REPORT 60631

FARO TAILINGS ABANDONMENT PLAN DEVELOPMENT PROGRAM

1990 REPORT ON THE TAILINGS COVERS TEST FACILITY

DRAFT

STEFFEN ROBERTSON & KIRSTEN

Consulting Engineers

REPORT 60631

FARO TAILINGS ABANDONMENT PLAN DEVELOPMENT PROGRAM

1990 REPORT ON THE TAILINGS COVERS TEST FACILITY

DRAFT

Prepared for:

CURRAGH RESOURCES LTD.

Prepared by:

STEFFEN ROBERTSON AND KIRSTEN (B.C.) INC.
580 Hornby Street
Vancouver, B.C. V6C 3B6
Canada

January 1991

FARO TAILINGS ABANDONMENT PLAN DEVELOPMENT PROGRAM

CONTENTS

LIST OF TABLES

LIST OF FIGURES

FARO TAILINGS ABANDONMENT
PLAN DEVELOPMENT PROGRAM
1990 REPORT ON THE
TAILINGS COVERS TEST FACILITY

1.0 INTRODUCTION

Curragh Resources Inc. initiated the Tailings Abandonment Plan Development Program (APDP) for the Faro, Yukon lead-zinc mine in 1987. A part of this four year program, scheduled for completion in March, 1991, included testing the affects of various cover types on Faro tailings. The APDP is described in detail in Steffen Robertson and Kirsten Report 60602, 1986.

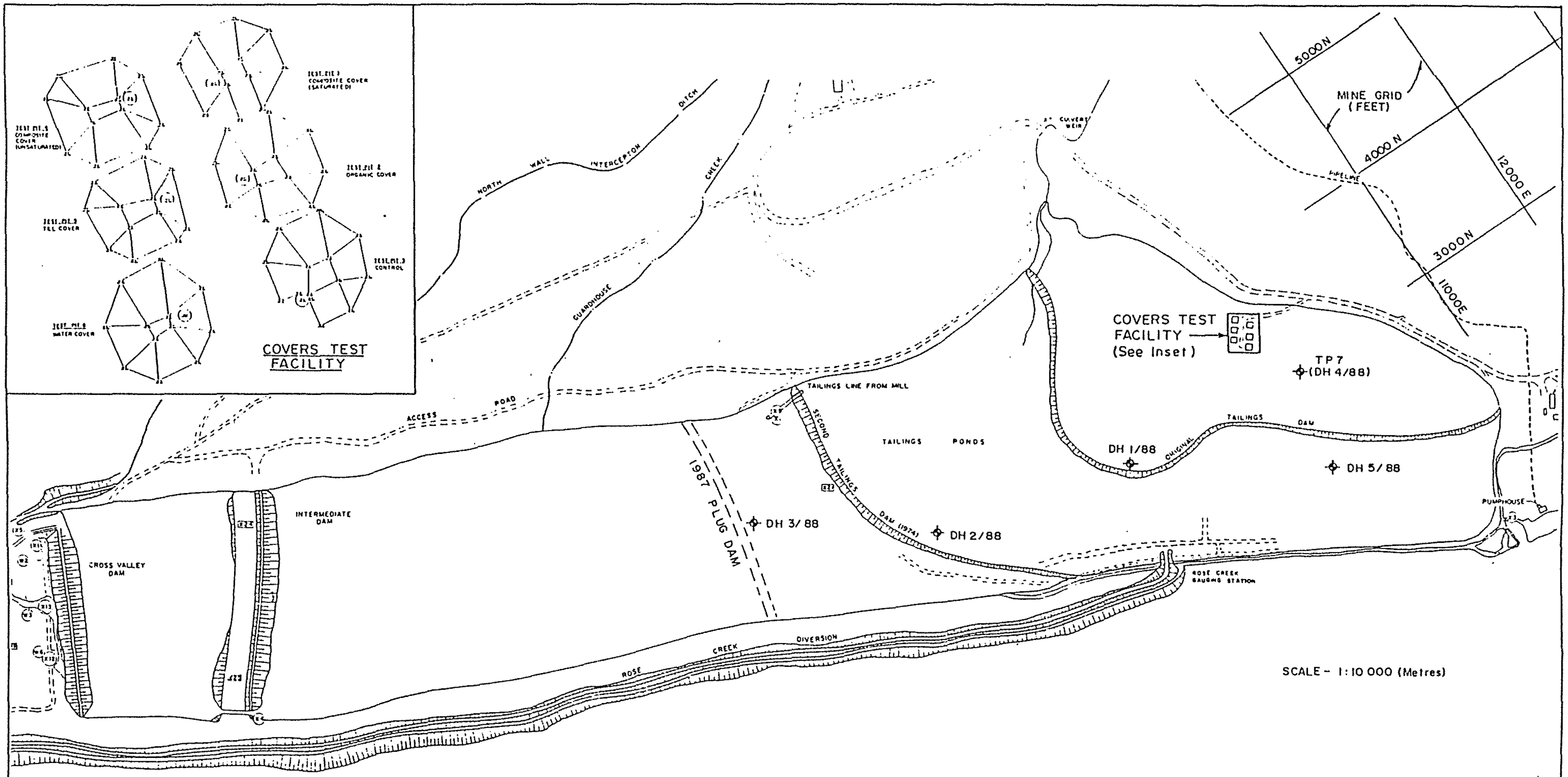
The tailings covers test facility was designed to test the abilities of various cover materials for inhibiting acid generation in the tailing waste and for reducing the transport rate of leached contaminants through the tailings. The test facility was constructed during the summer of 1987 and is lcoated in the oldest of Faro's three tailings impoundment areas shown on Figure 1-1.

The cover test facility consists of six test pits and one site designated TP7 within the old tailings adjacent to the test plots. Tailings were deposited in the test pits in 1987; tailings at site TP7 were deposited between 1969 and 1976. Five different cover types are being investigated in the test pits. Covers include: a shallow water cover; a till cover; an unsaturated composite cover; a saturated composite cover; and an organic cover. One test pit acts as a control. (During 1989, monitoring and sampling of the shallow water cover test pit was terminated due to maintenance and technical difficulties). Vertical profiles of the tailings and the covers in the test pits are shown schematically in Figure 1-2. Site TP7 within the old tailings was instrumented in 1988 (Drill hole DH4/88) and provides comparative information on more mature tailings.

The test facility has been monitored and sampled since completion of construction. Details of the construction of the test facility and the baseline chemical composition of the tailings in the test pits are presented in the 1987 Progress Report (CRI, Apr. 1988). A summary of 1988 and 1889 maintenance work, and interim sampling and monitoring results are presented in the 1988 Progress Report (CRI, Oct. 1988) and the 1989 Progress Report (SRK, Report 60620, Apr.1990).

In 1990, the pore water and tailings in the test pits were sampled during June and September. Chemical analyses of the water samples were performed by ASL Laboratories; chemical analyses of the covers and tailings materials were performed by Coastech Laboratories. Temperature, oxygen, carbon dioxide, pH, Eh, conductivity, alkalinity, and acidity were measured in the field during each sampling period. Temperature profiles for each test pit were determined monthly.

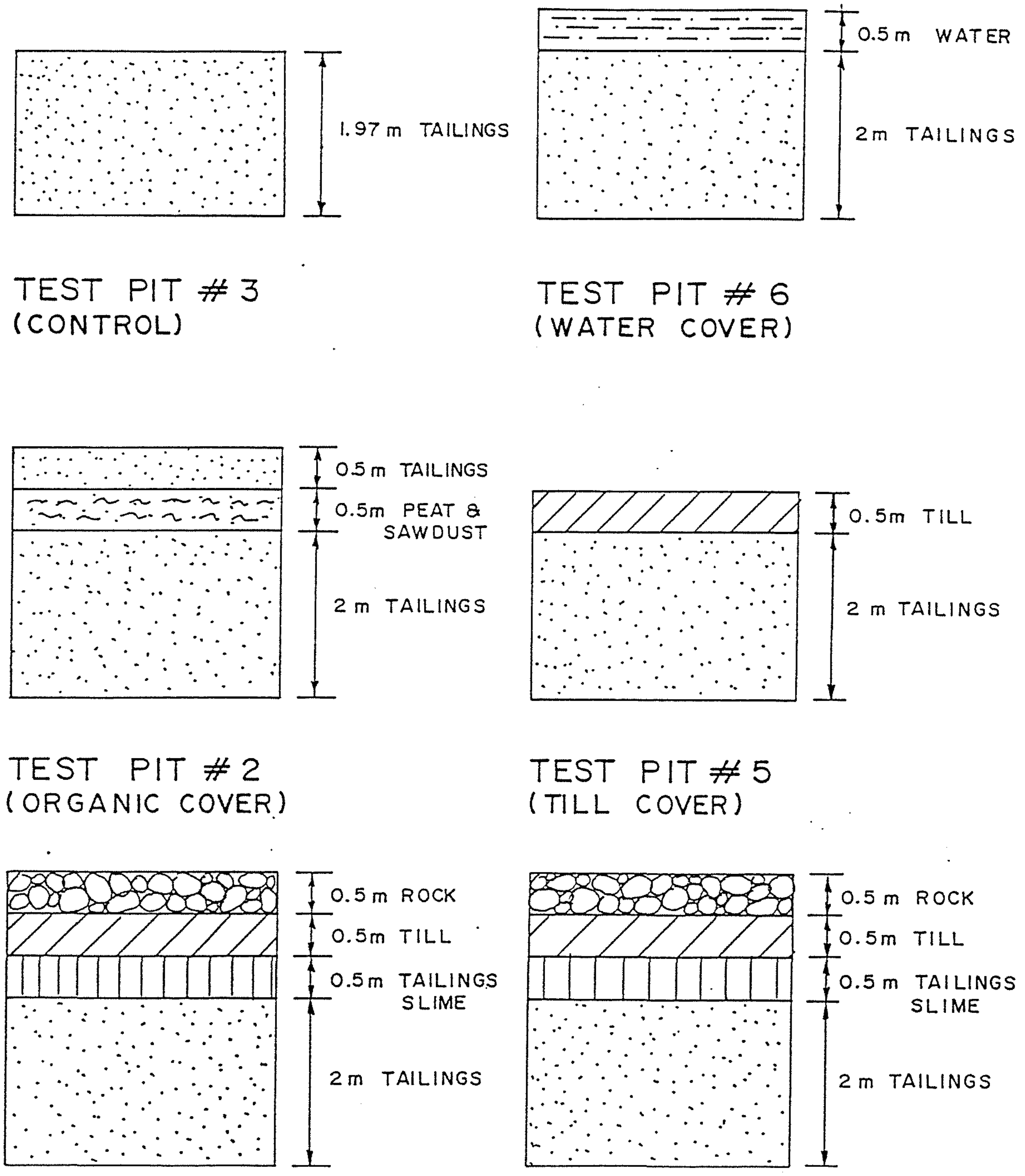
The sampling and monitoring of the test facility provided for in the Tailings Abandonment Plan Development Program was concluded in October, 1990; however, further annual monitoring to evaluate the long term performance of the covers is recommended. This report provides a summary of all of the monitoring and chemical analysis results to date, and discusses changes in physical and chemical parameters with depth within the test pits since 1987. This evaluation is intended to provide guidance for the selection of an appropriate tailings cover for the Faro tailings impoundment(s).



LEGEND

DH 2/88 1988 DRILL HOLE
(Approx. location)

CURRAGH RESOURCES - FARO MINE	DATE APRIL 1990
	PROJ NO 60620
TAILINGS TEST FACILITY FARO TAILINGS IMPOUNDMENT AREA	APPROVED
	NO 1-1



TEST PIT # 3
(CONTROL)

TEST PIT # 6
(WATER COVER)

TEST PIT # 2
(ORGANIC COVER)

TEST PIT # 5
(TILL COVER)

TEST PIT # 1
(COMPOSITE COVER)
SATURATED

TEST PIT # 4
(COMPOSITE COVER)
UNSATURATED

CURRAGH RESOURCES – FARO MINE

TAILINGS TEST FACILITY

SCHEMATIC OF VERTICAL PROFILES OF TAILINGS AND COVERS IN TEST PITS

DATE APRIL 1990
PROJ. NO. 60620
APPROVED
NO. 1-2

2.0 METHODS AND PROCEDURES

2.1 Instrumentation Monitoring

Two types of instruments were installed in the test pits: thermisters and piezometers. In September,1988,the forty thermisters in the test pits were monitored. In 1989, forty-nine thermisters were monitored monthly, beginning in July, inlcuding the nine thermisters installed at site TP7. Monthly monitoring continued up to October, 1990. Temperature is read directly from each thermistor lead.

Twenty pneumatic piezometers were monitored in September, 1988, and July, September, October, and November, 1989 to determine pore water pressures. Monitoring of the pneumatic piezometers ended in 1989 as pore pressures dropped below the sensitivity of the instruments.

2.2 Water Sampling

Sampling devices installed in 1987 included a total of 30 air/ water samplers, 28 lysimeters, and 6 pit bottom drains. Water samples were collected from the air/ water samplers, the lysimeters, and pit bottom drains in September 1988, July 1989, October 1989, June 1990, and September, 1990. The number of samples collected during each sampling period, and the percentage of instruments functioning during each period are presented in Table 2-1. The ability to obtain samples was determined substantially by the frozen conditions in the tailings plots and sampling lines.

Pore water was extracted from the air/ water samplers using a variable speed peristaltic pump and from the lysimeters using a vacuum pump.

Temperature, pH, Eh, and conductivity were measured on unfiltered sample water. Measurements were made at one minute intervals over a ten minute period or until the readings stabilized.

A liquid filled combination pH electrode and a combination platinum electrode were used to determine pH and Eh, respectively. The pH electrode was calibrated using 4.0, 7.0 and 10.0 buffers maintained at tail water temperatures. The Eh electrode was checked regularly using Zobell's solution.

TABLE 2-1

NUMBER OF WATER SAMPLES COLLECTED DURING EACH SAMPLING PERIOD.

DATE	AIR/ WATER SAMPLERS	LYSIMETER SAMPLERS	BOTTOM DRAIN SAMPLERS	TOTAL SAMPLED	PERCENT WORKING/ SAMPLED
SEP/90 *	22	17	5	44	80 %
JUN/90 *	23	16	5	44	80 %
OCT/89	19	8	4	31	48 %
JUL/89	27	10	5	42	66 %
SEP/88	25	4	4	33	52 %
ORIGINAL	30 (* 26)	28 (* 24)	6 (* 5)	64 (* 55)	-

* Number of original water samplers excluding those in Test Pit 6. Sampling of Test Pit 6 was discontinued in 1989.

Alkalinity and acidity were measured immediately in the field by titration. Alkalinity and acidity were determined by titration with standardized H_2SO_4 and NaOH respectively. The titrations were completed immediately to limit the effects of iron oxidation and hydrogen ion generation.

After field measurements were completed, water samples were extracted and filtered through 0.45 micron millipore filters. Two samples from each air/ water sampler and lysimeter were collected in clean, acid washed plastic 250 millilitre containers. Samples for cation analysis were acidified immediately to a pH of less than one using concentrated nitric acid. (In 1988 and 1989, samples were acidified with concentrated hydrochloric acid). Both the acidified cation samples and the non-acidified anion samples were refrigerated to four degrees Celsius, and shipped to a commercial laboratory for chemical analysis. In 1988 and 1989, chemical analysis was performed by B.C. Research Laboratory; in 1990, the chemical analysis was performed by ASL Laboratories. The chemical parameters determined by laboratory analysis are presented in Table 2-2 below:

TABLE 2-2

CHEMICAL ANALYSIS PARAMETERS FOR WATER SAMPLES

SAMPLE A		SAMPLE A		SAMPLE NA	
Silver	Ag	Potassium	K	Chlorine	Cl
Arsenic	As	Magnesium	Mg	Fluorine	F
Calcium	Ca	Manganese	Mn	Nitrates	NO3
Cadmium	Cd	Sodium	Na	Sulphates	SO4
Cobalt	Co	Nickel	Ni	DIC ***	
Chromium	Cr	Lead	Pb	Lab pH	
Copper	Cu	Selenium	Se		
Iron	Fe	Zinc	Zn		

* Sample A: Acidified

** Sample NA: Non-acidified

** DIC: Dissolved Inorganic Carbon

2.3 Solids (Tailings) Sampling

In October, 1987, during the placement of tailings into the test pits, samples were collected and submitted to B.C. Research Laboratory for analysis. Solids samples were not collected during 1988; however, in October, 1989, a tailings sample was collected from near surface in each of four test pits. (Test Pit 2, 3, 5, and 6). Samples were extracted from the uppermost of the horizontal PVC sampling tubes installed in these test pits using a two inch diameter auger. Prior to auger insertion, the PVC pipes were flushed with nitrogen. After each sample was collected, the sampling tube was again flushed with nitrogen, and then sealed. A duplicate sample was collected from Test Pit 2. Sample extraction from Test Pit 1 and Test Pit 4 was not successful. The five tailings samples were shipped to B.C. Research Laboratory. Samples were analyzed for metals, total sulphur, sulphate sulphur, and sulphide sulphur. Acid/ base accounting was also performed.

In September, 1990, a tailings sample was extracted from each of test pits one through five by augering from the surface to a depth of 30 centimetres. A sample of the cover materials on each test pit was also collected. All samples were sent to Coastech Laboratories for analysis. Samples were analyzed for metals, total sulphur, sulphate sulphur, and sulphide sulphur. Acid/ base accounting and shake flask tests were performed, as well as tests for bacterial activity. In addition, physical parameters were measured. Particle distributions were determined and specific densities were measured.

2.4 Oxygen/Carbon Dioxide Measurements

Oxygen and carbon dioxide concentrations in the unsaturated zone of the test tailings were measured in October 1989, February 1990, and June, 1990.

In October, 1989, 11 measurements were made from dry air/ water samplers and lysimeters in the test pits. Fourteen measurements were made from air sampler tubes installed at various depths in the old tailings area (TP7). In February, 1990, 24 measurements were made from dry air/ water samplers and lysimeters in the test pits and 14 measurements were made from the air sampler tubes installed in the old tailings site (TP7). In June, 1990, 12 measurements were made from air/ water and lysimeter samplers located in the test pits and 14 measurements were made from air samplers located at site TP7. Air sample collection and concentration measurement were made using a portable O_2/CO_2 gas analyzer.

3.0 RESULTS

In 1990 the samplers in test pits one through five continued to function well, with 85 percent of the air/ water samplers and 71 percent of the lysimeters still operational. The bottom drains in each of these test pits continued to operate as designed, and samples were extracted from these drains in both June and September, 1990. Solid samples were extracted from the surface using a hand auger in 1990 rather than from the horizontal PVC extractors to ensure that the upper 30 centimetres of tailings in each test pit was extracted for analysis.

Of the instrumentation, the thermisters continued to function well, with 86 percent still operational in September, 1990. As stated in the April, 1990 Progress Report, the pore pressure instrumentation has not proven to be successful because the pore pressures in the tailings are at or near the resolution of the pressure read-out monitor. Pore pressures were not measured during 1990. The gas analyzer used in measuring the oxygen and carbon dioxide concentrations continued to be unreliable in 1990, with frequent technical failures requiring lengthy servicing periods. As a result, only one set of oxygen and carbon dioxide concentrations measurements was obtained during the summer of 1990.

Chemical analysis of the pore water and tailings solids indicates that five of the six test pits are functioning within design expectations. The testing of the shallow water cover on Test Pit 6, however, was terminated due to difficulties in maintaining water levels and suspected contamination of the test pit as indicated by 1989 chemical analysis results. A detailed review of the problems encountered with the shallow water cover test pit has been presented in the April, 1990 Progress Report.

Selected results of the 1990 sampling programs are presented below. The 1987, 1988 and 1989 results are presented for comparison. Pore water and air sample results are presented in Sections 3.1 to 3.4. Solids (Tailings) sample results are presented in Section 3.5

3.1 Temperature, pH, Alkalinity, Acidity, and O_2/ CO_2

Temperature, pH, Eh, alkalinity, acidity, and oxygen/ carbon dioxide parameters were measured in the field. Results are presented in Table 3-1, 3-2 and 3-3. (Section 3 Tables are presented at the end of the report).

3.2 Calcium, Potassium, Sodium, Magnesium, and Manganese

The pore water samples collected in 1990 were sent to ASL Laboratories and analyzed for concentrations of calcium (Ca), potassium (K), sodium (Na), magnesium (Mg), and manganese (Mn). Results are presented in Table 3-4. (Section 3 Tables are presented at the end of the report).

3.3 Chlorine, Fluorine, Nitrates, and Sulphates

The pore water samples collected in 1990 were sent to ASL Laboratories and analyzed for concentrations of chlorine (Cl), fluorine (F), nitrates (NO^-_3) and sulphates (SO^-_4). Results are presented in Table 3-5. (Section 3 Tables are presented at the end of the report).

3.4 Chromium, Copper, Iron, Nickel, Lead, and Zinc

The pore water samples collected in 1990 were sent to ASL Laboratories and analyzed for concentrations of chromium (Cr), copper (Cu), iron (Fe), nickel (Ni), lead (Pb), and zinc (Zn). Results are presented in Table 3-6. (Section 3 Tables are presented at the end of the report).

3.5 Solids (Tailings) Samples

In 1990, five tailings samples were sent to Coastech Laboratory and analyzed for metal and sulphur concentrations. Results are presented in Table 3-7. Results of the 1987 baseline chemical composition of the tailings in the test pits and the 1989 tailings samples are included for comparison.

Acid/ base accounting was performed on the 1990 and 1989 samples. Results from these tests, together with acid/ base accounting test results from tailings samples collected in 1987 are presented in Table 3-8.

In 1990, shake flask tests were also performed on the five tailings samples. Results are presented in Table 3-9. (Section 3 Tables are presented at the end of the report).

4.0 DISCUSSION

The Faro covers test facility was designed to test the abilities of various cover materials to inhibit acid generation in tailing waste and to reduce the transport rate of leached contaminants through the tailings. To evaluate the abilities of each cover type, it is important first to review briefly the factors controlling acid generation and subsequent contaminant transport.

Acid generation is a time-dependent process and is controlled primarily by:

- the presence and nature of reactive sulphides
- the exposure of the reactive sulphides
- the pH and the presence of alkaline reactants
- the temperature
- the availability of oxygen (by convection and diffusion)
- the availability of water

In assessing the covers on the test pits, selected physical and chemical parameters measured during 1987, 1988, 1989, and 1990 are reviewed. The objective is to establish a similar baseline condition for the tailings as placed in each test pit in 1987, and then identify and evaluate changes in physical and chemical parameters both with respect to depth and time. Variations between test pits, and most importantly differences between covered tailings and the uncovered tailings of the control test pit should be indicative of the relative abilities of each cover type in inhibiting acid generation within the tailings.

4.1 Initial Conditions

In 1987, normal mill tailings were placed in each of the six test pits. It was recognized that the chemical characteristics of tailings being discharged from an operating mill vary daily, monthly and yearly due to the variability of the ore from the mine; six distinct ore types are recognized at Faro. Further, each ore or mill feed composite requires modification in the daily operation of the concentrator mill, with reagent additions being adjusted on an as required basis. However, for a profitable operation, there are specific standards or targets which on average must be achieved. Thus, the chemical composition of tailings being discharged from the mill over extended periods should be representative of average conditions, at least with respect to the concentrations of economic minerals such as lead and zinc, and with respect to the ore type currently being mined and processed.

If comparisons between different test pits are to be meaningful, the tailings placed in each test pit must be similar. At the same time, to ensure that the test results are representative of actual chemistry found within a tailings impoundment, some of the normal variability found in tailings must be maintained. To achieve these objectives, tailings were discharged into the test pits in 1987 over a one month period.

Major tailings constituents which influence the acid generation potential, and/or the metals leaching rates, include the concentrations of iron, total sulphur, zinc, lead and calcium, and the solution pH. The initial concentrations of these parameters, and 1990 solids concentrations have been presented in Table 3-7., together with a chemical profile of typical Faro tailings. A summary is presented below, with the objectives of: showing that the test pit tailings are representative of typical Faro tailings; and, that the tailings within each test pit is of similar enough chemical composition to be suitable for comparisons between test pits.

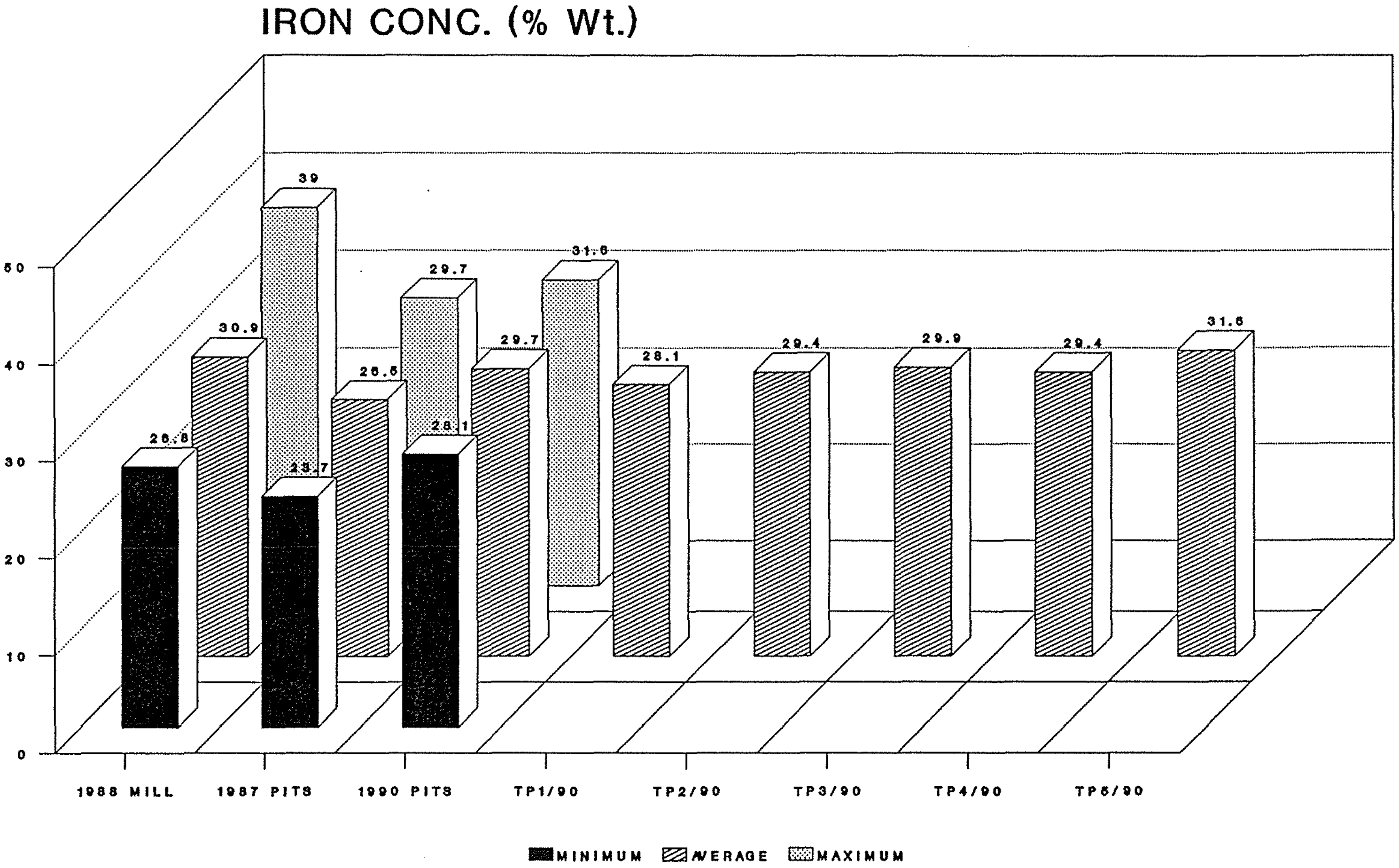
4.1.1 Iron Concentration in the Tailings Solids

A summary of the percent by weight iron concentration in the tailings solids is shown in Figure 4-1. Average concentrations, and ranges are presented. Typically, the tailings at Faro has approximately 30 percent iron content. In 1988, for example, the monthly average iron content in the mill tailings discharge was 30.9 percent. Six monthly averages of the average daily iron concentration in the mill tailings were reviewed. These monthly average iron concentrations ranged between 26.7 and 39 percent.

In 1987, the iron concentration of the tailings discharged into the test pits was similar to typical Faro tailings. A total of 19 samples were analyzed, and an average iron concentration of 26.6 percent by weight was determined. In 1990, a tailings sample was collected from each test, and the resultant average iron concentration of the test pit tailings was 29.7 percent, with a range of 28.1 to 31.6 percent. The 1990 iron concentration of the tailings solids should be and is relatively similar to the 1987 tailings, in that the rate of oxidation in immature tailings is insufficient at present to generate noticeable changes in the solids chemical composition. Having shown that the average iron concentrations in the test pits are relatively the same in 1990 as in 1987, it is possible to use the iron concentrations measured in the 1990 tailings samples and collected from the individual pits to determine if the tailings within each pit are comparable. As shown in Figure 4-1, the individual iron concentrations within each test pit are well within the expected range of concentration iron values for typical tailings. Therefore, based on iron concentrations, results from the test pits are comparable.

Figure 4-1

FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
IRON CONCENTRATIONS



Mill: Based on Ave. Monthly Tail Results
Calculated Using Daily Ave. Data

4.1.2 Sulphur Concentration in the Tailings Solids

A summary of the percent by weight sulphur concentration in the tailings solids is shown in Figure 4-2. In 1987, the sulphur concentration of the tailings discharged into the test pits averaged 29 percent by weight and ranged between 21.4 to 37.9 percent. These sulphur concentrations correspond to the ranges of pyritic and other sulphide mineral concentrations found in the ore at Faro, and thus, are considered typical of Faro tailings. Tailings samples collected in 1990 had a similar average and range, the average being 29.2 percent with a range of 23.6 to 35.8 percent. These results indicate that like iron, the reaction rates within the test pits are as yet insufficient to produce noticeable change in the sulphur content.

Having shown that the average sulphur concentrations in the test pits are relatively the same in 1990 as in 1987, it is possible to use the sulphur concentrations measured in the 1990 tailings samples and collected from the individual pits to determine if the tailings within each pit are comparable. As shown in Figure 4-2, the concentrations in each test pit are within the expected range of sulphur concentrations for typical tailings. However, it should be noted that the sulphur concentration of 23.6 percent in Test Pit 1 is at the extreme low end of the 1987 range of sulphur values, and Test Pit 5, with 35.8 percent sulphur is at the extreme high end of the range. These differences are not large enough to preclude the validity of comparing test results derived from the separate test pits; however, they should be considered in evaluating rates of reaction in the different test pits.

