Period of record:

Apr 1 - Jun 30, 1984

Date of report:

Oct. 1984

QUALITY ASSURANCE REPORT

Atlanta Central Laboratory

Denver Central Laboratory

By

Dale B. Peart and Nancy A. Thomas

CONTENTS

TABLES

ILLUSTRATIONS

Page

QUALITY ASSURANCE REPORT

INTRODUCTION

Standard reference materials taken from the U.S. Geological Survey Standard Reference Water Sample (SRWS) Program (Schroder and others, 1980; Skougstad and Fishman, 1975), and non-Central Laboratory sources are prepared in the Ocala Water Quality Service Unit (QWSU), Ocala, Florida, disguised as routine samples, and distributed to Water Resources Division (WRD) offices. The reference materials are then submitted to the Central Laboratories by the WRD offices on a specified schedule for the determination of major constituents, nutrients, and trace metals. The analytical schedules are chosen to reflect the frequency of analyses for the various constituents. The program is designed so that at least one reference sample should be sent to each laboratory each day for constituents that are determined daily. All constituents in reference materials used to date have been in the dissolved phase; data designated as "total" or "total recoverable" are from samples which have undergone a digestion process, rather than from unfiltered or "whole-water" samples. All samples designated as "total" were analyzed by atomic absorption spectrometry. For the period of this report, analyses were limited to major constituents including specific conductance, nutrients, trace elements, precipitation level analyses and selected organic constituents.

It was originally the intention of this project to retrieve the QA data from WATSTORE six weeks following the close of the quarter. After analyzing the data coming through LABRPRIM, it was determined that far too many samples for the quarter were still incomplete at that point. It was then decided, after consultation with the Quality Assurance Specialist that the retrieval and report preparation would be postponed until less than 10% of the new data entering WATSTORE each week was from the quarter in question. For this quarter, the scheduled retrieval date was August 17. The retrieval criteria were not met until September 28 and then only because the retrieval program will only retrieve data for the previous 12 weeks thus, eliminating any June samples from the retrieval. The data in table A show the percentage of samples identified as being new entries for August 17 through September 28. This would indicate that the scheduled retrieval should be moved to 10-12 weeks following the close of the quarter or that the labs should implement some program to reduce the turnaround time for their analyses.

Table A. -- Weekly percentages for new samples entering WATSTORE

Date	Number of observations in LABCHIEF	Percent in April to June quarter	Number of Atlanta observations	Percent in April to June quarter	Number of Denver observations	Percent in April to June quarter
Aug 17	27	63	19	79	8	25
Aug 24	61	57	23	30	38	74
Sep 4	25	48	18	50	7	43
Sep 10	14	64	2	50	12	67
Sep 14	26	31	10	60	16	12
Sep 21	36	25	30	30	6	0
Sep 28	39	0	22	0	17	0

For the period of this report, the following terms are defined:

Major constituents - Alkalinity, boron, calcium, chloride, dissolved solids, fluoride, magnesium, potassium, silica, sodium and sulfate.

Trace Metals - Aluminum; antimony; arsenic; barium; barium, total recoverable; beryllium; cadmium; cadmium, total recoverable; chromium; chromium, total recoverable; cobalt; cobalt, total recoverable; copper, copper, total recoverable; iron; iron, total recoverable; lead; lead, total recoverable; lithium; manganese; manganese, total recoverable; molybdenum; nickel; nickel, total recoverable; selenium; silver; silver, total recoverable; strontium; zinc and zinc, total recoverable.

Nutrients- Ammonia; ammonia plus organic nitrogen; carbon, organic; nitrate plus nitrite-nitrogen; nitrite-nitrogen; phosphorous and phosphorous, ortho.

Precipitation samples - Specific conductance and low detection level analyses of: Calcium, chloride, fluoride, magnesium, nitrate-nitrogen, phosphorous, potassium, sodium and sulfate.

Organic constituents - Chlorophenoxyacid herbicides, organochlorine insecticides and organophosphate insecticides.

ICP - Analyses done by inductively coupled plasma spectrometry.

AA - Analyses done by atomic absorption spectrometry.

Once the analysis has passed through the laboratories' quality control and quality assurance routines, the data are permanently stored in WATSTORE. These data reflect the typical quality of results produced by each laboratory and received by each district.

Although reruns are not normally asked for by this project, a rerun was requested for three parameters on one Denver analysis. The original values (copper(ICP) with a value of 2000, iron(ICP) with a value of 2000, and lithium with a value of 3000) were used in the report even though they seemed to be high by a factor of ten. The rerun values (copper(ICP), 1800; iron(ICP), 210; and lithium, 3000) showed a factor of ten change for only one parameter.

The purpose of this program is to document the quality of data that is generated by the laboratories. The program is not intended to replace the internal quality assurance programs administered by the laboratory chiefs.

Tables 1 and 2 summarize the results of major constituents including specific conductance and trace elements, respectively for the Atlanta and Denver Central Laboratories. Expectation of a normal distribution implies that about 68 percent of the results would be within 1 standard deviation of the most probable value (MPV) and about 95 percent would be within 2 standard deviations. Analyses are considered acceptable if they are within 2 standard deviations of the MPV.

Table 3 through 6 list each individual value which exceeded the two most probable standard deviation (MPSD) criteria.

Table 7 lists the means and standard deviations for each nutrient mixture submitted to each laboratory.

Table 8 shows the results of a modified Wilcoxon rank-sum test on the data in table 7.

Table 9 lists the means and standard deviations for each precipitation level mixture submitted to each laboratory.

Table 10 shows the results of a modified Wilcoxon rank-sum test on the data in table 9.

Table 11 lists the means and standard deviations for each organic mixture submitted to each laboratory.

Table 12 shows the results of a modified Wilcoxon rank-sum test on the data in table 11.

Figures A1 through A54 and D1 through D54 are control charts of each constituent with time and give a pictorial view of the precision, bias, and possible trends of the data for each laboratory. The ranges given in the legend are approximate and represent the lower, middle, and upper thirds of the range of reference materials available. Data are now plotted by log-in dates which is causing a slight problem. Some samples are supposed to be shipped to the laboratories daily and therefore each log-in date would be unique. However, it appears that three or more samples are receiving the same log-in date and the points are frequently plotting on top of one another. If tables 3 through 6 are used in conjuction with the plots, any confusion should be cleared. Those samples which are not completed when the final retrieval is done will no longer be plotted until the annual report is published.

Evaluation and statistical criteria

Many of the reference samples were prepared by mixing together two or more SRWSs. The most probable values (MPV) were calculated using a volume-weighted average of the known MPVs. Although a theoretical specific conductance which is calculated by simply averaging the individual specific conductance values may not always be accurate, this approach has been shown to be acceptable for these samples (Peart & Thomas, 1983a). Mixtures that do not behave in a linear fashion have not been used.

The means and standard deviations for all parameters are now taken from the results of the interlaboratory, method specific analyses of SRWS No. 24 through 83. In conformance with WRD Memorandum 81.79, an individual value was considered acceptable if it was less than or equal to 2 standard deviations from the most probable value. The MPSD for each constituent was calculated using a least squares regression analysis of the means and standard deviations obtained from the stated sources. In certain situations, this criterion was impossible to meet. An administrative decision was made to establish a minimum standard deviation for each constituent equal to three-quarters of the value of the reporting level to allow at least one reportable value on each side of the MPV to be accepted. For example, the minimum standard deviation for copper reported to the nearest 10 μg/L is set to 7.5 μg/L and for silver reported to the nearest 1 μg/L is 0.75 μg/L.

Because of an insufficient supply of SRWSs for nutrients and organic constituents, most of the reference materials used during this period were made from reagent chemicals in the Ocala facility. Methods for preparing these samples are essentially the same as those used in preparing the nutrient samples for the SRWS program; however, stability is uncertain and there are no data from which a list of most probable values can be determined. Therefore, the samples were treated as split samples of unknown concentrations and statistical tests were performed to determine if significant differences existed between the performance of the two laboratories.

In tables 7, 9 & 11 where a standard deviation is indicated and the number of values (N) is 2, the approximate difference between the values can be calculated by multiplying the standard deviations by 1.4. The standard deviations themselves are not very meaningful when N = 2 but they do provide a basis for gathering other important information about the spread in the values.

As more fully described in WRD Memorandum 81.79 and Friedman, Bradford and Peart, 1983, a binomial distribution was used to evaluate the overall analytical precision for each major and trace constituent. The criteria used gave less than a 1 percent chance that a determination will be considered "unacceptable" solely due to random errors.

Similarly, bias was determined by first examining the number of values which were greater than and less than the MPVs. A binomial probability distribution (at the 50 percent level) was then used such that there was less than a 1 percent chance that a determination would be considered biased solely due to random errors.

To determine a measure of comparability between the two laboratories, the raw data for each major and trace constituent were evaluated using a modification of the Wilcoxon Rank-Sum test (Crawford, Slack & Hirsch, 1983). Each mixture was ranked separately so that the actual concentration differences between mixtures did not affect the outcome of the test. By using this method, the undesireable effects of outliers are eliminated without eliminating the outliers themselves from the data under consideration.

ANALYTICAL PRECISION

Determination of the following constituents showed statistically significant lack of precision:

Atlanta Central Laboratory - dissolved solids and iron, total recoverable.

Denver Central Laboratory - lead(AA); nickel, total recoverable; and zinc(ICP).

ANALYTICAL BIAS

Determination of the following constituents showed statistically significant bias:

Atlanta Central Laboratory

Positive bias: barium(ICP); chloride; cobalt(ICP); dissolved solids; iron(ICP); lead(ICP); lead(AA); lead, total recoverable; manganese(ICP); molybdenum(ICP); selenium; specific conductance; strontium; and zinc(ICP).

Negative bias: arsenic, boron, and potassium.

Denver Central Laboratory

Positive bias: chloride; cobalt(ICP); copper, total recoverable; fluoride; iron(AA); iron, total recoverable; lead(ICP); molybdenum(ICP); silica; sodium(ICP); specific conductance; zinc(ICP); zinc(AA); and zinc, total recoverable.

Negative bias: aluminum; arsenic; barium(ICP); boron; magnesium(AA); manganese(ICP); and potassium.

COMPARABILITY BETWEEN LABORATORIES

The following constituents showed statistically significant differences with respect to the means of the ranked data, indicating lack of comparability between the laboratories: alkalinity; arsenic; barium(ICP); beryllium; calcium(ICP); dissolved solids; fluoride; iron(ICP); iron(AA); lead, total recoverable; lithium; magnesium(ICP); manganese(ICP); molybdenum(AA); nickel; nickel, total recoverable; silica; silver, total recoverable; sodium(ICP); strontium;; zinc(ICP); and zinc(AA). This represents a little over 40% of all parameters tested for comparability.

Data in table 8 show that both laboratories are performing similarly on all nutrient parameters except ammonia plus organic nitrogen, nitrogen, nitrite nitrogen, and phosphorus.

Data in table 10 show that both laboratories are reporting similarly on all precipitation level constituents except calcium and sulfate where the data was not comparable and bromide and phosphate where different minimum reporting (less than) values prevented a comparison.

Data in table 12 show that both laboratories are reporting similarly on all organic constituents except diazinon, dieldrin, heptachlor expoxide, heptachlor, methyl parathion, and silvex. This represents 30% of the organic constituents.

DISCUSSION AND RECOMMENDATIONS

No data for mercury are presented here. We will resume our quality-assurance efforts for mercury beginning in FY 85 to coincide with the change in sample preservation for that constituent.

It appears that both laboratories are consistent and in compliance with the Quality of Water Branch policy of reporting "less than the lower limit of detection" rather than zeros for major constituents and trace elements.

Analyzing the data for this report revealed several parameters where the laboratories tended to agree with each other but not with the MPV. This shows up very well in table 4 and 6 for iron with MPV of 170 and zinc with MPV of 270. The SRWS reports were checked and no reason could be found to indicate an error in the MPV. A third laboratory was asked to analyze these same mixes and the results were in between those produced by the laboratories and the MPV.

The concentration problems with the pesticides samples that occurred last quarter have worked through the system. The samples used for this reporting period were properly prepared. Data in table 11 shows there are several cases, most of which are from Atlanta, where the standard deviation is large compared to the mean. This shows the precision was poor on those particular mixes. Both labs correctly reported less than 0.01 µg/L for 2,4-DP on all analyses and for 2, 4, 5-t for all analyses except for one in Atlanta. Both labs identified comparable amounts of 2, 4-D; diazinon; endrin; ethion; and methoxychlor in mix 1 and diazinon, lindane, mirex, and parathion in mix 5 even though the sample was supposedly free of these constituents. Atlanta incorrectly reported less than 0.001 µg/L for all analyses of mix 3 for aldrin, DDD, DDE, DDT, dieldrin, endrin, heptachlor, and lindane; Denver's values were all very near the theoretical values for the same mix. Less than values were reported at different levels by the two laboratories for heptachlor epoxide and mirex in mix 3. These values were deleted before proceeding with the rank-sum test. In cases where only one laboratory reported a less than value or both laboratories reported the same less than value, the less than sign was dropped and the value was used in the rank-sum test.

Both labs correctly reported less than values for all precipitate level samples for phosphate, ortho and on all except one Denver sample for bromide. However, Atlanta reported bromide as less than 0.1 mg/L and phosphate, ortho as less than 0.06 mg/L while Denver reported less than 0.01 mg/L and less than 0.01 mg/L for the same two constituents. Since the less than values were different, it was impossible to use the rank-sum test on these two constituents.

Each of the statistical tests applied to the data as well as the information displayed in the figures (figs. A1-D54) shows a different aspect of the data and may produce results which appear confusing and even contradictory at times. However, a careful evaluation will allow the correct conclusion to be reached. One example is a situation where a constituent shows no lack of precision or bias in either laboratory, but the Wilcoxon rank-sum test indicates a significant difference between the two laboratories. One can then look at the figures and may see that one laboratory has a slight (though not statistically significant) bias in one direction while the other laboratory has a slight bias in the other direction; or in a much less obvious situation, the figures may look almost identical. One would then conclude that one laboratory has a general tendency to produce data that is slightly biased with respect to the other, although this bias would not affect data interpretation because neither laboratory is producing data that can be classified as biased or imprecise.

In a second example, neither laboratory shows lack of precision, one laboratory shows bias but the rank-sum test indicates no significant differences and the figures look very similar. The fact that one laboratory shows significant bias and the other does not is probably due to the fact that it is a borderline situation. There are frequent instances where a constituent misses being classified or is classified as biased by one or two data points. The figures are important in this situation to determine the magnitude of the bias and its resultant effect on data interpretation. If the data are clustered together very close to the zero line, but enough are on one side to indicate a significant bias, this bias would probably not affect data interpretation. It is also important to remember that the standards used here are "most probable values" not a series of "true values", and that they were determined empirically. Consistent or frequently recurring bias of this type may then be interpreted as method or operator related. One must conclude that the two laboratories are producing comparable data.

SUMMARY AND CONCLUSIONS

Many constituents passed all the statistical tests and can therefore be classified as having acceptable precision, bias and comparability between the laboratories. Others have shown some statistically significant difference but in a way that would not affect data interpretation (see discussion and examples in the previous section). And others do indeed have notable differences.

Constituents for which no statistically significant difference was found for any test applied during this quarter include: antimony; barium(AA); barium, total recoverable; cadmium(ICP); cadmium(AA); cadmium, total recoverable; calcium(AA); chromilium; chromium, total recoverable; cobalt(AA); cobalt, total recoverable; copper(ICP); copper(AA); manganese(AA); manganese, total recoverable; silver; sodium(AA); and sulfate. This represents 1/3 of all the constituents.

Constituents for which a significant difference was found for at least one test but where the difference(s) is considered to be of minimal importance include: alkalinity; aluminum; beryllium; boron; calcium(ICP); chloride; copper, total recoverable; iron(ICP); lead(ICP); lithium; magnesium(ICP); magnesium(AA); manganese(ICP); molybdenum(AA); nickel; selenium; silica; silver, total recoverable; strontium; zinc(AA); and zinc, total recoverable.

Constituents for which both laboratories show bias in the same direction but where over 95% of the data fall within two standard deviations from the MPV and therefore the bias is of minimal importance include: arsenic, cobalt(ICP), molybdenum(ICP), potassium, and specific conductance.

Constituents for which a significant difference was found for at least one test but where the influence of the difference(s) on data interpretation is questionable include:

Barium(ICP) - Atlanta shows a positive bias and Denver shows a negative bias which would point to an operator bias. The rank-sum test indicates data are not comparable which would be expected when the labs show opposite bias.

Fluoride - Denver shows a positive bias and the rank-sum test indicates data are not comparable. Denver had a positive bias in the annual report for water-year 1982 and 1983 (Peart and Thomas, 1983b, 1984).

Iron(AA) - Denver shows a positive bias and the rank-sum test indicates data are not comparable. Iron has been split by method for this water-year only and this is the third time Denver has had a positive bias. Atlanta has not shown any bias for the three quarters.

Iron, total recoverable - Atlanta shows a lack of precision and Denver shows a positive bias. The total recoverable parameters are analyzed using the AA method. The lack of precision for Atlanta must be coming from the extra handling that the total recoverable samples require. The positive bias for Denver is consistent with the positive bias Denver shows for Iron(AA).

Lead, total recoverable - Atlanta shows a positive bias and the rank-sum test indicates the data are not comparable. Both labs show approximately 80% of data are within two standard deviations.

Sodium(ICP) - Denver shows a positive bias and the rank-sum test indicates the data are not comparable. Both labs had a positive bias in the annual report for water-year 1982 and 1983 (Peart and Thomas, 1983b, 1984).

Constituents for which significant differences were found for at least one test and that appear to warrant some corrective action include:

Dissolved solids - Atlanta shows a lack of precision and a positive bias. The rank-sum test indicates the data are not comparable. Atlanta had less than 60% of the data within two standard deviations while Denver has 97% within two standard deviations. Better control of precision and bias in Atlanta is warranted for this constituent.

Lead(AA) - Denver shows a lack of precision and Atlanta shows a positive bias. The rank-sum test indicates the data are comparable. Better control of precision in Denver is warranted for this constituent.

Nickel, total recoverable - Denver shows a lack of precision and the rank-sum test indicates the data are not comparable. Denver has only 60% of data within 2 standard deviations while Atlanta has 100% within two standard deviations. Better control of precision in Denver is warranted for this constituent.

Zinc(ICP) - Denver show a lack of precision. Both labs show a positive bias and the rank-sum test indicates the data are comparable. Better control of precision in Denver is warranted for this constituent.

REFERENCES

Crawford, C. G., Slack, J. R., and Hirsch, R. M., 1983, Non-Parametric Tests for Trends in Water-Quality Data Using the Statistical Analysis System. U.S. Geological Survey Open-File Report 83-550. 102 p.

Friedman, L. C., Bradford, W. L., and Peart, D. B., 1983, Application of Binomial Distributions to Quality Assurance of Quantitative Chemical Analyses. J. Environ. Sci. Health, A18(4). pp 561-570.

Peart, D. B., and Thomas, N. A., 1983a, Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey: 1981 Annual Report. U.S. Geological Survey Water-Resources-Investigations Report 83-4090. pp 3-5.

Peart, D. B., and Thomas, N. A., 1983b, Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey for Water-Year 1982. U.S. Geological Survey Water-Resources-Investigations Report 83-4264. pp. 9-13.

Peart, D. B., and Thomas, N. A., 1984, Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geological Survey for Water-Year 1983. U.S. Geological Survey Water-Resources-Investigations Relport 84-4234.

Schroder, L. J., Fishman, M. J., Friedman, L. C., and Darlington, G. W., 1980, The use of standard reference water samples by the U.S. Geological Survey: U.S. Geological Survey Open-File Report 80-738. 11 p.

Skougstad, M. W., and Fishman, M. J., 1975, Standard reference water samples: Proceedings, AWWA Water Quality Technology Conference, December, 1974, American Water Works Association, p. XIX-1 - XIX-6.

SUPPLEMENTAL DATA

Table 1.--Summary of results for major constituents and specific conductance
[All constituents were in the dissolved phase]

Determination	Atlanta			Denver		
	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations
Alkalinity	55	96.4	100	69	82.6	98.6
Boron	19	89.5	89.5	22	95.5	100
Calcium(ICP)	41	100	100	55	87.3	100
Calcium(AA)	11	81.8	90.9	11	100	100
Chloride	56	78.6	92.9	69	81.2	95.7
Dissolved solids	52	34.6	55.8	66	87.9	97.0
Fluoride	55	60.0	98.2	69	55.1	92.8
Magnesium(ICP)	41	100	100	55	87.3	98.2
Magnesium(AA)	11	63.6	90.9	11	90.9	100
Potassium	52	92.3	98.1	66	89.4	97.0
Silica	55	100	100	68	94.1	97.1
Sodium(ICP)	41	95.1	97.6	55	74.5	89.1
Sodium(AA)	11	90.9	90.9	11	90.9	100
Specific Conductance[1]	56	89.3	100	69	87.0	98.6
Sulfate	56	96.4	98.2	69	97.1	100

[1] See Discussion and Recommendations.

Table 2.--Summary of results for trace metals
[All constituents were in the dissolved phase; data designated as "total recoverable" are from samples which have undergone a preliminary digestion]

Determination	Atlanta			Denver		
	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations
Aluminum	21	100	100	21	100	100
Antimony	2	100	100	2	100	100
Arsenic	43	83.7	97.7	41	90.2	100
Barium(ICP)	19	52.6	94.7	24	91.7	91.7
Barium(AA)	11	81.8	100	9	88.9	100
Barium, total recoverable	11	90.9	100	10	70.0	100
Beryllium	19	100	100	23	91.3	95.7
Cadmium(ICP)	19	100	100	24	75.0	87.5
Cadmium(AA)	30	53.3	86.7	28	67.9	92.9
Cadmium, total recoverable	11	72.7	81.8	10	80.0	100
Chromium	32	68.8	90.6	31	77.4	93.5
Chromium, total recoverable	11	45.5	72.7	10	80.0	80.0

Table 2.--Summary of results for trace metals--Continued

Determination	Atlanta			Denver		
	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations
Cobalt(ICP)	19	100	100	24	95.8	95.8
Cobalt(AA)	11	36.4	100	9	66.7	88.9
Cobalt, total recoverable	11	27.3	100	10	80.0	90.0
Copper(ICP)	19	89.5	100	24	66.7	91.7
Copper(AA)	27	96.3	100	28	67.9	96.4
Copper, total recoverable	9	88.9	100	10	100	100
Iron(ICP) [1]	19	78.9	94.7	24	79.2	83.3
Iron(AA) [1]	30	63.3	90.0	28	39.3	85.7
Iron, total recoverable	11	36.4	45.5	10	20.0	90.0
Lead(ICP)	19	52.6	100	24	54.2	91.7
Lead(AA)	30	60.0	100	28	35.7	78.6
Lead, total recoverable	11	27.3	81.8	10	60.0	80.0
Lithium	19	89.5	100	23	78.3	91.3

Table 2.--Summary of results for trace metals--Continued

Determination	Atlanta			Denver		
	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations	No. of samples	Percent ≤ 1 standard deviation	Percent ≤ 2 standard deviations
Manganese(ICP)	19	100	100	24	91.7	95.8
Manganese(AA)	30	76.7	90.0	28	85.7	100
Manganese, total recoverable	11	54.5	81.8	10	80.0	100
Molybdenum(ICP)	19	73.7	100	23	73.9	95.7
Molybdenum(AA)	19	63.2	89.5	19	47.4	84.2
Nickel	32	87.5	100	31	61.3	96.8
Nickel, total recoverable	11	81.8	100	10	30.0	60.0
Selenium	24	100	100	22	100	100
Silver	13	61.5	84.6	12	83.3	91.7
Silver, total recoverable	11	45.5	72.7	10	60.0	100
Strontium	19	94.7	100	23	87.0	91.3
Zinc(ICP) [1]	19	84.2	84.2	24	41.7	79.2
Zinc(AA) [1]	30	83.3	90.0	28	82.1	89.3
Zinc, total recoverable [1]	11	72.7	72.7	10	70.0	70.0

[1] See Discussion and Recommendations

Table 3.--Tabulation of data over 2 standard deviations from the most probable value for the Atlanta laboratory: major constituents and specific conductance

[All constituents were in dissolved phase]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (mg/L)	Reported value (mg/L)	Most probable value (mg/L)	Most probable standard deviation (mg/L)	Number of standard deviations
Boron/10.5/19	36-242	50	171	37.2	-3.3
		50	171	37.2	-3.3
Calcium(AA)/ 9.1/11	9.3-36	46	9.3	0.56	66
Chloride/7.1/56	1.8-99	120	98.8	3.45	6.1
		120	98.8	3.45	6.1
		18	22.2	1.39	-3.0
		.8	22.2	1.39	-15
Dissolved solids/ 44.2/52	59-926	647	534	24.1	4.7
		600	534	24.1	2.7
		583	534	24.1	2.0
		350	292	18.3	3.2
		335	292	18.3	2.4
		329	292	18.3	2.0
		1140	926	33.5	6.4
		1170	926	33.5	7.3
		548	480	22.8	3.0
		544	480	22.8	2.8
		532	480	22.8	2.3
		671	583	25.3	3.5
		424	489	23.0	-2.8
		548	489	23.0	2.6
		555	489	23.0	2.9
		348	292	18.3	3.1
		332	292	18.3	2.2
		330	292	18.3	2.1
		336	292	18.3	2.4
		330	292	18.3	2.1
		312	534	24.1	-9.2
		605	534	24.1	2.9
		591	534	24.1	2.4

Table 3.--Tabulation of data over 2 standard deviations from the most probable value for the Atlanta laboratory: major constituents and specific conductance--continued

[All constituents were in dissolved phase]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (mg/L)	Reported value (mg/L)	Most probable value (mg/L)	Most probable standard deviation (mg/L)	Number of standard deviations
Fluoride/1.8/55	0.39-1.99	0.2	1.12	0.07	-12
Magnesium(AA)/ 9.1/11	2.4-14	22	2.4	0.15	129
Potassium/1.9/52	1.3-5.6	2.2	1.3	0.09	10
Sodium(ICP)/ 2.4/41	13-100	57	62.3	2.45	-2.2
Sodium(AA)/9.1/11	4.2-39	5.0	4.2	0.38	2.0
Sulfate/1.8/56	19-416	<0.2	110	13.6	-8.1

Table 4.--Tabulation of data over 2 standard deviations from the most probable value for the Atlanta laboratory: trace metals

[All constituents were in dissolved phase; data designated as 'total recoverable' are from samples which have undergone a preliminary digestion]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (μg/L)	Reported value (μg/L)	Most probable value (μg/L)	Most probable standard deviation (μg/L)	Number of standard deviations
Arsenic/2.3/43	1.8-25	7.0	24.5	6.8	-2.6
Barium(ICP)/	18-171	110	90	6.6	3.0
Cadmium(AA)/ 13.3/30	2.2-8.6	5.0	2.8	0.8	2.9
		6.0	2.2	.8	5.1
		1.0	5.7	1.1	-4.3
		1.0	5.7	1.1	-4.3
Cadmium, total recoverable/ 18.2/11	2.2-8.6	6.0	2.2	0.8	5.1
		4.0	2.2	.8	2.4
Chromium/9.4/32	1.9-28	10	28	7.2	-2.5
		10	28	7.2	-2.5
		30	4.7	7.2	3.5
Chromium, total recoverable/ 27.3/11	15-28	30	15.2	7.2	2.1
		30	15.2	7.2	2.1
		30	15.2	7.2	2.1
Iron(ICP)[1]/5.3/19	15-188	220	170	24.4	2.1
Iron(AA)/10/30	15-704	20	170	29.8	-5.0
		350	262	35.9	2.5
		340	262	35.9	2.2
Iron, total recoverable/ 54.5/11	20-704	180	20	19.9	8.0
		110	20	19.9	4.5
		110	20	19.9	4.5
		410	262	35.9	4.1
		390	262	35.9	3.6
		340	262	35.9	2.2
Lead, total recoverable/ 18.2/11	3.5-16.6	7	3.5	1.3	2.8
		7	3.5	1.3	2.8

Table 4.--Tabulation of data over 2 standard deviations from the most probable value for the Atlanta laboratory: trace metals--continued

[All constituents were in dissolved phase; data designated as 'total recoverable' are from samples which have undergone a preliminary digestion]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (µg/L)	Reported value (µg/L)	Most probable value (µg/L)	Most probable standard deviation (µg/L)	Number of standard deviations
Manganese(AA)/ 10/30	79-546	50	79	12.7	-2.3
		50	79	12.7	-2.3
		50	79	12.7	-2.3
Manganese, total recoverable/ 18.2/11	79-546	40	79	12.7	-3.1
		40	79	12.7	-3.1
Molybdenum(AA)/ 10.5/19	5.4-43	9	5.4	1.7	2.1
		1	10.3	2.0	-4.6
Silver/15.4/13	0.5-3.9	5.0	1.1	0.8	5.1
		2.0	3.9	.8	-2.6
Silver, total recoverable/ 27.3/11	1.1-3.9	5.0	1.1	0.8	5.1
		5.0	1.1	.8	5.1
		3.0	1.1	.8	2.5
Zinc(ICP)/15.8/ 19	51-120	94	60.9	14.0	2.4
		170	120	14.0	3.6
		150	120	14.0	2.1
Zinc(AA)[1]/10/30	51-270	390	270	48.1	2.5
		400	270	48.1	2.7
		390	270	48.1	2.5
Zinc, total recoverable[1]/ 27.3/11	102-270	470	270	48.1	4.2
		410	270	48.1	2.9
		430	270	48.1	3.3

1 See Discussions and Recommendations

Table 5.--Tabulation of data over 2 standard deviations from the most probable value for the Denver laboratory: major constituents and specific conductance

[All constituents were in dissolved phase]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (mg/L)	Reported value (mg/L)	Most probable value (mg/L)	Most probable standard deviation (mg/L)	Number of standard deviations
Alkalinity/1.4/69	16.6-152	92	75.3	6.70	2.5
Chloride/4.3/69	1.3-99	120	98.8	3.45	6.1
		120	98.8	3.45	6.1
		120	98.8	3.45	6.1
Dissolved solids/ 3.0/66	43-926	999	926	33.5	2.2
		245	292	18.3	-2.6
Fluoride/7.2/69	0.29-1.99	2.2	1.99	0.07	2.8
		2.2	1.99	.07	2.8
		0.7	.39	.07	4.2
		1.1	.72	.07	5.1
		0.4	1.07	.07	-8.9
Magnesium(ICP)/ 1.8/55	1.8-55	53	32	1.48	14
Potassium/ 3.0/66	0.9-5.6	1.2	0.9	0.07	3.4
		1.2	.9	.07	3.4
Silica/2.9/68	3.9-13.3	42	6.6	1.10	32
		7.7	5.3	1.10	2.2
Sodium(ICP)/ 10.9/55	3-100	80	55.9	2.27	11
		110	99.8	3.46	3.0
		110	99.8	3.46	3.0
		110	99.8	3.46	3.0
		120	99.8	3.46	5.8
		59	53.7	2.21	2.4
Specific conductance[1]/ 1.4/69	69-1306	731	861	42.7	-3.0

1 Units are μmhos/cm at 25° C.

Table 6.--Tabulation of data over 2 standard deviations from the most probable value for the Denver laboratory: trace metals

[All constituents were in dissolved phase; data designated as 'total recoverable' are from samples which have undergone a preliminary digestion]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (µg/L)	Reported value (µg/L)	Most probable value (µg/L)	Most probable standard deviation (µg/L)	Number of standard deviations
Barium(ICP)/ 8.3/24	18-205	300	205	13.0	7.3
		25	171	11.1	-13
Beryllium/ 4.3/23	2.3-25	0.5	25.2	2.7	-9.2
Cadmium(ICP)/ 12.5/24	1.3-7.9	1.0	7.8	1.6	-4.3
		5.0	2.6	.8	3.2
		1.0	2.6	.8	-2.2
Cadmium(AA)/ 7.1/28	2.2-13.3	1.0	7.8	1.6	-4.4
		11	7.8	1.6	2.0
Chromium/6.5 31	1.9-28	10	28	7.2	-2.5
		<10	28	7.2	-2.5
Chromium, total recoverable/ 20/10	3.9-28	20	3.9	7.2	2.2
		60	15.2	7.2	6.2
Cobalt(ICP)/ 4.2/24	1.1-14.5	3	14.5	3.3	-3.5
Cobalt(AA)/ 11.1/9	2.3-11.2	<1	5.0	1.6	-2.5
Cobalt, total recoverable/ 10/10	2.3-11.2	10	2.9	1.6	4.4
Copper(ICP)/	14-180	2000	180	14.7	110
		10	180	14.7	-12
Copper(AA)/ 3.6/28	14-180	6	180	17.7	-9.8

Table 6.--Tabulation of data over 2 standard deviations from the most probable value for the Denver laboratory: trace metals--continued

[All constituents were in dissolved phase; data designated as 'total recoverable' are from samples which have undergone a preliminary digestion]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (µg/L)	Reported value (µg/L)	Most probable value (µg/L)	Most probable standard deviation (µg/L)	Number of standard deviations
Iron(ICP)[1]/ 16.7/24	15-352	330	262	24.4	2.8
		2000	170	24.4	79
		39	170	24.4	-5.4
		420	352	24.4	2.8
Iron(AA)[1]/ 14.3/28	15-704	270	170	29.8	3.4
		260	170	29.8	3.0
		60	20	19.9	2.0
		70	20	19.9	2.5
Iron, total recoverable/ 10/10	20-704	130	20	19.9	5.5
Lead(ICP)/ 8.3/24	1.7-16.6	30	4.4	7.5	3.4
		5000	4.4	7.5	679
Lead(AA)/ 21.4/28	1.7-16.6	1	14.1	3.7	-3.5
		1	14.1	3.7	-3.5
		<1	4.5	1.5	-2.4
		8	3.5	1.3	3.6
		12	3.5	1.3	6.7
		20	8.3	2.4	4.9
Lead, total recoverable/ 20/10	3.5-16.6	14	8.4	2.4	2.3
		3	8.4	2.4	-2.3
Lithium/8.7/23	14-309	3000	309	32	84
		9	309	32	-9.4
Manganese(ICP)/ 4.2/24	48-405	5	239	23.1	-10
Molybdenum(ICP)/ 4.3/23	2.5-43	70	42.4	5.7	4.8

Table 6.--Tabulation of data over 2 standard deviations from the most probable value for the Denver laboratory: trace metals--continued

[All constituents were in dissolved phase; data designated as 'total recoverable' are from samples which have undergone a preliminary digestion]

Determination/ Percent > 2 standard deviations/ Total Analyses	Concentration range of reference samples (μg/L)	Reported value (μg/L)	Most probable value (μg/L)	Most probable standard deviation (μg/L)	Number of standard deviations
Molybdenum(AA)/ 15.8/19	5.4-43	29	39.6	4.0	-2.6
		28	39.6	4.0	-2.9
		27	39.6	4.0	-3.1
Nickel/3.2/31	4.6-13	3	12.9	4.3	-2.3
Nickel, total recoverable/ 40/10	5-12	24	11.7	4.3	2.9
		30	11.7	4.3	4.3
		26	5.1	4.3	4.9
		18	5.1	4.3	3.0
Silver/8.3/12	0.5-3.9	2.0	3.9	0.8	-2.6
Strontium/ 8.7/23	60-1196	60	418	21.3	-17
		5000	1000	54.0	69
Zinc(ICP)[1]/ 20.8/24	51-270	440	270	14.0	12
		150	120	14.0	2.1
		10	120	14.0	-7.9
		5000	103	14.0	350
		160	51	14.0	7.8
Zinc(AA)[1]/ 10.7/28	51-270	440	270	48.1	3.5
		450	270	48.1	3.7
		60	168	48.1	-2.3
Zinc, total recoverable[1]/ 30/10	102-270	430	270	48.1	3.3
		420	270	48.1	3.1
		430	270	48.1	3.3

1 See Discussions and Recommendations

Table 7.--Comparison of results for nutrient samples

Constituent	Mix	Atlanta N	Atlanta Mean	Atlanta Standard deviation	Denver N	Denver Mean	Denver Standard deviation
Ammonia	1	10	0.33	0.042	10	0.27	0.027
	2	6	2.8	.137	14	2.3	.929
	3	10	2.1	.085	12	1.9	.513
	4	10	2.4	.399	12	2.1	.617
	5	8	.56	.037	6	.52	.014
	6	6	.89	.313	14	<1.1	.313
	7	8	.31	.088	10	.33	.045
	8	12	.24	.072	8	.23	.080
	9	10	1.8	.048	8	1.8	.200
	10	6	1.8	.110	10	1.6	.611
	11	9	2.1	.071	12	2.3	.250
	12	12	2.0	.079	10	2.4	.666
Ammonia plus organic nitrogen	1	10	0.59	0.307	10	1.1	0.312
	2	6	4.6	.877	14	3.4	.287
	3	10	3.4	1.09	12	3.2	.181
	4	10	3.8	.613	12	4.6	.306
	5	8	1.6	.256	6	1.6	.138
	6	6	1.6	.504	14	2.0	.327
	7	8	.96	.466	10	1.4	.179
	8	12	.63	.280	8	1.0	.440
	9	10	2.3	.372	8	2.4	.295
	10	6	3.1	.372	10	3.4	.268
	11	9	3.7	.596	12	3.7	.219
	12	12	3.1	.378	10	2.9	.170
Carbon, organic	1	10	2.3	0.508	10	2.7	0.787
	2	3	41	1.155	3	32	2.887
	3	2	32	0.707	3	26	2.646
	5	6	11	0.516	6	13	2.251
	6	1	6.9	.000	3	5.1	1.00
	7	1	8.1	.000	3	8.3	.458
	9	10	16	0.699	8	15	1.808
	10	3	3.6	.173	3	4.1	.755
	11	3	7.3	2.89	3	8.7	.252
Nitrite plus nitrate nitrogen	1	10	3.2	0.114	10	3.3	0.114
	2	6	1.7	.103	14	1.6	.061
	3	10	1.7	.053	12	1.6	.192
	4	10	4.3	.114	12	4.5	.103
	5	8	.29	.024	6	.26	.045
	6	6	1.5	.825	14	2.1	.105
	7	8	.44	.158	10	.64	.165
	8	12	1.1	.391	8	1.1	.226
	9	10	1.5	.000	8	1.5	.141
	10	6	2.7	.052	10	2.7	.094

Table 7.--Comparison of results for nutrient samples--continued

Constituent	Mix	Atlanta N	Atlanta Mean	Atlanta Standard deviation	Denver N	Denver Mean	Denver Standard deviation
Nitrite plus nitrate nitrogen-cont.	11	9	1.8	0.050	12	1.8	0.067
	12	12	1.4	.039	10	1.3	.000
	13	8	2.1	.074	9	2.3	.866
	14	5	<.10	.000	4	<1.2	1.87
Nitrite-nitrogen	1	10	0.28	0.040	10	0.45	0.372
	3	3	.34	.000	3	.37	.032
	5	8	.09	.007	6	.09	.005
	9	10	.39	.007	8	.37	.143
	11	3	.34	.006	3	.37	.006
Phosphorus	1	10	2.9	0.375	10	2.8	0.960
	2	3	<1.2	1.03	7	1.5	.381
	3	10	2.8	.242	12	2.4	.067
	4	10	3.3	.297	12	2.9	1.60
	5	8	.52	.017	6	.53	.015
	6	3	.68	.254	7	.85	.044
	7	8	.71	.207	10	.91	.035
	8	12	.38	.126	8	.44	.173
	9	10	2.2	.047	8	3.3	.169
	10	3	1.4	1.20	5	3.3	.493
	11	9	1.6	.574	12	2.6	.193
	12	12	1.2	.029	10	1.8	.254
	13	8	.25	.038	8	.24	.011
	14	4	.12	.013	3	.11	.026
Phosphorus, ortho	1	10	2.3	0.725	10	2.3	0.895
	3	6	2.1	.000	6	2.2	.133
	5	8	.11	.008	6	.09	.039
	7	4	.39	.054	4	.44	.122
	9	10	2.0	.053	8	2.1	.512
	11	3	1.0	.000	3	1.0	.000

Table 8.--Results of statistical evaluation for nutrients

Constituent	Comparability test results	Constituent	Comparability test results
Ammonia	A	Nitrite N	B
Ammonia plus organic N	B	Phosphorus	B
Carbon, organic	A	Phosphorus, ortho	A
Nitrite plus nitrate N	A		

A = Data are comparable
B = Data are not comparable

Table 9.--Comparison of results for precipitation level analyses

Constituent	MPV	Mix	Atlanta N	Atlanta Mean	Atlanta Std. Dev.	Denver N	Denver Mean	Denver Std. Dev.
Ammonia	----	2	2	0.04	0.014	2	0.01	0.004
	----	3	2	<.001	.000	1	.059	.000
	----	5	2	.033	.006	2	<.004	.001
Bromide	----	1	1	<.10	----	2	<.02	0.014
	----	2	2	<.10	0.000	2	<.01	.000
	----	3	2	<.10	.000	1	.03	----
	----	4	2	<.10	.000	2	<.01	.000
	----	5	2	<.10	.000	2	<.01	.000
Calcium	1.90	1	1	2.1	----	2	1.7	0.141
	1.87	2	2	1.9	0.212	2	1.6	.212
	1.90	3	2	1.9	.000	1	1.7	.000
	.82	4	2	.74	.134	2	.67	.007
	.25	5	2	.25	.035	2	.21	.000
Chloride	0.60	1	1	0.50	.000	2	0.51	0.007
	.27	2	2	.33	0.028	2	.35	.007
	.60	3	2	.54	.007	1	.50	.000
	.81	4	2	.47	.007	2	.47	.007
	.16	5	2	<.20	.000	2	.24	.021
Fluoride	0.10	1	1	0.11	----	2	0.11	0.000
	.01	2	2	<.03	0.021	1	.03	----
	.10	3	2	.11	.000	1	.11	----
	----	4	2	.19	.233	2	<.02	.007
Magnesium	0.32	1	1	0.34	----	2	0.30	0.035
	1.20	2	2	1.3	0.071	2	1.2	.071
	.32	3	2	.31	.014	1	.32	.000
	.10	4	2	.10	.007	2	.10	.007
	.06	5	2	.06	.000	2	.06	.007
Phosphorus, dissolved	0.027	2	2	0.01	0.018	2	0.006	0.001
	-----	3	2	.01	.007	1	.007	.000
	.003	5	1	.006	.000	1	.008	.000
Phosphate, ortho	-----	1	1	<0.06	----	2	<0.01	0.000
	-----	2	2	<.06	0.000	2	<.01	.000
	-----	3	2	<.06	.000	1	<.01	----
	-----	4	2	<.06	.000	2	<.01	.000
	-----	5	2	<.06	.000	2	<.01	.000

Table 9.--Comparison of results for precipitation level analyses-cont.

