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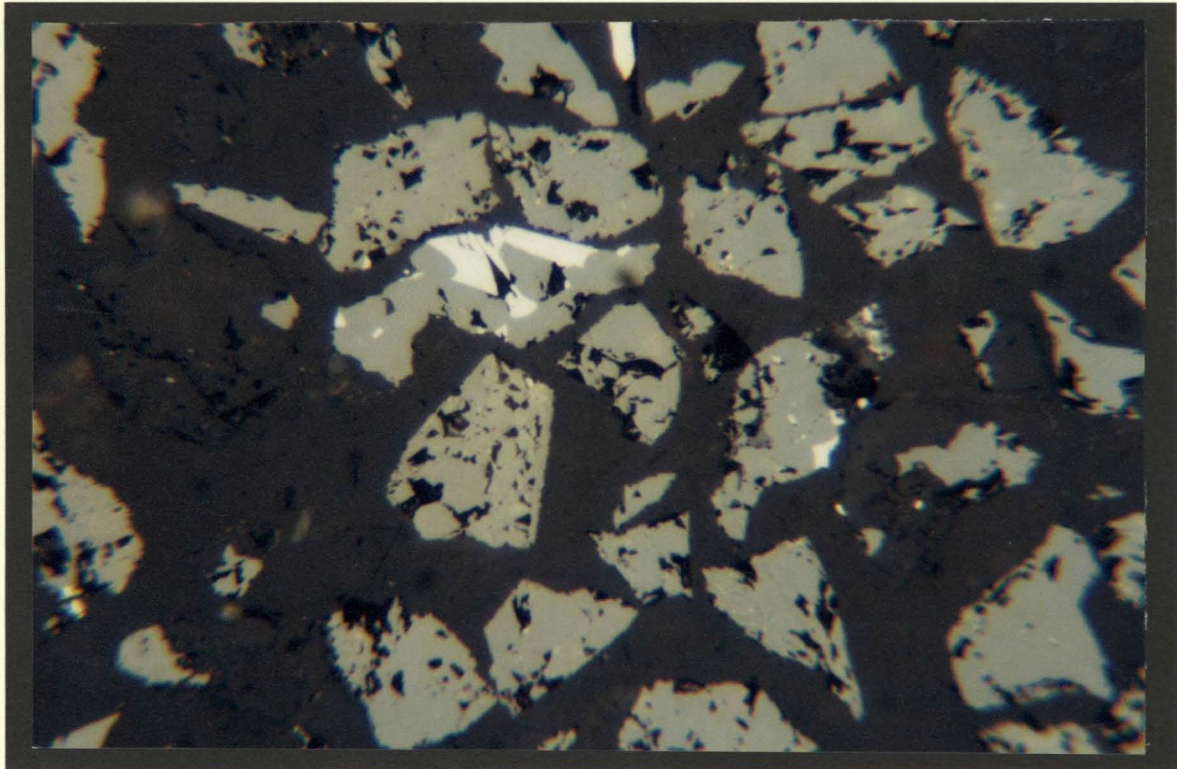
**ANVIL RANGE - FLOTATION PLANT SURVEY SAMPLES**

**A PROGRAM OF MODAL ANALYSIS**

**ANVIL RANGE MINING CORPORATION**

**FARO YUKON TERRITORY**

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March 6, 1996

Vladimir Salatic  
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Postal Bag 100  
Faro, Yukon Y0B 1K0

Dear Sir:

Re: Preliminary Modal Surveys - Anvil Range Flotation Plant

We have now completed our modal studies on both sets of samples cut from the flotation plant streams. In the attached technical brief we have summarized the results of our studies. Since the samples provided in this program did not allow us to form process loops, we can offer only limited interpretations of the significance of this data.

We believe that the following points may be of interest to you in your efforts to optimize the metallurgical performance at the Anvil concentrator:

- Most of the galena lost from the lead circuit rougher tails is locked in binary composites with sphalerite, with nonsulphide gangue, or in multiphase composites which contain near equal amounts of sphalerite, pyrite and gangue. Therefore, to improve overall lead recovery in the rougher flotation circuit, more of these galena-bearing binary and multiphase particles will have to be captured into the lead rougher concentrate.

- About half of the galena losses from the lead cleaner-scavenger tail occur as liberated grains of galena. Most of the remainder of the lead losses occur as galena-sphalerite composites. It may be possible to reduce the losses of liberated galena from the cleaner tail stream by physically pulling the lead cleaner circuit more aggressively, or by adding some collector in the cleaners.
  
- Approximately half of the sphalerite in the zinc rougher tails occurs as liberated grains of sphalerite. The remainder occurs as sphalerite-gangue composites, which in our opinion, contain sufficient sphalerite to be readily captured by conventional flotation techniques. Possibly the zinc rougher flotation circuit is not yet optimized to achieve maximum recoveries of all classes of particles which contain sphalerite.
  
- The majority of the sphalerite losses from the zinc cleaner circuit tails occur as liberated grains of sphalerite. A cleaner circuit malfunction, possibly related to the capabilities of the flotation columns, and exacerbated by the extreme complexity of the zinc cleaner circuit flowsheet would cause this type of liberated sphalerite loss.
  
- The zinc concentrate contains about 16 percent by weight diluents, of which pyrite and gangue are the most important. Two thirds of these diluents are liberated and could be removed by more efficient zinc cleaner circuit operations. On a practical basis improvements in zinc concentrate grade of the order 2-4 percent zinc at constant zinc recovery may be attainable.
  
- Theoretical calculations suggest that improved zinc cleaner flotation circuit efficiency will be more likely to enhance zinc concentrate grade, than finer regrinding of the zinc cleaner feed, to further increase mineral liberation. Laboratory testwork, involving repeated dilution cleaning tests of the current zinc concentrate, would verify the requirement for improved cleaner circuit efficiency.

Please contact us if you wish to review any aspect of this program or our interpretations of the data. If you are planning any further plant surveys involving modal studies it may be worthwhile reviewing your objectives with us. In this way we may be able to assist you to select a sample suite, which will maximize the amount of information produced by your modal investigations.

Meanwhile thank you for allowing us to participate in your project. Should the opportunity occur, please visit us here in Kamloops at our new laboratory complex. We have comparative modal data for all of the major lead-zinc stratiform concentrators currently in operation.

Yours truly



P.J. Brown, P.Eng.  
Consulting Metallurgical Engineer



*per* T.H. Lafreniere, A.Sc.T.  
Consulting Metallurgist

MARCH 1996  
KM585/599

ANVIL RANGE - FLOTATION PLANT SURVEY SAMPLES

A TECHNICAL BRIEF

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## **1.0 Introduction**

Samples, consisting mostly of plant tailings streams, were cut from the concentrator circuits during surveys conducted in December, 1995 and February, 1996.\* The points in the circuit from which the samples were taken during these surveys are indicated in Figure 1.

In the December survey, the plant samples were reportedly reprocessed in the site laboratory, presumably to scavenge out galena or sphalerite. Unfortunately only the laboratory tailings from this survey were dispatched for modal studies, thereby limiting the amount of data which could be derived from this work.

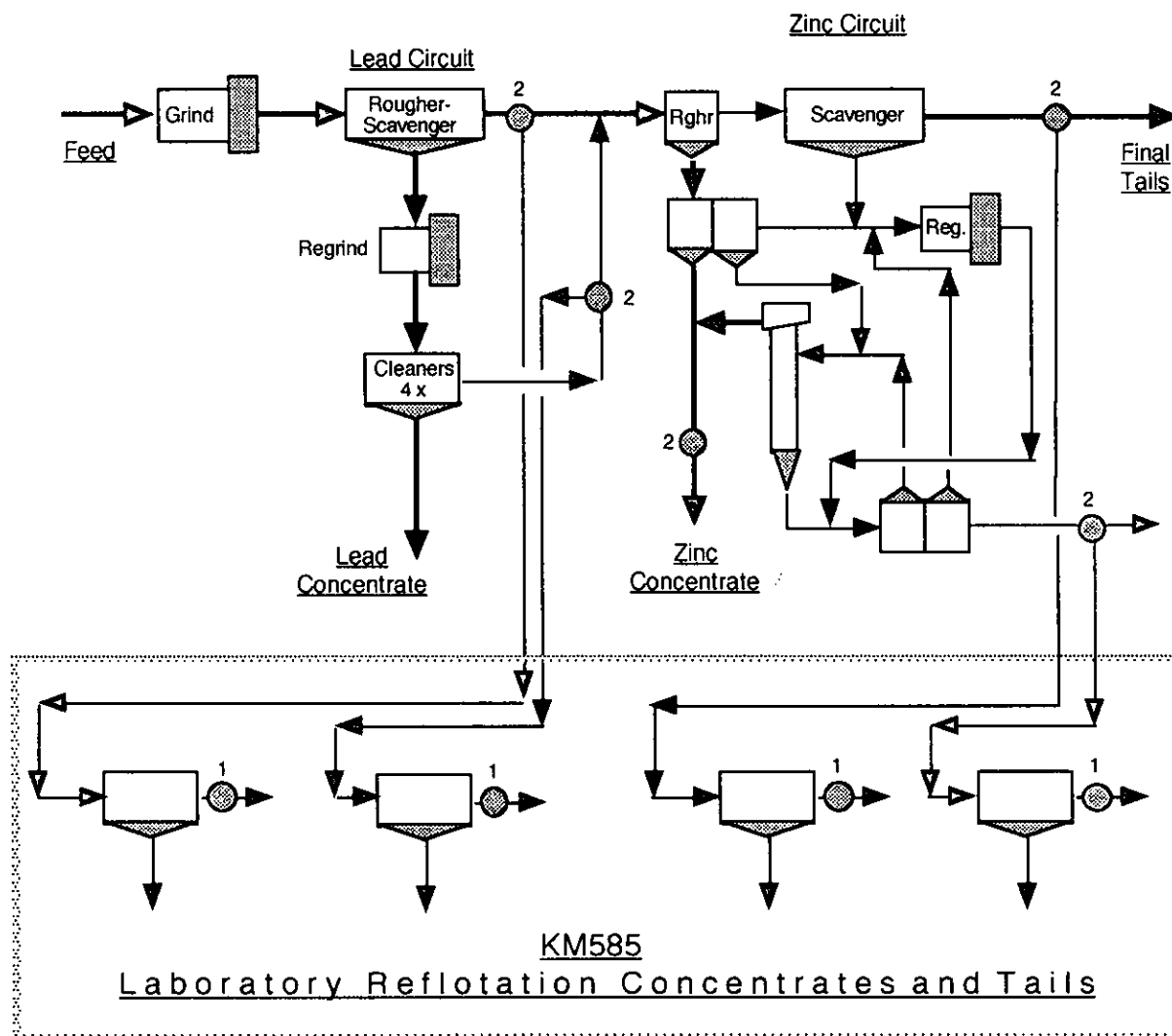
The samples taken in the February survey were not reprocessed in the laboratory. These samples are believed to be representative of the actual plant streams: Accordingly the modal data can be used with considerable confidence to guide future development programs at Faro. Most of the discussion, and interpretation of data in this technical brief, refers to the information produced by the February survey samples.

The modal data derived from both surveys are presented and discussed in this technical brief with regard to mineral composition and mineral liberation in the process streams. Using the modal data for February we have provided a preliminary assessment of how lead and zinc losses to the plant tailings occur, and indicated the remedial measures which might be taken in the plant to minimize these losses.

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\* A more detailed discussion of the samples submitted to the laboratory for modal evaluation is presented in Appendix I.

FIGURE 1  
ANVIL MINING RANGE SCHEMATIC FLOWSHEET AND SAMPLE POINTS



SAMPLE POINTS

1 ● KM585 - Lead Scavenger Tail	2 ● KM599 - Lead Scavenger Tail
1 ● KM585 - Lead Cleaner Tail	2 ● KM599 - Lead Cleaner Tail
1 ● KM585 - Zinc Scavenger Tail	2 ● KM599 - Zinc Scavenger Tail
1 ● KM585 - Zinc Cleaner Tail	2 ● KM599 - Zinc Cleaner Tail
	2 ● KM599 - Zinc Concentrate

## 2.0 Lead Circuit Tailings

There are two tailing streams exiting the lead flotation circuit: The lead rougher tails and the lead cleaner-scavenger. In the plant flowsheet both of these streams are combined to form the zinc rougher flotation circuit feed.

### 2.1 The Lead Rougher Tails

The lead rougher tails stream consists principally of silicates dominated by quartzite. About one quarter of the material consist of pyrite with minor amounts of pyrrhotite. Sphalerite and sparsely distributed occurrences of galena constitute the remainder of the solids in these samples. The mineral compositions of the lead rougher tails are summarized in Table 1 and are similar for both surveys.

TABLE 1  
MINERAL COMPOSITION  
Lead Rougher Tails

Mineral	Mineral Composition - Weight Percent	
	December 1995	February 1996
Galena	0.4	0.4
Sphalerite	5.2	7.0
Pyrite	25.2	25.3
Nonsulphide	69.2	67.2

- Notes: a) These mineral composite data were taken from Appendix III, Tables 1C and 5C.  
b) The December rougher tail samples has been rescavenged in the plant laboratory.

The status of the minerals in the lead rougher tails streams is of interest. Both of the lead rougher tailings samples possessed similar sizing parameters of about 70  $\mu\text{m K}_{80}$ , and the overall distributions of the key minerals into the various classes of association\* were similar.

**TABLE 2**  
**MINERAL DISTRIBUTION BY MINERAL CLASS**  
**Lead Rougher Tails**

Mineral Class	December 1995 (71 $\mu\text{mK}_{80}$ )				February 1996 (68 $\mu\text{mK}_{80}$ )			
	Ga	Sp	Py	Gn	Ga	Sp	Py	Gn
Liberated Particles	3	69	91	94	19	72	89	92
Binary with Galena	-	1	<1	1	-	1	<1	1
Binary with Sphalerite	17	-	2	2	13	-	1	3
Binary with Pyrite	<1	7	-	2	2	9	-	3
Binary with Gangue	52	17	5	-	44	14	8	-
Multiphase Particles	28	6	2	1	22	5	1	1

- Notes: a) These data taken from Appendix III, Tables 1A and 5A.  
 b) These data are two dimensional uncorrected estimates of mineral liberation.  
 c) Standard mineral abbreviations Gn - galena, Sp - sphalerite, Py - pyrite, Gn - nonsulphide gangue.

The data in Table 2 indicate that most of the galena in the rougher tails is in composite form: About 15 percent is present in galena-sphalerite binary composites, which typically are structurally simple, and contain near equal weights of galena and sphalerite. Most of the remaining galena is present in structurally simple binary composite particles with gangue, or in multiphase composites with gangue and sphalerite.

\*See Appendix 1, Section 4.0 for a discussion of the criteria used to classify mineral assemblages.

## 2.2 The Lead Cleaner-Scavenger Tails

The lead cleaner-scavenger tail stream consists of relatively fine particles, averaging less than 20µm in size. The dominant mineral component is pyrite, which accounts for 40-50 percent of the sample mass. Nonsulphides occupy about one third of the sample mass; Sphalerite and minor amounts of galena, complete the mineral suite.

**TABLE 3**  
**MINERAL COMPOSITION**  
**Lead Cleaner-Scavenger Tails**

Mineral	Mineral Composition - Weight Percent	
	December 1995	February 1996
Galena	3.4	3.6
Sphalerite	17.4	20.3
Pyrite	42.3	49.4
Gangue	36.8	26.7

- Notes: a) These mineral composition data was taken from Appendix III, Tables 2C and 6C.  
b) The December cleaner-scavenger tail stream sample was rescavenged in the plant laboratory.

The concentration of pyrite in the lead cleaner suggests that the lead roughers may be recovering a substantial amount of pyrite, which must then be rejected in the lead cleaners. Based on the modal data available most of the pyrite is probably liberated. The presence of the some of this pyrite may be attributable to entrainment: However, some of the pyrite may be chemically activated, and could perhaps be suppressed by modifying the processing conditions in the lead rougher circuit.

In the February sample of lead cleaner tails, about sixty percent of the galena was present as liberated grains of galena. The remainder of the galena was present as composite particles with sphalerite. About one third of the mass of these composite particles consists of galena, and should render these particles recoverable in the lead cleaner circuit under normal flotation conditions.

**TABLE 4**  
**FRAGMENTATION CHARACTERISTICS**  
**Lead Cleaner-Scavenger Tails**

Mineral Class	December 1995 (18 $\mu$ mK <sub>80</sub> )				February 1996 (19 $\mu$ mK <sub>80</sub> )			
	Ga	Sp	Py	Gn	Ga	Sp	Py	Gn
Liberated Particles	7	77	95	93	58	83	92	93
Binary with Galena	-	18	1	5	-	8	1	1
Binary with Sphalerite	46	-	2	2	30	-	2	2
Binary with Pyrite	7	2	-	<1	2	1	-	3
Binary with Gangue	21	2	1	-	7	7	5	-
Multiphase Particles	19	1	1	<1	3	1	<1	1

Note: a) Data taken from Appendix III, Tables 2A and 5A.

Since no sample of lead concentrate was provided in either survey, it is not possible to determine the proportions of each mineral class which are recovered into the lead concentrate. Future surveys should include samples of the lead final concentrate and the lead rougher concentrate streams\* to allow process loops to be formed.

\*With these samples, the efficiency of the rougher and cleaner circuits and the contribution to mineral liberation made by the lead regrinding stage would become apparent.

### 3.0 The Zinc Circuit Tailings

The overall configuration of the zinc flotation circuit appears to be relatively complex.\* The potential for large circulating loads to occur with this flowsheet configuration is large. These recirculating loads could build up resulting in reduced flotation residence times and contributing to increased zinc losses to final tails.

A zinc flotation-scavenger tail and an open circuit cleaner-scavenger tail both discharge into the combined plant tailings stream. Based on very limited data the solids mass ratio in these two streams is estimated to be about 15:1.

#### 3.1 The Zinc Rougher Tails

About three quarters of the solids in the zinc rougher tails consists of nonsulphides of various types. Most of the remainder of this stream consists of fragments of pyrite together with sparsely distributed occurrences of galena and sphalerite.

