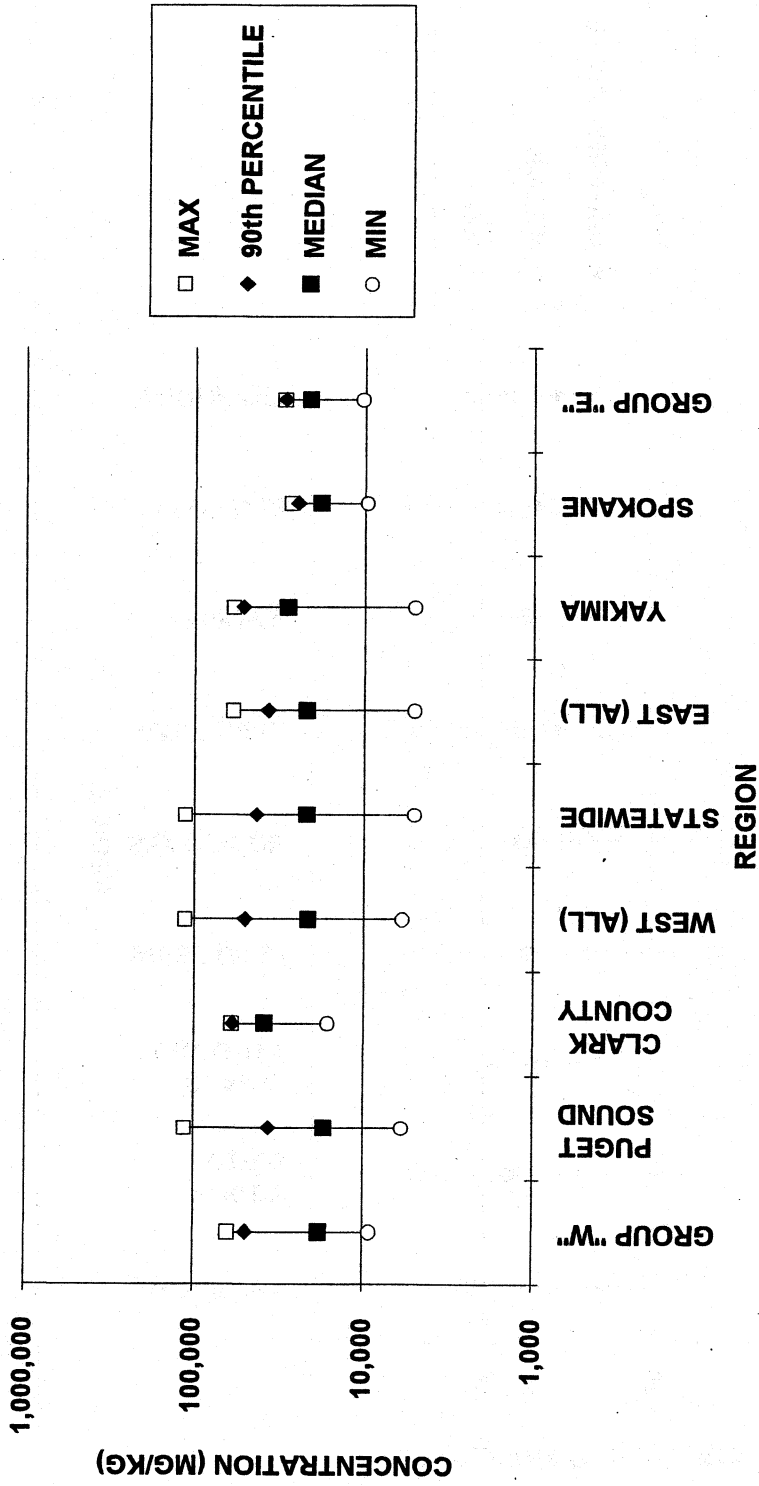
FIGURE 16: COPPER REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	99.4	243.5	51.71	243.5	243	53	50.15	29.03	53
90th PERCENTILE	52.85	36.35	34.43	43.23	35.01	23.4	25.97	21.51	23.42
MEDIAN	8.05	15	21.78	17.8	17.07	16.3	19.225	14.14	14.7
MIN	4.33	4	9.71	4	4	4	4.125	4.04	9.1

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

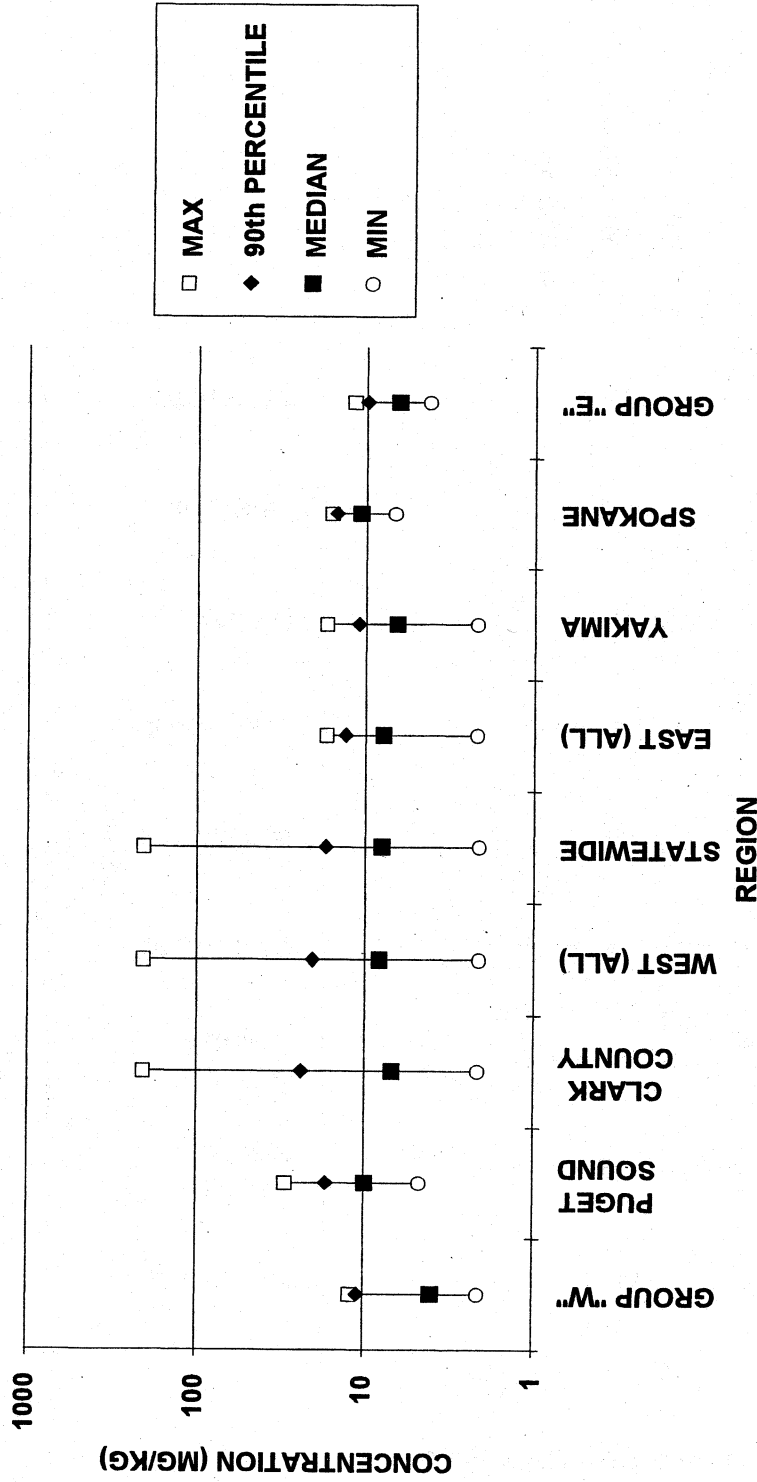
FIGURE 17: IRON REGIONAL ANALYSIS



ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	62,800	112,500	59,850	112,500	112,500	112,500	58,880	27,000	30,000
90th PERCENTILE	49,178	36,128	58,886	50,125	43,106	43,106	51,451	25,025	29,521
MEDIAN	18,200	17,050	38,508	21,433	22,033	22,116	28,821	18,150	21,300
MIN	9,160	5,920	16,350	5,920	5,025	5,025	5,025	9,670	10,400

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

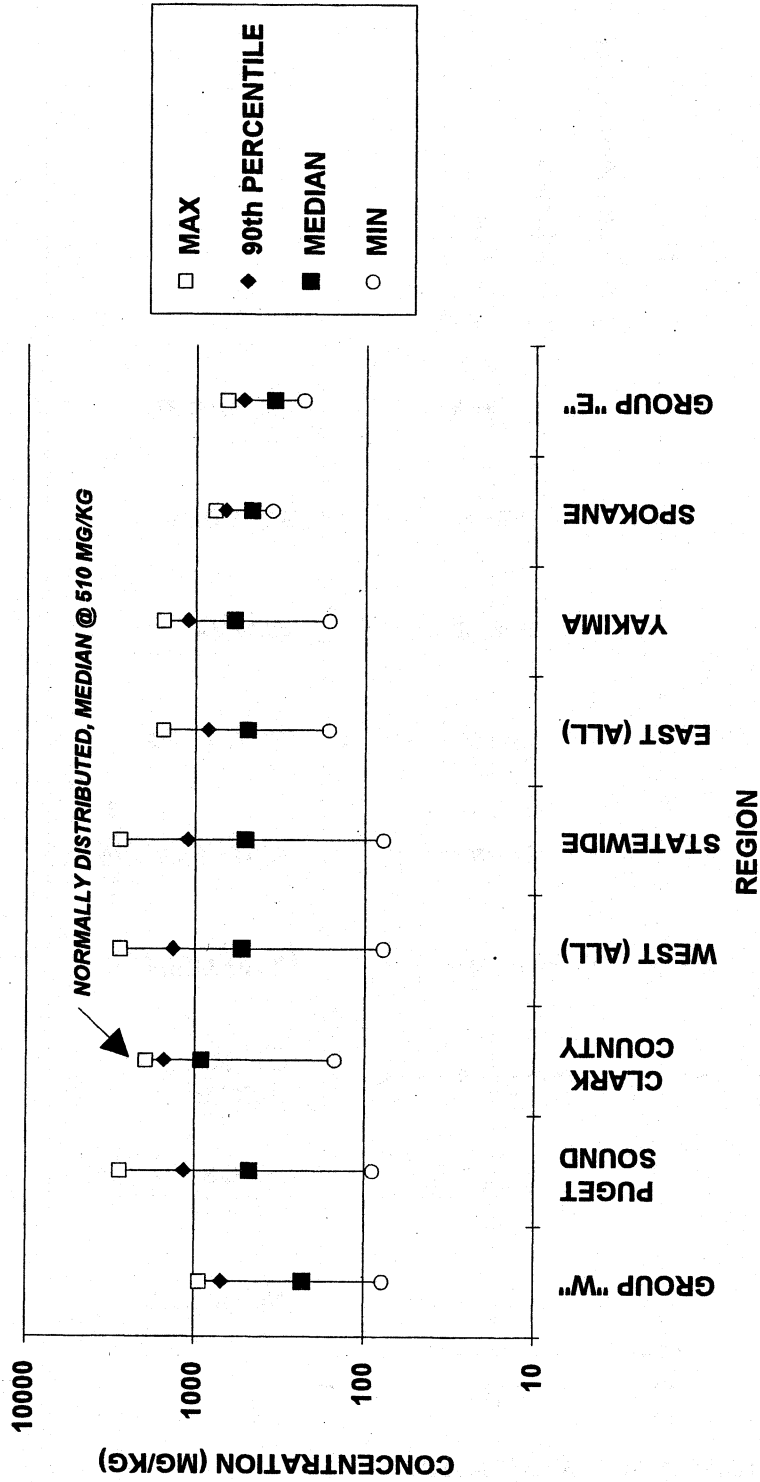
FIGURE 18: LEAD REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	12	29.6	207.5	207.5	207.5	207.5	17.1	16	11.7
90th PERCENTILE	10.97	16.83	74.02	20.42	17.09	20.42	11	14.91	9.85
MEDIAN	4	9.8	6.86	8.2	7.9	8.2	6.525	10.8	6.4
MIN	2.1	4.65	2.125	2.1	2.1	2.1	2.17	6.75	4.2

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

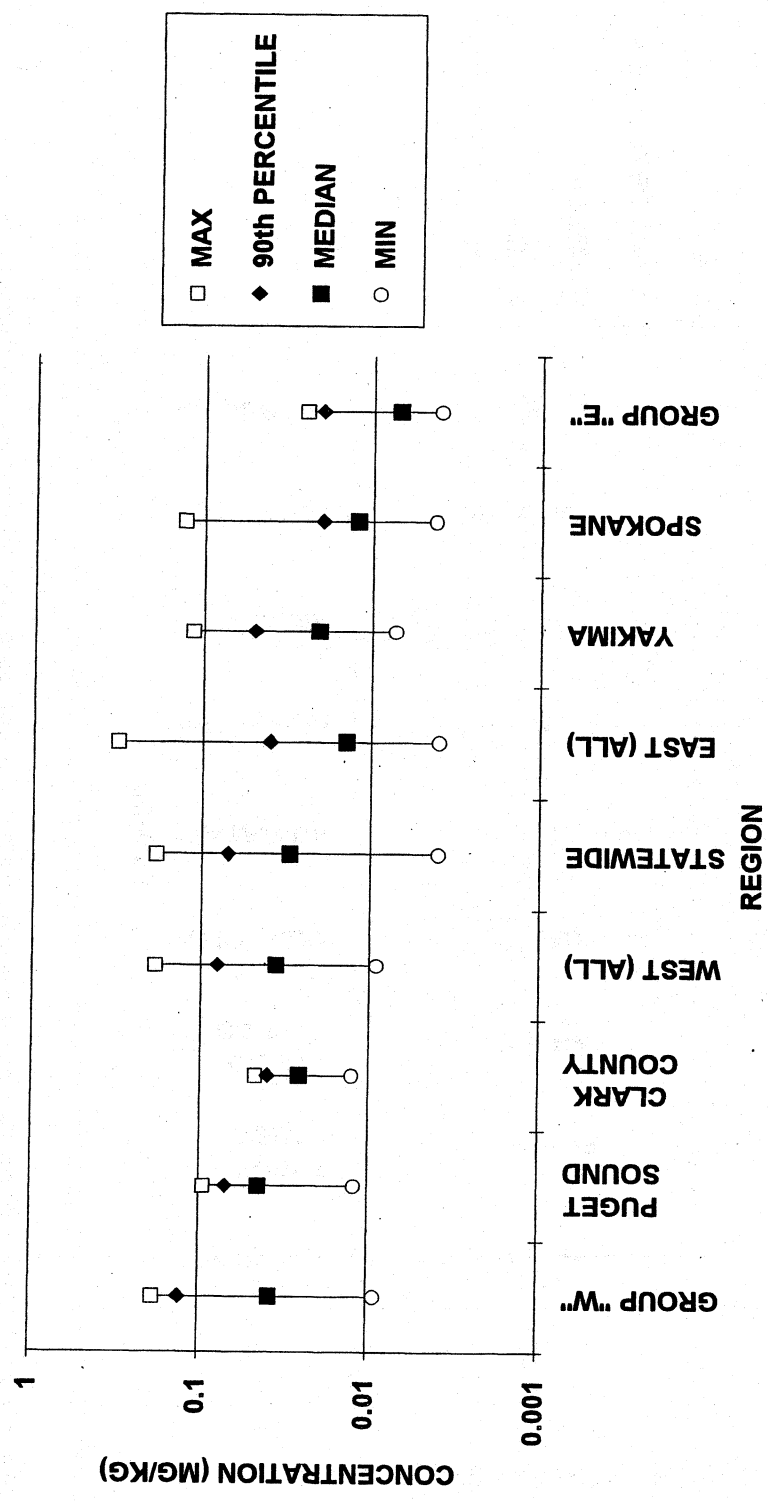
FIGURE 19: MANGANESE REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	930	2750	1960	2750	2750	1546.12	1546	769.5	652
90th PERCENTILE	691.75	1146	1511	1337.27	1694.95	836	1101.84	653.48	526.59
MEDIAN	231	474	915.5	531.25	509.58	490.75	589	470	345
MIN	78	90	150	78	78	164.45	164.45	354.5	233

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

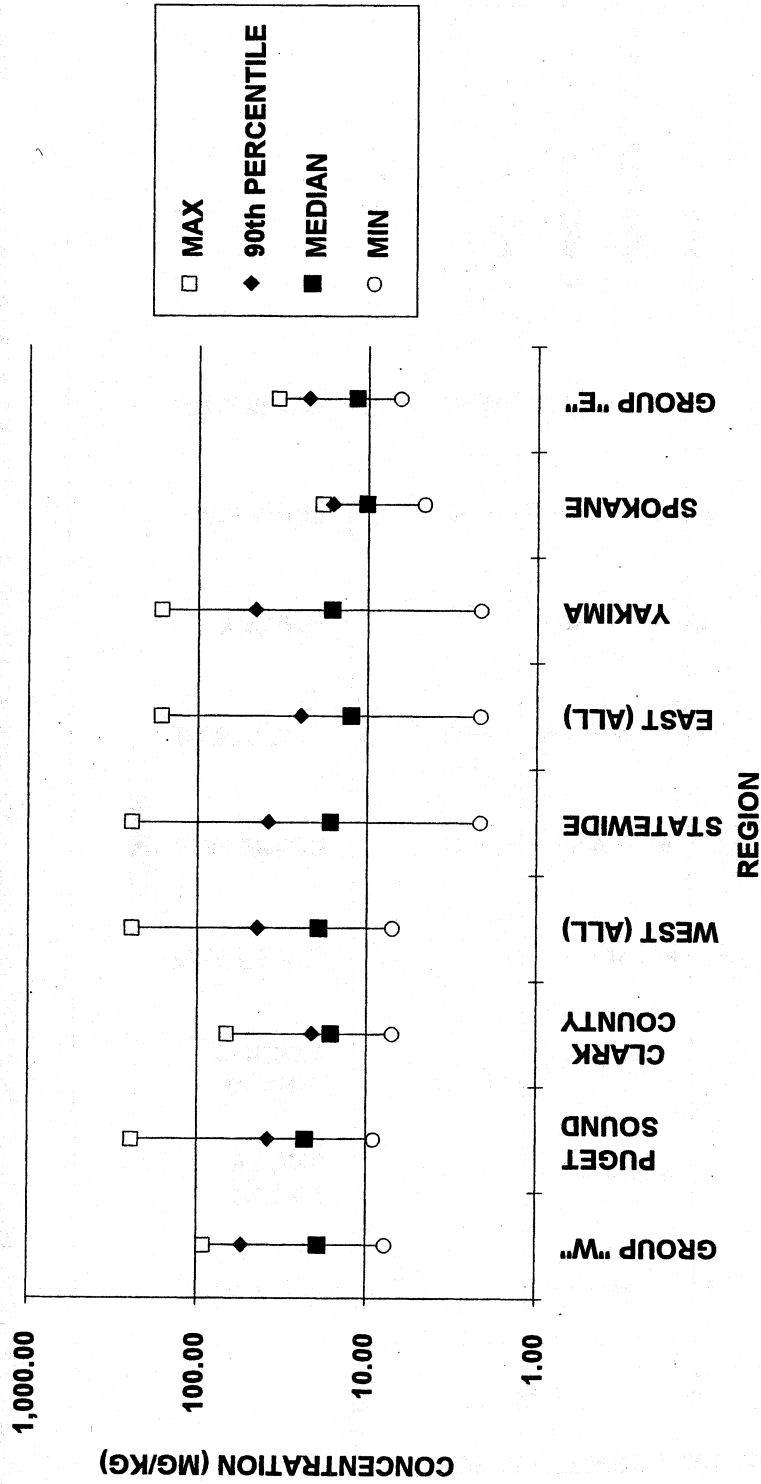
FIGURE 20: MERCURY REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.185	0.0944	0.047	0.185	0.185	0.185	0.1165	0.1312	0.025
90th PERCENTILE	0.13	0.07	0.04	0.08	0.07	0.04	0.05	0.02	0.02
MEDIAN	0.038	0.04475	0.026	0.0358	0.03	0.014	0.02075	0.01225	0.007
MIN	0.009	0.012	0.0125	0.009	0.004	0.004	0.00725	0.00425	0.004

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

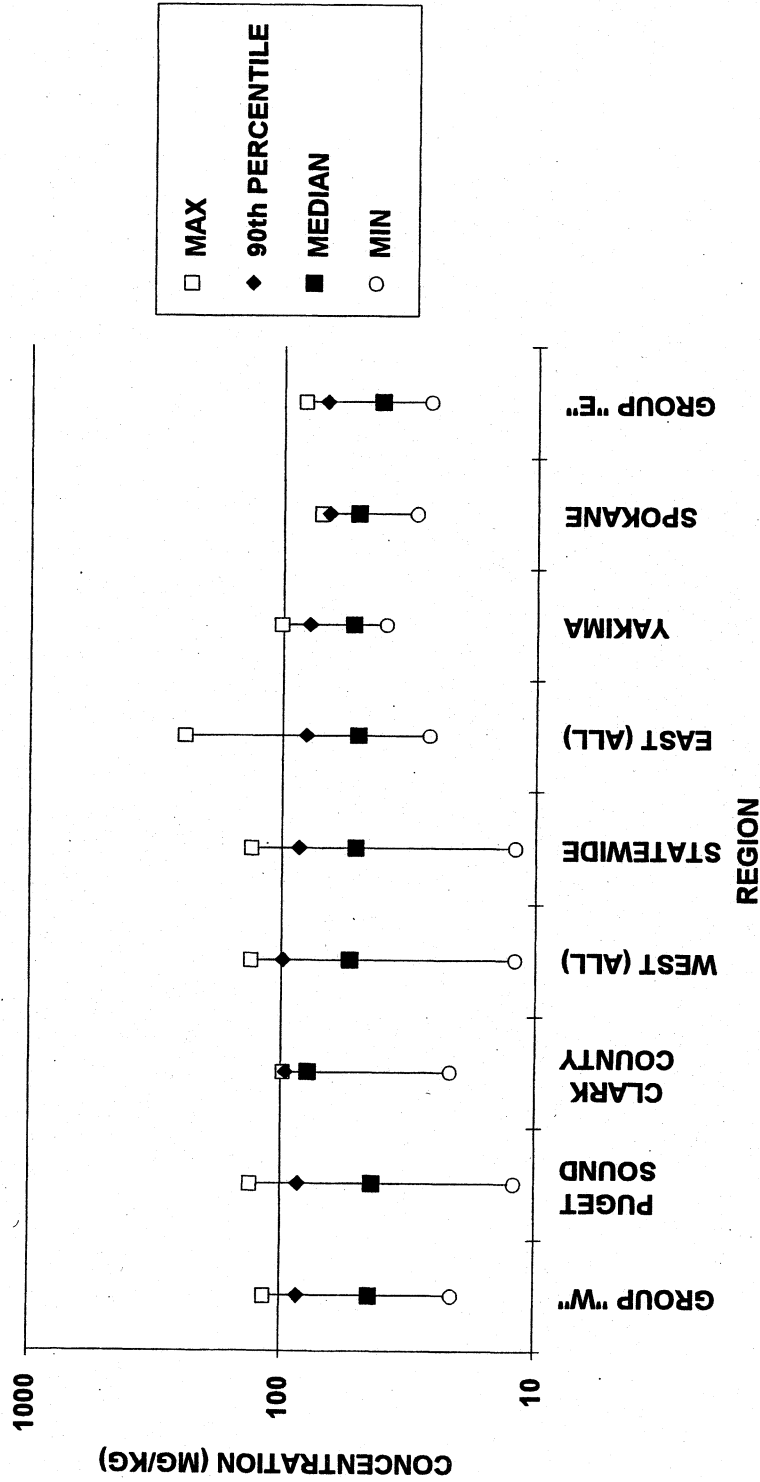
FIGURE 21: NICKEL REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10
90th PERCENTILE	54.19	38.19	21.04	44.30	35.19	24.54	45.89	15.19	22.41
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 22: ZINC REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	116	132.5	97.7	132.5	132.5	244.5	101.43	71	82.3
90th PERCENTILE	85.56	85.05	95.52	98.39	85.82	80.41	78.71	66.4	67.47
MEDIAN	44.5	43.65	78.5	54.075	51.12	50.64	52.9	50.9	41
MIN	21.1	12	21.4	12	12	26.3	39.3	29.7	26.3

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

VIII. USE AND APPLICATION OF BACKGROUND VALUES

Site-Specific or Area Studies of Natural Background

The intent of this report is to provide detailed information on the natural background concentration of metals in soils throughout Washington State. However, site-specific assessments of natural or area background can still be initiated if desired. At least ten samples must be collected for a site-specific study into natural background and at least 20 are required for area background (Ch 173-340-708 11 (d) WAC).

Use of the Statewide and Regional Values

Statewide and regional 90th percentile values for the Puget Sound Basin, Clark County, Yakima Basin, and Spokane Basin are presented in Table 6. The statewide values can be used for any purpose (i.e., comparison against data from toxic waste sites, waste streams, etc.) and there are no restrictions on the use of this data. The regional 90th percentile values for Puget Sound, Clark County, Yakima Basin, and Spokane Basin are to be compared against data from those regions only (see Table 12 below).

Table 12: Counties Encompassed by Regional Background Values

Region	Counties
Puget Sound Basin	Clallam, Jefferson, Mason, Thurston, Pierce, King, Kitsap, Island, Snohomish
Clark County	Clark, Cowlitz, Skamania
Yakima Basin	Yakima, Kittitas, Klickitat, Chelan, Benton
Spokane Basin	Spokane, Lincoln, Adams, Whitman

Other Areas

Sites that are not located within the four main regional areas may use the statewide values or the 10 sampling locations (see latitude/longitude coordinates, data tables) that are closest to a given site or area.

Application of Background Values

When comparing cleanup- or contaminated-site data against background values, the 95 % upper confidence limit (UCL) of a given data set is compared against the 90th percentile of the background data set. Please refer to Ecology's publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). Detailed instructions on how to derive soil cleanup standards based on background standards are included in that document. Please use caution when comparing individual data points against the 90th percentile value of the background data set. When comparing individual

data points against the 90th percentile value, there is a 10% chance that an individual data point will exceed the 90th percentile value.

Alternative Procedures

The 90th percentile has been selected by Ecology as the default assumption for determining background. If background values are used as cleanup levels, no single sample concentration shall be greater than two times the 90th percentile value and less than ten percent of the sample concentrations shall exceed the 90th percentile value (Ch 173-340-740 (7) (e), see Table 13). However, alternative procedures for determining background are allowed. Specifically, a numerical cleanup standard is established, based on different data evaluation procedures. This could be the result of site-specific characteristics, such as the form of the background data distribution, its coefficient of variation (CV) or degree of skew, the number of samples available, or other such factors. For more information on alternative procedures for determining background, consultant Ecology's *Statistical Guidance for Site Managers* (August, 1992, see flowchart of p. 38 for alternative procedures).

TABLE 13: 90th PERCENTILE VALUES

ALL VALUES = MG/KG

	Al	As	Be	Cd	Cr	Cu					
GROUP "W"	62,905	125,810	16.9	0.8	1.5	0.1	0.2	78.5	156.9	52.9	105.7
PUGET SOUND	32,581	65,162	14.6	0.6	1.2	0.8	1.5	48.2	95.3	36.4	72.7
CLARK COUNTY	52,276	104,552	11.6	2.1	4.1	0.9	1.9	26.6	53.1	34.4	68.9
WEST (ALL)	45,735	91,470	12.7	1.5	3.0	1.2	2.4	47.4	94.8	43.2	86.5
STATEWIDE	37,206	74,412	14.0	1.4	2.9	1.0	2.0	41.9	83.8	36.0	72.0
EAST (ALL)	28,299	56,598	15.2	1.3	2.5	0.8	1.6	31.9	63.8	28.4	56.8
YAKIMA BASIN	33,379	66,758	10.3	1.6	3.1	0.9	1.9	38.3	76.5	26.5	52.9
SPOKANE BASIN	21,376	42,752	18.7	0.8	1.7	0.7	1.4	17.8	35.6	21.6	43.2
GROUP "E"	25,591	51,182	11.5	0.6	1.2	N/A	N/A	37.8	75.6	28.4	56.8

	Fe	Hg	Mn	Ni	Pb	Zn					
GROUP "W"	49,170	98,340	0.26	691.8	1.384	54.2	108.4	10.9	21.7	85.6	171.1
PUGET SOUND	36,128	72,256	0.14	1146.0	2.292	38.2	76.4	16.8	33.7	85.1	170.1
CLARK COUNTY	58,665	117,330	0.08	1511.0	3.022	21.0	42.1	24.0	48.0	95.5	191.0
WEST (ALL)	50,125	100,250	0.16	1337.3	2.675	44.2	88.4	20.4	40.8	98.4	196.8
STATEWIDE	43,106	86,212	0.07	1094.9	2.190	38.2	76.4	17.1	34.2	85.8	171.6
EAST (ALL)	36,644	73,288	0.04	836.0	1.672	24.5	49.1	13.1	26.2	80.9	161.8
YAKIMA BASIN	51,451	102,902	0.10	1104.8	2.210	45.9	91.8	11.0	22.0	78.7	157.4
SPOKANE BASIN	25,026	50,052	0.04	663.5	1.327	16.2	32.4	14.9	29.8	66.4	132.8
GROUP "E"	29,631	59,262	0.04	526.6	1.053	22.4	44.8	9.9	19.7	67.5	134.9

SHADED COLUMN = TWICE THE 90th PERCENTILE VALUE

NOTE ON COMPLIANCE MONITORING: A) NO SINGLE SAMPLE CONCENTRATION SHALL BE GREATER THAN TWO TIMES THE 90th PERCENTILE VALUE, B) LESS THAN TEN PERCENT OF THE SAMPLE CONCENTRATIONS SHALL EXCEED THE SOIL CLEANUP LEVEL. Ch 173-340-740 (7) (e) WAC.

IX. SCATTER PLOTS, DISTRIBUTION GRAPHS, & CONCENTRATION MAPS

Summary

Scatter plots, statistical distribution graphs, and statewide concentration maps for the 12 elements are presented in this section. The statewide concentration maps were prepared by Ecology's Environmental Investigation and Laboratory Services Program (EILS) via use of their geographic information system (GIS). The XY scatter plots were prepared using Microsoft Excel.

FIGURE 23: ALUMINUM X, Y SCATTER PLOT

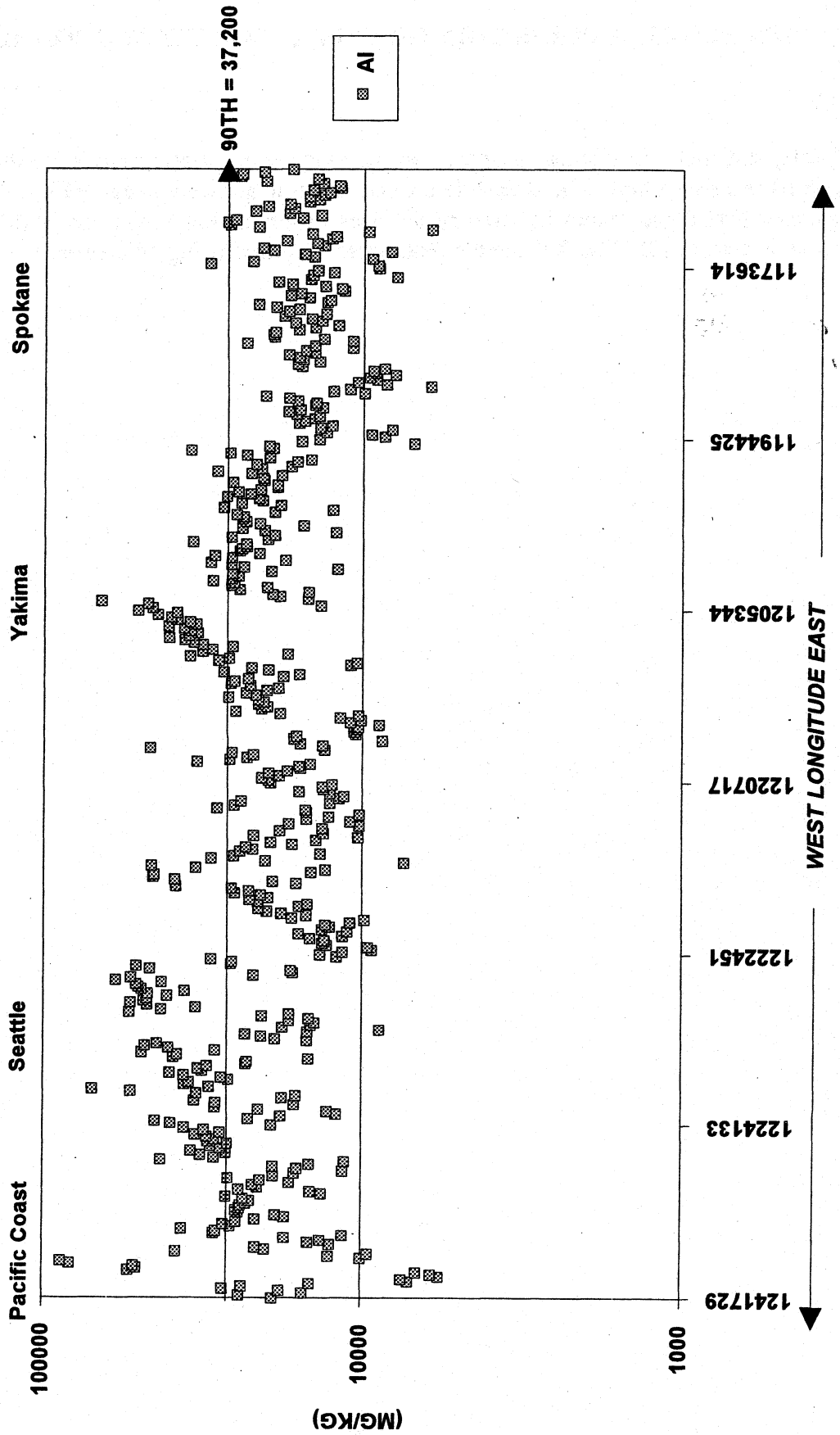
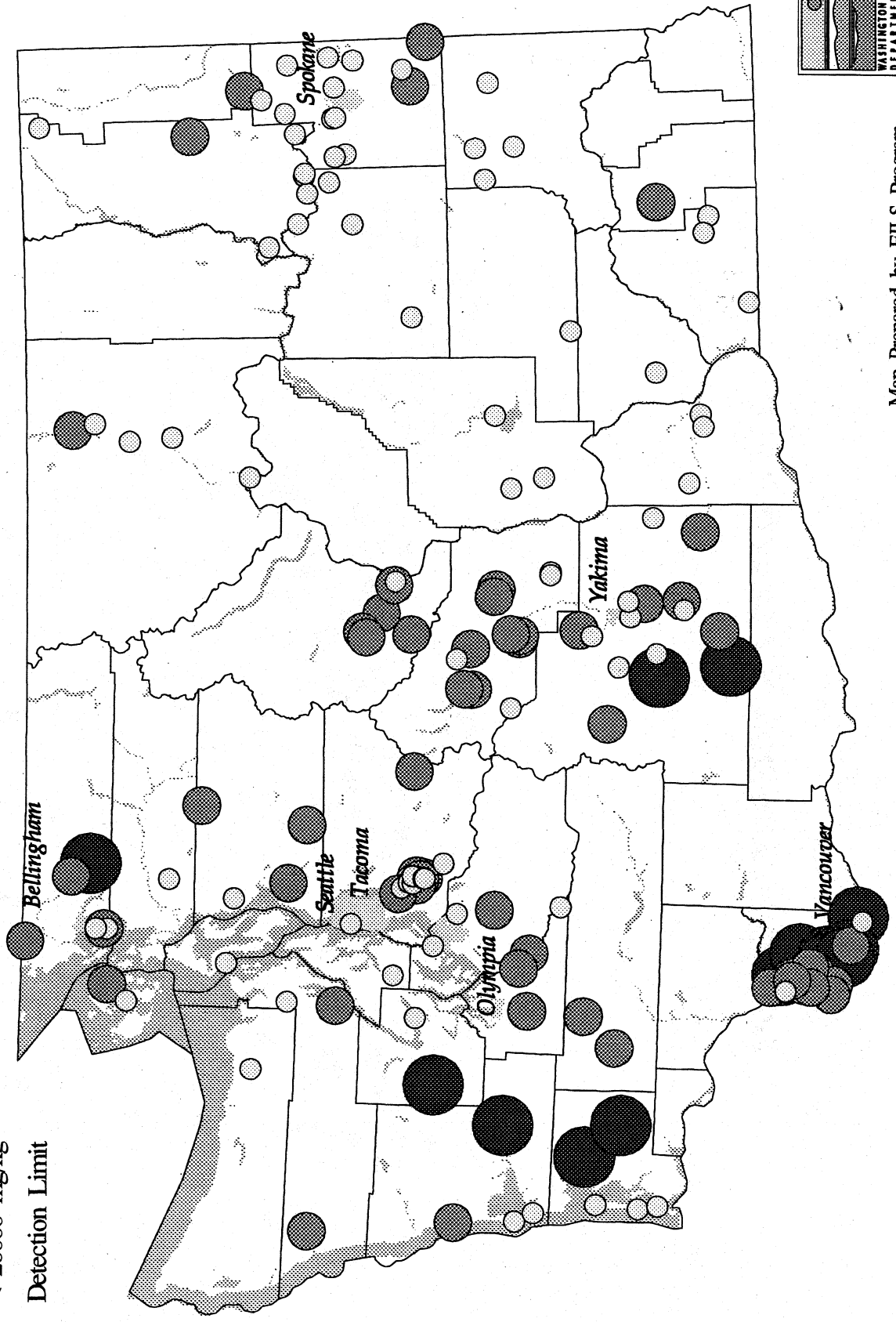


Figure 24: Aluminum Concentrations

- > 40000 mg/kg
- >= 20000 < 40000 mg/kg
- < 20000 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

NOTE: PLOT IS BASED ON GRAPHITE FURANCE ATOMIC ABSORPTION (GFAA) ANALYSIS.

FIGURE 25: ARSENIC X,Y SCATTER PLOT

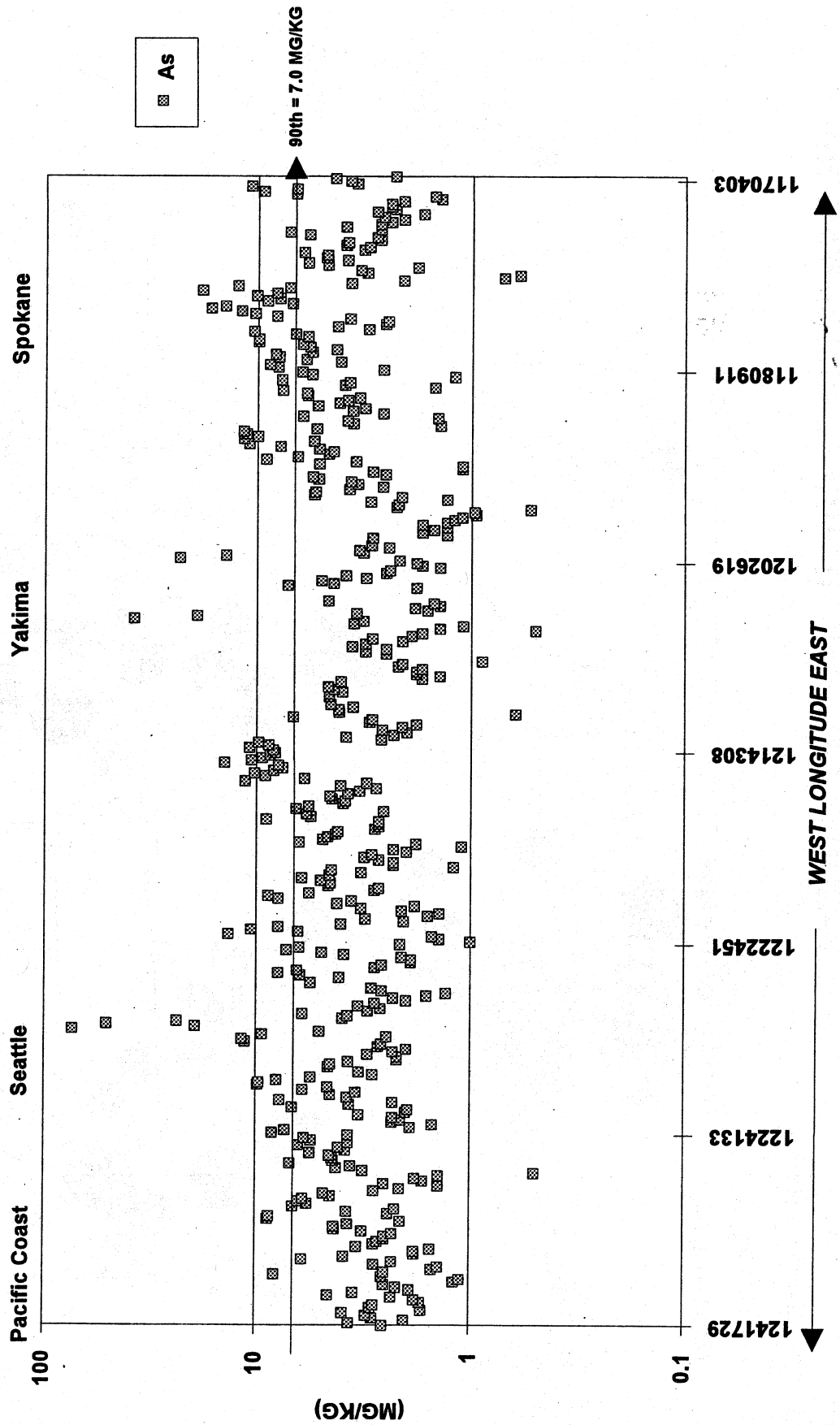






Figure 26: Arsenic Concentrations

-  > 10 mg/kg
-  >= 5 < 10 mg/kg
-  < 5 mg/kg
-  +
- Detection Limit

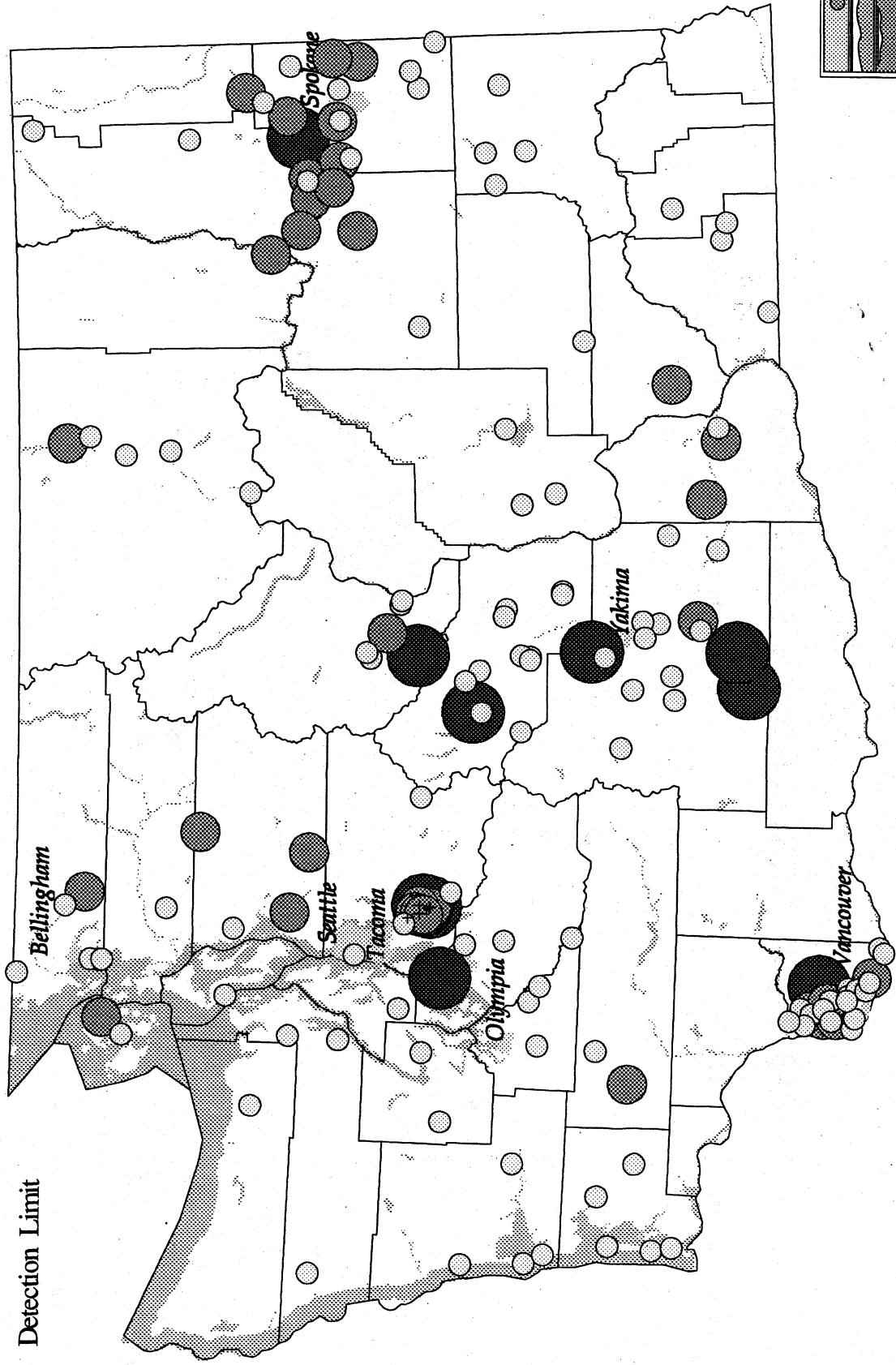


FIGURE 27: BERYLLIUM X,Y SCATTER PLOT

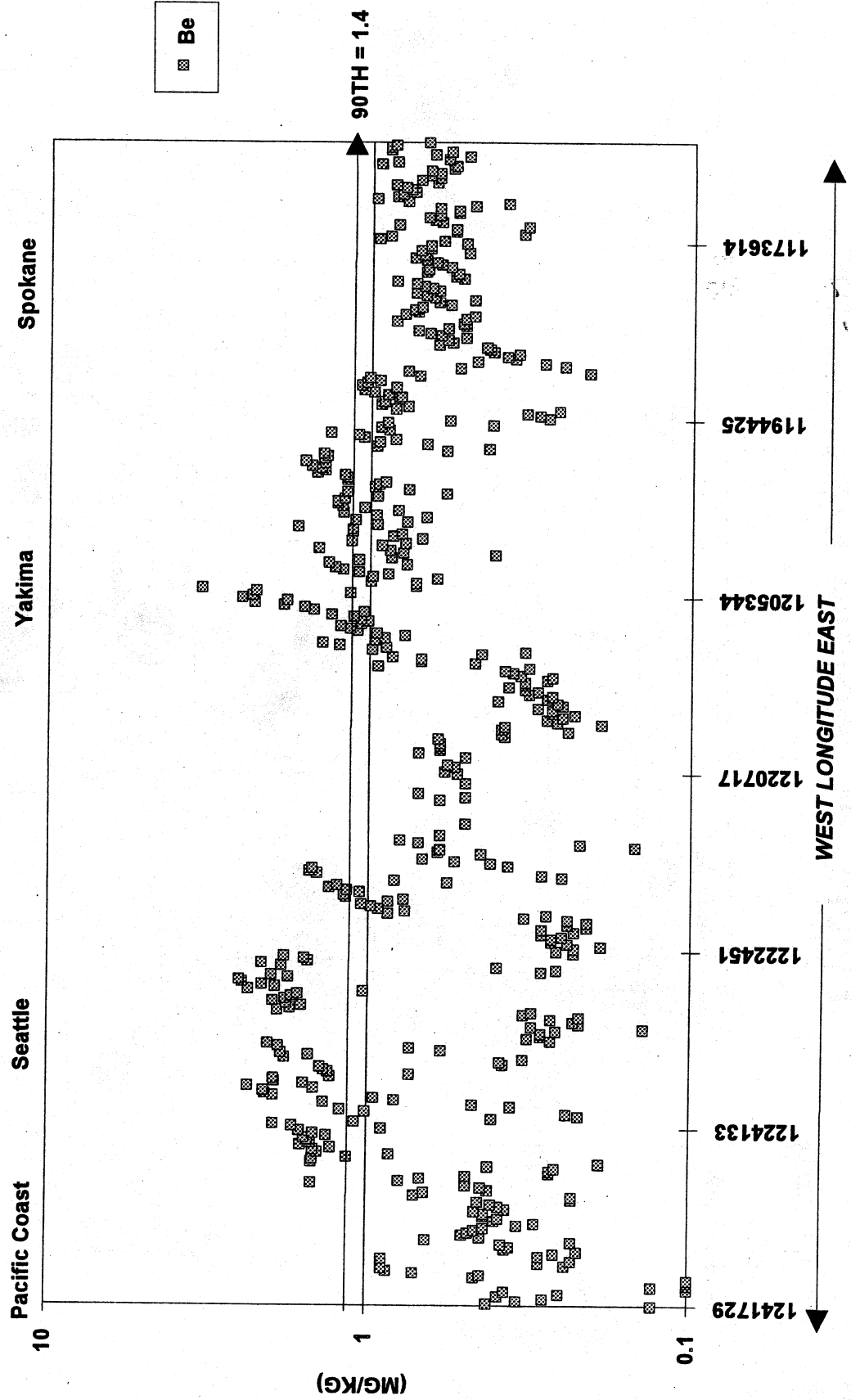
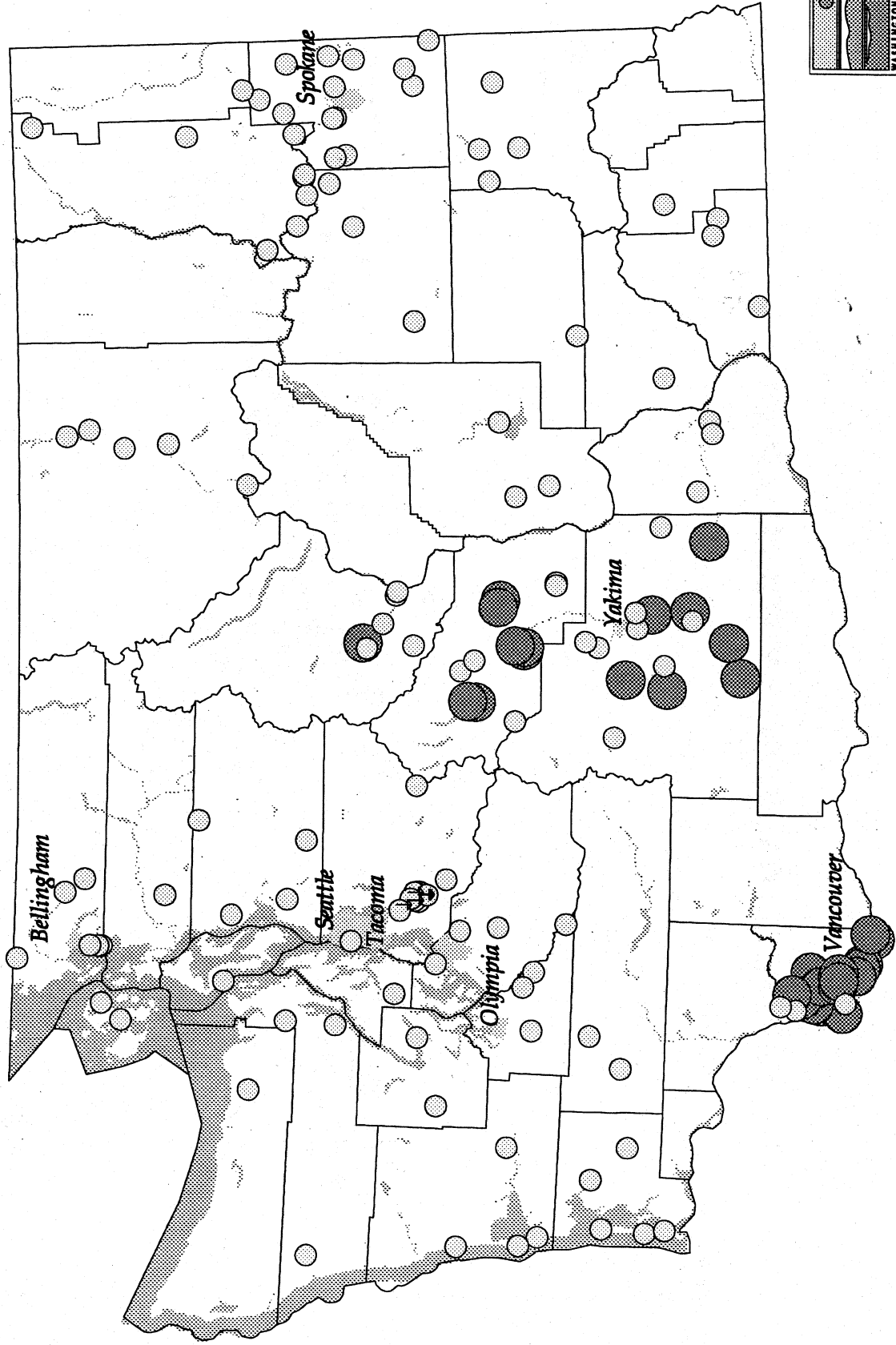