Constituent	MPV	Mix	Atlanta N	Atlanta Mean	Atlanta Std. Dev.	Denver N	Denver Mean	Denver Std. Dev.
Potassium	0.19	1	1	.18	----	2	.21	0.007
	.10	2	2	.09	0.000	2	.10	.014
	.19	3	2	.19	.000	1	.20	----
	.09	4	2	.07	.007	2	.08	.028
	.02	5	2	.02	.000	2	.02	.000
Sodium	0.66	1	1	.60	----	2	0.62	0.014
	1.59	2	2	1.6	.071	2	1.6	.000
	.66	3	2	.62	.000	1	.65	----
	.19	4	2	.18	.000	2	.23	.078
	.16	5	2	.15	.000	2	.15	.000
Specific Conductance	18.6	1	1	17.	----	2	20.	0.000
	----	2	2	700.	19.80	2	691.	1.414
	18.6	3	2	19.	0.707	1	20.	----
	8.6	4	2	9.0	.000	2	9.0	.000
	----	5	1	414.	----	2	418.	2.121
Sulfate	3.24	1	1	3.0	----	2	2.9	.021
	9.29	2	2	9.9	.106	2	8.9	.255
	3.24	3	2	3.1	.042	1	2.9	----
	1.55	4	2	1.2	.035	2	1.1	.049
	.36	5	2	<.26	.078	2	.31	.000

Table 10.--Results of statistical evaluation for precipitation level analyses

Constituent	Comparability test results	Constituent	Comparability test results
Ammonia	A	Phosphorus, ortho	C
Bromide	C	Potassium	A
Calcium	B	Sodium	A
Chloride	A	Specific Conductance	A
Fluoride	A	Sulfate	B
Magnesium	A		
Phosphorus, dissolved	A		

A = Data are comparable
B = Data are not comparable
C = Inconsistent minimum reporting values

Table 11.--Comparison of results for organic samples

Constituent	Theoretical Value	Mix	Atlanta N	Atlanta Mean	Atlanta Std. Dev.	Denver N	Denver Mean	Denver Std. Dev.
2, 4-D	0.045	1	4	7.6	2.45	4	8.2	1.46
	.012	2	4	12.7	3.46	4	10.7	1.45
	----	3	2	.12	.049	2	.20	.042
	.032	4	4	.04	.005	4	.05	.005
	.047	5	4	.06	.005	3	.08	.015
2, 4 DP	----	1	4	<0.01	0.000	4	<0.01	0.000
	----	2	4	<.01	.000	4	<.01	.000
	----	3	2	<.01	.000	2	<.01	.000
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	<.01	.000	3	<.01	.000
2, 4 5-T	----	1	4	<0.01	0.000	4	<0.01	0.000
	----	2	4	<.01	.000	4	<.01	.000
	----	3	2	<.01	.000	2	<.01	.000
	----	4	4	<.02	.010	4	<.01	.000
	----	5	4	<.01	.000	3	<.01	.000
Aldrin	0.032	1	4	0.04	0.025	4	0.06	0.003
	.065	2	4	<.03	.020	4	.04	.002
	.050	3	2	<.001	.000	2	.03	.000
	.037	4	4	.03	.005	4	.03	.005
	.025	5	4	.02	.000	4	.02	.000
DDD	0.168	1	4	0.13	0.024	4	0.17	0.005
	.099	2	4	<.12	.081	4	.22	.006
	.116	3	2	<.001	.000	2	.21	.064
	.087	4	4	.04	.019	4	.05	.005
	.058	5	4	.02	.005	4	.03	.006
DDE	0.078	1	4	0.18	0.045	4	0.14	0.005
	.042	2	4	<.10	.064	4	.12	.005
	.068	3	2	<.001	.000	2	.05	.014
	.051	4	4	.24	.252	4	.08	.006
	.034	5	4	.01	.000	4	.05	.017
DDT	0.125	1	4	0.15	0.024	4	0.19	0.006
	.098	2	4	<3.18	2.148	4	3.18	.206
	.102	3	2	<.001	.000	2	.11	.028
	.077	4	4	1.15	.383	4	1.25	.100
	.051	5	4	.02	.000	4	.02	.000

Table 11.--Comparison of results for organic samples--cont.

Constituent	Theo-retical Value	Mix	Atlanta N	Atlanta Mean	Atlanta Std. Dev.	Denver N	Denver Mean	Denver Std. Dev.
Diazinon	----	1	4	0.33	0.437	4	0.14	0.005
	----	2	4	.19	.017	4	.21	.019
	----	3	2	.14	.014	2	.18	.007
	----	4	4	.08	.010	4	.09	.005
	----	5	4	.10	.000	4	<.10	.005
Dieldrin	0.056	1	4	0.07	0.014	4	0.11	0.005
	.015	2	4	<.10	.089	4	.07	.002
	.075	3	2	<.001	.000	2	.08	.028
	.056	4	4	<.13	.153	4	.05	.000
	.038	5	4	<.01	.000	4	.03	.000
Endrin	----	1	4	0.11	0.031	4	0.09	0.006
	----	2	4	<.001	.000	4	.01	.002
	0.105	3	2	<.001	.000	2	.07	.028
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	<.01	.000	4	<.01	.000
Ethion	----	1	4	0.07	0.013	4	0.06	0.005
	----	2	4	.24	.043	4	.21	.024
	----	3	2	<.01	.000	2	<.01	.000
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	<.01	.000	4	<.01	.000
Heptachlor epoxide	----	1	4	<0.001	0.000	4	<0.003	0.002
	----	2	4	<.002	.001	4	<.004	.002
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	<.01	.000	4	<.01	.000
Heptachlor	0.096	1	4	<0.007	0.007	4	0.017	0.000
	.062	2	4	<.006	.003	4	<.009	.001
	.024	3	2	<.001	.000	2	.02	.007
	.018	4	4	<.01	.000	4	<.01	.000
	.012	5	4	<.01	.000	4	.01	.000
Lindane	0.078	1	4	0.03	0.024	4	0.04	0.001
	.034	2	4	<.06	.052	4	.03	.001
	.021	3	2	<.001	.000	2	.02	.000
	----	4	4	<.01	.000	4	.01	.000
	----	5	4	.02	.000	4	.02	.000

Table 11.--Comparison of results for organic samples--cont.

Constituent	Theo- retical Value	Mix	Atlanta N	Atlanta Mean	Atlanta Std. Dev.	Denver N	Denver Mean	Denver Std. Dev.
Malathion	----	1	4	<0.02	0.014	4	<0.03	0.015
	----	2	4	<.07	.057	4	.06	.013
	----	3	2	<.01	.000	2	.03	.014
	----	4	4	<.03	.013	4	<.02	.010
	----	5	4	.06	.010	4	<.02	.013
Methoxychlor	----	1	4	7.68	1.338	4	5.0	0.082
	----	2	4	<.33	.367	4	0.64	.025
	----	3	2	<.01	.000	2	.14	.014
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	<.01	.000	4	.01	.000
Methyl- parathion	----	1	4	<0.03	0.013	4	0.03	0.006
	----	2	4	.09	.041	4	.05	.000
	----	3	2	<.02	.007	2	.03	.000
	----	4	4	.09	.017	4	.08	.010
	----	5	4	.10	.006	4	.06	.010
Mirex	----	1	4	<0.01	0.000	4	0.01	0.000
	----	2	4	<.01	.000	4	.01	.005
	----	4	4	<.01	.000	4	<.01	.000
	----	5	4	.02	.005	4	.02	.000
Parathion	----	1	4	<0.01	0.000	4	0.01	0.000
	----	2	4	<.01	.005	4	.01	.000
	----	3	2	<.01	.000	2	.01	.000
	----	4	4	.08	.013	4	.08	.013
	----	5	4	.03	.005	4	.03	.000
Silvex	0.056	1	4	0.67	0.211	4	0.64	0.104
	.078	2	4	1.90	.753	4	1.22	.180
	----	3	2	.04	.014	2	.06	.007
	.114	4	4	.03	.022	4	.01	.005
	.170	5	4	.02	.005	3	.02	.006

Table 12.--Results of statistical evaluation for organics

Constituent	Comparability test results	Constituent	Comparability test results
2, 4-D	A	Ethion	A
2, 4-DP	A	Heptachlor epoxide	B
2, 4 5-T	A	Heptachlor	B
Aldrin	A	Lindane	A
DDD	A	Malathion	A
DDE	A	Methoxychlor	A
DDT	A	Methylparathion	B
Diazinon	B	Mirex	A
Dieldrin	B	Parathion	A
Endrin	A	Silvex	B

A = Data are comparable
B = Data are not comparable

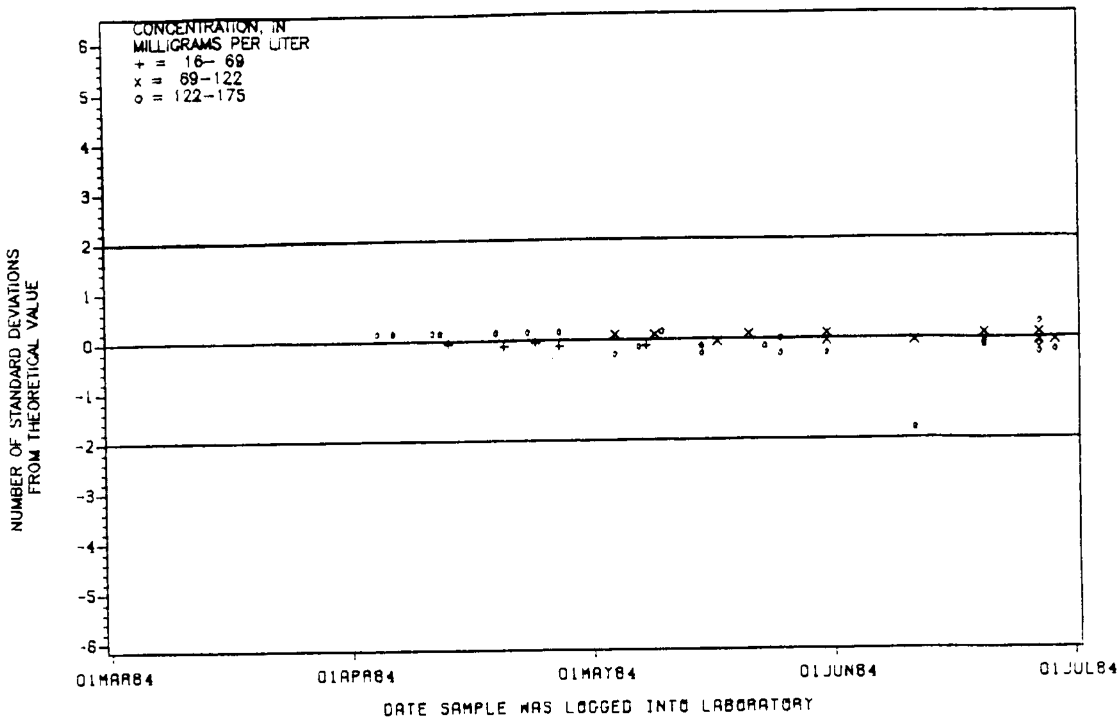

Figure A1.—Alkalinity data from the Atlanta laboratory.

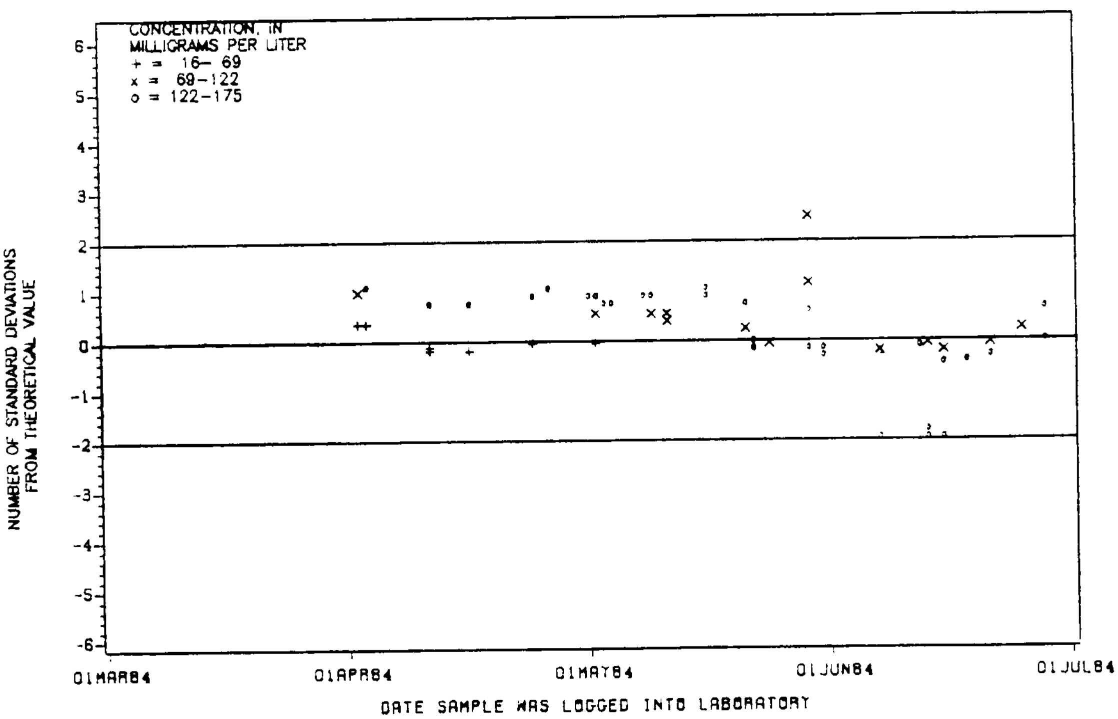

Figure D1.—Alkalinity data from the Denver laboratory.

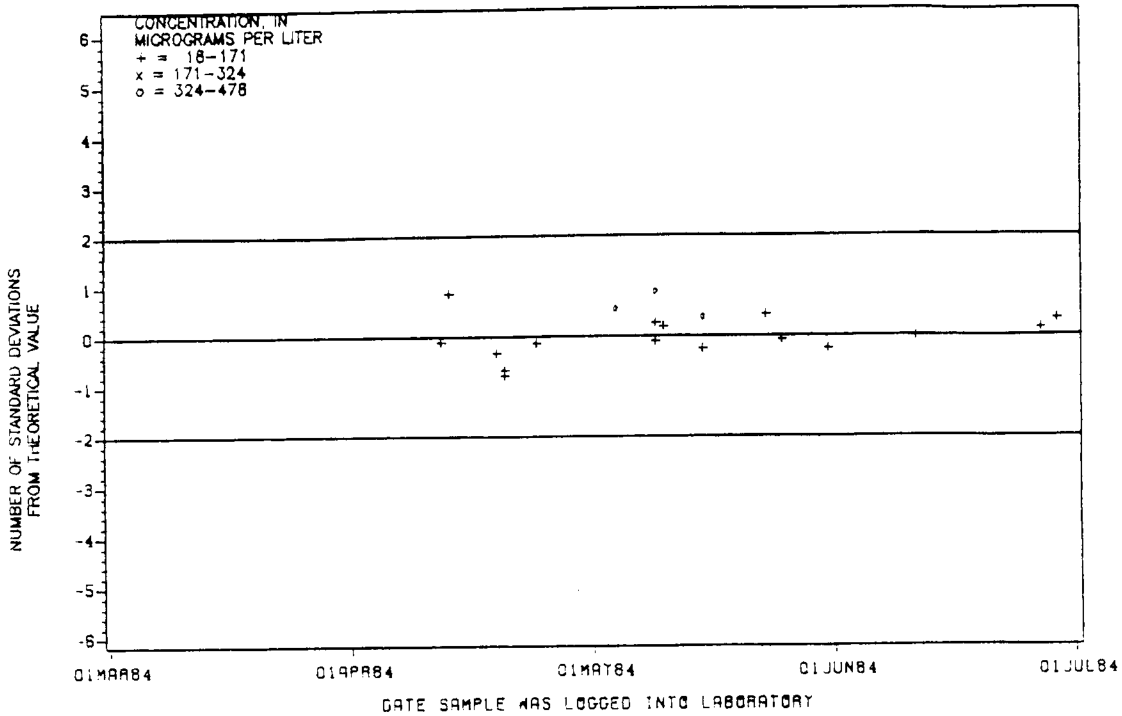

Figure A2.--Aluminum data from the Atlanta laboratory.

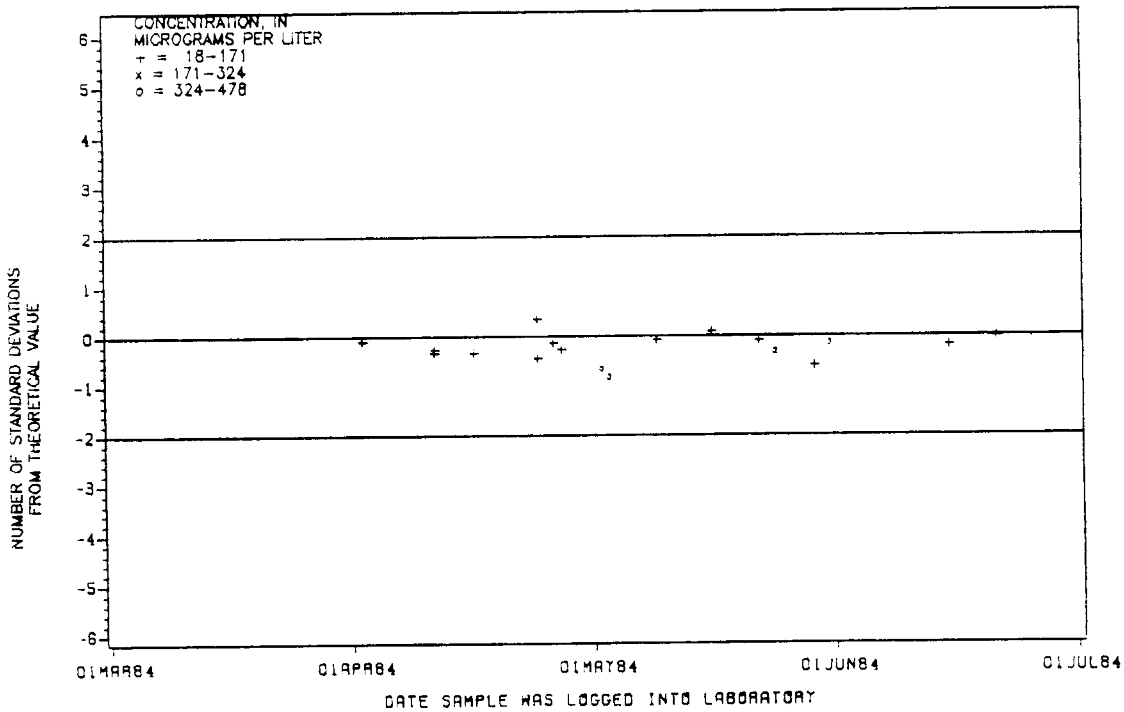

Figure D2.--Aluminum data from the Denver laboratory.

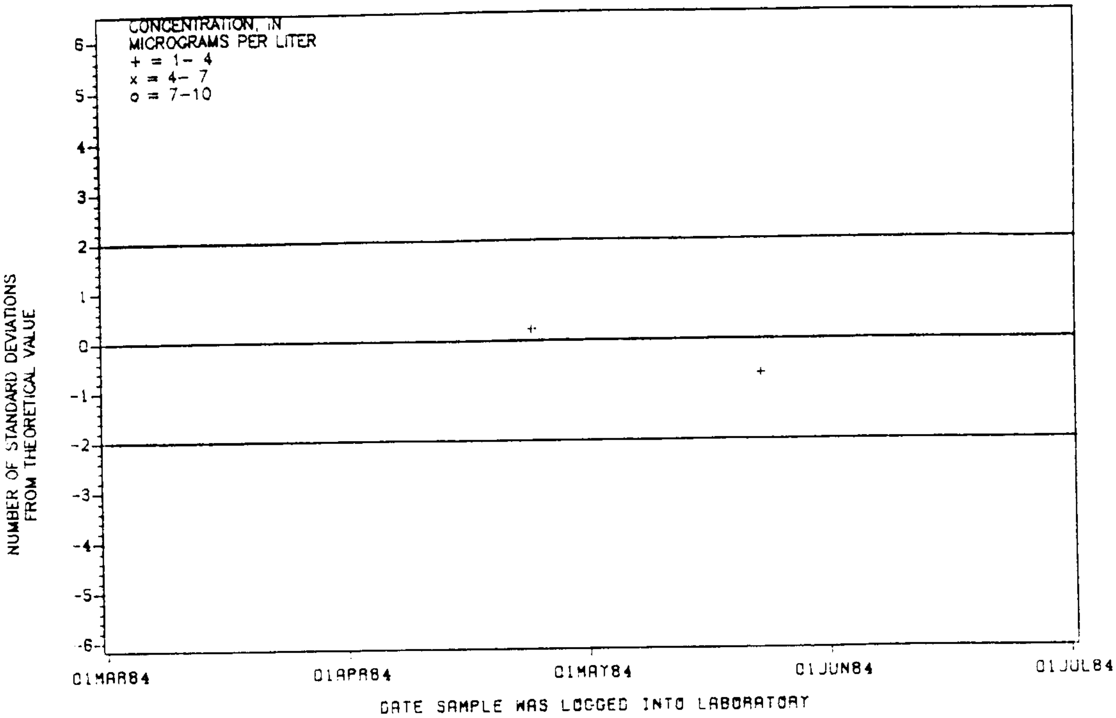

Figure A3.--Antimony data from the Atlanta laboratory.

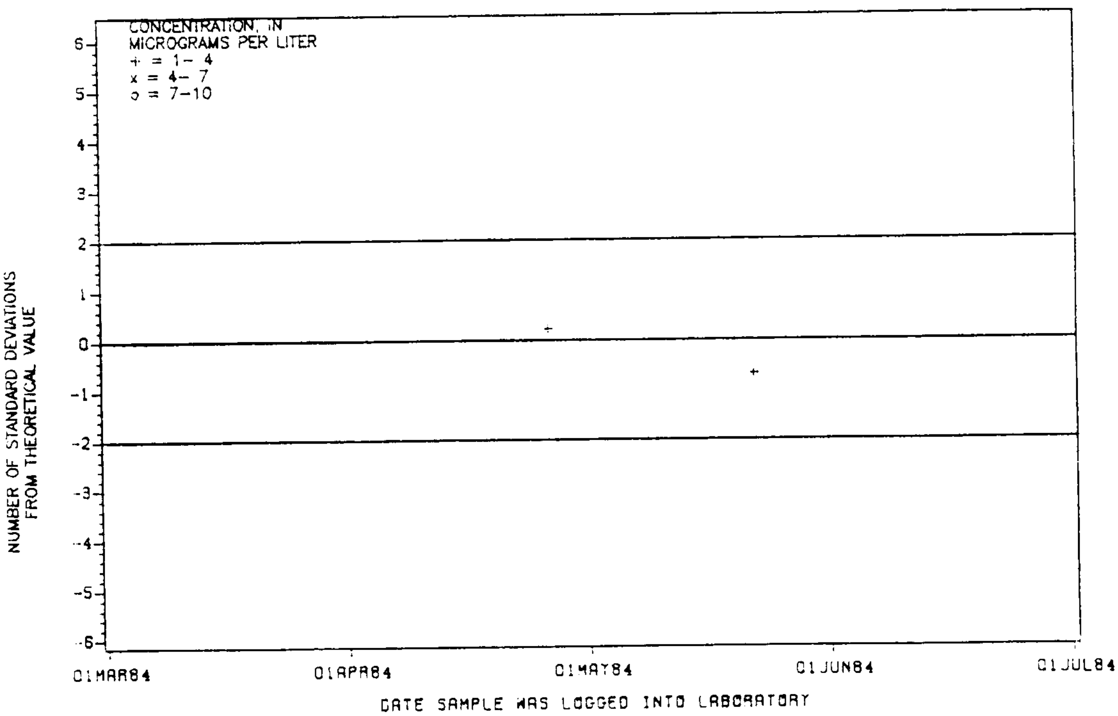

Figure D3.--Antimony data from the Denver laboratory.

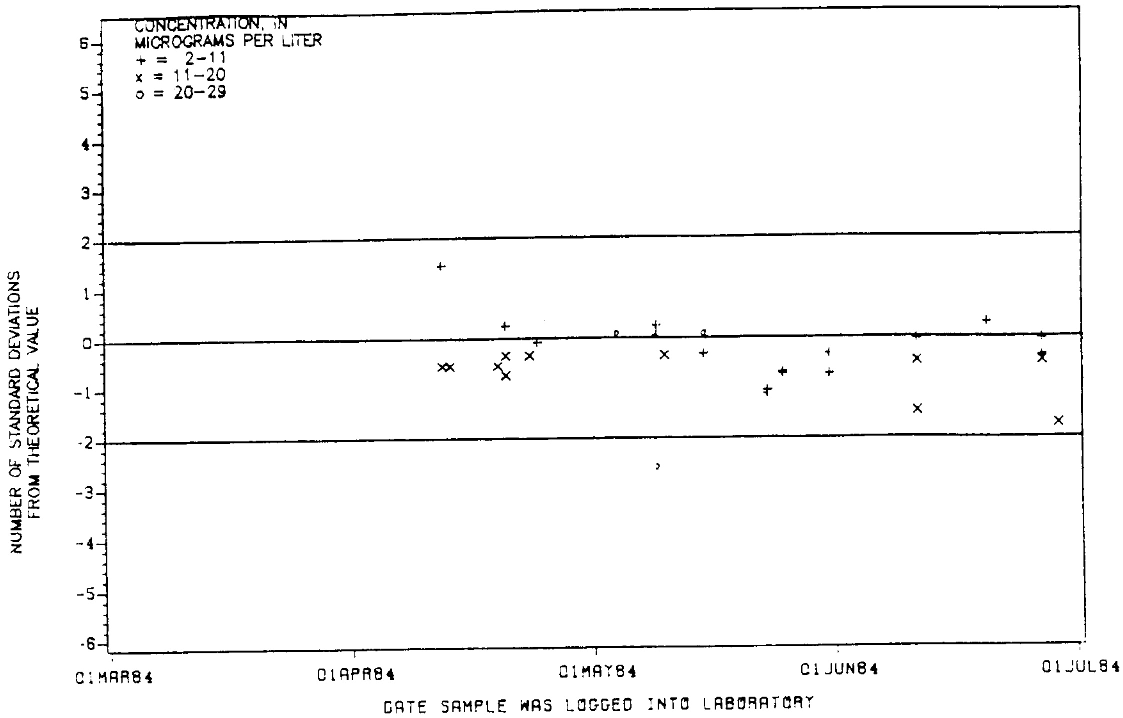

Figure A4.--Arsenic data from the Atlanta laboratory.

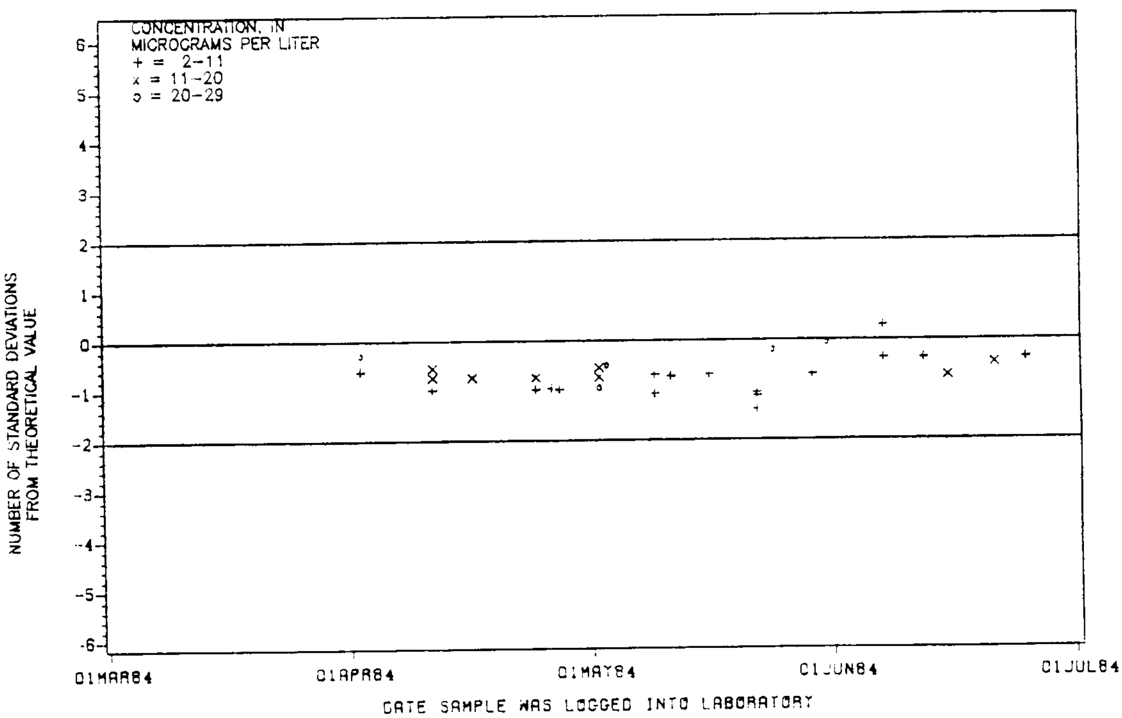

Figure D4.--Arsenic data from the Denver laboratory.

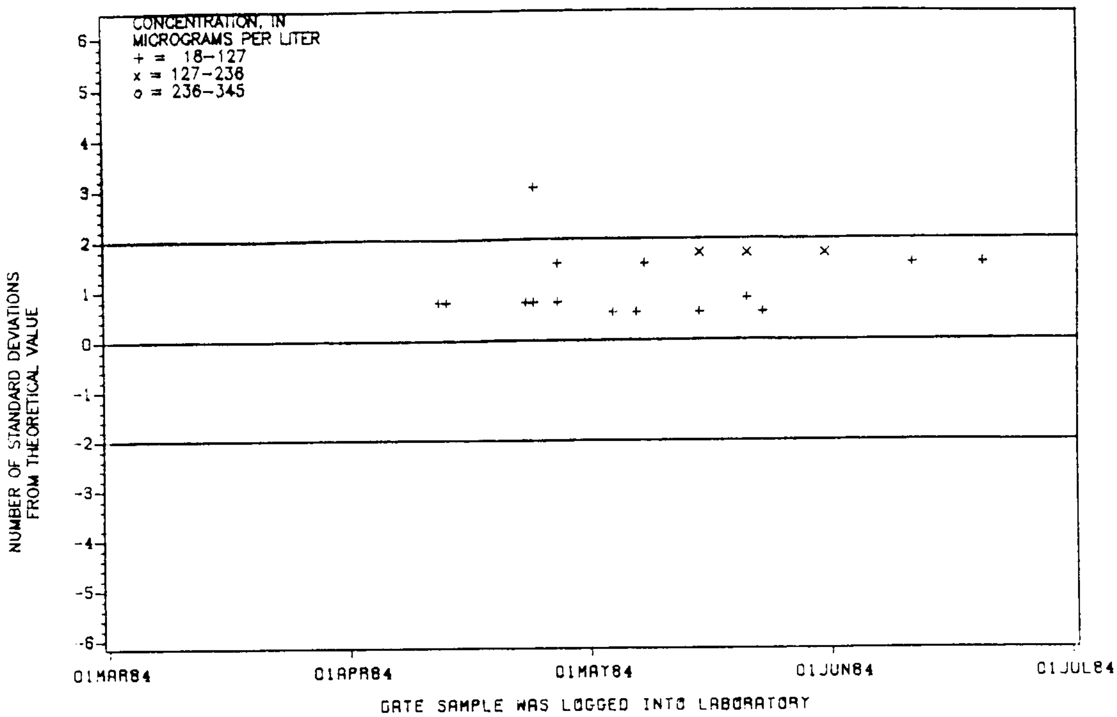

Figure A5.--Barium(ICP) data from the Atlanta laboratory.

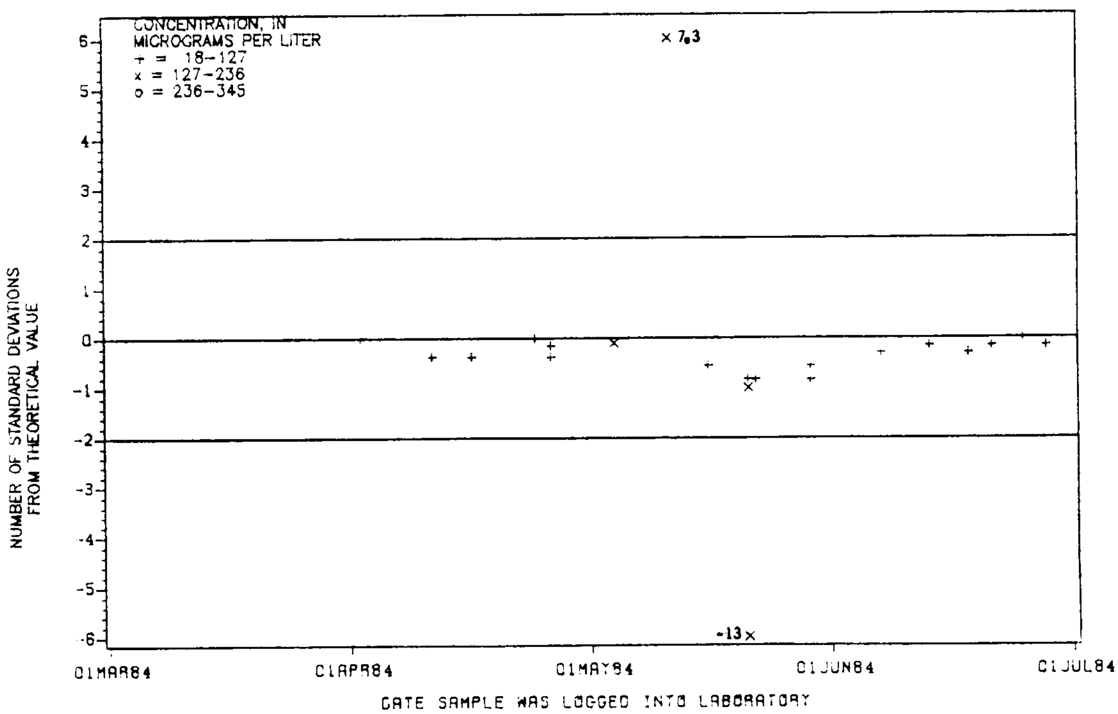

Figure D5.--Barium(ICP) data from the Denver laboratory.

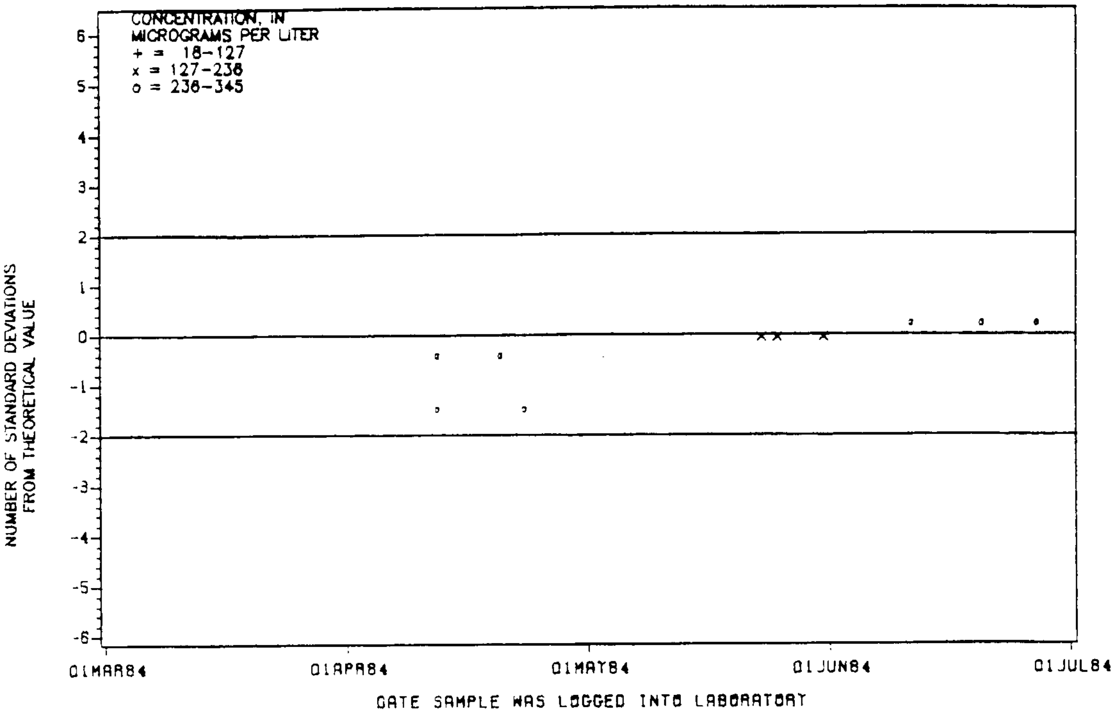

Figure A6.--Barium(AA) data from the Atlanta laboratory.

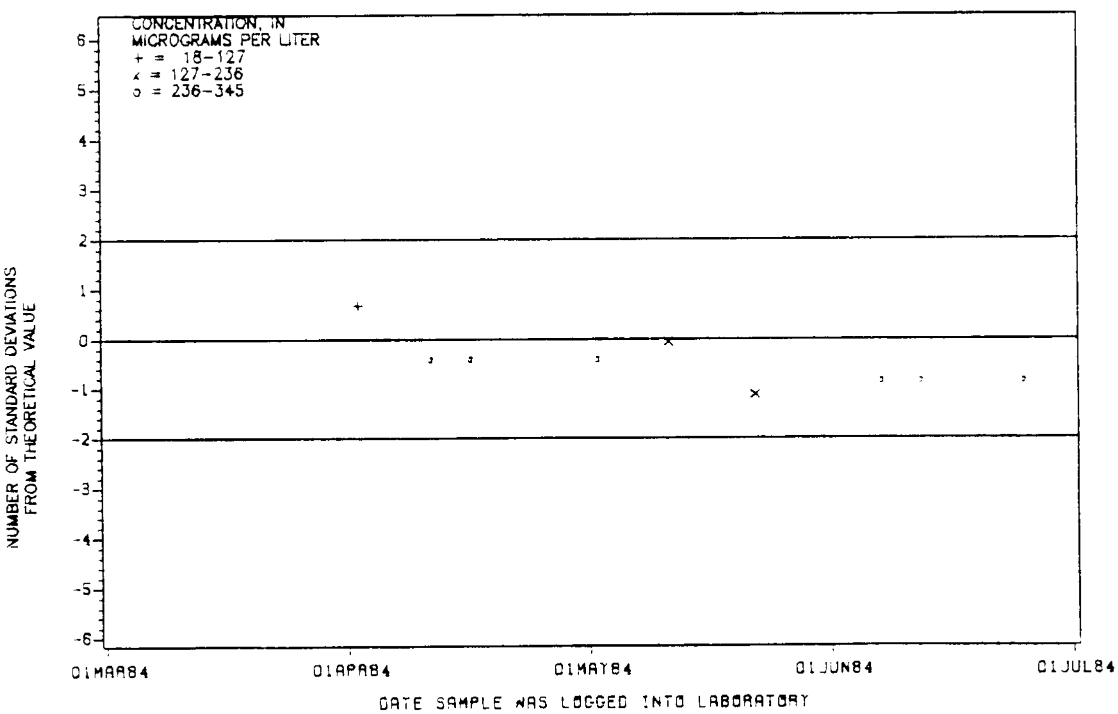

Figure D6.--Barium(AA) data from the Denver laboratory.