TABLE 5  
MINERAL COMPOSITION  
Zinc Rougher Tails

Mineral	Mineral Composition - Weight Percent	
	December 1995	February 1996
Galena	0.3	0.5
Sphalerite	1.1	2.0
Pyrite	25.5	26.5
Gangue	73.1	71.1

- Notes: a) These data were taken from Appendix III, Tables 3C and 7C.  
b) The December rougher tail stream sample was rescavenged in the mill laboratory.

\* See Figure 1 on page 2 of this report for a schematic presentation of the zinc circuit flowsheet.

TABLE 6  
FRAGMENTATION CHARACTERISTICS  
Zinc Rougher Tails

Mineral Class	December 1995 (71 $\mu$ m K <sub>80</sub> )				February 1996 (68 $\mu$ m K <sub>80</sub> )			
	Ga	Sp	Py	Gn	Ga	Sp	Py	Gn
Liberated Particles	2	15	90	93	44	56	88	95
Binary with Galena	-	1	<1	1	-	3	<1	<1
Binary with Sphalerite	3	-	2	2	8	-	1	1
Binary with Pyrite	3	11	-	3	<1	3	-	4
Binary with Gangue	64	50	6	-	42	32	11	-
Multiphase Particles	29	23	1	1	7	6	<1	<1

Note: a) Data taken from Appendix III, Tables 3A and 7A.

In the February survey, about half of the sphalerite in the zinc rougher tails stream was present as liberated grains. It is not known why these particles were not recovered by the zinc rougher flotation stage. Possibly the flotation residence time is inadequate, or more probably, insufficient collector is being deployed in the zinc circuit to ensure maximum sphalerite flotation kinetics.

About one third of the sphalerite in the zinc rougher tails was combined with nonsulphides in structurally simple composite particles. On average these particles contained about 45 percent by weight sphalerite. Based on our experience with many other stratiform lead-zinc deposits, particles with this composition should be readily floatable under almost any conditions.\*

\* It has been our experience that composite particles containing greater than 15 percent by weight of the target mineral should be efficiently recovered into a flotation froth.

### 3.2 The Zinc Cleaner Tails

The solids in the zinc cleaner tails stream are a relatively finely sized, averaging less than 20 $\mu$ m. Half of the solids in the zinc cleaner tails are pyrite and most of the remainder are nonsulphide gangue. Small quantities of galena and sphalerite are also present in this stream.

TABLE 7  
MINERAL COMPOSITION  
Zinc Cleaner Tails

Mineral	Mineral Composition - Weight Percent	
	December 1995	February 1996
Galena	1.1	2.3
Sphalerite	2.6	16.1
Pyrite	51.1	46.8
Gangue	45.2	34.8

Notes: a) These data were taken from Appendix III, Tables 4C and 8C.  
b) The December

The fragmentation data for the zinc cleaner tails are summarized in Table 8. The data shows that at this current particle sizings, the majority of the minerals present in the zinc cleaner tails stream were completely liberated from each other.

Of more significance is that in the February survey, most of the sphalerite contained in the zinc cleaner tails was completely liberated. This is most

unusual since liberated grains of sphalerite, when correctly activated with copper sulphate and provided with sufficient collector, float very rapidly indeed in most flotation circuits. This conclusion may be supported by the December survey data where presumably the liberated sphalerite was recovered from the cleaner-scavenger tails by rescavenging in the laboratory.\*

**TABLE 8**  
**FRAGMENTATION CHARACTERISTICS**  
**Zinc Cleaner-Scavenger Tails**

Mineral Class	December 1995 (22 $\mu$ m K <sub>80</sub> )				February 1996 (19 $\mu$ m K <sub>80</sub> )			
	Ga	Sp	Py	Gn	Ga	Sp	Py	Gn
Liberated Particles	2	12	94	89	62	81	88	89
Binary with Galena	-	<1	<1	3	-	2	<1	1
Binary with Sphalerite	1	-	5	6	15	-	3	5
Binary with Pyrite	<1	42	-	2	<1	5	-	3
Binary with Gangue	63	22	1	-	17	9	8	-
Multiphase Particles	34	24	<1	<1	6	4	2	2

Note: a) These data were taken from Appendix III, Tables 4A and 8A.

A major operational problem may exist somewhere in the zinc cleaner circuit. We suspect that the zinc cleaner columns may not be operating efficiently, causing a large circulating load of solids to develop. Given the extreme complexity of the zinc cleaner circuit flowsheet, the existence and growth of even a relatively modest circulating load would rapidly prove fatal to circuit stability.

\* If the laboratory concentrates had been provided for modal study this conjecture could be avoided.

It is recommended that a modal evaluation of the zinc cleaner circuit be undertaken as soon as possible. The survey could target individual sections of the zinc circuit which may be contributing to losses of liberated and composite sphalerite grains.\* Alternatively, an overall zinc cleaner circuit survey including the recirculating streams could be conducted over a 24 hour period. The results of a modal analysis on this suite of samples would produce unequivocal evidence identifying the source of the current losses.

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\* Zinc circuit samples consisting of the cleaner feed, concentrate and tail streams are required to determine the efficiency of the selected circuit at recovering the mineral species by class and by size range.

#### 4.0 The Zinc Concentrate

The zinc concentrate sample provided in the February survey was relatively fine at  $23\mu\text{m K}_{80}$ . The concentrate was contaminated with the diluents pyrite, galena and nonsulphide gangue: Overall, these diluents constituted 16 percent of the zinc concentrate mass.

TABLE 9  
MINERAL COMPOSITION  
Zinc Concentrate

Mineral	Mineral Composition Weight Percent
Galena	3.3
Sphalerite	84.0
Pyrite	7.5
Gangue	5.2

Note: a) These data were taken from Appendix III, Table 9C.

The fragmentation data which are summarized in Table 10 for the zinc concentrate indicate that the diluents galena, pyrite and nonsulphide gangue present in the zinc concentrate are about 60 percent liberated. The unliberated diluents are locked in composite particles with sphalerite in structurally simple associations.

**TABLE 10**  
**FRAGMENTATION CHARACTERISTICS**  
**Zinc Concentrate February 12, 1996**

Mineral Class	February 1996 (23 $\mu$ m K <sub>80</sub> )			
	Ga	Sp	Py	Gn
Liberated Particles	58	87	64	62
Binary with Galena	-	4	7	<1
Binary with Sphalerite	35	-	21	30
Binary with Pyrite	<1	5	-	1
Binary with Gangue	3	2	3	-
Multiphase Particles	5	2	6	7

Note: a) These data were taken from Appendix III, Table 9A.

Using the fragmentation data a mineralogically limiting grade recovery-curve was formed for the zinc concentrate. The limiting curve shown in Figure 2 reveals the following:

- Removal of all of the liberated diluents from the concentrate would improve the grade of the zinc concentrate from 52 to approach 58 percent zinc. We estimate that about half of the diluents could be removed by a practical cleaning process thereby increasing the zinc grade to about 55 percent.
- The improvement of zinc concentrate grade would coincidentally reduce the nonsulphide gangue in the concentrate from 5 percent to less than 4 percent. This effect of increasing zinc concentrate grade on the nonsulphide component is demonstrated in Figure 3.

FIGURE 2  
MINERALOGICALLY LIMITING ZINC GRADE RECOVERY DATA

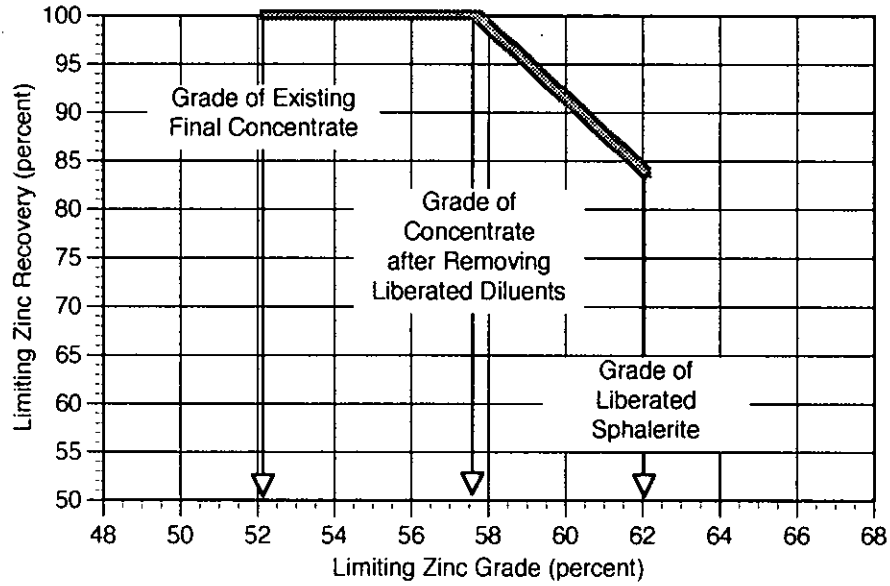
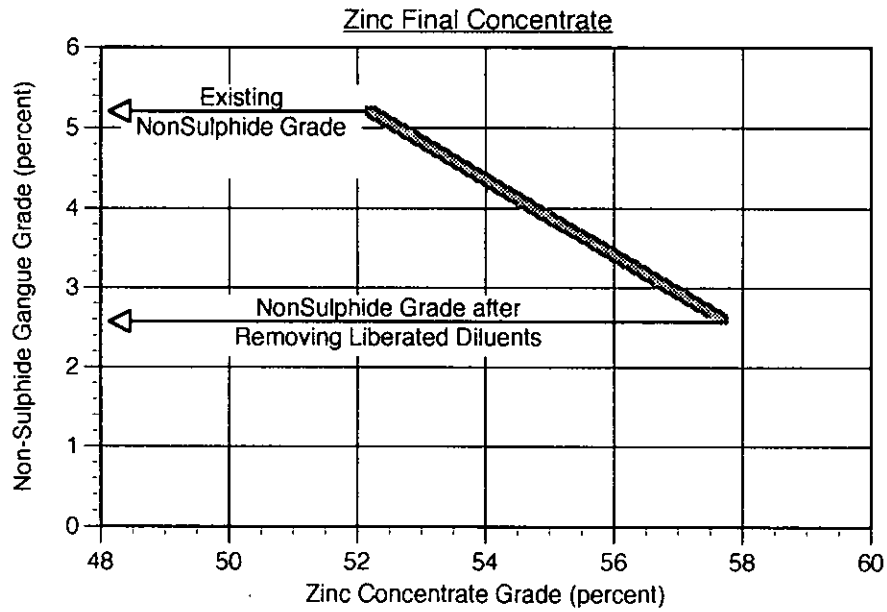


FIGURE 3  
EFFECT OF ZINC GRADE ON NON-SULPHIDE GANGUE CONTENT



The deployment of additional regrinding power to completely liberate all of the sphalerite, now locked in the composites, could theoretically improve the zinc concentrate grade from 58 to 62 percent zinc. However, we do not believe that finer regrinding at this time will improve the grade of the zinc concentrate until the operation of the zinc cleaner circuits are stabilized.

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APPENDIX I - KM585/599

METHODS AND PROCEDURES

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## 1.0 ORIGIN OF THE ORE SAMPLES

In mid December, G&T Metallurgical Services received a group of four tailing samples. These tailing samples were taken from the Anvil concentrator on December 1 and 7, 1995 and then reprocessed through a laboratory flotation machine. This group of samples are identified by the prefix KM585.

A second group of samples were received on February 29 and were grouped together as project KM599. The process tailing samples in this survey were taken from the same streams as the first survey, however, these samples were not reprocessed in the laboratory. In addition to the process tailing samples, a final zinc concentrate sample was also provided.

TABLE I-1  
CHEMICAL COMPOSITION OF THE PROCESS STREAM SAMPLES

Project	Stream Samples	Assays - Percent			
		Copper	Lead	Zinc	Iron
KM585	Dec. 7 Lead Scavenger Tail (GH)	0.04	0.30	3.43	12.3
	Dec. 7 Lead Cleaner Tail (I)	0.24	2.92	11.6	20.8
	Dec. 1 Zinc Scavenger Tail (KL)	0.02	0.28	0.69	12.6
	Dec. 1 Zinc Cleaner Tail (J)	0.13	0.94	1.78	24.8
KM599	Feb. 9 Lead Scavenger Tails.	-	0.35	4.20	12.8
	Feb. 9 Lead Cleaner Tail	-	2.96	12.6	24.5
	Feb. 9 Zinc Cleaner Tail	-	0.35	1.25	12.9
	Feb. 9 Zinc Scavenger Tail	-	1.80	9.68	23.4
	Feb. 12 Zinc Concentrate	-	2.68	52.2	7.67

Note: a) The KM585 process samples had been rescavenged in a laboratory flotation unit by Anvil Mining technical staff.

## 2.0 ASSAYING PROCEDURES

The tailing and concentrate samples destined for mineralogical studies were assayed at Kamloops by utilizing standard atomic absorption methods. The elements selected for assay varied according to the requirements of the procedures. The critical parameters for the atomic absorption analytical methods are summarized in Table I-2.

TABLE I-2  
DETAILS OF ATOMIC ABSORPTION METHODS

Element	Wave Length	Gas Mixture	Relative Precision %
Cu	324.8	Acetylene-Air	1
Pb	283.3	Acetylene-Air	1
Zn	213.9	Acetylene-Air	2
Fe	372.0	Acetylene-Air	5

- Notes: a) Wave length in nanometres (nm).  
 b) Measurements were made by Varian 475 and Perkin Elmer 3110 atomic absorption spectrometers.  
 c) Multiple element determinations were based on the dissolution of 200mg solid sample in aqua regia and bromine.

The zinc concentrate head sample was reassayed using standard titrimetric procedures. The titrimetric technique used was the ferrocyanide method for zinc. The accuracy of the titre method at the 40 - 70 percent contained metal range is believed to be better than 0.3 percent relative metal content 95 percent of the time.

Canadian certified standards and several internal laboratory standards were used as reference materials to check the atomic absorption and titre assaying techniques at Kamloops. The metal composition of these certified reference standards are detailed in Table I-3.

TABLE I-3  
ASSAY CALIBRATION STANDARDS

Standard	Metal Content - Percent				
	Lead	Zinc	Iron	Silver	Copper
MP - 1a	4.33 ± .03	19.02 ± .10	6.2	69.7 ± 2.2	1.44 ± .01
KC-1a	2.24 ± .03	34.65 ± .15	10.9	1670 ± 20	0.629 ± .015
CPB - 1	64.74 ± .12	4.42 ± .04	8.43 ± .06	626.0 ± 6.0	0.254 ± .004
CZN - 1	7.45 ± .05	44.74 ± .11	10.93 ± .06	93.00 ± 3.0	0.144 ± .003

- Notes: a) The calibration standards are produced and certified by CANMET, Energy, Mines and Resources Canada.  
 b) Reported assay data without confidence limits are not certified values. These values are used as secondary reference standards only. Silver values are expressed in grams per tonne. All other values in percent by weight metal.

At Kamloops, assay calibration standards were selected to approximate the chemical compositions of the samples being analyzed. These standards were included in each of the assay runs. The assay rechecks were performed on a random basis with a nominal frequency of one in eight of the reported assay values.\*

\* Alternatively, when a calculated head assay was considered atypical, assay rechecks were instituted.

### 3.0 SAMPLE SIZING PROCEDURES

#### 3.1 Sieve Analysis

The flotation plant samples, were wet screened on a 400 Tyler mesh screen ahead of cyclosizing. The oversize was dry screened on 65, 100, 150, 270 and 400 mesh. The minus 400 mesh dry screened material was added to the wet screen minus 400 mesh material.

#### 3.2 Cyclosizing Procedures

Sub-sieve size analyses on the process stream samples were performed on the minus 400 mesh material using a cyclosizer. For the later group of samples, cyclosizing was performed in combination with a pre-cyclone. The pre-cyclone, operating at 550 Kpa removed the nominal minus 5 micron material from the sample via the pre-cyclone overflow.\* The mass of precyclone overflow ranged between 27 and 45 percent of the cyclone feed.

The pre-cyclone under flow was introduced to the cyclosizer, and was split into five sized fractions. The cyclosizer discharge was collected and flocculated to recover the residual material. This material, which theoretically averaged between 5-10 $\mu$ m, equivalent Stokesian diameter, formed a significant fraction of the sample.

The sizings determined in this manner were verified by making grain size estimates using a graduated graticule. The comparisons between  $K_{80}$

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\* This technique was used in processing the second group of tailing and concentrate samples. These samples are identified under project KM599. See Table 1 earlier in this appendix.

estimates based on the cyclosizer precyclone data, and the estimates produced by direct measurements were excellent.

The elutriation time for the Kamloops cyclosizer was 20 minutes at the recommended water flow rate. Water temperature varied between 4°C and 6°C during the cyclosizing work performed during this program. Typical cyclosizer cut sizes for mineral standards are shown in Table I-4 for reference purposes.

**TABLE I-4**  
**TYPICAL CUT SIZES FOR THE WARMAN CYCLOSIZER**

Mineral	Solids S.G.	Estimated Cyclosizer Cut Sizes (µm)					
		C1	C2	C3	C4	C5	C6
Quartz	2.7	45	34	24	16	12	7
Sphalerite	4.0	29	22	15	10	7	5
Chalcopyrite	4.2	28	21	15	9	7	5
Pyrite	5.0	26	19	13	8	6	5
Galena	7.5	19	14	10	7	5	3

- Notes: a) The cut size data shown were calculated based on pure standards sheet.  
 b) The C<sub>6</sub> range, when utilized, involves the use of a specially designed small high pressure cyclone cutting at a nominal 5µm.

Using standard correction tables, the effective cut size of each cyclosizer cone was determined for each sample tested. The cumulative percent passing at size was estimated from a log-probability plot.\* The effective cyclosizer cut values indicate the Stokesian equivalent diameter in microns, of the particles contained in the cyclosizer cones.\*\*

Individual sizing sheets including the specific gravity estimates of each of the pulp samples are presented together in Appendix II.

\* The sizing data shown in this report is often expressed in terms of K<sub>80</sub> values: The values represent the theoretical square aperture through which 80 weight percent of the original sample would pass.