Figure 28: Beryllium Concentrations

- > 1 mg/kg
- < 1 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 29: CADMIUM X,Y SCATTER PLOT

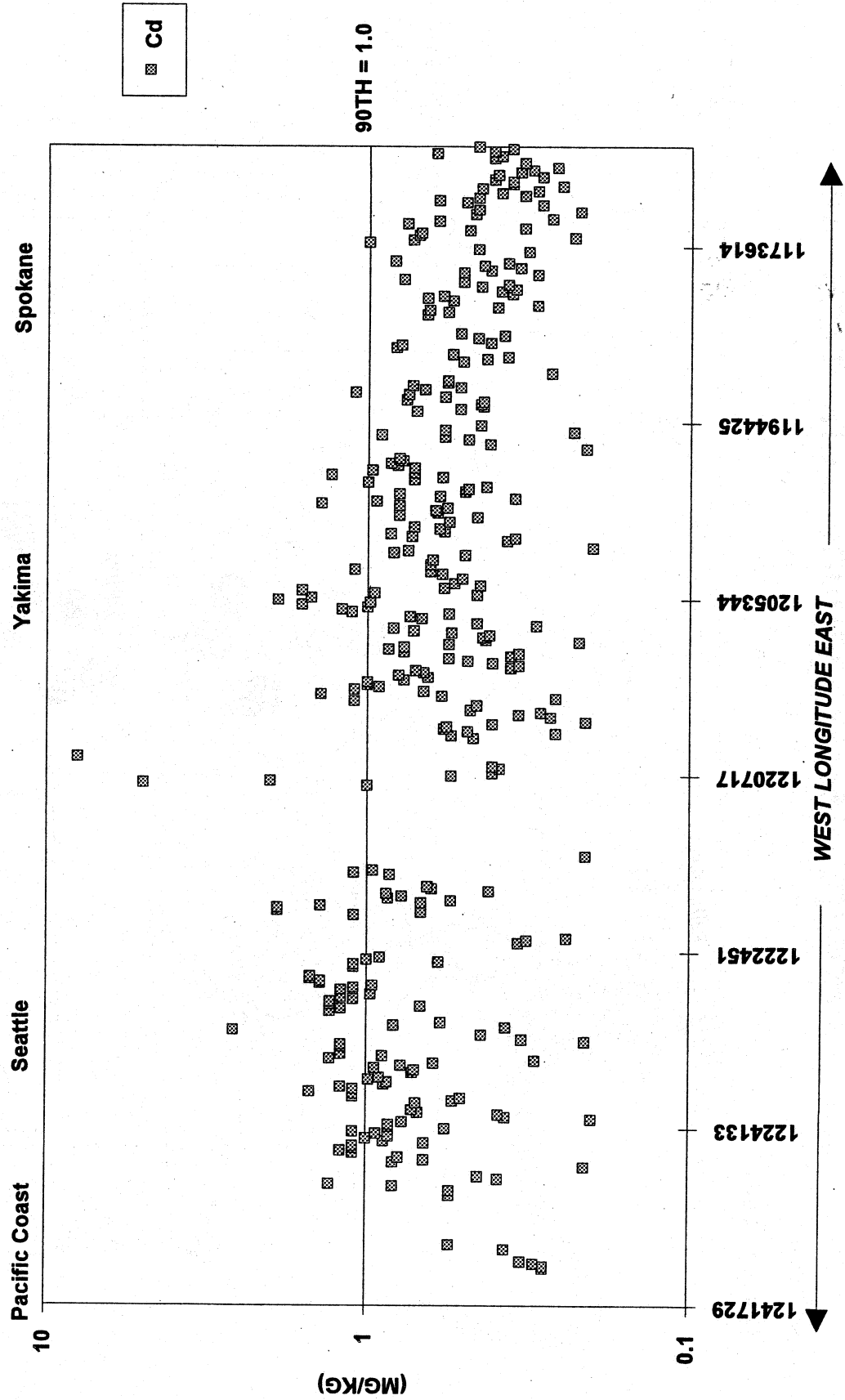


Figure 30: Cadmium Concentrations

- > 2 mg/kg
- $\geq 1 < 2$ mg/kg
- < 1 mg/kg
- ↓ Detection Limit

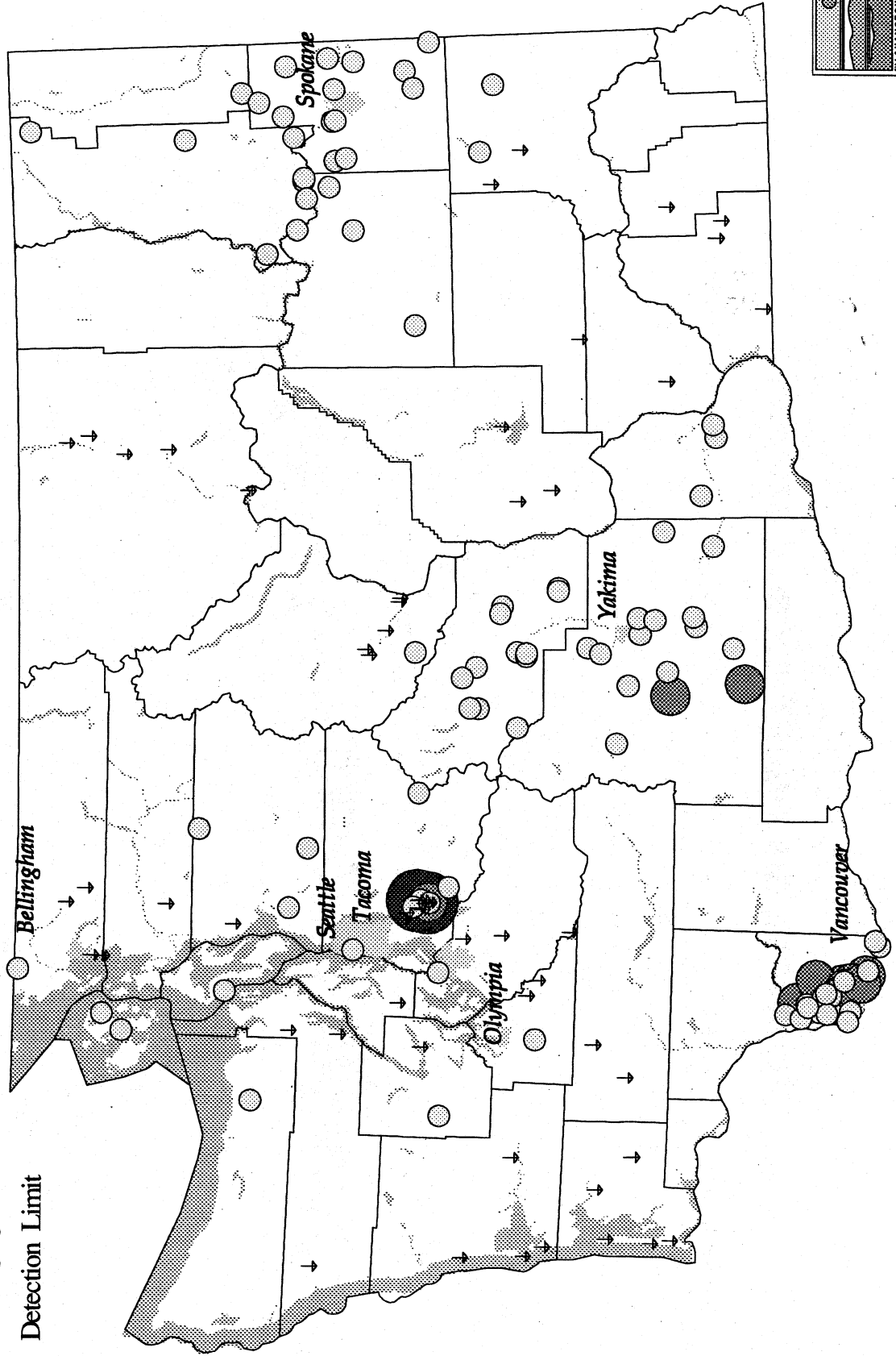


FIGURE 31: CHROMIUM X,Y SCATTER PLOT

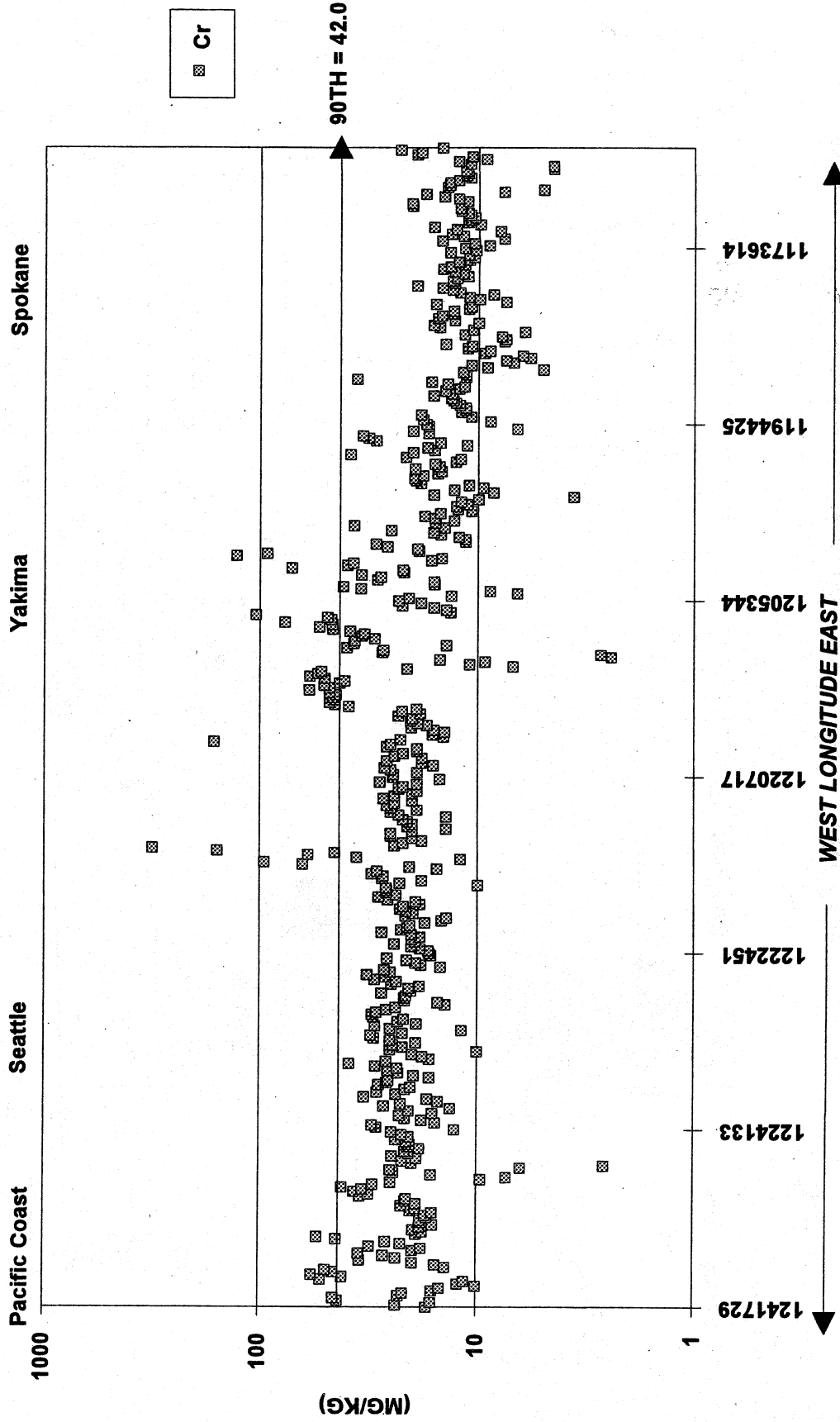


Figure 32: Chromium Concentrations

- > 30 mg/kg
- >= 20 < 30 mg/kg
- < 20 mg/kg
- ↓ Detection Limit

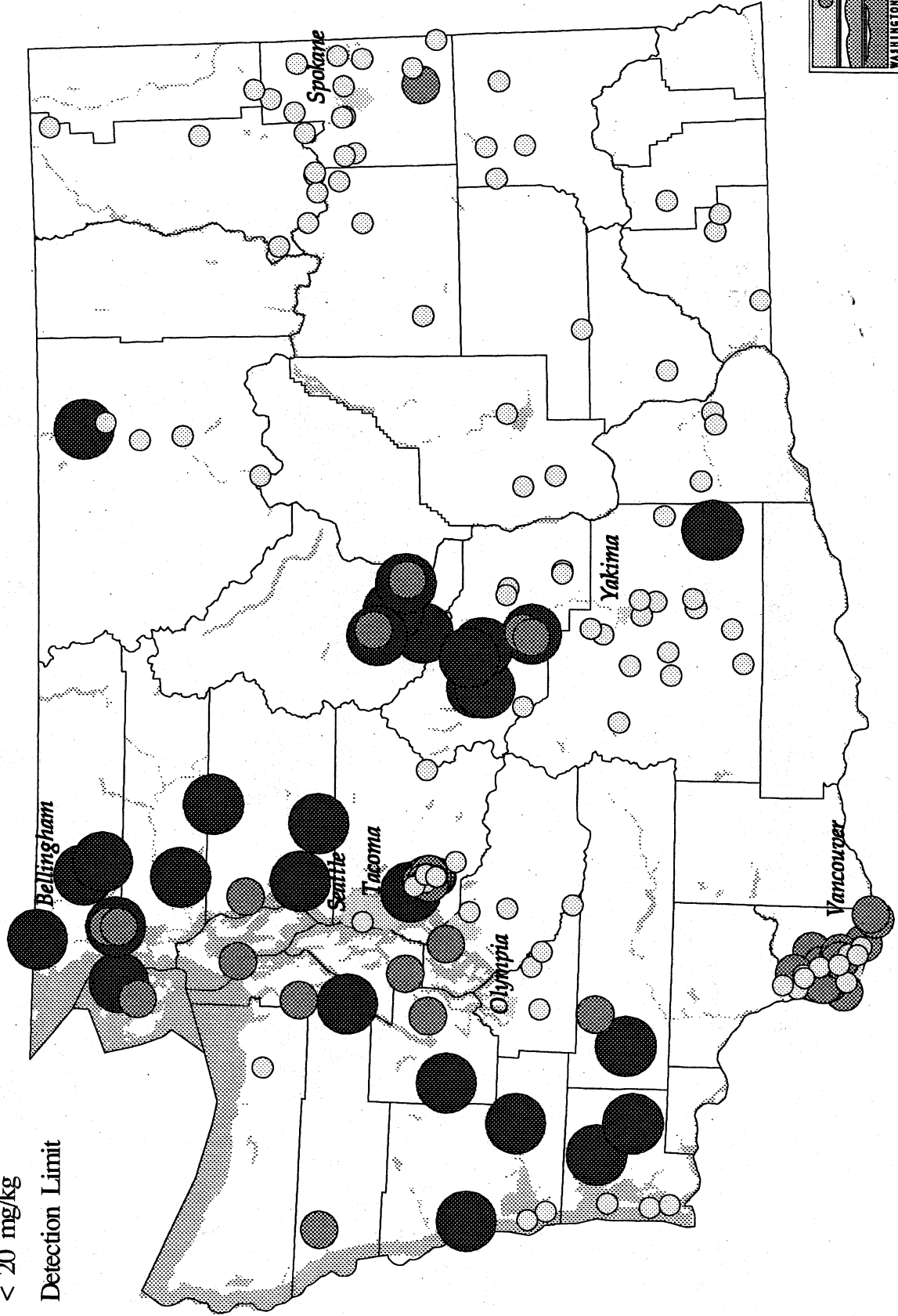


FIGURE 33: COPPER X,Y SCATTER PLOT

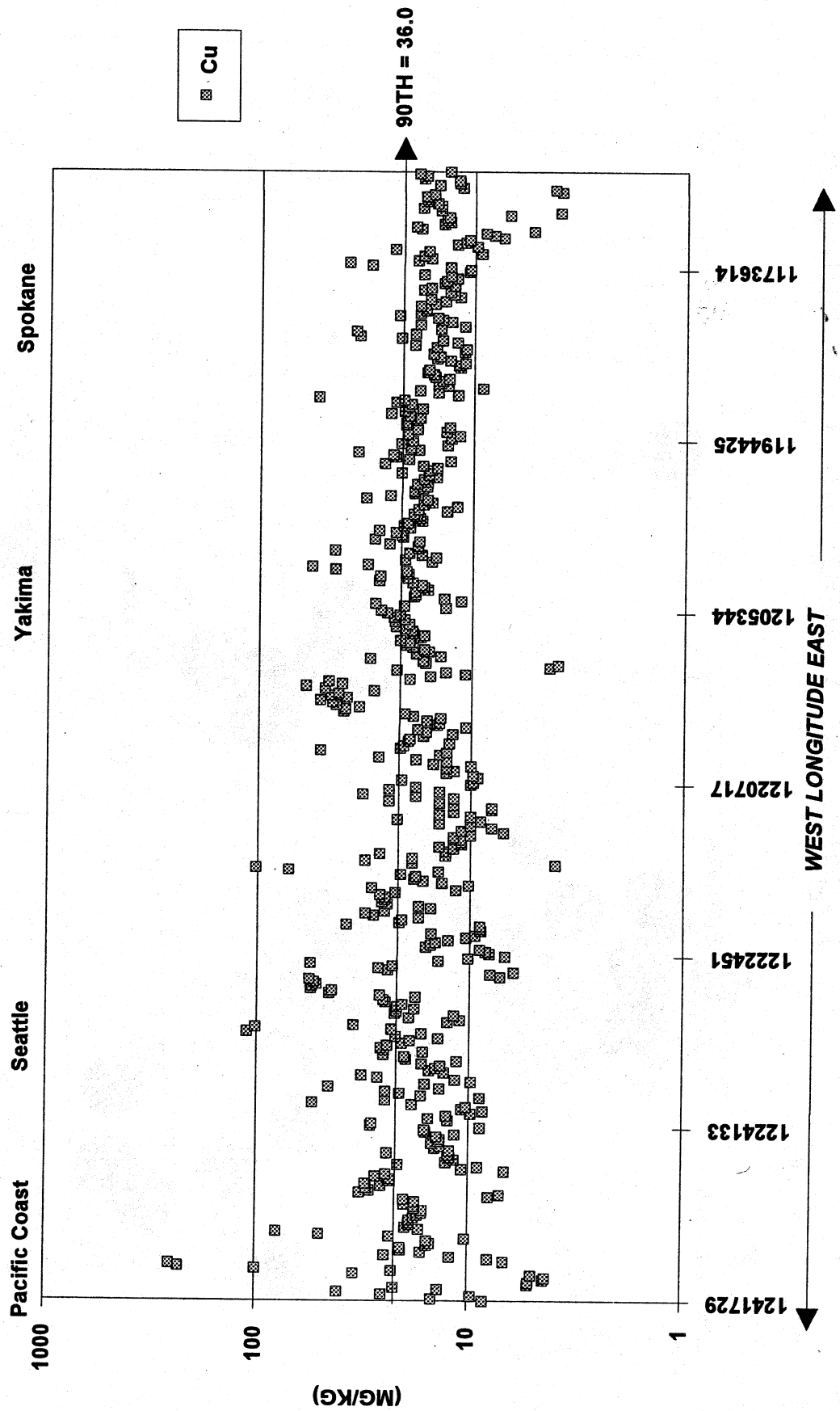


Figure 34: Copper Concentrations

- > 40 mg/kg
- >= 20 < 40 mg/kg
- < 20 mg/kg
- ↓ Detection Limit

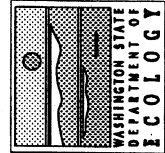
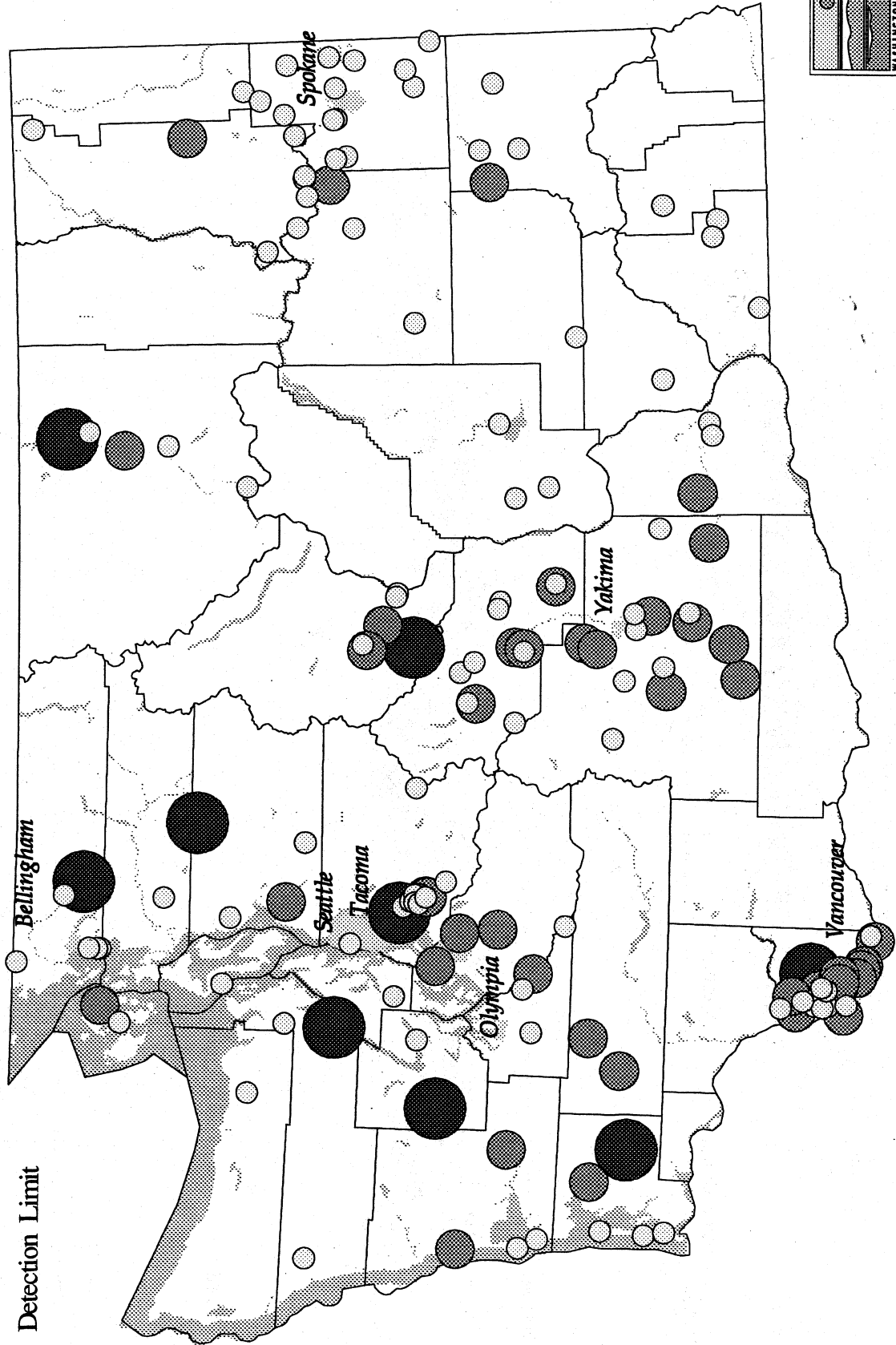


FIGURE 35: IRON X,Y SCATTER PLOT

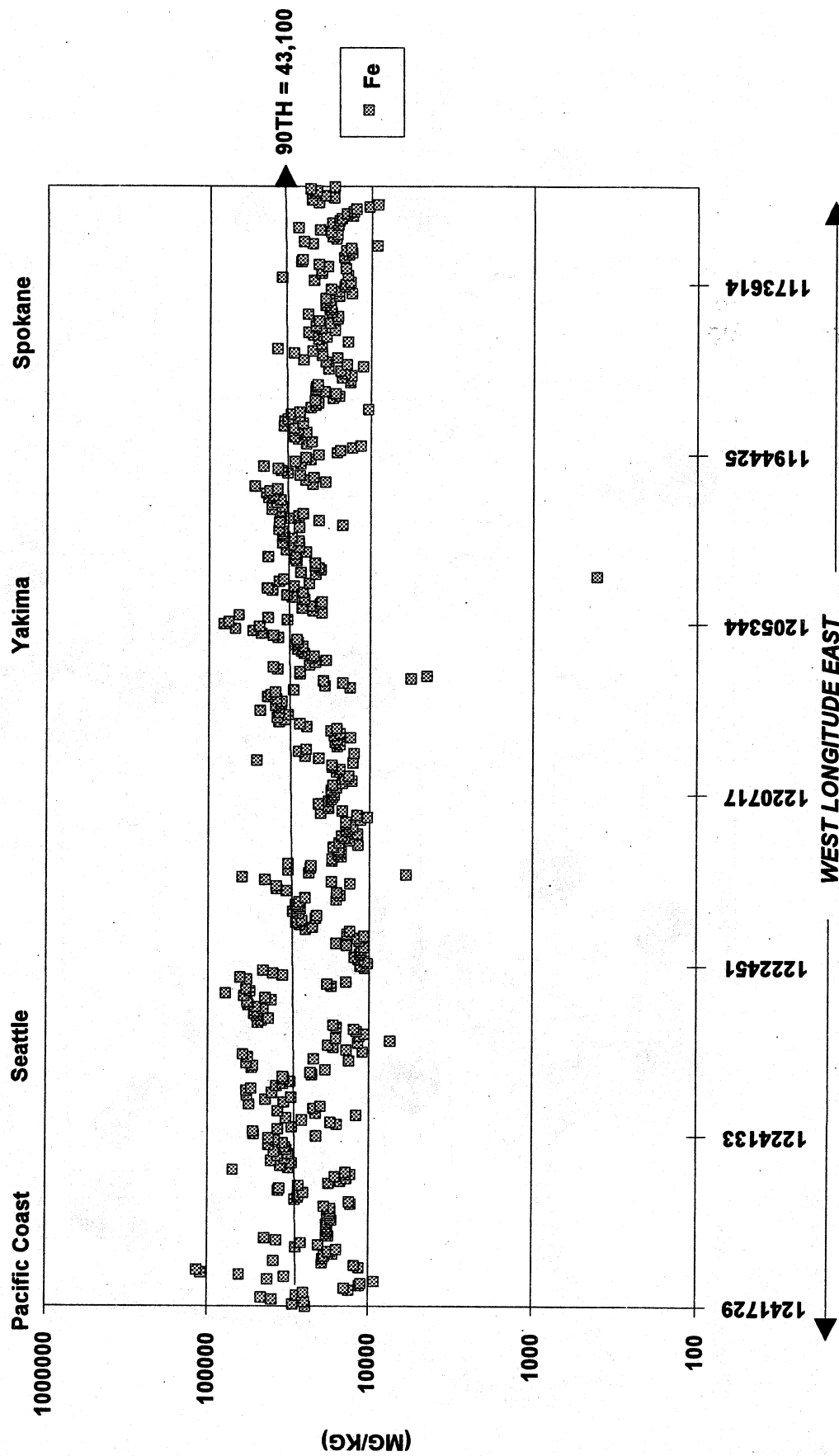


Figure 36: Iron Concentrations

- > 40000 mg/kg
- >= 20000 < 40000 mg/kg
- < 20000 mg/kg
- ↓ Detection Limit

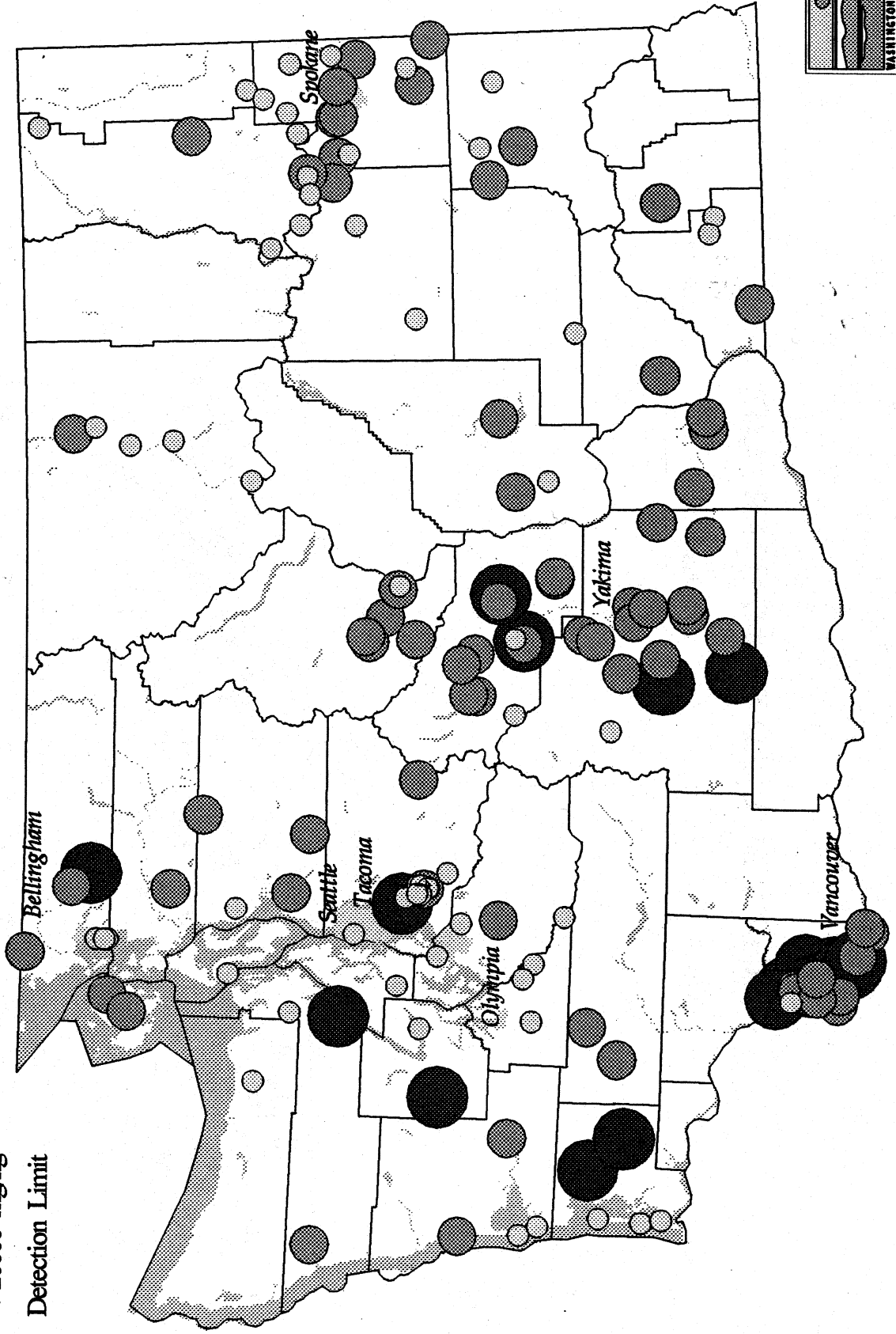


FIGURE 37: LEAD X, Y SCATTER PLOT

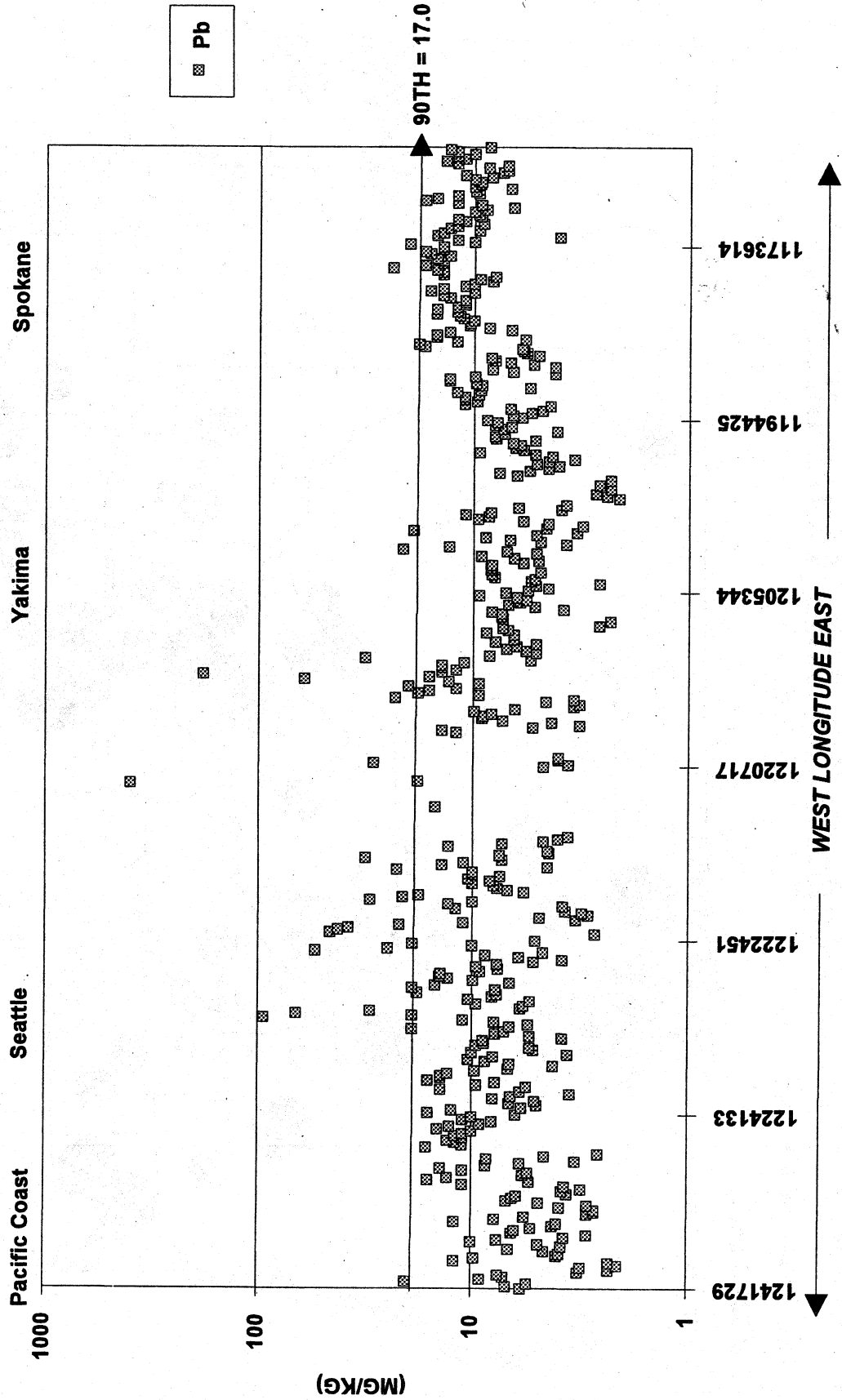
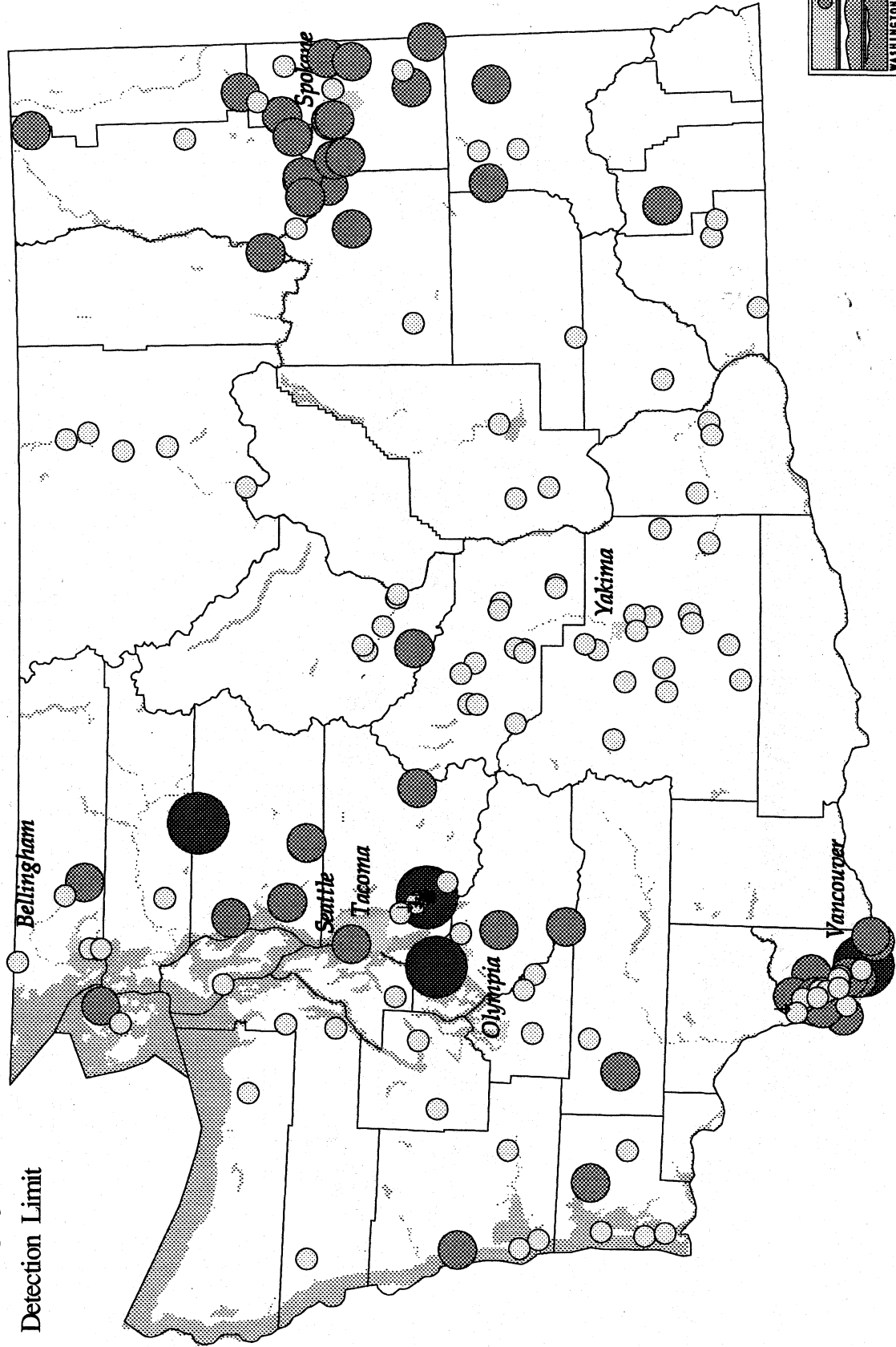


Figure 38: Lead Concentrations

- > 20 mg/kg
- >= 10 < 20 mg/kg
- < 10 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 39: MANGANESE X,Y SCATTER PLOT

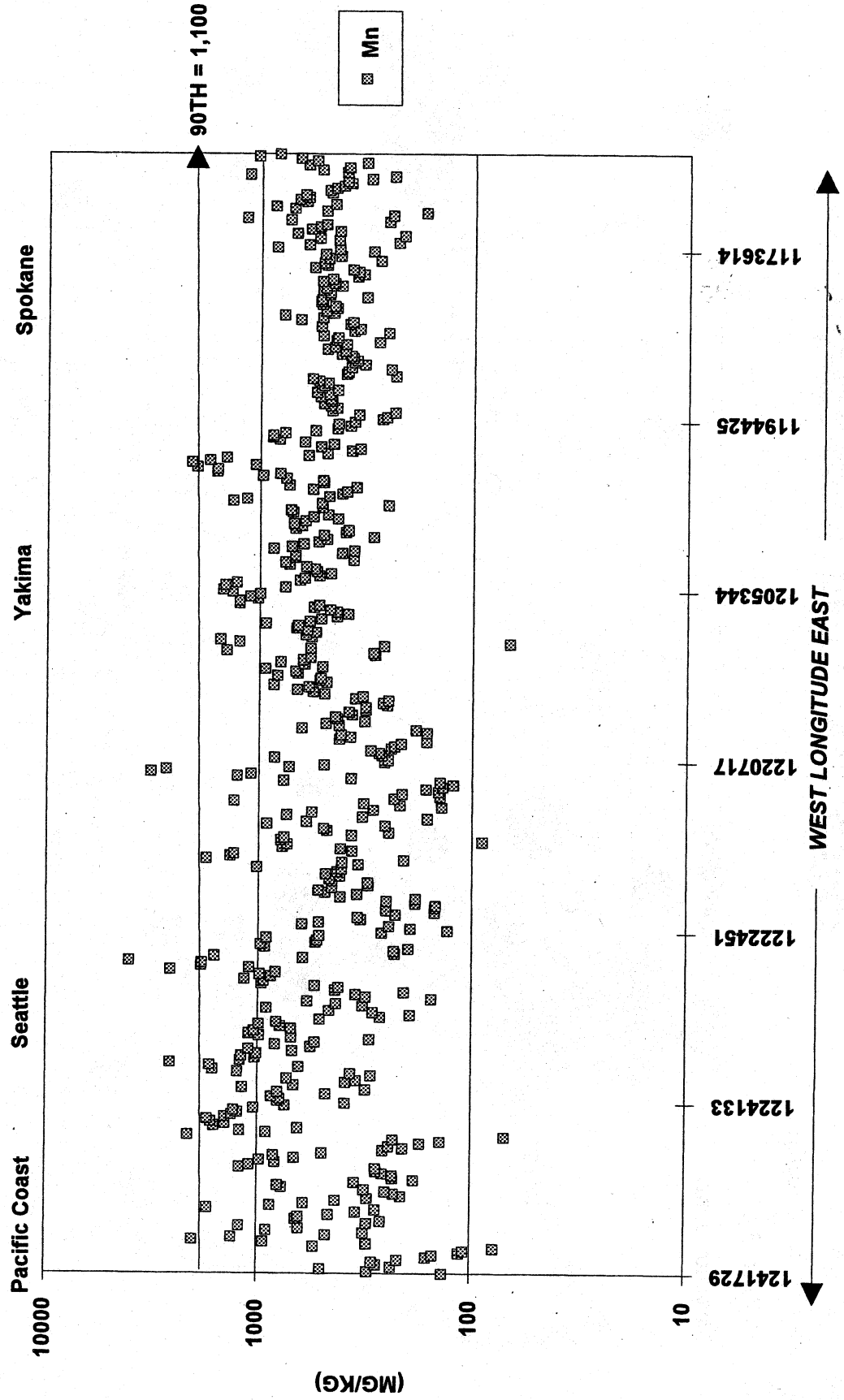
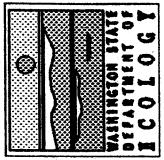
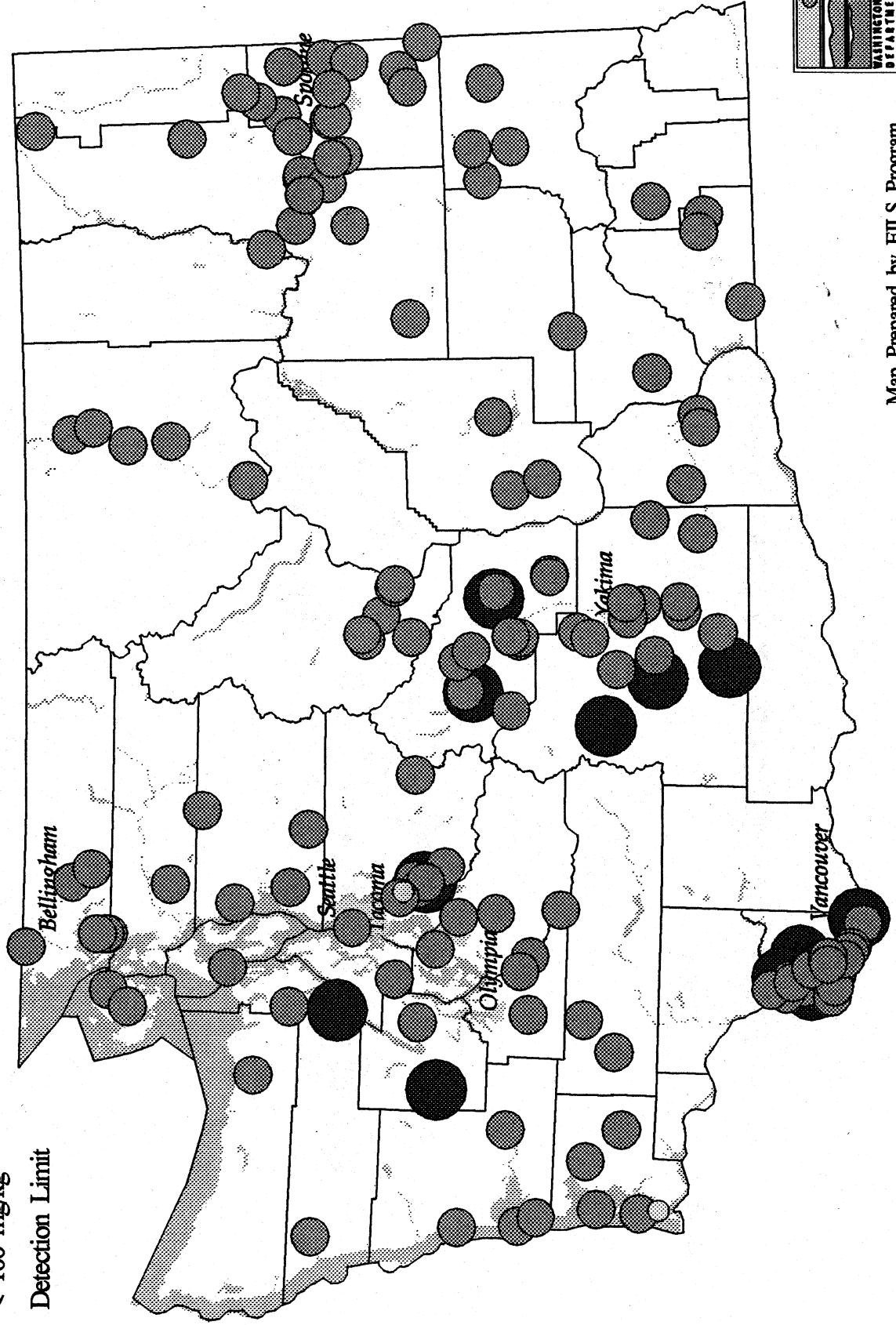


Figure 40: Manganese Concentrations

- > 1000 mg/kg
- ≥ 100 < 1000 mg/kg
- < 100 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 41: MERCURY X,Y SCATTER PLOT