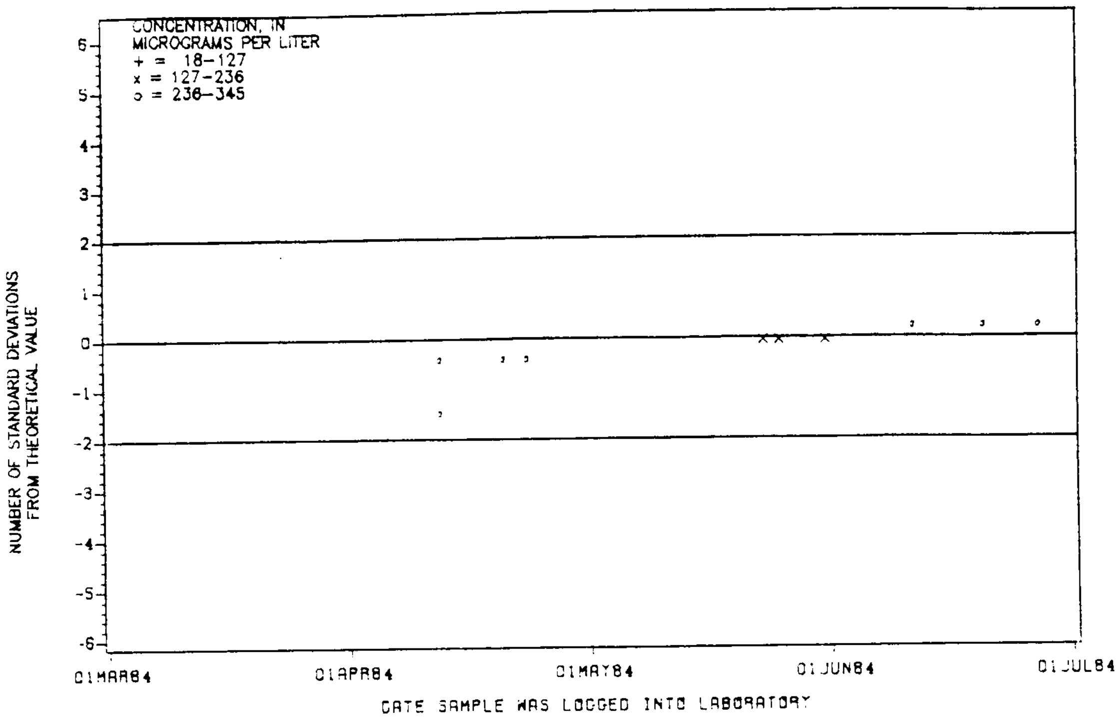

Figure A7.--Barium, total recoverable data from the Atlanta laboratory.

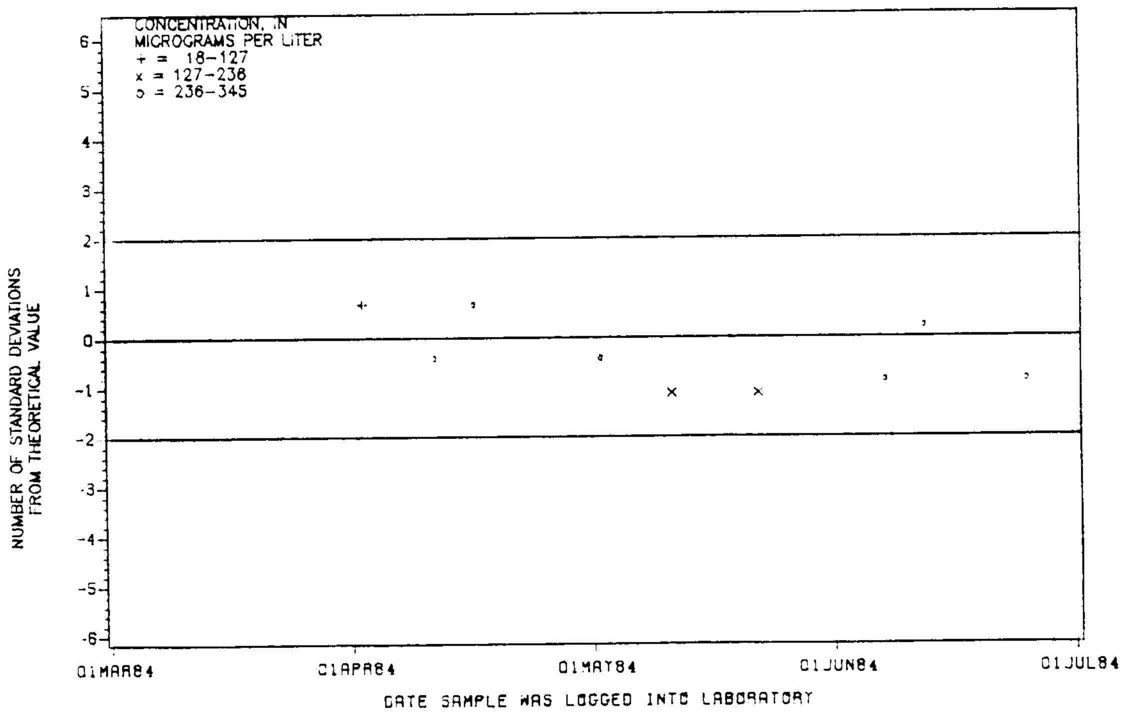

Figure D7.--Barium, total recoverable data from the Denver laboratory.

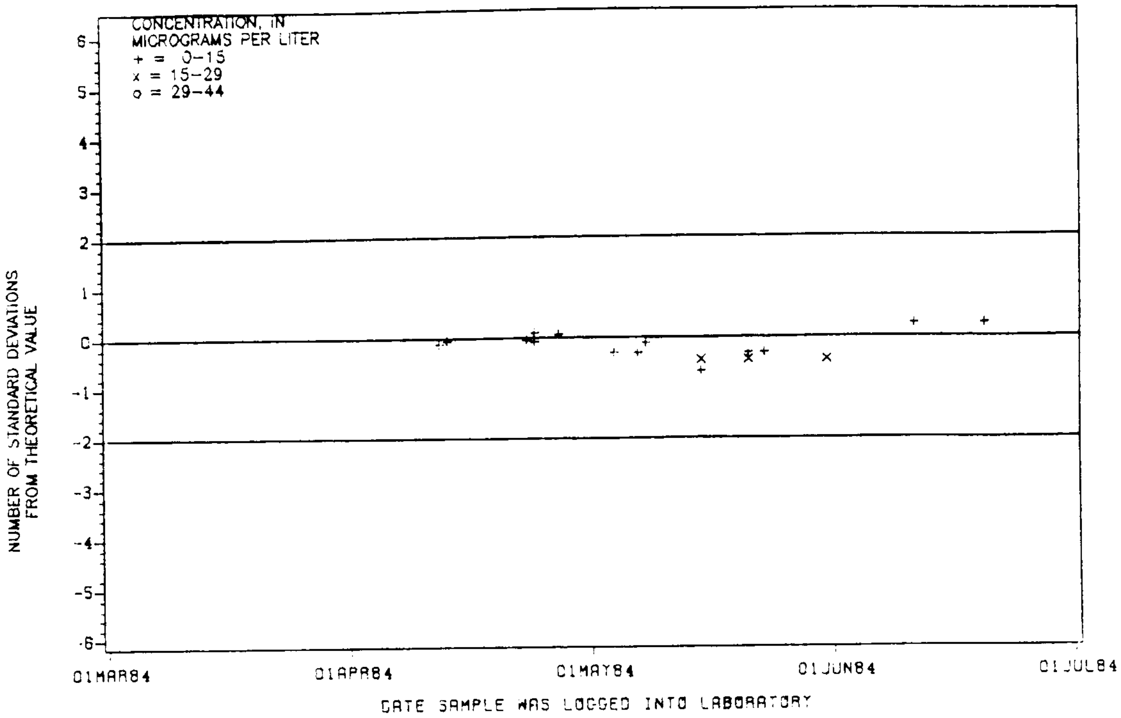

Figure A8. --Beryllium data from the Atlanta laboratory.

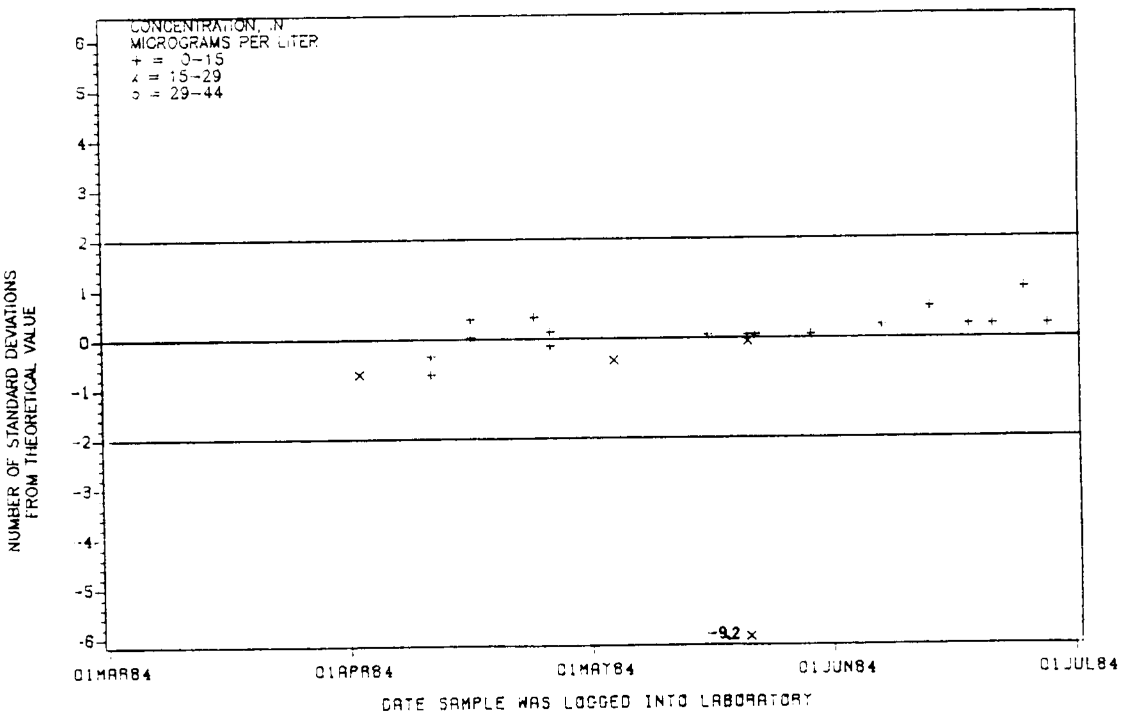

Figure D8. --Beryllium data from the Denver laboratory.

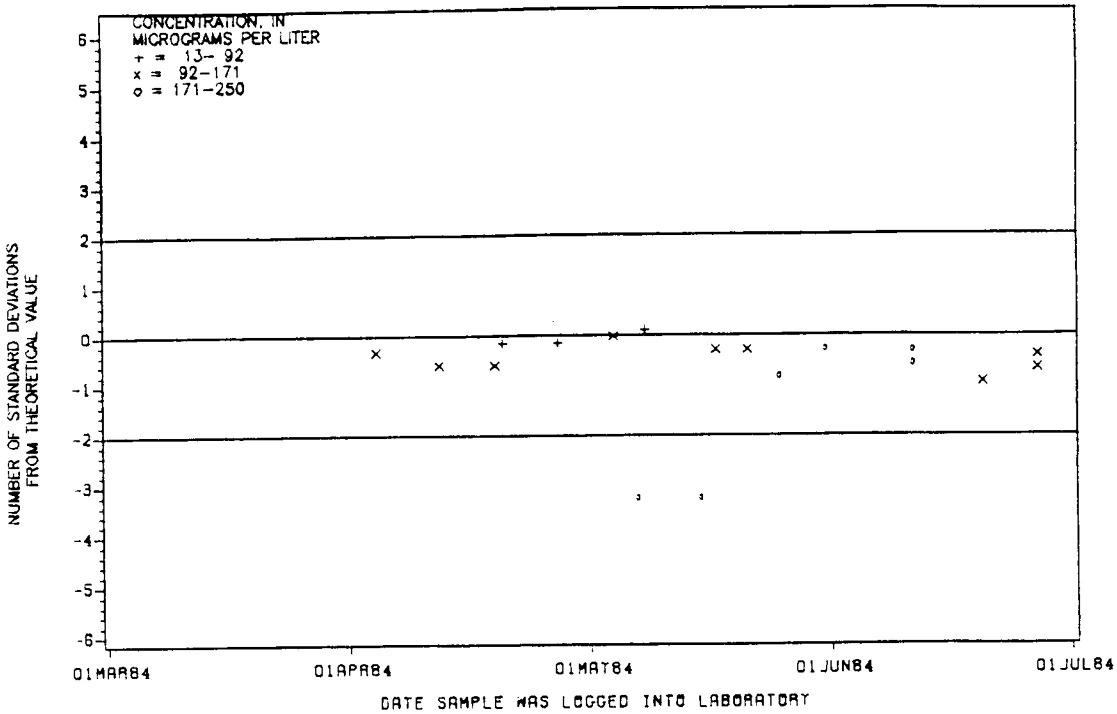

Figure A9.--Boron data from the Atlanta laboratory.

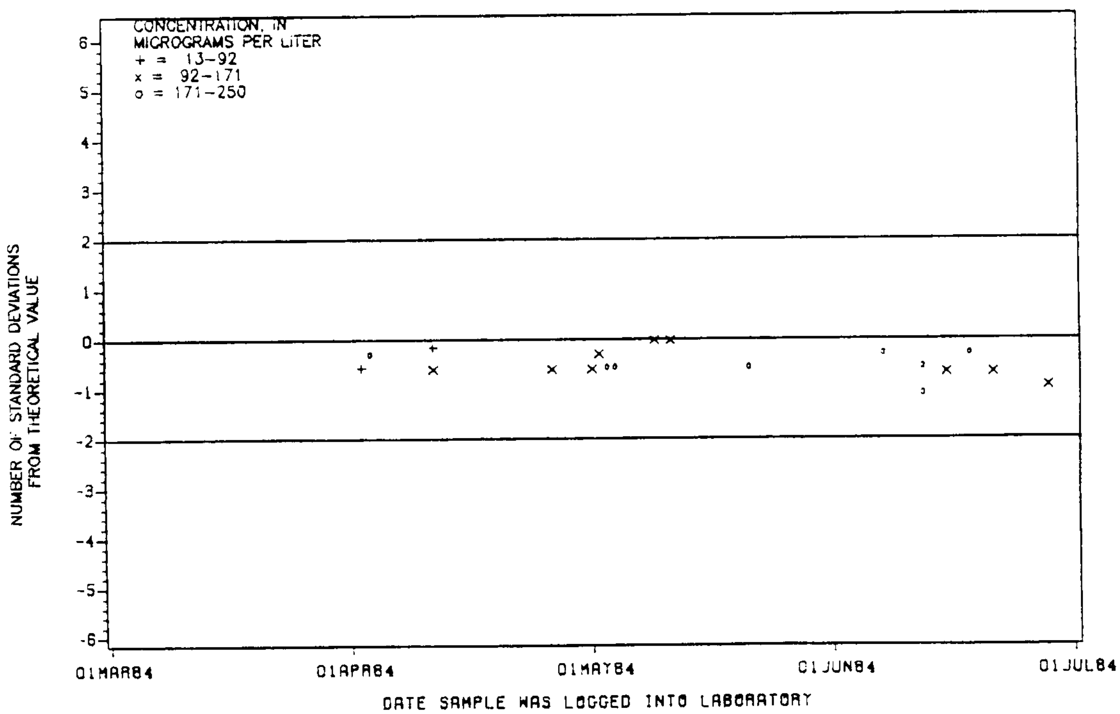

Figure D9.--Boron data from the Denver laboratory.

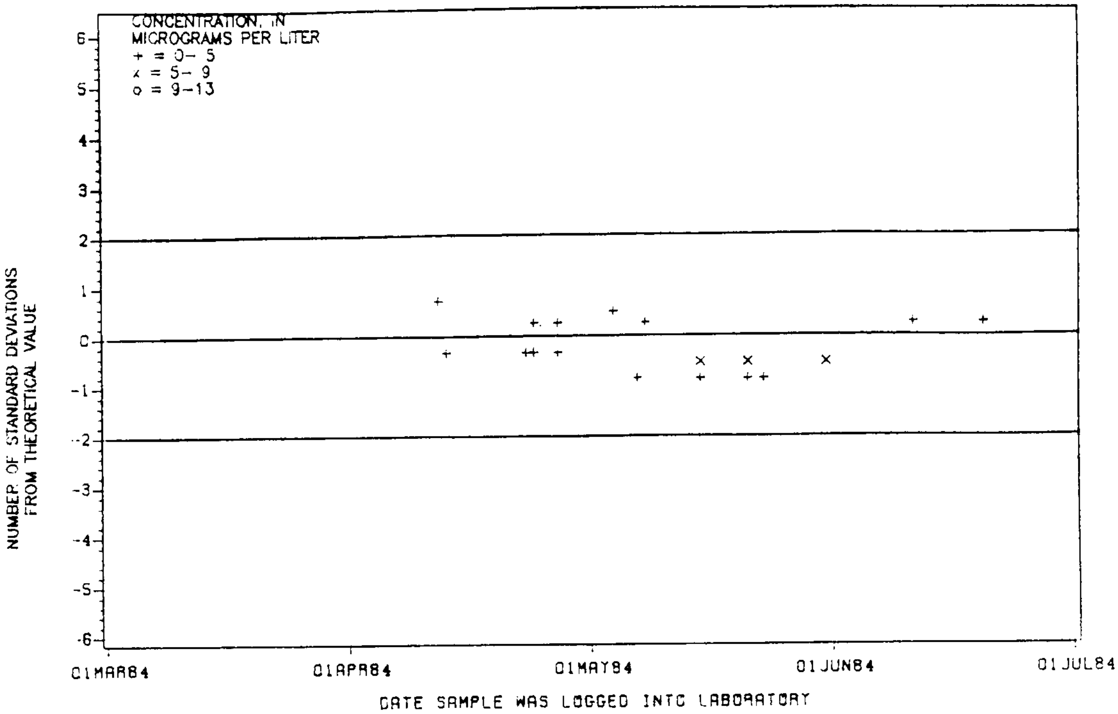

Figure A10.––Cadmium(ICP) data from the Atlanta laboratory.

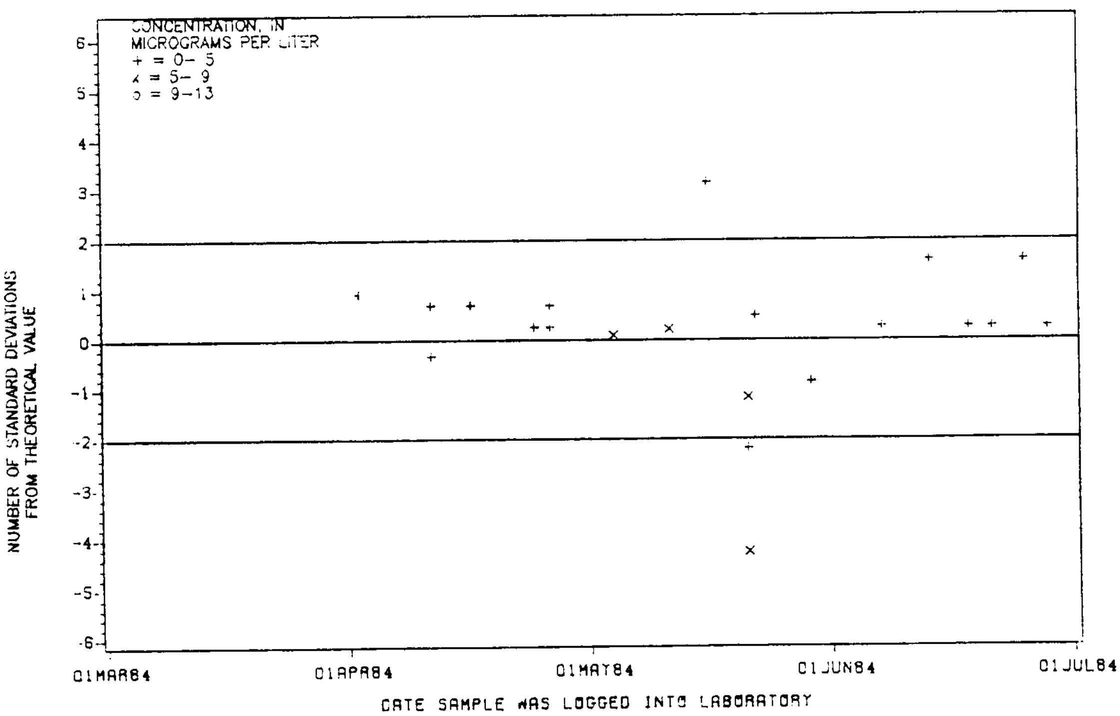

Figure D10.––Cadmium(ICP) data from the Denver laboratory.

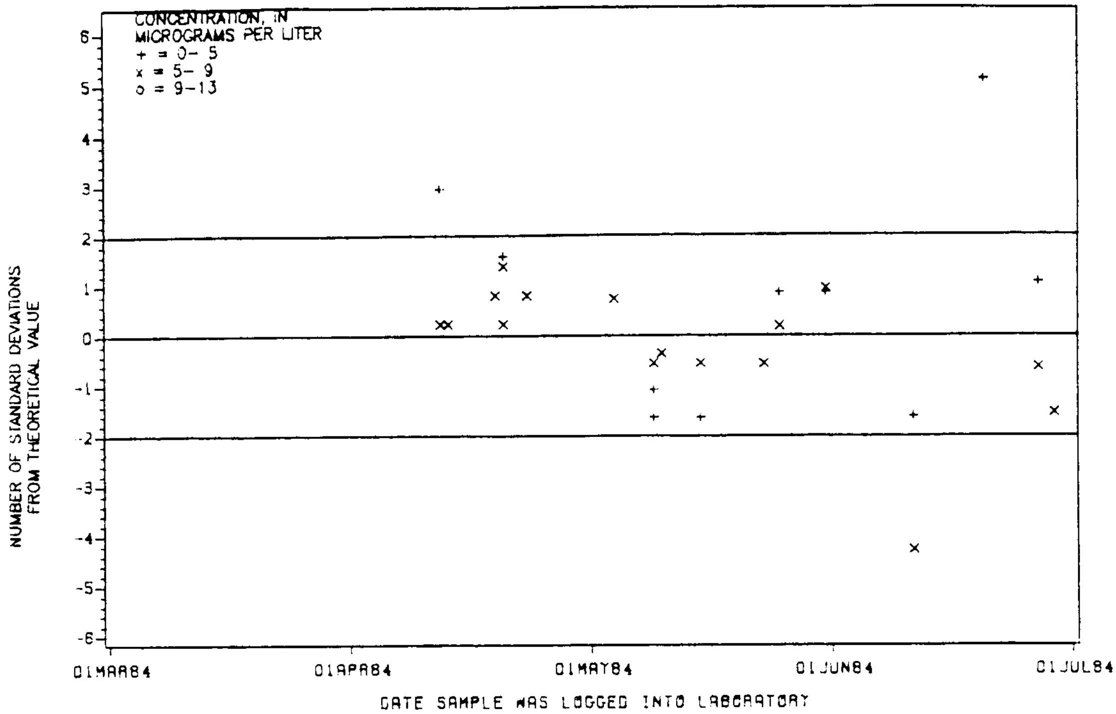

Figure A11.--Cadmium(AA) data from the Atlanta laboratory.

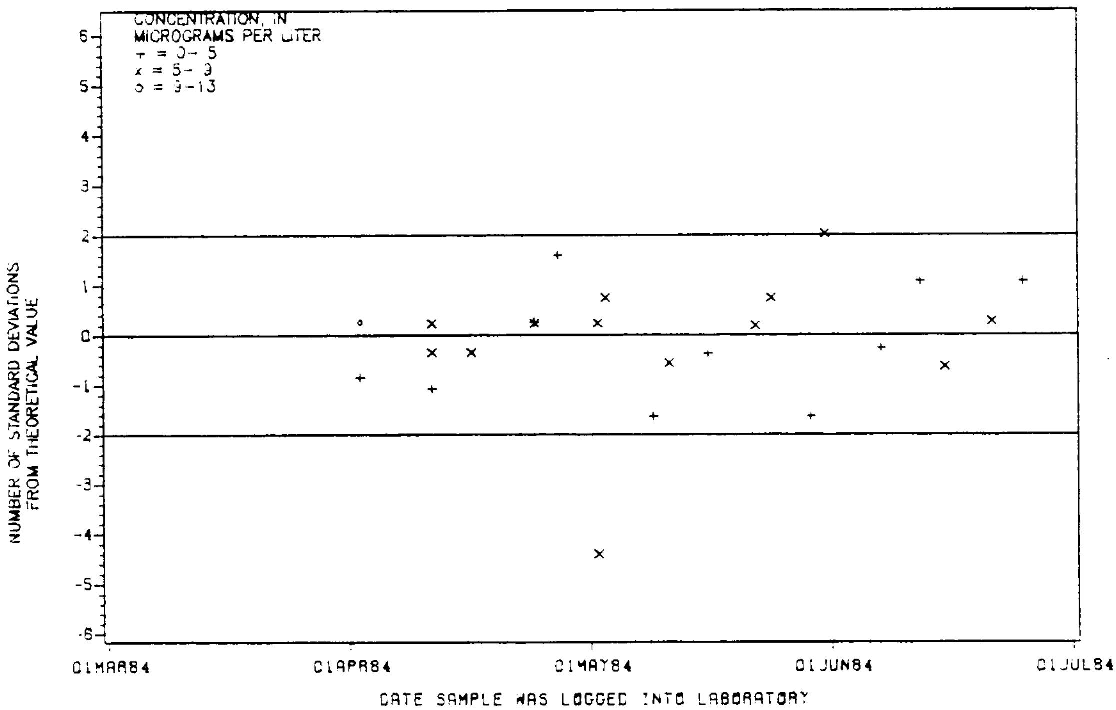

Figure D11.--Cadmium(AA) data from the Denver laboratory.

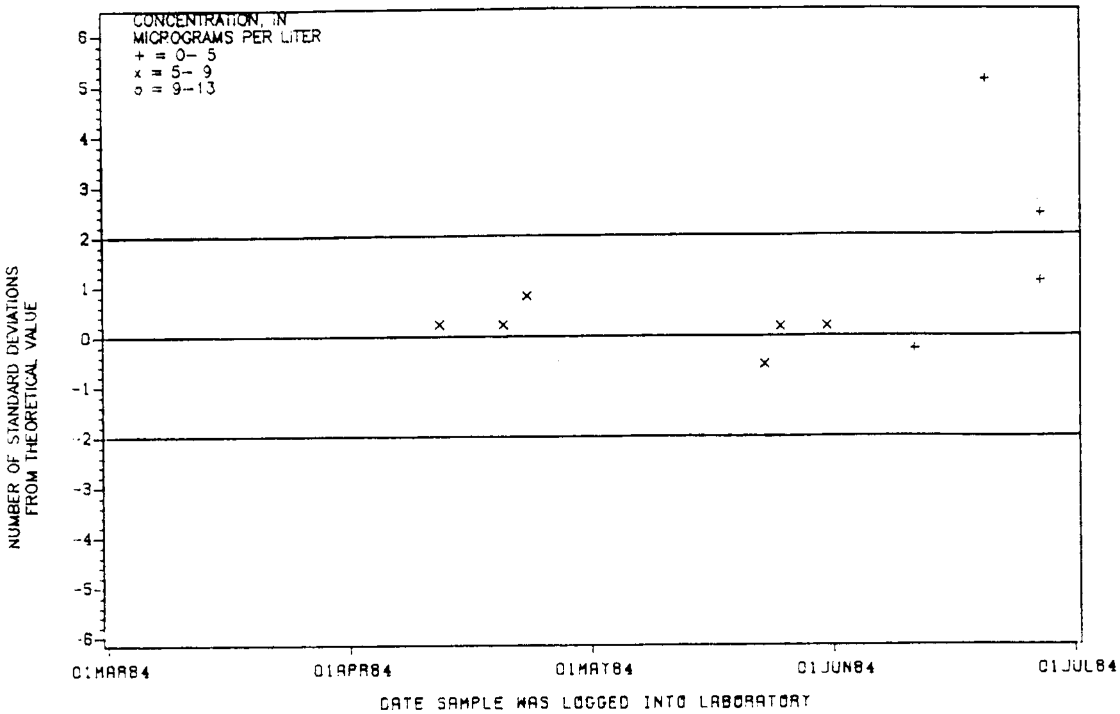

Figure A12.--Cadmium, total recoverable data from the Atlanta laboratory.

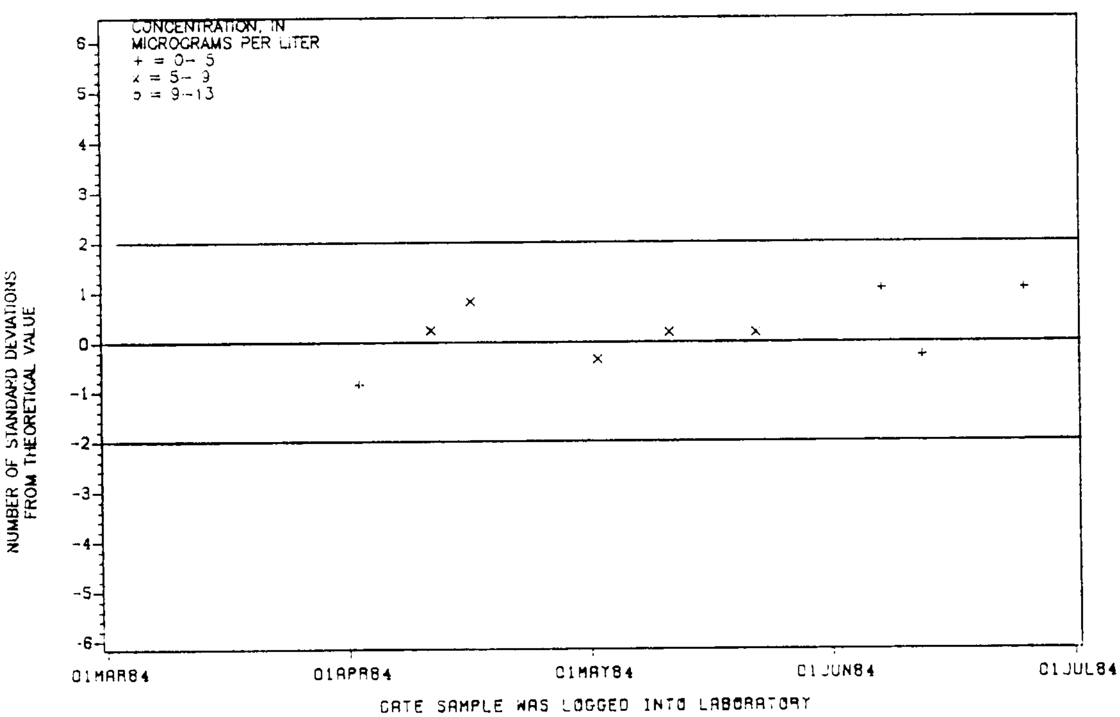

Figure D12.--Cadmium, total recoverable data from the Denver laboratory.

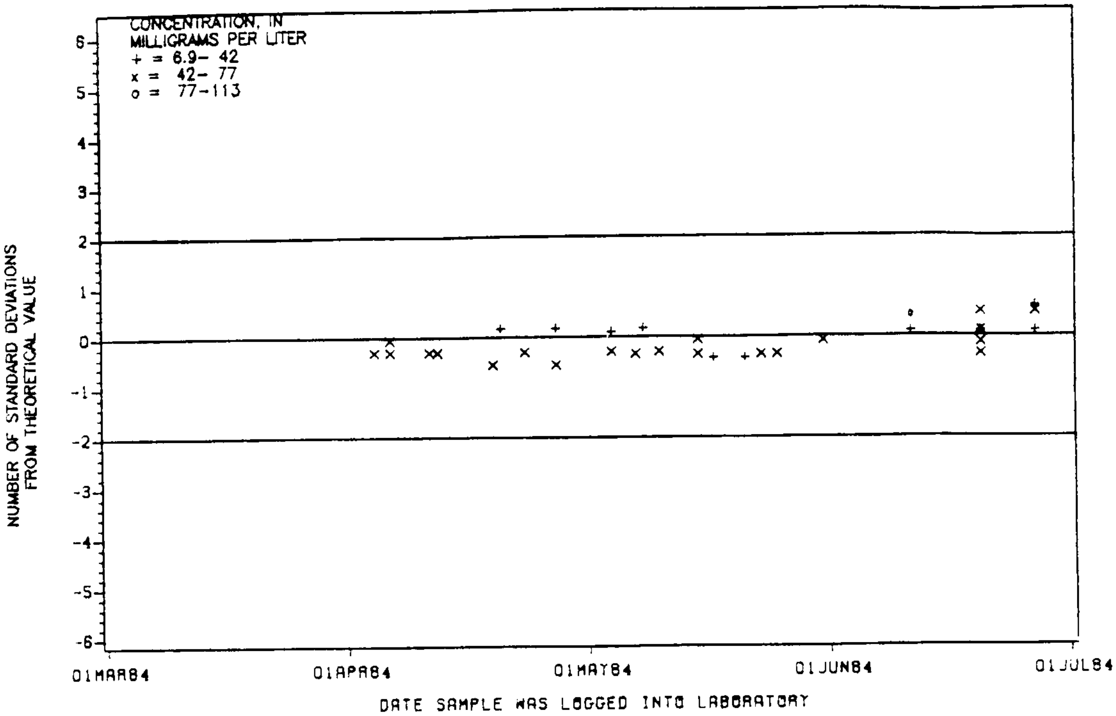

Figure A13.--Calcium(ICP) data from the Atlanta laboratory.

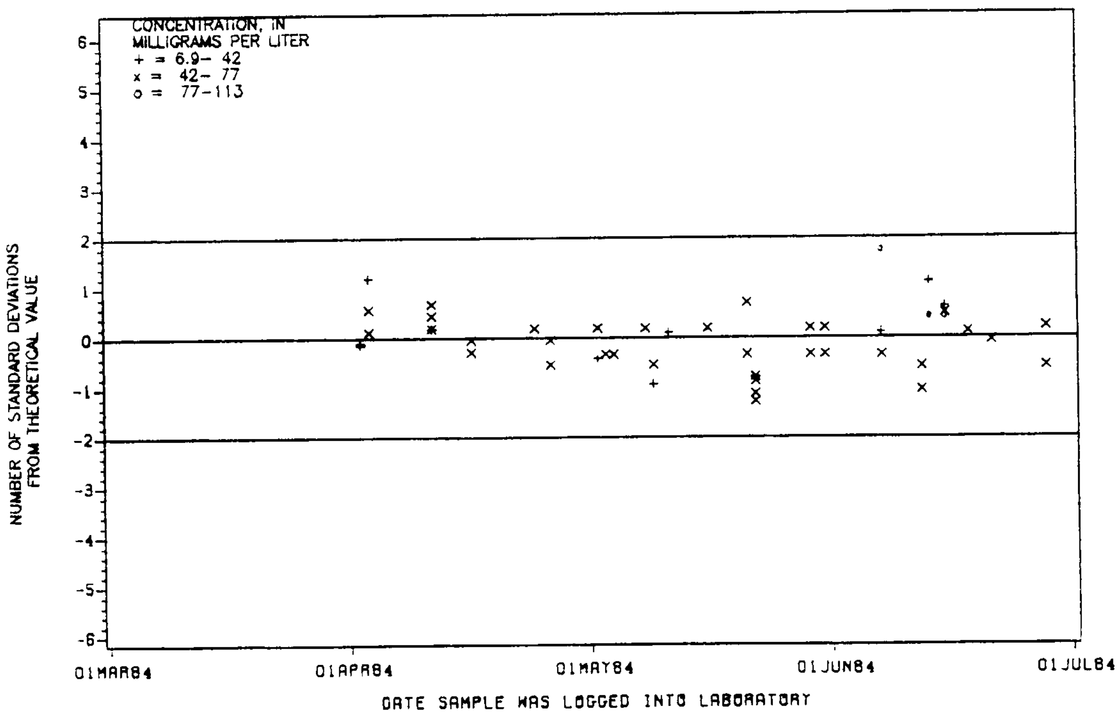

Figure D13.--Calcium(ICP) data from the Denver laboratory.

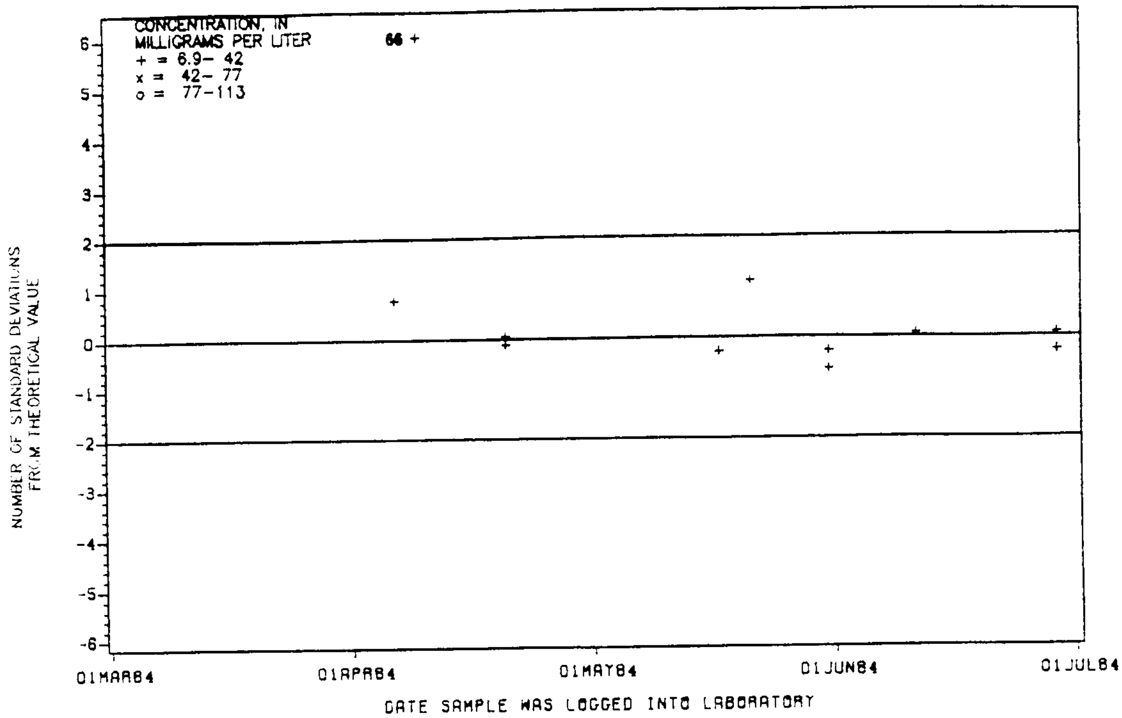

Figure A14 --Calcium(AA) data from the Atlanta laboratory

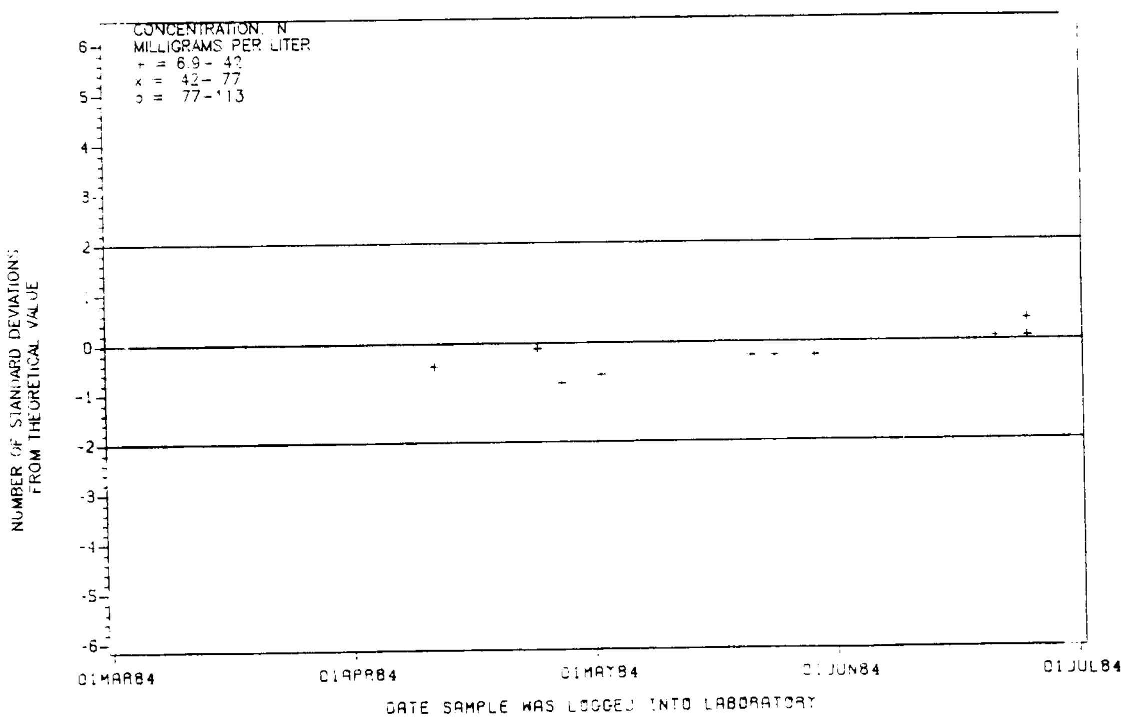

Figure D14 --Calcium(AA) data from the Denver laboratory.