\*\* These cut sizes are subject of verification during the point counting procedures. Calibrated viewing graticules provide a method for determining the physical sizes of the particles in any particular mount.

#### 4.0 MINERALOGICAL AND POINT COUNT TECHNIQUES

The laboratory test samples from the Anvil Range samples were sized, mounted, and subjected to standard point count and gross count studies. Four major reference minerals were designated for this study.\* They were galena (Ga), sphalerite (Sp), pyrite (Py), and all classes of nonsulphide gangue (Gn).

For each of these reference minerals, five mineralogical classes were recognized: The classes were liberated, as binaries with each of the other three reference minerals, or as multiphase assemblages. The designation multiphase includes any mineral grain encompassing three or more mineral phases. The liberation and mineralogical data for sized fractions of the flotation feed are presented in Appendix III to this report.

##### 4.1 Point Count Procedures

The point count procedure adopted was to select an appropriate magnification ranging between 50 - 700 times for the particles contained in the sample mount. A 10x10 square graticule was then set randomly on the field of view. Mineral grains which were intercepted by the graticule cross hairs were identified, and recorded by direct entry into the logging computers using a binary mineral identification code.

The binary assemblages were identified by first naming the mineral intercepted by the graticule, and then the associated mineral. Ternaries were

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\* Chalcopyrite was present in the sized mounts. For the purposes of this study, copper minerals were excluded from the modal analysis.

classified on the basis of the mineral intercepted by the graticule cross-hair. For the purposes of the modal-mineralogical analyses conducted on the Anvil Range samples considered in this program, some special mineral classification criteria were adopted:

- The term 'liberated' signified a mineral grain with less than the equivalent of two percent of another mineral embedded, or attached to it. For this reason some of the grains of sphalerite, with multiple tiny inclusions of galena or pyrite, were classified as liberated in this study. In these cases the inclusions amounted to less than 2 percent of the estimated particle mass.
- 'Binary' signified the presence of any particles containing two mineral phases. The binary composites in the Anvil Range samples most frequently observed were galena-sphalerite, sphalerite-pyrite and sphalerite-gangue. These major classes of composites were usually simple in structure.
- The designation 'ternary', or 'multiphase' particle, encompassed all mineral particles with three or more mineral phases enclosed within a single particle: Each of the phases contributing more than two weight percent to the total particle make-up. These particles were common in the coarser particle size ranges in the Anvil Range samples. Typically these multiphase particles would contain pyrite, sphalerite and galena in structurally complex assemblages.

A minimum of 900 individual particles were recorded for each of the composite sample fractions examined. The data was converted to weight percent content for each mineral present in the fraction, then checked automatically by the computer for accuracy by comparison with the chemical assay.\*

#### 4.2 Modified Gross Point Counting Procedure

This procedure involved determining the total number of particles bearing the target mineral in an optical frame. Each particle was then examined in detail and further classified. The discrimination criteria for the mineral classes for this work were as liberated, as binary with other reference minerals, or as multiphase assemblages.

Sufficient optical frames were inspected to ensure that a minimum of 100 particles of the target mineral were identified and classified. The liberation characteristics determined from this modified procedure, were then applied to the original point count data.

By adopting this procedure very large number of particles could be scanned, and statistically significant sulphide mineral liberation values assigned to the low grade samples.

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\*The computer converts weight percent mineral to assay percent by employing standard gravimetric factors before attempting any data comparison between observed composition and assayed composition.

### 4.3 Accuracy of the Method

The agreement between measured and assayed mineral content for the major components of each sample is invariably acceptable.\* However, minor components, accounting for less than about 10 percent of a sample, occasionally exhibited poorer correlations. Table I-5 indicates the approximate level of accuracy which is theoretically achievable with the point counting method. These theoretical estimates are derived using standard probability theory. The data displayed in the table is based on the statistical evaluation of point count methods.

TABLE I-5  
MINERAL CONTENT AND RELATIVE ACCURACY  
POINT AND GROSS COUNTS

Mineral (Percent)	Point Counts Absolute Error (2σ)%	Gross Counts Absolute Error (2σ)%
1	± 1.0	± 0.5
5	± 1.5	± 0.5
10	± 2.5	± 0.5
30	± 3.0	± 1.0
50	± 3.5	± 1.5
80	± 3.0	± 1.0
90	± 2.5	± 0.5
95	± 1.5	± 0.5
99	± 1.0	± 0.5

- Notes: a) Point counts assume a minimum of 900 recorded intercepts per mount.  
 b) Gross counts assume a minimum of 7500 grains scanned per mount.  
 c) Percent mineral content is shown in terms of area percent, and has not been adjusted for particle specific gravity.

\*In fact, these mineralogical estimates described in this report, are automatically checked against assay data by the data processing computer. When a discrepancy is detected, a mineralogical recount is executed. Where necessary, the sample is also reassayed to verify chemical composition. Appendix III contains comparisons of point count data and assay-based estimates of sample mineralogy by size range for each of the laboratory test samples.

#### 4.4 Stoichiometric Factors

The values of the factors used in this program on the Anvil Range plant samples to convert metal assays to mineral assays, are summarized below in Table I-6. The assay conversions are based on modifications of the standard metal to mineral factors for pure mineral species.

TABLE I-6  
ASSAY TO MINERAL CONVERSION FACTORS USED FOR  
ANVIL RANGE PLANT SAMPLES

Element %	Samples	Convert to	Factor Used
Lead	All	Galena	1.16 * Pb
Copper	All	Chalcopyrite	2.56 * Cu
Zinc	All	Sphalerite	1.61 * Zn
Iron	All	Pyrite	2.15 * Fe

Note: a) A minor adjustment was made to account for interstitial iron contained in the sphalerite lattice. Estimates from differential point counting suggest that the interstitial iron contained in the sphalerite is of the order five percent.

The quantity of iron contained in the sphalerite crystal lattice is an important, and occasionally, a highly variable parameter in stratiform mineralized zones. Changes in the value of this factor may impose mineralogical limits on metallurgical performance. It is recommended that the interstitial iron level be determined by using EDX methods for future sets of Anvil Range plant samples.\*

\* In fact, a considerable amount of EDX work has been reported for Anvil Range ores. Specific data regarding interstitial iron in the sphalerite should be gathered on a regular basis.

#### 4.5 Stereological Corrections

In reflected light grain counting studies involving opaque minerals, a problem in mineral grain classification becomes apparent. Clearly, it is possible to section a composite particle through a given plane so that the particle appears to be liberated. However, a liberated particle cannot be sectioned in any plane so as to appear locked. The probability of this former occurrence depends upon the relative amounts of the minerals within a given mineral grain, and their structures which are encompassed within the composite particle.

A series of corrections have been proposed to convert two dimensional point count estimates into three dimensional approximations for the mineral liberation characteristics. A simplified and conservative version of some of these corrections has been applied to some of our calculations which are reviewed in the report text. In contrast, the mineralogical data which are displayed in Appendix III to this report are uncorrected and are two dimensional observed modal distribution information.

To maintain the mineral balance in a given sample, the difference in value between the two dimensional observed and the three dimensional corrected liberation estimates, must be proportionally redistributed between the other mineral classes containing the target mineral.\*

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\* The use of three dimensional liberation data are used extensively in estimating the potential for metallurgical improvements from the modal characteristic of the samples.

Table I-6 illustrates the manner in which the mineral distribution data varies with the application of these stereographic transforms.

**TABLE I-6**  
**AN EXAMPLE OF THE USE OF STEREOGRAPHIC TRANSFORMS**  
**(Sphalerite in Zinc Concentrate)**

Mineral Class	Percent Liberated	
	Two Dimensional Observed	Three Dimensional Corrected
Liberated	87	84
Locked with Galena	4	5
Locked with Pyrite	5	6
Locked with Gangue	2	2
Multiphase	2	3

Note: a) The example in this table is shown in detail in Appendix III, Table 9A.

In this case, 87 percent liberation of sphalerite in two dimensions, decreases to approximately 84 percent true sphalerite liberation in three dimensions, after applying the simplified corrections. The metal which constitutes the difference in sphalerite liberation in the sample (87-84), is then proportionally distributed between the other sphalerite-bearing composites present, effectively increasing their values.

\* \* \*

APPENDIX II - KM585/599

SIZING ANALYSIS DATA

## INDEX

<u>TABLE</u>	<u>KM585 SIZINGS</u>	<u>µm K<sub>80</sub></u>	<u>PAGE</u>
II-1	KM585. Lead Scavenger Tail (G/H) - December 7, 1995.	71	1
II-2	KM585. Lead Cleaner Tail (I) - December 7, 1995.	19	2
II-3	KM585. Zinc Scavenger Tail (K/L) - December 1, 1995.	70	3
II-4	KM585. Zinc Cleaner Tail (J) - December 1, 1995.	22	4

### KM599 SIZINGS

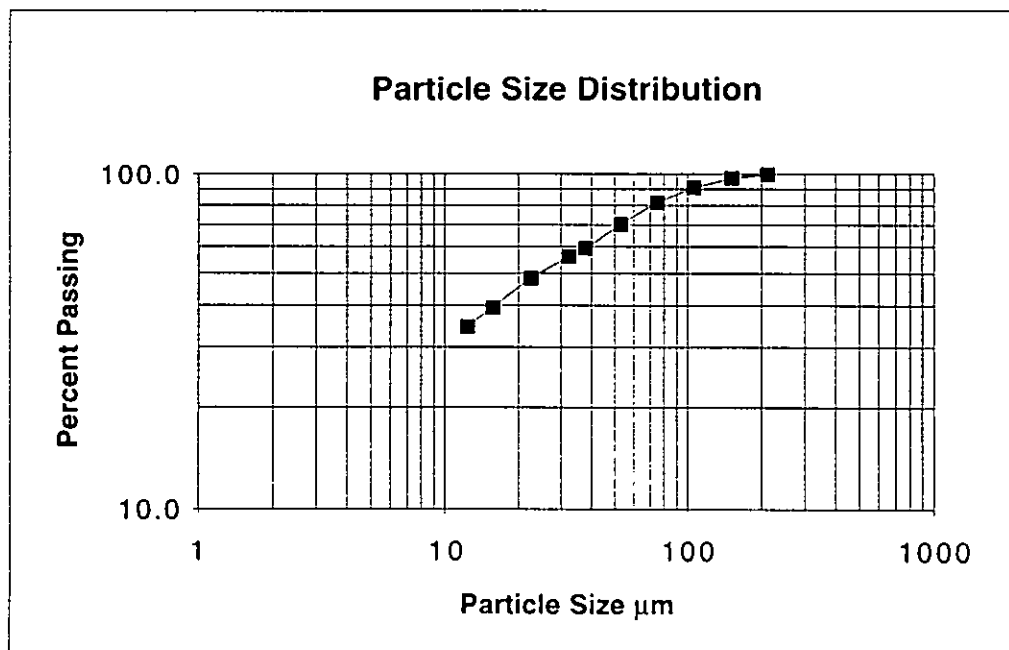
II-5	KM599. Lead Scavenger Tail February 9, 1996.	68	5
II-6	KM599. Lead Cleaner Tail - February 9, 1996.	18	6
II-7	KM599. Zinc Scavenger Tail - February 9, 1996.	63	7
II-8	KM599. Zinc Cleaner Tail - February 9, 1996.	19	8
II-9	KM599. Zinc Concentrate - February 12, 1996.	23	9

KM585 SIZINGS

**TABLE II-1**  
**CYCLOSIZING ANALYSIS**  
**KM585 - Lead Scavenger Tail (G/H) - December 7, 1995**

Product	Size (μm)		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
65 Mesh	212	212	0.5	99.5
100 Mesh	150	150	2.5	97.0
150 Mesh	106	106	6.3	90.7
200 Mesh	75	75	8.9	81.8
270 Mesh	53	53	11.3	70.5
400 Mesh	38	38	11.1	59.5
Cyclone 1	45	46	0.6	58.9
Cyclone 2	31	32	2.9	56.0
Cyclone 3	22	22	7.7	48.3
Cyclone 4	15	16	8.9	39.4
Cyclone 5	12	12	4.8	34.6
Total			100.0	**

Operating Conditions	Measured	Factor
Temperature (°C)	5.50	1.220
Specific Gravity	3.16	0.876
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		1.033
<b>K80 Size (microns)</b>		<b>71</b>



**TABLE II-2**  
**CYCLOSIZING ANALYSIS**  
 KM585 - Lead Cleaner Tail (I) - December 7, 1995

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
100 Mesh	150	150	0.0	100.0
150 Mesh	106	106	0.1	99.9
200 Mesh	75	75	0.5	99.4
270 Mesh	53	53	1.9	97.5
400 Mesh	38	38	3.4	94.1
Cyclone 1	45	41	0.2	93.9
Cyclone 2	31	29	2.9	90.9
Cyclone 3	22	20	9.2	81.7
Cyclone 4	15	14	12.8	68.9
Cyclone 5	12	11	10.0	59.0
Total			100.0	**

Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	5.50	1.220
Specific Gravity	3.71	0.782
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		0.922
<b>K80 Size (microns)</b>		<b>19</b>

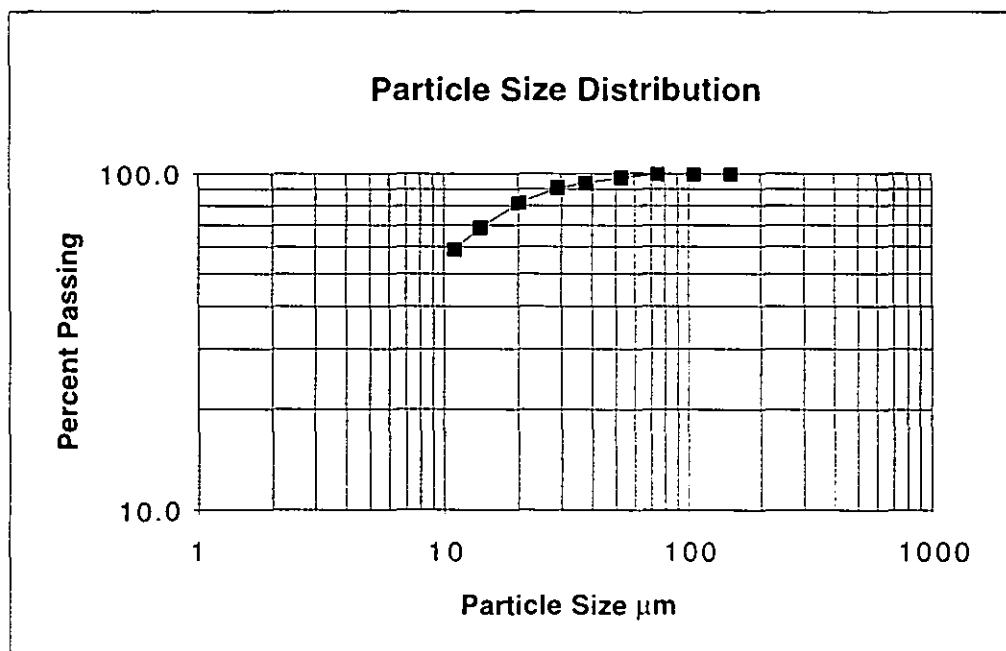
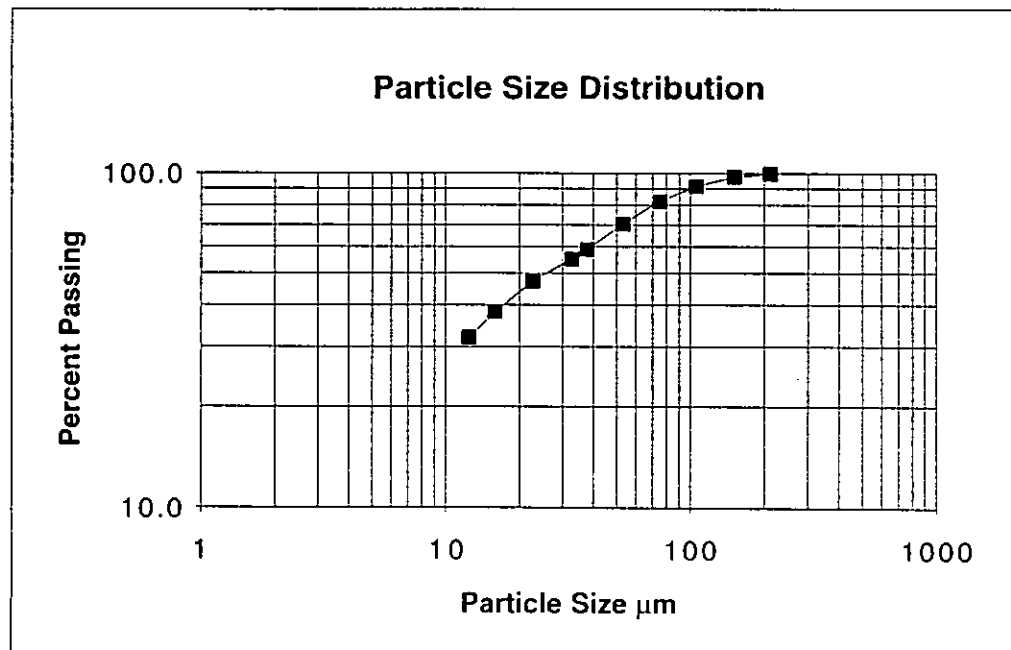


TABLE II-3  
CYCLOSIZING ANALYSIS  
KM585 - Zinc Scavenger Tail (K/L) - December 1, 1995

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
65 Mesh	212	212	0.4	99.6
100 Mesh	150	150	2.2	97.4
150 Mesh	106	106	6.1	91.4
200 Mesh	75	75	9.2	82.2
270 Mesh	53	53	11.8	70.3
400 Mesh	38	38	11.3	59.0
Cyclone 1	45	47	0.7	58.3
Cyclone 2	31	33	3.1	55.3
Cyclone 3	22	23	7.8	47.5
Cyclone 4	15	16	9.3	38.2
Cyclone 5	12	12	6.2	32.0
Total			100.0	**

