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# TRANSFORMATIONS OF INORGANIC COAL CONSTITUENTS IN COMBUSTION SYSTEMS

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# SECTION 1

# EXECUTIVE SUMMARY

# 1. EXECUTIVE SUMMARY

The technical objectives of this project are:

a. To: 1) define the partitioning of inorganic constituents associated with raw coal particles among products (including vapors, aerosols, and residual char/ash particles) formed under conditions representative of pulverized coal flames as a function of the specific (intrinsic and extrinsic) characteristics of the raw coal and the environment in which the transformations occur; and 2) characterize the resultant spectrum of products in detail.

b. To elucidate and quantify the fundamental processes (involving basic principles of physics, chemistry, thermodynamics) by which transformations of the inorganic constituents occur.

c. To develop, based on the information required in a. and b. above, a tractable "process" model capable of predicting the significant features of the transformation process, most importantly, the nature and distribution of products.

The contract approach and description of each task is included in Section 2 of this report. This report summarizes work accomplished during the twenty-first quarter of this project.

The work discussed herein highlights recent accomplishments at: the University of Kentucky (UK), in the CCSEM and Mössbauer analysis of several ash and coal samples submitted by the University of Arizona and PSI Technology Co,; at the University of Arizona (UA), in the study of the evolution of alkali species during pulverized coal combustion; and at PSI Technology Co. (PSIT), in the continuing analysis of tests of ash formation during low-rank coal combustion conducted jointly with the State Electricity Commission of Victoria (SECV).

In Section 3 of this report, recent UK CCSEM analysis of ash samples collected at the SECV 35 kg/hr combustor by PSIT and SECV is reported. Ash samples collected from extraction probes and the electrostatic precipitator during combustion of Beulah lignite (U.S. coal), Loy Yang 1953 (Australian brown coal), and treated Loy Yang 1953 were examined. Beulah lignite results demonstrated the formation of a sodium aluminosilicate phase similar to nepheline in composition. A similar result was observed in prior testing of this coal at PSIT and UA. Calcium aluminosilicate formation was also observed. Sodium sulfate and calcium sulfate phases were detected in the precipitator ashes from the Beulah. In contrast, the low-ash, low-mineral content Loy Yang produced calcium, magnesium, and aluminum rich phases during combustion. Sodium aluminosilicate formation was also observed for this coal, although the composition of the phase did not correspond to nepheline. Addition of soluble aluminum to the coal resulted in a decrease in the concentration of sodium aluminosilicate in the ash.

In Section 3, recent UK analysis of ash samples collected in the UA self-sustained down-fired coal combustor is also presented. Loy Yang samples fired with kaolinite demonstrate the formation of sodium aluminosilicate phases, indicative of sodium reaction with the extraneous additive.

Mössbauer analysis of UA Kentucky #11 ash samples, also reported in Section 3, was used to assess the interaction of iron with aluminosilicate minerals under various combustion conditions. Combustion under sub-stoichiometric conditions appears to favor the interaction of iron with aluminosilicate minerals.

In Section 4, the evolution of potassium during pulverized coal combustion is discussed by the University of Arizona. Because potassium is primarily present in aluminosilicate form (e.g., illite) in bituminous coals, little vaporization was expected. Previous experimental results indicated, however, that some potassium did vaporize during combustion. By conducting several experiments with bituminous and low-rank coals, and adding dopants to some of these coals, it was concluded that potassium vaporization is significantly enhanced by the presence of volatile sodium. For example, extraneous sodium acetate added to Kentucky #11 bituminous coal increased the fraction of potassium vaporized compared to the baseline case. Sodium chloride vapor also contributed to increased potassium release. Enhancement of potassium vaporization was not observed in the presence of chloride alone in the UA study.

In Section 5, recent analysis of test data obtained by PSIT in conjunction with SECV is presented. The discussion focuses on Beulah lignite coal samples and combustion-generated Beulah lignite ash samples collected from the combustion chamber, convective passages (i.e., horizontal duct and deposition tube banks of the SECV facility), and electrostatic precipitator. Results indicate that sodium aluminosilicate particles and calcium rich particle surfaces are formed, as observed in prior laboratory testing at PSIT and SECV. This is consistent with the conclusion drawn previously with this coal - chemical composition of the ash particles is independent of firing rate (i.e., combustor scale) provided that comparable flame temperatures are maintained. Sulfur capture by calcium containing ash particles at long residence times was suggested by the data. Both mineral and ash particle size distributions were smaller, however, in SECV testing of this coal. Comparable coal particle size distributions in the three test series (PSIT, UA, SECV) suggests another cause for the observed difference in mineral size. It is speculated that mineral degradation (pyrite degradation in particular) is responsible, pending further analysis of the samples.

# SECTION 2

# INTRODUCTION AND OVERVIEW OF PROGRAM TASKS

## 2. INTRODUCTION AND OVERVIEW OF PROGRAM TASKS

This project consists of an integrated series of experimental and modeling tasks performed by PSI Technology Company (PSIT) and three subcontractors (identified below) to achieve the project objectives. Additional work is to be conducted jointly with the University of North Dakota Energy and Environmental Research Center (UND EERC) and the State Electricity Commission of Victoria, Australia (SECV) through cooperative agreements. Important elements of this work include coal and ash characterization using advanced analytical techniques, testing in small scale furnaces, testing in moderate to large-pilot scale units, adaptation of fundamental submodels developed previously to beneficiated coal systems, and integration of these submodels and experimental findings into an engineering model used to predict ash particle composition and size distributions. A breakdown of the work to be performed in each task is presented below.

### Task 1 - Program Planning, Management, Reporting, and Peer Review

This task, to be performed by PSIT, consists of: (1) preparation and annual updating of a Program Plan; (2) overall coordination, management, and integration of the subcontracts and project results; (3) preparation of project monthly reports; (4) integration and final preparation of project quarterly reports; and (5) conduct of semi-annual peer review and project coordination meetings of the project Principal Investigators.

### Task 2 - Coal Selection, Preparation, and Characterization

This task will be performed by PSIT using the guidelines for mineralogy-based coal selection developed by Foster Wheeler Development Corporation (FWDC) during the first phase of this project. Five parent coals plus one beneficiated sample of each coal with an optional two sets of additional coals will be selected to permit an experimental determination of beneficiation related variables on inorganic transformations during combustion. Emphasis will be placed on obtaining both eastern and western coals, cleaned with currently accepted and advanced beneficiation strategies. Coals will be acquired by PSIT, pulverized as necessary by an independent contractor on a purchase order basis, and shipped to the various investigators.

### Task 3 - Advanced Techniques for Coal and Mineral Characterization

The University of Kentucky (UK) will apply advanced analytical techniques to determine the form, size, and associations of the coal minerals and the resulting ash particles. Work to be performed in this broad area can be broken down into three Subtasks. Under Subtask 3.1, UK will work with other research groups to make improvements in the computer controlled scanning electron microscopy (CCSEM) technique. This will include software improvements to permit the CCSEM to distinguish between extraneous and included mineral matter in an automated fashion. Under Subtask 3.2, UK will apply CCSEM, Mössbauer spectroscopy, x-ray absorption fine structure analysis (XAFS), and scanning transmission electron microscopy (STEM) to analyze the mineral forms in the parent coals and the resulting ash products. X-ray diffraction will also be used as needed for mineral analysis. Under Subtask 3.3, UK will develop an in-situ XAFS capability at the Brookhaven National Laboratories (BNL) Light Source, to be used to determine the associations of inorganic species in ash particles and initial sticky particle layers without the complications posed by quenching and extractive sampling.

### Task 4 - Fundamental Studies of Selected Ash Vaporization, Nucleation, Condensation, and Coagulation Phenomena

Task 4, to be performed by PSIT, involves thermochemical modeling of the inorganic species expected to be present in the parent coal particles, the beneficiated coal particles, and the final ash particles at various combustion conditions.

### Task 5 - Fundamental Studies of Mineral Matter Vaporization and Residual Ash Formation

Experimental and modeling studies are to be conducted at the Massachusetts Institute of Technology (MIT) on two Subtasks. Under Subtask 5.1, drop tube furnace combustion experiments will be conducted with parent coals, beneficiated coals, and model chars to assess the importance of the various mechanisms which control residual ash formation. Emphasis will be placed on the expected increasing importance of char fragmentation in shaping the distribution, both experimentally and through adaptation of the percolative fragmentation model developed in the first phase of this project. In Subtask 5.2, the extent of vaporization of inorganic species contained in the parent and beneficiated coals will be examined experimentally. Vaporization models developed previously will be utilized to interpret results from beneficiated systems.

### Task 6 - Pulverized Coal Combustion Studies of Ash Enrichment by Volatiles

The objectives of this task, to be performed at the University of Arizona (UA) self-sustained reactor facility, are to determine the different fume amounts, compositions, and structures resulting from various beneficiation processes. Mechanistic descriptions of the size and surface composition of the submicron fume formed during combustion will be developed. Testing will occur on selected parent and cleaned coals, chosen subsequent to initial screening in the PSIT reactor facility. As part of this effort, the size of the residual ash particles will be measured in-situ using an optical single particle measuring instrument provided by PSIT. A model capable of describing the general ash particle size distribution including the effects of fume formation and char fragmentation will also be developed.

### Task 7 - Idealized Combustion Determination of Ash Particle Formation and Surface Stickiness

In this task, PSIT will employ an idealized combustion system to determine ash particle size and composition distributions for comparison with results obtained at MIT and UA. Emphasis will be placed on quantifying the amount of fume, and the amount and chemical composition of ash generated from the various beneficiated coals. Particle stickiness as it pertains to inertial impaction and thermophoretic deposition will be addressed. Particle size will be analyzed by several means as part of the task, including CCSEM, laser diffraction, and aerodynamic impaction. In addition, the combustor portion of an in-situ XAFS cell will be designed and constructed. Experiments utilizing this cell will be conducted with UK and BNL at the BNL Light Source to determine ash composition and sticky particle composition in-situ.

## Task 8 - Model Development and Integration

In this task, PSIT will synthesize the mineral redistribution, char particle fragmentation, and mineral transformation models developed under the various tasks into an overall ash formation model. The result of this synthesis will be an engineering model capable of describing the size and, more importantly, the chemical composition of residual ash generated during pulverized coal combustion and the quantity and composition of the ash fume. The information provided by this model will then be used to assess the benefits of coal cleaning though a parametric study of ash properties resulting from selective mineral removal.

# SECTION 3

# ADVANCED TECHNIQUES FOR COAL, MINERAL, AND ASH CHARACTERIZATION

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# 3. ADVANCED TECHNIQUES FOR COAL, MINERAL, AND ASH CHARACTERIZATION

## 3.1 Introduction

This quarter, CCSEM characterization has continued of various ash samples collected at the large scale combustor at the Research Facility of the State Electricity Commission of Victoria (SECV), Australia, and at the University of Arizona (UA) combustor. A description of the data for twenty-seven ash samples and two coal samples collected at both combustors and a preliminary discussion of the results on the samples collected at SECV are included in this report. Mössbauer data are also included for a set of Kentucky #11 ash samples prepared under different conditions at the UA combustor.

## 3.2 CCSEM Characterization of Ash Samples

During the latest quarter, numerous CCSEM analyses of different ash samples have been carried out. Two sets of Loy Yang ashes (three tests, two samples per test, total of six samples) and a set of Beulah lignite ashes (three samples) were collected at the 35 kg/hr pilot-scale combustion test facility of the SECV. Samples collected at the air cooled ash probe were reported in an earlier Quarterly Report but for reasons explained below we are reporting these sets of data again. The other set of SECV ash samples analyzed were collected at the electrostatic precipitator plates at the outlet of the testing system. Two bottom ashes of coals with additives, that were combusted at about 1350°C in the self-sustained laboratory-scale pulverized coal combustor at the University of Arizona, have also been analyzed. These were Loy Yang 2301 coal doped with extraneous (non-coal) kaolinite (aluminosilicate) and Kentucky #11 coal doped with sodium acetate trihydrate. Also, several other size segregated ash samples collected from the UA's combustor were analyzed; these will be briefly mentioned here and complete discussions on them will be reported at a later date. Mineralogical analyses of Loy Yang coal and Beulah coal have also been carried out, the latter in triplicate. For the above ash samples, CCSEM results are presented in tabular form in Tables 3-1 through 3-27. The CCSEM analyses of the two coals are presented in Tables 3-28 and 3-29.

CCSEM on the low-rank coals (specific samples used in the tests at SECV) has finally proved possible because the moisture content of the coals was eliminated before preparation in epoxy. The coals were held at 135°C in a vacuum oven for a period of 12 hr. The dried coals were then immediately made into CCSEM samples by mixing with epoxy and polishing in the usual fashion. CCSEM data for the Loy Yang coal, when calculated to an elemental analysis and compared to the ash analysis, suggest that much of the sodium, magnesium, aluminum, sulfur, chlorine, and some calcium are dispersed throughout the coal and do not form discrete minerals. Only iron and silicon appear to exist mainly as discrete minerals, iron oxide/oxyhydroxide, minor pyrite, and quartz, respectively. In particular, clay minerals are very low in comparison to most U.S. coals. The analyses of the Beulah coal are reported in triplicate; the differences between these analyses are more or less within the experimental uncertainty of the CCSEM technique. These analyses are similar to that reported in the Final

Report, except that the coal shows the significant presence of calcium and iron sulfates and iron oxide/hydroxide minerals, indicating that appreciable oxidation of the pyrite has occurred in the SECV Beulah. This oxidation almost certainly also caused the formation of the calcium sulfates by reaction of the sulfuric acid produced from pyrite oxidation and the carboxyl-bound calcium. Note that the miscellaneous sulfate category is very abundant, indicating perhaps that the pyrite oxidation and calcium sulfate formation occur (only?) in close proximity. Similar observations have been made previously [1].

CCSEM results on the SECV ash samples collected at the ash probe were reported in Quarterly Report No. 19. More recent examination of these data included a correction factor for sodium overestimation due to the presence of appreciable zinc, significantly revising the results. In addition, in the process of modifying the analysis technique, a minor programming error was also corrected in the analysis program. The new data shown in this report (Tables 3-1 through 3-5) therefore supersedes the summaries reported in the Quarterly report #19. The error was only present in the results in Quarterly Report 19 and is absent in other previous reports. Also, only the results summarized in the tables were found to be incorrect; the figures and plots are correct as they are prepared by means of a separate program.

All of the SECV ashes of Loy Yang 1953 coal (untreated and treated) show a substantial presence of zinc. Since the L x-ray emission line of zinc and K x-ray emission line of sodium are only 0.038 eV apart from each other, which is less than the resolved widths of the X-ray emission lines in the SEM, both zinc L and sodium K x-rays contribute to the region of interest defined as sodium. Hence, sodium in samples that also contain zinc will be overestimated. Analyses on a zinc standard, zinc sulfate, were carried out and a suitable correction factor was computed to estimate the zinc L line contribution to the sodium region of interest. This correction factor has now been incorporated in the analysis.

Figures 3-1 and 3-2 show the Mg+Al-Si-Ca ternary plots for the ash collected at electrostatic precipitator plates of the untreated Loy Yang coal. Similar results were reported earlier for the ash probe samples of the untreated Loy Yang samples. The ternary plot of the Mg+Al-Si-Ca for test 4 ash probe is presented in Figure 3-3. No cluster of particle compositions near nepheline in a Na-Al-Si plot (not shown) was found in these ash samples, again, presumably as a result of the absence of aluminosilicates in the coal.

Figures 3-4, 3-5 and 3-6 show the Zn-Al-(Ca+Mg+S+Fe+Si) ternary plot of tests 1, 3, and 4. Treated coal was burnt in test 3. From the trend, it appears that zinc from the treated coal remained in the test system contaminating the ash of the untreated coal burnt in test 4. Total zinc levels reported for the untreated sample were, however, 5 to 6 times smaller. Similar trends were also observed in the ash probe samples.

The CCSEM data for the precipitator ash sample from the burn on Beulah lignite in the SECV pilot-scale test combustor indicates the formation of nepheline (Figure 3-7) and also shows an interaction between volatile sodium and quartz. Figure 3-8 shows the Ca-Si-Al ternary for the same sample. There seem to be little interaction between Fe and aluminosilicates as shown in the ternary plot of Fe-Si-Al in Figure 3-9, but rather extensive interaction of calcium with aluminosilicates. Similar observations have been noticed previously in smaller scale tests.

As observed in the ash probe samples discussed in the previous quarterly, carboxyl-bound calcium from the coal forms a Ca-S phase ($CaSO_4$), and frequently such phases are associated with an iron-rich phase in the precipitator ash sample. This is presented in 3-D plot in Figure 3-10. The corresponding 3-D plot for the ash probe samples are presented in Figures 3-11 and 3-12 for comparison. While there appears to be little compound formation between the $CaSO_4$ and iron-rich oxide particles derived from pyrite, substantial mixing is observed for Ca-Na-S phase, as illustrated by the ternary diagram of Figure 3-13. There appears to be almost a complete range of solid solution between $Na_2SO_4$ and $CaSO_4$. At approximately 50% $Na_2SO_4$ - 50% $CaSO_4$, the melting point of this binary system drops to 900°C [2].

Several ash samples from the University of Arizona (UA) combustor have also been analyzed. The bottom ash of Loy Yang coal with a kaolinite additive shows a lot of interaction between sodium and the added aluminosilicate. This is shown in the ternary plot of Na-Si-Al in Figure 3-14. It clearly indicates the formation of a nepheline phase, which is probably due to the condensation and reaction of sodium vapors on the added kaolinite. Although sodium exhibits significant interaction with the aluminosilicate additive, such interaction is not found for calcium. Both calcium and magnesium show a preference to interact with sulfur (Figure 3-15). More complex sulfates, involving both alkali elements (Na) and alkaline earth elements (Mg, Ca), may be formed, as suggested by the Na-Mg-S ternary plot (Figure 3-16).

The CCSEM analyses of the bottom ash of Ky #11 coal doped with sodium acetate trihydrate are summarized in Table 3-11 and in Figures 3-17 through 3-19. As observed for the undoped KY#11 ash reported earlier, there is little interaction between calcium and aluminosilicates, as shown in Figure 3-17, because calcium exists in this coal principally in discrete form as calcite. The Na-Si-Al and K-Si-Al diagrams (Figures 3-18 and 3-19) are fairly similar, indicating that Na is incorporated into the slag derived from illite with essentially the same structure as the K which is already present, rather than forming a distinct nepheline phase. Substantial uncombined sodium is found in the ash, which may be either a carbonate or possibly an oxide.

In addition to these UA samples, analysis on several other ashes were carried out. These were the ashes obtained by combusting different coals at different feed rates and temperatures in a down-fired combustor. Samples were collected on the cascade impactors and several stages of these impactors were combined during sampling in an effort to increase the mass in the smaller size ranges. The data for these samples are included in Tables 3-12 through 3-27.

## 3.3 Mössbauer Data for Kentucky #11 Ash Samples

Mössbauer spectra were obtained on four samples from the University of Arizona combustion experiments to investigate the conversion of pyrite to iron oxides and the concomitant incorporation of iron into aluminosilicate glass as a function of temperature and the oxygen conditions of the burn. These samples are the "cup + Im1" samples that represent all of the material reaching the impactor, without regard to size. Generally, the material on individual impactor filters, except for the first and coarsest filter (Im1), is insufficient to be useful for a Mössbauer experiment, especially if it is also to be used for XAFS and CCSEM investigations.

The four samples are as follows:

| U.K.I.D. | U. Az. I.D. | Sample Description |
|---|---|---|
| 650 | 56-6-CUP-A' | Ky #11 coal, Port 11 material, 1.4 Kg/hr, 1240°C |
| 653 | 56-6-CUP-D' | Ky #11 coal, Port 11 material, 2.4 Kg/hr, 1430°C |
| 656 | 75-6-CUP-A' | Ky #11 coal, Port 11 material, 1.8 Kg/hr, 1120°C (sub)[1] |
| 659 | 58-C-CUP-C' | Ky #11 coal, Port 11 material, 1.8 Kg/hr, 1440°C (sup)[2] |

[1] sub - substoichiometric; [2] sup - superstoichiometric.

The Mössbauer spectra of all samples appear to be a mixture of magnetic iron oxides (hematite and magnetite) and iron in non-magnetic phases, principally aluminosilicate glass. Both $Fe^{2+}$ and $Fe^{3+}$ appear to be present in the non-magnetic phases, but there is significant variation among the four samples in the iron absorptions that make up this component. The results of the computer fitting of the spectra are shown in Table 3-30 and Figures 3-20 and 3-21. The Mössbauer parameters listed in Table 3-30 for iron in aluminosilicate glass for the two highest-temperature runs are quite consistent with values expected for both $Fe^{3+}$ and $Fe^{2+}$ absorptions in glass. However, for the two lowest-temperature runs, the Mössbauer parameters for these absorptions are less consistent with iron in glass. For the substoichiometric run (57-6-CUP-A'), the parameters for one non-magnetic absorption are consistent with $Fe^{2+}$ in glass, whereas the parameters for the other non-magnetic absorption appear to be very similar to those for pyrite ($FeS_2$: IS = 0.31, and QS = 0.62). Hence, in this sample, some residual pyrite may have survived the journey through the furnace without alteration. It should be noted that the Mössbauer spectrum of this sample also indicates the presence of a minor amount of iron sulfide (pyrrhotite, $Fe_{1-x}S$). Due to the low oxygen fugacity of the substoichiometric run, predominantly ferrous glass is formed. For the next lowest-temperature run (56-6-CUP-A'), the Mössbauer parameters for one absorption are consistent with $Fe^{3+}$ in aluminosilicate glass and/or with superparamagnetic ferric oxides, whereas the other non-magnetic doublet may arise from superparamagnetic magnetite. Spectra at cryogenic temperatures would help to resolve some of these ambiguities and will be carried out in the near future. These observations appear to imply that at relatively low temperatures, in the one case, ferric oxide is not easily incorporated into the aluminosilicate glass, while, in the other case (the substoichiometric run, 57-6-A'), ferrous iron is readily incorporated into glass, despite the significantly lower temperature of the run.

With the differences in temperature and oxygen conditions, there is consistent variation in the hematite/magnetite ratio for the four samples. Generally, lower temperatures will favor the formation of hematite relative to magnetite; however, in these four samples, the substoichiometric run of lowest temperature has the lowest ratio of hematite relative to magnetite. This occurs, presumably, due to the consumption of all free oxygen in this run, that inhibits hematite formation. The next lowest-temperature run is the one with the highest ratio of hematite to magnetite. For the two highest-temperature runs, the superstoichiometric run has a significantly higher hematite/magnetite ratio, despite the similarity of the temperature of these runs. This observation can be attributed to the excess oxygen in the superstoichiometric run.

## 3.4 References

1. Huggins, F.E., Huffman, G.P., and Lin, M.C., Internat. J. Coal Geol., 3, (1983), 157-182.

2. Levin, E. M., McMurdie, H. F. and Hall, H. P., Phase Diagrams for Ceramists, American Ceramic Society, Columbus, Ohio (1964).

Table 3-1. Sample #593 PSI/SECV Loy Yang Test 1 Untreated Ash Probe (ring 7) on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | Si - - | 3. | 0. | 1. | 92. | 0. | 0. | 0. | 0. | 1. | 0. | 2. | 0. | 1. | 0. | 0. | 2.0 |
| 21 | Fe - - | 0. | 2. | 2. | 0. | 0. | 0. | 0. | 0. | 3. | 1. | 88. | 0. | 3. | 0. | 0. | 2.2 |
| 9 | Al - - | 0. | 1. | 82. | 0. | 0. | 3. | 0. | 0. | 3. | 4. | 2. | 1. | 3. | 0. | 0. | 0.4 |
| 5 | Ca - - | 0. | 2. | 0. | 3. | 0. | 1. | 1. | 0. | 89. | 0. | 0. | 4. | 0. | 0. | 0. | 0.3 |
| 9 | Si Na - | 17. | 0. | 0. | 80. | 0. | 0. | 0. | 0. | 1. | 0. | 1. | 0. | 2. | 0. | 0. | 0.5 |
| 1 | Si Ca - | 0. | 0. | 0. | 89. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Si - | 0. | 0. | 0. | 25. | 0. | 0. | 4. | 5. | 63. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Al - | 0. | 0. | 27. | 70. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Mg - | 0. | 13. | 0. | 0. | 0. | 2. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Na - | 21. | 0. | 4. | 0. | 0. | 0. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 35 | Si Na Al | 21. | 2. | 13. | 53. | 0. | 1. | 0. | 0. | 3. | 1. | 5. | 0. | 2. | 0. | 0. | 1.7 |
| 16 | Si Al Na | 15. | 3. | 25. | 47. | 0. | 0. | 0. | 0. | 3. | 1. | 5. | 0. | 2. | 0. | 0. | 1.4 |
| 5 | Al Si Na | 17. | 6. | 37. | 24. | 0. | 1. | 0. | 0. | 5. | 3. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 9 | Si Al Fe | 1. | 0. | 17. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0.5 |
| 3 | Si Fe Al | 1. | 0. | 10. | 73. | 0. | 0. | 0. | 0. | 0. | 1. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al Si Fe | 3. | 6. | 51. | 19. | 0. | 0. | 0. | 0. | 7. | 2. | 10. | 0. | 3. | 0. | 0. | 0.1 |
| 19 | Al Mg S | 1. | 21. | 52. | 1. | 0. | 11. | 1. | 1. | 5. | 0. | 4. | 0. | 2. | 0. | 0. | 1.2 |
| 1 | Al S Mg | 0. | 16. | 43. | 0. | 0. | 17. | 0. | 8. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Mg Al S | 0. | 34. | 26. | 2. | 0. | 19. | 5. | 0. | 11. | 1. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl Na Si | 34. | 0. | 3. | 6. | 0. | 0. | 52. | 0. | 2. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Cl Al | 0. | 0. | 14. | 37. | 0. | 10. | 21. | 0. | 7. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 187 | Al Mg Ca | 0. | 27. | 43. | 3. | 0. | 3. | 0. | 0. | 14. | 1. | 6. | 0. | 2. | 0. | 0. | 17.5 |
| 3 | Ca Mg Al | 0. | 28. | 18. | 2. | 0. | 4. | 0. | 0. | 32. | 0. | 14. | 0. | 1. | 0. | 0. | 0.1 |
| 29 | Al Ca Mg | 0. | 16. | 45. | 4. | 0. | 1. | 0. | 1. | 20. | 1. | 7. | 0. | 2. | 0. | 0. | 2.8 |
| 72 | Mg Ca Al | 0. | 52. | 15. | 3. | 0. | 1. | 0. | 0. | 21. | 0. | 7. | 0. | 1. | 0. | 0. | 8.0 |
| 162 | Mg Al Ca | 0. | 42. | 27. | 4. | 0. | 3. | 0. | 0. | 15. | 1. | 6. | 0. | 2. | 0. | 0. | 15.3 |
| 4 | Si Na Fe | 17. | 3. | 5. | 55. | 0. | 1. | 0. | 0. | 5. | 4. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe Na | 9. | 0. | 0. | 65. | 0. | 0. | 0. | 0. | 0. | 0. | 26. | 0. | 0. | 0. | 0. | 0.0 |
| 14 | Si Mg Ca | 1. | 24. | 13. | 35. | 0. | 0. | 0. | 0. | 16. | 2. | 8. | 0. | 2. | 0. | 0. | 0.7 |
| 15 | Mg Si Ca | 0. | 45. | 9. | 24. | 0. | 0. | 0. | 0. | 16. | 1. | 5. | 0. | 0. | 0. | 0. | 0.8 |
| 12 | Mg Ca Si | 1. | 43. | 10. | 16. | 0. | 1. | 0. | 0. | 23. | 0. | 6. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | K Cl Na | 9. | 0. | 0. | 0. | 0. | 3. | 38. | 46. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 18 | Si Al Mg | 1. | 17. | 21. | 37. | 0. | 2. | 0. | 0. | 10. | 1. | 8. | 0. | 2. | 0. | 0. | 1.8 |
| 15 | Al Si Mg | 0. | 16. | 33. | 26. | 0. | 0. | 0. | 1. | 13. | 0. | 8. | 0. | 2. | 0. | 0. | 1.4 |
| 20 | Si Mg Al | 1. | 23. | 18. | 34. | 0. | 0. | 0. | 0. | 10. | 1. | 9. | 0. | 4. | 0. | 0. | 2.3 |
| 9 | Mg Al Si | 1. | 38. | 25. | 16. | 0. | 3. | 0. | 0. | 11. | 1. | 5. | 0. | 0. | 0. | 0. | 0.5 |
| 14 | Mg Si Al | 1. | 33. | 18. | 22. | 0. | 2. | 0. | 0. | 12. | 0. | 11. | 1. | 1. | 0. | 0. | 0.6 |
| 28 | Al Mg Si | 0. | 25. | 37. | 16. | 0. | 1. | 0. | 0. | 10. | 2. | 7. | 0. | 2. | 0. | 0. | 2.6 |
| 1 | Fe Na S | 17. | 0. | 0. | 0. | 0. | 8. | 6. | 0. | 0. | 0. | 69. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Na K | 13. | 0. | 10. | 66. | 0. | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Mg Fe | 0. | 19. | 16. | 29. | 0. | 0. | 0. | 0. | 15. | 0. | 18. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Si Fe Mg | 4. | 18. | 14. | 36. | 0. | 0. | 0. | 0. | 7. | 0. | 21. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg Si Fe | 0. | 32. | 16. | 22. | 0. | 0. | 0. | 0. | 13. | 0. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Cl Al S | 0. | 0. | 27. | 0. | 0. | 20. | 41. | 4. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl S Al | 0. | 0. | 18. | 0. | 0. | 28. | 54. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 30 | Mg Ca Fe | 0. | 50. | 7. | 5. | 0. | 1. | 0. | 0. | 24. | 0. | 13. | 0. | 0. | 0. | 0. | 2.5 |
| 4 | Ca Mg Fe | 0. | 32. | 11. | 3. | 0. | 2. | 0. | 0. | 37. | 0. | 16. | 0. | 0. | 0. | 0. | 0.4 |
| 5 | Mg Fe Ca | 0. | 44. | 4. | 0. | 0. | 1. | 0. | 0. | 17. | 1. | 33. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca Fe Mg | 0. | 16. | 7. | 2. | 0. | 3. | 2. | 0. | 36. | 0. | 31. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Fe Mg Ca | 0. | 28. | 3. | 4. | 0. | 0. | 0. | 0. | 19. | 0. | 46. | 0. | 0. | 0. | 0. | 0.0 |
| 13 | Si Al Ca | 0. | 4. | 29. | 41. | 0. | 1. | 0. | 2. | 17. | 1. | 3. | 0. | 1. | 0. | 0. | 1.4 |

# Table 3-1. Sample #593 PSI/SECV Loy Yang Test 1 Untreated Ash Probe (ring 7) on Filter (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Si | Ca | Al | 0. | 0. | 22. | 39. | 0. | 0. | 0. | 0. | 30. | 2. | 6. | 0. | 1. | 0. | 0. | 0.0 |
| 2 | Ca | Si | Al | 0. | 0. | 14. | 27. | 0. | 0. | 0. | 1. | 51. | 1. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Al | Si | 0. | 8. | 16. | 12. | 0. | 0. | 0. | 2. | 55. | 2. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Al | Si | Ca | 0. | 7. | 53. | 20. | 0. | 0. | 0. | 1. | 16. | 0. | 1. | 0. | 1. | 0. | 0. | 0.6 |
| 2 | Si | S | Ca | 0. | 0. | 0. | 69. | 0. | 15. | 6. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | S | Si | 0. | 0. | 10. | 18. | 0. | 23. | 15. | 0. | 23. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | Al | Fe | Mg | 0. | 18. | 35. | 5. | 0. | 3. | 1. | 0. | 8. | 0. | 24. | 0. | 7. | 0. | 0. | 0.9 |
| 47 | Al | Mg | Fe | 0. | 22. | 43. | 3. | 1. | 4. | 1. | 0. | 8. | 1. | 13. | 0. | 3. | 0. | 0. | 5.5 |
| 10 | Fe | Al | Mg | 0. | 17. | 25. | 2. | 0. | 5. | 0. | 1. | 9. | 0. | 37. | 0. | 2. | 0. | 0. | 0.6 |
| 30 | Mg | Al | Fe | 1. | 41. | 29. | 2. | 0. | 3. | 0. | 0. | 9. | 1. | 12. | 0. | 3. | 0. | 0. | 3.8 |
| 1 | Na | Ca | S | 45. | 0. | 11. | 0. | 0. | 14. | 0. | 11. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Na | Ca | 29. | 0. | 0. | 3. | 0. | 43. | 0. | 0. | 26. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Fe | Si | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 49. | 0. | 44. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe | Ca | Si | 0. | 3. | 0. | 15. | 0. | 0. | 0. | 0. | 23. | 5. | 53. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Si | Fe | 0. | 8. | 10. | 26. | 0. | 0. | 0. | 0. | 36. | 0. | 13. | 0. | 7. | 0. | 0. | 0.1 |
| 4 | Si | Ca | Fe | 2. | 12. | 7. | 46. | 0. | 0. | 0. | 0. | 18. | 1. | 13. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si | S | Cl | 0. | 0. | 11. | 42. | 0. | 20. | 16. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Mg | S | 0. | 20. | 9. | 26. | 0. | 17. | 0. | 9. | 7. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | S | Mg | 0. | 20. | 16. | 0. | 0. | 23. | 24. | 0. | 0. | 0. | 9. | 0. | 8. | 0. | 0. | 0.1 |
| 1 | Si | Fe | Ti | 0. | 5. | 3. | 50. | 0. | 0. | 0. | 0. | 10. | 13. | 19. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl | Na | S | 27. | 2. | 7. | 3. | 0. | 9. | 48. | 1. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Fe | Ca | 0. | 0. | 11. | 0. | 0. | 29. | 10. | 0. | 20. | 0. | 23. | 0. | 7. | 0. | 0. | 0.1 |
| 1 | S | Cl | Zn | 0. | 0. | 14. | 12. | 0. | 26. | 19. | 0. | 0. | 0. | 14. | 0. | 14. | 0. | 0. | 0.1 |
| 1 | Cl | K | Ca | 0. | 0. | 0. | 14. | 0. | 7. | 38. | 25. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | S | Ca | 0. | 0. | 0. | 0. | 0. | 22. | 43. | 11. | 13. | 10. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Al | Ca | Fe | 0. | 0. | 62. | 1. | 0. | 1. | 1. | 0. | 18. | 1. | 10. | 0. | 5. | 0. | 0. | 0.7 |
| 6 | Al | Fe | Ca | 0. | 5. | 60. | 2. | 0. | 2. | 0. | 0. | 15. | 0. | 16. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Ca | Fe | Al | 0. | 4. | 8. | 0. | 0. | 0. | 0. | 0. | 59. | 0. | 29. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | P | S | 0. | 0. | 0. | 0. | 10. | 8. | 0. | 6. | 76. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Si | Na | Mg | 18. | 12. | 7. | 52. | 0. | 0. | 0. | 0. | 5. | 1. | 3. | 0. | 1. | 0. | 0. | 0.4 |
| 2 | Si | Mg | Na | 14. | 16. | 5. | 53. | 0. | 0. | 0. | 0. | 7. | 0. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | S | Na | Al | 27. | 9. | 15. | 4. | 0. | 31. | 4. | 0. | 5. | 0. | 2. | 0. | 2. | 0. | 0. | 0.1 |
| 2 | Al | S | Na | 15. | 10. | 47. | 0. | 0. | 17. | 0. | 0. | 9. | 0. | 1. | 1. | 1. | 0. | 0. | 0.1 |
| 23 | Al | Mg | Zn | 0. | 27. | 41. | 2. | 0. | 4. | 1. | 0. | 5. | 1. | 6. | 0. | 12. | 0. | 0. | 2.0 |
| 6 | Al | Zn | Mg | 0. | 14. | 45. | 2. | 0. | 2. | 0. | 3. | 9. | 1. | 7. | 0. | 17. | 0. | 0. | 0.5 |
| 3 | Al | Si | Zn | 3. | 4. | 45. | 25. | 0. | 1. | 0. | 0. | 8. | 0. | 0. | 0. | 14. | 0. | 0. | 0.3 |
| 1 | Mg | S | Ca | 3. | 52. | 3. | 4. | 0. | 18. | 3. | 0. | 13. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Cl | K | 0. | 0. | 0. | 0. | 0. | 38. | 36. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl | S | K | 0. | 0. | 0. | 0. | 0. | 33. | 34. | 19. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S | Ca | Al | 0. | 5. | 15. | 4. | 0. | 36. | 0. | 0. | 29. | 0. | 6. | 0. | 6. | 0. | 0. | 0.2 |
| 4 | Al | Ca | S | 0. | 0. | 65. | 1. | 0. | 10. | 4. | 1. | 16. | 0. | 2. | 0. | 1. | 0. | 0. | 0.4 |
| 3 | Al | S | Ca | 0. | 0. | 66. | 3. | 0. | 14. | 3. | 0. | 11. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al | Fe | Zn | 1. | 8. | 48. | 2. | 0. | 1. | 0. | 0. | 0. | 7. | 17. | 0. | 15. | 0. | 0. | 0.2 |
| 1 | Al | Zn | Na | 12. | 0. | 41. | 4. | 0. | 4. | 6. | 4. | 4. | 0. | 9. | 0. | 15. | 0. | 0. | 0.0 |
| 5 | Si | Na | Zn | 19. | 5. | 0. | 53. | 0. | 0. | 2. | 1. | 4. | 1. | 5. | 0. | 9. | 0. | 0. | 0.4 |
| 1 | Al | Si | S | 0. | 0. | 41. | 21. | 0. | 12. | 0. | 0. | 7. | 4. | 10. | 0. | 4. | 0. | 0. | 0.0 |
| 1 | Ca | Zn | Al | 0. | 18. | 18. | 8. | 0. | 4. | 0. | 0. | 25. | 0. | 7. | 0. | 19. | 0. | 0. | 0.0 |
| 1 | Mg | Al | Cl | 0. | 31. | 23. | 0. | 0. | 14. | 14. | 0. | 10. | 0. | 0. | 0. | 8. | 0. | 0. | 0.0 |
| 113 | OTHERS - | | | 3. | 13. | 31. | 8. | 0. | 6. | 2. | 0. | 11. | 3. | 17. | 1. | 6. | 0. | 0. | 8.6 |
| 1199 | TOTALS - | | | 1. | 26. | 29. | 12. | 0. | 3. | 1. | 0. | 13. | 1. | 10. | 0. | 3. | 0. | 0. | 100.0 |

## Table 3-1. Sample #593 PSI/SECV Loy Yang Test 1 Untreated Ash Probe (ring 7) on Filter (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Al Mg Ca | 17.5 | 27. | 40. | 20. | 12. | 1. | 0. | 0. |
| Mg Ca Al | 8.0 | 15. | 62. | 20. | 2. | 0. | 0. | 0. |
| Mg Al Ca | 15.3 | 29. | 47. | 20. | 4. | 0. | 0. | 0. |
| Al Mg Fe | 5.5 | 25. | 59. | 12. | 4. | 0. | 0. | 0. |
| OTHERS - | 8.6 | 42. | 23. | 22. | 13. | 0. | 0. | 0. |
| OTHERS - | 45.2 | 20. | 32. | 26. | 13. | 7. | 3. | 0. |
| TOTALS - | 100.0 | 24. | 39. | 23. | 10. | 3. | 1. | 0. |

# Table 3-2. Sample #594 PSI/SECV Loy Yang Test 4 Untreated Ash Probe (horizontal duct) on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | Fe - - | 0. | 2. | 2. | 1. | 0. | 0. | 0. | 0. | 1. | 0. | 92. | 0. | 2. | 0. | 0. | 1.7 |
| 103 | Si - - | 3. | 0. | 1. | 95. | 0. | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 7.1 |
| 5 | Al - - | 0. | 0. | 82. | 0. | 0. | 0. | 1. | 5. | 7. | 1. | 4. | 0. | 1. | 0. | 0. | 0.3 |
| 9 | Si Al - | 0. | 0. | 14. | 84. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Fe Si - | 4. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 2. | 0. | 80. | 0. | 0. | 0. | 0. | 0.1 |
| 29 | Si Na - | 22. | 0. | 1. | 71. | 0. | 0. | 0. | 0. | 2. | 0. | 2. | 0. | 1. | 0. | 0. | 2.5 |
| 1 | Ti S - | 0. | 0. | 0. | 0. | 0. | 17. | 0. | 0. | 0. | 83. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ti - | 0. | 0. | 0. | 76. | 0. | 0. | 0. | 4. | 3. | 18. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl Na - | 38. | 0. | 0. | 0. | 0. | 0. | 62. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Mg Ca - | 0. | 71. | 4. | 1. | 0. | 0. | 1. | 0. | 19. | 0. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 14 | Si Al Na | 15. | 2. | 20. | 53. | 0. | 0. | 0. | 0. | 3. | 1. | 5. | 0. | 0. | 0. | 0. | 0.8 |
| 71 | Si Na Al | 23. | 1. | 12. | 56. | 0. | 0. | 0. | 0. | 2. | 1. | 5. | 0. | 0. | 0. | 0. | 5.5 |
| 2 | Al Si Na | 17. | 3. | 48. | 17. | 0. | 0. | 0. | 1. | 5. | 5. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 13 | Si Mg Ca | 1. | 26. | 8. | 38. | 0. | 1. | 0. | 0. | 16. | 0. | 9. | 0. | 0. | 0. | 0. | 1.3 |
| 3 | Si Ca Mg | 0. | 16. | 8. | 38. | 0. | 0. | 0. | 0. | 21. | 3. | 14. | 0. | 0. | 0. | 0. | 0.4 |
| 26 | Mg Ca Si | 0. | 44. | 10. | 16. | 0. | 0. | 0. | 0. | 22. | 0. | 7. | 0. | 0. | 0. | 0. | 1.8 |
| 25 | Mg Si Ca | 0. | 40. | 9. | 26. | 0. | 0. | 0. | 0. | 16. | 0. | 8. | 0. | 0. | 0. | 0. | 1.7 |
| 1 | Ca Mg Si | 0. | 28. | 3. | 20. | 0. | 0. | 0. | 0. | 33. | 6. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 12 | Si Al Fe | 2. | 1. | 19. | 64. | 0. | 0. | 0. | 0. | 3. | 1. | 10. | 0. | 0. | 0. | 0. | 0.6 |
| 10 | Si Fe Al | 3. | 5. | 11. | 54. | 0. | 0. | 0. | 0. | 7. | 3. | 17. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | Fe Si Al | 6. | 6. | 17. | 28. | 0. | 0. | 0. | 0. | 6. | 1. | 36. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Al Si Fe | 0. | 5. | 40. | 20. | 0. | 0. | 2. | 0. | 12. | 4. | 15. | 0. | 2. | 0. | 0. | 0.2 |
| 6 | Si Na Mg | 21. | 12. | 10. | 40. | 0. | 0. | 0. | 0. | 9. | 1. | 7. | 0. | 0. | 0. | 0. | 0.5 |
| 6 | Si Mg Na | 11. | 19. | 7. | 48. | 0. | 0. | 0. | 0. | 9. | 2. | 4. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si Ca Na | 17. | 11. | 6. | 43. | 0. | 0. | 0. | 0. | 17. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Na Ca | 13. | 0. | 6. | 71. | 0. | 0. | 0. | 0. | 6. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si S Fe | 0. | 0. | 0. | 78. | 0. | 14. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Si Fe Ca | 0. | 5. | 8. | 56. | 0. | 0. | 0. | 1. | 11. | 2. | 17. | 0. | 0. | 0. | 0. | 0.3 |
| 5 | Si Ca Fe | 0. | 9. | 7. | 43. | 0. | 0. | 0. | 0. | 21. | 5. | 16. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Fe Si Ca | 0. | 5. | 6. | 30. | 0. | 0. | 0. | 0. | 12. | 3. | 43. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Cl P | 0. | 0. | 44. | 0. | 18. | 0. | 38. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | Si Na Fe | 24. | 2. | 4. | 55. | 0. | 0. | 1. | 0. | 3. | 1. | 11. | 0. | 1. | 0. | 0. | 0.8 |
| 2 | Si Fe Na | 16. | 0. | 5. | 49. | 0. | 0. | 0. | 0. | 4. | 0. | 26. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Fe S Ca | 0. | 0. | 6. | 9. | 0. | 30. | 0. | 4. | 16. | 3. | 31. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Mg Fe | 0. | 20. | 7. | 34. | 0. | 0. | 0. | 0. | 12. | 6. | 16. | 0. | 4. | 0. | 0. | 0.1 |
| 3 | Mg Si Fe | 0. | 33. | 10. | 29. | 0. | 3. | 0. | 0. | 10. | 0. | 13. | 0. | 2. | 0. | 0. | 0.7 |
| 3 | Si Ca Al | 5. | 0. | 12. | 50. | 0. | 0. | 0. | 0. | 30. | 0. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Si Al Ca | 5. | 6. | 19. | 46. | 0. | 0. | 2. | 0. | 14. | 2. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al Ca Si | 0. | 17. | 35. | 21. | 0. | 0. | 0. | 0. | 22. | 0. | 5. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Ca Al Si | 0. | 9. | 21. | 19. | 0. | 0. | 0. | 0. | 36. | 0. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Ti Na | 15. | 0. | 3. | 48. | 0. | 0. | 0. | 0. | 4. | 24. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Na Ti | 14. | 0. | 1. | 69. | 0. | 0. | 0. | 0. | 3. | 7. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 15 | Si Mg Al | 1. | 23. | 18. | 37. | 0. | 1. | 0. | 0. | 11. | 2. | 7. | 0. | 1. | 0. | 0. | 0.8 |
| 8 | Si Al Mg | 3. | 14. | 22. | 44. | 0. | 0. | 0. | 0. | 9. | 1. | 3. | 0. | 3. | 0. | 0. | 1.0 |
| 25 | Mg Si Al | 0. | 39. | 16. | 24. | 0. | 0. | 0. | 0. | 13. | 1. | 7. | 0. | 0. | 0. | 0. | 2.3 |
| 7 | Al Si Mg | 0. | 20. | 38. | 21. | 0. | 0. | 0. | 0. | 15. | 0. | 5. | 0. | 1. | 0. | 0. | 1.2 |
| 28 | Mg Al Si | 0. | 39. | 22. | 16. | 0. | 1. | 1. | 0. | 12. | 1. | 6. | 1. | 1. | 0. | 0. | 1.9 |
| 1 | Cl Ca Fe | 0. | 0. | 7. | 11. | 0. | 0. | 34. | 0. | 26. | 5. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Cl S | 0. | 0. | 9. | 41. | 0. | 17. | 20. | 6. | 0. | 0. | 0. | 0. | 7. | 0. | 0. | 0.0 |
| 2 | Si Ti Fe | 0. | 0. | 2. | 72. | 0. | 0. | 0. | 0. | 0. | 17. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Ti Si | 0. | 0. | 2. | 14. | 0. | 0. | 0. | 8. | 0. | 14. | 62. | 0. | 0. | 0. | 0. | 0.1 |
| 10 | Mg Fe Ca | 0. | 52. | 6. | 2. | 0. | 2. | 1. | 0. | 17. | 0. | 19. | 0. | 1. | 0. | 0. | 0.6 |
| 5 | Ca Mg Fe | 0. | 32. | 6. | 3. | 0. | 1. | 0. | 0. | 38. | 0. | 20. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Ca Fe Mg | 0. | 22. | 6. | 1. | 0. | 0. | 0. | 0. | 38. | 1. | 32. | 0. | 0. | 0. | 0. | 0.2 |

## Table 3-2. Sample #594 PSI/SECV Loy Yang Test 4 Untreated Ash Probe (horizontal duct) on Filter (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | Mg | Ca | Fe | 0. | 54. | 5. | 3. | 0. | 1. | 0. | 0. | 26. | 0. | 11. | 0. | 0. | 0. | 0. | 2.1 |
| 5 | Fe | Mg | Ca | 0. | 21. | 8. | 7. | 0. | 1. | 0. | 0. | 18. | 0. | 45. | 0. | 0. | 0. | 0. | 1.0 |
| 83 | Al | Mg | Ca | 0. | 27. | 44. | 4. | 0. | 2. | 1. | 1. | 13. | 0. | 6. | 0. | 2. | 0. | 0. | 8.2 |
| 62 | Mg | Ca | Al | 0. | 50. | 14. | 4. | 0. | 1. | 0. | 0. | 22. | 0. | 7. | 0. | 0. | 0. | 0. | 5.5 |
| 140 | Mg | Al | Ca | 0. | 44. | 26. | 4. | 0. | 2. | 1. | 0. | 15. | 0. | 6. | 0. | 1. | 0. | 0. | 11.9 |
| 17 | Al | Ca | Mg | 0. | 18. | 51. | 2. | 0. | 2. | 0. | 0. | 23. | 0. | 5. | 0. | 0. | 0. | 0. | 2.5 |
| 2 | Ca | Al | Mg | 0. | 21. | 23. | 2. | 0. | 0. | 0. | 0. | 38. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe | Ca | Al | 0. | 7. | 17. | 5. | 0. | 4. | 0. | 3. | 19. | 1. | 42. | 0. | 2. | 0. | 0. | 0.1 |
| 1 | Ca | Al | Fe | 0. | 17. | 18. | 6. | 0. | 2. | 0. | 0. | 38. | 0. | 17. | 0. | 2. | 0. | 0. | 0.0 |
| 6 | Al | Ca | Fe | 0. | 8. | 43. | 0. | 0. | 3. | 0. | 1. | 27. | 0. | 17. | 0. | 1. | 0. | 0. | 0.3 |
| 1 | S | Cl | Mg | 0. | 18. | 14. | 9. | 0. | 30. | 21. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | K | Al | 9. | 0. | 9. | 69. | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Mg | S | 0. | 22. | 11. | 8. | 0. | 12. | 0. | 0. | 38. | 0. | 6. | 0. | 1. | 0. | 0. | 0.1 |
| 3 | Mg | Ca | S | 0. | 69. | 1. | 1. | 0. | 7. | 2. | 0. | 16. | 0. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 35 | Al | Zn | Mg | 1. | 16. | 42. | 2. | 0. | 4. | 1. | 0. | 5. | 1. | 6. | 0. | 21. | 0. | 0. | 3.1 |
| 28 | Al | Mg | Zn | 0. | 23. | 39. | 7. | 0. | 2. | 2. | 0. | 7. | 1. | 6. | 0. | 13. | 0. | 0. | 3.0 |
| 2 | Si | Mg | Zn | 1. | 18. | 6. | 42. | 0. | 4. | 2. | 3. | 6. | 0. | 7. | 0. | 10. | 0. | 0. | 0.1 |
| 1 | Al | S | Ca | 10. | 9. | 26. | 0. | 0. | 25. | 0. | 0. | 19. | 0. | 0. | 0. | 12. | 0. | 0. | 0.0 |
| 4 | Al | Ca | S | 0. | 3. | 53. | 4. | 0. | 12. | 3. | 2. | 16. | 0. | 5. | 0. | 3. | 0. | 0. | 0.2 |
| 1 | S | Mg | Al | 0. | 26. | 21. | 0. | 0. | 27. | 2. | 0. | 5. | 2. | 6. | 0. | 10. | 0. | 0. | 0.1 |
| 9 | Al | Mg | S | 2. | 24. | 39. | 3. | 0. | 12. | 1. | 0. | 8. | 0. | 5. | 0. | 5. | 0. | 0. | 0.3 |
| 1 | S | Al | Mg | 0. | 19. | 30. | 9. | 0. | 43. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Mg | Al | S | 1. | 35. | 23. | 2. | 0. | 17. | 3. | 0. | 9. | 0. | 6. | 0. | 3. | 0. | 0. | 0.4 |
| 2 | Al | Si | Zn | 2. | 11. | 35. | 20. | 0. | 3. | 1. | 0. | 5. | 0. | 7. | 0. | 16. | 0. | 0. | 0.1 |
| 2 | Si | Zn | Al | 7. | 2. | 12. | 50. | 0. | 0. | 0. | 0. | 0. | 0. | 7. | 0. | 22. | 0. | 0. | 0.3 |
| 36 | Al | Mg | Fe | 0 | 26. | 41. | 2. | 0. | 4. | 1. | 1. | 8. | 1. | 13. | 0. | 3. | 0. | 0. | 3.8 |
| 4 | Mg | Fe | Al | 0. | 35. | 19. | 6. | 0. | 7. | 0. | 0. | 12. | 0. | 21. | 0. | 0. | 0. | 0. | 0.3 |
| 9 | Fe | Al | Mg | 0. | 15. | 23. | 7. | 0. | 1. | 2. | 1. | 8. | 0. | 36. | 0. | 7. | 0. | 0. | 1.2 |
| 25 | Mg | Al | Fe | 0. | 43. | 28. | 3. | 0. | 1. | 1. | 0. | 9. | 1. | 12. | 0. | 2. | 0. | 0. | 1.7 |
| 5 | Al | Fe | Zn | 0. | 4. | 45. | 0. | 0. | 1. | 0. | 1. | 4. | 1. | 25. | 1. | 17. | 0. | 0. | 0.2 |
| 4 | Al | Zn | Fe | 0. | 2. | 40. | 3. | 0. | 7. | 2. | 0. | 7. | 6. | 12. | 0. | 22. | 0. | 0. | 0.3 |
| 1 | Cl | Si | Mg | 0. | 19. | 0. | 22. | 0. | 10. | 29. | 0. | 0. | 0. | 9. | 10. | 0. | 0. | 0. | 0.0 |
| 1 | Mg | Ca | Cl | 15. | 19. | 13. | 0. | 0. | 15. | 16. | 0. | 18. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Al | Zn | 0. | 12. | 22. | 5. | 0. | 0. | 23. | 0. | 4. | 5. | 8. | 0. | 20. | 0. | 0. | 0.0 |
| 4 | Al | Zn | Ca | 0. | 5. | 48. | 8. | 0. | 5. | 0. | 0. | 13. | 1. | 4. | 0. | 17. | 0. | 0. | 0.2 |
| 3 | Al | Ca | Zn | 0. | 0. | 72. | 1. | 0. | 0. | 0. | 0. | 15. | 0. | 4. | 0. | 8. | 0. | 0. | 0.1 |
| 1 | Ti | Ca | S | 0. | 5. | 4. | 2. | 0. | 9. | 0. | 0. | 26. | 52. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Al | Na | Fe | 16. | 0. | 53. | 10. | 0. | 2. | 2. | 0. | 3. | 1. | 12. | 0. | 2. | 0. | 0. | 0.2 |
| 1 | Na | Mg | Al | 28. | 20. | 16. | 6. | 0. | 11. | 10. | 0. | 4. | 4. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si | Na | Zn | 13. | 0. | 0. | 74. | 0. | 4. | 0. | 0. | 2. | 0. | 0. | 0. | 7. | 0. | 0. | 0.7 |
| 2 | Al | Ti | Zn | 0. | 8. | 55. | 0. | 0. | 0. | 2. | 0. | 7. | 14. | 6. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Al | Zn | Ti | 0. | 8. | 29. | 3. | 0. | 8. | 4. | 0. | 8. | 15. | 6. | 0. | 19. | 0. | 0. | 0.0 |
| 7 | Al | Zn | S | 0. | 10. | 35. | 0. | 0. | 14. | 1. | 4. | 10. | 1. | 5. | 0. | 21. | 0. | 0. | 0.4 |
| 2 | Al | Si | Ti | 10. | 2. | 50. | 21. | 0. | 0. | 0. | 0. | 3. | 13. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al | Ti | Fe | 0. | 7. | 32. | 6. | 0. | 4. | 0. | 0. | 6. | 28. | 10. | 0. | 4. | 0. | 0. | 0.1 |
| 101 | OTHERS - | | | 1. | 17. | 23. | 9. | 0. | 4. | 2. | 0. | 13. | 3. | 17. | 0. | 10. | 0. | 0. | 10.0 |
| 1199 | TOTALS - | | | 3. | 23. | 22. | 23. | 0. | 2. | 1. | 0. | 11. | 1. | 10. | 0. | 3. | 0. | 0. | 100.0 |

Table 3-2. Sample #594 PSI/SECV Loy Yang Test 4 Untreated Ash Probe (horizontal duct) on Filter (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si - - | 7.1 | 0. | 4. | 9. | 36. | 33. | 17. | 0. |
| Si Na Al | 5.5 | 8. | 26. | 13. | 27. | 23. | 4. | 0. |
| Al Mg Ca | 8.2 | 22. | 54. | 19. | 5. | 1. | 0. | 0. |
| Mg Ca Al | 5.5 | 12. | 50. | 31. | 6. | 0. | 0. | 0. |
| Mg Al Ca | 11.9 | 36. | 43. | 17. | 4. | 0. | 0. | 0. |
| OTHERS - | 10.0 | 31. | 37. | 13. | 18. | 0. | 0. | 0. |
| OTHERS - | 51.8 | 20. | 33. | 22. | 17. | 7. | 1. | 0. |
| TOTALS - | 100.0 | 21. | 35. | 19. | 16. | 7. | 2. | 0. |