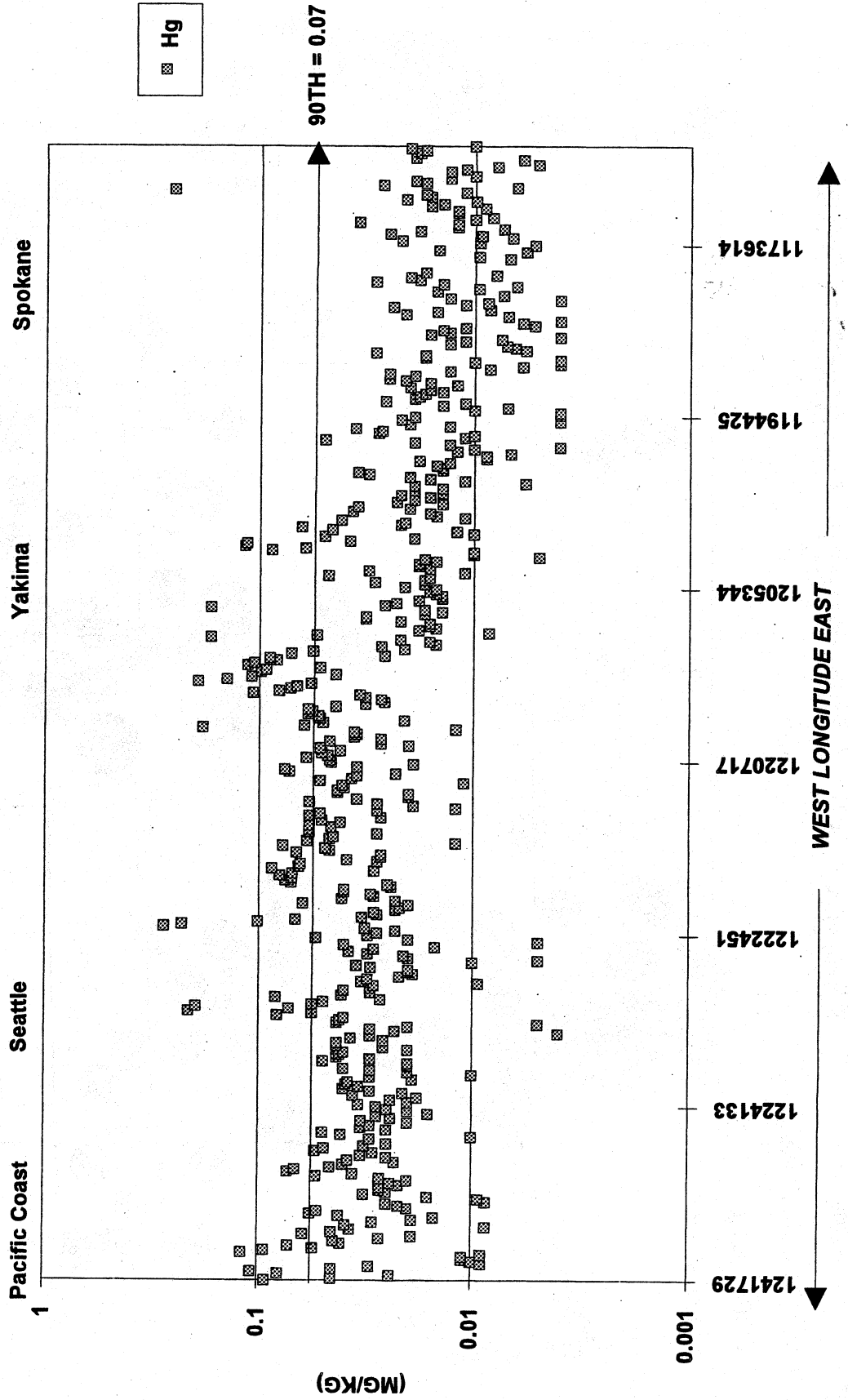
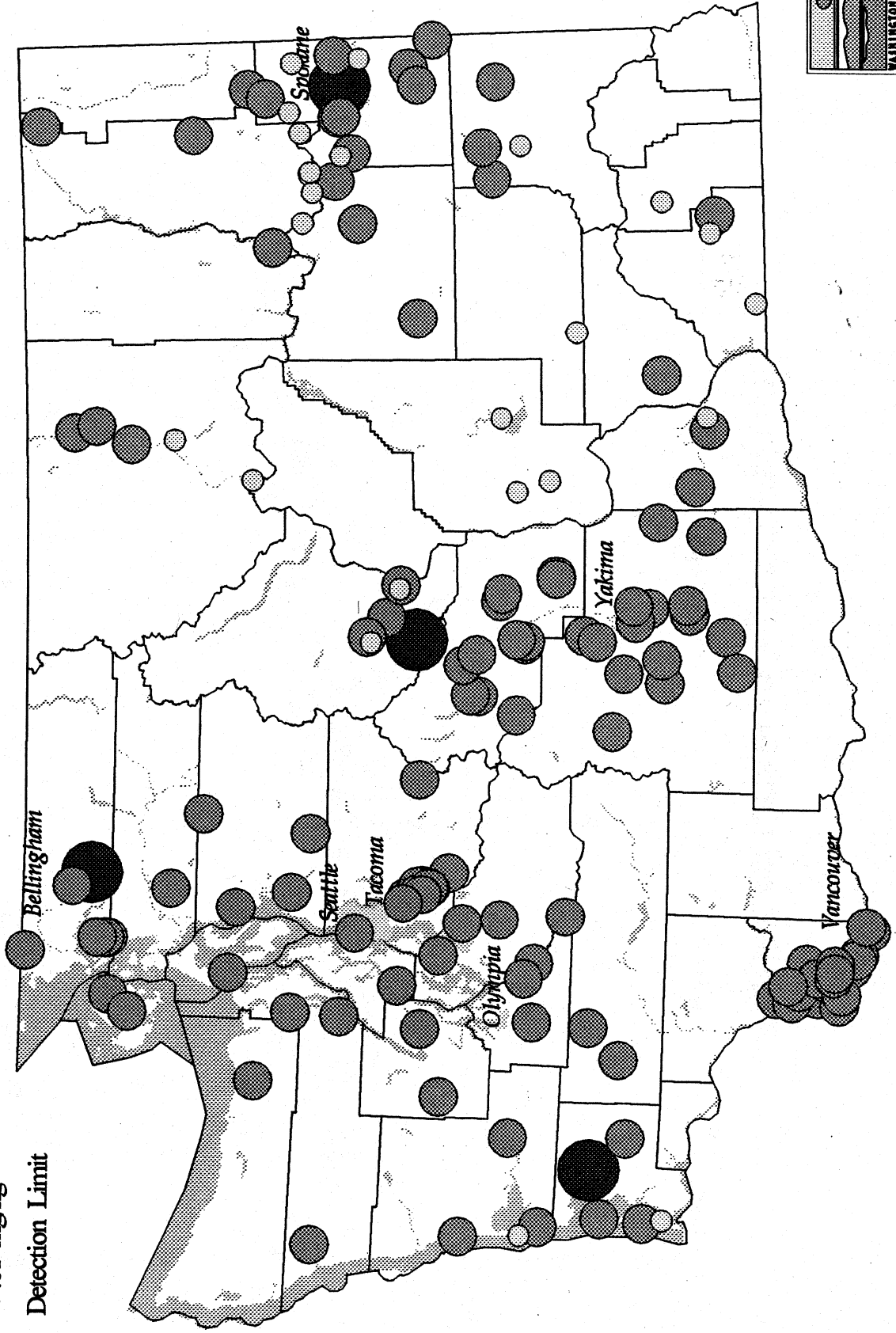


Figure 42: Mercury Concentrations

- $> .1$ mg/kg
- $\geq .01 < .1$ mg/kg
- $< .01$ mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 43: NICKEL X,Y SCATTER PLOT

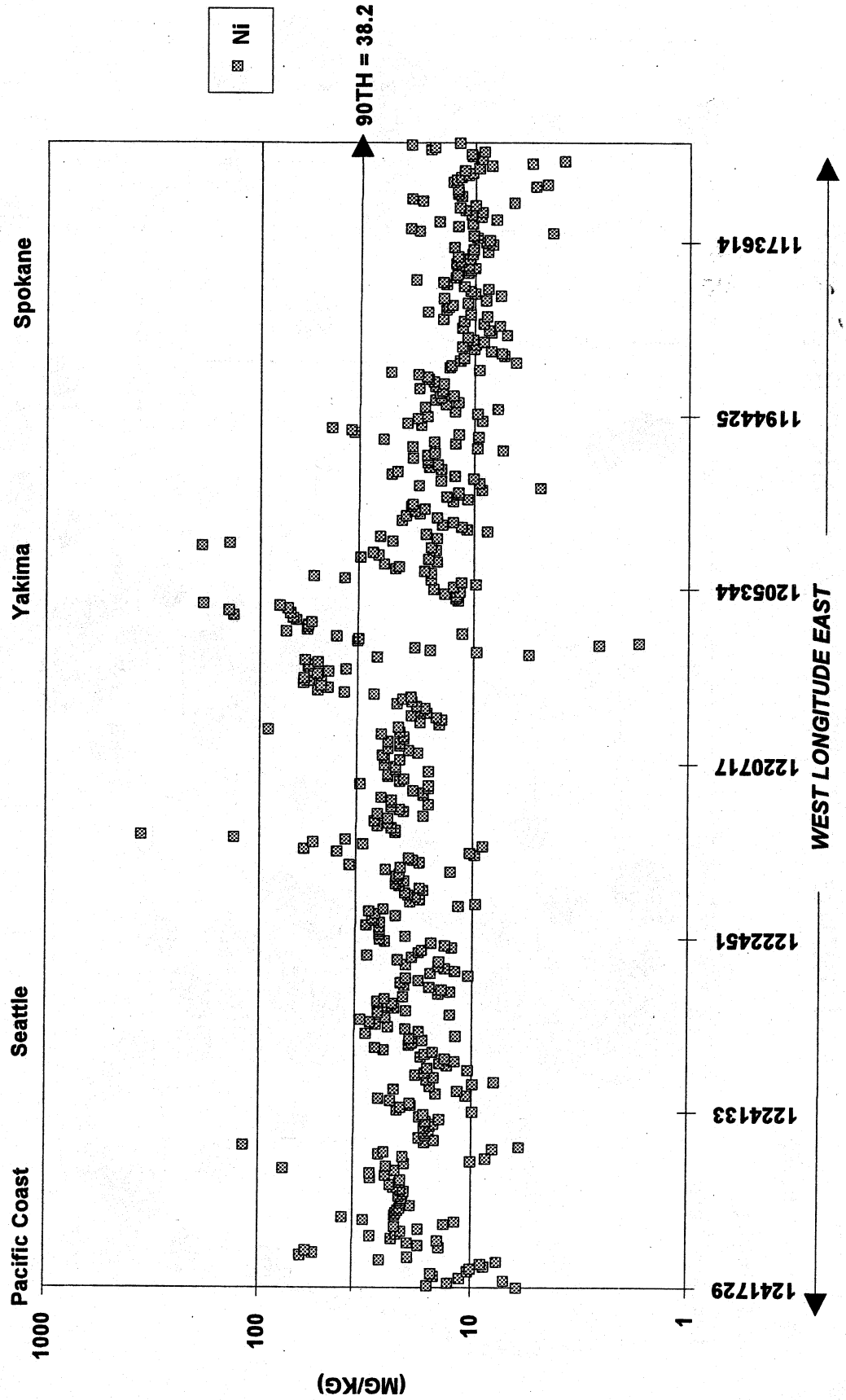
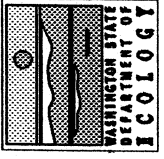
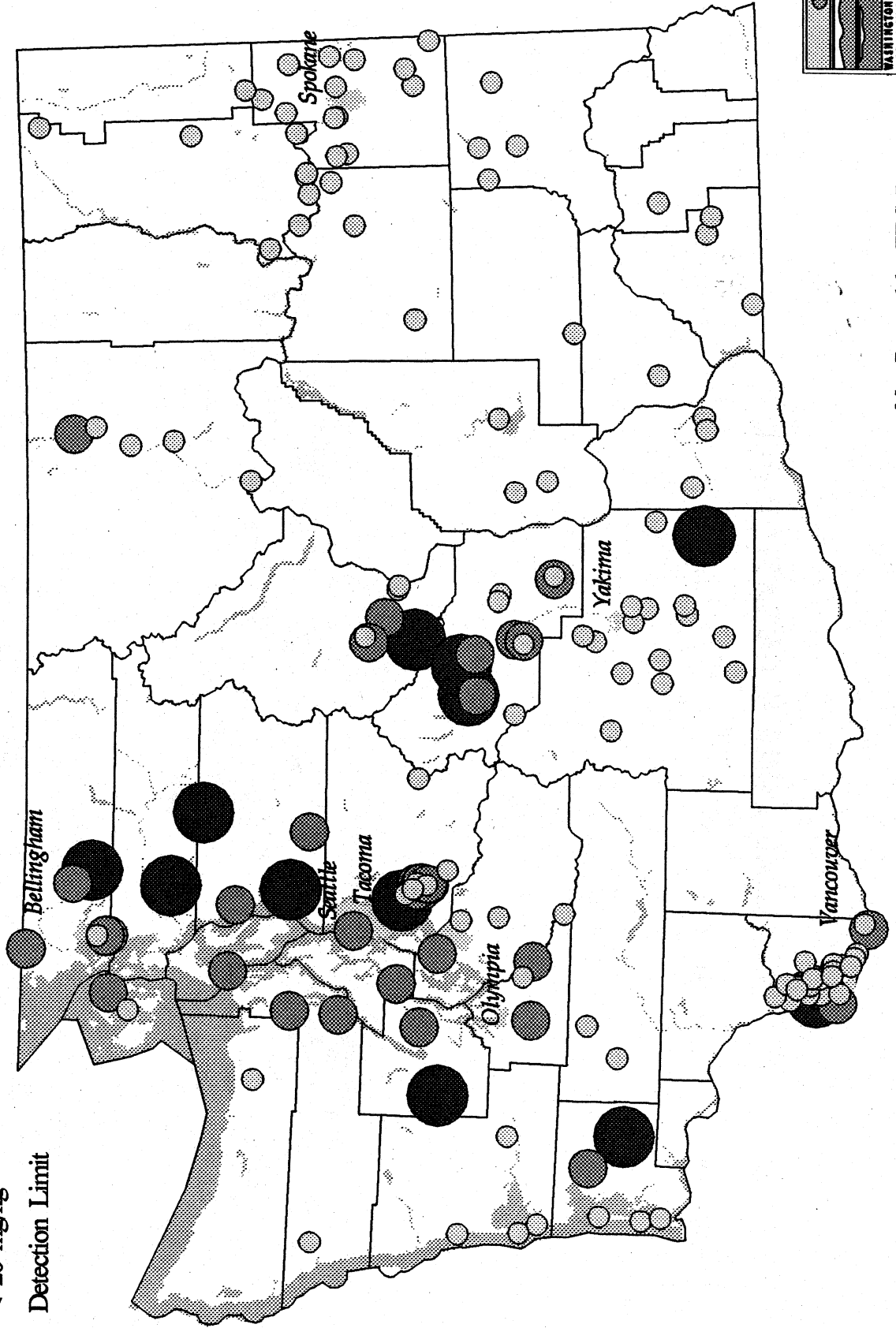


Figure 44: Nickel Concentrations

- > 40 mg/kg
- >= 20 < 40 mg/kg
- < 20 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 45: ZINC X,Y SCATTER PLOT

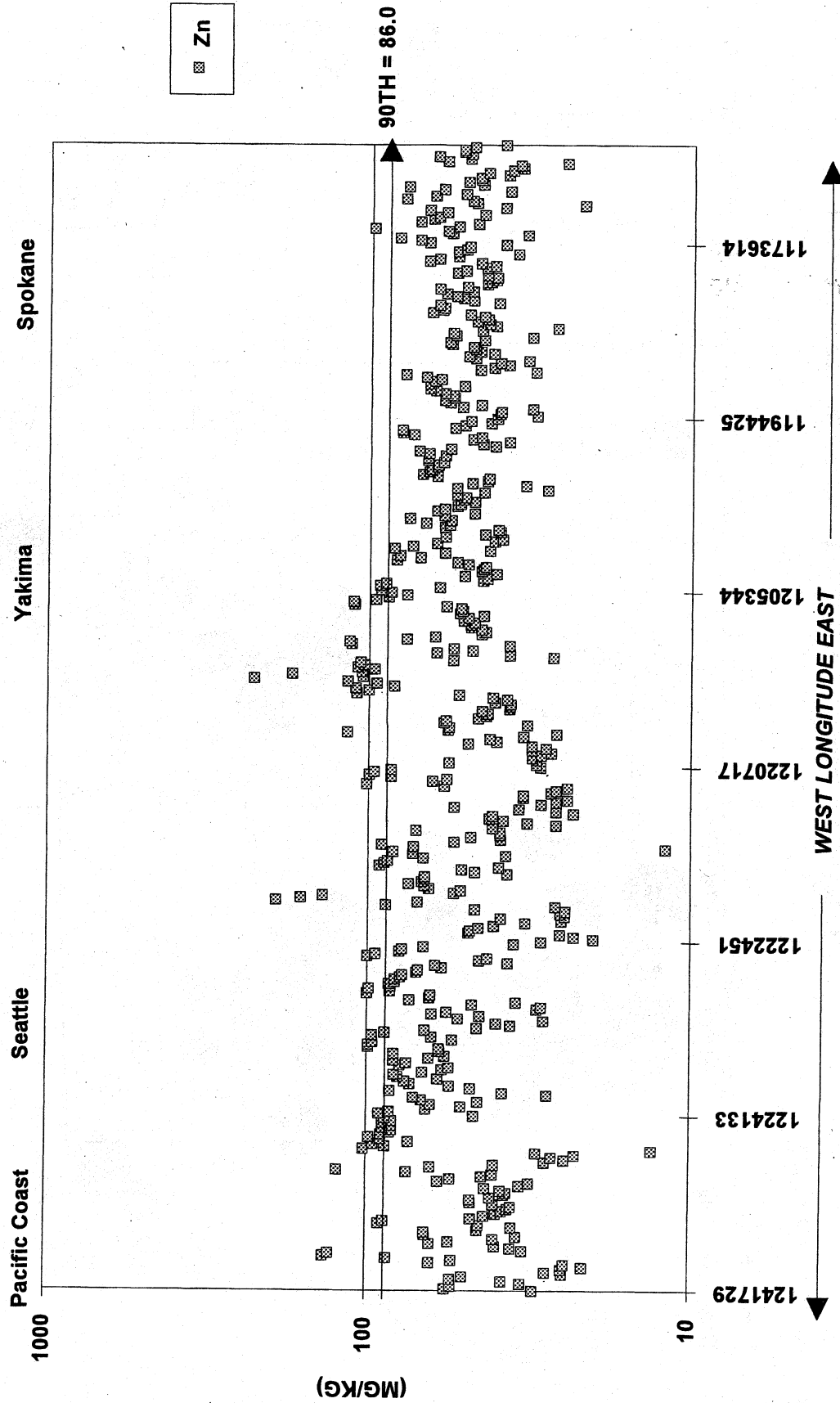
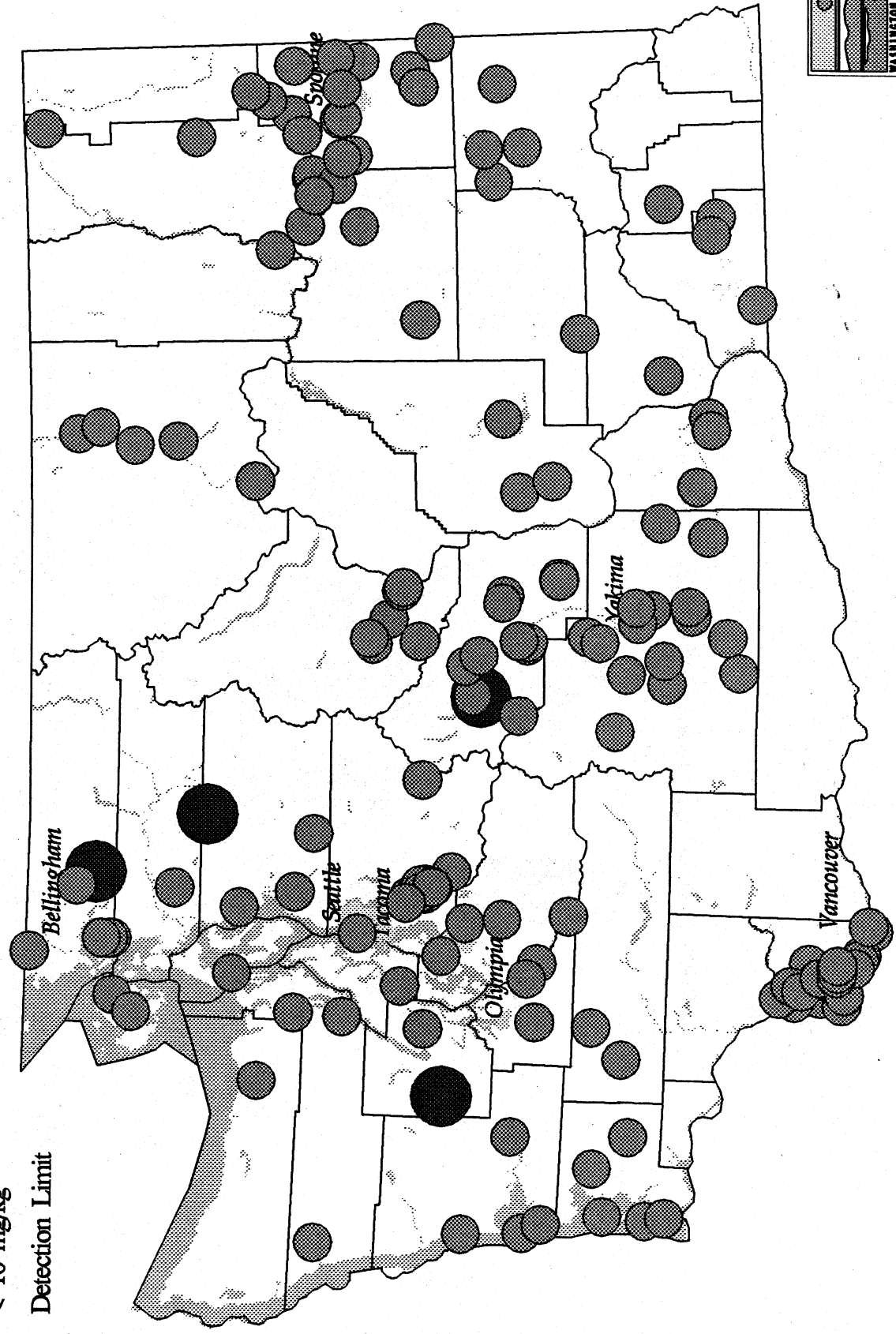


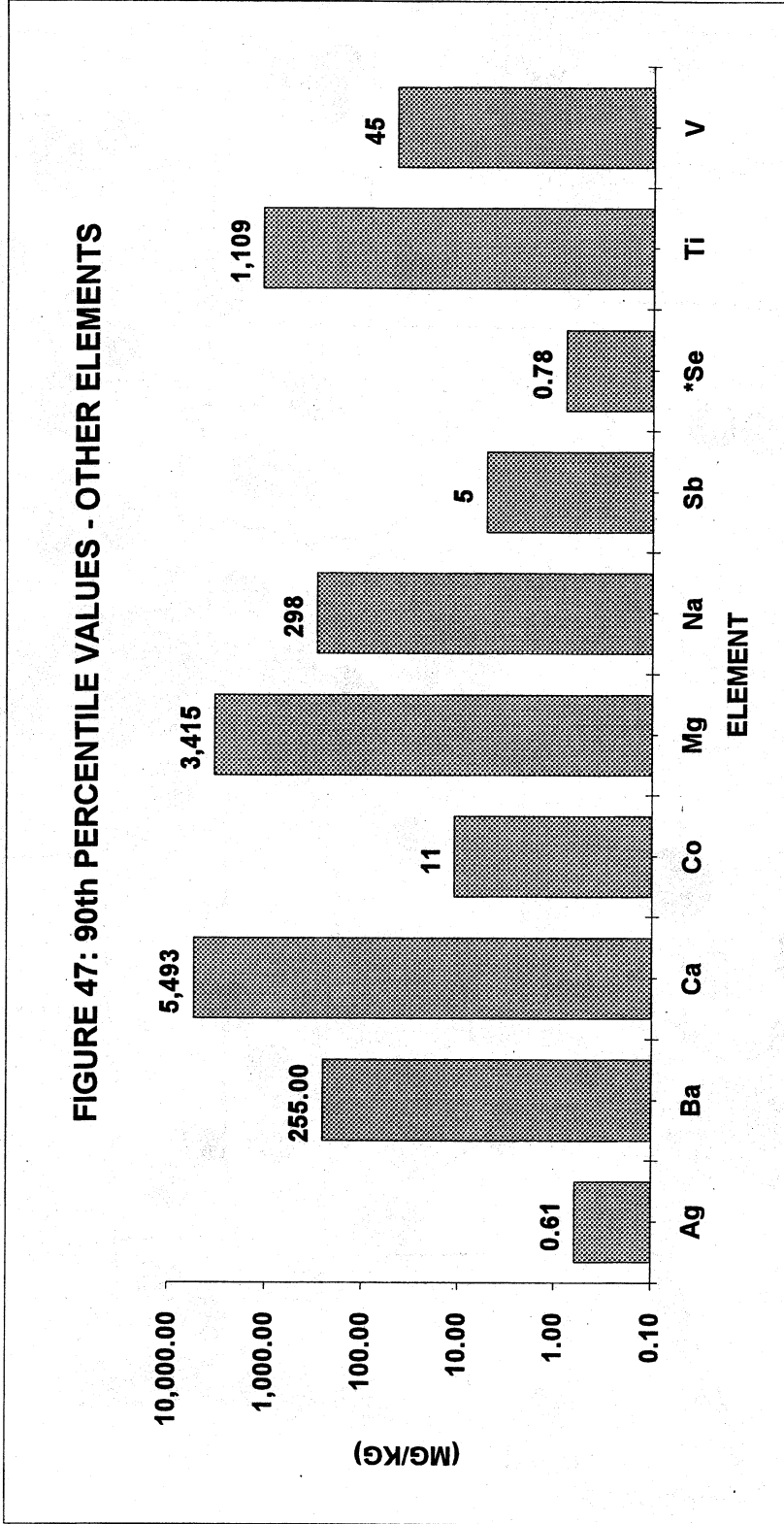
Figure 46: Zinc Concentrations

- > 100 mg/kg
- >= 10 < 100 mg/kg
- < 10 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program

FIGURE 47: 90th PERCENTILE VALUES - OTHER ELEMENTS



	Ag	Ba	Ca	Co	Mg	Na	Sb	*Se	Ti	V
90th Percentile	0.61	255.00	5,493	11	3,415	298	5	0.78	1,109	45
Population (n)	33	72	72	72	72	69	50	14	72	72
Detection Limit	0.3						3	0.19		
Number > Detection Limit	33						50	14		

* Se 90th BASED ON ATOMIC ABSORPTION (AA) ANALYSIS.

Note: Ba, Ca, Co, Mg, Na, Ti, V data from Spokane Basin Only. Data may not be representative of statewide conditions.

X. DATA TABLES

Data Retrieval

All of the Manchester Laboratory analytical data for this project was obtained and retrieved electronically for QA/QC purposes. A data extraction program known as "Monarch" was then used to compile the data into spreadsheet form. Microsoft Excel was then used to compile all of the data into a spreadsheet format.

Interpreting the Data Tables

Two sets of data tables have been included. The first set contains values for Al - Fe. The second set contains data for Pb - Zn. All of the data table values are in units of parts per million or mg/kg. A brief description of each column in the data table is presented below.

Latitude and Longitude

Latitude and longitude coordinates have been assigned to all 166 sampling locations (first two columns, data tables).

Site Codes

The column entitled "Site" contains an alpha-numeric code for each sampling location. Each site code can be broken down into four parts: primary code, regional code, sample location number, and sample depth. Example site codes and their definitions are given in Table 14 below. Not every sample has all four parts; for example, samples collected in the 12-region study do not have a primary code. Several samples have a suffix with the letters "SS," "DUP," "V," or "RS." Definitions for these codes are given in Table 15.

Table 14: Site Code Definitions (read table left to right).

Site Code	Primary Code	Regional Code	Sample Location	Sample Depth
"SWRA2.5"	SW = Statewide	RA = Region "A"	N/A	2.5 = feet
"PSL2A0.5"	PSL = Puget Sound, Soos Creek	N/A	No. 2	0.5 = feet
"CL81.4V"	CL = Clark County	N/A	No. 8	1.4 = feet V = Vertical Profile Sample
"PS20.3"	PS = Puget Sound	N/A	No. 2	0.3 = feet
"SB310.3SS"	SB = Spokane Basin	N/A	No. 31	0.3 = feet "SS" = Sample Split
"YBRO2.5"	YB = Yakima Basin	RO = Region "O"	N/A	2.5 = feet

Table 15: Site Code Suffix Definition

Suffix	Definition
"V"	Vertical Profile Sample
"SS"	Sample Split
"DUP"	Duplicate Sample

Number Column

The Manchester sample number is given in this column. The first two digits give the year in which the sample was analyzed. The area in which a sample was collected can also be identified by sample number; i.e., all of the Soos Creek work was done in 1987, the 12-region study was completed in 1990, etc.(see Table 16 below)

Table 16: Background Soil Metals Study Chronology

Study	Completed In
Soos Creek	1987
Twelve Region	1990
Clark County	1991
Yakima Basin	1991
Spokane Basin	1992
Puget Sound Basin	1993

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	AL	AS	BA	CA	CD	CR	CU	FE	FE
463937	1234536	SWRA2.5	90478080	53,500	4.55	0.46	0.46	<0.2	61.5	51.5	33.9	41,800
463952	1233542	SWRA2.5	90478081	50,500	3.48	0.44	0.44	<0.2	41.2	41.2	22.5	33,000
463110	1233352	SWRA2.5	90478082	51,500	1.9	0.71	0.71	<0.2	56.7	56.7	99.4	52,800
464120	1225527	SWRA2.3	90478083	28,800	1.8	0.55	0.55	<0.2	26	26	23.2	26,100
463337	1230623	SWRA2.3	90478084	37,800	8.12	0.89	0.89	<0.2	34.2	34.2	24.4	38,400
465553	1240957	SWRC2.5	90478086	7,070	2.9	0.1	0.1	<0.2	16	16	5.2	13,200
465125	1240634	SWRC2.6	90478087	7,450	2.8	0.13	0.13	<0.2	14.8	14.8	5.18	14,100
463628	1240232	SWRC2.6	90478088	6,020	1.8	0.1	0.1	<0.2	12.2	12.2	4.33	11,100
462602	1240317	SWRC2.5	90478089	5,570	1.7	0.1	0.1	<0.2	10.1	10.1	4.4	11,300
462116	1240157	SWRC2.5	90478090	5,580	2.32	0.1	0.1	<0.2	11.4	11.4	5.04	9,160
483954	1222930	SWRD2.3	90478092	21,700	2.8	0.29	0.29	<0.2	32	32	7.2	17,100
483908	1222926	SWRD2.3	90478093	16,600	1.9	0.4	0.4	<0.2	26.7	26.7	6.23	13,900
484152	1222929	SWRD2.6	90478094	16,400	2.6	0.26	0.26	<0.2	25.1	25.1	8.05	18,200
484809	1221033	SWRD2.7	90478095	25,100	4.55	0.6	0.6	<0.2	45.2	45.2	18.7	23,300
484332	1220527	SWRD2.5	90478096	46,100	8.99	0.61	0.61	<0.2	163	163	50.9	49,900
484833	1192416	SWRJ2.7	90478107	20,100	5.28	0.71	0.71	<0.2	35.9	35.9	53	27,700
483446	1192836	SWRJ3	90478108	13,000	1.1	0.33	0.33	<0.2	10.8	10.8	20.2	13,000
480522	1194153	SWRJ2.8	90478109	9,430	2.9	0.3	0.3	<0.2	17.9	17.9	11.6	16,500
482415	1192705	SWRJ3.2	90478110	8,130	1.1	0.26	0.26	<0.2	18.3	18.3	13.4	11,500
484313	1192153	SWRJ3	90478111	9,940	1.4	0.21	0.21	<0.2	11.4	11.4	11.9	10,400
473642	1204021	SWRL2.7	90478112	25,600	0.5	0.5	0.77	<0.2	71.3	71.3	27.3	26,200
473251	1203128	SWRL2.7	90478113	25,700	7.19	0.77	0.77	<0.2	36.9	36.9	28.7	25,000
473740	1203824	SWRL2.7	90478114	29,000	1.4	1.14	1.14	<0.2	29.3	29.3	14.8	20,200
472924	1202000	SWRL2.7	90478115	16,700	2.25	0.43	0.43	<0.2	20	20	14.7	19,100
472943	1202117	SWRL2.6	90478116	20,700	0.53	0.58	0.58	<0.2	38.4	38.4	16	22,900
470608	1175445	SWRP2.8	90478128	18,900	4.1	0.79	0.79	<0.2	15.4	15.4	21.9	30,000
465848	1174302	SWRP3	90478129	14,800	3.73	0.54	0.54	<0.2	12.6	12.6	16	24,700
462437	1180414	SWRP3	90478130	23,100	2.6	0.84	0.84	<0.2	16.1	16.1	18.9	26,100
461153	1180928	SWRP3	90478131	15,100	1.2	0.58	0.58	<0.2	6.1	6.1	11.1	11,200
461307	1181528	SWRP3.2	90478132	15,400	1.49	0.51	0.51	<0.2	7.6	7.6	12.9	13,200
470446	1191953	SWRR2.5	90478134	6,140	1.44	0.25	0.25	<0.2	5	5	9.1	21,300
470053	1194611	SWRR2.7	90478135	6,930	3.55	0.42	0.42	<0.2	6.6	6.6	13.2	23,500
464554	1184944	SWRR2.5	90478136	10,400	2.6	0.47	0.47	<0.2	10.8	10.8	14.6	17,100
465250	1194216	SWRR2.5	90478137	8,570	2.53	0.28	0.28	<0.2	8.8	8.8	12.7	16,200
462524	1190452	SWRR2.3	90478138	8,460	6.12	0.29	0.29	<0.2	9.1	9.1	13.2	22,200
454159	1223043	CL10.3	91238155	43,800	2.9	1.64	1.335	0.97	21.2	24.35	22	50,000
		CLR12.2	90478102	46,900		1.03		<0.2	27.5	26.2	26.2	55,700

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO	Al	As	Ba	Be	Cd	Cr	Cu	Pb	Mn	Mo	Ni	Se	Tl	V	Zn
454014	1224057	CL20.3	91238156	22,500	20,150	1.5	1.09	0.75	0.77	16.75	12.5	13.95	36,600	33,350				
		CLRG22.2	90478103	17,800	1.5		0.41	0.2	17.9	15.4			30,100					
454050	1224424	CL30.3	91238157	26,000	22,350	2.8	1.48	1.135	0.7	27.35	23.4	23.3	35,700	31,400				
		CLRG32.2	90478104	18,700	2.8		0.79	<0.2	24.8	23.2			27,100					
454653	1223558	CL40.3	91238158	35,900	37,850	5.54	1.3	1.02	0.505	18.05	26.7	29.2	37,400	35,700				
		CLRG42.2	90478105	39,800	5.54		0.74	<0.2	19.5	31.7			34,000					
454742	1224135	CL50.3	91238159	26,400	30,250	6.89	1.15	1	0.445	21.7	12.4	18.15	30,000	35,050				
		CLRG52.2	90478106	34,100	6.89		0.85	<0.2	24.5	23.9			40,100					
455548	1224243	CL60.3	91238160	11,300	26,800		0.42	0.305	0.155	4.425	21.3	17	13,900	41,550				
		CL62.2	91238161	42,500			0.19	<0.2	2.6	12.7			69,400					
455207	1224355	CL70.3	91238162	16,100	13,750	2.12	0.68	0.585	0.42	8.44	27.1	25.65	17,700	16,350				
		CL72.2	91238163	11,400			0.49	0.45	7.29	24.2			15,000					
453343	1221828	CL80.3A	91238169	16,500	19,354	3.796	0.87	1.03077	0.95538	23.1154	20.8	23.3385	24,900	26,123				
		CL80.3B	91238170	14,900			0.77	0.68	19.7	17.3			22,600					
		CL80.3C	91238173	17,800			0.93	1.9	21.3	28.2			27,000					
		CL80.3D	91238175	19,700			0.98	1.9	22.6	30.9			28,400					
		CL80.3V	91238164	21,000			1.05	1.4	21.9	26			26,100					
		CL80.8V	91238166	15,700	5.65		0.87	0.68	18.4	15.2			21,500					
		CL81.4V	91258511	14,800	2.82		0.78	0.55	19.2	17.3			21,200					
		CL82.2A	91238170	21,100	2.70		1.17	0.86	25.8	24.3			27,500					
		CL82.2B	91238172	22,400			1.19	0.78	28.3	25.7			29,900					
		CL82.2C	91238174	19,600			1.06	0.87	23.6	25.1			26,800					
		CL82.2D	91238176	20,700			1.16	0.42	26	24.9			27,500					
		CL82.2V	91238167	24,900	4.56		1.32	0.63	26.1	26.4			28,300					
		CL83.0V	91238168	22,500	3.25		1.25	0.65	26.2	22.3			27,200					
455053	1223855	CL90.3	91258512	33,300	25,500	6.74	1.36	1.09	0.62	18.75	54	39.25	36,600	29,300				
		CL92.2	91258513	17,700	3.65		0.82	0.54	15.1	24.5			22,000					
455036	1223958	CL100.3	91238177	20,900	24,800		1.01	1.11	0.69	18.3	8.62	9.71	25,000	29,900				
		CL102.2	91238178	28,700			1.21	0.72	20.6	10.8			32,500					
454614	1223507	CL110.3	91238179	31,400	31,400	3.08	1.32	1.36	0.715	23.9567	13.1	14.2333	30,600	32,733				
		CL112.2	91238180	32,400	3.31		1.36	0.71	25.6	15.3			33,500					
		CL312.2.3SS	91258446	30,400			1.4	0.94	23.3	14.3			34,100					
454745	1223805	CL120.3	91238181	29,900	33,433	3.42	1.46	1.79	1.05	23.2567	13.7	25	30,300	42,200				

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Be	Cd	Cl	Cu	Fe
		CL120.08V	91238193	35,800		2.34	1.2	20.2	45.3	56,900
		CL122.2	91238182	34,600		1.57	0.88	28.2	16	39,800
454717	1223827	CL130.3	91238183	16,000	24,400	0.95	0.51	17	8.89	19,900
		CL132.2	91238184	32,800		1.95	1.1	32.8	16.7	55,000
453623	1222654	CL140.3	91238185	25,600	26,967	1.53	0.83667	19.2	22.0667	34,300
		CL280.3SS	91238209	25,400	4.95	1.57	1	21.1	56	39,200
		CL142.2	91238186	29,600		1.81	0.91	25.9	14	45,200
454222	1223140	CL150.3	91238187	53,500	43,000	1.9	1.74333	29	26.2333	48,800
		CL282.2SS	91238210	42,500	3.35	1.73	1.2	26	21.9	46,200
		CL162.2	91238188	33,000		1.6	0.68	23.7	18	41,900
454503	1223605	CL160.3	91238189	26,000	26,700	1.93	0.86	25.9	9.79	56,900
		CL162.2	91238190	27,400		1.95	0.98	25.5	11.6	53,000
454552	1224208	CL170.3	91238191	28,800	30,300	1.48	0.82	19.9	11.7	31,300
		CL172.2	91238192	31,800	4.18	1.47	0.66	22	12.2	35,200
453449	1221647	CL180.3	91258504	38,500	42,767	3.67	0.97	27.1	28.8333	32,700
		CL182.2	91258505	45,100	3.14	1.52	1.1	30.5	18.2	37,500
		CL292.2SS	91258510	44,700	2.90	1.49	0.96	28.9	17.9	37,600
454854	1223018	CL190.08V	91238193	35,800	48,667	6.034	1.2	20.2	23.3714	56,500
		CL190.3	91238197	49,100	5.56	1.93	1.1	20.7	44	40,400
		CL190.3V	91238194	50,200		2.12	0.96	18.5	55.6	43,700
		CL191.0V	91238212	51,000	4.09	2.45	1.4	24.8	54.8	69,000
		CL191.6V	91238195	42,300	6.21	2.51	1.4	23.5	52.1	77,600
		CL192.2	91238198	59,200	7.87	1.76	1.5	29.5	53.6	54,400
		CL192.2V	91238196	53,000	6.44	1.98	1.5	26.4	56.6	57,400
454442	1224133	CL200.3A	91238211	27,600	30,985	5.583	1.1	20.6	21.9154	33,100
		CL200.3B	91258514	29,600	4.37	1.46	1.2	21.4	14.3	36,500
		CL200.3C	91238201	26,200	4.50	1.29	1.1	18.4	13.6	31,300
		CL200.3D	91238203	30,100	5.57	1.6	1.1	20.7	14.8	38,600
		CL200.3V	91258500	28,800		1.49	0.66	20.3	13.8	32,400
		CL200.8V	91258501	30,400		1.52	0.88	21	13.6	33,000
		CL201.8A	91258518	33,000	6.29	1.56	1	23.5	14.1	41,600
		CL201.8B	91258515	27,600	3.70	1.33	0.85	20.6	11.6	34,100
		CL201.8C	91238202	30,900	5.51	1.46	0.93	22.1	15.8	38,100
		CL201.8D	91258517	35,800	5.92	1.61	1.1	24.6	16	41,600
		CL201.8V	91258502	19,000		0.9	0.57	12.7	9.86	21,200
		CL203.0V	91258503	39,500	8.34	1.7	0.85	28.9	28.7	51,300

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

STAT	LOI	SITE	NO.	AI	AS	BS	CD	CE	CU	FE
		CL205.1V	91238199	44,300	7.30	1.95	0.85	30.2	28.4	51,500
456307	1223815	CL210.3	91238204	52,900	3.75	4.115	1.92	1.225	23.825	23.825
		CL212.2	91238205	69,800	4.48	2.09	1.5	28.7	24.5	43,500
453958	1223100	CL220.3	91258506	48,300	1.60	1.45	1.8	1.53	5.65	21.5
		CL222.2	91258507	47,200	1.30	1.72	1.72	1.2	21.5	25.2
453748	1223115	CL230.3	91258508	47,000	2.00	2.15	1.3	14.1	21.8	49,200
		CL232.2	91258509	53,100	2.30	1.96	1.3	16.2	20.6	51,200
454215	1223453	CL240.3	38,800	3.01	1.8	1.72333	1.3	16.6	19.6	52,900
		CL300.3SS	91258447	37,700	1.52	1.52	0.89	17.8	20	52,100
		CL242.2	91238206	48,900	3.01	1.85	1.2	19.9	25.1	56,800
454200	1223313	CL250.3	91238207	47,700	2.70	1.88	1.2	22	26.7	56,200
		CL252.2	91238208	43,700	2.60	2.03	1.2	24.4	24.1	59,900
453654	1222824	CL260.3	91258516	46,100	1.90	1.85	1.1	14.8	24.1	56,800
		CL262.2	91258519	50,900	2.10	2.13	1.1	18.1	26.7	62,800
		CL270.3RS	91258520	19,200	2.80	0.53	0.55	24.5	10	16,500
		CL272.2RS	91258521	19,500	2.70	0.58	0.41	24.4	9.71	16,500
472129	1220717	PSL1A0.5	87278100	20,500				19	21	17,300
472256	1220642	PSL2A0.5	87278101	32,800				24	15	
472317	1220642	PSL3A0.1	87278104	25,900				22	13	16,100
		PSL3A0.5	87278105	22,800				19	18	16,300
		PSL5A0.5DUP	87278102	21,800				19	27	17,000
		PSL3A1.0	87278106	25,500				26	14	17,200
		PSL3A4.0	87278107	13,100				25	13	12,700
472407	1220657	PSL4A0.5	87278108	17,100				16	13	14,800
472410	1220657	PSL4B0.5	87278109	15,500				18	12	12,900
		PSL6A0.5	87278111	15,700				26	13	14,200
		PSB8A0.5DUP	87278147	14,500				18	10	13,500
472220	1220800	PSB1A0.5	87278112	23,800				24	14	20,100
472308	1221004	PSB2A0.5	87278113	21,900				23	13	17,000
		PSB6A0.5DUP	87278145	23,000				22	12	17,000

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

STAT	LOC	SITE	NO.	Al	As	Ba	Bd	Cr	Cu	Fe		
472404	1220945	PSB3A0.1	87278114	16,500	14,975	<.5	0.35	<.8	14	12	15,000	16,300
		PSB3A1.0	87278118	19,200		0.6	<.8	20	11		15,700	
		PSB3A3.0	87278123	13,900		<.5	<.8	25	11		15,000	
		PSB3A6.0	87278124	10,300		<.5	<.8	25	11		15,500	
472405	1220943	PSB3B0.1	87278128	13,200	13,675	<.5	0.3125	<.8	10	9	11,800	13,700
		PSB3B1.0	87278129	18,000		0.5	<.8	21	7		15,500	
		PSB3B2.0	87278130	13,300		<.5	<.8	20	11		13,300	
		PSB3B4.0	87278131	10,200		<.5	<.8	21	8		14,200	
472406	1220941	PSB3C0.1	87278132	10,900	12,175	<.5	<.5	14	14	14	11,900	12,950
		PSB3C2.0	87278133	14,900		<.5	<.8	23	9		13,900	
		PSB3C4.0	87278134	12,700		<.5	<.8	25	22		13,300	
		PSB3C5.0	87278135	10,200		<.5	<.8	19	10		12,700	
472405	1220942	PSB3D1.0	87278136	16,900	16,900	<.5	<.5	22	10	10	14,900	14,900
472404	1220944	PSB3E1.0	87278139	21,700	21,700	<.6	<.5	20	12	12	16,800	16,800
472508	1220914	PSB4A0.1	87278140	14,900	19,160	<.5	0.37	<.8	14	11	14,000	12,320
		PSB4A0.5	87278141	15,000		<.5	<.8	26	12		14,000	
		PSB4A2.0	87278142	28,300		0.6	<.8	24	8		11,300	
		PSB7A2.0DUP	87278146	25,000		0.5	<.8	20	8		10,300	
		PSB4A4.0	87278143	12,600		<.5	<.8	27	12		12,000	
472653	1221116	PSB5A0.5	87278144	7,390	7,390	<.5	<.5	12	4	4	5,920	5,920
472143	1220734	PSSED1A	87278148	13,200	13,200	<.5	<.5	19	14	14	17,900	17,900
472129	1220742	PSSED1B	87278149	11,800	11,800	<.5	<.5	20	24	18	14,800	16,350
		PSSED1C	87278150	11,400		<.5	<.8	19	12		17,900	
472131	1220725	PSSED2A	87278151	13,300	12,850	<.5	<.5	28	24	21	17,300	17,100
		PSSED2B	87278152	12,400		<.5	<.8	15	18		16,900	
472112	1220742	PSSED3A	87278153	12,600	14,150	<.5	0.375	<.8	18	25	18,100	19,450
		PSSED3B	87278154	16,700		0.5	1	22	32		20,800	
483845	1225008	PS10.3	93088519	24,000	20,800	0.71	0.544	34.1	32.1	29.24	28,700	29,040
		PS300.3DUP	93088637	21,000	5.72	0.66	<.2	31.2	28.8		27,400	
		PS12.2	93088520	21,700	6.29	0.42	0.55	36.3	29.8		27,300	
		PS302.2DUP	93088638	16,700	5.99	0.44	<.2	33.4	25.4		25,500	
		PS155	93088521	20,600	4.45	0.49	0.82	41.5	30.1		36,300	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	At	As	Ba	Ca	Co	Cd	Cu	Pb	Fe					
483355	1225604	PS20.3	93088522	14,500	14,175	2.79	3.735	0.37	0.37	0.37	19.6	22.525	15.5	14.075	17,700	20,525	
		PS270.3DUP	93088631	13,400	2.3	0.36		<0.2			17.9		16		15,800		
		PS22.2	93088523	17,300	6	0.38		0.55			30.8		15.5		28,200		
		PS272.2DUP	93088632	11,400	3.85	0.23		<0.2			22.2		10.3		20,400		
485910	1223507	PS30.3	93088524	22,900	20,057	4.58	4.25	0.38	0.36667	0.78	0.56667	29.2	31.3	13.6	13.8667	22,500	21,433
		PS32.2	93088525	22,700	4.48	0.39		0.32			38.6		16.6		23,100		
		PS355	93088526	14,500	3.69	0.33		0.3			26.1		11.4		18,700		
481630	1214308	PS40.3V	93088527	20,600	21,936	9.07	9.39786	0.28	0.32	1.1	0.83143	47.8	46.1214	39.5	42.8425	36,600	37,757
		PS320.3SS	93088641	19,700	10.2	0.27		0.26			45.1		38.8		33,400		
		PS41.0V	93088528	21,100	8.3	0.32		0.59			46.2		33.5		37,400		
		PS42.2V	93088529	20,300	7.56	0.3		1.4			44.6		42.9		32,100		
		PS43.0V	93088530	21,100	7.91	0.33		0.87			47.6		44.6		36,500		
		PS44.9V	93088531	26,200	14.1	0.37		1.1			59.2		51.2		47,400		
		PS40.3A	93088532	21,500	10.5	0.33		0.92			47.7		38.2		36,600		
		PS40.3B	93088533	23,000	9.43	0.33		1			50.6		45.4		38,100		
		PS40.3C	93088534	19,800	8.66	0.28		1			42.8		41.8		36,500		
		PS40.3D	93088535	18,200	8.16	0.27		0.77			40.8		28.5		35,200		
		PS42.2A	93088536	22,300	8.35	0.34		0.65			50.1		48.6		37,900		
		PS42.2B	93088537	25,700	10.8	0.36		0.8			59		59.8		42,600		
		PS42.2C	93088538	25,000	8.77	0.38		0.67			54.2		40.3		40,900		
		PS42.2D	93088539	22,500	9.76	0.32		0.71			52		46.7		38,400		
480938	1224043	PS50.3	93088540	12,000	12,400	2.32	2.215	0.22	0.23	0.37	0.38	21.4	22	11.235	15,800	16,650	
		PS51.5	93088541	12,800	2.11	0.24		0.24			22.6		9.77		17,300		
480239	1231923	PS60.3	93088542	10,000	10,713	1.18	1.61657	0.24	0.25333	0.28	0.30333	14	15.3667	6.78	11,400	14,333	
		PS62.2	93088543	12,500	1.11	0.29		0.3			15.5		8.04		12,200		
		PS655	93088544	9,540	2.56	0.23		0.33			19.6		12.1		19,400		
471643	1220203	PS70.3V	93088545	13,300	11,550	5.57	4.27429	0.38	0.29143	0.47	0.36571	22.6	15.7429	21.4	20,700	18,079	
		PS71.4V	93088546	15,500	5.82	0.39		0.55			14.4		20.7		25,300		
		PS72.2V	93088547	8,650	2.56	0.24		0.26			16.1		12.6		12,500		
		PS73.0V	93088548	16,300	6.51	0.39		0.49			14.2		19.6		27,600		
		PS73.8V	93088549	16,000	5.68	0.38		0.58			15.9		19.3		24,900		
		PS70.3A	93088550	10,500	3.93	0.19		0.57			20.2		16.7		15,900		
		PS70.3B	93088551	10,500	3.84	0.26		0.41			17.1		12.2		15,300		
		PS70.3C	93088552	10,400	4.44	0.28		0.21			18.9		16.2		16,400		
		PS310.3SS	93088539	10,300	4.54	0.25		<0.2			20.3		17.7		15,900		
		PS70.3D	93088553	8,850	3.75	0.23		0.27			20		10.6		13,200		
		PS72.2A	93088554	10,900	3.3	0.27		0.34			23.1		14.4		16,600		
		PS72.2B	93088555	10,100	2.77	0.27		0.29			18.3		14.1		15,300		