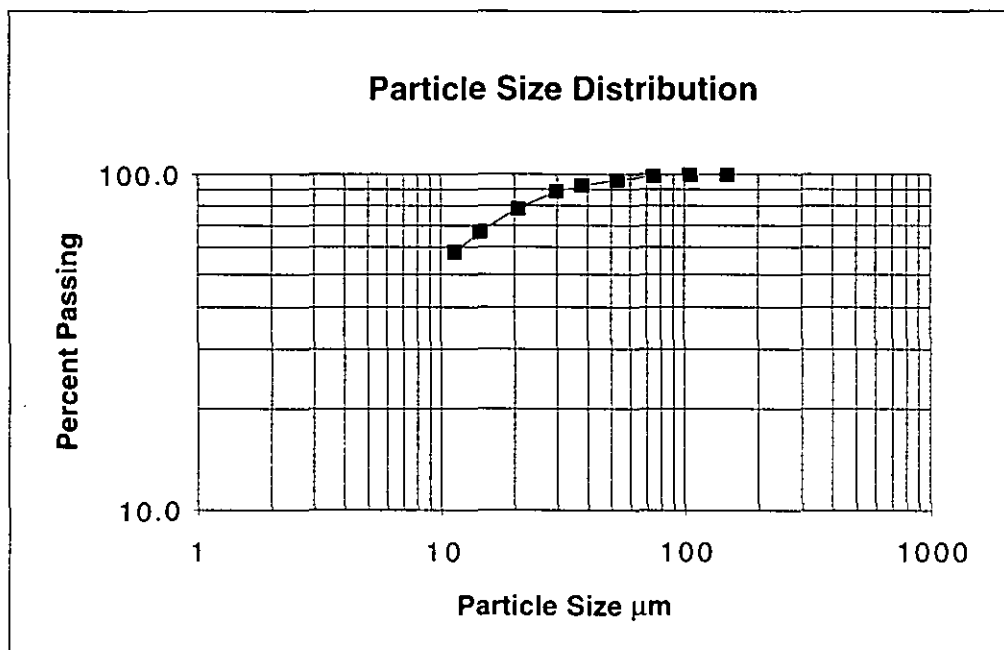
Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	6.00	1.212
Specific Gravity	3.06	0.895
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		1.048
K80 Size (microns)		70



**TABLE II-4**  
**CYCLOSIZING ANALYSIS**  
 KM585 - Zinc Cleaner Tail (J) - December 1, 1995

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
100 Mesh	150	150	0.0	100.0
150 Mesh	106	106	0.2	99.8
200 Mesh	75	75	0.9	98.8
270 Mesh	53	53	2.7	96.2
400 Mesh	38	38	3.9	92.3
Cyclone 1	45	43	0.2	92.1
Cyclone 2	31	30	3.6	88.5
Cyclone 3	22	21	9.6	78.9
Cyclone 4	15	14	12.1	66.7
Cyclone 5	12	11	8.7	58.0
Total			100.0	**

Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	5.50	1.220
Specific Gravity	3.54	0.807
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		0.952
K80 Size (microns)		22



KM599 SIZINGS

TABLE II-5  
CYCLOSIZING ANALYSIS  
KM599 - Lead Scavenger Tail - February 9, 1996

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
65 Mesh	212	212	0.7	99.3
100 Mesh	150	150	3.5	95.9
150 Mesh	106	106	5.5	90.3
200 Mesh	75	75	7.9	82.4
270 Mesh	53	53	8.7	73.7
400 Mesh	38	38	11.2	62.5
Cyclone 1	45	48	0.3	62.2
Cyclone 2	31	34	1.9	60.3
Cyclone 3	22	24	6.3	53.9
Cyclone 4	15	16	8.7	45.3
Cyclone 5	12	13	5.9	39.4
Cyclone 6		7	12.1	27.3
Total			100.0	**

Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	4.50	1.24
Specific Gravity	3.03	0.904
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		1.083
<b>K80 Size (microns)</b>		<b>68</b>

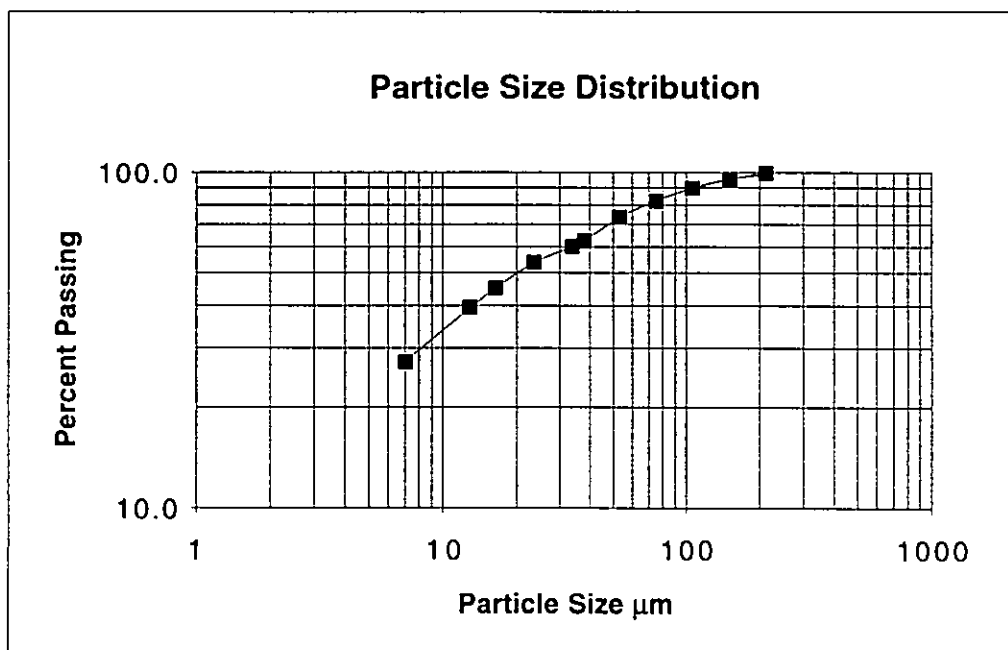
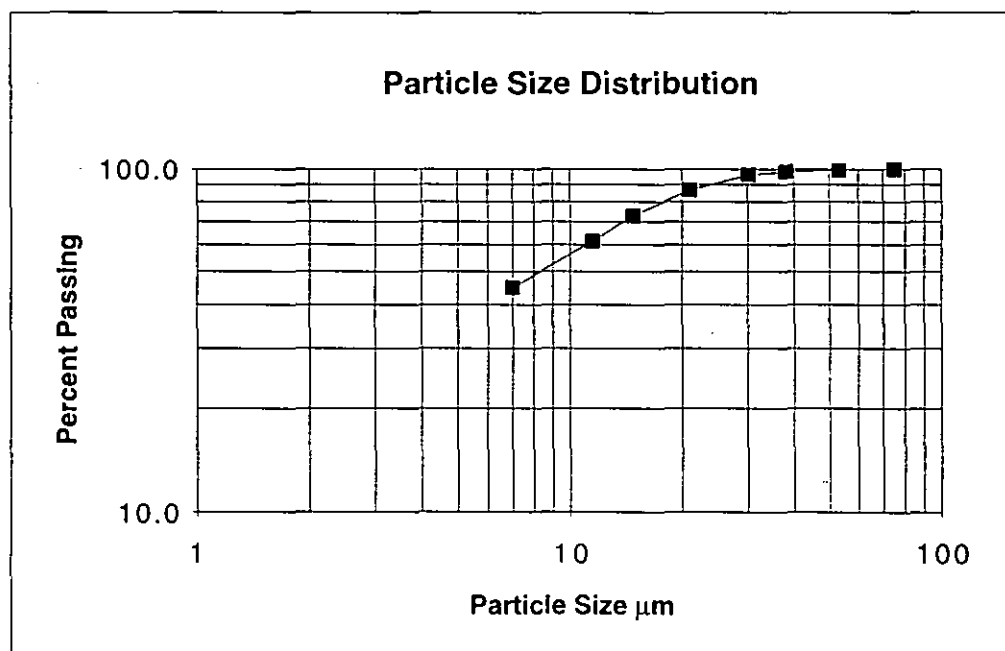


TABLE II-6  
CYCLOSIZING ANALYSIS  
KM599 - Lead Cleaner Tail - February 9, 1996

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
200 Mesh	75	75	0.0	100.0
270 Mesh	53	53	0.3	99.7
400 Mesh	38	38	1.6	98.1
Cyclone 1	45	43	0.2	97.9
Cyclone 2	31	30	1.9	96.1
Cyclone 3	22	21	9.3	86.7
Cyclone 4	15	15	14.0	72.8
Cyclone 5	12	11	11.4	61.3
Cyclone 6		7	16.6	44.8
Total			100.0	**

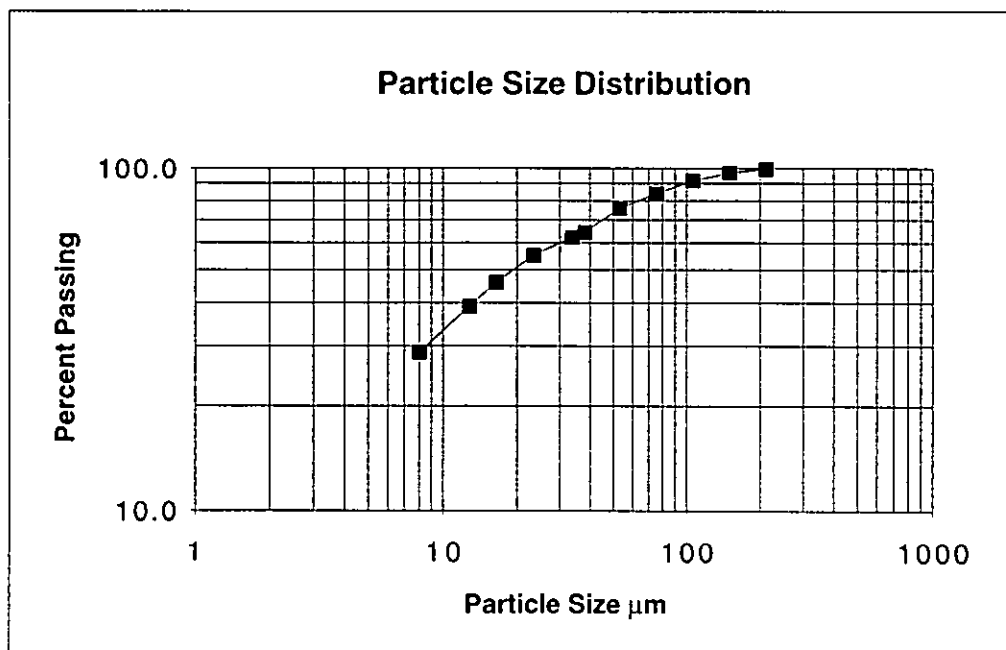
Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	4.50	1.24
Specific Gravity	3.56	0.805
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		0.965
<b>K80 Size (microns)</b>		<b>18</b>



**TABLE II-7**  
**CYCLOSIZING ANALYSIS**  
**KM599 - Zinc Scavenger Tail - February 9, 1996**

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
65 Mesh	212	212	0.4	99.7
100 Mesh	150	150	2.9	96.7
150 Mesh	106	106	5.0	91.7
200 Mesh	75	75	7.6	84.1
270 Mesh	53	53	8.5	75.7
400 Mesh	38	38	11.1	64.6
Cyclone 1	45	48	0.5	64.1
Cyclone 2	31	34	2.0	62.1
Cyclone 3	22	23	6.8	55.3
Cyclone 4	15	16	9.5	45.8
Cyclone 5	12	13	6.5	39.3
Cyclone 6		8	10.6	28.7
Total			100.0	**

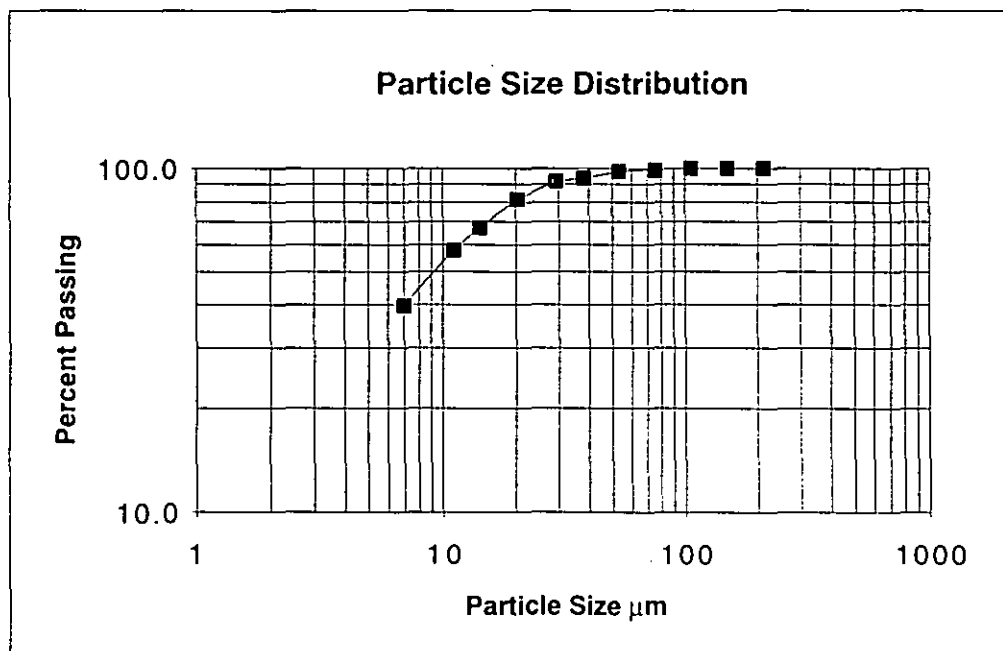
Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	5.00	1.23
Specific Gravity	3.03	0.904
Flow Rate (mm)	180	1.012
Elutriation Time (min)	20	0.955
Overall Factor		1.075
<b>K80 Size (microns)</b>		<b>63</b>



**TABLE II-8**  
**CYCLOSIZING ANALYSIS**  
**KM599 - Zinc Cleaner Tail - February 9, 1996**

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
65 Mesh	212	212	0.0	100.0
100 Mesh	150	150	0.0	100.0
150 Mesh	106	106	0.1	99.9
200 Mesh	75	75	0.3	99.6
270 Mesh	53	53	1.6	98.0
400 Mesh	38	38	4.2	93.8
Cyclone 1	45	42	0.2	93.7
Cyclone 2	31	29	2.0	91.7
Cyclone 3	22	20	10.5	81.2
Cyclone 4	15	14	13.8	67.4
Cyclone 5	12	11	9.6	57.8
Cyclone 6		7	18.0	39.9
Total			100.0	**

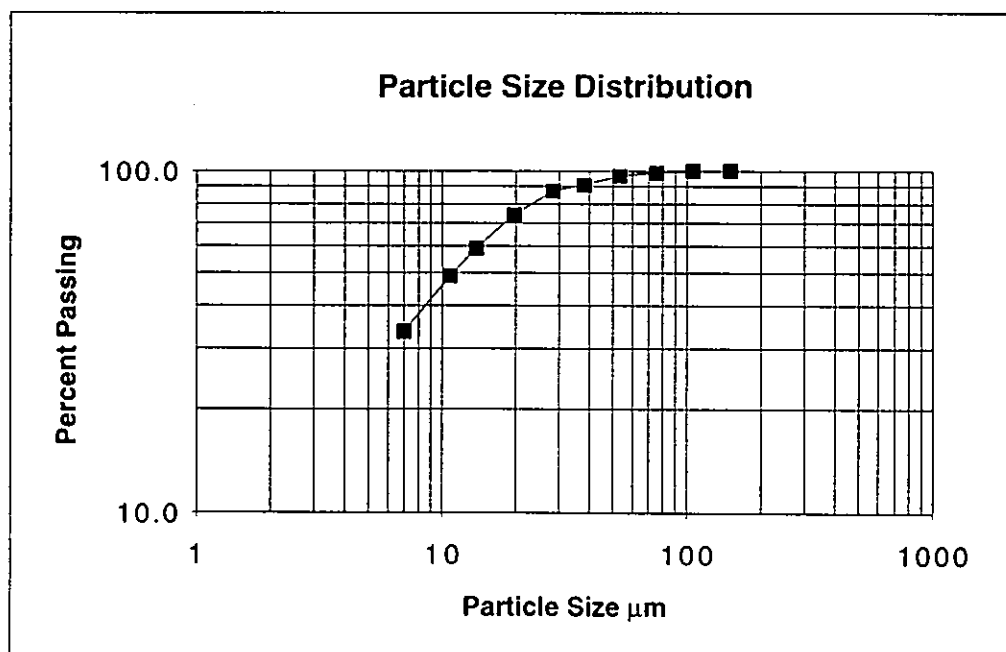
Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	4.50	1.24
Specific Gravity	3.76	0.775
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		0.929
<b>K80 Size (microns)</b>		<b>19</b>



**TABLE II-9**  
**CYCLOSIZING ANALYSIS**  
**KM599 - Zinc Concentrate - February 12, 1996**

Product	Size ( $\mu\text{m}$ )		Weight % Retained	Cumulative % Passing
	Limiting	Effective		
100 Mesh	150	150	0.0	100.0
150 Mesh	106	106	0.1	99.9
200 Mesh	75	75	0.7	99.3
270 Mesh	53	53	2.5	96.8
400 Mesh	38	38	5.6	91.2
Cyclone 1	45	40	0.4	90.8
Cyclone 2	31	28	3.6	87.3
Cyclone 3	22	20	13.1	74.2
Cyclone 4	15	14	14.9	59.3
Cyclone 5	12	11	10.5	48.9
Cyclone 6		7	15.1	33.7
Total			100.0	**

Operating Conditions	Measured	Factor
Temperature ( $^{\circ}\text{C}$ )	4.50	1.24
Specific Gravity	3.91	0.756
Flow Rate (mm)	180	1.012
Elutration Time (min)	20	0.955
Overall Factor		0.906
K80 Size (microns)		23