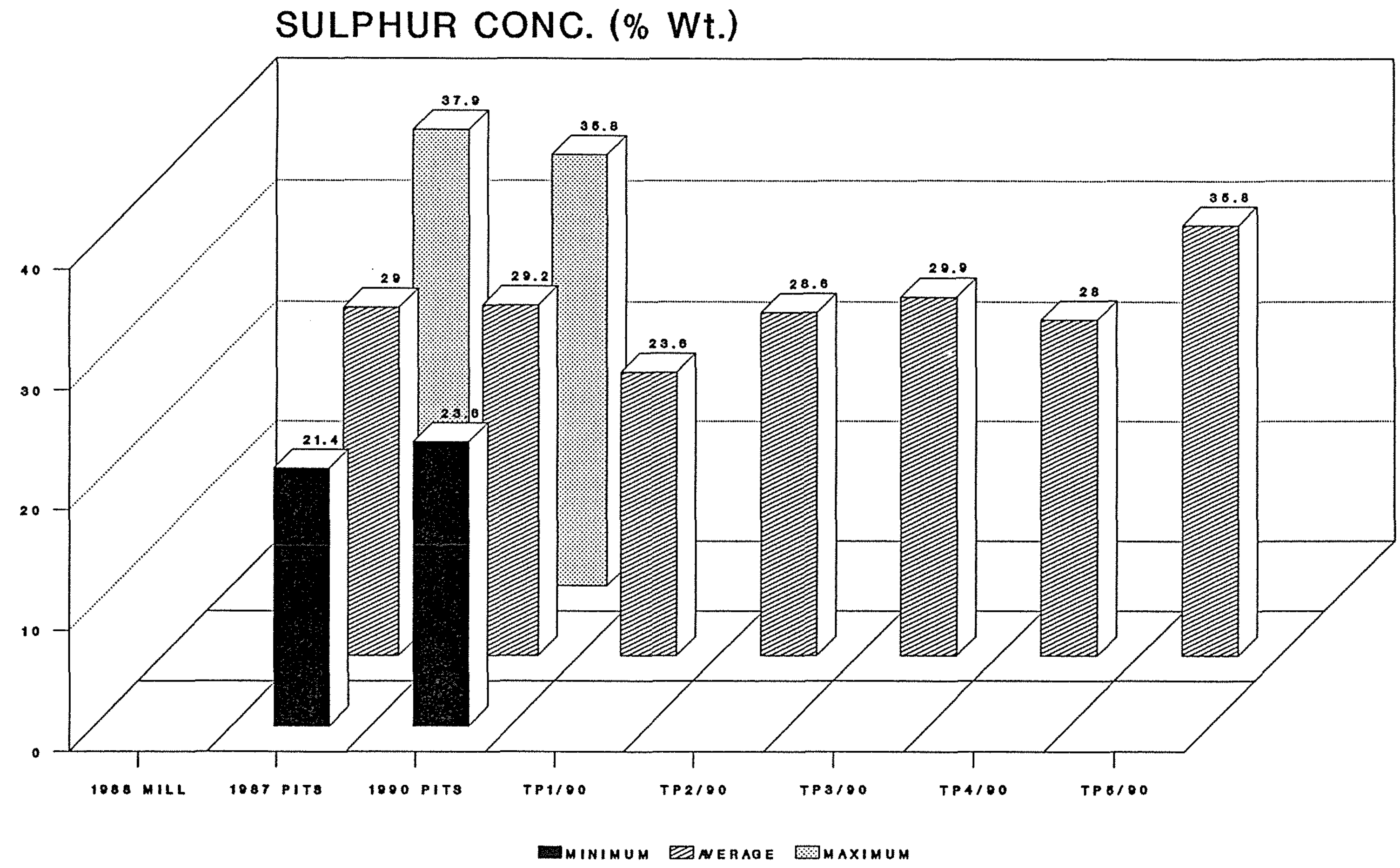
4.1.3 Lead Concentration in the Tailings Solids

A summary of the percent by weight lead concentration in the tailings solids is shown in Figure 4-3. Typical tailings, as represented by six monthly averages for 1988, indicate that the percent lead averages 0.67 and ranges between 0.46 to 0.76 percent. In 1987, the lead content of the tailings solids was not measured; however, in 1990, the lead content was found to be comparable to typical tailings. The average in 1990 was 0.54 percent by weight, and concentrations ranged between 0.36 and 0.76 percent.

A comparison of tail lead concentrations between pits, as shown in Figure 4-3, indicates considerable variability. Test Pit 2, with a lead concentration of 0.76 percent had the highest concentration in 1990. This concentration is within the range found in typical tailings, but is at the upper extreme of the range. Test Pit 4 and Test Pit 5 had concentrations of 0.44 and 0.36 percent by weight respectively. Both pits have concentrations that are slightly below the typical tailings lead range as derived from 1988 average monthly concentrations; however, the effects of the concentration differences should have minimal effect when considering metal leaching process. The solids lead concentrations in all cases represent sufficient sources, such that saturated dissolved lead solutions can be produced in an acid generating environment within the tailings. In summary, the lead concentrations will not be rate limiting with respect to lead metal loading within the tailings, and should have no affect upon the rates of reaction of acid generation. Thus, results from the different test pits are comparable.

Figure 4-2

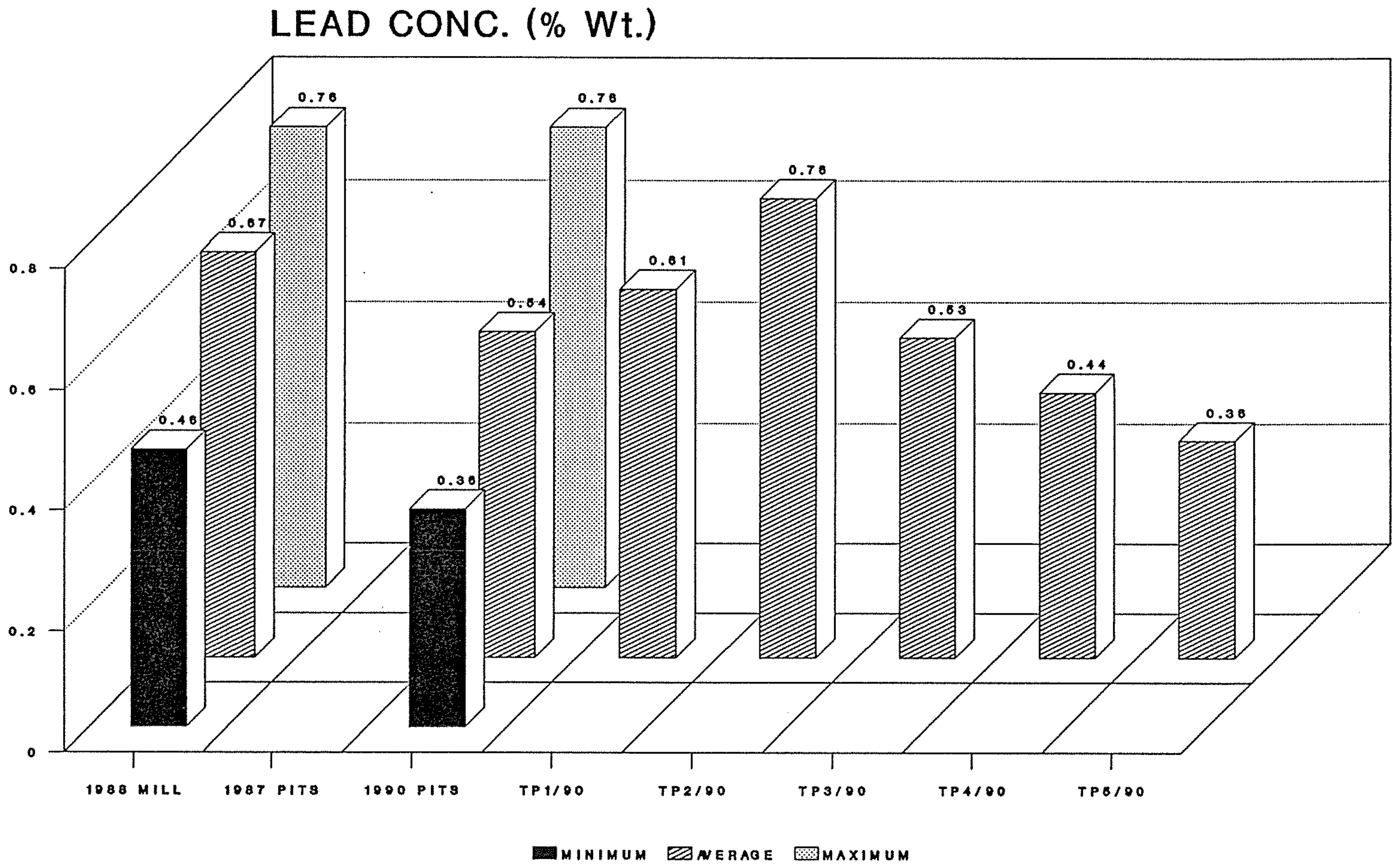
FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
SULPHUR CONCENTRATIONS



Sulphur not avail. for Mill Tails
Estimated at 30 Percent

Figure 4-3

FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
LEAD CONCENTRATIONS



Mill: Based on Ave. Monthly Tail Results
Calculated Using Daily Ave. Data

4.1.4 Zinc Concentration in the Tailings Solids

A summary of the percent by weight zinc concentration in the tailings solids is shown in Figure 4-4. Typical tailings, as represented by six monthly averages for 1988, indicate that the percent zinc averages 1.06 and ranges between 0.99 to 1.18 percent. These results are based upon six monthly averages calculated from daily averages. This statistical process tends to reduce variability; however, more confidence can be placed upon the average. In 1987, the zinc content of the tailings solids placed in the test facility averaged 1.31 percent and ranged between 0.36 and 4.44 percent. These results were based upon 19 grab samples collected randomly over a one month period. This type of sampling tends to be more informative into actual concentration variability; however, extremes can disproportionately affect the calculated average.

With a higher average zinc concentration, and larger zinc concentration variability, the 1987 tailings appears different from the typical 1988 tailings. However, if the tailings do have greater variability than is indicated in the 1988 tailings summary, then the 1987 test pit tailings are probably reasonably representative of typical Faro tailings with respect to zinc concentrations. In 1990, five samples of tailings solids were collected from the test pits and analyzed. The 1990 and 1987 solid zinc concentrations should be similar, considering the short time period since deposition. The average zinc concentration in the five test pit samples was 0.88, with a range of 0.58 to greater than 1 percent. These results, opposite of the 1987 results, averaged below the typical 1988 Faro average tailings zinc concentration of 1.06 percent by weight, and indicate that zinc concentrations within the tailings are most likely extremely variable. In summary, the test pit tailings, with respect to zinc concentrations, can be considered typical Faro tailings. Further, the test results indicate that the average zinc concentration in the tailings solids ranges from 0.88 to 1.31, with a variability extending from 0.36 to 4.44 percent.

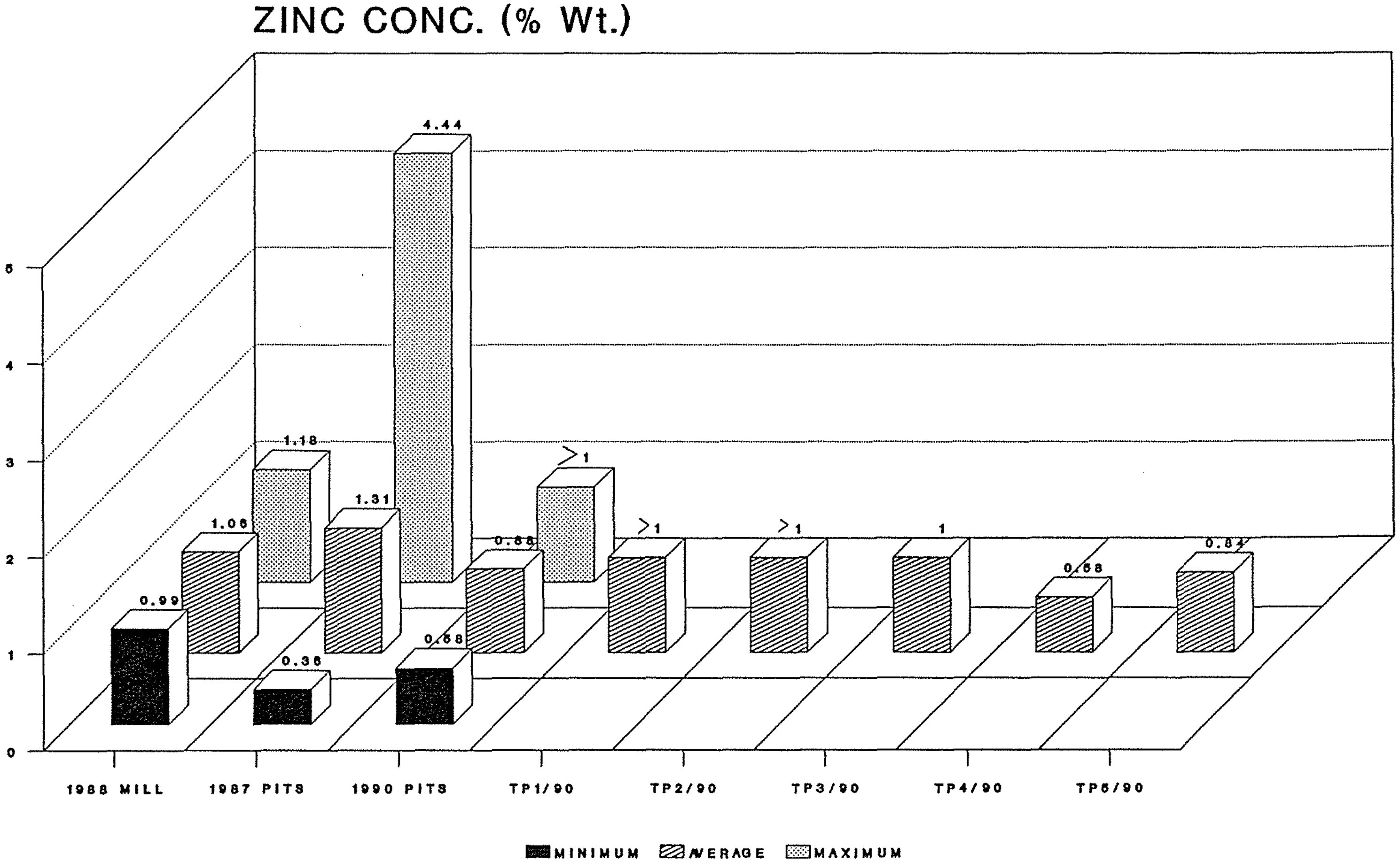
A comparison of tail zinc concentrations between pits and measured in 1990, are shown in Figure 4-4. As was the case with lead, the concentrations of zinc in the tailings solids do not affect the rates of reaction of acid generation. Also, the effects of the concentration differences should be minimal when considering metal leaching process, provided that the mass of solids zinc is a sufficient source such that saturated dissolved zinc solutions can be produced in an acid generating environment within the tailings. In each test pit, there is sufficient zinc, and thus the results from the different test pits should be comparable.

4.1.5 Calcium Concentration in the Tailings Solids

A summary of the percent by weight calcium concentration in the tailings solids is shown in Figure 4-5. In 1987, the calcium concentration of the tailings discharged into the test pits averaged 0.15 percent by weight and ranged between 0.08 to 0.21 percent. Lime additions in the concentrator mill during tailings placement into the test facility were within normal operational averages and thus, the test pit tailings are considered typical of Faro tailings with respect to calcium. Tailings samples collected in 1990 had a

Figure 4-4

FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
ZINC CONCENTRATIONS



Mill: Based on Ave. Monthly Tail Results
Calculated Using Daily Ave. Data

similar average of 0.24 percent, with a range of 0.17 to 0.35 percent. The calcium concentration range in 1990 was slightly smaller than in 1987.

With respect to variability between test pits, the maximum concentration of 0.36 percent by weight calcium was measured in Test Pit 1 and the minimum calcium concentration of 0.17 percent was measured in Test Pit 3. These differences are not large enough to preclude the validity of comparing test results derived from the separate test pits; however, they should be considered in evaluating rates of reaction in the different test pits.

4.1.6 The pH of Solution of the Original Tailings

As a final confirmation of the similarity of the test pit tailings to typical Faro tailings, and of the validity of comparing results, the pH of tailings solution during October, 1987 was measured. This parameter was perhaps the most constant of all the parameters measured in the tailings discharge during tailings placement. The average pH was 9.6 with a standard deviation of 0.2. The pH ranged between 9.4 and 10.2. The relative stability of tailings solution pH is to be expected, as this is a concentrator controlled parameter. Lime additions are varied in response to the type of ore feed and to the concentration and form of the sulphides and iron in the ore.

4.2 Acid Generation Potential of the Test Pit Tailings

Acid/ base accounting tests have been performed on tailings samples collected in 1987, 1989, and 1990. Test results were presented in Table 3-8. A summary of the Net Neutralization Potential (NNP) of the tailings solids is presented in Figure 4-6 (note all values are negative).

As shown, the NNP of the tailings in 1987 averaged -865 kg $CaCO_3$/ tonne with a range between -695 to -1182 kg/ tonne. In 1990, the NNP of the tailings samples averaged -889 kg $CaCO_3$/ tonne with a range of -706 to -1106 kg/ tonne. These very low NNP's indicate that these tailings have the potential to be very major acid generators. In other terms, the tailings have a high sulphur content, with a very low alkaline neutralization potential. The alkaline neutralization potential is less than 3 percent of the acid generation potential.

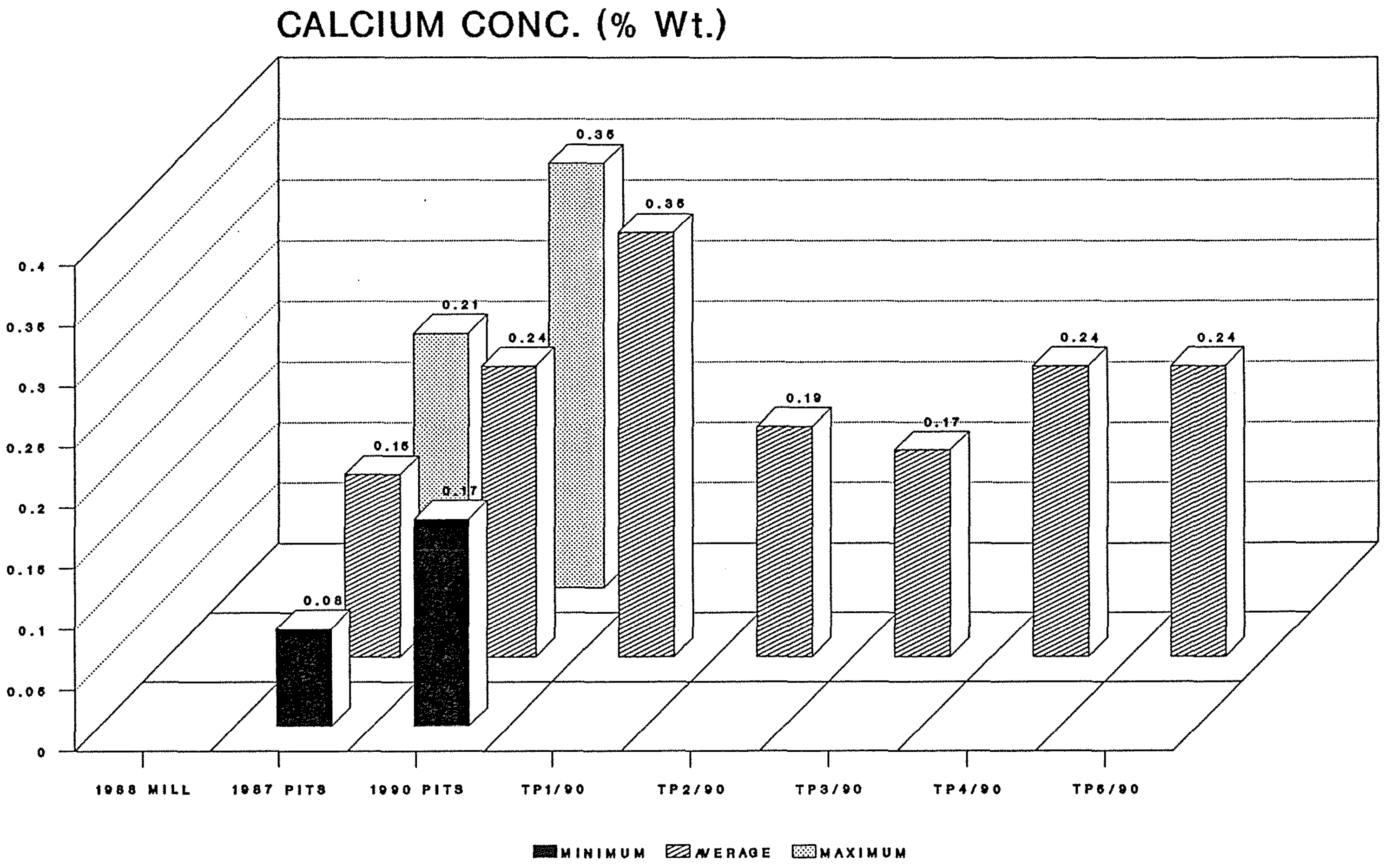
As a further test to the acid generating and metal loadings potential of the tailings, standard shake flask tests were performed on a tailings sample from each test pit in 1990. The results were presented in Table 3-9. These results are summarized in Figure 4-7.

As shown, the solution extracts decanted from the tailings samples after a 24 hour period had average iron concentrations of 0.9 mg/ L; average zinc concentrations of 7.6 mg/ L; average lead concentrations of 10.27 mg/ L; average calcium concentrations of 22.6 mg/ L; and average sulphate concentrations of 85 mg/ L.

Figure 4-5

FARO TEST FACILITY

CHEMISTRY OF TAILINGS SOLIDS
CALCIUM CONCENTRATIONS



Mill: Based on Ave. Monthly Tail Results
Calculated Using Daily Ave. Data

The average pH of the solution in the test flasks after 24 hours was 4.8. Both the NNP and the shake flask tests indicate elevated acid generation and metals leaching potential for the Faro tailings.

4.3 Factors Controlling Acid Generation

As shown above in Section 4.2, the Faro tailings contains a sufficient quantity of reactive sulphides, with a limited amount of neutralizing alkaline reactants, such that the net acid generating potential of these tailings is high. Given this acid generating potential, two factors are considered primary controls of the rate of acid generation, namely, temperature and the availability of oxygen. Both of these factors, to some degree, can be influenced by tailings cover materials. The extent of influence is controlled by the type of cover, particularly its physical properties which reduce oxygen availability and its ability to withstand long term erosion forces. Temperature, which directly controls chemical rates of reaction, is to a large extent a site specific factor. Temperature effects are a function of cover thickness, cover composition and cover grain size distribution.

The volume of tailings susceptible to acid production is limited to some extent by the characteristics of the tailings and tailings impoundment. Fine grained saturated tailings located below the water table have little exposure to oxygen and are therefore not subject to oxidation. The availability of oxygen is less in fine grained tailings as opposed to coarse grained tailings located in the unsaturated groundwater zone. To allow isolation of the affects of cover materials on the rates of oxidation and of acid generation in the tailings, each test pit was filled with tailings of similar nature, as demonstrated in Section 4.1 above.
In the Faro covers test facility, the temperature variation of the tailings with depth was measured monthly.

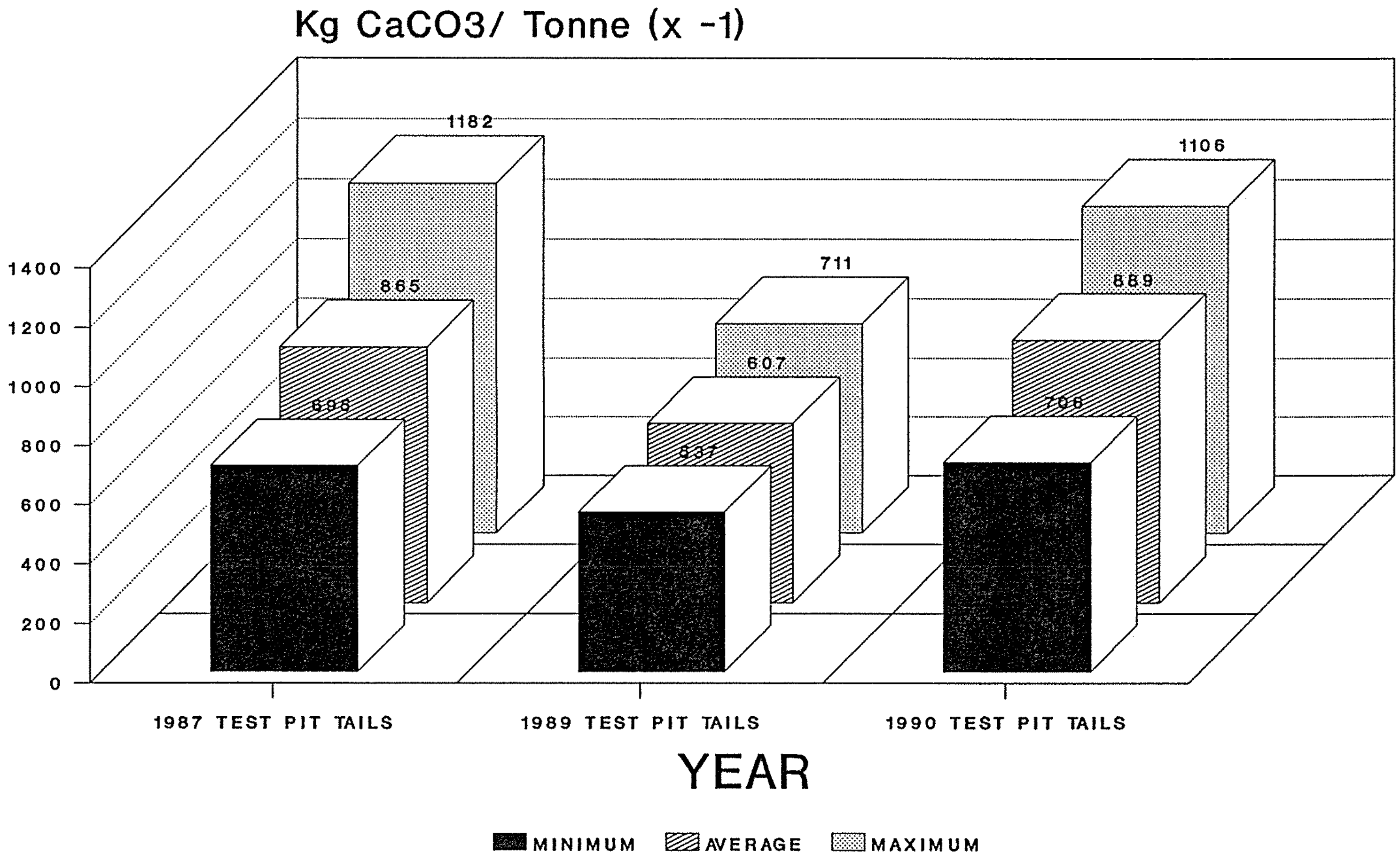
Direct oxygen concentrations in the unsaturated soil pores were measured at a minimum of once a year. (Technical difficulties were frequently encountered when using the oxygen concentration analyzer). It is the intent of this discussion to briefly review temperature and oxygen measurements, indicating differences in measurements in the tailings in pits with differing cover materials. Following this, the pore water chemistry will be reviewed, with the objective of identifying pits in which the rates of oxidation and acid generation appear different. In this manner, it is intended to demonstrate that the some of the covers are affecting acid generation rates, either through temperature or oxygen reduction control, or both.

4.3.1 Temperature

The temperature of the tailings is an acid generation rate controller, as illustrated in Figure 4-8. In simple terms, cold temperatures inhibits acid generation, and conversely warm temperature accelerate the process. The first stage of acid generation (as defined in Figure 4-9) is essentially a first order chemical reaction. Once Stage II and Stage III acid generation occurs, the chemical process becomes one of consecutive reactions. However, in all of these rate stages, temperature affects the rate of product formation. In general terms, the reaction rate doubles for each 10 degree Celsius rise in temperature.

Figure 4-6

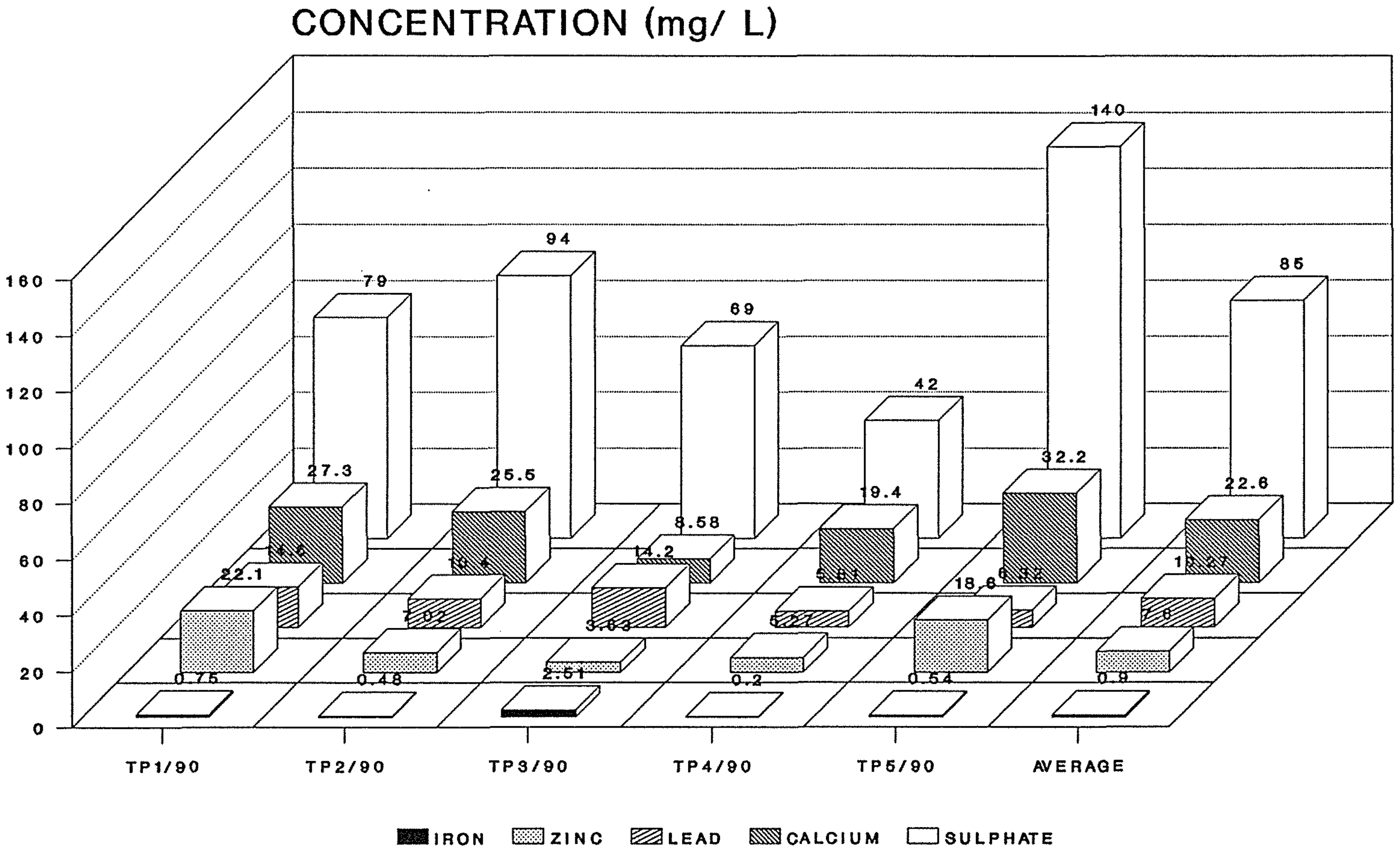
FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
NET NEUTRALIZATION POTENTIAL



All Net Netralization Potentials Shown Are Negative (ie. Acid Generation)

Figure 4-7

FARO TEST FACILITY
CHEMISTRY OF TAILINGS SOLIDS
SHAKE FLASK TESTS



Concentration in Solution Extractant
From Tailings Samples

As an example of the affects of temperature, a first order reaction is illustrated below. A first order reaction equation can be expressed as:

$$C = C_0 * 10^{-(k1)(t)}$$

where C_0 is the initial concentration,
k_1 is the rate constant for the reaction, and
t is time.

The change in rate constant with temperature can be expressed by the Arrhenius equation as follows:

$$\ln (k_2/ k_1) = (E_a * (T_2 - T_1)/ (R * T_2 * T_1)$$

where k_1 and k_2 are the rate constants at temperatures T_1 and T_2 respectively, and with temperature expressed in kelvins,
R is the universal gas constant, and
E_a is the activation energy

The reactions in the tailings at Faro occurs over a small range near ambient temperatures, and thus $(E_a)/ (R * T_2 * T_1)$ is considered equal to a constant O. Therefore, the change in rate constant can be expressed as:

$$k2/ k1 = e^{O(T2 - T1)}$$

With a O constant between 0.05 and 0.14 for most reactions occurring within temperatures ranging between 4 and 30 degrees Celsius, it is evident that the reaction rate approximately doubles for each 10 degree Celsius rise in temperature.

At Faro, one of the objectives of the tailings covers test facility was to investigate the effects of various cover types on tailings temperature regimes. To facilitate this, two uncovered control areas were established; site TP7 is located in the original tailings impoundment and contains pre-1976 tailings; and control test pit TP3 is located in the tailings covers test facility and contains tailings deposited in 1987. Temperature profiles collected from covered test pits during various seasons are compared to these controls to delineate temperature effects resulting from overlying covers.

Summaries of the temperature profile results for each test pit are presented graphically in Figures 4-10 to 4-15. Control area temperatures are reviewed below, together with covered test pit temperatures.