## Table 3-3. Sample #595 PSI/SECV Loy Yang Test 3 Treated Ash Probe (horizontal duct) on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | Si - - | 3. | 0. | 2. | 93. | 0. | 0. | 0. | 0. | 0. | 1. | 1. | 0. | 1. | 0. | 0. | 3.5 |
| 19 | Fe - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 96. | 0. | 3. | 0. | 0. | 1.3 |
| 4 | Ti - - | 0. | 3. | 5. | 0. | 0. | 0. | 0. | 0. | 3. | 86. | 1. | 0. | 3. | 0. | 0. | 0.5 |
| 2 | Al - - | 0. | 0. | 91. | 0. | 0. | 0. | 0. | 0. | 0. | 5. | 0. | 0. | 4. | 0. | 0. | 0.2 |
| 2 | Ca - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Si Mg - | 0. | 31. | 0. | 69. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Si - | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 5. | 79. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | K Si - | 0. | 0. | 0. | 22. | 0. | 0. | 0. | 76. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si Na - | 12. | 0. | 2. | 80. | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 4. | 0. | 0. | 0.4 |
| 1 | S Al - | 0. | 0. | 16. | 0. | 0. | 84. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca S - | 0. | 0. | 0. | 0. | 0. | 31. | 0. | 0. | 65. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 15 | Zn Al - | 0. | 0. | 32. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 1. | 67. | 0. | 0. | 1.0 |
| 15 | S Al Zn | 1. | 3. | 25. | 4. | 0. | 40. | 6. | 0. | 1. | 0. | 1. | 0. | 18. | 0. | 0. | 1.2 |
| 10 | S Zn Al | 2. | 2. | 19. | 0. | 0. | 44. | 1. | 0. | 2. | 0. | 1. | 0. | 29. | 0. | 0. | 0.9 |
| 12 | Al S Zn | 4. | 4. | 42. | 0. | 0. | 24. | 3. | 0. | 5. | 0. | 1. | 0. | 17. | 0. | 0. | 0.8 |
| 52 | Al Zn S | 1. | 2. | 51. | 1. | 0. | 13. | 0. | 1. | 3. | 2. | 3. | 0. | 23. | 0. | 0. | 4.6 |
| 14 | Zn Al S | 0. | 1. | 31. | 1. | 1. | 12. | 1. | 1. | 3. | 0. | 4. | 0. | 44. | 0. | 0. | 0.9 |
| 5 | Zn S Al | 0. | 0. | 24. | 1. | 0. | 31. | 0. | 0. | 1. | 2. | 5. | 2. | 34. | 0. | 0. | 0.3 |
| 10 | Si Al Zn | 4. | 2. | 27. | 47. | 0. | 1. | 0. | 0. | 4. | 0. | 3. | 0. | 12. | 0. | 0. | 0.9 |
| 68 | Al Zn Si | 0. | 6. | 44. | 13. | 0. | 2. | 0. | 0. | 4. | 1. | 5. | 0. | 24. | 0. | 0. | 5.9 |
| 5 | Si Zn Al | 0. | 0. | 19. | 48. | 0. | 1. | 0. | 0. | 2. | 0. | 5. | 0. | 26. | 0. | 0. | 0.4 |
| 25 | Al Si Zn | 0. | 6. | 47. | 20. | 0. | 1. | 0. | 0. | 6. | 1. | 5. | 0. | 15. | 0. | 0. | 2.0 |
| 3 | S Al Si | 0. | 0. | 31. | 17. | 0. | 39. | 3. | 5. | 0. | 0. | 0. | 0. | 5. | 0. | 0. | 0.1 |
| 1 | Si S Al | 0. | 0. | 16. | 36. | 0. | 33. | 10. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Al S | 4. | 0. | 35. | 36. | 0. | 9. | 2. | 0. | 6. | 0. | 0. | 0. | 6. | 0. | 0. | 0.1 |
| 6 | S Al Mg | 0. | 20. | 24. | 5. | 4. | 34. | 1. | 0. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0.9 |
| 2 | S Mg Al | 0. | 25. | 22. | 0. | 0. | 36. | 12. | 0. | 2. | 0. | 0. | 0. | 3. | 0. | 0. | 0.2 |
| 3 | Al S Mg | 8. | 20. | 30. | 4. | 0. | 23. | 0. | 0. | 3. | 1. | 0. | 3. | 9. | 0. | 0. | 0.5 |
| 6 | Al Mg S | 0. | 25. | 49. | 0. | 0. | 11. | 5. | 0. | 0. | 0. | 7. | 0. | 2. | 0. | 0. | 0.9 |
| 1 | Na Cl S | 30. | 0. | 15. | 5. | 0. | 19. | 24. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | S Cl Al | 0. | 0. | 21. | 4. | 0. | 36. | 27. | 2. | 0. | 4. | 2. | 0. | 4. | 0. | 0. | 0.5 |
| 1 | Al Cl S | 0. | 0. | 45. | 0. | 7. | 17. | 23. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl S Al | 0. | 0. | 20. | 5. | 0. | 34. | 34. | 0. | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 0.1 |
| 9 | S Al Cl | 0. | 2. | 27. | 3. | 0. | 38. | 17. | 3. | 2. | 0. | 0. | 5. | 2. | 0. | 0. | 0.7 |
| 4 | Al S Cl | 0. | 0. | 37. | 1. | 0. | 28. | 18. | 0. | 10. | 1. | 0. | 1. | 3. | 0. | 0. | 0.6 |
| 2 | Cl Al S | 0. | 0. | 28. | 3. | 0. | 21. | 37. | 3. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Al Ca | 7. | 0. | 27. | 36. | 0. | 5. | 0. | 0. | 23. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 6 | Si Ca Al | 5. | 0. | 21. | 38. | 0. | 2. | 0. | 1. | 25. | 1. | 7. | 0. | 0. | 0. | 0. | 0.5 |
| 6 | Ca Si Al | 0. | 0. | 19. | 27. | 0. | 1. | 0. | 0. | 43. | 0. | 10. | 0. | 0. | 0. | 0. | 0.7 |
| 4 | Al Si Ca | 0. | 2. | 48. | 29. | 0. | 0. | 0. | 2. | 9. | 2. | 5. | 0. | 3. | 0. | 0. | 0.3 |
| 6 | Si Al Fe | 1. | 1. | 23. | 59. | 0. | 0. | 0. | 2. | 3. | 2. | 9. | 0. | 1. | 0. | 0. | 0.4 |
| 1 | Fe Si Al | 9. | 6. | 21. | 28. | 0. | 0. | 0. | 0. | 3. | 4. | 29. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Fe Si | 0. | 0. | 11. | 19. | 0. | 0. | 0. | 0. | 42. | 4. | 23. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca Si Fe | 1. | 0. | 12. | 24. | 0. | 0. | 0. | 0. | 39. | 0. | 18. | 0. | 5. | 0. | 0. | 0.3 |
| 2 | S Al Na | 18. | 5. | 22. | 0. | 0. | 31. | 4. | 0. | 5. | 0. | 0. | 4. | 10. | 0. | 0. | 0.1 |
| 2 | Na Al S | 42. | 5. | 26. | 0. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 7. | 0. | 0. | 0.1 |
| 2 | Ti Al Si | 0. | 0. | 25. | 10. | 0. | 0. | 0. | 0. | 1. | 58. | 4. | 0. | 1. | 0. | 0. | 0.2 |
| 5 | Si Al Ti | 4. | 6. | 24. | 35. | 0. | 5. | 3. | 0. | 1. | 15. | 3. | 0. | 4. | 0. | 0. | 0.3 |
| 3 | Ti Si Al | 0. | 5. | 13. | 21. | 0. | 0. | 0. | 0. | 0. | 51. | 3. | 0. | 6. | 0. | 0. | 0.3 |
| 1 | Al Ti Si | 9. | 8. | 46. | 13. | 0. | 0. | 0. | 0. | 0. | 15. | 3. | 0. | 4. | 0. | 0. | 0.0 |
| 23 | Al Mg Fe | 0. | 22. | 45. | 1. | 0. | 4. | 0. | 0. | 8. | 1. | 13. | 0. | 6. | 0. | 0. | 1.9 |
| 10 | Al Fe Mg | 0. | 16. | 42. | 3. | 0. | 0. | 0. | 0. | 4. | 0. | 26. | 0. | 8. | 0. | 0. | 1.5 |
| 1 | Mg Al Fe | 0. | 39. | 31. | 0. | 0. | 7. | 0. | 7. | 0. | 0. | 9. | 0. | 6. | 0. | 0. | 0.0 |
| 1 | Al S Ti | 0. | 0. | 41. | 0. | 0. | 18. | 13. | 0. | 8. | 13. | 6. | 0. | 0. | 0. | 0. | 0.0 |

## Table 3-3. Sample #595 PSI/SECV Loy Yang Test 3 Treated Ash Probe (horizontal duct) on Filter (Continued)

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S Fe Cl | 0. | 0. | 5. | 0. | 0. | 45. | 18. | 8. | 0. | 0. | 24. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si Na Al | 12. | 2. | 9. | 72. | 0. | 0. | 0. | 1. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 0.5 |
| 1 | Al Si Na | 16. | 0. | 36. | 30. | 0. | 0. | 0. | 0. | 3. | 11. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si Al Na | 17. | 2. | 29. | 37. | 0. | 0. | 0. | 0. | 3. | 7. | 3. | 0. | 2. | 0. | 0. | 0.6 |
| 26 | Al Zn Ca | 0. | 2. | 55. | 3. | 0. | 2. | 1. | 0. | 10. | 0. | 4. | 0. | 24. | 0. | 0. | 2.2 |
| 5 | Zn Al Ca | 0. | 0. | 25. | 2. | 0. | 1. | 0. | 0. | 13. | 1. | 4. | 0. | 55. | 0. | 0. | 0.4 |
| 1 | Al Ca Fe | 0. | 9. | 47. | 0. | 0. | 3. | 0. | 0. | 19. | 0. | 16. | 0. | 5. | 0. | 0. | 0.1 |
| 1 | Ca Al Fe | 0. | 6. | 14. | 8. | 0. | 0. | 0. | 0. | 49. | 0. | 12. | 0. | 10. | 0. | 0. | 0.1 |
| 3 | Al Fe Ca | 0. | 2. | 53. | 0. | 0. | 2. | 0. | 0. | 14. | 0. | 27. | 0. | 1. | 0. | 0. | 0.2 |
| 1 | S Zn Ti | 0. | 0. | 0. | 0. | 0. | 71. | 0. | 0. | 8. | 10. | 0. | 0. | 10. | 0. | 0. | 0.2 |
| 1 | Al S K | 0. | 0. | 44. | 0. | 0. | 43. | 0. | 12. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na Cl Al | 36. | 0. | 17. | 0. | 0. | 6. | 28. | 6. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Si S | 0. | 0. | 12. | 26. | 0. | 13. | 0. | 0. | 46. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Na Mg | 11. | 10. | 8. | 60. | 0. | 0. | 0. | 0. | 2. | 0. | 2. | 0. | 6. | 0. | 0. | 0.0 |
| 28 | Zn Al Fe | 0. | 1. | 31. | 1. | 0. | 3. | 0. | 1. | 2. | 1. | 11. | 0. | 48. | 0. | 0. | 1.5 |
| 72 | Al Zn Fe | 0. | 2. | 49. | 3. | 0. | 2. | 0. | 1. | 4. | 1. | 12. | 0. | 26. | 0. | 0. | 5.1 |
| 6 | Fe Al Zn | 0. | 4. | 24. | 2. | 0. | 3. | 0. | 1. | 4. | 3. | 41. | 0. | 17. | 0. | 0. | 0.4 |
| 12 | Al Fe Zn | 0. | 8. | 43. | 2. | 0. | 2. | 1. | 0. | 5. | 2. | 22. | 0. | 14. | 0. | 0. | 0.5 |
| 3 | Zn Fe Al | 0. | 4. | 26. | 0. | 0. | 0. | 0. | 1. | 0. | 1. | 29. | 0. | 39. | 0. | 0. | 0.2 |
| 31 | Zn Al Mg | 0. | 16. | 30. | 2. | 0. | 1. | 2. | 0. | 2. | 1. | 6. | 0. | 40. | 0. | 0. | 2.1 |
| 115 | Al Mg Zn | 0. | 23. | 46. | 2. | 0. | 2. | 0. | 0. | 4. | 1. | 5. | 0. | 15. | 0. | 0. | 10.1 |
| 162 | Al Zn Mg | 0. | 16. | 44. | 4. | 0. | 3. | 0. | 0. | 4. | 1. | 4. | 0. | 24. | 0. | 0. | 12.6 |
| 10 | Al Mg Si | 0. | 22. | 48. | 11. | 0. | 0. | 0. | 0. | 7. | 1. | 5. | 0. | 7. | 0. | 0. | 0.7 |
| 5 | Si Al Mg | 0. | 14. | 31. | 41. | 0. | 0. | 0. | 0. | 5. | 0. | 4. | 0. | 5. | 0. | 0. | 0.5 |
| 16 | Al Si Mg | 0. | 14. | 45. | 22. | 0. | 0. | 0. | 0. | 6. | 1. | 6. | 0. | 5. | 0. | 0. | 1.6 |
| 11 | Al Ti Mg | 0. | 14. | 43. | 3. | 1. | 2. | 1. | 1. | 4. | 22. | 5. | 0. | 5. | 0. | 0. | 0.9 |
| 2 | Ti Al Mg | 4. | 9. | 13. | 6. | 0. | 0. | 0. | 0. | 0. | 59. | 6. | 0. | 4. | 0. | 0. | 0.1 |
| 8 | Al Mg Ti | 0. | 21. | 47. | 2. | 0. | 0. | 0. | 0. | 4. | 12. | 5. | 0. | 8. | 0. | 0. | 0.9 |
| 2 | S Na Ca | 20. | 3. | 12. | 0. | 0. | 44. | 0. | 0. | 15. | 1. | 2. | 0. | 3. | 0. | 0. | 0.1 |
| 4 | Zn Al Ti | 0. | 0. | 35. | 0. | 0. | 3. | 0. | 0. | 2. | 11. | 0. | 0. | 49. | 0. | 0. | 0.2 |
| 15 | Al Zn Ti | 0. | 2. | 50. | 3. | 0. | 2. | 0. | 0. | 1. | 14. | 2. | 0. | 24. | 0. | 0. | 1.1 |
| 1 | Al Zn P | 0. | 0. | 44. | 0. | 10. | 0. | 0. | 0. | 7. | 0. | 9. | 0. | 30. | 0. | 0. | 0.1 |
| 6 | Al Zn Cl | 0. | 0. | 51. | 1. | 0. | 7. | 12. | 0. | 0. | 0. | 1. | 6. | 22. | 0. | 0. | 0.5 |
| 1 | Si Ti Na | 9. | 7. | 8. | 53. | 0. | 0. | 0. | 0. | 0. | 20. | 0. | 0. | 2. | 0. | 0. | 0.1 |
| 5 | Al Ca Mg | 0. | 10. | 51. | 1. | 0. | 4. | 2. | 0. | 16. | 4. | 5. | 0. | 8. | 0. | 0. | 0.9 |
| 10 | Al Mg Ca | 0. | 26. | 46. | 2. | 0. | 2. | 2. | 0. | 10. | 1. | 4. | 1. | 4. | 0. | 0. | 1.6 |
| 1 | Si S Zn | 0. | 0. | 0. | 55. | 0. | 16. | 0. | 0. | 0. | 13. | 0. | 0. | 15. | 0. | 0. | 0.0 |
| 14 | Si Zn Na | 13. | 0. | 3. | 58. | 0. | 1. | 0. | 0. | 0. | 0. | 1. | 0. | 24. | 0. | 0. | 1.5 |
| 1 | S Na Zn | 29. | 0. | 9. | 0. | 0. | 46. | 0. | 0. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0.0 |
| 1 | Zn Al K | 0. | 0. | 30. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 54. | 0. | 0. | 0.1 |
| 3 | Al Ti Ca | 0. | 0. | 60. | 2. | 0. | 1. | 1. | 3. | 7. | 25. | 0. | 0. | 1. | 0. | 0. | 0.2 |
| 2 | Zn Si Fe | 0. | 0. | 4. | 26. | 0. | 0. | 0. | 0. | 1. | 1. | 11. | 0. | 57. | 0. | 0. | 0.1 |
| 1 | S Ca Al | 3. | 0. | 24. | 0. | 0. | 30. | 0. | 0. | 25. | 0. | 7. | 0. | 11. | 0. | 0. | 0.1 |
| 2 | K Si Na | 17. | 0. | 0. | 32. | 0. | 0. | 0. | 51. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Al Fe S | 0. | 0. | 50. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 28. | 0. | 6. | 0. | 0. | 0.3 |
| 166 | OTHERS - | 4. | 4. | 26. | 9. | 1. | 6. | 4. | 4. | 6. | 3. | 13. | 0. | 19. | 0. | 0. | 13.6 |
| 1198 | TOTALS - | 2. | 9. | 36. | 11. | 0. | 6. | 2. | 1. | 5. | 3. | 8. | 0. | 18. | 0. | 0. | 100.0 |

## Table 3-3. Sample #595 PSI/SECV Loy Yang Test 3 Treated Ash Probe (horizontal duct) on Filter (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Al Mg Zn | 10.1 | 13. | 35. | 39. | 13. | 0. | 0. | 0. |
| Al Zn Mg | 12.6 | 27. | 28. | 36. | 9. | 0. | 0. | 0. |
| Al Zn S | 4.6 | 22. | 32. | 38. | 9. | 0. | 0. | 0. |
| Al Zn Si | 5.9 | 30. | 36. | 28. | 6. | 0. | 0. | 0. |
| Al Zn Fe | 5.1 | 27. | 25. | 39. | 9. | 0. | 0. | 0. |
| OTHERS - | 13.6 | 32. | 22. | 28. | 19. | 0. | 0. | 0. |
| OTHERS - | 48.0 | 18. | 18. | 28. | 24. | 9. | 3. | 0. |
| TOTALS - | 100.0 | 22. | 23. | 31. | 18. | 4. | 2. | 0. |

## Table 3-4. Sample #596 PSI/SECV Beulah Lignite Ash Probe (combustion chamber) on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | Ca - - | 0. | 4. | 2. | 3. | 0. | 4. | 0. | 0. | 83. | 0. | 3. | 0. | 0. | 0. | 0. | 3.8 |
| 54 | Fe - - | 0. | 1. | 0. | 2. | 0. | 1. | 0. | 0. | 2. | 1. | 93. | 0. | 0. | 0. | 0. | 5.1 |
| 29 | Si - - | 3. | 0. | 0. | 95. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 1.7 |
| 1 | Ti - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 95. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Ca - | 5. | 0. | 0. | 0. | 0. | 49. | 0. | 0. | 46. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 64 | Ca S - | 0. | 1. | 0. | 1. | 0. | 33. | 0. | 0. | 65. | 0. | 0. | 0. | 0. | 0. | 0. | 5.0 |
| 2 | Si Ca - | 0. | 2. | 0. | 74. | 0. | 0. | 0. | 0. | 22. | 1. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Fe - | 0. | 0. | 2. | 1. | 0. | 0. | 0. | 0. | 75. | 0. | 22. | 0. | 0. | 0. | 0. | 0.2 |
| 10 | Fe Ca - | 0. | 2. | 1. | 2. | 0. | 3. | 0. | 0. | 19. | 0. | 73. | 0. | 0. | 0. | 0. | 1.3 |
| 1 | S Ti - | 0. | 0. | 0. | 4. | 0. | 49. | 0. | 0. | 0. | 46. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ti S - | 0. | 0. | 0. | 1. | 0. | 37. | 0. | 0. | 3. | 59. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 21 | Si Al - | 0. | 0. | 43. | 54. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 1. | 0. | 0. | 1.8 |
| 3 | Al Si - | 0. | 0. | 49. | 46. | 0. | 0. | 0. | 0. | 3. | 1. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 19 | Si Na - | 27. | 0. | 0. | 66. | 0. | 2. | 0. | 0. | 3. | 1. | 1. | 1. | 0. | 0. | 0. | 1.5 |
| 2 | Ca Al - | 0. | 3. | 20. | 2. | 0. | 0. | 0. | 0. | 70. | 2. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Ca Mg - | 0. | 14. | 3. | 0. | 0. | 4. | 0. | 0. | 76. | 0. | 4. | 0. | 0. | 0. | 0. | 0.9 |
| 2 | K Si - | 0. | 0. | 0. | 22. | 0. | 0. | 0. | 78. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 141 | Si Al Na | 22. | 0. | 32. | 40. | 0. | 1. | 0. | 0. | 4. | 0. | 1. | 0. | 0. | 0. | 0. | 11.5 |
| 9 | Al Si Na | 20. | 0. | 38. | 36. | 0. | 0. | 0. | 0. | 3. | 1. | 1. | 0. | 0. | 0. | 0. | 0.7 |
| 96 | Si Na Al | 31. | 0. | 24. | 37. | 0. | 1. | 0. | 0. | 4. | 0. | 2. | 0. | 0. | 0. | 0. | 7.5 |
| 53 | Na Si Al | 38. | 0. | 22. | 30. | 0. | 3. | 0. | 0. | 3. | 1. | 2. | 0. | 0. | 0. | 0. | 4.7 |
| 1 | Ca S Cl | 0. | 0. | 10. | 0. | 11. | 28. | 13. | 0. | 37. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 61 | Ca Si Al | 2. | 1. | 18. | 22. | 0. | 4. | 0. | 0. | 44. | 1. | 7. | 0. | 1. | 0. | 0. | 5.2 |
| 3 | Al Si Ca | 0. | 0. | 45. | 38. | 0. | 0. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 13 | Si Ca Al | 5. | 0. | 20. | 35. | 0. | 2. | 0. | 0. | 29. | 2. | 6. | 0. | 0. | 0. | 0. | 1.1 |
| 34 | Si Al Ca | 1. | 0. | 34. | 45. | 0. | 1. | 0. | 0. | 17. | 1. | 1. | 0. | 0. | 0. | 0. | 3.0 |
| 19 | Ca Al Si | 0. | 6. | 18. | 14. | 0. | 5. | 0. | 0. | 51. | 0. | 5. | 0. | 0. | 0. | 0. | 1.3 |
| 26 | Ca S Si | 3. | 3. | 9. | 13. | 0. | 20. | 0. | 0. | 45. | 1. | 6. | 0. | 0. | 0. | 0. | 1.5 |
| 12 | S Ca Si | 1. | 0. | 7. | 19. | 0. | 33. | 0. | 1. | 26. | 0. | 11. | 0. | 0. | 0. | 0. | 0.5 |
| 7 | Ca Si S | 0. | 2. | 14. | 19. | 0. | 16. | 0. | 0. | 44. | 0. | 5. | 0. | 0. | 0. | 0. | 0.9 |
| 9 | Ca Mg Al | 0. | 16. | 9. | 5. | 0. | 3. | 0. | 0. | 61. | 1. | 4. | 0. | 1. | 0. | 0. | 0.5 |
| 5 | Ca Al Mg | 0. | 8. | 17. | 3. | 0. | 1. | 0. | 0. | 68. | 0. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Al K | 0. | 0. | 38. | 43. | 0. | 0. | 0. | 12. | 1. | 0. | 1. | 0. | 6. | 0. | 0. | 0.4 |
| 16 | Fe Ca Si | 0. | 0. | 10. | 17. | 0. | 8. | 0. | 0. | 21. | 1. | 43. | 0. | 0. | 0. | 0. | 1.2 |
| 3 | Si Ca Fe | 8. | 0. | 7. | 45. | 0. | 3. | 0. | 0. | 20. | 1. | 15. | 0. | 0. | 0. | 0. | 0.1 |
| 10 | Ca Si Fe | 2. | 4. | 10. | 19. | 0. | 2. | 0. | 0. | 45. | 2. | 16. | 0. | 0. | 0. | 0. | 0.9 |
| 3 | Fe Si Ca | 0. | 0. | 8. | 14. | 0. | 4. | 0. | 0. | 11. | 3. | 59. | 0. | 1. | 0. | 0. | 0.3 |
| 9 | Ca Fe Si | 1. | 3. | 10. | 16. | 0. | 5. | 0. | 0. | 40. | 0. | 23. | 0. | 1. | 0. | 0. | 0.3 |
| 1 | Si Fe Ca | 9. | 0. | 3. | 39. | 0. | 0. | 0. | 0. | 12. | 0. | 36. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Na Ca | 19. | 1. | 8. | 15. | 0. | 9. | 0. | 0. | 17. | 6. | 26. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Na Ca Fe | 21. | 8. | 13. | 13. | 0. | 13. | 0. | 0. | 18. | 0. | 16. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | K S Cl | 0. | 0. | 0. | 0. | 0. | 22. | 17. | 38. | 13. | 0. | 0. | 0. | 10. | 0. | 0. | 0.0 |
| 6 | Fe Si Al | 3. | 0. | 13. | 18. | 0. | 2. | 0. | 0. | 4. | 2. | 58. | 0. | 0. | 0. | 0. | 0.2 |
| 6 | Si Al Fe | 11. | 0. | 27. | 40. | 0. | 1. | 1. | 0. | 4. | 1. | 14. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Si Fe Al | 8. | 0. | 21. | 31. | 0. | 2. | 0. | 1. | 11. | 0. | 26. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Ti Fe | 0. | 0. | 13. | 14. | 0. | 11. | 0. | 0. | 29. | 19. | 15. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Al Ti | 0. | 7. | 16. | 7. | 0. | 0. | 0. | 0. | 56. | 9. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al Ca Ti | 0. | 0. | 53. | 0. | 0. | 0. | 0. | 0. | 18. | 15. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 16 | S Ca Na | 16. | 0. | 2. | 2. | 0. | 42. | 0. | 0. | 33. | 0. | 3. | 0. | 1. | 0. | 0. | 2.5 |
| 14 | S Na Ca | 27. | 1. | 8. | 8. | 0. | 31. | 0. | 0. | 19. | 0. | 7. | 0. | 0. | 0. | 0. | 1.6 |
| 22 | Ca S Na | 15. | 2. | 5. | 7. | 0. | 26. | 0. | 0. | 35. | 1. | 7. | 0. | 0. | 0. | 0. | 2.4 |
| 8 | Na S Ca | 35. | 0. | 5. | 9. | 0. | 24. | 0. | 2. | 16. | 2. | 6. | 0. | 1. | 0. | 0. | 0.9 |
| 2 | Ca Na S | 19. | 0. | 11. | 12. | 0. | 18. | 0. | 0. | 27. | 3. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Na Ca S | 30. | 0. | 2. | 8. | 0. | 26. | 0. | 0. | 27. | 1. | 6. | 0. | 0. | 0. | 0. | 0.4 |

# Table 3-4. Sample #596 PSI/SECV Beulah Lignite Ash Probe (combustion chamber) on Filter (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | Ca S Fe | 3. | 2. | 5. | 5. | 0. | 25. | 0. | 0. | 44. | 2. | 14. | 0. | 0. | 0. | 0. | 2.8 |
| 6 | Fe S Ca | 5. | 0. | 6. | 11. | 0. | 26. | 0. | 0. | 21. | 0. | 30. | 1. | 0. | 0. | 0. | 0.3 |
| 14 | Fe Ca S | 3. | 1. | 5. | 8. | 0. | 13. | 0. | 0. | 19. | 0. | 50. | 0. | 0. | 0. | 0. | 0.8 |
| 6 | S Fe Ca | 2. | 0. | 8. | 11. | 0. | 30. | 0. | 0. | 21. | 2. | 25. | 0. | 0. | 0. | 0. | 0.5 |
| 10 | Ca Fe S | 1. | 4. | 9. | 6. | 0. | 14. | 0. | 0. | 39. | 1. | 26. | 0. | 0. | 0. | 0. | 1.0 |
| 14 | S Ca Fe | 1. | 4. | 2. | 6. | 0. | 38. | 0. | 0. | 33. | 2. | 14. | 0. | 0. | 0. | 0. | 1.7 |
| 8 | Ca Mg Fe | 0. | 20. | 3. | 1. | 0. | 2. | 0. | 0. | 58. | 0. | 16. | 0. | 1. | 0. | 0. | 0.7 |
| 6 | Ca Fe Mg | 0. | 9. | 6. | 5. | 0. | 7. | 0. | 0. | 50. | 0. | 23. | 0. | 0. | 0. | 0. | 0.7 |
| 3 | Fe Ca Mg | 0. | 9. | 3. | 3. | 0. | 3. | 0. | 1. | 30. | 1. | 49. | 0. | 1. | 0. | 0. | 0.1 |
| 1 | Mg Fe Ca | 0. | 31. | 5. | 0. | 0. | 12. | 0. | 0. | 26. | 0. | 27. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | Ca S Al | 5. | 3. | 14. | 9. | 0. | 20. | 0. | 0. | 39. | 1. | 8. | 0. | 1. | 0. | 0. | 0.8 |
| 8 | Ca Al S | 1. | 4. | 17. | 5. | 0. | 11. | 0. | 0. | 57. | 0. | 5. | 1. | 0. | 0. | 0. | 0.4 |
| 3 | Ca Ti Si | 0. | 2. | 3. | 10. | 0. | 0. | 0. | 0. | 62. | 17. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca Si Ti | 0. | 0. | 12. | 29. | 0. | 1. | 0. | 1. | 37. | 14. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Ca Fe Al | 0. | 5. | 13. | 7. | 0. | 5. | 0. | 0. | 46. | 0. | 23. | 0. | 0. | 0. | 0. | 0.6 |
| 7 | Ca Al Fe | 0. | 2. | 18. | 5. | 0. | 5. | 0. | 0. | 60. | 0. | 10. | 0. | 0. | 0. | 0. | 0.3 |
| 5 | Fe Ca Al | 0. | 1. | 10. | 5. | 0. | 2. | 0. | 0. | 18. | 2. | 62. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | Ti S Si | 0. | 0. | 8. | 19. | 0. | 34. | 0. | 0. | 0. | 38. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 2 | S Si Ti | 0. | 0. | 0. | 24. | 0. | 57. | 0. | 0. | 7. | 12. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Si Na Ca | 24. | 0. | 5. | 42. | 0. | 7. | 0. | 0. | 14. | 0. | 8. | 0. | 0. | 0. | 0. | 0.5 |
| 8 | Si Ca Na | 18. | 2. | 11. | 36. | 0. | 2. | 0. | 0. | 25. | 2. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | Ca Si Na | 14. | 2. | 12. | 26. | 0. | 3. | 0. | 0. | 36. | 1. | 6. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Ca Na Si | 17. | 0. | 12. | 16. | 0. | 13. | 0. | 0. | 30. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Ca Mg Si | 0. | 12. | 6. | 8. | 0. | 4. | 0. | 0. | 63. | 1. | 6. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Ca Si Mg | 0. | 14. | 4. | 22. | 0. | 1. | 0. | 0. | 57. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca Mg | 0. | 8. | 0. | 60. | 0. | 0. | 0. | 0. | 32. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Na Si | 18. | 0. | 9. | 16. | 0. | 27. | 0. | 0. | 14. | 2. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Na S Si | 30. | 0. | 12. | 16. | 0. | 18. | 0. | 0. | 14. | 2. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 30 | Ca S Mg | 0. | 10. | 2. | 2. | 0. | 25. | 0. | 0. | 57. | 0. | 3. | 0. | 0. | 0. | 0. | 2.3 |
| 13 | Ca Mg S | 0. | 14. | 5. | 5. | 0. | 9. | 0. | 0. | 62. | 0. | 5. | 0. | 0. | 0. | 0. | 0.7 |
| 3 | Fe Ti Si | 0. | 0. | 5. | 14. | 0. | 6. | 0. | 0. | 11. | 19. | 45. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe Na | 17. | 0. | 0. | 48. | 0. | 0. | 0. | 0. | 2. | 0. | 33. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe Na Si | 17. | 0. | 14. | 16. | 0. | 5. | 0. | 0. | 8. | 0. | 40. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | Na Si Fe | 30. | 0. | 13. | 23. | 0. | 7. | 0. | 0. | 9. | 0. | 17. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si Na Fe | 24. | 0. | 18. | 35. | 0. | 1. | 0. | 0. | 1. | 0. | 20. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Si Na | 11. | 0. | 9. | 12. | 0. | 0. | 0. | 0. | 2. | 0. | 65. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al S Fe | 0. | 0. | 30. | 10. | 0. | 28. | 0. | 0. | 11. | 0. | 21. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Al S | 0. | 0. | 31. | 37. | 0. | 17. | 0. | 0. | 3. | 10. | 1. | 0. | 1. | 0. | 0. | 0.5 |
| 3 | Ti S Ca | 0. | 2. | 2. | 5. | 0. | 28. | 0. | 1. | 17. | 44. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Ti S | 0. | 8. | 4. | 3. | 0. | 8. | 0. | 0. | 62. | 14. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ti Fe | 0. | 0. | 0. | 8. | 0. | 56. | 0. | 0. | 1. | 20. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Si Fe | 0. | 0. | 3. | 33. | 0. | 37. | 0. | 0. | 4. | 3. | 20. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe S Na | 21. | 0. | 6. | 9. | 0. | 22. | 0. | 3. | 15. | 0. | 24. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti S Cl | 0. | 0. | 0. | 3. | 0. | 24. | 6. | 0. | 0. | 66. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Na | 9. | 0. | 0. | 6. | 0. | 43. | 0. | 0. | 4. | 35. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 50 | OTHERS - | 3. | 5. | 14. | 17. | 1. | 18. | 1. | 1. | 17. | 9. | 14. | 0. | 0. | 0. | 0. | 6.6 |
| 1199 | TOTALS - | 10. | 2. | 14. | 22. | 0. | 11. | 0. | 0. | 26. | 2. | 13. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-4. Sample #596 PSI/SECV Beulah Lignite Ash Probe (combustion chamber) on Filter (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Fe - - | 5.1 | 11. | 64. | 17. | 7. | 2. | 0. | 0. |
| Ca S - | 5.0 | 2. | 19. | 23. | 43. | 14. | 0. | 0. |
| Si Al Na | 11.5 | 18. | 40. | 20. | 17. | 5. | 0. | 0. |
| Si Na Al | 7.5 | 49. | 31. | 14. | 7. | 0. | 0. | 0. |
| Na Si Al | 4.7 | 57. | 39. | 4. | 0. | 0. | 0. | 0. |
| Ca Si Al | 5.2 | 10. | 57. | 21. | 7. | 7. | 0. | 0. |
| OTHERS - | 6.6 | 34. | 65. | 1. | 0. | 0. | 0. | 0. |
| OTHERS - | 54.3 | 13. | 40. | 24. | 20. | 3. | 0. | 0. |
| TOTALS - | 100.0 | 19. | 42. | 20. | 16. | 4. | 0. | 0. |

# Table 3-5. Sample #597 PSI/SECV Beulah Lignite Ash Probe (horizontal duct) on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | Ca - - | 0. | 4. | 3. | 2. | 0. | 6. | 0. | 0. | 83. | 1. | 2. | 0. | 0. | 0. | 0. | 3.6 |
| 22 | Si - - | 5. | 0. | 0. | 94. | 0. | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 1.7 |
| 39 | Fe - - | 0. | 0. | 1. | 2. | 0. | 3. | 0. | 0. | 3. | 0. | 91. | 0. | 0. | 0. | 0. | 2.6 |
| 3 | S Ca - | 0. | 0. | 0. | 0. | 0. | 55. | 0. | 0. | 44. | 0. | 0. | 1. | 0. | 0. | 0. | 0.1 |
| 57 | Ca S - | 0. | 0. | 0. | 0. | 0. | 25. | 0. | 0. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 4.6 |
| 5 | Fe Ca - | 0. | 0. | 1. | 3. | 0. | 1. | 0. | 0. | 18. | 1. | 75. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Si - | 0. | 0. | 53. | 47. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 15 | Si Al - | 0. | 0. | 41. | 57. | 0. | 0. | 0. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Ca Si - | 4. | 5. | 5. | 35. | 0. | 0. | 0. | 0. | 51. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Si - | 0. | 0. | 3. | 11. | 0. | 3. | 0. | 0. | 0. | 0. | 83. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Mg - | 0. | 20. | 4. | 2. | 0. | 2. | 0. | 0. | 72. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 22 | Si Na - | 19. | 0. | 0. | 77. | 0. | 2. | 0. | 0. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 1.9 |
| 2 | Ti S - | 0. | 0. | 0. | 0. | 0. | 39. | 1. | 0. | 2. | 57. | 0. | 0. | 1. | 0. | 0. | 0.1 |
| 1 | Ca Ti - | 0. | 4. | 3. | 5. | 0. | 0. | 0. | 0. | 78. | 10. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Fe - | 0. | 4. | 4. | 0. | 0. | 4. | 0. | 0. | 61. | 0. | 27. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Si Ca | 8. | 0. | 36. | 35. | 0. | 4. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 64 | Ca Si Al | 3. | 3. | 17. | 23. | 0. | 5. | 0. | 0. | 41. | 1. | 6. | 0. | 0. | 0. | 0. | 4.0 |
| 24 | Si Ca Al | 7. | 0. | 21. | 34. | 1. | 3. | 0. | 0. | 26. | 2. | 6. | 0. | 0. | 0. | 0. | 2.4 |
| 39 | Si Al Ca | 6. | 0. | 32. | 40. | 0. | 2. | 0. | 0. | 16. | 1. | 2. | 0. | 0. | 0. | 0. | 4.5 |
| 4 | Ca Al Si | 0. | 2. | 17. | 13. | 0. | 4. | 0. | 0. | 56. | 0. | 8. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Ca Si Na | 16. | 1. | 14. | 22. | 0. | 14. | 0. | 0. | 29. | 1. | 4. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | Ca Na Si | 23. | 0. | 16. | 21. | 0. | 11. | 0. | 0. | 27. | 0. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Si Ca Na | 13. | 0. | 9. | 48. | 0. | 2. | 0. | 0. | 20. | 4. | 4. | 0. | 0. | 0. | 0. | 0.7 |
| 5 | Si Na Ca | 22. | 0. | 3. | 54. | 0. | 3. | 0. | 0. | 13. | 3. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Na Ca Si | 23. | 0. | 12. | 17. | 0. | 15. | 0. | 0. | 20. | 3. | 8. | 2. | 0. | 0. | 0. | 0.1 |
| 3 | S Ti Si | 5. | 0. | 3. | 17. | 0. | 40. | 1. | 0. | 7. | 25. | 0. | 0. | 2. | 0. | 0. | 0.1 |
| 2 | S Si Ti | 0. | 0. | 9. | 25. | 0. | 44. | 0. | 0. | 4. | 18. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 12 | Ca S Al | 5. | 6. | 10. | 5. | 0. | 21. | 0. | 0. | 46. | 1. | 5. | 0. | 0. | 0. | 0. | 0.7 |
| 5 | Ca Al S | 0. | 5. | 15. | 4. | 0. | 11. | 0. | 0. | 61. | 0. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 26 | S Na Ca | 26. | 1. | 4. | 8. | 0. | 34. | 0. | 0. | 17. | 1. | 7. | 0. | 1. | 0. | 0. | 2.6 |
| 8 | Na S Ca | 34. | 2. | 5. | 8. | 0. | 29. | 0. | 0. | 15. | 0. | 6. | 0. | 0. | 0. | 0. | 0.4 |
| 21 | Ca S Na | 12. | 3. | 5. | 4. | 0. | 32. | 0. | 0. | 41. | 1. | 3. | 0. | 0. | 0. | 0. | 2.3 |
| 31 | S Ca Na | 18. | 1. | 4. | 5. | 0. | 38. | 0. | 0. | 27. | 1. | 7. | 0. | 0. | 0. | 0. | 3.2 |
| 4 | Ca Na S | 19. | 0. | 10. | 16. | 0. | 17. | 0. | 0. | 28. | 0. | 7. | 0. | 2. | 0. | 0. | 0.3 |
| 100 | Si Na Al | 29. | 0. | 25. | 36. | 0. | 3. | 0. | 0. | 3. | 1. | 2. | 0. | 0. | 0. | 0. | 9.7 |
| 156 | Si Al Na | 21. | 0. | 31. | 39. | 0. | 2. | 0. | 0. | 4. | 1. | 3. | 0. | 0. | 0. | 0. | 11.7 |
| 4 | Al Si Na | 22. | 0. | 30. | 28. | 0. | 8. | 0. | 0. | 8. | 0. | 4. | 0. | 0. | 0. | 0. | 0.7 |
| 33 | Na Si Al | 35. | 0. | 23. | 30. | 0. | 4. | 0. | 1. | 3. | 1. | 4. | 0. | 0. | 0. | 0. | 3.5 |
| 14 | Fe Ca Si | 0. | 0. | 6. | 12. | 0. | 5. | 0. | 0. | 20. | 1. | 55. | 0. | 0. | 0. | 0. | 1.0 |
| 8 | Fe Si Ca | 3. | 0. | 10. | 20. | 0. | 2. | 0. | 0. | 13. | 2. | 51. | 0. | 0. | 0. | 0. | 0.3 |
| 13 | Ca Fe Si | 0. | 4. | 10. | 14. | 0. | 5. | 0. | 0. | 44. | 2. | 21. | 0. | 0. | 0. | 0. | 0.8 |
| 10 | Ca Si Fe | 6. | 2. | 11. | 19. | 0. | 8. | 0. | 0. | 40. | 0. | 13. | 0. | 0. | 0. | 0. | 0.7 |
| 7 | Si Ca Fe | 1. | 0. | 10. | 37. | 0. | 5. | 0. | 0. | 28. | 2. | 16. | 0. | 1. | 0. | 0. | 0.5 |
| 3 | Si Fe Ca | 0. | 0. | 6. | 52. | 0. | 9. | 0. | 0. | 12. | 2. | 16. | 0. | 4. | 0. | 0. | 0.1 |
| 13 | Ca Mg S | 0. | 15. | 3. | 3. | 0. | 9. | 0. | 0. | 64. | 1. | 3. | 0. | 0. | 0. | 0. | 0.8 |
| 42 | Ca S Mg | 1. | 11. | 4. | 4. | 0. | 20. | 0. | 0. | 54. | 1. | 5. | 0. | 0. | 0. | 0. | 2.5 |
| 16 | Ca Si S | 1. | 2. | 8. | 20. | 0. | 13. | 0. | 1. | 45. | 2. | 8. | 0. | 1. | 0. | 0. | 1.3 |
| 35 | Ca S Si | 1. | 5. | 8. | 12. | 0. | 19. | 0. | 0. | 48. | 1. | 6. | 0. | 0. | 0. | 0. | 2.2 |
| 2 | Si Ca S | 6. | 0. | 3. | 58. | 0. | 11. | 0. | 2. | 16. | 0. | 3. | 2. | 0. | 0. | 0. | 0.1 |
| 16 | S Ca Si | 1. | 0. | 7. | 16. | 0. | 34. | 0. | 1. | 26. | 2. | 9. | 0. | 3. | 0. | 0. | 0.8 |
| 2 | Si S Ca | 0. | 0. | 18. | 29. | 0. | 19. | 0. | 0. | 18. | 6. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Si Ca | 5. | 0. | 5. | 25. | 0. | 37. | 0. | 0. | 18. | 0. | 7. | 2. | 2. | 0. | 0. | 0.1 |
| 11 | S Fe Ca | 11. | 0. | 8. | 13. | 0. | 27. | 0. | 0. | 18. | 1. | 21. | 0. | 1. | 0. | 0. | 0.9 |
| 5 | Fe S Ca | 4. | 0. | 8. | 11. | 0. | 25. | 0. | 0. | 19. | 1. | 32. | 0. | 1. | 0. | 0. | 0.3 |

# Table 3-5. Sample #597 PSI/SECV Beulah Lignite Ash Probe (horizontal duct) on Filter (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Fe Ca S | 0. | 2. | 1. | 5. | 0. | 15. | 0. | 0. | 31. | 1. | 43. | 0. | 1. | 0. | 0. | 1.8 |
| 28 | Ca S Fe | 0. | 4. | 5. | 5. | 0. | 28. | 0. | 0. | 45. | 0. | 13. | 0. | 0. | 0. | 0. | 2.5 |
| 14 | S Ca Fe | 0. | 0. | 8. | 11. | 0. | 40. | 0. | 0. | 26. | 1. | 14. | 0. | 1. | 0. | 0. | 2.0 |
| 17 | Ca Fe S | 4. | 3. | 6. | 6. | 0. | 15. | 0. | 0. | 40. | 1. | 25. | 0. | 0. | 0. | 0. | 1.9 |
| 3 | S Ti Ca | 0. | 2. | 0. | 6. | 0. | 43. | 0. | 0. | 18. | 31. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca S Ti | 0. | 5. | 5. | 7. | 0. | 19. | 0. | 0. | 46. | 11. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ca Ti | 0. | 13. | 8. | 12. | 0. | 25. | 0. | 0. | 22. | 16. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti S Ca | 0. | 0. | 0. | 5. | 0. | 35. | 0. | 0. | 22. | 35. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti Ca S | 0. | 0. | 0. | 13. | 0. | 17. | 0. | 0. | 28. | 35. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si S Al | 0. | 0. | 12. | 34. | 0. | 32. | 0. | 0. | 8. | 5. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Si Al S | 0. | 0. | 27. | 40. | 0. | 16. | 1. | 0. | 4. | 4. | 6. | 0. | 3. | 0. | 0. | 0.3 |
| 5 | Si Al Ti | 0. | 0. | 26. | 38. | 0. | 8. | 0. | 0. | 7. | 13. | 9. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca Mg Ti | 0. | 16. | 6. | 2. | 0. | 7. | 0. | 0. | 56. | 10. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S Si Na | 16. | 0. | 5. | 26. | 0. | 38. | 0. | 0. | 4. | 2. | 8. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Si Na S | 19. | 0. | 1. | 51. | 0. | 14. | 0. | 0. | 8. | 1. | 5. | 1. | 0. | 0. | 0. | 0.9 |
| 5 | S Na Si | 25. | 0. | 7. | 15. | 0. | 34. | 0. | 0. | 11. | 2. | 5. | 0. | 0. | 0. | 0. | 0.7 |
| 3 | Na Si S | 25. | 0. | 15. | 19. | 0. | 17. | 0. | 0. | 15. | 1. | 4. | 0. | 4. | 0. | 0. | 0.3 |
| 4 | Na S Si | 35. | 0. | 10. | 15. | 0. | 25. | 0. | 0. | 9. | 3. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Si Fe S | 0. | 0. | 18. | 25. | 0. | 19. | 0. | 0. | 14. | 0. | 22. | 3. | 0. | 0. | 0. | 0.1 |
| 3 | S Fe Si | 3. | 0. | 14. | 17. | 0. | 28. | 0. | 0. | 15. | 3. | 18. | 0. | 1. | 0. | 0. | 0.3 |
| 4 | Fe S Si | 3. | 0. | 6. | 15. | 0. | 18. | 0. | 0. | 10. | 2. | 43. | 0. | 3. | 0. | 0. | 0.2 |
| 2 | S Si Fe | 0. | 0. | 10. | 23. | 0. | 31. | 0. | 1. | 16. | 0. | 19. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | Si Na Fe | 20. | 0. | 12. | 40. | 0. | 6. | 0. | 0. | 4. | 0. | 18. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe Na | 21. | 0. | 16. | 24. | 0. | 11. | 0. | 0. | 5. | 2. | 21. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Fe Si Na | 17. | 0. | 13. | 19. | 0. | 4. | 0. | 0. | 6. | 2. | 39. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Ca Mg Fe | 0. | 14. | 5. | 6. | 0. | 4. | 0. | 0. | 60. | 3. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Fe Mg | 0. | 9. | 7. | 1. | 0. | 5. | 0. | 0. | 51. | 0. | 26. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Fe Ca Al | 0. | 0. | 7. | 1. | 0. | 1. | 0. | 0. | 21. | 2. | 67. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca Al Fe | 0. | 5. | 15. | 5. | 0. | 7. | 0. | 0. | 60. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Fe Al | 0. | 0. | 13. | 2. | 0. | 5. | 0. | 0. | 48. | 0. | 31. | 0. | 1. | 0. | 0. | 0.1 |
| 6 | Ca Al Mg | 0. | 12. | 16. | 5. | 0. | 7. | 0. | 0. | 56. | 0. | 5. | 0. | 0. | 0. | 0. | 0.5 |
| 10 | Fe Si Al | 11. | 0. | 17. | 22. | 0. | 4. | 0. | 0. | 6. | 0. | 40. | 0. | 0. | 0. | 0. | 1.1 |
| 11 | Si Al Fe | 4. | 0. | 32. | 42. | 0. | 1. | 0. | 0. | 6. | 0. | 15. | 0. | 0. | 0. | 0. | 0.8 |
| 2 | Si Fe Al | 13. | 0. | 19. | 30. | 0. | 3. | 0. | 0. | 13. | 0. | 23. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Si Ti | 0. | 0. | 7. | 21. | 0. | 9. | 0. | 0. | 42. | 17. | 3. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | Fe Ti S | 0. | 0. | 0. | 6. | 0. | 24. | 0. | 0. | 0. | 30. | 40. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe S Ti | 0. | 0. | 0. | 8. | 0. | 28. | 0. | 0. | 16. | 18. | 29. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Ca Si Mg | 0. | 9. | 5. | 17. | 0. | 2. | 0. | 0. | 62. | 2. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | Ca Mg Si | 0. | 13. | 6. | 9. | 0. | 6. | 0. | 0. | 60. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 8 | S Na Fe | 24. | 0. | 7. | 10. | 0. | 30. | 0. | 0. | 12. | 0. | 15. | 0. | 2. | 0. | 0. | 0.4 |
| 3 | Fe S Na | 22. | 0. | 3. | 8. | 0. | 25. | 0. | 0. | 9. | 1. | 33. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca S Cu | 0. | 0. | 0. | 0. | 0. | 33. | 0. | 0. | 59. | 0. | 0. | 8. | 0. | 0. | 0. | 0.0 |
| 2 | S Na Ti | 23. | 0. | 3. | 5. | 0. | 39. | 0. | 0. | 9. | 18. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Fe Ti | 0. | 0. | 0. | 10. | 0. | 15. | 0. | 0. | 27. | 22. | 26. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al Zn | 0. | 0. | 39. | 48. | 0. | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 6. | 0. | 0. | 0.0 |
| 32 | OTHERS - | 13. | 2. | 15. | 17. | 0. | 16. | 0. | 0. | 12. | 1. | 22. | 0. | 0. | 0. | 0. | 2.8 |
| 1199 | TOTALS - | 12. | 2. | 14. | 23. | 0. | 12. | 0. | 0. | 25. | 1. | 11. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-5. Sample #597 PSI/SECV Beulah Lignite Ash Probe (horizontal duct) on Filter (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Ca S - | 4.6 | 8. | 35. | 31. | 26. | 0. | 0. | 0. |
| Si Na Al | 9.7 | 22. | 59. | 18. | 1. | 0. | 0. | 0. |
| Si Al Na | 11.7 | 21. | 39. | 33. | 7. | 0. | 0. | 0. |
| Si Al Ca | 4.5 | 13. | 63. | 15. | 9. | 0. | 0. | 0. |
| OTHERS - | 69.4 | 13. | 49. | 32. | 6. | 0. | 0. | 0. |
| TOTALS - | 100.0 | 15. | 49. | 30. | 7. | 0. | 0. | 0. |

## Table 3-6. Sample #598 PSI/SECV Loy Yang Test 1 Untreated; ESP Ash on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Si - - | 3. | 0. | 0. | 94. | 0. | 0. | 1. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 1.2 |
| 44 | Fe - - | 1. | 2. | 1. | 0. | 0. | 2. | 1. | 0. | 1. | 0. | 92. | 0. | 0. | 0. | 0. | 3.4 |
| 27 | Al - - | 2. | 4. | 67. | 0. | 0. | 4. | 4. | 1. | 7. | 5. | 5. | 0. | 1. | 0. | 0. | 1.5 |
| 1 | Si Mg - | 0. | 34. | 0. | 66. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg Fe - | 0. | 56. | 0. | 3. | 0. | 0. | 0. | 0. | 5. | 0. | 36. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Cl - | 0. | 0. | 0. | 4. | 0. | 0. | 25. | 0. | 0. | 0. | 71. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ti Fe - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 70. | 30. | 0. | 0. | 0. | 0. | 0.1 |
| 12 | Cl Na - | 33. | 0. | 1. | 0. | 0. | 0. | 64. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Ca Fe - | 0. | 4. | 3. | 0. | 0. | 5. | 0. | 0. | 76. | 0. | 12. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al - | 4. | 0. | 11. | 85. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Al Ti - | 0. | 2. | 56. | 0. | 0. | 1. | 0. | 1. | 3. | 35. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 6 | Ca S - | 1. | 0. | 0. | 0. | 0. | 31. | 0. | 0. | 65. | 0. | 3. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Fe S - | 5. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 5. | 0. | 79. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Cl Na | 20. | 2. | 9. | 0. | 0. | 35. | 27. | 4. | 2. | 1. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Cl S Na | 19. | 0. | 11. | 2. | 0. | 25. | 39. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 8 | Na S Cl | 37. | 2. | 9. | 1. | 0. | 25. | 16. | 1. | 2. | 1. | 6. | 0. | 0. | 0. | 0. | 1.3 |
| 3 | S Na Cl | 26. | 3. | 6. | 2. | 0. | 32. | 17. | 6. | 4. | 1. | 3. | 0. | 0. | 0. | 0. | 0.7 |
| 6 | Ca Si Fe | 0. | 3. | 7. | 19. | 0. | 0. | 0. | 0. | 59. | 0. | 12. | 0. | 0. | 0. | 0. | 0.8 |
| 7 | Ca Fe Si | 4. | 2. | 12. | 16. | 0. | 3. | 1. | 0. | 40. | 0. | 21. | 0. | 0. | 0. | 0. | 1.2 |
| 2 | Si Ca Fe | 2. | 0. | 4. | 58. | 0. | 0. | 0. | 4. | 24. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 76 | Al Mg Ca | 0. | 19. | 55. | 1. | 0. | 6. | 2. | 1. | 11. | 1. | 5. | 0. | 0. | 0. | 0. | 6.0 |
| 16 | Al Ca Mg | 1. | 11. | 57. | 0. | 0. | 7. | 3. | 1. | 14. | 0. | 5. | 0. | 0. | 0. | 0. | 1.6 |
| 2 | Mg Ca Al | 0. | 43. | 16. | 1. | 0. | 5. | 2. | 0. | 24. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 30 | Cl Na Al | 29. | 1. | 16. | 0. | 0. | 5. | 41. | 0. | 4. | 1. | 4. | 0. | 0. | 0. | 0. | 3.5 |
| 7 | Na Cl Al | 33. | 3. | 19. | 0. | 0. | 12. | 25. | 1. | 4. | 1. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 29 | Al Na Cl | 21. | 6. | 36. | 0. | 0. | 9. | 14. | 1. | 5. | 3. | 4. | 0. | 0. | 0. | 0. | 2.9 |
| 18 | Al Cl Na | 19. | 5. | 31. | 0. | 0. | 7. | 23. | 1. | 5. | 4. | 5. | 0. | 0. | 0. | 0. | 1.6 |
| 8 | Cl Al Na | 19. | 6. | 24. | 0. | 0. | 11. | 29. | 1. | 6. | 1. | 3. | 0. | 2. | 0. | 0. | 0.7 |
| 5 | Al Cl Ca | 2. | 4. | 50. | 0. | 0. | 2. | 21. | 5. | 11. | 1. | 2. | 0. | 1. | 0. | 0. | 0.2 |
| 1 | Cl Ca Si | 18. | 0. | 0. | 20. | 0. | 0. | 35. | 0. | 20. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Cl Si | 2. | 4. | 12. | 15. | 0. | 8. | 16. | 2. | 31. | 0. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Na Mg | 41. | 7. | 3. | 0. | 0. | 46. | 1. | 1. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Na Mg S | 29. | 22. | 5. | 0. | 0. | 18. | 13. | 4. | 9. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Na S Mg | 43. | 12. | 1. | 0. | 0. | 27. | 7. | 7. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 7 | Cl Na Fe | 24. | 1. | 7. | 0. | 0. | 4. | 48. | 0. | 1. | 0. | 15. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Cl S K | 0. | 0. | 7. | 4. | 4. | 30. | 44. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | Si Ca Al | 3. | 0. | 22. | 38. | 0. | 0. | 0. | 2. | 29. | 0. | 5. | 0. | 0. | 0. | 0. | 0.7 |
| 26 | Ca Si Al | 1. | 1. | 17. | 24. | 0. | 1. | 1. | 0. | 44. | 1. | 8. | 0. | 0. | 0. | 0. | 2.1 |
| 9 | Ca Al Si | 0. | 3. | 18. | 15. | 0. | 8. | 4. | 1. | 40. | 2. | 9. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | Si Al Ca | 3. | 0. | 31. | 41. | 0. | 0. | 0. | 4. | 15. | 1. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 24 | Al S Mg | 3. | 16. | 45. | 0. | 0. | 19. | 4. | 1. | 7. | 1. | 3. | 0. | 0. | 0. | 0. | 1.8 |
| 2 | S Mg Al | 0. | 34. | 28. | 0. | 0. | 34. | 1. | 1. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 43 | Al Mg S | 0. | 20. | 52. | 0. | 0. | 12. | 1. | 2. | 6. | 1. | 5. | 0. | 0. | 0. | 0. | 4.2 |
| 1 | S Ca Fe | 4. | 0. | 0. | 0. | 0. | 46. | 0. | 0. | 43. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe S Ca | 2. | 9. | 0. | 0. | 0. | 24. | 10. | 4. | 19. | 0. | 32. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | Ca S Fe | 0. | 0. | 0. | 0. | 0. | 30. | 1. | 0. | 49. | 0. | 19. | 0. | 0. | 0. | 0. | 0.5 |
| 7 | Fe Ca S | 1. | 6. | 6. | 2. | 0. | 12. | 2. | 1. | 23. | 0. | 46. | 1. | 0. | 0. | 0. | 0.4 |
| 2 | Ca Fe S | 2. | 12. | 0. | 0. | 0. | 16. | 0. | 1. | 45. | 0. | 24. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Mg S | 0. | 25. | 0. | 47. | 0. | 14. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 21 | Fe Ca Mg | 0. | 17. | 2. | 0. | 0. | 2. | 0. | 0. | 29. | 0. | 50. | 0. | 0. | 0. | 0. | 1.9 |
| 5 | Mg Ca Fe | 0. | 61. | 4. | 5. | 0. | 1. | 0. | 0. | 20. | 0. | 10. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Cl Al | 0. | 0. | 20. | 0. | 0. | 44. | 30. | 2. | 3. | 0. | 0. | 1. | 0. | 0. | 0. | 0.1 |
| 11 | Al Cl S | 0. | 3. | 56. | 0. | 0. | 11. | 17. | 1. | 4. | 4. | 3. | 0. | 1. | 0. | 0. | 0.7 |
| 5 | Cl S Al | 0. | 0. | 25. | 0. | 1. | 30. | 33. | 10. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0.4 |