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

DATE	LOC	SITE	NO.	Al	As	Be	Cd	Cr	Cu	Pb	Mn	Ni	Se	Zn
		PS72.2C	93088556	11,700	4.06	0.3	0.48	22.2	16.1	17,500				
		PS72.2D	93088557	10,300	3.07	0.25	<0.2	19.1	13.9	16,000				
475035	1214917	PS80.3	93088558	18,000	21,400	0.26	0.46	38.9	41.95	24,600	25,860			
		PS82.2	93088559	24,800	6.93	0.4	<0.2	46	20.4	27,100				
474226	1225456	PS90.3	93088560	28,300	32,300	0.44	<0.2	43.9	48.75	37,100	40,400			
		PS91	93088561	36,300	1.52	0.5	<0.2	53.6	79.4	43,700				
475420	1225412	PS100.3	93088562	13,300	13,860	0.23	<0.2	21.3	21.15	12,900	13,050			
		PS102.2	93088563	14,400	2.24	0.23	<0.2	21	7.15	13,200				
471843	1223157	PS110.3V	93088564	14,800	16,540	0.27	0.25615	19.1	24.3538	10,900	13,354			
		PS111.4V	93088565	18,600	11.6	0.32	0.33	25	18.9	13,800				
		PS112.2V	93088566	20,500	2.46	0.29	<0.2	29.6	13.9	16,600				
		PS113.0V	93088567	23,000	9.34	0.29	0.44	30.7	22	18,000				
		PS114.0V	93088568	14,700	5.04	0.26	<0.2	22	16.7	11,700				
		PS110.3A	93088569	8,820	73.3	0.14	2.6	11.8	111	7,400				
		PS110.3B	93088570	17,600	19.3	0.31	0.37	26	23	16,100				
		PS110.3C	93088571	14,400	50.7	0.22	0.82	29.4	101	11,400				
		PS110.3D	93088572	14,000	23.5	0.23	0.59	19	34.7	10,700				
		PS112.2A	93088573	16,800	3.94	0.27	<0.2	23.2	12.6	12,000				
		PS112.2B	93088574	14,600	3.75	0.22	<0.2	21.7	11.1	12,400				
		PS112.2C	93088575	20,400	6.04	0.33	<0.2	29.8	19.1	16,900				
		PS112.2D	93088576	16,800	3.02	0.31	<0.2	30.3	11.3	16,700				
472827	1224307	PS120.3	93088577	15,800	16,367	0.27	<0.2	16.2	21.7	13,700	14,300			
		PS122.2	93088578	18,800	1.66	0.27	<0.2	24	10.7	16,200				
		PS292.2SS	93088536	14,500	1.8	0.26	<0.2	24.9	9.06	13,000				
471723	1232215	PS130.3	93088579	82,100	84,800	0.86	<0.2	45.3	47.25	109,000	112,500			
		PS132.2	93088580	87,700	2.5	0.89	0.28	49.2	256	116,000				
472232	1225818	PS140.3	93088581	19,900	17,900	0.29	<0.2	23.4	28.2	19,200	18,200			
		PS141.5	93088582	21,300	1.5	0.26	<0.2	26.7	20.4	18,800				
		PS1455	93088583	12,500	1.4	0.22	<0.2	34.5	20.6	16,600				
465604	1225420	PS150.3V	93088584	25,500	23,193	0.48	<0.2	18.9	18.3429	17,700	17,793			
		PS151.2V	93088585	26,900	2.8	0.46	<0.2	17.7	19.5	18,300				
		PS152.2V	93088586	24,400	2.7	0.43	<0.2	19.5	18.7	18,000				
		PS153.0V	93088587	21,300	2.5	0.34	<0.2	18.2	18.8	18,000				
		PS154.3V	93088588	17,300	2.5	0.3	<0.2	15.9	18.6	18,000				
		PS312.2SS	93088640	18,400	2.3	0.4	<0.2	18	47.8	18,200				
		PS150.3A	93088589	24,100	3.18	0.39	<0.2	18.1	17.1	17,900				

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOU	SFF	NG	Al	As	Ba	Cd	Cr	Cu	Fe
480812	1221653	PS160.3B	93088590	24,500	4.27	0.43	<0.2	17	16.4	16,900
		PS160.3C	93088591	23,900	4.28	0.43	<0.2	17.2	16.3	17,200
		PS160.3D	93088592	23,700	3.7	0.46	<0.2	16	17.6	18,000
		PS162.2A	93088593	22,800	2.1	0.37	<0.2	20.1	17.7	17,400
		PS162.2B	93088594	22,200	8.75	0.39	<0.2	19.1	19.7	17,200
		PS162.2C	93088595	23,300	8.63	0.41	<0.2	22.1	17.6	17,300
		PS162.2D	93088596	26,400	2.4	0.45	<0.2	19	19.9	19,000
471307	1222000	PS170.3	93088599	10,900	17,450	2.3	<0.2	18	22.6	15,550
		PS172.2	93088600	9,820	2.3	0.29	<0.2	27.2	13.5	15,900
471055	1241132	PS180.3	93088601	17,900	3.25	0.33	<0.2	14.6	14.25	13,700
		PS182.2	93088602	27,000	1.82	0.28	<0.2	13.9	21.4	13,200
		PS282.2SS	93088634	23,400	20,675	2.36	<0.2	43.2	33.225	39,300
		PS1855	93088603	14,400	3.04	0.39	<0.2	45.2	40.5	45,700
474657	1241729	PS190.3	93088604	18,800	3.89	0.25	<0.2	22.8	13.7	27,800
		PS192.2	93088605	23,900	1.67	0.37	<0.2	21.7	22	25,200
		PS1955	93088606	15,200	2.54	0.13	<0.2	17	21.225	24,400
473919	1222451	PS200.3V	93088607	12,000	3.64	0.42	<0.2	23.4	14.6	29,300
		PS200.8V	93088608	13,500	2.01	0.34	<0.2	16.2	9.64	24,900
		PS202.2V	93088609	11,500	2.54	0.23	<0.2	17	8.43	24,400
		PS203.0V	93088610	9,310	12,462	0.26	<0.2	23.4	14.6	29,300
		PS204.5V	93088611	9,620	2.14	0.23	<0.2	16.2	9.64	24,900
		PS200.3A	93088612	12,900	1	0.19	<0.2	18.3	8.46	10,700
		PS290.3SS	93088635	13,300	1.4	0.24	<0.2	20.1	8.98	11,700
		PS200.3B	93088613	13,100	1.51	0.27	<0.2	24.1	16	12,300
		PS200.3C	93088614	14,500	13.5	0.27	0.34	24.1	16	12,300
		PS200.3D	93088615	11,500	6.38	0.25	0.32	19.3	15.2	11,400
		PS202.2A	93088616	15,700	10.5	0.29	0.24	20	14.5	11,200
		PS280.3SS	93088633	11,100	7.9	0.23	<0.2	18.3	12.6	11,200
		PS202.2B	93088617	13,300	4.02	0.29	<0.2	20.1	10.4	10,800
		PS202.2C	93088618	12,600	2.06	0.23	<0.2	27.4	9.45	13,800
		PS202.2D	93088619	13,000	3.11	0.21	<0.2	22.4	15.1	16,000
470353	1221824	PS210.3	93088620	25,500	3.11	0.24	<0.2	21	8.88	11,500
		PSWRF2.7	90478097	38,100	1.58	0.24	<0.2	20.4	8.98	11,900
465501	1223333	PS220.3	93088621	28,700	1.4	0.21	<0.2	17.4	9	10,800
		PSWRF2.5	90478098	40,200	2.1	0.24	<0.2	10	16.385	16,000
					4.46	0.57	<0.2	9.97	20.3	25,000
					1.2	0.83	<0.2	22.8	28.9	25,000
					2.3	0.59	<0.2	10	17.55	13,300
					1.99	0.74	<0.2	25.1	24.9	22,000

ALL VALUES = MG/KG

10-10

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO	Al	As	Be	Cd	Cl	Cu	Fe					
465728	1223904	PS230.3	93088622	16,200	22,400	1.975	0.36	0.416	<0.2	13.3	19.95	10.3	14.3	12,000	16,700
		PSWRF2.5	90478099	28,600	1.95	0.47	<0.2	26.6	18.3	21,400				21,400	
476451	1221040	PS240.3	93088623	20,000	24,800	5.865	0.45	0.53	0.21	35.8	47.75	18.7	24.9	23,700	27,750
		PSWRF2.6	90478100	29,600	4.88	0.61	<0.2	69.7	31.1	31,800				31,800	
482413	1221025	PS250.3	93088624	13,500	18,750	4.215	0.15	0.185	<0.2	157	235	13.1	19.8	23,000	27,500
		PSWRF2.7	90478101	24,000	4.17	0.22	<0.2	313	26.5	32,000				32,000	
464743	1221631	PSLB10.3	93088625	14,400	13,700	2.15	0.37	0.395	<0.2	15.4	17.95	21.1	17.5	13,200	15,150
		PSLB12.2	93088626	13,000	2.3	0.42	<0.2	20.5	14.1	17,100				17,100	
472742	1221326	PSLB20.3	93088627	33,000	39,300	1.45	0.54	0.51	<0.2	63.2	79.05	71.3	86.65	44,200	52,550
		PSLB22.2	93088628	45,600	1.8	0.68	<0.2	94.9	102	60,900				60,900	
460223	1184019	PS260.3RS	93088629	9,330	8,970	3.57	0.43	0.435	<0.2	9.35	9.11	16.5	16.35	21,900	21,550
		PS262.2RS	93088630	8,510	3.35	0.44	<0.2	8.87	16.2	21,400				21,400	
472457	1184356	SB10.3	92268500	9,070	8,934	4.0275	0.36	0.3775	0.51	6.87	6.5675	14	14.4	15,700	15,400
		SB330.3SS	92268574	9,570	3.15	0.38	0.43	7.45	13.1	16,500				16,500	
		SB12.2	92268501	7,940	5.22	0.35	0.37	5.73	15.1	19,400				19,400	
		SB320.3SS	92268573	9,155	4.15	0.42	0.55	6.22	15.4	22,000				22,000	
473910	1180946	SB20.3	92268502	15,800	15,700	5.11333	0.61	0.66333	0.46	7.47	8.95333	14.9	14.9333	14,500	16,133
		SB340.3SS	92268575	17,100	3.72	0.66	0.38	7.79	14.4	15,400				15,400	
		SB22.2	92268503	14,200	7.70	0.72	0.52	11.6	15.5	18,400				18,400	
475026	1175046	SB30.3	92268504	13,500	14,575	7.9475	0.64	0.6675	0.55	7.48	9.235	12.8	15.025	19,000	20,500
		SB32.2	92268505	14,500	9.87	0.68	0.66	9.93	14.1	22,900				22,900	
		SB270.3 SS	92268568	17,600	9.92	0.73	0.59	11	14.8	24,500				24,500	
		SB3SSBD	92268506	13,100	5.83	0.62	0.36	8.53	22.4	16,800				16,800	
470819	1174318	SB40.3	92268507	13,000	12,850	2.516	0.52	0.535	0.51	12.9	13.05	15.2	14.45	16,200	16,100
		SB41.2	92268508	12,700	2.48	0.55	0.78	13.2	13.7	16,000				16,000	
474232	1173037	SB50.3	92268509	13,300	13,650	4.305	0.64	0.655	0.76	9.87	10.535	9.82	15.95	27,200	27,000
		SB51.3	92268510	14,000	4.79	0.67	0.61	11.2	12.1	26,500				26,500	
480033	117325	SB60.3	92268511	12,200	10,623	3.485	0.54	0.505	0.47	10.9	11.6	7.32	7.415	13,200	12,518
		SB290.3SS	92268570	14,500	3.03	0.62	0.22	11.2	8.15	14,300				14,300	
		SB62.2	92268512	9,580	3.90	0.48	0.46	12.1	8.89	13,400				13,400	
		SB6SS	92268513	5,110	3.80	0.38	<0.2	12.2	5.3	9,170				9,170	

ALL VALUES = MG/KG

10-11

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Be	Cd	Cr	Cu	Pb	Sb	Tl	Zn			
481824	1173603	SB70.3	92268514	30,100	20,537	1.13867	0.95	0.72333	1	0.55333	10.5	10.9767	30.2	29.0333	22,700	24,100
		SB71.8	92268515	22,100	0.71	0.88	0.73	14.8	38.6	0.73	14.8	38.6	35,600			
		SB7SS	92268516	9,410	0.60	0.34	0.23	7.63	18.3	0.23	7.63	18.3	14,000			
475949	1181738	SB80.3	92268517	15,500	15,067	6.45333	0.62	0.58667	0.82	0.67667	11.2	12.0333	11.6	11.4667	13,400	13,967
		SB310.3SS	92268572	16,000	6.90	0.56	0.79	10.7	11.8	0.79	10.7	11.8	13,400			
		SB82.2	92268518	13,700	7.64	0.58	0.42	14.2	11	0.42	14.2	11	15,100			
485517	1173112	SB90.3	92268519	14,300	12,803	2.74	0.55	0.47667	0.7	0.62667	11.8	11.0533	15.9	14.1433	20,500	18,400
		SB91.4	92268520	15,300	3.32	0.55	0.69	13.4	17.2	0.69	13.4	17.2	20,300			
		SB9SBD	92268521	8,210	1.80	0.33	0.49	7.96	9.33	0.49	7.96	9.33	14,400			
480433	1171952	SB100.3	92268522	26,600	25,850	6.41	0.84	0.825	0.61	0.535	11.3	11.85	13.9	13.5	16,500	17,000
		SB102.2	92268523	25,100	7.08	0.81	0.46	12.4	13.1	0.46	12.4	13.1	17,500			
474434	1175413	SB110.3	92268524	19,100	16,975	6.9275	0.72	0.6825	0.66	0.57	14.8	13.025	34.2	26.725	23,000	25,300
		SB111.3	92268525	18,800	7.95	0.74	0.57	13.1	18.8	0.57	13.1	18.8	37,800			
		SB350.3SS	92268576	15,900	8.27	0.7	0.65	13.1	35.6	0.65	13.1	35.6	20,200			
		SB11SBD	92268526	14,100	5.57	0.57	0.4	11.1	14.3	0.4	11.1	14.3	20,200			
474018	1174407	SB120.3	92268527	18,700	19,950	3.845	0.73	0.785	0.45	0.41	14.7	16.95	16.8	17.3	17,900	19,500
		SB122.2	92268528	21,200	4.24	0.84	0.37	19.2	17.8	0.37	19.2	17.8	21,100			
471929	1170403	SB130.3	92268529	24,200	21,275	3.45	0.88	0.82	0.62	0.4625	19.2	18.775	17.2	16.3	22,300	21,225
		SB300.3SS	92268571	23,900	2.30	0.88	0.41	18.3	16.8	0.41	18.3	16.8	21,800			
		SB132.2	92268530	20,400	4.35	0.85	0.36	22.9	18.1	0.36	22.9	18.1	23,900			
		SB13SBD	92268531	16,600	3.69	0.67	0.46	14.7	13.1	0.46	14.7	13.1	16,900			
472534	1171355	SB140.3	92268532	16,500	15,383	2.3	0.63	0.62525	0.25	0.34	14	12.3375	14.4	15.8525	16,000	14,563
		SB142.2	92268533	19,900	2.60	0.71	0.36	13.7	17.4	0.36	13.7	17.4	17,600			
		SB140.3V	92268534	17,000	1.70	0.62	0.36	13.6	14.4	0.36	13.6	14.4	15,800			
		SB140.8V	92268535	14,800	2.80	0.66	0.41	12.4	15	0.41	12.4	15	15,300			
		SB142.2V	92268536	13,800	2.30	0.62	0.29	10.9	16.5	0.29	10.9	16.5	13,100			
		SB280.3SS	92268559	14,800	2.40	0.66	0.4	11.4	16.8	0.4	11.4	16.8	14,200			
		SB143.7V	92268537	13,300	2.40	0.56	0.34	11.2	16.9	0.34	11.2	16.9	12,900			
		SB145.0V	92268538	12,800	2.10	0.55	0.31	11.5	15.5	0.31	11.5	15.5	12,400			
470433	1171952	SB150.3	92268539	15,500	14,550	3.3	0.74	0.75	0.33	0.35	14.5	16	13.5	13.35	16,300	17,050
		SB152.2	92268540	13,600	3.90	0.76	0.39	17.5	13.2	0.39	17.5	13.2	17,800			
472343	1172004	SB160.3	92268541	21,200	23,550	2.75	0.78	0.875	0.29	0.385	20.2	20.25	17.7	15.25	23,300	24,750
		SB162.2	92268542	26,100	2.80	0.97	0.5	20.3	18.8	0.5	20.3	18.8	26,200			
474257	1174500	SB170.3	92268543	17,100	16,500	8.53	0.65	0.57	0.39	0.37	12.2	12.7	17.8	17.3	20,200	21,100

ALL VALUES = MG/KG

10-12

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Pb	Mn	Zn
474346	1170832	SB172.2	92268544	16,900	10.40	0.69	0.36	13.2	16.8	22,000	18,150	18,150
		SB180.3	92268545	20,100	6.57	0.64	0.41	9.18	11.8	17,000	17,000	17,000
		SB182.2	92268546	13,900	10.70	0.57	0.39	10.7	11.9	19,300	19,300	19,300
476233	1173614	SB190.3V	92268547	16,900	8.16	0.68	0.33863	11.2	11.7886	17,600	17,600	17,600
		SB191.2V	92268548	16,700	10.30	0.67	0.51	11.8	12.6	18,100	18,100	18,100
		SB192.2V	92268549	11,500	11.90	0.57	0.42	12.9	13	17,800	17,800	17,800
		SB193.6V	92268550	11,700	16.60	0.61	0.34	14.6	17.2	19,200	19,200	19,200
		SB194.4V	92268551	13,200	14.20	0.63	0.44	13.5	15.9	19,100	19,100	19,100
		SB190.3A	92268552	16,700	6.89	0.68	0.37	11.6	12.4	18,100	18,100	18,100
		SB192.2A	92268553	18,400	9.02	0.74	0.83	12.4	13.8	19,200	19,200	19,200
		SB190.3B	92268554	14,800	7.89	0.69	<0.3	11	13.6	15,800	15,800	15,800
		SB192.2B	92268555	7,880	10.10	0.5	<0.3	10.5	12.1	13,200	13,200	13,200
		SB190.3C	92268556	14,400	8.16	0.71	<0.3	11.1	12.9	15,800	15,800	15,800
		SB192.2C	92268557	12,400	18.20	0.66	0.32	13.6	17.2	17,800	17,800	17,800
		SB190.3D	92268558	13,900	7.07	0.66	0.46	10.3	10.6	14,700	14,700	14,700
		SB192.2D	92268559	8,990	12.40	0.51	<0.3	11.6	10.5	14,400	14,400	14,400
		SB19.SS	92268560	9,020	3.67	0.6	<0.3	8.94	13	13,500	13,500	13,500
474232	1171937	SB200.3	92268561	17,100	2.70	0.79	0.32	7.62	6.96	20,900	24,650	24,650
		SB202.2	92268562	21,800	2.40	0.86	0.45	5	3.97	28,400	28,400	28,400
473743	1171000	SB210.3	92268563	11,900	6.62	0.58	0.33	10.9	11.4	21,200	22,300	22,300
		SBRU2.3	90478140	13,400	9.4	0.5	<0.2	12.4	14.6	23,400	23,400	23,400
474313	1173053	SB220.3	92268564	19,100	4.72	0.83	0.72	12.7	16.4	18,700	20,000	20,000
		SBRU2.5	90478141	20,500	5.8	0.61	<0.2	16.1	23.5	21,300	21,300	21,300
475037	1175147	SB230.3	92268565	12,000	4.29	0.62	0.55	10.8	11.1	13,900	17,550	17,550
		SBRU2.8	90478142	16,300	5.7	0.48	<0.2	15.7	17.8	21,200	21,200	21,200
475002	1175805	SB240.3	92268566	10,800	8.04	0.51	0.495	10	12	16,200	18,150	18,150
		SBRU2.6	90478143	13,300	8.8	0.48	<0.2	12.9	14.1	20,100	20,100	20,100
475232	1180911	SB250.3	92268567	10,800	5.55	0.51	0.515	10.6	10.9	14,100	16,600	16,600
		SBRU2.6	90478144	14,200	5.55	0.52	<0.2	15.1	15	19,100	19,100	19,100
475453	1172838	SB380.3	92268577	17,400	4.75	0.62	0.58	10.9	11	14,800	14,300	14,300
		SB382.2	92268578	12,600	6.08	0.54	<0.2	10.4	10.6	13,800	13,800	13,800
475349	1171054	SB390.3	92268579	14,400	1.40	0.94	0.39	4.5	3.9	10,300	9,670	9,670
		SB391.5	92268580	11,800	1.50	0.84	<0.2	4.5	4.19	9,040	9,040	9,040

ALL VALUES = MG/KG

10-13

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO	Al	As	Ba	Cd	Cr	Cu	Fe	
463437	1205022	YB10.3	91258554	13,500	0.9	0.89	1.15	0.46	13.3	13.3	32,600
463222	1202650	YB20.3	91258556	15,300	2.5	0.82	0.52	0.61	15	19.6	27,800
463153	1203223	YB30.3	91258558	19,700	1.8	0.95	0.95	0.72	14.3	17.7	29,000
462523	1195653	YB40.3	91258559	19,000	2.6	2.995	0.805	0.405	17	18.75	27,300
		YB42.2	91258560	19,600	3.4	0.93	0.58	20	19.6	29,300	
461355	1192417	YB50.3A	91258566	13,600	5.1	7.52571	0.52071	0.52929	12	13.1571	25,100
		YB50.3B	91258568	12,500	3.5	0.77	0.52	11.4	12.9	23,200	
		YB50.3C	91258537	15,800	9.1	0.93	0.44	11.5	20.7	28,100	
		YB50.3D	91258539	15,200	6.5	0.91	0.45	12.2	20.7	29,900	
		YB50.3V	91258574	14,200	4.6	0.82	0.44	12.7	18.4	25,400	
		YB340.3SS	91258582	13,700	4.4	0.81	0.76	13.1	17.7	25,100	
		YB50.7V	91258575	16,100	5.1	0.89	0.58	13.4	19.9	28,200	
		YB51.3V	91258576	17,100	7.8	0.98	0.75	16.1	24.4	29,800	
		YB52.2A	91258567	15,700	10.9	1.05	1.1	13.3	21	34,300	
		YB52.2B	91258564	13,400	5.4	0.84	0.67	14.2	17.3	26,500	
		YB52.2C	91258538	14,100	11.5	1.07	0.52	12.3	20.1	34,000	
		YB52.2D	91258540	14,000	9.9	1.03	0.73	11.6	19.5	32,600	
		YB52.2V	91258577	16,000	11.2	0.94	0.67	13.9	23	27,600	
		YB53.2V	91258565	17,000	11.5	1.01	0.57	16.5	21.1	31,200	
461445	1200151	YB50.3	91258562	23,000	5.4	4.82	1.15567	0.55	29.3	27.0567	35,600
		YB332.2SS	91258569	26,000	5.4	1.09	0.58	31.8	23.6	37,400	
		YB52.2	91258563	34,400	3.7	1.33	0.91	33.7	34.6	45,800	
460709	1204921	YB70.3	91258421	47,100		2.26	2.79	6.54	20.8	24.6	42,800
		YB72.2	91258422	66,000		3.33	1.6	8.8	28.4	64,800	
460959	1203706	YB80.3	91258423	23,000		2.43	1.31	0.57567	14.9	20.1333	28,800
		YB362.2	91258429	23,100		1.13	0.58	16	18	29,100	
		YB81.8	91258424	33,900		1.67	0.6	25	24.5	42,800	
461920	1202619	YB90.3A	91258571	20,900	2.4	1.04	1.04429	0.56571	10.7	18.6143	30,700
		YB90.3B	91258573	23,100	1.4	1.22	0.57	12.4	20.1	34,000	
		YB90.3C	91258578	23,700	1.7	1.26	0.8	12.6	17.2	34,900	
		YB342.2SS	91258583	23,500	1.8	1.26	1.4	11.2	17.6	34,900	
		YB90.3D	91258581	24,700	2.2	1.2	0.94	12	18.2	36,900	
		YB90.3V	91258417	18,800		0.95	0.35	9.98	18.9	27,600	
		YB90.7V	91258418	12,400		0.58	0.6	3.6	13.2	14,900	
		YB92.2A	91258572	27,200	3.2	1.18	0.8	16	17.9	36,500	
		YB92.2B	91258580	18,000	3.4	0.76	0.5	8.5	11.9	20,900	

ALL VALUES = MG/KG

10-14

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOH	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe
		YB92.2C	91258579	23,900	2.4	0.97	0.49	12.9	17	31,100
		YB92.2D	91258541	20,500	2.9	0.94	0.43	9.46	15.5	27,800
		YB92.2V	91258419	21,100	0.9	0.9	<0.2	11	16.3	26,100
		YB93.5V	91258420	26,600	1.18	1.18	1	18.4	31.5	36,200
		YB95.0V	91258570	22,400	2.9	1.18	0.72	19.3	24.3	40,600
462827	1202727	YB100.3	91258542	20,200	3.1	3.475	0.63	15.8	22.9	31,200
		YB102.2	91258543	23,700	3.9	1.21	0.8	17.6	27.4	35,000
464415	1203715	YB110.3	91258544	21,000	1.5	0.69	0.37	11.4	17.2	20,900
		YB360.3SS	91258412	24,200	0.85	0.85	0.36	11.5	19.7	22,000
		YB112.2	91258411	23,800	0.8	0.8	0.73	12.3	44.2	22,000
471215	1205848	YB12.2	91258555	17,100	0.6	1.4	0.56	14	14	39,800
		YB120.3A	91258430	31,600	4.1	0.96	0.22	36.9	18.1	23,700
		YB120.3B	91258432	29,400	4.1	0.9	0.43	36.5	15.8	21,900
		YB120.3C	91258413	25,400	3.6	0.78	0.44	29.6	16.7	18,800
		YB120.3D	91258415	31,600	4.5	0.95	0.42	33.9	18.9	22,800
		YB120.3V	91258425	33,600	1.09	1.09	0.55	33	20.2	22,300
		YB120.7V	91258426	35,900	1.15	1.15	0.72	38.4	19.5	26,700
		YB121.0V	91258427	40,300	1.23	1.23	0.83	46	21.6	26,700
		YB122.2A	91258431	34,800	4.6	1.06	0.3	53.1	17.3	28,100
		YB122.2B	91258433	32,600	4.0	1.01	0.46	46.3	16.7	26,100
		YB122.2C	91258414	34,300	4.4	1.06	<0.2	76.8	18.8	29,400
		YB122.2D	91258416	36,100	4.6	1.12	0.68	47	19	28,000
		YB122.2V	91258428	40,400	4.6	1.31	0.74	48.9	20.5	28,500
		YB123.2V	91258526	33,000	4.1	1.04	0.56	104	22.6	37,200
471015	1205856	YB130.3	91258404	28,100	2.9	0.98	0.77	27.4	16.4	27,100
		YB360.3SS	91258408	26,100	2.9	0.89	0.86	27.1	16.9	27,200
		YB132.2	91258405	34,600	4.1	1.24	0.77	39.9	29.8	37,500
470505	1202520	YB140.2	91258524	24,400	1.3	1.34286	0.59	19.6	18.7	35,100
		YB140.2V	91258545	20,800	1.7	1.46	1.3	17.9	18.8	40,500
		YB140.5V	91258546	18,400	1.5	1.38	0.72	15.4	17.1	38,000
		YB330.3SS	91258551	18,400	1.3	1.42	0.97	14.8	16.4	35,900
		YB141.0	91258523	25,400	1.3	1.52	0.72	19.5	18.2	42,300
		YB141.0V	91258547	20,300	1.3	1.38	0.81	15.1	16.3	39,800
		YB141.7V	91258548	20,400	1.2	1.59	0.85	15.8	17	43,800
		YB142.5V	91258525	17,900	1.1	1.39	0.78	12.7	14.8	41,900
465850	1204027	YB150.3	91258549	25,100	1.9	1.3	0.64	21.9	17.2	30,400
		YB151.6	91258550	29,300	1.7	1.28	1.1	22.1	-19	32,900

ALL VALUES = MG/KG

10-15

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe			
471047	1204419	YB160.3	91258406	24,200	3.12	2.5	0.98	0.4	28.9	30.3	17.1333	20,400	22,033
		YB362.2SS	91258409	19,800	2.1	0.88	<0.2	27.8	16.1	20,000		20,000	
		YB162.2	91258407	25,700	2.9	1.08	0.59	34.2	16.8	25,700		25,700	
471407	1204807	YB170.3	91258552	14,800	2.5	2.815	0.72	0.515	34.3	37.85	12.4	20,000	21,350
		YB172.1	91258553	18,100	3.1	0.72	0.45	41.4	13.5	22,700		22,700	
463713	1211038	YB180.3	91258528	19,600	2.0	0.89	0.49	9.27	13.2	14,800	17.75	14,800	17,200
		YB182.2	91258527	22,100	2.6	0.85	0.56	15	22.3	19,600		19,600	
462441	1205344	YB190.3	91258403	34,600	41,400	1.83333	1.12	1.32857	13.4	18,2286	22.8	39,700	58,800
		YB190.3V	91258529	37,900	1.4	1.59	1.2	14	22.9	46,800		46,800	
		YB190.7V	91258530	39,600	1.8	1.84	1	15.9	20.7	52,800		52,800	
		YB191.2V	91258400	43,700	1.8	2.27	1.6	22.2	23.1	68,400		68,400	
		YB192.2	91258410	38,000	1.7	1.8	0.98	18.2	21.8	48,300		48,300	
		YB192.2V	91258401	50,500	2.2	2.49	1.9	23.1	24.9	80,500		80,500	
		YB194.0V	91258402	45,500	2.1	2.31	1.5	20.8	26.6	75,100		75,100	
470048	1210530	YB200.3	91258533	10,900	10,550	1.95	0.39	0.35	2.41	2.555	4.125	5,600	5,025
		YB201.0	91258534	10,400	1.8	0.33	0.34	2.7	3.94	4,450		4,450	
472528	1203915	YB210.3	91258535	23,400	24,550	28.5	0.83	0.665	128	110.3	50.15	36,400	36,450
		YB210.8	91258536	25,700	19.1	0.87	0.83	92.6	56.6	34,500		34,500	
472417	1212858	YB22.2	91258557	17,600	20,133	2.91667	0.7	0.37	21.1	12.96	15.2333	29,800	20,733
		YB220.3	91258531	15,700	3.8	0.47	0.34	6.88	15.6	13,300		13,300	
		YB222.0	91258532	27,100	2.3	0.69	0.41	10.9	10.7	19,100		19,100	
461432	1191954	YB230.3	91258439	12,400	11,700	3.885	0.85	0.185	11.4	11.6	16.2	23,500	22,750
		YB202.5	90478123	11,000	3.8	0.53	<0.2	11.8	17.8	22,000		22,000	
461727	1194425	YB240.3	91258440	15,500	14,500	5.33	0.73	0.275	17	17.15	20.5	25,300	23,150
		YB202.5	90478124	13,700	5.5	0.57	<0.2	17.3	19.2	21,000		21,000	
462522	1204526	YB250.3	91258441	19,100	16,900	3.05	0.805	0.32	15.8	15.85	18.55	26,400	24,550
		YB202.5	90478125	14,700	3.6	0.62	<0.2	15.9	18.4	22,700		22,700	
461843	1202937	YB260.3	91258442	18,800	15,450	4.895	0.89	0.33	16.7	14.3	21.3	33,100	30,350
		YB202.3	90478126	12,100	5	0.97	<0.2	12.9	21.5	27,600		27,600	
464114	1203916	YB270.3	91258443	19,200	15,500	3.365	0.635	0.365	16.4	15.55	20.1	29,900	26,900
		YB202.2	90478127	12,000	3.2	0.41	<0.2	14.7	20.3	23,900		23,900	
470433	1202247	YB280.3	91258435	22,200	25,300	0.96	1.38	0.45	12.1	16.8	18.85	37,700	44,700

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOW	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe
465846	1203919	YBRM2.5	90478118	28,400	0.97	1.4	<0.2	21.5	21.6	51,700
		YB290.3	91258436	24,300	1.4	1.245	0.64	39.6	38.45	40,200
		YBRM2.6	90478119	25,600	1.09	1.08	<0.2	37.3	26.9	43,200
465114	1201724	YB300.3	91258437	21,500	2.2	2.55	0.21	15.9	16.5	25,200
		YBRM2.6	90478120	16,000	2.96	0.97	<0.2	17.1	25.9	22,800
465112	1201624	YB310.3	91258438	14,500	1.3	1.55	0.42	11.3	13.15	27,500
		YBRM2.6	90478121	19,500	2.0	0.94	<0.2	15	20	32,500
470058	1203855	YB32.2	91258561	29,800	3.4	1.44	1.04687	18.6	21.2333	406
		YB320.3	91258434	17,400	1.6	0.92	0.2	19	15.5	21,800
		YBRM2.3	90478122	25,600	2.0	0.78	<0.2	26.1	20.7	26,900
		YB370.3RS	91258444	18,100	2.7	0.54	0.39	25.1	25.95	16,000
		YB372.2RS	91258445	19,500	2.7	0.57	0.41	25.6	9.79	16,900

ALL VALUES = MG/KG

10-17

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Ni	Zn
463937	1234636	SWRA2.5	90478080	12	537	0.119	26.8	53.1
465952	1233642	SWRA2.5	90478081	9.7	303	0.093	19.6	53.8
463110	1233352	SWRA2.5	90478082	4	930	0.055	63.2	86
464120	1225527	SWRA2.3	90478083	4	277	0.042	11.9	44.6
463337	1230623	SWRA2.3	90478084	10	633	0.061	14.2	63
465553	1240957	SWRC2.5	90478086	3.2	159	0.009	10.3	24.4
465125	1240634	SWRC2.6	90478087	2.3	149	0.01	10	27.5
463628	1240232	SWRC2.6	90478088	2.1	107	0.011	9	21.1
462502	1240317	SWRC2.5	90478089	3.1	112	0.011	8.7	24.6
462116	1240157	SWRC2.5	90478090	2.3	79	0.009	7.6	24.1
483954	1222930	SWRD2.3	90478092	5.2	229	0.021	22.3	36.7
483908	1222926	SWRD2.3	90478093	6.1	197	0.038	31.3	42.4
484152	1222929	SWRD2.6	90478094	3.8	231	0.031	19.1	45
484809	1221033	SWRD2.7	90478095	4.7	366	0.045	39.8	64
484332	1220527	SWRD2.5	90478096	12	631	0.185	91.1	116
484833	1192416	SWRJ2.7	90478107	9.9	571	0.025	24.6	77.9
483446	1192836	SWRJ3	90478108	6.4	345	0.01	7.8	39.4
480522	1194153	SWRJ2.8	90478109	6.6	256	0.004	12.3	39.6
482415	1192705	SWRJ3.2	90478110	4.8	234	0.007	17	31.4
484313	1192153	SWRJ3	90478111	4.2	233	0.013	9.5	30.7
473642	1204021	SWRL2.7	90478112	5	363	0.005	34.1	82.3
473251	1203128	SWRL2.7	90478113	9.5	430	0.015	20.8	75.4
473740	1203824	SWRL2.7	90478114	8.8	294	0.01	16.7	58.3
472924	1202000	SWRL2.7	90478115	6.4	340	0.013	12.2	41
472943	1202117	SWRL2.6	90478116	5.9	372	0.004	19.4	56.4
470608	1175445	SWRP2.8	90478128	11.7	652	0.021	16.5	49.4
465848	1174302	SWRP3	90478129	8	516	0.008	10.7	43.8
462437	1180414	SWRP3	90478130	10.4	523	0.004	14	47.1
461153	1180928	SWRP3	90478131	6.7	252	0.011	7.7	26.3
461307	1181528	SWRP3.2	90478132	5.8	279	0.004	7.1	31.5
470446	1191953	SWRR2.5	90478134	4.2	245	0.004	6.4	37.4
470053	1194611	SWRR2.7	90478135	8	378	0.004	9.2	42.2
464554	1184944	SWRR2.5	90478136	6.8	325	0.004	11.2	32.4
465250	1194216	SWRR2.5	90478137	6	268	0.004	9.7	30.3
462524	1190452	SWRR2.3	90478138	5.3	377	0.01	11.7	39.7
454159	1223043	CL10.3	91238155	6.7	904.5	0.0205	17.7	85.5
		CLRG12.2	90478102	9.9	825	0.019	20.4	82.1

ALL VALUES = MG/KG

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

DATE	LOC	SITE	NO	Pb	Mg	Mn	Mo	Ni	NO	Pb	Zn	
454014	1224057	CL20.3	91238166	5.9	5.45	857	667.5	0.021	19.2	19.3	65.2	58
		CLRG22.2	90478103	5		478	0.018	19.4			50.8	
454050	1224424	CL30.3	91238157	14	11.3	837	866.5	0.0315	25.1	22.85	123	93
		CLRG32.2	90478104	8.6		494	0.025	20.6			63	
454553	1223558	CL40.3	91238158	6.7	7.7	1010	849	0.0425	12	12.55	78.9	77.1
		CLRG42.2	90478105	8.7		686	0.042	13.3			75.3	
454742	1224135	CL60.3	91238159	12	12.5	1210	927	0.0455	14.9	16.2	95	84.5
		CLRG52.2	90478106	13		644	0.06	17.5			74	
455548	1224243	CL60.3	91238160	<2	<2	230	150	0.01375	8	7	29.7	21.4
		CL62.2	91238161	<2		70	<0.005	6			13.1	
455207	1224355	CL70.3	91238162	6	4.65	256	231.5	0.031	10.1	9.35	40.1	33.95
		CL72.2	91238163	3.3		207	0.029	8.6			27.8	
453343	1221828	CL80.3A	91238169	13	12.04385	412	420.7692	0.047931	19.5	20.26923	88	89.51538
		CL80.3B	91238170	10		344	0.029	17.5			70.1	
		CL80.3C	91238173	30		485	0.03	18.3			193	
		CL80.3D	91238175	21.1		521	0.04	20			162	
		CL80.3V	91238164	17.8		450	0.04	20.7			138	
		CL80.8V	91238166	5.8		306	0.024	17			54.1	
		CL81.4V	91258511	6.9		307	0.025	17.6			51.5	
		CL82.2A	91238170	7.7		452	0.0706	22			64.4	
		CL82.2B	91238172	8		463	0.0749	22.9			66.7	
		CL82.2C	91238174	10		414	0.07	20.9			74.8	
		CL82.2D	91238176	8.3		483	0.08	22.3			68.1	
		CL82.2V	91238167	10.5		425	0.0696	22.8			66.6	
		CL83.0V	91238168	7.47		408	0.029	22			66.4	
455053	1223856	CL90.3	91258512	14	9.8	726	809.5	0.0285	15.6	12.75	84.7	66.15
		CL92.2	91258513	5.6		293	0.019	9.9			47.6	
455036	1223958	CL100.3	91238177	8	7.3	1180	926.5	0.035	10.6	12.5	67.4	59.45
		CL102.2	91238178	6.6		673	0.04	14.6			71.5	
454614	1223507	CL110.3	91238179	10.4	9.185	1100	829.6567	0.03	17.2	16.26667	82.4	67.86667
		CL112.2	91238180	7.97		592	0.02	16.5			64	
		CL312.2.3SS	91258446	3.6		827	0.026	15.1			57.2	
454745	1223805	CL120.3	91238181	14	12.23333	1688	1836	0.026667	16.5	14.3	80.1	76.4

ALL VALUES = MG/KG

10-19

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Ni	Zn
		CL120.08V	91238193	13	2610	0.02	10.4	82.2
		CL122.2	91238192	9.7	1210	0.02	16	66.9
454717	1223827	CL130.3	91238183	9.5	365	0.03	7.9	55.3
		CL132.2	91238184	7.8	1250	0.01	16.1	73.3
453623	1222654	CL140.3	91238185	54	536	0.04	12.4	74.9
		CL280.3SS	91238209	24.8	529	0.005	13.4	78.1
		CL142.2	91238186	10	912	0.02	15.5	67
454222	1223140	CL150.3	91238187	10.4	434	0.03	21	67.1
		CL282.2SS	91238210	8.1	420	0.04	14.3	63.9
		CL152.2	91238188	7.7	540	0.03	12.6	63.5
454503	1223605	CL160.3	91238189	6.8	1030	0.05	13	58.2
		CL162.2	91238190	4.2	1190	0.03	14.1	55.5
454552	1224208	CL170.3	91238191	16.3	2140	0.03	117	102
		CL172.2	91238192	11.1	911	0.01	16.5	87.5
453449	1221647	CL180.3	91258504	13.9	1770	0.039	17.6	92.1
		CL182.2	91258505	11	1370	0.027	19	89
		CL292.2SS	91258510	7.3	1310	0.027	19.9	86.9
454854	1223018	CL190.08V	91238193	13	2610	0.02	10.4	82.2
		CL190.3	91238197	14.2	1100	0.02	15.6	79.1
		CL190.3V	91238194	14.1	1870	0.03	12	78
		CL191.0V	91238212	9.2	1850	0.035	13.4	70.4
		CL191.8V	91238195	7.6	4060	0.01	14.3	69.7
		CL192.2	91238198	9.6	616	0.005	20.4	58.8
		CL192.2V	91238196	7.7	1620	0.02	14.2	61.5
454442	1224133	CL200.3A	91238211	11	1610	0.025	16.3	90.1
		CL200.3B	91258514	12	1430	0.033	16.5	98.1
		CL200.3C	91238201	11	1670	0.03	15.7	89.7
		CL200.3D	91238203	10	1730	0.02	16.6	84.5
		CL200.3V	91258500	14.5	1430	0.033	15.6	83.3
		CL200.8V	91258501	12.7	1330	0.024	16	89
		CL201.8A	91258518	9.2	1240	0.028	16.3	83.8
		CL201.8B	91258515	8.1	1300	0.016	14.1	88.9
		CL201.8C	91238202	11	1040	0.02	17.4	83.5
		CL201.8D	91258517	10	743	0.025	16.7	87.4
		CL201.8V	91258502	6.27	387	0.028	9.9	46.3
		CL203.0V	91258503	16	804	0.034	22.4	91.3

ALL VALUES = MG/KG

10-20

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Cd	Ni	Cu	Zn
		CL205.1V	91238199	12.4	784	0.02		21.5		85
455307	1223815	CL210.3	91238204	16	1640	0.02	0.0285	15	18.9	79.9
		CL212.2	91238205	14	639	0.03		18.2		60.1
453968	1223100	CL220.3	91268506	19	1160	0.033	0.0266	20.8	17.975	92.1
		CL222.2	91268507	15	870	0.031		21.6		84.6
453748	1223115	CL230.3	91268508	18	963	0.029	0.0192	13.8	14.75	100
		CL232.2	91268509	7.8	942	0.0094		15.7		85
454215	1223453	CL240.3		9.6	986	0.037	0.0206	19	18.5	98.6
		CL300.3SS	91268447	8.8	1100	0.03		17		98.8
		CL242.2	91238206	8.9	1040	0.004		19.5		95.7
454200	1223313	CL250.3	91238207	7.8	989	0.02	0.0125	17.6	19	96.4
		CL252.2	91238208	7.1	816	0.005		20.4		88
453654	1222824	CL260.3	91268516	8.7	928	0.029	0.022	17.7	17.4	100
		CL262.2	91268519	4.7	974	0.015		17.1		94.6
		CL270.3RS	91268520	4.7	268	0.046	0.0465	26.1	13.0735	29.1
		CL272.2RS	91268521	3.6	247	0.047		0.047		30
472129	1220717	PSL1A0.5	87278100	29	846	0.06	0.06	22	22	56
472256	1220642	PSL2A0.5	87278101	<4	163	0.047	0.047	22	22	31
472317	1220642	PSL3A0.1	87278104	<4	420	0.027	0.0292	25	23	38
		PSL3A0.5	87278105	<4	373	0.036		21		40
		PSL5AO.5DUP	87278102	<4	412	0.035		21		42
		PSL3A1.0	87278106	<4	163	0.036		27		33
		PSL3A4.0	87278107	<4	184	0.012		22		26
472407	1220657	PSL4A0.5	87278108	<4	299	0.042	0.042	18	18	29
472410	1220657	PSL4B0.5	87278109	<4	239	0.052	0.033	20	22	27
		PSL6A0.5	87278111	<4	231	0.02		25		31
		PSB8AO.5DUP	87278147	<4	216	0.027		22		28
472220	1220800	PSB1A0.5	87278112	<4	763	0.052	0.052	34	34	68
472308	1221004	PSB2A0.5	87278113	<4	494	0.058	0.052	23	23	39
		PSB6AO.5DUP	87278145	<4	255	0.046		23		39

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Cd	Cu	Zn				
472404	1220945	PSB3A0.1	87278114	<5	2.125	916	499	0.058	0.0446	24	27	71	43
		PSB3A1.0	87278118	<4		595		0.042		28		41	
		PSB3A3.0	87278123	<4		161		0.051		25		26	
		PSB3A5.0	87278124	<4		324		0.027		29		32	
472405	1220943	PSB3B0.1	87278128	<4	<4	562	302	0.052	0.02775	17	22	42	33
		PSB3B1.0	87278129	<4		291		0.028		28		41	
		PSB3B2.0	87278130	<4		138		0.012		21		23	
		PSB3B4.0	87278131	<4		218		0.019		22		26	
472406	1220941	PSB3C0.1	87278132	15	6.25	1,310	474	0.058	0.03325	16	23	54	33
		PSB3C2.0	87278133	<4		232		0.035		24		29	
		PSB3C4.0	87278134	<4		141		0.02		24		26	
		PSB3C5.0	87278135	<4		212		0.02		27		24	
472405	1220942	PSB3D1.0	87278136	<4	<4	321	321	0.028	0.028	24	24	34	34
472404	1220944	PSB3E1.0	87278139	<4	<4	738	738	0.058	0.058	25	25	38	38
472508	1220914	PSB4A0.1	87278140	<4	<4	143	141	0.043	0.0356	17	17	33	29
		PSB4A0.5	87278141	<4		164		0.043		17		33	
		PSB4A2.0	87278142	<4		137		0.04		19		27	
		PSB7A2.0DUP	87278146	<4		122		0.041		16		26	
		PSB4A4.0	87278143	<4		141		0.011		16		24	
472653	1221116	PSB5A0.5	87278144	<4	<4	90	90	0.012	0.012	9	9	12	12
472143	1220734	PSSD1A	87278148	<4	<4	2,750	2,750	0.076	0.076	16	16	99	99
472129	1220742	PSSD1B	87278149	397	207.5	367	818.5	0.037	0.036	22	21.5	101	82
		PSSD1C	87278150	18		1,270		0.035		21		63	
472131	1220726	PSSD2A	87278151	<4	<4	721	607	0.035	0.027	23	23	96	90.5
		PSSD2B	87278152	<4		493		0.019		23		85	
472112	1220742	PSSD3A	87278153	<4	<4	1,090	2,170	0.023	0.0475	25	25	57	71
		PSSD3B	87278154	<4		3,250		0.072		25		85	
483845	1225008	PS10.3	93088519	16	10.26	1210	951.5	0.0726	0.04974	29.8	36.85	59.6	54.6
		PS300.3DUP	93088637	13		1090		0.0671		25.3		54.6	
		PS12.2	93088620	5.8		819		0.046		30		43.6	
		PS302.2DUP	93088638	5.5		972		0.04		22.8		40.5	

ALL VALUES = MG/KG

10-22

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

DATE	LOC	SITE	NO	Pb	Mn	Co	Ni	Cu	Zn
483356	1225604	PS156	93088521	11	667	0.023	76.4	18.7	74.7
		PS20.3	93088522	6.5	6033333	0.039	21.3	17.5	65.1
		PS270.3DUP	93088523	6.3	637	0.029	17.5	22.7	65.4
		PS22.2	93088523	6.3	459	0.019	22.7	13.3	44.7
		PS272.2DUP	93088524	4.2	342	0.016	13.3	25.9	35.1
485910	1223507	PS30.3	93088524	10	538	0.043	25.9	28.5	82.5
		PS32.2	93088525	5.2	298	0.043	28.5	19.6	59.4
		PS355	93088526	5.4	693	0.026	19.6	53.7	59.6
481630	1214308	PS40.3V	93088527	18	663	0.0712	53.7	64.68571	109
		PS320.3SS	93088541	16	596	0.0665	48.4	51.8	100
		PS41.0V	93088528	12	854	0.0571	51.8	62.5	110
		PS42.2V	93088529	20	484	0.195	62.5	58.9	83.3
		PS43.0V	93088530	9.4	520	0.143	58.9	62.3	94.5
		PS44.9V	93088531	13	513	0.109	62.3	51.8	116
		PS40.3A	93088532	61.3	819	0.044	51.8	64.1	227
		PS40.3B	93088533	16	660	0.0986	64.1	48.1	104
		PS40.3C	93088534	182	673	0.0928	48.1	39.9	173
		PS40.3D	93088535	14	934	0.0521	39.9	59.6	105
		PS42.2A	93088536	12	506	0.114	59.6	59.1	96.7
		PS42.2B	93088537	14	611	0.106	59.1	53.8	108
		PS42.2C	93088538	14	793	0.0829	53.8	61.6	103
		PS42.2D	93088539	11	623	0.0895	61.6	24.1	106
480938	1224043	PS50.3	93088540	6.7	804	0.036	24.1	25.8	63.2
		PS51.5	93088541	5.1	311	0.021	27.5	17.06667	45.1
480239	1231923	PS60.3	93088542	6.7	471	0.044	14	17.5	32.5
		PS62.2	93088543	3.8	314	0.027	17.5	19.7	35.4
		PS655	93088544	4.9	898	0.019	19.7	18.17143	39.5
471643	1220203	PS70.3V	93088545	14	422	0.0616	22.3	14.3	56.6
		PS71.4V	93088546	5.3	485	0.0506	14.3	17.6	56
		PS72.2V	93088547	3.2	319	0.021	17.6	14	32.1
		PS73.0V	93088548	4.3	429	0.0623	14	14.8	58.3
		PS73.8V	93088549	7.3	438	0.0632	14.8	19.4	57.3
		PS70.3A	93088550	9.1	366	0.0691	19.4	16.4	45.6
		PS70.3B	93088551	9	379	0.0665	16.4	17.5	43.1
		PS70.3C	93088552	8.2	315	0.0591	17.5	16.8	42.6
		PS310.3SS	93088539	9.9	316	0.044	16.8	18.3	44.5
		PS70.3D	93088553	6.4	251	0.032	18.3	22.8	36.5
		PS72.2A	93088554	3.4	262	0.026	22.8	350.5714	36.4