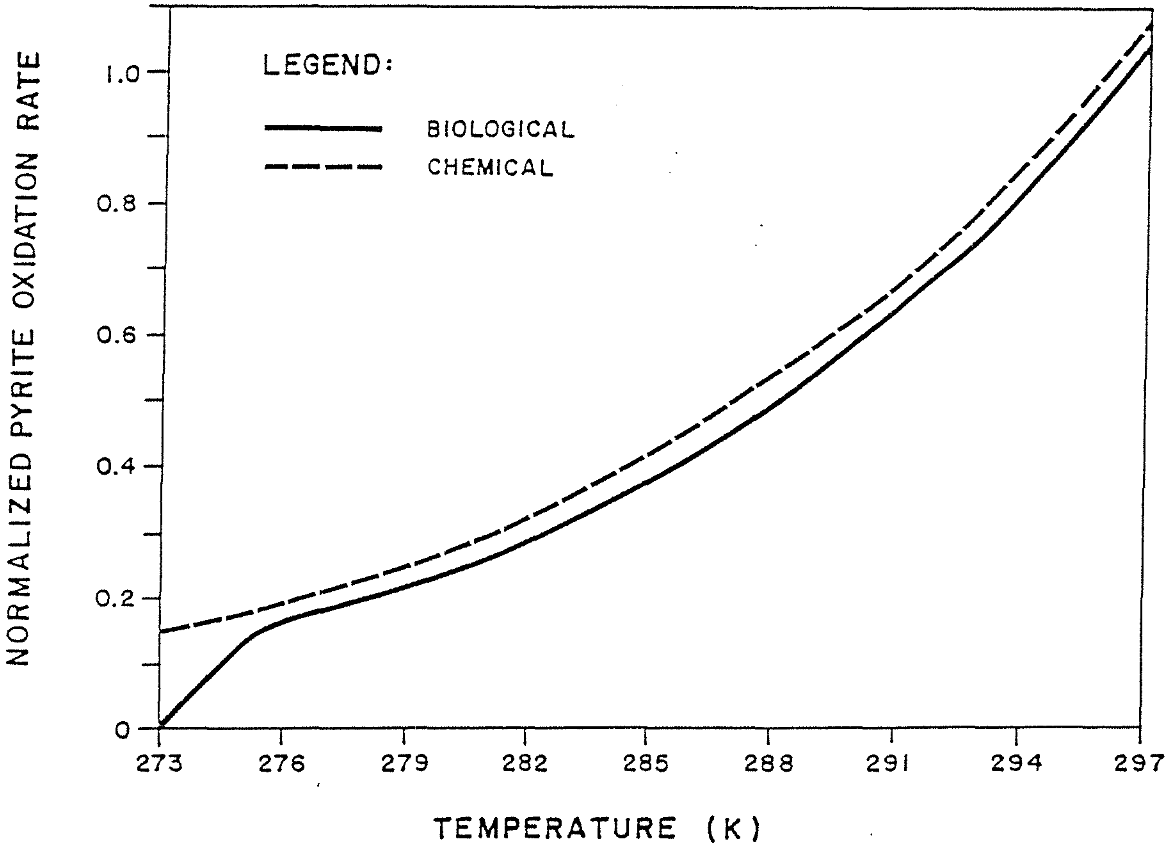
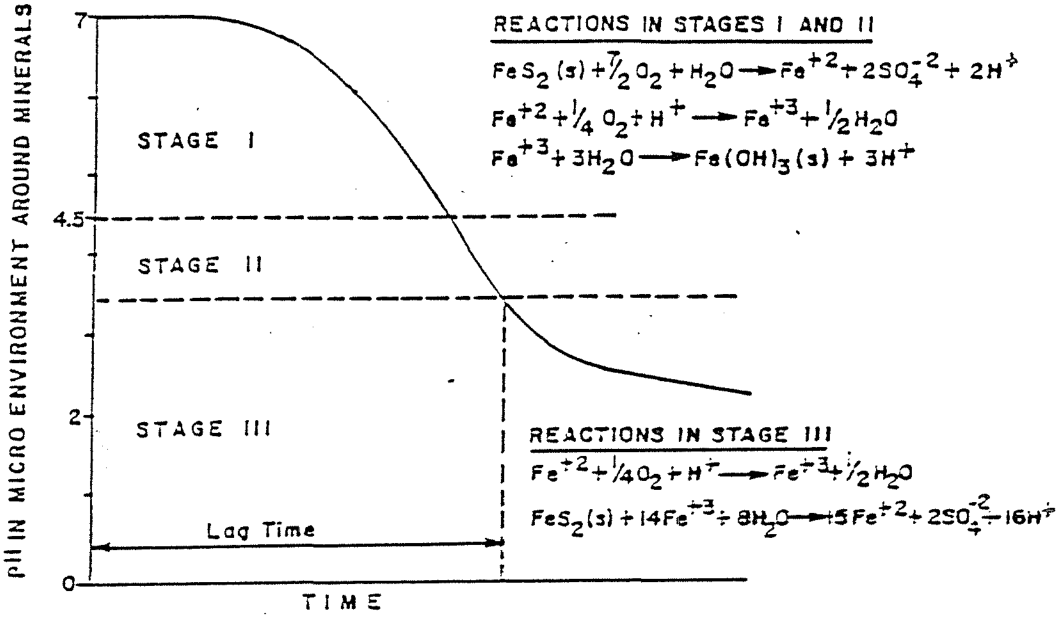


Figure 4-8
EFFECT OF TEMPERATURE ON BIOLOGICAL AND CHEMICAL OXIDATION RATE
(after Knapp, 1987)

Figure 4-9

STAGES IN THE FORMATION OF ACID MINE DRAINAGE



REACTIONS IN STAGES I AND II

$FeS_2(s) + \frac{7}{2}O_2 + H_2O \rightarrow Fe^{+2} + 2SO_4^{-2} + 2H^+$

$Fe^{+2} + \frac{1}{4}O_2 + H^+ \rightarrow Fe^{+3} + \frac{1}{2}H_2O$

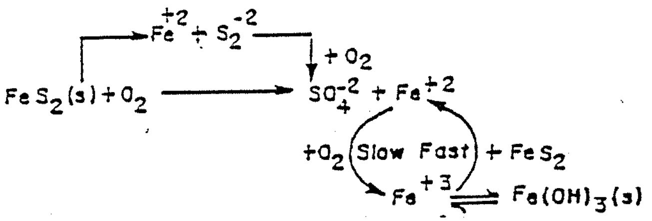
$Fe^{+3} + 3H_2O \rightarrow Fe(OH)_3(s) + 3H^+$

REACTIONS IN STAGE III

$Fe^{+2} + \frac{1}{4}O_2 + H^+ \rightarrow Fe^{+3} + \frac{1}{2}H_2O$

$FeS_2(s) + 14Fe^{+3} + 8H_2O \rightarrow 15Fe^{+2} + 2SO_4^{-2} + 16H^+$

OVERALL PROCESS (Stumm and Morgan, 1981)



FORMATION OF ACID MINE DRAINAGE FROM PYRITE OXIDATION

Original Tailings Control Area: (TP7)

Thermister readings indicate large yearly fluctuations in temperatures with depth. Tailings are thawed to a depth of 2.0 metres by the end of May and to 4.0 metres from June through to the end of October. The depth of 4.0 metres appears to be the extent of thaw. It should be noted that these tailings are located within the unsaturated zone.

By mid-summer, surface temperatures between 15 to 17 degrees C. were measured. Temperatures below a depth of 1.0 metre peak at between 4.0 to 6.0 degrees C. Fall cooling profiles appear to be hysteretic, as compared with summer warming. As temperatures decrease at the surface, the temperature gradient with depth slowly shifts towards 0.0 degrees C. Constant temperatures were measured at depth as this process occurs.

Control Test Pit: (TP3)

The temperature gradient within the tailings of the control test pit are similar to the gradients found in the Original Tailings Control, except that the temperature gradients are shifted to the left. Temperature extremes within the depth profile are reduced by 1.0 degree C. in the spring and fall, and by as much as 5.0 degrees C. in the summer. It is presumed that the pit environment is slightly more protected than the tailings impoundment area, and because of the physical configuration of the test pits, insulating snow and spring run-off water are more persistent on test pit tailings than is actually the case on the in-situ tailings located in the old tailings impoundment. It should also be noted that the wetter, finer tailings in the test pits will have a greater thermal coefficient than the coarser, drier tailings located at the in-situ test site (TP7).

It should be noted that the control test pit is frozen by the end of October. This differs from the Original Tailings Control, which retains an unfrozen zone (at a temperature of 1.0 degrees C.) for a depth of between 1.0 to 3.5 metres.

Saturated and Unsaturated Composite Covers Test Pits: (TP1 and TP4)

These two pits show the most noticeable change in temperature profiles in tailings as a result of the placement of covers. The composite covers, approximately 1.5 metres thick, appear to act as efficient isolators, and decrease the rates of heat conductance into and through the tailings.

The period during which the tailings are thawed is reduced in both cases by two months. The tailings remain frozen during both May and June. Therefore, chemical activity should be limited to the unfrozen months of June, July and August. Further, near surface temperatures in the tailings are much lower than in the uncovered tailings. Temperatures within the covered tailings did not exceed 6 degrees C. Maximum temperatures in the control tailings ranged from 9 to 10 degrees C. These reductions in temperature maximums during the summer months could result in a reduction in the rate of chemical reaction within the tailings by as much as 50 percent. More significantly, with reference to Figure 4-8, biological oxidation could be severely restructed under such temperature regimes. Biological reactions, unlike chemical reactions, shut down completely at zero degrees celcius. Further, once tailings temperatures increase above zero, it is considered that a lag time occurs prior to restoration of biological activity and oxidation. If the covers reduce the period during which the tailings temperatures are above zero degrees celcius, there may not be sufficient time for biological activity to reactivate. It is important to note that temperatures between zero and four degrees celcius are also not ideal for biological activity. In the unsaturated test pit (TP4), temperature depression during the summer months appears to be slightly better than is the case with test pit (TP1).

During the autumn, the insulating value of the covers becomes less favourable as heat loss from the tailings is impeded. September temperatures in near surface tailings range from 3 to 6 degrees C. Near surface temperatures in the control range from 2 to 2.5 degrees C.

Till Covered Test Pit: (TP5)

This cover does not appear to have any appreciable effects on tailings temperatures in the spring or summer. In the fall, temperature gradient reductions lag by approximately 1.0 degree C. It should be noted that this cover is only 0.5 metres thick, whereas the composites are 1.5 metres thick. It is possible that similar insulating effects would be achieved with a similar thickness of till.

Organic Covered Test Pit: (TP2)

DRAFT

During the spring and summer, this cover appears to result in a 3.0 to 6.0 temperature suppression. Lower temperatures should reduce chemical reaction rates; however, this cover did not impede tailings thaw in the spring to any appreciable extent. Tailings were unfrozen from May through to the end of September.

In September, cooling is impeded, with the temperature profile with depth lagging the control profile by 1.5 to 2.5 degrees C.

In summary, in uncovered tailings, near surface tailings temperatures fluctuate with ambient air temperatures. In the winter, temperatures of minus one to minus five degrees Celsius were recorded. In the summer, near surface temperatures ranged from 12 to 20 degrees Celsius. With depth in the tailings, temperatures decrease. In the winter, temperatures are fairly uniform and similar to the near surface temperatures of minus one to minus five degrees Celsius. During the summer, temperatures increase up to ten degrees Celsius to a depth of two metres.

In contrast, tailings with composite covers (TP1 and TP4), and an organic cover (TP2), display a much reduced temperature variation with changes in season. Winter temperatures are equivalent to the temperatures found in uncovered tailings. However, summer temperatures, even near the tailings surface, are much less than the temperatures in the uncovered tailings. In these covered tailings, near surface temperatures ranged from five to nine degrees Celsius. The till covered tailings (TP5) did not display temperature profiles significantly different than those in the uncovered control tailings.

Reduction in tailings temperature throughout the year can have several favourable effects with respect to acid generation. Lower temperatures reduce the rate of chemical reaction and are less favourable to the biological growth of T. Ferrooxidans. Bacterial action and biological oxidation could therefore be inhibited. Temperature profiles indicate that the two composite covers and the organic cover are depressing temperatures in the near surface tailings in the summer.

4.3.2 Oxygen/ Carbon Dioxide Concentrations

In the unsaturated zone of the tailings, the depletion of oxygen with depth is in part a function of two processes: the oxidation rate of sulphides; and the rate of oxygen diffusion into the tailings. Oxygen diffusion is in turn dependent on temperature and the permeability of the tailings.

The carbon dioxide concentration profiles are considered to reflect the chemical reaction rates of carbonates. Products of carbonate breakdown are gypsum and carbonic acid. Deposits of salts (or hardpan) are found in the old tailings test area. Depending on partial pressures within the pore spaces of the tailings, carbonic acid can then form carbon dioxide.

Oxygen and carbon dioxide concentration measurements are shown in Table 3-3. Concentrations have been measured on three occasions: October, 1989; February, 1990, and June, 1990.

In the pre-1976 tailings of test area TP7, the oxygen and carbon dioxide concentrations measured in June 1990 are dramatically different from previous measurements. The 1990 measurements display a sharp reduction in oxygen with depth, and a high relatively uniform concentration of carbon dioxide with depth. In June 1990, measurements indicate that the tailings oxygen was depleted from a surface concentration of 20.8 percent to a concentration of 0.2 percent at 1.5 metres and greater; while in October 1989 the tailings oxygen was depleted to 19.7 percent at 1.5 metres and greater. Carbon dioxide measurements were also very different in 1990 and 1989, with the 1990 measurements averaging in the 4700 ppm's from a depth of 0.30 metres and greater; and the 1989 measurements averaging in the 50 ppm's from 0.30 metres and below.

The oxygen/ carbon dioxide gas analyzer has undergone a series of technical problems, and the differences in the measurements shown above are considered a reflection of these difficulties. Another possibility, however, could be that the degree of saturation of the tailings was considerably different between the sampling periods, possibly as a result of a precipitation event occurring prior to one sampling event and not the other. Oxygen diffusion into dry, unsaturated coarse tailings should be greater than in partially saturated tailings. Hence, the rate of oxygen depletion with depth should be considerably less in the drier tailings. Another possibility is that oxygen depleting reactions, in October, 1989, were shut down due to temperature. In the test pits, differences between the 1990 and 1989 measurements are not evident, thus providing some indication that the gas analyzer was functioning properly.

In the test pits, the June 1990 measurements of oxygen and carbon dioxide were similar to those taken in 1989. However, like these previous measurements, an oxygen depletion pattern with depth is not evident. Similarly, the carbon dioxide profiles do not as yet indicate interpretable changes with depth.

The planned frequency for measuring oxygen and carbon dioxide profiles was greater than the actual number of sampling events, due mainly to technical problems encountered with the gas analyzer. Further, without a greater number of measurements, it is not possible to determine if measurements are representative of actual field conditions. In summary, it is not possible with the present data to derive oxygen depletion trends within the tailings in either the control plots or in the covered test pits; or, to make comparisons of affects different covers have on oxygen availability to underlying tailings.

Figure 4-10

TEMPERATURE PROFILE
TEST PIT TP7

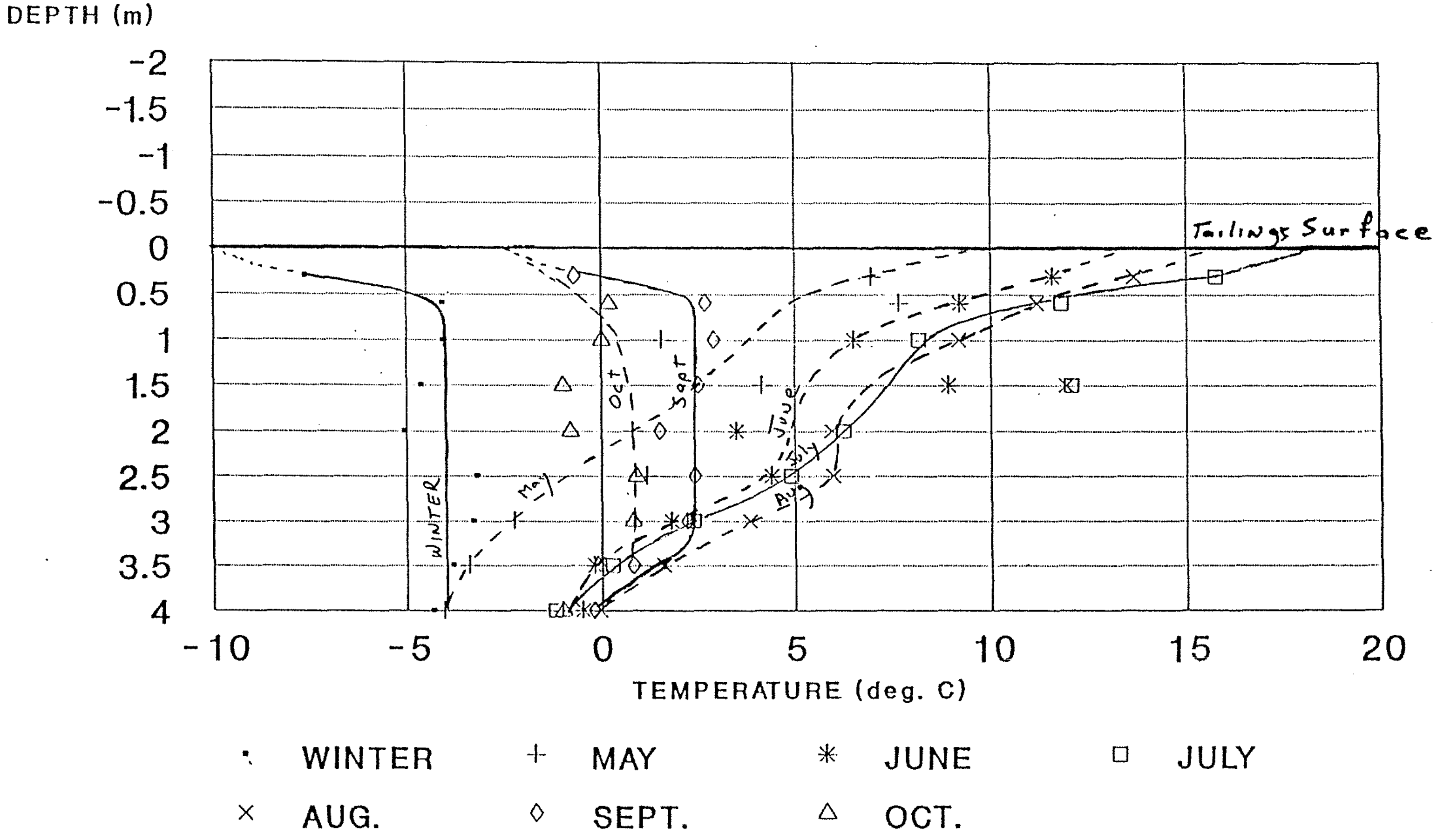


Figure 4-11

TEMPERATURE PROFILE

TEST PIT TP3

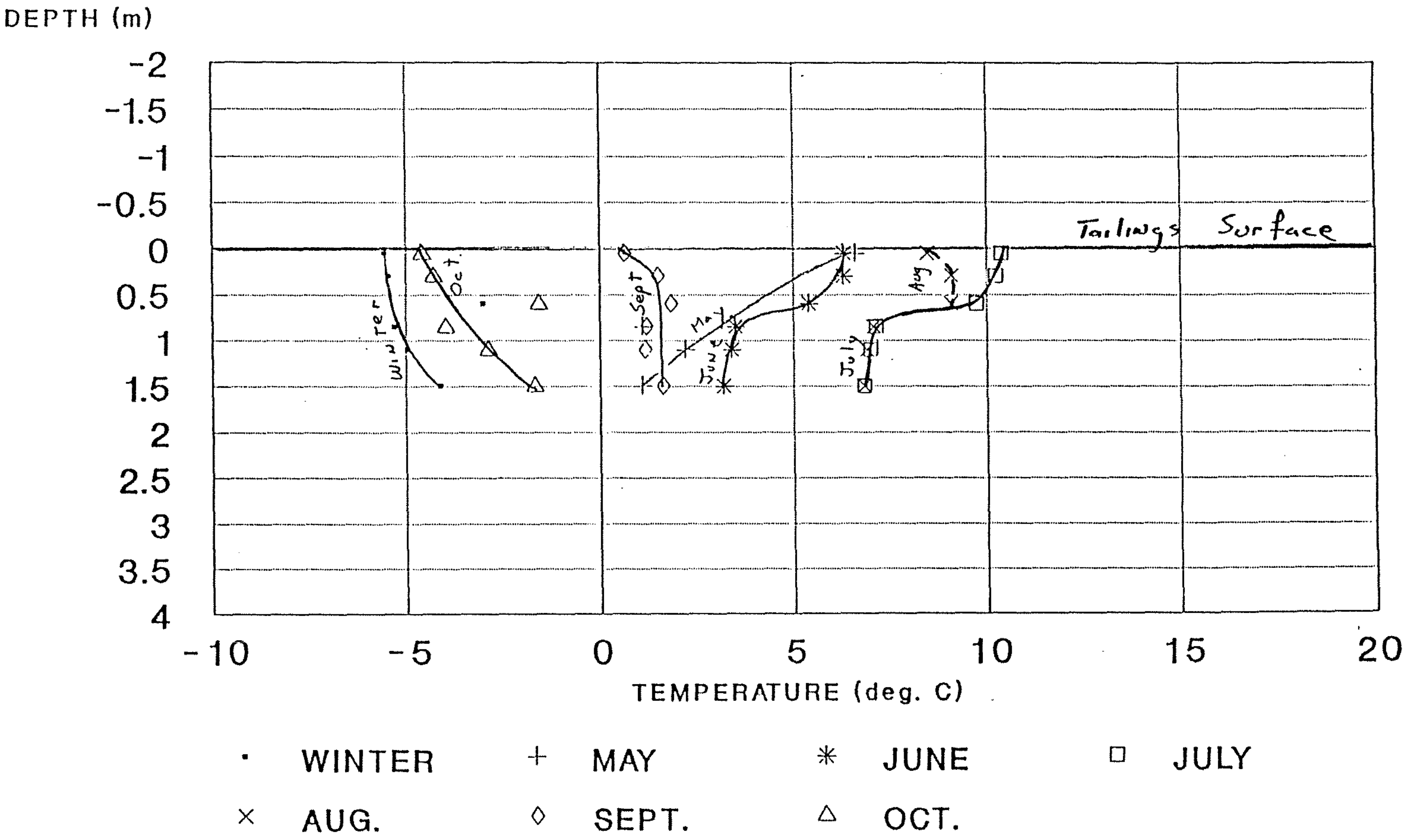


Figure 4-12

TEMPERATURE PROFILE

TEST PIT TP1

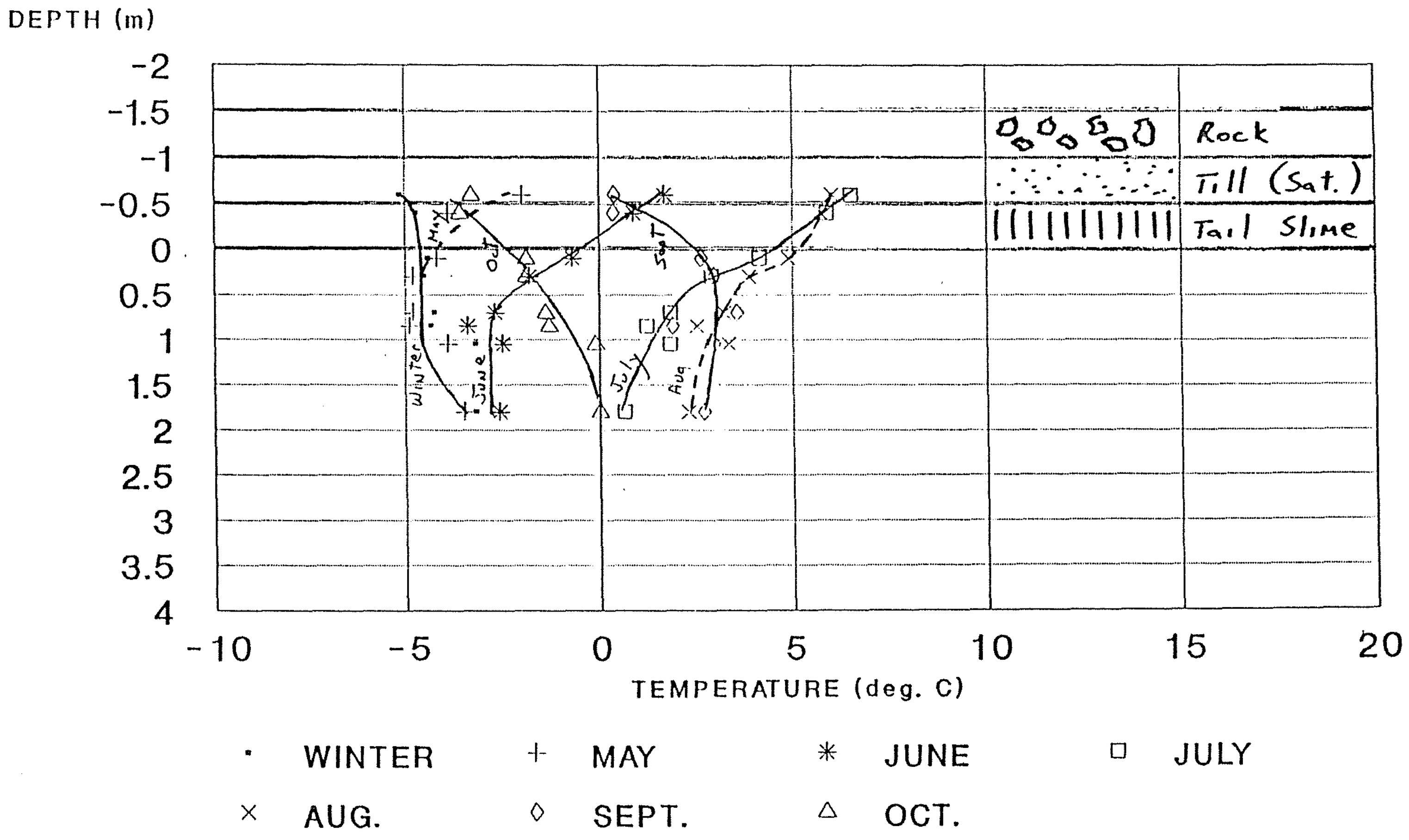


Figure 4-13

TEMPERATURE PROFILE

TEST PIT TP4

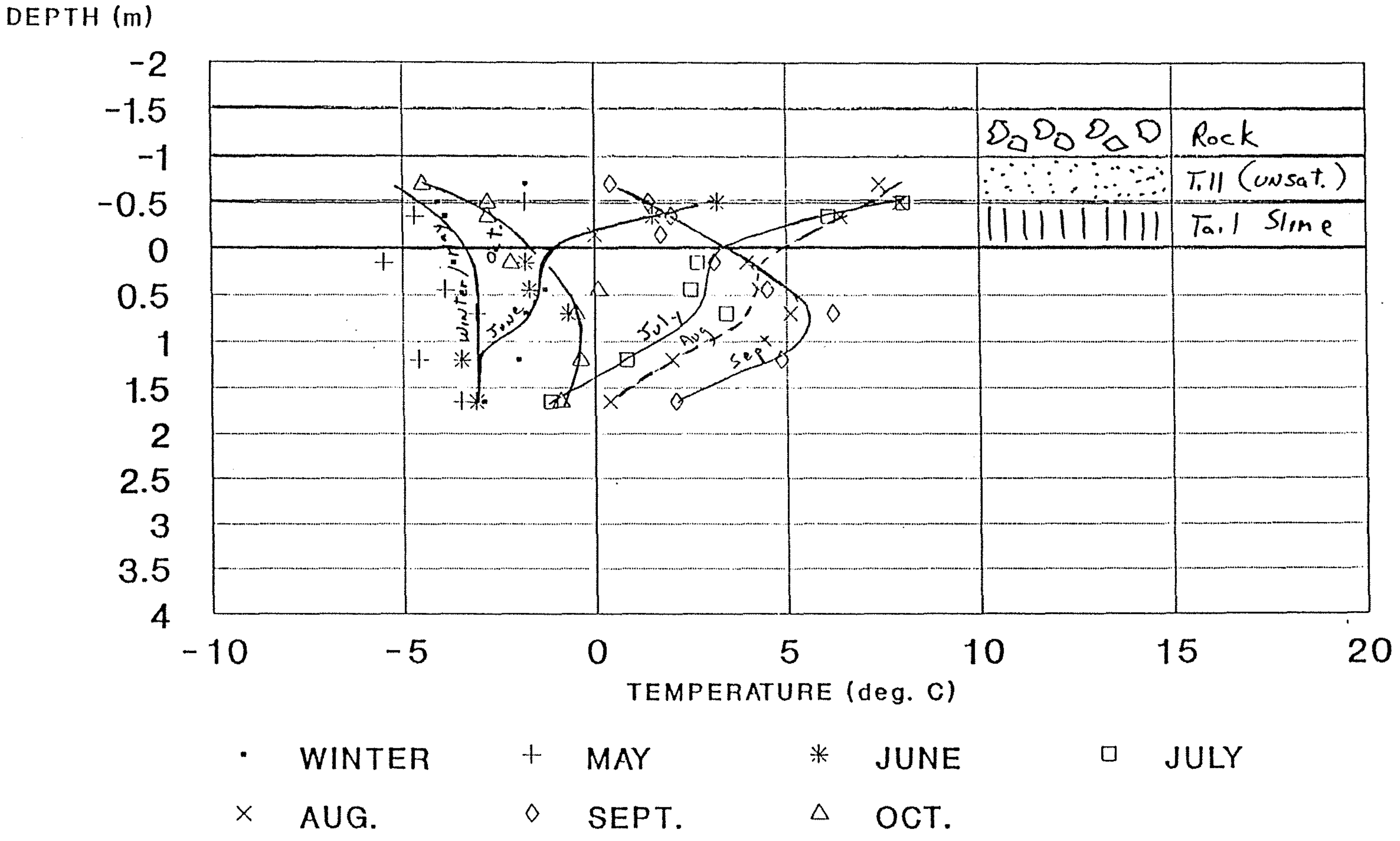


Figure 4-14

TEMPERATURE PROFILE

TEST PIT TP5

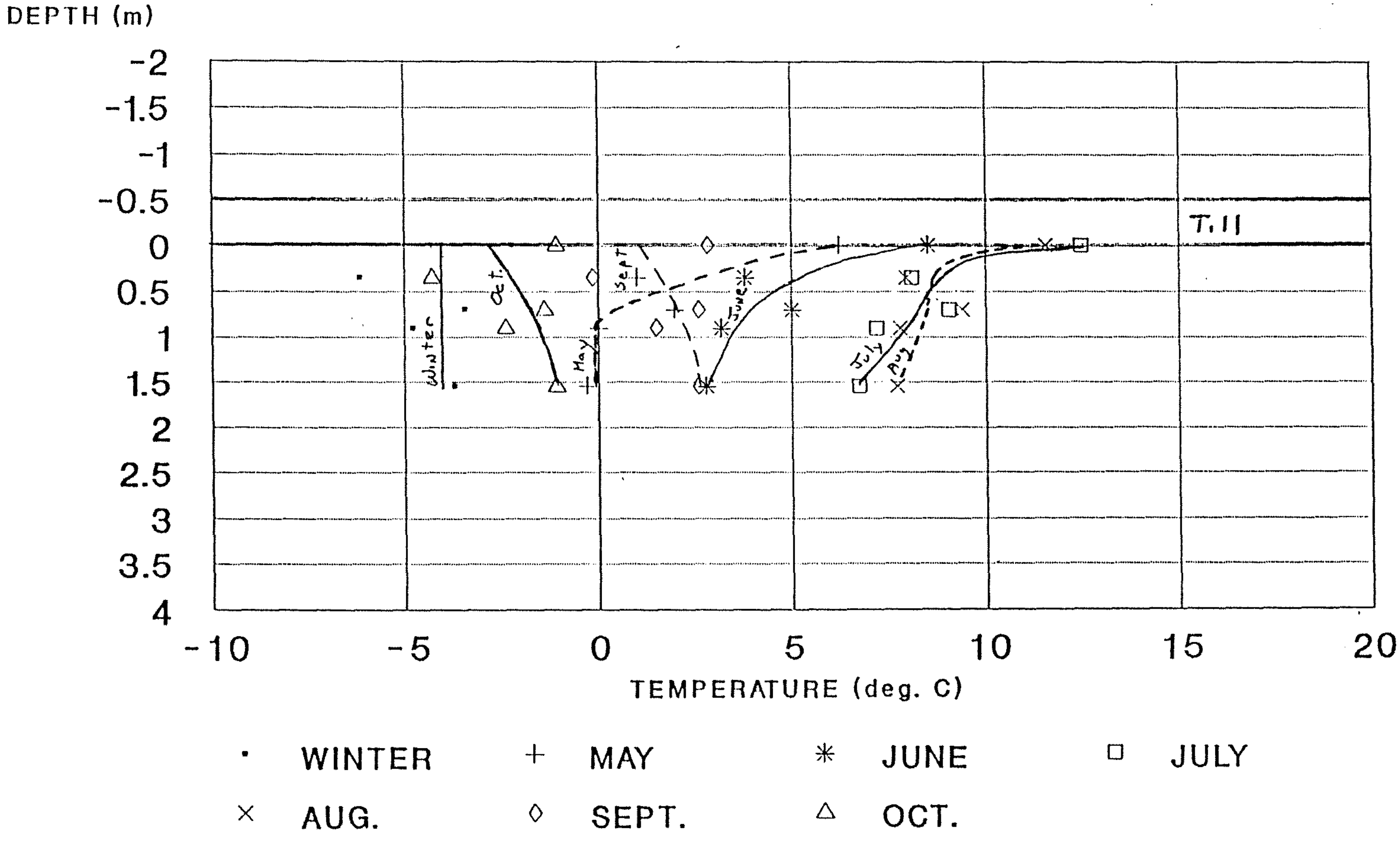
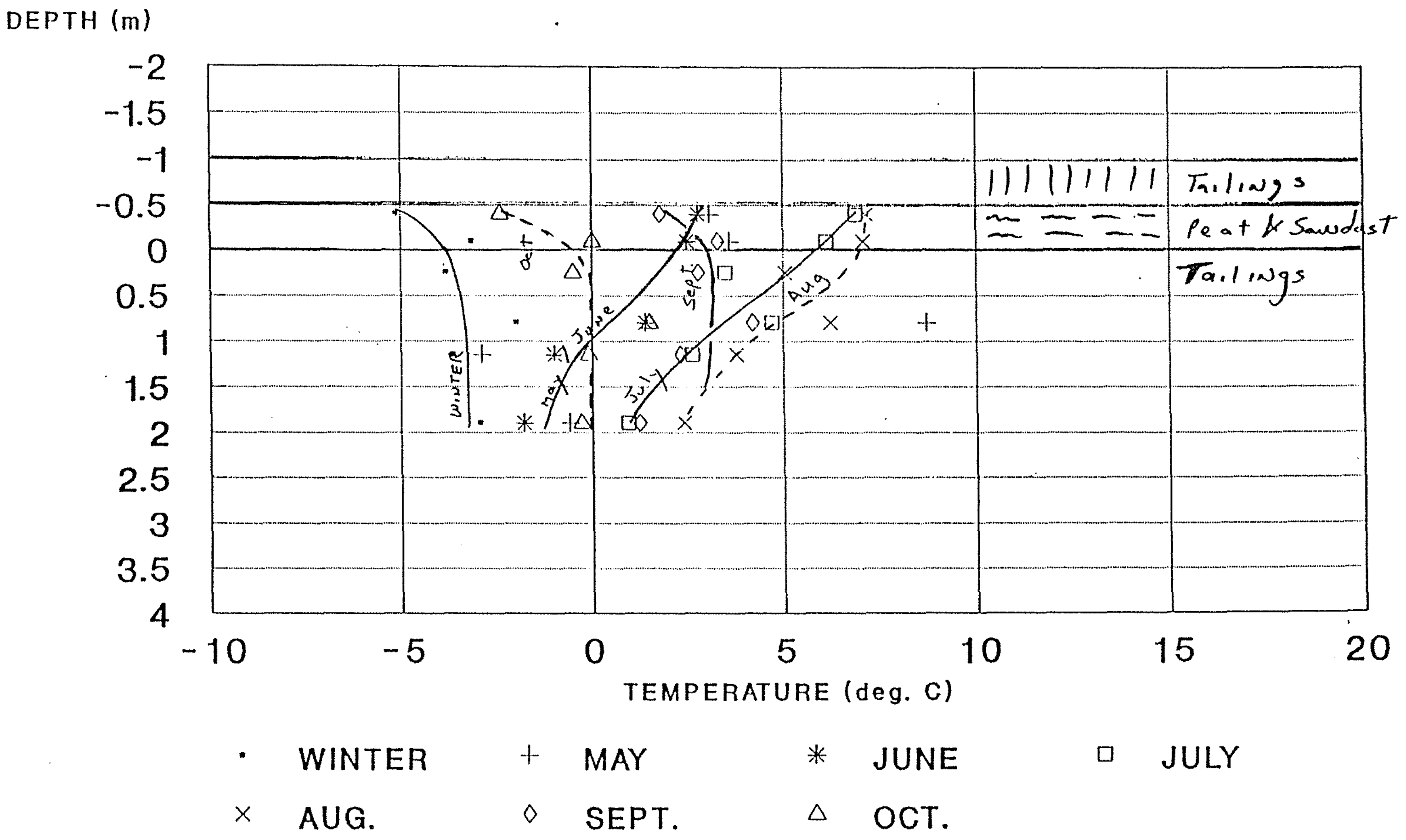