## Table 3-6. Sample #598 PSI/SECV Loy Yang Test 1 Untreated; ESP Ash on Filter (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Al | Fe | Ca | 6. | 3. | 48. | 5. | 0. | 6. | 1. | 0. | 11. | 0. | 19. | 0. | 0. | 0. | 0. | 0.7 |
| 8 | Al | Ca | Fe | 3. | 7. | 52. | 2. | 0. | 4. | 1. | 0. | 16. | 2. | 12. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Ca | Al | Fe | 2. | 4. | 14. | 7. | 0. | 8. | 1. | 0. | 51. | 1. | 11. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg | Cl | S | 0. | 41. | 11. | 0. | 0. | 19. | 23. | 4. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ti | A | Na | 15. | 2. | 23. | 1. | 1. | 5. | 10. | 3. | 2. | 37. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Al | Na | Ti | 19. | 0. | 38. | 1. | 0. | 10. | 8. | 5. | 2. | 13. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S | Al | Na | 22. | 0. | 22. | 0. | 0. | 26. | 11. | 7. | 6. | 0. | 2. | 2. | 1. | 0. | 0. | 0.0 |
| 10 | Na | Al | S | 30. | 6. | 25. | 0. | 0. | 17. | 7. | 1. | 5. | 2. | 6. | 0. | 0. | 0. | 0. | 1.4 |
| 10 | Al | S | Na | 17. | 8. | 39. | 1. | 0. | 18. | 1. | 1. | 11. | 2. | 2. | 0. | 0. | 0. | 0. | 0.8 |
| 10 | S | Na | Al | 34. | 1. | 15. | 0. | 0. | 37. | 2. | 2. | 5. | 1. | 2. | 0. | 0. | 0. | 0. | 1.1 |
| 37 | Al | Na | S | 23. | 5. | 39. | 0. | 0. | 16. | 3. | 1. | 5. | 2. | 5. | 0. | 0. | 0. | 0. | 4.6 |
| 6 | Al | Si | Ti | 10. | 1. | 36. | 27. | 0. | 0. | 0. | 0. | 3. | 19. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Al | Ti | Si | 3. | 5. | 43. | 16. | 0. | 0. | 1. | 1. | 1. | 27. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ti | Al | Si | 9. | 0. | 27. | 15. | 0. | 0. | 0. | 0. | 3. | 43. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Fe | S | Na | 13. | 0. | 3. | 0. | 0. | 13. | 6. | 0. | 9. | 0. | 55. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Na | Fe | S | 33. | 4. | 8. | 0. | 0. | 25. | 3. | 0. | 0. | 0. | 27. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | S | Na | Fe | 32. | 2. | 4. | 1. | 0. | 37. | 0. | 2. | 7. | 0. | 14. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Al | Cl | Ti | 1. | 0. | 54. | 0. | 0. | 8. | 20. | 1. | 2. | 12. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 6 | Al | Ti | Cl | 0. | 1. | 48. | 1. | 0. | 2. | 11. | 0. | 8. | 21. | 7. | 0. | 0. | 0. | 0. | 0.6 |
| 3 | Ti | Al | Cl | 4. | 5. | 31. | 0. | 0. | 1. | 13. | 0. | 5. | 37. | 6. | 0. | 0. | 0. | 0. | 0.3 |
| 9 | Si | Al | Na | 13. | 2. | 24. | 49. | 0. | 3. | 1. | 1. | 5. | 2. | 1. | 0. | 0. | 0. | 0. | 0.6 |
| 10 | Al | Mg | Cl | 1. | 19. | 52. | 0. | 1. | 7. | 10. | 0. | 5. | 3. | 2. | 0. | 0. | 0. | 0. | 1.6 |
| 1 | S | Mg | K | 0. | 19. | 10. | 13. | 0. | 21. | 10. | 17. | 0. | 0. | 0. | 9. | 0. | 0. | 0. | 0.0 |
| 1 | S | K | Mg | 0. | 15. | 10. | 0. | 0. | 40. | 0. | 21. | 9. | 4. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al | Cl | Fe | 3. | 4. | 53. | 0. | 0. | 3. | 22. | 3. | 4. | 0. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 16 | Al | Ti | Ca | 0. | 2. | 55. | 1. | 0. | 3. | 0. | 0. | 10. | 22. | 6. | 0. | 0. | 0. | 0. | 2.3 |
| 5 | Al | Ca | Ti | 0. | 1. | 60. | 0. | 0. | 3. | 2. | 0. | 14. | 12. | 8. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Si | Ca | S | 9. | 0. | 6. | 42. | 0. | 11. | 0. | 0. | 24. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Na | Mg | 28. | 16. | 4. | 0. | 0. | 2. | 40. | 0. | 4. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 11 | Al | Ti | Fe | 1. | 4. | 53. | 0. | 0. | 2. | 2. | 1. | 5. | 21. | 10. | 0. | 1. | 0. | 0. | 0.6 |
| 2 | Ti | Al | Fe | 0. | 4. | 27. | 0. | 0. | 3. | 0. | 0. | 5. | 48. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe | Al | Ti | 0. | 2. | 30. | 0. | 0. | 4. | 0. | 4. | 1. | 14. | 42. | 0. | 3. | 0. | 0. | 0.1 |
| 2 | Si | Fe | Al | 3. | 0. | 22. | 33. | 0. | 0. | 5. | 1. | 8. | 0. | 26. | 1. | 0. | 0. | 0. | 0.1 |
| 6 | Fe | Al | Mg | 0. | 19. | 22. | 4. | 1. | 5. | 1. | 0. | 10. | 1. | 38. | 0. | 0. | 0. | 0. | 0.3 |
| 31 | Al | Mg | Fe | 0. | 18. | 52. | 0. | 0. | 7. | 1. | 1. | 6. | 1. | 11. | 0. | 1. | 0. | 0. | 2.1 |
| 5 | Al | S | Fe | 2. | 6. | 44. | 0. | 0. | 21. | 6. | 0. | 3. | 1. | 17. | 0. | 1. | 0. | 0. | 0.4 |
| 2 | Al | Fe | S | 0. | 10. | 51. | 0. | 0. | 12. | 1. | 0. | 8. | 0. | 17. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Al | Mg | Na | 13. | 16. | 37. | 2. | 0. | 9. | 4. | 0. | 8. | 2. | 6. | 0. | 1. | 0. | 0. | 0.4 |
| 4 | Al | K | S | 0. | 1. | 45. | 1. | 0. | 19. | 0. | 25. | 5. | 2. | 1. | 2. | 1. | 0. | 0. | 0.1 |
| 18 | Al | S | Ca | 0. | 4. | 51. | 0. | 0. | 19. | 1. | 1. | 14. | 3. | 6. | 0. | 1. | 0. | 0. | 0.7 |
| 1 | Si | Mg | Ca | 0. | 30. | 9. | 34. | 0. | 0. | 0. | 0. | 15. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Fe | Ca | 12. | 13. | 0. | 0. | 0. | 4. | 34. | 0. | 16. | 0. | 20. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al | S | Cu | 0. | 0. | 62. | 0. | 0. | 17. | 0. | 0. | 7. | 6. | 0. | 7. | 0. | 0. | 0. | 0.1 |
| 1 | Cl | Al | K | 0. | 0. | 23. | 0. | 0. | 11. | 46. | 12. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | S | Ti | 0. | 3. | 4. | 0. | 0. | 12. | 3. | 0. | 5. | 7. | 65. | 0. | 0. | 0. | 0. | 0.0 |
| 354 | OTHERS - | | | 10. | 9. | 26. | 8. | 0. | 10. | 6. | 1. | 12. | 3. | 15. | 0. | 0. | 0. | 0. | 30.6 |
| 1177 | TOTALS - | | | 10. | 8. | 30. | 6. | 0. | 10. | 7. | 1. | 11. | 3. | 13. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-6. Sample #598 PSI/SECV Loy Yang Test 1 Untreated; ESP Ash on Filter (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Al Mg Ca | 6.0 | 27. | 29. | 26. | 17. | 1. | 0. | 0. |
| Al Na S | 4.6 | 12. | 67. | 15. | 6. | 0. | 0. | 0. |
| Al Mg S | 4.2 | 22. | 43. | 23. | 12. | 0. | 0. | 0. |
| OTHERS - | 30.6 | 25. | 37. | 21. | 16. | 0. | 0. | 0. |
| OTHERS - | 54.6 | 14. | 35. | 26. | 21. | 4. | 0. | 0. |
| TOTALS - | 100.0 | 19. | 37. | 24. | 18. | 2. | 0. | 0. |

# Table 3-7. Sample #599 PSI/SECV Loy Yang Test 4 Untreated; ESP Ash on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Fe - - | 1. | 1. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 95. | 0. | 2. | 0. | 0. | 0.9 |
| 7 | Si - - | 5. | 0. | 0. | 90. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0.5 |
| 1 | Cl - - | 9. | 3. | 3. | 5. | 0. | 0. | 64. | 0. | 6. | 0. | 6. | 0. | 2. | 0. | 0. | 0.0 |
| 1 | Al - - | 0. | 9. | 56. | 0. | 0. | 7. | 9. | 0. | 5. | 5. | 0. | 0. | 8. | 0. | 0. | 0.1 |
| 5 | Ca S - | 0. | 0. | 0. | 0. | 0. | 47. | 0. | 0. | 53. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Si Al - | 1. | 0. | 30. | 65. | 0. | 0. | 1. | 0. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 0.1 |
| 1 | Cu Zn - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 75. | 25. | 0. | 0. | 0.0 |
| 34 | Cl Na - | 33. | 1. | 3. | 0. | 0. | 2. | 59. | 0. | 1. | 0. | 1. | 0. | 1. | 0. | 0. | 3.2 |
| 1 | Si Cl - | 4. | 0. | 0. | 85. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 64 | Al Mg Zn | 1. | 22. | 48. | 1. | 0. | 4. | 4. | 0. | 3. | 1. | 4. | 0. | 10. | 0. | 0. | 5.2 |
| 12 | Mg Al Zn | 0. | 37. | 24. | 1. | 0. | 5. | 5. | 0. | 9. | 1. | 4. | 0. | 13. | 0. | 0. | 1.1 |
| 4 | Si Al Na | 15. | 8. | 23. | 38. | 0. | 0. | 1. | 0. | 5. | 0. | 6. | 0. | 4. | 0. | 0. | 0.5 |
| 14 | Si Na Al | 18. | 3. | 12. | 53. | 0. | 1. | 3. | 0. | 2. | 0. | 4. | 0. | 3. | 0. | 0. | 1.3 |
| 16 | Mg Al Cl | 4. | 37. | 26. | 1. | 0. | 5. | 12. | 0. | 7. | 0. | 2. | 0. | 4. | 0. | 0. | 0.9 |
| 69 | Al Mg Cl | 2. | 22. | 40. | 1. | 0. | 5. | 13. | 1. | 6. | 0. | 4. | 0. | 5. | 0. | 0. | 6.1 |
| 37 | Al Cl Mg | 5. | 15. | 38. | 1. | 0. | 5. | 20. | 1. | 3. | 1. | 3. | 0. | 7. | 0. | 0. | 3.3 |
| 11 | Mg Cl Al | 6. | 35. | 13. | 2. | 0. | 6. | 20. | 0. | 8. | 1. | 4. | 1. | 3. | 0. | 0. | 1.0 |
| 14 | Cl Al Mg | 4. | 16. | 21. | 3. | 0. | 10. | 31. | 0. | 5. | 0. | 3. | 0. | 5. | 0. | 0. | 1.8 |
| 4 | Cl Mg Al | 10. | 24. | 14. | 1. | 0. | 8. | 29. | 0. | 8. | 0. | 4. | 0. | 1. | 0. | 0. | 0.4 |
| 5 | Mg Si Ca | 0. | 37. | 9. | 26. | 0. | 0. | 1. | 0. | 14. | 1. | 8. | 0. | 4. | 0. | 0. | 0.4 |
| 6 | Si Mg Ca | 4. | 27. | 9. | 40. | 0. | 0. | 0. | 0. | 12. | 0. | 6. | 0. | 2. | 0. | 0. | 0.3 |
| 2 | Mg Ca Si | 0. | 39. | 8. | 16. | 0. | 1. | 4. | 0. | 16. | 0. | 10. | 0. | 5. | 0. | 0. | 0.1 |
| 1 | Cl K Na | 13. | 0. | 0. | 0. | 0. | 10. | 53. | 20. | 0. | 0. | 0. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | S Cl Na | 14. | 9. | 0. | 0. | 0. | 60. | 14. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0.0 |
| 26 | Cl Na S | 28. | 5. | 6. | 1. | 0. | 15. | 39. | 0. | 1. | 0. | 3. | 0. | 2. | 0. | 0. | 3.1 |
| 7 | Cl S Na | 18. | 10. | 8. | 2. | 0. | 22. | 32. | 1. | 2. | 0. | 1. | 0. | 4. | 0. | 0. | 0.5 |
| 11 | Na Cl S | 36. | 3. | 6. | 1. | 0. | 16. | 30. | 0. | 3. | 1. | 2. | 0. | 1. | 0. | 0. | 0.9 |
| 1 | Ca S Al | 0. | 16. | 16. | 0. | 0. | 24. | 0. | 0. | 32. | 0. | 8. | 0. | 3. | 0. | 0. | 0.0 |
| 2 | Cl Fe Na | 15. | 3. | 10. | 7. | 0. | 8. | 30. | 0. | 0. | 0. | 22. | 0. | 5. | 0. | 0. | 0.1 |
| 62 | Al Mg Ca | 1. | 26. | 44. | 2. | 0. | 4. | 3. | 1. | 12. | 0. | 4. | 0. | 3. | 0. | 0. | 5.3 |
| 38 | Mg Al Ca | 0. | 39. | 29. | 4. | 0. | 3. | 3. | 0. | 13. | 0. | 6. | 0. | 3. | 0. | 0. | 3.2 |
| 13 | Mg Ca Al | 0. | 46. | 13. | 4. | 0. | 3. | 5. | 0. | 19. | 0. | 8. | 0. | 2. | 0. | 0. | 1.7 |
| 1 | Cl Fe Mg | 4. | 13. | 7. | 2. | 0. | 5. | 34. | 0. | 5. | 0. | 27. | 0. | 2. | 0. | 0. | 0.0 |
| 1 | Mg Si Fe | 0. | 35. | 12. | 22. | 0. | 0. | 0. | 0. | 14. | 0. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Fe Mg | 7. | 14. | 8. | 23. | 0. | 5. | 7. | 0. | 12. | 4. | 16. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Al Ca Fe | 0. | 7. | 52. | 0. | 0. | 0. | 6. | 0. | 19. | 0. | 13. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Fe Al Ca | 0. | 15. | 20. | 12. | 0. | 0. | 4. | 0. | 15. | 0. | 30. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Na K Ca | 49. | 0. | 9. | 0. | 0. | 7. | 8. | 16. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 8 | Na S Mg | 36. | 16. | 5. | 0. | 0. | 32. | 6. | 1. | 3. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 17 | S Na Mg | 28. | 13. | 6. | 0. | 0. | 43. | 4. | 0. | 4. | 0. | 1. | 0. | 1. | 0. | 0. | 1.1 |
| 15 | S Mg Na | 19. | 25. | 5. | 1. | 0. | 40. | 4. | 1. | 1. | 0. | 1. | 0. | 3. | 0. | 0. | 1.1 |
| 1 | S Cl K | 0. | 9. | 5. | 0. | 0. | 34. | 26. | 10. | 6. | 4. | 0. | 0. | 4. | 0. | 0. | 0.0 |
| 52 | Al Mg S | 1. | 24. | 45. | 1. | 0. | 12. | 3. | 0. | 5. | 1. | 3. | 1. | 4. | 0. | 0. | 4.2 |
| 20 | Al S Mg | 3. | 17. | 42. | 1. | 0. | 20. | 5. | 1. | 5. | 0. | 3. | 0. | 5. | 0. | 0. | 2.1 |
| 10 | S Mg Al | 10. | 22. | 16. | 1. | 0. | 31. | 6. | 1. | 2. | 3. | 2. | 0. | 5. | 0. | 0. | 0.8 |
| 1 | S Al Mg | 15. | 19. | 24. | 0. | 0. | 36. | 0. | 0. | 3. | 0. | 0. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | S Ca Mg | 6. | 13. | 0. | 0. | 0. | 54. | 4. | 4. | 14. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ti Al Mg | 0. | 13. | 26. | 1. | 0. | 1. | 2. | 0. | 7. | 43. | 5. | 0. | 2. | 0. | 0. | 0.2 |
| 1 | Al Ti Mg | 0. | 21. | 48. | 0. | 0. | 0. | 0. | 0. | 4. | 24. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 20 | Al Mg Fe | 1. | 22. | 47. | 1. | 0. | 5. | 5. | 1. | 5. | 0. | 10. | 0. | 4. | 0. | 0. | 1.8 |
| 3 | Al Fe Mg | 0. | 18. | 40. | 0. | 0. | 1. | 1. | 0. | 10. | 0. | 26. | 0. | 4. | 0. | 0. | 0.2 |
| 2 | Al S Na | 17. | 12. | 31. | 0. | 0. | 24. | 2. | 0. | 5. | 1. | 3. | 0. | 5. | 0. | 0. | 0.1 |
| 4 | Mg Ca Fe | 0. | 48. | 2. | 4. | 0. | 2. | 1. | 0. | 32. | 0. | 10. | 0. | 1. | 0. | 0. | 0.9 |
| 15 | Al Cl Zn | 5. | 9. | 34. | 0. | 0. | 6. | 23. | 0. | 3. | 0. | 3. | 0. | 15. | 0. | 0. | 1.2 |

Table 3-7. Sample #599 PSI/SECV Loy Yang Test 4 Untreated; ESP Ash on Filter (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Al | Zn | Cl | 4. | 13. | 33. | 0. | 0. | 7. | 15. | 0. | 4. | 2. | 3. | 1. | 18. | 0. | 0. | 0.2 |
| 3 | Zn | Al | Cl | 11. | 3. | 20. | 8. | 1. | 12. | 15. | 1. | 0. | 0. | 4. | 0. | 24. | 0. | 0. | 0.7 |
| 2 | Cl | Al | Zn | 11. | 6. | 21. | 0. | 0. | 8. | 38. | 0. | 3. | 0. | 2. | 0. | 12. | 0. | 0. | 0.2 |
| 1 | S | Ca | Cu | 0. | 0. | 0. | 10. | 0. | 63. | 0. | 0. | 17. | 0. | 0. | 10. | 0. | 0. | 0. | 0.0 |
| 4 | S | Mg | Cl | 5. | 23. | 6. | 2. | 0. | 38. | 15. | 0. | 4. | 0. | 0. | 0. | 7. | 0. | 0. | 0.3 |
| 3 | Cl | S | Mg | 0. | 20. | 1. | 0. | 0. | 30. | 42. | 6. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 1.0 |
| 1 | Cl | Al | Cu | 0. | 12. | 27. | 3. | 0. | 0. | 29. | 0. | 3. | 0. | 0. | 14. | 12. | 0. | 0. | 0.0 |
| 1 | Si | Ca | Fe | 0. | 15. | 8. | 35. | 0. | 0. | 0. | 0. | 23. | 0. | 16. | 0. | 2. | 0. | 0. | 0.0 |
| 1 | S | Ca | Si | 0. | 0. | 18. | 22. | 0. | 30. | 0. | 0. | 24. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Al | Fe | 0. | 14. | 19. | 0. | 0. | 13. | 24. | 0. | 3. | 0. | 15. | 0. | 14. | 0. | 0. | 0.0 |
| 1 | Fe | Ti | Al | 8. | 3. | 18. | 13. | 0. | 0. | 8. | 0. | 3. | 22. | 22. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Ti | Fe | Al | 0. | 3. | 16. | 12. | 0. | 0. | 3. | 0. | 5. | 29. | 27. | 0. | 4. | 0. | 0. | 0.0 |
| 2 | Cl | Fe | S | 0. | 7. | 10. | 2. | 0. | 11. | 35. | 1. | 4. | 0. | 23. | 0. | 6. | 0. | 0. | 0.0 |
| 2 | Cl | S | Zn | 1. | 1. | 7. | 2. | 0. | 29. | 40. | 1. | 5. | 0. | 5. | 0. | 10. | 0. | 0. | 0.1 |
| 1 | Al | Ca | Cl | 0. | 7. | 44. | 0. | 0. | 9. | 10. | 0. | 10. | 0. | 9. | 0. | 9. | 0. | 0. | 0.0 |
| 4 | Al | Cl | S | 1. | 9. | 35. | 0. | 0. | 15. | 25. | 1. | 11. | 1. | 0. | 0. | 2. | 0. | 0. | 0.4 |
| 2 | Cl | Al | S | 1. | 3. | 27. | 0. | 0. | 18. | 40. | 7. | 1. | 0. | 1. | 0. | 2. | 0. | 0. | 0.1 |
| 20 | Cl | Al | Na | 17. | 9. | 23. | 1. | 0. | 5. | 33. | 0. | 3. | 0. | 2. | 0. | 6. | 0. | 0. | 2.3 |
| 41 | Cl | Na | Al | 26. | 5. | 13. | 1. | 0. | 4. | 42. | 0. | 2. | 0. | 2. | 0. | 4. | 0. | 0. | 4.2 |
| 11 | Al | Na | Cl | 19. | 5. | 42. | 1. | 0. | 8. | 14. | 1. | 4. | 0. | 3. | 0. | 4. | 0. | 0. | 1.6 |
| 1 | Cl | Si | Ca | 9. | 3. | 0. | 12. | 0. | 0. | 61. | 0. | 11. | 0. | 2. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Si | Ca | Cl | 0. | 0. | 3. | 45. | 0. | 6. | 14. | 2. | 20. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Cl | Zn | 8. | 0. | 0. | 71. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Mg | Zn | S | 0. | 53. | 2. | 4. | 0. | 13. | 4. | 0. | 7. | 0. | 4. | 0. | 13. | 0. | 0. | 0.1 |
| 1 | S | Na | Zn | 19. | 0. | 5. | 6. | 0. | 42. | 11. | 2. | 0. | 0. | 0. | 0. | 15. | 0. | 0. | 0.0 |
| 3 | Al | Na | Ca | 19. | 9. | 45. | 2. | 0. | 8. | 1. | 1. | 9. | 0. | 5. | 0. | 1. | 0. | 0. | 0.3 |
| 3 | Si | Na | Cl | 23. | 0. | 6. | 49. | 0. | 2. | 16. | 0. | 1. | 0. | 1. | 0. | 3. | 0. | 0. | 0.2 |
| 1 | Na | Cl | Si | 25. | 7. | 8. | 13. | 0. | 12. | 21. | 0. | 3. | 0. | 3. | 0. | 7. | 0. | 0. | 0.0 |
| 1 | S | Si | Zn | 0. | 10. | 8. | 16. | 0. | 23. | 11. | 0. | 11. | 0. | 6. | 0. | 14. | 0. | 0. | 0.1 |
| 1 | Zn | Al | Si | 0. | 5. | 31. | 26. | 0. | 0. | 0. | 0. | 2. | 3. | 2. | 0. | 31. | 0. | 0. | 0.1 |
| 5 | Si | Mg | Al | 5. | 21. | 13. | 33. | 0. | 2. | 3. | 0. | 8. | 1. | 6. | 0. | 8. | 0. | 0. | 0.2 |
| 13 | Al | Mg | Si | 0. | 22. | 43. | 12. | 0. | 1. | 2. | 0. | 6. | 1. | 5. | 1. | 6. | 0. | 0. | 1.6 |
| 5 | Mg | Si | Al | 0. | 40. | 15. | 22. | 0. | 0. | 3. | 0. | 12. | 0. | 6. | 0. | 2. | 0. | 0. | 0.3 |
| 1 | Si | Al | Mg | 14. | 15. | 23. | 25. | 0. | 14. | 2. | 0. | 4. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Cl | Mg | Na | 16. | 22. | 8. | 3. | 0. | 6. | 32. | 0. | 7. | 0. | 4. | 0. | 2. | 0. | 0. | 0.5 |
| 9 | Cl | Na | Mg | 23. | 14. | 11. | 1. | 0. | 6. | 35. | 1. | 3. | 0. | 2. | 0. | 2. | 0. | 0. | 0.4 |
| 1 | Na | Cl | Zn | 41. | 0. | 0. | 0. | 0. | 0. | 37. | 0. | 9. | 0. | 0. | 0. | 13. | 0. | 0. | 0.0 |
| 2 | Cl | Zn | Na | 16. | 8. | 7. | 5. | 0. | 9. | 29. | 0. | 5. | 0. | 1. | 3. | 18. | 0. | 0. | 0.2 |
| 2 | Mg | Ca | Zn | 0. | 36. | 11. | 2. | 0. | 5. | 4. | 0. | 21. | 0. | 8. | 0. | 13. | 0. | 0. | 0.1 |
| 1 | Cl | Zn | K | 0. | 0. | 0. | 0. | 0. | 0. | 61. | 14. | 11. | 0. | 0. | 0. | 14. | 0. | 0. | 0.2 |
| 3 | Fe | Cl | Zn | 2. | 0. | 1. | 0. | 0. | 0. | 33. | 0. | 0. | 0. | 52. | 0. | 13. | 0. | 0. | 0.2 |
| 2 | Si | Zn | Na | 9. | 0. | 0. | 73. | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 16. | 0. | 0. | 0.1 |
| 2 | Si | Mg | Na | 12. | 18. | 7. | 35. | 0. | 3. | 7. | 0. | 8. | 1. | 4. | 0. | 4. | 0. | 0. | 0.1 |
| 1 | S | Ca | Cl | 8. | 11. | 9. | 9. | 0. | 21. | 12. | 0. | 20. | 0. | 3. | 0. | 6. | 0. | 0. | 0.1 |
| 3 | Mg | Ca | Cl | 0. | 53. | 5. | 1. | 0. | 4. | 11. | 1. | 15. | 0. | 9. | 0. | 1. | 0. | 0. | 0.4 |
| 322 | OTHERS - | | | 13. | 14. | 20. | 8. | 0. | 12. | 12. | 1. | 6. | 1. | 5. | 0. | 7. | 0. | 0. | 26.4 |
| 1165 | TOTALS - | | | 10. | 17. | 25. | 5. | 0. | 10. | 15. | 1. | 6. | 1. | 5. | 0. | 5. | 0. | 0. | 100.0 |

# Table 3-7. Sample #599 PSI/SECV Loy Yang Test 4 Untreated; ESP Ash on Filter (Continued)

| SPECIES | Volume % | Volume DISTRIBUTION<br>0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Al Mg Zn | 5.2 | 24. | 29. | 27. | 18. | 1. | 0. | 0. |
| Al Mg Cl | 6.1 | 8. | 17. | 40. | 31. | 4. | 0. | 0. |
| Al Mg Ca | 5.3 | 14. | 28. | 27. | 29. | 2. | 0. | 0. |
| Al Mg S | 4.2 | 29. | 13. | 41. | 15. | 1. | 0. | 0. |
| Cl Na Al | 4.2 | 10. | 40. | 38. | 12. | 0. | 0. | 0. |
| OTHERS - | 26.4 | 22. | 21. | 34. | 23. | 0. | 0. | 0. |
| OTHERS - | 48.7 | 9. | 25. | 33. | 29. | 4. | 0. | 0. |
| TOTALS - | 100.0 | 14. | 24. | 34. | 26. | 2. | 0. | 0. |

# Table 3-8. Sample #600 PSI/SECV Loy Yang Test 3 (Treated) ESP Ash on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Si - - | 4. | 1. | 3. | 89. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 0. | 0.5 |
| 1 | Ti - - | 0. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 95. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe - - | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 93. | 0. | 6. | 0. | 0. | 0.2 |
| 1 | Al - - | 0. | 10. | 60. | 4. | 0. | 7. | 5. | 0. | 5. | 0. | 0. | 0. | 9. | 0. | 0. | 0.1 |
| 15 | Al Mg - | 0. | 31. | 56. | 0. | 0. | 1. | 3. | 0. | 2. | 0. | 2. | 1. | 2. | 0. | 0. | 1.7 |
| 2 | Fe Zn - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 82. | 0. | 18. | 0. | 0. | 0.2 |
| 1 | Cl Na - | 38. | 0. | 0. | 0. | 0. | 2. | 57. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 253 | Al Mg Zn | 1. | 25. | 43. | 1. | 0. | 5. | 4. | 0. | 3. | 1. | 4. | 0. | 13. | 0. | 0. | 20.2 |
| 199 | Al Zn Mg | 1. | 16. | 39. | 2. | 0. | 5. | 4. | 0. | 3. | 1. | 5. | 0. | 24. | 0. | 0. | 17.3 |
| 97 | Zn Al Mg | 1. | 14. | 27. | [illegible] | 0. | 5. | 5. | 0. | 2. | 1. | 4. | 0. | 37. | 0. | 0. | 8.3 |
| 2 | Mg Zn Al | 0. | 27. | 23. | 0. | 0. | 8. | 1. | 0. | 6. | 0. | 11. | 0. | 24. | 0. | 0. | 0.1 |
| 15 | Mg Al Zn | 1. | 40. | 30. | 1. | 0. | 5. | 3. | 0. | 3. | 0. | 2. | 0. | 15. | 0. | 0. | 0.7 |
| 4 | Zn Mg Al | 0. | 24. | 21. | 0. | 0. | 4. | 0. | 0. | 1. | 2. | 2. | 0. | 46. | 0. | 0. | 0.1 |
| 3 | Si Mg Fe | 0. | 32. | 8. | 35. | 0. | 0. | 0. | 0. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Si Mg | 0. | 24. | 8. | 34. | 0. | 0. | 0. | 0. | 0. | 0. | 35. | 0. | 0. | 0. | 0. | 0.2 |
| 36 | Al Zn Cl | 1. | 7. | 39. | 1. | 0. | 5. | 13. | 0. | 2. | 0. | 2. | 0. | 29. | 0. | 0. | 4.3 |
| 5 | Al Cl Zn | 2. | 10. | 34. | 0. | 0. | 8. | 21. | 2. | 3. | 0. | 2. | 0. | 17. | 0. | 0. | 0.5 |
| 58 | Zn Al Cl | 2. | 7. | 21. | 0. | 0. | 7. | 13. | 1. | 1. | 0. | 3. | 0. | 44. | 0. | 0. | 5.7 |
| 28 | Zn Cl Al | 2. | 7. | 14. | 0. | 1. | 10. | 19. | 0. | 1. | 0. | 2. | 0. | 45. | 0. | 0. | 3.1 |
| 2 | Cl Al Zn | 12. | 9. | 24. | 0. | 0. | 4. | 28. | 0. | 1. | 1. | 2. | 0. | 20. | 0. | 0. | 0.3 |
| 4 | Cl Zn Al | 2. | 2. | 20. | 0. | 2. | 5. | 36. | 2. | 2. | 0. | 1. | 0. | 26. | 0. | 0. | 0.2 |
| 11 | Al Mg Cl | 0. | 26. | 45. | 0. | 0. | 6. | 12. | 4. | 2. | 0. | 1. | 0. | 3. | 0. | 0. | 1.0 |
| 4 | Mg Al Cl | 4. | 36. | 25. | 0. | 0. | 4. | 12. | 0. | 6. | 0. | 4. | 0. | 9. | 0. | 0. | 1.1 |
| 2 | Al Cl Mg | 6. | 18. | 33. | 0. | 0. | 2. | 24. | 0. | 0. | 4. | 5. | 0. | 6. | 0. | 0. | 0.1 |
| 14 | Al Mg Ti | 1. | 25. | 48. | 2. | 0. | 1. | 0. | 1. | 4. | 10. | 3. | 1. | 4. | 0. | 0. | 0.9 |
| 1 | Ti Al Mg | 0. | 10. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 68. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al Ti Mg | 1. | 16. | 49. | 2. | 0. | 2. | 0. | 0. | 3. | 19. | 3. | 0. | 6. | 0. | 0. | 0.2 |
| 1 | Mg Al Ti | 0. | 38. | 33. | 0. | 0. | 5. | 0. | 0. | 0. | 11. | 5. | 0. | 7. | 0. | 0. | 0.1 |
| 4 | Al Fe Mg | 1. | 17. | 41. | 2. | 0. | 3. | 0. | 0. | 3. | 0. | 26. | 0. | 7. | 0. | 0. | 0.2 |
| 3 | Mg Al Fe | 0. | 41. | 31. | 0. | 0. | 5. | 1. | 0. | 6. | 0. | 9. | 0. | 6. | 0. | 0. | 0.4 |
| 14 | Al Mg Fe | 0. | 27. | 46. | 1. | 0. | 4. | 2. | 0. | 2. | 1. | 12. | 1. | 4. | 0. | 0. | 0.9 |
| 4 | Fe Al Mg | 0. | 14. | 27. | 0. | 2. | 7. | 0. | 0. | 8. | 0. | 33. | 0. | 9. | 0. | 0. | 0.6 |
| 37 | Al Mg S | 1. | 28. | 44. | 1. | 0. | 9. | 2. | 1. | 4. | 1. | 2. | 0. | 6. | 0. | 0. | 2.4 |
| 5 | Al S Mg | 10. | 15. | 34. | 1. | 0. | 18. | 2. | 0. | 7. | 2. | 3. | 0. | 8. | 0. | 0. | 0.5 |
| 2 | Mg Al S | 0. | 36. | 35. | 0. | 0. | 13. | 3. | 0. | 2. | 0. | 5. | 0. | 7. | 0. | 0. | 0.1 |
| 2 | Mg Al Si | 0. | 34. | 30. | 12. | 0. | 0. | 0. | 0. | 5. | 2. | 5. | 2. | 11. | 0. | 0. | 0.0 |
| 11 | Al Mg Si | 2. | 21. | 44. | 14. | 0. | 1. | 1. | 1. | 4. | 1. | 3. | 0. | 7. | 0. | 0. | 0.9 |
| 1 | Si Mg Al | 0. | 26. | 19. | 34. | 0. | 0. | 0. | 2. | 0. | 0. | 13. | 0. | 6. | 0. | 0. | 0.0 |
| 3 | Si Al Mg | 2. | 9. | 21. | 54. | 0. | 1. | 0. | 0. | 4. | 2. | 2. | 0. | 4. | 0. | 0. | 0.2 |
| 6 | Al Si Mg | 3. | 17. | 36. | 22. | 0. | 0. | 0. | 0. | 6. | 2. | 7. | 0. | 5. | 0. | 0. | 0.8 |
| 3 | Al Zn Ti | 0. | 1. | 56. | 5. | 0. | 6. | 0. | 5. | 7. | 8. | 1. | 0. | 12. | 0. | 0. | 0.4 |
| 3 | Al Ti Zn | 0. | 7. | 32. | 0. | 0. | 2. | 0. | 0. | 7. | 28. | 3. | 0. | 20. | 0. | 0. | 0.1 |
| 2 | Zn Al Ti | 0. | 1. | 26. | 0. | 0. | 1. | 1. | 0. | 4. | 20. | 4. | 0. | 44. | 0. | 0. | 0.3 |
| 1 | Ti Al Zn | 4. | 7. | 26. | 0. | 0. | 0. | 0. | 0. | 3. | 48. | 3. | 0. | 8. | 0. | 0. | 0.0 |
| 14 | Al Mg Ca | 0. | 28. | 47. | 0. | 0. | 3. | 2. | 0. | 10. | 0. | 5. | 0. | 4. | 0. | 0. | 0.9 |
| 2 | S Cl Al | 0. | 0. | 12. | 0. | 0. | 47. | 27. | 0. | 0. | 10. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl Al S | 0. | 0. | 25. | 0. | 0. | 21. | 31. | 0. | 0. | 8. | 0. | 0. | 15. | 0. | 0. | 0.0 |
| 1 | Ca Si S | 0. | 9. | 0. | 34. | 0. | 12. | 0. | 8. | 34. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na S Si | 36. | 0. | 12. | 19. | 0. | 26. | 0. | 0. | 0. | 0. | 3. | 0. | 4. | 0. | 0. | 0.0 |
| 28 | Zn Al S | 2. | 6. | 21. | 1. | 0. | 12. | 6. | 0. | 2. | 1. | 3. | 0. | 46. | 0. | 0. | 2.4 |
| 20 | Al Zn S | 2. | 6. | 36. | 0. | 1. | 15. | 6. | 2. | 4. | 1. | 3. | 0. | 24. | 0. | 0. | 1.6 |
| 11 | Zn S Al | 3. | 9. | 15. | 1. | 2. | 17. | 9. | 0. | 4. | 0. | 2. | 0. | 37. | 0. | 0. | 1.0 |
| 20 | Al Mg Na | 13. | 23. | 41. | 0. | 0. | 6. | 3. | 0. | 3. | 1. | 3. | 0. | 6. | 0. | 0. | 1.2 |
| 5 | Al Na Mg | 22. | 18. | 35. | 0. | 0. | 2. | 6. | 0. | 0. | 0. | 4. | 0. | 12. | 0. | 0. | 0.3 |

# Table 3-8. Sample #600 PSI/SECV Loy Yang Test 3 (Treated) ESP Ash on Filter (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Mg | Al | Na | 12. | 38. | 26. | 0. | 0. | 5. | 8. | 0. | 2. | 0. | 0. | 0. | 9. | 0. | 0. | 0.1 |
| 1 | Na | Al | Mg | 39. | 10. | 37. | 0. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 7. | 0. | 0. | 0.2 |
| 24 | Zn | Cl | S | 1. | 2. | 5. | 1. | 0. | 14. | 21. | 0. | 1. | 0. | 1. | 0. | 52. | 0. | 0. | 2.8 |
| 5 | Zn | S | Cl | 3. | 2. | 8. | 0. | 0. | 16. | 12. | 0. | 1. | 0. | 1. | 0. | 55. | 0. | 0. | 0.3 |
| 1 | Na | Mg | S | 24. | 22. | 13. | 3. | 0. | 15. | 12. | 2. | 2. | 0. | 0. | 0. | 7. | 0. | 0. | 0.1 |
| 2 | S | Al | Na | 16. | 9. | 24. | 0. | 0. | 34. | 0. | 0. | 2. | 0. | 4. | 2. | 7. | 0. | 0. | 0.1 |
| 2 | S | Na | Al | 26. | 10. | 21. | 0. | 0. | 34. | 0. | 0. | 3. | 0. | 4. | 0. | 3. | 0. | 0. | 0.3 |
| 1 | Al | S | Na | 17. | 0. | 32. | 0. | 0. | 23. | 6. | 0. | 4. | 0. | 3. | 0. | 15. | 0. | 0. | 0.5 |
| 1 | S | Na | Cl | 17. | 0. | 14. | 0. | 0. | 32. | 16. | 0. | 11. | 0. | 2. | 0. | 9. | 0. | 0. | 0.1 |
| 2 | Si | Al | Zn | 3. | 2. | 19. | 59. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 14. | 0. | 0. | 0.1 |
| 5 | Zn | Al | Si | 0. | 8. | 21. | 11. | 0. | 0. | 2. | 0. | 3. | 3. | 7. | 0. | 45. | 0. | 0. | 0.4 |
| 5 | Al | Zn | Si | 0. | 6. | 32. | 15. | 0. | 6. | 2. | 0. | 4. | 1. | 8. | 0. | 27. | 0. | 0. | 0.3 |
| 2 | Al | Si | Zn | 6. | 10. | 40. | 18. | 0. | 2. | 0. | 0. | 5. | 3. | 2. | 0. | 14. | 0. | 0. | 0.2 |
| 1 | Si | Zn | Al | 0. | 6. | 14. | 46. | 0. | 0. | 0. | 0. | 3. | 0. | 4. | 0. | 27. | 0. | 0. | 0.1 |
| 2 | Cl | Al | Na | 19. | 6. | 19. | 0. | 0. | 4. | 35. | 2. | 1. | 1. | 3. | 0. | 11. | 0. | 0. | 0.1 |
| 1 | Al | Si | Na | 16. | 0. | 34. | 32. | 0. | 0. | 3. | 0. | 0. | 0. | 7. | 0. | 7. | 0. | 0. | 0.2 |
| 12 | Al | Zn | Na | 15. | 6. | 38. | 0. | 1. | 4. | 6. | 2. | 1. | 0. | 3. | 0. | 24. | 0. | 0. | 0.9 |
| 1 | Na | Al | Zn | 32. | 0. | 30. | 0. | 0. | 10. | 6. | 0. | 0. | 0. | 0. | 0. | 22. | 0. | 0. | 0.1 |
| 17 | Zn | Al | Na | 15. | 6. | 21. | 1. | 0. | 6. | 6. | 1. | 1. | 0. | 2. | 0. | 41. | 0. | 0. | 1.2 |
| 2 | Al | Na | Zn | 23. | 1. | 25. | 0. | 0. | 10. | 14. | 0. | 0. | 13. | 0. | 0. | 14. | 0. | 0. | 0.1 |
| 6 | Zn | Na | Al | 17. | 4. | 11. | 2. | 0. | 9. | 9. | 1. | 3. | 2. | 2. | 1. | 39. | 0. | 0. | 0.3 |
| 8 | Zn | Al | Fe | 0. | 7. | 25. | 1. | 0. | 4. | 2. | 0. | 3. | 0. | 15. | 0. | 43. | 0. | 0. | 1.0 |
| 7 | Al | Zn | Fe | 0. | 7. | 40. | 1. | 1. | 4. | 1. | 0. | 1. | 0. | 14. | 0. | 31. | 0. | 0. | 0.3 |
| 2 | Fe | Al | Zn | 0. | 12. | 27. | 2. | 0. | 1. | 2. | 0. | 3. | 1. | 32. | 0. | 20. | 0. | 0. | 0.1 |
| 4 | Zn | Fe | Al | 0. | 9. | 22. | 0. | 0. | 2. | 0. | 0. | 0. | 2. | 26. | 0. | 38. | 0. | 0. | 0.8 |
| 4 | Zn | S | Na | 13. | 3. | 8. | 0. | 0. | 16. | 10. | 1. | 3. | 0. | 3. | 0. | 41. | 0. | 0. | 0.3 |
| 7 | Al | Zn | Ca | 0. | 3. | 44. | 0. | 2. | 8. | 5. | 1. | 14. | 2. | 2. | 0. | 20. | 0. | 0. | 0.2 |
| 2 | Si | Zn | Na | 16. | 3. | 6. | 53. | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 20. | 0. | 0. | 0.3 |
| 2 | Cl | Na | Zn | 27. | 0. | 6. | 0. | 0. | 0. | 58. | 0. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.3 |
| 2 | Cl | Zn | Na | 19. | 4. | 16. | 0. | 0. | 5. | 35. | 2. | 0. | 0. | 0. | 0. | 19. | 0. | 0. | 0.1 |
| 1 | S | Ca | Al | 0. | 7. | 18. | 0. | 0. | 30. | 0. | 4. | 24. | 0. | 3. | 0. | 14. | 0. | 0. | 0.0 |
| 1 | Al | S | Ca | 4. | 7. | 43. | 0. | 3. | 16. | 0. | 0. | 12. | 3. | 2. | 0. | 9. | 0. | 0. | 0.0 |
| 1 | Al | K | S | 0. | 0. | 23. | 0. | 0. | 20. | 0. | 22. | 9. | 0. | 9. | 0. | 15. | 0. | 0. | 0.1 |
| 1 | Ti | Al | Si | 0. | 11. | 26. | 20. | 0. | 0. | 0. | 0. | 2. | 27. | 5. | 0. | 8. | 0. | 0. | 0.1 |
| 1 | Ti | Si | Al | 0. | 9. | 22. | 23. | 0. | 0. | 0. | 0. | 0. | 44. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Zn | Cl | Fe | 0. | 0. | 6. | 6. | 0. | 6. | 13. | 0. | 2. | 0. | 10. | 0. | 58. | 0. | 0. | 0.1 |
| 4 | Zn | Cl | Mg | 6. | 11. | 5. | 0. | 0. | 9. | 14. | 1. | 0. | 2. | 1. | 0. | 48. | 0. | 0. | 0.2 |
| 1 | Zn | S | Mg | 0. | 18. | 15. | 0. | 0. | 19. | 8. | 0. | 5. | 0. | 5. | 0. | 29. | 0. | 0. | 0.1 |
| 1 | Cl | K | S | 0. | 0. | 0. | 14. | 0. | 19. | 44. | 20. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | Ca | Si | 0. | 0. | 9. | 14. | 0. | 0. | 0. | 0. | 23. | 0. | 43. | 0. | 10. | 0. | 0. | 0.0 |
| 3 | Al | Mg | K | 0. | 23. | 57. | 0. | 0. | 0. | 0. | 9. | 1. | 4. | 1. | 1. | 4. | 0. | 0. | 0.2 |
| 1 | Ca | Fe | Na | 9. | 0. | 0. | 4. | 0. | 7. | 2. | 2. | 44. | 3. | 27. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe | Al | S | 0. | 9. | 26. | 0. | 0. | 23. | 0. | 0. | 3. | 0. | 26. | 0. | 13. | 0. | 0. | 0.1 |
| 2 | Zn | Al | K | 0. | 6. | 21. | 0. | 0. | 5. | 7. | 7. | 3. | 6. | 6. | 0. | 36. | 0. | 0. | 0.4 |
| 2 | Zn | Na | Mg | 19. | 11. | 7. | 0. | 0. | 6. | 5. | 3. | 0. | 0. | 0. | 0. | 48. | 0. | 0. | 0.1 |
| 50 | OTHERS - | | | 15. | 6. | 11. | 10. | 0. | 7. | 20. | 4. | 3. | 1. | 1. | 0. | 21. | 0. | 0. | 4.4 |
| 1180 | TOTALS - | | | 3. | 15. | 32. | 3. | 0. | 6. | 7. | 1. | 3. | 1. | 4. | 0. | 24. | 0. | 0. | 100.0 |

# Table 3-8. Sample #600 PSI/SECV Loy Yang Test 3 (Treated) ESP Ash on Filter (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Al Mg Zn | 20.2 | 11. | 12. | 28. | 45. | 5. | 0. | 0. |
| Al Zn Mg | 17.3 | 10. | 26. | 32. | 30. | 2. | 0. | 0. |
| Zn Al Mg | 8.3 | 31. | 28. | 26. | 15. | 0. | 0. | 0. |
| Al Zn Cl | 4.3 | 6. | 42. | 18. | 32. | 2. | 0. | 0. |
| Zn Al Cl | 5.7 | 20. | 40. | 30. | 11. | 0. | 0. | 0. |
| OTHERS - | 4.4 | 45. | 55. | 0. | 0. | 0. | 0. | 0. |
| OTHERS - | 39.8 | 18. | 29. | 29. | 22. | 2. | 0. | 0. |
| TOTALS - | 100.0 | 17. | 27. | 27. | 26. | 2. | 0. | 0. |

# Table 3-9. Sample #601 PSI/SECV Beulah Lignite ESP Ash

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | Ca - - | 0. | 2. | 1. | 1. | 0. | 3. | 0. | 0. | 90. | 0. | 2. | 0. | 0. | 0. | 0. | 2.3 |
| 7 | Si - - | 2. | 0. | 0. | 97. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 44 | Fe - - | 3. | 0. | 2. | 3. | 0. | 4. | 0. | 0. | 2. | 0. | 86. | 0. | 0. | 0. | 0. | 3.7 |
| 3 | S - - | 0. | 0. | 3. | 6. | 0. | 75. | 0. | 0. | 7. | 0. | 6. | 0. | 3. | 0. | 0. | 0.1 |
| 5 | Si Al - | 4. | 0. | 46. | 48. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al Si - | 3. | 0. | 46. | 44. | 0. | 2. | 1. | 2. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S Ca - | 0. | 0. | 1. | 0. | 0. | 76. | 0. | 1. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 53 | Ca S - | 1. | 0. | 0. | 0. | 0. | 26. | 0. | 0. | 72. | 0. | 0. | 0. | 0. | 0. | 0. | 2.5 |
| 1 | Ca Fe - | 0. | 3. | 5. | 2. | 0. | 3. | 0. | 0. | 62. | 0. | 24. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Fe Ca - | 0. | 1. | 1. | 1. | 0. | 2. | 0. | 0. | 25. | 0. | 71. | 0. | 0. | 0. | 0. | 0.2 |
| 11 | Na S - | 49. | 0. | 0. | 2. | 0. | 43. | 0. | 1. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 1.0 |
| 8 | S Na - | 40. | 0. | 3. | 3. | 0. | 46. | 0. | 0. | 4. | 1. | 2. | 0. | 0. | 0. | 0. | 0.9 |
| 2 | S Ti - | 5. | 0. | 0. | 2. | 0. | 56. | 0. | 0. | 4. | 34. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ti S - | 1. | 0. | 0. | 0. | 0. | 38. | 0. | 0. | 0. | 61. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 24 | Si Na - | 26. | 0. | 0. | 68. | 0. | 4. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 1.1 |
| 5 | Fe S Ca | 9. | 1. | 3. | 3. | 0. | 15. | 0. | 0. | 11. | 2. | 56. | 0. | 0. | 0. | 0. | 0.7 |
| 14 | Ca Fe S | 6. | 5. | 7. | 6. | 0. | 16. | 0. | 0. | 38. | 1. | 20. | 0. | 0. | 0. | 0. | 1.2 |
| 15 | Fe Ca S | 4. | 0. | 1. | 1. | 0. | 9. | 0. | 0. | 25. | 0. | 59. | 0. | 0. | 0. | 0. | 1.3 |
| 19 | Ca S Fe | 6. | 6. | 4. | 6. | 0. | 24. | 0. | 0. | 41. | 2. | 11. | 0. | 0. | 0. | 0. | 1.6 |
| 217 | Si Al Na | 22. | 0. | 29. | 36. | 0. | 5. | 0. | 0. | 4. | 1. | 3. | 0. | 0. | 0. | 0. | 15.9 |
| 2 | Al Si Na | 13. | 0. | 37. | 36. | 0. | 6. | 0. | 2. | 5. | 0. | 1. | 0. | 0. | 0. | 0. | 0.0 |
| 35 | Na Si Al | 35. | 0. | 22. | 28. | 0. | 11. | 0. | 0. | 3. | 1. | 1. | 0. | 0. | 0. | 0. | 2.5 |
| 71 | Si Na Al | 28. | 0. | 25. | 32. | 0. | 8. | 0. | 0. | 2. | 1. | 3. | 0. | 0. | 0. | 0. | 9.1 |
| 49 | Ca Si Al | 8. | 1. | 18. | 24. | 0. | 5. | 0. | 0. | 38. | 0. | 6. | 0. | 0. | 0. | 0. | 3.5 |
| 32 | Si Al Ca | 11. | 0. | 26. | 34. | 0. | 4. | 0. | 0. | 18. | 3. | 5. | 0. | 0. | 0. | 0. | 3.1 |
| 2 | Al Si Ca | 2. | 0. | 42. | 40. | 0. | 0. | 0. | 0. | 14. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 12 | Si Ca Al | 16. | 0. | 21. | 29. | 0. | 5. | 0. | 0. | 23. | 1. | 5. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Ca Al Si | 5. | 3. | 21. | 17. | 0. | 3. | 0. | 0. | 42. | 1. | 7. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl S K | 0. | 0. | 0. | 9. | 0. | 26. | 42. | 14. | 0. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 39 | Ca S Mg | 5. | 11. | 3. | 2. | 0. | 21. | 0. | 0. | 53. | 0. | 3. | 0. | 0. | 0. | 0. | 2.7 |
| 15 | Ca Mg S | 0. | 14. | 3. | 1. | 0. | 10. | 1. | 0. | 68. | 0. | 2. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Ca Ti Cl | 0. | 0. | 11. | 12. | 0. | 14. | 15. | 8. | 26. | 15. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 19 | Ca S Si | 5. | 3. | 8. | 12. | 0. | 18. | 0. | 0. | 47. | 0. | 8. | 0. | 0. | 0. | 0. | 2.6 |
| 7 | Ca Si S | 10. | 4. | 13. | 19. | 0. | 15. | 0. | 0. | 33. | 0. | 5. | 0. | 0. | 0. | 0. | 0.9 |
| 2 | S Ca Si | 0. | 0. | 5. | 11. | 2. | 47. | 2. | 1. | 26. | 0. | 3. | 2. | 0. | 0. | 0. | 0.2 |
| 1 | S Si Ca | 0. | 0. | 13. | 19. | 0. | 43. | 0. | 0. | 17. | 0. | 0. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Si Ca S | 14. | 0. | 8. | 35. | 0. | 14. | 0. | 0. | 25. | 2. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 24 | Ca S Na | 14. | 5. | 5. | 4. | 0. | 31. | 0. | 0. | 38. | 0. | 3. | 0. | 0. | 0. | 0. | 4.1 |
| 1 | Na Ca S | 30. | 13. | 0. | 0. | 0. | 21. | 0. | 0. | 21. | 11. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 38 | S Ca Na | 18. | 1. | 2. | 3. | 0. | 43. | 0. | 0. | 30. | 0. | 3. | 0. | 0. | 0. | 0. | 4.6 |
| 63 | S Na Ca | 31. | 2. | 2. | 2. | 0. | 42. | 0. | 0. | 17. | 1. | 2. | 0. | 0. | 0. | 0. | 8.3 |
| 17 | Na S Ca | 42. | 1. | 3. | 3. | 0. | 36. | 0. | 1. | 12. | 0. | 1. | 0. | 0. | 0. | 0. | 1.4 |
| 20 | Na S Si | 36. | 0. | 12. | 16. | 0. | 26. | 0. | 1. | 5. | 1. | 4. | 0. | 0. | 0. | 0. | 2.2 |
| 17 | Si Na S | 30. | 0. | 1. | 51. | 0. | 14. | 0. | 0. | 3. | 1. | 1. | 0. | 0. | 0. | 0. | 1.1 |
| 10 | S Na Si | 28. | 0. | 6. | 11. | 0. | 40. | 0. | 0. | 4. | 4. | 3. | 1. | 1. | 0. | 0. | 1.1 |
| 6 | Na Si S | 31. | 0. | 18. | 23. | 0. | 18. | 0. | 0. | 5. | 1. | 3. | 0. | 0. | 0. | 0. | 0.8 |
| 1 | Si S P | 0. | 0. | 0. | 25. | 21. | 24. | 0. | 16. | 0. | 0. | 0. | 0. | 14. | 0. | 0. | 0.0 |
| 1 | Al Mg S | 0. | 26. | 56. | 0. | 0. | 7. | 6. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Ti Si | 0. | 3. | 7. | 14. | 0. | 7. | 0. | 0. | 48. | 17. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Si Ti | 4. | 7. | 4. | 24. | 0. | 5. | 0. | 0. | 44. | 8. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Mg S | 0. | 38. | 0. | 0. | 0. | 6. | 3. | 0. | 4. | 0. | 48. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe Si Al | 9. | 0. | 14. | 18. | 0. | 2. | 0. | 0. | 7. | 1. | 50. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si Al Fe | 7. | 1. | 31. | 38. | 0. | 4. | 0. | 1. | 5. | 0. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca Fe Al | 0. | 4. | 9. | 5. | 0. | 6. | 0. | 0. | 51. | 0. | 24. | 0. | 0. | 0. | 0. | 0.1 |