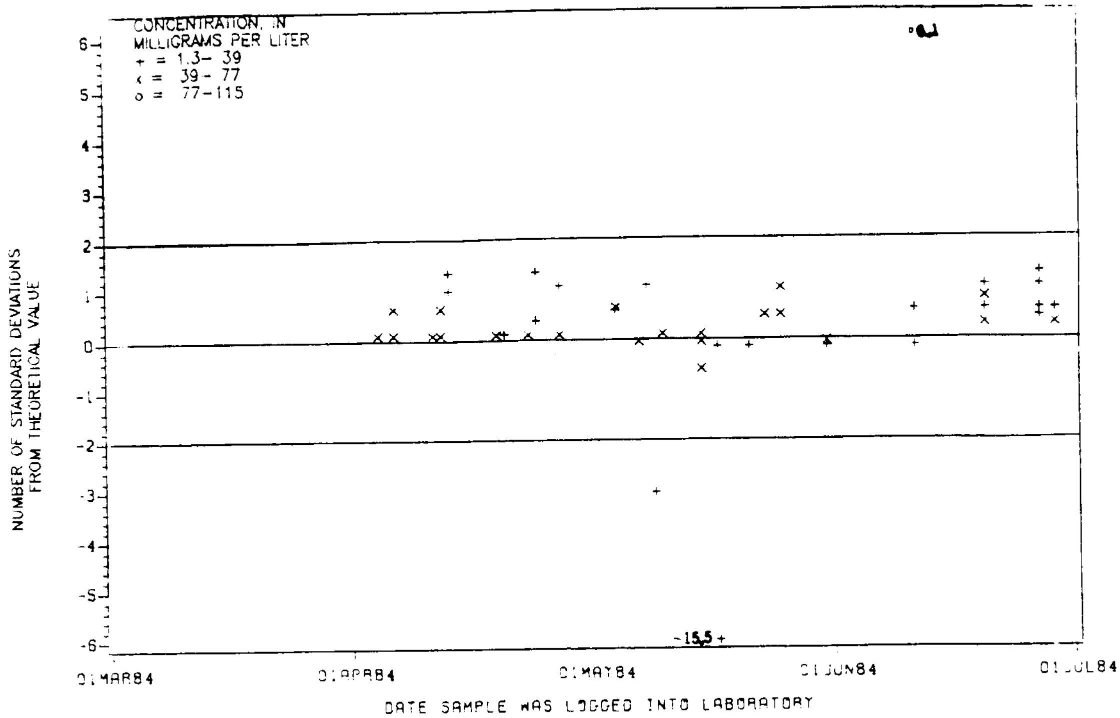

Figure A15.--Chloride data from the Atlanta laboratory.

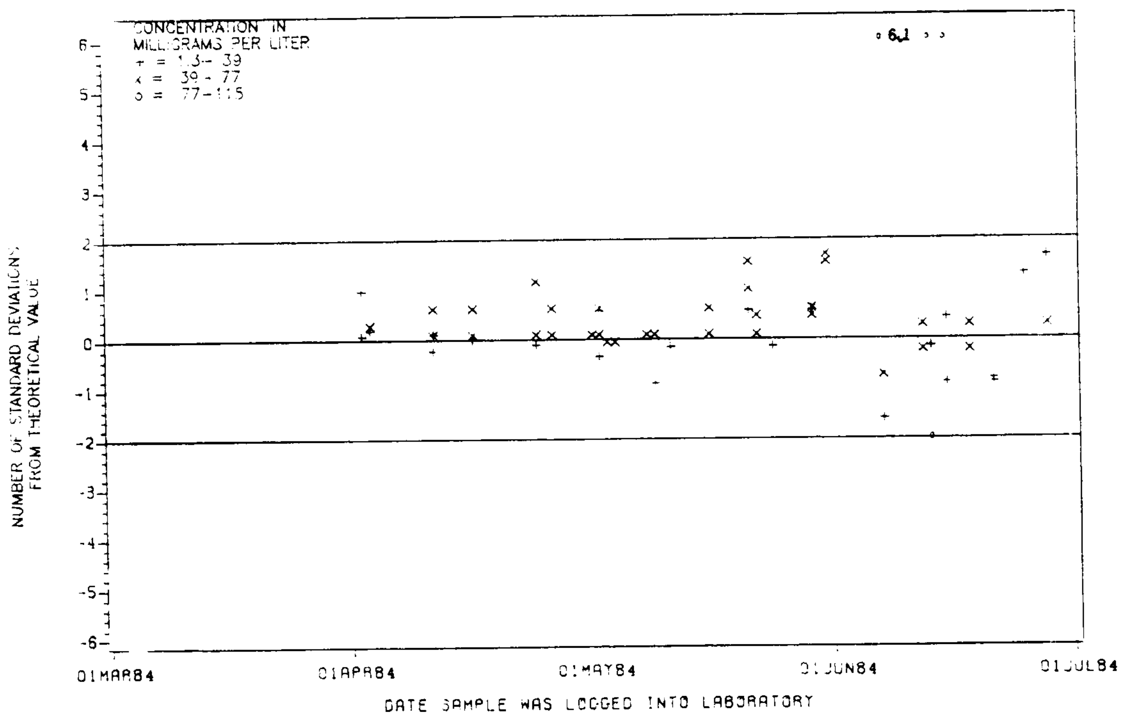

Figure D15.--Chloride data from the Denver laboratory.

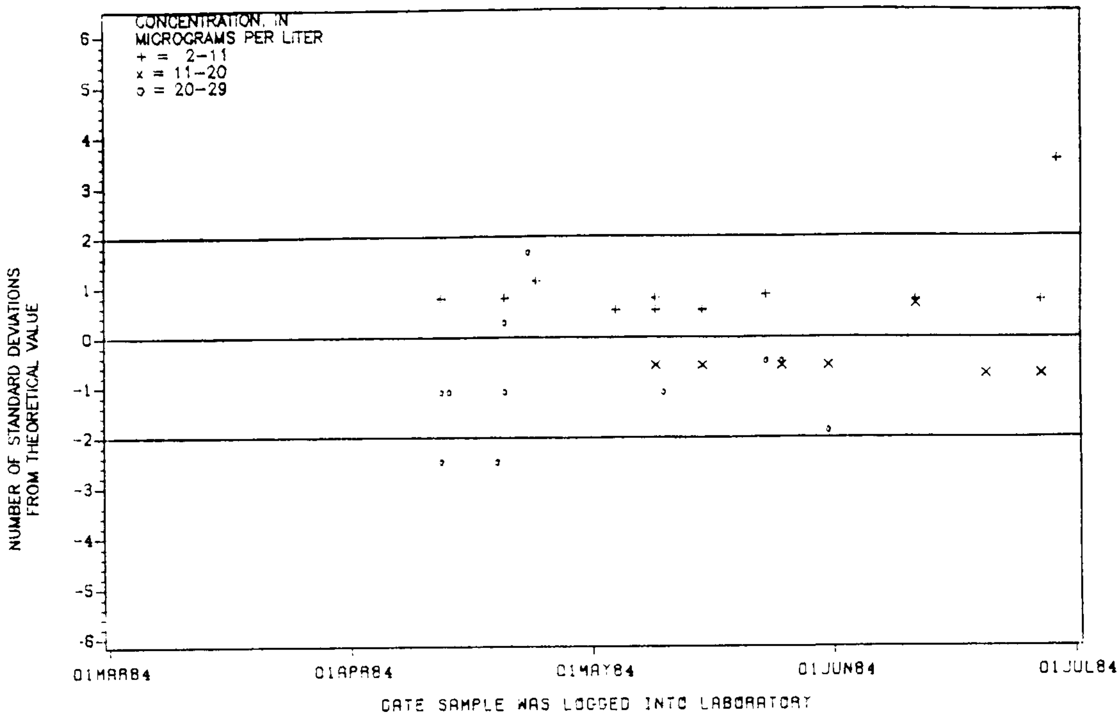

Figure A16.--Chromium data from the Atlanta laboratory.

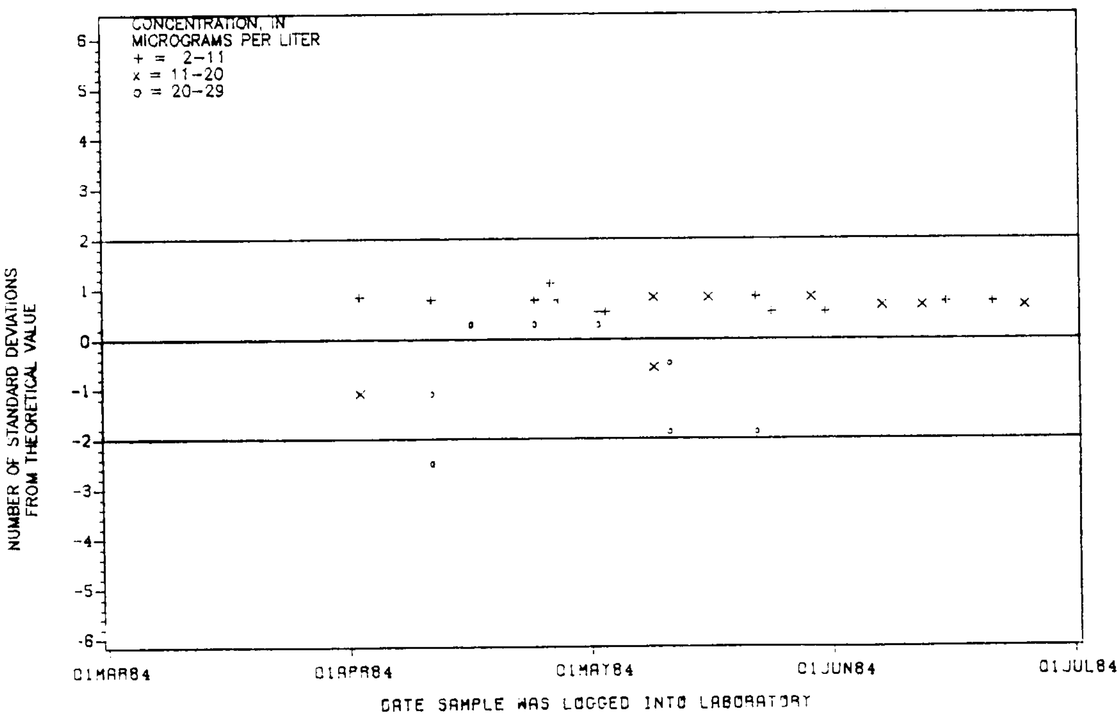

Figure D16.--Chromium data from the Denver laboratory.

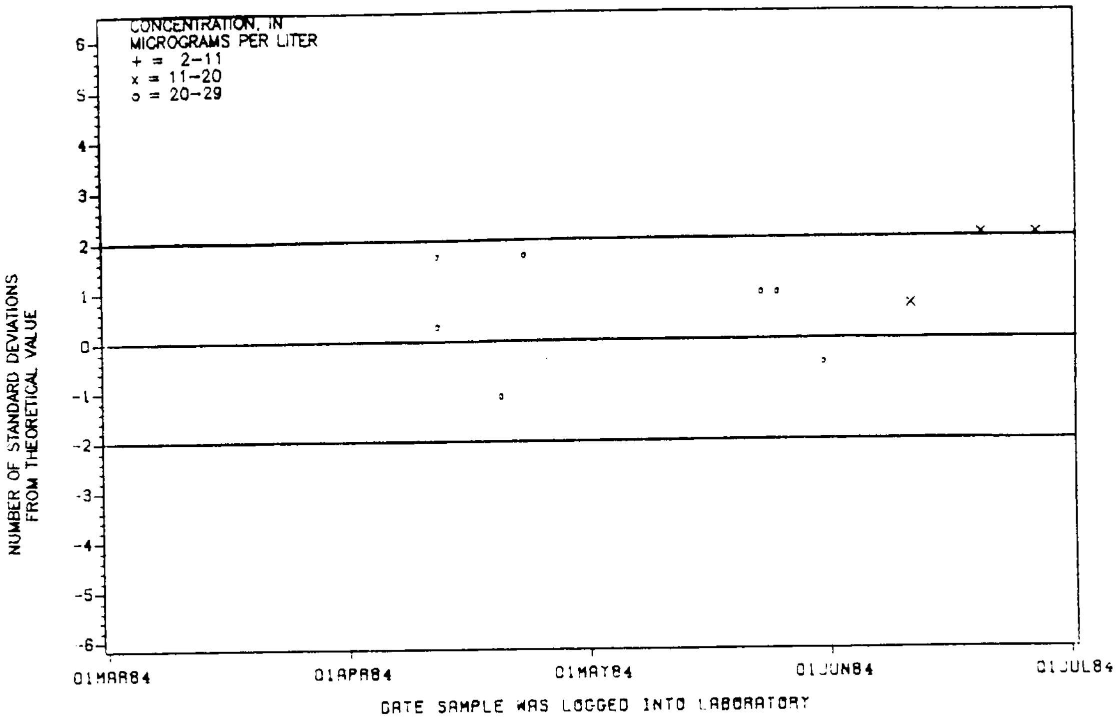

Figure A17.--Chromium, total recoverable data from the Atlanta laboratory.

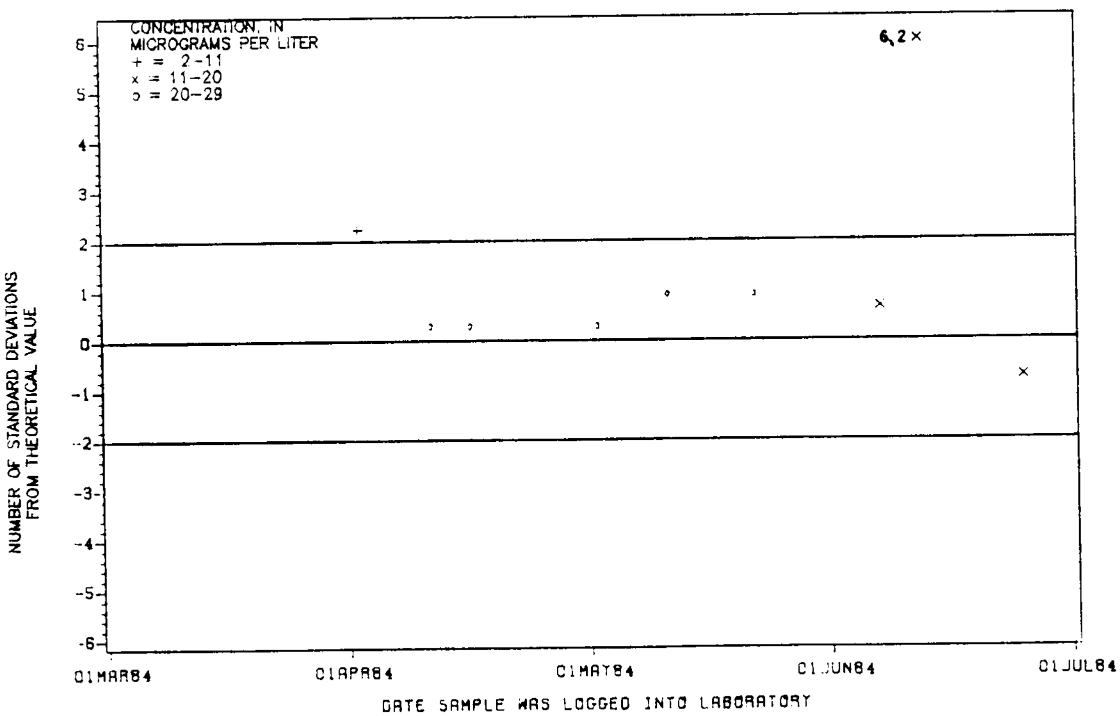

Figure D17.--Chromium, total recoverable data from the Denver laboratory.

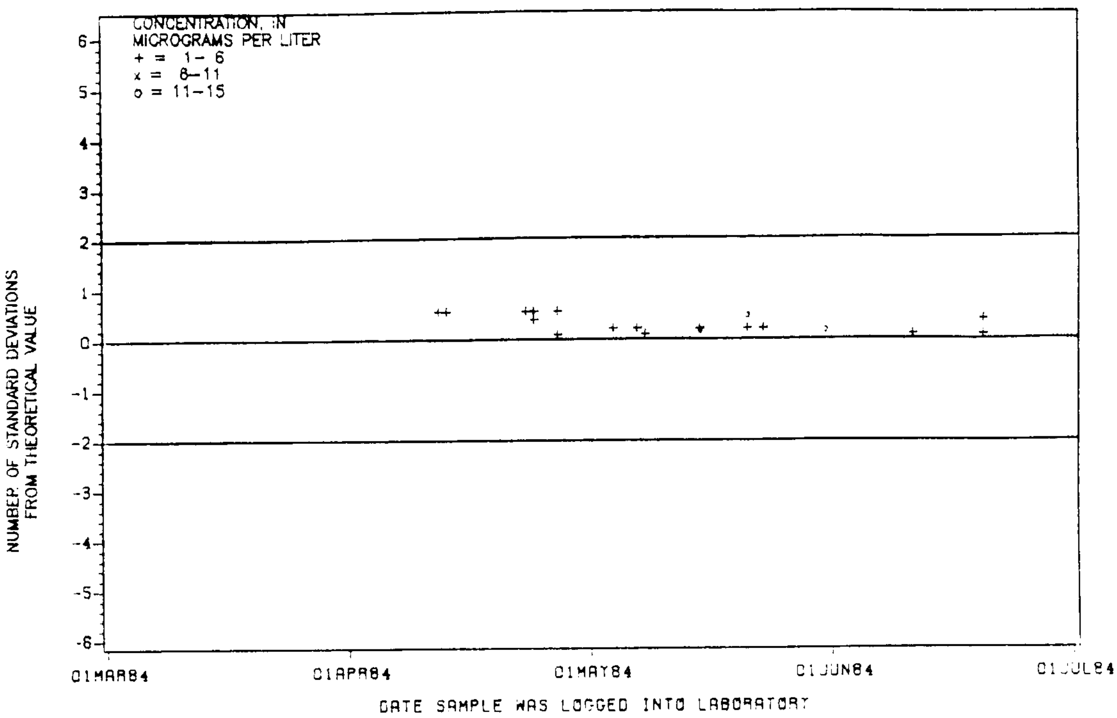

Figure A18. --Cobalt(ICP) data from the Atlanta laboratory.

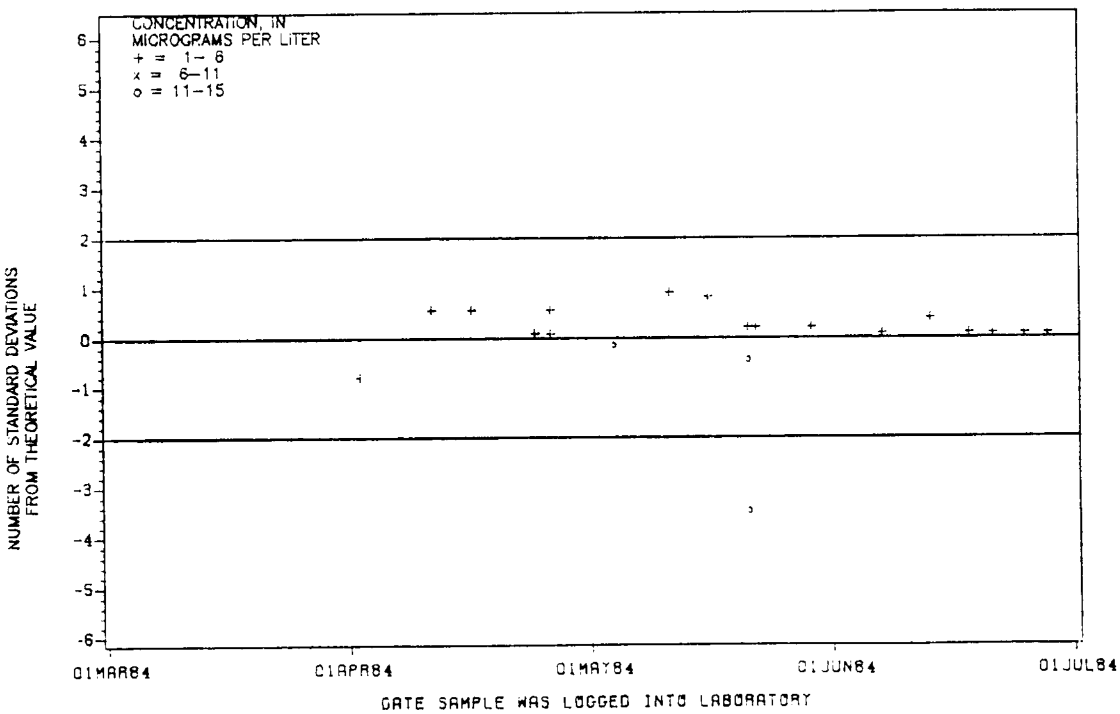

Figure D18. --Cobalt(ICP) data from the Denver laboratory.

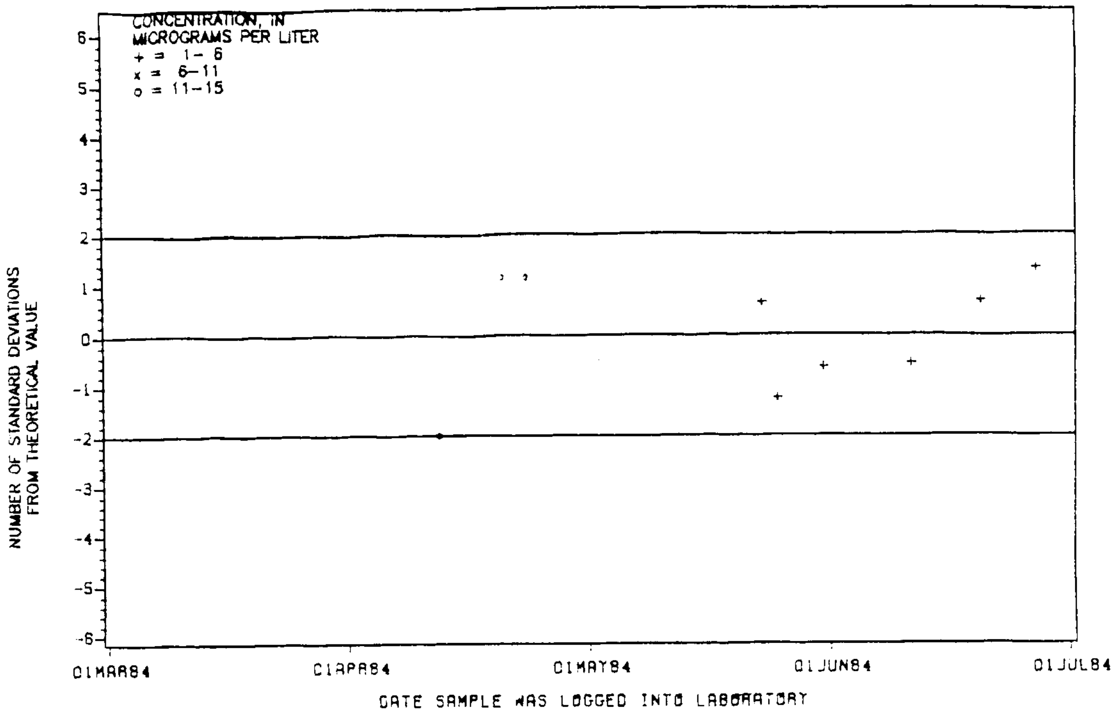

Figure A19.--Cobalt(AA) data from the Atlanta laboratory.

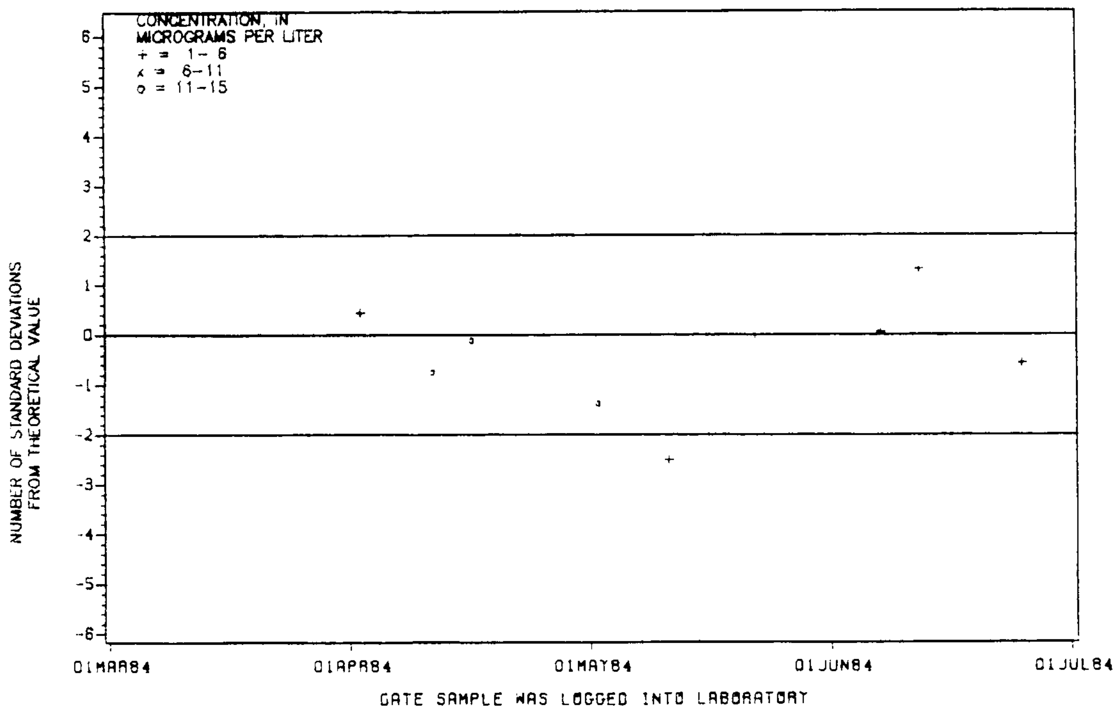

Figure D19.--Cobalt(AA) data from the Denver laboratory.

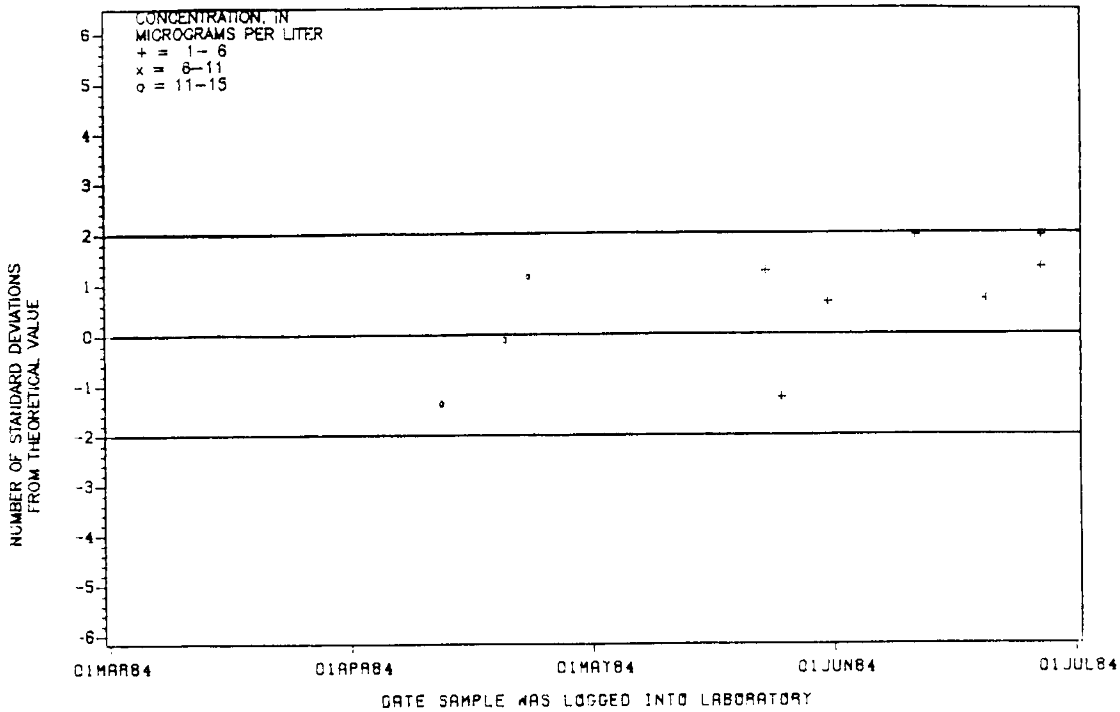

Figure A20.--Cobalt, total recoverable data from the Atlanta laboratory.

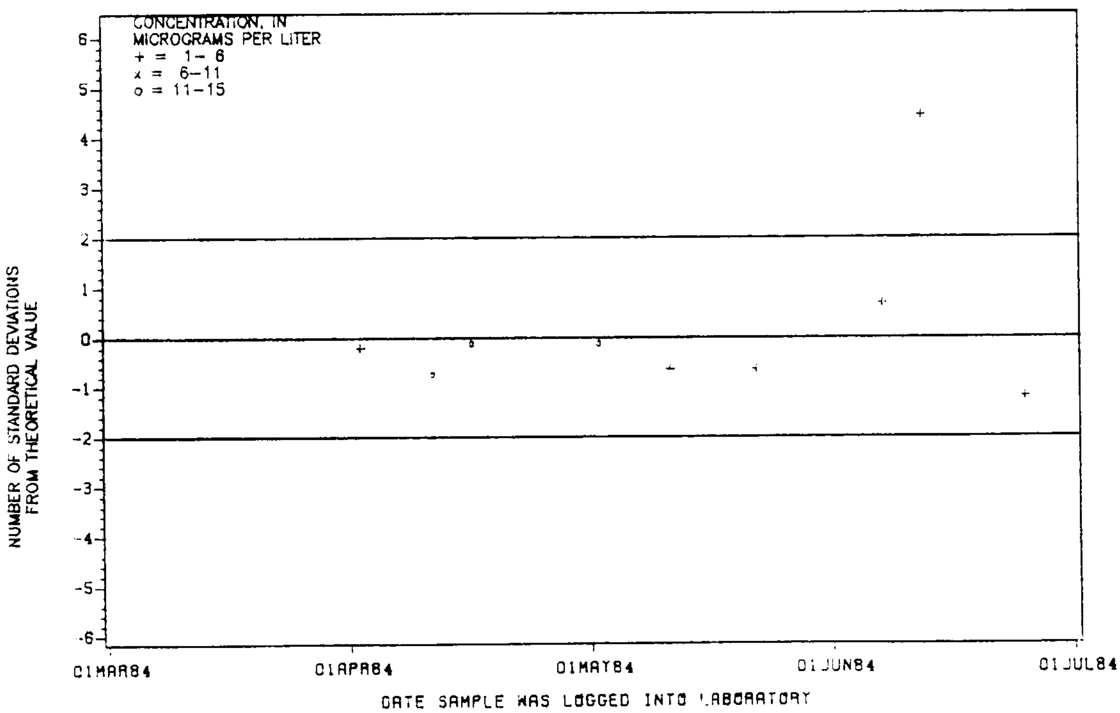

Figure D20.--Cobalt, total recoverable data from the Denver laboratory.

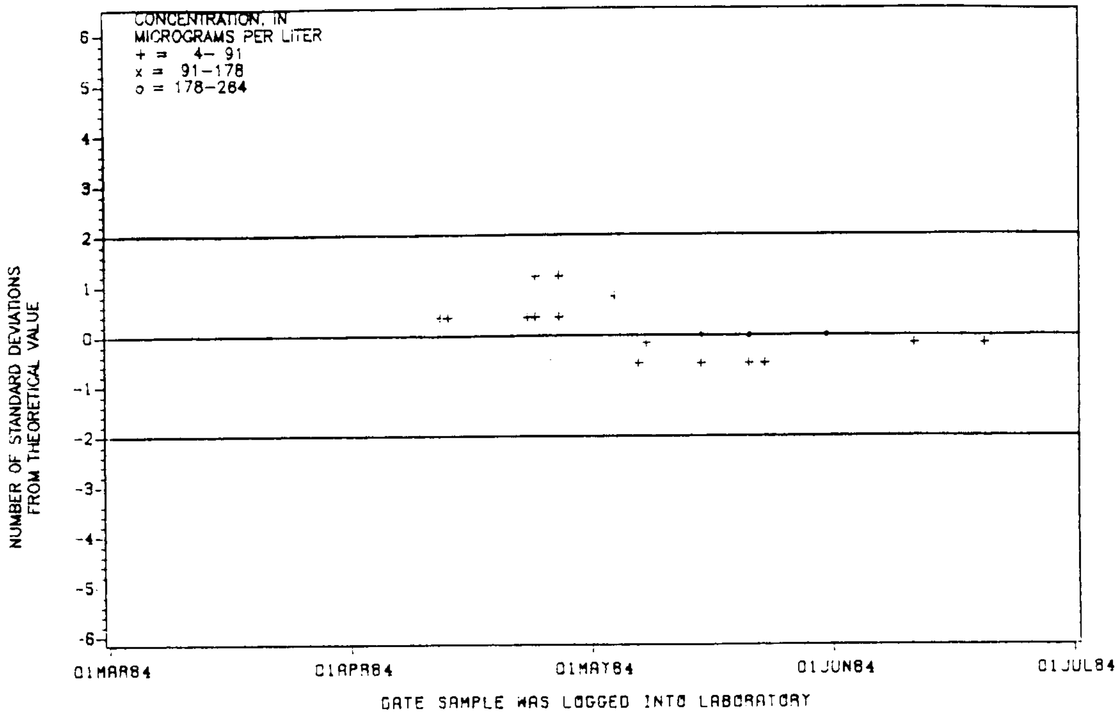

Figure A21.--Copper(ICP) data from the Atlanta laboratory.

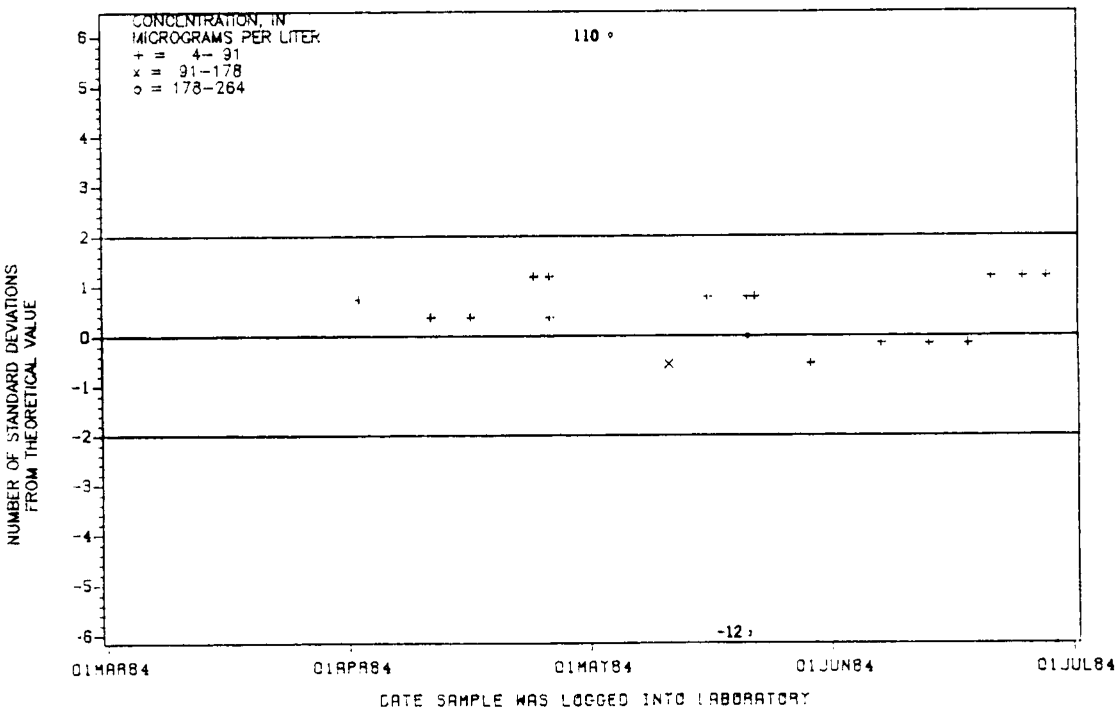

Figure D21.--Copper(ICP) data from the Denver laboratory.

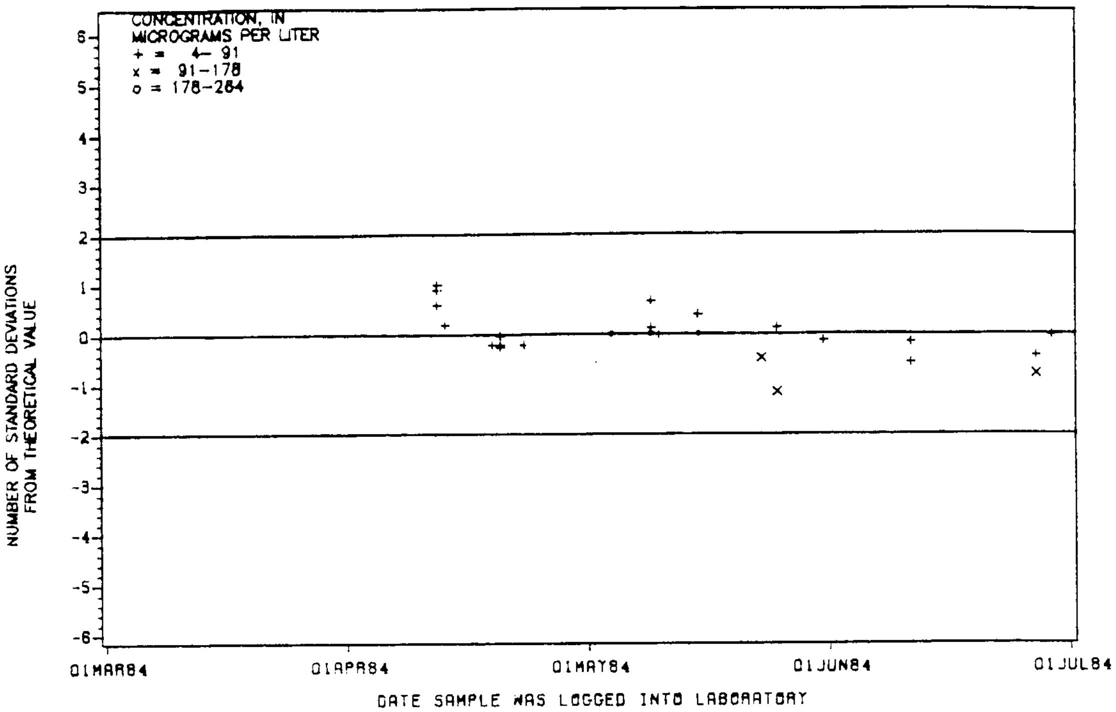

Figure A22.--Copper(AA) data from the Atlanta laboratory.

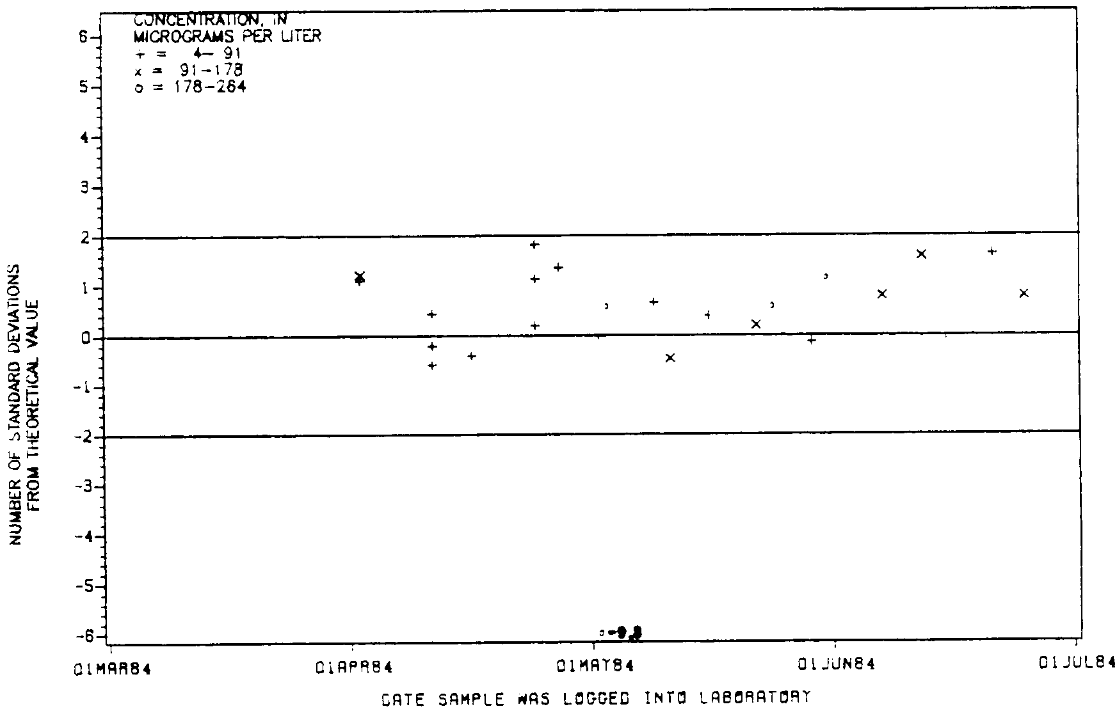

Figure D22.--Copper(AA) data from the Denver laboratory.