Figure 4-15

TEMPERATURE PROFILE

TEST PIT TP2



4.4 Pore Water Chemistry

4.4.1 Pore Water pH and Eh

The pH and Eh of tailings pore water are indicative, on a macroscopic scale, of the stage of acid generation of the tailings. In general, the tailings at Faro are discharged at an alkaline pH of approximately 9.6, as indicated by analysis of the pore water during placement in the test pits in 1987. During an initial period following the discharge of tailings from the mill, the tailings are primarily affected by the infiltration of rainwater at an approximate pH of 6.8. Rain water infiltration not only begins to flush metals from the tailings, but also begins to neutralize the alkaline buffering capacity of the pore water, thus lowering its pH of solution.

A summary of pore water pH and Eh changes with time are presented in Table 4-1 and the pH changes in each test pit over time are shown graphically in Figure 4-16. The results show that in each test pit, the initial pH of the tailings pore water in 1987 was approximately 9.6; by 1989, the pH in pore water extracted from shallow depths (<0.5 m) in each test pit was below 7.7 and by 1990 the pH in pore water extracted from shallow depth (<0.5 m) ranged from 6.2 to 7.4 and from intermediate depth (>0.5 to <2.0 m) the pore water ranged from 6.8 to 7.9. The range of pH values measured in 1990 indicate that the higher pH pore water typical of freshly discharged tailings has been flushed and/ or neutralized by rain water.

The various theoretical stages of acid generation within tailings are presented schematically on Figure 4-9. The reaction states of the tailings within the test pits, based upon 1990 pH measurements, are all within the early Stage I reaction.

An Eh-pH diagram is presented in Figure 4-17, and represents the Fe-H_2O system of the tailings during 1989 and 1990. At the Eh and pH representative of the tailings pore water in 1990, Fe^{2+} is the dominant species of dissolved iron, and $Fe(OH)_3$ is the stable solid phase. The stability field diagram further indicates that the test pit tailings are undergoing a stage I acid generation reaction with oxygen being the primary oxidant of the sulphides, and with ferric iron not as yet being a major contributor.

In early Stage I acid generation reactions, the measurement of pH is not very sensitive to small differences in the relative rates of reaction in the tailings of the different test pits. However, in the pore water extracted from tailings at shallow depths (0.0-0.5 m), the average pH in the saturated composite cover (TP1), the unsaturated composite cover (TP4), and the till cover (TP5) ranges between 7.0 to 7.4, while in the control test pit (TP3), the organic cover (TP2), and the water cover (TP6), the average pH ranges from 6.2 to 6.4. The maximum and minimum ranges display a similar trend. Thus, three covered test pits (TP1, TP4, and TP5) appear to have slower acid generating reaction rates as compared with the control test pit (TP3) and with the remaining two covered test pits (TP2 and TP5). It is considered that

TABLE 4-1: SUMMARY OF PORE WATER ANALYSIS
For pH and Eh Parameters

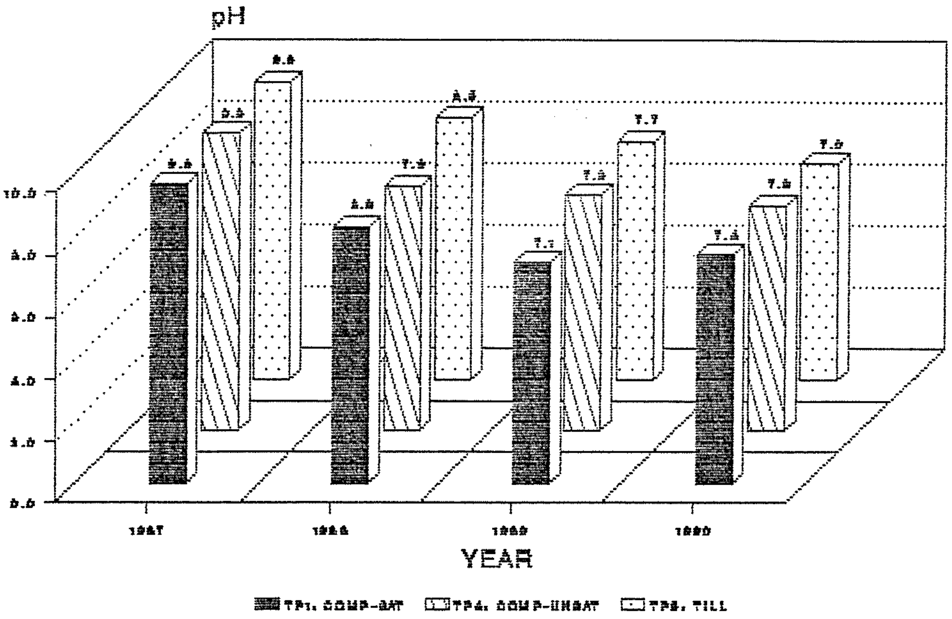
YEAR		pH (0.0 - 0.5 m)						Eh (0.0 - 0.5 m)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	7.4	6.3	6.2	7.3	7.0	6.2	345	407	443	349	319	-
	MAX	7.7	6.6	6.5	7.5	7.3	6.3	385	440	493	421	320	-
	MIN	7.1	6.0	6.0	6.5	6.3	6.0	283	361	343	290	318	-
	N	5	5	5	8	6	3	5	3	3	4	2	-
1989	MEAN	7.1	6.5	6.6	7.6	7.7	6.5	472	495	427	513	453	497
	MAX	7.3	6.8	6.3	7.8	7.9	6.7	545	518	436	661	553	588
	MIN	6.9	5.9	6.8	7.1	7.4	6.3	419	471	417	382	353	430
	N	4	3	2	5	3	3	4	2	2	4	2	3
1988	MEAN	8.3	7.1	7.8	7.9	8.5	7.2	343	363	220	333	595	384
	MAX	-	-	7.9	8.1	-	7.5	-	-	228	370	-	489
	MIN	-	-	7.7	7.3	-	6.3	-	-	211	295	-	279
	N	1	1	2	2	1	2	1	1	2	2	1	2
1987	MEAN	9.6	9.6	9.6	9.6	9.6	9.6	372	372	372	372	372	372
*	MAX	10.2	10.2	10.2	10.2	10.2	10.2	435	435	435	435	435	435
	MIN	9.4	9.4	9.4	9.4	9.4	9.4	310	310	310	310	310	310
	N	19	19	19	19	19	19	19	19	19	19	19	19

YEAR		pH (>0.5 - <2.0 m)						Eh (>0.5 - <2.0 m)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	7.6	7.9	7.0	7.7	7.9	6.8	311	364	350	284	330	-
	MAX	8.1	8.5	7.3	8.4	8.7	7.0	358	452	411	380	388	-
	MIN	6.7	6.3	6.2	6.4	6.5	6.2	239	308	282	210	230	-
	N	5	7	10	13	14	2	4	4	4	6	9	-
1989	MEAN	6.6	7.3	6.9	7.8	9.2	7.7	439	530	507	495	507	571
	MAX	6.8	7.7	6.9	8.6	9.8	8.0	490	584	597	563	546	584
	MIN	6.2	6.4	6.8	5.9	6.9	7.2	392	479	458	406	466	555
	N	7	5	4	10	10	3	6	4	3	7	10	3
1988	MEAN	8.3	8.9	8.2	8.7	9.4	8.8	346	452	469	460	610	410
	MAX	8.8	9.1	8.5	8.9	9.4	8.8	430	520	591	565	623	588
	MIN	6.9	8.5	7.1	6.1	9.3	8.8	217	383	347	325	602	210
	N	6	2	2	3	3	2	6	2	2	3	3	2
1987	MEAN	9.6	9.6	9.6	9.6	9.6	9.6	372	372	372	372	372	372
*	MAX	10.2	10.2	10.2	10.2	10.2	10.2	435	435	435	435	435	435
	MIN	9.4	9.4	9.4	9.4	9.4	9.4	310	310	310	310	310	310
	N	19	19	19	19	19	19	19	19	19	19	19	19

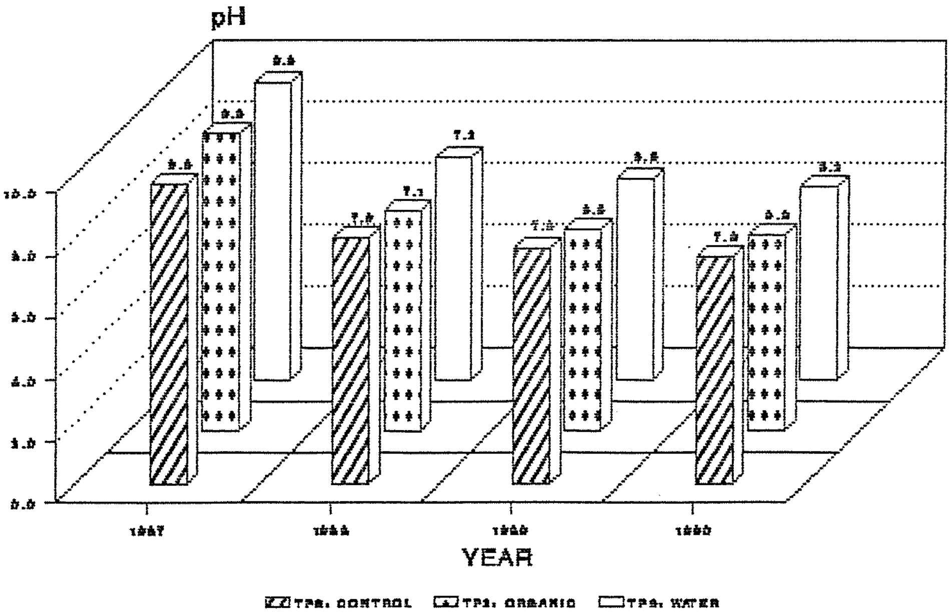
* 1987 Analysis on Mill Tailings being Discharged into Test Pits.

Figure 4-16

FARO TAILINGS TEST FACILITY
pH BETWEEN 0.0 AND 0.5 m



FARO TAILINGS TEST FACILITY
pH BETWEEN 0.0 AND 0.5 m



the composite (saturated and unsaturated) covers and the till cover are affecting either the temperature of reaction or the availability of oxygen to a noticeable degree.

4.4.2 Pore Water Alkalinity, Acidity and Calcium Concentrations

The alkalinity of the pore water is a measure of its capacity to neutralize acids, and is a result of the presence of hydroxides, carbonates and bicarbonates. Due primarily to salts of weak acids and strong bases, alkalinity acts as a buffer to resist a drop in pH resulting from acid addition. Acidity is a measure of carbon dioxide and mineral acidity in the water, or, is a measure of the amount of chemical needed to increase the pH to a specified level.

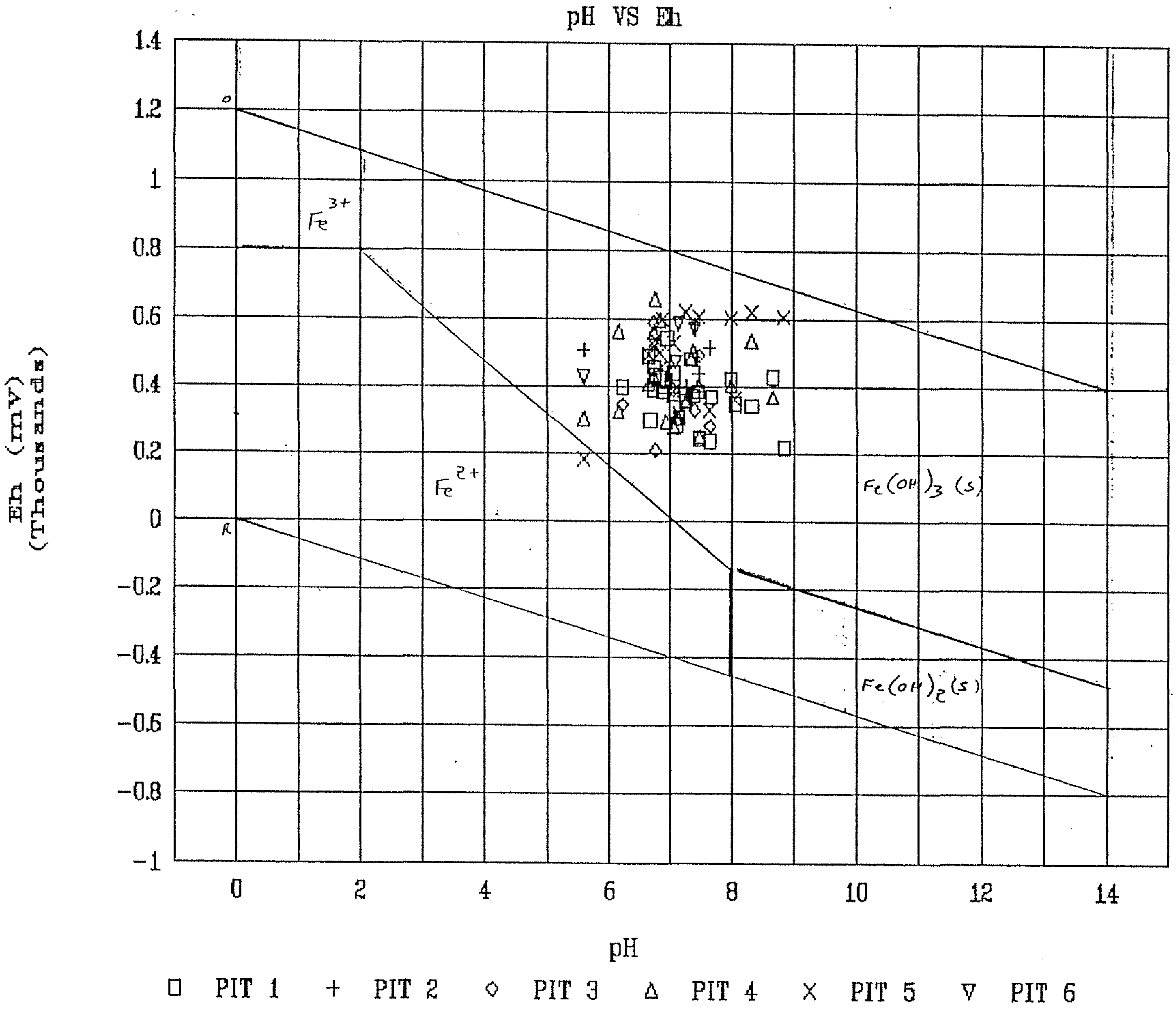
At Faro, the primary source of alkalinity is a result of liming which occurs during the ore concentrator process, prior to tailings discharge. The tailings, discharged as a slurry, has an alkalinity associated with the slurry water, and a source alkalinity in the form of unused carbonate solids associated with the tailings solids.

At the time of discharge into the tailings impoundment, or as was the case in 1987, into the test pits, the slurry water had a hydrogen-ion activity or pH of 9.6. It must be emphasized that pH is a measure of the intensity of the alkaline condition of the solution which is dependent upon the degree of solution ionization, and is not a measure of the total alkalinity of solution. The alkalinity of solution during tailings placement into the test pits in 1987 was not measured, however, as indicated by the decrease in pore water pH to an average pH of 7.0 in the following three years, it is most probable that much of the original tailings pore water has been displaced by rainwater infiltrating into the tailings. The solution alkalinity, measured in 1989 and 1990, therefore, is representative of alkalinity derived from the rainwater and from the carbonate source within the tailings solids.

As indicated in Section 4.1.5 above, there does not as yet appear to be a significant utilization of the calcium carbonate associated with the tailings solids. The average available calcium carbonate in the tailings solids, as derived from the percentage of calcium in the tailings solids, ranged between 0.08 to 0.35 percent in 1987 and between 0.17 to 0.35 percent in 1990. Thus, the calcium carbonate associated with the tailings solids is a potential present and future source of tailings pore water alkalinity. As noted in Section 4.2, however, this amount of calcium carbonate, when compared with the high percentage of sulphides in the tailings solids, represents a neutralization potential that is less than 3 percent of the acid generation potential of the tailings, and depending on the rate of acid generation, will be consumed at some future date.

Figure 4-17

FARO TTF



If, as proposed above, the rate of acid generation in the tailings is presently a Stage I reaction with the majority of the buffering capacity of the tailings still present, one would expect to observe the following:

- the pH of solutions collected from each test pit should decrease from the originally high alkaline discharge value of 9.6 to a pH of 6.8 approximating that of local rainwater;
- changes in calcium carbonate solids concentrations should not be noticeable, as depletion, recently initiated, should be occurring at a relatively constant rate. Depletion of the calcium carbonate solids should be a function of the rate of acid generation, the initial concentration of the calcium carbonate in the tailings solids, the depletion of alkalinity in the pore water, and temperature;
- the alkalinity of the pore water, after initial displacement by rainwater should remain relatively constant, being dependent on a relatively constant rate of replacement from the calcium carbonate solids associated with the tailings solids;
- the dissolved calcium in the pore water should remain relatively constant, or show a slight increase in concentration. As calcium carbonate is dissolved into solution to provide replacement for consumed alkalinity, calcium, dissolved in solution, will dissociate from the carbonate.
- the acidity of solution should be measurable, and will be a function of temperature, oxygen availability, and the initial concentration and type of sulphides;

A summary of the alkalinity of solution and the dissolved calcium in solution are presented in Table 4-2. Results are presented graphically in Figure 4-18 and Figure 4-19. As previously stated, the pH of solution in all the test pits has decreased from an average of 9.6 to an average of 7.0; the calcium carbonate associated with the tailings solids has remained relatively constant, averaging 0.2 percent; the alkalinity within each test pit has remained relatively constant, the acidity of solution is measurable, and the dissolved calcium in solution has increased only slightly 1989 to 1990 from an average of 366 mg/L to 448 mg/L.

Test pit results, therefore, indicate that initial flushing of the tailings pore water by rainwater is substantially complete, and that the tailings are now in Stage I of acid generation. Acid generation is confirmed by measurable acidity in the tailings pore water solution, which in 1990 averaged 184 mg/L $CaCO_3$ (average does not include the acidity of water covered test pit (TP6) which was 914 mg/L $CaCO_3$). A summary of acidity measurements is presented in Table 4-2.

The alkalinity of the tailings within each test pit should continue to be replaced as it is consumed by acid products, theoretically to the potential of the calcium carbonate solids associated with the tailings solids which act as a carbonate source. The rate of alkalinity replacement, however, is limited by, among other things, the temperature within the tailings, the chemical concentration within the pore water, the porosity of the tailings solids, the exposed surface area of the calcium carbonate, and the degree of saturation of the tailings. These same factors also reduce the total neutralization potential represented by the calcium carbonate. The differences between the theoretical and the actual neutralization potential are probably quite insignificant, though, when compared to the acid generation potential of these tailings. The neutralization potential will be consumed in time; the unknown being its rate of consumption which is solely dependent on the rate of acid generation within the tailings.

In looking at results on an individual test pit basis, both the alkalinity and acidity of pore water solution differ considerably, indicating varying rates of reaction for acid generation and for alkalinity replacement between test pits. Some of the variability is a function of the accuracy of the alkalinity and acidity determinations. Under ideal conditions, an accuracy of plus or minus 10 mg/ L should be possible. The sampling conditions at the Faro test facility are not ideal though, and an accuracy of plus or minus 30 mg/L should be considered possible. However, even with a correction factor applied to the results, differences are evident.

In 1990, the highest average pore water alkalinity of 229 mg/L $CaCO_3$ was observed in the organic covered test pit (TP2); the composite saturated covered test pit (TP1), the composite unsaturated covered test pit (TP4), the control test pit (TP3) and the water covered test pit (TP6) had similar average pore water alkalinities ranging from 87 to 132 mg/L $CaCO_3$, and the till covered test pit (TP5) had a average pore water alkalinity of 17 mg/ L $CaCO_3$. As the rate of alkalinity replacement appears to be relatively constant in each test pit, as indicated by the dissolved calcium concentrations in the pore water, these differences in pore water alkalinity are not considered to be a results of differences in the reaction rate controlling the replacement of the alkalinity from the calcium carbonate solids associated with the tailings solids. The higher alkalinity in the organic covered test pit (TP2) is probably a result of organic acids, such as humic acid, forming salts and adding to the alkalinity of the pore water. The cause of the lower alkalinity measured in the till covered test pit (TP5) is not known at this time.

Acidity, in opposition to the alkalinity available in the pore water, should and does differ between test pits. The acidity of the pore water is probably an ideal indicator of the rate of acid generation within the tailings test pits provided that the initial potential alkalinity of the tailings is similar. As this was shown to be the case in Section 4.1.5 above, the differences in acidity must be attributable to differing rates of acid generation within the test pits. (As indicated in Section 4.1.5, the percent of calcium carbonate available in the tailings in each test pit is essentially the same; however, Test Pit 1 had slightly more than the average 0.24 percent, being 0.35 percent; and Test Pit 3 had slightly less than the average, being 0.17 percent. Thus, the acidity of the pore water should be adjusted accordingly, with the average acidity of Test Pit 1 being increased to approximately 50 mg/L and Test Pit 3 being decreased to approximately 370 mg/L). It should also be noted that the higher alkalinity generated in the organic covered test pit (TP2), possibly because of humic acid salt formation, should impede acid generation, and hence reduce the

TABLE 4-2: SUMMARY OF PORE WATER ANALYSIS
For Alkalinity, Calcium, and Acidity Parameters

YEAR		Alkalinity (0.0 - 0.5 m) (mg/L CaCO3)						Calcium (0.0 - 0.5 m) (mg/L)						Acidity (0.0 - 0.5 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	132	229	90	87	17	69	314	491	424	485	494	477	50	139	370	131	229	914
	MAX	186	302	174	149	24	76	469	558	476	612	564	-	-	-	-	-	-	-
	MIN	76	202	40	13	12	62	222	455	367	401	354	-	-	-	-	-	-	-
	N	4	4	3	5	2	2	7	6	6	6	6	1	-	-	-	-	-	-
1989	MEAN	91	317	51	86	19	92	261	282	550	281	267	439	9	344	287	69	2	477
	MAX	178	319	75	188	-	106	442	330	600	350	308	540	-	-	-	-	-	-
	MIN	56	314	27	18	-	73	140	234	500	208	220	318	-	-	-	-	-	-
	N	4	2	2	4	1	3	5	2	2	4	3	3	-	-	-	-	-	-
1988	MEAN	-	152	19	132	34	94	620	320	370	310	64	513	3	66	46	45	8	92
	MAX	-	-	-	221	-	104	-	-	390	320	-	680	-	-	-	-	-	-
	MIN	-	-	-	43	-	83	-	-	350	300	-	320	-	-	-	-	-	-
	N	-	1	1	2	1	2	1	1	3	2	1	3	-	-	-	-	-	-

YEAR		Alkalinity (>0.5 - <2.0 m) (mg/L CaCO3)						Calcium (>0.5 - <2.0 m) (mg/L)						Acidity (>0.5 - <2.0 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	45	22	12	19	39	18	543	502	437	290	476	-	-	-	-	-	-	-
	MAX	76	38	46	48	150	-	589	616	508	569	560	-	-	-	-	-	-	-
	MIN	34	9	1	11	14	-	518	321	363	166	273	-	-	-	-	-	-	-
	N	3	4	6	10	8	1	4	7	10	12	12	-	-	-	-	-	-	-
1989	MEAN	135	27	44	19	42	32	365	272	355	211	97	450	-	-	-	-	-	-
	MAX	182	32	100	26	54	38	540	520	500	300	354	560	-	-	-	-	-	-
	MIN	22	22	14	10	26	22	199	161	109	136	6	390	-	-	-	-	-	-
	N	6	4	3	7	9	3	9	5	5	13	12	3	-	-	-	-	-	-
1988	MEAN	85	58	73	18	57	47	334	32	245	212	8	202	-	-	-	-	-	-
	MAX	114	71	126	25	60	63	470	52	310	285	10	360	-	-	-	-	-	-
	MIN	59	45	29	11	54	30	36	12	180	135	6	44	-	-	-	-	-	-
	N	3	2	2	2	3	2	4	2	2	5	4	2	-	-	-	-	-	-

Figure 4-18

FARO TEST FACILITY

ALKALINITY
OF PORE WATER (0-0.5 m)

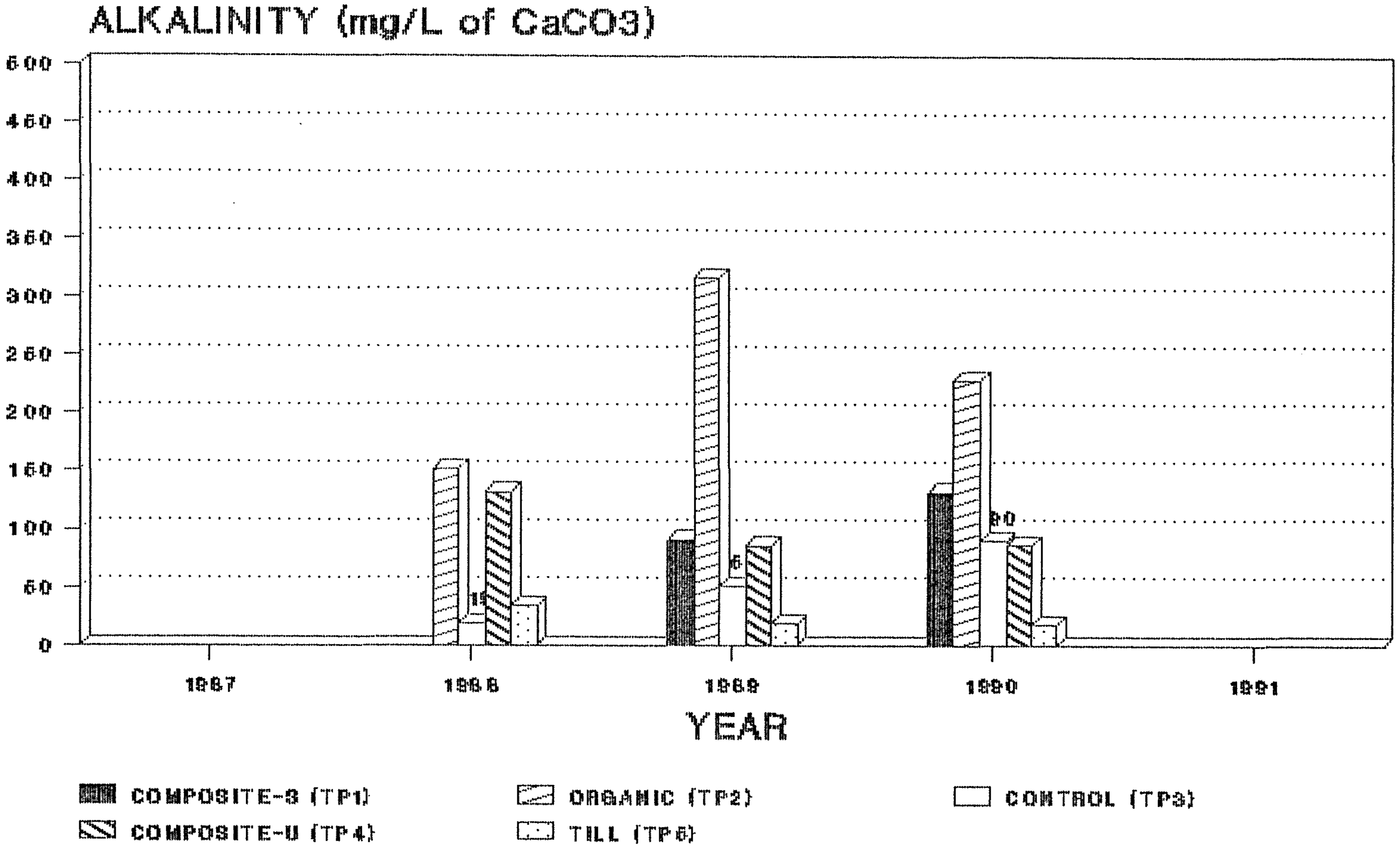
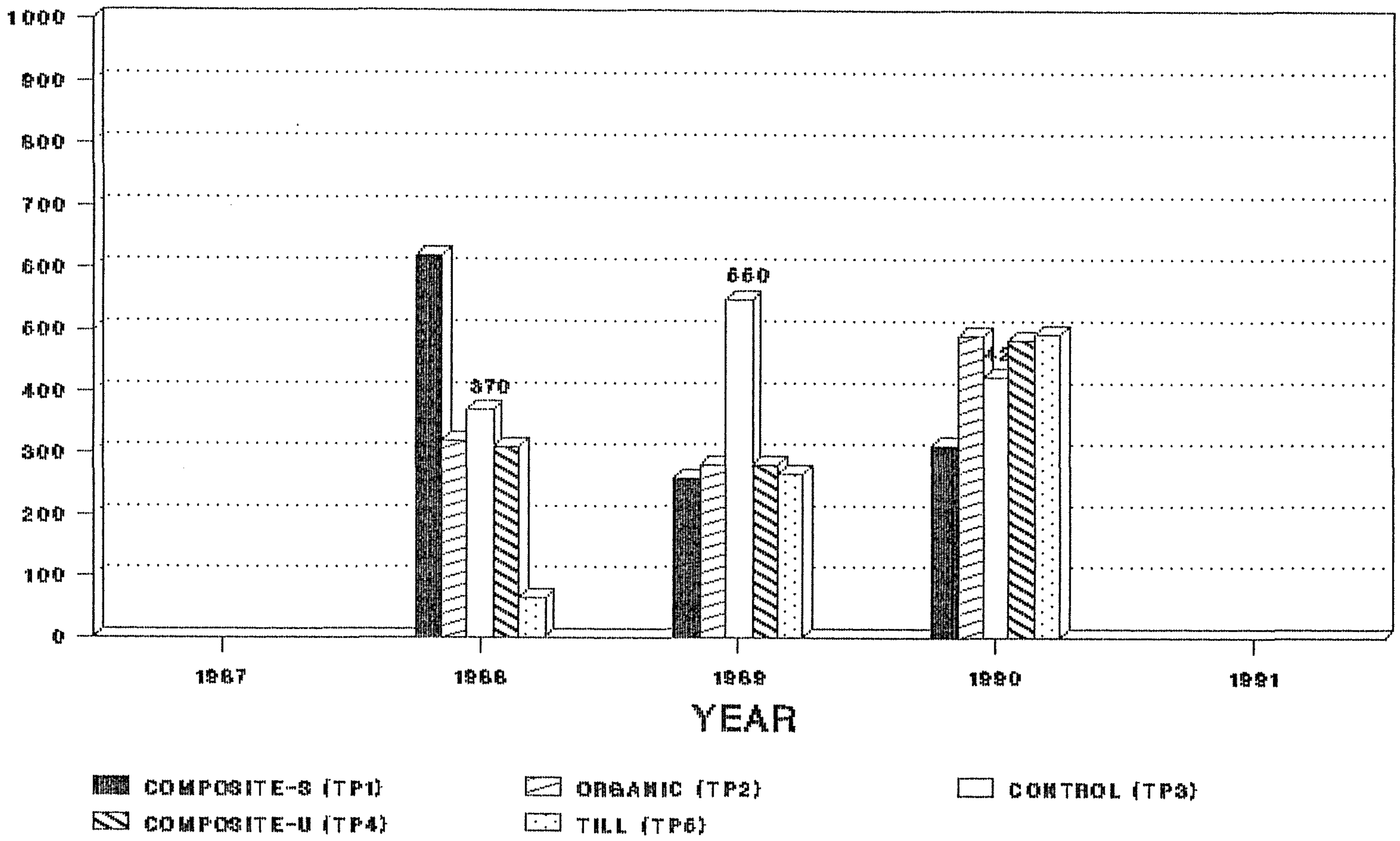


Figure 4-19

FARO TEST FACILITY
CALCIUM CONCENTRATIONS IN PORE WATER (0-0.5 m)



measurable acidity in Test Pit 2. The lower alkalinity of the till covered test pit (TP2) should have the opposite effect, being more favourable to acid generation and an increase in acidity.