# Table 3-9. Sample #601 PSI/SECV Beulah Lignite ESP Ash (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Fe Ca Al | 4. | 5. | 16. | 14. | 0. | 3. | 0. | 0. | 22. | 0. | 36. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | Ca Al Fe | 5. | 3. | 20. | 7. | 0. | 5. | 0. | 0. | 44. | 2. | 15. | 0. | 0. | 0. | 0. | 0.0 |
| 12 | Fe Na S | 20. | 0. | 3. | 2. | 0. | 17. | 0. | 0. | 3. | 2. | 53. | 0. | 1. | 0. | 0. | 0.7 |
| 9 | Na S Fe | 31. | 0. | 7. | 10. | 0. | 28. | 0. | 0. | 9. | 1. | 14. | 0. | 0. | 0. | 0. | 1.0 |
| 13 | Fe S Na | 14. | 0. | 5. | 5. | 0. | 17. | 0. | 0. | 4. | 0. | 53. | 0. | 0. | 0. | 0. | 1.1 |
| 9 | Ca S Al | 2. | 7. | 12. | 2. | 0. | 17. | 0. | 0. | 54. | 1. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ca Al S | 9. | 4. | 18. | 12. | 0. | 14. | 0. | 0. | 37. | 0. | 7. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | S Ca Al | 8. | 1. | 13. | 8. | 0. | 44. | 0. | 2. | 22. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al Ca S | 0. | 12. | 59. | 0. | 0. | 12. | 0. | 0. | 12. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Ca Mg | 0. | 9. | 5. | 4. | 0. | 3. | 0. | 0. | 25. | 0. | 53. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Fe Mg | 0. | 15. | 9. | 0. | 0. | 4. | 0. | 0. | 44. | 0. | 27. | 0. | 0. | 0. | 0. | 0.1 |
| 10 | Ca Si Fe | 4. | 2. | 7. | 20. | 0. | 3. | 0. | 0. | 48. | 2. | 13. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Fe Si Ca | 6. | 0. | 9. | 23. | 0. | 2. | 0. | 0. | 10. | 4. | 44. | 0. | 0. | 0. | 0. | 0.2 |
| 9 | Ca Fe Si | 6. | 1. | 10. | 16. | 0. | 5. | 0. | 0. | 40. | 0. | 22. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Si Ca Fe | 13. | 0. | 9. | 43. | 0. | 2. | 0. | 0. | 19. | 0. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Si Ca Na | 16. | 0. | 3. | 55. | 0. | 1. | 0. | 0. | 22. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Na Ca | 21. | 0. | 13. | 39. | 0. | 3. | 0. | 0. | 18. | 2. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Si Na | 17. | 0. | 14. | 21. | 0. | 14. | 0. | 0. | 30. | 0. | 4. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | S Ca Ti | 0. | 3. | 7. | 5. | 0. | 30. | 0. | 0. | 27. | 19. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ti S Ca | 0. | 0. | 3. | 9. | 0. | 24. | 0. | 0. | 13. | 46. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Ca | 9. | 0. | 0. | 6. | 0. | 58. | 0. | 0. | 11. | 11. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca S Ti | 0. | 0. | 8. | 10. | 0. | 24. | 0. | 0. | 35. | 17. | 6. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | S Na Al | 28. | 0. | 12. | 10. | 0. | 32. | 0. | 0. | 4. | 2. | 8. | 2. | 1. | 0. | 0. | 0.4 |
| 1 | Al Na S | 19. | 7. | 53. | 0. | 0. | 10. | 0. | 0. | 2. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | S Na Ti | 31. | 0. | 3. | 5. | 0. | 43. | 0. | 0. | 6. | 11. | 1. | 0. | 0. | 0. | 0. | 1.0 |
| 6 | S Ti Na | 10. | 0. | 0. | 3. | 0. | 51. | 0. | 0. | 2. | 34. | 1. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Al Fe Mg | 0. | 14. | 30. | 5. | 0. | 13. | 2. | 3. | 12. | 0. | 20. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca Mg Si | 0. | 18. | 9. | 10. | 0. | 4. | 0. | 0. | 53. | 0. | 7. | 0. | 0. | 0. | 0. | 0.9 |
| 7 | Ca Si Mg | 0. | 9. | 3. | 16. | 0. | 3. | 0. | 0. | 64. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Si Ca Cl | 0. | 0. | 7. | 34. | 0. | 10. | 14. | 3. | 29. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Ti Fe | 0. | 5. | 7. | 8. | 0. | 6. | 0. | 0. | 42. | 22. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Al Mg | 0. | 9. | 15. | 6. | 0. | 4. | 0. | 0. | 57. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Mg Al | 0. | 12. | 10. | 5. | 0. | 7. | 0. | 0. | 60. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cu Ca S | 0. | 0. | 3. | 3. | 0. | 9. | 3. | 7. | 17. | 0. | 0. | 58. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al K | 0. | 0. | 29. | 47. | 0. | 0. | 0. | 21. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca S Cl | 0. | 0. | 0. | 9. | 0. | 20. | 16. | 0. | 43. | 6. | 0. | 5. | 0. | 0. | 0. | 0.2 |
| 2 | Si Fe Na | 12. | 0. | 2. | 50. | 0. | 4. | 0. | 2. | 1. | 1. | 28. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti S Si | 6. | 0. | 14. | 18. | 0. | 22. | 0. | 0. | 6. | 32. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Na K | 28. | 0. | 0. | 3. | 0. | 62. | 0. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al Ca Na | 16. | 0. | 22. | 15. | 0. | 13. | 0. | 0. | 16. | 2. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Ti Mg | 0. | 10. | 55. | 0. | 0. | 0. | 0. | 0. | 6. | 24. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Ti Ca | 0. | 0. | 64. | 0. | 0. | 4. | 2. | 2. | 7. | 16. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Mg Si | 0. | 21. | 63. | 9. | 0. | 2. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Ti S | 0. | 0. | 66. | 0. | 0. | 9. | 2. | 0. | 0. | 18. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Al Ti | 13. | 0. | 26. | 36. | 0. | 6. | 0. | 0. | 2. | 17. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 49 | OTHERS - | 17. | 1. | 7. | 8. | 0. | 27. | 0. | 2. | 8. | 3. | 26. | 0. | 0. | 0. | 0. | 5.0 |
| 1193 | TOTALS - | 18. | 2. | 12. | 17. | 0. | 18. | 0. | 0. | 20. | 2. | 10. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-9. Sample #601 PSI/SECV Beulah Lignite ESP Ash
(Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si Al Na | 15.9 | 38. | 35. | 22. | 4. | 2. | 0. | 0. |
| Si Na Al | 9.1 | 34. | 58. | 8. | 0. | 0. | 0. | 0. |
| Ca S Na | 4.1 | 33. | 59. | 6. | 3. | 0. | 0. | 0. |
| S Ca Na | 4.6 | 14. | 64. | 12. | 10. | 0. | 0. | 0. |
| S Na Ca | 8.3 | 41. | 53. | 4. | 2. | 0. | 0. | 0. |
| OTHERS - | 5.0 | 57. | 38. | 4. | 1. | 0. | 0. | 0. |
| OTHERS - | 53.0 | 23. | 43. | 21. | 11. | 1. | 0. | 0. |
| TOTALS - | 100.0 | 29. | 46. | 17. | 7. | 1. | 0. | 0. |

## Table 3-10. Sample #473 Arizona Burn 42 Loy Yang + Kaolinite Ash on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Fe - - | 0. | 1. | 2. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 94. | 0. | 0. | 0. | 0. | 0.4 |
| 14 | S - - | 0. | 1. | 0. | 0. | 0. | 94. | 0. | 0. | 0. | 1. | 1. | 1. | 1. | 0. | 0. | 1.6 |
| 4 | Si - - | 3. | 0. | 2. | 89. | 0. | 1. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 14 | Mg - - | 0. | 76. | 3. | 2. | 0. | 3. | 0. | 0. | 8. | 0. | 7. | 0. | 0. | 0. | 0. | 1.2 |
| 3 | Ca - - | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 97. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al - - | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Mg - | 0. | 34. | 0. | 65. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | Mg Ca - | 0. | 79. | 0. | 0. | 0. | 0. | 1. | 1. | 15. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Mg S - | 0. | 80. | 0. | 2. | 0. | 13. | 0. | 0. | 3. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Mg Fe - | 0. | 80. | 0. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Al Si - | 0. | 0. | 57. | 41. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 19 | Si Al - | 0. | 0. | 46. | 51. | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 1.1 |
| 1 | Al S - | 0. | 0. | 52. | 4. | 0. | 39. | 0. | 0. | 0. | 0. | 3. | 0. | 2. | 0. | 0. | 0.0 |
| 2 | Ca S - | 0. | 0. | 0. | 0. | 1. | 47. | 0. | 0. | 52. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 3 | S Ca - | 0. | 0. | 3. | 0. | 0. | 50. | 0. | 0. | 47. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | S Fe - | 0. | 0. | 0. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Fe S - | 0. | 0. | 2. | 0. | 0. | 28. | 0. | 0. | 0. | 1. | 67. | 2. | 0. | 0. | 0. | 0.1 |
| 1 | Na S - | 61. | 0. | 0. | 0. | 0. | 34. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Na - | 13. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 459 | Si Al Na | 24. | 0. | 33. | 40. | 0. | 0. | 0. | 0. | 0. | 2. | 1. | 0. | 0. | 0. | 0. | 38.3 |
| 141 | Si Na Al | 32. | 0. | 28. | 36. | 0. | 0. | 0. | 0. | 1. | 2. | 1. | 0. | 0. | 0. | 0. | 11.6 |
| 42 | Na Si Al | 37. | 1. | 26. | 31. | 0. | 1. | 0. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 0. | 4.7 |
| 5 | Al Si Na | 22. | 1. | 35. | 33. | 0. | 0. | 1. | 0. | 0. | 6. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Na Al Si | 34. | 0. | 32. | 30. | 0. | 0. | 0. | 0. | 2. | 2. | 0. | 0. | 1. | 0. | 0. | 0.3 |
| 65 | Mg S Ca | 0. | 46. | 2. | 1. | 0. | 23. | 2. | 2. | 14. | 1. | 8. | 0. | 1. | 0. | 0. | 7.4 |
| 30 | Mg Ca S | 0. | 57. | 3. | 1. | 0. | 13. | 1. | 1. | 17. | 0. | 5. | 0. | 1. | 0. | 0. | 3.5 |
| 14 | S Mg Ca | 1. | 31. | 3. | 0. | 1. | 39. | 1. | 0. | 20. | 1. | 3. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | S Ca Mg | 0. | 24. | 0. | 0. | 0. | 36. | 0. | 7. | 33. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Mg S | 0. | 31. | 0. | 0. | 0. | 9. | 0. | 0. | 60. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 15 | Mg S Na | 19. | 37. | 2. | 1. | 0. | 23. | 0. | 1. | 11. | 0. | 5. | 2. | 0. | 0. | 0. | 2.2 |
| 14 | Mg Na S | 28. | 36. | 1. | 0. | 0. | 18. | 4. | 2. | 6. | 0. | 4. | 0. | 1. | 0. | 0. | 0.8 |
| 10 | S Mg Na | 20. | 25. | 1. | 1. | 0. | 33. | 1. | 2. | 12. | 0. | 4. | 0. | 0. | 0. | 0. | 0.6 |
| 8 | S Na Mg | 26. | 15. | 3. | 0. | 0. | 37. | 3. | 2. | 9. | 1. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 12 | Na Mg S | 31. | 26. | 0. | 1. | 1. | 20. | 5. | 2. | 10. | 0. | 2. | 1. | 0. | 0. | 0. | 1.7 |
| 11 | Na S Mg | 33. | 21. | 2. | 3. | 2. | 24. | 3. | 2. | 6. | 0. | 2. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | Ca Si Al | 0. | 0. | 13. | 22. | 0. | 11. | 3. | 3. | 46. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 9 | Si Al Ca | 3. | 1. | 34. | 43. | 0. | 2. | 0. | 1. | 15. | 0. | 1. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Al Si Ca | 4. | 0. | 46. | 37. | 0. | 0. | 0. | 2. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Al K | 1. | 0. | 30. | 52. | 0. | 2. | 0. | 12. | 0. | 1. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Si K | 0. | 0. | 46. | 45. | 0. | 0. | 0. | 6. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca Mg | 9. | 9. | 0. | 69. | 0. | 0. | 0. | 0. | 12. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Mg Ca Si | 0. | 72. | 0. | 10. | 0. | 1. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Mg Si Ca | 1. | 48. | 10. | 25. | 0. | 1. | 0. | 0. | 10. | 2. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 12 | Si Al Ti | 2. | 0. | 38. | 46. | 0. | 0. | 1. | 0. | 1. | 11. | 1. | 0. | 0. | 0. | 0. | 0.7 |
| 2 | Al Si Ti | 0. | 0. | 57. | 29. | 0. | 0. | 0. | 0. | 2. | 9. | 3. | 0. | 1. | 0. | 0. | 0.1 |
| 3 | Ti Si Al | 9. | 0. | 17. | 20. | 0. | 0. | 0. | 0. | 0. | 54. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si Al S | 1. | 0. | 27. | 42. | 0. | 13. | 0. | 8. | 9. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S Al Si | 0. | 0. | 16. | 12. | 0. | 62. | 0. | 0. | 0. | 0. | 7. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Si S Al | 0. | 0. | 23. | 33. | 0. | 31. | 0. | 0. | 5. | 3. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Si Al | 0. | 0. | 23. | 24. | 0. | 50. | 0. | 2. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Zn Si | 0. | 0. | 7. | 23. | 0. | 6. | 0. | 3. | 0. | 4. | 32. | 0. | 24. | 0. | 0. | 0.0 |
| 3 | Mg Fe S | 0. | 47. | 5. | 5. | 0. | 13. | 2. | 0. | 8. | 0. | 15. | 0. | 5. | 0. | 0. | 0.1 |
| 2 | S Mg Fe | 0. | 33. | 4. | 0. | 0. | 40. | 1. | 0. | 10. | 0. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Mg S | 0. | 28. | 0. | 0. | 0. | 10. | 0. | 5. | 7. | 0. | 50. | 0. | 0. | 0. | 0. | 0.5 |

# Table 3-10. Sample #473 Arizona Burn 42 Loy Yang + Kaolinite Ash on Filter (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Mg S Fe | 0. | 57. | 2. | 0. | 0. | 21. | 2. | 0. | 7. | 0. | 10. | 0. | 0. | 0. | 0. | 2.5 |
| 4 | Mg Fe Ca | 0. | 54. | 4. | 0. | 0. | 8. | 2. | 0. | 13. | 3. | 16. | 0. | 0. | 0. | 0. | 1.3 |
| 25 | Mg Ca Fe | 0. | 60. | 2. | 1. | 1. | 2. | 0. | 0. | 22. | 1. | 10. | 0. | 0. | 0. | 0. | 2.8 |
| 1 | Fe S Ca | 0. | 18. | 0. | 0. | 0. | 31. | 0. | 0. | 19. | 0. | 33. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ca Fe | 0. | 0. | 0. | 6. | 0. | 48. | 0. | 0. | 33. | 0. | 12. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe S Zn | 4. | 0. | 6. | 0. | 0. | 21. | 0. | 3. | 0. | 0. | 48. | 0. | 17. | 0. | 0. | 0.2 |
| 1 | Zn Fe S | 0. | 0. | 12. | 12. | 0. | 21. | 0. | 0. | 0. | 0. | 22. | 0. | 33. | 0. | 0. | 0.0 |
| 2 | Si Al Fe | 0. | 0. | 23. | 48. | 0. | 7. | 0. | 7. | 0. | 2. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Mg S Cl | 0. | 54. | 7. | 1. | 3. | 22. | 11. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Cl S Mg | 19. | 20. | 5. | 0. | 0. | 20. | 22. | 0. | 13. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al Fe Mg | 0. | 18. | 24. | 0. | 0. | 15. | 9. | 0. | 14. | 0. | 19. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Mg S K | 0. | 48. | 1. | 7. | 0. | 33. | 0. | 10. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Mg K S | 0. | 47. | 4. | 0. | 0. | 15. | 0. | 18. | 12. | 0. | 0. | 3. | 0. | 0. | 0. | 0.1 |
| 1 | S Mg K | 0. | 29. | 0. | 0. | 0. | 41. | 0. | 12. | 9. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S K Cl | 0. | 0. | 0. | 8. | 12. | 35. | 15. | 23. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Cl K | 0. | 0. | 0. | 15. | 0. | 31. | 23. | 18. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | Na S Ca | 49. | 9. | 0. | 0. | 0. | 27. | 0. | 2. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Na Ca | 32. | 7. | 3. | 2. | 1. | 39. | 0. | 0. | 12. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Na S Cl | 48. | 0. | 2. | 2. | 0. | 24. | 13. | 0. | 3. | 2. | 3. | 0. | 2. | 0. | 0. | 0.4 |
| 3 | Na Cl S | 35. | 9. | 3. | 1. | 0. | 15. | 30. | 0. | 5. | 1. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Al K | 0. | 0. | 24. | 0. | 0. | 32. | 10. | 21. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | K S Ca | 0. | 0. | 0. | 0. | 0. | 28. | 0. | 34. | 26. | 12. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca S K | 0. | 0. | 0. | 10. | 0. | 24. | 15. | 21. | 30. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Mg Al | 7. | 24. | 19. | 29. | 0. | 0. | 0. | 0. | 10. | 3. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Mg Si Al | 2. | 36. | 16. | 21. | 0. | 2. | 0. | 0. | 9. | 6. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Na S K | 36. | 0. | 0. | 4. | 7. | 25. | 0. | 18. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na Mg K | 41. | 18. | 10. | 0. | 0. | 10. | 0. | 14. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S K Si | 0. | 0. | 0. | 13. | 0. | 54. | 11. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg S Zn | 0. | 53. | 0. | 0. | 0. | 32. | 0. | 7. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Si S Fe | 0. | 0. | 6. | 64. | 0. | 16. | 0. | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ca Zn | 0. | 0. | 0. | 0. | 0. | 32. | 0. | 14. | 22. | 0. | 0. | 12. | 20. | 0. | 0. | 0.0 |
| 1 | S Mg Al | 0. | 23. | 19. | 10. | 0. | 26. | 0. | 8. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Mg Ca Al | 0. | 60. | 12. | 2. | 0. | 1. | 0. | 1. | 19. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Mg Al Ca | 0. | 48. | 21. | 6. | 0. | 3. | 0. | 0. | 15. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Ti Ca | 0. | 7. | 18. | 24. | 0. | 0. | 0. | 0. | 20. | 23. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Mg P | 0. | 42. | 0. | 0. | 9. | 42. | 0. | 0. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Ti Cu | 0. | 0. | 0. | 0. | 5. | 73. | 0. | 0. | 0. | 15. | 0. | 6. | 0. | 0. | 0. | 0.0 |
| 3 | Mg S Si | 0. | 70. | 0. | 9. | 5. | 11. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 2 | Na Ca Mg | 37. | 13. | 0. | 4. | 0. | 10. | 0. | 11. | 18. | 8. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Mg Ca Na | 23. | 27. | 0. | 0. | 0. | 19. | 0. | 0. | 23. | 0. | 8. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Na Mg Ca | 33. | 23. | 0. | 6. | 0. | 12. | 4. | 2. | 14. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg Ca Ti | 0. | 82. | 0. | 0. | 0. | 0. | 0. | 0. | 12. | 6. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Al Fe | 0. | 0. | 12. | 0. | 0. | 67. | 0. | 7. | 6. | 1. | 8. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Na Mg Cl | 38. | 24. | 0. | 0. | 0. | 13. | 19. | 0. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na Cl Ca | 46. | 12. | 0. | 0. | 0. | 0. | 18. | 10. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 35 | OTHERS - | 4. | 23. | 7. | 5. | 0. | 14. | 6. | 2. | 16. | 3. | 20. | 0. | 1. | 0. | 0. | 2.7 |
| 1127 | TOTALS - | 17. | 16. | 20. | 24. | 0. | 9. | 1. | 1. | 6. | 2. | 4. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-10. Sample #473 Arizona Burn 42 Loy Yang + Kaolinite Ash on Filter (Continued)

|  |  | Volume DISTRIBUTION |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si Al Na | 38.3 | 12. | 28. | 32. | 26. | 2. | 0. | 0. |
| Si Na Al | 11.6 | 22. | 33. | 28. | 13. | 3. | 0. | 0. |
| Na Si Al | 4.7 | 44. | 37. | 12. | 7. | 0. | 0. | 0. |
| Mg S Ca | 7.4 | 21. | 60. | 16. | 3. | 0. | 0. | 0. |
| OTHERS - | 38.0 | 31. | 43. | 18. | 8. | 0. | 0. | 0. |
| TOTALS - | 100.0 | 22. | 37. | 24. | 15. | 1. | 0. | 0. |

## Table 3-11. Sample #474 Arizona Burn 44 Kentucky #11 + NaAc Ash on Filter

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 79 | Si - - | 1. | 0. | 2. | 93. | 0. | 0. | 0. | 2. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 8.2 |
| 111 | Fe - - | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 97. | 0. | 0. | 0. | 0. | 8.8 |
| 30 | Na - - | 91. | 0. | 0. | 1. | 0. | 3. | 3. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 3.0 |
| 78 | Ca - - | 0. | 0. | 0. | 1. | 0. | 4. | 1. | 0. | 92. | 0. | 1. | 0. | 0. | 0. | 0. | 5.8 |
| 2 | Zn - - | 0. | 0. | 0. | 0. | 0. | 8. | 0. | 2. | 0. | 0. | 0. | 0. | 91. | 0. | 0. | 0.1 |
| 16 | Fe Si - | 0. | 0. | 2. | 15. | 0. | 0. | 0. | 0. | 1. | 0. | 81. | 0. | 0. | 0. | 0. | 1.2 |
| 4 | Si Fe - | 1. | 0. | 1. | 76. | 0. | 0. | 0. | 5. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si Ti - | 0. | 0. | 0. | 47. | 0. | 0. | 0. | 4. | 0. | 45. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca Si - | 0. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 83. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca - | 0. | 0. | 0. | 83. | 0. | 0. | 0. | 3. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Fe S - | 0. | 0. | 0. | 0. | 0. | 22. | 0. | 0. | 0. | 0. | 78. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S Fe - | 0. | 0. | 0. | 0. | 0. | 68. | 0. | 0. | 0. | 0. | 32. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Na S - | 66. | 0. | 1. | 2. | 0. | 28. | 0. | 0. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 14 | S Na - | 31. | 0. | 0. | 0. | 0. | 68. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 1.4 |
| 70 | Ca S - | 1. | 0. | 0. | 1. | 0. | 23. | 0. | 0. | 75. | 0. | 0. | 0. | 0. | 0. | 0. | 5.7 |
| 2 | Cl K - | 0. | 0. | 0. | 0. | 0. | 0. | 67. | 33. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 51 | Si Al - | 1. | 0. | 32. | 60. | 0. | 0. | 0. | 3. | 1. | 1. | 1. | 0. | 0. | 0. | 0. | 4.8 |
| 4 | Al Si - | 0. | 0. | 52. | 48. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | Ca P - | 0. | 0. | 0. | 0. | 26. | 0. | 0. | 0. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S P - | 0. | 0. | 0. | 0. | 10. | 90. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Ca Na - | 26. | 0. | 0. | 0. | 1. | 2. | 1. | 0. | 69. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 135 | Si Al K | 1. | 0. | 25. | 57. | 0. | 1. | 0. | 11. | 1. | 1. | 3. | 0. | 0. | 0. | 0. | 12.4 |
| 3 | Si K Al | 0. | 0. | 16. | 49. | 0. | 3. | 0. | 20. | 3. | 2. | 8. | 0. | 0. | 0. | 0. | 0.3 |
| 70 | Si Al Na | 13. | 0. | 24. | 49. | 0. | 2. | 1. | 5. | 2. | 1. | 3. | 0. | 0. | 0. | 0. | 5.6 |
| 13 | Si Na Al | 28. | 0. | 17. | 41. | 0. | 5. | 0. | 4. | 3. | 0. | 2. | 0. | 0. | 0. | 0. | 0.6 |
| 6 | Na Si Al | 36. | 0. | 18. | 25. | 0. | 7. | 3. | 3. | 6. | 2. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Al Si Na | 12. | 0. | 43. | 40. | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 13 | Na S Ca | 40. | 0. | 2. | 6. | 0. | 28. | 1. | 3. | 17. | 3. | 0. | 0. | 0. | 0. | 0. | 1.3 |
| 3 | S Na Ca | 26. | 0. | 2. | 2. | 0. | 46. | 4. | 2. | 15. | 2. | 0. | 0. | 1. | 0. | 0. | 0.3 |
| 5 | Si S Na | 13. | 0. | 4. | 48. | 0. | 24. | 0. | 1. | 8. | 0. | 1. | 0. | 0. | 0. | 0. | 0.8 |
| 2 | S Si Na | 21. | 0. | 15. | 23. | 0. | 33. | 0. | 3. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 9 | Na S Si | 44. | 0. | 7. | 11. | 0. | 28. | 0. | 3. | 3. | 2. | 1. | 0. | 0. | 0. | 0. | 1.0 |
| 5 | Na Si S | 42. | 0. | 12. | 22. | 0. | 14. | 1. | 3. | 4. | 0. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | S Na Si | 25. | 0. | 11. | 18. | 0. | 27. | 1. | 4. | 12. | 0. | 0. | 0. | 2. | 0. | 0. | 0.3 |
| 40 | Si Al Fe | 1. | 0. | 25. | 53. | 0. | 1. | 0. | 7. | 1. | 1. | 10. | 0. | 0. | 0. | 0. | 4.0 |
| 12 | Fe Si Al | 3. | 0. | 12. | 27. | 0. | 0. | 0. | 3. | 3. | 0. | 52. | 0. | 0. | 0. | 0. | 0.9 |
| 19 | Si Fe Al | 3. | 0. | 16. | 46. | 0. | 1. | 0. | 5. | 2. | 1. | 25. | 0. | 0. | 0. | 0. | 1.9 |
| 27 | Si Al Ca | 1. | 0. | 25. | 46. | 0. | 2. | 2. | 2. | 15. | 1. | 6. | 0. | 0. | 0. | 0. | 1.9 |
| 6 | Ca Si Al | 0. | 0. | 10. | 27. | 1. | 0. | 2. | 2. | 55. | 1. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Si Ca Al | 3. | 0. | 15. | 49. | 0. | 4. | 1. | 4. | 19. | 0. | 2. | 0. | 1. | 0. | 0. | 0.4 |
| 1 | Si Ti Al | 0. | 0. | 19. | 32. | 0. | 0. | 10. | 11. | 0. | 19. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Al Ti | 2. | 0. | 21. | 60. | 0. | 0. | 0. | 6. | 0. | 7. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | Si Fe K | 2. | 0. | 9. | 49. | 0. | 1. | 0. | 12. | 2. | 4. | 22. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si K Fe | 0. | 0. | 13. | 43. | 0. | 0. | 0. | 20. | 0. | 5. | 16. | 0. | 2. | 0. | 0. | 0.2 |
| 1 | Fe Si K | 0. | 0. | 3. | 29. | 0. | 3. | 0. | 15. | 9. | 5. | 35. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl K Al | 0. | 0. | 11. | 0. | 0. | 9. | 55. | 16. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Al Si S | 0. | 0. | 48. | 41. | 0. | 6. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | S Si Al | 5. | 5. | 13. | 21. | 0. | 45. | 0. | 1. | 3. | 1. | 5. | 0. | 0. | 0. | 0. | 0.6 |
| 6 | Si S Al | 1. | 0. | 16. | 48. | 0. | 24. | 1. | 3. | 5. | 1. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 6 | Si Al S | 1. | 0. | 21. | 61. | 0. | 10. | 2. | 2. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | S Al Si | 0. | 0. | 19. | 15. | 0. | 57. | 0. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca S Fe | 0. | 0. | 2. | 1. | 0. | 16. | 2. | 1. | 67. | 2. | 10. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Fe S Ca | 0. | 3. | 2. | 10. | 1. | 24. | 6. | 0. | 18. | 6. | 28. | 0. | 2. | 0. | 0. | 0.1 |
| 1 | S Ca P | 0. | 0. | 0. | 7. | 8. | 47. | 0. | 0. | 30. | 7. | 0. | 0. | 0. | 0. | 0. | 0.1 |

## Table 3-11. Sample #474 Arizona Burn 44 Kentucky #11 + NaAc Ash on Filter (Continued)

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Na | S | Al | 49. | 0. | 14. | 2. | 0. | 30. | 2. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S | Ca | Si | 0. | 0. | 2. | 19. | 4. | 39. | 0. | 9. | 26. | 0. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 8 | Ca | Si | S | 0. | 0. | 1. | 20. | 0. | 11. | 0. | 1. | 65. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si | Ca | S | 7. | 0. | 4. | 47. | 0. | 17. | 0. | 4. | 19. | 1. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 11 | Ca | S | Si | 0. | 0. | 4. | 16. | 0. | 27. | 1. | 3. | 44. | 0. | 5. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | S | P | Cl | 0. | 0. | 14. | 13. | 24. | 24. | 14. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na | S | Cl | 57. | 0. | 5. | 3. | 0. | 23. | 8. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl | Na | S | 21. | 0. | 0. | 0. | 0. | 16. | 43. | 14. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 11 | Na | Cl | S | 43. | 0. | 2. | 2. | 0. | 14. | 27. | 4. | 6. | 1. | 0. | 0. | 0. | 0. | 0. | 1.4 |
| 1 | Na | S | K | 46. | 0. | 0. | 9. | 0. | 23. | 6. | 11. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S | Na | K | 25. | 0. | 0. | 2. | 0. | 56. | 0. | 13. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S | Ca | K | 0. | 0. | 0. | 2. | 0. | 56. | 0. | 10. | 32. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Fe | Ca | 0. | 6. | 0. | 40. | 0. | 3. | 0. | 0. | 23. | 0. | 28. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S | Ca | Al | 0. | 0. | 11. | 0. | 0. | 62. | 2. | 4. | 20. | 0. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Fe | S | Si | 0. | 0. | 3. | 13. | 0. | 19. | 0. | 5. | 7. | 0. | 54. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S | Si | Fe | 0. | 0. | 9. | 22. | 0. | 58. | 0. | 0. | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Si | S | Fe | 0. | 0. | 8. | 39. | 0. | 25. | 0. | 9. | 5. | 0. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S | Fe | Na | 24. | 0. | 0. | 6. | 0. | 39. | 0. | 3. | 0. | 0. | 29. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Fe | S | Na | 18. | 0. | 6. | 6. | 0. | 26. | 0. | 5. | 4. | 0. | 35. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Cl | Na | K | 25. | 0. | 3. | 3. | 0. | 11. | 38. | 15. | 5. | 0. | 1. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Si | Ca | K | 5. | 0. | 0. | 74. | 0. | 5. | 0. | 6. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si | Al | Mg | 8. | 15. | 22. | 30. | 0. | 14. | 0. | 2. | 6. | 1. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Cl | S | Ca | 0. | 0. | 0. | 1. | 0. | 28. | 37. | 10. | 21. | 0. | 2. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Cl | Ca | S | 0. | 0. | 0. | 0. | 0. | 26. | 33. | 12. | 29. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca | S | Cl | 0. | 0. | 0. | 6. | 0. | 20. | 12. | 0. | 57. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl | Na | Si | 26. | 0. | 0. | 12. | 0. | 10. | 43. | 0. | 5. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | K | Cu | 0. | 0. | 0. | 12. | 0. | 13. | 27. | 23. | 0. | 0. | 10. | 14. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Cl | S | 0. | 0. | 0. | 23. | 0. | 20. | 22. | 18. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Si | S | 0. | 0. | 0. | 16. | 0. | 14. | 54. | 10. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na | Si | Ca | 63. | 0. | 6. | 16. | 0. | 2. | 0. | 6. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Si | Na | 16. | 0. | 8. | 25. | 0. | 9. | 2. | 3. | 35. | 0. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca | Na | Si | 18. | 0. | 5. | 13. | 0. | 6. | 1. | 2. | 54. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl | Ti | S | 0. | 0. | 0. | 0. | 0. | 28. | 39. | 0. | 0. | 34. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Ti | Cl | 0. | 0. | 0. | 0. | 0. | 27. | 21. | 16. | 13. | 22. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Cl | Al | 0. | 0. | 17. | 0. | 0. | 35. | 24. | 0. | 10. | 13. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Cl | S | K | 0. | 0. | 2. | 4. | 2. | 23. | 42. | 16. | 9. | 2. | 0. | 0. | 0. | 0. | 0. | 1.0 |
| 8 | Cl | K | S | 0. | 0. | 1. | 3. | 0. | 16. | 49. | 25. | 5. | 1. | 0. | 0. | 1. | 0. | 0. | 1.0 |
| 4 | S | Cl | K | 0. | 0. | 0. | 2. | 2. | 42. | 24. | 16. | 9. | 0. | 3. | 3. | 0. | 0. | 0. | 0.8 |
| 1 | S | K | Al | 0. | 0. | 7. | 0. | 0. | 83. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Ti | Si | 0. | 0. | 8. | 15. | 0. | 37. | 0. | 0. | 11. | 24. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Si | K | 0. | 0. | 13. | 20. | 0. | 55. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Cl | Ca | K | 0. | 0. | 0. | 0. | 0. | 13. | 38. | 19. | 23. | 0. | 5. | 0. | 3. | 0. | 0. | 0.3 |
| 2 | Cl | K | Ca | 0. | 0. | 0. | 0. | 0. | 0. | 63. | 18. | 14. | 5. | 0. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Na | Fe | Si | 36. | 0. | 5. | 13. | 0. | 7. | 2. | 2. | 7. | 0. | 27. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Ti | K | 0. | 0. | 0. | 14. | 0. | 31. | 0. | 15. | 12. | 16. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 123 | OTHERS - | | | 10. | 1. | 5. | 14. | 1. | 17. | 10. | 6. | 24. | 4. | 9. | 0. | 1. | 0. | 0. | 9.9 |
| 1140 | TOTALS - | | | 9. | 0. | 10. | 31. | 0. | 10. | 4. | 5. | 16. | 1. | 14. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-11. Sample #474 Arizona Burn 44 Kentucky #11 + NaAc Ash on Filter (Continued)

| SPECIES | Volume % | Volume DISTRIBUTION<br>0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Si - - | 8.2 | 5. | 37. | 9. | 24. | 19. | 6. | 0. |
| Fe - - | 8.8 | 8. | 8. | 6. | 27. | 50. | 2. | 0. |
| Ca - - | 5.8 | 15. | 33. | 20. | 21. | 9. | 3. | 0. |
| Si Al - | 4.8 | 9. | 21. | 11. | 21. | 30. | 7. | 0. |
| Ca S - | 5.7 | 18. | 22. | 14. | 24. | 13. | 10. | 0. |
| Si Al K | 12.4 | 8. | 22. | 8. | 17. | 30. | 15. | 0. |
| Si Al Na | 5.6 | 13. | 37. | 13. | 17. | 13. | 7. | 0. |
| OTHERS - | 9.9 | 15. | 28. | 15. | 42. | 0. | 0. | 0. |
| OTHERS - | 38.9 | 6. | 10. | 12. | 32. | 29. | 11. | 0. |
| TOTALS - | 100.0 | 9. | 19. | 11. | 28. | 24. | 8. | 0. |

# Table 3-12. Sample #552 PSI/Arizona Burn 47 Illinois #6 Ash, 1.4 Kg/hr, 1340°C, Port 11, Imp. #1 + Cup

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 128 | Si - - | 0. | 0. | 2. | 93. | 0. | 1. | 0. | 2. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 12.0 |
| 3 | S - - | 0. | 0. | 0. | 2. | 0. | 94. | 0. | 0. | 0. | 2. | 0. | 0. | 2. | 0. | 0. | 0.2 |
| 1 | Al - - | 0. | 0. | 95. | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0.1 |
| 39 | Fe - - | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 1. | 1. | 94. | 0. | 0. | 0. | 0. | 3.3 |
| 3 | Ca - - | 0. | 2. | 0. | 7. | 0. | 2. | 1. | 1. | 83. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ti - - | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 92. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 16 | Al Si - | 0. | 0. | 52. | 47. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 2.4 |
| 79 | Si Al - | 0. | 0. | 31. | 61. | 0. | 1. | 0. | 3. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 7.2 |
| 1 | Si S - | 0. | 0. | 5. | 67. | 0. | 20. | 0. | 0. | 4. | 4. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Si - | 0. | 0. | 0. | 41. | 0. | 59. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Si Fe - | 0. | 0. | 3. | 83. | 0. | 0. | 0. | 3. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Fe Si - | 0. | 0. | 2. | 26. | 0. | 0. | 0. | 1. | 0. | 0. | 71. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si Ca - | 0. | 0. | 0. | 84. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Si - | 0. | 0. | 4. | 34. | 0. | 0. | 0. | 3. | 59. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe S - | 0. | 0. | 0. | 0. | 0. | 36. | 0. | 0. | 0. | 0. | 64. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Fe - | 0. | 0. | 0. | 0. | 0. | 84. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S Ca - | 0. | 0. | 0. | 0. | 0. | 55. | 0. | 0. | 44. | 0. | 0. | 0. | 1. | 0. | 0. | 0.4 |
| 22 | Ca S - | 0. | 0. | 0. | 1. | 0. | 43. | 0. | 0. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 1.8 |
| 1 | Fe Ca - | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 14. | 0. | 82. | 0. | 0. | 0 | 0. | 0.1 |
| 1 | Fe Al - | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 90. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Cu - | 0. | 0. | 0. | 0. | 0. | 88. | 0. | 0. | 0. | 0. | 0. | 12. | 0. | 0. | 0. | 0.1 |
| 1 | Si K - | 0. | 0. | 3. | 78. | 0. | 0. | 0. | 11. | 5. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Na - | 27. | 0. | 4. | 0. | 0. | 0. | 63. | 0. | 3. | 0. | 0. | 0. | 3. | 0. | 0. | 0.1 |
| 2 | Si Mg - | 0. | 36. | 0. | 64. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Al Si | 0. | 0. | 20. | 16. | 0. | 63. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 24 | Si S Al | 0. | 0. | 17. | 45. | 0. | 28. | 0. | 2. | 2. | 1. | 4. | 0. | 1. | 0. | 0. | 2.4 |
| 63 | Si Al S | 0. | 0. | 27. | 51. | 0. | 12. | 0. | 3. | 2. | 0. | 4. | 0. | 0. | 0. | 0. | 5.3 |
| 11 | S Si Al | 0. | 0. | 15. | 31. | 0. | 47. | 0. | 2. | 1. | 2. | 1. | 0. | 1. | 0. | 0. | 0.9 |
| 2 | Al Si S | 0. | 0. | 58. | 35. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 208 | Si Al K | 0. | 0. | 28. | 57. | 0. | 1. | 0. | 8. | 1. | 1. | 3. | 0. | 0. | 0. | 0. | 19.7 |
| 2 | Al Si K | 0. | 0. | 40. | 37. | 0. | 7. | 0. | 10. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Si K Al | 0. | 0. | 13. | 68. | 0. | 0. | 0. | 14. | 1. | 0. | 4. | 0. | 1. | 0. | 0. | 0.4 |
| 6 | Si Ca S | 0. | 0. | 13. | 37. | 1. | 16. | 1. | 4. | 20. | 2. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 7 | Si S Ca | 0. | 0. | 9. | 43. | 0. | 21. | 5. | 5. | 12. | 0. | 2. | 0. | 1. | 0. | 0. | 0.8 |
| 6 | S Ca Si | 0. | 0. | 9. | 17. | 0. | 37. | 0. | 0. | 31. | 2. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 16 | Ca S Si | 0. | 0. | 4. | 14. | 0. | 26. | 0. | 0. | 52. | 0. | 2. | 0. | 0. | 0. | 0. | 1.0 |
| 12 | Ca Si S | 0. | 0. | 5. | 20. | 0. | 14. | 0. | 0. | 51. | 4. | 6. | 0. | 0. | 0. | 0. | 1.4 |
| 6 | Ca Si Fe | 0. | 0. | 7. | 28. | 1. | 2. | 0. | 0. | 47. | 0. | 14. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca Fe Si | 0. | 0. | 5. | 18. | 0. | 4. | 0. | 0. | 40. | 0. | 33. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Fe Si Ca | 0. | 0. | 9. | 24. | 0. | 7. | 0. | 0. | 12. | 2. | 47. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca Fe | 0. | 0. | 0. | 60. | 0. | 0. | 0. | 0. | 33. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Ca Si | 0. | 0. | 9. | 22. | 0. | 9. | 0. | 0. | 24. | 3. | 32. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe Ca | 0. | 0. | 3. | 40. | 0. | 11. | 0. | 5. | 20. | 0. | 20. | 0. | 0. | 0. | 0. | 0.1 |
| 149 | Si Al Fe | 0. | 0. | 26. | 51. | 0. | 2. | 0. | 5. | 3. | 1. | 11. | 0. | 0. | 0. | 0. | 14.7 |
| 27 | Si Fe Al | 0. | 0. | 17. | 46. | 0. | 3. | 0. | 5. | 3. | 1. | 24. | 0. | 0. | 0. | 0. | 1.9 |
| 25 | Fe Si Al | 0. | 0. | 12. | 21. | 0. | 3. | 0. | 1. | 5. | 0. | 57. | 0. | 0. | 0. | 0. | 2.4 |
| 1 | S Ca Cu | 0. | 0. | 0. | 0. | 0. | 52. | 0. | 0. | 38. | 0. | 0. | 10. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Cu | 0. | 0. | 0. | 0. | 0. | 39. | 0. | 0. | 49. | 0. | 0. | 13. | 0. | 0. | 0. | 0.1 |
| 1 | S Si Ti | 0. | 0. | 10. | 23. | 0. | 24. | 0. | 7. | 13. | 15. | 0. | 0. | 7. | 0. | 0. | 0.0 |
| 1 | Cl Zn S | 0. | 0. | 0. | 0. | 0. | 17. | 60. | 0. | 0. | 0. | 0. | 0. | 23. | 0. | 0. | 0.0 |
| 1 | Cl S Ca | 0. | 0. | 0. | 0. | 12. | 21. | 33. | 0. | 20. | 0. | 0. | 0. | 14. | 0. | 0. | 0.0 |
| 1 | Ca S Cl | 0. | 0. | 0. | 6. | 0. | 25. | 12. | 5. | 36. | 0. | 5. | 0. | 11. | 0. | 0. | 0.1 |
| 1 | Cl Ca Zn | 0. | 0. | 0. | 0. | 0. | 12. | 44. | 0. | 27. | 0. | 0. | 0. | 17. | 0. | 0. | 0.0 |
| 1 | Ca Si K | 0. | 0. | 9. | 20. | 0. | 16. | 6. | 19. | 21. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |

## Table 3-12. Sample #552 PSI/Arizona Burn 47 Illinois #6 Ash, 1.4 Kg/hr, 1340°C, Port 11, Imp. #1 + Cup (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Si K Ca | 0. | 0. | 14. | 28. | 0. | 0. | 13. | 19. | 14. | 0. | 11. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S Fe Si | 0. | 0. | 4. | 29. | 0. | 38. | 0. | 0. | 0. | 0. | 29. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si S Fe | 0. | 0. | 7. | 63. | 0. | 18. | 0. | 2. | 2. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe Si S | 0. | 0. | 0. | 11. | 0. | 7. | 0. | 0. | 4. | 0. | 77. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Cl K S | 0. | 0. | 3. | 6. | 0. | 15. | 51. | 22. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | S Ca Fe | 0. | 0. | 3. | 4. | 0. | 44. | 0. | 0. | 32. | 0. | 16. | 0. | 1. | 0. | 0. | 0.3 |
| 3 | S Fe Ca | 0. | 0. | 7. | 14. | 0. | 33. | 0. | 0. | 15. | 0. | 31. | 0. | 0. | 0. | 0. | 0.3 |
| 7 | Ca S Fe | 0. | 0. | 4. | 5. | 0. | 33. | 0. | 0. | 46. | 0. | 11. | 1. | 0. | 0. | 0. | 0.7 |
| 2 | S Si Zn | 0. | 0. | 0. | 38. | 0. | 46. | 0. | 0. | 0. | 0. | 0. | 6. | 11. | 0. | 0. | 0.1 |
| 1 | Si S Zn | 0. | 0. | 0. | 75. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 9. | 0. | 0. | 0.3 |
| 1 | Al Cl P | 0. | 0. | 49. | 2. | 17. | 0. | 32. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al P Cl | 0. | 0. | 52. | 0. | 26. | 0. | 12. | 6. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si S Cl | 0. | 0. | 1. | 29. | 0. | 24. | 20. | 8. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si Ti Al | 0. | 0. | 18. | 38. | 0. | 2. | 0. | 3. | 7. | 22. | 10. | 0. | 0. | 0. | 0. | 0.2 |
| 6 | Si Al Ti | 0. | 0. | 23. | 50. | 0. | 3. | 0. | 4. | 4. | 9. | 6. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | Ti Si Al | 0. | 0. | 13. | 33. | 0. | 0. | 0. | 2. | 1. | 44. | 8. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Si Al Zn | 0. | 0. | 25. | 65. | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.1 |
| 8 | Ca Si Al | 0. | 0. | 16. | 29. | 0. | 1. | 0. | 0. | 43. | 1. | 10. | 0. | 0. | 0. | 0. | 0.6 |
| 50 | Si Al Ca | 0. | 0. | 24. | 49. | 0. | 5. | 0. | 3. | 12. | 1. | 5. | 1. | 0. | 0. | 0. | 5.4 |
| 13 | Si Ca Al | 0. | 0. | 19. | 40. | 0. | 3. | 0. | 2. | 26. | 0. | 10. | 0. | 0. | 0. | 0. | 1.5 |
| 3 | Al Si Ca | 0. | 0. | 49. | 34. | 2. | 0. | 2. | 2. | 9. | 1. | 1. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Cl Si Al | 0. | 0. | 21. | 27. | 0. | 6. | 28. | 6. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0.1 |
| 1 | Al Si Cl | 0. | 0. | 48. | 39. | 0. | 0. | 6. | 3. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Al | 0. | 0. | 9. | 8. | 0. | 22. | 0. | 8. | 52. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Al Ca | 0. | 0. | 18. | 14. | 0. | 41. | 0. | 0. | 16. | 10. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | P Ca Mg | 0. | 11. | 0. | 0. | 63. | 0. | 4. | 0. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca S Zn | 0. | 0. | 0. | 2. | 0. | 39. | 0. | 0. | 49. | 0. | 1. | 0. | 9. | 0. | 0. | 0.3 |
| 1 | S Ca Zn | 0. | 0. | 0. | 0. | 0. | 48. | 0. | 0. | 38. | 7. | 0. | 0. | 7. | 0. | 0. | 0.0 |
| 7 | Si Al Na | 13. | 0. | 22. | 50. | 0. | 1. | 0. | 6. | 0. | 0. | 7. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Fe Al Ca | 0. | 0. | 26. | 0. | 0. | 0. | 0. | 0. | 13. | 0. | 61. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Ca Al | 0. | 0. | 9. | 6. | 0. | 4. | 0. | 0. | 15. | 0. | 65. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Fe Al | 0. | 0. | 15. | 0. | 0. | 11. | 0. | 0. | 58. | 0. | 15. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca S K | 0. | 0. | 0. | 3. | 0. | 21. | 3. | 8. | 66. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Ca Ti | 0. | 0. | 0. | 0. | 0. | 54. | 0. | 0. | 28. | 14. | 0. | 0. | 5. | 0. | 0. | 0.2 |
| 1 | Ca S Ti | 0. | 0. | 0. | 0. | 0. | 42. | 0. | 0. | 52. | 6. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S K Si | 0. | 0. | 0. | 13. | 0. | 57. | 0. | 18. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0.3 |
| 1 | Al Fe S | 0. | 0. | 51. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 43. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca P Si | 0. | 0. | 6. | 8. | 22. | 7. | 0. | 0. | 56. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Mg Si | 0. | 19. | 5. | 17. | 0. | 8. | 0. | 2. | 45. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Si Mg | 0. | 17. | 4. | 21. | 0. | 7. | 1. | 0. | 48. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ti Si Ca | 0. | 0. | 7. | 25. | 0. | 2. | 0. | 2. | 7. | 53. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Si Ti | 0. | 0. | 0. | 38. | 0. | 0. | 0. | 0. | 0. | 22. | 40. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Fe Ti | 0. | 0. | 10. | 15. | 0. | 0. | 0. | 14. | 28. | 16. | 18. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca S Mg | 0. | 16. | 0. | 11. | 0. | 16. | 0. | 0. | 50. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 8 | OTHERS - | 0. | 7. | 9. | 10. | 0. | 8. | 0. | 0. | 38. | 3. | 24. | 0. | 2. | 0. | 0. | 0.9 |
| 1068 | TOTALS - | 0. | 0. | 19. | 49. | 0. | 7. | 0. | 4. | 8. | 1. | 10. | 0. | 0. | 0. | 0. | 100.0 |

## Table 3-12. Sample #552 PSI/Arizona Burn 47 Illinois #6 Ash, 1.4 Kg/hr, 1340°C, Port 11, Imp. #1 + Cup (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si - - | 12.0 | 1. | 28. | 41. | 21. | 9. | 0. | 0. |
| Si Al - | 7.2 | 2. | 21. | 42. | 28. | 6. | 2. | 0. |
| Si Al K | 19.7 | 4. | 29. | 28. | 23. | 12. | 3. | 0. |
| Si Al S | 5.3 | 9. | 27. | 24. | 23. | 12. | 4. | 0. |
| Si Al Fe | 14.7 | 11. | 45. | 28. | 12. | 4. | 0. | 0. |
| Si Al Ca | 5.4 | 6. | 41. | 28. | 23. | 2. | 0. | 0. |
| OTHERS - | 35.6 | 7. | 29. | 27. | 23. | 12. | 2. | 0. |
| TOTALS - | 100.0 | 6. | 31. | 30. | 22. | 10. | 2. | 0. |

# Table 3-13. Sample #553 PSI/Arizona Burn 47 Illinois #6 Imp. 2+3+4, 1.4 Kg/hr, 1403°C, 11 Port

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85 | Si - - | 0. | 0. | 1. | 92. | 0. | 1. | 0. | 2. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 7.7 |
| 29 | S - - | 0. | 0. | 3. | 2. | 0. | 90. | 0. | 0. | 1. | 1. | 1. | 1. | 0. | 0. | 0. | 2.5 |
| 19 | Fe - - | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 97. | 0. | 0. | 0. | 0. | 2.2 |
| 1 | K - - | 0. | 0. | 0. | 44. | 0. | 0. | 0. | 56. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca - - | 0. | 0. | 7. | 8. | 5. | 7. | 0. | 0. | 69. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 72 | Ca S - | 0. | 0. | 1. | 2. | 0. | 43. | 0. | 0. | 52. | 0. | 1. | 0. | 0. | 0. | 0. | 2.4 |
| 3 | S Ca - | 0. | 0. | 0. | 5. | 0. | 81. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ti - | 0. | 0. | 0. | 0. | 0. | 86. | 0. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe S - | 0. | 0. | 0. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Fe - | 0. | 0. | 0. | 5. | 0. | 80. | 0. | 0. | 0. | 0. | 11. | 4. | 0. | 0. | 0. | 0.0 |
| 1 | S Al - | 0. | 0. | 17. | 0. | 0. | 83. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 68 | Si Al - | 0. | 0. | 38. | 53. | 0. | 2. | 0. | 4. | 1. | 1. | 2. | 0. | 0. | 0. | 0. | 5.8 |
| 1 | Al Cl - | 0. | 0. | 82. | 0. | 0. | 3. | 12. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Al S - | 0. | 0. | 80. | 0. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Si - | 0. | 0. | 5. | 25. | 0. | 4. | 0. | 0. | 0. | 3. | 63. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Si S - | 1. | 0. | 1. | 79. | 0. | 17. | 0. | 0. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 0.1 |
| 1 | Ca Mg - | 0. | 45. | 0. | 2. | 0. | 0. | 0. | 2. | 49. | 0. | 0. | 2. | 0. | 0. | 0. | 0.1 |
| 2 | Si Fe - | 0. | 0. | 0. | 67. | 0. | 0. | 0. | 0. | 0. | 0. | 33. | 0. | 0. | 0. | 0. | 0.0 |
| 41 | Si S Al | 0. | 0. | 21. | 41. | 0. | 26. | 0. | 1. | 2. | 5. | 3. | 0. | 1. | 0. | 0. | 1.8 |
| 101 | Si Al S | 0. | 0. | 31. | 45. | 0. | 16. | 0. | 1. | 1. | 1. | 3. | 0. | 0. | 0. | 0. | 9.7 |
| 29 | S Si Al | 0. | 0. | 16. | 22. | 0. | 57. | 0. | 0. | 2. | 0. | 2. | 1. | 0. | 0. | 0. | 3.1 |
| 9 | S Al Si | 0. | 0. | 28. | 23. | 0. | 45. | 0. | 2. | 1. | 2. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 2 | Al S Si | 0. | 0. | 53. | 15. | 0. | 18. | 0. | 0. | 10. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Al Si S | 0. | 0. | 42. | 40. | 0. | 15. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 3 | Fe Al Ca | 0. | 0. | 18. | 12. | 0. | 8. | 0. | 0. | 13. | 3. | 44. | 0. | 2. | 0. | 0. | 0.7 |
| 1 | Al Fe Ca | 0. | 9. | 24. | 15. | 0. | 16. | 0. | 0. | 16. | 0. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | Si Ca S | 0. | 0. | 19. | 35. | 0. | 20. | 0. | 5. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 1.1 |
| 70 | Ca S Si | 0. | 0. | 6. | 11. | 0. | 35. | 0. | 0. | 43. | 2. | 1. | 0. | 0. | 0. | 0. | 2.1 |
| 11 | S Ca Si | 0. | 0. | 9. | 15. | 0. | 44. | 1. | 0. | 25. | 0. | 1. | 4. | 0. | 0. | 0. | 0.4 |
| 3 | S Si Ca | 0. | 0. | 11. | 20. | 0. | 35. | 0. | 0. | 17. | 8. | 9. | 0. | 0. | 0. | 0. | 0.3 |
| 6 | Si S Ca | 0. | 0. | 5. | 49. | 0. | 32. | 0. | 1. | 12. | 0. | 1. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | Ca Si S | 0. | 0. | 7. | 17. | 3. | 14. | 0. | 0. | 52. | 0. | 6. | 0. | 1. | 0. | 0. | 0.2 |
| 176 | Si Al K | 0. | 0. | 29. | 56. | 0. | 2. | 0. | 9. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 15.6 |
| 1 | Si K Al | 0. | 0. | 14. | 61. | 0. | 9. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 18 | Si Fe Al | 0. | 0. | 19. | 47. | 0. | 3. | 0. | 4. | 4. | 1. | 22. | 0. | 0. | 0. | 0. | 2.4 |
| 139 | Si Al Fe | 1. | 0. | 27. | 49. | 0. | 4. | 0. | 6. | 2. | 1. | 10. | 0. | 0. | 0. | 0. | 22.2 |
| 11 | Fe Si Al | 0. | 0. | 15. | 30. | 0. | 3. | 0. | 3. | 4. | 1. | 42. | 0. | 2. | 0. | 0. | 0.7 |
| 1 | Fe Al Si | 0. | 0. | 20. | 11. | 0. | 9. | 3. | 0. | 7. | 0. | 50. | 0. | 0. | 0. | 0. | 0.0 |
| 47 | Si Al Ca | 0. | 0. | 25. | 45. | 0. | 5. | 0. | 3. | 12. | 2. | 7. | 1. | 0. | 0. | 0. | 3.9 |
| 10 | Si Ca Al | 0. | 0. | 14. | 44. | 0. | 5. | 0. | 2. | 27. | 1. | 7. | 0. | 0. | 0. | 0. | 1.0 |
| 6 | Ca Si Al | 0. | 0. | 15. | 27. | 1. | 3. | 0. | 0. | 47. | 0. | 7. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | Al Si Ca | 0. | 0. | 36. | 29. | 0. | 2. | 0. | 0. | 15. | 4. | 14. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Al Ca Si | 0. | 0. | 50. | 8. | 0. | 2. | 0. | 0. | 29. | 4. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 16 | Si Al Na | 11. | 0. | 23. | 52. | 0. | 2. | 0. | 6. | 0. | 1. | 5. | 0. | 0. | 0. | 0. | 1.6 |
| 1 | K Ca Cl | 0. | 0. | 0. | 0. | 0. | 10. | 13. | 49. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Fe K | 0. | 0. | 7. | 70. | 0. | 0. | 0. | 8. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Si Na | 15. | 0. | 8. | 15. | 5. | 4. | 8. | 0. | 25. | 7. | 5. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Si Ca Na | 13. | 0. | 0. | 69. | 0. | 0. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ti Al | 0. | 0. | 18. | 35. | 0. | 0. | 0. | 7. | 7. | 20. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Si Al Ti | 0. | 0. | 26. | 48. | 0. | 2. | 0. | 5. | 6. | 8. | 4. | 0. | 1. | 0. | 0. | 0.5 |
| 1 | Ti Si Al | 9. | 0. | 11. | 24. | 0. | 0. | 0. | 3. | 2. | 44. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 20 | Ca S Fe | 0. | 0. | 0. | 3. | 4. | 23. | 0. | 0. | 58. | 0. | 10. | 0. | 0. | 0. | 0. | 1.3 |
| 2 | Fe Ca S | 0. | 0. | 0. | 12. | 0. | 20. | 0. | 0. | 21. | 0. | 47. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe S Ca | 0. | 7. | 8. | 7. | 0. | 19. | 0. | 0. | 15. | 0. | 44. | 0. | 0. | 0. | 0. | 0.0 |