ALL VALUES = MG/KG

10-23

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Ni	Cd	Zn
475035	1214917	PS72.2B	93088555	3.2	247	0.027	19.3		36.2
		PS72.2C	93088556	4.6	353	0.032	21.4		40.6
		PS72.2D	93088557	3.4	326	0.034	19.5		37.2
		PS80.3	93088558	23	493	0.107	29.3	34.95	41.2
		PS82.2	93088559	9.4	558	0.0809	40.6		52.4
474226	1225456	PS90.3	93088560	12	1720	0.0569	32.1	36.3	90.8
		PS91	93088561	7.8	863	0.0528	40.5		88
475420	1225412	PS100.3	93088562	11	276	0.0555	21.6	21.5	33.4
		PS102.2	93088563	5.4	277	0.036	21.4		31.2
471843	1223157	PS110.3V	93088564	19	510	0.043	24.8	25.24615	65.9
		PS111.4V	93088565	6.7	267	0.042	28.4		45.4
		PS112.2V	93088566	5.5	193	0.04	30.2		35.8
		PS113.0V	93088567	7.9	289	0.0816	33.6		39.6
		PS114.0V	93088568	11	462	0.0562	25.5		28.3
		PS110.3A	93088569	94.1	908	0.215	12.6		52.1
		PS110.3B	93088570	19	321	0.072	27.7		44.6
		PS110.3C	93088571	66.3	428	0.198	20.3		62.9
		PS110.3D	93088572	29.9	585	0.0562	23.2		56.6
		PS112.2A	93088573	6	153	0.05	24.7		29.7
		PS112.2B	93088574	5.8	312	0.027	23.6		28.8
		PS112.2C	93088575	9.6	348	0.083	27.9		47.2
		PS112.2D	93088576	5.4	207	0.041	25.7		34.5
472827	1224307	PS120.3	93088577	8.5	241	0.0541	20.9	24.53333	24.2
		PS122.2	93088578	4.6	172	0.049	27.2		26.6
		PS292.2SS	93088636	2.6	138	0.032	25.8		22.5
471723	1232215	PS130.3	93088579	3.9	2020	0.0717	55.2	57.45	135
		PS132.2	93088580	4.6	1320	0.041	59.7		130
472232	1225818	PS140.3	93088581	7.6	1210	0.045	23.5	25.23333	55.1
		PS141.5	93088582	3.7	303	0.037	29.9		39.9
		PS1455	93088583	2.9	262	0.0086	22.3		34
465504	1225420	PS150.3V	93088584	5.7	603	0.02	22.8	21.52857	47
		PS151.2V	93088585	2.9	425	0.022	22.5		42.8
		PS152.2V	93088586	2.7	302	0.025	22		39.3
		PS153.0V	93088587	2.7	210	0.0086	21.5		37.7
		PS154.3V	93088588	3.9	227	0.0093	19.2		36.2
		PS312.2SS	93088640	2.9	249	0.016	21.2		35.4

ALL VALUES = MG/KG

10-24

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb	Mg	Hg	Mn	Zn
480812	1221853	PS160.3A	93088589	4.9	312	0.032	21.3	40.1
		PS160.3B	93088590	6.9	764	0.025	21	47.2
		PS160.3C	93088591	6.5	799	0.027	21.7	47.3
		PS160.3D	93088592	6.2	348	0.027	20.8	41
		PS162.2A	93088593	3.6	183	0.022	20.5	37.2
		PS162.2B	93088594	3.8	230	0.024	21.4	36.6
		PS162.2C	93088595	3.1	232	0.02	23	38.2
		PS162.2D	93088596	3.7	257	0.027	23.9	42.6
		PS160.3	93088597	22.5	405	0.064	21.7	51.1
		PS161.2	93088598	4.5	208	0.028	38.1	39.2
471307	1222000	PS170.3	93088599	12	250	0.0623	11.6	46.5
		PS172.2	93088600	3.8	182	0.023	9.7	26.1
471055	1241132	PS180.3	93088601	20.2	233	0.0799	7	32.9
		PS182.2	93088602	9.1	274	0.108	11.2	37.6
		PS282.2SS	93088634	7.1	287	0.045	14.8	54.3
		PS1855	93088603	7.5	217	0.03	15.2	49.8
474667	1241729	PS190.3	93088604	5.9	134	0.0919	6.1	30.1
		PS192.2	93088605	6.9	300	0.045	15.8	56.4
		PS1955	93088606	5.5	500	0.024	12.7	54.1
473919	1222451	PS200.3V	93088607	19	516	0.0541	25.7	36.2
		PS200.8V	93088608	5.1	264	0.031	27.3	28.9
		PS202.2V	93088609	<2	129	0.028	20.6	19.9
		PS203.0V	93088610	<2	193	0.023	27.5	22.9
		PS204.5V	93088611	2.7	244	0.032	27.3	25.2
		PS200.3A	93088612	46.1	621	0.28	27.2	48.6
		PS290.3SS	93088635	42.4	519	0.231	27.4	48.1
		PS200.3B	93088613	37.8	330	0.101	31.6	45.3
		PS200.3C	93088614	21.9	341	0.0674	27.3	40.6
		PS200.3D	93088615	11	228	0.033	29	32.4
		PS202.2A	93088616	3.3	149	0.028	29.7	24.9
		PS280.3SS	93088633	4.9	252	0.029	22.9	38.7
		PS202.2B	93088617	2.9	148	0.023	28.6	24.4
		PS202.2C	93088618	3.1	147	0.022	30.7	25.1
		PS202.2D	93088619	3.7	184	0.02	26.2	24.3
470353	1221824	PS210.3	93088620	10	1020	0.0869	12.6	36.9
		PSWRF2.7	90478097	10	339	0.065	25.6	46.5
465501	1223333	PS220.3	93088621	3.8	697	0.023	11.9	54.2
								58.45

ALL VALUES = MG/KG

10-25

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

BAT	LO#	SITE	NO	PB	MG	HG	NI	ZN
465728	1223904	PSWRF2.5	90478098	5.4	783	0.03	31.5	62.7
475451	1221040	PS240.3	93088623	13	784	0.0595	32.8	72.2
482413	1221025	PS260.3	93088624	4	245	0.028	131	38.8
464743	1221631	PSLB10.3	93088625	31.5	364	0.0665	9.8	67.3
472742	1221326	PSLB20.3	93088627	4.4	772	0.049	43.5	72.6
460223	1184019	PS260.3RS	93088629	5.9	420	0.0065	11.4	47.6
472457	1184356	SB10.3	92268500	8	364	0.017	7.3	47.3
473910	1180946	SB20.3	92268502	15	443	0.014333	8.4	54.6
475026	1175046	SB30.3	92268504	11	515	0.013	7.6	51.9
470819	1174318	SB40.3	92268507	8.2	418	0.018	12.3	41.2
474232	1173037	SB50.3	92268509	9.1	586	0.035	8	70.6
480033	1172325	SB60.3	92268511	9.6	730	0.012	11.1	58.5
		SB290.3SS	92268570	10	1170	0.012	11.8	66.3
		SB62.2	92268512	8.8	242	0.009	10	38.6
		SB6SS	92268513	6.6	169	0.016	6.6	21.8

ALL VALUES = MG/KG

10-26

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

DATE	LOC	SITE	NO	Pb	Mg	Mn	Hg	NI	CU	Zn			
481824	1173603	SB70.3	92268514	10	8.666667	847	557.3333	0.022	0.012667	9.8	8.1	70.7	51.8
		SB71.8	92268515	12		597		0.0067	10.2			81.9	
		SB75S	92268516	4		228		0.0093	4.3			32.8	
476949	1181738	SB80.3	92268517	17	15.666667	488	446	0.013	0.0105	9.1	10.033333	56.1	52.666667
		SB310.3SS	92268572	18		452		0.011	10.2			57	
		SB82.2	92268518	12		398		0.0075	10.8			44.6	
485517	1173112	SB90.3	92268519	15	12.833333	434	394.3333	0.025	0.0168	18.1	16.7	56.3	70.8
		SB91.4	92268520	14		535		0.018	20			58	
		SB95BD	92268521	9.5		214		0.0074	12			98.1	
480433	1171952	SB100.3	92268522	17	16	858	655	0.021	0.0185	11.6	11.8	78.4	71
		SB102.2	92268523	15		452		0.016	12			63.6	
474434	1175413	SB110.3	92268524	15	13.5	514	551.25	0.015	0.014625	13.5	12.55	64.4	51.325
		SB111.3	92268525	12		777		0.0085	13.2			60	
		SB350.3SS	92268576	15		456		0.024	12.7			59.4	
		SB115BD	92268526	12		498		0.011	10.8			61.6	
474018	1174407	SB120.3	92268527	11	10.5	514	505	0.014	0.0215	14	15.4	43.8	43.2
		SB122.2	92268528	10		496		0.029	18.8			42.6	
471929	1170403	SB130.3	92268529	10	10.875	550	794.75	0.018	0.01625	16	15.775	51.8	47.575
		SB300.3SS	92268571	12		656		0.017	15.4			51.9	
		SB132.2	92268530	13		1030		0.02	19.9			48	
		SB135BD	92268531	8.5		823		0.01	11.8			38.6	
472534	1171355	SB140.3	92268532	10	9.05	469	390.875	0.027	0.014063	12.6	10.35125	45.3	42.4875
		SB142.2	92268533	9.4		481		0.017	12.2			50.3	
		SB140.3V	92268534	9.3		445		0.019	11.7			46	
		SB140.8V	92268535	10		411		0.013	10.8			46.2	
		SB142.2V	92268536	8.3		381		0.01	10.3			37.8	
		SB280.3SS	92268569	11		397		<0.005	11.2			43.6	
		SB143.7V	92268537	7.4		305		0.013	9.61			36.7	
		SB145.0V	92268538	7		238		0.011	8.4			34	
470433	1171952	SB150.3	92268539	12	10.8	614	638.5	0.017	0.014	12	12.05	51.2	44.3
		SB152.2	92268540	9.6		663		0.011	12.1			37.4	
472343	1172004	SB160.3	92268541	9.3	10.55	498	599	0.014	0.01195	17.5	18.6	47.4	46.15
		SB162.2	92268542	12		700		0.0099	19.7			48.9	

ALL VALUES = MG/KG

10-27

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

EAT	LO#	SITE	NO	PB	MG	NI	NI	NI	NI	ZN	ZN
474257	1174500	SB170.3	92268543	16	477	476	0.0096	0.008	11.2	12.35	61.5
		SB172.2	92268544	14	473		0.0064		13.5		60.6
474346	1170832	SB180.3	92268545	11	601	481	0.019	0.01075	10.4	9.75	62.2
		SB182.2	92268546	12	321		<0.005		9.1		49.1
475233	1173614	SB190.3V	92268547	14	464	417.4286	0.017	0.006164	10.5	10.36643	54.2
		SB191.2V	92268548	14	354		<0.005		10		51.1
		SB192.2V	92268549	15	330		<0.005		10.7		43.9
		SB193.6V	92268550	23.9	349		<0.005		12.2		41.3
		SB194.4V	92268551	17	371		<0.005		11.6		45.8
		SB190.3A	92268552	14	563		<0.005		10.6		66.2
		SB192.2A	92268553	14	490		0.0069		12		61.7
		SB190.3B	92268554	15	508		0.0096		10.3		53.8
		SB192.2B	92268555	13	276		<0.005		8.73		35.2
		SB190.3C	92268556	16	483		0.0058		10.2		54
		SB192.2C	92268557	17	424		0.0147		12.5		50.8
		SB190.3D	92268558	14	501		<0.005		8.3		49.8
		SB192.2D	92268559	14	299		0.0053		8.9		38.5
		SB19.SS	92268560	20	432		0.0095		8.6		66.2
474232	1171937	SB200.3	92268561	9.9	600	611	0.256	0.1312	6.2	4.9	68.4
		SB202.2	92268562	6.8	622		0.0064		4.6		76.9
473743	1171000	SB210.3	92268563	12	518	454	<0.005	0.00425	9.3	9.8	58.2
		SBRU2.3	90478140	13.6	390		0.006		10.3		49.6
474313	1173053	SB220.3	92268564	13	652	565	0.012	0.012	10.3	12.45	53.9
		SBRU2.5	90478141	12	428		0.012		14.6		46.8
475037	1176147	SB230.3	92268565	11	441	445.5	0.0087	0.00635	8.9	11.4	40.3
		SBRU2.8	90478142	11	450		0.004		13.9		48.2
475002	1175805	SB240.3	92268566	10	382	376.5	<0.005	0.00475	8.8	9.85	43.5
		SBRU2.6	90478143	11.2	371		0.007		10.6		44.6
475232	1180911	SB250.3	92268567	8.5	365	354.5	0.0053	0.00666	9.1	10.15	41.1
		SBRU2.6	90478144	10.5	344		0.006		11.2		42.9
475453	1172838	SB380.3	92268577	12	496	374	0.0083	0.0054	10.4	9.85	62
		SB382.2	92268578	9.3	252		<0.005		9.3		44.7
475349	1171054	SB390.3	92268579	8.6	1140	769.5	0.0079	0.0065	5.4	4.5	34.7

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

DATE	LOC	SITE	NO	Pb	Mn	Hg	Ni	Zn
		SB391.5	92268580	7	399	0.0051	3.8	24.7
463437	1205022	YB10.3	91258554	4.5	761	0.017	9.8	60.6
463222	1202650	YB20.3	91258556	6.2	510	0.014	19.3	53.6
463153	1203223	YB30.3	91258558	5.9	613	0.011	14.8	55.9
462623	1195663	YB40.3	91258559	7.3	552	0.015	17.6	54.6
		YB42.2	91258560	6.7	435	0.02	20.6	50.8
461355	1192417	YB50.3A	91258566	6.8	461	0.014	13.5	51.9
		YB50.3B	91258568	4.4	437	0.011	11.9	45.4
		YB50.3C	91258537	11	469	0.026	15.1	56.8
		YB50.3D	91258539	9.7	505	0.019	14.2	58.9
		YB50.3V	91258574	11	465	0.018	12.5	55
		YB340.3SS	91258582	11	470	0.017	14.5	55.8
		YB50.7V	91258575	9.5	525	0.014	14.1	58.9
		YB51.3V	91258576	12	477	0.016	18	62.7
		YB52.2A	91258567	9.3	546	0.02	15.1	65.4
		YB52.2B	91258564	5.5	435	0.012	13.9	51.3
		YB52.2C	91258538	9.2	518	0.016	15.4	65.5
		YB52.2D	91258540	9.8	505	0.021	16.3	63.3
		YB52.2V	91258577	13	484	0.025	16.6	60.4
		YB53.2V	91258565	13	535	0.019	18.2	67.2
461445	1200151	YB60.3	91258562	8	875	0.028	38.6	77.43333
		YB332.2SS	91258569	7.2	876	0.027	37.9	79.3
		YB62.2	91258563	4.1	769	0.036	46.6	79.7
460709	1204921	YB70.3	91258421	5.15	1460	0.029	11.4	92.5
		YB72.2	91258422	2.6	1290	0.017	16.7	88.9
460959	1203706	YB80.3	91258423	4.6	681	0.022	14	60.7
		YB362.2	91258429	3.1	638	0.021	12.5	56.6
		YB81.8	91258424	4.5	694	0.042	21.7	67
461920	1202619	YB90.3A	91258571	3.7	250	0.023	12.5	52.4
		YB90.3B	91258573	<2	514	0.019	10.7	47.3
		YB90.3C	91258578	<2	1350	0.016	13.4	51.3
		YB342.2SS	91258583	2.1	1160	0.022	11.8	50.4
		YB90.3D	91258581	2.4	475	0.014	11.8	53.8
		YB90.3V	91258417	2.7	412	0.019	9.2	44.3
		YB90.7V	91258418	<2	392	0.014	4.9	28

ALL VALUES = MG/KG

10-29

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Cd	Hg	Ni	Zn
		YB92.2A	91258572	2.3	566	0.019	18	53.8
		YB92.2B	91258580	<2	354	0.0068	9.45	32.8
		YB92.2C	91258579	2.6	729	0.011	14.2	48.2
		YB92.2D	91258541	<2	501	0.016	10.1	43.3
		YB92.2V	91258419	2.3	507	0.02	12.3	42.8
		YB93.5V	91258420	<2	756	0.031	24.3	62
		YB96.0V	91258570	6.3	971	0.035	22.9	68.7
462827	1202727	YB100.3	91258542	8.3	701	0.02	17	61.8
		YB102.2	91258543	3.9	716	0.035	19.6	58.8
464415	1203715	YB110.3	91258544	5.1	501	0.012	8.7	43.9
		YB360.3SS	91258412	3.3	397	0.046	10.8	39.3
		YB112.2	91258411	19	385	0.0638	11.4	39.9
471215	1205848	YB12.2	91258555	<2	607	0.0085	11.3	62.4
		YB120.3A	91258430	6.5	543	0.018	76.3	44.7
		YB120.3B	91258432	8.7	593	0.016	60.3	43.4
		YB120.3C	91258413	6.9	668	0.016	59.8	44.8
		YB120.3D	91258415	7.3	660	0.016	59.6	48.2
		YB120.3V	91258425	2.6	936	0.022	57.5	48.4
		YB120.7V	91258426	<2	583	0.032	67.6	47
		YB121.0V	91258427	2.3	514	0.032	70.2	50.9
		YB122.2A	91258431	7.3	434	0.017	133	49.1
		YB122.2B	91258433	7.4	385	0.014	72.1	44.1
		YB122.2C	91258414	7.4	433	0.017	140	52.3
		YB122.2D	91258416	8.2	466	0.17	74.1	51.3
		YB122.2V	91258428	3.8	555	0.026	80.8	51.9
		YB123.2V	91258526	5.2	525	0.023	183	57.6
471015	1205856	YB130.3	91258404	5.1	1250	0.022	35.1	113
		YB350.3SS	91258408	7.9	1540	0.17	34.7	115
		YB132.2	91258405	6.5	567	0.054	44.2	76.3
470505	1202520	YB140.2	91258524	7.6	809	0.014	14.2	65.5
		YB140.2V	91258545	5.5	1610	0.014	16.1	64.6
		YB140.6V	91258546	4.5	1600	0.015	14.7	61.8
		YB330.3SS	91258551	4	2000	0.013	16.4	61.4
		YB141.0	91258523	5.1	1050	0.018	16.4	59.1
		YB141.0V	91258547	4.5	2110	0.0088	19.3	66.2
		YB141.7V	91258548	3.4	1740	0.0088	16.5	66.3
		YB142.5V	91258525	4.3	1450	0.0068	15.2	58.4
465850	1204027	YB150.3	91258549	8.2	725	0.015	14.8	49.3
			7.05	741.5	0.016	15.5	51.35	

ALL VALUES = MG/KG

10-30

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

DATE	LOC	SITE	NO	Pb	Mg	Mn	Cu	Zn
471047	1204419	YB151.6	91258550	5.9	758	0.017	16.2	53.4
		YB160.3	91258406	4.9	7.168667	0.016	23.3	44.3
		YB352.2SS	91258409	8.3	554	0.018	22.3	44.3
		YB162.2	91258407	8.3	604	0.018	26.4	43.6
471407	1204807	YB170.3	91258552	5.4	5.3	0.016	40.4	43.76
		YB172.1	91258553	5.2	615	0.048	56.1	43.1
463713	1211038	YB180.3	91258528	5.1	5.4	0.021	15.8	61.7
		YB182.2	91258527	5.7	576	0.027	18.8	47.8
462441	1205344	YB190.3	91258403	6.9	6.728571	0.018	11.8	94.17143
		YB190.3V	91258529	6.1	1250	0.014	12.1	112
		YB190.7V	91258530	5.7	1020	0.014	12	95.4
		YB191.2V	91258400	6.3	1110	0.015	13.6	87.1
		YB192.2	91258410	9.4	998	0.016	11.5	76.3
		YB192.2V	91258401	7.1	1350	0.015	15.3	85.6
		YB194.0V	91258402	5.6	1500	0.021	12.4	91.8
470048	1210530	YB200.3	91258533	7	5.65	0.015	2.6	54.7
		YB201.0	91258534	6.3	67.9	0.016	1.7	36.7
472528	1203915	YB210.3	91258535	21.2	17.1	0.118	187	78.85
		YB210.8	91258536	13	710	0.115	139	73.7
472417	1212858	YB22.2	91258557	5.4	575	0.026	28.4	39.26667
		YB220.3	91258531	31.8	286	0.0708	5.5	26.7
		YB222.0	91258532	8.4	292	0.0562	9.7	36.5
461432	1191954	YB230.3	91258439	6.6	396	0.0085	13	45.6
		YBRO2.5	90478123	8.2	389	0.006	12.8	41.5
461727	1194425	YB240.3	91258440	7.8	432	0.022	18.3	44.7
		YBRO2.5	90478124	8.7	361	0.019	16.5	40.5
462522	1204526	YB250.3	91258441	8	524	0.011	15.7	45.55
		YBRO2.5	90478125	8.2	465	0.031	17	40.5
461843	1202937	YB260.3	91258442	8.5	561	0.016	17.8	53.05
		YBRO2.3	90478126	10.9	480	0.037	18.9	47.4
464114	1203916	YB270.3	91258443	5.1	411	0.0877	15	58.4
		YBRO2.2	90478127	7	361	0.061	15.7	42.4

ALL VALUES = MG/KG

10-31

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb	Mn	Hg	Ni	Cd	Zn	Pb
470433	1202247	YB280.3 YBRM2.5	91258435 90478118	5.2 9.4	696 485	0.012 0.01	0.011 9.7	8.56 70.5	65.7 75.2	88.1
465846	1203919	YB290.3 YBRM2.6	91258436 90478119	6.5 9.2	680 680	0.01 0.01	28 29.9	28.95 40.95	69.7 80.7	75.2
465114	1201724	YB300.3 YBRM2.6	91258437 90478120	6.1 6.6	619 463	0.019 0.05	15.3 26.6	20.95 37	44.7 37	40.95
465112	1201624	YB310.3 YBRM2.6	91258438 90478121	5.2 7.9	618 814	0.011 0.01	9.6 11.8	10.7 45.2	48 45.2	46.6
470058	1203856	YB32.2 YB320.3 YBRM2.3	91258561 91258434 90478122	3.7 4.9 6.8	625 631 486	0.038 0.019 0.05	0.035567 14.8 27.6	22.13333 41 38.8	61.9 41 38.8	47.23333
		YB370.3RS YB372.2RS	91258444 91258445	4 4	265 273	0.048 0.051	26 26.6	26.3 30.9	30 30.9	30.45

ALL VALUES = MG/KG

10-32

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

XI. MTCASat CALCULATIONS & SUMMARY STATISTICS

Calculation of Background Values

This Section contains all of the MTCASat (MTCASat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) calculations for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. For more information on how to calculate the 90th percentile, consult the "Statistical Guidance for Site Managers" (August, 1992). A summary of all MTCASat statistical calculations is presented in **Table 17**. The statistical distribution maps were prepared using the Statgraphics program.

ALL VALUES = MG/KG

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
AI									
MAX	56,550.00	84,900.00	54,550.00	84,900.00	84,900.00	56,550.00	56,550.00	25,850.00	29,000.00
90th	62,905.00	12,581.00	52,275.00	55,735.00	37,205.00	26,299.00	33,379.00	21,375.00	25,591.00
Coeff. Var.	1.20	0.47	0.39	0.63	0.55	0.42	0.38	0.26	0.53
MEAN	25,392.70	20,354.00	34,355.00	25,460.15	21,956.00	18,190.00	22,263.40	15,842.10	15,003.00
MEDIAN	21,700.00	17,900.00	31,192.00	21,760.00	21,956.00	16,600.00	20,800.00	15,000.00	14,800.00
50th	18,748.95	18,376.60	32,446.90	21,899.36	19,277.97	67,234.76	20,892.90	15,380.90	13,525.60
4 X 50th	74,995.80	73,506.40	129,787.60	87,597.44	77,111.88	268,939.04	83,571.60	61,523.60	54,102.40
MIN	5,670.00	7,390.00	13,750.00	5,670.00	5,670.00	6,140.00	10,650.00	8,933.00	6,140.00
As - GFAA ANALYSIS									
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19
90th	8.47	7.30	5.61	6.37	6.99	7.61	5.13	6.34	5.76
Coeff. Var.	N/A	0.7	0.47	0.58	0.7	0.82	N/A	0.65	0.91
MEAN	3.49	3.96	3.56	3.71	3.82	3.9	3.73	5.02	2.7
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53
50th	2.80	3.24	3.26	3.19	3.10	3.03	2.64	4.39	2.14
4 X 50th	11.20	12.96	13.04	12.76	12.40	12.12	10.56	17.56	8.56
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5
Be									
MAX	0.89	0.88	2.16	2.16	2.79	2.79	2.79	0.89	0.88
90th	0.75	0.61	2.07	1.51	1.44	1.27	1.57	0.84	0.61
Coeff. Var.	0.73	0.44	0.35	1.03	0.78	0.50	0.39	0.22	0.45
MEAN	0.39	0.41	1.43	0.75	0.76	0.77	1.03	0.65	0.38
MEDIAN	0.40	0.36	1.48	0.53	0.67	0.72	0.93	0.66	0.31
50th	0.39	0.35	1.43	0.51	0.59	0.70	0.97	0.64	0.35
4 X 50th	1.56	1.40	5.72	2.04	2.36	2.80	3.88	2.56	1.40
MIN	0.10	0.19	0.30	0.10	0.10	0.21	0.39	0.38	0.23
Cd									
MAX	N/A	5.00	1.32	5.00	5.00	1.32	1.32	0.69	N/A
90th	0.10	0.77	0.93	1.26	0.99	0.61	0.93	0.72	N/A
Coeff. Var.	N/A	N/A	0.54	N/A	1.09	0.88	0.54	0.58	N/A
MEAN	N/A	0.80	0.55	0.83	0.63	0.48	0.55	0.40	N/A
MEDIAN	N/A	0.40	0.49	0.83	0.49	0.48	0.49	0.40	N/A
50th	0.10	0.37	0.49	0.40	0.32	0.30	0.49	0.36	N/A
4 X 50th	0.40	1.48	1.96	1.60	1.28	1.20	1.96	1.44	N/A
MIN	N/A	0.10	0.16	0.10	0.10	0.13	0.16	0.13	N/A

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

Cr	GROUP "W" PUGET SOUND		CLARK COUNTY		WEST (ALL)		STATEWIDE		EAST (ALL)		YAKIMA BASIN		SPOKANE BASIN		GROUP "E"		
	MAX	90th	163.00	76.46	235.00	48.15	28.83	26.57	235.00	41.85	110.30	31.88	110.30	36.27	20.25	17.81	71.30
Coeff. Var.	0.95	N/A	N/A	N/A	N/A	N/A	N/A	0.70	0.66	N/A	0.66	N/A	0.36	0.36	0.85	0.85	0.85
MEAN	37.74	30.29	20.64	28.67	23.37	17.67	21.67	23.37	17.67	21.67	17.67	21.67	11.95	11.95	18.92	18.92	18.92
MEDIAN	26.70	22.00	21.99	22.00	18.42	13.15	16.42	18.42	13.15	16.42	13.15	16.42	11.78	11.78	12.60	12.60	12.60
50th	28.18	22.00	21.99	22.00	18.69	14.51	16.43	18.69	14.51	16.43	14.51	16.43	11.43	11.43	14.69	14.69	14.69
4 X 50th	112.72	88.00	87.96	88.00	74.76	58.04	65.72	74.76	58.04	65.72	58.04	65.72	45.72	45.72	58.76	58.76	58.76
MIN	10.10	12.00	4.42	4.42	2.56	2.55	2.55	2.56	2.55	2.55	2.55	2.55	4.50	4.50	5.00	5.00	5.00
Cu	99.40	243.50	51.71	243.50	243.00	53.00	53.00	243.00	53.00	50.15	29.03	29.03	53.00	29.03	53.00	29.03	53.00
90th	52.85	34.33	0.42	23.15	17.07	16.30	19.23	17.07	16.30	19.23	16.30	19.23	14.42	14.42	14.70	14.70	14.70
Coeff. Var.	1.56	N/A	0.81	0.65	20.46	17.58	20.16	20.46	17.58	20.16	17.58	20.16	14.42	14.42	14.70	14.70	14.70
MEAN	21.24	15.00	21.78	17.80	16.80	64.88	76.92	16.80	16.22	19.23	16.22	19.23	14.42	14.42	58.80	58.80	58.80
MEDIAN	8.05	60.00	81.96	69.44	67.20	4.00	4.13	67.20	64.88	76.92	64.88	76.92	57.68	57.68	9.10	9.10	9.10
50th	12.75	4.00	9.71	4.00	4.00	4.00	4.00	4.00	4.00	4.13	4.00	4.13	4.04	4.04	9.10	9.10	9.10
4 X 50th	51.00	4.00	9.71	4.00	4.00	4.00	4.00	4.00	4.00	4.13	4.00	4.13	4.04	4.04	9.10	9.10	9.10
MIN	4.33	4.00	9.71	4.00	4.00	4.00	4.00	4.00	4.00	4.13	4.00	4.13	4.04	4.04	9.10	9.10	9.10
Fe	62,800.00	112,500.00	59,850.00	112,500.00	112,500.00	58,800.00	58,800.00	112,500.00	58,800.00	58,880.00	27,000.00	27,000.00	58,800.00	27,000.00	30,000.00	27,000.00	30,000.00
90th	49,170.00	36,128.00	59,665.00	50,125.00	43,195.00	36,644.00	51,451.00	43,195.00	36,644.00	51,451.00	25,026.00	25,026.00	51,451.00	25,026.00	29,631.00	25,026.00	29,631.00
Coeff. Var.	0.72	N/A	0.32	0.62	0.52	0.42	0.51	0.52	0.42	0.51	0.25	0.25	0.51	0.25	0.36	0.36	0.36
MEAN	25,557.33	21,680.10	40,734.60	28,192.00	25,903.72	23,471.67	29,780.40	25,903.72	23,471.67	29,780.40	18,744.84	18,744.84	29,780.40	18,744.84	19,935.70	18,744.84	19,935.70
MEDIAN	18,200.00	17,050.00	38,508.00	21,433.00	22,033.00	22,116.00	28,821.00	22,033.00	22,116.00	28,821.00	18,150.00	18,150.00	28,821.00	18,150.00	21,300.00	18,150.00	21,300.00
50th	21,446.18	17,050.00	39,180.10	24,152.41	22,987.15	21,810.59	27,689.80	22,987.15	21,810.59	27,689.80	18,276.16	18,276.16	27,689.80	18,276.16	19,027.40	18,276.16	19,027.40
4 X 50th	85,784.72	68,200.00	156,720.40	96,609.64	91,948.60	87,242.36	110,759.20	91,948.60	87,242.36	110,759.20	73,104.64	73,104.64	110,759.20	73,104.64	76,109.60	73,104.64	76,109.60
MIN	9,160.00	5,920.00	16,350.00	5,920.00	5,025.00	5,025.00	5,025.00	5,025.00	5,025.00	5,025.00	9,670.00	9,670.00	5,025.00	9,670.00	10,400.00	9,670.00	10,400.00
Hg	0.19	0.09	0.05	0.19	0.19	0.31	0.12	0.19	0.31	0.12	0.13	0.13	0.31	0.13	0.03	0.03	0.03
90th	0.13	0.07	0.04	0.08	0.07	0.04	0.05	0.07	0.04	0.05	0.02	0.02	0.04	0.02	0.02	0.02	0.02
Coeff. Var.	1.47	0.44	0.37	0.65	0.65	0.96	0.75	0.65	0.96	0.75	N/A	N/A	0.96	N/A	N/A	N/A	N/A
MEAN	0.05	0.05	0.03	0.04	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.02	0.01	0.01	0.01
MEDIAN	0.04	0.04	0.03	0.04	0.03	0.01	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01
50th	0.03	0.04	0.03	0.04	0.03	0.01	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01
4 X 50th	0.12	0.16	0.12	0.16	0.00	0.04	0.08	0.00	0.04	0.08	0.04	0.08	0.00	0.04	0.04	0.04	0.04
MIN	0.01	0.01	0.05	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00

ALL VALUES = MG/KG

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

Min	GROUP "W"		PUGET SOUND		CLARK COUNTY		WEST (ALL)		STATEWIDE		EAST (ALL)		YAKIMA BASIN		SPOKANE BASIN		GROUP "E"		
	930.00	2,750.00	1,960.00	2,750.00	2,750.00	2,750.00	2,750.00	2,750.00	2,750.00	1,546.12	1,546.00	1,546.00	769.50	652.00					
MAX	930.00	2,750.00	1,960.00	2,750.00	2,750.00	2,750.00	2,750.00	2,750.00	2,750.00	1,546.12	1,546.00	1,546.00	769.50	652.00					
90th	691.75	1,146.00	1,511.00	1,337.27	1,094.85	936.00	1,194.84	563.48	538.59	0.33	0.23	0.33	538.59	0.33					
Coeff. Var.	0.90	0.61	0.50	0.91	0.69	0.43	0.49	0.23	0.33	0.43	0.49	0.23	0.33	0.33					
MEAN	329.30	592.21	924.20	646.71	592.60	534.40	669.00	506.50	364.95	534.40	669.00	506.50	364.95	364.95					
MEDIAN	231.00	474.00	915.50	531.25	509.58	490.75	589.00	470.00	345.00	490.75	589.00	470.00	345.00	345.00					
50th	257.10	461.62	924.20	494.28	492.82	491.30	611.46	494.78	348.73	491.30	611.46	494.78	348.73	348.73					
4 X 50th	1,028.40	1,846.48	3,696.80	1,977.12	1,971.28	1,965.20	2,445.84	1,979.12	1,394.92	1,965.20	2,445.84	1,979.12	1,394.92	1,394.92					
MIN	78.00	90.00	150.00	78.00	78.00	164.45	164.45	354.50	233.00	164.45	164.45	354.50	233.00	233.00					
Ni																			
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10	163.00	163.00	163.00	18.60	34.10					
90th	54.19	38.19	21.04	44.20	38.19	24.54	45.89	16.19	23.41	24.54	45.89	16.19	23.41	23.41					
Coeff. Var.	0.97	N/A	N/A	0.65	0.71	N/A	N/A	0.35	0.48	N/A	N/A	0.35	0.48	0.48					
MEAN	25.66	29.82	17.72	25.44	21.49	17.25	24.83	10.96	13.77	17.25	24.83	10.96	13.77	13.77					
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70	12.50	16.30	10.15	11.70	11.70					
50th	19.12	23.00	16.23	20.57	16.92	12.40	16.23	10.49	12.54	12.40	16.23	10.49	12.54	12.54					
4 X 50th	76.46	92.00	64.92	82.28	67.68	49.60	64.92	41.96	50.16	49.60	64.92	41.96	50.16	50.16					
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40	2.15	2.15	4.60	6.40	6.40					
Pb																			
MAX	12.00	29.60	207.50	207.50	207.50	17.10	17.10	16.00	11.70	17.10	17.10	16.00	11.70	11.70					
90th	10.87	16.83	24.07	30.42	17.09	13.30	11.00	14.91	9.85	13.30	11.00	14.91	9.85	9.85					
Coeff. Var.	0.72	2.14	0.47	1.42	0.79	0.42	0.24	0.42	0.32	0.42	0.24	0.42	0.32	0.32					
MEAN	5.63	15.90	10.65	11.90	10.05	8.44	11.29	7.00	6.92	8.44	11.29	7.00	6.92	6.92					
MEDIAN	4.00	9.80	6.86	8.20	7.90	7.82	6.53	10.80	6.40	7.82	6.53	10.80	6.40	6.40					
50th	4.75	4.47	9.50	5.92	6.98	7.84	11.01	6.56	6.64	7.84	11.01	6.56	6.64	6.64					
4 X 50th	19.00	17.88	38.00	23.68	27.92	31.36	44.04	26.24	26.56	31.36	44.04	26.24	26.56	26.56					
MIN	2.10	4.65	2.13	2.10	2.10	2.17	2.17	6.75	4.20	2.17	2.17	6.75	4.20	4.20					
Zn																			
MAX	116.00	132.50	97.70	132.50	132.50	244.50	101.43	71.00	82.30	244.50	101.43	71.00	82.30	82.30					
90th	85.96	89.06	95.57	88.39	85.82	80.91	78.71	58.40	67.47	80.91	78.71	58.40	67.47	67.47					
Coeff. Var.	0.58	0.50	N/A	0.52	0.41	0.35	0.28	0.21	0.35	0.35	0.28	0.21	0.35	0.35					
MEAN	48.41	51.45	76.01	58.34	55.53	55.55	57.54	51.77	45.74	55.55	57.54	51.77	45.74	45.74					
MEDIAN	44.50	43.65	78.50	54.08	51.12	50.64	52.90	50.90	41.00	50.64	52.90	50.90	41.00	41.00					
50th	42.85	46.52	78.50	52.50	51.56	52.29	55.66	50.83	43.40	52.29	55.66	50.83	43.40	43.40					
4 X 50th	171.40	186.08	314.00	210.00	206.24	209.16	222.64	203.32	173.60	209.16	222.64	203.32	173.60	173.60					
MIN	21.10	12.00	21.40	12.00	12.00	26.30	39.30	29.70	26.30	26.30	39.30	29.70	26.30	26.30					

MTCASat Background Calculations
ALUMINUM DATA

ALUMINUM
STATEWIDE DATA

5670
6020
6140
6680
6930
7070
7390
7450
8130
8460
8570
8933.75
8970
9430
9940
10360
10400
10622.5
10650
10713.33
11600
11680
11700
12050
12175
12400
12462
12500
12603.33
12650
12850
12850
13000
13100
13200
13235
13500
13650
13675
13700
13750
13850
14150
14150
14175
14550
14600
14675
14800
14885.71
14975
15000
15066.67
15100
15233.33
15300
15362.5
15400
15450
15600
15700
16366.67
16400

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	21,956.67
Censored	0	Lognormal mean	21,923.33
TOTAL	166	Std. devn.	12,153.93
		Median	19,575.00
		Min.	5,670.00
		Max.	84,900.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.99		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	37,206.39 37206.3906
L = lognormal		50th	19,277.87 37746.3129
N = normal		4 X 50th	77,111.49 36666.4683
X = neither (so use nonparametric method)		Coefficient of Variation = 0.55	

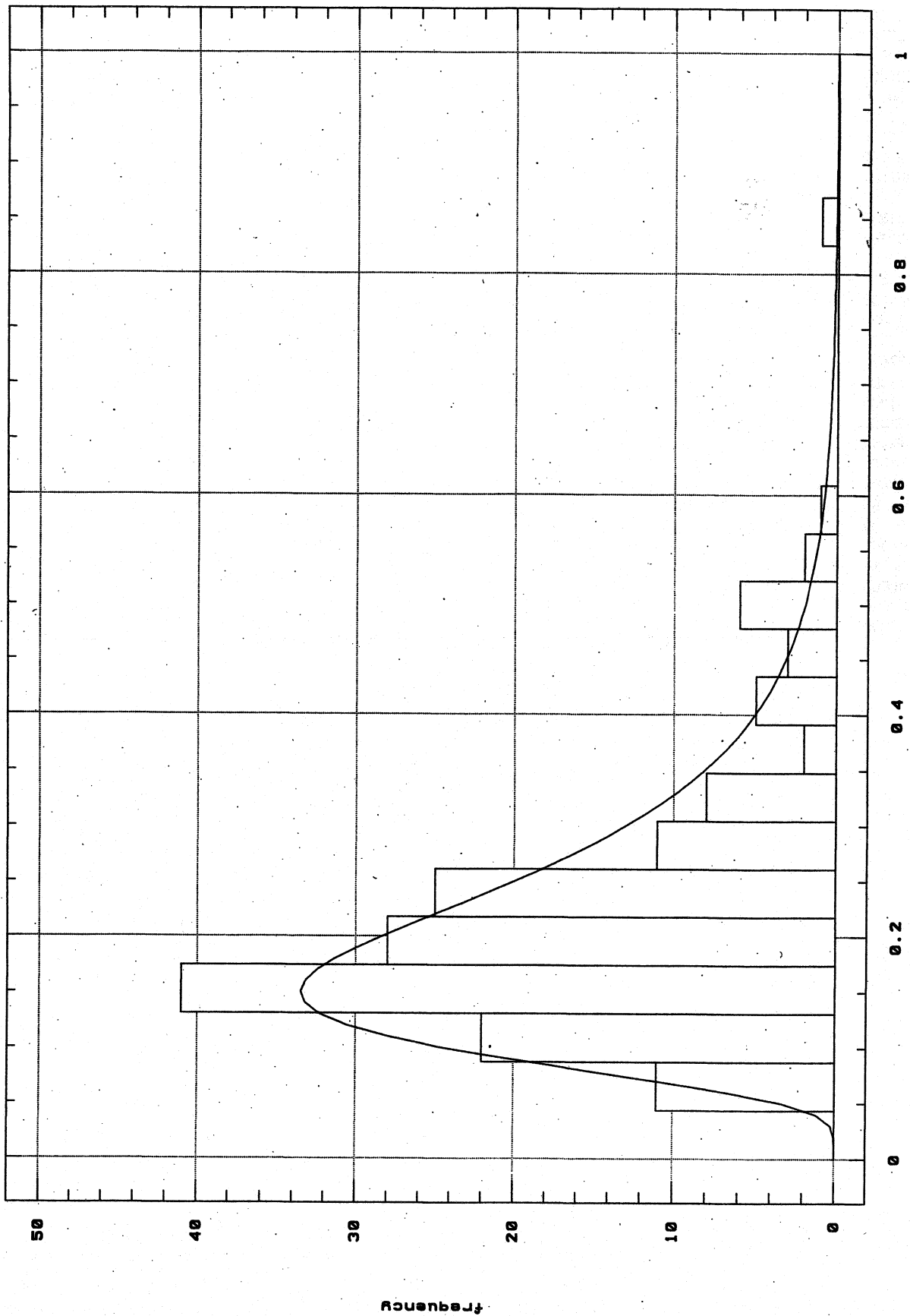
MTCASat Background Calculations
ALUMINUM DATA

16450
16500
16540
16600
16700
16900
16900
16975
17000
17000
17100
17450
17900
18750
18750
18900
19160
19300
19353.85
19450
19700
19850
19950
20066.67
20100
20125
20133.33
20150
20500
20536.67
20675
20700
20750
20800
20850
21275
21400
21700
21700
21820
21914.29
21935.71
21950
22350
22400
22450
23000
23100
23192.86
23233.33
23650
23800
24266.67
24400
24550
24800
24800
24900
25100
25300
25500
25600
25700
25850

MTCASat Background Calculations
ALUMINUM DATA

26666.67
26700
26866.67
26900
27200
27800
28800
29000
29600
30250
30300
30984.62
31400
31800
32300
32578.57
32800
33433.33
34450
37800
37850
39300
41400
41800
42766.67
43000
43800
45700
46100
48500
48657.14
48900
50050
50500

STATEWIDE ALUMINUM DISTRIBUTION



(X 100000)

ALUMINUM 90th = 37.206 MG/KG

Background calculations

5670
6020
6680
7070
7450
16400
16600
21700
25100
28800
37800
46100
50500
51500
53500

AI - GROUP "W"
REGIONS "A", "C", "D"

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	25392.67
Censored	0	Lognormal mean	27100.53
TOTAL	15	Std. devn.	18205.86
		Median	21700
		Min.	5670
		Max.	53500
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.90	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	62905.87
L = lognormal		50th	18748.95
N = normal		4 X 50th	74995.80
X = neither (so use nonparametric method)		Coefficient of Variation = 1.2	

MTCASat Background Calculations

AI - CLARK COUNTY

13750
 19353.85
 20150
 22350
 24400
 24800
 25500
 26700
 26866.67
 26900
 30250
 30300
 30984.62
 31400
 33433.33
 37850
 41800
 42766.67
 43000
 43800
 45700
 48500
 48657.14
 48900
 50050
 54550

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	34,335.09
Censored	0	Lognormal mean	34,526.80
TOTAL	26	Std. devn.	11,296.38
		Median	31,192.31
		Min.	13,750.00
		Max.	54,550.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	52,276.91 52276.9099
L = lognormal		50th	32,446.91 57113.9831
N = normal		4 X 50th	129,787.65 47439.8367
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39	

MTCASat Background Calculations

AI - PUGET SOUND BASIN

7390
 10360
 10713.33
 11600
 11680
 12175
 12400
 12462
 12850
 13200
 13675
 13700
 13850
 14150
 14175
 14975
 15233.33
 16366.67
 16540
 16900
 17100
 17450
 17900
 18750
 19160
 20066.67
 20125
 20500
 20675
 20800
 21400
 21700
 21820
 21935.71
 22400
 22450
 23192.86
 23800
 24800
 31800
 32300
 32800
 34450
 39300
 84900

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	20,354.90
Censored	0	Lognormal mean	20,083.46
TOTAL	45	Std. devn.	12,018.80
		Median	17,900.00
		Min.	7,390.00
		Max.	84,900.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.62	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		Value corresponding to that percentile is:	
N = normal		50th	18,376.61 32581.6593
X = neither (so use nonparametric method)		4 X 50th	73,506.44 29757.1642
		Coefficient of Variation = 0.47	

MTCASat Background Calculations

AI - YAKIMA BASIN

10650
 11700
 13500
 14600
 14885.71
 15300
 15450
 15600
 16450
 16900
 17000
 18750
 19300
 19700
 20133.33
 20750
 20850
 21914.29
 21950
 23000
 23233.33
 24266.67
 24550
 24900
 25300
 26666.67
 27200
 27800
 29600
 32578.57
 41400
 56550

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	22263.39
Censored	0	Lognormal mean	22211.65
TOTAL	32	Std. devn.	8991.12
		Median	20800
		Min.	10650
		Max.	56550
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	33379.65
L = lognormal		50th	20892.85
N = normal		4 X 50th	83571.39
X = neither (so use nonparametric method)		Coefficient of Variation = 0.38	

MTCASat Background Calculations

AI - SPOKANE BASIN

8933.75
 10622.5
 12050
 12500
 12603.33
 12650
 12850
 13100
 13235
 13650
 14150
 14550
 14675
 15000
 15066.67
 15362.5
 15700
 16500
 16975
 17000
 19450
 19850
 19950
 20536.67
 21275
 23650
 25850

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	15,842.05
Censored	0	Lognormal mean	15,854.55
TOTAL	27	Std. devn.	4,011.60
		Median	15,000.00
		Min.	8,933.75
		Max.	25,850.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		Value corresponding to that percentile is:	
N = normal		50th	21,376.01 21376.0061
X = neither (so use nonparametric method)		4 X 50th	15,380.88 22749.6662
		Coefficient of Variation = 0.26	

MTCASat Background Calculations

6140
6930
8130
8460
8570
8970
9430
9940
10400
13000
14800
15100
15400
16700
18900
20100
20700
23100
25600
25700
29000

AI - GROUP "E"
REGIONS "J","L","P","R"

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	15,003.33
Censored	0	Lognormal mean	15,114.02
TOTAL	21	Std. devn.	6,922.27
		Median	14,800.00
		Min.	6,140.00
		Max.	29,000.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	25,591.95	25591.9465
L = lognormal	50th	13,525.62	27971.4051
N = normal	4 X 50th	54,102.46	23212.4879
X = neither (so use nonparametric method)	Coefficient of Variation = 0.53		

MTCASat Background Calculations
ARSENIC DATA

ARSENIC

STATEWIDE DATA

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

0.5
 0.53
 0.89
 0.96
 1.1
 1.1
 1.136667
 1.2
 1.245
 1.3875
 1.4
 1.4
 1.44
 1.45
 1.45
 1.45
 1.49
 1.5
 1.616667
 1.665
 1.7
 1.715
 1.8
 1.8
 1.8
 1.8
 1.8
 1.814286
 1.9
 1.9
 1.95
 1.975
 1.993333
 2
 2.12
 2.145
 2.15
 2.15
 2.215
 2.25
 2.286667
 2.3
 2.3
 2.3
 2.32
 2.35
 2.43
 2.5
 2.5
 2.515
 2.53
 2.535
 2.55
 2.58
 2.6
 2.6
 2.6
 2.65
 2.706667
 2.74
 2.75
 2.8
 2.8

Number of samples		<u>Uncensored values</u>		
Uncensored	142	Mean	3.82	
Censored	0	Lognormal mean	3.77	
TOTAL	142	Std. devn.	3.15	
		Median	2.92	
		Min.	0.50	
		Max.	28.60	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.98		r-squared is: 0.64		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:
L		90		6.99 6.9938
L = lognormal		50th		3.10 7.2116
N = normal		4 X 50th		12.41 6.7760
X = neither (so use nonparametric method)		Coefficient of Variation = 0.7		

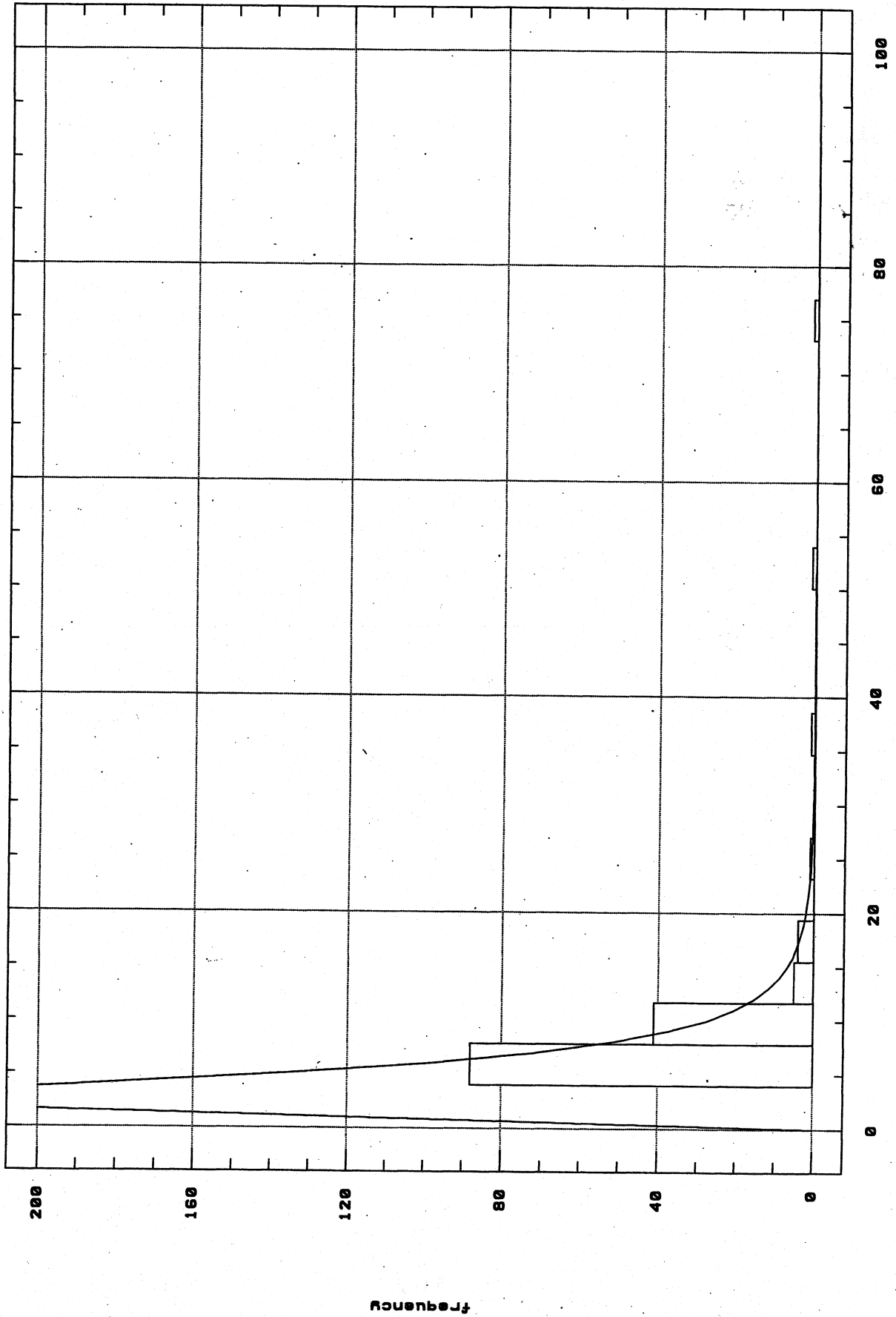
MTCASat Background Calculations
ARSENIC DATA