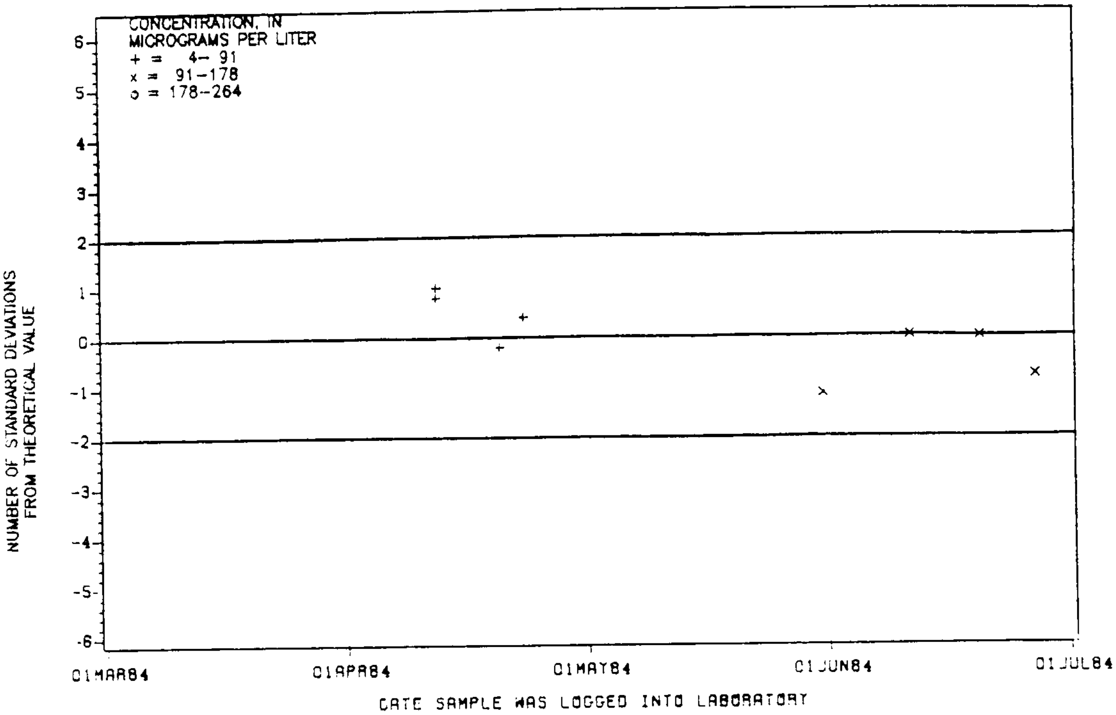

Figure A23.--Copper, total recoverable data from the Atlanta laboratory.

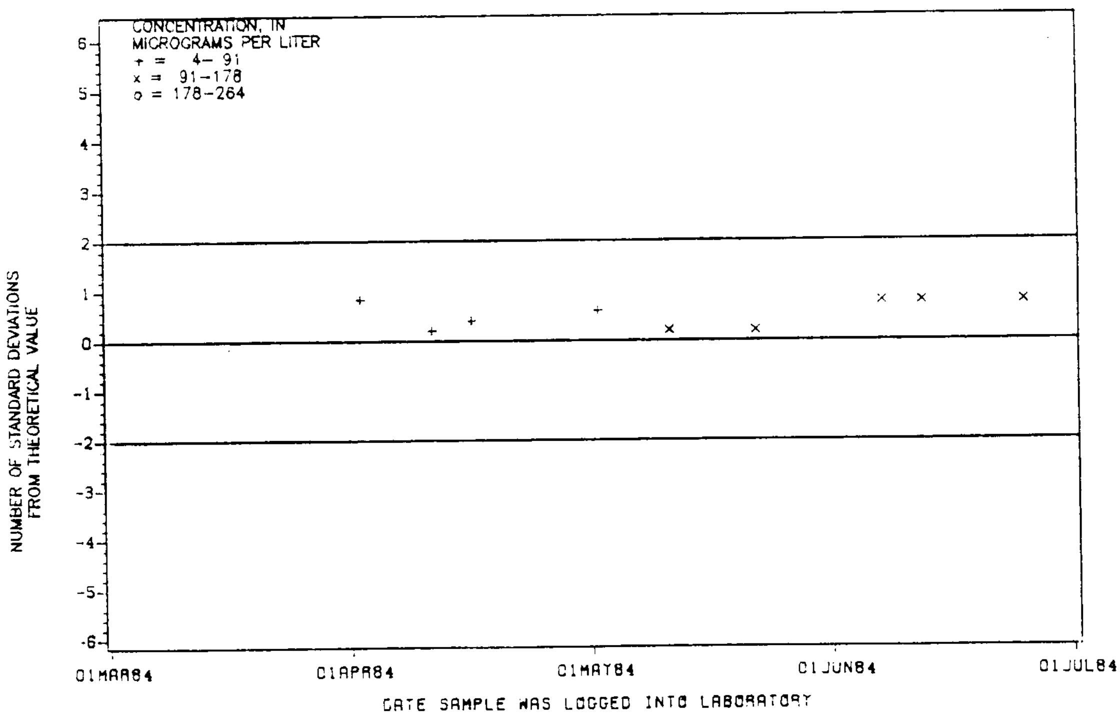

Figure D23.--Copper, total recoverable data from the Denver laboratory.

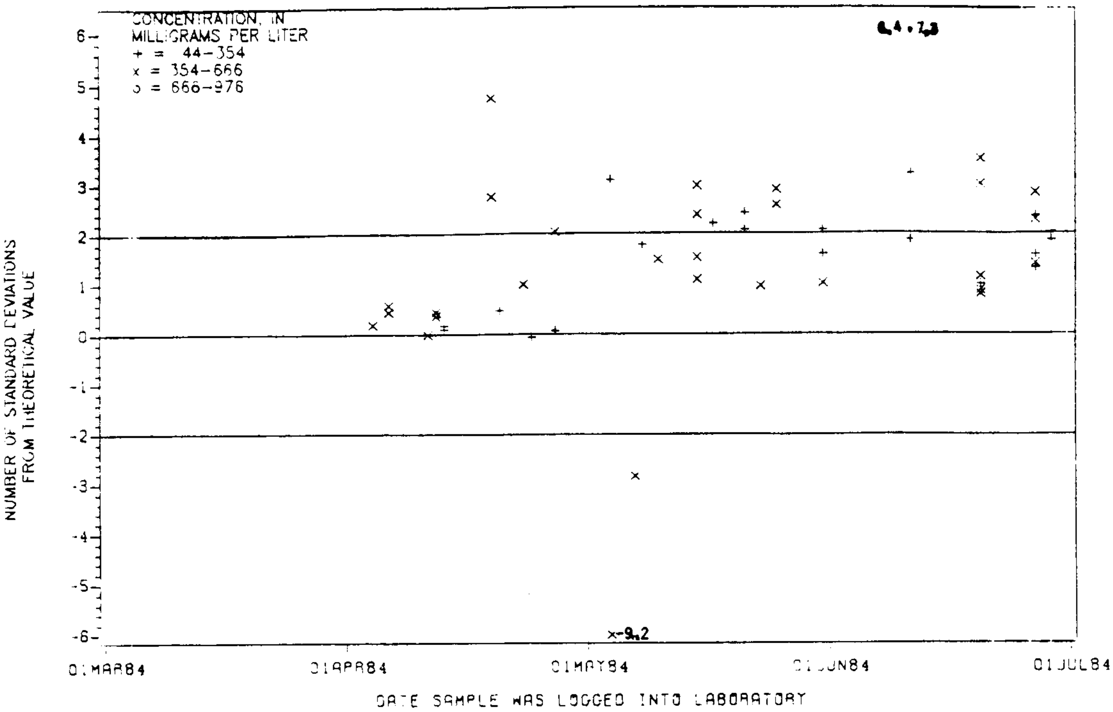

Figure A24.--Dissolved Solids, data from the Atlanta laboratory

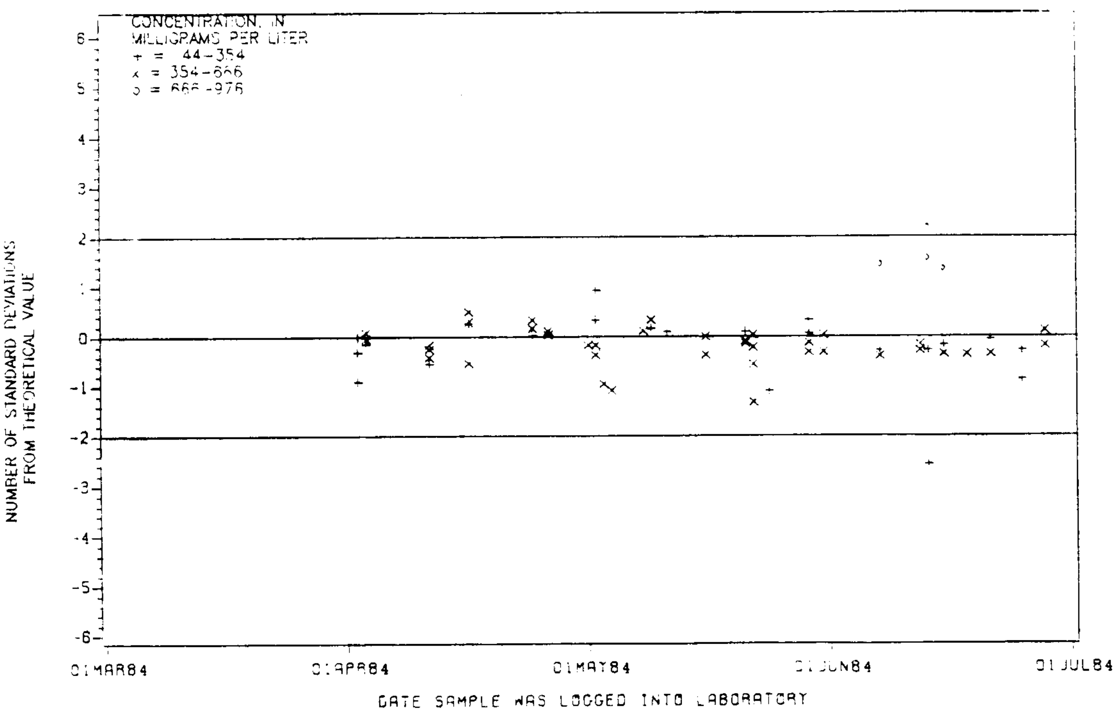

Figure D24.--Dissolved Solids, data from the Denver laboratory.

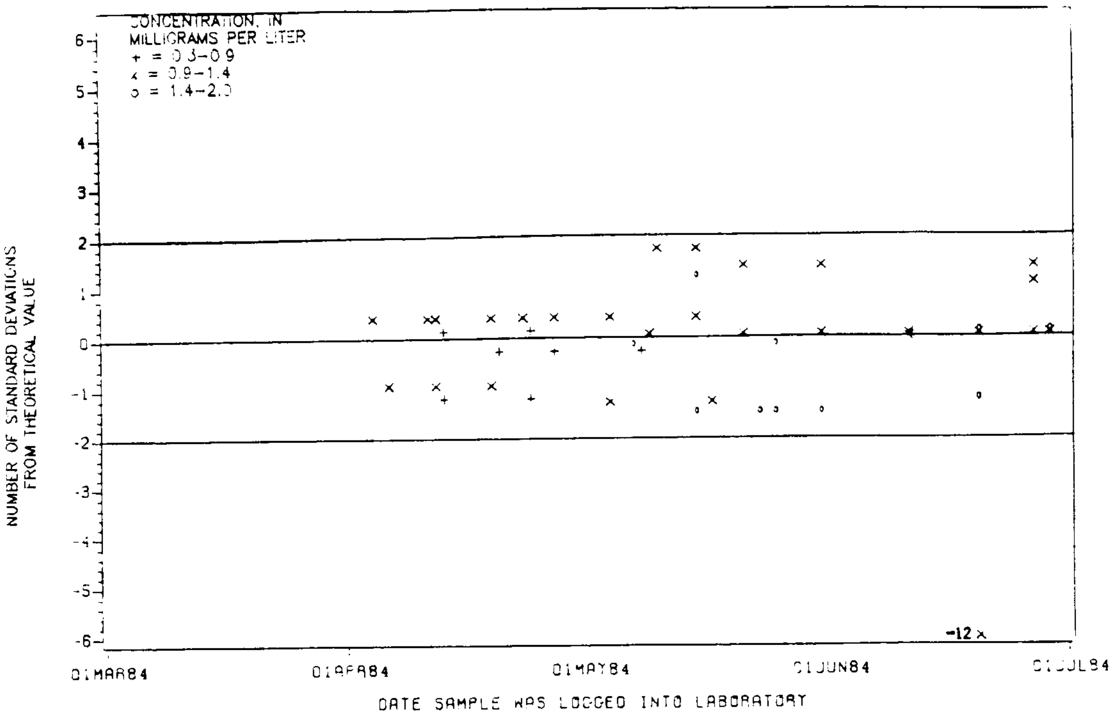

Figure A25.--Fluoride data from the Atlanta laboratory.

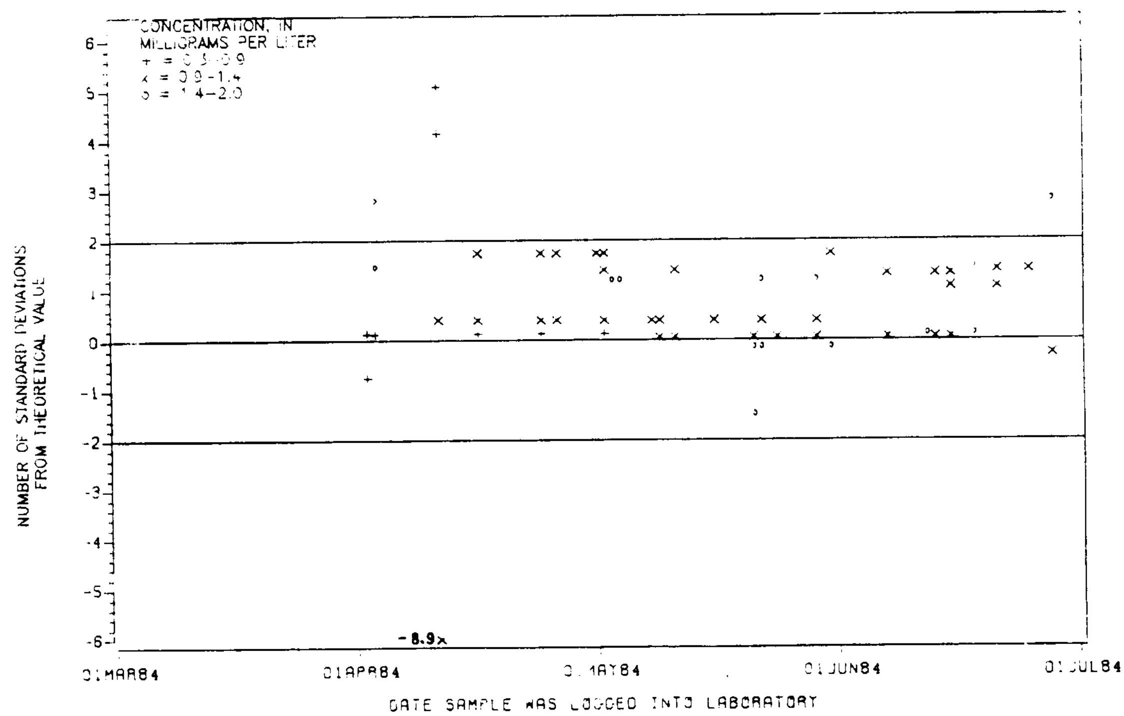

Figure D25.--Fluoride data from the Denver laboratory.

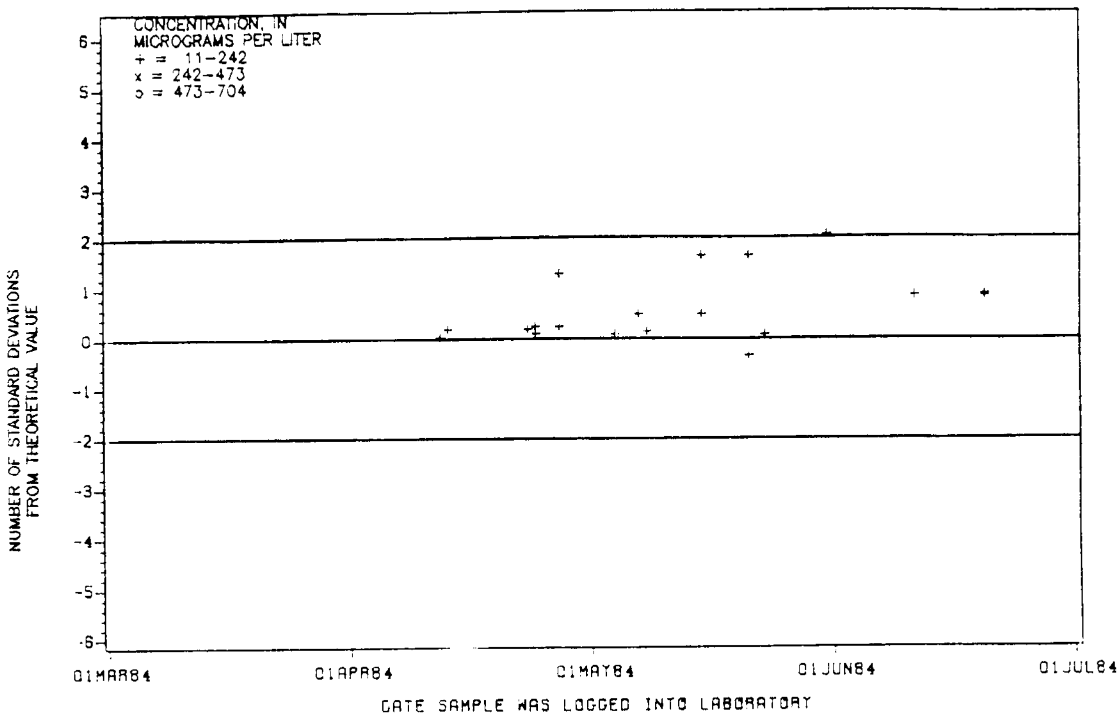

Figure A26.--Iron(ICP) data from the Atlanta laboratory.

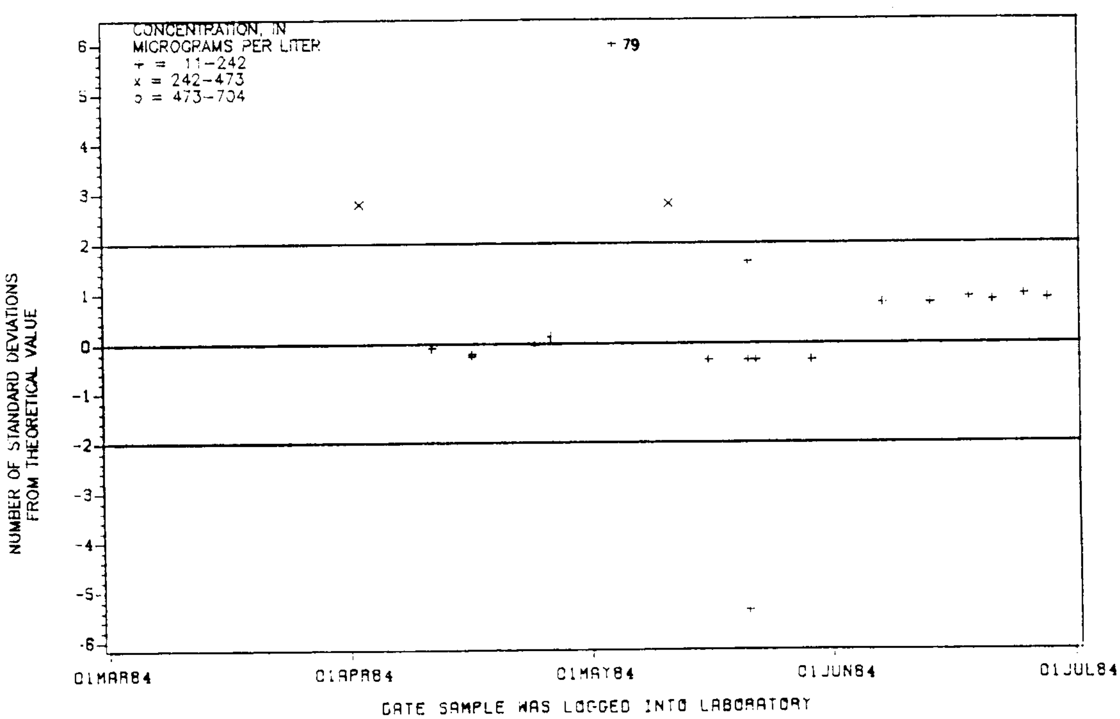

Figure D26.--Iron(ICP) data from the Denver laboratory.

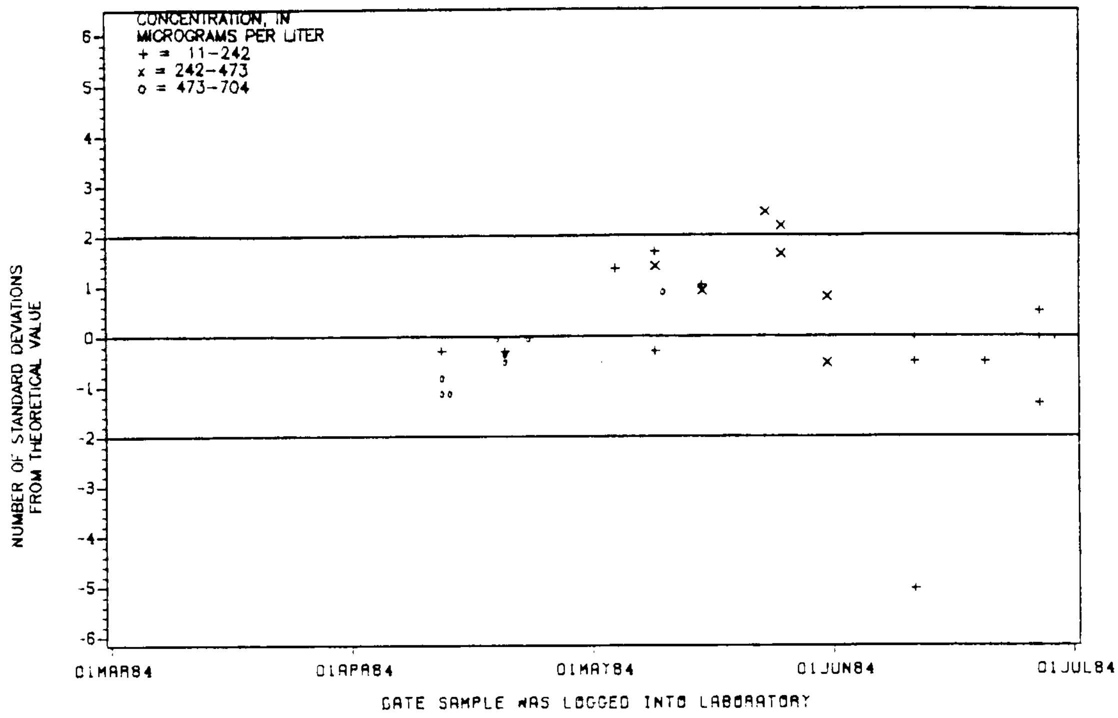

Figure A27.--Iron(AA) data from the Atlanta laboratory.

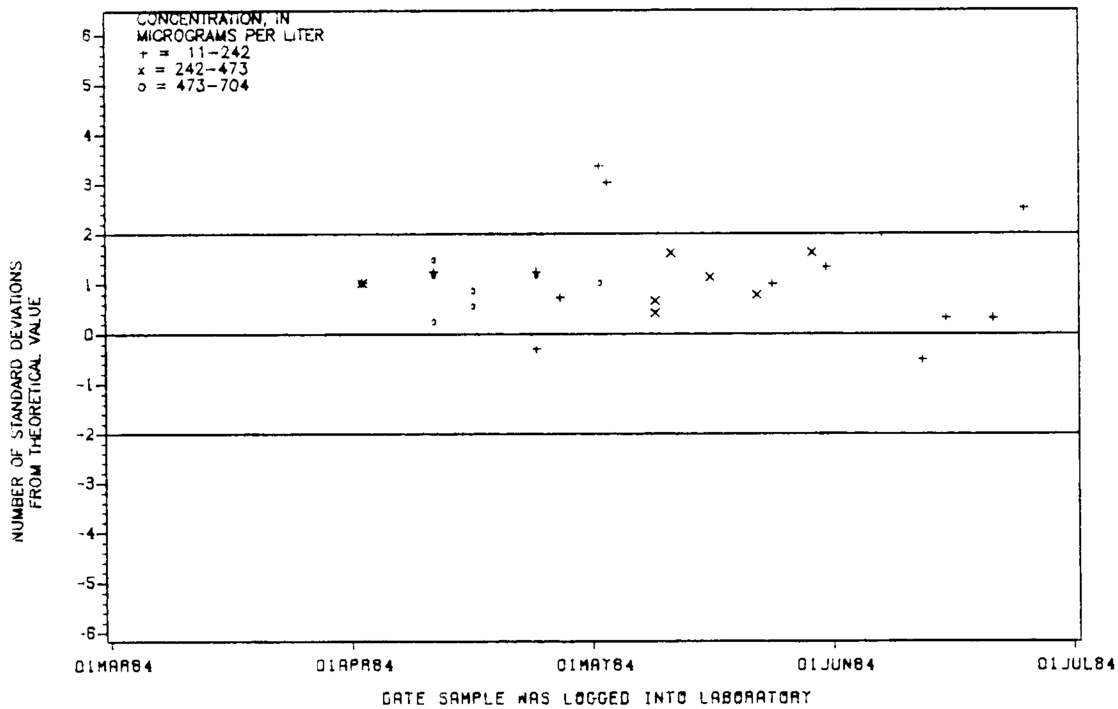

Figure D27.--Iron(AA) data from the Denver laboratory.

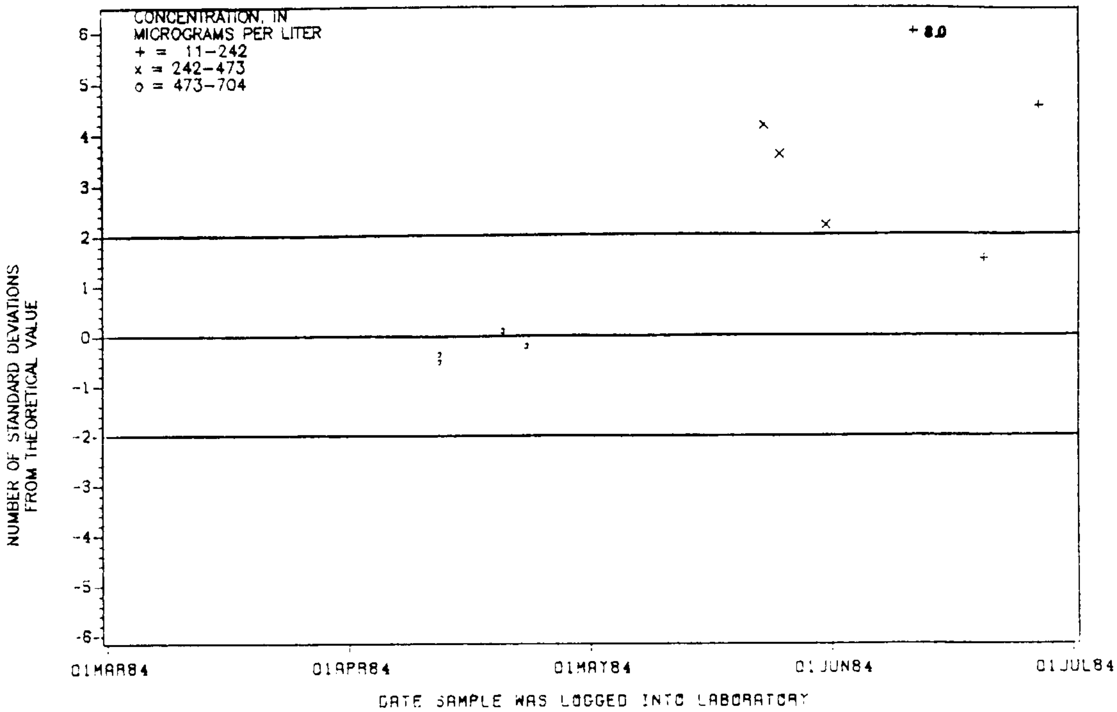

Figure A28.--Iron, total recoverable data from the Atlanta laboratory.

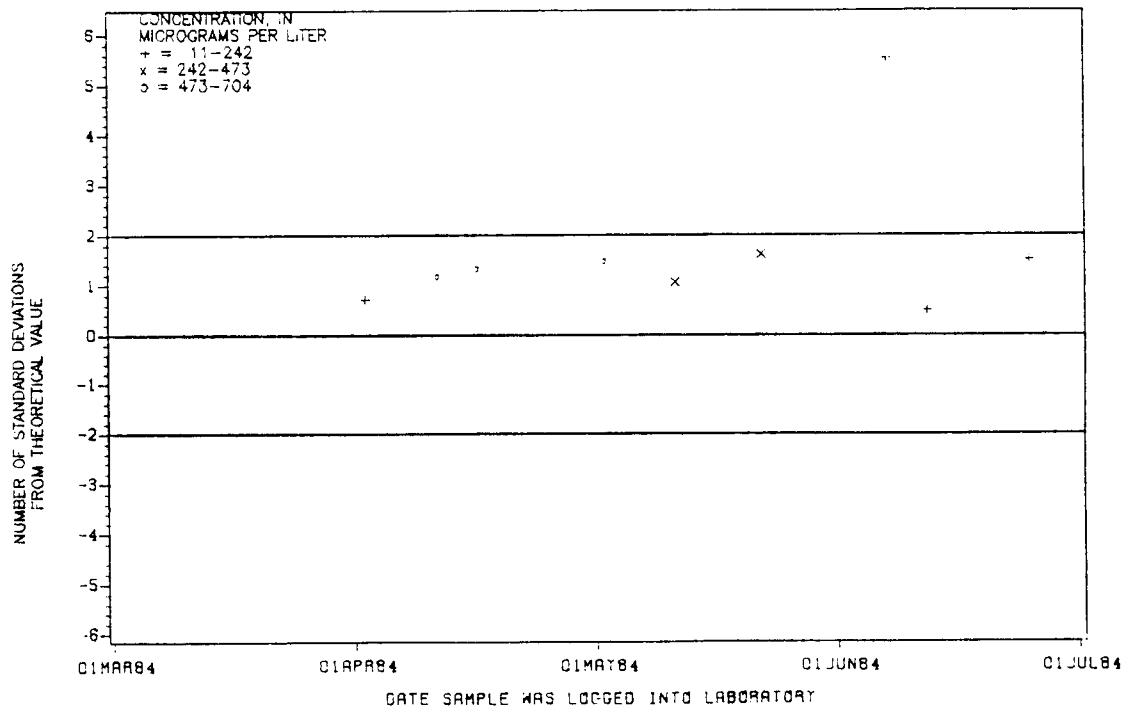

Figure D28.--Iron, total recoverable data from the Denver laboratory.

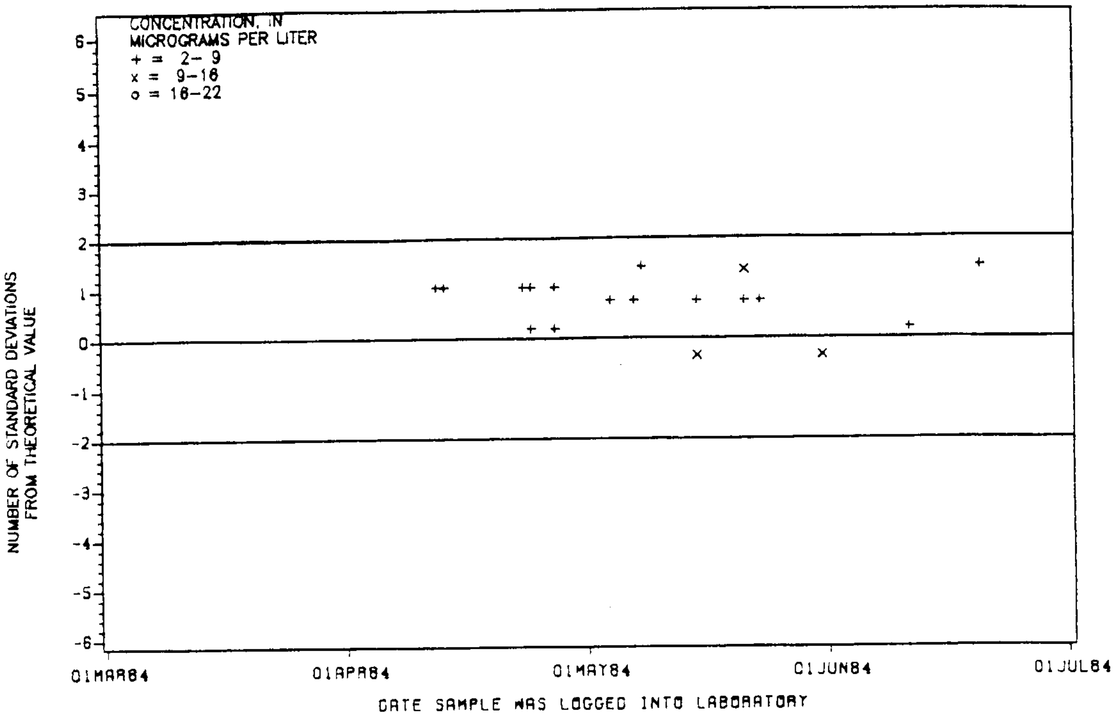

Figure A29.--Lead(ICP) data from the Atlanta laboratory.

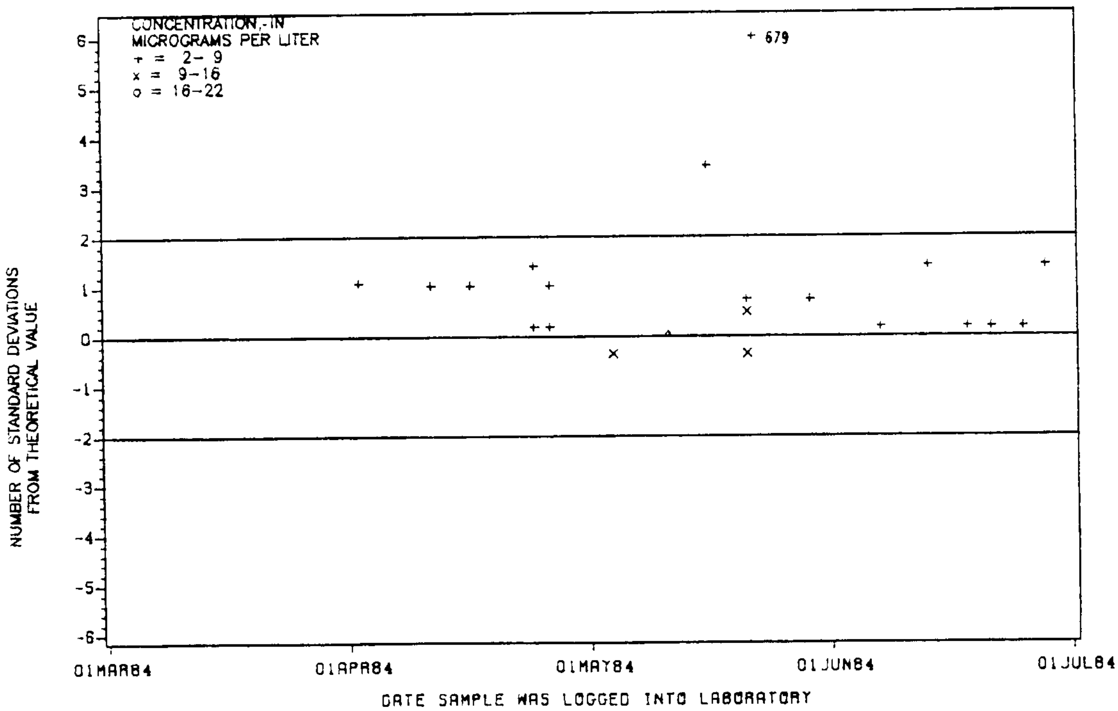

Figure D29.--Lead(ICP) data from the Denver laboratory.

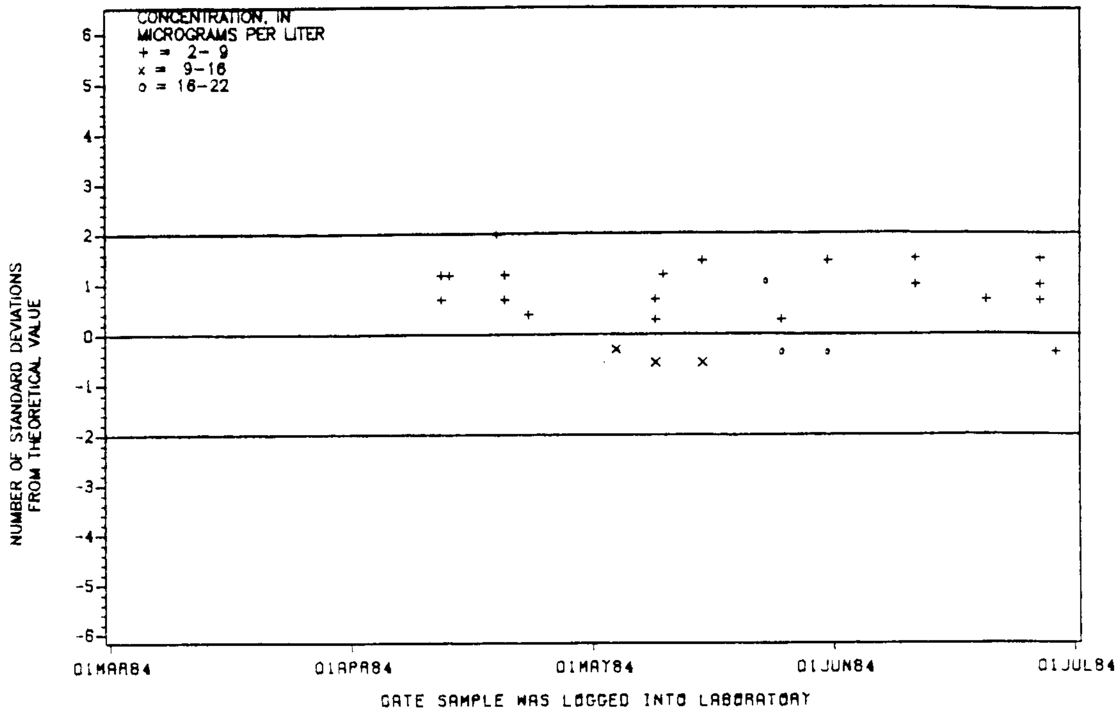

Figure A30.--Lead(AA) data from the Atlanta laboratory.

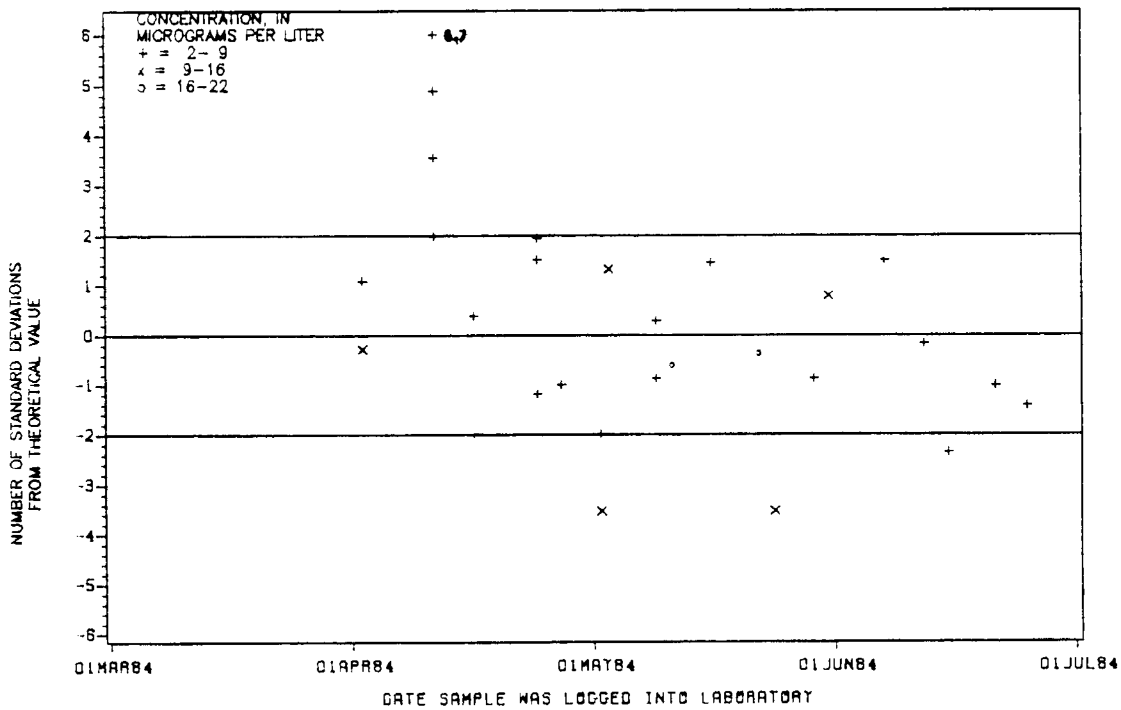

Figure D30.--Lead(AA) data from the Denver laboratory.