APPENDIX III - KM585/599

MINERALOGICAL AND MODAL DISTRIBUTION DATA

INDEX

<u>TABLE</u>	<u>KM585</u>	<u>PAGE</u>
1	Lead Scavenger Tails. (G/H) - December 7/95.	1
2	Lead Cleaner-Scavenger Tails. (I) - December 7/95.	8
3	Zinc Scavenger Tails. (K/L) - December 1/95.	15
4	Zinc Cleaner Tail 1. (J) - December 1/95.	22

KM599

5	Lead Scavenger Tail. - February 9/96.	29
6	Lead Cleaner-Scavenger Tail. - February 9/96.	37
7	Zinc Scavenger Tail. - February 9/96.	45
8	Zinc Cleaner Tail 1. - February 9/96.	53
9	Zinc Concentrate. - February 12/96.	61

**TABLE 1A**  
**SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS**  
**Lead Scavenger Tails (G/H) Composite - December 7, 1995**  
**KM585**

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.3	3.9	20.1	0.0	0.0	8.9	22.4	20.7	0.0	0.6	20.1	31.7	13.3
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.2	0.1	
Binary - Sp	0.0	0.0	0.0	0.7	0.8	0.0	3.8	0.0	0.6	0.4	0.0	1.8	0.2	0.4	
Binary - Py	0.0	0.4	0.2	0.0	1.5	0.0	0.0	2.9	0.0	0.6	0.0	0.0	2.2	0.1	
Binary - Gn	0.0	11.5	3.9	1.3	0.0	0.0	12.9	7.3	2.4	0.0	0.0	6.2	3.0	1.1	
Ternaries	0.0	9.2	2.7	0.3	0.5	0.0	5.3	2.7	1.2	0.0	0.0	4.9	0.7	0.2	0.0
Total	0.0	21.1	7.0	6.2	23.4	0.0	22.0	21.8	26.5	21.8	0.0	13.5	26.8	33.4	13.9

Size Range	<C4>C5					<C5				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.1	5.0	4.6	4.7	0.0	2.6	34.4	28.7	35.4
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	
Binary - Sp	0.0	0.6	0.0	0.1	0.0	0.0	10.3	0.2	0.6	
Binary - Py	0.0	0.0	0.2	0.0	0.0	0.0	1.2	0.1	0.1	
Binary - Gn	0.0	1.1	0.4	0.0	0.0	0.0	20.6	2.5	0.2	
Ternaries	0.0	0.4	0.0	0.0	0.0	0.0	7.7	0.3	0.0	0.0
Total	0.0	2.2	5.7	4.7	4.8	0.0	41.1	38.8	29.2	36.1

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	3.3	68.7	91.3	94.2	0.0	0.0	60.9	89.1	92.8
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	1.1	0.2	0.8	0.0	0.0	1.4	0.3	1.0
Binary - Sp	0.0	16.5	0.0	1.7	2.2	0.0	17.1	0.0	2.2	2.7
Binary - Py	0.0	0.4	6.7	0.0	2.4	0.0	0.4	8.4	0.0	3.0
Binary - Gn	0.0	52.2	17.0	5.1	0.0	0.0	54.0	21.3	6.3	0.0
Ternaries	0.0	27.6	6.4	1.7	0.5	0.0	28.5	8.0	2.2	0.6
Total	0.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 75 $\mu$ m sizing fraction corresponds to the Tyler 200 mesh screen. C1 to C5 indicates cyclones 1 to 5 on the Cyclosizer.  
4) Because the <C5 fraction is not counted an overall estimate is made by assuming the C5 and <C5 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 1B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
Lead Scavenger Tails (G/H) Composite - December 7, 1995

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	18.2		0.35	1.34	4.00		21.1	7.0	6.2
<75 $\mu$ m>C1	23.0		0.29	3.31	13.6		22.0	21.8	26.5
<C1>C4	19.5		0.21	4.79	20.2		13.5	26.8	33.4
<C4>C5	4.8		0.14	4.11	11.5		2.2	5.7	4.7
<C5	34.6		0.36	3.91	10.0		41.1	38.8	29.2
Total	100.0		0.30	3.49	11.8		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 1C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
Lead Scavenger Tails (G/H) Composite - December 7, 1995

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	18.2		0.4	2.0	8.5	89.0		21.1	7.0	6.2	23.4
<75 $\mu$ m>C1	23.0		0.3	5.0	29.1	65.6		22.0	21.8	26.5	21.8
<C1>C4	19.5		0.2	7.2	43.2	49.4		13.5	26.8	33.4	13.9
<C4>C5	4.8		0.2	6.2	24.6	69.1		2.2	5.7	4.7	4.8
<C5	34.6		0.4	5.9	21.3	72.4		41.1	38.8	29.2	36.1
Total	100.0		0.4	5.2	25.2	69.2		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 1D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Lead Scavenger Tails (G/H) Composite - December 7, 1995**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.01	3.59	23.0	65.2	0.00	0.00	3.18	22.4	64.2	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	0.06	0.06	0.55	0.00	0.00	0.07	0.07	0.69	0	54	98	78		
Binary - Sp	0.00	0.06	0.44	1.50	0.00	0.06	0.55	1.88	0	46	56	63			
Binary - Py	0.00	0.00	0.35	1.64	0.00	0.00	0.44	2.05	0	2	44	56			
Binary - Gn	0.00	0.18	0.89	1.27	0.00	0.19	1.11	1.59	0	22	37	44			
Termines	0.00	0.10	0.34	0.43	0.31	0.00	0.10	0.42	0.54	0.39	0	7	29	37	27
Average Composition	0.00	0.35	5.23	25.2	69.2	0.00	0.35	5.23	25.2	69.2					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 1E**  
**COMPARATIVE ASSAY TABLE**  
**Lead Scavenger Tails (G/H) Composite - December 7, 1995**

SIZE FRACTION	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75µm		0.4	2.0	8.5	89.0		0.4	1.3	4.5	93.8
<75µm>C1		0.3	5.0	29.1	65.6		0.9	2.4	27.2	69.5
<C1>C4		0.2	7.2	43.2	49.4		0.4	9.8	42.5	47.3
<C4>C5		0.2	6.2	24.6	69.1		0.7	10.3	26.4	62.7

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM585

PRODUCT: Lead Scavenger Tails (G/H) Composite - December 7, 1995

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	1.3
Pyrite	4.5
Gangue	93.8

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0	0.0		0.0	1.8	54.4	43.9

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
3.7	0.0	0.0		2.8	55.6	38.0

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
63.2	0.0	0.0	10.5		21.1	5.3

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
85.8	0.0	2.3	3.3	6.6		1.9

PROJECT: KM585

PRODUCT: Lead Scavenger Tails (G/H) Composite - December 7, 1995

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.9
Sphalerite	2.4
Pyrite	27.2
Gangue	69.5

Locking for: Chalcopyrite
---------------------------

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena
---------------------

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0	0.0	0.9	17.4	0.0	58.7	23.9

Locking for: Sphalerite
-------------------------

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
40.8	0.0	0.0	2.4	13.3	33.7	12.2

Locking for: Pyrite
---------------------

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
84.4	0.0	0.0	2.2	27.2	8.9	4.4

Locking for: Gangue
---------------------

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
95.3	0.0	0.0	1.9	2.8	69.5	0.0

PROJECT: KM585

PRODUCT: Lead Scavenger Tails (G/H) Composite - December 7, 1995

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	9.8
Pyrite	42.5
Gangue	47.3

Locking for: Chalcopyrite
---------------------------

Liberated	Locked in Binary With:						Ternaries
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0		0.0	0.0	0.0	0.0	0.0	

Locking for: Galena
---------------------

Liberated	Locked in Binary With:						Ternaries
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
4.5	0.0		13.6	0.0	45.5	36.4	

Locking for: Sphalerite
-------------------------

Liberated	Locked in Binary With:						Ternaries
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
75.0	0.0	2.8		8.3	11.1	2.8	

Locking for: Pyrite
---------------------

Liberated	Locked in Binary With:						Ternaries
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
94.7	0.0	0.7	0.7		3.3	0.7	

Locking for: Gangue
---------------------

Liberated	Locked in Binary With:						Ternaries
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
95.8	0.0	0.6	2.6	1.0		0.0	

PROJECT: KM585

PRODUCT: Lead Scavenger Tails (G/H) Composite - December 7, 1995

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.7
Sphalerite	10.3
Pyrite	26.4
Gangue	62.7

Locking for: Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
6.3	0.0	0.0	25.0	0.0	50.0	18.8

Locking for: Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
88.9	0.0	0.8	0.0	3.2	6.3	0.8

Locking for: Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
98.3	0.0	0.0	0.8	0.0	0.8	0.0

Locking for: Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
97.9	0.0	0.4	1.5	0.2	0.0	0.0

TABLE 2A  
 SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS  
 Lead Cleaner Scavenger Tails (I) - December 7, 1996  
 KM585

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	5.5	3.3	0.0	0.6	17.8	34.1	9.3
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.3	0.6	0.0	7.3	0.4	1.0	0.0
Binary - Sp	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.3	0.3	0.3	0.0	9.6	1.1	0.7	0.0
Binary - Py	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.2	0.0	0.9	0.6	0.2	0.0
Binary - Gn	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.2	0.2	0.2	0.0	3.6	0.2	0.6	0.0
Ternaries	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.4	0.7	0.2	0.0	4.3	0.6	0.3	0.2
Total	0.0	0.0	0.0	0.0	0.0	0.0	9.5	6.4	7.0	4.6	0.0	19.0	26.6	36.4	11.4

Size Range	<C4>C5					<C5				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.4	9.9	10.7	8.4	0.0	5.9	46.8	45.3	71.8
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	1.4	0.0	0.3	0.0	0.0	6.4	0.0	3.0
Binary - Sp	0.0	2.3	0.0	0.1	0.0	0.0	31.4	0.0	0.5	0.4
Binary - Py	0.0	0.4	0.3	0.0	0.0	0.0	5.2	1.3	0.0	0.0
Binary - Gn	0.0	1.0	0.2	0.0	0.0	0.0	13.7	0.9	0.0	0.0
Ternaries	0.0	0.8	0.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0
Total	0.0	4.8	11.7	10.8	8.8	0.0	66.8	55.3	45.8	75.2

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	6.9	77.0	95.5	92.7	0.0	0.0	71.3	94.4	90.9
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	18.2	0.8	5.0	0.0	0.0	22.7	0.9	6.2
Binary - Sp	0.0	46.5	0.0	2.0	1.5	0.0	49.9	0.0	2.5	1.9
Binary - Py	0.0	6.7	2.3	0.0	0.4	0.0	7.2	2.8	0.0	0.5
Binary - Gn	0.0	21.1	1.5	0.8	0.0	0.0	22.6	1.8	1.0	0.0
Ternaries	0.0	18.9	1.0	0.9	0.4	0.0	20.2	1.3	1.2	0.5
Total	0.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrholite, Gn-Gangue.  
 2) 0.0 indicates these minerals were not observed during the counting procedure.  
 3) 75 $\mu$ m sizing fraction corresponds to the Tyler 200 mesh screen. C1 to C5 indicates cyclones 1 to 5 on the Cyclosizer.  
 4) Because the <C5 fraction is not counted an overall estimate is made by assuming the C5 and <C5 liberation values are identical.  
 5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
 6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
 7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 2B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Lead Cleaner Scavenger Tails (I) - December 7, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	0.0		0.00	0.00	0.00		0.0	0.0	0.0
<75 $\mu$ m>C1	6.1		4.62	12.2	22.9		9.5	6.4	7.0
<C1>C4	24.9		2.26	12.4	29.0		19.0	26.6	36.4
<C4>C5	10.0		1.42	13.6	21.4		4.8	11.7	10.8
<C5	59.0		3.36	10.9	15.4		66.8	55.3	45.8
Total	100.0		2.97	11.6	19.8		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 2C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Lead Cleaner Scavenger Tails (I) - December 7, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1	6.1		5.4	18.3	48.8	27.5		9.5	6.4	7.0	4.6
<C1>C4	24.9		2.6	18.6	61.9	16.9		19.0	26.6	36.4	11.4
<C4>C5	10.0		1.6	20.4	45.6	32.3		4.8	11.7	10.8	8.8
<C5	59.0		3.9	16.4	32.8	46.9		66.8	55.3	45.8	75.2
Total	100.0		3.4	17.4	42.3	36.8		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 2D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Lead Cleaner Scavenger Tails (I) - December 7, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Compositon of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.24	13.4	40.4	34.1	0.00	0.00	12.4	39.9	33.5	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	3.17	0.32	1.83	0.00	0.00	3.96	0.40	2.29	0	70	62	75		
Binary - Sp	0.00	1.60	0.84	0.56	0.00	1.72	1.05	0.70	0	30	68	69			
Binary - Py	0.00	0.23	0.39	0.14	0.00	0.25	0.49	0.17	0	38	32	29			
Binary - Gn	0.00	0.73	0.25	0.33	0.00	0.78	0.32	0.41	0	25	31	71			
Ternaries	0.00	0.65	0.18	0.40	0.15	0.00	0.70	0.23	0.50	0.18	0	43	14	31	11
Average Composition	0.00	3.44	17.4	42.3	36.8	0.00	3.44	17.4	42.3	36.8					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 2E**  
**COMPARATIVE ASSAY TABLE**  
**Lead Cleaner Scavenger Tails (I) - December 7, 1996**

SIZE FRACTION	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1		5.4	18.3	48.8	27.5		3.4	23.2	47.5	25.9
<C1>C4		2.6	18.6	61.9	16.9		2.1	24.1	60.0	13.8
<C4>C5		1.6	20.4	45.6	32.3		1.1	25.7	49.5	23.7

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM585

PRODUCT: Lead Cleaner Scavenger Tails (I) - December 7, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.0
Sphalerite	0.0
Pyrite	0.0
Gangue	0.0

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT: KM585

PRODUCT: Lead Cleaner Scavenger Tails (I) - December 7, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	3.4
Sphalerite	23.2
Pyrite	47.5
Gangue	25.9

Locking for: Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0		34.0	1.9	29.2	34.9

Locking for: Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
38.8	0.0	49.1		1.7	3.4	6.9

Locking for: Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
78.4	0.0	4.7	4.2		3.2	9.5

Locking for: Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
71.4	0.0	13.5	7.3	3.6		4.2

PROJECT: KM585

PRODUCT: Lead Cleaner Scavenger Tails (I) - December 7, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	2.1
Sphalerite	24.1
Pyrite	60.0
Gangue	13.8

Locking for: Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
3.0	0.0	0.0	50.5	5.0	18.8	22.8

Locking for: Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
67.2	0.0	27.5	0.0	2.3	0.8	2.3

Locking for: Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
93.5	0.0	1.1	3.1	0.0	1.5	0.8

Locking for: Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
81.1	0.0	9.0	6.3	1.8	0.0	1.8

PROJECT: KM585

PRODUCT: Lead Cleaner Scavenger Tails (I) - December 7, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.1
Sphalerite	25.7
Pyrite	49.5
Gangue	23.7

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
8.8	0.0		47.1	7.8	20.6	15.7

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
84.6	0.0	11.5		2.3	1.5	0.0

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
99.0	0.0	0.0	1.0		0.0	0.0

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
95.5	0.0	4.0	0.6	0.0		0.0

**TABLE 3A**  
**SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS**  
**Zinc Scavenger Tails (K/L) Composite - December 1, 1996**  
**KM585**

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.2	4.7	18.9	0.0	0.0	0.3	22.6	20.2	0.0	0.0	1.9	29.6	15.0
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.3	0.0		0.3	0.4	0.5	0.0		0.5	0.1	0.1
Binary - Sp	0.0	0.0		0.3	0.7	0.0	0.4		0.6	0.6	0.0	0.7		0.4	0.3
Binary - Py	0.0	0.0	0.0		1.8	0.0	0.4	3.4		0.9	0.0	0.7	5.6		0.5
Binary - Gn	0.0	14.2	10.1	0.9		0.0	17.0	13.1	2.8		0.0	8.7	8.3	1.8	
Ternaries	0.0	11.4	10.1	0.4	0.2	0.0	8.7	7.6	0.4	0.3	0.0	2.0	2.1	0.3	0.1
Total	0.0	25.6	20.5	6.3	21.9	0.0	26.5	24.6	26.9	22.6	0.0	12.0	18.4	32.2	16.1

Size Range	<C4>C5					<C5				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.1	1.5	6.0	6.1	0.0	1.6	11.1	27.5	32.3
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.2
Binary - Sp	0.0	0.1		0.1	0.1	0.0	1.6		0.3	0.4
Binary - Py	0.0	0.1	0.3		0.0	0.0	1.6	2.0		0.2
Binary - Gn	0.0	1.6	2.2	0.1		0.0	22.3	16.1	0.6	
Ternaries	0.0	0.5	0.4	0.0	0.0	0.0	6.4	3.0	0.0	0.0
Total	0.0	2.4	4.4	6.2	6.2	0.0	33.5	32.2	28.4	33.2

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.7	14.9	90.4	92.6	0.0	0.0	0.0	88.0	90.7
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.8	0.6	1.2	0.0		0.9	0.7	1.6
Binary - Sp	0.0	2.8		1.7	2.2	0.0	2.8		2.1	2.7
Binary - Py	0.0	2.8	11.3		3.4	0.0	2.8	13.3		4.2
Binary - Gn	0.0	63.8	49.7	6.2		0.0	64.9	58.5	7.7	
Ternaries	0.0	28.9	23.3	1.1	0.6	0.0	29.4	27.3	1.4	0.8
Total	0.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 75 $\mu$ m sizing fraction corresponds to the Tyler 200 mesh screen. C1 to C5 indicates cyclones 1 to 5 on the Cyclosizer.  
4) Because the <C5 fraction is not counted an overall estimate is made by assuming the C5 and <C5 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 3B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Zinc Scavenger Tails (K/L) Composite - December 1, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75µm	17.9		0.41	0.83	4.20		25.6	20.5	6.3
<75µm>C1	23.8		0.32	0.75	13.5		26.5	24.6	26.9
<C1>C4	20.2		0.17	0.66	19.0		12.0	18.4	32.2
<C4>C5	6.2		0.11	0.51	11.9		2.4	4.4	6.2
<C5	32.0		0.30	0.73	10.6		33.5	32.2	28.4
<b>Total</b>	<b>100.0</b>		<b>0.29</b>	<b>0.72</b>	<b>11.9</b>		<b>100</b>	<b>100</b>	<b>100</b>