## Table 3-13. Sample #553 PSI/Arizona Burn 47 Illinois #6 Imp. 2+3+4, 1.4 Kg/hr, 1403°C, 11 Port (Continued)

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | S | Ca | Fe | 0. | 0. | 0. | 11. | 0. | 36. | 0. | 14. | 21. | 0. | 18. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si | S- | Fe | 0. | 0. | 0. | 50. | 0. | 33. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S | Si | Fe | 0. | 0. | 0. | 34. | 0. | 50. | 0. | 0. | 0. | 1. | 12. | 0. | 2. | 0. | 0. | 0.2 |
| 2 | Si | Fe | S | 0. | 0. | 8. | 40. | 0. | 21. | 0. | 2. | 4. | 0. | 25. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Fe | Si | 0. | 0. | 0. | 15. | 0. | 62. | 0. | 4. | 0. | 1. | 17. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe | S | Si | 0. | 0. | 12. | 15. | 0. | 25. | 0. | 0. | 5. | 0. | 43. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | S | Ca | Al | 0. | 0. | 18. | 5. | 0. | 40. | 2. | 0. | 25. | 3. | 7. | 0. | 2. | 0. | 0. | 0.1 |
| 7 | Ca | S | Al | 0. | 0. | 9. | 7. | 1. | 20. | 2. | 1. | 51. | 2. | 7. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Al | S | Ca | 0. | 0. | 30. | 0. | 0. | 28. | 0. | 0. | 27. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Al | Fe | 0. | 0. | 19. | 10. | 0. | 41. | 0. | 9. | 9. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Fe | Al | 0. | 0. | 14. | 11. | 0. | 37. | 11. | 0. | 9. | 0. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe | S | Al | 0. | 0. | 22. | 0. | 0. | 32. | 0. | 0. | 0. | 0. | 45. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Al | Fe | S | 0. | 0. | 38. | 3. | 13. | 17. | 0. | 0. | 6. | 0. | 23. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si | Ca | Fe | 0. | 0. | 10. | 46. | 0. | 2. | 0. | 2. | 25. | 2. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe | Ca | Si | 0. | 0. | 4. | 6. | 0. | 0. | 0. | 0. | 11. | 0. | 79. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca | S | Ti | 0. | 0. | 1. | 11. | 0. | 33. | 8. | 0. | 35. | 12. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca | Ti | S | 0. | 0. | 0. | 16. | 0. | 19. | 0. | 0. | 28. | 20. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | Ti | 0. | 0. | 0. | 10. | 0. | 33. | 0. | 10. | 18. | 16. | 12. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ti | Ca | 0. | 0. | 0. | 0. | 0. | 68. | 0. | 0. | 10. | 12. | 9. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | S | Si | Ti | 0. | 0. | 0. | 11. | 0. | 80. | 0. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | Si | S | Ti | 0. | 0. | 1. | 45. | 0. | 24. | 0. | 0. | 0. | 16. | 14. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Ti | Si | 0. | 0. | 12. | 14. | 0. | 42. | 9. | 0. | 0. | 15. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Ti | Si | 0. | 0. | 13. | 19. | 0. | 18. | 0. | 0. | 25. | 19. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti | Si | Ca | 0. | 0. | 8. | 16. | 0. | 6. | 0. | 0. | 10. | 50. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si | S | K | 0. | 0. | 9. | 39. | 0. | 19. | 9. | 16. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Zn | Si | 0. | 0. | 14. | 15. | 0. | 44. | 0. | 0. | 0. | 8. | 0. | 0. | 18. | 0. | 0. | 0.0 |
| 1 | Cu | Cl | Na | 23. | 0. | 0. | 0. | 0. | 0. | 24. | 11. | 0. | 0. | 0. | 37. | 5. | 0. | 0. | 0.0 |
| 1 | Al | P | Ca | 0. | 0. | 73. | 2. | 10. | 0. | 6. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na | Si | S | 28. | 0. | 19. | 24. | 0. | 23. | 0. | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Al | K | 0. | 0. | 24. | 19. | 0. | 36. | 0. | 21. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na | S | Al | 32. | 0. | 16. | 11. | 0. | 24. | 0. | 0. | 9. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ti | Fe | 0. | 0. | 0. | 0. | 0. | 67. | 0. | 0. | 11. | 12. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | P | S | 0. | 0. | 7. | 6. | 19. | 13. | 0. | 0. | 49. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | S | P | 0. | 0. | 0. | 0. | 6. | 21. | 0. | 0. | 69. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Cl | Si | 0. | 0. | 0. | 17. | 7. | 33. | 21. | 6. | 10. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti | Fe | Al | 0. | 0. | 14. | 5. | 0. | 0. | 0. | 0. | 9. | 50. | 22. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | S | P | 0. | 0. | 0. | 50. | 11. | 39. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S | Al | Zn | 0. | 0. | 13. | 11. | 0. | 43. | 0. | 11. | 0. | 11. | 0. | 0. | 11. | 0. | 0. | 0.5 |
| 1 | Si | Al | Zn | 0. | 0. | 28. | 47. | 0. | 7. | 0. | 0. | 0. | 0. | 6. | 0. | 11. | 0. | 0. | 0.2 |
| 1 | Si | Mg | Ca | 0. | 15. | 8. | 37. | 0. | 11. | 0. | 9. | 14. | 0. | 0. | 0. | 5. | 0. | 0. | 0.2 |
| 1 | Ti | S | Al | 0. | 0. | 20. | 12. | 0. | 30. | 0. | 8. | 0. | 30. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al | Ti | S | 0. | 0. | 45. | 5. | 0. | 13. | 0. | 0. | 9. | 14. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | Al | P | 0. | 0. | 30. | 8. | 16. | 8. | 0. | 0. | 6. | 0. | 31. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Al | Cl | 0. | 0. | 35. | 54. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti | Fe | Ca | 0. | 0. | 3. | 5. | 0. | 0. | 0. | 0. | 12. | 60. | 19. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | OTHERS - | | | 0. | 0. | 9. | 14. | 0. | 6. | 0. | 3. | 6. | 47. | 16. | 0. | 0. | 0. | 0. | 1.1 |
| 1129 | TOTALS - | | | 1. | 0. | 21. | 43. | 0. | 13. | 0. | 4. | 7. | 2. | 8. | 0. | 0. | 0. | 0. | 100.0 |

## Table 3-13. Sample #553 PSI/Arizona Burn 47 Illinois #6 Imp. 2+3+4, 1.4 Kg/hr, 1403°C, 11 Port (Continued)

|  |  | Volume DISTRIBUTION |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si - - | 7.7 | 27. | 59. | 10. | 3. | 0. | 0. | 0. |
| Si Al - | 5.8 | 68. | 20. | 11. | 0. | 0. | 0. | 0. |
| Si Al S | 9.7 | 43. | 47. | 10. | 0. | 0. | 0. | 0. |
| Si Al K | 15.6 | 43. | 44. | 11. | 1. | 0. | 0. | 0. |
| Si Al Fe | 22.2 | 46. | 51. | 3. | 1. | 0. | 0. | 0. |
| OTHERS - | 38.9 | 56. | 25. | 16. | 4. | 0. | 0. | 0. |
| TOTALS - | 100.0 | 49. | 38. | 11. | 2. | 0. | 0. | 0. |

# Table 3-14. Sample #558 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. #1 + Cup

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 149 | Si - - | 0. | 0. | 2. | 95. | 0. | 0. | 0. | 2. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 14.1 |
| 46 | Fe - - | 1. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 1. | 0. | 96. | 0. | 0. | 0. | 0. | 4.8 |
| 13 | Ca - - | 0. | 0. | 1. | 1. | 0. | 1. | 0. | 0. | 95. | 0. | 1. | 0. | 1. | 0. | 0. | 0.7 |
| 1 | Cl - - | 0. | 0. | 3. | 6. | 0. | 0. | 81. | 0. | 9. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 55 | Si Al - | 1. | 0. | 31. | 58. | 0. | 1. | 0. | 5. | 1. | 1. | 3. | 0. | 0. | 0. | 0. | 4.5 |
| 12 | Al Si - | 0. | 0. | 51. | 45. | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 3 | Si Fe - | 0. | 0. | 3. | 55. | 0. | 0. | 0. | 4. | 3. | 0. | 36. | 0. | 0. | 0. | 0. | 0.6 |
| 3 | Fe Si - | 0. | 0. | 3. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 83. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Ca - | 0. | 0. | 0. | 74. | 0. | 0. | 0. | 0. | 22. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Si - | 0. | 0. | 0. | 41. | 0. | 0. | 0. | 0. | 59. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 41 | Ca S - | 0. | 0. | 0. | 1. | 0. | 39. | 0. | 0. | 57. | 0. | 2. | 0. | 0. | 0. | 0. | 3.5 |
| 1 | Ca Fe - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 63. | 0. | 37. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Ca - | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 12. | 0. | 84. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si S - | 0. | 0. | 3. | 77. | 0. | 13. | 0. | 0. | 3. | 0. | 0. | 0. | 3. | 0. | 0. | 0.0 |
| 2 | Si Mg - | 0. | 33. | 0. | 64. | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 254 | Si Al K | 1. | 0. | 26. | 59. | 0. | 1. | 0. | 8. | 1. | 0. | 4. | 0. | 0. | 0. | 0. | 20.9 |
| 2 | Al Si K | 0. | 0. | 45. | 44. | 0. | 0. | 0. | 7. | 2. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 52 | Si Fe Al | 0. | 0. | 16. | 48. | 0. | 2. | 0. | 5. | 2. | 1. | 25. | 0. | 0. | 0. | 0. | 4.5 |
| 228 | Si Al Fe | 1. | 0. | 25. | 50. | 0. | 3. | 0. | 6. | 3. | 1. | 11. | 0. | 0. | 0. | 0. | 20.1 |
| 28 | Fe Si Al | 0. | 0. | 12. | 27. | 0. | 1. | 0. | 3. | 2. | 1. | 54. | 0. | 0. | 0. | 0. | 2.6 |
| 1 | Al Si Fe | 4. | 0. | 41. | 39. | 0. | 0. | 0. | 6. | 2. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si S Ca | 0. | 1. | 13. | 35. | 0. | 16. | 1. | 12. | 14. | 3. | 6. | 0. | 1. | 0. | 0. | 0.2 |
| 7 | S Si Ca | 0. | 0. | 12. | 23. | 0. | 31. | 4. | 7. | 13. | 0. | 8. | 0. | 3. | 0. | 0. | 0.6 |
| 16 | Ca S Si | 0. | 0. | 4. | 14. | 0. | 31. | 0. | 0. | 48. | 1. | 2. | 0. | 0. | 0. | 0. | 0.8 |
| 7 | Ca Si S | 1. | 0. | 7. | 21. | 2. | 17. | 0. | 1. | 48. | 0. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 5 | S Ca Si | 0. | 0. | 4. | 10. | 2. | 47. | 1. | 0. | 28. | 3. | 3. | 1. | 0. | 0. | 0. | 0.5 |
| 8 | Si Ca S | 0. | 0. | 9. | 44. | 0. | 16. | 0. | 1. | 24. | 0. | 6. | 0. | 0. | 0. | 0. | 0.8 |
| 13 | S Si Al | 0. | 0. | 18. | 25. | 0. | 40. | 1. | 1. | 4. | 3. | 3. | 0. | 4. | 0. | 0. | 0.6 |
| 21 | Si Al S | 0. | 0. | 23. | 48. | 1. | 13. | 0. | 3. | 6. | 0. | 5. | 1. | 0. | 0. | 0. | 1.7 |
| 3 | S Al Si | 0. | 0. | 24. | 21. | 0. | 43. | 2. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 14 | Si S Al | 0. | 0. | 16. | 41. | 0. | 28. | 1. | 2. | 6. | 0. | 5. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Al Si S | 0. | 11. | 30. | 27. | 0. | 17. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Fe Si | 0. | 0. | 5. | 20. | 0. | 10. | 0. | 0. | 34. | 0. | 31. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Fe Ca Si | 0. | 0. | 4. | 8. | 0. | 0. | 0. | 0. | 16. | 0. | 71. | 0. | 0. | 0. | 0. | 0.5 |
| 3 | Fe Si Ca | 0. | 0. | 9. | 16. | 0. | 4. | 0. | 0. | 12. | 1. | 57. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Fe Ca | 0. | 0. | 16. | 40. | 0. | 5. | 0. | 1. | 17. | 0. | 22. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca Fe | 0. | 0. | 4. | 59. | 0. | 0. | 0. | 0. | 24. | 0. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Si Fe | 0. | 0. | 13. | 27. | 0. | 7. | 0. | 0. | 38. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | S Ca Zn | 0. | 0. | 0. | 0. | 0. | 62. | 0. | 0. | 25. | 0. | 0. | 0. | 12. | 0. | 0. | 0.1 |
| 1 | Zn S Ca | 0. | 0. | 3. | 8. | 0. | 23. | 5. | 0. | 15. | 0. | 13. | 0. | 33. | 0. | 0. | 0.1 |
| 1 | S Zn Ca | 0. | 0. | 0. | 14. | 0. | 39. | 0. | 0. | 15. | 0. | 14. | 0. | 18. | 0. | 0. | 0.0 |
| 2 | Ca S Zn | 0. | 0. | 0. | 0. | 0. | 31. | 0. | 3. | 52. | 0. | 6. | 0. | 8. | 0. | 0. | 0.0 |
| 2 | S Cl Si | 0. | 0. | 0. | 13. | 0. | 41. | 23. | 11. | 10. | 2. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S Si Cl | 0. | 0. | 0. | 25. | 14. | 46. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Al Ca | 0. | 0. | 24. | 0. | 0. | 63. | 0. | 0. | 11. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca S Al | 0. | 0. | 8. | 6. | 0. | 31. | 0. | 0. | 50. | 0. | 5. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | S Ca Al | 0. | 0. | 11. | 2. | 0. | 43. | 0. | 2. | 31. | 4. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ca Al S | 0. | 0. | 23. | 13. | 0. | 15. | 0. | 0. | 41. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Fe Si Ti | 0. | 0. | 5. | 21. | 0. | 1. | 0. | 1. | 4. | 11. | 58. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Fe Ti | 0. | 0. | 14. | 38. | 0. | 4. | 0. | 5. | 5. | 16. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Ti Si | 0. | 0. | 7. | 9. | 0. | 0. | 0. | 0. | 5. | 10. | 68. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na Cl Ca | 28. | 0. | 0. | 6. | 0. | 14. | 27. | 9. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 37 | Si Al Ca | 1. | 0. | 29. | 47. | 0. | 2. | 0. | 4. | 10. | 1. | 5. | 0. | 0. | 0. | 0. | 3.5 |
| 12 | Si Ca Al | 0. | 1. | 16. | 43. | 0. | 4. | 0. | 2. | 25. | 1. | 8. | 0. | 0. | 0. | 0. | 0.9 |

# Table 3-14. Sample #558 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. #1 + Cup (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Ca | Si | Al | 0. | 1. | 14. | 26. | 0. | 2. | 0. | 1. | 51. | 0. | 4. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | Al | Si | Ca | 0. | 0. | 34. | 32. | 0. | 3. | 0. | 2. | 15. | 5. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ca | Al | Si | 0. | 0. | 38. | 15. | 0. | 0. | 0. | 0. | 42. | 0. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al | Ca | Si | 0. | 0. | 43. | 9. | 0. | 0. | 0. | 0. | 36. | 3. | 5. | 3. | 0. | 0. | 0. | 0.0 |
| 4 | Si | Fe | K | 0. | 0. | 8. | 61. | 0. | 0. | 0. | 10. | 0. | 1. | 20. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Fe | Ca | S | 0. | 0. | 5. | 3. | 0. | 19. | 2. | 0. | 25. | 3. | 42. | 0. | 1. | 0. | 0. | 0.1 |
| 16 | Ca | S | Fe | 0. | 0. | 2. | 4. | 1. | 21. | 0. | 0. | 63. | 0. | 8. | 0. | 0. | 0. | 0. | 1.1 |
| 1 | S | Ca | Fe | 0. | 0. | 0. | 0. | 0. | 53. | 0. | 0. | 32. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Fe | Ca | 0. | 0. | 0. | 0. | 0. | 70. | 0. | 0. | 14. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca | Fe | S | 0. | 5. | 3. | 5. | 2. | 10. | 0. | 0. | 47. | 2. | 25. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S | Fe | Si | 0. | 0. | 16. | 18. | 0. | 27. | 0. | 0. | 11. | 10. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Si | Fe | 0. | 0. | 11. | 28. | 0. | 31. | 0. | 0. | 14. | 0. | 15. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si | S | Fe | 0. | 0. | 0. | 50. | 0. | 37. | 0. | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | S | Ti | 0. | 0. | 0. | 6. | 0. | 15. | 0. | 0. | 69. | 6. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | Si | Ti | 0. | 0. | 8. | 16. | 9. | 0. | 0. | 0. | 43. | 9. | 7. | 7. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Ti | Si | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 13. | 37. | 21. | 12. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si | Ti | Ca | 0. | 0. | 18. | 30. | 0. | 11. | 0. | 0. | 18. | 23. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Si | Cl | 0. | 0. | 8. | 19. | 0. | 0. | 9. | 0. | 63. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | Si | Al | Ti | 0. | 0. | 22. | 45. | 0. | 1. | 0. | 3. | 6. | 15. | 7. | 0. | 0. | 0. | 0. | 1.3 |
| 1 | Si | Ti | Al | 0. | 0. | 8. | 64. | 0. | 0. | 0. | 3. | 2. | 20. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al | Si | Ti | 0. | 0. | 29. | 24. | 0. | 0. | 0. | 0. | 19. | 22. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | Cu | 0. | 0. | 0. | 10. | 0. | 52. | 0. | 0. | 26. | 0. | 0. | 12. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | S | Cu | 0. | 0. | 0. | 8. | 0. | 39. | 0. | 0. | 44. | 0. | 0. | 8. | 0. | 0. | 0. | 0.3 |
| 1 | S | Si | Ti | 0. | 0. | 0. | 23. | 0. | 49. | 10. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Mg | Al | 0. | 19. | 13. | 56. | 0. | 0. | 0. | 4. | 4. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Si | Al | Na | 10. | 0. | 20. | 50. | 0. | 5. | 0. | 4. | 5. | 0. | 6. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S | Ca | K | 0. | 0. | 0. | 0. | 0. | 50. | 0. | 15. | 22. | 0. | 13. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S | Mg | Si | 0. | 23. | 8. | 8. | 0. | 41. | 0. | 0. | 6. | 0. | 7. | 6. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | P | Si | 0. | 0. | 3. | 10. | 19. | 0. | 0. | 0. | 62. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Fe | K | 0. | 0. | 0. | 19. | 0. | 34. | 0. | 22. | 0. | 0. | 26. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | S | K | 0. | 0. | 12. | 42. | 0. | 21. | 0. | 17. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | Zn | S | 0. | 0. | 0. | 4. | 0. | 18. | 47. | 0. | 0. | 0. | 0. | 0. | 31. | 0. | 0. | 0.2 |
| 1 | S | Fe | Al | 0. | 0. | 10. | 8. | 0. | 64. | 0. | 0. | 7. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe | Al | Ti | 0. | 0. | 18. | 11. | 0. | 3. | 0. | 0. | 15. | 17. | 36. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti | Si | Zn | 0. | 0. | 0. | 27. | 0. | 0. | 10. | 0. | 14. | 31. | 0. | 0. | 18. | 0. | 0. | 0.0 |
| 1 | Fe | Ca | Al | 0. | 0. | 14. | 9. | 0. | 0. | 0. | 0. | 16. | 10. | 49. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | Al | Ca | 0. | 0. | 10. | 9. | 0. | 0. | 0. | 0. | 9. | 6. | 66. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Cl | Al | 0. | 0. | 12. | 37. | 0. | 5. | 26. | 10. | 4. | 0. | 6. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Ca | Fe | P | 0. | 0. | 3. | 4. | 6. | 3. | 0. | 0. | 47. | 0. | 36. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al | P | Si | 0. | 0. | 63. | 9. | 15. | 6. | 0. | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1177 | TOTALS - | | | 1. | 0. | 17. | 49. | 0. | 6. | 1. | 4. | 8. | 1. | 13. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-14. Sample #558 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. #1 + Cup (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Si - - | 14.1 | 7. | 27. | 23. | 35. | 7. | 2. | 0. |
| Fe - - | 4.8 | 18. | 39. | 18. | 23. | 2. | 0. | 0. |
| Si Al - | 4.5 | 8. | 34. | 24. | 21. | 13. | 0. | 0. |
| Si Al K | 20.9 | 5. | 13. | 25. | 42. | 12. | 3. | 0. |
| Si Fe Al | 4.5 | 12. | 26. | 21. | 31. | 7. | 3. | 0. |
| Si Al Fe | 20.1 | 37. | 35. | 15. | 12. | 1. | 0. | 0. |
| OTHERS - | 31.1 | 17. | 32. | 24. | 19. | 7. | 1. | 0. |
| TOTALS - | 100.0 | 16. | 28. | 22. | 25. | 7. | 1. | 0. |

## Table 3-15. Sample #559 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. 2+3+4

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 68 | Si - - | 0. | 0. | 2. | 91. | 0. | 1. | 0. | 2. | 1. | 0. | 3. | 0. | 0. | 0. | 0. | 8.9 |
| 16 | S - - | 0. | 0. | 4. | 3. | 0. | 81. | 1. | 0. | 7. | 0. | 3. | 0. | 1. | 0. | 0. | 2.0 |
| 5 | Ca - - | 1. | 1. | 1. | 2. | 0. | 3. | 0. | 0. | 91. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 41 | Fe - - | 0. | 0. | 2. | 5. | 0. | 1. | 0. | 0. | 2. | 1. | 89. | 0. | 0. | 0. | 0. | 3.6 |
| 1 | Al Si - | 0. | 0. | 54. | 41. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 26 | Si Al - | 1. | 0. | 37. | 55. | 0. | 1. | 0. | 3. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 2.0 |
| 1 | Si Ca - | 0. | 0. | 0. | 49. | 0. | 0. | 0. | 0. | 46. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca Si - | 0. | 1. | 0. | 19. | 0. | 3. | 0. | 0. | 74. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Al P - | 0. | 0. | 58. | 0. | 38. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Fe - | 0. | 0. | 0. | 82. | 0. | 0. | 0. | 5. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0.9 |
| 9 | Fe Si - | 0. | 0. | 3. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 82. | 0. | 0. | 0. | 0. | 1.0 |
| 57 | Ca S - | 0. | 0. | 0. | 1. | 0. | 43. | 0. | 0. | 54. | 0. | 1. | 0. | 0. | 0. | 0. | 1.3 |
| 1 | S Ca - | 0. | 0. | 0. | 3. | 0. | 79. | 0. | 0. | 11. | 0. | 4. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | Si S - | 0. | 0. | 0. | 73. | 0. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca P - | 0. | 0. | 0. | 0. | 29. | 0. | 0. | 0. | 71. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 107 | Ca S Si | 0. | 0. | 6. | 15. | 0. | 27. | 0. | 0. | 45. | 0. | 6. | 0. | 0. | 0. | 0. | 2.6 |
| 17 | Si Ca S | 0. | 0. | 10. | 39. | 0. | 17. | 2. | 2. | 21. | 1. | 6. | 2. | 0. | 0. | 0. | 0.3 |
| 7 | S Si Ca | 3. | 0. | 11. | 25. | 0. | 32. | 2. | 2. | 19. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 13 | Ca Si S | 0. | 0. | 13. | 22. | 0. | 17. | 1. | 4. | 38. | 0. | 6. | 0. | 0. | 0. | 0. | 1.1 |
| 9 | Si S Ca | 0. | 0. | 6. | 43. | 0. | 21. | 0. | 5. | 17. | 1. | 4. | 0. | 2. | 0. | 0. | 0.1 |
| 11 | S Ca Si | 0. | 1. | 8. | 14. | 2. | 42. | 1. | 0. | 23. | 0. | 7. | 2. | 1. | 0. | 0. | 0.3 |
| 4 | S Ca Fe | 0. | 0. | 3. | 10. | 0. | 49. | 0. | 1. | 23. | 0. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 35 | Ca S Fe | 0. | 0. | 2. | 4. | 4. | 22. | 0. | 0. | 57. | 0. | 11. | 0. | 0. | 0. | 0. | 3.7 |
| 1 | S Fe Ca | 0. | 0. | 0. | 0. | 0. | 40. | 0. | 0. | 22. | 6. | 25. | 0. | 7. | 0. | 0. | 0.0 |
| 14 | Ca Fe S | 0. | 0. | 2. | 6. | 6. | 12. | 0. | 0. | 53. | 0. | 19. | 0. | 0. | 0. | 0. | 1.4 |
| 2 | Fe Ca S | 0. | 0. | 0. | 6. | 3. | 15. | 0. | 3. | 30. | 9. | 34. | 0. | 0. | 0. | 0. | 0.2 |
| 305 | Si Al Fe | 1. | 0. | 26. | 48. | 0. | 4. | 0. | 5. | 3. | 1. | 12. | 0. | 0. | 0. | 0. | 34.1 |
| 47 | Si Fe Al | 1. | 0. | 19. | 43. | 0. | 4. | 0. | 4. | 4. | 1. | 24. | 0. | 0. | 0. | 0. | 5.2 |
| 31 | Fe Si Al | 0. | 0. | 14. | 24. | 0. | 3. | 0. | 2. | 4. | 3. | 49. | 0. | 0. | 0. | 0. | 3.3 |
| 2 | Fe Al Si | 0. | 0. | 18. | 13. | 0. | 0. | 0. | 0. | 1. | 3. | 64. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Al Si Fe | 0. | 0. | 38. | 27. | 0. | 2. | 0. | 2. | 6. | 4. | 22. | 0. | 0. | 0. | 0. | 0.3 |
| 10 | Ca Fe Si | 0. | 0. | 6. | 14. | 3. | 6. | 0. | 1. | 47. | 1. | 21. | 0. | 0. | 0. | 0. | 1.2 |
| 10 | Si Fe Ca | 0. | 0. | 8. | 52. | 0. | 3. | 0. | 4. | 13. | 1. | 18. | 0. | 1. | 0. | 0. | 0.4 |
| 6 | Fe Ca Si | 0. | 0. | 7. | 14. | 0. | 7. | 0. | 1. | 27. | 0. | 43. | 0. | 0. | 0. | 0. | 0.8 |
| 4 | Si Ca Fe | 0. | 0. | 4. | 52. | 0. | 1. | 0. | 0. | 29. | 1. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | Fe Si Ca | 0. | 0. | 4. | 18. | 0. | 2. | 0. | 4. | 10. | 0. | 59. | 0. | 4. | 0. | 0. | 0.2 |
| 12 | Ca Si Fe | 0. | 0. | 5. | 23. | 3. | 6. | 1. | 1. | 48. | 1. | 12. | 0. | 0. | 0. | 0. | 1.1 |
| 60 | Si Al K | 1. | 0. | 27. | 59. | 0. | 1. | 0. | 8. | 0. | 1. | 3. | 0. | 0. | 0. | 0. | 5.8 |
| 2 | Si K Al | 0. | 0. | 12. | 48. | 0. | 5. | 0. | 21. | 0. | 4. | 5. | 0. | 6. | 0. | 0. | 0.0 |
| 37 | Si Al Ca | 0. | 0. | 26. | 43. | 0. | 4. | 0. | 3. | 13. | 1. | 8. | 0. | 0. | 0. | 0. | 3.9 |
| 8 | Ca Si Al | 2. | 0. | 14. | 22. | 0. | 3. | 0. | 0. | 49. | 1. | 8. | 0. | 0. | 0. | 0. | 1.2 |
| 18 | Si Ca Al | 3. | 0. | 18. | 38. | 0. | 6. | 1. | 2. | 23. | 1. | 8. | 0. | 0. | 0. | 0. | 1.8 |
| 17 | Si S Al | 0. | 0. | 23. | 37. | 0. | 31. | 2. | 0. | 3. | 1. | 4. | 0. | 0. | 0. | 0. | 1.0 |
| 5 | S Al Si | 0. | 0. | 21. | 16. | 0. | 55. | 0. | 1. | 1. | 0. | 3. | 0. | 2. | 0. | 0. | 0.1 |
| 13 | S Si Al | 0. | 0. | 17. | 20. | 0. | 49. | 0. | 0. | 9. | 2. | 3. | 0. | 0. | 0. | 0. | 1.3 |
| 27 | Si Al S | 0. | 0. | 30. | 41. | 0. | 17. | 0. | 2. | 5. | 0. | 3. | 1. | 2. | 0. | 0. | 1.5 |
| 3 | Al Si S | 0. | 0. | 63. | 19. | 0. | 16. | 0. | 1. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al S Si | 0. | 0. | 28. | 16. | 0. | 20. | 0. | 9. | 11. | 0. | 15. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si S K | 0. | 0. | 6. | 53. | 0. | 18. | 0. | 9. | 6. | 0. | 5. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | S Si K | 0. | 0. | 0. | 21. | 9. | 33. | 0. | 18. | 10. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S K Cl | 0. | 0. | 0. | 16. | 13. | 34. | 16. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Al Mg | 0. | 18. | 18. | 15. | 0. | 29. | 0. | 0. | 0. | 0. | 13. | 7. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ca Na | 9. | 0. | 0. | 73. | 0. | 0. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Si Na | 9. | 0. | 8. | 29. | 0. | 3. | 2. | 4. | 37. | 2. | 6. | 0. | 0. | 0. | 0. | 0.0 |

## Table 3-15. Sample #559 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. 2+3+4 (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Si | S | Ti | 0. | 0. | 4. | 47. | 0. | 24. | 5. | 4. | 4. | 12. | 1. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S | Si | Ti | 0. | 0. | 11. | 20. | 0. | 39. | 4. | 3. | 5. | 12. | 4. | 2. | 0. | 0. | 0. | 0.0 |
| 1 | S | Cl | Si | 0. | 0. | 10. | 23. | 0. | 37. | 23. | 0. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | Ti | 0. | 0. | 0. | 5. | 0. | 44. | 0. | 0. | 32. | 13. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ti | Ca | 0. | 0. | 0. | 13. | 0. | 26. | 9. | 9. | 14. | 15. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | S | Si | Fe | 1. | 0. | 2. | 21. | 6. | 45. | 0. | 0. | 11. | 0. | 13. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | S | Fe | Si | 0. | 0. | 0. | 13. | 3. | 49. | 4. | 0. | 7. | 0. | 24. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si | S | Fe | 0. | 0. | 15. | 34. | 0. | 27. | 0. | 3. | 4. | 0. | 15. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Si | Fe | S | 0. | 0. | 8. | 39. | 0. | 11. | 0. | 10. | 9. | 0. | 16. | 0. | 6. | 0. | 0. | 0.0 |
| 2 | Fe | Si | S | 0. | 0. | 9. | 16. | 0. | 10. | 0. | 2. | 7. | 0. | 52. | 0. | 3. | 0. | 0. | 0.0 |
| 1 | S | Ca | Cl | 0. | 0. | 0. | 5. | 0. | 28. | 16. | 5. | 18. | 7. | 13. | 0. | 8. | 0. | 0. | 0.0 |
| 1 | Al | Ca | Ti | 0. | 0. | 44. | 0. | 0. | 0. | 0. | 0. | 30. | 25. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti | Ca | Si | 0. | 0. | 3. | 7. | 0. | 0. | 0. | 0. | 15. | 71. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca | Ti | Si | 0. | 0. | 7. | 14. | 0. | 0. | 8. | 0. | 46. | 16. | 2. | 6. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Ca | Ti | 0. | 0. | 10. | 29. | 0. | 13. | 0. | 0. | 28. | 20. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | P | 0. | 0. | 0. | 10. | 12. | 62. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | S | P | 0. | 0. | 0. | 6. | 11. | 28. | 0. | 0. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si | Ti | Al | 0. | 0. | 18. | 32. | 0. | 2. | 0. | 1. | 9. | 23. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti | Al | Si | 0. | 0. | 32. | 23. | 0. | 0. | 0. | 0. | 6. | 38. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Si | Al | Ti | 0. | 0. | 21. | 38. | 0. | 4. | 0. | 3. | 5. | 17. | 12. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca | Si | Zn | 0. | 0. | 0. | 17. | 0. | 12. | 9. | 12. | 30. | 0. | 8. | 0. | 12. | 0. | 0. | 0.0 |
| 6 | Si | Al | Na | 10. | 0. | 21. | 53. | 0. | 3. | 0. | 6. | 2. | 0. | 5. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | S | Ca | Na | 9. | 0. | 5. | 2. | 0. | 67. | 0. | 0. | 13. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | S | K | 0. | 0. | 0. | 0. | 0. | 42. | 0. | 6. | 52. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | K | 0. | 0. | 10. | 6. | 9. | 37. | 0. | 11. | 20. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na | Cu | Al | 28. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 15. | 25. | 15. | 0. | 0. | 0.0 |
| 1 | Ca | S | Al | 0. | 0. | 18. | 17. | 0. | 26. | 0. | 0. | 34. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Al | Ca | 0. | 0. | 15. | 0. | 0. | 72. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si | Al | Cl | 0. | 0. | 18. | 44. | 0. | 10. | 13. | 0. | 8. | 7. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | K | Cl | Ca | 0. | 0. | 0. | 0. | 0. | 3. | 29. | 58. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Fe | Cl | 0. | 0. | 0. | 32. | 11. | 11. | 16. | 0. | 11. | 0. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg | Cl | Fe | 0. | 20. | 12. | 12. | 0. | 12. | 16. | 0. | 0. | 12. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Fe | K | 0. | 0. | 6. | 51. | 0. | 0. | 0. | 7. | 3. | 0. | 33. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca | P | Si | 0. | 0. | 6. | 13. | 19. | 3. | 0. | 0. | 52. | 0. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si | K | Ca | 0. | 0. | 0. | 47. | 0. | 0. | 0. | 19. | 18. | 0. | 0. | 0. | 15. | 0. | 0. | 0.0 |
| 2 | Ca | P | Fe | 0. | 0. | 3. | 8. | 15. | 5. | 0. | 0. | 58. | 0. | 10. | 0. | 1. | 0. | 0. | 0.1 |
| 2 | Fe | Al | Ca | 0. | 0. | 22. | 6. | 0. | 0. | 0. | 0. | 16. | 8. | 47. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Fe | Ca | Al | 0. | 0. | 18. | 11. | 14. | 4. | 0. | 0. | 18. | 0. | 31. | 0. | 4. | 0. | 0. | 0.1 |
| 1 | S | Fe | Ti | 0. | 0. | 0. | 14. | 0. | 46. | 0. | 0. | 0. | 14. | 17. | 9. | 0. | 0. | 0. | 0.1 |
| 1 | S | Al | Fe | 0. | 0. | 15. | 10. | 0. | 24. | 0. | 0. | 11. | 11. | 11. | 9. | 7. | 0. | 0. | 0.1 |
| 1 | Ti | Fe | Si | 0. | 0. | 15. | 22. | 0. | 6. | 0. | 0. | 7. | 26. | 24. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si | Ti | Fe | 0. | 0. | 10. | 41. | 0. | 6. | 1. | 2. | 0. | 26. | 14. | 0. | 0. | 0. | 0. | 0.2 |
| 13 | OTHERS - | | | 0. | 0. | 12. | 11. | 1. | 27. | 0. | 1. | 22. | 7. | 18. | 1. | 1. | 0. | 0. | 1.6 |
| 1178 | TOTALS - | | | 1. | 0. | 17. | 41. | 1. | 9. | 0. | 3. | 12. | 1. | 16. | 0. | 0. | 0. | 0. | 100.0 |

## Table 3-15. Sample #559 PSI/Arizona Ash Illinois #6 Ash, 2.4 Kg/hr, 1368°C, 11 IMP. 2+3+4 (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si - - | 8.9 | 61. | 36. | 2. | 1. | 0. | 0. | 0. |
| Si Al Fe | 34.1 | 75. | 23. | 2. | 0. | 0. | 0. | 0. |
| Si Fe Al | 5.2 | 69. | 26. | 4. | 1. | 0. | 0. | 0. |
| Si Al K | 5.8 | 40. | 54. | 7. | 0. | 0. | 0. | 0. |
| OTHERS - | 46.0 | 65. | 19. | 11. | 5. | 0. | 0. | 0. |
| TOTALS - | 100.0 | 67. | 24. | 7. | 2. | 0. | 0. | 0. |

# Table 3-16. Sample #564 PSI/Arizona Beulah Ash
# 1.6 Kg/hr, 1160°C, 11 IMP. #1 + Cup

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | Si - - | 6. | 0. | 0. | 90. | 0. | 2. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 4.9 |
| 18 | Fe - - | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 3. | 0. | 95. | 0. | 0. | 0. | 0. | 1.4 |
| 64 | Ca - - | 1. | 3. | 5. | 5. | 0. | 4. | 0. | 0. | 79. | 1. | 4. | 0. | 0. | 0. | 0. | 6.4 |
| 4 | Ca Fe - | 0. | 0. | 2. | 2. | 0. | 3. | 0. | 0. | 68. | 1. | 24. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | Fe Ca - | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 13. | 0. | 86. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Si Ca - | 2. | 0. | 0. | 75. | 0. | 3. | 0. | 1. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 4 | Ca Si - | 2. | 4. | 1. | 19. | 0. | 2. | 0. | 0. | 68. | 1. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S Ca - | 0. | 0. | 0. | 0. | 0. | 85. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 19 | Ca S - | 0. | 1. | 0. | 1. | 0. | 23. | 0. | 0. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 1.1 |
| 1 | Ca Cl - | 0. | 0. | 0. | 0. | 0. | 0. | 14. | 0. | 86. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si Al - | 2. | 0. | 31. | 62. | 0. | 0. | 0. | 3. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Si - | 0. | 0. | 57. | 43. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Na - | 12. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Cu Zn - | 0. | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 76. | 23. | 0. | 0. | 0.5 |
| 1 | Fe S - | 0. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 89. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | Ca Fe Si | 0. | 2. | 7. | 13. | 0. | 2. | 0. | 0. | 51. | 1. | 24. | 0. | 0. | 0. | 0. | 0.9 |
| 8 | Ca Si Fe | 2. | 4. | 10. | 18. | 0. | 2. | 0. | 0. | 50. | 1. | 13. | 0. | 0. | 0. | 0. | 0.8 |
| 4 | Fe Ca Si | 0. | 0. | 14. | 17. | 0. | 2. | 0. | 0. | 25. | 2. | 39. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Ca Fe | 2. | 1. | 7. | 49. | 0. | 6. | 0. | 2. | 18. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Si Ca | 3. | 0. | 5. | 23. | 0. | 4. | 0. | 0. | 14. | 7. | 43. | 0. | 0. | 0. | 0. | 0.1 |
| 10 | Si Al Fe | 1. | 0. | 24. | 50. | 0. | 2. | 0. | 4. | 5. | 0. | 13. | 0. | 0. | 0. | 0. | 0.7 |
| 302 | Ca Si Al | 4. | 2. | 16. | 22. | 0. | 4. | 0. | 0. | 46. | 1. | 3. | 0. | 0. | 0. | 0. | 25.9 |
| 61 | Si Al Ca | 10. | 0. | 26. | 39. | 0. | 3. | 0. | 1. | 17. | 1. | 3. | 0. | 0. | 0. | 0. | 5.4 |
| 43 | Si Ca Al | 11. | 0. | 20. | 32. | 0. | 7. | 0. | 1. | 25. | 1. | 3. | 0. | 0. | 0. | 0. | 2.5 |
| 34 | Ca Al Si | 1. | 2. | 17. | 14. | 0. | 3. | 0. | 0. | 59. | 1. | 3. | 0. | 0. | 0. | 0. | 2.9 |
| 5 | Al Si Ca | 3. | 1. | 36. | 33. | 0. | 1. | 0. | 1. | 21. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 124 | Si Al Na | 21. | 0. | 30. | 37. | 0. | 1. | 0. | 0. | 9. | 0. | 1. | 0. | 0. | 0. | 0. | 8.6 |
| 22 | Si Na Al | 29. | 0. | 26. | 37. | 0. | 2. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 1.4 |
| 5 | Al Si Na | 15. | 0. | 43. | 40. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Na Si Al | 33. | 0. | 26. | 28. | 0. | 3. | 0. | 0. | 5. | 2. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 8 | Ca Si Mg | 0. | 9. | 7. | 14. | 0. | 2. | 0. | 0. | 65. | 1. | 3. | 0. | 0. | 0. | 0. | 0.7 |
| 17 | Ca Mg Si | 0. | 19. | 9. | 12. | 0. | 4. | 0. | 0. | 52. | 0. | 4. | 0. | 0. | 0. | 0. | 1.4 |
| 4 | Ca Mg Fe | 0. | 17. | 8. | 5. | 0. | 1. | 0. | 0. | 60. | 0. | 9. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca Fe Mg | 0. | 9. | 3. | 3. | 0. | 5. | 0. | 0. | 69. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca S K | 0. | 0. | 0. | 0. | 4. | 24. | 0. | 10. | 62. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 11 | Ca S Al | 2. | 4. | 11. | 6. | 0. | 23. | 2. | 1. | 50. | 0. | 2. | 0. | 0. | 0. | 0. | 1.0 |
| 3 | S Ca Al | 0. | 0. | 9. | 3. | 0. | 50. | 0. | 2. | 33. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Ca Al S | 0. | 2. | 15. | 7. | 0. | 13. | 0. | 0. | 58. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Al S Ca | 0. | 0. | 34. | 12. | 0. | 33. | 0. | 0. | 21. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca Si Na | 15. | 1. | 13. | 18. | 0. | 13. | 0. | 0. | 38. | 0. | 2. | 0. | 0. | 0. | 0. | 0.6 |
| 13 | Si Ca Na | 12. | 0. | 6. | 54. | 0. | 4. | 0. | 0. | 20. | 1. | 3. | 0. | 0. | 0. | 0. | 1.5 |
| 6 | Si Na Ca | 21. | 0. | 6. | 50. | 0. | 5. | 0. | 0. | 15. | 1. | 2. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Na Si Ca | 24. | 0. | 15. | 22. | 0. | 15. | 0. | 0. | 21. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 8 | Si Al K | 1. | 0. | 26. | 55. | 0. | 1. | 0. | 8. | 3. | 1. | 5. | 0. | 0. | 0. | 0. | 0.8 |
| 6 | S Ca Si | 1. | 0. | 4. | 16. | 0. | 43. | 0. | 0. | 31. | 2. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 89 | Ca S Si | 5. | 2. | 9. | 13. | 0. | 20. | 0. | 0. | 48. | 1. | 3. | 0. | 0. | 0. | 0. | 8.8 |
| 60 | Ca Si S | 6. | 2. | 11. | 19. | 0. | 15. | 0. | 0. | 43. | 1. | 4. | 0. | 0. | 0. | 0. | 5.6 |
| 9 | Si Ca S | 8. | 0. | 8. | 45. | 0. | 13. | 0. | 1. | 23. | 0. | 2. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Si S Ca | 0. | 0. | 4. | 60. | 0. | 16. | 0. | 3. | 14. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Si Ca | 0. | 0. | 0. | 15. | 0. | 72. | 0. | 0. | 10. | 1. | 1. | 0. | 1. | 0. | 0. | 0.2 |
| 3 | K Cl Na | 16. | 0. | 2. | 3. | 1. | 12. | 26. | 29. | 8. | 3. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl Na K | 24. | 0. | 0. | 0. | 0. | 0. | 44. | 20. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Ti S | 0. | 0. | 9. | 11. | 0. | 12. | 0. | 0. | 53. | 13. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti Ca S | 0. | 0. | 0. | 7. | 0. | 19. | 0. | 0. | 33. | 37. | 4. | 0. | 0. | 0. | 0. | 0.1 |

# Table 3-16. Sample #564 PSI/Arizona Beulah Ash 1.6 Kg/hr, 1160°C, 11 IMP. #1 + Cup (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S | Ti | Ca | 9. | 0. | 5. | 12. | 0. | 25. | 0. | 0. | 24. | 24. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti | S | Ca | 0. | 0. | 0. | 5. | 0. | 22. | 0. | 0. | 19. | 55. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | S | Ti | 0. | 4. | 0. | 0. | 0. | 16. | 0. | 0. | 68. | 7. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Al | Cl | 0. | 0. | 44. | 47. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Si | Na | S | 16. | 0. | 4. | 62. | 0. | 11. | 0. | 0. | 6. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Na | Si | 25. | 0. | 3. | 11. | 0. | 40. | 0. | 4. | 8. | 0. | 8. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si | S | Na | 13. | 0. | 0. | 63. | 0. | 19. | 0. | 0. | 3. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca | S | Mg | 3. | 13. | 6. | 5. | 0. | 25. | 0. | 0. | 43. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca | Mg | S | 2. | 23. | 6. | 6. | 0. | 15. | 0. | 0. | 39. | 0. | 8. | 0. | 1. | 0. | 0. | 0.1 |
| 6 | Si | Al | S | 3. | 0. | 28. | 40. | 0. | 18. | 0. | 1. | 8. | 0. | 2. | 0. | 1. | 0. | 0. | 0.7 |
| 3 | Si | S | Al | 8. | 0. | 19. | 31. | 0. | 23. | 0. | 1. | 16. | 1. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S | Si | Al | 0. | 0. | 13. | 28. | 0. | 42. | 0. | 4. | 4. | 0. | 4. | 0. | 4. | 0. | 0. | 0.0 |
| 2 | Si | Ca | Ti | 1. | 2. | 7. | 41. | 0. | 0. | 0. | 0. | 35. | 11. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ti | Ca | Si | 2. | 0. | 7. | 18. | 0. | 4. | 0. | 0. | 28. | 37. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ti | Si | Ca | 9. | 0. | 0. | 23. | 0. | 0. | 0. | 0. | 15. | 48. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca | Si | Ti | 4. | 3. | 4. | 32. | 0. | 0. | 0. | 0. | 36. | 18. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | S | Na | Ca | 29. | 3. | 4. | 7. | 0. | 36. | 0. | 0. | 20. | 1. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 21 | Ca | S | Na | 14. | 2. | 7. | 10. | 0. | 22. | 0. | 0. | 42. | 0. | 2. | 0. | 0. | 0. | 0. | 2.3 |
| 8 | S | Ca | Na | 19. | 1. | 4. | 7. | 0. | 37. | 0. | 0. | 29. | 0. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Ca | Na | S | 21. | 0. | 13. | 16. | 0. | 19. | 0. | 0. | 28. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na | S | Ca | 46. | 0. | 0. | 0. | 0. | 42. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca | S | Fe | 4. | 0. | 3. | 6. | 0. | 25. | 0. | 0. | 51. | 0. | 10. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Fe | Ca | S | 2. | 0. | 4. | 3. | 0. | 15. | 0. | 0. | 27. | 0. | 48. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca | Fe | S | 9. | 2. | 9. | 13. | 0. | 17. | 0. | 0. | 28. | 1. | 20. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cu | Cl | Zn | 5. | 0. | 0. | 0. | 0. | 3. | 18. | 4. | 0. | 0. | 0. | 56. | 13. | 0. | 0. | 0.1 |
| 1 | Ca | Cl | Al | 0. | 0. | 9. | 0. | 0. | 0. | 14. | 0. | 69. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca | Al | Mg | 0. | 10. | 14. | 8. | 0. | 3. | 0. | 0. | 60. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 9 | Ca | Mg | Al | 0. | 16. | 12. | 9. | 0. | 3. | 0. | 0. | 56. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg | Ca | Al | 0. | 31. | 16. | 13. | 0. | 14. | 0. | 0. | 22. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Si | K | 0. | 0. | 11. | 28. | 0. | 0. | 11. | 12. | 37. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | Ti | Al | 0. | 0. | 6. | 3. | 0. | 3. | 0. | 0. | 55. | 28. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl | K | Ca | 0. | 0. | 0. | 0. | 0. | 11. | 37. | 34. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si | Al | Ti | 4. | 0. | 24. | 38. | 0. | 0. | 0. | 8. | 8. | 11. | 8. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ti | Si | Al | 0. | 0. | 15. | 26. | 0. | 7. | 0. | 0. | 13. | 31. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | S | Ca | 0. | 0. | 0. | 0. | 0. | 24. | 37. | 8. | 18. | 13. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Cu | S | Si | 0. | 0. | 0. | 10. | 9. | 11. | 0. | 0. | 0. | 0. | 9. | 62. | 0. | 0. | 0. | 0.1 |
| 1 | Ti | Si | Fe | 0. | 0. | 6. | 18. | 0. | 0. | 0. | 0. | 10. | 56. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Fe | Al | 4. | 7. | 13. | 10. | 0. | 6. | 0. | 0. | 44. | 0. | 15. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | Ti | Fe | 0. | 6. | 0. | 4. | 0. | 3. | 0. | 0. | 60. | 17. | 10. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ti | Fe | Ca | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 14. | 58. | 17. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al | Na | S | 19. | 0. | 56. | 0. | 0. | 16. | 3. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Si | Ti | 0. | 0. | 0. | 28. | 0. | 51. | 0. | 0. | 9. | 11. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Si | Fe | 0. | 0. | 4. | 24. | 0. | 42. | 0. | 1. | 13. | 0. | 16. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cu | Zn | Na | 16. | 0. | 0. | 0. | 2. | 0. | 2. | 2. | 0. | 0. | 0. | 52. | 26. | 0. | 0. | 0.1 |
| 2 | Si | Na | Fe | 18. | 0. | 0. | 65. | 0. | 4. | 0. | 0. | 5. | 1. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | OTHERS - | | | 0. | 25. | 5. | 4. | 0. | 2. | 2. | 0. | 39. | 1. | 22. | 0. | 1. | 0. | 0 | 0.0 |
| 1191 | TOTALS - | | | 7. | 2. | 14. | 25. | 0. | 8. | 0. | 0. | 37. | 1. | 5. | 1. | 0. | 0. | 0. | 100.0 |

## Table 3-16. Sample #564 PSI/Arizona Beulah Ash 1.6 Kg/hr, 1160°C, 11 IMP. #1 + Cup (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Si - - | 4.9 | 1. | 15. | 17. | 55. | 13. | 0. | 0. |
| Ca - - | 6.4 | 3. | 23. | 17. | 45. | 12. | 1. | 0. |
| Ca Si Al | 25.9 | 6. | 29. | 33. | 26. | 4. | 2. | 0. |
| Si Al Ca | 5.4 | 7. | 25. | 12. | 46. | 8. | 2. | 0. |
| Si Al Na | 8.6 | 14. | 31. | 24. | 23. | 7. | 1. | 0. |
| Ca S Si | 8.8 | 6. | 14. | 36. | 43. | 1. | 0. | 0. |
| Ca Si S | 5.6 | 3. | 18. | 38. | 40. | 1. | 0. | 0. |
| OTHERS - | 34.4 | 8. | 18. | 30. | 35. | 7. | 2. | 0. |
| TOTALS - | 100.0 | 7. | 22. | 29. | 35. | 6. | 1. | 0. |

# Table 3-17. Sample #565 PSI/Arizona Beulah Ash
1.6 Kg/hr, 1160°C, Port 11 IMP. 2+3+4

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Ca - - | 0. | 1. | 3. | 4. | 0. | 1. | 3. | 0. | 86. | 2. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S - - | 2. | 2. | 0. | 8. | 0. | 78. | 0. | 4. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Fe - - | 0. | 0. | 1. | 5. | 0. | 5. | 0. | 0. | 1. | 0. | 88. | 0. | 0. | 0. | 0. | 0.8 |
| 1 | Si - - | 0. | 0. | 6. | 82. | 0. | 0. | 0. | 9. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 64 | S Na - | 38. | 0. | 1. | 1. | 0. | 55. | 0. | 1. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 4.9 |
| 5 | Na S - | 51. | 0. | 1. | 1. | 0. | 46. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S K - | 0. | 0. | 2. | 5. | 0. | 54. | 0. | 32. | 5. | 2. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Cl K | 0. | 0. | 0. | 6. | 0. | 35. | 33. | 15. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Cl S | 0. | 0. | 0. | 0. | 0. | 21. | 30. | 0. | 48. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Ca S | 0. | 0. | 0. | 0. | 0. | 18. | 33. | 17. | 31. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 128 | S Ca Na | 18. | 1. | 8. | 9. | 0. | 38. | 0. | 1. | 23. | 1. | 2. | 0. | 0. | 0. | 0. | 11.4 |
| 659 | S Na Ca | 27. | 1. | 5. | 7. | 0. | 43. | 0. | 1. | 15. | 1. | 1. | 0. | 0. | 0. | 0. | 54.2 |
| 19 | Ca S Na | 19. | 1. | 10. | 12. | 0. | 26. | 0. | 1. | 28. | 1. | 2. | 0. | 0. | 0. | 0. | 2.0 |
| 27 | Na S Ca | 37. | 1. | 5. | 7. | 0. | 32. | 0. | 2. | 14. | 0. | 1. | 0. | 0. | 0. | 0. | 3.1 |
| 2 | S Ca K | 0. | 0. | 3. | 7. | 0. | 57. | 0. | 14. | 15. | 4. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 7 | S K Ca | 0. | 0. | 1. | 5. | 0. | 53. | 0. | 32. | 8. | 0. | 1. | 0. | 1. | 0. | 0. | 0.6 |
| 1 | Al Cl S | 0. | 0. | 74. | 0. | 0. | 9. | 10. | 4. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 40 | S Ca Si | 10. | 1. | 10. | 14. | 0. | 36. | 0. | 2. | 23. | 1. | 3. | 0. | 0. | 0. | 0. | 3.3 |
| 32 | Ca S Si | 11. | 2. | 12. | 17. | 0. | 23. | 0. | 1. | 30. | 1. | 3. | 0. | 0. | 0. | 0. | 3.1 |
| 6 | S Si Ca | 10. | 0. | 15. | 21. | 0. | 30. | 0. | 2. | 18. | 0. | 2. | 0. | 1. | 0. | 0. | 0.4 |
| 3 | Si S Ca | 13. | 0. | 16. | 25. | 0. | 21. | 0. | 1. | 18. | 0. | 4. | 0. | 1. | 0. | 0. | 0.1 |
| 3 | Si Ca S | 10. | 0. | 18. | 25. | 0. | 18. | 0. | 0. | 21. | 2. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ca Si S | 12. | 2. | 15. | 22. | 0. | 19. | 0. | 0. | 27. | 1. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Ti | 0. | 0. | 0. | 0. | 0. | 37. | 11. | 0. | 38. | 14. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Ti S | 0. | 0. | 0. | 15. | 0. | 19. | 15. | 0. | 22. | 20. | 10. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Ca Na | 15. | 4. | 8. | 34. | 0. | 11. | 0. | 0. | 22. | 1. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Na Si | 24. | 0. | 15. | 19. | 0. | 18. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Na Ca | 21. | 4. | 4. | 27. | 0. | 17. | 0. | 3. | 20. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Cl Si | 0. | 0. | 0. | 16. | 0. | 53. | 17. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 49 | S Na Mg | 21. | 9. | 1. | 3. | 0. | 61. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 1.9 |
| 3 | Si Al S | 16. | 0. | 22. | 28. | 0. | 19. | 0. | 0. | 9. | 3. | 3. | 0. | 0. | 0. | 0. | 0.6 |
| 5 | S Si Al | 1. | 0. | 21. | 23. | 2. | 35. | 0. | 1. | 12. | 2. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si S Al | 14. | 0. | 19. | 27. | 0. | 19. | 0. | 0. | 18. | 0. | 2. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Al Si S | 9. | 0. | 26. | 24. | 0. | 22. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Na Al | 24. | 0. | 20. | 27. | 0. | 14. | 0. | 0. | 10. | 1. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Si Al Na | 23. | 0. | 28. | 32. | 0. | 6. | 0. | 0. | 8. | 0. | 2. | 0. | 0. | 0. | 0. | 0.8 |
| 32 | S Na Si | 26. | 0. | 8. | 14. | 0. | 38. | 0. | 1. | 11. | 0. | 1. | 0. | 0. | 0. | 0. | 2.6 |
| 2 | Si S Na | 16. | 0. | 7. | 45. | 0. | 20. | 0. | 0. | 10. | 1. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Na S Si | 31. | 0. | 11. | 17. | 0. | 26. | 0. | 1. | 12. | 0. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Si Na S | 24. | 0. | 14. | 29. | 0. | 22. | 0. | 3. | 4. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Si Na | 20. | 1. | 17. | 23. | 0. | 28. | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 6 | Si Al Ca | 14. | 0. | 23. | 27. | 0. | 13. | 0. | 1. | 20. | 0. | 1. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | Ca Si Al | 1. | 4. | 20. | 23. | 0. | 15. | 0. | 0. | 31. | 3. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | Si Ca Al | 16. | 0. | 19. | 26. | 0. | 13. | 0. | 1. | 23. | 0. | 3. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Ca Al Si | 18. | 0. | 22. | 20. | 0. | 13. | 0. | 0. | 22. | 0. | 6. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Cl Na K | 21. | 0. | 0. | 0. | 0. | 15. | 28. | 20. | 4. | 8. | 0. | 4. | 0. | 0. | 0. | 0.1 |
| 1 | Na Cl K | 34. | 0. | 0. | 5. | 5. | 0. | 31. | 26. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Na Fe | 31. | 0. | 5. | 2. | 0. | 40. | 0. | 3. | 9. | 0. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Fe Na | 28. | 0. | 0. | 0. | 0. | 32. | 0. | 0. | 10. | 0. | 29. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | S Ca Al | 2. | 0. | 12. | 6. | 0. | 56. | 0. | 0. | 17. | 6. | 1. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Ca S Al | 0. | 0. | 21. | 20. | 0. | 24. | 0. | 0. | 31. | 2. | 0. | 0. | 2. | 0. | 0. | 0.0 |
| 1 | Al S Ca | 15. | 6. | 30. | 9. | 0. | 18. | 0. | 0. | 15. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Ca Fe | 5. | 0. | 3. | 6. | 0. | 48. | 0. | 2. | 25. | 0. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Ca S | 9. | 1. | 6. | 9. | 0. | 17. | 0. | 0. | 25. | 2. | 31. | 0. | 0. | 0. | 0. | 0.0 |