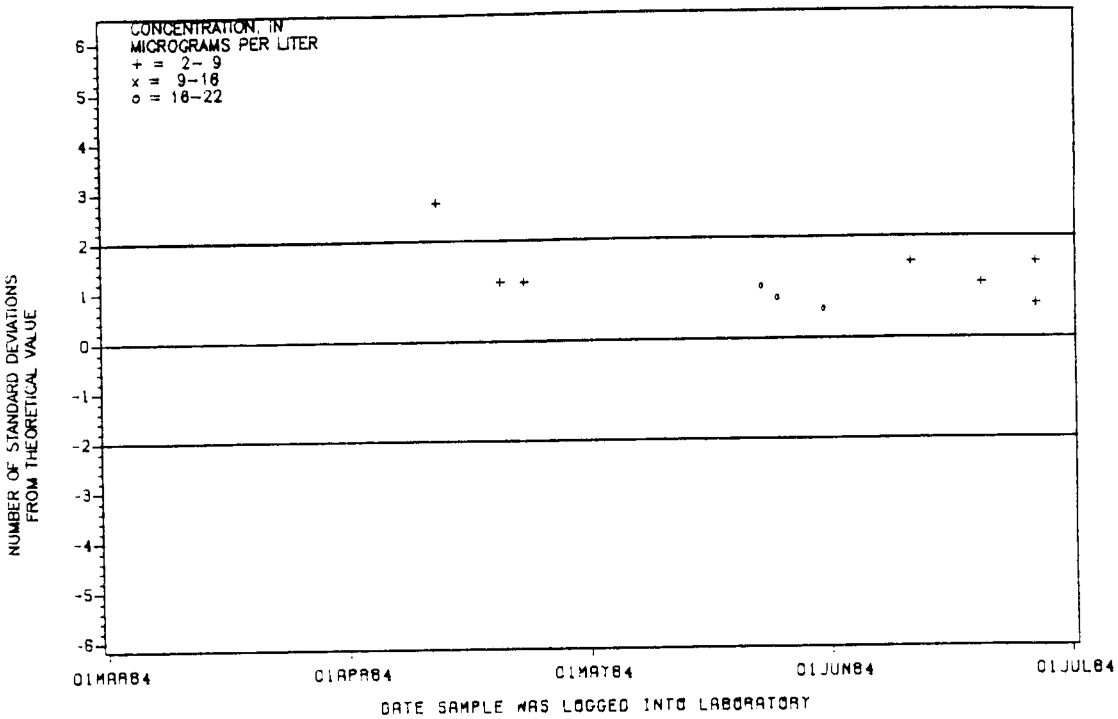

Figure A31.--Lead, total recoverable data from the Atlanta laboratory.

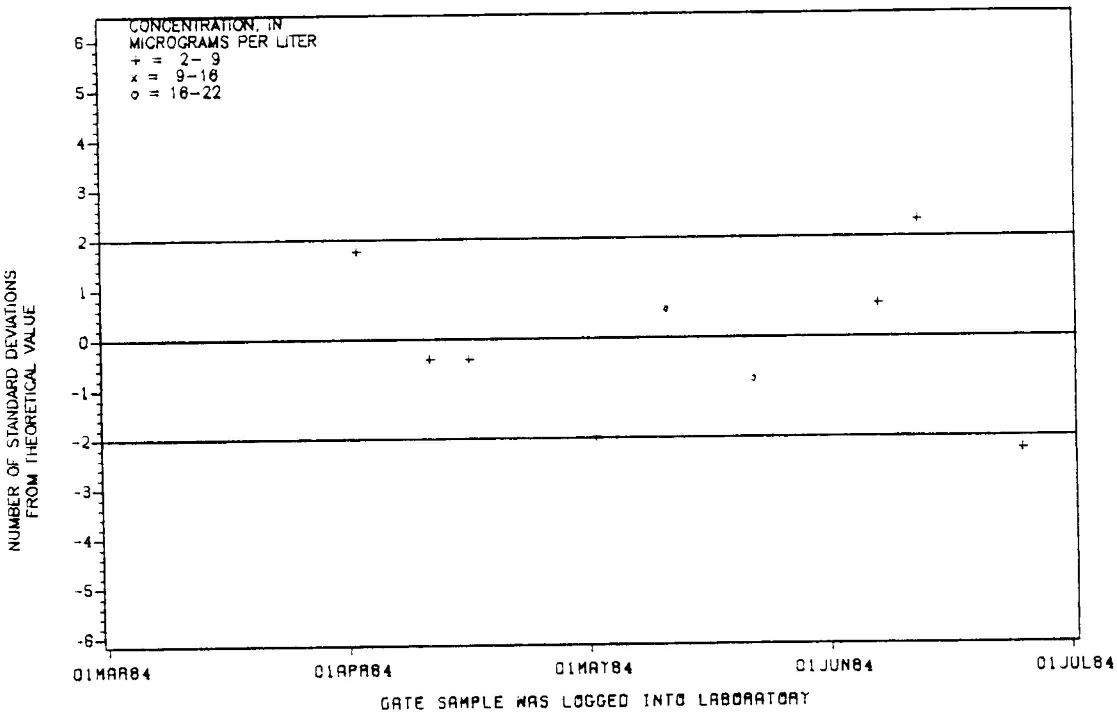

Figure D31.--Lead, total recoverable data from the Denver laboratory.

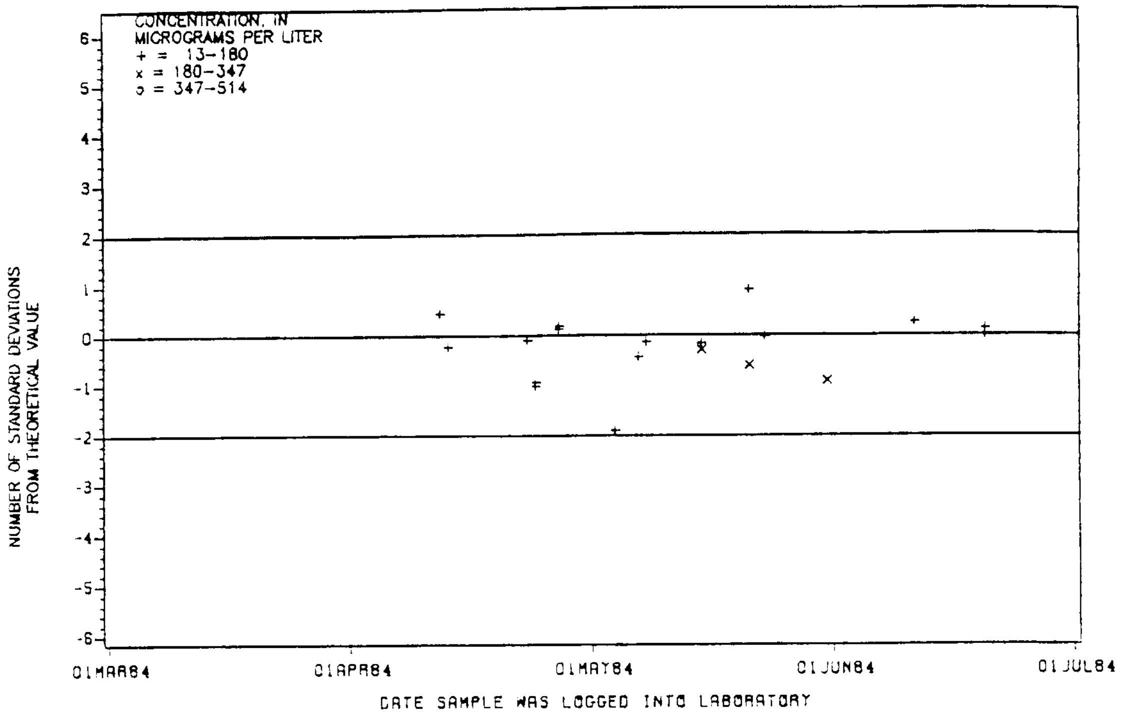

Figure A32.--Lithium data from the Atlanta laboratory.

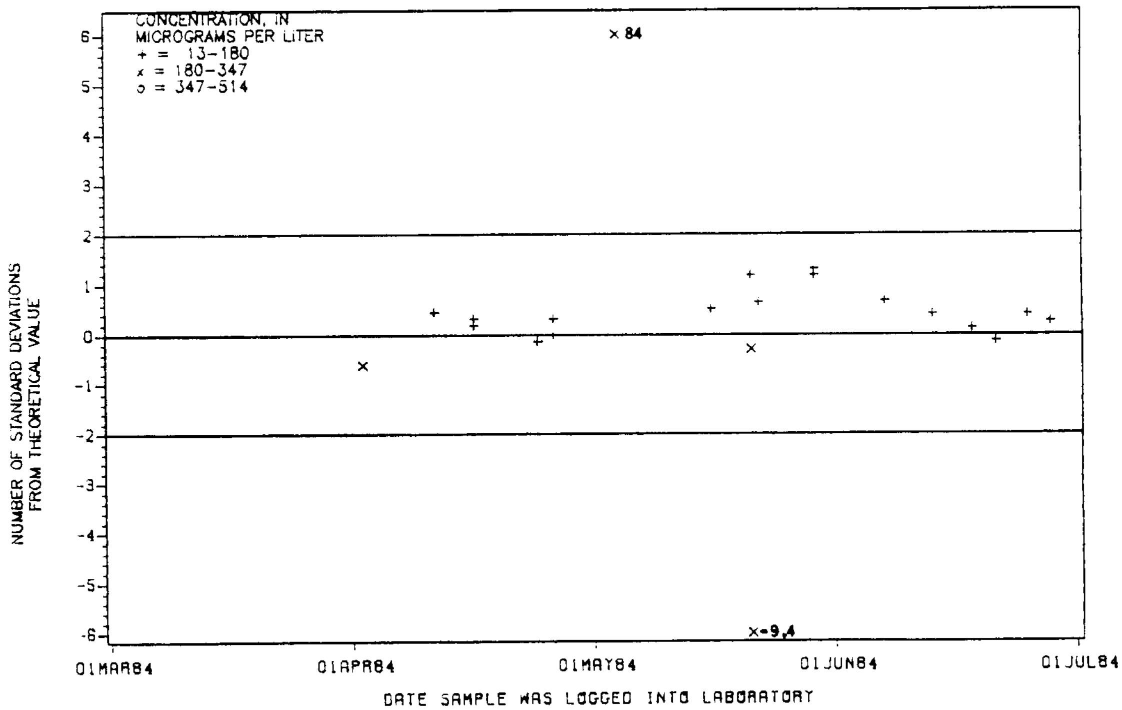

Figure D32.--Lithium data from the Denver laboratory.

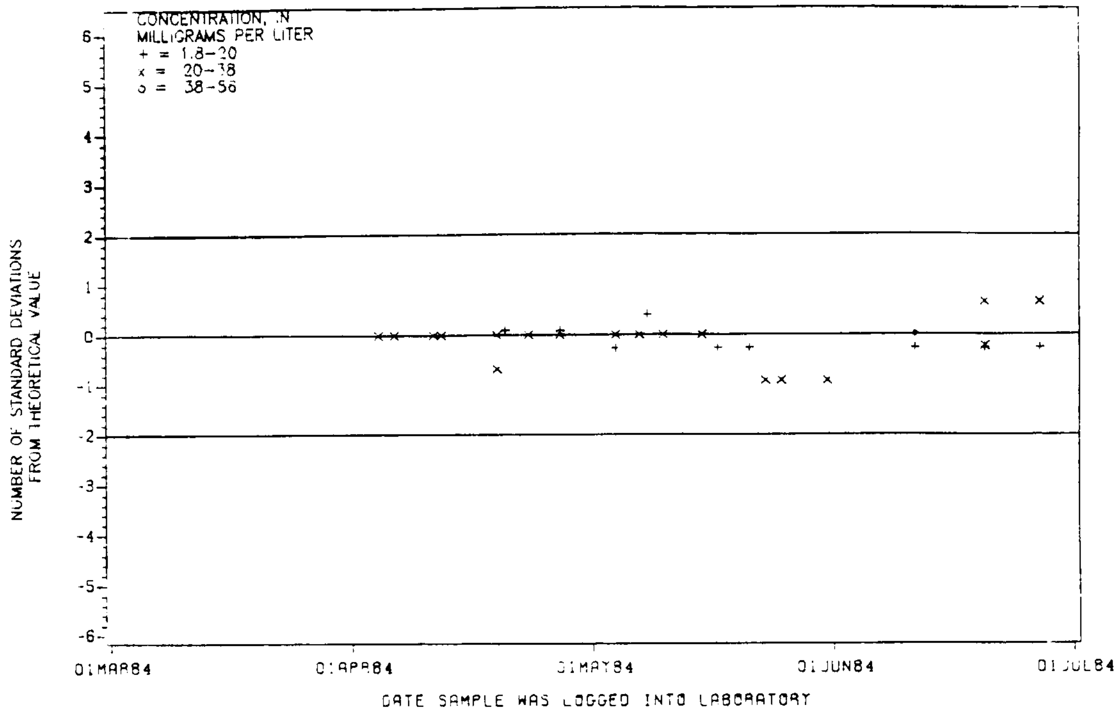

Figure A33.--Magnesium(ICP) data from the Atlanta laboratory.

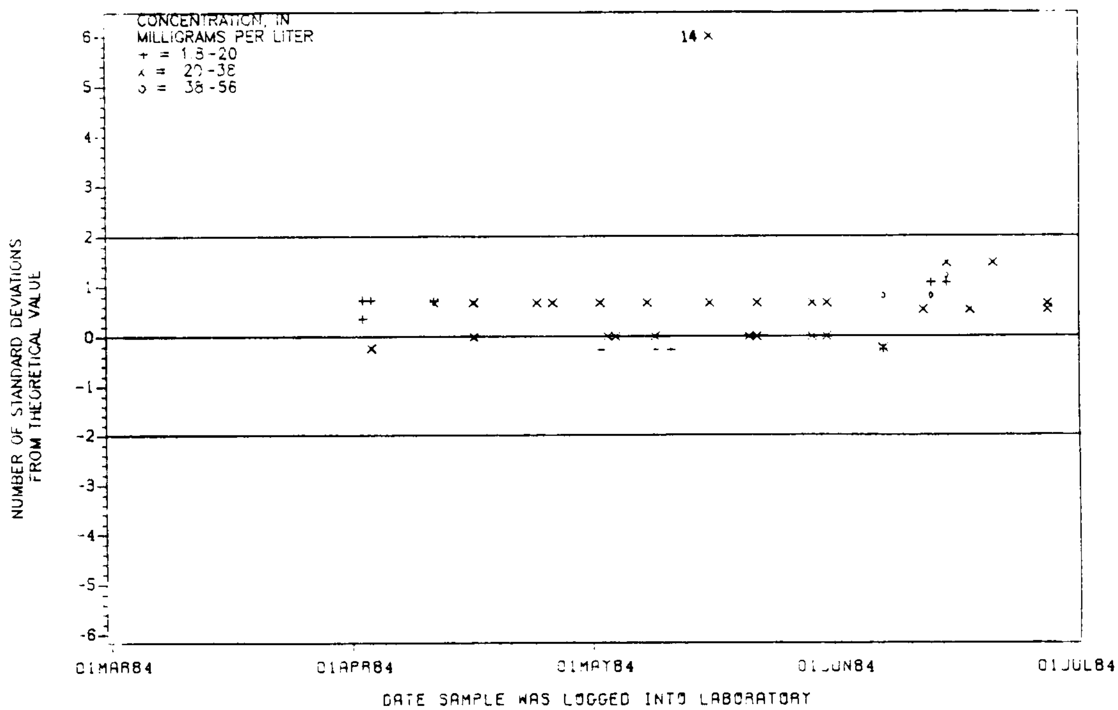

Figure D33.--Magnesium(ICP) data from the Denver laboratory.

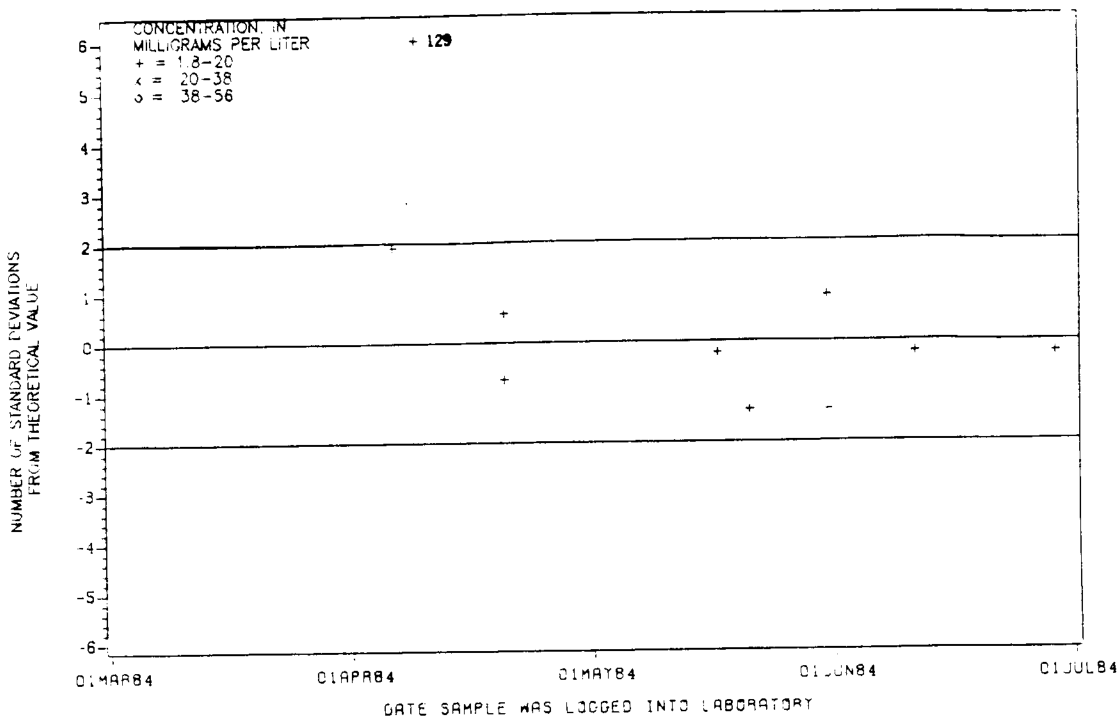

Figure A34.--Magnesium(AA) data from the Atlanta laboratory.

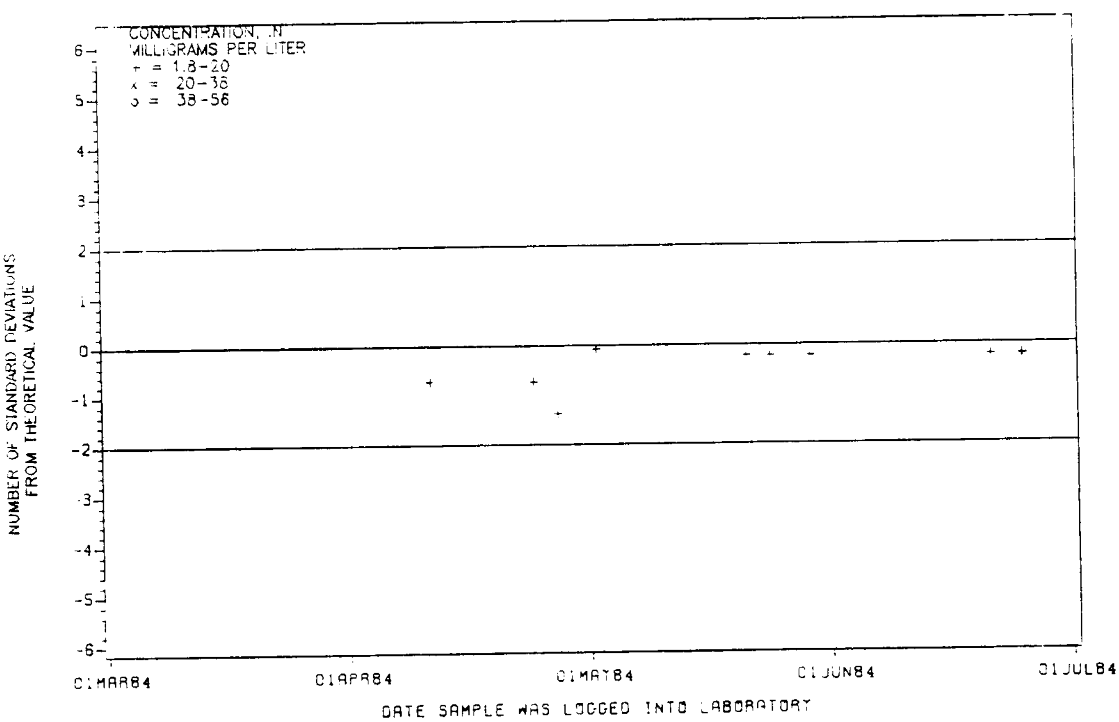

Figure D34.--Magnesium(AA) data from the Denver laboratory.

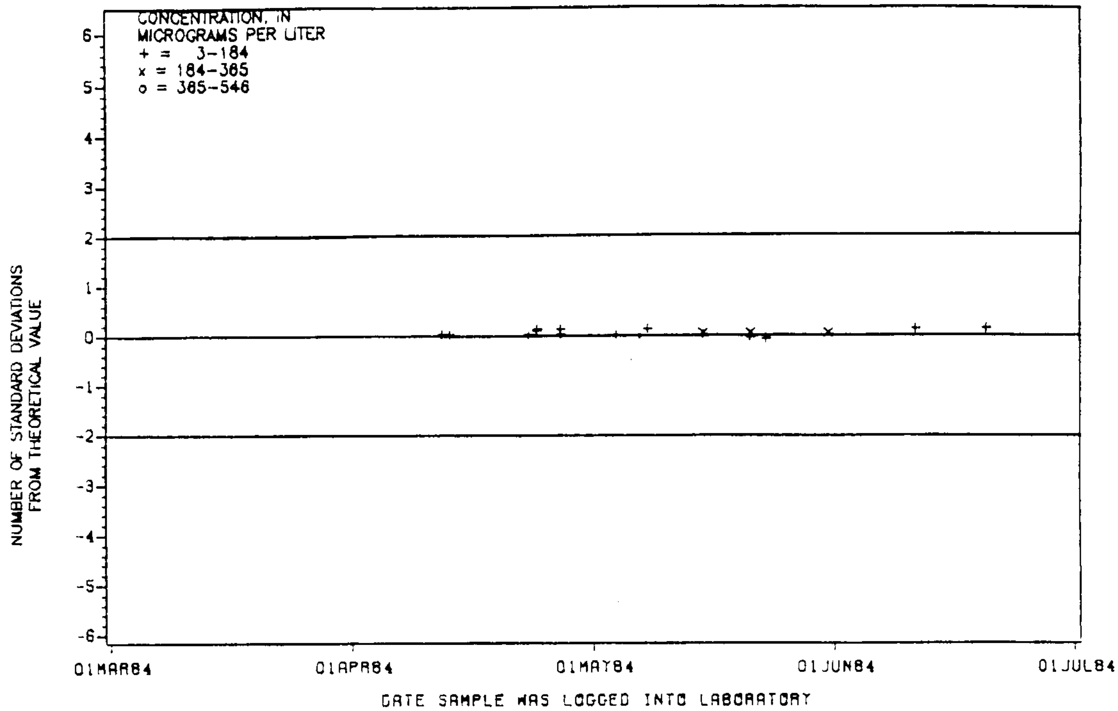

Figure A35.--Manganese(ICP) data from the Atlanta laboratory.

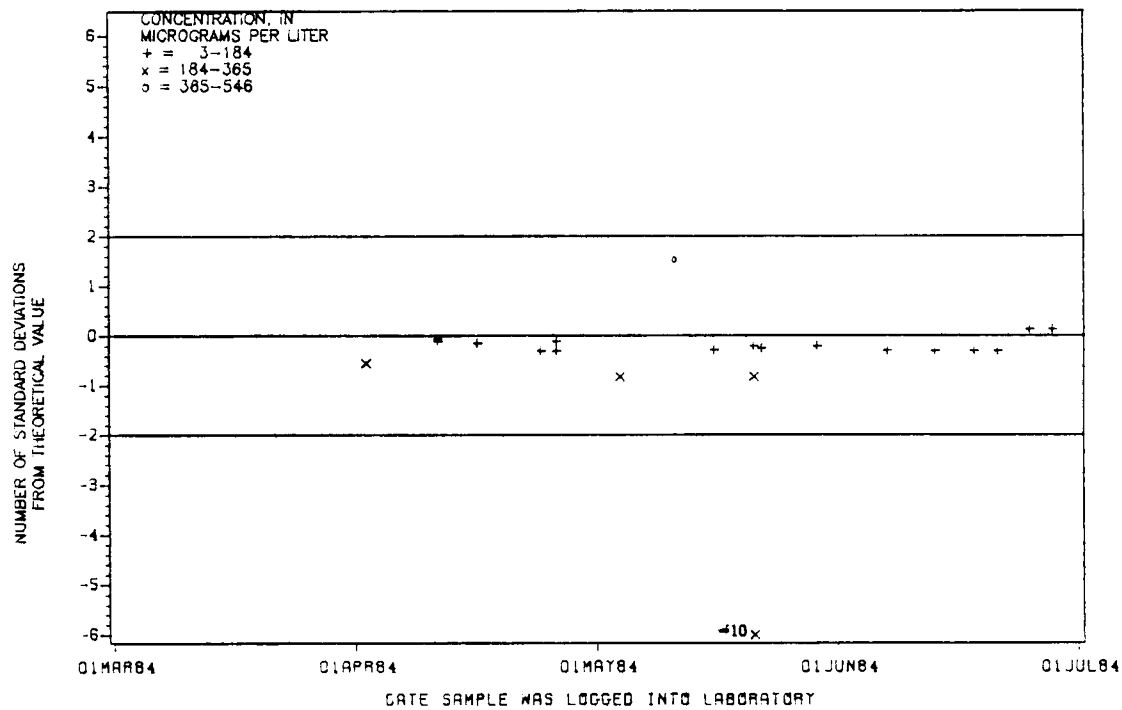

Figure D35.--Manganese(ICP) data from the Denver laboratory.

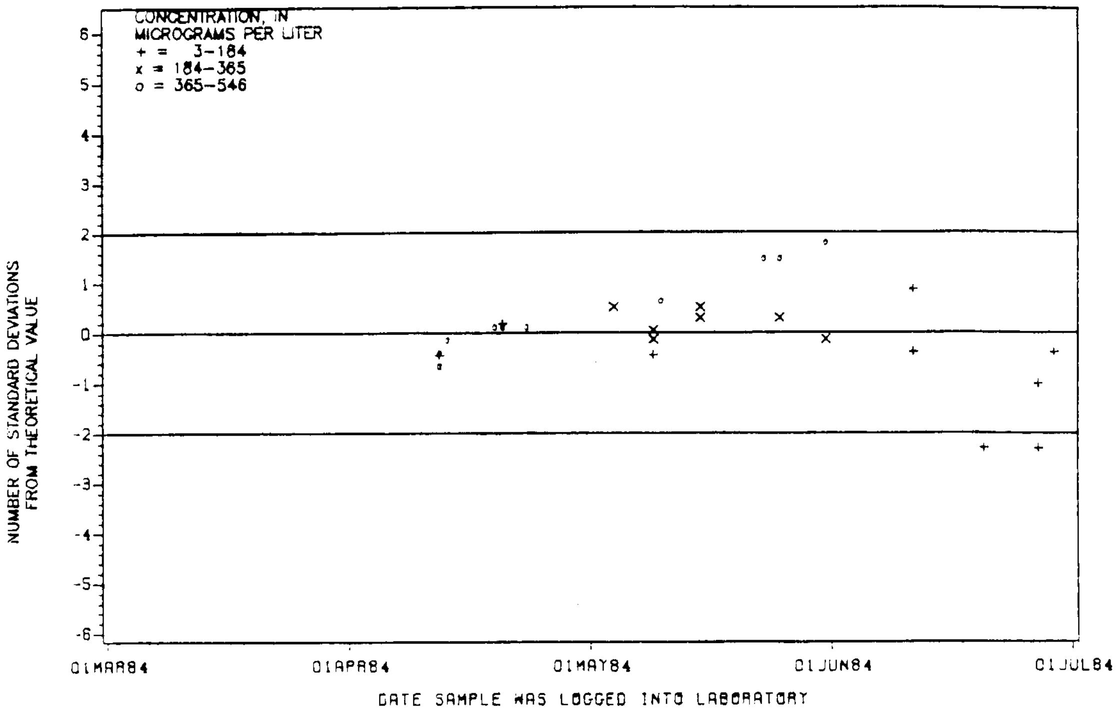

Figure A36.--Manganese(AA) data from the Atlanta laboratory.

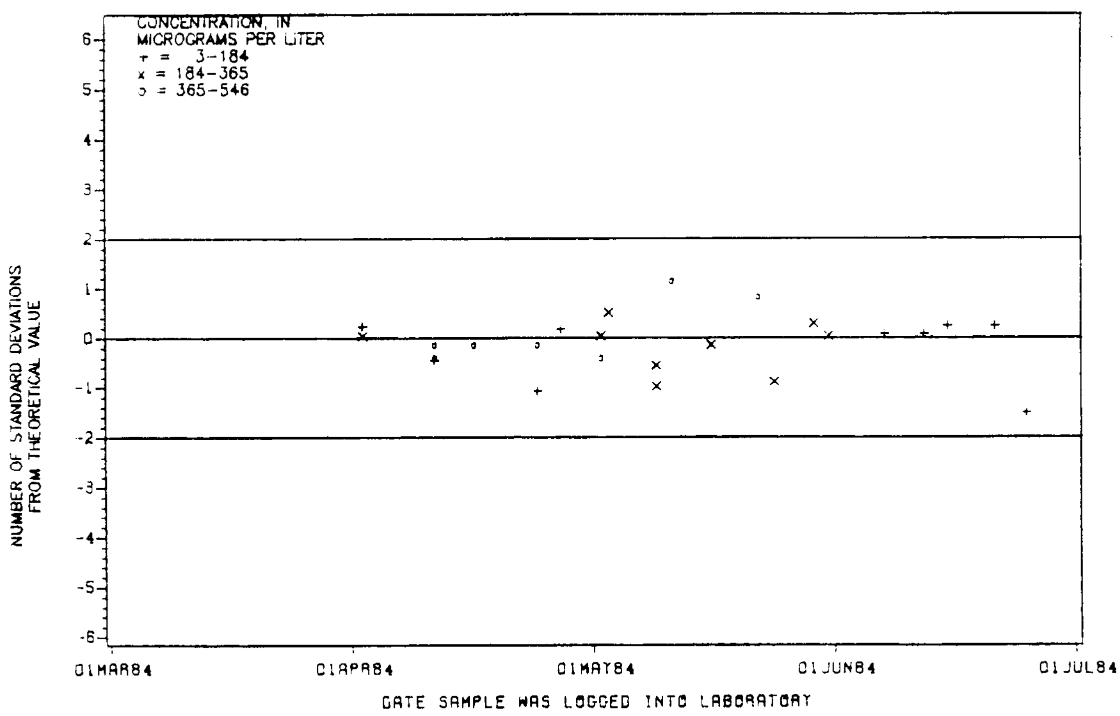

Figure D36.--Manganese(AA) data from the Denver laboratory.

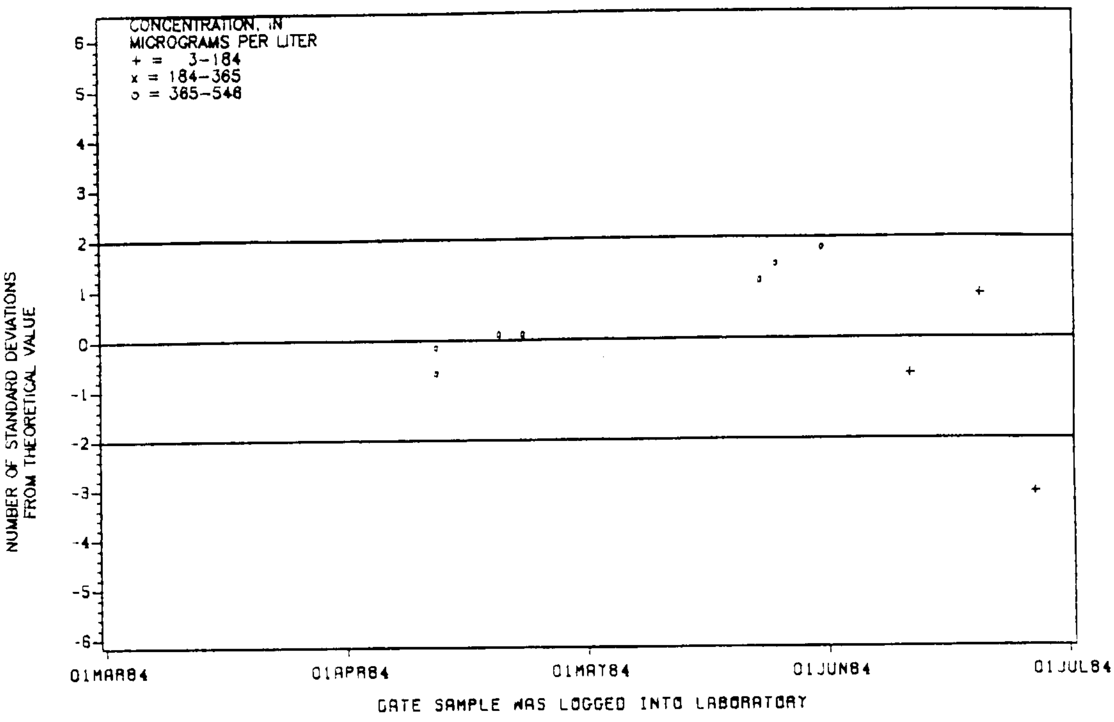

Figure A37.--Manganese, total recoverable data from the Atlanta laboratory.

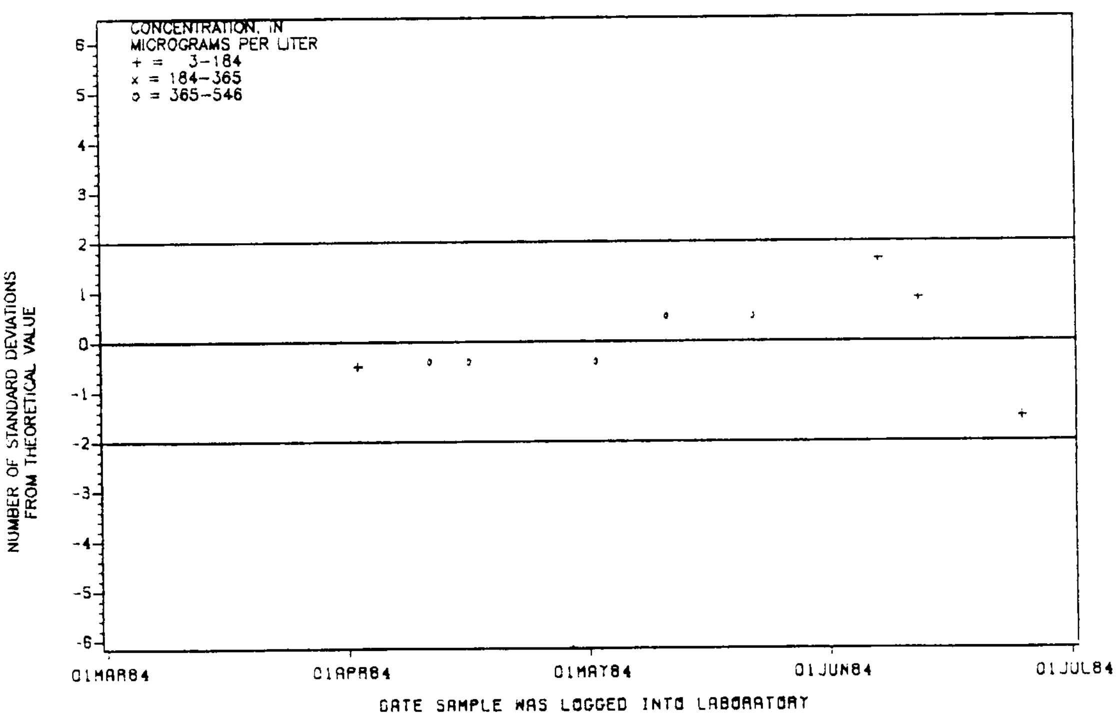

Figure D37.--Manganese, total recoverable data from the Denver laboratory.

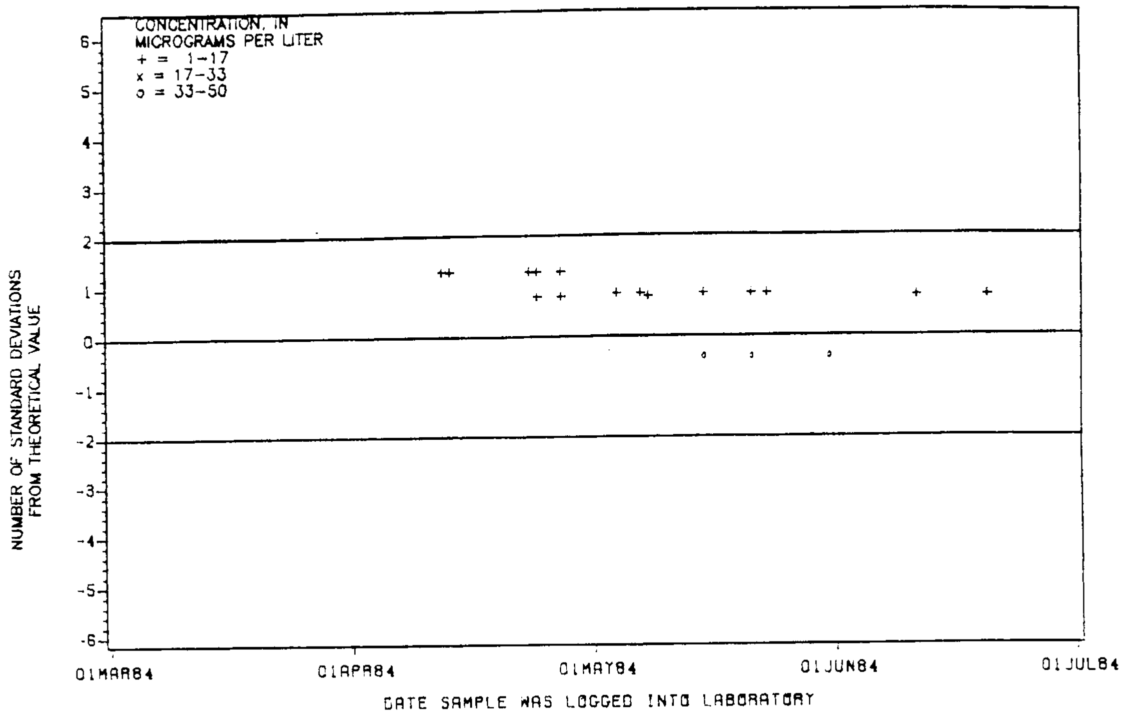

Figure A38.--Molybdenum(ICP) data from the Atlanta laboratory.

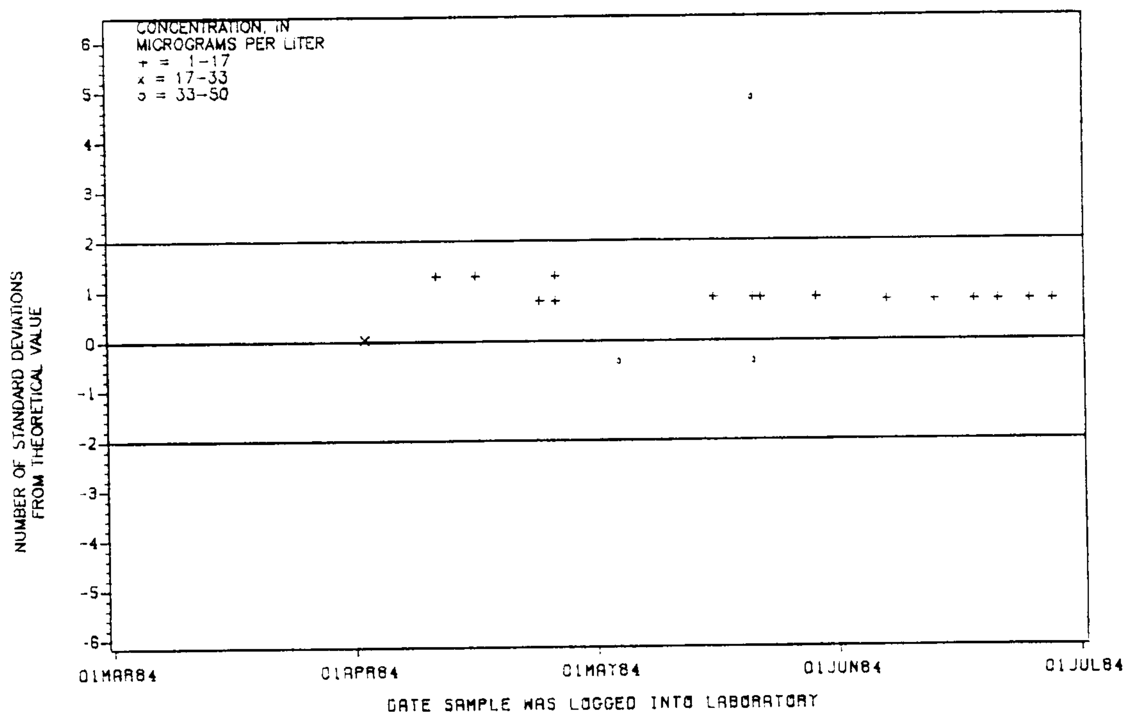

Figure D38.--Molybdenum(ICP) data from the Denver laboratory.