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 3C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Zinc Scavenger Tails (K/L) Composite - December 1, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75µm	17.9		0.5	1.2	9.0	89.3		25.6	20.5	6.3	21.9
<75µm>C1	23.8		0.4	1.1	28.9	69.6		26.5	24.6	26.9	22.6
<C1>C4	20.2		0.2	1.0	40.7	58.2		12.0	18.4	32.2	16.1
<C4>C5	6.2		0.1	0.8	25.5	73.6		2.4	4.4	6.2	6.2
<C5	32.0		0.3	1.1	22.7	75.9		33.5	32.2	28.4	33.2
<b>Total</b>	<b>100.0</b>		<b>0.3</b>	<b>1.1</b>	<b>25.5</b>	<b>73.1</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrholite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 3D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Zinc Scavenger Tails (K/L) Composite - December 1, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.01	0.16	23.1	67.7	0.00	0.00	0.00	22.4	66.3	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	0.01	0.14	0.91	0.00	0.01	0.18	1.14	0	52	95	84			
Binary - Sp	0.00	0.01	0.43	1.60	0.00	0.01	0.54	2.00	0	48	79	76			
Binary - Py	0.00	0.01	0.12	2.46	0.00	0.01	0.14	3.08	0	5	21	61			
Binary - Gn	0.00	0.21	0.54	1.57	0.00	0.22	0.64	1.97	0	16	24	39			
Ternaries	0.00	0.10	0.25	0.29	0.46	0.00	0.10	0.30	0.36	0.57	0	7	22	27	43
Average Composition	0.00	0.33	1.09	25.5	73.1	0.00	0.33	1.09	25.5	73.1					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 3E**  
**COMPARATIVE ASSAY TABLE**  
**Zinc Scavenger Tails (K/L) Composite - December 1, 1996**

SIZE FRACTION	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75µm		0.5	1.2	9.0	89.3	0.0	0.8	0.8	11.1	87.4
<75µm>C1		0.4	1.1	28.9	69.6	0.0	0.7	0.7	27.3	71.4
<C1>C4		0.2	1.0	40.7	58.2	0.0	0.3	1.4	45.0	53.4
<C4>C5		0.1	0.8	25.5	73.6	0.0	0.5	0.5	30.6	68.4

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM585

PRODUCT: Zinc Scavenger Tails (K/L) Composite - December 1, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.8
Sphalerite	0.8
Pyrite	11.1
Gangue	87.4

Locking for: Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Teraries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Teraries
0.0	0.0		0.0	0.0	55.6	44.4

Locking for: Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Teraries
1.2	0.0	0.0		0.0	49.4	49.4

Locking for: Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Teraries
75.0	0.0	0.0	4.5		13.6	6.8

Locking for: Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Teraries
86.2	0.0	1.4	3.4	8.1		0.9

PROJECT: KM585

PRODUCT: Zinc Scavenger Tails (K/L) Composite - December 1, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.7
Sphalerite	0.7
Pyrite	27.3
Gangue	71.4

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
0.0	0.0	0.7	1.6	1.6	64.1	32.8

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
1.1	0.0	1.1	0.7	13.8	53.2	30.9

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
84.0	0.0	1.6	2.4	27.3	10.4	1.6

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Termines
89.4	0.0	2.3	2.8	4.1	71.4	1.3

PROJECT: KM585

PRODUCT: Zinc Scavenger Tails (K/L) Composite - December 1, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.3
Sphalerite	1.4
Pyrite	45.0
Gangue	53.4

Locking for: Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
0.0	0.0		5.6	5.6	72.2	16.7

Locking for: Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
10.1	0.0	2.9		30.4	44.9	11.6

Locking for: Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
91.8	0.0	0.4	1.3		5.6	0.9

Locking for: Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
93.6	0.0	0.8	2.0	2.9		0.8

PROJECT: KM585

PRODUCT: Zinc Scavenger Tails (K/L) Composite - December 1, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.5
Sphalerite	0.5
Pyrite	30.6
Gangue	68.4

Locking for: Chalcopyrite
---------------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
4.8	0.0	0.0	4.8	4.8	66.7	19.0

Locking for: Sphalerite
-------------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
34.4	0.0	0.0	0.0	6.3	50.0	9.4

Locking for: Pyrite
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
96.9	0.0	0.0	1.0	0.0	2.1	0.0

Locking for: Gangue
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
97.5	0.0	0.7	1.2	0.5	0.0	0.0

TABLE 4A  
 SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS  
 Zinc Cleaner Tail 1 (J) - December 1, 1996  
 KM585

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	6.1	5.0	0.0	0.2	2.4	32.0	12.7
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.0	0.0		0.2	0.0	0.1	0.0		0.0	0.1	0.3
Binary - Sp	0.0	0.0		0.0	0.0	0.0	0.1		1.8	0.9	0.0	0.4		2.2	1.1
Binary - Py	0.0	0.0	0.0		0.0	0.0	0.1	6.9		0.3	0.0	0.2	10.3		0.6
Binary - Gn	0.0	0.0	0.0	0.0		0.0	4.6	5.1	0.3		0.0	8.7	3.6	0.5	
Ternaries	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.3	0.1	0.3	0.0	6.7	6.0	0.2	0.1
Total	0.0	0.0	0.0	0.0	0.0	0.0	10.1	19.7	8.4	6.6	0.0	16.2	22.2	35.0	14.8

Size Range	<C4>C5					<C5				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.1	0.8	9.7	7.0	0.0	1.3	8.6	45.8	64.4
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.2	0.0		0.0	0.0	2.1
Binary - Sp	0.0	0.0		0.1	0.4	0.0	0.0		0.6	3.4
Binary - Py	0.0	0.0	2.1		0.1	0.0	0.0	22.8		0.8
Binary - Gn	0.0	2.8	1.1	0.0		0.0	47.2	12.4	0.2	
Ternaries	0.0	1.3	0.9	0.0	0.0	0.0	21.0	9.5	0.0	0.3
Total	0.0	4.2	4.9	9.9	7.7	0.0	69.4	53.2	46.6	70.9

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.7	11.9	93.7	89.1	0.0	0.0	0.0	92.2	86.4
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.2	0.1	2.7	0.0		0.2	0.1	3.4
Binary - Sp	0.0	0.6		4.8	5.7	0.0	0.6		6.0	7.1
Binary - Py	0.0	0.3	42.1		1.8	0.0	0.3	47.8		2.2
Binary - Gn	0.0	63.3	22.1	1.0		0.0	64.4	25.1	1.3	
Ternaries	0.0	34.1	23.7	0.3	0.7	0.0	34.7	26.9	0.4	0.9
Total	0.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
 2) 0.0 Indicates these minerals were not observed during the counting procedure.  
 3) 75 $\mu$ m sizing fraction corresponds to the Tyler 200 mesh screen. C1 to C5 indicates cyclones 1 to 5 on the Cyclosizer.  
 4) Because the <C5 fraction is not counted an overall estimate is made by assuming the C5 and <C5 liberation values are identical.  
 5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
 6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
 7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 4B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Zinc Cleaner Tail 1 (J) - December 1, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75µm	0.0		0.00	0.00	0.00		0.0	0.0	0.0
<75µm>C1	7.9		1.20	4.24	25.5		10.1	19.7	8.4
<C1>C4	25.4		0.60	1.49	33.0		16.2	22.2	35.0
<C4>C5	8.7		0.45	0.96	27.2		4.2	4.9	9.9
<C5	58.1		1.12	1.56	19.2		69.4	53.2	46.6
Total	100.0		0.94	1.70	23.9		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 4C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Zinc Cleaner Tail 1 (J) - December 1, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75µm	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75µm>C1	7.9		1.4	6.4	54.5	37.7		10.1	19.7	8.4	6.6
<C1>C4	25.4		0.7	2.2	70.6	26.5		16.2	22.2	35.0	14.8
<C4>C5	8.7		0.5	1.4	58.2	39.8		4.2	4.9	9.9	7.7
<C5	58.1		1.3	2.3	41.1	55.3		69.4	53.2	46.6	70.9
Total	100.0		1.1	2.6	51.1	45.3		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite and Pyrrhotite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 4D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Zinc Cleaner Tail 1 (J) - December 1, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.02	0.30	47.9	40.3	0.00	0.00	0.00	47.1	39.1	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	0.01	0.05	1.23	0.00	0.01	0.06	1.54	0	0	49	94	69		
Binary - Sp	0.00	0.01	2.44	2.58	0.00	0.01	3.05	3.22	0	0	51	71	83		
Binary - Py	0.00	0.00	1.07	0.79	0.00	0.00	1.22	0.99	0	0	6	29	60		
Binary - Gn	0.00	0.69	0.57	0.53	0.00	0.70	0.64	0.67	0	0	31	17	40		
Ternaries	0.00	0.37	0.60	0.17	0.33	0.00	0.38	0.69	0.21	0.41	0	22	41	13	24
Average Composition	0.00	1.09	2.55	51.1	45.3	0.00	1.09	2.55	51.1	45.3					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 4E**  
**COMPARATIVE ASSAY TABLE**  
**Zinc Cleaner Tail 1 (J) - December 1, 1996**

SIZE FRACTION	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75µm		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75µm>C1		1.4	6.4	54.5	37.7		0.8	7.7	56.2	35.3
<C1>C4		0.7	2.2	70.6	26.5		0.3	1.2	78.8	19.6
<C4>C5		0.5	1.4	58.2	39.8		0.4	1.7	59.3	38.7

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM585

PRODUCT: Zinc Cleaner Tail 1 (J) - December 1, 1996

SIZE RANGE &lt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.0
Sphalerite	0.0
Pyrite	0.0
Gangue	0.0

Locking for: Chalcopyrite
---------------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Sphalerite
-------------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Pyrite
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Gangue
---------------------

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT: KM585

PRODUCT: Zinc Cleaner Tail 1 (J) - December 1, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.8
Sphalerite	7.7
Pyrite	56.2
Gangue	35.3

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
1.1	0.0		1.1	1.1	45.5	51.1

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
1.0	0.0	1.0		35.1	25.8	37.1

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
72.9	0.0	0.0	21.9		3.5	1.6

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Terminaries
75.6	0.0	2.2	13.0	3.9		5.3

PROJECT: KM585

PRODUCT: Zinc Cleaner Tail 1 (J) - December 1, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.3
Sphalerite	1.2
Pyrite	78.8
Gangue	19.6

Locking for: Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for: Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
1.4	0.0	0.3	2.7	1.4	53.4	41.1

Locking for: Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
10.8	0.0	0.0	1.2	46.2	16.1	26.9

Locking for: Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
91.5	0.0	0.3	6.2	78.8	1.4	0.6

Locking for: Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternaries
85.9	0.0	1.8	7.4	4.3	19.6	0.6

PROJECT: KM585

PRODUCT: Zinc Cleaner Tail 1 (J) - December 1, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	1.7
Pyrite	59.3
Gangue	38.7

Locking for: Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
0.0		0.0	0.0	0.0	0.0	0.0

Locking for: Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
1.9	0.0		0.0	0.0	67.9	30.2

Locking for: Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
16.1	0.0	0.0		42.9	23.2	.17.9

Locking for: Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
98.2	0.0	0.0	1.3		0.4	0.0

Locking for: Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Temaries
90.8	0.0	2.9	4.8	1.1		0.4

**TABLE 5A**  
**SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS**  
**Lead Scavenger Tail - February 9, 1996**  
**KM599**

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.6	2.1	18.9	0.0	0.0	6.9	20.9	16.9	0.0	0.4	17.9	23.3	12.3
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.2	0.0	1.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.2	0.0	0.0
Binary - Sp	0.0	2.3	0.0	0.0	1.1	0.0	1.2	0.0	0.7	0.9	0.0	0.4	0.0	0.1	0.3
Binary - Py	0.0	0.0	0.2	0.0	1.5	0.0	0.4	2.5	0.0	0.9	0.0	0.9	2.8	0.0	0.3
Binary - Gn	0.0	13.5	5.2	3.3	0.0	0.0	7.7	4.9	2.5	0.0	0.0	4.5	2.0	2.0	0.0
Terminaries	0.0	3.8	1.7	0.6	0.5	0.0	5.7	2.4	0.4	0.1	0.0	2.7	0.4	0.3	0.0
Total	0.0	19.5	7.9	6.0	23.0	0.0	14.9	16.9	24.5	19.0	0.0	8.9	23.2	25.7	13.0

Size Range	<C4>C5					<C5>C6					<C6				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.5	5.3	6.0	5.6	0.0	2.2	11.5	10.3	12.4	0.0	15.9	29.3	26.6	26.1
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.2	0.0
Binary - Sp	0.0	0.5	0.0	0.1	0.1	0.0	1.1	0.0	0.1	0.2	0.0	7.9	0.0	0.2	0.5
Binary - Py	0.0	0.5	0.4	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	1.9	0.0	0.1
Binary - Gn	0.0	0.5	0.6	0.1	0.0	0.0	2.2	0.4	0.0	0.0	0.0	15.9	1.1	0.0	0.0
Terminaries	0.0	0.5	0.1	0.0	0.0	0.0	1.1	0.1	0.0	0.0	0.0	7.9	0.3	0.0	0.0
Total	0.0	2.3	6.4	6.2	5.8	0.0	6.7	12.8	10.5	12.7	0.0	47.6	32.8	27.0	26.7

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	19.0	71.5	89.1	92.3	0.0	0.0	64.3	86.4	90.4
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	1.0	0.4	1.1	0.0	0.0	1.3	0.5	1.4
Binary - Sp	0.0	13.4	0.0	1.3	3.1	0.0	16.6	0.0	1.6	3.8
Binary - Py	0.0	1.8	8.5	0.0	2.8	0.0	2.2	10.6	0.0	3.5
Binary - Gn	0.0	44.2	14.2	8.0	0.0	0.0	54.6	17.7	9.9	0.0
Terminaries	0.0	21.6	4.9	1.2	0.6	0.0	26.7	6.1	1.6	0.8
Total	0	100	100	100	100	0	100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 53 $\mu$ m sizing fraction corresponds to the Tyler 270 mesh screen. C1 to C6 indicates cyclones 1 to 6 on the Cyclosizer.  
4) Because the <C6 fraction is not counted an overall estimate is made by assuming the C6 and <C6 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 5B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Lead Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	17.6		0.42	1.96	4.2		19.5	7.9	6.1
<75 $\mu$ m>C1	20.2		0.28	3.64	14.6		14.9	16.9	24.3
<C1>C4	16.9		0.20	5.99	18.4		8.9	23.2	25.6
<C4>C5	5.9		0.15	4.72	12.8		2.3	6.4	6.2
<C5>C6	12.1		0.21	4.62	10.6		6.7	12.8	10.6
<C6	27.3		0.66	5.24	12.1		47.6	32.8	27.2
Total	100.0		0.38	4.36	12.1		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 5C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Lead Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	17.6		0.5	3.2	8.7	87.7		19.5	7.9	6.0	23.0
<75 $\mu$ m>C1	20.2		0.3	5.9	30.8	63.1		14.9	16.9	24.5	19.0
<C1>C4	16.9		0.2	9.6	38.5	51.6		8.9	23.2	25.7	13.0
<C4>C5	5.9		0.2	7.6	26.7	65.5		2.3	6.4	6.2	5.8
<C5>C6	12.1		0.2	7.4	22.0	70.3		6.7	12.8	10.5	12.7
<C6	27.3		0.8	8.4	25.1	65.7		47.6	32.8	27.0	26.7
Total	100.0		0.4	7.0	25.3	67.2		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
3) See appendix I for details of gravimetric factors.  
4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 5D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Lead Scavenger Tail - February 9, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Compositon of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.08	5.02	22.6	62.1	0.00	0.00	4.52	21.9	60.8	0	100	100	100	100
Binary - Cp		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00		0	0	0	0
Binary - Ga	0.00		0.07	0.10	0.76	0.00		0.09	0.13	0.95	0		55	93	80
Binary - Sp	0.00	0.06		0.32	2.07	0.00	0.07		0.40	2.58	0	45		35	67
Binary - Py	0.00	0.01	0.59		1.89	0.00	0.01	0.74		2.36	0	7	65		48
Binary - Gn	0.00	0.19	1.00	2.02		0.00	0.24	1.25	2.52		0	20	33	52	
Ternaries	0.00	0.09	0.34	0.32	0.43	0.00	0.12	0.43	0.40	0.54	0	8	29	27	36
Average Composition	0.00	0.44	7.02	25.3	67.2	0.00	0.44	7.02	25.3	67.2					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 5E**  
**COMPARATIVE ASSAY TABLE**  
**Lead Scavenger Tail - February 9, 1996**

Size Fraction	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.5	3.2	8.7	87.7		0.5	2.2	6.9	90.3
<75 $\mu$ m>C1		0.3	5.9	30.8	63.1		0.4	6.7	33.9	59.0
<C1>C4		0.2	9.6	38.5	51.6		0.4	11.0	42.3	46.3
<C4>C5		0.2	7.6	26.7	65.5		0.4	7.6	29.5	62.4
<C5>C6		0.2	7.4	22.0	70.3		0.4	9.8	26.7	63.2

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM599

PRODUCT: Lead Scavenger Tail - February 9, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.5
Sphalerite	2.2
Pyrite	6.9
Gangue	90.3

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.5	11.5	0.0	69.2	19.2

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
8.0	0.0	3.0	2.2	2.0	66.0	21.0

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
35.0	0.0	0.0	0.0	6.9	55.0	10.0

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
82.4	0.0	4.4	4.8	6.4	90.3	2.1

PROJECT: KM599

PRODUCT: Lead Scavenger Tail - February 9, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	6.7
Pyrite	33.9
Gangue	59.0

Locking for Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	8.1	2.7	51.4	37.8

Locking for Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
41.1	0.0	0.9	0.0	15.0	29.0	14.0