# Table 3-17. Sample #565 PSI/Arizona Beulah Ash
1.6 Kg/hr, 1160°C, Port 11 IMP. 2+3+4 (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Zn Cl Ca | 0. | 0. | 0. | 0. | 0. | 7. | 15. | 0. | 10. | 0. | 0. | 0. | 67. | 0. | 0. | 0.0 |
| 4 | S Na K | 20. | 0. | 2. | 6. | 0. | 45. | 0. | 16. | 10. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 5 | S K Na | 16. | 0. | 1. | 3. | 0. | 49. | 0. | 23. | 7. | 0. | 0. | 0. | 1. | 0. | 0. | 0.5 |
| 1 | Cl Si Ca | 0. | 0. | 0. | 20. | 9. | 13. | 27. | 14. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Fe Si | 0. | 0. | 0. | 14. | 0. | 43. | 0. | 8. | 10. | 0. | 14. | 0. | 11. | 0. | 0. | 0.1 |
| 1 | S Si Fe | 0. | 0. | 5. | 14. | 0. | 60. | 0. | 3. | 3. | 0. | 11. | 4. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Mg Cl | 0. | 15. | 6. | 3. | 0. | 9. | 9. | 0. | 49. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Si | 0. | 0. | 0. | 17. | 0. | 39. | 0. | 0. | 16. | 29. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | S Si Ti | 6. | 0. | 6. | 20. | 0. | 42. | 0. | 1. | 7. | 16. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Al Fe | 0. | 0. | 31. | 43. | 0. | 9. | 0. | 3. | 2. | 0. | 11. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Si Al | 14. | 0. | 20. | 24. | 0. | 5. | 0. | 0. | 13. | 0. | 25. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S Ti Al | 0. | 7. | 11. | 10. | 0. | 41. | 0. | 4. | 10. | 12. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S K Ti | 0. | 0. | 0. | 0. | 0. | 65. | 0. | 17. | 9. | 9. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Na Al | 22. | 0. | 18. | 16. | 0. | 23. | 0. | 2. | 15. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ca Mg | 12. | 12. | 5. | 6. | 0. | 34. | 0. | 0. | 19. | 2. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 1192 | TOTALS - | 23. | [illegible] | 6. | 9. | 0. | 39. | 0. | 2. | 16. | 1. | 2. | 0. | 0. | 0. | 0. | 100.0 |

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| S Na - | 4.9 | 1. | 54. | 25. | 21. | 0. | 0. | 0. |
| S Ca Na | 11.4 | 50. | 22. | 14. | 12. | 3. | 0. | 0. |
| S Na Ca | 54.2 | 55. | 19. | 17. | 9. | 0. | 0. | 0. |
| OTHERS - | 29.6 | 62. | 18. | 13. | 6. | 1. | 0. | 0. |
| TOTALS - | 100.0 | 54. | 20. | 16. | 9. | 1. | 0. | 0. |

## Table 3-18. Sample #568 PSI/Arizona Beulah Ash
## 1.6 Kg/hr, 1160°C, Port 5 IMPS. 2+3+4

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Cl - - | 0. | 0. | 0. | 0. | 0. | 0. | 94. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | S - - | 0. | 0. | 0. | 0. | 0. | 93. | 0. | 0. | 5. | 0. | 0. | 0. | 3. | 0. | 0. | 0.2 |
| 1 | Cu - - | 9. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 91. | 0. | 0. | 0. | 0.0 |
| 13 | Si - - | 1. | 0. | 2. | 94. | 0. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 1.6 |
| 1 | Al - - | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ti - - | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 4. | 87. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca - - | 0. | 7. | 7. | 6. | 0. | 6. | 0. | 0. | 69. | 0. | 6. | 0. | 0. | 0. | 0. | 0.7 |
| 3 | Fe - - | 0. | 0. | 3. | 3. | 0. | 3. | 0. | 0. | 4. | 0. | 87. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl K - | 0. | 0. | 3. | 0. | 0. | 0. | 59. | 38. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Al - | 0. | 0. | 42. | 55. | 0. | 1. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ca - | 0. | 0. | 0. | 1. | 0. | 67. | 0. | 0. | 32. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | Ca S - | 1. | 0. | 0. | 0. | 0. | 43. | 0. | 0. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Ca Fe - | 0. | 0. | 0. | 4. | 0. | 3. | 0. | 0. | 59. | 0. | 34. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Mg - | 0. | 30. | 0. | 64. | 0. | 0. | 0. | 0. | 2. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Al Ca | 0. | 0. | 21. | 15. | 0. | 48. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 19 | Ca S Al | 1. | 1. | 16. | 10. | 0. | 24. | 1. | 1. | 42. | 1. | 3. | 0. | 0. | 0. | 0. | 1.7 |
| 4 | S Ca Al | 0. | 0. | 10. | 4. | 0. | 47. | 0. | 0. | 33. | 3. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 8 | Ca Al S | 2. | 3. | 18. | 10. | 0. | 14. | 0. | 0. | 47. | 4. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 3 | S Ca Cl | 0. | 0. | 4. | 10. | 0. | 37. | 17. | 7. | 25. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 26 | S Ca Si | 1. | 2. | 4. | 13. | 0. | 44. | 1. | 0. | 32. | 2. | 2. | 0. | 0. | 0. | 0. | 3.6 |
| 87 | Ca S Si | 5. | 2. | 10. | 15. | 0. | 24. | 0. | 1. | 40. | 1. | 3. | 0. | 0. | 0. | 0. | 6.4 |
| 52 | Ca Si S | 4. | 2. | 14. | 21. | 0. | 16. | 0. | 0. | 36. | 4. | 2. | 0. | 0. | 0. | 0. | 4.1 |
| 7 | Si Ca S | 3. | 4. | 9. | 39. | 0. | 13. | 0. | 0. | 24. | 0. | 8. | 0. | 0. | 0. | 0. | 0.8 |
| 2 | Si S Ca | 7. | 0. | 12. | 26. | 0. | 25. | 0. | 6. | 16. | 1. | 5. | 0. | 1. | 0. | 0. | 0.1 |
| 3 | S Si Ca | 11. | 2. | 10. | 21. | 0. | 34. | 0. | 1. | 19. | 1. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Si Ca | 0. | 0. | 0. | 22. | 0. | 12. | 31. | 17. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Cl Si | 0. | 0. | 0. | 10. | 0. | 7. | 15. | 0. | 47. | 0. | 7. | 7. | 8. | 0. | 0. | 0.0 |
| 448 | Ca Si Al | 6. | 4. | 18. | 23. | 0. | 6. | 0. | 0. | 39. | 1. | 4. | 0. | 0. | 0. | 0. | 34.7 |
| 40 | Ca Al Si | 3. | 6. | 19. | 16. | 0. | 4. | 0. | 0. | 46. | 2. | 4. | 0. | 0. | 0. | 0. | 3.6 |
| 50 | Si Ca Al | 9. | 2. | 21. | 31. | 0. | 5. | 0. | 0. | 27. | 1. | 4. | 0. | 0. | 0. | 0. | 3.3 |
| 47 | Si Al Ca | 12. | 1. | 26. | 32. | 0. | 4. | 0. | 0. | 20. | 1. | 2. | 0. | 0. | 0. | 0. | 5.7 |
| 2 | Al Si Ca | 3. | 3. | 28. | 27. | 0. | 11. | 0. | 0. | 22. | 0. | 2. | 5. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Si Al | 0. | 0. | 13. | 21. | 0. | 3. | 46. | 0. | 11. | 5. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Al Cl | 0. | 0. | 20. | 19. | 0. | 0. | 19. | 0. | 41. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Ca | 0. | 0. | 0. | 0. | 0. | 60. | 0. | 0. | 18. | 21. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | S Ca Ti | 0. | 0. | 5. | 0. | 0. | 44. | 0. | 8. | 30. | 14. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Ti | 0. | 6. | 8. | 6. | 0. | 26. | 0. | 0. | 43. | 8. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Ti S | 0. | 16. | 0. | 0. | 0. | 17. | 0. | 0. | 32. | 19. | 8. | 8. | 0. | 0. | 0. | 0.0 |
| 1 | S P Ca | 0. | 0. | 0. | 10. | 12. | 58. | 0. | 0. | 11. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ca P | 0. | 0. | 0. | 12. | 18. | 49. | 0. | 0. | 21. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Fe Si Al | 0. | 0. | 9. | 28. | 0. | 1. | 0. | 1. | 3. | 0. | 58. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Al Fe | 0. | 0. | 14. | 67. | 0. | 5. | 0. | 4. | 3. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 29 | Ca S Na | 17. | 4. | 9. | 12. | 0. | 24. | 0. | 0. | 30. | 2. | 2. | 0. | 0. | 0. | 0. | 3.1 |
| 13 | S Ca Na | 18. | 1. | 7. | 10. | 0. | 33. | 0. | 0. | 28. | 0. | 3. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | Ca Na S | 21. | 2. | 12. | 15. | 0. | 19. | 0. | 0. | 27. | 1. | 2. | 1. | 0. | 0. | 0. | 0.1 |
| 1 | Na Ca S | 30. | 0. | 10. | 15. | 0. | 20. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Ca Fe Si | 0. | 7. | 8. | 13. | 0. | 4. | 1. | 0. | 48. | 0. | 19. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Fe Si Ca | 9. | 1. | 13. | 22. | 0. | 6. | 0. | 0. | 19. | 0. | 30. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca Si Fe | 1. | 4. | 10. | 17. | 0. | 8. | 0. | 0. | 44. | 2. | 14. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Fe Ca Si | 0. | 5. | 9. | 14. | 0. | 7. | 0. | 0. | 21. | 0. | 44. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe Ca | 0. | 0. | 20. | 32. | 0. | 4. | 0. | 2. | 20. | 0. | 22. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ca Mg | 0. | 13. | 5. | 4. | 0. | 39. | 0. | 0. | 33. | 0. | 0. | 2. | 3. | 0. | 0. | 0.1 |
| 4 | Ca S Mg | 0. | 15. | 9. | 7. | 0. | 19. | 0. | 0. | 42. | 1. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Mg Ca | 0. | 11. | 0. | 6. | 0. | 72. | 0. | 0. | 7. | 0. | 0. | 3. | 0. | 0. | 0. | 0.0 |

# Table 3-18. Sample #568 PSI/Arizona Beulah Ash
# 1.6 Kg/hr, 1160°C, Port 5 IMPS. 2+3+4 (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Ca Si Mg | 2. | 15. | 12. | 20. | 0. | 9. | 0. | 0. | 36. | 0. | 5. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Si Ca Mg | 0. | 11. | 3. | 44. | 0. | 4. | 0. | 0. | 33. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Ca Mg Si | 0. | 19. | 9. | 10. | 0. | 6. | 0. | 1. | 49. | 1. | 5. | 0. | 0. | 0. | 0. | 0.4 |
| 23 | Ca Si Na | 20. | 1. | 16. | 24. | 0. | 7. | 0. | 0. | 27. | 2. | 2. | 0. | 0. | 0. | 0. | 2.4 |
| 10 | Si Ca Na | 19. | 1. | 12. | 34. | 0. | 5. | 0. | 0. | 24. | 1. | 4. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Na Si Ca | 24. | 0. | 17. | 23. | 0. | 9. | 0. | 0. | 21. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | Si Na Ca | 18. | 1. | 9. | 46. | 0. | 5. | 0. | 1. | 14. | 2. | 4. | 0. | 0. | 0. | 0. | 0.8 |
| 4 | Ca Na Si | 20. | 0. | 12. | 18. | 0. | 16. | 0. | 2. | 29. | 1. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Na Ca Si | 25. | 0. | 18. | 20. | 0. | 18. | 0. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca S Fe | 0. | 1. | 6. | 1. | 0. | 31. | 0. | 1. | 48. | 0. | 11. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | S Ca Fe | 0. | 0. | 0. | 8. | 0. | 45. | 0. | 0. | 40. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe S Ca | 0. | 0. | 4. | 9. | 0. | 21. | 4. | 0. | 17. | 3. | 39. | 4. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Fe S | 0. | 5. | 9. | 11. | 0. | 13. | 0. | 0. | 39. | 0. | 22. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Ca S | 0. | 0. | 11. | 12. | 0. | 12. | 0. | 0. | 32. | 0. | 32. | 0. | 0. | 0. | 0. | 0.0 |
| 36 | Si Na Al | 29. | 0. | 22. | 35. | 0. | 2. | 0. | 0. | 8. | 1. | 2. | 0. | 0. | 0. | 0. | 3.4 |
| 70 | Si Al Na | 22. | 0. | 28. | 34. | 0. | 2. | 0. | 0. | 11. | 0. | 2. | 0. | 0. | 0. | 0. | 8.3 |
| 9 | Na Si Al | 35. | 0. | 24. | 31. | 0. | 1. | 0. | 1. | 6. | 1. | 1. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Al Si Na | 20. | 0. | 33. | 32. | 0. | 2. | 0. | 0. | 11. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Mg Al | 0. | 21. | 14. | 7. | 0. | 5. | 0. | 0. | 47. | 1. | 5. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Ca Al Mg | 0. | 13. | 19. | 5. | 0. | 3. | 0. | 0. | 52. | 1. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Cl K | 0. | 0. | 11. | 11. | 0. | 27. | 23. | 16. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Na Cu K | 26. | 0. | 0. | 0. | 0. | 0. | 0. | 17. | 11. | 9. | 8. | 20. | 8. | 0. | 0. | 0.1 |
| 1 | Na Ca Al | 27. | 0. | 18. | 16. | 0. | 16. | 0. | 0. | 20. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Na Al | 18. | 7. | 14. | 11. | 0. | 13. | 0. | 1. | 31. | 2. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 4 | Ca Si Ti | 0. | 0. | 14. | 26. | 0. | 4. | 0. | 0. | 33. | 18. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Ti Si | 12. | 6. | 11. | 14. | 0. | 6. | 0. | 0. | 24. | 20. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Si Al | 0. | 0. | 23. | 29. | 0. | 34. | 0. | 0. | 11. | 0. | 2. | 2. | 0. | 0. | 0. | 0.6 |
| 3 | Si S Al | 2. | 4. | 12. | 41. | 0. | 27. | 0. | 0. | 8. | 1. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Al S | 0. | 0. | 33. | 41. | 0. | 13. | 0. | 0. | 8. | 4. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al S Si | 0. | 0. | 62. | 12. | 0. | 15. | 0. | 4. | 5. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Ca K | 0. | 0. | 0. | 9. | 0. | 49. | 0. | 16. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | Ca S K | 0. | 9. | 5. | 2. | 0. | 21. | 0. | 12. | 44. | 1. | 0. | 0. | 4. | 0. | 0. | 0.6 |
| 1 | S Si Na | 19. | 0. | 10. | 19. | 0. | 27. | 0. | 4. | 12. | 9. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Na S | 22. | 0. | 18. | 23. | 0. | 19. | 0. | 0. | 18. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si Al K | 0. | 0. | 35. | 55. | 0. | 2. | 0. | 8. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Al Si K | 0. | 0. | 46. | 38. | 0. | 6. | 0. | 6. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Al Ti | 0. | 0. | 22. | 10. | 0. | 4. | 0. | 0. | 44. | 10. | 5. | 0. | 4. | 0. | 0. | 0.0 |
| 2 | Ca Fe Al | 3. | 4. | 12. | 9. | 0. | 5. | 0. | 0. | 40. | 1. | 25. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Fe S | 0. | 0. | 8. | 8. | 0. | 13. | 34. | 7. | 11. | 0. | 19. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na Cl Ca | 31. | 0. | 5. | 9. | 0. | 9. | 25. | 0. | 11. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Cl Ca | 0. | 0. | 0. | 12. | 12. | 7. | 18. | 7. | 16. | 9. | 19. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Mg Ca Fe | 0. | 45. | 6. | 4. | 0. | 6. | 0. | 0. | 26. | 0. | 13. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Ca Fe Mg | 0. | 11. | 4. | 4. | 0. | 0. | 0. | 0. | 63. | 0. | 18. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca Mg Fe | 0. | 22. | 11. | 9. | 0. | 5. | 0. | 0. | 40. | 0. | 13. | 0. | 1. | 0. | 0. | 0.4 |
| 1 | Si S Fe | 0. | 9. | 0. | 28. | 0. | 23. | 0. | 0. | 17. | 0. | 22. | 0. | 0. | 0. | 0. | 0.2 |
| 7 | OTHERS - | 3. | 8. | 9. | 12. | 0. | 13. | 0. | 1. | 27. | 13. | 12. | 2. | 0. | 0. | 0. | 0.5 |
| 1175 | TOTALS - | 8. | 3. | 17. | 24. | 0. | 11. | 0. | 1. | 31. | 1. | 4. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-18. Sample #568 PSI/Arizona Beulah Ash
# 1.6 Kg/hr, 1160°C, Port 5 IMPS. 2+3+4 (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Ca S Si | 6.4 | 2. | 22. | 46. | 27. | 1. | 2. | 0. |
| Ca Si S | 4.1 | 9. | 35. | 43. | 13. | 0. | 0. | 0. |
| Ca Si Al | 34.7 | 24. | 37. | 32. | 6. | 0. | 1. | 0. |
| Si Al Ca | 5.7 | 18. | 68. | 13. | 2. | 0. | 0. | 0. |
| Si Al Na | 8.3 | 42. | 50. | 8. | 0. | 0. | 0. | 0. |
| OTHERS - | 41.0 | 31. | 36. | 23. | 8. | 2. | 0. | 0. |
| TOTALS - | 100.0 | 26. | 38. | 27. | 8. | 1. | 0. | 0. |

# Table 3-19. Sample #570 PSI/Arizona Beulah Ash
## 2.9 Kg/hr, 1245°C, Port 11 IMP. #1 + Cup

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | Si - - | 3. | 0. | 0. | 93. | 0. | 1. | 0. | 1. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 3.0 |
| 16 | Fe - - | 0. | 0. | 2. | 4. | 0. | 0. | 0. | 0. | 4. | 0. | 89. | 0. | 0. | 0. | 0. | 1.6 |
| 25 | Ca - - | 0. | 4. | 6. | 6. | 0. | 7. | 0. | 0. | 73. | 1. | 3. | 0. | 0. | 0. | 0. | 2.3 |
| 1 | Cu - - | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 92. | 3. | 0. | 0. | 0.0 |
| 31 | Ca S - | 1. | 0. | 1. | 3. | 0. | 19. | 0. | 0. | 75. | 0. | 1. | 0. | 0. | 0. | 0. | 2.2 |
| 2 | Ca Si - | 4. | 3. | 3. | 17. | 0. | 5. | 0. | 0. | 64. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Si Ca - | 3. | 0. | 3. | 61. | 0. | 3. | 0. | 0. | 29. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S Si - | 0. | 0. | 0. | 22. | 0. | 71. | 0. | 0. | 4. | 3. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca Fe - | 0. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 76. | 2. | 20. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Ca - | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 43. | 0. | 52. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Na - | 17. | 0. | 0. | 81. | 0. | 1. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | Si Mg - | 0. | 30. | 0. | 66. | 0. | 0. | 0. | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Si Al - | 0. | 0. | 34. | 53. | 0. | 1. | 0. | 5. | 3. | 1. | 4. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Fe Si - | 4. | 0. | 5. | 19. | 0. | 0. | 0. | 0. | 5. | 2. | 65. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cu Zn - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 69. | 31. | 0. | 0. | 0.1 |
| 2 | Ca Al - | 0. | 1. | 13. | 4. | 0. | 4. | 0. | 0. | 71. | 2. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 306 | Ca Si Al | 3. | 4. | 17. | 22. | 0. | 4. | 0. | 0. | 46. | 1. | 3. | 0. | 0. | 0. | 0. | 26.4 |
| 70 | Si Al Ca | 11. | 0. | 28. | 35. | 0. | 3. | 0. | 0. | 21. | 1. | 2. | 0. | 0. | 0. | 0. | 6.7 |
| 42 | Ca Al Si | 1. | 5. | 20. | 15. | 0. | 2. | 0. | 0. | 52. | 2. | 3. | 0. | 0. | 0. | 0. | 3.2 |
| 46 | Si Ca Al | 10. | 1. | 21. | 33. | 0. | 6. | 0. | 0. | 26. | 1. | 2. | 0. | 0. | 0. | 0. | 3.2 |
| 1 | Al Si Ca | 4. | 0. | 44. | 40. | 0. | 0. | 0. | 0. | 9. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Al Ca Si | 0. | 14. | 25. | 22. | 0. | 9. | 0. | 0. | 22. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 162 | Si Al Na | 22. | 0. | 30. | 37. | 0. | 1. | 0. | 0. | 7. | 0. | 1. | 0. | 0. | 0. | 0. | 13.4 |
| 1 | Al Si Na | 16. | 0. | 35. | 34. | 0. | 0. | 0. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 14 | Si Na Al | 27. | 0. | 24. | 40. | 0. | 3. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 1.8 |
| 4 | Na Si Al | 36. | 0. | 27. | 31. | 0. | 1. | 0. | 0. | 3. | 1. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Si Fe Al | 1. | 0. | 13. | 41. | 0. | 2. | 0. | 4. | 8. | 5. | 26. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Al Fe | 0. | 0. | 24. | 57. | 0. | 0. | 0. | 7. | 2. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 14 | Si Ca Na | 14. | 0. | 6. | 51. | 0. | 4. | 0. | 0. | 23. | 1. | 1. | 0. | 0. | 0. | 0. | 0.9 |
| 8 | Ca Si Na | 20. | 1. | 18. | 24. | 0. | 6. | 0. | 0. | 29. | 1. | 1. | 0. | 0. | 0. | 0. | 0.8 |
| 10 | Si Na Ca | 18. | 0. | 2. | 66. | 0. | 0. | 0. | 0. | 11. | 0. | 1. | 0. | 0. | 0. | 0. | 0.8 |
| 1 | Na Si Ca | 24. | 0. | 18. | 23. | 0. | 15. | 0. | 0. | 19. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Na Si | 16. | 0. | 12. | 14. | 0. | 13. | 0. | 0. | 38. | 0. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Ti Na | 16. | 0. | 0. | 59. | 0. | 0. | 0. | 0. | 2. | 20. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 81 | Ca S Si | 6. | 2. | 8. | 13. | 0. | 18. | 0. | 0. | 49. | 1. | 3. | 0. | 0. | 0. | 0. | 6.8 |
| 10 | Si Ca S | 5. | 0. | 7. | 36. | 0. | 18. | 0. | 3. | 26. | 0. | 5. | 0. | 0. | 0. | 0. | 1.0 |
| 33 | Ca Si S | 6. | 3. | 11. | 19. | 0. | 15. | 0. | 0. | 42. | 2. | 2. | 0. | 0. | 0. | 0. | 2.7 |
| 2 | S Ca Si | 16. | 0. | 11. | 18. | 0. | 27. | 0. | 0. | 24. | 3. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Si Ca | 6. | 0. | 4. | 25. | 0. | 38. | 0. | 0. | 19. | 0. | 0. | 7. | 1. | 0. | 0. | 0.0 |
| 1 | Ca Si Cl | 0. | 0. | 18. | 24. | 0. | 10. | 23. | 0. | 26. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe Ca Si | 0. | 5. | 10. | 17. | 0. | 0. | 0. | 0. | 19. | 0. | 49. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca Fe Si | 2. | 4. | 11. | 14. | 0. | 5. | 0. | 0. | 45. | 0. | 19. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Fe Si Ca | 1. | 0. | 2. | 28. | 0. | 0. | 0. | 5. | 18. | 10. | 37. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca Fe | 9. | 0. | 11. | 37. | 0. | 0. | 0. | 0. | 23. | 2. | 17. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Ca Si Fe | 0. | 6. | 9. | 13. | 0. | 3. | 0. | 0. | 56. | 1. | 11. | 0. | 0. | 0. | 0. | 0.4 |
| 23 | Ca Mg Si | 0. | 23. | 8. | 14. | 0. | 4. | 0. | 1. | 46. | 0. | 5. | 0. | 0. | 0. | 0. | 2.9 |
| 7 | Ca Si Mg | 0. | 11. | 6. | 26. | 0. | 1. | 0. | 0. | 52. | 0. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 15 | Ca Mg Al | 0. | 19. | 13. | 9. | 0. | 4. | 0. | 0. | 49. | 0. | 6. | 0. | 0. | 0. | 0. | 1.0 |
| 13 | Ca Al Mg | 0. | 14. | 17. | 5. | 0. | 3. | 0. | 0. | 55. | 0. | 5. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Mg Ca Al | 0. | 39. | 13. | 7. | 0. | 3. | 0. | 0. | 27. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Al Ti | 0. | 0. | 34. | 35. | 0. | 0. | 0. | 0. | 1. | 30. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti Si Al | 0. | 0. | 21. | 23. | 0. | 0. | 0. | 0. | 0. | 56. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ti Al | 0. | 0. | 29. | 35. | 0. | 1. | 0. | 1. | 2. | 31. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Mg Fe | 0. | 23. | 3. | 7. | 0. | 4. | 0. | 0. | 49. | 5. | 8. | 0. | 0. | 0. | 0. | 0.1 |

## Table 3-19. Sample #570 PSI/Arizona Beulah Ash
## 2.9 Kg/hr, 1245°C, Port 11 IMP. #1 + Cup (Continued)

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ca | Fe | Mg | 0. | 9. | 6. | 5. | 0. | 3. | 0. | 0. | 59. | 0. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg | Ca | Fe | 0. | 34. | 5. | 9. | 0. | 4. | 0. | 0. | 30. | 0. | 18. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Fe | S | 0. | 5. | 4. | 2. | 0. | 10. | 0. | 0. | 66. | 0. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Fe | Ca | S | 1. | 0. | 0. | 3. | 0. | 11. | 0. | 0. | 27. | 0. | 58. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | Ca | S | Fe | 5. | 5. | 6. | 6. | 0. | 20. | 0. | 0. | 45. | 0. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | S | Ca | 0. | 0. | 0. | 3. | 0. | 28. | 0. | 0. | 24. | 0. | 45. | 0. | 0. | 0. | 0. | 0.0 |
| 14 | Ca | S | Al | 1. | 5. | 12. | 6. | 0. | 19. | 0. | 1. | 51. | 0. | 4. | 0. | 1. | 0. | 0. | 0.8 |
| 5 | Ca | Al | S | 0. | 4. | 20. | 3. | 0. | 9. | 0. | 0. | 58. | 0. | 5. | 0. | 0. | 0. | 0. | 0.3 |
| 25 | S | Ca | Na | 19. | 0. | 3. | 5. | 0. | 42. | 0. | 0. | 30. | 0. | 0. | 0. | 0. | 0. | 0. | 2.6 |
| 17 | Ca | S | Na | 15. | 1. | 7. | 9. | 0. | 27. | 0. | 0. | 40. | 1. | 1. | 0. | 0. | 0. | 0. | 2.6 |
| 1 | Na | Ca | S | 24. | 0. | 13. | 19. | 0. | 21. | 0. | 0. | 21. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca | Na | S | 13. | 7. | 0. | 0. | 1. | 11. | 1. | 1. | 65. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | S | Na | Ca | 27. | 0. | 3. | 5. | 0. | 40. | 0. | 1. | 24. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Na | S | Ca | 24. | 0. | 13. | 18. | 0. | 22. | 0. | 0. | 21. | 3. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca | Ti | Si | 0. | 3. | 9. | 18. | 0. | 6. | 0. | 0. | 41. | 21. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Ca | Si | Ti | 1. | 0. | 12. | 19. | 0. | 2. | 0. | 0. | 49. | 13. | 3. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Ti | S | Si | 0. | 0. | 5. | 14. | 0. | 22. | 0. | 0. | 8. | 50. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ti | Si | 0. | 0. | 14. | 20. | 0. | 27. | 0. | 0. | 16. | 22. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | Al | Fe | 0. | 7. | 15. | 0. | 0. | 5. | 0. | 0. | 62. | 2. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca | Fe | Al | 0. | 12. | 13. | 4. | 0. | 1. | 0. | 0. | 47. | 2. | 21. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Fe | Ca | Al | 0. | 7. | 11. | 7. | 0. | 2. | 0. | 0. | 20. | 0. | 53. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca | Mg | S | 0. | 15. | 5. | 5. | 0. | 8. | 0. | 0. | 62. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 17 | Ca | S | Mg | 0. | 10. | 4. | 4. | 0. | 16. | 0. | 0. | 63. | 0. | 2. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Ti | Ca | S | 9. | 0. | 7. | 12. | 0. | 16. | 0. | 3. | 25. | 25. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | S | Ti | 0. | 0. | 0. | 0. | 0. | 19. | 0. | 0. | 68. | 12. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ti | S | Ca | 0. | 0. | 5. | 11. | 0. | 32. | 0. | 0. | 17. | 35. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Ca | Ti | S | 0. | 2. | 6. | 7. | 0. | 12. | 0. | 0. | 48. | 21. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S | Ti | Ca | 0. | 4. | 7. | 8. | 0. | 38. | 0. | 3. | 12. | 28. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | Si | Al | S | 0. | 0. | 35. | 49. | 0. | 12. | 0. | 0. | 2. | 2. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Si | Na | 21. | 0. | 11. | 22. | 0. | 24. | 0. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | Na | S | 17. | 0. | 0. | 73. | 0. | 6. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na | Si | S | 25. | 0. | 18. | 22. | 0. | 19. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si | Al | K | 1. | 0. | 35. | 49. | 0. | 0. | 0. | 8. | 3. | 0. | 3. | 1. | 0. | 0. | 0. | 0.3 |
| 3 | Ca | S | K | 0. | 0. | 0. | 1. | 0. | 15. | 0. | 11. | 69. | 4. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | Al | S | 0. | 0. | 24. | 7. | 9. | 23. | 0. | 0. | 8. | 0. | 29. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si | K | Ca | 0. | 0. | 6. | 55. | 0. | 7. | 0. | 12. | 11. | 4. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Cl | Si | 0. | 0. | 0. | 14. | 8. | 48. | 18. | 0. | 0. | 12. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1188 | TOTALS - | | | 8. | 3. | 16. | 25. | 0. | 8. | 0. | 0. | 34. | 1. | 4. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-19. Sample #570 PSI/Arizona Beulah Ash
# 2.9 Kg/hr, 1245°C, Port 11 IMP. #1 + Cup (Continued)

|  |  | Volume DISTRIBUTION |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Ca Si Al | 26.4 | 18. | 34. | 30. | 16. | 1. | 0. | 0. |
| Si Al Ca | 6.7 | 13. | 49. | 23. | 13. | 3. | 0. | 0. |
| Si Al Na | 13.4 | 28. | 30. | 22. | 16. | 3. | 0. | 0. |
| Ca S Si | 6.8 | 12. | 16. | 45. | 26. | 0. | 1. | 0. |
| OTHERS - | 46.7 | 19. | 30. | 28. | 21. | 2. | 0. | 0. |
| TOTALS - | 100.0 | 19. | 31. | 28. | 19. | 2. | 0. | 0. |

# Table 3-20. Sample #571 PSI/Arizona Beulah Ash
# 2.9 Kg/hr, 1245°C, Port 11 IMPS 2+3+4

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Si - - | 8. | 0. | 0. | 82. | 0. | 4. | 0. | 2. | 1. | 0. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S - - | 0. | 0. | 0. | 0. | 0. | 74. | 0. | 0. | 0. | 9. | 0. | 9. | 9. | 0. | 0. | 0.0 |
| 2 | Fe - - | 0. | 0. | 4. | 9. | 0. | 9. | 0. | 0. | 6. | 3. | 69. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Cu Zn - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 74. | 26. | 0. | 0. | 0.1 |
| 5 | Ca S - | 0. | 1. | 1. | 3. | 0. | 33. | 0. | 0. | 61. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | S Ca - | 4. | 0. | 5. | 5. | 0. | 48. | 0. | 0. | 37. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al - | 0. | 0. | 38. | 51. | 0. | 3. | 0. | 0. | 0. | 5. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Na - | 21. | 0. | 0. | 69. | 0. | 3. | 0. | 0. | 5. | 0. | 2. | 0. | 0. | 0. | 0. | 0.2 |
| 72 | S Ca Si | 10. | 0. | 11. | 16. | 0. | 34. | 0. | 0. | 28. | 1. | 1. | 0. | 0. | 0. | 0. | 4.9 |
| 178 | Ca S Si | 8. | 1. | 11. | 16. | 0. | 25. | 0. | 0. | 33. | 1. | 3. | 0. | 0. | 0. | 0. | 11.8 |
| 7 | S Si Ca | 8. | 0. | 12. | 26. | 0. | 30. | 0. | 0. | 20. | 4. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 11 | Si Ca S | 11. | 2. | 9. | 41. | 0. | 15. | 0. | 1. | 18. | 1. | 2. | 0. | 1. | 0. | 0. | 0.5 |
| 27 | Ca Si S | 9. | 0. | 13. | 25. | 0. | 18. | 0. | 0. | 30. | 1. | 2. | 0. | 1. | 0. | 0. | 2.5 |
| 6 | Si S Ca | 4. | 0. | 11. | 37. | 0. | 20. | 0. | 0. | 17. | 6. | 0. | 4. | 0. | 0. | 0. | 0.5 |
| 135 | Ca Si Al | 2. | 6. | 19. | 24. | 0. | 5. | 0. | 0. | 39. | 1. | 4. | 0. | 0. | 0. | 0. | 12.1 |
| 12 | Ca Al Si | 0. | 10. | 20. | 17. | 0. | 3. | 0. | 0. | 44. | 0. | 5. | 0. | 0. | 0. | 0. | 1.0 |
| 66 | Si Al Ca | 8. | 1. | 27. | 36. | 0. | 4. | 0. | 0. | 19. | 2. | 3. | 0. | 0. | 0. | 0. | 6.8 |
| 37 | Si Ca Al | 10. | 2. | 21. | 30. | 0. | 7. | 0. | 0. | 26. | 1. | 4. | 0. | 0. | 0. | 0. | 6.0 |
| 4 | Al Si Ca | 5. | 7. | 33. | 30. | 0. | 1. | 0. | 0. | 18. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Ca Si | 0. | 11. | 40. | 14. | 0. | 13. | 0. | 0. | 15. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 344 | S Ca Na | 18. | 0. | 5. | 7. | 0. | 39. | 0. | 0. | 29. | 0. | 1. | 0. | 0. | 0. | 0. | 18.2 |
| 16 | S Na Ca | 26. | 0. | 5. | 7. | 0. | 38. | 0. | 0. | 23. | 0. | 0. | 0. | 0. | 0. | 0. | 3.9 |
| 49 | Ca S Na | 14. | 3. | 9. | 11. | 0. | 29. | 0. | 0. | 31. | 1. | 3. | 0. | 0. | 0. | 0. | 2.2 |
| 5 | Na S Ca | 26. | 2. | 13. | 14. | 0. | 24. | 0. | 0. | 19. | 0. | 3. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Ca Na S | 21. | 8. | 11. | 12. | 0. | 19. | 0. | 0. | 21. | 0. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Na Ca S | 27. | 2. | 13. | 15. | 0. | 17. | 0. | 0. | 18. | 4. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S Na Si | 23. | 0. | 15. | 20. | 0. | 24. | 0. | 0. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si S Na | 20. | 0. | 6. | 35. | 0. | 23. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Na S | 22. | 0. | 15. | 27. | 0. | 18. | 0. | 0. | 16. | 3. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 65 | Si Al Na | 20. | 0. | 29. | 37. | 0. | 3. | 0. | 0. | 9. | 1. | 2. | 0. | 0. | 0. | 0. | 8.1 |
| 17 | Si Na Al | 28. | 0. | 25. | 31. | 0. | 6. | 0. | 0. | 7. | 1. | 1. | 0. | 0. | 0. | 0. | 2.8 |
| 2 | Na Si Al | 36. | 0. | 25. | 29. | 0. | 4. | 0. | 2. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ca Fe | 14. | 0. | 8. | 3. | 0. | 31. | 0. | 2. | 26. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Ca S Fe | 5. | 10. | 7. | 9. | 0. | 19. | 0. | 0. | 34. | 2. | 14. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S Ca Ti | 4. | 0. | 7. | 12. | 0. | 38. | 0. | 0. | 25. | 13. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca S Ti | 9. | 1. | 9. | 9. | 0. | 26. | 0. | 0. | 33. | 11. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Ti S | 0. | 0. | 10. | 9. | 0. | 11. | 0. | 0. | 52. | 12. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Ca | 9. | 0. | 4. | 5. | 0. | 40. | 0. | 0. | 14. | 27. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 16 | Ca S Al | 7. | 2. | 12. | 10. | 0. | 28. | 0. | 0. | 37. | 1. | 2. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | S Ca Al | 0. | 0. | 18. | 13. | 0. | 44. | 0. | 0. | 19. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Al Ca | 0. | 13. | 19. | 13. | 0. | 24. | 0. | 7. | 15. | 8. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca S Mg | 2. | 17. | 9. | 9. | 0. | 22. | 0. | 0. | 38. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Mg S | 0. | 22. | 8. | 8. | 0. | 18. | 0. | 0. | 27. | 2. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ca Mg | 14. | 16. | 8. | 8. | 0. | 25. | 0. | 0. | 19. | 0. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Mg S Ca | 0. | 62. | 3. | 4. | 0. | 11. | 0. | 2. | 10. | 0. | 9. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | Si Na Ca | 13. | 0. | 3. | 67. | 0. | 3. | 0. | 0. | 10. | 1. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 6 | Si Ca Na | 18. | 0. | 4. | 39. | 0. | 13. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0. | 0. | 1.6 |
| 3 | Ca Si Na | 17. | 3. | 14. | 20. | 0. | 12. | 0. | 1. | 29. | 1. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Mg Ti | 0. | 13. | 5. | 9. | 0. | 11. | 0. | 0. | 46. | 11. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Si Al S | 14. | 0. | 20. | 30. | 0. | 17. | 0. | 2. | 15. | 0. | 2. | 0. | 0. | 0. | 0. | 1.9 |
| 5 | Si S Al | 0. | 4. | 20. | 33. | 0. | 26. | 0. | 2. | 7. | 5. | 2. | 0. | 1. | 0. | 0. | 0.3 |
| 1 | S Si Al | 0. | 0. | 8. | 24. | 0. | 62. | 0. | 0. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Ca Mg Si | 0. | 18. | 9. | 11. | 0. | 5. | 0. | 0. | 47. | 1. | 8. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Si Mg Ca | 0. | 23. | 19. | 23. | 0. | 5. | 0. | 0. | 22. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |

# Table 3-20. Sample #571 PSI/Arizona Beulah Ash
## 2.9 Kg/hr, 1245°C, Port 11 IMPS 2+3+4 (Continued)

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Mg Ca Si | 0. | 34. | 14. | 16. | 0. | 2. | 0. | 0. | 24. | 1. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Si Mg | 0. | 15. | 13. | 18. | 0. | 0. | 0. | 0. | 46. | 1. | 7. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg Si Ca | 0. | 31. | 17. | 21. | 0. | 0. | 0. | 0. | 18. | 0. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Ca Al Mg | 0. | 22. | 26. | 5. | 0. | 1. | 0. | 0. | 40. | 0. | 5. | 0. | 0. | 0. | 0. | 0.7 |
| 4 | Ca Mg Al | 0. | 25. | 13. | 9. | 0. | 5. | 0. | 0. | 40. | 0. | 8. | 0. | 0. | 0. | 0. | 1.5 |
| 1 | Mg Ca Al | 0. | 41. | 14. | 13. | 0. | 0. | 0. | 0. | 24. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Mg Al Fe | 0. | 30. | 20. | 10. | 0. | 7. | 1. | 1. | 10. | 1. | 17. | 0. | 1. | 0. | 0. | 0.0 |
| 1 | Ca Ti Si | 0. | 5. | 14. | 17. | 0. | 4. | 0. | 0. | 38. | 20. | 3. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Si Al K | 0. | 0. | 30. | 54. | 0. | 0. | 0. | 9. | 0. | 0. | 7. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Ca Si Fe | 0. | 5. | 17. | 26. | 0. | 2. | 0. | 0. | 29. | 0. | 21. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca Fe | 0. | 4. | 3. | 56. | 0. | 7. | 0. | 0. | 16. | 4. | 10. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Fe Ca Si | 5. | 0. | 12. | 20. | 0. | 13. | 0. | 2. | 22. | 0. | 24. | 0. | 2. | 0. | 0. | 0.1 |
| 1 | Ca Fe Si | 0. | 0. | 3. | 6. | 5. | 4. | 0. | 0. | 67. | 0. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Ti Si | 0. | 0. | 0. | 11. | 0. | 59. | 0. | 0. | 10. | 20. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | S Si Ti | 4. | 1. | 14. | 22. | 0. | 30. | 0. | 0. | 8. | 17. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Mg Ca Fe | 0. | 47. | 9. | 9. | 0. | 5. | 0. | 3. | 15. | 0. | 12. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg Fe Ca | 0. | 33. | 8. | 8. | 0. | 10. | 0. | 0. | 17. | 4. | 19. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe S Si | 0. | 14. | 14. | 16. | 0. | 19. | 0. | 0. | 13. | 0. | 20. | 0. | 5. | 0. | 0. | 0.0 |
| 1 | S Fe Si | 0. | 0. | 7. | 18. | 0. | 37. | 0. | 0. | 15. | 0. | 22. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Al Fe | 0. | 0. | 17. | 61. | 0. | 3. | 0. | 8. | 2. | 0. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Si Al | 0. | 0. | 8. | 10. | 0. | 0. | 0. | 0. | 7. | 0. | 74. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Na Si | 12. | 5. | 10. | 11. | 0. | 2. | 0. | 0. | 3. | 0. | 56. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al Mg | 0. | 15. | 23. | 26. | 0. | 14. | 0. | 0. | 11. | 0. | 8. | 3. | 0. | 0. | 0. | 0.1 |
| 1 | Si Mg Fe | 0. | 20. | 11. | 24. | 0. | 11. | 0. | 4. | 12. | 0. | 18. | 0. | 0. | 0. | 0. | 0.3 |
| 1191 | TOTALS - | 11. | 3. | 15. | 21. | 0. | 19. | 0. | 0. | 27. | 1. | 3. | 0. | 0. | 0. | 0. | 100.0 |

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| S Ca Si | 4.9 | 9. | 45. | 35. | 10. | 1. | 0. | 0. |
| Ca S Si | 11.8 | 9. | 34. | 35. | 21. | 1. | 0. | 0. |
| Ca Si Al | 12.1 | 82. | 8. | 8. | 1. | 0. | 0. | 0. |
| Si Al Ca | 6.8 | 84. | 13. | 3. | 0. | 0. | 0. | 0. |
| Si Ca Al | 6.0 | 44. | 50. | 5. | 0. | 0. | 0. | 0. |
| S Ca Na | 18.2 | 13. | 35. | 48. | 4. | 0. | 0. | 0. |
| Si Al Na | 8.1 | 81. | 13. | 6. | 0. | 0. | 0. | 0. |
| OTHERS - | 32.2 | 43. | 41. | 12. | 3. | 0. | 0. | 0. |
| TOTALS - | 100.0 | 43. | 32. | 21. | 5. | 0. | 0. | 0. |

# Table 3-21. Sample #573 PSI/Arizona Ash Loy Yang 2301
## 2.4 Kg/hr, 1275°C, Port 11 IMP #1 + CUP

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 327 | Ca - - | 0. | 1. | 0. | 0. | 0. | 4. | 2. | 0. | 92. | 0. | 0. | 0. | 0. | 0. | 0. | 22.1 |
| 2 | Si - - | 0. | 0. | 0. | 97. | 0. | 0. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 97. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg - - | 0. | 58. | 2. | 4. | 0. | 7. | 9. | 0. | 9. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Ca - | 0. | 0. | 0. | 0. | 0. | 60. | 0. | 0. | 40. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 185 | Ca S - | 0. | 2. | 0. | 1. | 0. | 32. | 1. | 0. | 64. | 0. | 0. | 0. | 0. | 0. | 0. | 15.6 |
| 1 | S Fe - | 0. | 0. | 0. | 0. | 0. | 63. | 0. | 0. | 0. | 0. | 37. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Ca - | 0. | 0. | 0. | 0. | 0. | 4. | 0. | 0. | 34. | 0. | 62. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Cl Na - | 33. | 0. | 0. | 0. | 0. | 0. | 67. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 7 | Ca Cl - | 1. | 1. | 0. | 0. | 0. | 3. | 14. | 0. | 81. | 0. | 0. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | Ca Si - | 0. | 3. | 0. | 37. | 0. | 1. | 0. | 0. | 55. | 0. | 2. | 0. | 1. | 0. | 0. | 0.0 |
| 2 | Ca Ti - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 87. | 13. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 8 | Ca Mg - | 0. | 14. | 0. | 1. | 0. | 4. | 3. | 1. | 76. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Fe Si - | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 87. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl Ca Mg | 0. | 12. | 2. | 2. | 0. | 11. | 39. | 0. | 30. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca Cl Mg | 1. | 16. | 3. | 0. | 0. | 12. | 19. | 0. | 48. | 0. | 2. | 0. | 0. | 0. | 0. | 0.8 |
| 4 | Mg Ca Cl | 0. | 39. | 6. | 2. | 0. | 7. | 12. | 1. | 22. | 0. | 7. | 1. | 2. | 0. | 0. | 0.2 |
| 13 | Ca Mg Cl | 0. | 20. | 1. | 1. | 0. | 7. | 11. | 0. | 57. | 0. | 3. | 0. | 0. | 0. | 0. | 0.6 |
| 239 | Ca S Mg | 0. | 10. | 0. | 1. | 0. | 25. | 4. | 0. | 56. | 0. | 2. | 0. | 0. | 0. | 0. | 26.8 |
| 7 | S Ca Mg | 0. | 16. | 2. | 2. | 0. | 37. | 9. | 3. | 24. | 3. | 3. | 0. | 2. | 0. | 0. | 0.5 |
| 17 | Ca Mg S | 0. | 20. | 5. | 2. | 0. | 14. | 8. | 0. | 47. | 0. | 4. | 0. | 0. | 0. | 0. | 1.3 |
| 1 | S Mg Ca | 0. | 27. | 9. | 0. | 0. | 27. | 0. | 11. | 18. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Mg Ca S | 0. | 35. | 5. | 4. | 0. | 15. | 8. | 0. | 28. | 0. | 5. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Al Fe | 0. | 0. | 22. | 33. | 0. | 4. | 0. | 13. | 8. | 6. | 14. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl S K | 0. | 0. | 0. | 16. | 0. | 22. | 44. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 127 | Ca S Cl | 2. | 5. | 0. | 1. | 0. | 23. | 11. | 1. | 56. | 0. | 1. | 0. | 0. | 0. | 0. | 12.0 |
| 35 | Ca Cl S | 5. | 6. | 1. | 1. | 0. | 15. | 21. | 1. | 50. | 0. | 1. | 0. | 0. | 0. | 0. | 2.1 |
| 12 | S Ca Cl | 0. | 4. | 1. | 1. | 1. | 43. | 16. | 3. | 29. | 0. | 1. | 0. | 0. | 0. | 0. | 1.7 |
| 5 | S Cl Ca | 0. | 6. | 2. | 5. | 0. | 44. | 22. | 2. | 20. | 1. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 6 | Cl Ca S | 3. | 1. | 0. | 1. | 0. | 17. | 45. | 5. | 28. | 0. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl S Ca | 0. | 0. | 0. | 9. | 0. | 33. | 43. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Ca S Na | 14. | 4. | 1. | 1. | 0. | 25. | 10. | 2. | 41. | 0. | 1. | 1. | 0. | 0. | 0. | 1.3 |
| 4 | S Ca Na | 15. | 8. | 0. | 3. | 0. | 36. | 11. | 0. | 25. | 0. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 3 | S Na Ca | 22. | 7. | 3. | 0. | 0. | 39. | 11. | 2. | 15. | 0. | 0. | 1. | 0. | 0. | 0. | 0.2 |
| 3 | Ca Na S | 20. | 1. | 0. | 0. | 0. | 17. | 10. | 3. | 48. | 1. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na S Ca | 30. | 11. | 0. | 0. | 0. | 21. | 18. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 11 | Ca S Fe | 0. | 4. | 0. | 1. | 0. | 24. | 4. | 0. | 57. | 0. | 10. | 0. | 0. | 0. | 0. | 0.5 |
| 5 | Ca Fe S | 0. | 4. | 0. | 0. | 0. | 18. | 4. | 0. | 52. | 0. | 22. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Fe Ca S | 0. | 0. | 0. | 0. | 0. | 9. | 3. | 0. | 37. | 0. | 51. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | Cl S Na | 22. | 0. | 0. | 0. | 0. | 29. | 40. | 0. | 9. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S Na Cl | 20. | 7. | 4. | 0. | 0. | 30. | 18. | 3. | 14. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Na S | 18. | 3. | 0. | 5. | 0. | 15. | 45. | 10. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 15 | Ca S Si | 1. | 6. | 1. | 11. | 0. | 24. | 2. | 1. | 53. | 0. | 2. | 0. | 0. | 0. | 0. | 1.7 |
| 5 | Ca Si S | 6. | 5. | 4. | 31. | 0. | 15. | 0. | 0. | 38. | 0. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si Ca S | 0. | 0. | 4. | 39. | 0. | 23. | 5. | 4. | 25. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Ca Si | 0. | 0. | 3. | 13. | 2. | 46. | 0. | 3. | 33. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Ca Cl Na | 11. | 0. | 0. | 0. | 0. | 4. | 15. | 0. | 69. | 1. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | Cl Na Ca | 21. | 1. | 0. | 1. | 0. | 6. | 55. | 0. | 15. | 0. | 1. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Ca Na Cl | 17. | 5. | 0. | 0. | 0. | 11. | 12. | 0. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Cl Ca Na | 16. | 4. | 1. | 1. | 0. | 11. | 47. | 0. | 19. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca Al Cl | 9. | 9. | 20. | 5. | 0. | 15. | 17. | 0. | 23. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl Ca Al | 1. | 12. | 14. | 3. | 0. | 9. | 28. | 3. | 22. | 0. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ti Si | 0. | 0. | 0. | 12. | 0. | 48. | 10. | 9. | 0. | 20. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ti Ca | 4. | 0. | 7. | 36. | 1. | 5. | 2. | 2. | 18. | 22. | 2. | 0. | 0. | 0. | 0. | 0.1 |

# Table 3-21. Sample #573 PSI/Arizona Ash Loy Yang 2301
# 2.4 Kg/hr, 1275°C, Port 11 IMP #1 + CUP (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ca Si Ti | 0. | 5. | 6. | 15. | 0. | 4. | 2. | 0. | 54. | 10. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Cl Si Al | 7. | 0. | 21. | 22. | 0. | 0. | 28. | 11. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Ca K | 0. | 0. | 0. | 0. | 0. | 11. | 34. | 20. | 22. | 13. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl K Ca | 0. | 0. | 0. | 0. | 0. | 0. | 37. | 32. | 20. | 0. | 0. | 10. | 0. | 0. | 0. | 0.2 |
| 1 | Na Cl K | 36. | 0. | 0. | 0. | 0. | 0. | 27. | 21. | 10. | 6. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na K Cl | 34. | 0. | 0. | 3. | 0. | 14. | 14. | 31. | 2. | 2. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca K S | 0. | 0. | 0. | 0. | 0. | 18. | 7. | 22. | 45. | 0. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca S K | 0. | 0. | 0. | 3. | 3. | 23. | 7. | 11. | 51. | 0. | 0. | 2. | 0. | 0. | 0. | 0.4 |
| 1 | S K Ca | 0. | 0. | 0. | 0. | 0. | 40. | 11. | 27. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Ca Mg Fe | 0. | 19. | 6. | 2. | 0. | 6. | 9. | 1. | 44. | 0. | 12. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Ca Mg | 0. | 7. | 0. | 0. | 0. | 5. | 0. | 0. | 16. | 0. | 71. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Mg Ca Fe | 0. | 56. | 7. | 2. | 0. | 2. | 5. | 0. | 16. | 0. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Ti | 0. | 0. | 0. | 0. | 6. | 30. | 0. | 0. | 51. | 9. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ca Ti | 0. | 0. | 8. | 5. | 0. | 41. | 0. | 0. | 33. | 12. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Al Ca | 11. | 3. | 27. | 38. | 0. | 3. | 0. | 0. | 16. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Ca Si Al | 1. | 8. | 13. | 21. | 0. | 6. | 4. | 1. | 41. | 0. | 5. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si Ca Al | 9. | 0. | 11. | 56. | 0. | 6. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Si Ca | 0. | 0. | 45. | 40. | 0. | 0. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl K Mg | 0. | 20. | 0. | 0. | 0. | 14. | 25. | 21. | 9. | 0. | 0. | 11. | 0. | 0. | 0. | 0.0 |
| 2 | Si Ca Fe | 0. | 10. | 1. | 39. | 0. | 2. | 1. | 1. | 28. | 2. | 15. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca Si Fe | 0. | 0. | 4. | 30. | 0. | 8. | 2. | 4. | 30. | 11. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Ca Cu | 0. | 0. | 0. | 0. | 0. | 62. | 0. | 0. | 27. | 0. | 0. | 11. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Al Mg | 0. | 21. | 26. | 0. | 0. | 11. | 12. | 0. | 30. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Al Ca Mg | 0. | 11. | 47. | 4. | 0. | 6. | 9. | 3. | 16. | 3. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca Mg Al | 0. | 16. | 14. | 0. | 0. | 2. | 12. | 0. | 48. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg Ca Al | 0. | 26. | 18. | 16. | 0. | 3. | 10. | 0. | 19. | 4. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Mg Ca | 0. | 29. | 30. | 0. | 0. | 15. | 0. | 0. | 16. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Mg Si | 0. | 14. | 5. | 10. | 0. | 7. | 2. | 0. | 53. | 1. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca Si Mg | 0. | 13. | 3. | 23. | 0. | 11. | 5. | 0. | 42. | 1. | 2. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Si Ca Mg | 9. | 9. | 0. | 39. | 0. | 4. | 0. | 0. | 34. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Al Ca Fe | 0. | 0. | 43. | 0. | 0. | 5. | 2. | 0. | 41. | 0. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Ca Al | 0. | 11. | 19. | 0. | 0. | 0. | 2. | 0. | 32. | 0. | 35. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Fe Si S | 0. | 0. | 8. | 21. | 0. | 20. | 0. | 5. | 9. | 0. | 36. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Al K | 0. | 0. | 39. | 47. | 0. | 0. | 0. | 6. | 3. | 0. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Na Mg | 21. | 18. | 2. | 4. | 0. | 14. | 23. | 0. | 15. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca S Zn | 0. | 0. | 0. | 0. | 0. | 38. | 0. | 0. | 50. | 0. | 6. | 0. | 6. | 0. | 0. | 0.0 |
| 1 | Si Mg Al | 0. | 22. | 19. | 31. | 0. | 0. | 4. | 5. | 0. | 0. | 8. | 6. | 4. | 0. | 0. | 0.0 |
| 1 | Ca S P | 0. | 0. | 11. | 0. | 18. | 21. | 0. | 15. | 22. | 0. | 0. | 0. | 14. | 0. | 0. | 0.3 |
| 1 | Si Ca Na | 20. | 5. | 0. | 43. | 0. | 3. | 0. | 0. | 20. | 2. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si Al Na | 20. | 0. | 30. | 37. | 0. | 0. | 0. | 0. | 9. | 2. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg Cl Al | 0. | 49. | 18. | 0. | 0. | 0. | 19. | 2. | 8. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | OTHERS - | 0. | 0. | 7. | 42. | 0. | 13. | 1. | 14. | 18. | 0. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 1180 | TOTALS - | 1. | 6. | 1. | 2. | 0. | 20. | 6. | 1. | 61. | 0. | 2. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-21. Sample #573 PSI/Arizona Ash Loy Yang 2301 2.4 Kg/hr, 1275°C, Port 11 IMP #1 + CUP (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Ca - - | 22.1 | 22. | 40. | 11. | 19. | 8. | 1. | 0. |
| Ca S - | 15.6 | 8. | 16. | 13. | 47. | 15. | 1. | 0. |
| Ca S Mg | 26.8 | 2. | 10. | 14. | 63. | 10. | 1. | 0. |
| Ca S Cl | 12.0 | 1. | 2. | 8. | 60. | 29. | 2. | 0. |
| OTHERS - | 23.5 | 6. | 8. | 16. | 43. | 20. | 6. | 0. |
| TOTALS - | 100.0 | 8. | 16. | 13. | 46. | 15. | 2. | 0. |