Thus, in terms of acidity measured in the tailings pore water, in 1990, the highest average pore water acidity of 914 mg/L $CaCO_3$ was observed in the water covered test pit (TP6); the control test pit (TP3) and the till covered test pit (TP5) had similar average pore water acidities being 370 and 229 mg/L $CaCO_3$, respectively; and the composite saturated covered test pit (TP1), the composite unsaturated covered test pit (TP4), and the organic covered test pit (TP2) had similar average pore water acidities of 50, 131, and 139 mg/ L $CaCO_3$, respectively.

In summary, the alkalinity and acidity measurements indicate that the tailings in all the test pits are presently in a Stage I acid generation state; the rate of acid generation in the water covered test is significantly higher (twice the control) than in the other test pits; the acid generation rate in the control test pit (TP3) tailings is 2 times greater than the acid generation rate in the till covered test pit (TP5); and the acid generation rate in the control test pit (TP3) is 3 to 4 times greater than the acid generation rate in the saturated composite covered test pit (TP1), the unsaturated composite covered test pit (TP4), and the organic covered test pit (TP2). These differences in rate may be attributable to several factors including: differences in test pit temperature regimes as indicated in Section 4.3.1, differences in the availability of oxygen, or to the composition of the cover material. The first two factors are a function of cover type and construction, whereas the latter is a function of the reactivity of the cover material.

4.4.3 Pore Water Iron and Sulphate Concentrations

Increasing dissolved iron and sulphate concentrations in tailings pore water, like increasing acidity, decreasing pH and increasing Eh, are indicators of acid generation within tailings. As shown below, both iron and sulphate are reaction products of Stage I acid generation:

$$FeS_{2(s)} + 7/2\ O_2 + H_2O\ >>>>\ Fe^{+2} + 2\ SO_4^{-2} + 2\ H^+$$

A summary of the dissolved iron and sulphate concentrations measured in the pore water collected from the test pits is presented in Table 4-3. Average iron and sulphate concentrations, and maximum and minimum concentrations are presented for 1988, 1989, and 1990 over two depth intervals; these being 0.0 to 0.5 metres and greater than 0.5 metres to less than 2.0 metres. Average iron and sulphate concentrations in pore water extracted between 0.0 and 0.5 metres are presented graphically in Figures 4-20 and 4-21.

As acid generation in tailings is initially expected to be focused in the near surface tailings, there should be a difference between iron and sulphate concentrations measured at depth to those measured near the surface. (As only a partial 1990 sampling from the water covered test pit (TP6) was undertaken, this discussion will focus only on the remaining five test pits). On a collective basis, this in fact was the case.

As indicated in Sections 4.1.1 and 4.1.2, the iron and sulphur content of the original tailings were similar enough for valid comparison of results between test pits. In 1990, the average pore water iron concentrations collected from near surface (0.0 - 0.5 m) to those collected at depth (>0.5 - < 2.0 m) were 326 mg/L and 79 mg/L, respectively. In the same year, the average pore water sulphate concentrations collected from near surface (0.0 - 0.5 m) to those collected at depth (>0.5 - < 2.0 m) were 2860 mg/L and 2175 mg/L, respectively. These results indicate that, at least within one or more of the test pits, the tailings are generating acid.

Reviewed on a individual test pit basis, near surface pore water iron and sulphate concentrations are significantly greater than concentrations measured at depth for all the test pits, with the exception of the unsaturated composite covered test pit (TP1), which shows no increase in either parameter. This would indicate, either that acid generation is not occurring in Test Pit 1, or the rate of acid generation is noticeably slower in this test pit as compared with the other four test pits. As there appears to be a small increase in pore water iron concentrations in samples collected from near surface (0.0 - 0.5 m) from 1989 to 1990, the latter reasoning, being that acid generation is occurring but at a very slow rate, is considered the most likely.

By focusing only on iron and sulphate concentration measurements of samples collected from the near surface (0.0 - 0.5 m), relative rates of acid generation in each test pit can be ascertained. In terms of average iron and sulphate concentration product, the control test pit (TP3) had the highest average concentrations with 898 mg/L and 3932 mg/L, respectively. The organic covered test pit (TP2) had the next highest average concentrations with 721 mg/L of iron and 3722 mg/L of sulphate, followed by the till covered test pit with the significantly lower average concentrations of 99 mg/L of iron and 2867 mg/L of sulphate. The unsaturated and saturated composite covered test pits (TP1 and TP2) had similar iron concentrations of 22 and 69 mg/L respectively, and similar sulphate concentrations of 1508 and 2270 mg/L.

In summary, iron and sulphur concentrations measured in the individual test pits indicate that all of the test pits appear to be generating acid, with the control test pit (TP1) generating at the fastest rate, followed by the organic covered test pit (TP2), the till covered test pit (TP5), and the saturated and unsaturated composite covered test pits (TP1 and TP4). These results correlate with pore water acidity and pH results, which also indicate that the control test pit (TP3) is generating the most acid.

4.4.4 Pore Water Lead and Zinc Concentrations

Metal concentrations in tailings pore water result from the process of acid generation in the tailings, followed subsequently by leaching of metals available within the tailings solids. A summary of the pore water lead and zinc concentrations of the test pits is presented in Table 4-4. The average lead and zinc concentrations of pore water extracted from near surface tailings in the test pits are presented in Figure 4-22 and 4-23.

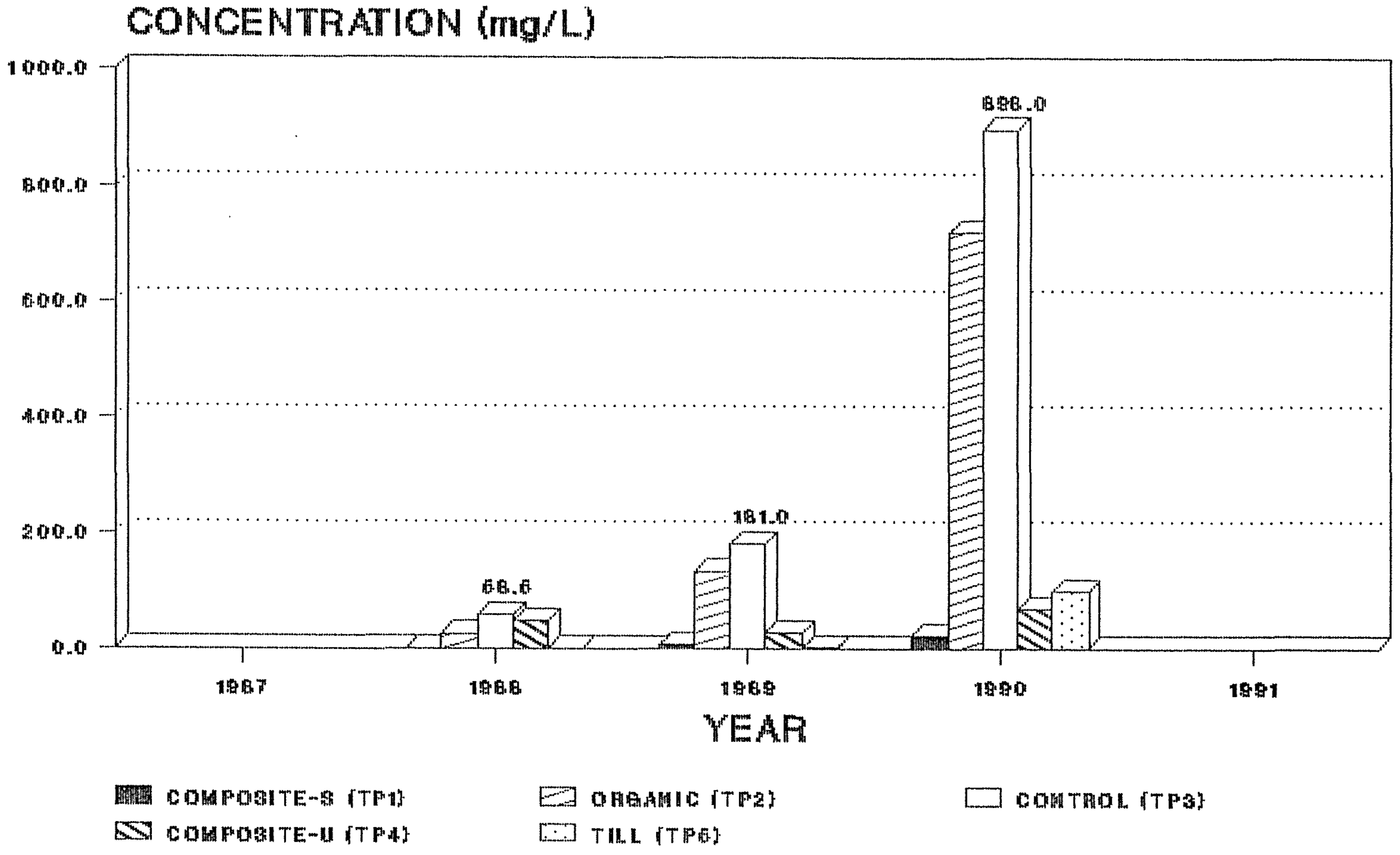
TABLE 4-3: SUMMARY OF PORE WATER ANALYSIS
For Iron and Sulphate Parameters

YEAR		Iron (0.0 - 0.5 m) (mg/L)						Sulphate (0.0 - 0.5 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	22.4	721	898	69.0	99.4	737	1508	3722	3932	2270	2867	-
	MAX	45.5	925	1210	161	177	747	1810	4730	4850	2620	3190	-
	MIN	8.7	535	631	0.2	39.5	727	1140	2620	3120	2040	2240	-
	N	7	6	6	9	6	2	6	6	5	3	3	-
1989	MEAN	6.1	134	181	28.1	1.3	332	1183	791	1684	1490	993	2097
	MAX	16.0	182	320	99.0	4.1	520	1705	1171	2260	2260	1030	2446
	MIN	2.3	88.0	41.0	0.3	0.1	40.0	620	568	1108	1030	955	1775
	N	4	2	2	5	4	3	5	3	2	6	2	3
1988	MEAN	0.5	26.0	58.0	47.3	0.5	65.7	2250	1150	1517	1800	340	2456
	MAX	-	-	88.0	94.0	-	76.0	-	-	1700	1900	-	3700
	MIN	-	-	4.0	0.5	-	51.0	-	-	1400	1700	-	1815
	N	1	1	3	2	1	3	1	1	3	1	1	3

YEAR		Iron (>0.5 - <2.0 m) (mg/L)						Sulphate (>0.5 - <2.0 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	49.9	5.8	326	9.3	3.4	5.3	2245	2792	2565	1473	1800	-
	MAX	134	10.4	699	45.8	11.5	-	2590	4240	3130	2140	2900	-
	MIN	1.9	0.9	28.5	0.3	0.1	-	1900	1910	1760	1220	279	-
	N	4	5	8	13	15	1	4	6	6	6	12	-
1989	MEAN	58.9	0.5	14.1	5.5	0.3	0.7	1580	819	1082	1024	431	1717
	MAX	107	0.6	30.0	20.0	1.1	0.9	1950	912	1510	1540	950	1898
	MIN	1.0	0.3	4.6	0.1	0.1	0.4	1220	700	487	487	153	1400
	N	9	5	5	13	12	3	7	5	4	11	9	3
1988	MEAN	22.7	1.2	15.2	1.7	0.4	1.2	2154	250	775	947	137	875
	MAX	118	2.0	30.0	4.0	0.5	2.0	4200	330	1100	1283	181	1450
	MIN	0.3	0.5	0.5	0.5	0.1	0.5	420	170	450	650	110	300
	N	6	2	2	5	4	2	5	2	2	5	4	2

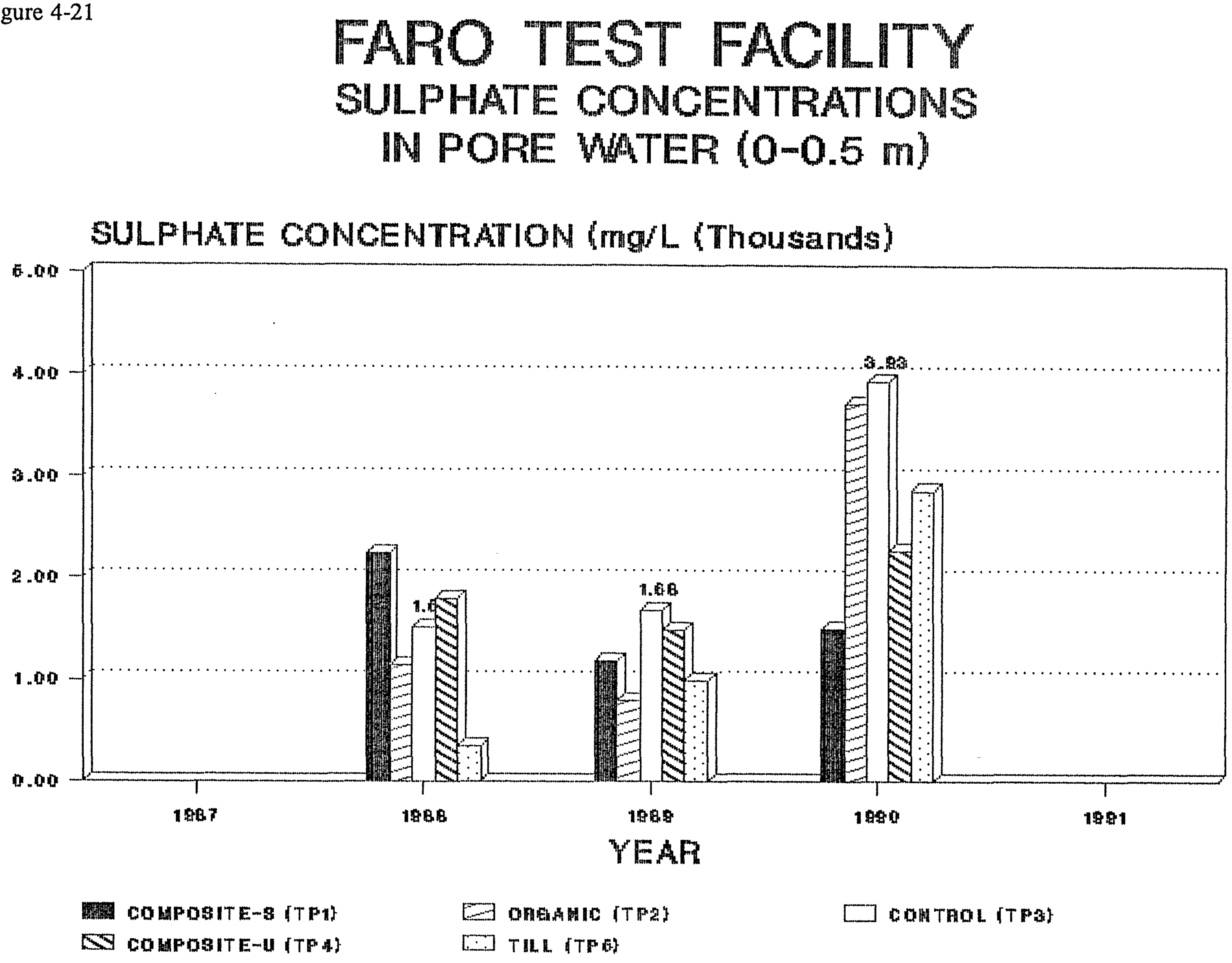
Figure 4-20

FARO TEST FACILITY
IRON CONCENTRATIONS IN PORE WATER (0-0.5 m)



* 1988 Base Line - uses data from all test pits.

Figure 4-21


FARO TEST FACILITY
SULPHATE CONCENTRATIONS
IN PORE WATER (0-0.5 m)
SULPHATE CONCENTRATION (mg/L (Thousands)
5.00
4.00
3.00
2.00
1.00
0.00
1.6
1.66
3.93
1987
1988
1989
1990
1991
YEAR
COMPOSITE-S (TP1)
ORGANIC (TP2)
CONTROL (TP3)
COMPOSITE-U (TP4)
TILL (TP5)

As introduction to the discussion of metals within the test pit pore water, it is important to emphasize that the tailings within these pits are relatively young, and as indicated above, have only just recently began to generate acid at a rate characterized as a Stage I. Therefore, high metal concentrations, and in particular, lead and zinc concentrations, are not expected. In general, this assumption is correct. In 1990, average lead concentrations in the pore water collected from the test pits ranged from 0.01 to 0.09 mg/L in samples from all the test pits with the exception of samples from the water covered test pit (TP6), which averaged 1.35 mg/L of dissolved lead. In the same year, average zinc concentrations in the pore water ranged from 0.03 to 0.71 in the unsaturated composite covered test pit (TP1), the saturated composite covered test pit (TP4), the till covered test pit (TP5), and the organic covered test pit (TP2). However, elevated average zinc concentrations were measured in the water covered test pit (TP6) and the control test pit (TP3), these being 41.8 and 57.2 mg/L respectively.

As noted in the 1989 progress report, the water covered test pit (TP6) was subjected to metals contaminated water as well as technical difficulties in maintaining a constant depth of water; therefore, elevated lead and zinc concentrations are to be expected. The elevated average zinc concentration in the near surface tailings pore waters of the control test pit; however, is not considered to be a function of external contamination. It is important to note that the zinc concentration in the control test pit (TP3) both in 1988 and 1989 averaged 0.07 mg/L, thus indicating that elevated dissolved zinc concentrations are a recent 1990 phenomenon. Further, elevated lead concentrations were not observed. At the average solution pH of 6.2 measured in the control test pit in 1990, the theoretical zinc solubility is approximately 60 mg/L. The theoretical lead solubility for the same pH, though, is approximately 0.3 mg/L. Thus, on a solubility basis alone, the zinc concentrations measured in the near surface tailings pore water are possible.

The control test pit (TP3) also has other characteristics previously discussed which correlate to the elevated average zinc concentration in its near surface pore water. In 1990, of all the test pits (excluding the water covered test pit (TP6)), near surface (0.0 - 0.5 m) tailings pore water in test pit 3 had the lowest average pH at 6.2; the highest average Eh at 443 mV; the highest acidity at 370 mg/L $CaCO_3$; the highest dissolved iron at 898 mg/L; and the highest dissolved sulphate at 3932 mg/L. Thus, the elevated average tailings pore water zinc concentration of the control test pit (TP3) is at minimum an indication that the acid generation reaction rate in the tailings of this test pit is faster than that within the tailings of the remaining test pits. At the most, the elevated average zinc concentration, in combination with measurements of the above noted parameters, could be an indication that the tailings reaction rate is shifting towards the much faster Stage I/ Stage II acid generation reaction rate.

TABLE 4-4: SUMMARY OF PORE WATER ANALYSIS
For Lead and Zinc Parameters

YEAR		Lead (0.0 - 0.5 m) (mg/L)						Zinc (0.0 - 0.5 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	0.008	0.01	0.041	0.042	0.086	1.35	0.312	0.706	57.2	0.031	0.269	41.8
	MAX	0.013	0.025	0.130	0.340	0.207	2.72	1.80	1.50	71.5	0.130	0.850	74.1
	MIN	0.005	0.001	0.007	0.001	0.001	0.002	0.006	0.460	31.3	0.005	0.026	9.46
	N	8	6	6	9	6	2	8	4	6	8	6	2
1989	MEAN	0.002	0.011	0.004	0.010	0.015	0.025	0.035	0.395	0.065	0.022	0.047	27.7
	MAX	0.004	0.017	0.005	0.044	0.031	0.070	0.130	0.400	0.110	0.100	0.110	51.0
	MIN	0.001	0.004	0.002	0.001	0.004	0.003	0.001	0.390	0.019	0.001	0.008	0.009
	N	5	2	2	0	4	3	4	2	2	5	4	3
1988	MEAN	0.005	0.005	0.043	0.023	0.005	0.136	0.020	1.28	0.073	0.050	0.005	35.0
	MAX	0.005	-	0.120	0.044	-	0.360	0.020	-	0.080	0.080	-	25.0
	MIN	0.005	-	0.005	0.005	-	0.005	0.020	-	0.060	0.020	-	0.005
	N	2	1	3	2	1	3	2	1	3	2	1	3

YEAR		Lead (>0.5 - <2.0 m) (mg/L)						Zinc (>0.5 - <2.0 m) (mg/L)					
		PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6	PIT 1	PIT 2	PIT 3	PIT 4	PIT 5	PIT 6
1990	MEAN	0.012	0.007	0.005	0.008	0.017	0.010	0.007	0.017	2.004	0.134	0.081	0.840
	MAX	0.021	0.020	0.014	0.023	0.086	-	0.012	,045	5.260	0.720	0.395	-
	MIN	0.005	0.001	0.001	0.002	0.001	-	0.005	0.005	0.011	0.005	0.005	-
	N	4	7	10	13	15	1	4	6	8	13	15	1
1989	MEAN	0.015	0.016	0.017	0.016	0.029	0.008	0.060	0.018	0.174	0.076	0.025	0.031
	MAX	0.050	0.050	0.050	0.060	0.090	0.012	0.220	0.080	0.340	0.620	0.060	0.090
	MIN	0.001	0.001	0.004	0.001	0.001	0.002	0.001	0.001	0.080	0.001	0.001	0.001
	N	9	5	5	13	12	3	9	5	5	13	12	3
1988	MEAN	0.005	0.005	0.060	0.005	0.015	0.005	0.082	0.020	0.030	0.021	0.006	0.020
	MAX	0.005	0.005	0.080	0.005	0.040	0.005	0.300	0.020	0.040	0.040	0.011	0.020
	MIN	0.005	0.005	0.040	0.005	0.005	0.005	0.005	0.020	0.020	0.005	0.005	0.020
	N	6	2	2	5	4	2	6	2	2	5	4	2

Figure 4-22

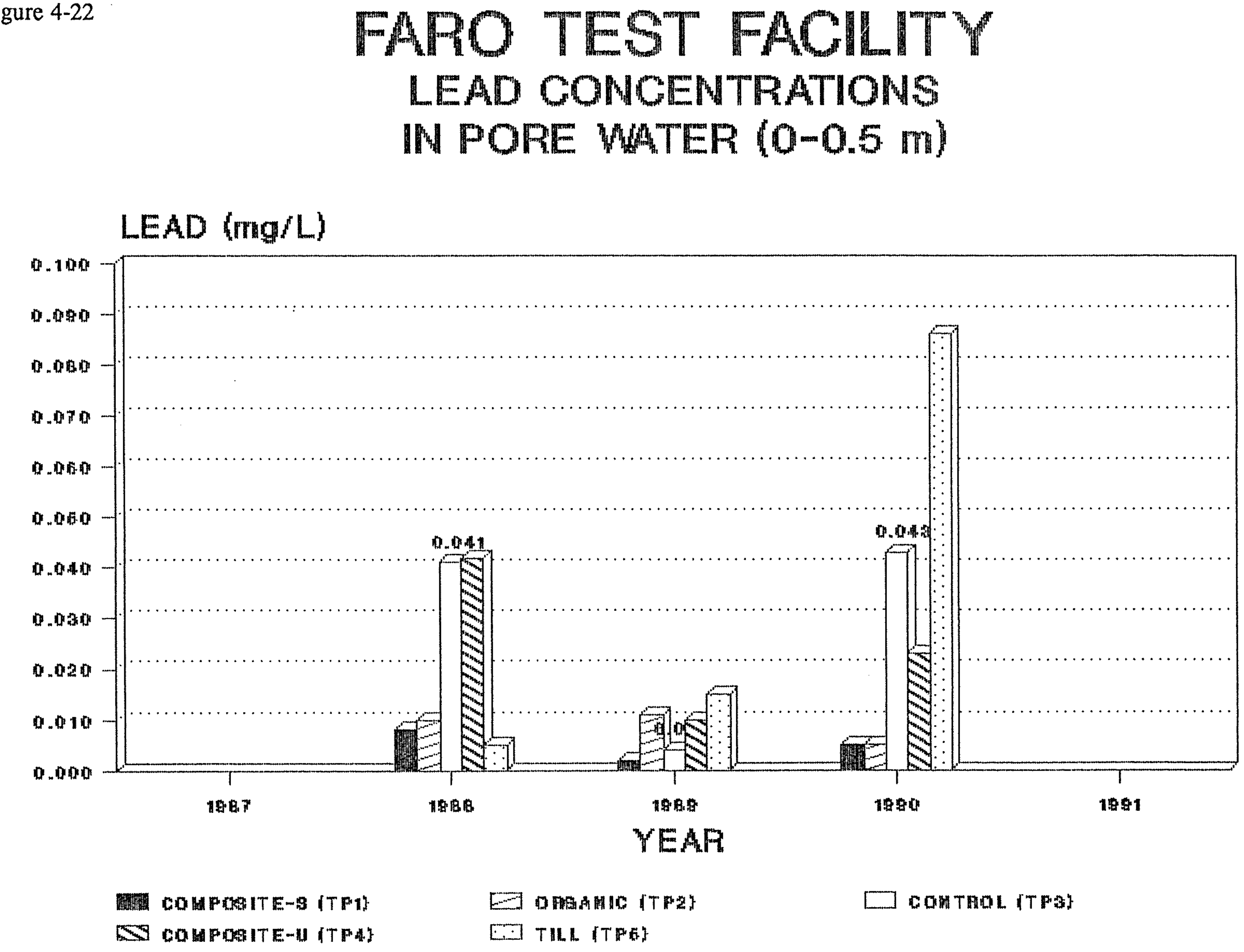
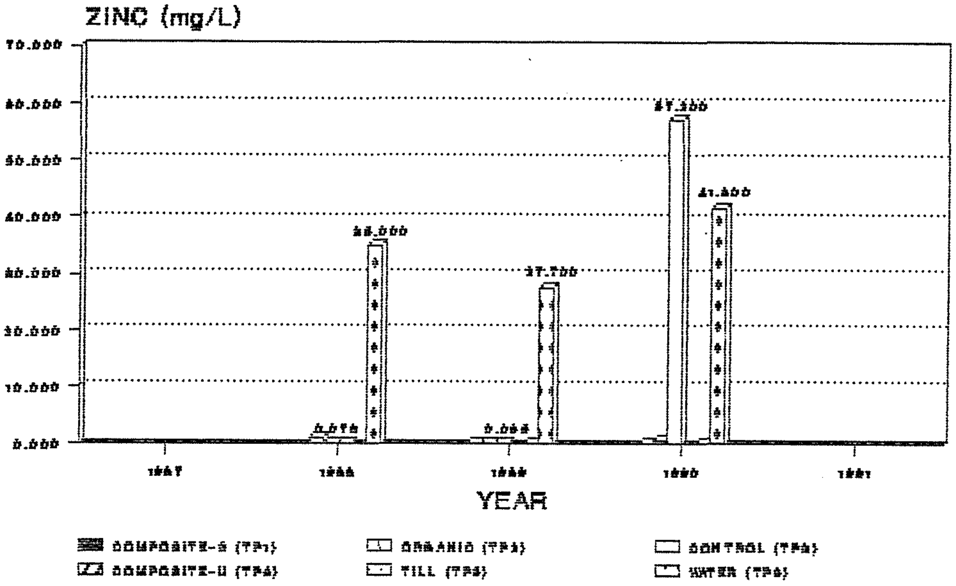
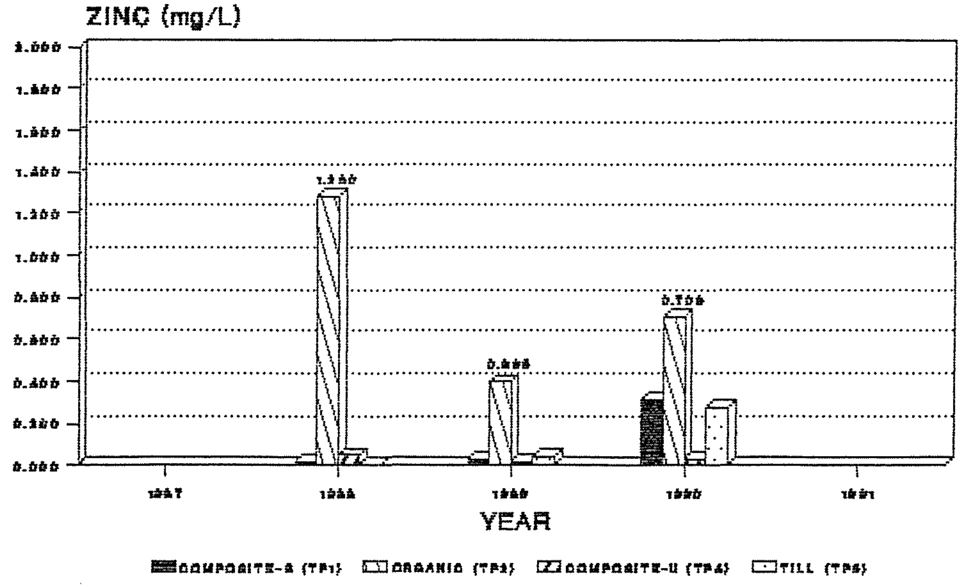

FARO TEST FACILITY
LEAD CONCENTRATIONS
IN PORE WATER (0-0.5 m)
LEAD (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0.041
0.0
0.043
1987
1988
1989
1990
1991
YEAR
COMPOSITE-S (TP1)
ORGANIC (TP2)
CONTROL (TP3)
COMPOSITE-U (TP4)
TILL (TP6)

Figure 4-23

FARO TEST FACILITY
ZINC CONCENTRATIONS
IN PORE WATER (0-0.5 m)



FARO TEST FACILITY
ZINC CONCENTRATIONS
IN PORE WATER (0-0.5 m)



The remaining four test pits, excluding the control test pit (TP3) and the water covered test pit (TP6), have as stated above, much lower average pore water concentrations of both lead and zinc. When the maximum and minimum concentration values are considered, there is no significant difference between the concentrations of the different test pits. Further, the observed concentrations with respect to associated pore water pH are possible. At a pore water pH of 7.0, the theoretical solubility of lead is approximately 0.03 mg/L and the theoretical solubility of zinc is approximately 7.0 mg/L. The measured concentrations are within theoretical limits. In conclusion, with respect to these four test pits, it can be inferred from the relatively low metals concentrations in solution that the acid generation rate within these tests pits is still slow as compared to the control test pit (TP3).