2.8
2.815
2.83
2.86
2.9
2.9
2.9
2.913333
2.916667
2.935
2.99
2.995
2.995
3.01
3.065
3.08
3.3
3.42
3.45
3.475
3.48
3.485
3.53
3.57
3.57
3.645
3.65
3.67
3.73
3.735
3.796
3.819286
3.862
4.0275
4.1
4.115
4.203333
4.215
4.25
4.274286
4.305
4.326
4.39
4.42
4.55
4.65
4.82
4.995
5.113333
5.16
5.195
5.26
5.28
5.415
5.54
5.55
5.583
5.585
5.818
6.034
6.12
6.41
6.453333
6.89

MTCASat Background Calculations
ARSENIC DATA

6.9275
7.19
7.625714
7.9475
8.01
8.12
8.42
8.53
8.615
8.635
8.99
9.397857
10.32571
17.16846
28.6

STATEWIDE ARSENIC DISTRIBUTION



ARSENIC 90th = 7 MG/KG

MTCASat Background Calculations

1.7
1.8
1.8
1.9
1.9
2.32
2.6
2.8
2.8
2.9
3.48
4.55
4.65
8.12
8.99

As - GROUP "W"

**DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
WESTERN WASHINGTON, REGIONS A,C,D**

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	3.49
Censored	0	Lognormal mean	3.46
TOTAL	15	Std. devn.	2.26
		Median	2.8
		Min.	1.7
		Max.	8.99
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.75	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	8.47	
L = lognormal	50th	2.80	
N = normal	4 X 50th	11.20	
X = neither (so use nonparametric method)	Coefficient of Variation = N/A		

MTCASat Background Calculations

1.45
1.5
2
2.12
2.15
2.65
2.8
2.9
2.913333
2.995
3.01
3.08
3.42
3.67
3.796
4.115
4.42
5.195
5.54
5.583
6.034
6.89

As - CLARK COUNTY

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>		
Uncensored	22	Mean	3.56	
Censored	0	Lognormal mean	3.58	
TOTAL	22	Std. devn.	1.50	
		Median	3.045	
		Min.	1.45	
		Max.	6.89	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.98		r-squared is: 0.94		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	5.81	
L = lognormal		50th	3.26	
N = normal		4 X 50th	13.05	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47		

MTCASat Background Calculations

As - PUGET SOUND BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

1.45
 1.616667
 1.665
 1.8
 1.975
 1.993333
 2.145
 2.15
 2.215
 2.3
 2.35
 2.535
 2.83
 2.86
 2.935
 2.99
 3.735
 3.819286
 4.215
 4.25
 4.274286
 4.326
 5.585
 5.818
 8.615
 9.397857
 17.16846

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	3.96
Censored	0	Lognormal mean	3.85
TOTAL	27	Std. devn.	3.30
		Median	2.86
		Min.	1.45
		Max.	17.1684615
Lognormal distribution?		Normal distribution?	
r-squared is: 0.92		r-squared is: 0.65	
Recommendations:			
Use lognormal distribution.			
		GFAA ANALYSIS	
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	7.30	
L = lognormal	50th	3.24	
N = normal	4 X 50th	12.94	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.7		

MTCASat Background Calculations

0.89
 0.96
 1.245
 1.3875
 1.715
 1.8
 1.8
 1.814286
 1.95
 2.286667
 2.3
 2.43
 2.5
 2.5
 2.58
 2.706667
 2.815
 2.916667
 2.995
 3.065
 3.475
 3.53
 3.57
 3.862
 4.203333
 4.39
 4.82
 5.16
 7.625714
 28.6

As - YAKIMA BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>	
Uncensored	30	Mean	3.73
Censored	0	Lognormal mean	3.44
TOTAL	30	Std. devn.	4.90
		Median	2.64333333
		Min.	0.89
		Max.	28.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.88		r-squared is: 0.39	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X		Enter percentile	90
L = lognormal		50th	2.64
N = normal		4 X 50th	10.57
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

1.136667
 1.45
 2.3
 2.515
 2.55
 2.74
 2.75
 3.3
 3.45
 3.485
 3.645
 4.0275
 4.305
 4.995
 5.113333
 5.26
 5.415
 5.55
 6.41
 6.453333
 6.9275
 7.9475
 8.01
 8.42
 8.53
 8.635
 10.32571

As - SPOKANE BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	5.02
Censored	0	Lognormal mean	5.13
TOTAL	27	Std. devn.	2.48
		Median	4.995
		Min.	1.13666667
		Max.	10.3257143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	9.34	
L = lognormal		50th	4.39
N = normal		4 X 50th	17.54
X = neither (so use nonparametric method)		Coefficient of Variation = 0.65	

MTCASat Background Calculations

0.5
0.53
1.1
1.1
1.2
1.4
1.4
1.44
1.49
2.25
2.53
2.6
2.6
2.9
3.57
3.65
3.73
4.1
5.28
6.12
7.19

As - GROUP "E"

**DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
EASTERN WASHINGTON, REGIONS J,L,P,R**

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	2.70
Censored	0	Lognormal mean	2.80
TOTAL	21	Std. devn.	1.83
		Median	2.53
		Min.	0.5
		Max.	7.19
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.91	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		90	5.76
L = lognormal		50th	2.14
N = normal		4 X 50th	8.54
X = neither (so use nonparametric method)		Coefficient of Variation = 0.91	

MTCASat Background Calculations
BERYLLIUM DATA

BERYLLIUM

STATEWIDE DATA

0.1
 0.1
 0.1
 0.1
 0.13
 0.185
 0.21
 0.23
 0.23
 0.243333
 0.25
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 0.253333
 0.256667
 0.26
 0.26
 0.266154
 0.27
 0.27
 0.28
 0.29
 0.29
 0.291429
 0.296667
 0.3
 <0.6
 0.305
 0.305
 0.3125
 0.32
 0.3225
 0.33
 0.33
 0.333333
 0.35
 0.366667
 0.37
 0.37
 0.375
 0.3775
 0.39
 0.395
 0.4
 0.41
 0.415
 0.42
 0.43
 0.435
 0.44
 0.46
 0.47
 0.47
 0.476667
 0.495
 0.505
 0.51
 0.515

Number of samples		<u>Uncensored values</u>		
Uncensored	157	Mean	0.76	
Censored	8	Lognormal mean	0.77	
TOTAL	165	Std. devn.	0.49	
		Median	0.67	
		Min.	0.10	
		Max.	2.79	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.98		r-squared is: 0.88		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	1.44	1.4373
L = lognormal		50th	0.59	1.6116
N = normal		4 X 50th	2.37	1.2629
X = neither (so use nonparametric method)		Coefficient of Variation = 0.78		

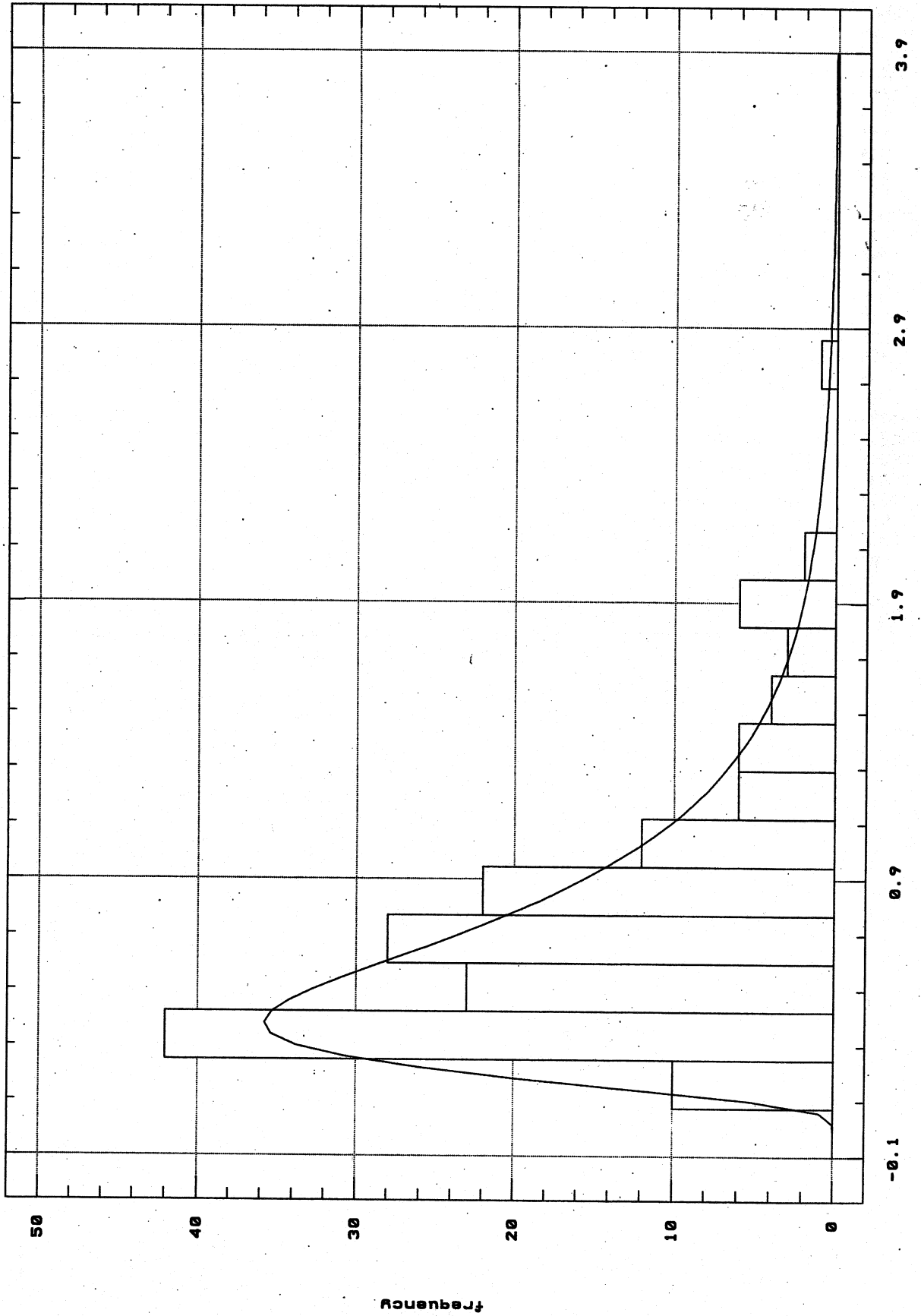
MTCASat Background Calculations
BERYLLIUM DATA

0.53
0.53
0.535
0.54
0.54
0.544
0.55
0.58
0.58
0.58
0.585
0.586667
0.6
0.605
0.61
0.61
0.62625
0.635
0.636429
0.65
0.65
0.655
0.663333
0.665
0.6675
0.67
0.6825
0.7
0.7
0.7
0.7
0.71
0.71
0.72
0.72
0.723333
0.73
0.75
0.75
0.75
0.77
0.77
0.77
0.78
0.785
0.79
0.805
0.815
0.82
0.82
0.82
0.825
0.83
0.84
0.875
0.875
0.89
0.89
0.89
0.89
0.905
0.920714
0.95
0.98

MTCASat Background Calculations
BERYLLIUM DATA

1
1.02
1.030769
1.036667
1.044286
1.046667
1.075714
1.085
1.09
1.11
1.135
1.14
1.15
1.156667
1.21
1.245
1.31
1.335
1.36
1.38
1.4175
1.45
1.475
1.483333
1.483846
1.636667
1.723333
1.743333
1.79
1.815
1.87
1.92
1.94
1.955

STATEWIDE BERYLLIUM DISTRIBUTION



BERYLLIUM 90th = 1.5 MG/KG

MTCASat Background Calculations

0.1
0.1
0.1
0.1
0.13
0.26
0.29
0.4
0.44
0.46
0.6
0.61
0.65
0.71
0.89

Be - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	0.39
Censored	0	Lognormal mean	0.42
TOTAL	15	Std. devn.	0.26
		Median	0.4
		Min.	0.1
		Max.	0.89
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.93	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
N	90	0.75	
L = lognormal	50th	0.39	
N = normal	4 X 50th	1.56	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.73		

MTCASat Background Calculations

Be - CLARK COUNTY

0.305
 0.585
 0.75
 1
 1.02
 1.030769
 1.09
 1.11
 1.135
 1.335
 1.36
 1.45
 1.475
 1.483333
 1.483846
 1.636667
 1.723333
 1.743333
 1.79
 1.815
 1.87
 1.92
 1.94
 1.955
 1.99
 2.155714

Number of samples		Uncensored values	
Uncensored	26	Mean	1.43
Censored	0	Lognormal mean	1.46
TOTAL	26	Std. devn.	0.47
		Median	1.47916667
		Min.	0.305
		Max.	2.15571429
Lognormal distribution?		Normal distribution?	
r-squared is: 0.83		r-squared is: 0.96	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
N	90	2.07	
L = lognormal		50th	1.43
N = normal		4 X 50th	5.72
X = neither (so use nonparametric method)		Coefficient of Variation = 0.35	

MTCASat Background Calculations

Be - PUGET SOUND BASIN

0.185
 0.23
 0.23
 0.243333
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 <0.5
 0.253333
 0.256667
 0.266154
 0.27
 0.27
 0.291429
 0.296667
 <0.6
 0.305
 0.3125
 0.32
 0.3225
 0.33
 0.333333
 0.35
 0.366667
 0.37
 0.37
 0.375
 0.395
 0.41
 0.415
 0.47
 0.53
 0.53
 0.544
 0.61
 0.665
 0.7
 0.7
 0.7
 0.75
 0.875

Number of samples		<u>Uncensored values</u>		
Uncensored	36	Mean	0.41	
Censored	8	Lognormal mean	0.41	
TOTAL	44	Std. devn.	0.18	
		Median	0.35833333	
		Min.	0.185	
		Max.	0.875	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.91		r-squared is: 0.82		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	0.61	
L = lognormal		50th	0.35	
N = normal		4 X 50th	1.40	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.44		

MTCASat Background Calculations

Be - YAKIMA BASIN

- 0.39
- 0.635
- 0.65
- 0.7
- 0.72
- 0.73
- 0.77
- 0.78
- 0.805
- 0.815
- 0.82
- 0.83
- 0.89
- 0.89
- 0.905
- 0.920714
- 0.95
- 0.98
- 1.036667
- 1.044286
- 1.046667
- 1.075714
- 1.085
- 1.15
- 1.156667
- 1.21
- 1.245
- 1.31
- 1.38
- 1.4175
- 1.97
- 2.79

Number of samples		Uncensored values	
Uncensored	32	Mean	1.03
Censored	0	Lognormal mean	1.03
TOTAL	32	Std. devn.	0.43
		Median	0.93535714
		Min.	0.39
		Max.	2.79
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.76	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	1.57
L = lognormal		50th	0.97
N = normal		4 X 50th	3.88
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39	

MTCASat Background Calculations

Be - SPOKANE BASIN

0.3775
 0.476667
 0.495
 0.505
 0.515
 0.535
 0.54
 0.55
 0.58
 0.586667
 0.605
 0.62625
 0.636429
 0.655
 0.663333
 0.6675
 0.67
 0.6825
 0.72
 0.723333
 0.75
 0.785
 0.82
 0.825
 0.875
 0.89

Number of samples		Uncensored values	
Uncensored	27	Mean	0.65
Censored	0	Lognormal mean	0.65
TOTAL	27	Std. devn.	0.13
		Median	0.655
		Min.	0.3775
		Max.	0.89
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.98	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.84	
L = lognormal	50th	0.64	
N = normal	4 X 50th	2.55	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.22		

MTCASat Background Calculations

0.23
 0.23
 0.243333
 0.253333
 0.256667
 0.266154
 0.27
 0.296667
 0.305
 0.3225
 0.366667
 0.41
 0.415
 0.47
 0.544
 0.665
 0.875

Be - GROUP "E"
 REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	17	Mean	0.38
Censored	0	Lognormal mean	0.38
TOTAL	17	Std. devn.	0.18
		Median	0.305
		Min.	0.23
		Max.	0.875
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.61	
L = lognormal	50th	0.35	
N = normal	4 X 50th	1.39	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.45		

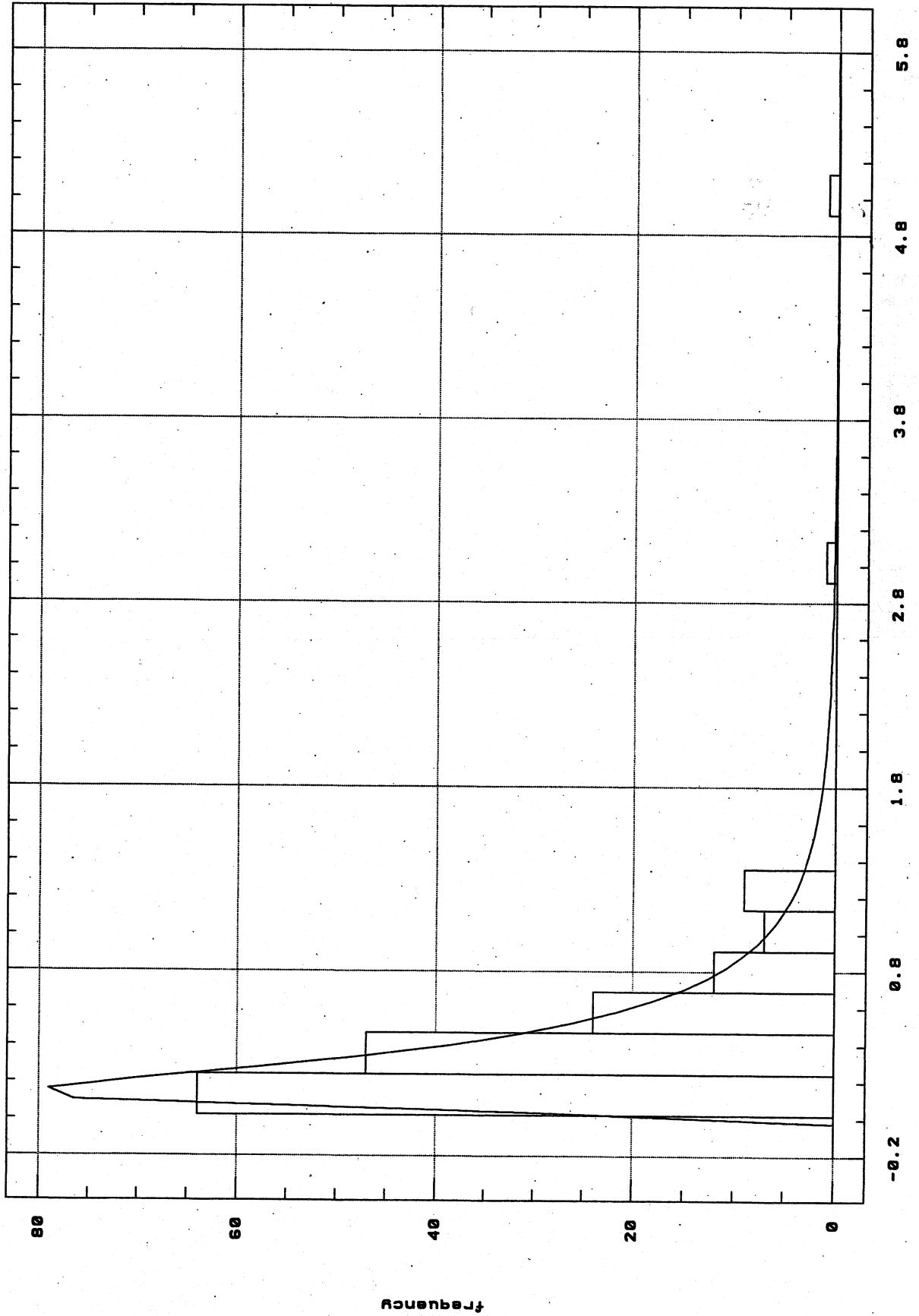
MTCASat Background Calculations
CADMIUM DATA

0.215
0.26
0.275
0.28
0.303333
0.3125
0.32
0.33
0.338571
0.34
0.34
0.35
0.35
0.36
0.365
0.365714
0.37
0.37
0.37
0.375
0.38
0.395
0.4
0.4
0.4
0.4
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
0.405
0.41
0.42
0.424
0.445
0.45
0.453333
0.458462
0.46
0.4625
0.465
0.483333
0.485
0.500714
0.505
0.515
0.525
0.535
0.535
0.54
0.566667
0.57
0.61
0.62
0.626667
0.629286
0.63

MTCASat Background Calculations
CADMIUM DATA

0.645
0.653333
0.66
0.665
0.665714
0.676667
0.676667
0.685
0.7
0.7
0.705
0.715
0.72
0.74
0.8
0.805
0.831429
0.836667
0.8425
0.87
0.92
0.937692
0.955385
0.97
1.06
1.06
1.1
1.2
1.2
1.225
1.225
1.25
1.275
1.294286

STATEWIDE CADMIUM DISTRIBUTION



CADMIUM 90th = 1.0 MG/KG

MTCASat Background Calculations

<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2

Cd - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	0	Mean	N/A
Censored	14	Lognormal mean	N/A
TOTAL	14	Std. devn.	N/A
		Median	N/A
		Min.	N/A
		Max.	N/A
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Review of data needed for background decision.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	
		Value corresponding to that percentile is:	
		0.10	
		0.10	
		0.40	

MTCASat Background Calculations

Cd - CLARK COUNTY

0.155
 0.42
 0.445
 0.485
 0.505
 0.535
 0.62
 0.7
 0.705
 0.715
 0.74
 0.805
 0.836667
 0.92
 0.937692
 0.955385
 0.97
 1.06
 1.06
 1.1
 1.2
 1.225
 1.225
 1.25
 1.294286
 1.3

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	0.55
Censored	0	Lognormal mean	0.55
TOTAL	32	Std. devn.	0.27
		Median	0.49202381
		Min.	0.155
		Max.	1.32857143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.89	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.93	
L = lognormal	50th	0.49	
N = normal	4 X 50th	1.95	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.54		

MTCASat Background Calculations

Cd - PUGET SOUND BASIN

- 0.1
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- <0.2
- 0.14
- 0.155
- 0.19
- 0.28
- 0.303333
- 0.34
- 0.365714
- 0.38
- 0.4
- 0.4
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- <0.8
- 0.424
- 0.458462
- 0.566667
- 0.7
- 0.831429
- 1.2
- 2.933333
- 5

Number of samples		Uncensored values	
Uncensored	19	Mean	0.80
Censored	25	Lognormal mean	0.73
TOTAL	44	Std. devn.	1.20
		Median	0.4
		Min.	0.1
		Max.	5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.81		r-squared is: 0.45	
Recommendations:			
More than half the data are censored. Nonparametric method recommended.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	0.77
L = lognormal		50th	0.37
N = normal		4 X 50th	1.49
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cd - YAKIMA BASIN

0.155
 0.185
 0.26
 0.275
 0.32
 0.33
 0.35
 0.35
 0.365
 0.37
 0.37
 0.4
 0.405
 0.45
 0.46
 0.483333
 0.500714
 0.515
 0.525
 0.61
 0.629286
 0.63
 0.66
 0.665
 0.665714
 0.676667
 0.72
 0.8
 0.8425
 0.87
 1.275
 1.328571

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	0.55
Censored	0	Lognormal mean	0.55
TOTAL	32	Std. devn.	0.27
		Median	0.49202381
		Min.	0.155
		Max.	1.32857143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.89	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.93
L = lognormal		50th	0.49
N = normal		4 X 50th	1.95
X = neither (so use nonparametric method)		Coefficient of Variation = 0.54	

Background calculations

Cd - SPOKANE BASIN

0.125
 0.125
 0.18
 0.185
 0.2
 0.215
 0.215
 0.3125
 0.338571
 0.34
 0.36
 0.37
 0.375
 0.395
 0.4
 0.41
 0.453333
 0.4625
 0.465
 0.535
 0.54
 0.57
 0.626667
 0.645
 0.653333
 0.676667
 0.685

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	0.40
Censored	0	Lognormal mean	0.41
TOTAL	27	Std. devn.	0.17
		Median	0.395
		Min.	0.125
		Max.	0.685
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.72
L = lognormal		50th	0.36
N = normal		4 X 50th	1.44
X = neither (so use nonparametric method)		Coefficient of Variation = 0.58	

Background calculations

<0.2
<0.2
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<0.2
<0.2
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<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2

Cd - GROUP "E"

REGIONS "J", "L", "P", "R" - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	0	Mean	N/A
Censored	21	Lognormal mean	N/A
TOTAL	21	Std. devn.	N/A
		Median	N/A
		Min.	N/A
		Max.	N/A
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Review of data needed for background decision.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th N/A	
N = normal		4 X 50th N/A	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	
		Value corresponding to that percentile is:	
		N/A	

**MTACASat Background Calculations
CHROMIUM DATA**

**CHROMIUM
STATEWIDE**

2.555
4.425
4.5
5
6.1
6.31
6.5675
6.6
7.6
7.67
8.44
8.8
8.953333
9.1
9.11
9.235
9.94
10.1
10.535
10.65
10.8
10.8
10.97667
11.05333
11.4
11.4
11.45
11.6
11.6
11.65
11.73333
11.78857
11.85
12
12.00286
12.03333
12.135
12.2
12.3375
12.6
12.7
12.85
12.96
13.025
13.05
13.15
13.15714
13.25
13.3
14.25
14.3
14.3
14.4
14.65
14.8
15
15.4
15.55
15.85
16
16
16
16.1

Number of samples		<u>Uncensored values</u>			
Uncensored	166	Mean	23.37		
Censored	0	Lognormal mean	22.51		
TOTAL	166	Std. devn.	24.10		
		Median	18.42		
		Min.	2.56		
		Max.	235.00		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.95		r-squared is: 0.48			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:	
L		90	41.88	0.0000	
L = lognormal		50th	18.69	0.0000	
N = normal		4 X 50th	74.76	0.0000	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.7			

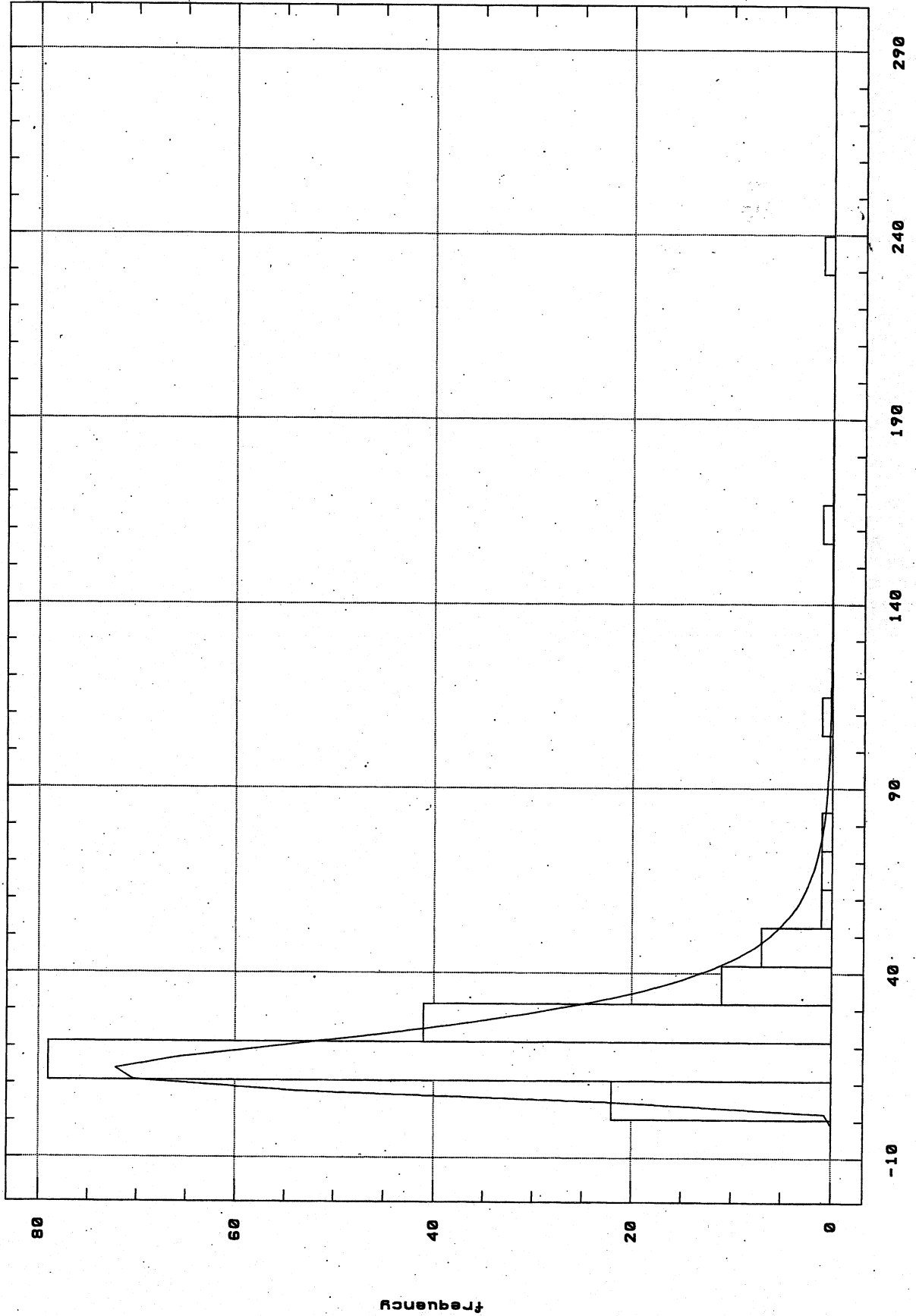
MTACASat Background Calculations
CHROMIUM DATA

16.35
16.36667
16.385
16.45
16.5
16.7
16.75
16.8
16.95
17.15
17.55
17.9
17.95
18.05
18.1
18.1
18.22857
18.3
18.3
18.34286
18.5
18.63333
18.74286
18.75
18.775
19
19
19
19.5
19.92
19.95
20
20
20.25
20.25
20.66667
20.95
21.15
21.225
21.23333
21.5
21.7
21.7
21.91538
22
22
22
22
22.06667
22.2
22.5
22.6
22.625
23
23.11538
23.2
23.26667
23.37143
23.825
23.96667
24
24
24.35
24.35385

MTACASat Background Calculations
CHROMIUM DATA

24.4
24.9
25.1
25.7
26
26.23333
26.7
27.35
28.2
28.83333
29.3
30.3
31.3
31.46667
• 31.6
32
33.225
34.2
35.3
35.9
36.9
37.85
38.4
38.45
41.2
41.95
45.2
46.02857
47.25
47.75
48.75
49.12143
51.5
56.7

STATEWIDE CHROMIUM DISTRIBUTION



MTCASat Background Calculations

10.1
11.4
12.2
14.8
16
25.1
26
26.7
32
34.2
41.2
45.2
51.5
56.7
163

Cr - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	37.74
Censored	0	Lognormal mean	37.08
TOTAL	15	Std. devn.	37.68
		Median	26.7
		Min.	10.1
		Max.	163
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.62	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	78.46	
L = lognormal	50th	28.18	
N = normal	4 X 50th	112.73	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.95		

MTCASat Background Calculations

Cr - CLARK COUNTY

4.425
 8.44
 14.65
 16.45
 16.75
 18.05
 18.1
 18.1
 18.3
 18.75
 20.95
 21.7
 21.91538
 22.06667
 23.11538
 23.2
 23.26667
 23.37143
 23.825
 23.96667
 24.35
 24.9
 25.7
 26.23333
 27.35
 28.83333

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	20.64
Censored	0	Lognormal mean	21.09
TOTAL	26	Std. devn.	5.52
		Median	21.9910256
		Min.	4.425
		Max.	28.8333333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.69		r-squared is: 0.89	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	26.57	
L = lognormal		50th	21.99
N = normal		4 X 50th	87.96
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cr - PUGET SOUND BASIN

12
 14.25
 16
 16.36667
 16.385
 17.55
 17.95
 18.34286
 18.74286
 19
 19
 19
 19.5
 19.92
 19.95
 20
 20.25
 20.66667
 21.15
 21.225
 21.5
 21.7
 22
 22
 22
 22.2
 22.5
 22.6
 22.625
 23
 24
 24
 24.35385
 24.4
 28.2
 31.3
 33.225
 35.3
 41.95
 47.25
 47.75
 48.75
 49.12143
 79.05
 235

Number of samples		Uncensored values	
Uncensored	45	Mean	30.29
Censored	0	Lognormal mean	28.28
TOTAL	45	Std. devn.	33.54
		Median	22
		Min.	12
		Max.	235
Lognormal distribution?		Normal distribution?	
r-squared is: 0.75		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	
X		90	
		Value corresponding to that percentile is:	
L = lognormal		50th	22.00
N = normal		4 X 50th	88.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cr - YAKIMA BASIN

2.555
 7.67
 11.6
 11.73333
 12.00286
 12.135
 12.96
 13.15
 13.15714
 13.3
 14.3
 14.3
 15
 15.55
 15.85
 16.35
 16.5
 16.7
 16.8
 17.15
 18.22857
 18.5
 18.63333
 21.23333
 22
 30.3
 31.46667
 31.6
 37.85
 38.45
 46.02857
 110.3

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	21.67
Censored	0	Lognormal mean	21.41
TOTAL	32	Std. devn.	18.73
		Median	16.425
		Min.	2.555
		Max.	110.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.57	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	38.27	
L = lognormal	50th	16.43	
N = normal	4 X 50th	65.70	
X = neither (so use nonparametric method)	Coefficient of Variation = N/A		

MTCASat Background Calculations

Cr - SPOKANE BASIN

4.5
6.31
6.5675
8.953333
9.235
9.94
10.535
10.65
10.97667
11.05333
11.45
11.6
11.65
11.78857
11.85
12.03333
12.3375
12.7
12.85
13.025
13.05
13.25
14.4
16
16.95
18.775
20.25

Number of samples		Uncensored values	
Uncensored	27	Mean	11.95
Censored	0	Lognormal mean	12.02
TOTAL	27	Std. devn.	3.46
		Median	11.7885714
		Min.	4.5
		Max.	20.25
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
		Value corresponding to that percentile is:	
L = lognormal		50th	11.43
N = normal		4 X 50th	45.70
X = neither (so use nonparametric method)		Coefficient of Variation = 0.36	

MTCASat Background Calculations

5
6.1
6.6
7.6
8.8
9.1
9.11
10.8
10.8
11.4
12.6
15.4
16.1
17.9
18.3
20
29.3
35.9
36.9
38.4
71.3

Cr - GROUP "E"
REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	21	Mean	18.92
Censored	0	Lognormal mean	18.74
TOTAL	21	Std. devn.	15.85
		Median	12.6
		Min.	5
		Max.	71.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.75	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	37.80
L = lognormal		50th	14.69
N = normal		4 X 50th	58.77
X = neither (so use nonparametric method)		Coefficient of Variation = 0.85	

MTCATStat Background Calculations
COPPER DATA

COPPER
STATEWIDE

4
4.045
4.125
4.33
4.4
5.04
5.18
5.2
5.415
6.23
7.2
7.415
7.59
8.05
8.846667
8.973333
9
9.1
9.71
10
10.695
10.8
10.8
10.84933
10.96
11.1
11.235
11.46667
11.6
11.66667
11.75
11.85
11.85
11.9
11.95
12
12.4
12.5
12.7
12.795
12.9
12.95
13
13
13.05
13.2
13.2
13.3
13.30714
13.35
13.4
13.5
13.75
13.86667
13.95
14
14
14.075
14.14333
14.23333
14.3
14.4
14.45

Number of samples		<u>Uncensored values</u>			
Uncensored	166	Mean	20.46		
Censored	0	Lognormal mean	19.75		
TOTAL	166	Std. devn.	21.37		
		Median	17.07		
		Min.	4.00		
		Max.	243.50		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.93		r-squared is: 0.41			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	36.01	0.0000	
L = lognormal		50th	16.80	0.0000	
N = normal		4 X 50th	67.19	0.0000	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.65			

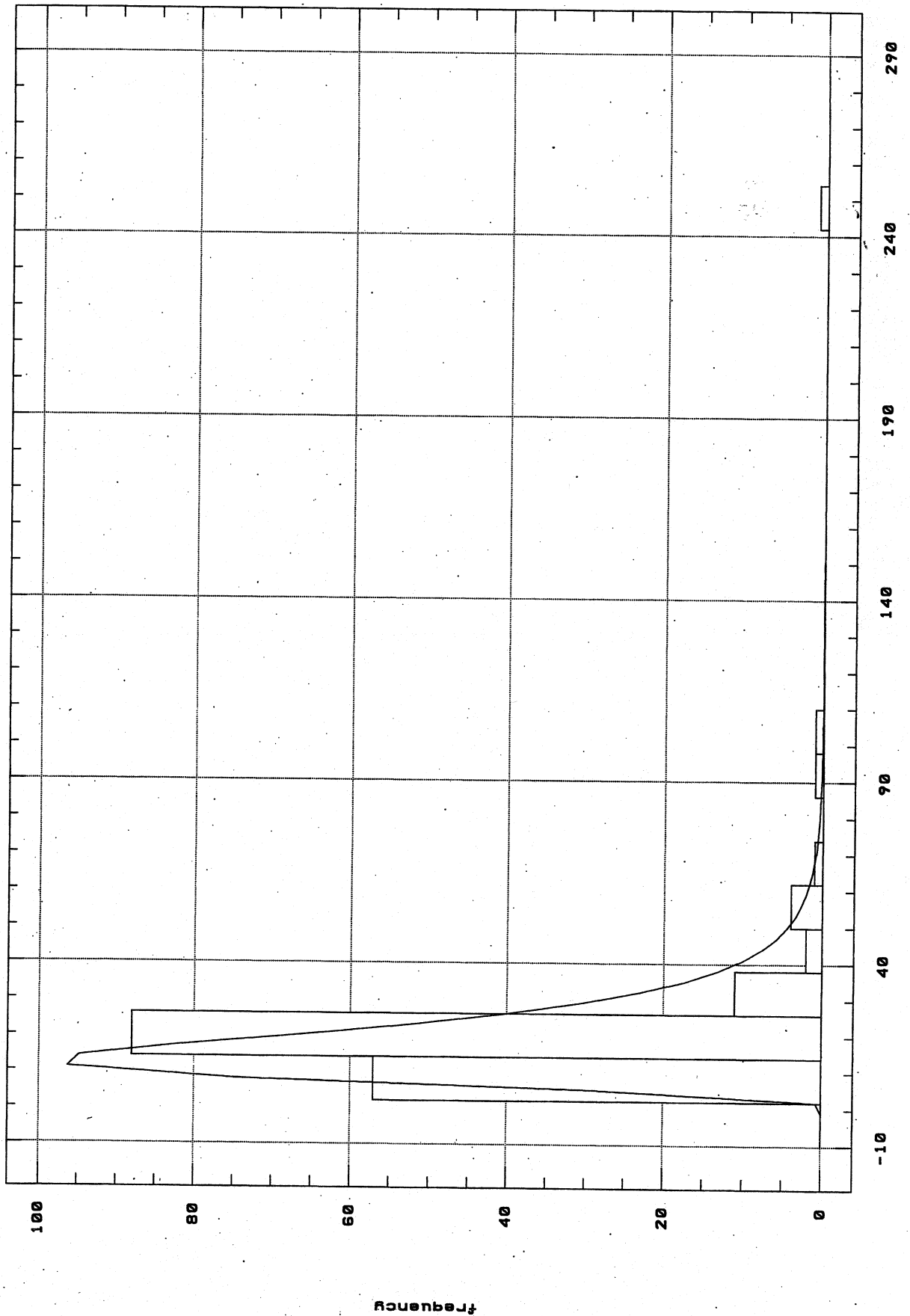
MTCATStat Background Calculations
COPPER DATA

14.45
14.6
14.6825
14.7
14.8
14.93333
15
15.23333
15.83538
15.8625
16
16
16.025
16.10714
16.2
16.3
16.35
16.4
17
17
17.13333
17.1625
17.3
17.3
17.56667
17.6
17.7
17.75
18
18.04286
18.1
18.15
18.25
18.55
18.55
18.61429
18.7
18.75
18.85
18.9
19.16667
19.5
19.6
19.63571
19.8
19.95
20.1
20.13333
20.2
20.3
20.5
20.65
20.7
21
21
21.03333
21.2
21.3
21.5
21.56667
21.9
22
22.33333
22.5

MTCATStat Background Calculations
COPPER DATA

22.8
23.05
23.2
23.3
23.33846
23.5
23.825
24.4
24.6
24.9
24.9
25
25
25.15
25.3
25.4
25.65
25.725
27.03333
27.06667
27.3
28.7
29.03333
29.2
29.24
29.65
30.96667
32.03077
33.9
39.25
42.84286
50.15
50.9
51.71429

STATEWIDE COPPER DISTRIBUTION



MTCASat Background Calculations

4.33
4.4
5.04
5.18
5.2
6.23
7.2
8.05
18.7
22.5
23.2
24.4
33.9
50.9
99.4

Cu - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	15	Mean	21.24
Censored	0	Lognormal mean	21.14
TOTAL	15	Std. devn.	25.52
		Median	8.05
		Min.	4.33
		Max.	99.4
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.68	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = 1.56	
		Value corresponding to that percentile is:	
		52.85	
		12.75	
		50.99	

MTCASat Background Calculations

Cu - CLARK COUNTY

9.71
 10.695
 11.95
 12.795
 13.95
 14.23333
 15.83538
 17
 17.56667
 18.15
 20.7
 21.2
 21.56667
 22
 23.05
 23.3
 23.33846
 23.825
 24.9
 25
 25.4
 25.65
 29.2
 30.96667
 39.25
 51.71429

Number of samples		Uncensored values	
Uncensored	26	Mean	22.04
Censored	0	Lognormal mean	22.08
TOTAL	26	Std. devn.	9.06
		Median	21.7833333
		Min.	9.71
		Max.	51.7142857
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.42	
		Value corresponding to that percentile is:	
		34.43	
		20.49	
		81.94	

MTCASat Background Calculations

Cu - PUGET SOUND BASIN

4
 7.59
 8.846667
 8.973333
 9
 10
 10.8
 10.84933
 11.235
 11.66667
 11.75
 11.85
 12
 12.5
 13
 13.75
 13.86667
 14
 14
 14.075
 14.3
 14.6825
 15
 16.10714
 17
 17.6
 18
 18.04286
 19.16667
 19.5
 19.8
 20.3
 20.65
 21
 21
 24.9
 25
 25.3
 29.24
 29.65
 32.03077
 42.84286
 64.55
 86.65
 243.5

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	24.43
Censored	0	Lognormal mean	21.90
TOTAL	45	Std. devn.	36.38
		Median	15
		Min.	4
		Max.	243.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.86		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	36.36
L = lognormal		50th	15.00
N = normal		4 X 50th	60.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cu - YAKIMA BASIN

4.125
 12.4
 13.3
 15.23333
 16.2
 16.4
 17.13333
 17.1625
 17.7
 17.75
 18.1
 18.55
 18.55
 18.61429
 18.75
 18.85
 19.6
 19.63571
 20.1
 20.13333
 20.5
 21.03333
 21.3
 21.5
 22.33333
 22.8
 23.5
 24.6
 25.15
 27.03333
 27.06667
 50.15

Number of samples		Uncensored values	
Uncensored	32	Mean	20.16
Censored	0	Lognormal mean	20.38
TOTAL	32	Std. devn.	7.03
		Median	19.225
		Min.	4.125
		Max.	50.15
Lognormal distribution?		Normal distribution?	
r-squared is: 0.74		r-squared is: 0.73	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	
X		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	
		Value corresponding to that percentile is:	
		26.47	
		19.23	
		76.90	

MTCASat Background Calculations

Cu - SPOKANE BASIN

4.045
 5.415
 7.415
 10.8
 10.96
 11.46667
 11.85
 12.95
 13
 13.05
 13.30714
 13.35
 13.5
 14.14333
 14.4
 14.45
 14.45
 14.93333
 15.8625
 16.025
 16.3
 17.3
 17.3
 18.25
 19.95
 25.725
 29.03333

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	14.42
Censored	0	Lognormal mean	14.59
TOTAL	27	Std. devn.	5.19
		Median	14.1433333
		Min.	4.045
		Max.	29.0333333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.91	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
N	90	21.61	
L = lognormal	50th	14.42	
N = normal	4 X 50th	57.66	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.39		

MTCASat Background Calculations

9.1
11.1
11.6
11.9
12.7
12.9
13.2
13.2
13.4
14.6
14.7
14.8
16
16
16.35
18.9
20.2
21.9
27.3
28.7
53

Cu - GROUP "E"
REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	17.69
Censored	0	Lognormal mean	17.49
TOTAL	21	Std. devn.	9.53
		Median	14.7
		Min.	9.1
		Max.	53
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.65	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90		28.42
L = lognormal		50th	14.70
N = normal		4 X 50th	58.80
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations
IRON DATA

IRON
 STATEWIDE

5025
 5920
 9160
 9670
 10400
 11100
 11200
 11300
 11500
 11700
 12320
 12517.5
 12950
 13000
 13050
 13200
 13200
 13353.85
 13450
 13533.33
 13700
 13900
 13966.67
 14100
 14300
 14300
 14333.33
 14662.5
 14800
 14900
 15150
 15300
 15500
 15550
 15660
 16100
 16133.33
 16200
 16350
 16350
 16368.67
 16550
 16600
 16700
 16735.71
 16800
 17000
 17000
 17050
 17100
 17100
 17100
 17200
 17300
 17550
 17650
 17792.86
 17900
 18078.57
 18150
 18150
 18200
 18200

Number of samples		<u>Uncensored values</u>			
Uncensored	165	Mean	25,903.72		
Censored	0	Lognormal mean	25,835.70		
TOTAL	165	Std. devn.	13,978.67		
		Median	22,033.33		
		Min.	5,025.00		
		Max.	112,500.00		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.98		r-squared is: 0.83			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	43,106.14	0.0000	
L = lognormal		50th	22,987.15	0.0000	
N = normal		4 X 50th	91,948.59	0.0000	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.52			

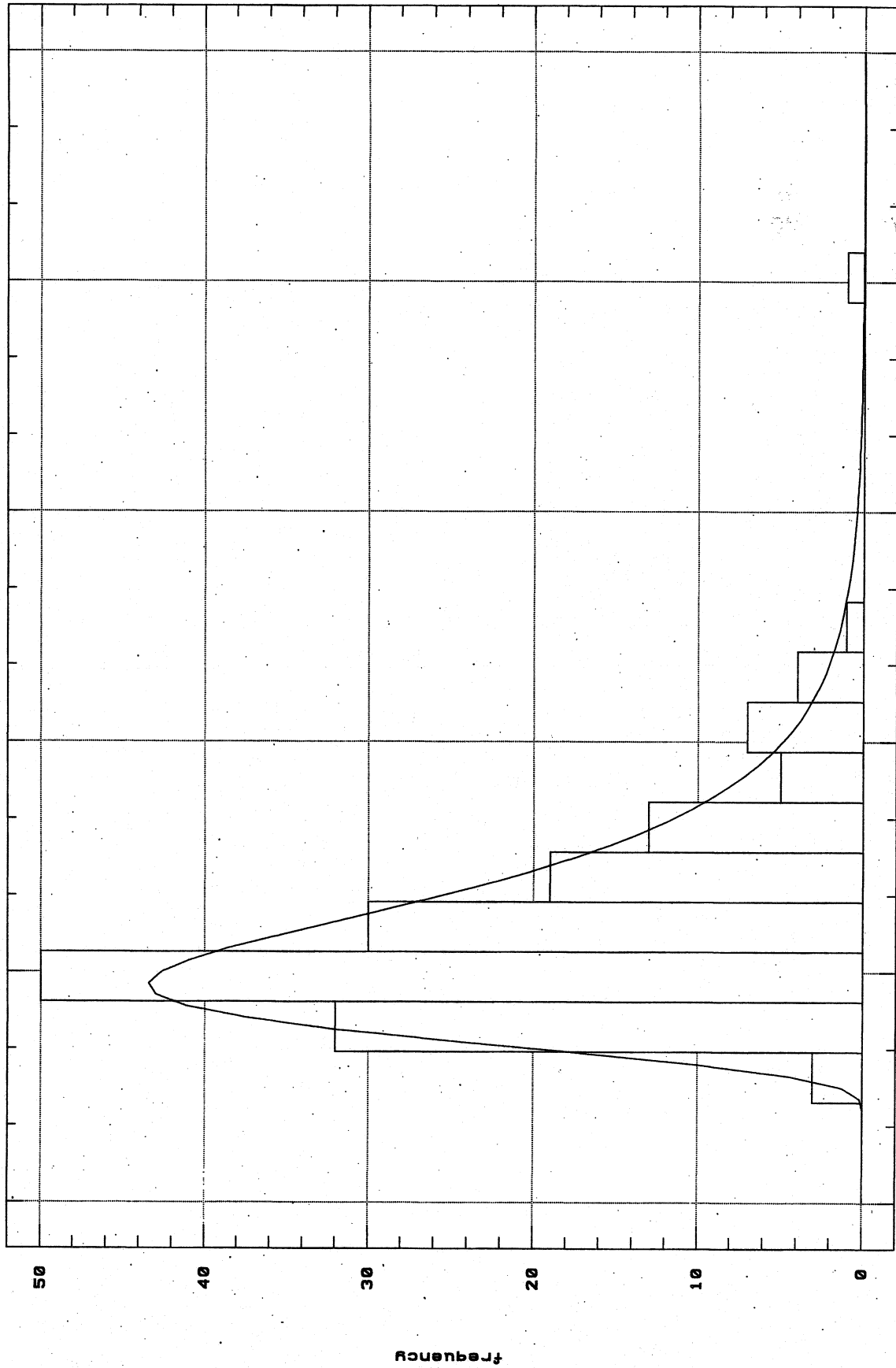
MTCASat Background Calculations
IRON DATA