# Table 3-22. Sample #576 PSI/Arizona Ash Loy Yang 2301
# 3.8 Kg/hr, 1420°C, Port 11 IMP 1 + CUP

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 478 | Ca - - | 0. | 2. | 0. | 0. | 0. | 5. | 2. | 0. | 90. | 0. | 0. | 0. | 0. | 0. | 0. | 44.7 |
| 8 | Si - - | 0. | 0. | 0. | 98. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Cl - - | 9. | 0. | 0. | 0. | 0. | 4. | 83. | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 97. | 0. | 0. | 0. | 0. | 0.0 |
| 268 | Ca S - | 0. | 2. | 0. | 0. | 0. | 29. | 1. | 0. | 67. | 0. | 1. | 0. | 0. | 0. | 0. | 20.7 |
| 1 | Fe Ca - | 0. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 24. | 0. | 72. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | Ca Cl - | 1. | 1. | 0. | 0. | 0. | 2. | 21. | 0. | 73. | 0. | 0. | 0. | 1. | 0. | 0. | 1.1 |
| 1 | Cl Na - | 27. | 0. | 0. | 0. | 0. | 3. | 67. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Mg - | 0. | 35. | 0. | 0. | 0. | 5. | 2. | 0. | 55. | 0. | 2. | 0. | 1. | 0. | 0. | 0.3 |
| 2 | Ca P - | 0. | 1. | 0. | 0. | 32. | 3. | 0. | 0. | 62. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Ti - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 88. | 12. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 177 | Ca S Mg | 0. | 10. | 1. | 1. | 0. | 25. | 5. | 0. | 54. | 0. | 3. | 0. | 0. | 0. | 0. | 14.9 |
| 19 | Ca Mg S | 0. | 20. | 1. | 3. | 0. | 13. | 6. | 0. | 53. | 0. | 3. | 0. | 0. | 0. | 0. | 1.2 |
| 2 | Mg Ca S | 0. | 32. | 0. | 4. | 0. | 15. | 12. | 2. | 24. | 0. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Ca Mg | 0. | 23. | 0. | 2. | 0. | 36. | 2. | 10. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Mg Ca | 0. | 20. | 0. | 0. | 0. | 27. | 11. | 0. | 16. | 12. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | Ca Cl Na | 16. | 0. | 0. | 1. | 0. | 4. | 21. | 1. | 57. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Cl Na Ca | 28. | 0. | 0. | 0. | 0. | 3. | 62. | 0. | 7. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl Ca Na | 13. | 10. | 0. | 0. | 0. | 5. | 35. | 0. | 30. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Ca P | 0. | 0. | 0. | 0. | 16. | 34. | 0. | 10. | 31. | 0. | 0. | 9. | 0. | 0. | 0. | 0.0 |
| 17 | Ca Cl S | 3. | 4. | 0. | 1. | 0. | 14. | 23. | 0. | 53. | 0. | 1. | 0. | 0. | 0. | 0. | 0.9 |
| 65 | Ca S Cl | 0. | 6. | 1. | 1. | 0. | 25. | 10. | 0. | 54. | 0. | 3. | 0. | 0. | 0. | 0. | 5.1 |
| 3 | Cl Ca S | 2. | 4. | 2. | 3. | 0. | 15. | 39. | 8. | 24. | 0. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl S Ca | 0. | 0. | 0. | 4. | 0. | 31. | 31. | 12. | 15. | 0. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Ca Cl | 4. | 5. | 0. | 0. | 0. | 12. | 15. | 0. | 19. | 0. | 44. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Cl Fe | 1. | 9. | 4. | 8. | 0. | 8. | 15. | 0. | 42. | 0. | 12. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl Ca Fe | 0. | 8. | 10. | 0. | 0. | 6. | 54. | 0. | 13. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Si S | 4. | 5. | 4. | 14. | 0. | 9. | 3. | 0. | 58. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 11 | Ca S Si | 1. | 3. | 3. | 10. | 0. | 20. | 3. | 0. | 56. | 1. | 3. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si Ca S | 4. | 0. | 0. | 75. | 0. | 6. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 17 | Ca S Fe | 0. | 4. | 0. | 1. | 0. | 22. | 4. | 0. | 59. | 1. | 9. | 0. | 0. | 0. | 0. | 1.6 |
| 1 | Fe Ca S | 0. | 0. | 0. | 0. | 0. | 7. | 0. | 0. | 34. | 0. | 59. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca Fe S | 0. | 7. | 0. | 3. | 0. | 18. | 4. | 0. | 44. | 0. | 24. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si Ca Cl | 0. | 0. | 17. | 36. | 0. | 0. | 17. | 0. | 18. | 12. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl Si Al | 0. | 0. | 23. | 24. | 0. | 0. | 33. | 0. | 19. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Al Ca | 13. | 0. | 28. | 40. | 0. | 0. | 0. | 0. | 15. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Ca Al | 5. | 3. | 13. | 42. | 0. | 9. | 1. | 0. | 21. | 2. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca Si Al | 2. | 5. | 11. | 16. | 0. | 6. | 5. | 0. | 51. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Al S | 0. | 4. | 33. | 1. | 0. | 16. | 3. | 0. | 40. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Ca S Al | 0. | 3. | 8. | 2. | 0. | 20. | 3. | 0. | 62. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca S Na | 8. | 0. | 0. | 0. | 0. | 37. | 5. | 3. | 47. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Ca Na S | 17. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 71. | 3. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Fe Ca Si | 0. | 1. | 10. | 14. | 0. | 4. | 0. | 1. | 22. | 9. | 39. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca Si Fe | 0. | 5. | 9. | 34. | 0. | 1. | 0. | 0. | 38. | 2. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 14 | Ca Mg Cl | 0. | 20. | 2. | 3. | 0. | 8. | 11. | 1. | 51. | 1. | 4. | 0. | 0. | 0. | 0. | 1.3 |
| 2 | Ca Cl Mg | 2. | 11. | 3. | 2. | 0. | 8. | 16. | 0. | 53. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | Mg Ca Cl | 0. | 43. | 0. | 1. | 0. | 2. | 15. | 3. | 32. | 0. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 7 | Mg Cl Ca | 0. | 63. | 0. | 2. | 0. | 4. | 20. | 0. | 10. | 0. | 1. | 0. | 0. | 0. | 0. | 0.8 |
| 1 | Cl Ca Mg | 0. | 13. | 0. | 0. | 0. | 9. | 43. | 0. | 31. | 0. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Mg Fe Cl | 0. | 29. | 0. | 2. | 0. | 11. | 19. | 0. | 17. | 0. | 22. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Cl Mg | 0. | 26. | 0. | 2. | 0. | 4. | 27. | 2. | 7. | 0. | 32. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Mg Cl Fe | 0. | 40. | 0. | 5. | 0. | 6. | 21. | 1. | 12. | 0. | 14. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Fe Al Ca | 0. | 4. | 30. | 0. | 0. | 0. | 0. | 0. | 25. | 0. | 40. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Cl K | 0. | 0. | 0. | 0. | 0. | 7. | 18. | 12. | 10. | 0. | 53. | 0. | 0. | 0. | 0. | 0.2 |

# Table 3-22. Sample #576 PSI/Arizona Ash Loy Yang 2301
3.8 Kg/hr, 1420°C, Port 11 IMP 1 + CUP (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Ca Mg Fe | 0. | 30. | 4. | 0. | 0. | 11. | 9. | 0. | 34. | 0. | 12. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Ca Fe Mg | 0. | 12. | 5. | 1. | 0. | 8. | 7. | 0. | 44. | 0. | 23. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca Mg Al | 0. | 11. | 10. | 1. | 0. | 7. | 6. | 0. | 62. | 0. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Na Cl | 31. | 0. | 0. | 0. | 0. | 35. | 15. | 0. | 13. | 0. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg Cl Si | 0. | 36. | 0. | 16. | 0. | 9. | 19. | 0. | 15. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl K S | 0. | 0. | 0. | 0. | 0. | 19. | 40. | 31. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Ca P Fe | 0. | 0. | 0. | 0. | 13. | 5. | 0. | 0. | 75. | 0. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca S Ti | 0. | 0. | 0. | 0. | 0. | 23. | 4. | 2. | 63. | 6. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Ti S | 0. | 0. | 0. | 0. | 7. | 9. | 0. | 0. | 74. | 10. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S K | 0. | 0. | 0. | 0. | 0. | 17. | 0. | 7. | 76. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg Ca Ti | 0. | 41. | 0. | 0. | 0. | 11. | 0. | 0. | 16. | 12. | 10. | 0. | 9. | 0. | 0. | 0.0 |
| 1 | Si Ca Na | 9. | 0. | 0. | 72. | 0. | 4. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si Ca Mg | 0. | 6. | 0. | 52. | 0. | 0. | 0. | 0. | 42. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Zn | 0. | 0. | 0. | 0. | 0. | 12. | 0. | 0. | 81. | 0. | 0. | 0. | 7. | 0. | 0. | 0.1 |
| 1 | Ca Zn Cl | 0. | 0. | 0. | 9. | 9. | 0. | 13. | 0. | 52. | 0. | 0. | 0. | 17. | 0. | 0. | 0.0 |
| 1192 | TOTALS - | 0. | 5. | 1. | 2. | 0. | 15. | 4. | 0. | 71. | 0. | 2. | 0. | 0. | 0. | 0. | 100.0 |

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Ca - - | 44.7 | 38. | 36. | 13. | 10. | 3. | 0. | 0. |
| Ca S - | 20.7 | 13. | 28. | 20. | 26. | 12. | 0. | 0. |
| Ca S Mg | 14.9 | 20. | 17. | 20. | 36. | 7. | 0. | 0. |
| Ca S Cl | 5.1 | 1. | 35. | 20. | 32. | 12. | 0. | 0. |
| OTHERS - | 14.6 | 31. | 16. | 15. | 26. | 9. | 3. | 0. |
| TOTALS - | 100.0 | 27. | 29. | 16. | 21. | 7. | 0. | 0. |

# Table 3-23. Sample #578 PSI/Arizona Ash Loy Yang 2301
# 3.8 Kg/hr, 1420°C, Port 11 IMP #5+6+7+8

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | S - - | 0. | 6. | 1. | 2. | 0. | 80. | 2. | 1. | 2. | 1. | 3. | 0. | 2. | 0. | 0. | 2.5 |
| 3 | Si - - | 2. | 0. | 0. | 98. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Mg - - | 0. | 63. | 0. | 0. | 3. | 9. | 7. | 0. | 10. | 0. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca S - | 0. | 0. | 0. | 0. | 0. | 48. | 0. | 0. | 52. | 0. | 0. | 0. | 0. | 0. | 0. | 0.6 |
| 30 | S Mg - | 0. | 18. | 0. | 0. | 0. | 76. | 0. | 1. | 3. | 1. | 1. | 0. | 0. | 0. | 0. | 3.5 |
| 1 | S K - | 0. | 0. | 0. | 0. | 0. | 84. | 0. | 11. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Si - | 0. | 0. | 0. | 48. | 0. | 52. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Cl - | 0. | 0. | 0. | 0. | 0. | 62. | 32. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 29 | Cl Na - | 31. | 1. | 0. | 0. | 0. | 3. | 63. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Cl K - | 4. | 0. | 0. | 0. | 0. | 2. | 52. | 36. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ca Si | 0. | 0. | 0. | 18. | 0. | 36. | 14. | 0. | 32. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 63 | S Cl Mg | 0. | 17. | 1. | 2. | 0. | 42. | 22. | 1. | 9. | 1. | 4. | 0. | 0. | 0. | 0. | 6.6 |
| 47 | Cl Mg S | 2. | 25. | 0. | 1. | 0. | 18. | 31. | 1. | 13. | 1. | 8. | 0. | 0. | 0. | 0. | 4.3 |
| 83 | S Mg Cl | 0. | 20. | 1. | 1. | 0. | 51. | 14. | 1. | 8. | 0. | 4. | 0. | 0. | 0. | 0. | 9.1 |
| 52 | Cl S Mg | 3. | 19. | 0. | 1. | 0. | 22. | 32. | 2. | 14. | 0. | 6. | 0. | 1. | 0. | 0. | 3.9 |
| 33 | Mg Cl S | 0. | 33. | 1. | 2. | 0. | 18. | 23. | 2. | 13. | 0. | 8. | 0. | 0. | 0. | 0. | 4.9 |
| 43 | Mg S Cl | 0. | 32. | 0. | 1. | 0. | 23. | 17. | 2. | 13. | 1. | 10. | 0. | 0. | 0. | 0. | 2.5 |
| 49 | S Ca Mg | 0. | 15. | 0. | 1. | 0. | 47. | 7. | 2. | 21. | 0. | 6. | 0. | 1. | 0. | 0. | 6.2 |
| 187 | S Mg Ca | 0. | 21. | 1. | 1. | 0. | 52. | 4. | 1. | 12. | 0. | 5. | 0. | 1. | 0. | 0. | 17.0 |
| 82 | Mg S Ca | 0. | 32. | 1. | 1. | 0. | 24. | 12. | 2. | 18. | 1. | 8. | 0. | 0. | 0. | 0. | 5.2 |
| 15 | Ca S Mg | 0. | 21. | 1. | 1. | 0. | 26. | 12. | 1. | 30. | 0. | 7. | 0. | 0. | 0. | 0. | 1.0 |
| 28 | Mg Ca S | 0. | 31. | 1. | 2. | 0. | 21. | 13. | 1. | 23. | 0. | 7. | 0. | 0. | 0. | 0. | 2.3 |
| 9 | Ca Mg S | 0. | 25. | 1. | 0. | 0. | 22. | 11. | 1. | 26. | 0. | 14. | 0. | 0. | 0. | 0. | 0.4 |
| 68 | Cl Na S | 22. | 8. | 0. | 0. | 0. | 13. | 44. | 1. | 7. | 0. | 3. | 0. | 0. | 0. | 0. | 3.7 |
| 26 | Cl S Na | 17. | 10. | 0. | 0. | 0. | 21. | 37. | 1. | 10. | 0. | 4. | 0. | 0. | 0. | 0. | 0.9 |
| 6 | S Cl Na | 18. | 14. | 0. | 1. | 0. | 33. | 22. | 1. | 8. | 0. | 0. | 2. | 0. | 0. | 0. | 1.0 |
| 15 | Cl Na Ca | 22. | 9. | 0. | 1. | 0. | 9. | 43. | 1. | 11. | 0. | 4. | 0. | 0. | 0. | 0. | 1.0 |
| 24 | S Cl Ca | 1. | 13. | 0. | 1. | 0. | 39. | 22. | 3. | 14. | 1. | 5. | 0. | 1. | 0. | 0. | 1.5 |
| 21 | Cl S Ca | 2. | 14. | 0. | 1. | 0. | 22. | 36. | 2. | 17. | 0. | 6. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Ca Cl S | 0. | 22. | 0. | 7. | 0. | 22. | 22. | 0. | 23. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 12 | S Ca Cl | 0. | 8. | 0. | 1. | 0. | 53. | 12. | 2. | 17. | 0. | 5. | 0. | 0. | 0. | 0. | 0.8 |
| 6 | Cl Ca S | 4. | 16. | 0. | 1. | 0. | 19. | 30. | 2. | 21. | 0. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Ca S Cl | 4. | 1. | 0. | 0. | 0. | 39. | 11. | 1. | 41. | 0. | 2. | 0. | 1. | 0. | 0. | 0.1 |
| 21 | Cl Mg Ca | 1. | 23. | 0. | 2. | 0. | 13. | 36. | 1. | 17. | 0. | 6. | 0. | 0. | 0. | 0. | 1.4 |
| 18 | Mg Cl Ca | 0. | 31. | 1. | 3. | 0. | 14. | 23. | 1. | 18. | 0. | 9. | 0. | 0. | 0. | 0. | 1.5 |
| 6 | Mg Ca Cl | 0. | 31. | 1. | 1. | 0. | 16. | 17. | 1. | 20. | 0. | 13. | 0. | 0. | 0. | 0. | 0.7 |
| 5 | Cl Ca Mg | 7. | 16. | 0. | 0. | 0. | 13. | 39. | 0. | 16. | 0. | 8. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Ca Mg Cl | 0. | 24. | 7. | 0. | 0. | 15. | 16. | 0. | 30. | 0. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S Mg K | 0. | 12. | 0. | 5. | 0. | 74. | 0. | 7. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si Cl S | 18. | 0. | 0. | 31. | 0. | 18. | 20. | 5. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Na S | 22. | 0. | 0. | 36. | 0. | 13. | 11. | 4. | 10. | 3. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl S Ti | 0. | 0. | 0. | 0. | 0. | 31. | 32. | 14. | 9. | 14. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 13 | Cl Mg Na | 16. | 19. | 0. | 2. | 0. | 13. | 33. | 0. | 11. | 0. | 5. | 0. | 0. | 0. | 0. | 1.7 |
| 26 | Cl Na Mg | 24. | 13. | 0. | 1. | 0. | 9. | 39. | 2. | 9. | 0. | 4. | 0. | 0. | 0. | 0. | 2.3 |
| 1 | S Mg Na | 19. | 19. | 3. | 0. | 0. | 35. | 11. | 0. | 12. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Na Ca | 14. | 7. | 4. | 0. | 0. | 53. | 7. | 0. | 10. | 2. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ca Al | 0. | 8. | 8. | 0. | 0. | 58. | 5. | 0. | 10. | 4. | 0. | 6. | 0. | 0. | 0. | 0.0 |
| 1 | Ca S Al | 0. | 9. | 18. | 0. | 0. | 24. | 10. | 2. | 29. | 0. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 35 | S Mg Fe | 0. | 20. | 0. | 1. | 0. | 59. | 4. | 1. | 4. | 0. | 9. | 0. | 1. | 0. | 0. | 1.7 |
| 21 | Mg S Fe | 0. | 38. | 0. | 3. | 1. | 24. | 9. | 1. | 10. | 0. | 13. | 0. | 1. | 0. | 0. | 0.7 |
| 1 | S Fe Mg | 0. | 16. | 0. | 0. | 0. | 53. | 0. | 0. | 9. | 0. | 16. | 0. | 5. | 0. | 0. | 0.0 |
| 1 | Mg Fe S | 0. | 41. | 0. | 4. | 0. | 16. | 9. | 0. | 14. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S Ca Fe | 0. | 1. | 0. | 1. | 0. | 44. | 4. | 2. | 13. | 0. | 8. | 2. | 2. | 0. | 0. | 0.5 |
| 1 | Ca S Fe | 0. | 8. | 0. | 4. | 0. | 27. | 6. | 3. | 40. | 0. | 11. | 0. | 0. | 0. | 0. | 0.2 |

# Table 3-23. Sample #578 PSI/Arizona Ash Loy Yang 2301 3.8 Kg/hr, 1420°C, Port 11 IMP #5+6+7+8 (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Fe | S | Ca | 0. | 21. | 0. | 5. | 0. | 23. | 6. | 0. | 21. | 0. | 25. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Fe | Ca | 0. | 0. | 0. | 0. | 0. | 78. | 0. | 0. | 11. | 0. | 11. | 0. | 0. | 0. | 0. | 0.8 |
| 4 | S | Mg | Si | 0. | 18. | 0. | 9. | 0. | 70. | 0. | 1. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | S | Si | Mg | 0. | 11. | 0. | 11. | 0. | 73. | 0. | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.5 |
| 13 | Mg | Cl | Fe | 0. | 41. | 0. | 2. | 0. | 11. | 20. | 1. | 9. | 1. | 15. | 0. | 0. | 0. | 0. | 0.4 |
| 5 | Mg | Fe | Cl | 0. | 43. | 1. | 6. | 0. | 12. | 14. | 0. | 9. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Cl | Mg | Fe | 0. | 25. | 1. | 0. | 1. | 12. | 33. | 1. | 4. | 3. | 14. | 2. | 3. | 0. | 0. | 0.3 |
| 4 | S | Mg | Zn | 0. | 17. | 0. | 1. | 0. | 65. | 0. | 0. | 4. | 0. | 4. | 3. | 6. | 0. | 0. | 0.7 |
| 3 | S | Mg | Al | 0. | 13. | 6. | 4. | 0. | 73. | 0. | 0. | 1. | 2. | 1. | 0. | 0. | 0. | 0. | 0.7 |
| 2 | S | Mg | Cu | 0. | 23. | 0. | 0. | 0. | 59. | 3. | 0. | 4. | 0. | 2. | 7. | 2. | 0. | 0. | 0.0 |
| 3 | S | Mg | Ti | 0. | 26. | 0. | 0. | 0. | 63. | 0. | 1. | 2. | 7. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Zn | Si | 14. | 0. | 0. | 15. | 0. | 51. | 0. | 0. | 0. | 0. | 0. | 0. | 20. | 0. | 0. | 0.0 |
| 1 | S | Fe | Al | 0. | 11. | 11. | 0. | 0. | 54. | 0. | 0. | 9. | 0. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl | S | Al | 0. | 0. | 12. | 0. | 0. | 35. | 53. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg | Na | Ca | 24. | 25. | 0. | 3. | 6. | 11. | 8 | 4. | 11. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Fe | K | 0. | 0. | 9. | 0. | 0. | 63. | 0. | 9. | 6. | 0. | 12. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Fe | Ca | Mg | 0. | 6. | 0. | 0. | 0. | 4. | 3. | 0. | 25. | 0. | 61. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Mg | Ca | Fe | 0. | 34. | 0. | 2. | 0. | 12. | 3. | 4. | 32. | 0. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | Mg | Ca | 0. | 24. | 0. | 2. | 0. | 10. | 15. | 0. | 22. | 0. | 27. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg | Ca | K | 0. | 30. | 0. | 0. | 0. | 15. | 8. | 15. | 17. | 0. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 1181 | TOTALS - | | | 3. | 19. | 1. | 2. | 0. | 38. | 17. | 2. | 12. | 0. | 6. | 0. | 1. | 0. | 0. | 100.0 |

# Table 3-23. Sample #578 PSI/Arizona Ash Loy Yang 2301 3.8 Kg/hr, 1420°C, Port 11 IMP #5+6+7+8 (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| S Cl Mg | 6.6 | 14. | 68. | 16. | 2. | 0. | 0. | 0. |
| Cl Mg S | 4.3 | 25. | 52. | 17. | 6. | 0. | 0. | 0. |
| S Mg Cl | 9.1 | 18. | 66. | 15. | 1. | 0. | 0. | 0. |
| Mg Cl S | 4.9 | 18. | 75. | 7. | 0. | 0. | 0. | 0. |
| S Ca Mg | 6.2 | 25. | 63. | 12. | 0. | 0. | 0. | 0. |
| S Mg Ca | 17.0 | 13. | 67. | 19. | 1. | 0. | 0. | 0. |
| Mg S Ca | 5.2 | 49. | 23. | 25. | 3. | 0. | 0. | 0. |
| OTHERS - | 46.8 | 26. | 43. | 23. | 8. | 1. | 0. | 0. |
| TOTALS - | 100.0 | 23. | 53. | 19. | 5. | 0. | 0. | 0. |

# Table 3-24. Sample #579 PSI/Arizona Loy Yang 1953
## 2.4 Kg/hr, 1160°C, Port 11 IMP #1 + CUP

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Si - - | 1. | 0. | 2. | 94. | 0. | 1. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 1.2 |
| 222 | S - - | 0. | 0. | 2. | 1. | 0. | 90. | 0. | 1. | 2. | 1. | 1. | 0. | 1. | 0. | 0. | 19.2 |
| 9 | Ca - - | 0. | 0. | 0. | 0. | 0. | 1. | 1. | 0. | 98. | 0. | 0. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | P - - | 0. | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 14 | Fe - - | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 96. | 0. | 0. | 0. | 0. | 1.3 |
| 3 | Mg - - | 0. | 92. | 0. | 0. | 0. | 2. | 1. | 0. | 4. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 277 | Ca S - | 0. | 0. | 0. | 0. | 0. | 46. | 0. | 0. | 53. | 0. | 0. | 0. | 0. | 0. | 0. | 22.6 |
| 61 | S Ca - | 0. | 0. | 1. | 0. | 0. | 62. | 0. | 0. | 35. | 0. | 1. | 0. | 0. | 0. | 0. | 5.6 |
| 7 | S Al - | 0. | 1. | 22. | 3. | 0. | 70. | 2. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.6 |
| 11 | Al S - | 0. | 0. | 60. | 0. | 0. | 35. | 2. | 1. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.9 |
| 3 | S Cl - | 0. | 0. | 0. | 0. | 0. | 87. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Cl S - | 0. | 0. | 0. | 0. | 0. | 49. | 51. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 14 | S Mg - | 0. | 28. | 0. | 0. | 0. | 70. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 1.1 |
| 17 | S Na - | 21. | 0. | 0. | 0. | 0. | 77. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 1.5 |
| 7 | S K - | 0. | 0. | 0. | 0. | 0. | 84. | 0. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 5 | S Zn - | 0. | 0. | 0. | 0. | 0. | 86. | 0. | 0. | 0. | 0. | 0. | 0. | 14. | 0. | 0. | 0.2 |
| 2 | S Fe - | 0. | 0. | 4. | 2. | 0. | 75. | 0. | 0. | 4. | 1. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Fe - | 0. | 0. | 0. | 78. | 0. | 0. | 0. | 0. | 0. | 0. | 22. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe Ca S | 0. | 0. | 5. | 5. | 0. | 23. | 0. | 0. | 28. | 0. | 39. | 0. | 0. | 0. | 0. | 0.1 |
| 9 | Ca S Fe | 0. | 1. | 3. | 1. | 0. | 38. | 0. | 0. | 47. | 0. | 9. | 0. | 0. | 0. | 0. | 1.2 |
| 2 | S Fe Ca | 0. | 0. | 0. | 4. | 0. | 71. | 0. | 0. | 11. | 1. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 8 | S Ca Fe | 1. | 1. | 7. | 2. | 0. | 49. | 0. | 3. | 23. | 0. | 13. | 0. | 0. | 0. | 0. | 0.4 |
| 7 | S Al Ca | 0. | 0. | 21. | 4. | 0. | 49. | 1. | 5. | 14. | 3. | 1. | 0. | 2. | 0. | 0. | 0.6 |
| 7 | Ca S Al | 0. | 0. | 9. | 3. | 0. | 39. | 0. | 2. | 45. | 0. | 2. | 0. | 0. | 0. | 0. | 0.7 |
| 29 | S Ca Al | 0. | 0. | 14. | 1. | 0. | 48. | 0. | 2. | 32. | 0. | 1. | 0. | 1. | 0. | 0. | 4.4 |
| 8 | Al S Ca | 3. | 0. | 43. | 0. | 1. | 30. | 3. | 4. | 14. | 0. | 2. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | Ca Al S | 0. | 0. | 29. | 0. | 0. | 20. | 8. | 3. | 36. | 0. | 4. | 0. | 0. | 0. | 0. | 0.8 |
| 1 | Si Na Cl | 27. | 4. | 8. | 29. | 0. | 0. | 10. | 4. | 5. | 3. | 3. | 3. | 2. | 0. | 0. | 0.1 |
| 3 | Si Al Ti | 0. | 0. | 30. | 54. | 0. | 1. | 0. | 4. | 1. | 10. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 4 | S Si Cl | 0. | 0. | 6. | 14. | 1. | 58. | 10. | 6. | 4. | 1. | 0. | 1. | 0. | 0. | 0. | 0.3 |
| 1 | S Mg Cl | 0. | 18. | 0. | 12. | 0. | 56. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Cl Mg | 0. | 24. | 2. | 2. | 0. | 38. | 30. | 0. | 0. | 1. | 0. | 0. | 2. | 0. | 0. | 0.5 |
| 2 | S Ca Cu | 0. | 0. | 0. | 6. | 6. | 56. | 0. | 0. | 24. | 0. | 0. | 9. | 0. | 0. | 0. | 0.1 |
| 3 | S Cu Ca | 0. | 0. | 0. | 4. | 0. | 47. | 7. | 5. | 16. | 2. | 0. | 19. | 0. | 0. | 0. | 0.1 |
| 7 | S Mg K | 0. | 20. | 3. | 4. | 0. | 49. | 5. | 11. | 4. | 0. | 3. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | S K Mg | 0. | 12. | 0. | 9. | 0. | 56. | 0. | 13. | 0. | 9. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Si Na S | 18. | 3. | 10. | 44. | 0. | 15. | 0. | 1. | 4. | 0. | 5. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si S Na | 13. | 0. | 1. | 59. | 0. | 23. | 0. | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | S Na Si | 28. | 4. | 3. | 11. | 0. | 51. | 2. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | Ca Cl Si | 0. | 0. | 0. | 22. | 5. | 0. | 29. | 7. | 32. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Al Cl | 0. | 4. | 27. | 1. | 0. | 43. | 12. | 0. | 1. | 1. | 0. | 6. | 5. | 0. | 0. | 0.3 |
| 16 | Al S Cl | 1. | 0. | 58. | 2. | 0. | 24. | 9. | 3. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 1.7 |
| 1 | S Cl Al | 0. | 0. | 14. | 0. | 0. | 48. | 24. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | Ca Si Al | 0. | 1. | 19. | 25. | 0. | 8. | 0. | 3. | 37. | 1. | 7. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Si Al Ca | 0. | 0. | 11. | 63. | 0. | 3. | 0. | 5. | 9. | 7. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Ca Si Mg | 0. | 17. | 5. | 32. | 0. | 5. | 0. | 0. | 34. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Mg Si | 0. | 22. | 9. | 16. | 0. | 0. | 0. | 0. | 41. | 2. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S Mg Al | 0. | 23. | 19. | 0. | 0. | 47. | 2. | 0. | 1. | 0. | 1. | 7. | 0. | 0. | 0. | 0.4 |
| 8 | S Ca K | 0. | 0. | 1. | 1. | 0. | 56. | 0. | 11. | 28. | 1. | 0. | 0. | 2. | 0. | 0. | 0.7 |
| 2 | S Ca Mg | 0. | 15. | 1. | 10. | 0. | 40. | 0. | 3. | 30. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S Mg Ca | 0. | 17. | 4. | 4. | 3. | 59. | 0. | 4. | 9. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Ca S Mg | 0. | 12. | 3. | 3. | 0. | 31. | 0. | 3. | 40. | 4. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca S | 0. | 6. | 4. | 32. | 0. | 17. | 0. | 0. | 23. | 9. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Ca S Si | 1. | 0. | 7. | 14. | 0. | 34. | 0. | 0. | 44. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |

# Table 3-24. Sample #579 PSI/Arizona Loy Yang 1953
# 2.4 Kg/hr, 1160°C, Port 11 IMP #1 + CUP (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | S Ca Si | 0. | 0. | 2. | 12. | 0. | 51. | 7. | 7. | 19. | 0. | 2. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Ca_Si S | 1. | 0. | 9. | 24. | 0. | 12. | 5. | 7. | 38. | 0. | 3. | 0. | 0. | 0. | 0. | 0.5 |
| 4 | S Si K | 0. | 0. | 0. | 19. | 1. | 61. | 2. | 12. | 2. | 0. | 2. | 0. | 1. | 0. | 0. | 0.4 |
| 1 | K S Si | 0. | 0. | 0. | 14. | 0. | 19. | 11. | 21. | 13. | 11. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Mg Si | 0. | 35. | 3. | 14. | 0. | 45. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Si Ti | 0. | 0. | 0. | 14. | 0. | 68. | 7. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti S Si | 0. | 0. | 16. | 16. | 0. | 18. | 0. | 13. | 15. | 22. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 25 | Si Al S | 0. | 0. | 33. | 40. | 0. | 21. | 0. | 2. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 2.6 |
| 13 | S Si Al | 0. | 2. | 20. | 23. | 0. | 49. | 0. | 2. | 2. | 0. | 2. | 2. | 0. | 0. | 0. | 1.1 |
| 2 | Si S Al | 4. | 0. | 17. | 33. | 0. | 24. | 4. | 3. | 10. | 0. | 3. | 3. | 0. | 0. | 0. | 0.1 |
| 6 | Al Si S | 0. | 0. | 35. | 31. | 0. | 17. | 0. | 3. | 9. | 3. | 2. | 0. | 0. | 0. | 0. | 0.4 |
| 4 | Al S Si | 2. | 0. | 38. | 16. | 0. | 23. | 3. | 2. | 7. | 0. | 10. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S Ca Ti | 0. | 0. | 5. | 0. | 0. | 66. | 0. | 0. | 16. | 13. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 7 | S Na Ca | 17. | 2. | 1. | 0. | 0. | 61. | 0. | 4. | 10. | 0. | 4. | 0. | 0. | 0. | 0. | 1.4 |
| 5 | S Ca Na | 14. | 1. | 2. | 0. | 0. | 49. | 0. | 2. | 30. | 0. | 1. | 0. | 0. | 0. | 0. | 0.3 |
| 8 | S Na Mg | 27. | 14. | 0. | 1. | 0. | 56. | 0. | 0. | 0. | 0. | 1. | 1. | 0. | 0. | 0. | 0.5 |
| 1 | Si Ca Na | 18. | 3. | 6. | 51. | 0. | 0. | 0. | 0. | 23. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S Cl Ca | 0. | 0. | 4. | 9. | 0. | 44. | 25. | 3. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Ti K | 0. | 0. | 0. | 0. | 0. | 59. | 13. | 14. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si S Fe | 1. | 1. | 5. | 48. | 0. | 22. | 0. | 0. | 10. | 0. | 11. | 0. | 1. | 0. | 0. | 0.1 |
| 1 | S Fe Si | 0. | 0. | 12. | 13. | 0. | 49. | 0. | 0. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Si Al Na | 14. | 0. | 26. | 41. | 0. | 4. | 0. | 1. | 8. | 2. | 3. | 0. | 0. | 0. | 0. | 0.6 |
| 4 | S Na Al | 24. | 3. | 14. | 3. | 0. | 42. | 2. | 5. | 6. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | Al S Na | 10. | 0. | 51. | 0. | 0. | 28. | 3. | 4. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Cl Na S | 30. | 0. | 0. | 0. | 0. | 10. | 57. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na Cl S | 33. | 10. | 0. | 9. | 0. | 10. | 26. | 5. | 2. | 5. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si Mg Al | 2. | 19. | 14. | 22. | 0. | 10. | 5. | 4. | 6. | 5. | 7. | 0. | 5. | 0. | 0. | 0.0 |
| 1 | Al Si Mg | 8. | 10. | 41. | 25. | 0. | 4. | 2. | 0. | 5. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | K Cl S | 0. | 0. | 0. | 4. | 0. | 18. | 18. | 44. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S K Cl | 0. | 0. | 0. | 0. | 0. | 66. | 15. | 19. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S Al Fe | 1. | 1. | 22. | 13. | 0. | 35. | 1. | 1. | 9. | 0. | 18. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | Al Fe S | 0. | 0. | 34. | 0. | 0. | 21. | 5. | 12. | 4. | 0. | 25. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Mg Ti Ca | 0. | 69. | 0. | 0. | 9. | 0. | 0. | 0. | 10. | 12. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti Cl | 0. | 0. | 0. | 8. | 0. | 68. | 11. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Na Cl Al | 30. | 0. | 13. | 4. | 0. | 9. | 29. | 8. | 0. | 6. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S Cu Si | 0. | 0. | 0. | 10. | 0. | 78. | 0. | 0. | 0. | 0. | 0. | 11. | 0. | 0. | 0. | 0.2 |
| 1 | S Fe P | 0. | 0. | 0. | 0. | 20. | 47. | 0. | 0. | 0. | 0. | 33. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | Al S K | 0. | 1. | 52. | 0. | 0. | 30. | 2. | 11. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 1.4 |
| 6 | S Al K | 0. | 0. | 31. | 0. | 0. | 44. | 7. | 14. | 3. | 1. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Cl K Si | 0. | 0. | 0. | 20. | 0. | 0. | 39. | 24. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Mg Si Fe | 0. | 27. | 14. | 20. | 0. | 3. | 0. | 0. | 18. | 0. | 19. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Al P | 0. | 0. | 18. | 0. | 15. | 47. | 0. | 9. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Cl Zn | 0. | 0. | 0. | 0. | 0. | 62. | 30. | 0. | 0. | 0. | 0. | 0. | 8. | 0. | 0. | 0.1 |
| 4 | S Fe K | 0. | 0. | 5. | 2. | 0. | 55. | 3. | 10. | 5. | 0. | 19. | 1. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Si Al | 0. | 7. | 17. | 22. | 0. | 4. | 0. | 1. | 15. | 3. | 31. | 0. | 0. | 0. | 0. | 0.0 |
| 113 | OTHERS - | 3. | 5. | 15. | 12. | 0. | 34. | 4. | 4. | 9. | 2. | 8. | 1. | 2. | 0. | 0. | 11.5 |
| 1108 | TOTALS - | 2. | 2. | 9. | 7. | 0. | 51. | 2. | 2. | 21. | 1. | 4. | 0. | 1. | 0. | 0. | 100.0 |

# Table 3-24. Sample #579 PSI/Arizona Loy Yang 1953
# 2.4 Kg/hr, 1160°C, Port 11 IMP #1 + CUP (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| S - - | 19.2 | 53. | 25. | 12. | 8. | 1. | 1. | 0. |
| S Ca - | 5.6 | 24. | 31. | 23. | 21. | 1. | 0. | 0. |
| Ca S - | 22.6 | 16. | 32. | 34. | 15. | 1. | 1. | 0. |
| S Ca Al | 4.4 | 16. | 51. | 13. | 18. | 2. | 0. | 0. |
| OTHERS - | 11.5 | 26. | 41. | 16. | 17. | 0. | 0. | 0. |
| OTHERS - | 36.6 | 14. | 28. | 23. | 26. | 6. | 2. | 0. |
| TOTALS - | 100.0 | 24. | 31. | 22. | 18. | 3. | 1. | 0. |

# Table 3-25. Sample #581 PSI/Arizona Loy Yang 1953
## 2.4 Kg/hr, 1160°C, Port 11 IMP #5+6+7+8+A

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Cl - - | 5. | 0. | 0. | 0. | 0. | 1. | 93. | 0. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.8 |
| 48 | S - - | 2. | 1. | 1. | 2. | 0. | 75. | 0. | 7. | 4. | 1. | 5. | 0. | 1. | 0. | 0. | 4.3 |
| 5 | Ca - - | 2. | 0. | 0. | 4. | 0. | 1. | 0. | 0. | 92. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Si - - | 0. | 0. | 0. | 98. | 0. | 0. | 0. | 0. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe - - | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0.1 |
| 66 | S Na - | 35. | 0. | 0. | 0. | 0. | 62. | 0. | 1. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 4.5 |
| 6 | Na S - | 53. | 0. | 0. | 0. | 0. | 47. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 2 | S Cl - | 3. | 0. | 0. | 0. | 0. | 59. | 34. | 0. | 0. | 0. | 2. | 2. | 1. | 0. | 0. | 0.1 |
| 3 | Cl S - | 3. | 0. | 0. | 0. | 0. | 36. | 56. | 2. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 19 | S K - | 0. | 0. | 0. | 0. | 0. | 80. | 0. | 19. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 2.0 |
| 12 | K S - | 2. | 1. | 0. | 0. | 0. | 40. | 1. | 55. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Na Si - | 73. | 0. | 4. | 12. | 2. | 3. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 233 | Cl Na - | 25. | 0. | 0. | 0. | 0. | 0. | 75. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 12.7 |
| 1 | Si Mg - | 0. | 34. | 0. | 66. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | Ca Si - | 0. | 0. | 2. | 42. | 0. | 2. | 0. | 0. | 54. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe Si - | 0. | 0. | 0. | 36. | 0. | 0. | 0. | 0. | 3. | 0. | 61. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Fe Ca - | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 30. | 0. | 66. | 0. | 0. | 0. | 0. | 0.0 |
| 10 | S Fe - | 0. | 0. | 0. | 0. | 0. | 85. | 0. | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0.7 |
| 29 | S K Na | 12. | 2. | 1. | 1. | 0. | 49. | 0. | 24. | 7. | 0. | 4. | 0. | 0. | 0. | 0. | 2.3 |
| 99 | S Na K | 25. | 2. | 1. | 1. | 0. | 52. | 1. | 10. | 3. | 1. | 4. | 0. | 0. | 0. | 0. | 10.9 |
| 8 | K S Na | 9. | 1. | 0. | 0. | 0. | 39. | 0. | 49. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 37 | Cl Na S | 25. | 1. | 0. | 1. | 0. | 15. | 54. | 3. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 2.2 |
| 9 | S Na Cl | 29. | 0. | 0. | 0. | 0. | 56. | 13. | 2. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 0.9 |
| 4 | Na S Cl | 29. | 3. | 1. | 4. | 0. | 27. | 22. | 3. | 2. | 0. | 6. | 0. | 2. | 0. | 0. | 0.5 |
| 14 | Cl S Na | 22. | 0. | 0. | 0. | 0. | 28. | 41. | 5. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 2.3 |
| 7 | S Cl Na | 22. | 2. | 0. | 2. | 0. | 38. | 26. | 4. | 2. | 0. | 2. | 0. | 2. | 0. | 0. | 1.0 |
| 1 | Na Cl S | 67. | 0. | 0. | 0. | 0. | 13. | 19. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Cl S K | 6. | 2. | 0. | 0. | 0. | 28. | 44. | 14. | 4. | 0. | 1. | 0. | 1. | 0. | 0. | 0.1 |
| 3 | Cl K S | 5. | 0. | 2. | 0. | 0. | 21. | 39. | 22. | 9. | 1. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S Cl K | 6. | 1. | 0. | 1. | 0. | 46. | 24. | 12. | 4. | 0. | 3. | 0. | 3. | 0. | 0. | 0.3 |
| 1 | K S Cl | 13. | 0. | 0. | 0. | 0. | 31. | 14. | 39. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S K Cl | 0. | 2. | 0. | 0. | 0. | 57. | 10. | 20. | 3. | 0. | 5. | 0. | 3. | 0. | 0. | 0.1 |
| 1 | Cl Si Ca | 0. | 0. | 0. | 24. | 0. | 15. | 33. | 13. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca Cl | 0. | 0. | 0. | 72. | 0. | 0. | 10. | 7. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl K Fe | 0. | 0. | 0. | 0. | 7. | 7. | 43. | 19. | 10. | 0. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Ca K | 0. | 0. | 0. | 8. | 7. | 7. | 46. | 15. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca Cl K | 9. | 0. | 3. | 9. | 0. | 10. | 12. | 11. | 33. | 10. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Cl K | 4. | 0. | 0. | 44. | 0. | 2. | 26. | 20. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl K Si | 0. | 0. | 0. | 18. | 0. | 0. | 41. | 24. | 16. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl K Na | 11. | 0. | 0. | 2. | 0. | 8. | 45. | 28. | 5. | 1. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl Na K | 38. | 0. | 0. | 0. | 0. | 0. | 56. | 6. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | K Cl P | 0. | 0. | 0. | 4. | 23. | 7. | 24. | 35. | 3. | 4. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | S Na Mg | 23. | 14. | 0. | 2. | 0. | 52. | 0. | 5. | 0. | 0. | 1. | 0. | 2. | 0. | 0. | 2.5 |
| 3 | Si Al Ca | 0. | 3. | 20. | 56. | 0. | 4. | 0. | 2. | 12. | 1. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca Al | 0. | 0. | 22. | 29. | 0. | 8. | 10. | 0. | 22. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca Si Al | 0. | 0. | 9. | 21. | 0. | 4. | 4. | 3. | 49. | 3. | 6. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca Si Mg | 0. | 10. | 1. | 16. | 0. | 5. | 0. | 0. | 68. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Al S Na | 16. | 1. | 43. | 0. | 0. | 31. | 4. | 2. | 1. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | S Al Na | 15. | 0. | 24. | 2. | 0. | 47. | 1. | 5. | 1. | 0. | 4. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Cl S Mg | 0. | 14. | 0. | 0. | 0. | 32. | 46. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl S Fe | 0. | 0. | 0. | 0. | 0. | 22. | 70. | 0. | 0. | 0. | 8. | 0. | 1. | 0. | 0. | 0.2 |
| 1 | Cl Fe S | 0. | 0. | 0. | 0. | 0. | 16. | 65. | 0. | 0. | 0. | 19. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl S Ca | 0. | 0. | 0. | 0. | 0. | 31. | 61. | 0. | 8. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Cl | 0. | 0. | 0. | 3. | 0. | 27. | 26. | 7. | 34. | 4. | 0. | 0. | 0. | 0. | 0. | 0.0 |

# Table 3-25. Sample #581 PSI/Arizona Loy Yang 1953
# 2.4 Kg/hr, 1160°C, Port 11 IMP #5+6+7+8+A (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ca | Cl | S | 0. | 0. | 0. | 0. | 0. | 29. | 29. | 0. | 37. | 0. | 0. | 6. | 0. | 0. | 0. | 0.1 |
| 1 | Cl | Ca | S | 0. | 0. | 0. | 0. | 0. | 18. | 34. | 16. | 22. | 10. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Cl | Ca | 0. | 0. | 0. | 6. | 0. | 33. | 31. | 7. | 13. | 11. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 59 | S | K | Fe | 0. | 1. | 1. | 3. | 0. | 65. | 0. | 14. | 4. | 1. | 10. | 0. | 1. | 0. | 0. | 6.2 |
| 34 | S | Fe | K | 3. | 2. | 3. | 3. | 0. | 61. | 0. | 11. | 2. | 1. | 13. | 0. | 1. | 0. | 0. | 4.0 |
| 1 | Na | Si | Cl | 31. | 0. | 0. | 24. | 0. | 6. | 13 | 6. | 10. | 9. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 15 | S | Ca | K | 0. | 0. | 0. | 5. | 0. | 61. | 0. | 13. | 13. | 1. | 7. | 0. | 1. | 0. | 0. | 2.6 |
| 115 | S | K | Ca | 2. | 1. | 1. | 1. | 0. | 55. | 0. | 24. | 12. | 0. | 4. | 0. | 0. | 0. | 0. | 9.3 |
| 5 | K | S | Ca | 0. | 0. | 2. | 0. | 0. | 36. | 1. | 39. | 20. | 2. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si | Cl | Mg | 0. | 13. | 0. | 40. | 0. | 9. | 14. | 10. | 4. | 5. | 5. | 0. | 0. | 0. | 0. | 0.1 |
| 8 | S | K | Mg | 1. | 9. | 1. | 2. | 0. | 52. | 1. | 23. | 5. | 0. | 5. | 0. | 1. | 0. | 0. | 0.2 |
| 1 | K | S | Mg | 0. | 13. | 0. | 0. | 0. | 41. | 0. | 46. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 5 | S | Mg | K | 0. | 16. | 0. | 3. | 0. | 66. | 0. | 10. | 2. | 0. | 2. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Cl | Si | S | 0. | 0. | 0. | 21. | 0. | 12. | 56. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 24 | S | Na | Ca | 26. | 0. | 0. | 2. | 0. | 51. | 0. | 5. | 10. | 1. | 4. | 0. | 1. | 0. | 0. | 2.1 |
| 1 | S | Ca | Na | 9. | 5. | 0. | 4. | 0. | 65. | 0. | 0. | 13. | 0. | 3. | 0. | 0. | 0. | 0. | 0.0 |
| 52 | S | Na | Fe | 22. | 3. | 1. | 2. | 0. | 56. | 0. | 6. | 2. | 1. | 8. | 0. | 1. | 0. | 0. | 5.9 |
| 6 | S | Fe | Na | 10. | 1. | 2. | 5. | 0. | 60. | 0. | 6. | 2. | 0. | 11. | 0. | 4. | 0. | 0. | 1.1 |
| 1 | Ca | Na | Si | 41. | 0. | 0. | 10. | 0. | 0. | 6. | 0. | 43. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca | S | Si | 0. | 0. | 0. | 19. | 0. | 28. | 0. | 0. | 53. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Si | Ca | 0. | 0. | 3. | 17. | 0. | 61. | 3. | 0. | 13. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 5 | S | Ca | Si | 0. | 0. | 1. | 13. | 0. | 68. | 0. | 4. | 14. | 0. | 1. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | S | Fe | Mg | 0. | 12. | 2. | 1. | 0. | 53. | 0. | 7. | 2. | 0. | 22. | 1. | 0. | 0. | 0. | 0.6 |
| 8 | S | Mg | Fe | 5. | 21. | 4. | 4. | 0. | 39. | 5. | 8. | 0. | 2. | 11. | 0. | 3. | 0. | 0. | 1.1 |
| 1 | Na | Si | Al | 30. | 0. | 15. | 26. | 0. | 9. | 4. | 0. | 8. | 7. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si | Al | Fe | 0. | 0. | 21. | 45. | 0. | 0. | 0. | 11. | 11. | 0. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Ca | Al | 0. | 0. | 13. | 0. | 0. | 47. | 9. | 0. | 31. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 7 | S | K | Si | 0. | 0. | 3. | 10. | 0. | 69. | 0. | 16. | 2. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 2 | S | Ti | Si | 0. | 0. | 0. | 15. | 0. | 59. | 0. | 0. | 0. | 17. | 0. | 9. | 0. | 0. | 0. | 0.2 |
| 5 | S | K | Zn | 0. | 0. | 0. | 1. | 0. | 64. | 0. | 18. | 3. | 1. | 5. | 0. | 9. | 0. | 0. | 0.5 |
| 4 | Cl | S | Zn | 0. | 0. | 0. | 0. | 0. | 28. | 41. | 8. | 1. | 0. | 4. | 0. | 17. | 0. | 0. | 0.7 |
| 1 | Cl | Zn | S | 0. | 0. | 0. | 0. | 0. | 19. | 40. | 10. | 0. | 0. | 12. | 0. | 19. | 0. | 0. | 0.2 |
| 1 | Zn | S | Cl | 0. | 0. | 0. | 0. | 0. | 16. | 11. | 0. | 7. | 0. | 0. | 0. | 65. | 0. | 0. | 0.0 |
| 2 | Si | Ca | Fe | 2. | 2. | 2. | 59. | 0. | 0. | 0. | 0. | 21. | 0. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | S | Ti | 0. | 0. | 0. | 0. | 0. | 25. | 0. | 0. | 67. | 8. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 9 | S | Fe | Ca | 0. | 4. | 2. | 3. | 0. | 58. | 0. | 7. | 11. | 1. | 12. | 0. | 2. | 0. | 0. | 1.0 |
| 4 | S | Ca | Fe | 0. | 0. | 0. | 0. | 0. | 76. | 0. | 2. | 13. | 0. | 10. | 0. | 0. | 0. | 0. | 1.3 |
| 3 | S | Si | Fe | 0. | 2. | 3. | 15. | 0. | 57. | 1. | 6. | 3. | 1. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | S | Fe | Si | 0. | 0. | 2. | 13. | 0. | 53. | 3. | 4. | 4. | 0. | 20. | 2. | 0. | 0. | 0. | 0.4 |
| 1 | Si | Ca | K | 0. | 0. | 16. | 43. | 0. | 2. | 0. | 17. | 21. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | S | K | Al | 0. | 0. | 9. | 3. | 0. | 65. | 0. | 16. | 3. | 0. | 5. | 0. | 0. | 0. | 0. | 1.2 |
| 2 | S | Al | K | 6. | 0. | 25. | 0. | 0. | 48. | 0. | 14. | 4. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | K | S | Al | 0. | 0. | 16. | 9. | 0. | 37. | 0. | 37. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Al | Cl | 0. | 0. | 15. | 6. | 0. | 52. | 14. | 0. | 6. | 0. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 7 | S | K | Ti | 0. | 0. | 0. | 0. | 0. | 70. | 0. | 15. | 0. | 9. | 3. | 0. | 3. | 0. | 0. | 0.7 |
| 53 | OTHERS - | | | 7. | 5. | 3. | 5. | 0. | 55. | 2. | 3. | 1. | 2. | 11. | 1. | 4. | 0. | 0. | 5.7 |
| 1162 | TOTALS - | | | 13. | 2. | 1. | 2. | 0. | 47. | 14. | 9. | 4. | 1. | 5. | 0. | 1. | 0. | 0. | 100.0 |

## Table 3-25. Sample #581 PSI/Arizona Loy Yang 1953
## 2.4 Kg/hr, 1160°C, Port 11 IMP #5+6+7+8+A (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| S - - | 4.3 | 62. | 15. | 10. | 10. | 4. | 0. | 0. |
| S Na - | 4.5 | 27. | 0. | 6. | 4. | 28. | 35. | 0. |
| Cl Na - | 12.7 | 1. | 0. | 7. | 23. | 43. | 26. | 0. |
| S K Fe | 6.2 | 45. | 37. | 12. | 5. | 0. | 0. | 0. |
| S Fe K | 4.0 | 44. | 45. | 10. | 2. | 0. | 0. | 0. |
| S Na K | 10.9 | 56. | 33. | 9. | 2. | 0. | 1. | 0. |
| S K Ca | 9.3 | 35. | 41. | 20. | 3. | 0. | 0. | 0. |
| S Na Fe | 5.9 | 42. | 40. | 10. | 8. | 0. | 0. | 0. |
| OTHERS - | 5.7 | 85. | 14. | 1. | 0. | 0. | 0. | 0. |
| OTHERS - | 36.4 | 34. | 30. | 11. | 11. | 8. | 7. | 0. |
| TOTALS - | 100.0 | 38. | 26. | 10. | 9. | 10. | 7. | 0. |