4.5 Affects of the Covers on the Tailings Test Pits

From the discussions above, it can be seen that comparisons between test pits are relevant in that the tailings within each test pit are similar in at least the most significant parameters. It has also been shown that the Faro tailings have the potential to be major acid generators and subsequently leach high levels of metal contaminants into solution for transport. The above discussions also point out that the tailings in the test pits are presently generating acid, even if at the low reaction rate associated with a Stage I acid generation reaction. Further, it has been demonstrated that the reaction rates within the tailings of the different test pits are themselves different from each other, with the highest reaction rates indicated for the water covered test pit (TP6) followed by the control test pit (TP3). Finally, the only other difference between the test pits are the covers placed on them.

Of all the covers, it appears that both the unsaturated and saturated composite covers (TP1 and TP4) are the most effective in retarding the rate of acid generation in the tailings below them. For all intent and purposes, the similarities between the results of these two test pits is expected, in that rigorous maintenance of the physical difference in these two covers, namely through the continued application of water on the saturated cover (TP4) was not undertaken. In general, both covers oscillated from saturation to unsaturation, depending solely on climatic conditions. The next most effective cover in retarding acid generation appears to be the till cover (TP5), followed by the organic cover (TP2).

From theoretical considerations, it is known that two factors which can affect the rates of oxidation of tailings are temperature, and the availability of oxygen. We have observed that the composite covers affect the temperature regime of the tailings in associated test pits. Temperature affects were also noted in the organic covered test pit, but the affects were much more subdued. As a general comment, the temperature affects are a function of cover thickness, and of physical properties of the covers. As the composite covers are much thicker, and by definition composed of layers of differing materials, it correlates that the more noticeable temperature effects were evident in these test pits.

What is not known, however, is the extent to which the oxidation retardation was caused by temperature control as compared to oxygen diffusion reduction. These same covers, as well as the till and organic covers, also have the capability of acting at least partially as a barrier to oxygen entry. The composite covered test pits, one being saturated and one unsaturated, were designed in part to investigate which, if either of these factors, was influencing the rate of acid generation within the tailings. The till cover, however, does provide evidence that oxygen diffusion is being reduced by the covers in that, the till cover had little effect on the temperature regime in its underlying tailings as compared to the control test pit; however, acid generation in the till covered test pit (TP2) appears to be lower than that in the control test pit.

5.0 CONCLUSIONS

In 1990, the Faro tailings covers test facility was sampled in June and September. Water samples were collected during both periods, and tailings solids samples were collected in October. Samples were shipped to ASL Laboratories and Coastech Laboratories for chemical analysis and characterization. Temperatures were recorded monthly from May, 1990, and oxygen/ carbon dioxide concentrations were measured in June, 1990.

The instrumentation, and the water and solids samplers continue to work within expectations. The piezometers and read-out monitor are the exception. Pore pressures cannot presently be determined because pore pressures are at or near the resolution of the instrument.

<u>CONCLUSIONS SECTION WILL BE COMPLETED BY MONDAY.</u>

- basical will summarize discussion;
- indicate that short term results are provising;
- recomment continued monitoring (with maintenance including sump pumps in tanks) to investigate long term changes in acid gen. rates, and the relative affects the covers have.

SECTION 3.0

TABLES

TABLE 3-1: TEMPERATURE PROFILES OF THE TAILING COVERS TEST PITS

DESCRIPTION	SENSOR NUMBER	DEPTH (m)	WINTER	MAY	JUN	JUL	AUG	SEP	OCT
			Temperatures Recorded in 1988, 1989, 1990						
TEST PIT ONE (TP1)	1.1	-0.60	-5.1	-2.0	1.7	6.5	6.0	0.4	-3.3
	1.2	-0.40	-4.7	-3.9	0.9	5.9	5.7	0.4	-3.6
ROCK (3.0 to 3.5 m)	1.3	-0.15							
TILL (2.5 to 3.0 m)	1.4	0.10	-4.4	-4.2	-0.7	4.1	4.9	2.6	-1.9
SLIME (2.0 to 2.5 m)	1.5	0.30	-4.5	-4.8	-1.8	2.9	3.9	3.0	-1.9
TAIL (0 to 2.0 m)	1.6	0.70	-4.3	-4.8	-2.7	1.8	3.2	3.6	-1.4
	1.7	0.85	-4.4	-4.9	-3.4	1.2	2.5	1.9	-1.3
	1.8	1.05	-3.2	-3.9	-2.5	1.8	3.4	3.0	-0.1
	1.9	1.80	-3.2	-3.5	-2.6	0.6	2.3	2.7	0.0
TEST PIT TWO (TP2)	2.6	-0.40	-5.1	3.1	2.8	6.9	7.2	1.8	-2.4
	2.5	-0.10	-3.2	3.6	2.5	6.1	7.1	3.3	0.0
TILL (2.4 to 2.9 m)	2.4	0.25	-3.8			3.5	5.1	2.8	-0.5
ORGANICS (1.9- 2.4 m)	2.3	0.80	-2.0	8.7	1.4	4.7	6.2	4.2	1.5
TAIL (0 to 1.9 m)	2.2	1.15	-3.7	-2.9	-1.0	2.6	3.8	2.3	-0.1
	2.1	1.90	-3.0	-0.6	-1.8	0.9	2.4	1.2	-0.3
TEST PIT THREE (TP3)	3.6	0.05	-5.6	6.6	6.3	10.4	8.5	0.6	-4.6
	3.5	0.30	-5.4	18.3	6.3	10.2	9.1	1.5	-4.3
TAIL (0 to 1.9 m)	3.4	0.60	-3.0	21.6	5.4	9.7	9.1	1.8	-1.6
	3.3	0.85	-5.3	1.1	3.5	7.1	7.1	1.2	-4.0
	3.2	1.10	-5.0	2.2	3.4	7.0	6.9	1.2	-2.9
	3.1	1.50	-4.1	1.1	3.2	6.8	6.8	1.6	-1.7
TEST PIT FOUR (TP4)	4.9	-0.70	-1.8				7.4	0.4	-4.5
	4.8	-0.50	-4.1	-1.8	3.2	8.0	8.0	1.4	-2.8
ROCK (3.0 to 3.5 m)	4.7	-0.35	-3.9	-4.7	1.5	6.1	6.4	2.0	-2.8
TILL (2.5 to 3.0 m)	4.6	-0.15					0.0	1.7	
SLIME (2.0 to 2.5 m)	4.5	0.15	-3.7	-5.5	-1.8	2.7	3.9	3.1	-2.2
TAIL (0 to 2.0 m)	4.4	0.45	-1.3	-3.9	-1.7	2.5	4.3	4.5	0.1
	4.3	0.70	-1.8	-3.1	-0.7	3.4	5.1	6.2	-0.5
	4.2	1.20	-2.0	-4.6	-3.5	0.8	2.0	4.9	-0.4
	4.1	1.65	-2.9	-3.5	-3.1	-1.2	0.4	2.1	-0.9

Page 1 of 2.

TABLE 3-1: TEMPERATURE PROFILES OF THE TAILING COVERS TEST PITS

DESCRIPTION	SENSOR NUMBER	DEPTH (m)	WINTER	MAY	JUN	JUL	AUG	SEP	OCT
			Temperatures Recorded in 1988, 1989, 1990						
TEST PIT Five (TP5)	5.6	0.00	-2.3	6.2	8.5	12.5	11.6	2.9	-1.1
	5.5	0.35	-6.2	1.0	3.8	8.1	7.9	-0.2	-4.3
TILL (2.0 to 2.5 m)	5.4	0.70	-3.5	2.0	5.0	9.0	9.4	2.6	-1.4
TAIL (0 to 2.0 m)	5.3	0.90	-4.8	0.0	3.2	7.2	7.8	1.5	-2.4
	5.2	1.55	-3.7	-0.3	2.8	6.7	7.7	2.6	-1.1
	5.1	2.00	-4.6	-1.6	1.0	4.8	6.5	1.3	-2.3
TEST PIT SIX (TP6)	6.6	-0.25	-4.9	9.2		11.9	9.0	1.5	-4.4
	6.5	0.30	-4.1	6.6		5.4	9.9	2.8	-3.5
WATER (1.8 to 2.3 m)	6.4	0.70	-5.3	6.5		8.6	9.3	2.2	-3.1
TAIL (0 to 1.8 m)	6.3	1.00	-5.2	3.2		6.5	6.9	1.2	-4.0
	6.2	1.40	-3.9	4.2		7.4	8.1	3.2	-1.8
	6.1	1.80	-4.0	2.7			8.6	2.1	-1.6
"OLD TAILS" SITE (#7)	7.1	0.30	-7.7	7.0	11.6	15.7	13.7	-0.7	
	7.2	0.60	-4.1	7.7	9.2	11.8	11.2	2.7	0.2
	7.3	1.00	-4.1	1.6	6.5	8.1	9.2	2.9	0.0
	7.4	1.50	-4.6	4.2	8.9	12.1	11.9	2.5	-1.0
	7.5	2.00	-5.1	0.8	3.5	6.2	5.9	1.5	-0.8
	7.6	2.50	-3.2	1.2	4.4	4.9	6.0	2.4	0.9
	7.7	3.00	-3.3	-2.3	1.8	2.4	3.8	2.2	0.8
	7.8	3.50	-3.8	-3.4	-0.2	0.3	1.6	0.8	-0.1
	7.9	4.00	-4.3	-4.1	-0.5	-1.2	-0.1	-0.2	-1.0

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
L1-6	Sep-90	-0.30				
AW1-5	Sep-90	-0.10	6.98		142	7
L1-5	Sep-90	0.15				
AW1-6	Sep-90	0.20	7.46	385	138	4
L1-4	Sep-90	0.50				
AW1-4	Sep-90	0.50	7.67	370	76	4
AW1-6 DUP	Sep-90	0.50	7.24	379		
L1-3	Sep-90	0.55				
L1-2	Sep-90	0.60				
AW1-3	Sep-90	0.65	8.05	349	25	1
AW1-2	Sep-90	0.75	7.25	358	76	12
AW1-1	Sep-90	0.85				
L1-1	Sep-90	0.95				
T1#PTRAP	Sep-90	2.00	7.05	379	175	96
L1-6	Jun-90	-0.30				
AW1-5	Jun-90	-0.10				
L1-5	Jun-90	0.15				
AW1-6	Jun-90	0.20	7.09	283	186	92
AW1-4	Jun-90	0.50	7.13	307	128	34
AW1-4 DUP	Jun-90	0.50				
L1-4	Jun-90	0.50	5.60			
L1-3	Jun-90	0.55	7.40			
L1-2	Jun-90	0.60				
AW1-3	Jun-90	0.65	7.64	239	34	40
AW1-2	Jun-90	0.75	6.67	299		218
AW1-1	Jun-90	0.85				
L1-1	Jun-90	0.95				
T1#PTRAP	Jun-90	2.00	6.09			
AW1-5	Oct-89	-0.10			DRY	DRY
L1-5	Oct-89	0.15				
AW1-6	Oct-89	0.20	6.95	545	56	8
L1-4	Oct-89	0.50				
AW1-4	Oct-89	0.50	6.94	419	56	8
L1-3	Oct-89	0.55				
L1-2	Oct-89	0.60				
AW1-3	Oct-89	0.65	6.75	435	22	8
AW1-2 DUP	Oct-89	0.75				
AW1-2	Oct-89	0.75	6.73	392	92	118
AW1-1	Oct-89	0.85	6.23	400	182	346
L1-1	Oct-89	0.95	6.40			
T1#PTRAP	Oct-89	2.00	5.80			
AW1-5	Jul-89	-0.10				
AW1-6	Jul-89	0.20	7.05	440	178	18
AW1-4	Jul-89	0.50	7.34	483	75	6
AW1-3	Jul-89	0.65				

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
AW1-2	Jul-89	0.75	6.74	460	45	43
AW1-1 DUP	Jul-89	0.85	6.65	490	321	244
AW1-1	Jul-89	0.85	6.83	427	339	203
L1-1	Jul-89	0.95				
AW1-4 DUP	Sep-88	0.50				
AW1-4	Sep-88	0.50	8.32	343		3
L1-3	Sep-88	0.55	7.38	375		
L1-2	Sep-88	0.60	6.87	385		
AW1-3	Sep-88	0.65	7.99	422	59	
AW1-2	Sep-88	0.75	8.83	217	83	5
AW1-1	Sep-88	0.85	7.47	245	114	127
L1-1	Sep-88	0.95	8.66	430		
T1#PTRAP	Sep-88	2.00	6.93		138	276
AW2-3 DUP	Sep-90	0.45	6.16	440	202	156
AW2-3	Sep-90	0.45	6.17	421	206	120
L2-3	Sep-90	0.50	6.56		205	142
L2-2	Sep-90	0.75				
AW2-2	Sep-90	0.85	7.63	357	21	22
AW2-1	Sep-90	0.90	7.91	452	18	2
L2-1	Sep-90	0.90	6.69		9	7
T2#PTRAP	Sep-90	2.00	7.17	398	24	43
AW2-3 DUP	Jun-90	0.45				
AW2-3	Jun-90	0.45	6.01	361	302	1358
L2-3	Jun-90	0.50	6.13			
L2-2	Jun-90	0.75	6.25			
AW2-2	Jun-90	0.85	8.15	340	38	14
L2-1	Jun-90	0.90	6.87			
AW2-1	Jun-90	0.90	8.47	308	302	1358
T2#PTRAP	Jun-90	2.00	6.36			
AW2-3	Oct-89	0.45	5.93	471	314	372
AW2-2	Oct-89	0.85	7.40	510	28	0
AW2-1	Oct-89	0.90	6.72	584	22	0
T2#PTRAP	Oct-89	2.00	6.70			
AW2-3	Jul-89	0.45	6.19	518	319	316
L2-3	Jul-89	0.50	6.80			
AW2-2	Jul-89	0.85	7.42	479	32	4
L2-1	Jul-89	0.90	6.40			
AW2-1	Jul-89	0.90	7.66	546	24	2
T2#PTRAP	Jul-89	2.00	6.60			
AW2-3	Sep-88	0.45	7.14	363	152	66
AW2-2	Sep-88	0.85	8.53	383	71	
AW2-1	Sep-88	0.90	9.05	520	45	2
T2#PTRAP	Sep-88	2.00	7.85		83	4

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
AW3-5	Sep-90	0.30	6.01	493	40	374
AW3-5 DUP	Sep-90	0.30	6.01	493	<1.0	946
L3-4	Sep-90	0.40	6.48		56	248
AW3-4	Sep-90	0.45				
L3-3	Sep-90	0.55	6.71		2	1030
AW3-3	Sep-90	0.60	7.04	411	2	966
L3-2	Sep-90	0.65	6.48		3	263
L3-1	Sep-90	0.90	6.95		<1.0	1310
AW3-2	Sep-90	1.00				
AW3-1	Sep-90	1.25	7.26	379	15	105
T3#PTRAP	Sep-90	2.00	7.13	391	10	552
L3-4	Jun-90	0.40	6.04			
AW3-4	Jun-90	0.45				
L3-3	Jun-90	0.55	6.28			
L3-2	Jun-90	0.65	6.52			
L3-1	Jun-90	0.90	6.17			
AW3-5	Jun-90	0.30	6.09	343	174	1718
AW3-5 DUP	Jun-90	0.30				
AW3-3	Jun-90	0.60	7.09	329	46	322
AW3-2	Jun-90	1.00				
AW3-1	Jun-90	1.25	7.33	282	58	54
T3#PTRAP	Jun-90	2.00				
AW3-5	Jul-89	0.30	6.32	417	75	552
AW3-4	Jul-89	0.45	6.81	436	27	22
L3-3	Jul-89	0.55				
AW3-3	Jul-89	0.60	6.92	467	17	10
AW3-3 DUP	Jul-89	0.60	6.89	597	14	57
L3-1	Jul-89	0.90	6.80			
AW3-2	Jul-89	1.00				
AW3-1	Jul-89	1.25	6.81	458	100	45
T3#PTRAP	Jul-89	2.00	5.20			
AW3-5 DUP	Sep-88	0.30				
AW3-5	Sep-88	0.30	7.87	211	102	84
AW3-4	Sep-88	0.45	7.67	228	19	8
AW3-3	Sep-88	0.60	8.48	591	29	5
AW3-1	Sep-88	1.25	7.13	347	126	32
T3#PTRAP	Sep-88	2.00	8.10		45	1
AW4-6	Sep-90	-0.10	6.89	406	106	156
AW4-6 DUP	Sep-90	-0.10				
L4-6	Sep-90	0.00	7.46			
L4-5	Sep-90	0.05	6.76		139	163

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
AW4-5	Sep-90	0.10	7.00	380	120	224
AW4-4	Sep-90	0.50	7.24	421	13	6
L4-4	Sep-90	0.55	6.85		14	5
AW4-3	Sep-90	0.65	7.94	356	12	9
L4-3	Sep-90	0.65	7.14		11	1
L4-2	Sep-90	0.70	6.93		14	8
AW4-2	Sep-90	0.70	8.42	279	20	4
L4-1	Sep-90	0.95	7.14		12	8
AW4-1	Sep-90	1.00	7.22	380	24	71
T4#PTRAP	Sep-90	2.00	7.02	423	3	304
AW4-6	Jun-90	-0.10	6.50	307	136	100
L4-6	Jun-90	0.00	7.51			
L4-5	Jun-90	0.05	7.05			
AW4-5	Jun-90	0.10	6.49	304	149	260
AW4-4 DUP	Jun-90	0.50				
AW4-4	Jun-90	0.50	7.52	290	16	2
L4-4	Jun-90	0.55	7.28			
L4-3	Jun-90	0.65	7.21			
AW4-3	Jun-90	0.65	7.84	216	14	8
L4-2	Jun-90	0.70				
AW4-2	Jun-90	0.70	7.95	210	18	6
L4-1	Jun-90	0.95	6.35			
AW4-1	Jun-90	1.00	6.95	260	48	34
T4#PTRAP	Jun-90	2.00				
AW4-6	Oct-89	-0.10	6.89	441	130	108
L4-6	Oct-89	0.00	7.50			
L4-5	Oct-89	0.05				
AW4-5	Oct-89	0.10	7.07	382	188	168
AW4-4	Oct-89	0.50	7.83	661	18	0
L4-4	Oct-89	0.55	6.70			
AW4-3	Oct-89	0.65	7.53	563	10	0
L4-3	Oct-89	0.65	5.50			
AW4-2	Oct-89	0.70	8.11	500	14	0
L4-2	Oct-89	0.70	6.30			
L4-1	Oct-89	0.95	5.90			
AW4-1 DUP	Oct-89	1.00				
AW4-1	Oct-89	1.00	5.91	486	26	44
T4#PTRAP	Oct-89	2.00	5.30			
AW4-6	Jul-89	-0.10	7.13	430	98	86
AW4-5	Jul-89	0.10	7.13	409	116	37
AW4-4	Jul-89	0.50	7.79	598	21	3
L4-3	Jul-89	0.65				
AW4-3	Jul-89	0.65	7.41	465	23	4
AW4-2 DUP	Jul-89	0.70	7.79	538	21	12
AW4-2	Jul-89	0.70	8.60	510	16	3

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
L4-2	Jul-89	0.70				
AW4-1	Jul-89	1.00	7.42	406	20	4
T4#PTRAP	Jul-89	2.00	6.00			
AW4-6	Sep-88	-0.10	8.24	252	148	109
AW4-5	Sep-88	0.10	8.13	370	221	85
AW4-4	Sep-88	0.50	7.28	295	43	5
AW4-3	Sep-88	0.65	6.12	491	11	5
AW4-3 DUP	Sep-88	0.65				
AW4-2	Sep-88	0.70	8.86	565	25	1
AW4-1	Sep-88	1.00	8.88	325		
AW4-1 DUP	Sep-88	1.00				
T4#PTRAP	Sep-88	2.00				
T4#PTRAP	Sep-88	2.00	6.80		124	250
L5-5	Sep-90	0.35	7.31			
AW5-6	Sep-90	0.50	7.25	318	14	269
L5-4	Sep-90	0.50	7.13			
AW5-6 DUP	Sep-90	0.50			12	277
L5-3	Sep-90	0.70	7.14		16	14
AW5-5	Sep-90	0.75	7.85	323	14	18
AW5-4	Sep-90	0.90	7.84	366	15	23
L5-2	Sep-90	0.90	6.84	622		
L5-1	Sep-90	1.00				
AW5-2	Sep-90	1.25	8.28	322		
AW5-3	Sep-90	1.30	7.97	388		
AW5-1	Sep-90	1.30	8.69	351		
T5#PTRAP	Sep-90	2.00	7.61		110	18
L5-5	Jun-90	0.35	6.69			
L5-4	Jun-90	0.50	6.75			
AW5-6	Jun-90	0.50	6.30	320	24	140
L5-3	Jun-90	0.70	6.89			
AW5-5	Jun-90	0.75	6.85	184	14	8
AW5-5 DUP	Jun-90	0.75				
L5-2	Jun-90	0.90	6.97			
AW5-4	Jun-90	0.90	6.52	331	20	10
L5-1	Jun-90	1.00	7.24			
AW5-2	Jun-90	1.25	6.70	357	40	26
AW5-1	Jun-90	1.30	7.38	304	150	14
AW5-3	Jun-90	1.30	9.47	230	45	
T5#PTRAP	Jun-90	2.00	7.33			
AW5-6	Oct-89	0.50	7.92	353		
AW5-5	Oct-89	0.75				
AW5-4	Oct-89	0.90				
L5-1	Oct-89	1.00				

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
AW5-2	Oct-89	1.25	9.31	489	48	
AW5-3	Oct-89	1.30	9.67	503	44	
AW5-1	Oct-89	1.30	9.82	540	54	
AW5-3 DUP	Oct-89	1.30				
L5-5	Jul-89	0.35	7.40			
L5-4	Jul-89	0.50				
AW5-6	Jul-89	0.50	7.54	553	19	2
L5-3	Jul-89	0.70		475		
AW5-5	Jul-89	0.75	8.08	546	33	1
AW5-4	Jul-89	0.90	7.74	530	26	1
L5-1	Jul-89	1.00	6.90			
AW5-2 DUP	Jul-89	1.25	7.76	466	43	16
AW5-3	Jul-89	1.30	8.17	525	48	1
AW5-3 DUP	Jul-89	1.30	8.68	496	50	3
AW5-1	Jul-89	1.30	7.31	501	36	3
T5#PTRAP	Jul-89	2.00				
AW5-6	Sep-88	0.50	8.46	595	34	8
AW5-2	Sep-88	1.25	9.41	623	60	
AW5-2 DUP	Sep-88	1.25				
AW5-3	Sep-88	1.30	9.30	602	57	
AW5-1	Sep-88	1.30	9.41	605	54	
AW5-5		0.75	9.05	608		
AW5-4		0.90	9.05	608		
AW5-2		1.25	8.00			
L6-4	Jun-90	0.25	3.57			
AW6-4	Jun-90	0.35	6.13		62	1340
L6-3	Jun-90	0.45	6.00			
AW6-3	Jun-90	0.50	6.25		76	488
L6-2	Jun-90	0.60				
AW6-2	Jun-90	0.65	6.20		18	4
AW6-1	Jun-90	0.80	6.95			
L6-1	Jun-90	0.90				
T6#PTRAP	Jun-90	2.00	6.19			
AW6-4	Oct-89	0.35				
AW6-3	Oct-89	0.50				
AW6-2	Oct-89	0.65	7.96	584	22	0
AW6-1	Oct-89	0.80				
T6#PTRAP	Oct-89	2.00	5.20			
AW6-4	Jul-89	0.35	6.32	474	98	720
AW6-4 DUP	Jul-89	0.35	6.30	588	106	626
AW6-3 DUP	Jul-89	0.50				
AW6-3	Jul-89	0.50	6.66	430	73	85
AW6-2	Jul-89	0.65	7.71	573	37	5

* Anomalous values: not included in statistical summaries.

TABLE 3-2
pH, Eh, ALKALINITY, ACIDITY
OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	TERM pH	Eh (+475) (mV)	ALKAL. (mg/L)	ACID. (mg/L)
AW6-1	Jul-89	0.80	7.23	555	38	5
T6#PTRAP	Jul-89	2.00	5.70			
AW6-4 DUP	Sep-88	0.35				
AW6-4	Sep-88	0.35	6.33	489	83	96
AW6-3	Sep-88	0.50	7.49	279	104	87
AW6-2	Sep-88	0.65	8.83	232	30	3
AW6-1	Sep-88	0.80	8.80	588	63	1
L6-1		0.90	6.20			
END	END	END	END	END	END	END

TABLE 3-3
OXYGEN/CARBON DIOXIDE CONCENTRATIONS IN THE TEST PIT

Sensor	Depth	CO_2 Oct. 23/89	0_2	C_{02} Feb/90	0_2	CO_2 June/90	0_2
TEST PIT #1							
AW 1-5	-0.10	160	20.7	169	19.7	15	20.7
AW 1-6	0.20	-	-	165	19.8		
AW 1-4	0.50	-	-	155	19.8		
AW 1-3	0.65	-	-	179	19.8		
AW 1-2	0.75	-	-	177	19.9		
AW 1-1	0.85	-	-	20.5	20.1	188	20.7
LYS 1-1						15	20.8
LYS 1-2						18	20.7
LYS 1-5						14	20.8
LYS 1-6						59	20.8
TEST PIT #2							
AW 2-3	0.45	-	-	140	19.7		
AW 2-2	0.85	-	-	124	19.6		
AW 2-1	0.90	-	-	180	19.6		
TEST PIT #3							
AW 3-5	0.30	42	20.7	22	19.8		
AW 3-4	0.45	50	20.7	18	19.8	13	20.8
AW 3-3	0.60	52	20.7	22	19.8		
AW 3-2	1.00	53	20.7	22	19.8	-	20.8
AW 3-1	1.25	25	20.6	38	19.8		
TEST PIT #4							
AW 4-6	-0.10	-	-	-	-		
AW 4-5	0.10	-	-	-	-		
AW 4-4	0.50	-	-	-	-		
AW 4-3	0.65	-	-	-	-		
AW 4-2	0.70	-	-	-	-		
AW 4-1	1.00	-	-	-	-		
LYS 4-2						101	20.7

Sensor	Depth	CO_2 Oct. 23/89	0_2	C_{02} Feb/90	0_2	CO_2 June/90	0_2
TEST PIT #5							
AW 5-6	0.50	154	20.8	121	19.8		
AW 5-5	0.75	138	20.7	95	19.9		
AW 5-4	0.90			86	20.0		
AW 5-2	1.20			109	20.4		
AW 5-1	1.30			130	19.6		
AW 5-3	1.30			98	20.1		
TEST PIT #6							
AW 6-4	0.35	160	20.7	84	19.8		
AW 6-3	0.50	125	20.7	116	19.7		
AW 6-2	0.65	-	-	131	19.7		
AW 6-1	0.80	141	20.7	125	19.7	25	20.7
LYS 6-2						25	20.7
TEST PIT #7							
7.10	0.00	88	20.8	58	20.4	130	20.8
7.20	0.30	71	20.6	50	20.2	4761	11.1
7.30	0.60	81	20.4	51	20.0	4720	3.3
7.40	0.90	67	20.1	47	19.9	4708	2.8
7.50	1.20	61	19.9	47	19.8	-	-
7.60	1.50	59	19.7	70	19.7	4704	0.3
7.70	1.80	80	19.6	52	19.7	4645	0.3
7.80	2.10	61	19.6	50	19.6	-	-
7.90	2.40	58	19.6	52	19.6	4703	0.3
7.10	2.70	659	19.6	48	19.5	4693	0.3
7.11	3.00	51	19.7	42	19.5	-	-
7.12	3.30	64	19.7	39	19.4	4757	0.5
7.13	3.60	41	19.7	24	19.5	4766	*3.8
7.14	3.90	38	19.7	25	19.5	3616	0.2

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
L1-6	Sep-90	-0.30					
AW1-5	Sep-90	-0.10					
L1-5	Sep-90	0.15	230	17.5	61.1	2.04	251
AW1-6	Sep-90	0.20	264	16.7	79.8	0.46	273
L1-4	Sep-90	0.50					
AW1-4	Sep-90	0.50	469	15.2	60.1	3.24	272
AW1-6 DUP	Sep-90	0.50	253	16.4	75.9	0.47	275
L1-3	Sep-90	0.55					
L1-2	Sep-90	0.60					
AW1-3	Sep-90	0.65	518	19.3	75.7	1.48	260
AW1-2	Sep-90	0.75	589	14.4	88.4	0.36	280
AW1-1	Sep-90	0.85					
L1-1	Sep-90	0.95					
T1#PTRAP	Sep-90	2.00	430	21.2	200.0	7.68	240
L1-6	Jun-90	-0.30					
AW1-5	Jun-90	-0.10					
L1-5	Jun-90	0.15					
AW1-6	Jun-90	0.20	222	11.8	32.3	1.26	295
AW1-4	Jun-90	0.50	386	13.5	53.2	6.93	277
AW1-4 DUP	Jun-90	0.50	377	13.8	52.6	6.25	275
L1-4	Jun-90	0.50					
L1-3	Jun-90	0.55					
L1-2	Jun-90	0.60					
AW1-3	Jun-90	0.65	534	22.7	108.0	2.14	3
AW1-2	Jun-90	0.75	532	14.0	103.0	0.91	298
AW1-1	Jun-90	0.85					
L1-1	Jun-90	0.95					
T1#PTRAP	Jun-90	2.00	289	15.9	112.0	1.77	174
AW1-5	Oct-89	-0.10					
L1-5	Oct-89	0.15	250	16.0	71.0	8.90	310
AW1-6	Oct-89	0.20	140	11.0	16.0	1.09	280
L1-4	Oct-89	0.50					
AW1-4	Oct-89	0.50	320	14.0	40.0	4.60	280
L1-3	Oct-89	0.55					
L1-2	Oct-89	0.60					
AW1-3	Oct-89	0.65	490	25.0	100.0	3.10	250
AW1-2 DUP	Oct-89	0.75	340	14.0	61.0	0.77	280
AW1-2	Oct-89	0.75	350	13.0	63.0	0.53	270
AW1-1	Oct-89	0.85	360	14.0	62.0	1.71	300
L1-1	Oct-89	0.95	290	22.0	290.0	0.20	250
T1#PTRAP	Oct-89	2.00	320	14.0	86.0	2.70	230
AW1-5	Jul-89	-0.10					
AW1-6	Jul-89	0.20	155	11.0	20.0	0.96	1
AW1-4	Jul-89	0.50	442	15.0	43.0	5.30	1
AW1-3	Jul-89	0.65					
AW1-2	Jul-89	0.75	540	21.0	106.0	2.70	1
AW1-1 DUP	Jul-89	0.85	358	26.0	82.0	2.01	1