Locking for Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
85.4	0.0	0.0	2.9	0.0	10.2	1.5

Locking for Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
89.4	0.0	0.7	4.5	4.8	0.0	0.7

PROJECT: KM599

PRODUCT: Lead Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	11.0
Pyrite	42.3
Gangue	46.3

Locking for Chalcopyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0		0.0	0.0	0.0	0.0	0.0	

Locking for Galena

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
5.0	0.0		5.0	10.0	50.0	30.0	

Locking for Sphalerite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
76.9	0.0	0.9		12.0	8.5	1.7	

Locking for Pyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
90.5	0.0	0.0	0.6		7.8	1.1	

Locking for Gangue

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
94.8	0.0	0.0	2.5	2.5		0.3	

PROJECT: KM599

PRODUCT: Lead Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	7.6
Pyrite	29.5
Gangue	62.4

Locking for ChalcopyriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for GalenaLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
20.0	0.0	0.0	20.0	20.0	20.0	20.0

Locking for SphaleriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
82.6	0.0	0.9	0.0	6.1	9.6	0.9

Locking for PyriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
96.0	0.0	1.0	1.0	0.0	2.0	0.0

Locking for GangueLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
98.2	0.0	0.0	1.3	0.5	0.0	0.0

PROJECT: KM599

PRODUCT: Lead Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C5&gt;C6

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	9.8
Pyrite	26.7
Gangue	63.2

Locking for ChalcopyriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for GalenaLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
33.3	0.0	0.4	16.7	0.0	33.3	16.7

Locking for SphaleriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
89.3	0.0	0.8	9.8	5.7	3.3	0.8

Locking for PyriteLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
98.2	0.0	0.9	0.9	26.7	0.0	0.0

Locking for GangueLocked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
97.9	0.0	0.0	1.8	0.2	63.2	0.0

**TABLE 6A**  
**SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS**  
**Lead Cleaner Scavenger Tail - February 9, 1996**  
**KM599**

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	3.1	0.0	0.5	12.7	25.0	13.1
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.0	0.0		0.1	0.0	0.2	0.0		4.3	0.7	0.3
Binary - Sp	0.0	0.0		0.0	0.0	0.0	0.1		0.0	0.4	0.0	7.9		1.5	0.8
Binary - Py	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.4	0.0	0.4	0.9		2.8
Binary - Gn	0.0	0.0	0.0	0.0		0.0	1.0	0.3	0.2		0.0	1.3	3.6	4.2	
Ternaries	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3	0.1	0.2	0.0	2.2	0.7	0.1	0.3
Total	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.0	1.3	4.3	0.0	12.3	22.2	31.6	17.4

Size Range	<C4>C5					<C5>C6					<C6				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.7	9.9	12.0	9.4	0.0	7.4	17.3	15.5	17.3	0.0	47.8	43.1	38.4	50.1
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.8	0.0	0.1	0.0		0.7	0.0	0.0	0.0		1.7	0.0	0.0
Binary - Sp	0.0	2.2		0.1	0.2	0.0	2.7		0.1	0.2	0.0	17.6		0.2	0.5
Binary - Py	0.0	0.0	0.1		0.2	0.0	0.2	0.0		0.0	0.0	1.4	0.0		0.0
Binary - Gn	0.0	0.7	1.0	0.4		0.0	0.5	0.7	0.1		0.0	3.5	1.7	0.2	
Ternaries	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
Total	0.0	4.7	11.7	12.6	9.8	0.0	10.9	18.7	15.7	17.5	0.0	70.3	46.4	38.9	50.9

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	57.5	83.2	91.9	92.9	0.0	46.8	79.0	89.9	91.2
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		7.5	0.7	0.6	0.0		9.4	0.9	0.8
Binary - Sp	0.0	30.5		2.0	2.1	0.0	38.1		2.5	2.6
Binary - Py	0.0	2.1	1.0		3.5	0.0	2.6	1.3		4.3
Binary - Gn	0.0	7.1	7.3	5.1		0.0	8.9	9.1	6.4	
Ternaries	0.0	2.9	0.9	0.2	0.9	0.0	3.6	1.2	0.3	1.1
Total	0	100	100	100	100	0	100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 53 $\mu$ m sizing fraction corresponds to the Tyler 270 mesh screen. C1 to C6 indicates cyclones 1 to 6 on the Cyclosizer.  
4) Because the <C6 fraction is not counted an overall estimate is made by assuming the C6 and <C6 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 6B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Lead Cleaner Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	0.0		0.00	0.0	0.0		0.0	0.0	0.0
<75 $\mu$ m>C1	2.1		2.54	6.1	14.9		1.7	1.0	1.3
<C1>C4	25.2		1.52	11.1	29.7		12.3	22.2	31.2
<C4>C5	11.4		1.29	13.0	26.4		4.7	11.7	12.5
<C5>C6	16.6		2.04	14.2	22.8		10.9	18.7	15.8
<C6	44.8		4.88	13.1	21.0		70.3	46.4	39.2
Total	100.0		3.10	12.6	24.0		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 6C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Lead Cleaner Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1	2.1		2.9	9.9	31.0	56.2		1.7	1.0	1.3	4.3
<C1>C4	25.2		1.8	17.9	61.9	18.4		12.3	22.2	31.6	17.4
<C4>C5	11.4		1.5	20.9	54.5	23.1		4.7	11.7	12.6	9.8
<C5>C6	16.6		2.4	22.9	46.6	28.2		10.9	18.7	15.7	17.5
<C6	44.8		5.7	21.1	42.9	30.4		70.3	46.4	38.9	50.9
Total	100.0		3.6	20.3	49.4	26.7		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 6D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Lead Cleaner Scavenger Tail - February 9, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	2.07	16.9	45.4	24.8	0.00	1.69	16.1	44.4	24.3	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	1.52	0.35	0.17	0.00	0.00	1.90	0.44	0.21	0	58	83	40		
Binary - Sp	0.00	1.10	0.99	0.56	0.00	1.37	1.24	0.70	0	42	82	27			
Binary - Py	0.00	0.07	0.21	0.92	0.00	0.09	0.27	1.16	0	17	18	27			
Binary - Gn	0.00	0.26	1.48	2.54	0.00	0.32	1.85	3.18	0	60	73	73			
Ternaries	0.00	0.10	0.19	0.12	0.23	0.00	0.13	0.24	0.15	0.29	0	16	29	18	36
Average Composition	0.00	3.60	20.3	49.4	26.7	0.00	3.60	20.3	49.4	26.7					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 6E**  
**COMPARATIVE ASSAY TABLE**  
**Lead Cleaner Scavenger Tail - February 9, 1996**

Size Fraction	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1		2.9	9.9	31.0	56.2		1.9	11.0	23.6	63.4
<C1>C4		1.8	17.9	61.9	18.4		1.7	17.4	68.3	12.7
<C4>C5		1.5	20.9	54.5	23.1		1.1	21.5	55.0	22.4
<C5>C6		2.4	22.9	46.6	28.2		1.2	28.4	44.3	26.1

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM599

PRODUCT: Lead Cleaner Scavenger Tail - February 9, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.0
Sphalerite	0.0
Pyrite	0.0
Gangue	0.0

Locking for Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT: KM599

PRODUCT: Lead Cleaner Scavenger Tail - February 9, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.9
Sphalerite	11.0
Pyrite	23.6
Gangue	63.4

Locking for Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0		0.0	0.0	0.0	0.0	0.0

Locking for Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0		4.4	0.9	61.1	33.6

Locking for Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
28.0	0.0	8.6		3.2	34.4	25.8

Locking for Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
73.1	0.0	0.0	3.1		17.7	6.2

Locking for Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
71.4	0.0	5.7	8.3	10.2		4.3

PROJECT: KM599

PRODUCT: Lead Cleaner Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.7
Sphalerite	17.4
Pyrite	68.3
Gangue	12.7

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
4.0	0.0	0.0	64.4	3.0	10.9	17.8

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
57.1	0.0	19.4	0.0	4.1	16.3	3.1

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
79.2	0.0	2.3	4.9	0.0	13.3	0.3

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
75.5	0.0	1.9	4.7	16.0	0.0	1.9

PROJECT: KM599

PRODUCT: Lead Cleaner Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.1
Sphalerite	21.5
Pyrite	55.0
Gangue	22.4

Locking for Chalcopyrite

Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
36.6	0.0	0.0	45.5	1.0	13.9	3.0

Locking for Sphalerite

Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
84.4	0.0	6.4	0.0	0.9	8.3	0.0

Locking for Pyrite

Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
95.5	0.0	0.0	0.9	0.0	3.1	0.4

Locking for Gangue

Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
95.2	0.0	0.6	1.8	2.4	0.0	0.0

PROJECT: KM599

PRODUCT: Lead Cleaner Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C5&gt;C6

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.2
Sphalerite	28.4
Pyrite	44.3
Gangue	26.1

Locking for Chalcopyrite						
Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena						
Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
68.0	0.0	0.0	25.0	2.0	5.0	0.0

Locking for Sphalerite						
Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
92.8	0.0	3.6	0.0	0.0	3.6	0.0

Locking for Pyrite						
Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
98.8	0.0	0.0	0.6	0.0	0.6	0.0

Locking for Gangue						
Liberated	Locked in Binary With:					Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	
98.4	0.0	0.0	1.1	0.0	0.0	0.5

TABLE 7A  
SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS  
Zinc Scavenger Tail - February 9, 1996  
KM599

Size Range	>75 $\mu$ m					<75 $\mu$ m>C1					<C1>C4				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.9	17.8	0.0	0.0	2.8	17.8	18.4	0.0	5.1	6.3	24.6	14.0
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		1.6	0.0	0.0
Binary - Sp	0.0	0.0		0.0	0.5	0.0	0.0		0.0	0.3	0.0	3.4		0.2	0.0
Binary - Py	0.0	0.0	0.3		1.7	0.0	0.0	0.4		1.1	0.0	0.0	1.6		0.5
Binary - Gn	0.0	13.6	8.1	3.1		0.0	10.9	9.1	3.1		0.0	5.1	5.8	3.7	
Termines	0.0	2.1	2.1	0.3	0.4	0.0	2.4	2.8	0.2	0.1	0.0	1.7	1.0	0.0	0.0
Total	0.0	15.7	10.5	4.3	20.3	0.0	13.3	15.1	21.1	19.9	0.0	15.3	16.3	28.5	14.6

Size Range	<C4>C5					<C5>C6					<C6				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.3	2.3	6.2	6.1	0.0	5.0	7.8	9.6	10.8	0.0	32.2	36.9	29.1	27.5
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		0.4	0.0	0.0	0.0		0.1	0.0	0.0	0.0		0.7	0.0	0.0
Binary - Sp	0.0	0.8		0.1	0.1	0.0	0.5		0.1	0.1	0.0	3.2		0.3	0.2
Binary - Py	0.0	0.0	0.4		0.2	0.0	0.0	0.1		0.1	0.0	0.0	0.7		0.2
Binary - Gn	0.0	1.3	1.3	0.7		0.0	1.5	1.3	0.0		0.0	9.7	5.9	0.0	
Termines	0.0	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	3.6	4.7	7.0	6.4	0.0	7.0	9.3	9.7	11.0	0.0	45.1	44.2	29.4	27.8

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	43.6	56.1	88.2	94.7	0.0	29.5	45.2	85.3	93.3
Binary - Cp		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Binary - Ga	0.0		2.8	0.0	0.0	0.0		3.5	0.0	0.1
Binary - Sp	0.0	7.9		0.7	1.1	0.0	9.9		0.8	1.4
Binary - Py	0.0	0.0	3.4		3.7	0.0	0.0	4.3		4.7
Binary - Gn	0.0	42.0	31.5	10.6		0.0	52.5	39.3	13.2	
Termines	0.0	6.5	6.2	0.5	0.5	0.0	8.1	7.7	0.7	0.6
Total	0	100	100	100	100	0	100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 53 $\mu$ m sizing fraction corresponds to the Tyler 270 mesh screen. C1 to C6 indicates cyclones 1 to 6 on the Cyclosizer.  
4) Because the <C6 fraction is not counted an overall estimate is made by assuming the C6 and <C6 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 7B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Zinc Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	15.9		0.39	0.8	3.4		15.7	10.5	4.4
<75 $\mu$ m>C1	20.1		0.26	0.9	13.0		13.3	15.1	21.0
<C1>C4	18.3		0.33	1.1	19.3		15.3	16.3	28.4
<C4>C5	6.5		0.22	0.9	13.3		3.6	4.7	7.0
<C5>C6	10.6		0.26	1.1	11.4		7.0	9.3	9.7
<C6	28.7		0.62	1.9	12.8		45.1	44.2	29.5
Total	100.0		0.39	1.2	12.4		100	100	100

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 7C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Zinc Scavenger Tail - February 9, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	15.9		0.5	1.3	7.2	91.0		15.7	10.5	4.3	20.3
<75 $\mu$ m>C1	20.1		0.3	1.5	27.8	70.4		13.3	15.1	21.1	19.9
<C1>C4	18.3		0.4	1.8	41.3	56.6		15.3	16.3	28.5	14.6
<C4>C5	6.5		0.3	1.4	28.4	69.9		3.6	4.7	7.0	6.4
<C5>C6	10.6		0.3	1.7	24.3	73.6		7.0	9.3	9.7	11.0
<C6	28.7		0.7	3.0	27.2	69.0		45.1	44.2	29.4	27.8
Total	100.0		0.5	2.0	26.5	71.1		100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix 1 for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 7D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Zinc Scavenger Tail - February 9, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	0.20	1.11	23.4	67.3	0.00	0.13	0.89	22.6	66.3	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	0.05	0.00	0.03	0.03	0.00	0.07	0.00	0.04	0.04	0	60	0	13	
Binary - Sp	0.00	0.04	0.17	0.78	0.00	0.05	0.22	0.98	0	40	0	72	56		
Binary - Py	0.00	0.00	0.07	2.66	0.00	0.00	0.08	3.32	0	0	28	49			
Binary - Gn	0.00	0.19	0.62	2.81	0.00	0.24	0.78	3.51	0	87	44	51			
Ternaries	0.00	0.03	0.12	0.14	0.32	0.00	0.04	0.15	0.18	0.41	0	5	20	23	52
Average Composition	0.00	0.46	1.97	26.5	71.1	0.00	0.46	1.97	26.5	71.1					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 7E**  
**COMPARATIVE ASSAY TABLE**  
**Zinc Scavenger Tail - February 9, 1996**

Size Fraction	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.5	1.3	7.2	91.0		0.5	1.1	5.0	93.3
<75 $\mu$ m>C1		0.3	1.5	27.8	70.4		0.4	1.6	30.8	67.2
<C1>C4		0.4	1.8	41.3	56.6		0.4	1.1	38.6	59.9
<C4>C5		0.3	1.4	28.4	69.9		0.5	1.0	33.2	65.4
<C5>C6		0.3	1.7	24.3	73.6		0.4	2.2	28.8	68.6

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM599

PRODUCT: Zinc Scavenger Tail - February 9, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.5
Sphalerite	1.1
Pyrite	5.0
Gangue	93.3

Locking for Chalcopyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0		0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0	0.0		0.0	0.0	86.5	13.5	

Locking for Sphalerite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0	0.0	0.0		2.7	77.3	20.0	

Locking for Pyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
21.4	0.0	0.0	0.0		71.4	7.1	

Locking for Gangue

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
87.4	0.0	0.0	2.3	8.4		1.9	

PROJECT: KM599

PRODUCT: Zinc Scavenger Tail - February 9, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	1.6
Pyrite	30.8
Gangue	67.2

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	81.8	18.2

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
18.4	0.0	0.0	0.0	2.6	60.5	18.4

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
84.4	0.0	0.0	0.0	0.0	14.8	0.8

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
92.5	0.0	0.2	1.4	5.5	0.4	0.4

PROJECT: KM599

PRODUCT: Zinc Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	1.1
Pyrite	38.6
Gangue	59.9

Locking for Chalcopyrite						
Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena						
Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
33.3	0.0	0.4	22.2	0.0	33.3	11.1

Locking for Sphalerite						
Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
38.7	0.0	9.7	1.1	9.7	35.5	6.5

Locking for Pyrite						
Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
86.1	0.0	0.0	0.7	38.6	13.1	0.0

Locking for Gangue						
Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
96.4	0.0	0.0	0.3	3.3	59.9	0.0

PROJECT: KM599

PRODUCT: Zinc Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.5
Sphalerite	1.0
Pyrite	33.2
Gangue	65.4

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
35.7	0.0	0.5	21.4	0.0	35.7	7.1

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
50.0	0.0	8.3	1.0	8.3	27.8	5.6

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
88.7	0.0	0.0	0.9	33.2	9.4	0.9

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
95.9	0.0	0.0	1.0	3.1	65.4	0.0

PROJECT: KM599

PRODUCT: Zinc Scavenger Tail - February 9, 1996

SIZE RANGE &lt;C5&gt;C6

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	2.2
Pyrite	28.8
Gangue	68.6

Locking for Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
71.4	0.0	0.4	7.1	0.0	21.4	0.0

Locking for Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
83.6	0.0	1.5	2.2	1.5	13.4	0.0

Locking for Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
99.0	0.0	0.0	1.0	28.8	0.0	0.0

Locking for Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
98.7	0.0	0.0	0.7	0.7	68.6	0.0

TABLE 8A  
SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS  
Zinc Cleaner Tail 1 - February 9, 1996  
KM599

Size Range	>75µm					<75µm>C1					<C1>C4				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	7.7	0.0	0.8	4.6	26.9	16.5
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.6	0.0	0.5	
Binary - Sp	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	2.7	0.0	2.4	0.0	2.1	1.5	
Binary - Py	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	2.1	0.0	1.9	
Binary - Gn	0.0	0.0	0.0	0.0	0.0	2.1	2.6	0.3	0.0	0.0	5.4	3.0	5.8	0.0	
Terminaries	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.9	0.5	0.8	0.0	4.4	1.5	1.0	0.6
Total	0.0	0.0	0.0	0.0	0.0	0.0	3.9	4.1	2.9	12.0	0.0	13.0	11.8	35.8	20.9