18400
18400
19100
19450
19500
20000
20100
20200
20500
20525
20733.33
20800
21100
21225
21300
21350
21433.33
21633.33
21650
22033.33
22200
22300
22750
22900
23150
23300
23500
23900
24100
24550
24650
24700
24750
25000
25300
25850
26100
26100
26123.08
26200
26675
26900
27000
27071.43
27500
27700
27750
27800
28300
28642.86
29000
29040
29300
29300
30000
30050
30350
30600
30935.71
31400
31650
32600
32733.33
33000

MTCASat Background Calculations
IRON DATA

33100
33250
33350
33566.67
34500
35050
35450
35700
35933.33
37253.85
37450
37757.14
38400
39566.67
39600
39662.5
40400
41650
41700
41800
42200
42825
44700
45633.33
48625
49900
50200
52550
52850
53800
53933.33
54950
55571.43
58050

STATEWIDE IRON DISTRIBUTION



(X 10000)

IRON 90th = 43.106 MG/KG

MTCASat Background Calculations

9160
11100
11300
13200
13900
14100
17100
18200
23300
26100
33000
38400
41800
49900
62800

Fe - GROUP "W"

REGIONS J,L,P,R - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	25557.33
Censored	0	Lognormal mean	25757.52
TOTAL	15	Std. devn.	16247.65
		Median	18200
		Min.	9160
		Max.	62800
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.88	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	49170.89	
L = lognormal		50th	21446.18
N = normal		4 X 50th	85784.73
X = neither (so use nonparametric method)		Coefficient of Variation = 0.72	

MTCASat Background Calculations

Fe - CLARK COUNTY

16350
 26123.08
 29300
 29300
 31400
 32733.33
 33250
 33350
 35050
 35700
 35933.33
 37253.85
 37450
 39566.67
 41650
 42200
 42825
 45633.33
 48625
 50200
 52850
 53933.33
 54950
 55571.43
 58050
 59850

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	40734.55
Censored	0	Lognormal mean	40923.09
TOTAL	26	Std. devn.	11005.31
		Median	38508.3333
		Min.	16350
		Max.	59850
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	58665.27	
L = lognormal		50th	39180.95
N = normal		4 X 50th	156723.80
X = neither (so use nonparametric method)		Coefficient of Variation = 0.32	

MTCASat Background Calculations

Fe - PUGET SOUND BASIN

5920
 11700
 12320
 12950
 13050
 13353.85
 13450
 13533.33
 13700
 14300
 14333.33
 14800
 14900
 15150
 15300
 15550
 15660
 16350
 16550
 16700
 16800
 17000
 17100
 17300
 17650
 17792.86
 17900
 18078.57
 18200
 19450
 20100
 20500
 20525
 21433.33
 25850
 26675
 27500
 27750
 29040
 34500
 37757.14
 40400
 52550
 112500

Number of samples		<u>Uncensored values</u>	
Uncensored	44	Mean	21680.05
Censored	0	Lognormal mean	21082.33
TOTAL	44	Std. devn.	16424.87
		Median	17050
		Min.	5920
		Max.	112500
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.52	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	36128.57
L = lognormal		50th	17050.00
N = normal		4 X 50th	68200.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Fe - YAKIMA BASIN

5025
 16368.67
 17200
 20733.33
 21350
 21633.33
 22033.33
 22750
 23150
 23900
 24550
 26900
 27071.43
 27800
 28300
 28642.86
 29000
 30050
 30350
 30600
 30935.71
 31650
 32600
 33100
 33566.67
 35450
 39600
 39662.5
 41700
 44700
 53800
 58800

Number of samples Uncensored 32 Censored 0 TOTAL 32		Uncensored values Mean 29780.40 Lognormal mean 30339.72 Std. devn. 10562.32 Median 28821.4286 Min. 5025 Max. 58800	
Lognormal distribution? r-squared is: 0.82		Normal distribution? r-squared is: 0.94	
Recommendations: <p style="text-align: center;">Use normal distribution.</p>			
Enter distribution (L, N or X) L L = lognormal N = normal X = neither (so use nonparametric method)		Enter percentile 90 50th 4 X 50th Coefficient of Variation = 0.51	
		Value corresponding to that percentile is: 51451.49 27689.82 110759.30	

MTCASat Background Calculations

Fe - SPOKANE BASIN

9670
 12517.5
 13966.67
 14300
 14662.5
 16100
 16133.33
 16600
 16735.71
 17000
 17050
 17550
 18150
 18150
 18400
 18400
 19500
 20000
 20800
 21100
 21225
 22300
 24100
 24650
 24750
 25300
 27000

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	18744.84
Censored	0	Lognormal mean	18783.35
TOTAL	27	Std. devn.	4172.08
		Median	18150
		Min.	9670
		Max.	27000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.98	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	25026.20	
L = lognormal		50th	18278.16
N = normal		4 X 50th	73112.65
X = neither (so use nonparametric method)		Coefficient of Variation = 0.25	

MTCASat Background Calculations

10400
11200
11500
13000
13200
15500
16200
17100
19100
20200
21300
21650
22200
22900
23500
24700
25000
26100
26200
27700
30000

Fe - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	21	Mean	19935.71
Censored	0	Lognormal mean	20046.16
TOTAL	21	Std. devn.	5885.98
		Median	21300
		Min.	10400
		Max.	30000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	29631.58	
L = lognormal	50th	19027.40	
N = normal	4 X 50th	76109.59	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.36		

MTCASat Background Calculations
LEAD DATA

LEAD
 STATEWIDE

<2
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 <4
 2.1
 2.125
 2.171429
 2.3
 2.3
 3.1
 3.2
 3.8
 3.8
 3.875
 4
 4
 4.066667
 4.2
 4.2
 4.25
 4.25
 4.45
 4.5
 4.6
 4.65
 4.7
 4.733333
 4.75
 4.8
 4.8625
 5
 5.133333
 5.133333
 5.2
 5.233333
 5.25
 5.3
 5.3
 5.4
 5.4
 5.4
 5.45
 5.5
 5.8
 5.9
 5.9
 5.9
 5.95
 6
 6.033333
 6.05
 6.1

Number of samples		<u>Uncensored values</u>			
	Uncensored	151	Mean	10.05	
	Censored	15	Lognormal mean	9.26	
	TOTAL	166	Std. devn.	16.83	
			Median	7.90	
			Min.	2.10	
			Max.	207.50	
Lognormal distribution?		Normal distribution?			
r-squared is: 0.91		r-squared is: 0.23			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:	
	L	90	17.09	0.0000	
	L = lognormal	50th	6.98	0.0000	
	N = normal	4 X 50th	27.92	0.0000	
	X = neither (so use nonparametric method)	Coefficient of Variation = 0.79			

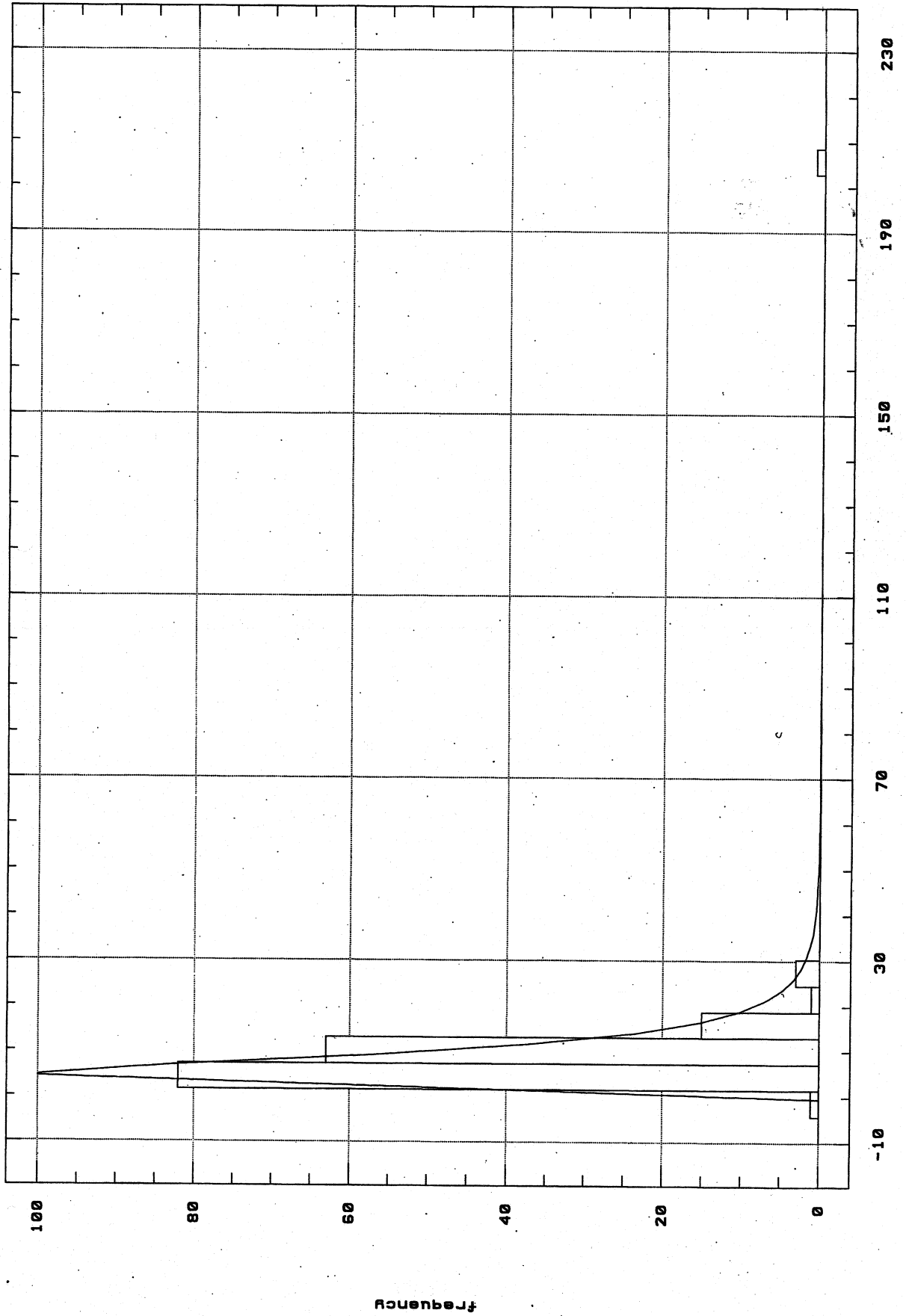
MTCASat Background Calculations
LEAD DATA

6.1
6.1
6.2
6.35
6.4
6.433333
6.5
6.521429
6.55
6.6
6.65
6.7
6.7
6.728571
6.75
6.8
6.866667
7
7.05
7.166667
7.3
7.3
7.4
7.45
7.7
7.8
7.85
7.9
8
8
8.1
8.2
8.25
8.3
8.35
8.65
8.666667
8.733333
8.75
8.8
8.8
9.05
9.1
9.133333
9.185
9.5
9.5
9.657143
9.7
9.7
9.8
9.9
9.9
10
10
10.05
10.15
10.26
10.4
10.5
10.6
10.65
10.65
10.73333

MTCASat Background Calculations
LEAD DATA

10.77143
10.8
10.875
10.975
11
11.09
11.3
11.5
11.7
12
12
12
12.04385
12.23333
12.5
12.5
12.8
12.83333
12.9
13.5
13.5
13.5
13.7
13.72667
14.33333
14.925
15
15.2
15.66667
15.77857
15.975
16
16.2
17.1

STATEWIDE LEAD DISTRIBUTION



LEAD 90th = 17.1 MG/KG

MTCASat Background Calculations

2.1
2.3
2.3
3.1
3.2
3.8
4
4
4.7
5.2
6.1
9.7
10
12
12

Pb - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	15	Mean	5.63
Censored	0	Lognormal mean	5.68
TOTAL	15	Std. devn.	3.52
		Median	4
		Min.	2.1
		Max.	12
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.85	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.72	
		Value corresponding to that percentile is:	
		10.87	
		4.75	
		18.98	

MTCASat Background Calculations

Pb - CLARK COUNTY

<2
 4.65
 5.45
 5.5
 6.7
 7.3
 7.45
 7.7
 8.3
 8.65
 8.73333
 9.1
 9.185
 9.8
 10.73333
 10.77143
 11.09
 11.3
 12.04385
 12.23333
 12.5
 12.9
 13.7
 14.925
 15.975
 29.6

Number of samples		Uncensored values	
Uncensored	25	Mean	10.65
Censored	1	Lognormal mean	10.63
TOTAL	26	Std. devn.	4.93
		Median	9.8
		Min.	4.65
		Max.	29.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	16.83
L = lognormal		50th	9.50
N = normal		4 X 50th	37.99
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

MTCASat Background Calculations

Pb - PUGET SOUND BASIN

<4
<4
<4
<4
<4
<4
<4
<4
<4
<4
<4
<4
2.125
3.8
4.25
4.25
4.45
4.6
4.733333
4.75
5.133333
5.233333
5.25
5.9
6.033333
6.1
6.521429
6.866667
7.9
8.2
9.9
10
10.15
10.26
10.975
13.5
13.5
13.72667
16.2
22.01538
29
29.47857
207.5

Number of samples		<u>Uncensored values</u>		
Uncensored	31	Mean	15.88	
Censored	14	Lognormal mean	12.39	
TOTAL	45	Std. devn.	36.21	
		Median	6.8666667	
		Min.	2.125	
		Max.	207.5	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.90		r-squared is: 0.37		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	24.02	
L = lognormal		50th	4.47	
N = normal		4 X 50th	17.88	
X = neither (so use nonparametric method)		Coefficient of Variation = 2.14		

MTCASat Background Calculations

Pb - YAKIMA BASIN

2.171429
 3.875
 4.066667
 4.5
 4.8625
 5.133333
 5.3
 5.4
 5.4
 5.9
 6.05
 6.1
 6.2
 6.35
 6.433333
 6.5
 6.55
 6.65
 6.728571
 7
 7.05
 7.166667
 7.3
 7.4
 7.85
 8.1
 8.25
 9.133333
 9.657143
 9.7
 15.2
 17.1

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	7.03
Censored	0	Lognormal mean	7.04
TOTAL	32	Std. devn.	2.90
		Median	6.525
		Min.	2.17142857
		Max.	17.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.92		r-squared is: 0.80	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90		11.00
L = lognormal		50th	6.56
N = normal		4 X 50th	26.24
X = neither (so use nonparametric method)		Coefficient of Variation = 0.42	

MTCASat Background Calculations

Pb - SPOKANE BASIN

6.75
 7.8
 8.35
 8.66667
 8.75
 8.8
 9.05
 9.5
 10.05
 10.5
 10.6
 10.65
 10.65
 10.8
 10.875
 11
 11.5
 12
 12.5
 12.8
 12.83333
 13.5
 14.33333
 15
 15.66667
 15.77857
 16

Number of samples		Uncensored values	
Uncensored	27	Mean	11.29
Censored	0	Lognormal mean	11.30
TOTAL	27	Std. devn.	2.55
		Median	10.8
		Min.	6.75
		Max.	16
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	14.91	
L = lognormal	50th	11.01	
N = normal	4 X 50th	44.04	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.24		

MTCASat Background Calculations

4.2
4.2
4.8
5
5.3
5.4
5.8
5.9
5.95
6
6.4
6.6
6.7
6.8
8
8
8.8
9.5
9.9
10.4
11.7

Pb - GROUP "E"
REGIONS J.L.P,R - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	21	Mean	6.92
Censored	0	Lognormal mean	6.93
TOTAL	21	Std. devn.	2.11
		Median	6.4
		Min.	4.2
		Max.	11.7
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.93	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	9.85	
L = lognormal		50th	6.64
N = normal		4 X 50th	26.56
X = neither (so use nonparametric method)		Coefficient of Variation = 0.32	

MTCASat Background Calculations
MANGANESE DATA

MANGANESE
STATEWIDE DATA

78
90
107
112
141.4
149
150
159
163
164.45
183.6667
197
216
228.3333
229
231
231.5
233
234
234.5
245
252
252.75
256
268
276.5
277
279
284.3333
294
299
302.25
303
306.5
310.4
321
325
340
345
350.5714
354.5
361.5
363
365
366
366
367.2143
372
374
374.5
376.5
377
378
383.3077
384.3333
386
387.5
390.875
392.5
394.3333
396.5
411
417.4286

Number of samples		<u>Uncensored values</u>		
Uncensored	166	Mean	592.56	
Censored	0	Lognormal mean	595.61	
TOTAL	166	Std. devn.	395.53	
		Median	509.58	
		Min.	78.00	
		Max.	2,750.00	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.99		r-squared is: 0.82		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:
L		90	1,094.85	1094.8454
L = lognormal		50th	492.82	1111.1408
N = normal		4 X 50th	1,971.30	1078.5499
X = neither (so use nonparametric method)		Coefficient of Variation = 0.69		

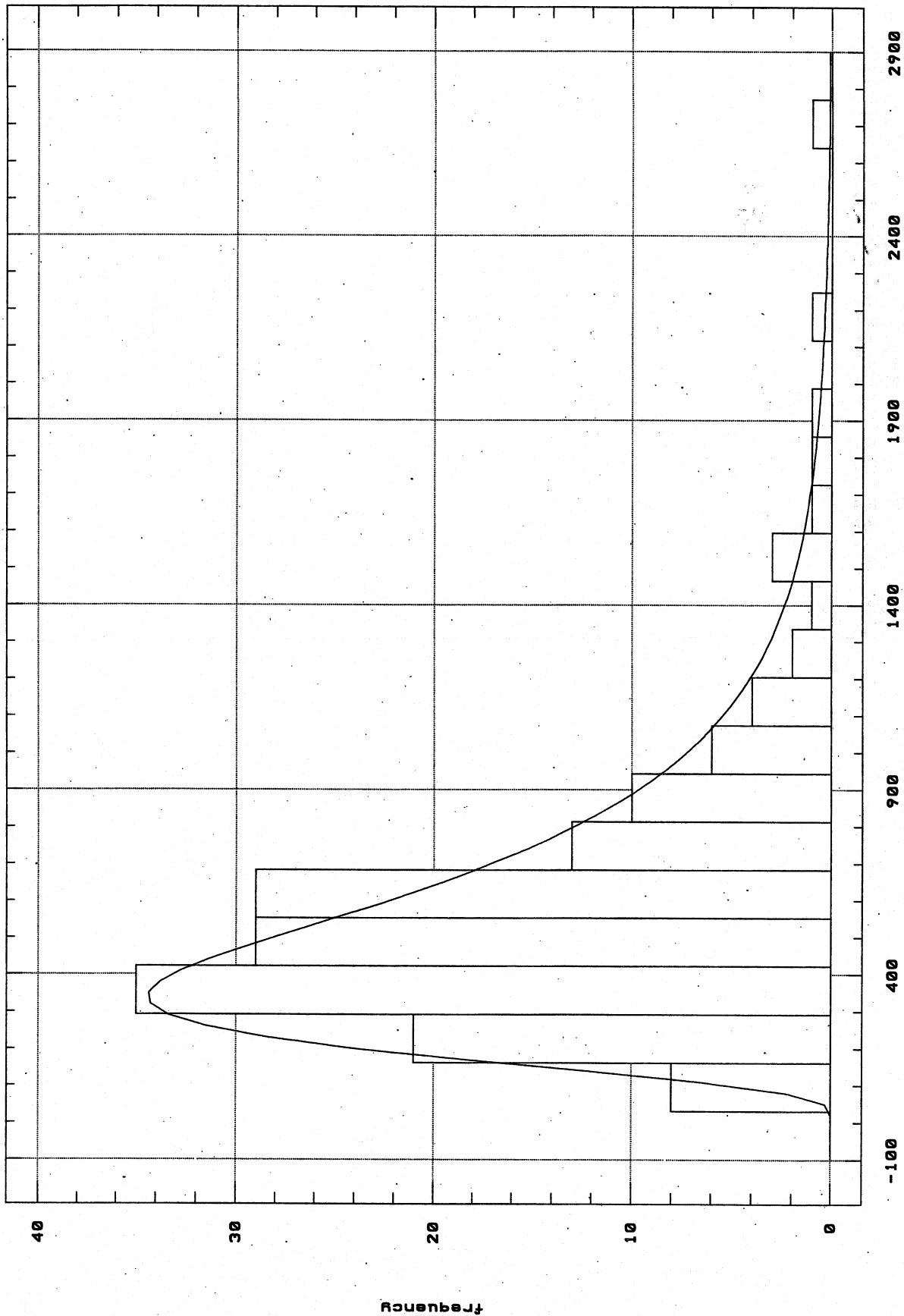
MTCASat Background Calculations
MANGANESE DATA

420.7692
427.6667
430
436
445.5
446
454
461
463.3333
464.6667
470
473.75
475
486
488
493.5
494.5
499
505
509.5
509.6667
510
516
520.5
523
523
525.5
537
540.5
547.3333
555
557.3333
557.5
558
561
561.25
564.4286
565.6667
571
577.75
591.6667
599
607
611
613
631
631
633
638.3571
638.5
652
655
659
659.9286
665.5
667.5
671
679.5
680
708.5
716
738
740
741.5

MTCASat Background Calculations
MANGANESE DATA

753.5
761
763
764.75
769.5
770.5
786.5
807.5
818.5
829.6667
840
846
848
902.5
904.5
926.5
927
930
951
951.6
952.5
983.75
1008
1042
1077.25
1110
1119
1192.154
1210.857
1291.5
1375
1483.333
1525.5
1546.125

STATEWIDE MANGNESE DISTRIBUTION



MANGNESE 90th = 1,095 MG/KG

MTCASat Background Calculations

78
107
112
149
159
197
229
231
277
303
366
537
631
633
930

Mn - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	15	Mean	329.27
Censored	0	Lognormal mean	335.74
TOTAL	15	Std. devn.	246.48
		Median	231
		Min.	78
		Max.	930
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	691.75	
L = lognormal	50th	257.06	
N = normal	4 X 50th	1028.24	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.9		

MTCASat Background Calculations

Mn - CLARK COUNTY

150
231.5
420.7692
464.6667
509.5
659
665.5
667.5
807.5
829.6667
848
902.5
904.5
926.5
927
951
952.5
983.75
1042
1077.25
1110
1192.154
1483.333
1525.5
1836
1960.857

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	924.17
Censored	0	Lognormal mean	956.78
TOTAL	26	Std. devn.	432.53
		Median	915.5
		Min.	150
		Max.	1960.85714
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.95	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
N	90	1511.59	
L = lognormal	50th	924.17	
N = normal	4 X 50th	3696.68	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.5		

MTCASat Background Calculations

Mn - PUGET SOUND BASIN

90
 141.4
 163
 183.6667
 216
 228.3333
 234.5
 252.75
 276.5
 284.3333
 299
 302.25
 306.5
 310.4
 321
 350.5714
 361.5
 365
 367.2143
 374.5
 383.3077
 387.5
 473.75
 499
 509.6667
 523
 525.5
 557.5
 561
 591.6667
 607
 659.9286
 679.5
 738
 740
 753.5
 763
 770.5
 818.5
 846
 951.6
 1291.5
 1670
 2170
 2750

Number of samples		<u>Uncensored values</u>		
Uncensored	45	Mean	592.21	
Censored	0	Lognormal mean	584.83	
TOTAL	45	Std. devn.	511.10	
		Median	473.75	
		Min.	90	
		Max.	2750	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.98		r-squared is: 0.70		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	1146.25	
L = lognormal		50th	461.62	
N = normal		4 X 50th	1846.48	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.81		

MTCASat Background Calculations

Mn - YAKIMA BASIN

164.45
 384.3333
 386
 392.5
 396.5
 427.6667
 486
 488
 493.5
 494.5
 510
 520.5
 540.5
 547.3333
 564.4286
 565.6667
 613
 631
 638.3571
 671
 680
 708.5
 716
 741.5
 761
 786.5
 840
 1008
 1119
 1210.857
 1375
 1546.125

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	668.99
Censored	0	Lognormal mean	672.23
TOTAL	32	Std. devn.	300.40
		Median	589.333333
		Min.	164.45
		Max.	1546.125
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	1104.84
L = lognormal		50th	611.46
N = normal		4 X 50th	2445.82
X = neither (so use nonparametric method)		Coefficient of Variation = 0.49	

MTCASat Background Calculations

Mn - SPOKANE BASIN

354.5
 366
 374
 376.5
 390.875
 394.3333
 417.4286
 436
 445.5
 446
 454
 461
 463.3333
 470
 475
 505
 555
 557.3333
 558
 561.25
 577.75
 599
 611
 638.5
 655
 764.75
 769.5

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	506.54
Censored	0	Lognormal mean	506.73
TOTAL	27	Std. devn.	114.86
		Median	470
		Min.	354.5
		Max.	769.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	663.48	
L = lognormal	50th	494.78	
N = normal	4 X 50th	1979.12	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.23		

MTCASat Background Calculations

233
234
245
252
256
268
279
294
325
340
345
363
372
377
378
411
430
516
523
571
652

Mn - GROUP "E"
REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		Uncensored values	
Uncensored	21	Mean	364.95
Censored	0	Lognormal mean	365.18
TOTAL	21	Std. devn.	117.77
		Median	345
		Min.	233
		Max.	652
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.91	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	526.59	
L = lognormal	50th	348.73	
N = normal	4 X 50th	1394.92	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.33		

MTCASat Background Calculations
MERCURY DATA

MERCURY
 STATEWIDE DATA

0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.00425
 0.00475
 0.005
 0.0054
 0.00565
 0.006164
 0.00635
 0.0065
 0.0068
 0.007
 0.00725
 0.008
 0.008
 0.009
 0.009
 0.009475
 0.01
 0.01
 0.01
 0.01
 0.01
 0.0105
 0.0105
 0.01075
 0.011
 0.011
 0.011
 0.011
 0.011
 0.01195
 0.012
 0.012
 0.01225
 0.0123
 0.0125
 0.012667
 0.013
 0.013
 0.01375
 0.014
 0.014
 0.014063
 0.014333
 0.014625
 0.015
 0.0155
 0.016
 0.016143
 0.01625
 0.0165
 0.0168
 0.017
 0.0172
 0.017333
 0.017714

Number of samples		<u>Uncensored values</u>			
	Uncensored	166	Mean	0.03	
	Censored	0	Lognormal mean	0.03	
	TOTAL	166	Std. devn.	0.03	
			Median	0.02	
			Min.	0.00	
			Max.	0.19	
Lognormal distribution?		Normal distribution?			
r-squared is: 0.99		r-squared is: 0.80			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:	
	L	90		0.07	0.0656
	L = lognormal	50th		0.02	0.2486
	N = normal	4 X 50th		0.09	-0.1174
	X = neither (so use nonparametric method)	Coefficient of Variation = 1.02			

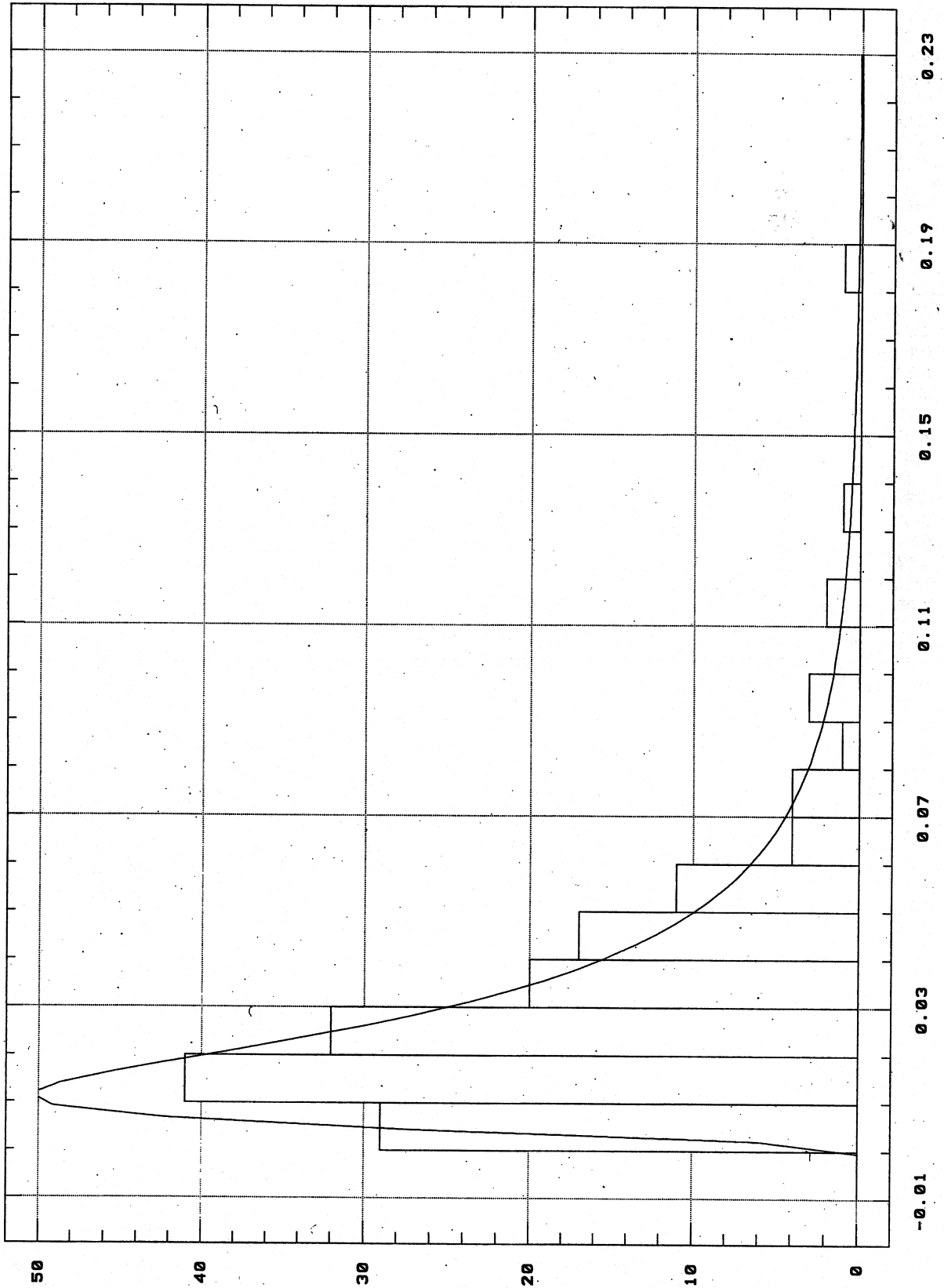
MTCASat Background Calculations
MERCURY DATA

0.0185
0.018914
0.019
0.0192
0.02
0.02
0.02
0.0205
0.0205
0.0205
0.021
0.021
0.021
0.021
0.0215
0.021667
0.021779
0.022
0.0225
0.023
0.024
0.025
0.0256
0.025846
0.0265
0.0265
0.026667
0.027
0.0275
0.02775
0.028
0.028333
0.0285
0.0285
0.0285
0.029
0.0292
0.03
0.03
0.0302
0.030333
0.030464
0.031
0.031
0.031
0.0315
0.032
0.033
0.03325
0.033333
0.0345
0.035
0.0356
0.035667
0.036
0.0365
0.037333
0.038
0.04
0.0406
0.042
0.042
0.0425
0.04265

MTCASat Background Calculations
MERCURY DATA

0.043
0.043457
0.0445
0.04475
0.045
0.045033
0.0455
0.046
0.047
0.0475
0.047931
0.04974
0.051
0.052
0.052
0.05325
0.053633
0.05485
0.055
0.05635
0.05675
0.058
0.06
0.061
0.0631
0.065725
0.066833
0.07435
0.07595
0.076
0.077308
0.082
0.093
0.09395

STATEWIDE MERCURY DISTRIBUTION



MERCURY 90th = 0.07 MG/KG

Frequency

MTCASat Background Calculations

0.009
 0.009
 0.01
 0.011
 0.021
 0.031
 0.038
 0.042
 0.045
 0.055
 0.061
 0.093
 0.119
 0.185

Hg - GROUP "W"
 REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	0.05
Censored	0	Lognormal mean	0.05
TOTAL	15	Std. devn.	0.05
		Median	0.038
		Min.	0.009
		Max.	0.185
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.13	
L = lognormal	50th	0.03	
N = normal	4 X 50th	0.13	
X = neither (so use nonparametric method)	Coefficient of Variation = 1.47		

MTCASat Background Calculations

Hg - CLARK COUNTY

0.0125
 0.01375
 0.0192
 0.02
 0.02
 0.0205
 0.0205
 0.021
 0.021667
 0.022
 0.0256
 0.025846
 0.026667
 0.0285
 0.0285
 0.03
 0.031
 0.031
 0.0315
 0.033333
 0.035
 0.04
 0.0425
 0.0455
 0.047931

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	0.03
Censored	0	Lognormal mean	0.03
TOTAL	26	Std. devn.	0.01
		Median	0.02625641
		Min.	0.0125
		Max.	0.04793077
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.04	
L = lognormal		50th	0.03
N = normal		4 X 50th	0.10
X = neither (so use nonparametric method)		Coefficient of Variation = 0.37	

MTCASat Background Calculations

Hg - PUGET SOUND BASIN

0.012
 0.021779
 0.0265
 0.027
 0.02775
 0.028
 0.0285
 0.029
 0.0292
 0.03
 0.0302
 0.033
 0.03325
 0.0356
 0.036
 0.0365
 0.037333
 0.042
 0.04265
 0.043
 0.043457
 0.0445
 0.04475
 0.045033
 0.046
 0.047
 0.0475
 0.04974
 0.052
 0.052
 0.05325
 0.053633
 0.05485
 0.05635
 0.05675
 0.058
 0.06
 0.0631
 0.065725
 0.066833
 0.07595
 0.076
 0.077308
 0.09395
 0.094407

Number of samples Uncensored 45 Censored 0 TOTAL 45		<u>Uncensored values</u> Mean 0.05 Lognormal mean 0.05 Std. devn. 0.02 Median 0.04475 Min. 0.012 Max. 0.09440714	
Lognormal distribution? r-squared is: 0.97		Normal distribution? r-squared is: 0.95	
Recommendations: <p style="text-align: center;">Use lognormal distribution.</p>			
Enter distribution (L, N or X) L L = lognormal N = normal X = neither (so use nonparametric method)		Enter percentile 90 50th 4 X 50th Coefficient of Variation = 0.44	
		Value corresponding to that percentile is: 0.07 0.04 0.17	

MTCASat Background Calculations

Hg - YAKIMA BASIN

0.00725
 0.01
 0.0105
 0.011
 0.011
 0.0123
 0.014
 0.0155
 0.016
 0.016143
 0.0165
 0.017
 0.017333
 0.017714
 0.018914
 0.0205
 0.021
 0.023
 0.024
 0.0265
 0.0275
 0.028333
 0.030333
 0.030464
 0.032
 0.0345
 0.035667
 0.0406
 0.051
 0.07435
 0.082
 0.1165

Number of samples		Uncensored values	
Uncensored	32	Mean	0.03
Censored	0	Lognormal mean	0.03
TOTAL	32	Std. devn.	0.02
		Median	0.02075
		Min.	0.00725
		Max.	0.1165
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.71	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.05
L = lognormal		50th	0.02
N = normal		4 X 50th	0.09
X = neither (so use nonparametric method)		Coefficient of Variation = 0.75	

MTCASat Background Calculations

Hg - SPOKANE BASIN

0.00425
 0.00475
 0.0054
 0.00565
 0.006164
 0.00635
 0.0065
 0.008
 0.009475
 0.0105
 0.01075
 0.01195
 0.012
 0.01225
 0.012667
 0.014
 0.014063
 0.014333
 0.014625
 0.01625
 0.0168
 0.0172
 0.0185
 0.019
 0.0215
 0.0225
 0.1312

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	0.02
Censored	0	Lognormal mean	0.02
TOTAL	27	Std. devn.	0.02
		Median	0.01225
		Min.	0.00425
		Max.	0.1312
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	0.02	
L = lognormal	50th	0.01	
N = normal	4 X 50th	0.05	
X = neither (so use nonparametric method)	Coefficient of Variation = N/A		

MTCASat Background Calculations

0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.004
 0.005
 0.0068
 0.007
 0.008
 0.01
 0.01
 0.01
 0.011
 0.013
 0.013
 0.015
 0.021
 0.025

Hg - GROUP "E"
 REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	0.01
Censored	0	Lognormal mean	0.01
TOTAL	21	Std. devn.	0.01
		Median	0.007
		Min.	0.004
		Max.	0.025
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.82	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90		0.02
L = lognormal		50th	0.01
N = normal		4 X 50th	0.03
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations
NICKEL DATA

NICKEL
 STATEWIDE DATA

2.15
 4.6
 4.9
 6.4
 7
 7.1
 7.6
 7.7
 7.8
 8.1
 8.325
 8.55
 8.7
 8.7
 9
 9
 9.2
 9.2
 9.35
 9.466667
 9.5
 9.65
 9.7
 9.75
 9.8
 9.8
 9.85
 9.875
 10
 10.03333
 10.05
 10.15
 10.3
 10.3
 10.36643
 10.65
 10.65
 10.7
 10.7
 10.85125
 11.2
 11.4
 11.7
 11.8
 11.9
 12
 12.05
 12.05
 12.2
 12.2
 12.3
 12.35
 12.45
 12.55
 12.6
 12.65
 12.68571
 12.75
 12.9
 12.975
 13.25357
 13.55
 13.55

Number of samples		<u>Uncensored values</u>			
	Uncensored	166	Mean	21.49	
	Censored	0	Lognormal mean	20.36	
	TOTAL	166	Std. devn.	24.44	
			Median	16.43	
			Min.	2.15	
			Max.	244.50	
Lognormal distribution?		Normal distribution?			
r-squared is: 0.93		r-squared is: 0.44			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:	
	L	90	38.19	38.1907	
	L = lognormal	50th	16.92	39.8195	
	N = normal	4 X 50th	67.68	36.5618	
	X = neither (so use nonparametric method)	Coefficient of Variation = 0.71			

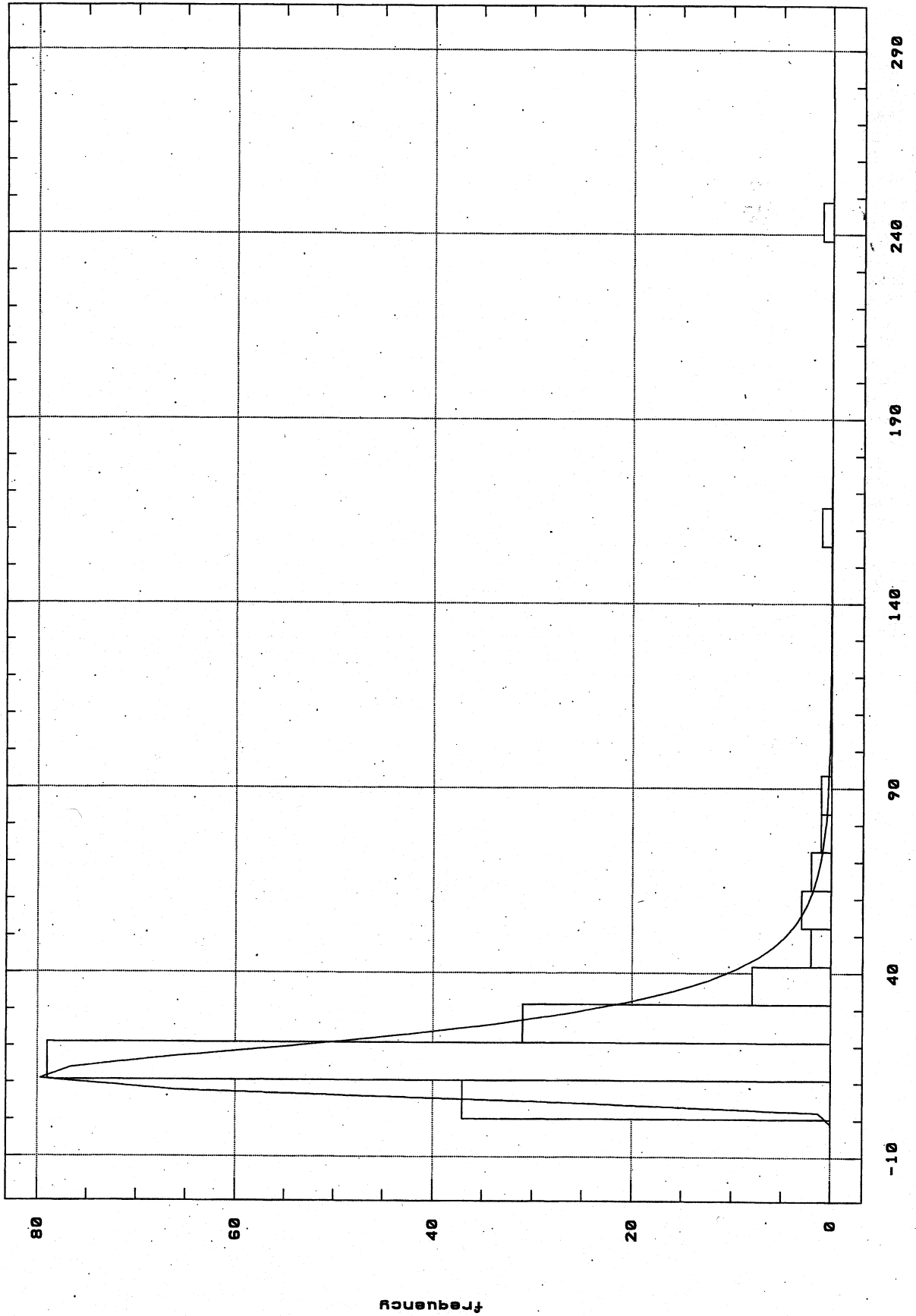
MTCASat Background Calculations
NICKEL DATA

13.76667
14
14.2
14.3
14.32857
14.53333
14.75
14.8
14.95
15.35
15.5
15.775
15.96667
16
16.06667
16.1
16.2
16.26667
16.35
16.4
16.46154
16.5
16.7
16.7
17
17
17.06667
17.3
17.35
17.4
17.4
17.975
18
18.17143
18.3
18.35
18.5
18.6
18.7
18.83333
18.9
19
19.05
19.1
19.1
19.1
19.3
19.3
19.4
19.6
20.26923
20.8
20.95
21.5
21.5
21.62857
21.7
22
22
22
22.13333
22.3
22.33333
22.75

MTCASat Background Calculations
NICKEL DATA

22.85
23
23
23.2
24
24
24.6
24.63333
24.66667
25
25
25.23333
25.24615
25.8
26.5
26.8
27.26667
28.95
29.9
31.3
34
34.1
34.95
36.3
36.86
38
39.8
40.36667
44.5
48.25
52.7
54.68571
57.45
63.2

STATEWIDE NICKEL DISTRIBUTION



NICKEL 90th = 38.2 MG/KG

MTCATStat Background Calculations

7.6
8.7
9
10
10.3
11.9
14.2
19.1
19.6
22.3
26.8
31.3
39.8
63.2
91.1

Ni - GROUP "W"

REGIONS "A", "C", "D"

Number of samples		Uncensored values	
Uncensored	15	Mean	25.66
Censored	0	Lognormal mean	25.38
TOTAL	15	Std. devn.	23.47
		Median	19.1
		Min.	7.6
		Max.	91.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.74	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	54.19
L = lognormal		50th	19.12
N = normal		4 X 50th	76.46
X = neither (so use nonparametric method)		Coefficient of Variation = 0.97	

MTCASat Background Calculations

Ni - CLARK COUNTY

7
9.35
12
12.6
12.65
12.75
13.55
13.76667
14.3
14.32857
14.75
15.96667
16.2
16.26667
16.46154
17.4
17.975
18.5
18.83333
18.9
19
19.05
19.3
20.26923
22.85
66.75

Number of samples		Uncensored values	
Uncensored	26	Mean	17.72
Censored	0	Lognormal mean	17.44
TOTAL	26	Std. devn.	10.61
		Median	16.2333333
		Min.	7
		Max.	66.75
Lognormal distribution?		Normal distribution?	
r-squared is: 0.79		r-squared is: 0.48	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	21.04	
L = lognormal	50th	16.23	
N = normal	4 X 50th	64.93	
X = neither (so use nonparametric method)	Coefficient of Variation = N/A		

MTCASat Background Calculations

Ni - PUGET SOUND BASIN

9
 10.05
 10.65
 12.05
 12.975
 16
 17
 17.06667
 17.35
 18
 18.17143
 18.7
 19.1
 21.5
 21.5
 21.62857
 21.7
 22
 22
 22
 22.33333
 22.75
 23
 23
 23.2
 24
 24.63333
 24.66667
 25
 25
 25.23333
 25.24615
 25.8
 26.5
 27.26667
 29.9
 34
 34.95
 36.3
 36.86
 44.5
 52.7
 54.68571
 57.45
 244.5

Number of samples		Uncensored values	
Uncensored	45	Mean	29.82
Censored	0	Lognormal mean	27.94
TOTAL	45	Std. devn.	34.45
		Median	23
		Min.	9
		Max.	244.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.83		r-squared is: 0.35	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	
X		90	
		Value corresponding to that percentile is:	
L = lognormal		50th	23.00
N = normal		4 X 50th	92.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Ni - YAKIMA BASIN

2.15
 8.55
 9.8
 10.3
 10.7
 12.68571
 12.9
 13.25357
 13.55
 14.53333
 14.8
 14.95
 15.35
 15.5
 16.06667
 16.1
 16.35
 17.3
 17.4
 18.3
 18.35
 19.1
 19.3
 20.95
 22.13333
 24
 28.95
 38
 40.36667
 48.25
 81.75714
 163

Number of samples		Uncensored values	
Uncensored	32	Mean	24.83
Censored	0	Lognormal mean	23.73
TOTAL	32	Std. devn.	29.11
		Median	16.225
		Min.	2.15
		Max.	163
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.49	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	
X		90	
L = lognormal		Value corresponding to that percentile is:	
N = normal		45.89	
X = neither (so use nonparametric method)		50th 16.23	
		4 X 50th 64.90	
		Coefficient of Variation = N/A	

MTCASat Background Calculations

Ni - SPOKANE BASIN

- 4.6
- 4.9
- 8.1
- 8.325
- 8.7
- 9.2
- 9.466667
- 9.65
- 9.75
- 9.8
- 9.85
- 9.875
- 10.03333
- 10.15
- 10.36643
- 10.85125
- 11.4
- 11.8
- 12.05
- 12.2
- 12.35
- 12.45
- 12.55
- 15.775
- 16.4
- 16.7
- 18.6

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	10.96
Censored	0	Lognormal mean	11.01
TOTAL	27	Std. devn.	3.20
		Median	10.15
		Min.	4.6
		Max.	18.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.93	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	16.19
L = lognormal		50th	10.49
N = normal		4 X 50th	41.96
X = neither (so use nonparametric method)		Coefficient of Variation = 0.35	

MTCASat Background Calculations

6.4
7.1
7.7
7.8
9.2
9.5
9.7
10.65
10.7
11.2
11.7
12.2
12.3
14
16.5
16.7
17
19.4
20.8
24.6
34.1

Ni - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	13.77
Censored	0	Lognormal mean	13.75
TOTAL	21	Std. devn.	6.71
		Median	11.7
		Min.	6.4
		Max.	34.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.85	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	22.41	
L = lognormal	50th	12.54	
N = normal	4 X 50th	50.14	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.48		

MTCASat Background Calculations
ZINC DATA

ZINC
STATEWIDE DATA

12
21.1
21.4
24.1
24.4
24.43333
24.6
26.3
27.5
28.6
28.66667
29
29.7
30.3
30.7
31
31.4
31.5
32.3
32.3
32.4
32.7
33
33.25
33.95
34
35.8
36.3
36.7
37.4
38
38
39
39.26667
39.4
39.6
39.7
40.61429
40.85
41
41.03333
41.05
41.7
42
42.2
42.4
42.4875
42.5
43
43.2
43.35
43.6
43.65
43.75
43.8
43.95385
44.05
44.25
44.3
44.3
44.5
44.5
44.7

Number of samples		<u>Uncensored values</u>		
Uncensored	166	Mean	55.53	
Censored	0	Lognormal mean	55.68	
TOTAL	166	Std. devn.	21.55	
		Median	51.12	
		Min.	12.00	
		Max.	132.50	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.99		r-squared is: 0.95		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	85.82	85.8205
L = lognormal		50th	51.56	87.3942
N = normal		4 X 50th	206.23	84.2468
X = neither (so use nonparametric method)		Coefficient of Variation = 0.41		