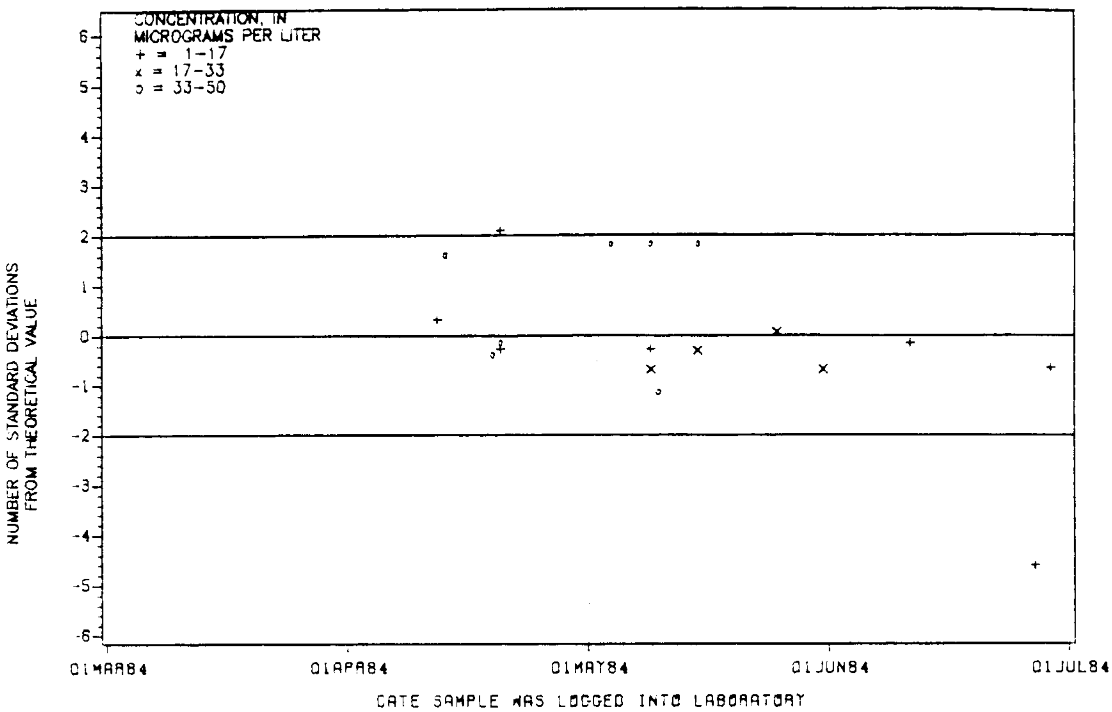

Figure A39.--Molybdenum(AA) data from the Atlanta laboratory.

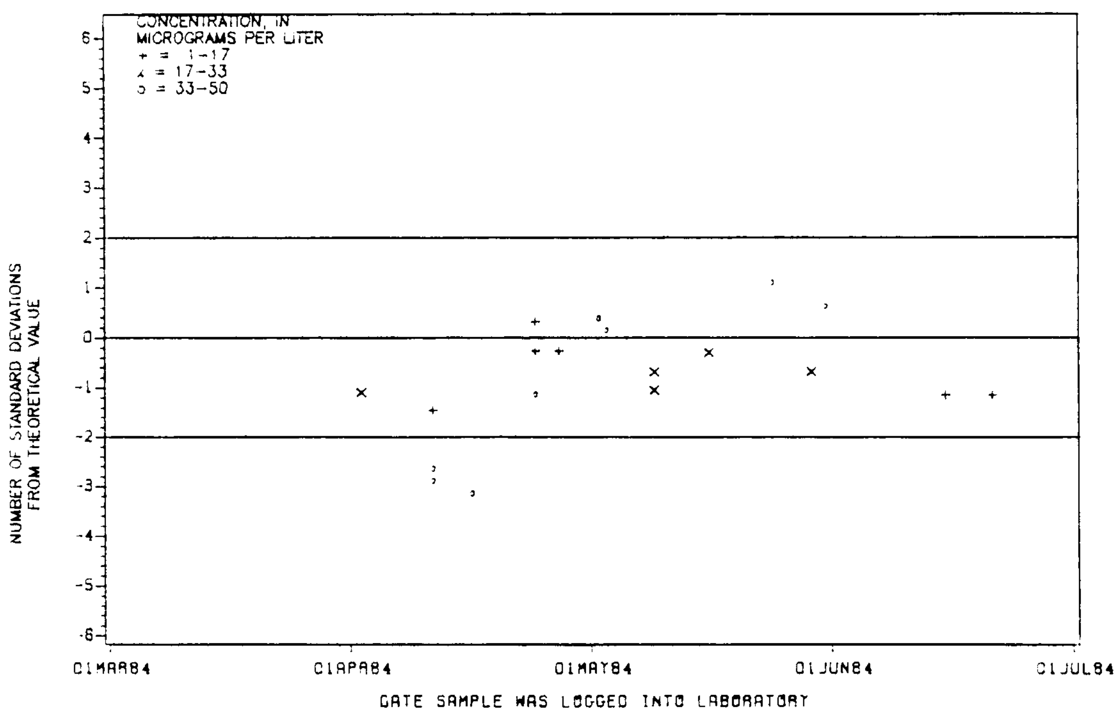

Figure D39.--Molybdenum(AA) data from the Denver laboratory.

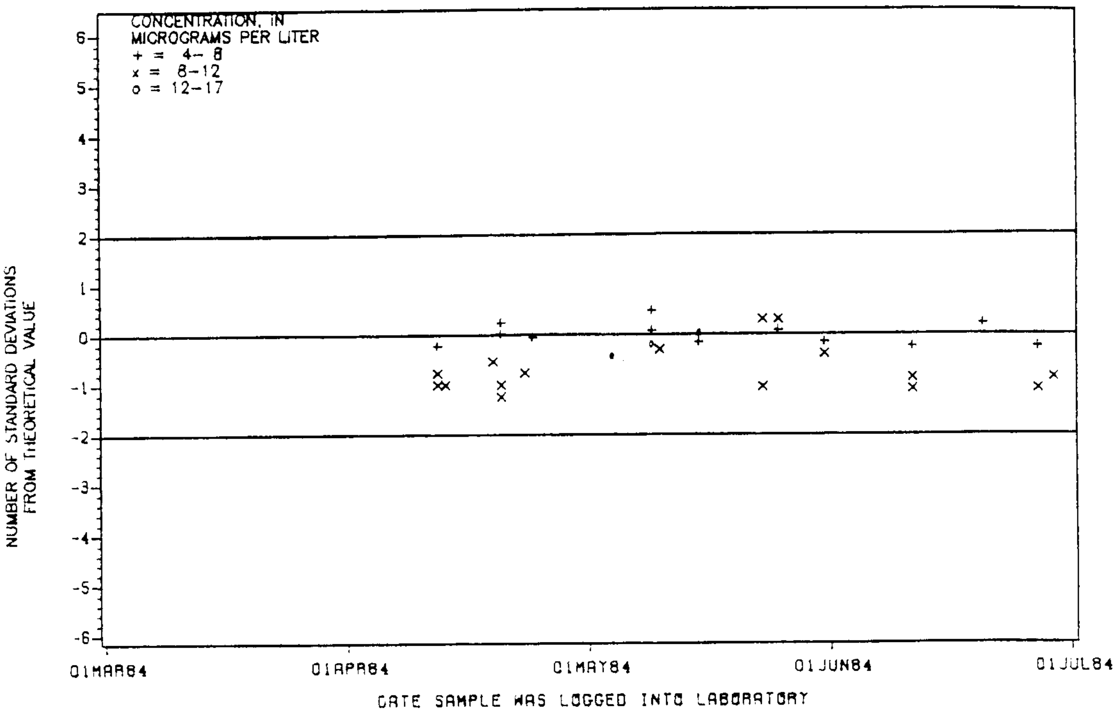

Figure A40.--Nickel data from the Atlanta laboratory.

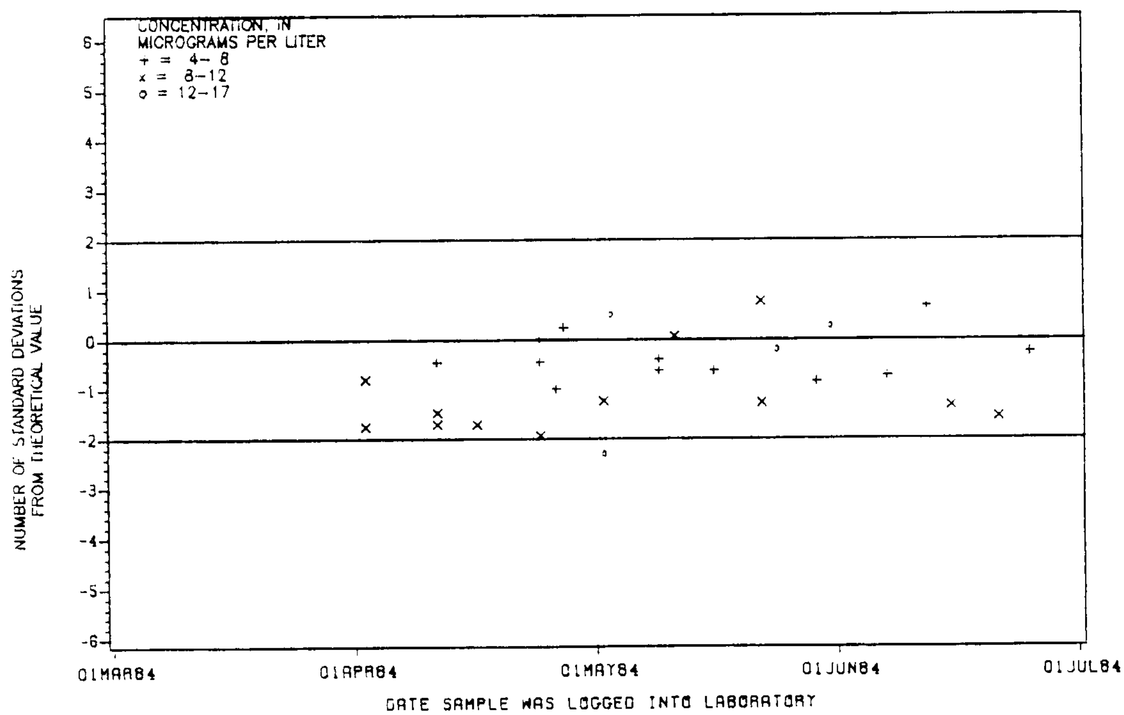

Figure D40.--Nickel data from the Denver laboratory.

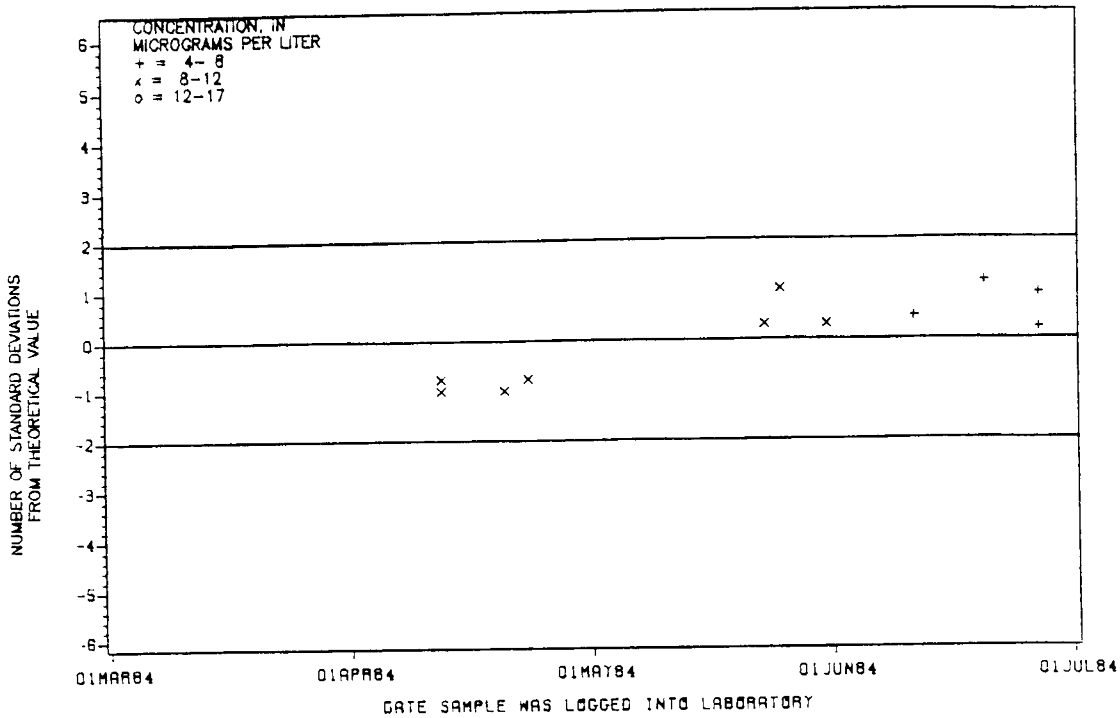

Figure A41.--Nickel, total recoverable data from the Atlanta laboratory.

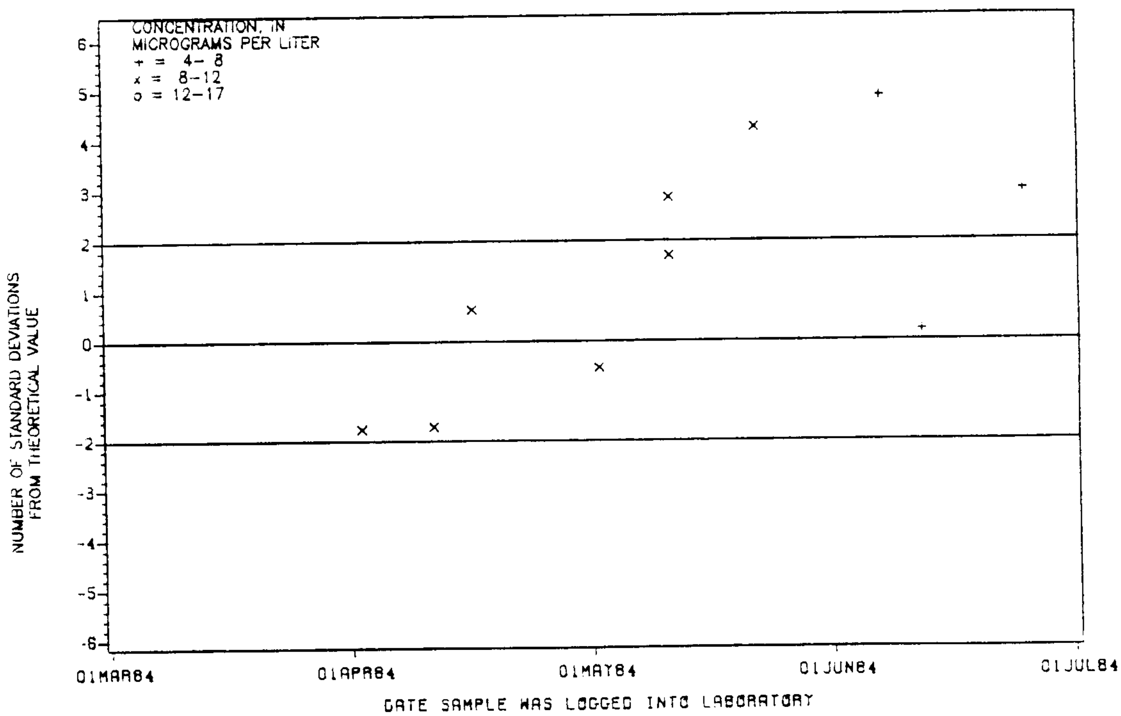

Figure D41.--Nickel, total recoverable data from the Denver laboratory.

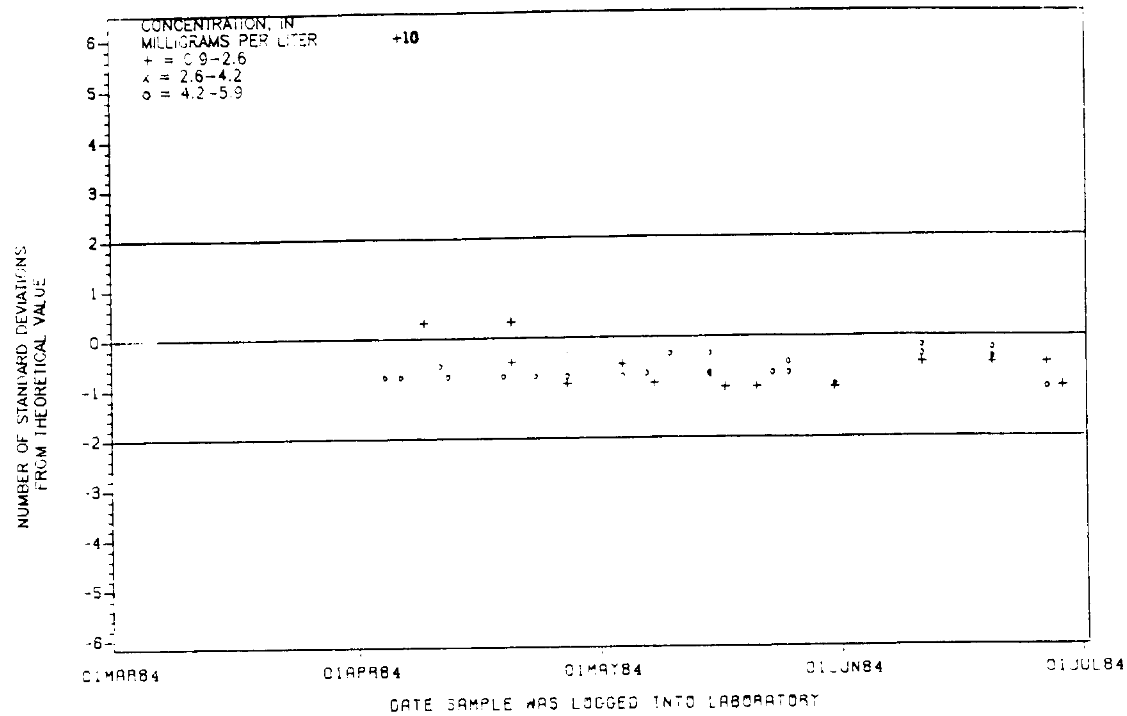

Figure A42.--Potassium data from the Atlanta laboratory.

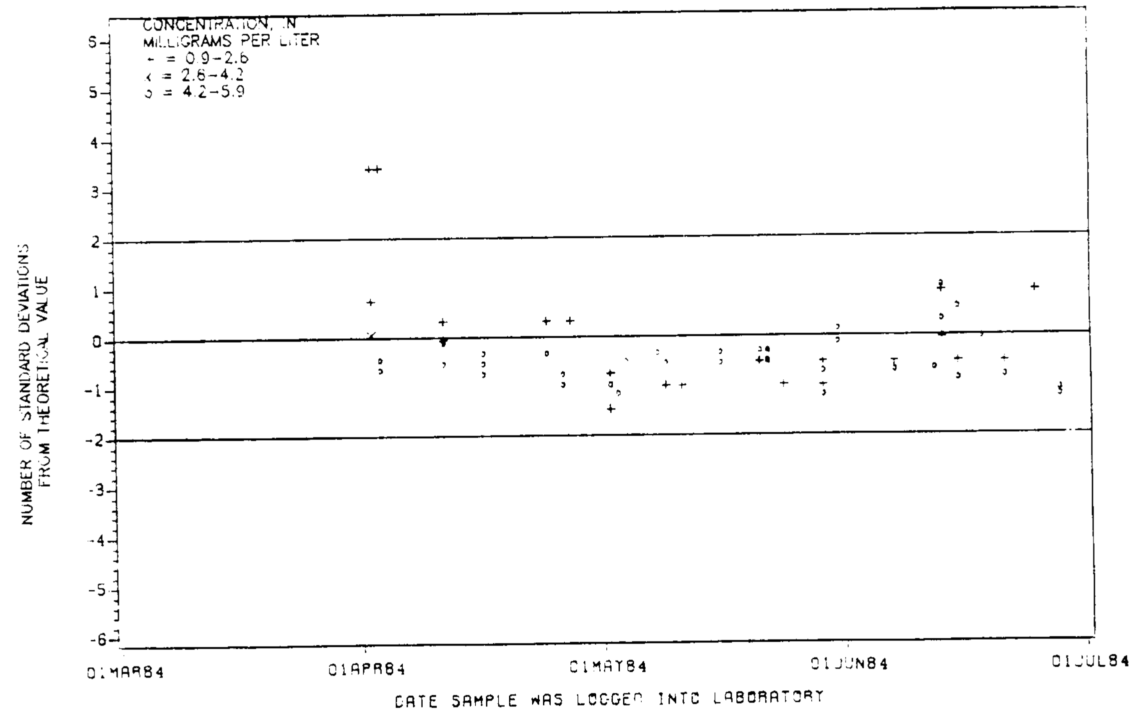

Figure D42.--Potassium data from the Denver laboratory.

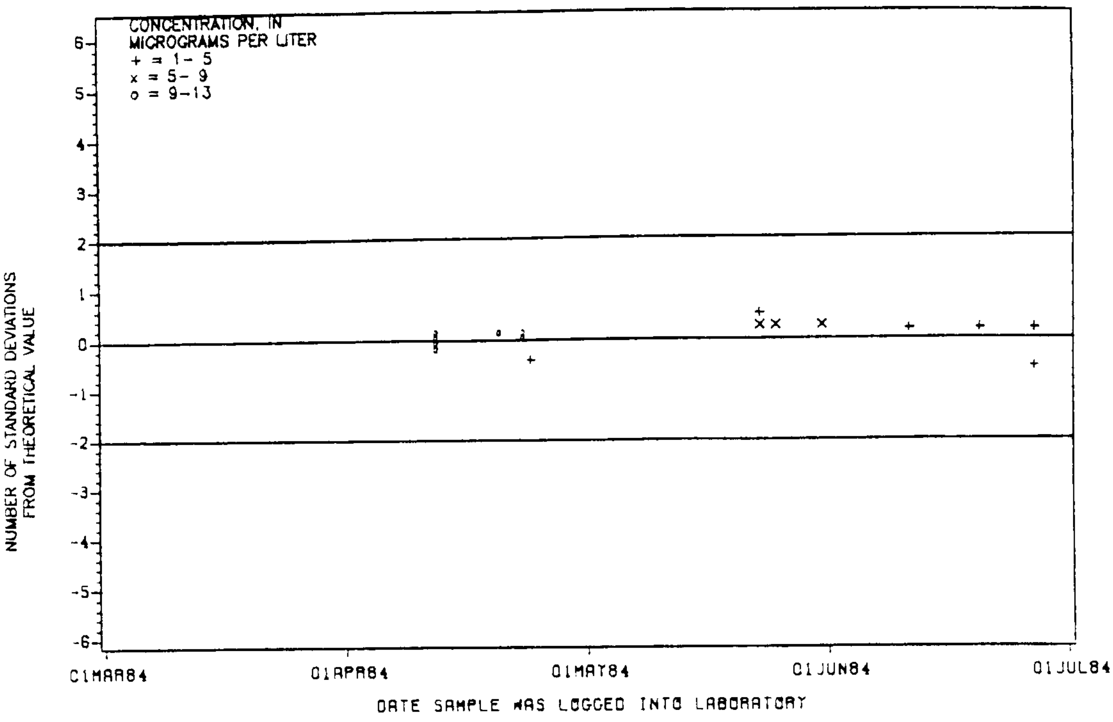

Figure A43.--Selenium data from the Atlanta laboratory.

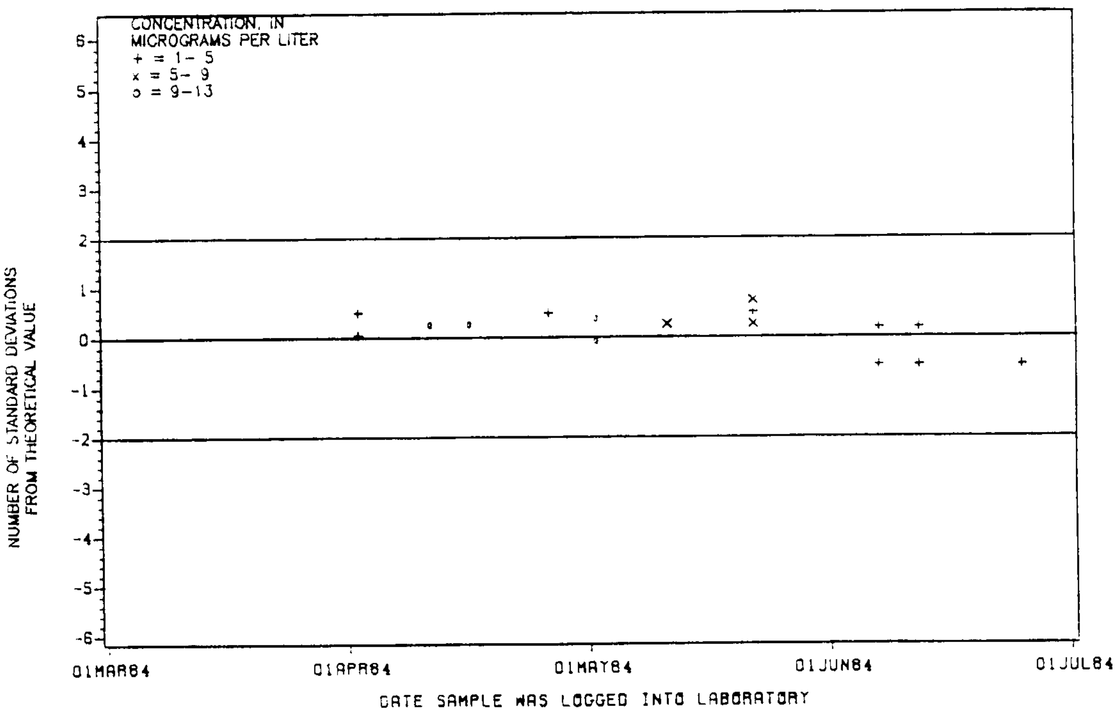

Figure D43.--Selenium data from the Denver laboratory.

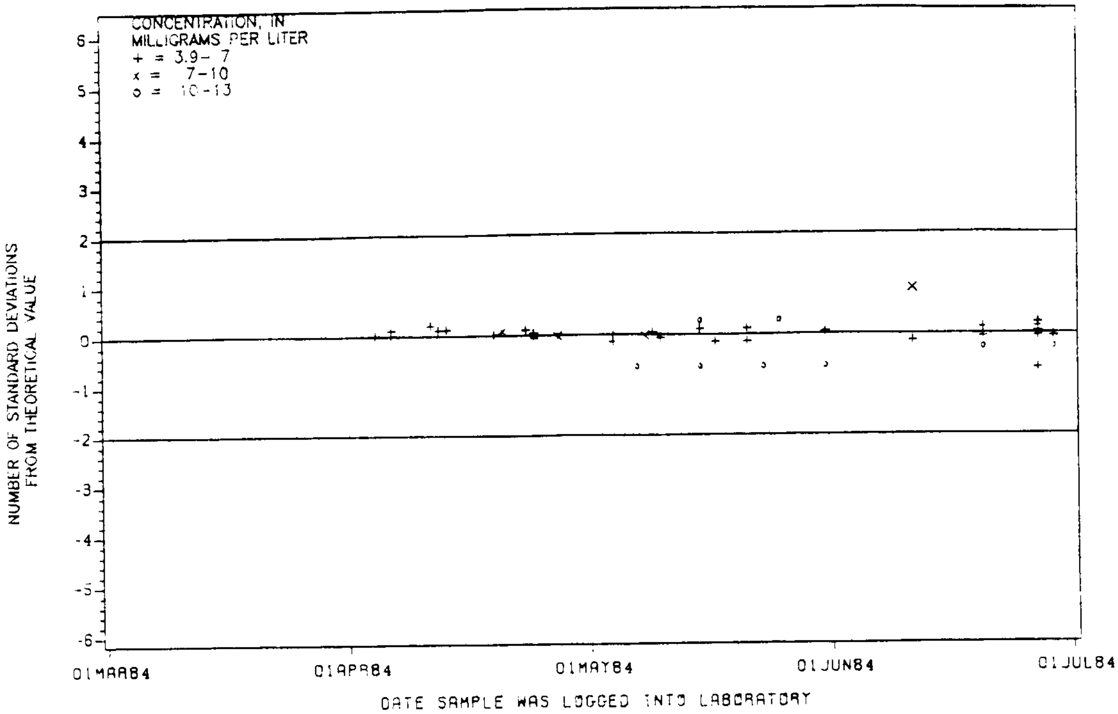

Figure A44.--Silica data from the Atlanta laboratory

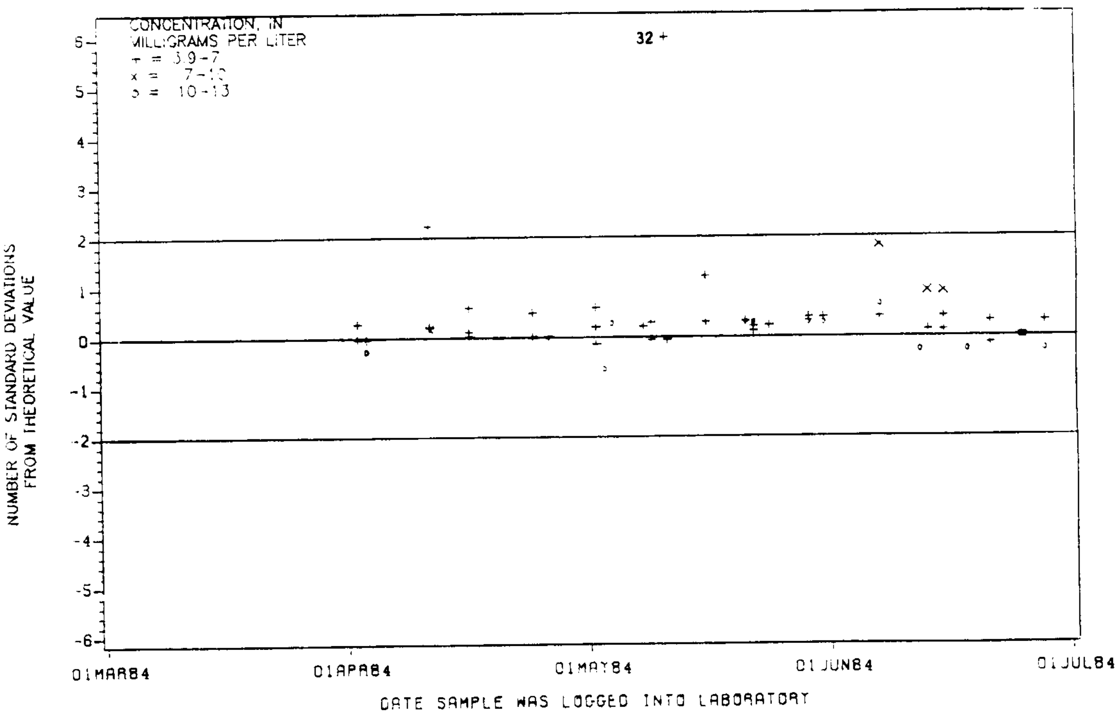

Figure D44.--Silica data from the Denver laboratory.

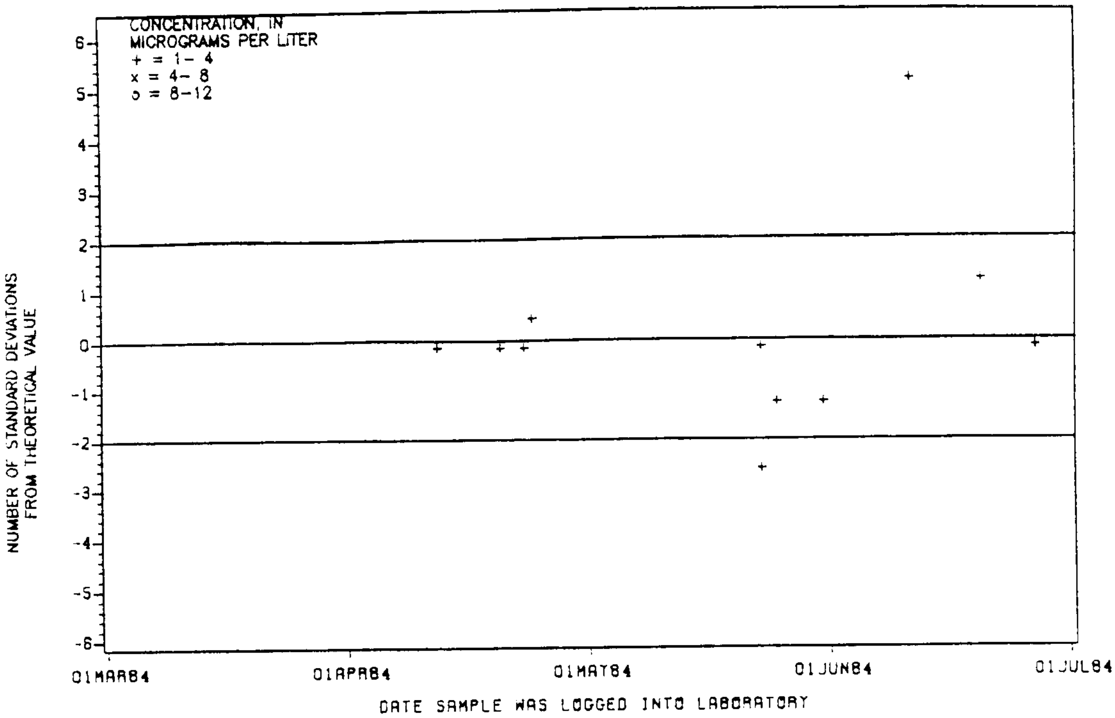

Figure A45.--Silver data from the Atlanta laboratory.

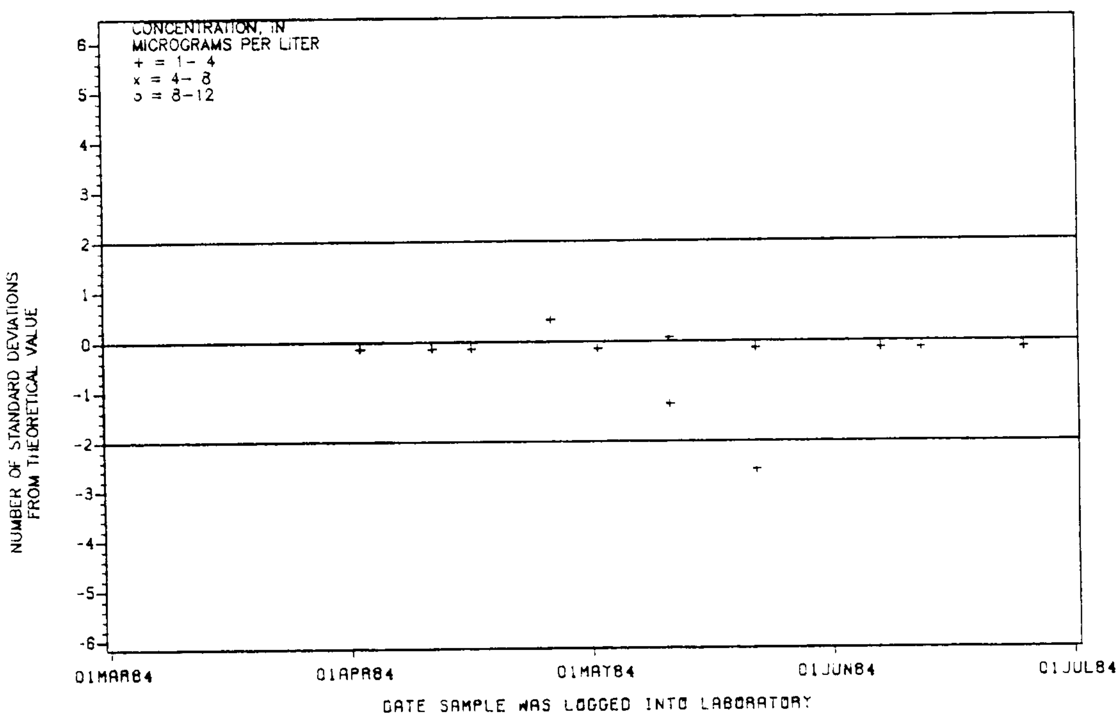

Figure D45.--Silver data from the Denver laboratory.

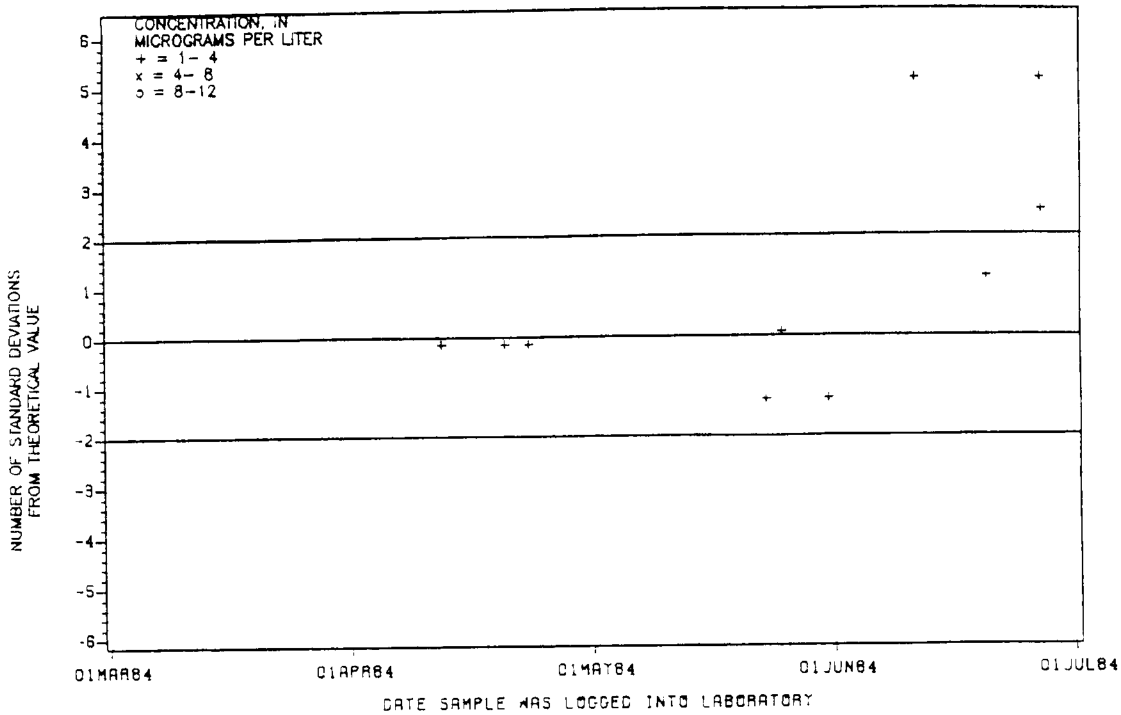

Figure A46.--Silver, total recoverable data from the Atlanta laboratory.

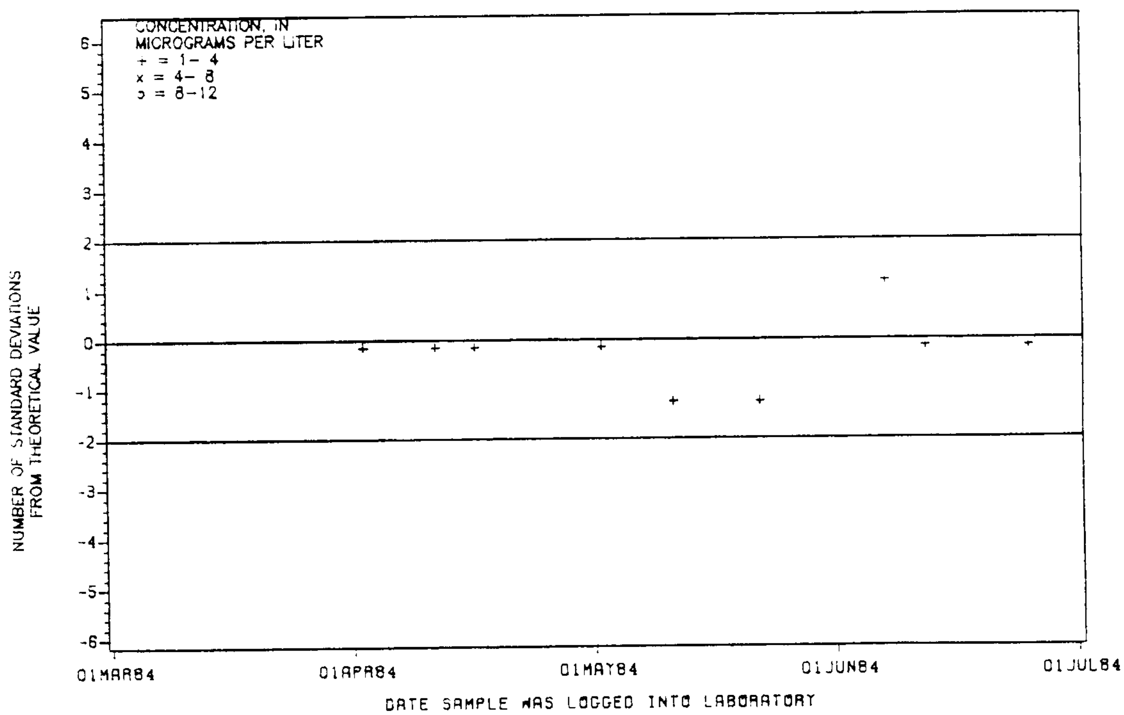

Figure D46.--Silver, total recoverable data from the Denver laboratory.