Size Range	<C4>C5					<C5>C6					<C6				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.4	3.0	10.1	7.9	0.0	14.7	18.0	17.7	17.2	0.0	45.4	54.9	31.3	40.1
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.8	0.0	0.0	
Binary - Sp	0.0	0.8	0.0	0.3	0.6	0.0	2.8	0.0	0.1	0.0	8.7	0.0	0.0	0.2	
Binary - Py	0.0	0.0	0.5	0.0	0.2	0.0	0.0	0.5	0.0	0.2	0.0	1.6	0.0	0.5	
Binary - Gn	0.0	2.2	0.9	1.6	0.0	1.7	0.5	0.1	0.0	0.0	5.2	1.6	0.2	0.0	
Terminaries	0.0	0.0	0.6	0.1	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Total	0.0	4.5	4.9	12.0	8.8	0.0	19.2	19.6	17.8	17.5	0.0	59.3	59.6	31.5	40.7

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
Mineral Status	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	62.3	81.1	87.8	89.4	0.0	52.9	76.3	84.8	86.7
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	1.7	0.0	1.1	0.0	2.1	0.0	1.4	
Binary - Sp	0.0	15.0	0.0	2.6	5.0	0.0	18.8	0.0	3.3	6.2
Binary - Py	0.0	0.0	4.7	0.0	3.1	0.0	0.0	5.9	0.0	3.8
Binary - Gn	0.0	16.7	8.6	8.0	0.0	20.9	10.7	10.0	0.0	0.0
Terminaries	0.0	6.0	4.0	1.5	1.5	0.0	7.4	5.0	1.9	1.8
Total	0	100	100	100	100	0	100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 53µm sizing fraction corresponds to the Tyler 270 mesh screen. C1 to C6 indicates cyclones 1 to 6 on the Cyclosizer.  
4) Because the <C6 fraction is not counted an overall estimate is made by assuming the C6 and <C6 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 8B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Zinc Cleaner Tail 1 - February 9, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	0.0		0.00	0.00	0.0		0.0	0.0	0.0
<75 $\mu$ m>C1	6.3		1.22	6.56	10.6		3.9	4.1	3.0
<C1>C4	26.3		0.97	4.50	30.1		13.0	11.8	35.0
<C4>C5	9.6		0.91	5.12	27.7		4.5	4.9	11.8
<C5>C6	18.0		2.09	10.9	22.4		19.2	19.6	17.8
<C6	39.9		2.91	15.0	18.4		59.3	59.6	32.5
<b>Total</b>	<b>100.0</b>		<b>1.95</b>	<b>10.0</b>	<b>22.6</b>		<b>100</b>	<b>100</b>	<b>100</b>

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 8C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Zinc Cleaner Tail 1 - February 9, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1	6.3		1.4	10.6	21.7	66.4		3.9	4.1	2.9	12.0
<C1>C4	26.3		1.1	7.2	63.9	27.7		13.0	11.8	35.8	20.9
<C4>C5	9.6		1.1	8.2	58.7	32.0		4.5	4.9	12.0	8.8
<C5>C6	18.0		2.4	17.5	46.3	33.7		19.2	19.6	17.8	17.5
<C6	39.9		3.4	24.2	37.0	35.5		59.3	59.6	31.5	40.7
<b>Total</b>	<b>100.0</b>		<b>2.3</b>	<b>16.1</b>	<b>46.8</b>	<b>34.7</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 8D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
**Zinc Cleaner Tail 1 - February 9, 1996**

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	1.41	13.1	41.2	31.1	0.00	1.20	12.3	39.7	30.1	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	0.27	0.00	0.39	0.00	0.00	0.34	0.00	0.49	0	0	44	0	51	
Binary - Sp	0.00	0.34	1.23	1.73	0.00	0.43	1.54	2.16	0	56	0	62	56		
Binary - Py	0.00	0.00	0.76	1.06	0.00	0.00	0.94	1.33	0	0	38	0	22		
Binary - Gn	0.00	0.38	1.38	3.74	0.00	0.47	1.73	4.67	0	49	44	78			
Ternaries	0.00	0.14	0.6	0.72	0.51	0.00	0.17	0.81	0.91	0.63	0	7	32	36	25
Average Composition	0.00	2.27	16.1	46.8	34.7	0.00	2.27	16.1	46.8	34.7					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 8E**  
**COMPARATIVE ASSAY TABLE**  
**Zinc Cleaner Tail 1 - February 9, 1996**

Size Fraction	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1		1.4	10.6	21.7	66.4		0.4	10.8	22.1	66.7
<C1>C4		1.1	7.2	63.9	27.7		0.3	7.7	63.2	28.8
<C4>C5		1.1	8.2	58.7	32.0		1.2	6.8	57.1	35.0
<C5>C6		2.4	17.5	46.3	33.7		1.9	15.8	46.5	35.8

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM599

PRODUCT: Zinc Cleaner Tail 1 - February 9, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.0
Sphalerite	0.0
Pyrite	0.0
Gangue	0.0

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT: KM599

PRODUCT: Zinc Cleaner Tail 1 - February 9, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.4
Sphalerite	10.8
Pyrite	22.1
Gangue	66.7

Locking for Chalcopyrite

Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.4	6.6	0.0	54.1	39.3

Locking for Sphalerite

Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
12.6	0.0	0.5	10.8	1.1	63.7	22.0

Locking for Pyrite

Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
66.7	0.0	0.0	7.8	22.1	8.9	16.7

Locking for Gangue

Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
63.9	0.0	4.4	22.5	2.8	66.7	6.4

PROJECT: KM599

PRODUCT: Zinc Cleaner Tail 1 - February 9, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.3
Sphalerite	7.7
Pyrite	63.2
Gangue	28.8

Locking for Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0		0.0	0.0	0.0	0.0	0.0

Locking for Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
6.2	0.0		18.5	0.0	41.5	33.8

Locking for Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
39.4	0.0	4.8		17.6	25.5	12.7

Locking for Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
75.0	0.0	0.0	5.9		16.3	2.8

Locking for Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
78.9	0.0	2.2	7.0	8.9		3.0

PROJECT: KM599

PRODUCT: Zinc Cleaner Tail 1 - February 9, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.2
Sphalerite	6.8
Pyrite	57.1
Gangue	35.0

Locking for Chalcopyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
0.0		0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
31.6	0.0		18.4	0.0	50.0	0.0	0.0

Locking for Sphalerite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
60.6	0.0	0.7		9.9	17.6	11.3	

Locking for Pyrite

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
83.8	0.0	0.0	2.3		13.5	0.5	

Locking for Gangue

Liberated	Locked in Binary With:						Ternary
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue		
89.3	0.0	1.6	6.3	2.0		0.8	

PROJECT: KM599

PRODUCT: Zinc Cleaner Tail 1 - February 9, 1996

SIZE RANGE &lt;C5&gt;C6

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.9
Sphalerite	15.8
Pyrite	46.5
Gangue	35.8

Locking for Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
76.5	0.0	0.0	14.7	0.0	8.8	0.0

Locking for Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
92.1	0.0	1.3	0.0	2.6	2.6	1.3

Locking for Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
99.4	0.0	0.0	0.0	0.0	0.6	0.0

Locking for Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
98.4	0.0	0.0	0.4	1.2	0.0	0.0

**TABLE 9A**  
**SUMMARY OF PERCENT LIBERATION BY SIZE AND CLASS**  
**Zinc Concentrate - February 12, 1996**  
**KM599**

Size Range	>75µm					<75µm>C1					<C1>C4				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6.2	3.9	4.1	0.0	1.5	24.4	29.4	7.2
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.4	0.0	0.0	1.6	4.2	0.0	0.0
Binary - Sp	0.0	0.0	0.0	0.0	0.0	3.1	0.6	6.0	7.7	0.0	11.4	0.0	12.6	7.2	0.0
Binary - Py	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.2	0.2	0.0	0.2	3.2	0.0	0.0	
Binary - Gn	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.7	0.0	0.0	0.8	0.9	2.1	0.0	
Ternaries	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.4	3.2	2.9	0.0	2.3	1.4	2.1	3.1
Total	0.0	0.0	0.0	0.0	0.0	0.0	4.7	8.6	14.0	15.3	0.0	16.1	31.4	50.3	17.4

Size Range	<C4>C5					<C5>C6					<C6				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	1.4	9.7	5.7	4.4	0.0	8.5	15.4	6.8	9.7	0.0	45.9	31.4	18.3	36.6
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	0.7	0.5	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.7	1.0	0.0	0.0
Binary - Sp	0.0	3.6	1.0	1.6	0.0	2.7	0.4	2.8	0.0	0.0	14.5	1.0	10.5	0.0	0.0
Binary - Py	0.0	0.1	0.5	1.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	
Binary - Gn	0.0	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	1.2	0.1	0.0	
Ternaries	0.0	0.2	0.1	0.5	0.5	0.0	0.1	0.1	0.0	0.0	0.0	0.6	0.1	0.0	-0.0
Total	0.0	5.5	11.1	7.7	7.7	0.0	11.5	16.1	7.6	12.5	0.0	62.2	32.8	20.4	47.1

Size Range	Mineral Liberation-2 Dimensions					Mineral Liberation-3 Dimensions				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.0	57.4	87.1	64.0	62.0	0.0	46.8	83.8	55.0	52.5
Binary - Cp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Binary - Ga	0.0	4.1	6.5	0.4	0.0	0.0	5.1	8.1	0.5	0.5
Binary - Sp	0.0	35.3	21.0	29.7	0.0	44.2	26.2	37.1	0.0	0.0
Binary - Py	0.0	0.3	4.9	1.3	0.0	0.4	6.2	1.6	0.0	0.0
Binary - Gn	0.0	2.5	1.8	2.8	0.0	3.1	2.3	3.5	0.0	0.0
Ternaries	0.0	4.5	2.1	5.8	6.6	0.0	5.6	2.6	7.2	8.2
Total	0	100	100	100	100	0	100	100	100	100

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
2) 0.0 Indicates these minerals were not observed during the counting procedure.  
3) 53µm sizing fraction corresponds to the Tyler 270 mesh screen. C1 to C6 indicates cyclones 1 to 6 on the Cyclosizer.  
4) Because the <C6 fraction is not counted an overall estimate is made by assuming the C6 and <C6 liberation values are identical.  
5) The Total line is the distribution of mineral in the size fraction. Original data is from the size by assay and distribution tables.  
6) The calculated liberation of the unsized product as measured in two dimensions has been converted to three dimensions using an adaptation of correction factors developed by Petruk, Broussaud, and G & T Metallurgical Services.  
7) The three dimension liberation is zero if the liberation in two dimensions is less than 20 percent.

**TABLE 9B**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON METAL CONTENT**  
**Zinc Concentrate - February 12, 1996**

Size Fraction	Weight %	Assays				Distribution			
		Cu	Pb	Zn	Fe	Cu	Pb	Zn	Fe
>75 $\mu$ m	0.0		0.00	0.0	0.0		0.0	0.0	0.0
<75 $\mu$ m>C1	9.2		1.42	48.6	9.2		4.7	8.6	11.0
<C1>C4	31.6		1.43	51.9	9.7		16.1	31.4	40.0
<C4>C5	10.5		1.47	55.3	7.0		5.5	11.1	9.6
<C5>C6	15.1		2.14	55.6	6.2		11.5	16.1	12.2
<C6	33.6		5.19	51.0	6.2		62.2	32.8	27.2
<b>Total</b>	<b>100.0</b>		<b>2.80</b>	<b>52.2</b>	<b>7.7</b>		<b>100</b>	<b>100</b>	<b>100</b>

Notes 1) The assays shown in this table are utilized to determine the mineralogical distribution shown in Table C

**TABLE 9C**  
**SIZE BY ASSAY AND DISTRIBUTION BASED ON MINERAL CONTENT**  
**Zinc Concentrate - February 12, 1996**

Size Fraction	Weight %	Assays					Distribution				
		Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1	9.2		1.6	78.2	11.4	8.7		4.7	8.6	14.0	15.3
<C1>C4	31.6		1.7	83.6	11.9	2.9		16.1	31.4	50.3	17.4
<C4>C5	10.5		1.7	89.0	5.5	3.8		5.5	11.1	7.7	7.7
<C5>C6	15.1		2.5	89.5	3.7	4.3		11.5	16.1	7.6	12.5
<C6	33.6		6.0	82.1	4.5	7.3		62.2	32.8	20.4	47.1
<b>Total</b>	<b>100.0</b>		<b>3.3</b>	<b>84.0</b>	<b>7.5</b>	<b>5.2</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

- Notes 1) Cp-Chalcopyrite, Ga-Galena, Sp-Sphalerite, Py-Pyrite, Gn-Gangue.  
 2) Mineral assays are based on gravimetric factors to convert the metal to the pure mineral.  
 3) See appendix I for details of gravimetric factors.  
 4) An assay value of "0" indicates the assay value is less than the detection limit.

**TABLE 9D**  
**ESTIMATED RELATIVE PROPORTION AND COMPOSITION OF MINERAL GRAINS**  
*Zinc Concentrate - February 12, 1996*

Binary Component	Proportion by Weight-2D					Proportion by Weight-3D					Composition of Grains				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
Liberated	0.00	1.87	73.2	4.78	3.2	0.00	1.52	70.5	4.11	2.8	0	100	100	100	100
Binary - Cp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Binary - Ga	0.00	3.42	0.48	0.02	0.00	0.00	4.28	0.60	0.03	0	75	98	20		
Binary - Sp	0.00	1.15	1.57	1.56	0.00	0.00	1.44	1.96	1.95	0	25	27	51		
Binary - Py	0.00	0.01	4.14	0.07	0.00	0.00	0.01	5.18	0.08	0	2	73	24		
Binary - Gn	0.00	0.08	1.52	0.21	0.00	0.00	0.10	1.90	0.26	0	80	49	76		
Ternaries	0.00	0.14	1.78	0.43	0.34	0.00	0.18	2.22	0.54	0.43	0	5	66	16	13
Average Composition	0.00	3.25	84.0	7.5	5.2	0.00	3.25	84.0	7.5	5.2					

- Notes 1) The two-dimensional proportion of minerals is a weighted estimate which is based on the liberation and the mineral content of the unsized sample.
- 2) The three-dimensional data is based on converting the two dimensional liberation data using an adaptation of Petruk and Broussaud transforms.
- 3) Composition values of "0" represents values <2% and "100" represents values >98%.

**TABLE 9E**  
**COMPARATIVE ASSAY TABLE**  
*Zinc Concentrate - February 12, 1996*

Size Fraction	Chemical Assay					Point Count Assay				
	Cp	Ga	Sp	Py	Gn	Cp	Ga	Sp	Py	Gn
>75 $\mu$ m		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
<75 $\mu$ m>C1		1.6	78.2	11.4	8.7		1.8	78.2	9.7	10.2
<C1>C4		1.7	83.6	11.9	2.9		2.5	83.8	9.9	3.8
<C4>C5		1.7	89.0	5.5	3.8		1.4	88.0	7.1	3.6
<C5>C6		2.5	89.5	3.7	4.3		2.9	90.1	4.8	2.3

- Notes 1) This table compares the mineral composition of the samples determined by chemical analysis with the composition determined by point count analysis.
- 2) The point count data is based on the relative number of grains observed for each mineral and their estimated densities.

PROJECT: KM599

PRODUCT: Zinc Concentrate - February 12, 1996

SIZE RANGE &gt;75µm

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	0.0
Sphalerite	0.0
Pyrite	0.0
Gangue	0.0

Locking for Chalcopyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Sphalerite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Pyrite

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Gangue

Liberated	Locked in Binary With:					
	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT: KM599

PRODUCT: Zinc Concentrate - February 12, 1996

SIZE RANGE &lt;75µm&gt;C1

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.8
Sphalerite	78.2
Pyrite	9.7
Gangue	10.2

Locking for Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0		0.0	0.0	0.0	0.0	0.0

Locking for Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
1.8	0.0		67.0	1.8	2.8	26.6

Locking for Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
72.2	0.0	8.9		7.2	6.9	4.7

Locking for Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
27.5	0.0	2.5	42.5		5.0	22.5

Locking for Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
26.9	0.0	2.6	50.0	1.3		19.2

PROJECT: KM599

PRODUCT: Zinc Concentrate - February 12, 1996

SIZE RANGE &lt;C1&gt;C4

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	2.5
Sphalerite	83.8
Pyrite	9.9
Gangue	3.8

Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
9.4	0.0	0.0	70.8	0.9	4.7	14.2

Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
77.6	0.0	5.1	0.0	10.2	2.8	4.3

Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
58.3	0.0	8.3	25.0	0.0	4.2	4.2

Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
41.2	0.0	0.0	41.2	0.0	0.0	17.6

PROJECT: KM599

PRODUCT: Zinc Concentrate - February 12, 1996

SIZE RANGE &lt;C4&gt;C5

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	1.4
Sphalerite	88.0
Pyrite	7.1
Gangue	3.6

Locking for Chalcopyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0		0.0	0.0	0.0	0.0	0.0

Locking for Galena

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
26.0	0.0		66.0	1.0	3.0	4.0

Locking for Sphalerite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
87.2	0.0	6.0		4.3	1.3	1.3

Locking for Pyrite

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
73.3	0.0	6.7	13.3		0.0	6.7

Locking for Gangue

Locked in Binary With:						
Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
57.1	0.0	0.0	21.4	14.3		7.1

PROJECT: KM599

PRODUCT: Zinc Concentrate - February 12, 1996

SIZE RANGE &lt;C5&gt;C6

WEIGHT OF MINERALS

Chalcopyrite	0.0
Galena	2.9
Sphalerite	90.1
Pyrite	4.8
Gangue	2.3

## Locking for Chalcopyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
0.0		0.0	0.0	0.0	0.0	0.0

## Locking for Galena

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
73.8	0.0		23.3	0.0	1.9	1.0

## Locking for Sphalerite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
95.8	0.0	2.1		1.3	0.4	0.4

## Locking for Pyrite

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
90.0	0.0	5.0	5.0		0.0	0.0

## Locking for Gangue

## Locked in Binary With:

Liberated	Chalcopyrite	Galena	Sphalerite	Pyrite	Gangue	Ternary
77.8	0.0	0.0	22.2	0.0		0.0