* Anomalous values: not included in statistical summaries

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
AW1-1	Jul-89	0.85	354	14.0	80.0	2.30	1
L1-1	Jul-89	0.95	199	22.0	50.0	0.35	10
AW1-4 DUP	Sep-88	0.50	620	20.0	115.0	4.40	240
AW1-4	Sep-88	0.50	620	20.0	120.0	4.40	250
L1-3	Sep-88	0.55	1020	44.0	530.0	1.62	220
L1-2	Sep-88	0.60	850	38.0	510.0	8.70	230
AW1-3	Sep-88	0.65	430	34.0	230.0	4.40	200
AW1-2	Sep-88	0.75	400	26.0	140.0	2.40	270
AW1-1	Sep-88	0.85	470	20.0	135.0	10.00	260
L1-1	Sep-88	0.95	36	14.0	10.0	0.02	210
T1#PTRAP	Sep-88	2.00	0	0.5	0.5	0.00	0
AW2-3 DUP	Sep-90	0.45	473	14.1	225.0	20.00	35
AW2-3	Sep-90	0.45	472	13.8	219.0	17.50	35
L2-3	Sep-90	0.50	521	14.3	187.0	18.80	37
L2-2	Sep-90	0.75					
AW2-2	Sep-90	0.85	616	26.9	416.0	4.22	66
AW2-1	Sep-90	0.90	576	19.3	211.0	1.69	72
L2-1	Sep-90	0.90	561	19.5	164.0	0.42	69
T2#PTRAP	Sep-90	2.00	404	22.8	223.0	12.30	95
AW2-3 DUP	Jun-90	0.45	466	19.4	540.0	107.00	47
AW2-3	Jun-90	0.45	455	23.7	563.0	118.00	48
L2-3	Jun-90	0.50	558		397.0	51.90	
L2-2	Jun-90	0.75	454		755.0	106.00	
AW2-2	Jun-90	0.85	505	23.5	212.0	1.44	78
L2-1	Jun-90	0.90	321		110.0	0.36	
AW2-1	Jun-90	0.90	480	18.1	134.0	1.48	85
T2#PTRAP	Jun-90	2.00	281	21.4	121.0	1.31	114
AW2-3	Oct-89	0.45	330	12.0	57.0	1.26	52
AW2-2	Oct-89	0.85	260	19.0	66.0	0.58	68
AW2-1	Oct-89	0.90	250	20.0	70.0	1.50	78
T2#PTRAP	Oct-89	2.00	200	23.0	97.0	1.35	140
AW2-3	Jul-89	0.45	234	11.0	42.0	1.27	7
L2-3	Jul-89	0.50					
AW2-2	Jul-89	0.85	520	22.0	176.0	1.18	12
L2-1	Jul-89	0.90	161	21.0	60.0	0.22	18
AW2-1	Jul-89	0.90	168	19.0	58.0	1.70	10
T2#PTRAP	Jul-89	2.00	9	20.0	81.0	0.97	15
AW2-3	Sep-88	0.45	320	16.0	86.0	5.00	130
AW2-2	Sep-88	0.85	52	12.0	16.0	0.82	140
AW2-1	Sep-88	0.90	12	8.0	2.0	0.20	120
T2#PTRAP	Sep-88	2.00	2	2.0	0.5	0.00	0
AW3-5	Sep-90	0.30	373	8.3	139.0	55.70	10
AW3-5 DUP	Sep-90	0.30	367	8.4	140.0	57.20	10

* Anomalous values: not included in statistical summaries

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
L3-4	Sep-90	0.40	413	7.1	110.0	40.70	9
AW3-4	Sep-90	0.45					
L3-3	Sep-90	0.55	438	11.3	154.0	28.30	16
AW3-3	Sep-90	0.60	445	12.9	153.0	16.90	16
L3-2	Sep-90	0.65	413	14.8	212.0	22.30	30
L3-1	Sep-90	0.90	405	13.6	302.0	51.00	29
AW3-2	Sep-90	1.00					
AW3-1	Sep-90	1.25	435	23.4	399.0	8.44	42
T3#PTRAP	Sep-90	2.00	453	16.2	268.0	21.70	50
L3-4	Jun-90	0.40	452		306.0	58.80	
AW3-4	Jun-90	0.45					
L3-3	Jun-90	0.55	503		291.0	4.38	
L3-2	Jun-90	0.65	508		269.0	8.10	
L3-1	Jun-90	0.90	405		634.0	115.00	
AW3-5	Jun-90	0.30	476	13.9	430.0	115.00	19
AW3-5 DUP	Jun-90	0.30	460	13.6	370.0	99.00	19
AW3-3	Jun-90	0.60	453	16.8	277.0	10.70	61
AW3-2	Jun-90	1.00	1	0.1	0.3	<0.005	1
AW3-1	Jun-90	1.25	363	23.4	145.0	0.67	115
T3#PTRAP	Jun-90	2.00					
AW3-5	Jul-89	0.30	600	13.0	206.0	10.80	7
AW3-4	Jul-89	0.45	500	12.0	148.0	7.50	7
L3-3	Jul-89	0.55	322	42.0	86.0	0.99	11
AW3-3	Jul-89	0.60	500	16.0	128.0	3.90	10
AW3-3 DUP	Jul-89	0.60	480	11.0	126.0	8.20	4
L3-1	Jul-89	0.90	364	24.0	144.0	1.48	14
AW3-2	Jul-89	1.00					
AW3-1	Jul-89	1.25	109	16.0	8.7	0.62	14
T3#PTRAP	Jul-89	2.00	254	21.0	87.0	5.30	10
AW3-5 DUP	Sep-88	0.30	370	10.0	86.0	6.20	88
AW3-5	Sep-88	0.30	350	12.0	82.0	6.20	80
AW3-4	Sep-88	0.45	390	14.0	84.0	5.00	88
AW3-3	Sep-88	0.60	310	16.0	62.0	2.20	80
AW3-1	Sep-88	1.25	180	10.0	16.0	0.82	98
T3#PTRAP	Sep-88	2.00	0	0.5	0.5	0.00	0
			370	16.0	144.0	1.24	150
AW4-6	Sep-90	-0.10	484	15.1	112.0	0.93	220
AW4-6 DUP	Sep-90	-0.10	512	14.5	129.0	1.32	222
L4-6	Sep-90	0.00	526	17.6	118.0	0.92	298
L4-5	Sep-90	0.05	441	15.2	80.7	1.00	304
AW4-5	Sep-90	0.10	401	15.5	94.0	1.44	304
AW4-4	Sep-90	0.50	612	16.6	136.0	1.00	275
L4-4	Sep-90	0.55	569	16.1	126.0	1.31	245
AW4-3	Sep-90	0.65	258	18.5	66.3	0.57	203
L4-3	Sep-90	0.65	309	18.1	66.5	0.32	209
L4-2	Sep-90	0.70	234	22.8	70.6	0.19	209

* Anomalous values: not included in statistical summaries

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
L5-1	Jul-89	1.00	234	28.0	98.0	0.29	14
AW5-2 DUP	Jul-89	1.25					
AW5-3	Jul-89	1.30	7	17.0	1.2	0.01	13
AW5-3 DUP	Jul-89	1.30	9	16.0	1.7	0.02	13
AW5-1	Jul-89	1.30	16	14.0	3.1	0.05	11
T5#PTRAP	Jul-89	2.00	312	7.0	56.0	3.00	12
AW5-6	Sep-88	0.50	64	18.0	8.0	0.28	105
AW5-2	Sep-88	1.25	9	9.4	1.4	0.05	100
AW5-2 DUP	Sep-88	1.25	8	8.0	0.5	0.04	84
AW5-3	Sep-88	1.30	10	10.0	0.5	0.06	86
AW5-1	Sep-88	1.30	6	4.0	0.5	0.04	76
AW5-5		0.75					
AW5-4		0.90					
AW5-2		1.25	23	14.0	5.8	0.13	13
L6-4	Jun-90	0.25					
AW6-4	Jun-90	0.35					
L6-3	Jun-90	0.45	477		203.0	26.40	
AW6-3	Jun-90	0.50					
L6-2	Jun-90	0.60					
AW6-2	Jun-90	0.65					
AW6-1	Jun-90	0.80					
L6-1	Jun-90	0.90					
T6#PTRAP	Jun-90	2.00	294	15.8	113.0	1.86	173
AW6-4	Oct-89	0.35					
AW6-3	Oct-89	0.50					
AW6-2	Oct-89	0.65	400	17.0	102.0	0.91	50
AW6-1	Oct-89	0.80					
T6#PTRAP	Oct-89	2.00	270	15.0	192.0	34.00	54
AW6-4	Jul-89	0.35	460	18.0	171.0	36.00	5
AW6-4 DUP	Jul-89	0.35	318	14.0	114.0	22.00	4
AW6-3 DUP	Jul-89	0.50					
AW6-3	Jul-89	0.50	540	20.0	265.0	4.00	9
AW6-2	Jul-89	0.65	560	26.0	184.0	1.39	11
AW6-1	Jul-89	0.80	390	30.0	114.0	1.68	14
T6#PTRAP	Jul-89	2.00	382	14.0	134.0	10.00	6
AW6-4 DUP	Sep-88	0.35	320	11.0	127.0	17.00	68
AW6-4	Sep-88	0.35	540	14.0	160.0	10.00	86
AW6-3	Sep-88	0.50	680	12.0	240.0	7.50	64
AW6-2	Sep-88	0.65	360	24.0	125.0	1.58	145
AW6-1	Sep-88	0.80	44	12.0	10.0	0.36	130
L6-1		0.90	376	34.0	110.0	1.96	14
END	END	END	END	END	END	END	END

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
AW4-2	Sep-90	0.70	244	17.5	91.3	0.73	160
L4-1	Sep-90	0.95	229	19.9	66.7	0.15	212
AW4-1	Sep-90	1.00	432	21.7	129.0	0.34	248
T4#PTRAP	Sep-90	2.00	450	17.0	179.0	12.10	162
AW4-6	Jun-90	-0.10	393	11.3	69.5	0.55	190
L4-6	Jun-90	0.00					
L4-5	Jun-90	0.05	471		112.0	1.95	
AW4-5	Jun-90	0.10	457	12.6	132.0	3.37	250
AW4-4 DUP	Jun-90	0.50	104	10.9	28.5	0.37	61
AW4-4	Jun-90	0.50	102	11.2	29.8	0.33	63
L4-4	Jun-90	0.55					
L4-3	Jun-90	0.65	245		65.1	0.34	
AW4-3	Jun-90	0.65	231	18.1	69.4	0.77	199
L4-2	Jun-90	0.70					
AW4-2	Jun-90	0.70	278	19.5	92.5	1.17	172
L4-1	Jun-90	0.95	166		50.9	0.11	
AW4-1	Jun-90	1.00	280	16.9	90.8	0.69	231
T4#PTRAP	Jun-90	2.00	418	11.7	129.0	7.63	126
AW4-6	Oct-89	-0.10	350	14.0	63.0	0.86	330
L4-6	Oct-89	0.00	330	13.0	47.0	0.29	340
L4-5	Oct-89	0.05					
AW4-5	Oct-89	0.10	350	15.0	67.0	1.90	390
AW4-4	Oct-89	0.50	140	18.0	38.0	0.56	370
L4-4	Oct-89	0.55	160	19.0	46.0	0.40	350
AW4-3	Oct-89	0.65	220	22.0	62.0	1.11	260
L4-3	Oct-89	0.65	200	21.0	51.0	0.31	250
AW4-2	Oct-89	0.70	250	25.0	93.0	1.14	190
L4-2	Oct-89	0.70	160	26.0	38.0	0.16	240
L4-1	Oct-89	0.95	160	21.0	42.0	0.33	240
AW4-1 DUP	Oct-89	1.00	230	21.0	108.0	1.92	280
AW4-1	Oct-89	1.00	230	23.0	105.0	1.53	300
T4#PTRAP	Oct-89	2.00	326	12.0	84.0	4.50	250
AW4-6	Jul-89	-0.10	460	14.0	88.0	2.30	2
AW4-5	Jul-89	0.10	236	12.0	56.0	2.70	2
AW4-4	Jul-89	0.50	208	21.0	64.0	0.59	1
L4-3	Jul-89	0.65	0	0.0	0.0	0.00	0
AW4-3	Jul-89	0.65	210	21.0	52.0	1.22	20
AW4-2 DUP	Jul-89	0.70	300	26.0	82.0	1.36	21
AW4-2	Jul-89	0.70	240	26.0	60.0	1.22	21
L4-2	Jul-89	0.70	136	60.0	36.0	0.00	1
AW4-1	Jul-89	1.00	248	19.0	92.0	2.15	1
T4#PTRAP	Jul-89	2.00	312	7.0	58.0	3.30	13
AW4-6	Sep-88	-0.10	290	10.0	60.0	3.80	310
AW4-5	Sep-88	0.10	320	16.0	64.0	5.70	360
AW4-4	Sep-88	0.50	300	24.0	74.0	2.30	260
AW4-3	Sep-88	0.65	285	28.0	63.0	1.29	125
AW4-3 DUP	Sep-88	0.65	280	24.0	60.0	1.30	120

* Anomalous values: not included in statistical summaries

TABLE 3-4
CALCIUM, POTASSIUM, SODIUM, MAGNESIUM AND MANGANESE
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Ca (mg/L) (<2.0)	K (mg/L) (< 2)	Mg (mg/L) (< 2)	Mn (mg/L) (<0.02)	Na (mg/L) (< 2)
AW4-2	Sep-88	0.70	210	26.0	34.0	1.26	130
AW4-1	Sep-88	1.00	150	18.0	26.0	0.74	120
AW4-1 DUP	Sep-88	1.00	135	14.0	26.0	0.78	110
T4#PTRAP	Sep-88	2.00	0	0.1	0.0	0.00	0
T4#PTRAP	Sep-88	2.00	0	0.2	0.0	0.00	0
L5-5	Sep-90	0.35	464	14.1	159.0	5.77	14
AW5-6	Sep-90	0.50	561	18.5	315.0	4.71	45
L5-4	Sep-90	0.50	522	17.0	226.0	1.04	57
AW5-6 DUP	Sep-90	0.50	564	19.4	334.0	4.99	45
L5-3	Sep-90	0.70	511	18.3	191.0	1.11	49
AW5-5	Sep-90	0.75	543	16.6	190.0	2.28	37
AW5-4	Sep-90	0.90	509	20.0	197.0	2.94	41
L5-2	Sep-90	0.90	499	24.1	254.0	0.31	63
L5-1	Sep-90	1.00					
AW5-2	Sep-90	1.25	273	24.3	166.0	1.06	151
AW5-3	Sep-90	1.30	332	41.0	346.0	1.12	136
AW5-1	Sep-90	1.30	89	23.0	36.7	0.31	162
T5#PTRAP	Sep-90	2.00	68	11.8	27.0	2.04	120
L5-5	Jun-90	0.35	354		113.0	1.10	
L5-4	Jun-90	0.50					
AW5-6	Jun-90	0.50	500	18.6	215.0	5.80	43
L5-3	Jun-90	0.70	502		393.0	0.90	
AW5-5	Jun-90	0.75	505	21.6	235.0	3.25	44
AW5-5 DUP	Jun-90	0.75	512	21.0	243.0	3.49	44
L5-2	Jun-90	0.90	560		269.0	0.35	
AW5-4	Jun-90	0.90	545	25.0	326.0	4.10	72
L5-1	Jun-90	1.00					
AW5-2	Jun-90	1.25	416	36.2	227.0	4.22	162
AW5-1	Jun-90	1.30	55	23.5	15.6	0.36	161
AW5-3	Jun-90	1.30	11	15.9	2.2	0.07	130
T5#PTRAP	Jun-90	2.00	67	9.1	22.7	3.11	112
AW5-6	Oct-89	0.50	220	21.0	61.0	1.16	130
AW5-5	Oct-89	0.75					
AW5-4	Oct-89	0.90					
L5-1	Oct-89	1.00	190	23.0	65.0	0.09	170
AW5-2	Oct-89	1.25	6	13.0	1.2	0.00	140
AW5-3	Oct-89	1.30	8	15.0	1.4	0.01	150
AW5-1	Oct-89	1.30	8	11.0	2.2	0.05	120
AW5-3 DUP	Oct-89	1.30	10	16.0	2.5	0.03	150
L5-5	Jul-89	0.35	272	26.0	64.0	0.93	12
L5-4	Jul-89	0.50	82	28.0	26.0	0.24	16
AW5-6	Jul-89	0.50	308	26.0	88.0	1.23	11
L5-3	Jul-89	0.70	90	24.0	19.0	0.13	13
AW5-5	Jul-89	0.75	234	30.0	88.0	0.76	12
AW5-4	Jul-89	0.90	354	28.0	140.0	1.85	10

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
L1-6	Sep-90	-0.30				
AW1-5	Sep-90	-0.10				
L1-5	Sep-90	0.15				
AW1-6	Sep-90	0.20	23.2	1440	0.66	<0.005
L1-4	Sep-90	0.50				
AW1-4	Sep-90	0.50	20.6	1810	0.32	<0.005
AW1-6 DUP	Sep-90	0.50	23.4	1450	0.64	<0.005
L1-3	Sep-90	0.55				
L1-2	Sep-90	0.60				
AW1-3	Sep-90	0.65	24.3	1900	0.54	<0.005
AW1-2	Sep-90	0.75	33.1	1940	0.2	<0.005
AW1-1	Sep-90	0.85				
L1-1	Sep-90	0.95				
T1#PTRAP	Sep-90	2.00	31.8	2820	0.36	<0.005
L1-6	Jun-90	-0.30				
AW1-5	Jun-90	-0.10				
L1-5	Jun-90	0.15				
AW1-6	Jun-90	0.20	15.9	1140	0.43	<0.005
AW1-4	Jun-90	0.50	20.4	1620	0.28	<0.005
AW1-4 DUP	Jun-90	0.50	20.1	1590	0.27	<0.005
L1-4	Jun-90	0.50				
L1-3	Jun-90	0.55				
L1-2	Jun-90	0.60				
AW1-3	Jun-90	0.65	28.4	2590	0.55	<0.005
AW1-2	Jun-90	0.75	29.6	2550	0.12	<0.005
AW1-1	Jun-90	0.85				
L1-1	Jun-90	0.95				
T1#PTRAP	Jun-90	2.00	17.0	1570	1.23	<0.005
AW1-5	Oct-89	-0.10				
L1-5	Oct-89	0.15	0.0	1705	0.10	0.000
AW1-6	Oct-89	0.20	1.48	620	0.41	0.014
L1-4	Oct-89	0.50				
AW1-4	Oct-89	0.50	1.45	1490	0.35	0.010
L1-3	Oct-89	0.55				
L1-2	Oct-89	0.60				
AW1-3	Oct-89	0.65	1.72	1606	0.54	0.007
AW1-2 DUP	Oct-89	0.75				
AW1-2	Oct-89	0.75	0.67	1220	0.24	0.000
AW1-1	Oct-89	0.85	1.70	1770	0.13	0.000
L1-1	Oct-89	0.95	2.52	1540	1.10	0.010
T1#PTRAP	Oct-89	2.00	3.95	1370	0.70	0.000
AW1-5	Jul-89	-0.10				
AW1-6	Jul-89	0.20	2.90	661	0.33	0.033
AW1-4	Jul-89	0.50	1.59	1440	0.32	0.000
AW1-3	Jul-89	0.65				
AW1-2	Jul-89	0.75	2.11	1950	0.32	0.000
AW1-1 DUP	Jul-89	0.85	0.43	1494	0.17	0.000

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
AW1-1	Jul-89	0.85	4.10	1480	0.17	0.000
L1-1	Jul-89	0.95				
AW1-4 DUP	Sep-88	0.50	2.6	2250	0.45	0.02
AW1-4	Sep-88	0.50	2.6	2250	0.43	0.01
L1-3	Sep-88	0.55				0.00
L1-2	Sep-88	0.60	4.3	4200	0.62	0.00
AW1-3	Sep-88	0.65	7.7	1900	1.07	0.01
AW1-2	Sep-88	0.75	4.3	1950	0.55	0.01
AW1-1	Sep-88	0.85	6.7	2300	0.18	0.01
L1-1	Sep-88	0.95	7.7	420	3.72	0.00
T1#PTRAP	Sep-88	2.00	14.0	1	0.04	0.22
AW2-3 DUP	Sep-90	0.45	9.7	3200	0.19	<0.005
AW2-3	Sep-90	0.45	9.4	2620	0.16	<0.005
L2-3	Sep-90	0.50	11.4	4070	0.18	<0.005
L2-2	Sep-90	0.75				
AW2-2	Sep-90	0.85	8.9	3290	0.45	<0.005
AW2-1	Sep-90	0.90	11.7	2740	0.52	<0.005
L2-1	Sep-90	0.90	12.9	2100	0.73	<0.005
T2#PTRAP	Sep-90	2.00	17.5	2360	1.05	<0.005
AW2-3 DUP	Jun-90	0.45	6.2	3830	0.09	<0.005
AW2-3	Jun-90	0.45	6.2	4730	0.12	<0.005
L2-3	Jun-90	0.50	11.1	3880	0.19	
L2-2	Jun-90	0.75	12.2	4240	0.20	
AW2-2	Jun-90	0.85	11.2	2470	0.47	<0.005
L2-1	Jun-90	0.90				
AW2-1	Jun-90	0.90	13.3	1910	0.64	<0.005
T2#PTRAP	Jun-90	2.00	10.7	1450	1.68	<0.005
AW2-3	Oct-89	0.45	1.82	1171	0.16	0.000
AW2-2	Oct-89	0.85	1.82	912	0.64	0.000
AW2-1	Oct-89	0.90	1.75	885	0.78	0.016
T2#PTRAP	Oct-89	2.00	2.69	870	2.20	0.010
AW2-3	Jul-89	0.45	7.09	568	0.22	0.000
L2-3	Jul-89	0.50	3.45	635	0.52	0.000
AW2-2	Jul-89	0.85	4.06	860	0.63	0.000
L2-1	Jul-89	0.90	4.57	740	1.50	0.000
AW2-1	Jul-89	0.90	5.21	700	0.91	0.000
T2#PTRAP	Jul-89	2.00	3.53	840	2.70	0.000
AW2-3	Sep-88	0.45	4.8	1150	1.43	0.01
AW2-2	Sep-88	0.85	9.9	330	2.46	0.01
AW2-1	Sep-88	0.90	9.2	170	3.00	0.02
T2#PTRAP	Sep-88	2.00	7.8	1	0.04	0.01
AW3-5	Sep-90	0.30	5	3120	0.07	<0.005
AW3-5 DUP	Sep-90	0.30	3.9	3220	0.06	<0.005

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
L3-4	Sep-90	0.40				
AW3-4	Sep-90	0.45				
L3-3	Sep-90	0.55				
AW3-3	Sep-90	0.60	4.5	2900	0.23	<0.005
L3-2	Sep-90	0.65				
L3-1	Sep-90	0.90				
AW3-2	Sep-90	1.00				
AW3-1	Sep-90	1.25	19.2	3130	1.12	<0.005
T3#PTRAP	Sep-90	2.00	19.8	3110	0.56	<0.005
L3-4	Jun-90	0.40	18.9	3740	0.09	
AW3-4	Jun-90	0.45				
L3-3	Jun-90	0.55	12.8	2210	0.43	
L3-2	Jun-90	0.65	9.1	2310	0.65	
L3-1	Jun-90	0.90	14.5	5600	0.45	
AW3-5	Jun-90	0.30	19.4	4850	0.07	<0.005
AW3-5 DUP	Jun-90	0.30	25.4	4730	0.06	<0.005
AW3-3	Jun-90	0.60	10.0	3080	0.43	<0.005
AW3-2	Jun-90	1.00	0.7	2	<0.02	<0.005
AW3-1	Jun-90	1.25	21.6	1760	1.43	0.021
T3#PTRAP	Jun-90	2.00				
AW3-5	Jul-89	0.30	1.73	2260	0.13	0.000
AW3-4	Jul-89	0.45	11.70	1108	0.33	0.000
L3-3	Jul-89	0.55				
AW3-3	Jul-89	0.60	2.12	835	0.63	0.000
AW3-3 DUP	Jul-89	0.60	1.90	1494	0.38	0.000
L3-1	Jul-89	0.90	1.48	1510	1.40	0.015
AW3-2	Jul-89	1.00				
AW3-1	Jul-89	1.25	5.78	487	1.60	0.000
T3#PTRAP	Jul-89	2.00	1.74	1000	0.28	0.000
AW3-5 DUP	Sep-88	0.30	6.0	1450	0.26	0.01
AW3-5	Sep-88	0.30	4.7	1700	0.23	0.01
AW3-4	Sep-88	0.45	6.5	1400	0.69	0.01
AW3-3	Sep-88	0.60	3.5	1100	1.23	0.01
AW3-1	Sep-88	1.25	6.2	450	0.53	0.01
T3#PTRAP	Sep-88	2.00	4.9	1	0.01	0.00
			2.86	1640	0.82	0.012
AW4-6	Sep-90	-0.10	18.9	2060	0.43	<0.005
AW4-6 DUP	Sep-90	-0.10	20.1	2030	0.38	<0.005
L4-6	Sep-90	0.00				
L4-5	Sep-90	0.05				
AW4-5	Sep-90	0.10	27.3	2040	0.3	<0.005
AW4-4	Sep-90	0.50	24	2620	0.43	<0.005
L4-4	Sep-90	0.55				
AW4-3	Sep-90	0.65	17.6	1410	0.89	<0.005
L4-3	Sep-90	0.65				
L4-2	Sep-90	0.70				

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
AW4-2	Sep-90	0.70	17.7	1300	0.75	<0.005
L4-1	Sep-90	0.95				
AW4-1	Sep-90	1.00	32	2140	0.31	<0.005
T4#PTRAP	Sep-90	2.00	27.8	2830	0.42	<0.005
AW4-6	Jun-90	-0.10	22.6	1660	0.52	<0.005
L4-6	Jun-90	0.00				
L4-5	Jun-90	0.05				
AW4-5	Jun-90	0.10	26.6	2150	0.16	<0.005
AW4-4 DUP	Jun-90	0.50	6.5	439	0.88	0.012
AW4-4	Jun-90	0.50	6.4	444	0.89	<0.005
L4-4	Jun-90	0.55				
L4-3	Jun-90	0.65				
AW4-3	Jun-90	0.65	18.1	1220	0.98	<0.005
L4-2	Jun-90	0.70				
AW4-2	Jun-90	0.70	19.3	1380	0.83	<0.005
L4-1	Jun-90	0.95				
AW4-1	Jun-90	1.00	19.0	1390	0.50	0.120
T4#PTRAP	Jun-90	2.00	21.4	2220	0.22	<0.005
AW4-6	Oct-89	-0.10	1.14	1705	0.42	0.000
L4-6	Oct-89	0.00	3.21	1553	0.43	0.024
L4-5	Oct-89	0.05	0.0	1405	0.37	0.000
AW4-5	Oct-89	0.10	2.02	1640	0.26	0.000
AW4-4	Oct-89	0.50	1.45	1030	0.78	0.010
L4-4	Oct-89	0.55	1.55	1095	0.86	0.006
AW4-3	Oct-89	0.65	2.10	837	1.00	0.000
L4-3	Oct-89	0.65	1.99	1145	1.20	0.007
AW4-2	Oct-89	0.70	14.50	940	0.84	0.000
L4-2	Oct-89	0.70	3.24	861	1.40	0.012
L4-1	Oct-89	0.95	2.36	920	1.70	0.009
AW4-1 DUP	Oct-89	1.00				
AW4-1	Oct-89	1.00	1.49	1540	0.47	0.000
T4#PTRAP	Oct-89	2.00	3.28	1770	0.34	0.000
AW4-6	Jul-89	-0.10	23.30	1760	0.31	0.000
AW4-5	Jul-89	0.10	14.90	1053	0.39	0.000
AW4-4	Jul-89	0.50	1.73	2260	0.13	0.000
L4-3	Jul-89	0.65				
AW4-3	Jul-89	0.65	11.70	1108	0.33	0.000
AW4-2 DUP	Jul-89	0.70	1.90	1494	0.38	0.000
AW4-2	Jul-89	0.70	2.12	835	0.63	0.000
L4-2	Jul-89	0.70				
AW4-1	Jul-89	1.00	5.78	487	1.60	0.000
T4#PTRAP	Jul-89	2.00	3.32	1113	0.34	0.000
AW4-6	Sep-88	-0.10	2.4	2200	0.28	0.01
AW4-5	Sep-88	0.10	1.8	1900	0.30	0.01
AW4-4	Sep-88	0.50	3.8	1700	1.21	0.01
AW4-3	Sep-88	0.65	33.5	1283	1.65	0.03
AW4-3 DUP	Sep-88	0.65	5.6	1200	1.04	0.01

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
AW4-2	Sep-88	0.70	5.3	950	1.35	0.01
AW4-1	Sep-88	1.00	28.0	650	1.09	0.01
AW4-1 DUP	Sep-88	1.00	13.0	650	1.43	0.01
T4#PTRAP	Sep-88	2.00	1.0	0	0.05	0.06
T4#PTRAP	Sep-88	2.00	1.1	0	0.05	0.02
L5-5	Sep-90	0.35				
AW5-6	Sep-90	0.50	17.8	3190	0.38	<0.005
L5-4	Sep-90	0.50				
AW5-6 DUP	Sep-90	0.50	14.2	3170	0.34	6.94
L5-3	Sep-90	0.70	20	2130	0.66	0.14
AW5-5	Sep-90	0.75	17.3	2090	0.63	<0.005
AW5-4	Sep-90	0.90	16.6	1820	0.71	<0.005
L5-2	Sep-90	0.90				
L5-1	Sep-90	1.00				
AW5-2	Sep-90	1.25	13.5	1690	1.55	<0.005
AW5-3	Sep-90	1.30	7	2680	1.02	<0.005
AW5-1	Sep-90	1.30	8.3	620	1.51	1.58
T5#PTRAP	Sep-90	2.00	7.4	421	2.44	<0.005
L5-5	Jun-90	0.35				
L5-4	Jun-90	0.50				
AW5-6	Jun-90	0.50	18.4	2240	0.51	<0.005
L5-3	Jun-90	0.70	27.9	I.S.	0.91	
AW5-5	Jun-90	0.75	15.4	2150	0.81	<0.005
AW5-5 DUP	Jun-90	0.75	15.9	2190	0.78	<0.005
L5-2	Jun-90	0.90				
AW5-4	Jun-90	0.90	18.6	2900	0.83	<0.005
L5-1	Jun-90	1.00				
AW5-2	Jun-90	1.25	20.7	2580	1.23	<0.005
AW5-1	Jun-90	1.30	11.5	465	1.42	0.160
AW5-3	Jun-90	1.30	5.8	279	3.31	0.800
T5#PTRAP	Jun-90	2.00	4.5	373	2.16	<0.005
AW5-6	Oct-89	0.50				
AW5-5	Oct-89	0.75				
AW5-4	Oct-89	0.90				
L5-1	Oct-89	1.00				
AW5-2	Oct-89	1.25	1.84	235	3.40	0.000
AW5-3	Oct-89	1.30	1.13	242	3.60	0.000
AW5-1	Oct-89	1.30	1.36	181	3.60	0.006
AW5-3 DUP	Oct-89	1.30				
L5-5	Jul-89	0.35	11.80	955	1.20	0.000
L5-4	Jul-89	0.50				
AW5-6	Jul-89	0.50	6.74	1030	1.20	0.005
L5-3	Jul-89	0.70				
AW5-5	Jul-89	0.75	6.13	840	1.50	0.007
AW5-4	Jul-89	0.90	12.40	950	1.60	0.008