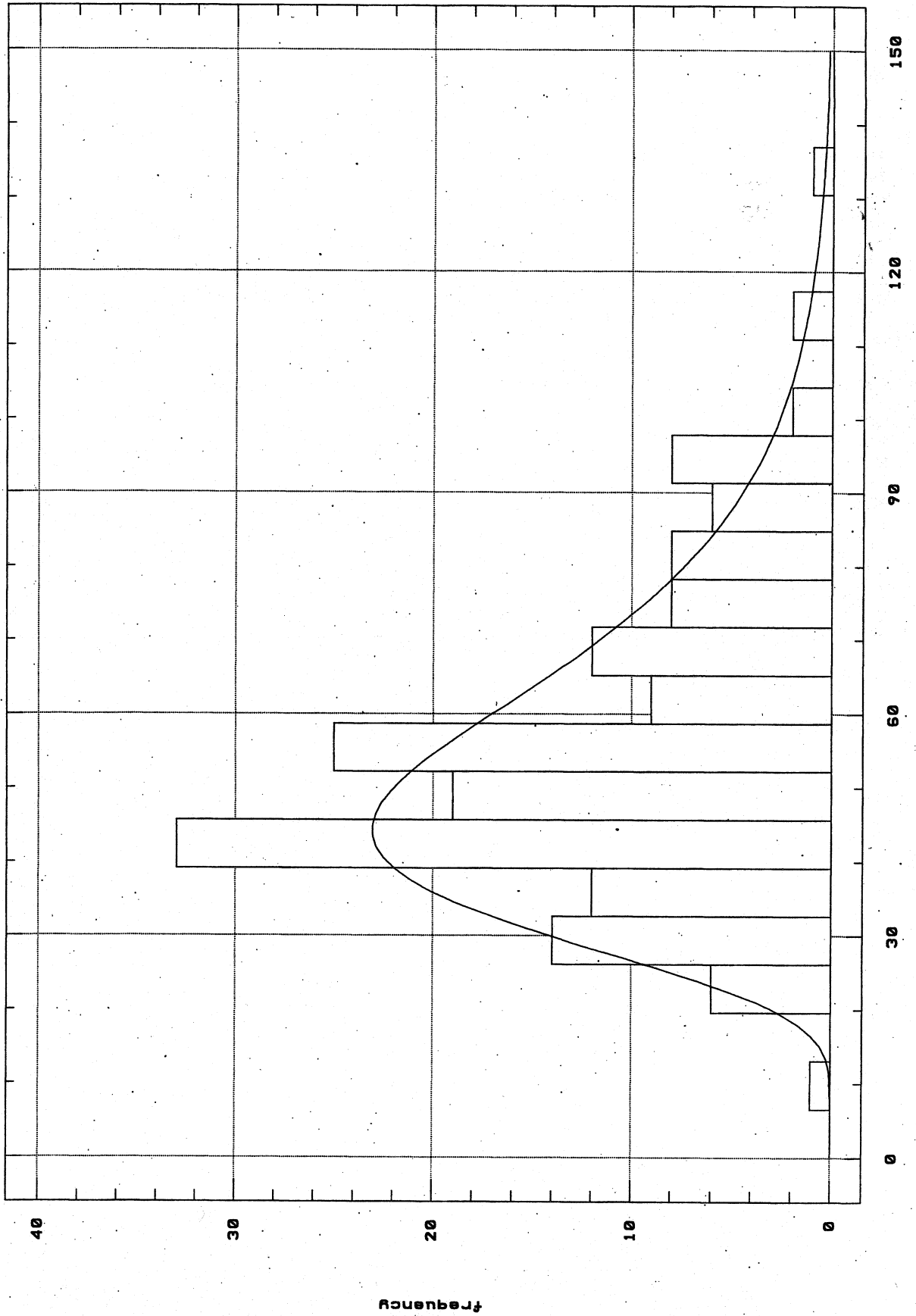
MTCASat Background Calculations
ZINC DATA

45
45.15
45.55
45.7
46.15
46.3
46.6
46.8
47.1
47.23333
47.575
47.65
47.95
48.15
48.50714
49.4
49.72143
50.35
50.4
50.89286
51.35
51.8
52.35
52.56667
52.575
52.7
53.05
53.3
53.35
53.6
53.8
53.9
54
54.15
54.6
54.75
55.65
55.9
56
56
56.4
56.85
58
58
58.3
58.45
58.46429
60.3
60.6
60.7
61.325
61.8
62.9125
63
63.1
64.3
66.15
67.1
67.16667
67.45
67.86667
68.1
68.4
69.45

MTCASat Background Calculations
ZINC DATA

70.8
71
71
71.38571
74.9
75.2
75.4
76.4
77.1
77.43333
77.9
78.1
78.85
79.9
81.45
82
82.3
83.8
84.5
84.68462
86
89.33333
89.4
89.51538
90.5
90.7
92.1
92.2
92.5
93
94.17143
94.75
97.3
97.7

STATEWIDE ZINC DISTRIBUTION



ZINC 90th = 85.8 MG/KG

MTCASat Background Calculations

21.1
24.1
24.4
24.6
27.5
36.7
42.4
44.5
45
53.8
54
63
63.1
86
116

Zn - GROUP "W"
REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	48.41
Censored	0	Lognormal mean	48.66
TOTAL	15	Std. devn.	26.17
		Median	44.5
		Min.	21.1
		Max.	116
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	85.56
L = lognormal		50th	42.85
N = normal		4 X 50th	171.39
X = neither (so use nonparametric method)		Coefficient of Variation = 0.58	

MTCASat Background Calculations

Zn - CLARK COUNTY

21.4
 33.95
 56.85
 58
 64.3
 66.15
 67.1
 67.86667
 69.45
 71.38571
 74.9
 76.4
 77.1
 79.9
 83.8
 84.5
 84.68462
 89.33333
 89.51538
 92.1
 92.2
 92.5
 93
 94.75
 97.3
 97.7

Number of samples		Uncensored values	
Uncensored	26	Mean	76.01
Censored	0	Lognormal mean	77.04
TOTAL	26	Std. devn.	18.79
		Median	78.5
		Min.	21.4
		Max.	97.7
Lognormal distribution?		Normal distribution?	
r-squared is: 0.72		r-squared is: 0.88	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90		95.52
L = lognormal		50th	78.50
N = normal		4 X 50th	314.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Zn - PUGET SOUND BASIN

12
 24.43333
 28.6
 28.66667
 29
 31
 32.3
 32.3
 32.7
 33
 33.25
 34
 35.8
 36.3
 38
 38
 39
 40.61429
 41.7
 42.5
 43
 43.35
 43.65
 43.95385
 44.5
 45.15
 46.8
 47.65
 52.35
 52.575
 54.15
 54.6
 56
 58
 58.45
 67.16667
 71
 78.1
 81.45
 82
 89.4
 90.5
 99
 116.75
 132.5

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	51.45
Censored	0	Lognormal mean	51.50
TOTAL	45	Std. devn.	24.93
		Median	43.65
		Min.	12
		Max.	132.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	90
L = lognormal		50th	46.52
N = normal		4 X 50th	186.08
X = neither (so use nonparametric method)		Coefficient of Variation = 0.5	

MTCASat Background Calculations

Zn - YAKIMA BASIN

39.26667
 40.85
 41.03333
 43.6
 43.75
 44.3
 44.7
 45.55
 45.7
 46.6
 47.23333
 48.50714
 49.72143
 50.4
 51.35
 52.7
 53.05
 53.6
 54.75
 55.9
 58.46429
 60.3
 60.6
 60.7
 62.9125
 68.1
 75.2
 77.43333
 78.85
 90.7
 94.17143
 101.4333

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	57.54
Censored	0	Lognormal mean	57.48
TOTAL	32	Std. devn.	16.18
		Median	52.875
		Min.	39.2666667
		Max.	101.433333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	78.71
L = lognormal		50th	55.66
N = normal		4 X 50th	222.65
X = neither (so use nonparametric method)		Coefficient of Variation = 0.28	

MTCASat Background Calculations

Zn - SPOKANE BASIN

29.7
 41.05
 42
 42.4875
 43.2
 44.05
 44.25
 44.3
 46.15
 46.3
 47.575
 48.15
 50.35
 50.89286
 51.8
 52.56667
 53.3
 53.35
 53.9
 55.65
 56
 61.325
 61.8
 67.45
 68.4
 70.8
 71

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	51.77
Censored	0	Lognormal mean	51.82
TOTAL	27	Std. devn.	10.03
		Median	50.8928571
		Min.	29.7
		Max.	71
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	66.35	
L = lognormal	50th	50.83	
N = normal	4 X 50th	203.33	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.21		

MTCASat Background Calculations

26.3
30.3
30.7
31.4
31.5
32.4
37.4
39.4
39.6
39.7
41
42.2
43.8
47.1
47.95
49.4
56.4
58.3
75.4
77.9
82.3

Zn - GROUP "E"
REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	45.74
Censored	0	Lognormal mean	45.73
TOTAL	21	Std. devn.	16.11
		Median	41
		Min.	26.3
		Max.	82.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		90	67.47
L = lognormal		50th	43.40
N = normal		4 X 50th	173.60
X = neither (so use nonparametric method)		Coefficient of Variation = 0.35	

MTCASat Background Calculations

0.24
0.31
0.31
0.31
0.31
0.32
0.32
0.33
0.34
0.35
0.35
0.35
0.37
0.37
0.37
0.37
0.37
0.38
0.38
0.39
0.4
0.41
0.42
0.44
0.46
0.49
0.58
0.6
0.61
0.63
0.71
0.73
0.75

*** Ag - STATEWIDE**

ALL DATA

** Background calculation based on values exceeding detection limit*

Number of samples		<u>Uncensored values</u>	
Uncensored	33	Mean	0.43
Censored	0	Lognormal mean	0.43
TOTAL	33	Std. devn.	0.13
		Median	0.37
		Min.	0.24
		Max.	0.75
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.84	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.61
L = lognormal		50th	0.41
N = normal		4 X 50th	1.64
X = neither (so use nonparametric method)		Coefficient of Variation = 0.31	

MTCASat Background Calculations
BARIUM DATA

Ba - SPOKANE BASIN

ALL DATA

47.6
 49.2
 67.9
 89.3
 92.9
 94.4
 95.1
 96.6
 98
 103
 104
 104
 109
 116
 116
 116
 118
 120
 122
 132
 133
 135
 136
 140
 141
 144
 145
 147
 148
 149
 153
 153
 154
 155
 155
 157
 158
 159
 159
 162
 168
 170
 175
 178
 178
 179
 181
 183
 184
 186
 189
 189
 190
 191
 192
 193
 194
 194
 197
 199
 201
 202
 209

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	164.29
Censored	0	Lognormal mean	164.87
TOTAL	72	Std. devn.	63.96
		Median	157.5
		Min.	47.6
		Max.	471
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	254.97	
L = lognormal	50th	153.28	
N = normal	4 X 50th	613.11	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.41		

NOTE: Ba DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
BARIUM DATA

210
213
232
242
266
280
293
326
471

MTCASat Background Calculations
CALCIUM DATA

Ca - SPOKANE BASIN

ALL DATA

888
 1400
 1600
 1850
 1880
 1880
 1920
 2020
 2030
 2040
 2100
 2120
 2120
 2150
 2150
 2160
 2190
 2190
 2220
 2280
 2290
 2320
 2340
 2350
 2360
 2380
 2480
 2490
 2520
 2660
 2800
 2880
 3000
 3120
 3160
 3260
 3270
 3340
 3350
 3380
 3450
 3460
 3520
 3660
 3700
 3710
 3720
 3760
 3850
 3890
 3900
 3930
 3940
 3980
 4040
 4050
 4120
 4220
 4240
 4450
 4450
 4480
 4550

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	9185.53
Censored	0	Lognormal mean	5216.31
TOTAL	72	Std. devn.	28877.71
		Median	3265
		Min.	888
		Max.	180000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.63		r-squared is: 0.23	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	5493.00	
L = lognormal		50th	3210.00
N = normal		4 X 50th	12840.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

NOTE: Ca DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
CALCIUM DATA

4810
5290
5580
6730
7140
13800
117000
135000
180000

MTCASat Background Calculations
COBALT DATA

Co - SPOKANE BASIN
 ALL DATA

3.29
 3.47
 3.95
 4.87
 5.06
 5.31
 5.38
 5.45
 5.47
 5.49
 5.5
 5.56
 5.68
 5.85
 5.94
 5.94
 6.01
 6.05
 6.24
 6.41
 6.42
 6.49
 6.55
 6.57
 6.58
 6.67
 6.72
 6.76
 6.98
 7
 7.05
 7.07
 7.15
 7.29
 7.33
 7.36
 7.37
 7.39
 7.43
 7.45
 7.59
 7.64
 7.75
 7.9
 8.15
 8.32
 8.38
 8.4
 8.5
 8.63
 8.64
 8.65
 8.7
 8.81
 8.91
 9.11
 9.19
 9.72
 9.91
 10.2
 10.3
 10.3
 10.5

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	7.82
Censored	0	Lognormal mean	7.82
TOTAL	72	Std. devn.	2.52
		Median	7.365
		Min.	3.29
		Max.	19.2
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.90	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	11.15	
L = lognormal	50th	7.47	
N = normal	4 X 50th	29.88	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.32		

NOTE: Co DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
COBALT DATA

10.5
10.6
10.7
11.4
12.1
12.3
12.4
13.4
19.2

MTCASat Background Calculations
MAGNESIUM DATA

Mg - SPOKANE BASIN
ALL DATA

72.8
74.5
75.8
79
85.9
90.1
91.7
103
104
109
109
111
112
114
116
120
121
123
124
125
126
128
128
129
129
129
134
140
140
162
162
165
172
175
176
177
177
184
185
186
186
188
189
189
190
193
194
201
201
201
204
206
213
215
215
219
225
225
271
278
285
298

Number of samples		<u>Uncensored values</u>	
Uncensored	69	Mean	244.01
Censored	0	Lognormal mean	209.37
TOTAL	69	Std. devn.	442.14
		Median	176
		Min.	72.8
		Max.	3520
Lognormal distribution?		Normal distribution?	
r-squared is: 0.78		r-squared is: 0.26	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
X	90	298.00	
L = lognormal	50th	175.00	
N = normal	4 X 50th	700.00	
X = neither (so use nonparametric method)	Coefficient of Variation = N/A		

NOTE: Mg DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
MAGNESIUM DATA

354
368
397
468
1602
3520

MTCASat Background Calculations

3.1
3.1
3.2
3.2
3.3
3.3
3.4
3.4
3.4
3.4
3.4
3.4
3.4
3.5
3.5
3.5
3.6
3.6
3.6
3.7
3.7
3.8
3.9
3.9
3.9
4
4
4.1
4.1
4.1
4.2
4.2
4.2
4.2
4.2
4.3
4.3
4.3
4.3
4.5
4.6
4.8
4.9
4.9
5.2
5.4
5.8
6.6
7.6

*** Sb - STATEWIDE**

ALL DATA

*** BACKGROUND CALCULATION BASED ON VALUES EXCEEDING DETECTION LIMIT**

Number of samples		<u>Uncensored values</u>	
Uncensored	50	Mean	4.10
Censored	0	Lognormal mean	4.10
TOTAL	50	Std. devn.	0.87
		Median	4
		Min.	3.1
		Max.	7.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	5.20
L = lognormal		50th	4.02
N = normal		4 X 50th	16.10
X = neither (so use nonparametric method)		Coefficient of Variation = 0.2	

MTCASat Background Calculations

0.4
0.41
0.44
0.45
0.47
0.51
0.51
0.54
0.59
0.62
0.74
0.74
0.77
0.84

*** SELENIUM**

*** STATEWIDE DATA - BACKGROUND CALCULATION BASED ON THOSE VALUES EXCEEDING DETECTION LIMIT ("AA" ANALYSIS)**

Number of samples		<u>Uncensored values</u>	
Uncensored	14	Mean	0.57
Censored	0	Lognormal mean	0.57
TOTAL	14	Std. devn.	0.15
		Median	0.525
		Min.	0.4
		Max.	0.84
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.92	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.78
L = lognormal		50th	0.56
N = normal		4 X 50th	2.23
X = neither (so use nonparametric method)		Coefficient of Variation = 0.27	

MTCASat Background Calculations
TITANIUM DATA

Ti - SPOKANE BASIN
ALL DATA

131
268
270
275
285
341
349
429
439
440
442
451
452
463
466
507
516
518
518
519
540
558
560
561
576
579
583
588
589
596
598
612
624
625
628
631
632
633
642
642
651
655
659
665
666
680
693
700
707
723
741
741
747
749
749
753
781
796
823
839
846
872
900

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	681.60
Censored	0	Lognormal mean	683.68
TOTAL	72	Std. devn.	311.17
		Median	631.5
		Min.	131
		Max.	2130
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	1109.73	
L = lognormal		50th	623.62
N = normal		4 X 50th	2494.48
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

NOTE: TI DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
TITANIUM DATA

903
910
1120
1270
1290
1320
1370
1550
2130

MTCASat Background Calculations
VANADIUM DATA

V - SPOKANE BASIN

ALL DATA

- 8.23
- 12.6
- 13.4
- 14.1
- 14.9
- 15
- 15.1
- 15.3
- 15.9
- 16.6
- 17
- 17.4
- 17.9
- 18
- 18
- 18.3
- 18.3
- 18.6
- 19.2
- 19.6
- 19.6
- 19.7
- 19.8
- 19.9
- 20.1
- 20.8
- 21.5
- 21.6
- 21.9
- 22
- 22
- 22
- 22.6
- 23.1
- 23.3
- 23.7
- 24.8
- 25.3
- 25.7
- 25.9
- 26.5
- 26.6
- 26.8
- 27.3
- 27.6
- 27.6
- 27.7
- 29.4
- 30
- 31.6
- 32.1
- 32.3
- 33.3
- 33.8
- 34.7
- 35.3
- 36.2
- 37
- 37.6
- 38.8

Number of samples		<u>Uncensored values</u>		
Uncensored	72	Mean	28.15	
Censored	0	Lognormal mean	28.06	
TOTAL	72	Std. devn.	13.57	
		Median	24.25	
		Min.	8.23	
		Max.	80.5	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.98		r-squared is: 0.86		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile		Value corresponding to that percentile is:
L		90		45.04
L = lognormal			50th	25.56
N = normal			4 X 50th	102.25
X = neither (so use nonparametric method)			Coefficient of Variation = 0.46	

NOTE: VANADIUM DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
VANADIUM DATA

39
39.4
40.2
42.3
43.1
48.5
49.4
57
59.8
60.2
66.2
80.5

XII. DATA QUALITY INFORMATION

Data Quality Assurance and Quality Control (QA/QC)

Information on the overall quality of the data used in this report is presented in this section. The background soil data presented in this report is based on analytical work performed by the Department of Ecology's Manchester Environmental Laboratory. Four primary methods or procedures are employed by Manchester to evaluate and control the accuracy of laboratory analyses: check standards, duplicates, spikes, and blanks. The check standard is routinely performed in the laboratory using lab control samples and spiked blanks. The most important of the quality control measures is the check standard, followed by duplicate samples.

Sample Splits, Duplicates, and Reference Samples

Sample splits, duplicates, and reference samples were periodically collected in each phase of this study. The sample preparation method outlined in ASTM D 3987-85 was used to prepare all sample splits and duplicates. In addition to sample splits and duplicates, reference samples were also collected. Reference samples were collected from a separate geographic location and included in another data set for analysis. For example, the two reference samples in the Puget Sound data base were actually collected in Walla Walla. These samples were labeled as coming from the Puget Sound data set for QA/QC purposes. Additional information on sample splits and duplicates is given in Table 18.

Table 18: Sample Splits, Duplicates, and Reference Samples

Study	Date	Sampling Locations	Splits	Duplicates	Reference Samples	Total No. Samples
Soos Creek	1987	18	0	4		41
Other Regions ¹	1990	35	0	0		35
Clark County ²	1991	26	5	0	2	86
Yakima ³	1991	32	7	0	2	117
Spokane ⁴	1992	27	9	0		84
Puget Sound ⁵	1993	28	6	4	2	127
	Total =	166	27	8	6	490

¹Regions "A", "C", "D", "J", "L", "P", "R"

²Includes Region "G"

³Includes Region "M", "O"

⁴Includes Region "U"

⁵Includes Region "F"

Laboratory Precision and Accuracy

In order to assess the quality of the data, relative percent difference calculations on the relative percent difference (RPD) for each sample split, duplicate, or "reference" sample is presented in this section. The RPD for each sample was calculating using the following formula:

$$\text{Relative Percent Difference (RPD)} = ((A-B)/(A+B))/2 \times 100 = (\%)$$

For example, sample "A" has a value of 16 mg/kg. Sample "B," which is a duplicate, has a value of 13.9 mg/kg. The RPD in this case is:

$$\text{RPD} = ((16-13.9)/(16+13.9))/2 \times 100 = 3.5\%$$

RPD values were not calculated if a laboratory detection limit value was reported for one or both samples.

Data Quality Results

RPD calculations for each sample split, duplicate, or reference sample is given in Table 18. The overall quality of the data was excellent-- the average relative percent difference for all sample splits, duplicates, or reference samples was 4%. The median relative percent difference value for each of the 12 elements was less than 6%. The RPD values were highest for the two elements cadmium and mercury. This variance can probably be attributed to the presence of both elements at concentrations that are at or near laboratory detection limits.

Analytical Effects - Arsenic

During the compilation of data for this study, it was noted that at lower levels (i.e., less than 50 mg/kg), the arsenic values produced by inductively coupled plasma atomic emission spectroscopy (ICP) were significantly higher than those produced by atomic absorption (AA). The effect of AA vs. ICP upon the Puget Sound Basin, Spokane, Clark County, and Yakima Basin data sets is graphically illustrated in Figures 49-52. ICP analysis can produce higher values for arsenic because of iron (iron acts as an interferant and is difficult to correct for when analyzing for arsenic using ICP methods). In contrast to ICP, AA analysis has a much lower detection limit (when analyzing for arsenic in soil, the Ecology Manchester Laboratory uses a detection limit of 0.15 mg/kg for GFAA and 3 mg/kg for ICP analysis) and is thus much more accurate than ICP at lower levels. Thus, it is important to be aware of this issue when analyzing for arsenic.

Quality Assurance Memos

Information on sample receipt, instrument calibrations, procedural blanks, spiked samples, and serial dilutions were summarized in "quality assurance" memos prepared by Manchester laboratory. An example quality assurance memo is included on p. 12-12.

TABLE 19: RELATIVE PERCENT DIFFERENCE SUMMARY STATISTICS (PER ELEMENT)

	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
MAX	11.9%	28.3%	12.3%	30.9%	9.1%	21.0%	15.2%	18.9%	16.0%	38.9%	13.1%	6.0%	
MEAN	2.7%	6.9%	2.4%	7.5%	2.1%	3.1%	1.9%	5.3%	3.3%	8.2%	2.7%	1.4%	
MEDIAN	1.9%	6.0%	1.6%	5.9%	1.6%	1.2%	1.3%	3.3%	2.4%	5.0%	2.0%	0.9%	
MIN	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
(n) =	38	33	37	24	38	38	38	33	38	36	38	38	

FIGURE 48: MEAN RELATIVE PERCENT DIFFERENCE PER ELEMENT

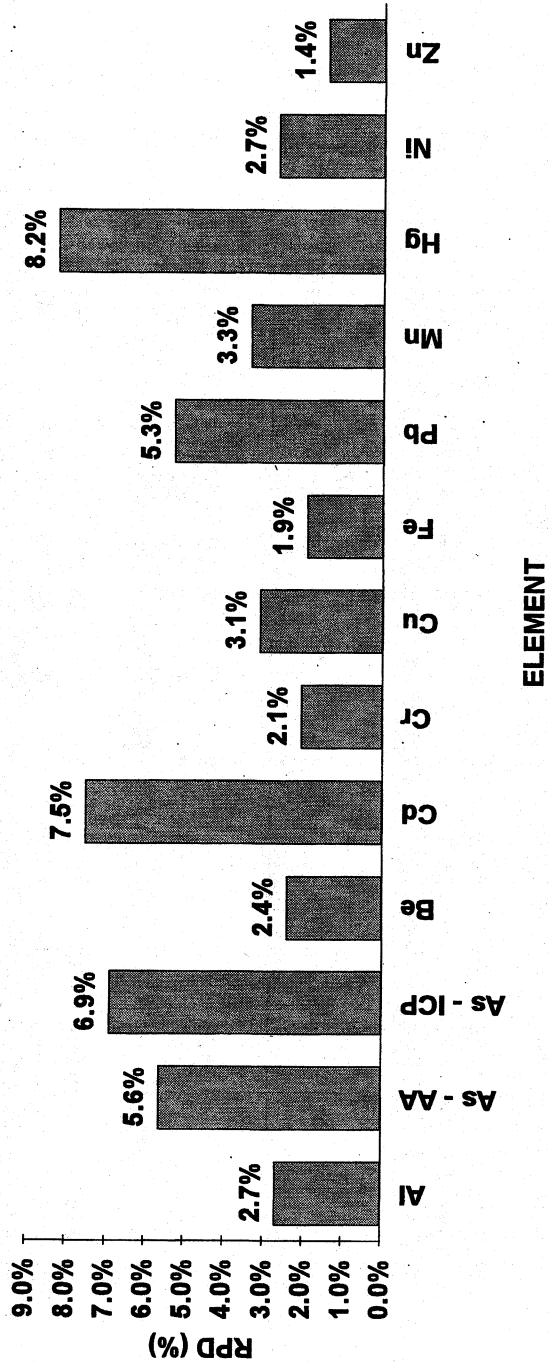


TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
	RPD =	1%	18%	8%	0%	2%	6%	1%	2%	2%	4%	5%	0%	0%	4%
PS260.3RS	93088629	9,330	4	12	0	<0.2	9	17	21,900	6	420	0	11	48	
PS262.2RS	93088630	8,610	3	14	0	<0.2	9	16	21,400	6	402	0	10	48	
	RPD =	2%	3%	4%	1%	1%	0%	1%	1%	0%	1%	2%	4%	0%	2%
SB10.3	92268500	9,070	3.59	7.8	0	1	7	14	15,700	8	364	0	7	47	
SB330.3SS	92268574	9,570	3.15	12.0	0	0	7	13	16,500	8	353	0	8	50	
	RPD =	1%	3%	11%	1%	4%	2%	2%	1%	1%	1%	0%	1%	1%	2%
SB12.2	92268501	7,940	5.22	8.7	0	0	6	15	19,400	5	369	0	8	42	
SB320.3SS	92268573	9,155	4.15	12.0	0	1	6	15	22,000	6	378	0	10	46	
	RPD =	4%	6%	8%	5%	10%	2%	0%	3%	3%	1%	33%	5%	2%	6%
SB20.3	92268502	15,800	3.92	10.0	1	0	7	15	14,600	15	443	0	8	55	
SB340.3SS	92268575	17,100	3.72	15.0	1	0	8	14	15,400	15	435	0	9	56	
	RPD =	2%	1%	10%	2%	5%	1%	1%	1%	0%	0%	5%	1%	0%	2%
SB32.2	92268505	14,500	9.87	17.0	1	1	10	14	22,900	13	526	0	10	54	
SB270.3 SS	92268568	17,600	9.92	24.0	1	1	11	15	24,500	14	520	<0.005	11	59	
	RPD =	5%	0%	9%	2%	3%	3%	1%	2%	2%	0%	0%	1%	2%	2%
SB60.3	92268511	12,200	3.21	9.7	1	0	11	7	13,200	10	730	0	11	59	
SB290.3SS	92268570	14,500	3.03	15.0	1	0	11	8	14,300	10	1170	0	12	66	
	RPD =	4%	1%	11%	3%	18%	1%	3%	2%	1%	12%	0%	2%	3%	5%
SB80.3	92268517	15,500	5.82	17.0	1	1	11	12	13,400	17	488	0	9	56	
SB310.3SS	92268572	16,000	5.90	14.0	1	1	11	12	13,400	18	452	0	10	57	
	RPD =	1%	0%	5%	3%	1%	1%	0%	0%	1%	2%	4%	3%	0%	2%
SB111.3	92268525	18,800	7.95	20.0	1	1	13	19	37,800	12	777	0	13	60	
SB350.3SS	92268576	15,900	8.27	19.0	1	1	13	36	20,200	15	456	0	13	59	
	RPD =	4%	1%	1%	1%	3%	0%	15%	15%	6%	13%	24%	1%	0%	7%
SB130.3	92268529	24,200	3.46	19.0	1	1	19	17	22,300	10	550	0	16	52	
SB300.3SS	92268571	23,900	2.30	13.0	1	0	18	17	21,800	12	656	0	15	52	
	RPD =	0%	10%	9%	0%	10%	1%	1%	1%	5%	4%	1%	1%	0%	3%
SB142.2V	92268536	13,800	2.30	14.0	1	0	11	17	13,100	8	381	0	10	38	

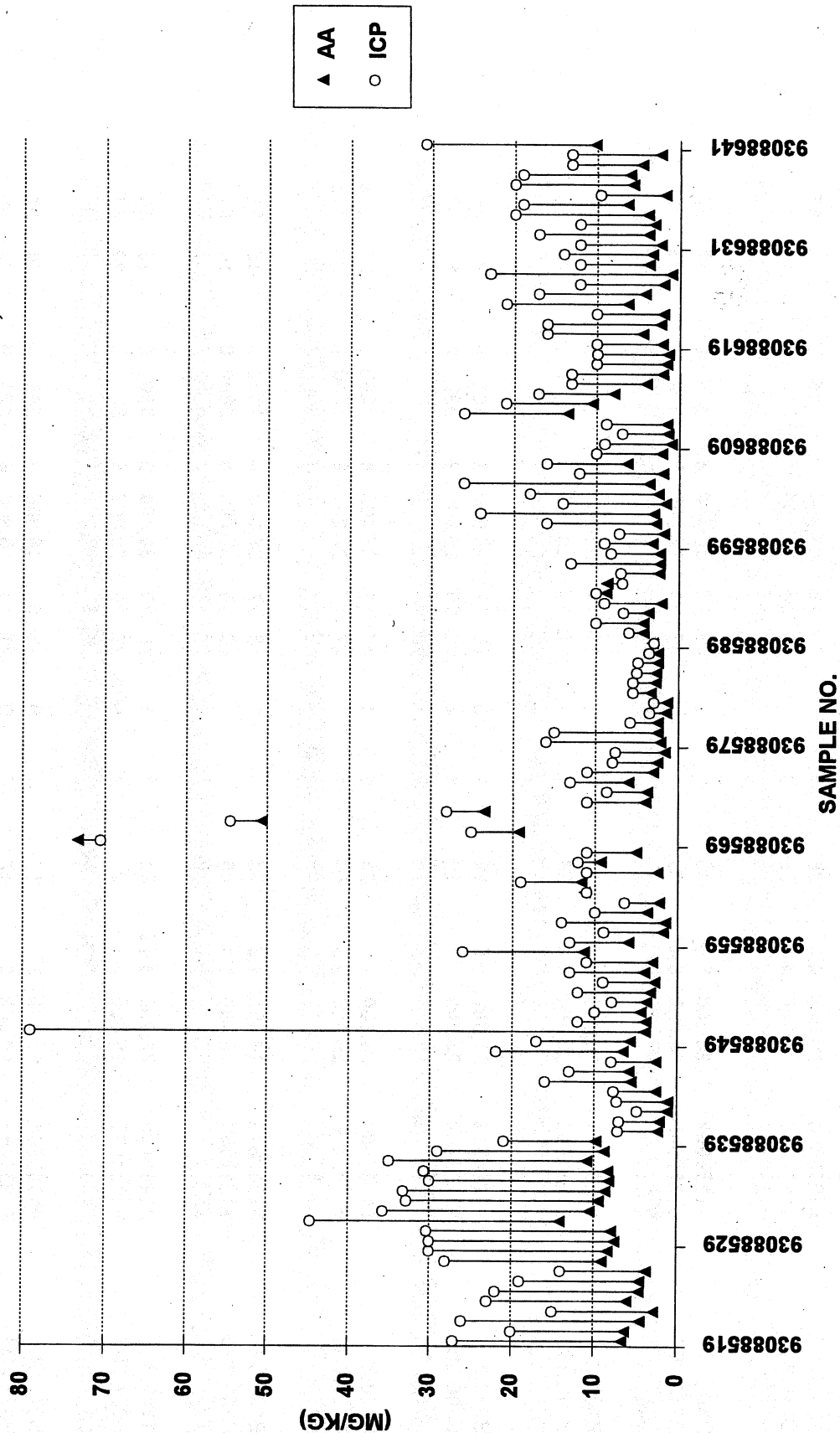
TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As-AA	As-ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
SB280.3SS	92268569	14,800	2.40	11.0	1	0	11	17	14,200	11	397	<0.005	11	44	
	RPD =	2%	1%	6%	2%	8%	1%	0%	2%	7%	1%		2%	4%	3%
YB50.3V	91258574	14,200	4.6	26	1	0	13	18	25,400	11	465	0	13	55	
	91258582	13,700	4.4	29	1	1	13	18	25,100	11	470	0	15	56	
YB340.3SS	RPD =	1%	1%	3%	0%	13%	1%	1%	0%	0%	0%	1%	4%	0%	2%
YB60.3	91258562	23,000	5.4	33	1	0	29	23	35,600	8	875	0	37	73	
	91258569	26,000	5.4	33	1	1	32	24	37,400	7	876	0	38	79	
YB332.2SS	RPD =	3%	0%	0%	1%	4%	2%	1%	1%	3%	0%	1%	1%	2%	1%
YB90.3C	91258578	23,700	1.7	33	1	1	13	17	34,900	<2	1350	0	13	51	
	91258583	23,500	1.8	30	1	1	11	18	34,900	2	1160	0	12	50	
YB342.2SS	RPD =	0%	1%	2%	0%	14%	3%	1%	0%	4%	5%		3%	0%	3%
YB110.3	91258544	21,000	1.5	20	1	0	11	17	20,900	5	501	0	9	44	
	91258412	24,200	20	20	1	0	12	20	22,000	3	397	0	11	39	
YB360.3SS	RPD =	4%	0%	0%	5%	1%	0%	3%	1%	11%	6%	29%	5%	3%	6%
YB130.3	91258404	28,100	23	23	1	1	27	16	27,100	5	1250	0	35	113	
	91258408	26,100	2.9	40	1	1	27	17	27,200	8	1540	0	35	115	
YB350.3SS	RPD =	2%	50%	13%	2%	3%	0%	1%	0%	11%	5%	39%	0%	0%	10%
YB140.6V	91258546	18,400	1.5	34	1	1	15	17	38,000	5	1600	0	15	62	
	91258551	18,400	1.3	30	1	1	15	16	35,900	4	2000	0	16	61	
YB330.3SS	RPD =	0%	4%	3%	1%	7%	1%	1%	1%	3%	5%	4%	3%	0%	3%
YB160.3	91258406	24,200	3.12	35	1	1	29	19	20,400	5	539	0	23	45	
	91258409	19,800	2.1	21	1	<0.2	28	16	20,000	8	554	0	22	44	
YB352.2SS	RPD =	5%	10%	13%	3%		1%	3%	0%	13%	1%	3%	1%	0%	4%
YB370.3RS	91258444	18,100	3	17	1	0	25	9	16,000	4	265	0	26	30	
	91258445	19,500	3	17	1	0	27	10	16,900	4	273	0	27	31	
YB372.2RS	RPD =	2%	0%	0%	1%	1%	1%	1%	1%	0%	1%	2%	1%	1%	1%

MEAN RELATIVE PERCENT DIFFERENCE (ALL SAMPLES) = 4%

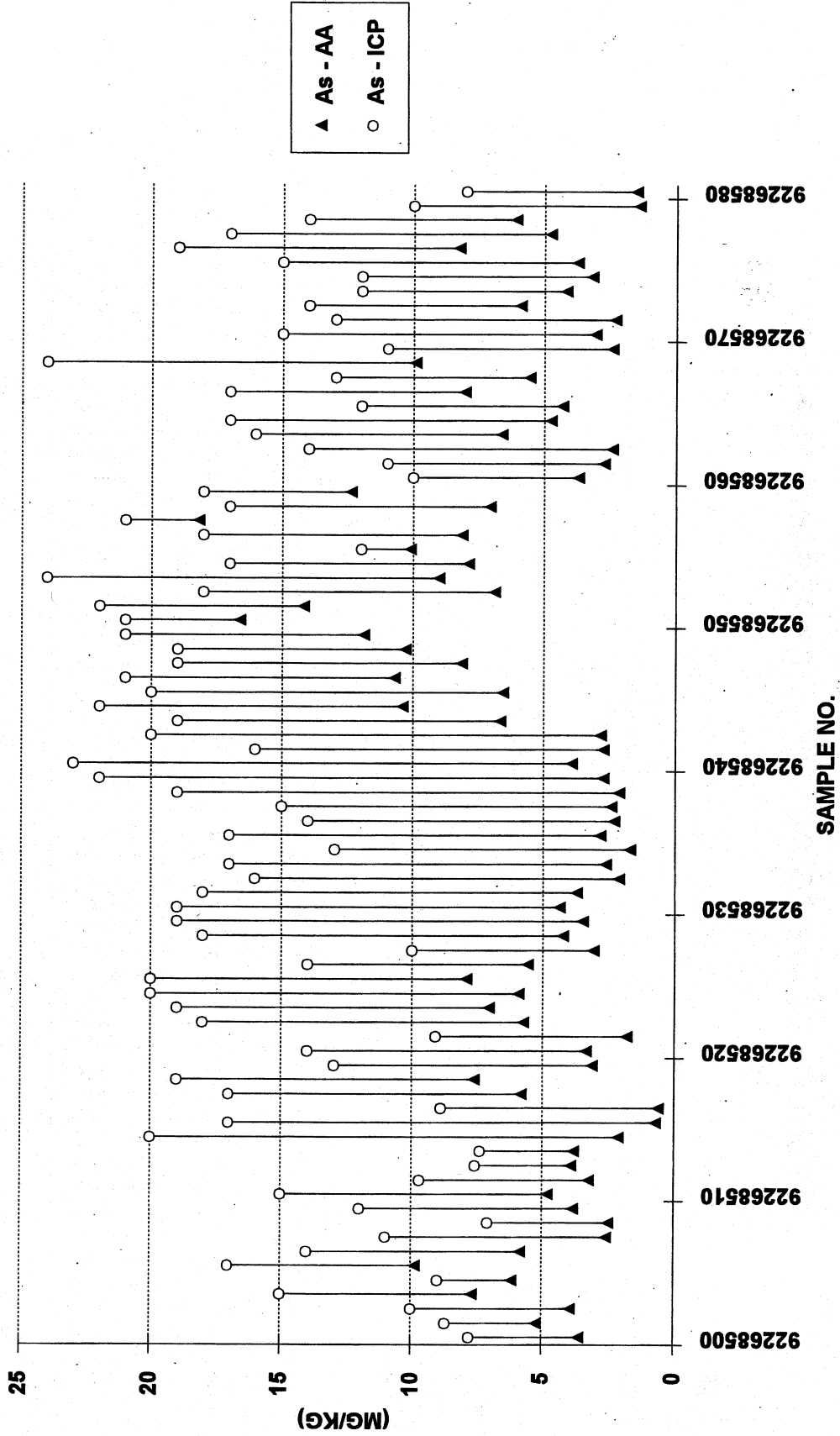
NOTE: CHART BASED ON 121 SAMPLES COLLECTED DURING 1993.

FIGURE 49: PUGET SOUND BASIN AA vs. ICP ARSENIC SAMPLES



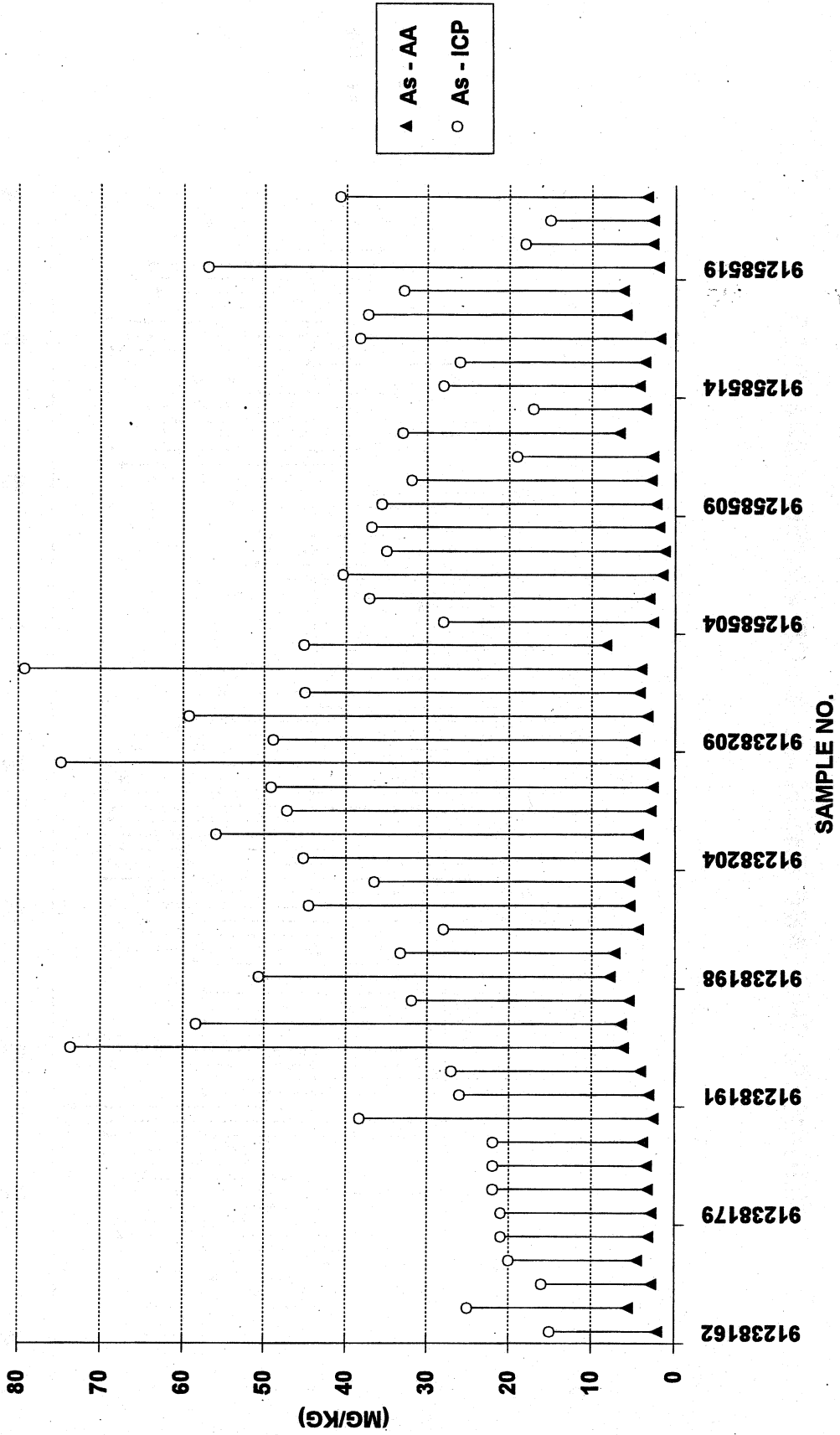
NOTE: CHART BASED ON 81 SAMPLES COLLECTED DURING 1992.

FIGURE 50: SPOKANE BASIN AA vs. ICP ARSENIC SAMPLES



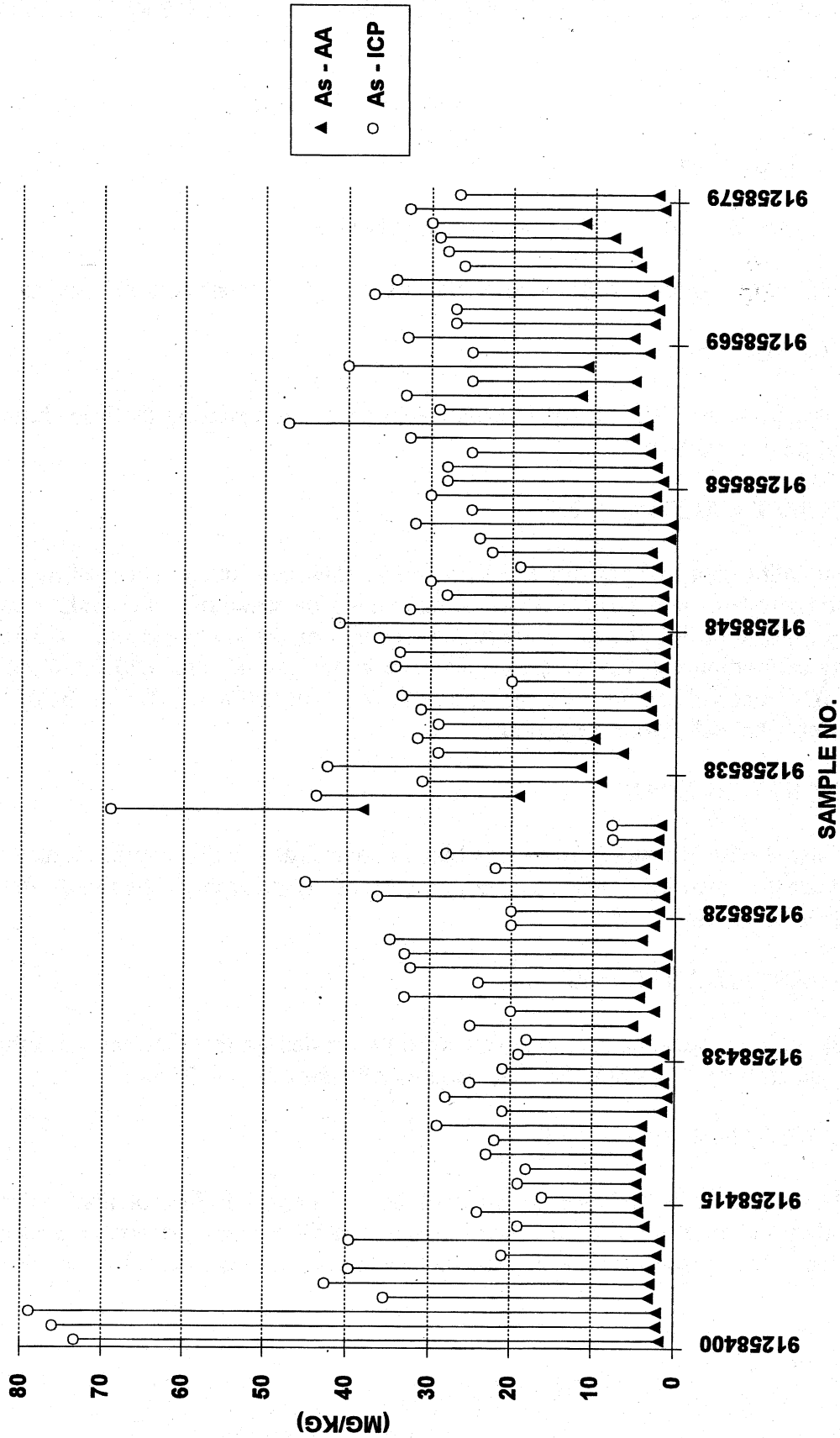
NOTE: CHART BASED ON 49 SAMPLES COLLECTED DURING 1991.

FIGURE 51: CLARK COUNTY AA vs ICP ARSENIC SAMPLES



NOTE: CHART BASED ON 84 SAMPLES COLLECTED DURING 1991.

FIGURE 52: YAKIMA BASIN AA vs. ICP ARSENIC SAMPLES



EXAMPLE QUALITY ASSURANCE MEMO - MANCHESTER LABORATORY

November 1992

TO: Pete Kmet

FROM: Bill Kammin, Environmental Lab Director

SUBJECT: Metals Quality Assurance memo for the 1992 Metals in Soils Project

SAMPLE RECEIPT

The samples from the 1992 Metals in Soils project were received by the Manchester Laboratory on 6/18/92 in good condition.

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA Contract Laboratory Program (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

Results flagged with B denote procedural blank contamination. Procedural blank problems were generally at ultra-trace levels. Blank contamination at these levels is commonly found in total recoverable digestions.

SPIKED SAMPLE ANALYSIS

Spike and duplicate spike sample analyses were performed on this data set. Results qualified with N denote spike recoveries outside the CLP acceptance limits of +/- 25%.

SERIAL DILUTION ANALYSES

Serial dilution is used in ICP analyses to examine sample results for potential interferences. Results not meeting CLP serial dilution specifications are qualified with E, denoting sample based interferences. The E qualifier is also used to denote results estimated for other sample based reasons.

SUMMARY AND DISCUSSION

Generally, the quality of the data provided is acceptable. Two representative data packages (one atomic absorption -- one ICP) were examined in exhaustive detail, to help assure project data quality. The detailed analysis of the entire data set for the total recoverable arsenic data showed 96% of all analytical quality control was in control, and 100% of calibration related (critical) QC was in control.

For the ICP data package examined in exhaustive detail (8/6/92 run), calibration blank related critical QC was in control for 132 of 135 (98%) Continuing Calibration Blank (CCB) results. The three results above the Instrument Detection Limit (IDL), are all below 4 ug/L, and are the result of carryover from a standard into the CCB. This carryover has no analytical significance, and results are not qualified as a result of this occurrence.

For ICP Continuing Calibration Verification (CCV) results, 100% of the critical QC data was in control (166/166 results). In addition, for the ICSAB interference check standard, 100% (52/52) of the QC results were in control.

Although the other data sets in this data package were not examined in this exhaustive detail, normal QC review procedures indicate data of similar quality.

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Provided as an attachment to this memo is a compilation of qualifier definitions.

Please call Bill Kammin at SCAN 744-4737 to further discuss this project.

XIII. REFERENCES

- Alt, David D., and Hyndman, D.W. (1984). *Roadside Geology of Washington*. Mountain Press Publishing Company. Missoula, Montana, 282 p.
- Ames, Kenneth C. (1993). *Background Concentrations of Metals in Soils from Selected Regions in the State of Washington* (draft report, subject to revisions). U.S. Geological Survey Water Resources Investigation Report.
- Blakley, Nigel (1992). *Statistical Guidance for Ecology Site Managers*. Washington State Department of Ecology Publication 92-54.
- Blakley, Nigel (1993). *MTCASat Statistical Software*. Published by the Washington State Department of Ecology, Toxics Cleanup Program.
- Bushnell, T.M. (1944). *The Story of Indiana Soils*, Purdue University Agricultural Experimental Station, Special Circulation 1, Lafayette, 52 p.
- Flint, R.F. (1971). *Glacial and Quaternary Geology*. John Wiley and Sons.
- Hunter, Fields, et.al. (1993). *A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey*. New Jersey Department of Environmental Protection.
- Jenny, Hans (1941). *Factors of Soils Formation*, McGraw-Hill Book Co., New York.
- Keller, W.D. (1957). *The Principles of Chemical Weathering*, Lucas Bros., Columbia, Missouri, 111 p.
- Lenfesty, C.D., and Reedy, T.E. (1985), *Soil Survey of Yakima County area, Washington*: U.S. Department of Agriculture Soil Conservation Service, Washington, D.C., 345 p.
- Ontario, Canada (1993). *Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags, and Snow, Version 1.0a*. Ontario Ministry of Environment and Energy.
- Poulson, E.N. (1953). *Soil Survey of Whatcom County Area, Washington*: U.S. Department of Agriculture Soil Conservation Service, Washington D.C., 153 p.
- Pringle, R.F. (1986). *Soil Survey of Grays Harbor County area, Pacific County, and Wahkiakum County, Washington*, U.S. Department of Agriculture Soil Conservation Service, Washington, D.C., 296 p.
- PTI Environmental Services (1989). *Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State*. Draft Report. Prepared for Washington Department of Ecology. Bellevue, WA.

- Reiche, P. (1950). A Survey of Weathering Processes and Products, Univ. of New Mexico, Univ. Albuquerque, Publs in Geology, 3, 95 p.
- Schaklette, H.T., and Boernegen, J.G. (1984). Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey Professional Paper 1270.
- Slayton, D., and Montgomery, D. (1991). Michigan Background Soil Survey. Michigan Department of Natural Resources.
- Thornbury, William D. (1969). Principles of Geomorphology (Second Edition).
- Thornes, J.T. (1979) Process in Geomorphology. John Wiley and Sons, New York. Halsted Press.
- United States Department of Energy (1993). Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, DOE/RL 92-24. U.S. Department of Energy, Richland Operations Office, Richland Washington.