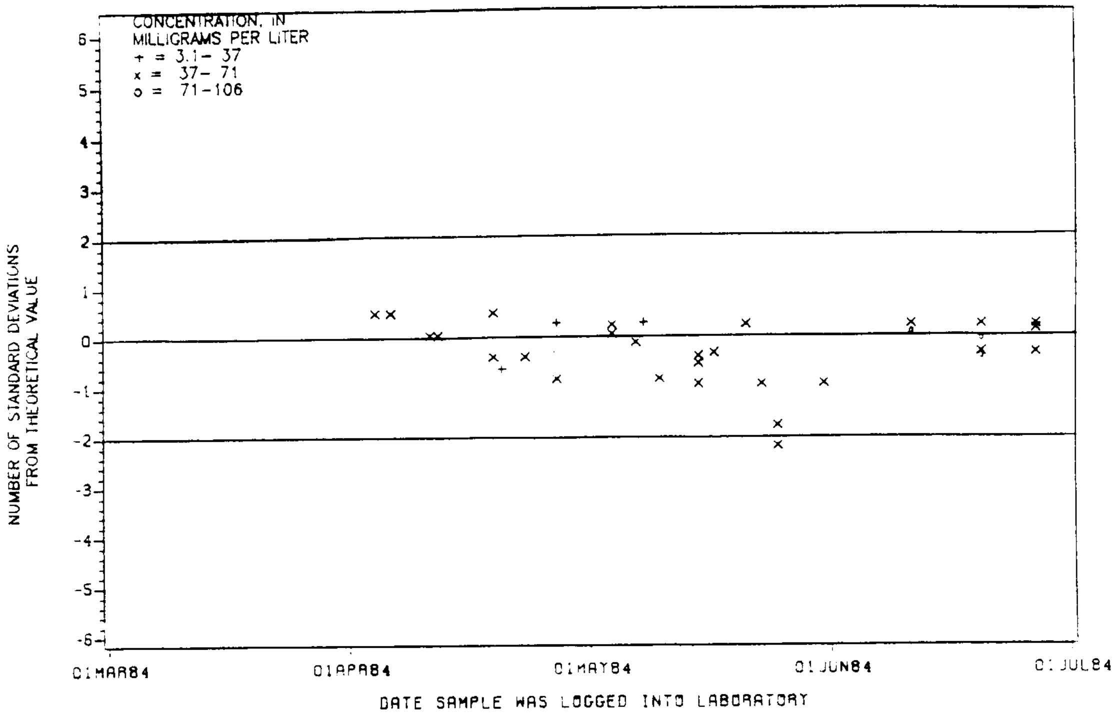

Figure A47.--Sodium(ICP) data from the Atlanta laboratory.

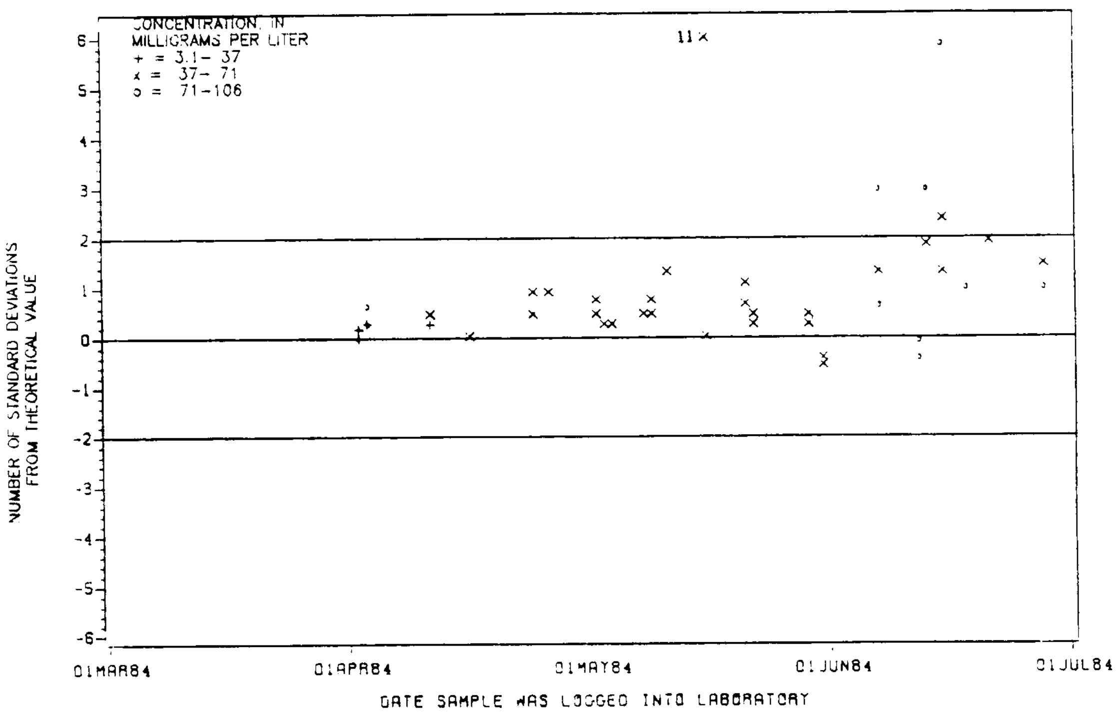

Figure D47.--Sodium(ICP) data from the Denver laboratory.

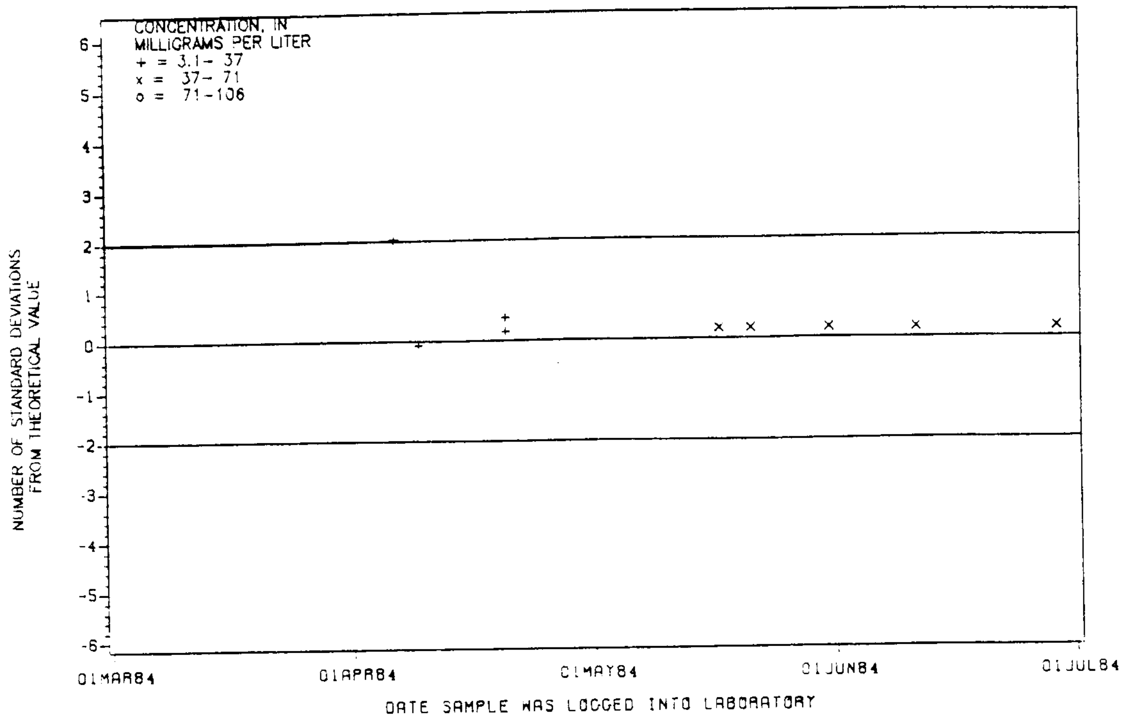

Figure A48.--Sodium(AA) data from the Atlanta laboratory.

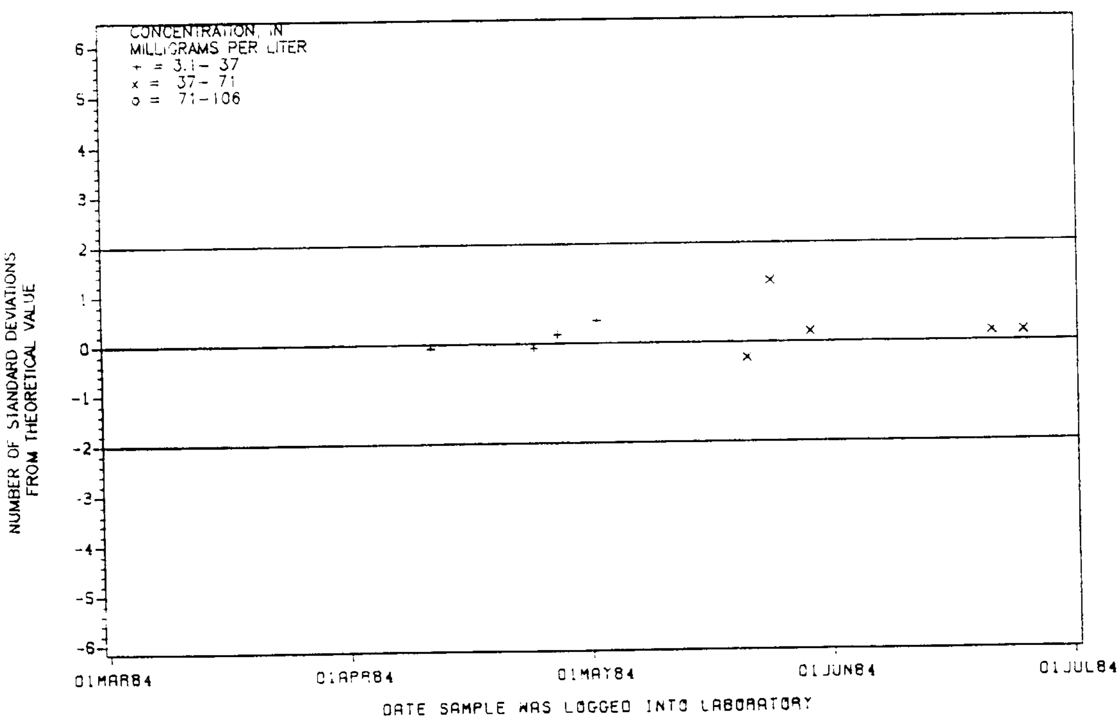

Figure D48.--Sodium(AA) data from the Denver laboratory.

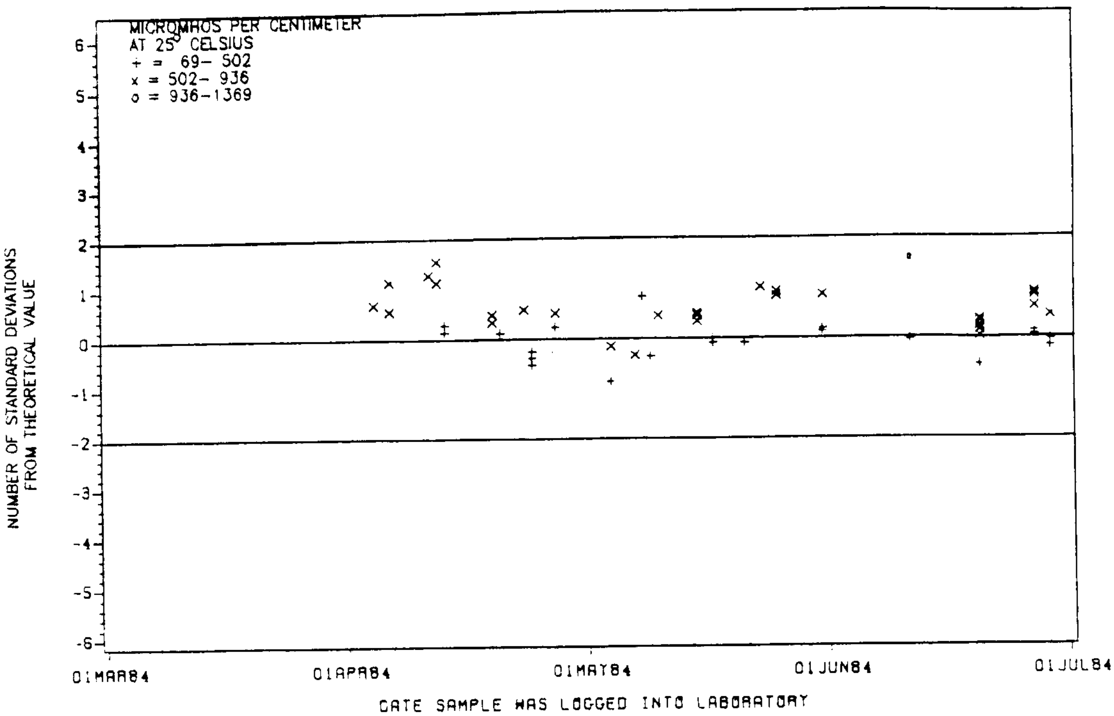

Figure A49.--Specific conductance, data from the Atlanta laboratory.

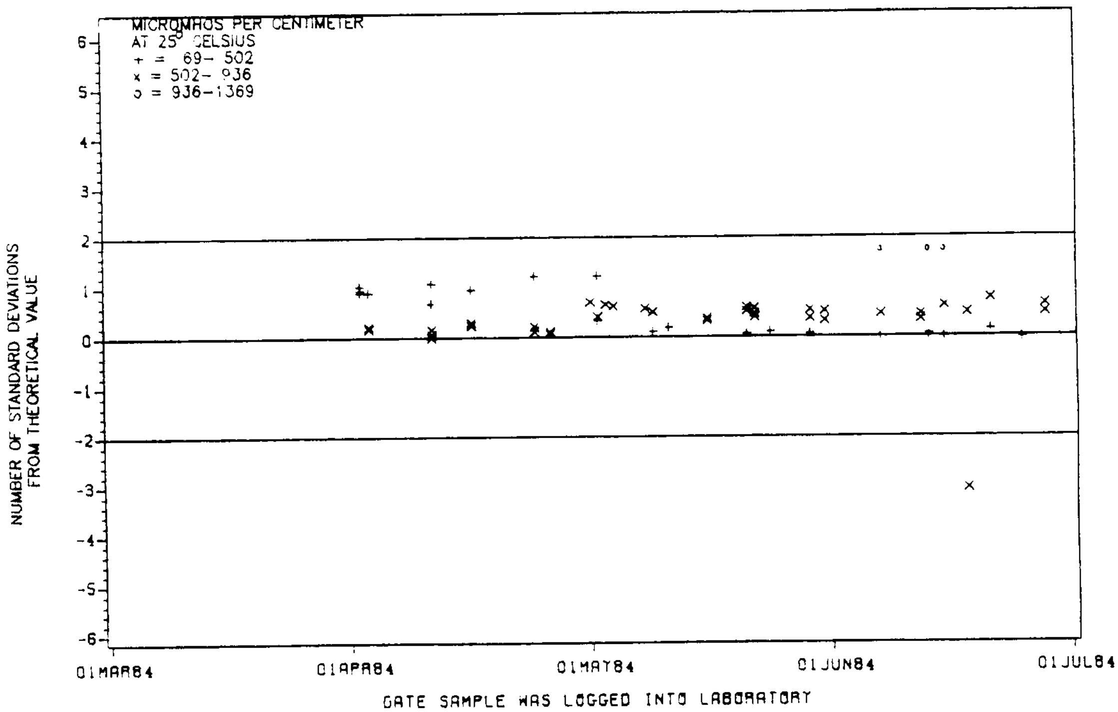

Figure D49.--Specific conductance, data from the Denver laboratory.

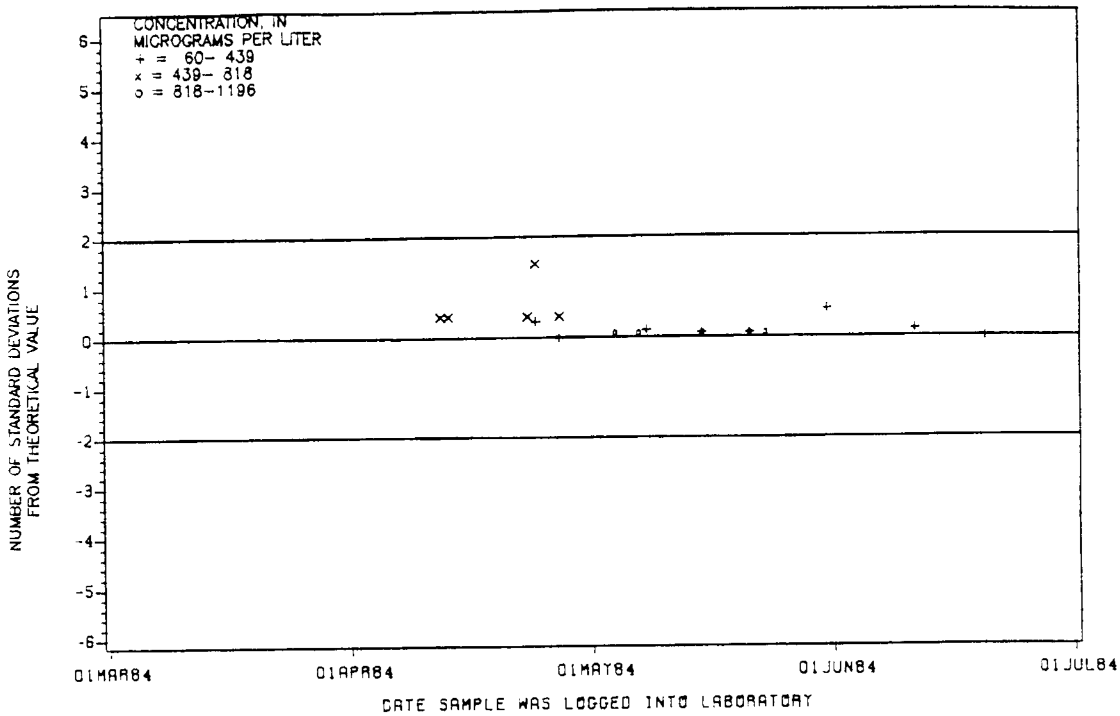

Figure A50.--Strontium data from the Atlanta laboratory.

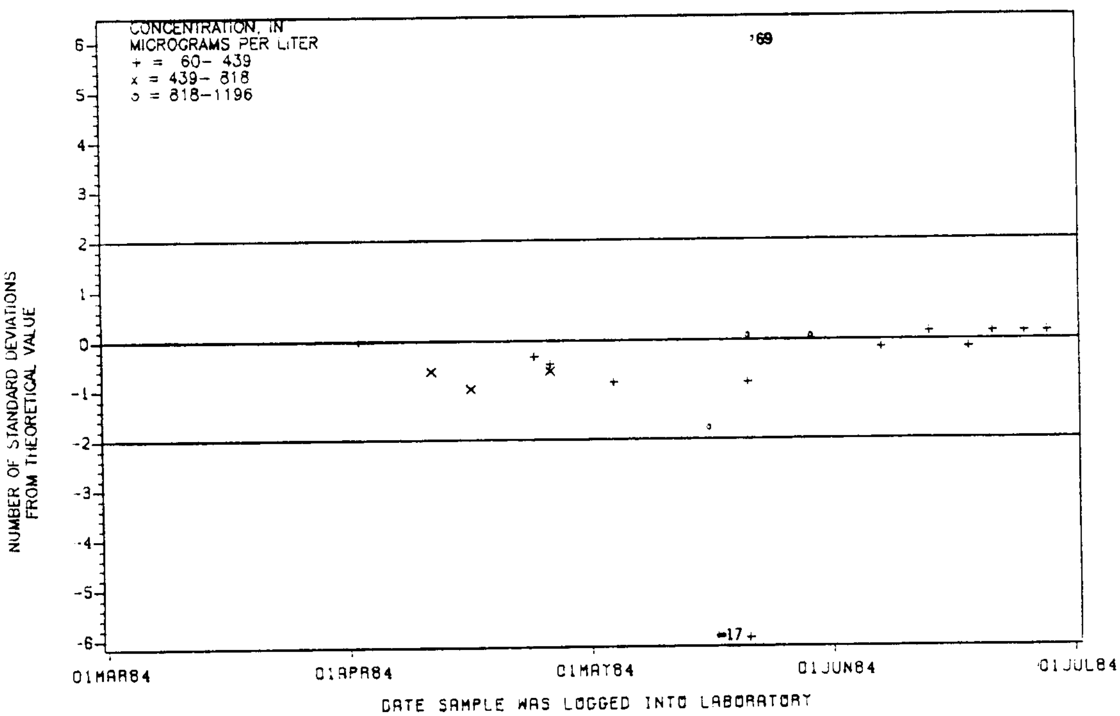

Figure D50.--Strontium data from the Denver laboratory.

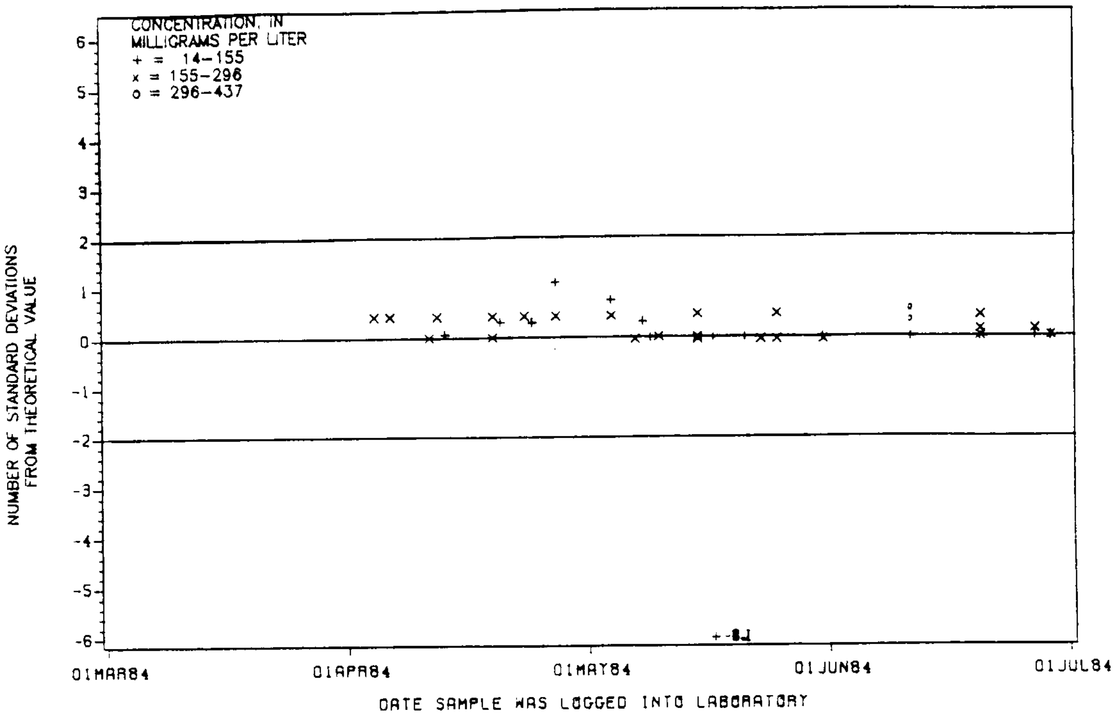

Figure A51.--Sulfate data from the Atlanta laboratory.

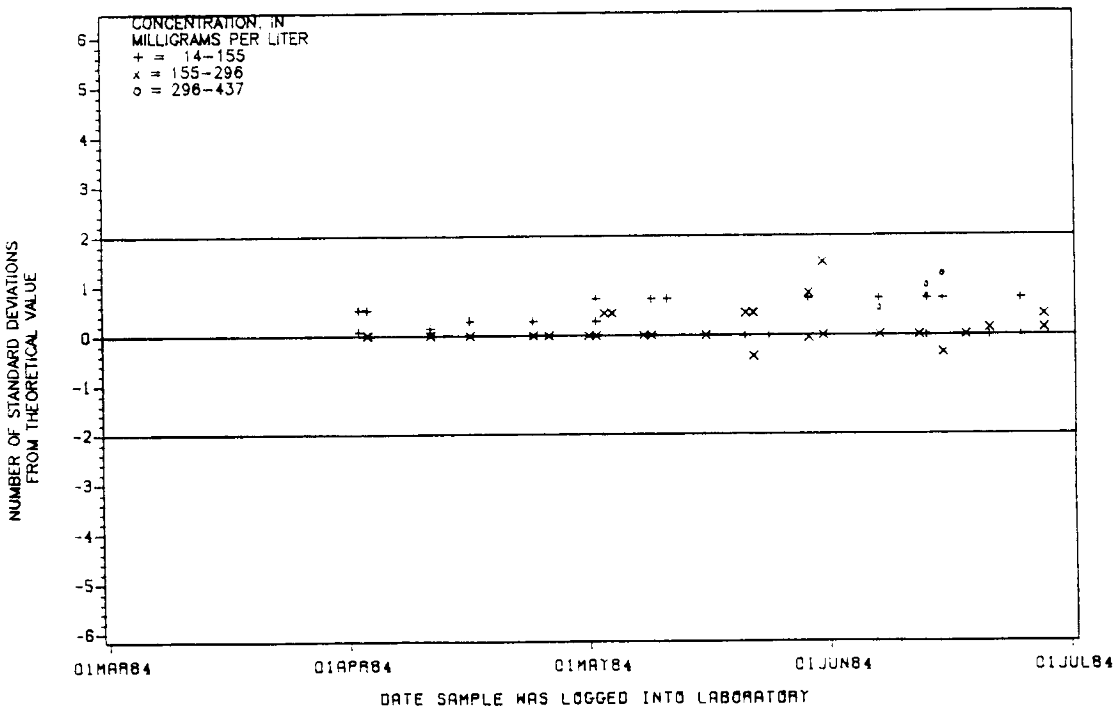

Figure D51.--Sulfate data from the Denver laboratory.

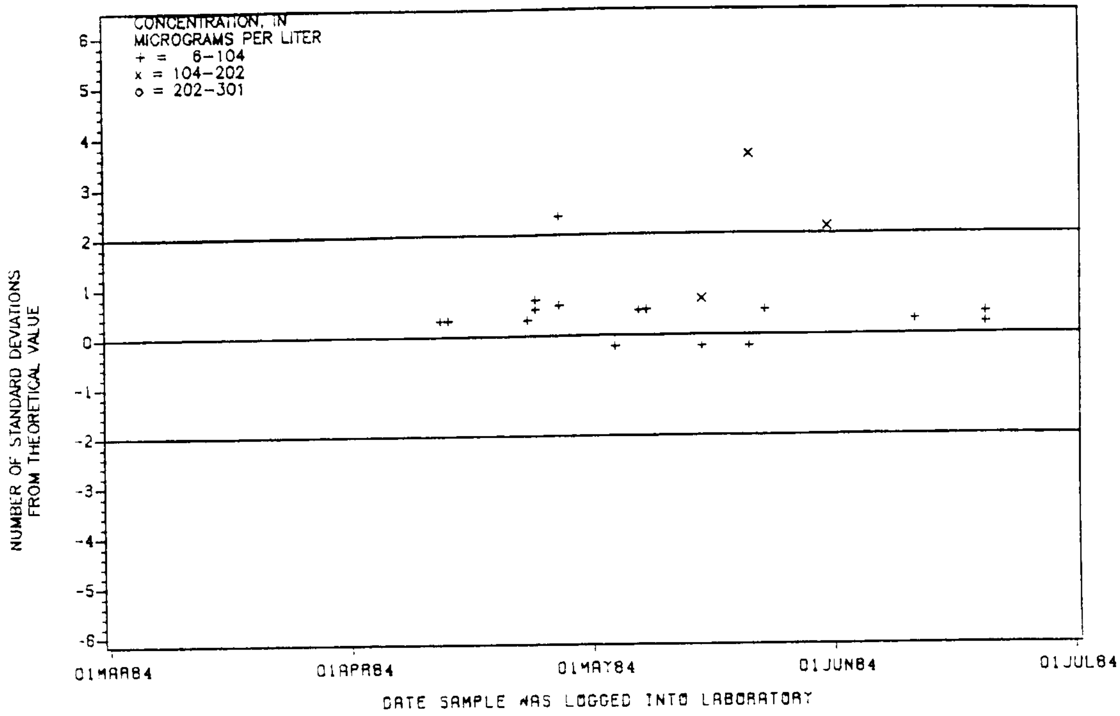

Figure A52.--Zinc(ICP) data from the Atlanta laboratory.

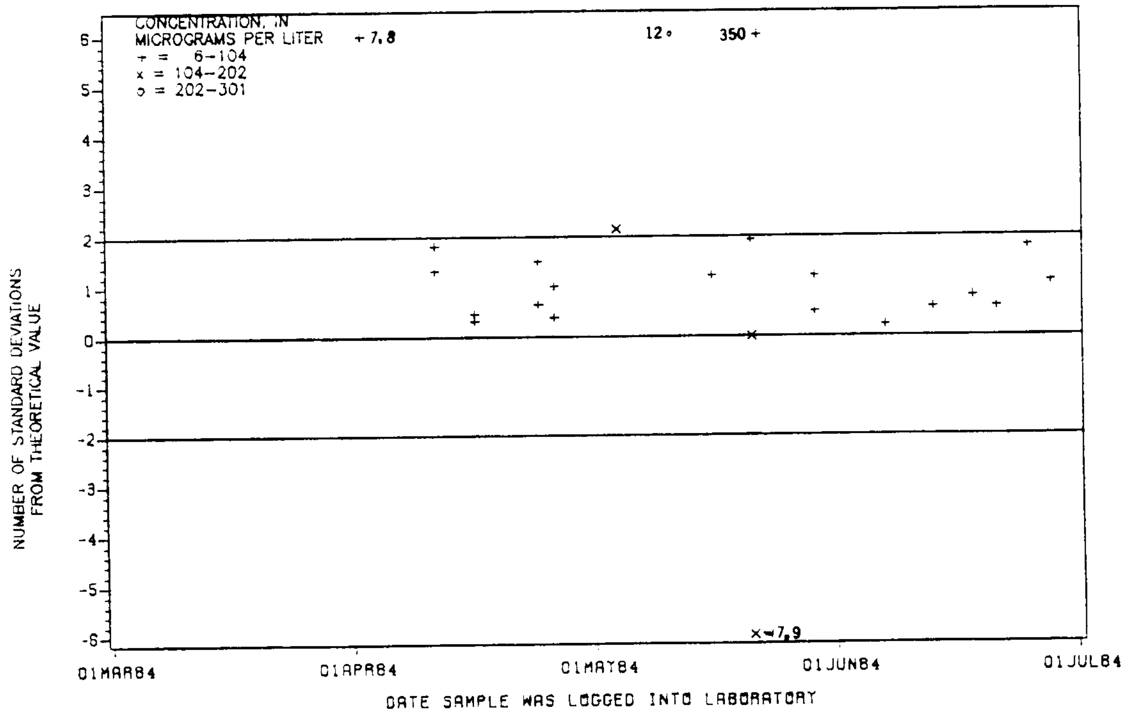

Figure D52.--Zinc(ICP) data from the Denver laboratory.

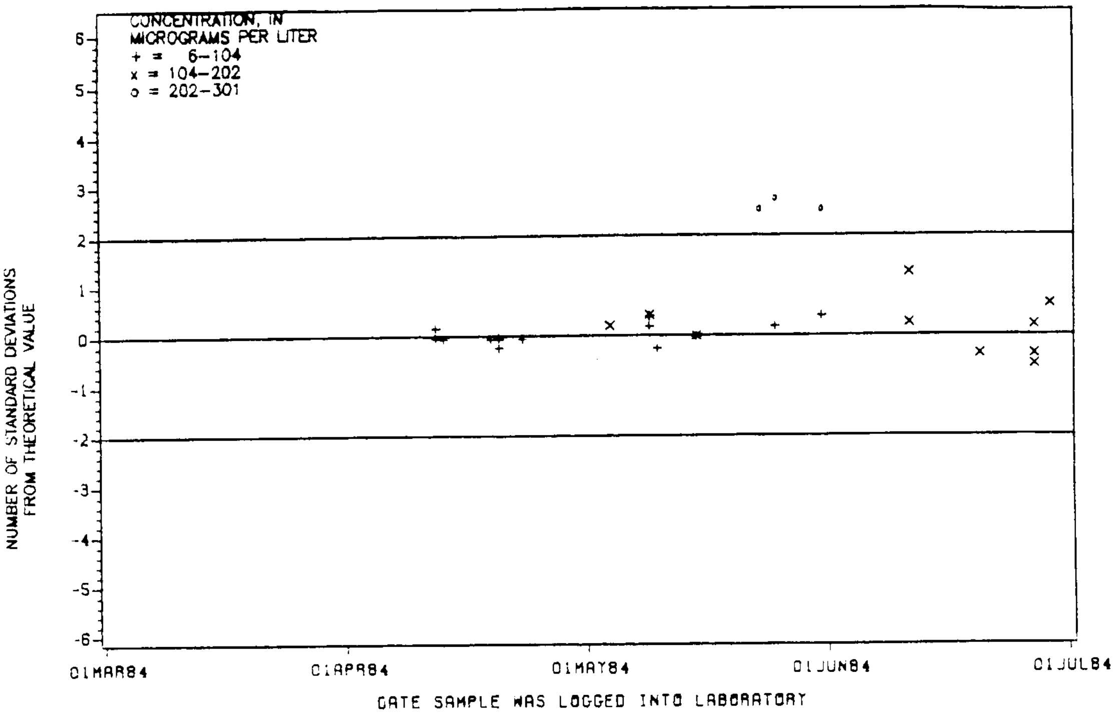

Figure A53.--Zinc(AA) data from the Atlanta laboratory.

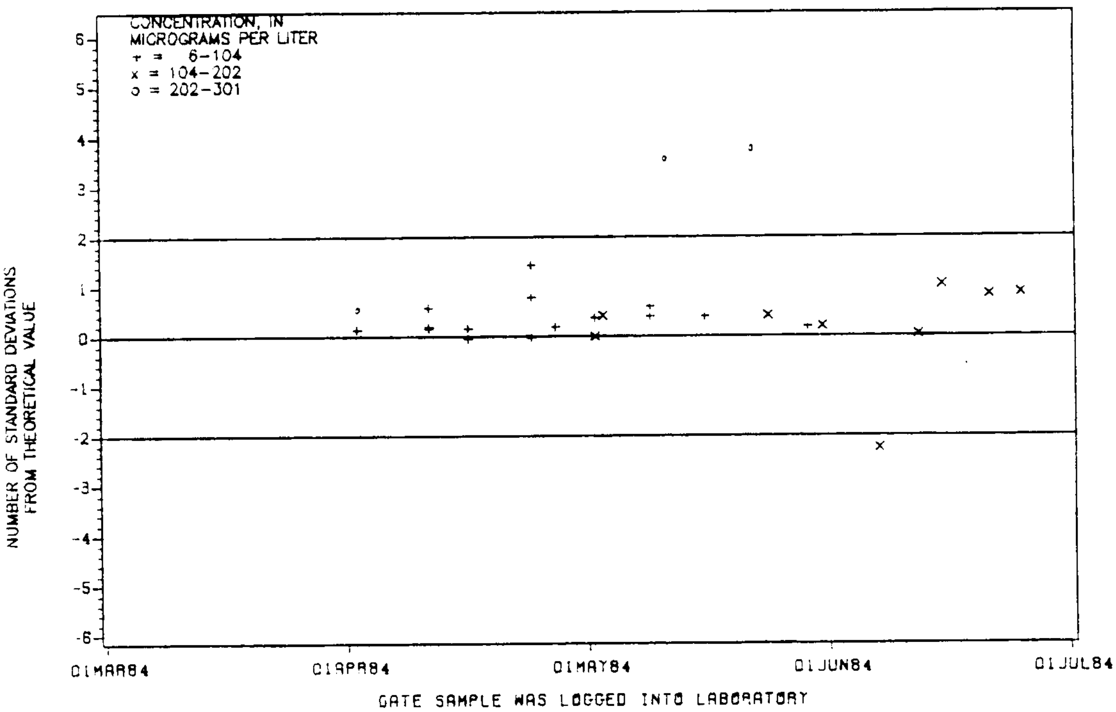

Figure D53.--Zinc(AA) data from the Denver laboratory.

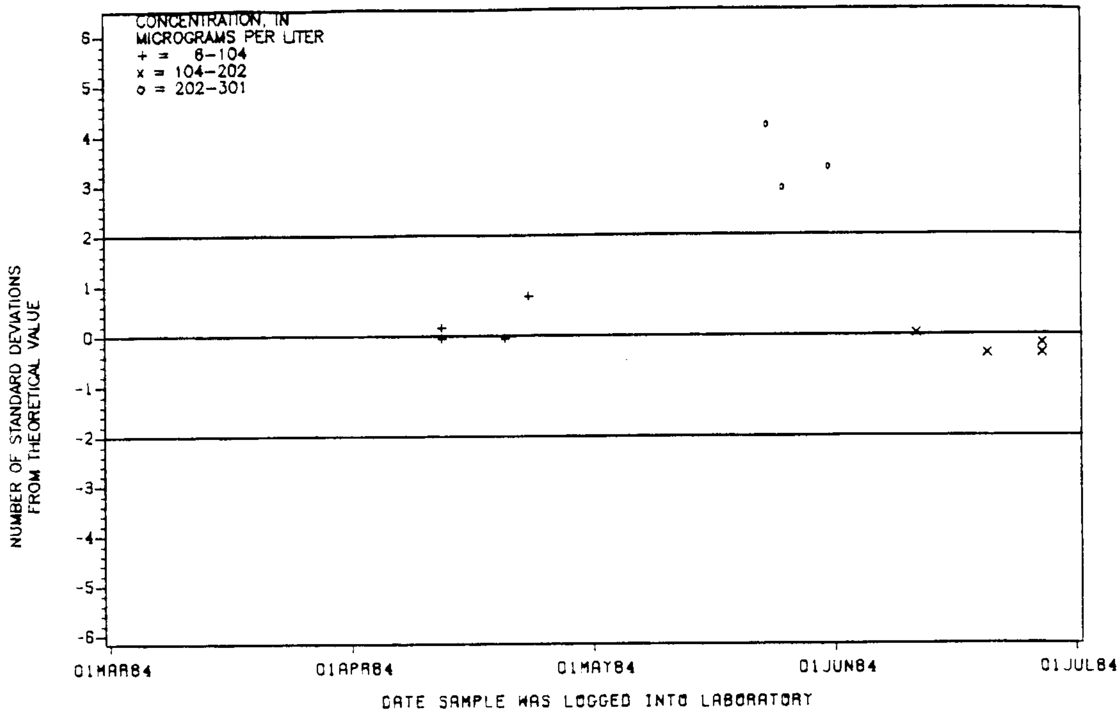

Figure A54.--Zinc, total recoverable data from the Atlanta laboratory.

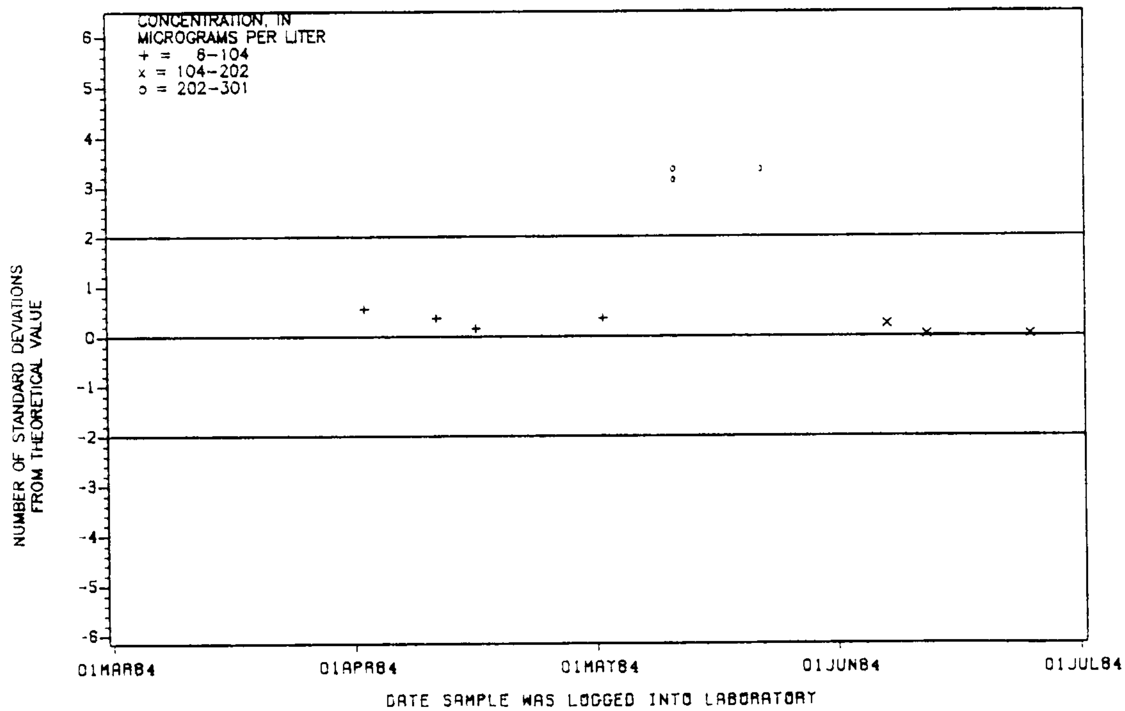

Figure D54.--Zinc, total recoverable data from the Denver laboratory.