* Anomalous values: not included in statistical summaries

TABLE 3-5
CHLORINE, FLOURINE, NITRATES AND SULPHATES
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cl (mg/L)	Sulfate (mg/L)	F (mg/L)	Nitrate (mg N/L
L5-1	Jul-89	1.00	16.50	888	2.00	0.000
AW5-2 DUP	Jul-89	1.25	3.24	167	3.80	0.000
AW5-3	Jul-89	1.30	3.99	223	3.80	0.005
AW5-3 DUP	Jul-89	1.30				
AW5-1	Jul-89	1.30	2.31	153	2.30	0.000
T5#PTRAP	Jul-89	2.00	2.10	334	1.70	0.000
AW5-6	Sep-88	0.50	7.8	340	2.79	0.01
AW5-2	Sep-88	1.25	14.8	181	4.60	0.15
AW5-2 DUP	Sep-88	1.25	7.4	140	4.25	0.01
AW5-3	Sep-88	1.30	7.5	110	4.27	0.01
AW5-1	Sep-88	1.30	8.8	115	3.99	0.01
AW5-5		0.75				
AW5-4		0.90				
AW5-2		1.25	2.05	206	2.30	0.007
L6-4	Jun-90	0.25				
AW6-4	Jun-90	0.35				
L6-3	Jun-90	0.45				
AW6-3	Jun-90	0.50				
L6-2	Jun-90	0.60				
AW6-2	Jun-90	0.65				
AW6-1	Jun-90	0.80				
L6-1	Jun-90	0.90				
T6#PTRAP	Jun-90	2.00	17.7	1620	1.20	<0.005
AW6-4	Oct-89	0.35				
AW6-3	Oct-89	0.50				
AW6-2	Oct-89	0.65	1.51	1853	0.60	0.000
AW6-1	Oct-89	0.80				
T6#PTRAP	Oct-89	2.00	1.15	1970	0.39	0.000
AW6-4	Jul-89	0.35	4.11	1775	0.12	0.023
AW6-4 DUP	Jul-89	0.35				
AW6-3 DUP	Jul-89	0.50	0.94	2446	0.08	0.007
AW6-3	Jul-89	0.50	3.35	2070	0.40	0.013
AW6-2	Jul-89	0.65	8.13	1898	0.60	0.000
AW6-1	Jul-89	0.80	3.91	1400	1.10	0.033
T6#PTRAP	Jul-89	2.00	0.67	1250	0.38	0.000
AW6-4 DUP	Sep-88	0.35	21	1815	0.20	0.76
AW6-4	Sep-88	0.35	4.8	1850	0.25	0.13
AW6-3	Sep-88	0.50	3.5	3700	0.29	0.01
AW6-2	Sep-88	0.65	2.1	1450	0.90	0.01
AW6-1	Sep-88	0.80	6.8	300	3.40	0.01
L6-1		0.90	6.06	1372	1.20	0.000
END	END	END	END	END	END	END

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
L1-6	Sep-90	-0.30						
AW1-5	Sep-90	-0.10						
L1-5	Sep-90	0.15	0.007	<0.001	159.0	0.001	0.006	1.8
AW1-6	Sep-90	0.20	0.006	0.001	22.3	0.004	<0.005	0.007
L1-4	Sep-90	0.50						
AW1-4	Sep-90	0.50	0.003	0.001	17.8	0.012	<0.005	0.008
AW1-6 DUP	Sep-90	0.50	0.009	0.001	22.5	0.003	0.006	0.006
L1-3	Sep-90	0.55						
L1-2	Sep-90	0.60						
AW1-3	Sep-90	0.65	0.003	0.001	1.9	0.001	<0.005	<0.005
AW1-2	Sep-90	0.75	0.005	0.001	61.0	0.002	0.015	<0.005
AW1-1	Sep-90	0.85						
L1-1	Sep-90	0.95						
T1#PTRAP	Sep-90	2.00	0.005	<0.001	338.0	<0.001	<0.005	<0.005
L1-6	Jun-90	-0.30						
AW1-5	Jun-90	-0.10						
L1-5	Jun-90	0.15						
AW1-6	Jun-90	0.20	0.004	<0.001	28.2	0.006	0.013	0.061
AW1-4	Jun-90	0.50	0.003	<0.001	8.7	0.007	0.012	0.047
AW1-4 DUP	Jun-90	0.50	0.005	<0.001	12.0	0.014	0.008	0.019
L1-4	Jun-90	0.50		0.011	45.5		0.011	0.550
L1-3	Jun-90	0.55						
L1-2	Jun-90	0.60						
AW1-3	Jun-90	0.65	0.003	<0.001	2.6	0.002	0.021	<0.005
AW1-2	Jun-90	0.75	0.003	0.001	134.0	0.004	0.007	0.012
AW1-1	Jun-90	0.85						
L1-1	Jun-90	0.95						
T1#PTRAP	Jun-90	2.00	0.005	<0.001	48.3	<0.001	0.001	0.006
AW1-5	Oct-89	-0.10						
L1-5	Oct-89	0.15	0.000	0.000	570.0	0.004	0.002	17.000
AW1-6	Oct-89	0.20	0.000	0.000	16.0	0.005	0.000	0.007
L1-4	Oct-89	0.50						
AW1-4	Oct-89	0.50	0.000	0.000	2.4	0.005	0.000	0.000
L1-3	Oct-89	0.55						
L1-2	Oct-89	0.60						
AW1-3	Oct-89	0.65	0.000	0.000	1.6	0.003	0.000	0.001
AW1-2 DUP	Oct-89	0.75	0.000	0.000	79.0	0.007	0.000	0.005
AW1-2	Oct-89	0.75	0.000	0.000	64.0	0.006	0.000	0.007
AW1-1	Oct-89	0.85	0.014	0.000	107.0	0.010	0.000	0.140
L1-1	Oct-89	0.95	0.000	0.000	1.0	0.007	0.026	0.002
T1#PTRAP	Oct-89	2.00	0.000	0.000	119.0	0.002	0.000	0.050
AW1-5	Jul-89	-0.10						
AW1-6	Jul-89	0.20	0.000	0.000	3.8	0.004	0.004	0.130
AW1-4	Jul-89	0.50	0.000	0.002	2.3	0.009	0.003	0.000
AW1-3	Jul-89	0.65						
AW1-2	Jul-89	0.75	0.000	0.005	44.0	0.014	0.035	0.080
AW1-1 DUP	Jul-89	0.85	0.000	0.000	91.0	0.034	0.013	0.220

* Anomalous values: not included in statistical summaries

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
AW1-1	Jul-89	0.85	0.000	0.000	105.0	0.032	0.010	0.003
L1-1	Jul-89	0.95	0.000	0.000	38.0	0.006	0.050	0.080
AW1-4 DUP	Sep-88	0.50	0.02	0.00	0.5	0.00	0.00	0.02
AW1-4	Sep-88	0.50	0.02	0.00	0.5	0.00	0.00	0.02
L1-3	Sep-88	0.55	0.06	0.00	16.0	0.00	0.00	0.30
L1-2	Sep-88	0.60	0.10	0.00	1.0	0.00	0.00	0.14
AW1-3	Sep-88	0.65	0.02	0.00	0.5	0.00	0.00	0.00
AW1-2	Sep-88	0.75	0.02	0.00	0.5	0.00	0.00	0.00
AW1-1	Sep-88	0.85	0.02	0.00	118.0	0.00	0.00	0.02
L1-1	Sep-88	0.95	0.18	0.00	0.3	0.00	0.00	0.02
T1#PTRAP	Sep-88	2.00	0.00	0.00	0.3	0.00	0.00	0.02
AW2-3 DUP	Sep-90	0.45	0.006	<0.001	710.0	0.002	0.02	1.5
AW2-3	Sep-90	0.45	0.007	<0.001	644.0	0.002	0.025	0.579
L2-3	Sep-90	0.50	0.004	<0.001	925.0	<0.001	<0.005	0.286
L2-2	Sep-90	0.75						
AW2-2	Sep-90	0.85	0.012	0.001	90.6	0.002	<0.005	<0.005
AW2-1	Sep-90	0.90	0.005	0.001	3.0	0.003	<0.005	<0.005
L2-1	Sep-90	0.90	0.003	0.002	10.4	<0.001	<0.005	0.035
T2#PTRAP	Sep-90	2.00	0.003	<0.001	218.0	<0.001	<0.005	<0.005
AW2-3 DUP	Jun-90	0.45	0.006	<0.001	735.0	0.007	0.006	16.900
AW2-3	Jun-90	0.45	0.005	<0.001	775.0	0.010	0.005	21.400
L2-3	Jun-90	0.50	<0.015	<0.001	535.0	<0.020	<0.001	0.460
L2-2	Jun-90	0.75	<0.015	<0.001	733.0	<0.020	0.022	33.400
AW2-2	Jun-90	0.85	0.005	<0.001	9.1	0.002	0.009	<0.005
L2-1	Jun-90	0.90	<0.015	<0.001	5.7	<0.020	0.024	0.045
AW2-1	Jun-90	0.90	0.006	<0.001	0.9	0.003	0.012	<0.005
T2#PTRAP	Jun-90	2.00	0.005	<0.001	18.0	<0.001	0.001	<0.005
AW2-3	Oct-89	0.45	0.000	0.000	182.0	0.034	0.017	0.390
AW2-2	Oct-89	0.85	0.000	0.000	0.6	0.002	0.000	0.002
AW2-1	Oct-89	0.90	0.000	0.000	0.3	0.004	0.000	0.003
T2#PTRAP	Oct-89	2.00	0.000	0.000	23.0	0.002	0.000	0.002
AW2-3	Jul-89	0.45	0.000	0.000	88.0	0.050	0.004	0.400
L2-3	Jul-89	0.50						
AW2-2	Jul-89	0.85	0.000	0.003	0.6	0.000	0.001	0.000
L2-1	Jul-89	0.90	0.000	0.015	0.3	0.003	0.027	0.080
AW2-1	Jul-89	0.90	0.000	0.001	0.4	0.000	0.050	0.003
T2#PTRAP	Jul-89	2.00	0.000	0.011	29.0	0.004	0.660	0.500
AW2-3	Sep-88	0.45	0.02	0.00	26.0	0.00	0.00	1.28
AW2-2	Sep-88	0.85	0.02	0.00	0.5	0.00	0.00	0.02
AW2-1	Sep-88	0.90	0.02	0.00	2.0	0.00	0.00	0.02
T2#PTRAP	Sep-88	2.00	0.02	0.00	0.5	0.00	0.00	0.02
AW3-5	Sep-90	0.30	0.008	0.005	775.0	0.005	0.13	69.3
AW3-5 DUP	Sep-90	0.30	0.006	0.002	785.0	0.006	0.076	71.5

* Anomalous values: not included in statistical summaries

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
L3-4	Sep-90	0.40	0.007	<0.001	631.0	0.002	0.016	31.3
AW3-4	Sep-90	0.45						
L3-3	Sep-90	0.55	0.008	<0.001	602.0	0.001	<0.005	0.29
AW3-3	Sep-90	0.60	0.004	<0.001	629.0	0.001	0.014	0.803
L3-2	Sep-90	0.65	0.022	0.002	699.0	0.007	<0.005	4.33
L3-1	Sep-90	0.90	0.006	0.002	1050.0	0.006	<0.005	14.7
AW3-2	Sep-90	1.00						
AW3-1	Sep-90	1.25	0.004	<0.001	115.0	0.004	0.009	0.011
T3#PTRAP	Sep-90	2.00	0.01	<0.001	342.0	<0.001	<0.005	0.166
L3-4	Jun-90	0.40	<0.015	0.001	899.0	<0.020	0.009	61.400
AW3-4	Jun-90	0.45						
L3-3	Jun-90	0.55	<0.015	<0.001	130.0	<0.020	0.001	1.020
L3-2	Jun-90	0.65	<0.015	<0.001	195.0	<0.020	<0.001	5.260
L3-1	Jun-90	0.90	<0.015	<0.001	1090.0	<0.020	<0.001	59.300
AW3-5	Jun-90	0.30	0.010	<0.001	1210.0	0.012	0.008	41.400
AW3-5 DUP	Jun-90	0.30	0.005	<0.001	1090.0	0.006	0.007	65.300
AW3-3	Jun-90	0.60	0.005	<0.001	211.0	0.017	0.003	4.310
AW3-2	Jun-90	1.00	0.009	<0.001	0.1	0.001	0.002	0.020
AW3-1	Jun-90	1.25	0.006	<0.001	28.5	0.002	0.002	0.011
T3#PTRAP	Jun-90	2.00						
AW3-5	Jul-89	0.30	0.000	0.000	320.0	0.050	0.005	0.110
AW3-4	Jul-89	0.45	0.000	0.000	41.0	0.029	0.002	0.019
L3-3	Jul-89	0.55	0.000	0.009	9.7	0.008	0.050	0.260
AW3-3	Jul-89	0.60	0.000	0.000	4.6	0.004	0.004	0.080
AW3-3 DUP	Jul-89	0.60	0.000	0.000	30.0	0.013	0.008	0.080
L3-1	Jul-89	0.90	0.000	0.001	13.0	0.002	0.012	0.340
AW3-2	Jul-89	1.00						
AW3-1	Jul-89	1.25	0.000	0.000	13.0	0.000	0.012	0.110
T3#PTRAP	Jul-89	2.00	0.023	0.270	49.0	0.050	2.700	4.200
AW3-5 DUP	Sep-88	0.30	0.02	0.00	82.0	0.00	0.00	0.08
AW3-5	Sep-88	0.30	0.02	0.00	88.0	0.00	0.12	0.08
AW3-4	Sep-88	0.45	0.02	0.00	4.0	0.00	0.00	0.06
AW3-3	Sep-88	0.60	0.02	0.00	0.5	0.00	0.08	0.02
AW3-1	Sep-88	1.25	0.02	0.00	30.0	0.00	0.04	0.04
T3#PTRAP	Sep-88	2.00	0.00	0.00	0.1	0.00	0.00	0.00
			0.000	0.020	4.7	0.003	0.048	1.060
AW4-6	Sep-90	-0.10	0.008	<0.001	81.9	0.002	<0.005	0.192
AW4-6 DUP	Sep-90	-0.10	<0.001	<0.001	29.1	0.001	<0.005	0.159
L4-6	Sep-90	0.00	0.007	<0.001	87.2	0.006	<0.005	0.079
L4-5	Sep-90	0.05	0.008	<0.001	97.0	0.002	<0.005	0.013
AW4-5	Sep-90	0.10	0.009	<0.001	128.0	0.002	<0.005	<0.005
AW4-4	Sep-90	0.50	0.006	0.001	3.0	0.003	<0.005	<0.005
L4-4	Sep-90	0.55	0.005	<0.001	16.5	0.003	<0.005	0.019
AW4-3	Sep-90	0.65	0.009	0.001	5.1	0.001	<0.005	<0.005
L4-3	Sep-90	0.65	0.006	<0.001	8.8	0.003	<0.005	0.007
L4-2	Sep-90	0.70	0.006	<0.001	2.2	0.001	0.005	0.034

* Anomalous values: not included in statistical summaries

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
L5-1	Jul-89	1.00	0.000	0.005	0.3	0.002	0.031	0.050
AW5-2 DUP	Jul-89	1.25						
AW5-3	Jul-89	1.30	0.000	0.000	0.2	0.000	0.022	0.016
AW5-3 DUP	Jul-89	1.30	0.000	0.000	0.2	0.000	0.010	0.012
AW5-1	Jul-89	1.30	0.000	0.000	0.6	0.002	0.090	0.050
T5#PTRAP	Jul-89	2.00	0.002	0.080	77.0	0.012	0.000	0.540
AW5-6	Sep-88	0.50	0.02	0.00	0.5	0.00	0.00	0.00
AW5-2	Sep-88	1.25	0.02	0.00	0.1	0.10	0.012	0.011
AW5-2 DUP	Sep-88	1.25	0.02	0.00	0.5	0.00	0.00	0.00
AW5-3	Sep-88	1.30	0.02	0.00	0.5	0.00	0.00	0.00
AW5-1	Sep-88	1.30	0.02	0.00	0.5	0.00	0.04	0.00
AW5-5		0.75						
AW5-4		0.90						
AW5-2		1.25	0.000	0.000	1.9	0.003	0.070	0.100
L6-4	Jun-90	0.25		0.560	747.0		2.720	74.100
AW6-4	Jun-90	0.35						
L6-3	Jun-90	0.45	<0.015	0.001	727.0	<0.020	0.002	9.460
AW6-3	Jun-90	0.50						
L6-2	Jun-90	0.60						
AW6-2	Jun-90	0.65						
AW6-1	Jun-90	0.80						
L6-1	Jun-90	0.90		0.002	5.3		0.010	0.840
T6#PTRAP	Jun-90	2.00	0.006	0.001	49.5	<0.001	0.007	0.016
AW6-4	Oct-89	0.35						
AW6-3	Oct-89	0.50						
AW6-2	Oct-89	0.65	0.000	0.000	0.4	0.003	0.002	0.004
AW6-1	Oct-89	0.80						
T6#PTRAP	Oct-89	2.00	0.000	0.000	295.0	0.009	0.000	4.800
AW6-4	Jul-89	0.35	0.000	0.005	520.0	0.120	0.003	51.000
AW6-4 DUP	Jul-89	0.35	0.000	0.005	435.0	0.050	0.070	32.000
AW6-3 DUP	Jul-89	0.50						
AW6-3	Jul-89	0.50	0.000	0.000	40.0	0.006	0.003	0.009
AW6-2	Jul-89	0.65	0.000	0.002	0.9	0.002	0.010	0.000
AW6-1	Jul-89	0.80	0.000	0.004	0.9	0.005	0.012	0.090
T6#PTRAP	Jul-89	2.00	0.000	0.000	140.0	0.005	0.005	0.290
AW6-4 DUP	Sep-88	0.35	0.00	0.00	51.0	0.02	0.043	25.000
AW6-4	Sep-88	0.35	0.02	0.00	70.0	0.30	0.36	10.00
AW6-3	Sep-88	0.50	0.04	0.00	76.0	0.00	0.00	0.00
AW6-2	Sep-88	0.65	0.02	0.00	2.0	0.00	0.00	<0.02
AW6-1	Sep-88	0.80	0.12	0.00	0.5	0.00	0.00	0.02
L6-1		0.90	0.000	0.006	10.8	0.014	0.060	

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
AW4-2	Sep-90	0.70	0.004	0.001	2.4	<0.001	<0.005	<0.005
L4-1	Sep-90	0.95	0.01	0.001	2.4	0.002	<0.005	0.103
AW4-1	Sep-90	1.00	0.006	0.001	45.8	0.018	<0.005	<0.005
T4#PTRAP	Sep-90	2.00	0.005	<0.001	410.0	0.005	<0.005	0.149
AW4-6	Jun-90	-0.10	0.005	<0.001	48.5	0.002	0.002	0.130
L4-6	Jun-90	0.00	-	0.006	2.7	-	0.340	1.120
L4-5	Jun-90	0.05	<0.015	0.001	142.0	<0.020	0.009	0.130
AW4-5	Jun-90	0.10	0.005	<0.001	161.0	0.001	0.001	<0.005
AW4-4 DUP	Jun-90	0.50	0.002	<0.001	0.2	<0.001	0.002	<0.005
AW4-4	Jun-90	0.50	0.004	<0.001	0.2	<0.001	0.002	0.008
L4-4	Jun-90	0.55	-	0.002	1.1	-	0.016	0.490
L4-3	Jun-90	0.65	<0.015	0.002	5.9	<0.020	0.023	0.720
AW4-3	Jun-90	0.65	0.004	<0.001	4.2	0.002	0.002	<0.005
L4-2	Jun-90	0.70						
AW4-2	Jun-90	0.70	0.004	0.001	2.9	0.002	0.006	0.016
L4-1	Jun-90	0.95	<0.015	0.003	0.3	<0.020	0.015	0.330
AW4-1	Jun-90	1.00	0.003	<0.001	24.0	0.003	0.004	<0.005
T4#PTRAP	Jun-90	2.00	0.007	<0.001	313.0	0.006	0.001	1.160
AW4-6	Oct-89	-0.10	0.000	0.000	56.0	0.004	0.000	0.220
L4-6	Oct-89	0.00	0.000	0.006	23.0	0.003	0.044	0.100
L4-5	Oct-89	0.05						
AW4-5	Oct-89	0.10	0.000	0.000	99.0	0.007	0.000	0.006
AW4-4	Oct-89	0.50	0.000	0.000	0.3	0.002	0.000	0.001
L4-4	Oct-89	0.55	0.000	0.002	1.4	0.003	0.039	0.008
AW4-3	Oct-89	0.65	0.000	0.000	0.8	0.002	0.005	0.002
L4-3	Oct-89	0.65	0.000	0.009	7.0	0.002	0.016	0.120
AW4-2	Oct-89	0.70	0.000	0.000	0.2	0.000	0.000	0.000
L4-2	Oct-89	0.70	0.000	0.004	2.7	0.002	0.012	0.110
L4-1	Oct-89	0.95	0.000	0.002	10.0	0.004	0.044	0.620
AW4-1 DUP	Oct-89	1.00	0.000	0.000	14.0	0.007	0.002	0.050
AW4-1	Oct-89	1.00	0.000	0.000	14.0	0.006	0.013	0.003
T4#PTRAP	Oct-89	2.00	0.000	0.000	141.0	0.003	0.000	0.013
AW4-6	Jul-89	-0.10	0.000	0.000	41.0	0.014	0.002	0.260
AW4-5	Jul-89	0.10	0.000	0.000	18.0	0.008	0.002	0.000
AW4-4	Jul-89	0.50	0.000	0.002	0.3	0.000	0.002	0.002
L4-3	Jul-89	0.65	0.000	0.000	0.0	0.036	0.000	0.000
AW4-3	Jul-89	0.65	0.000	0.002	0.3	0.005	0.007	0.009
AW4-2 DUP	Jul-89	0.70	0.000	0.002	0.3	0.002	0.010	0.008
AW4-2	Jul-89	0.70	0.000	0.000	0.2	0.000	0.002	0.000
L4-2	Jul-89	0.70	0.000	0.000	0.0	0.014	0.060	0.050
AW4-1	Jul-89	1.00	0.000	0.000	20.0	0.010	0.001	0.003
T4#PTRAP	Jul-89	2.00	0.002	0.080	77.0	0.011	2.100	3.500
AW4-6	Sep-88	-0.10	0.02	0.00	76.0	0.00	0.56	5.90
AW4-5	Sep-88	0.10	0.02	0.00	94.0	0.00	0.04	0.08
AW4-4	Sep-88	0.50	0.02	0.00	0.5	0.00	0.00	0.02
AW4-3	Sep-88	0.65	0.02	0.05	2.8	0.00	0.00	0.00
AW4-3 DUP	Sep-88	0.65	0.02	0.00	4.0	0.00	0.00	0.04

* Anomalous values: not included in statistical summaries

TABLE 3-6
CHROMIUM, COPPER, IRON, NICKEL, LEAD AND ZINC
CONCENTRATIONS OF THE TAILINGS POREWATER

SAMPLER #	DATE	2m-B() Depth from tail surface	Cr (mg/L) (0.001)	Cu (mg/L) (< 0.02 (0.001)	Fe (mg/L) (<2.0)	Ni (mg/L) (< 0.02 (0.002)	Pb (mg/L) (< 0.04 (0.001)	Zn (mg/L) (< 0.02 (0.001)
AW4-2	Sep-88	0.70	0.02	0.00	0.5	0.00	0.00	0.02
AW4-1	Sep-88	1.00	0.02	0.00	0.5	0.00	0.00	0.02
AW4-1 DUP	Sep-88	1.00	0.02	0.00	0.5	0.00	0.00	0.02
T4#PTRAP	Sep-88	2.00	0.00	0.04	0.1	0.00	0.02	0.02
T4#PTRAP	Sep-88	2.00	0.00	0.04	0.0	0.00	0.01	0.01
L5-5	Sep-90	0.35	0.014	<0.001	89.0	0.005	0.015	0.239
AW5-6	Sep-90	0.50	0.009	0.01	155.0	0.008	0.16	0.164
L5-4	Sep-90	0.50	0.01	<0.001	39.5	0.006	0.005	0.067
AW5-6 DUP	Sep-90	0.50	0.006	0.02	177.0	0.008	0.207	0.269
L5-3	Sep-90	0.70	0.003	0.001	6.7	0.006	0.045	0.395
AW5-5	Sep-90	0.75	0.006	<0.001	10.3	0.003	<0.005	0.027
AW5-4	Sep-90	0.90	0.005	<0.001	11.5	0.003	<0.005	0.008
L5-2	Sep-90	0.90	0.005	<0.001	0.1	0.002	<0.005	0.163
L5-1	Sep-90	1.00						
AW5-2	Sep-90	1.25	0.007	0.001	1.2	0.001	0.005	<0.005
AW5-3	Sep-90	1.30	0.011	0.001	1.9	0.002	<0.005	<0.005
AW5-1	Sep-90	1.30	0.007	<0.001	0.4	0.001	0.01	<0.005
T5#PTRAP	Sep-90	2.00	0.012	<0.001	10.6	0.006	<0.005	0.07
L5-5	Jun-90	0.35	<0.015	0.002	64.2	<0.020	<0.001	0.850
L5-4	Jun-90	0.50						
AW5-6	Jun-90	0.50	0.003	<0.001	71.4	0.007	0.130	0.026
L5-3	Jun-90	0.70	<0.015	0.002	1.0	0.033	0.005	0.200
AW5-5	Jun-90	0.75	0.003	<0.001	7.4	0.004	0.001	0.042
AW5-5 DUP	Jun-90	0.75	0.003	<0.001	5.4	0.003	0.004	0.030
L5-2	Jun-90	0.90	0.027	0.002	0.2	0.044	0.002	0.051
AW5-4	Jun-90	0.90	0.003	<0.001	1.8	0.003	0.002	0.048
L5-1	Jun-90	1.00						
AW5-2	Jun-90	1.25	0.004	0.001	1.9	0.004	0.052	0.110
AW5-1	Jun-90	1.30	0.004	0.005	1.3	0.002	0.086	0.120
AW5-3	Jun-90	1.30	0.004	<0.001	0.3	0.002	0.020	0.010
T5#PTRAP	Jun-90	2.00	0.006	0.014	16.6	0.005	0.052	0.630
AW5-6	Oct-89	0.50	0.000	0.000	0.6	0.004	0.004	0.050
AW5-5	Oct-89	0.75						
AW5-4	Oct-89	0.90						
L5-1	Oct-89	1.00	0.000	0.004	1.1	0.007	0.070	0.060
AW5-2	Oct-89	1.25	0.000	0.002	0.2	0.003	0.001	0.003
AW5-3	Oct-89	1.30	0.000	0.001	0.1	0.002	0.003	0.002
AW5-1	Oct-89	1.30	0.000	0.000	0.4	0.005	0.012	0.040
AW5-3 DUP	Oct-89	1.30	0.000	0.000	0.2	0.002	0.006	0.003
L5-5	Jul-89	0.35	0.000	0.021	4.1	0.003	0.015	0.110
L5-4	Jul-89	0.50	0.000	0.000	0.1	0.005	0.031	0.018
AW5-6	Jul-89	0.50	0.000	0.005	0.2	0.002	0.009	0.008
L5-3	Jul-89	0.70	0.000	0.000	0.3	0.000	0.031	0.019
AW5-5	Jul-89	0.75	0.000	0.002	0.1	0.002	0.010	0.001
AW5-4	Jul-89	0.90	0.000	0.002	0.4	0.000	0.060	0.040

* Anomalous values: not included in statistical summaries

TABLE 3-7: CHEMICAL CHARACTERIZATION OF TEST PIT TAILINGS SOLIDS

1990 Solids										
		Pit 1	Pit 2	Pit 3	Pit 4	Pit 5	Ave	Std	Max	Min
(1990)	Fe%	28.08	29.40	29.86	29.40	31.62	29.7	1.3	31.6	28.1
	S%	23.6	28.6	29.9	28.0	35.8	29.2	3.9	35.8	23.6
	Zn%	>1.0	>1.0	1.0	0.58	0.84	0.88	0.17	1.00	0.58
	Pb%	0.61	0.76	0.53	0.44	0.36	0.54	0.14	0.76	0.36
	Ca%	0.35	0.19	0.17	0.24	0.24	0.24	0.06	0.35	0.17
(1989)	Fe%	NS	22.5	26.8	NS	24.6	24.8	1.5	26.8	22.5
	S%	NS	21.5	23.4	NS	18.9	20.3	2.1	23.4	18.4
	Zn%	NS	1.59	0.89	NS	1.76	1.53	0.37	1.76	0.89
	Pb%	NS	0.65	0.49	NS	0.54	0.57	0.09	0.67	0.49
	ΔCa%	NS	0.40	NA	NS	0.14	-	-	-	-
(1987)	Fe	-	-	-	-	-	26.5	2.1	29.7	23.7
	S	-	-	-	-	-	29.0	4.9	37.9	21.4
	Zn	-	-	-	-	-	1.31	0.96	4.44	0.36
	Pb	-	-	-	-	-				
	Ca	-	-	-	-	-	0.15	0.03	0.21	0.08
(1988)	Fe	-	-	-	-	-	30.9	4.5	39.0	26.8
Tails	S	-	-	-	-	-	NA	NA	NA	NA
	Zn	-	-	-	-	-	1.06	0.07	0.99	1.18
	Pb	-	-	-	-	-	0.67	0.11	0.76	0.46
	Ca	-	-	-	-	-	0.67	0.11	0.76	0.46

TABLE 3-8:
ACID/ BASE ACCOUNTING ON TEST PIT TAILINGS SOLIDS

YEAR	SAMPLE NUMBER	PASTE pH *	SULPHUR TOTAL (Wt %)	SULPHATE (Wt %)	ACID AP (Kg CaCO3 / Tonne)	ACID NP (Kg CaCO3 / Tonne)	NET NP (Kg CaCO3 / Tonne)	STATISTICS	
1987	1	7.25	23.7	-	740	33	-707	AVERAGE	-865
	3	7.35	39.0	-	1218	36	-1182	SDEV.	-131
	5	7.40	30.2	-	943	17	-926	MINIMUM	-695
	11	4.25	30.9	-	965	15	-950	MAXIMUM	-1182
	13	5.95	27.2	-	849	18	-832	N	11
	19	4.65	31.1	-	971	18	-953		
	27	4.15	22.5	-	703	8	-695		
	33	5.51	29.4	-	918	43	-875		
	40	4.73	26.3	-	821	20	-801		
	43	4.60	25.7	-	802	37	-765		
	45	5.01	27.1	-	846	19	-827		
1989	TP2	3.90	21.3	-	664	10	-654	AVERAGE	-607
	TP2 **	3.40	17.2	-	537	-	-537	SDEV.	-66
	TP3	3.20	22.8	-	711	-	-711	MINIMUM	-537
	TP5	3.20	17.6	-	551	-	-551	MAXIMUM	-711
	TP6	3.60	18.8	-	586	3	-582	N	5
1990	TP1	5.95	23.6	0.25	729.7	23.5	-706	AVERAGE	-889
	TP2	5.24	28.6	0.27	885.3	12.6	-873	SDEV.	-129
	TP3	5.31	29.9	0.21	927.8	11.9	-916	MINIMUM	-706
	TP4	5.88	28.0	0.20	868.8	24.2	-845	MAXIMUM	-1106
	TP5	5.72	35.8	0.33	1108.4	2.7	-1106	N	5

*	1987 = Initial pH: 1989 and 1990 = Paste pH
**	TP2 ** is Duplicate
AP	Acid Potential
NP	Neutralization Potential

QTABLE 3-9:
SHAKE FLASK EXTRACTION TEST RESULTS
TAILINGS SOLIDS SAMPLES FROM FARO TEST PITS

SAMPLE:	PIT 1	PIT 2	PIT 3	PIT 4	Pit 5
Weight of Sample g	10.0	10.0	10.0	10.0	10.0
Volume of Extractant mL	200	200	200	200	200
pH of Extractant	7.03	7.03	7.03	7.03	7.03
pH after 5 mins.	5.96	4.96	4.98	6.45	4.54
Final pH	4.69	4.76	4.47	5.50	4.58
Ag	<0.01	<0.01	<0.01	<0.01	<0.01
Al	<1	<1	<1	<1	<1
As	0.06	0.05	<0.05	<0.05	0.04
Ba	<0.1	<0.1	<0.1	0.12	<0.1
Bi	0.11	0.11	0.06	0.06	0.17
Ca	27.3	25.5	8.58	19.40	32.2
Cd	0.06	0.03	0.04	0.01	0.03
Co	0.06	0.03	<0.02	<0.02	0.05
Cr	<0.02	<0.02	<0.02	<0.02	<0.02
Cu	0.17	0.03	0.02	<0.01	0.17
Fe	0.75	0.48	2.51	<0.20	0.54
Hg*	0.30	0.20	0.20	0.20	<0.05
K	<5	<5	<5	<5	<5
Mg	4.57	6.80	6.64	2.73	7.92
Mn	2.83	4.06	4.36	1.43	3.22
Mo	0.09	0.04	0.01	0.01	0.04
Na	3.61	<1	<1	2.98	1.0
Ni	0.11	0.02	<0.01	0.04	0.07
Pb	14.60	10.40	14.20	5.81	6.32
Sb	0.15	0.05	<0.05	<0.05	0.12
SO4	79	94	69	42	140
Zn	22.1	7.02	3.63	5.27	18.6

Final Solution Analysis (in ppm) *ppb