# Table 3-26. Sample #582 PSI/Arizona Ash Illinois #6 SOAP, 1.8 Kg/hr, 1310°C, Port 11 IMP #1 + CUP

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Ca - - | 0. | 0. | 0. | 0. | 0. | 7. | 0. | 0. | 93. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 32 | S - - | 0. | 0. | 2. | 3. | 0. | 85. | 1. | 1. | 2. | 1. | 5. | 0. | 0. | 0. | 0. | 2.5 |
| 2 | Ti - - | 0. | 0. | 0. | 2. | 0. | 4. | 0. | 0. | 0. | 94. | 0. | 0. | 0. | 0. | 0. | 0.5 |
| 41 | Si - - | 1. | 0. | 1. | 93. | 0. | 0. | 0. | 1. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 4.3 |
| 15 | Fe - - | 0. | 0. | 3. | 5. | 0. | 0. | 0. | 0. | 1. | 2. | 89. | 0. | 0. | 0. | 0. | 0.9 |
| 9 | S Fe - | 0. | 0. | 1. | 1. | 0. | 82. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0.6 |
| 7 | S Ca - | 0. | 0. | 0. | 2. | 0. | 57. | 0. | 0. | 41. | 0. | 0. | 0. | 0. | 0. | 0. | 0.7 |
| 34 | Ca S - | 0. | 0. | 0. | 1. | 0. | 44. | 0. | 0. | 53. | 0. | 1. | 0. | 0. | 0. | 0. | 4.0 |
| 5 | Fe Si - | 0. | 0. | 4. | 20. | 0. | 0. | 0. | 0. | 2. | 2. | 72. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | Si S - | 0. | 0. | 0. | 76. | 0. | 17. | 2. | 0. | 2. | 0. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 12 | S Si - | 0. | 0. | 1. | 18. | 0. | 79. | 0. | 1. | 1. | 0. | 1. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si P - | 0. | 0. | 0. | 63. | 33. | 0. | 0. | 0. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 19 | Si Al - | 0. | 0. | 39. | 57. | 0. | 0. | 0. | 2. | 0. | 1. | 1. | 0. | 0. | 0. | 0. | 1.3 |
| 1 | S Mg - | 0. | 13. | 0. | 0. | 0. | 87. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 2 | S K - | 0. | 0. | 0. | 0. | 0. | 86. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Zn - | 0. | 0. | 0. | 0. | 0. | 82. | 0. | 0. | 0. | 0. | 0. | 0. | 18. | 0. | 0. | 0.2 |
| 46 | S Fe Si | 0. | 0. | 4. | 14. | 0. | 57. | 1. | 1. | 1. | 1. | 18. | 0. | 1. | 0. | 0. | 4.7 |
| 75 | S Si Fe | 0. | 0. | 6. | 19. | 0. | 58. | 0. | 2. | 1. | 1. | 12. | 0. | 0. | 0. | 0. | 6.0 |
| 6 | Fe S Si | 0. | 1. | 5. | 15. | 0. | 30. | 1. | 3. | 4. | 1. | 40. | 0. | 1. | 0. | 0. | 0.4 |
| 4 | Si S Fe | 0. | 0. | 13. | 39. | 0. | 25. | 3. | 0. | 0. | 3. | 17. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | Si Al Ti | 1. | 0. | 24. | 35. | 0. | 0. | 0. | 15. | 1. | 21. | 4. | 0. | 0. | 0. | 0. | 0.1 |
| 66 | S Si Al | 0. | 0. | 13. | 23. | 0. | 54. | 1. | 2. | 1. | 1. | 5. | 0. | 0. | 0. | 0. | 5.8 |
| 27 | Si S Al | 0. | 0. | 16. | 44. | 0. | 26. | 0. | 3. | 2. | 1. | 7. | 1. | 0. | 0. | 0. | 2.3 |
| 10 | Si Al S | 0. | 0. | 27. | 48. | 0. | 14. | 0. | 6. | 1. | 1. | 3. | 0. | 0. | 0. | 0. | 1.7 |
| 11 | S Al Si | 0. | 0. | 15. | 13. | 1. | 62. | 1. | 1. | 1. | 0. | 5. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | Al S Si | 0. | 0. | 30. | 24. | 0. | 28. | 7. | 11. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Ca Si | 0. | 0. | 3. | 12. | 0. | 50. | 0. | 4. | 18. | 3. | 7. | 2. | 2. | 0. | 0. | 0.4 |
| 4 | Ca S Si | 0. | 0. | 4. | 12. | 0. | 34. | 0. | 0. | 43. | 0. | 7. | 0. | 0. | 0. | 0. | 0.8 |
| 9 | S Si Ca | 3. | 0. | 6. | 18. | 0. | 53. | 0. | 2. | 12. | 0. | 5. | 0. | 1. | 0. | 0. | 0.8 |
| 2 | Si S Ca | 0. | 0. | 14. | 32. | 0. | 20. | 0. | 3. | 17. | 0. | 13. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si Ca S | 0. | 0. | 11. | 24. | 0. | 18. | 0. | 12. | 21. | 7. | 0. | 0. | 8. | 0. | 0. | 0.1 |
| 134 | Si Al Fe | 2. | 0. | 25. | 50. | 0. | 0. | 0. | 6. | 1. | 1. | 14. | 0. | 0. | 0. | 0. | 11.4 |
| 144 | Fe Si Al | 0. | 0. | 15. | 26. | 0. | 0. | 0. | 2. | 5. | 5. | 46. | 0. | 0. | 0. | 0. | 11.3 |
| 140 | Si Fe Al | 1. | 0. | 18. | 42. | 0. | 1. | 0. | 4. | 3. | 4. | 27. | 0. | 0. | 0. | 0. | 11.2 |
| 1 | Na K Cl | 24. | 0. | 8. | 13. | 0. | 14. | 19. | 19. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Na Cl K | 43. | 0. | 0. | 0. | 0. | 13. | 23. | 16. | 4. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Si Ca K | 4. | 0. | 12. | 36. | 0. | 0. | 7. | 12. | 20. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Zn S Cl | 0. | 0. | 0. | 3. | 0. | 11. | 9. | 0. | 5. | 0. | 0. | 0. | 71. | 0. | 0. | 0.1 |
| 1 | S Na Cl | 25. | 0. | 0. | 4. | 0. | 33. | 21. | 0. | 18. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl K Si | 0. | 0. | 7. | 17. | 0. | 11. | 22. | 20. | 16. | 7. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 39 | Si Al K | 0. | 0. | 28. | 58. | 0. | 1. | 0. | 8. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 2.7 |
| 1 | S Si Na | 13. | 0. | 9. | 31. | 0. | 34. | 0. | 0. | 0. | 2. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S Na Si | 24. | 0. | 4. | 15. | 0. | 52. | 0. | 0. | 0. | 0. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Na Si S | 33. | 0. | 12. | 28. | 0. | 14. | 0. | 0. | 0. | 0. | 12. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | S Fe Ca | 0. | 0. | 1. | 12. | 0. | 37. | 0. | 10. | 17. | 0. | 22. | 0. | 0. | 0. | 0. | 1.3 |
| 4 | S Ca Fe | 0. | 0. | 0. | 2. | 0. | 74. | 0. | 1. | 16. | 0. | 7. | 0. | 0. | 0. | 0. | 0.2 |
| 5 | Ca S Fe | 0. | 1. | 2. | 4. | 1. | 32. | 0. | 1. | 49. | 0. | 9. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S Si Mg | 0. | 9. | 7. | 17. | 0. | 49. | 0. | 5. | 0. | 0. | 7. | 4. | 0. | 0. | 0. | 0.1 |
| 8 | S Si K | 0. | 0. | 3. | 19. | 0. | 63. | 0. | 10. | 1. | 0. | 3. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | Si K S | 0. | 0. | 15. | 47. | 0. | 15. | 7. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S K Si | 0. | 0. | 0. | 15. | 13. | 43. | 0. | 19. | 0. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Na Fe | 25. | 0. | 3. | 4. | 0. | 51. | 0. | 5. | 0. | 0. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Fe Na | 18. | 0. | 4. | 3. | 0. | 38. | 0. | 2. | 0. | 0. | 35. | 0. | 0. | 0. | 0. | 0.1 |
| 18 | S Fe Al | 0. | 0. | 13. | 4. | 0. | 56. | 0. | 8. | 0. | 1. | 19. | 0. | 0. | 0. | 0. | 2.6 |

## Table 3-26. Sample #582 PSI/Arizona Ash Illinois #6 SOAP, 1.8 Kg/hr, 1310°C, Port 11 IMP #1 + CUP (Continued)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | S | Al | Fe | 0. | 0. | 12. | 8. | 0. | 62. | 1. | 1. | 2. | 3. | 10. | 0. | 1. | 0. | 0. | 0.5 |
| 3 | Fe | S | Al | 0. | 2. | 18. | 9. | 0. | 23. | 0. | 4. | 7. | 0. | 38. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Ca | Si | Al | 0. | 0. | 22. | 32. | 0. | 0. | 0. | 4. | 36. | 0. | 6. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Si | Ca | Al | 0. | 0. | 12. | 57. | 0. | 0. | 0. | 5. | 15. | 0. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 6 | Si | Fe | Ca | 0. | 0. | 12. | 38. | 0. | 1. | 0. | 1. | 17. | 4. | 26. | 0. | 0. | 0. | 0. | 0.5 |
| 9 | Fe | Si | Ca | 0. | 0. | 11. | 26. | 0. | 1. | 0. | 0. | 17. | 3. | 42. | 0. | 0. | 0. | 0. | 1.1 |
| 3 | Ca | Si | Fe | 0. | 5. | 10. | 30. | 0. | 1. | 0. | 0. | 39. | 0. | 15. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S | Si | Cl | 0. | 0. | 0. | 18. | 0. | 65. | 10. | 3. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Cl | Si | 0. | 0. | 0. | 13. | 0. | 70. | 17. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Fe | P | 0. | 0. | 0. | 5. | 9. | 67. | 0. | 8. | 0. | 0. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | S | Fe | Ti | 0. | 0. | 0. | 7. | 0. | 70. | 0. | 0. | 0. | 11. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 9 | S | Fe | K | 0. | 0. | 8. | 7. | 0. | 59. | 0. | 10. | 0. | 1. | 14. | 1. | 0. | 0. | 0. | 1.0 |
| 2 | S | K | Fe | 0. | 0. | 13. | 5. | 0. | 53. | 0. | 15. | 0. | 0. | 14. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Fe | S | K | 0. | 0. | 12. | 0. | 0. | 35. | 0. | 14. | 0. | 0. | 39. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Si | P | 0. | 0. | 13. | 28. | 13. | 38. | 0. | 0. | 0. | 0. | 9. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | S | Al | Ti | 0. | 0. | 15. | 0. | 0. | 70. | 0. | 2. | 0. | 10. | 0. | 0. | 2. | 0. | 0. | 0.1 |
| 1 | S | Ti | Cl | 0. | 0. | 0. | 0. | 0. | 52. | 16. | 0. | 0. | 18. | 0. | 14. | 0. | 0. | 0. | 0.0 |
| 1 | S | Cl | Ti | 0. | 0. | 0. | 17. | 0. | 29. | 22. | 0. | 0. | 20. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Ca | K | 0. | 0. | 0. | 0. | 0. | 64. | 0. | 14. | 22. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | K | Ca | 0. | 0. | 0. | 0. | 0. | 68. | 0. | 18. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Cl | Ca | 0. | 0. | 0. | 0. | 0. | 70. | 16. | 0. | 14. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S | Ca | Cl | 0. | 0. | 0. | 13. | 0. | 36. | 22. | 0. | 29. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Mg | Al | 0. | 18. | 10. | 9. | 8. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Fe | Si | Ti | 0. | 0. | 12. | 23. | 0. | 0. | 0. | 1. | 3. | 14. | 47. | 0. | 0. | 0. | 0. | 0.2 |
| 6 | Si | Fe | Ti | 2. | 0. | 9. | 45. | 0. | 0. | 0. | 4. | 3. | 12. | 26. | 0. | 0. | 0. | 0. | 1.2 |
| 6 | S | Si | Ti | 0. | 0. | 2. | 14. | 0. | 66. | 0. | 1. | 2. | 11. | 4. | 0. | 0. | 0. | 0. | 0.5 |
| 2 | S | Ti | Si | 0. | 0. | 0. | 14. | 0. | 59. | 0. | 0. | 0. | 16. | 12. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Al | S | Na | 12. | 6. | 39. | 3. | 0. | 23. | 4. | 8. | 2. | 0. | 2. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S | Ca | Al | 0. | 0. | 9. | 5. | 0. | 63. | 0. | 0. | 16. | 0. | 8. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S | Zn | Si | 0. | 0. | 0. | 12. | 0. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 13. | 0. | 0. | 0.0 |
| 1 | S | Si | Zn | 0. | 0. | 0. | 21. | 0. | 70. | 0. | 0. | 0. | 0. | 0. | 0. | 9. | 0. | 0. | 0.1 |
| 1 | Si | Na | Al | 17. | 0. | 16. | 41. | 0. | 7. | 3. | 9. | 0. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Cl | Fe | 0. | 0. | 0. | 8. | 0. | 64. | 14. | 0. | 0. | 0. | 13. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S | Al | K | 0. | 0. | 10. | 8. | 0. | 56. | 7. | 9. | 0. | 0. | 8. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Al | Cu | S | 0. | 0. | 36. | 0. | 0. | 16. | 4. | 0. | 7. | 2. | 1. | 34. | 0. | 0. | 0. | 0.7 |
| 1 | Fe | Cu | S | 0. | 0. | 9. | 11. | 0. | 12. | 4. | 0. | 7. | 0. | 38. | 19. | 0. | 0. | 0. | 0.3 |
| 1 | K | Cu | Ca | 0. | 0. | 9. | 7. | 0. | 0. | 0. | 26. | 19. | 7. | 8. | 24. | 0. | 0. | 0. | 0.3 |
| 1 | S | Mg | Cu | 0. | 22. | 0. | 0. | 0. | 58. | 0. | 0. | 0. | 0. | 9. | 10. | 0. | 0. | 0. | 0.1 |
| 1 | S | Ca | Zn | 0. | 0. | 0. | 10. | 0. | 65. | 0. | 0. | 15. | 0. | 0. | 0. | 10. | 0. | 0. | 0.3 |
| 1 | Si | Cl | Ca | 0. | 0. | 0. | 40. | 0. | 0. | 35. | 9. | 9. | 0. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Cl | K | Ca | 0. | 0. | 0. | 12. | 0. | 0. | 62. | 14. | 12. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ca | Cl | K | 0. | 0. | 9. | 0. | 0. | 6. | 14. | 11. | 53. | 0. | 6. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | Mg | Ca | Si | 0. | 37. | 6. | 14. | 0. | 2. | 0. | 0. | 28. | 0. | 12. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Si | Fe | K | 0. | 0. | 7. | 66. | 0. | 0. | 0. | 10. | 2. | 2. | 14. | 0. | 0. | 0. | 0. | 0.7 |
| 1 | Si | Cl | Ti | 0. | 0. | 12. | 33. | 0. | 12. | 18. | 0. | 12. | 15. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 56 | OTHERS - | | | 3. | 2. | 13. | 27. | 0. | 12. | 2. | 4. | 6. | 5. | 23. | 1. | 1. | 0. | 0. | 5.5 |
| 1122 | TOTALS - | | | 1. | 0. | 13. | 30. | 0. | 25. | 1. | 3. | 6. | 3. | 18. | 1. | 0. | 0. | 0. | 100.0 |

# Table 3-26. Sample #582 PSI/Arizona Ash Illinois #6 SOAP, 1.8 Kg/hr, 1310°C, Port 11 IMP #1 + CUP (Continued)

Volume DISTRIBUTION

| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
|---|---|---|---|---|---|---|---|---|
| Si - - | 4.3 | 8. | 52. | 22. | 13. | 4. | 0. | 0. |
| S Fe Si | 4.7 | 2. | 19. | 19. | 44. | 16. | 0. | 0. |
| S Si Fe | 6.0 | 2. | 10. | 32. | 26. | 30. | 0. | 0. |
| S Si Al | 5.8 | 3. | 0. | 27. | 62. | 8. | 0. | 0. |
| Si Al Fe | 11.4 | 29. | 39. | 21. | 10. | 1. | 0. | 0. |
| Fe Si Al | 11.3 | 69. | 21. | 6. | 4. | 0. | 0. | 0. |
| Si Fe Al | 11.2 | 42. | 28. | 19. | 9. | 0. | 2. | 0. |
| OTHERS - | 5.5 | 34. | 44. | 14. | 8. | 0. | 0. | 0. |
| OTHERS - | 39.9 | 8. | 26. | 27. | 33. | 5. | 1. | 0. |
| TOTALS - | 100.0 | 22. | 26. | 22. | 24. | 5. | 1. | 0. |

# Table 3-27. Sample #583 PSI/Arizona Illinois #6 SOAP Ash, 1.8 Kg/hr, 1310°C, Port 11 IMP 2+3+4

AVERAGE SPECIES COMPOSITION

| # | SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Cu | Zn | Ba | X | Volume % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | S - - | 1. | 0. | 4. | 5. | 0. | 81. | 0. | 0. | 3. | 0. | 3. | 0. | 1. | 0. | 0. | 1.7 |
| 2 | Cl - - | 0. | 0. | 5. | 0. | 0. | 3. | 91. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 2.1 |
| 21 | Si - - | 0. | 0. | 0. | 91. | 0. | 0. | 0. | 2. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 2.8 |
| 1 | Al - - | 0. | 0. | 98. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. | 0.0 |
| 62 | Fe - - | 0. | 0. | 3. | 5. | 0. | 2. | 0. | 0. | 1. | 1. | 87. | 0. | 0. | 0. | 0. | 3.0 |
| 2 | Ca - - | 0. | 0. | 0. | 1. | 0. | 0. | 0. | 0. | 99. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | S Ca - | 0. | 0. | 0. | 1. | 2. | 47. | 0. | 2. | 43. | 2. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 27 | Ca S - | 0. | 0. | 1. | 0. | 0. | 46. | 0. | 0. | 50. | 0. | 2. | 0. | 0. | 0. | 0. | 2.5 |
| 4 | S Si - | 0. | 0. | 0. | 16. | 0. | 84. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Fe - | 0. | 0. | 0. | 0. | 0. | 84. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Si Al - | 0. | 0. | 38. | 54. | 0. | 0. | 0. | 5. | 0. | 0. | 4. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Ti Fe - | 0. | 0. | 4. | 4. | 0. | 0. | 0. | 0. | 0. | 70. | 22. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl S - | 0. | 0. | 0. | 0. | 0. | 26. | 74. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Zn S Ti | 0. | 0. | 0. | 0. | 0. | 28. | 0. | 0. | 0. | 14. | 0. | 0. | 58. | 0. | 0. | 0.2 |
| 1 | Ca S Ti | 0. | 0. | 0. | 0. | 0. | 38. | 0. | 0. | 39. | 23. | 0. | 0. | 0. | 0. | 0. | 0.9 |
| 1 | S Ti Ca | 0. | 0. | 12. | 0. | 0. | 38. | 12. | 0. | 16. | 21. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | K Cl Na | 21. | 0. | 0. | 0. | 0. | 11. | 29. | 31. | 3. | 2. | 0. | 0. | 3. | 0. | 0. | 0.3 |
| 1 | K Cl S | 0. | 0. | 0. | 0. | 0. | 19. | 40. | 41. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 1 | S Cl K | 0. | 0. | 0. | 0. | 0. | 46. | 35. | 20. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S K Cl | 0. | 0. | 0. | 0. | 0. | 75. | 12. | 13. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Cl S K | 0. | 0. | 0. | 8. | 0. | 28. | 49. | 12. | 3. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S Al | 0. | 0. | 16. | 8. | 0. | 34. | 7. | 0. | 35. | 0. | 0. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | S Ca Al | 0. | 4. | 8. | 7. | 0. | 59. | 0. | 0. | 10. | 4. | 7. | 0. | 0. | 0. | 0. | 0.0 |
| 9 | Si Al K | 2. | 0. | 32. | 51. | 0. | 1. | 0. | 8. | 0. | 0. | 5. | 0. | 0. | 0. | 0. | 0.3 |
| 9 | Fe S Al | 0. | 0. | 15. | 11. | 1. | 27. | 0. | 3. | 2. | 2. | 37. | 0. | 0. | 0. | 0. | 0.8 |
| 20 | S Fe Al | 0. | 0. | 16. | 3. | 1. | 45. | 0. | 7. | 2. | 1. | 24. | 0. | 0. | 0. | 0. | 1.5 |
| 6 | S Al Fe | 0. | 0. | 23. | 12. | 0. | 33. | 0. | 1. | 1. | 0. | 19. | 0. | 11. | 0. | 0. | 0.5 |
| 2 | Fe Al S | 0. | 0. | 26. | 19. | 0. | 23. | 0. | 3. | 0. | 0. | 27. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Si Ti Al | 0. | 0. | 19. | 31. | 0. | 0. | 0. | 7. | 3. | 27. | 13. | 0. | 0. | 0. | 0. | 0.0 |
| 13 | Si Al S | 0. | 0. | 22. | 42. | 0. | 17. | 0. | 3. | 3. | 5. | 4. | 2. | 1. | 0. | 0. | 0.5 |
| 16 | S Si Al | 0. | 0. | 15. | 20. | 0. | 56. | 2. | 4. | 1. | 0. | 2. | 0. | 0. | 0. | 0. | 1.7 |
| 10 | Si S Al | 0. | 0. | 22. | 35. | 0. | 24. | 0. | 5. | 1. | 0. | 12. | 0. | 0. | 0. | 0. | 0.9 |
| 5 | S Al Si | 0. | 0. | 17. | 13. | 0. | 61. | 0. | 2. | 4. | 0. | 3. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | Al Si S | 0. | 0. | 28. | 26. | 0. | 19. | 0. | 6. | 8. | 7. | 6. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Mg Si | 0. | 14. | 0. | 12. | 0. | 53. | 0. | 7. | 9. | 0. | 5. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Si Mg | 0. | 18. | 0. | 21. | 0. | 51. | 0. | 0. | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | S Ca Si | 0. | 0. | 4. | 14. | 3. | 48. | 3. | 0. | 25. | 0. | 3. | 0. | 0. | 0. | 0. | 0.4 |
| 7 | S Si Ca | 0. | 0. | 3. | 34. | 1. | 38. | 0. | 1. | 15. | 7. | 1. | 0. | 0. | 0. | 0. | 0.5 |
| 1 | Si S Ca | 0. | 0. | 0. | 43. | 0. | 31. | 0. | 0. | 10. | 0. | 7. | 9. | 0. | 0. | 0. | 0.0 |
| 16 | S Si Fe | 0. | 0. | 10. | 25. | 0. | 43. | 0. | 5. | 1. | 1. | 15. | 0. | 0. | 0. | 0. | 1.2 |
| 12 | Fe Si S | 0. | 0. | 12. | 20. | 1. | 15. | 1. | 4. | 3. | 4. | 40. | 0. | 0. | 0. | 0. | 1.3 |
| 11 | Fe S Si | 1. | 1. | 5. | 20. | 0. | 22. | 0. | 2. | 2. | 8. | 39. | 0. | 0. | 0. | 0. | 0.5 |
| 22 | S Fe Si | 0. | 0. | 3. | 16. | 0. | 51. | 2. | 3. | 2. | 2. | 22. | 0. | 0. | 0. | 0. | 1.4 |
| 11 | Si S Fe | 0. | 0. | 9. | 39. | 0. | 26. | 1. | 0. | 0. | 1. | 22. | 0. | 0. | 0. | 0. | 0.6 |
| 5 | Si Fe S | 0. | 0. | 14. | 30. | 0. | 20. | 0. | 4. | 5. | 4. | 24. | 0. | 0. | 0. | 0. | 1.1 |
| 1 | S Si Na | 22. | 0. | 10. | 24. | 0. | 26. | 0. | 0. | 0. | 0. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Na S Si | 38. | 0. | 0. | 15. | 0. | 30. | 0. | 3. | 10. | 2. | 2. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S K Si | 0. | 0. | 0. | 15. | 0. | 70. | 0. | 15. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Si S K | 0. | 0. | 6. | 35. | 0. | 29. | 0. | 14. | 0. | 0. | 9. | 0. | 6. | 0. | 0. | 0.1 |
| 10 | S Ca Fe | 0. | 0. | 3. | 5. | 0. | 51. | 0. | 1. | 28. | 0. | 12. | 0. | 0. | 0. | 0. | 1.6 |
| 9 | Ca S Fe | 0. | 0. | 0. | 4. | 0. | 35. | 0. | 0. | 51. | 0. | 10. | 0. | 0. | 0. | 0. | 0.9 |
| 4 | S Fe Ca | 0. | 0. | 3. | 6. | 0. | 58. | 1. | 1. | 10. | 1. | 20. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Fe Ca S | 0. | 0. | 7. | 10. | 0. | 12. | 0. | 0. | 30. | 0. | 40. | 0. | 0. | 0. | 0. | 0.2 |
| 3 | Fe S Ca | 0. | 0. | 5. | 8. | 0. | 23. | 0. | 3. | 15. | 2. | 44. | 0. | 0. | 0. | 0. | 0.1 |

## Table 3-27. Sample #583 PSI/Arizona Illinois #6 SOAP Ash, 1.8 Kg/hr, 1310°C, Port 11 IMP 2+3+4 (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S Al Ti | 0. | 0. | 13. | 11. | 6. | 43. | 0. | 6. | 0. | 12. | 9. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Ti_Fe | 0. | 0. | 7. | 0. | 0. | 57. | 0. | 0. | 0. | 22. | 14. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Fe Ti | 0. | 0. | 5. | 6. | 0. | 50. | 0. | 3. | 6. | 11. | 17. | 2. | 0. | 0. | 0. | 0.1 |
| 1 | Fe S Ti | 0. | 0. | 0. | 0. | 0. | 37. | 10. | 0. | 0. | 10. | 43. | 0. | 0. | 0. | 0. | 0.0 |
| 171 | Si Fe Al | 1. | 0. | 18. | 42. | 0. | 1. | 0. | 4. | 3. | 3. | 26. | 0. | 0. | 0. | 0. | 15.6 |
| 113 | Si Al Fe | 2. | 0. | 25. | 46. | 0. | 1. | 0. | 5. | 2. | 2. | 17. | 0. | 1. | 0. | 0. | 11.9 |
| 318 | Fe Si Al | 0. | 0. | 15. | 25. | 0. | 1. | 0. | 2. | 4. | 5. | 48. | 0. | 0. | 0. | 0. | 29.1 |
| 16 | Fe Al Si | 0. | 0. | 20. | 16. | 0. | 3. | 0. | 1. | 5. | 4. | 51. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Al Fe Si | 0. | 0. | 30. | 25. | 0. | 9. | 0. | 0. | 0. | 11. | 25. | 0. | 0. | 0. | 0. | 0.2 |
| 2 | S Cl Na | 22. | 0. | 1. | 0. | 0. | 29. | 24. | 8. | 11. | 2. | 0. | 1. | 3. | 0. | 0. | 0.4 |
| 1 | Cl S Na | 14. | 0. | 0. | 7. | 0. | 16. | 46. | 6. | 4. | 0. | 0. | 0. | 5. | 0. | 0. | 0.0 |
| 1 | Cl Na S | 34. | 0. | 0. | 0. | 0. | 8. | 53. | 0. | 5. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Fe Ca | 0. | 0. | 15. | 34. | 0. | 4. | 0. | 1. | 18. | 3. | 24. | 0. | 0. | 0. | 0. | 0.1 |
| 6 | Fe Si Ca | 0. | 0. | 9. | 26. | 0. | 1. | 1. | 0. | 18. | 4. | 41. | 0. | 0. | 0. | 0. | 1.0 |
| 1 | S Al K | 0. | 0. | 18. | 9. | 0. | 62. | 0. | 10. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | Fe S K | 0. | 0. | 6. | 7. | 0. | 36. | 0. | 13. | 0. | 0. | 38. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Fe K | 0. | 0. | 8. | 7. | 4. | 34. | 0. | 13. | 0. | 7. | 26. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Al Ca Si | 0. | 0. | 41. | 12. | 0. | 0. | 0. | 8. | 20. | 8. | 11. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | S Si Zn | 0. | 0. | 0. | 22. | 9. | 49. | 0. | 0. | 0. | 0. | 9. | 0. | 10. | 0. | 0. | 0.0 |
| 1 | S Fe Cl | 0. | 0. | 0. | 0. | 0. | 65. | 11. | 0. | 9. | 0. | 15. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl S Fe | 0. | 0. | 7. | 6. | 0. | 19. | 34. | 6. | 9. | 0. | 18. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Fe P | 0. | 0. | 0. | 10. | 15. | 40. | 0. | 11. | 0. | 0. | 25. | 0. | 0. | 0. | 0. | 0.6 |
| 1 | S Mg Al | 0. | 20. | 18. | 7. | 0. | 45. | 0. | 0. | 0. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 3 | S Si Cl | 0. | 0. | 4. | 18. | 0. | 50. | 11. | 5. | 0. | 5. | 1. | 5. | 0. | 0. | 0. | 0.1 |
| 1 | Ca S K | 0. | 0. | 0. | 0. | 0. | 46. | 0. | 6. | 48. | 0. | 0. | 0. | 0. | 0. | 0. | 0.2 |
| 1 | S Ca K | 0. | 0. | 0. | 0. | 0. | 60. | 0. | 10. | 30. | 0. | 0. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Cl Ca S | 0. | 0. | 0. | 0. | 0. | 18. | 49. | 6. | 27. | 0. | 0. | 0. | 0. | 0. | 0. | 0.6 |
| 2 | S Ca Cl | 0. | 0. | 5. | 6. | 0. | 28. | 22. | 0. | 24. | 8. | 7. | 0. | 0. | 0. | 0. | 0.1 |
| 2 | Cl S Ca | 4. | 0. | 0. | 6. | 0. | 21. | 35. | 1. | 19. | 5. | 10. | 0. | 0. | 0. | 0. | 0.1 |
| 4 | Ti Si Fe | 0. | 0. | 15. | 28. | 0. | 1. | 1. | 3. | 3. | 31. | 18. | 0. | 0. | 0. | 0. | 0.2 |
| 10 | Fe Ti Si | 1. | 0. | 10. | 15. | 0. | 2. | 0. | 0. | 4. | 19. | 49. | 0. | 1. | 0. | 0. | 0.7 |
| 3 | Si Fe Ti | 0. | 0. | 12. | 36. | 0. | 4. | 0. | 6. | 4. | 13. | 24. | 0. | 2. | 0. | 0. | 0.2 |
| 16 | Fe Si Ti | 0. | 0. | 11. | 20. | 0. | 1. | 0. | 1. | 4. | 15. | 48. | 0. | 0. | 0. | 0. | 1.2 |
| 1 | Ti Fe Si | 0. | 0. | 8. | 15. | 0. | 0. | 0. | 4. | 0. | 44. | 29. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | Cl K Ti | 0. | 0. | 0. | 14. | 0. | 0. | 35. | 20. | 15. | 15. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 2 | S Ti Si | 0. | 0. | 1. | 14. | 0. | 62. | 2. | 1. | 4. | 15. | 0. | 0. | 0. | 0. | 0. | 0.4 |
| 1 | Si S Ti | 0. | 0. | 0. | 40. | 0. | 36. | 0. | 0. | 0. | 12. | 11. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Si Ti | 0. | 0. | 9. | 13. | 0. | 61. | 0. | 0. | 0. | 9. | 8. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Al Zn | 0. | 0. | 29. | 0. | 0. | 55. | 0. | 0. | 0. | 0. | 0. | 0. | 16. | 0. | 0. | 0.0 |
| 1 | Si Al Zn | 0. | 0. | 19. | 43. | 0. | 0. | 0. | 0. | 0. | 9. | 11. | 0. | 18. | 0. | 0. | 0.0 |
| 1 | S Cl Al | 0. | 0. | 14. | 0. | 0. | 43. | 26. | 0. | 7. | 0. | 10. | 0. | 0. | 0. | 0. | 0.0 |
| 1 | S Ti K | 0. | 0. | 0. | 16. | 0. | 30. | 0. | 18. | 15. | 21. | 0. | 0. | 0. | 0. | 0. | 0.0 |
| 4 | Si Al Na | 12. | 0. | 30. | 44. | 0. | 0. | 0. | 5. | 1. | 0. | 9. | 0. | 0. | 0. | 0. | 0.4 |
| 6 | Si Fe K | 0. | 0. | 3. | 71. | 0. | 0. | 0. | 7. | 3. | 1. | 15. | 0. | 0. | 0. | 0. | 0.3 |
| 22 | OTHERS - | 1. | 5. | 10. | 24. | 2. | 16. | 1. | 1. | 10. | 6. | 23. | 0. | 0. | 0. | 0. | 2.0 |
| 1105 | TOTALS - | 1. | 0. | 14. | 27. | 0. | 12. | 3. | 3. | 6. | 3. | 29. | 0. | 0. | 0. | 0. | 100.0 |

# Table 3-27. Sample #583 PSI/Arizona Illinois #6 SOAP Ash, 1.8 Kg/hr, 1310°C, Port 11 IMP 2+3+4 (Continued)

| | | Volume DISTRIBUTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPECIES | Volume % | 0.0-2.5 | 2.5-5.0 | 5.0-10. | 10.- 20. | 20.- 40. | 40.- 80. | 80.-500. |
| Si Fe Al | 15.6 | 84. | 15. | 2. | 0. | 0. | 0. | 0. |
| Si Al Fe | 11.9 | 71. | 27. | 2. | 0. | 0. | 0. | 0. |
| Fe Si Al | 29.1 | 85. | 14. | 1. | 0. | 0. | 0. | 0. |
| OTHERS - | 43.4 | 44. | 25. | 14. | 6. | 3. | 8. | 0. |
| TOTALS - | 100.0 | 65. | 20. | 7. | 2. | 2. | 3. | 0. |

## Table 3-28. Sample #484 Loy Yang Coal 1953 from SECV

AVERAGE SPECIES COMPOSITION

| # | MINERAL SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Weight % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 182 | Quartz | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 23.1 |
| 1 | Kaolinite | 0. | 0. | 47. | 44. | 0. | 0. | 0. | 3. | 3. | 0. | 2. | 0.0 |
| 10 | Illite | 0. | 0. | 33. | 54. | 0. | 1. | 1. | 9. | 1. | 0. | 1. | 0.5 |
| 1 | Montmorillonite | 0. | 0. | 14. | 71. | 0. | 3. | 0. | 0. | 6. | 0. | 5. | 0.2 |
| 102 | Misc. Silicates | 0. | 3. | 12. | 68. | 0. | 2. | 0. | 1. | 2. | 1. | 9. | 7.8 |
| 1 | Elem. Sulfur | 0. | 0. | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0.3 |
| 51 | Pyrite | 0. | 0. | 0. | 0. | 0. | 66. | 0. | 0. | 0. | 0. | 33. | 5.8 |
| 6 | Misc. sulf. | 0. | 0. | 1. | 3. | 0. | 36. | 0. | 0. | 45. | 8. | 1. | 0.3 |
| 2 | Sylvite | 0. | 0. | 0. | 0. | 0. | 2. | 46. | 49. | 2. | 0. | 0. | 0.1 |
| 116 | Fe-rich | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 100. | 42.5 |
| 3 | Calcite | 0. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 99. | 0. | 0. | 0.1 |
| 60 | Mixed Carbonate | 0. | 3. | 1. | 4. | 0. | 11. | 1. | 0. | 48. | 0. | 30. | 4.4 |
| 1 | Ti oxide | 0. | 0. | 0. | 3. | 0. | 0. | 0. | 0. | 0. | 87. | 10. | 0.1 |
| 3 | Ti-rich | 0. | 0. | 0. | 5. | 0. | 5. | 0. | 0. | 0. | 90. | 0. | 0.2 |
| 1 | Quartz-Sulfate | 0. | 0. | 0. | 36. | 0. | 39. | 0. | 16. | 0. | 0. | 9. | 0.0 |
| 2 | Quartz-Pyrite | 0. | 0. | 0. | 64. | 0. | 21. | 4. | 0. | 0. | 0. | 10. | 0.0 |
| 35 | Alumina-rich | 0. | 0. | 91. | 4. | 0. | 2. | 1. | 1. | 1. | 0. | 0. | 2.2 |
| 170 | Misc. Mixed | 1. | 1. | 2. | 26. | 1. | 17. | 8. | 3. | 37. | 1. | 2. | 12.4 |
| 747 | GRAND TOTALS | 0. | 1. | 3. | 32. | 0. | 7. | 1. | 1. | 7. | 1. | 47. | 100.0 |

WEIGHT DISTRIBUTION

Size Ranges (Microns)

| MINERAL SPECIES | WT. % | 0.0<br>2.5 | 2.5<br>5.0 | 5.0<br>10.0 | 10.<br>20. | 20.<br>40. | 40.<br>80. | 80.<br>500. |
|---|---|---|---|---|---|---|---|---|
| Quartz | 23.1 | 11. | 20. | 6. | 10. | 6. | 15. | 32. |
| Misc. Silicates | 7.8 | 15. | 31. | 14. | 4. | 5. | 14. | 17. |
| Fe-rich | 42.5 | 3. | 9. | 3. | 9. | 4. | 8. | 63. |
| Misc. Mixed | 12.4 | 21. | 59. | 8. | 10. | 2. | 0. | 0. |
| MINOR MINERALS | 14.2 | 51. | 27. | 10. | 10. | 3. | 0. | 0. |
| GRAND TOTALS | 100.0 | 15. | 22. | 6. | 9. | 4. | 8. | 35. |

# Table 3-29. Sample 592 PSI Beulah Coal from SECV

## AVERAGE SPECIES COMPOSITION

| # | MINERAL SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Weight % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | Quartz | 0. | 0. | 0. | 99. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 6.4 |
| 155 | Kaolinite | 0. | 0. | 46. | 52. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 11.8 |
| 5 | Illite | 0. | 0. | 27. | 54. | 0. | 4. | 0. | 12. | 0. | 0. | 3. | 1.2 |
| 2 | K-Feldspar | 0. | 7. | 14. | 41. | 0. | 0. | 0. | 19. | 3. | 1. | 15. | 0.2 |
| 1 | Chlorite | 0. | 0. | 16. | 29. | 0. | 4. | 0. | 0. | 4. | 0. | 46. | 0.1 |
| 5 | Montmorillonite | 1. | 0. | 23. | 65. | 0. | 3. | 0. | 1. | 6. | 0. | 1. | 0.4 |
| 209 | Misc. Silicates | 0. | 0. | 35. | 55. | 0. | 3. | 0. | 0. | 5. | 0. | 2. | 14.6 |
| 75 | Pyrite | 0. | 0. | 0. | 0. | 0. | 60. | 0. | 0. | 0. | 0. | 40. | 12.5 |
| 24 | Ferrous Sulfate | 0. | 0. | 0. | 0. | 0. | 51. | 0. | 0. | 0. | 0. | 49. | 1.8 |
| 1 | Jarosite | 0. | 0. | 0. | 0. | 0. | 43. | 0. | 8. | 0. | 0. | 49. | 0.1 |
| 24 | Gypsum | 0. | 0. | 0. | 1. | 0. | 45. | 0. | 0. | 53. | 0. | 0. | 1.5 |
| 244 | Misc. sulf. | 0. | 0. | 1. | 2. | 0. | 40. | 0. | 1. | 39. | 6. | 10. | 21.6 |
| 13 | Fe-rich | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 2. | 0. | 95. | 1.6 |
| 2 | Calcite | 0. | 9. | 0. | 0. | 0. | 8. | 0. | 0. | 70. | 0. | 8. | 0.0 |
| 88 | Mixed Carbonate | 0. | 1. | 1. | 3. | 0. | 14. | 0. | 0. | 38. | 1. | 42. | 6.0 |
| 1 | Ti oxide | 0. | 0. | 0. | 4. | 0. | 4. | 0. | 0. | 7. | 85. | 0. | 0.0 |
| 18 | Ti-rich | 0. | 0. | 0. | 1. | 0. | 33. | 0. | 0. | 2. | 63. | 1. | 3.3 |
| 1 | Quartz-Sulfate | 0. | 0. | 0. | 23. | 0. | 59. | 0. | 0. | 10. | 4. | 0. | 0.1 |
| 1 | Quartz-Pyrite | 0. | 0. | 0. | 23. | 0. | 40. | 0. | 0. | 0. | 0. | 36. | 0.0 |
| 234 | Misc. Mixed | 0. | 1. | 9. | 16. | 0. | 22. | 1. | 1. | 39. | 3. | 7. | 16.8 |
| 1191 | GRAND TOTALS | 0. | 0. | 13. | 25. | 0. | 24. | 0. | 1. | 19. | 4. | 14. | 100.0 |

## WEIGHT DISTRIBUTION

Size Ranges (Microns)

| MINERAL SPECIES | WT. % | 0.0 | 2.5 | 5.0 | 10. | 20. | 40. | 80. |
|---|---|---|---|---|---|---|---|---|
| | | 2.5 | 5.0 | 10.0 | 20. | 40. | 80. | 500. |
| Kaolinite | 11.8 | 11. | 10. | 21. | 22. | 11. | 22. | 2. |
| Misc. Silicates | 14.6 | 41. | 24. | 16. | 10. | 5. | 4. | 0. |
| Pyrite | 12.5 | 1. | 5. | 11. | 18. | 18. | 16. | 32. |
| Misc. sulf. | 21.6 | 11. | 6. | 29. | 35. | 11. | 7. | 1. |
| Misc. Mixed | 16.8 | 15. | 24. | 30. | 26. | 4. | 2. | 0. |
| MINOR MINERALS | 22.7 | 11. | 22. | 23. | 13. | 12. | 13. | 7. |
| GRAND TOTALS | 100.0 | 15. | 15. | 23. | 21. | 10. | 10. | 6. |

## Table 3-29. Sample 592 PSI Beulah Coal from SECV (Continued)

AVERAGE SPECIES COMPOSITION

| # | MINERAL SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Weight % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | Quartz | 0. | 0. | 0. | 100. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 6.6 |
| 134 | Kaolinite | 0. | 0. | 47. | 52. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 10.3 |
| 5 | Illite | 0. | 0. | 31. | 50. | 0. | 1. | 0. | 12. | 2. | 0. | 3. | 0.4 |
| 1 | Chlorite | 0. | 0. | 19. | 27. | 0. | 6. | 0. | 0. | 7. | 0. | 41. | 0.1 |
| 1 | Montmorillonite | 0. | 0. | 25. | 69. | 0. | 2. | 0. | 0. | 4. | 0. | 0. | 0.1 |
| 122 | Misc. Silicates | 0. | 0. | 34. | 54. | 0. | 2. | 0. | 1. | 6. | 0. | 4. | 10.2 |
| 85 | Pyrite | 0. | 0. | 0. | 0. | 0. | 61. | 0. | 0. | 0. | 0. | 38. | 10.2 |
| 15 | Ferrous Sulfate | 0. | 0. | 0. | 0. | 0. | 52. | 0. | 0. | 0. | 0. | 48. | 1.4 |
| 1 | Jarosite | 0. | 0. | 3. | 5. | 0. | 39. | 0. | 5. | 0. | 0. | 48. | 0.0 |
| 26 | Gypsum | 0. | 0. | 0. | 1. | 0. | 45. | 0. | 0. | 53. | 0. | 1. | 1.1 |
| 263 | Misc. sulf. | 0. | 0. | 2. | 3. | 0. | 41. | 0. | 1. | 33. | 4. | 16. | 22.2 |
| 20 | Fe-rich | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 3. | 0. | 95. | 3.2 |
| 4 | Calcite | 0. | 5. | 0. | 1. | 0. | 4. | 0. | 0. | 83. | 2. | 3. | 0.3 |
| 110 | Mixed Carbonate | 0. | 1. | 0. | 2. | 0. | 14. | 0. | 0. | 22. | 0. | 60. | 10.7 |
| 1 | Ti oxide | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 3. | 97. | 0. | 0.1 |
| 9 | Ti-rich | 0. | 0. | 0. | 2. | 0. | 40. | 0. | 0. | 4. | 54. | 0. | 1.2 |
| 1 | Trace-rich | 29. | 0. | 0. | 0. | 0. | 7. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 1 | Quartz-Sulfate | 0. | 0. | 0. | 45. | 0. | 38. | 0. | 0. | 0. | 5. | 8. | 0.5 |
| 3 | Sil-sulf | 0. | 0. | 32. | 31. | 0. | 24. | 3. | 0. | 10. | 0. | 0. | 0.4 |
| 3 | Silicate-Pyrite | 0. | 0. | 14. | 21. | 0. | 27. | 0. | 0. | 2. | 8. | 28. | 0.1 |
| 301 | Misc. Mixed | 0. | 1. | 10. | 19. | 0. | 22. | 1. | 1. | 34. | 2. | 9. | 20.9 |
| 1186 | GRAND TOTALS | 0. | 0. | 11. | 23. | 0. | 24. | 0. | 0. | 18. | 2. | 20. | 100.0 |

WEIGHT DISTRIBUTION

Size Ranges (Microns)

| MINERAL SPECIES | WT. % | 0.0 | 2.5 | 5.0 | 10. | 20. | 40. | 80. |
|---|---|---|---|---|---|---|---|---|
|  |  | 2.5 | 5.0 | 10.0 | 20. | 40. | 80. | 500. |
| Kaolinite | 10.3 | 9. | 20. | 17. | 22. | 12. | 9. | 11. |
| Misc. Silicates | 10.2 | 27. | 31. | 19. | 16. | 2. | 5. | 0. |
| Pyrite | 10.2 | 4. | 0. | 12. | 28. | 19. | 32. | 4. |
| Misc. sulf. | 22.2 | 11. | 6. | 31. | 36. | 8. | 5. | 3. |
| Mixed Carbonate | 10.7 | 4. | 10. | 40. | 35. | 7. | 5. | 0. |
| Misc. Mixed | 20.9 | 12. | 10. | 35. | 37. | 4. | 1. | 0. |
| MINOR MINERALS | 15.4 | 6. | 17. | 22. | 29. | 11. | 7. | 8. |
| GRAND TOTALS | 100.0 | 10. | 12. | 27. | 31. | 9. | 8. | 3. |

# Table 3-29. Sample 592 PSI Beulah Coal from SECV (Continued)

AVERAGE SPECIES COMPOSITION

| # | MINERAL SPECIES | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Fe | Weight % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | Quartz | 0. | 0. | 0. | 98. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 8.8 |
| 168 | Kaolinite | 0. | 0. | 46. | 53. | 0. | 0. | 0. | 0. | 1. | 0. | 0. | 15.3 |
| 20 | Illite | 0. | 0. | 25. | 52. | 0. | 5. | 0. | 14. | 0. | 0. | 4. | 1.4 |
| 1 | Chlorite | 0. | 0. | 18. | 29. | 0. | 6. | 0. | 0. | 0. | 0. | 47. | 0.1 |
| 2 | Montmorillonite | 0. | 0. | 20. | 69. | 0. | 3. | 0. | 0. | 5. | 0. | 2. | 0.1 |
| 130 | Misc. Silicates | 0. | 0. | 34. | 57. | 0. | 2. | 0. | 1. | 4. | 0. | 2. | 14.2 |
| 92 | Pyrite | 0. | 0. | 0. | 0. | 0. | 60. | 0. | 0. | 0. | 0. | 40. | 10.1 |
| 25 | Ferrous Sulfate | 0. | 0. | 0. | 0. | 0. | 50. | 0. | 0. | 0. | 0. | 50. | 1.3 |
| 5 | Jarosite | 7. | 0. | 0. | 3. | 0. | 33. | 0. | 5. | 4. | 0. | 46. | 0.2 |
| 20 | Gypsum | 0. | 0. | 0. | 0. | 0. | 45. | 0. | 0. | 54. | 0. | 0. | 1.5 |
| 277 | Misc. sulf. | 0. | 0. | 1. | 4. | 0. | 38. | 0. | 1. | 35. | 3. | 18. | 24.6 |
| 10 | Fe-rich | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 2. | 0. | 95. | 0.7 |
| 1 | Calcite | 0. | 0. | 0. | 4. | 0. | 4. | 0. | 0. | 92. | 0. | 0. | 0.0 |
| 75 | Mixed Carbonate | 0. | 0. | 1. | 4. | 0. | 13. | 0. | 0. | 28. | 0. | 54. | 4.8 |
| 2 | Ti oxide | 0. | 0. | 0. | 0. | 0. | 3. | 0. | 0. | 9. | 88. | 0. | 0.2 |
| 18 | Ti-rich | 0. | 0. | 0. | 2. | 0. | 37. | 0. | 0. | 2. | 58. | 1. | 1.6 |
| 1 | Trace-rich | 21. | 0. | 0. | 0. | 0. | 7. | 3. | 0. | 0. | 0. | 0. | 0.1 |
| 3 | Quartz-Pyrite | 0. | 0. | 5. | 34. | 0. | 23. | 0. | 4. | 0. | 0. | 33. | 0.2 |
| 4 | Silicate-Pyrite | 0. | 0. | 14. | 25. | 0. | 23. | 0. | 0. | 8. | 0. | 30. | 0.1 |
| 246 | Misc. Mixed | 0. | 1. | 9. | 23. | 0. | 20. | 2. | 0. | 30. | 1. | 12. | 14.8 |
| 1188 | GRAND TOTALS | 0. | 0. | 14. | 30. | 0. | 21. | 0. | 1. | 16. | 2. | 15. | 100.0 |

WEIGHT DISTRIBUTION

Size Ranges (Microns)

| MINERAL SPECIES | WT. % | 0.0<br>2.5 | 2.5<br>5.0 | 5.0<br>10.0 | 10.<br>20. | 20.<br>40. | 40.<br>80. | 80.<br>500. |
|---|---|---|---|---|---|---|---|---|
| Quartz | 8.8 | 15. | 45. | 11. | 11. | 7. | 10. | 0. |
| Kaolinite | 15.3 | 5. | 42. | 18. | 18. | 9. | 4. | 3. |
| Misc. Silicates | 14.2 | 19. | 46. | 11. | 14. | 2. | 5. | 2. |
| Pyrite | 10.1 | 3. | 4. | 12. | 14. | 25. | 20. | 21. |
| Misc. sulf. | 24.6 | 18. | 41. | 10. | 10. | 9. | 6. | 5. |
| Misc. Mixed | 14.8 | 26. | 45. | 20. | 5. | 3. | 1. | 0. |
| MINOR MINERALS | 12.2 | 23. | 16. | 20. | 14. | 14. | 13. | 0. |
| GRAND TOTALS | 100.0 | 16. | 36. | 14. | 12. | 9. | 7. | 4. |

Table 3-30. Mössbauer Results for U. Arizona "CUP + Im1" Samples

| Sample | IS | QS | H0 | %Fe | Phase |
|---|---|---|---|---|---|
| UK 650 | 0.38 | -0.08 | 513 | 18 | Hematite |
| MK0958 | 0.31 | -- | 487 | 24 | Magnetite |
| 56-6-CUP-A' | 0.64 | -- | 456 | 23 | Magnetite |
| 1240 C | 0.62 | -- | 414 | 9 | Magnetite |
|  | 0.66 | 1.86 | -- | 11 | Fe/oxide?? |
|  | 0.34 | 0.75 | -- | 11 | Fe/glass?? |
| UK 653 | 0.38 | -0.09 | 513 | 8 | Hematite |
| MK0957 | 0.30 | -- | 488 | 26 | Magnetite |
| 56-6-CUP-D' | 0.63 | -- | 456 | 26 | Magnetite |
| 1430 C | 0.64 | -- | 414 | 10 | Magnetite |
|  | 0.38 | 0.99 | -- | 16 | $Fe^{3+}$/glass |
|  | 0.95 | 1.98 | -- | 14 | $Fe^{2+}$/glass |
| UK 656 | 0.40 | -0.10 | 515 | 4 | Hematite |
| MK1039 | 0.31 | -- | 489 | 17 | Magnetite |
| 57-6-CUP-A' | 0.69 | -- | 456 | 34 | Magnetite |
| 1120 C, sub | 0.76 | -- | 303 | 3 | Fe sulfide |
|  | 0.31 | 0.62 | -- | 16 | Pyrite? |
|  | 0.94 | 1.87 | -- | 24 | $Fe^{2+}$/glass |
| UK 659 | 0.38 | -0.06 | 514 | 11 | Hematite |
| MK0959 | 0.32 | -- | 491 | 22 | Magnetite |
| 58-6-CUP-C' | 0.59 | -- | 460 | 19 | Magnetite |
| 1440 C, super | 0.60 | -- | 421 | 10 | Magnetite |
|  | 0.36 | 1.26 | -- | 27 | $Fe^{3+}$/glass |
|  | 1.07 | 2.12 | -- | 12 | $Fe^{2+}$/glass |

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Mössbauer parameters are isomer shift (IS) relative to metallic iron and quadrupole splitting (QS) in mm/s; magnetic hyperfine splitting (H0) in kGauss; and percentage of iron in a given phase (%Fe).

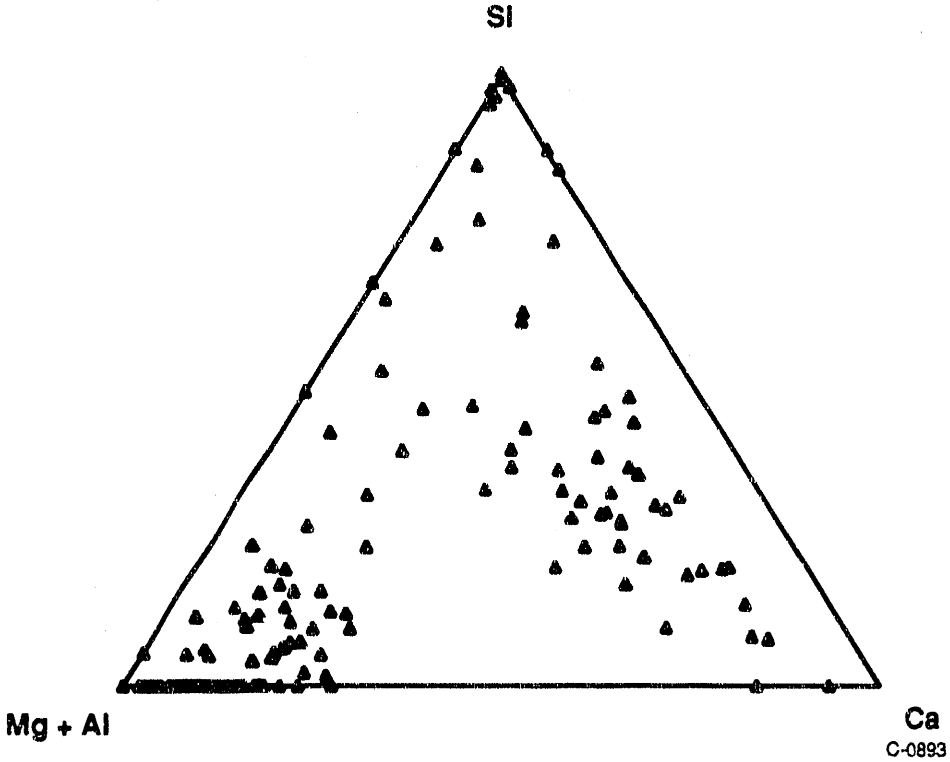


Figure 3-1. SECV/PSI Loy Yang test 1 precipitator ash (CFFLS#598), untreated.

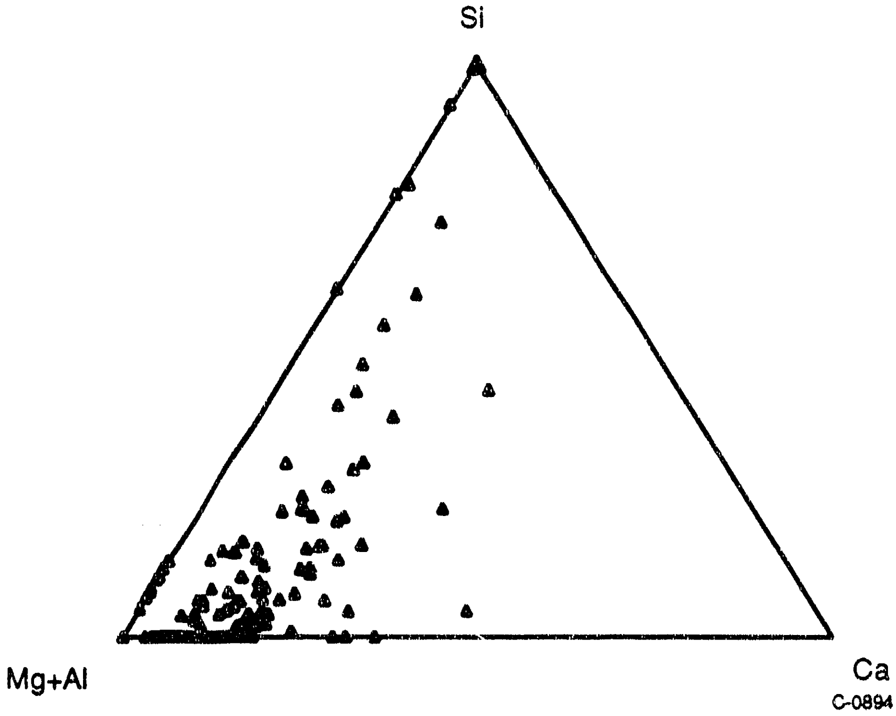


Figure 3-2. SECV Loy Yang test 4 precipitator ash (CFFLS#599), untreated.

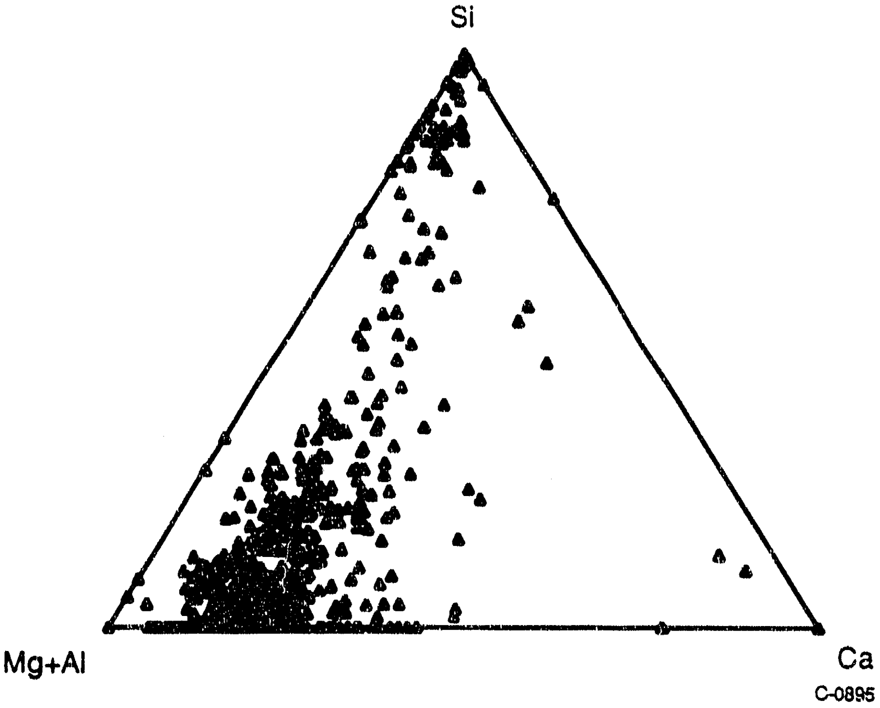


Figure 3-3. SECV Loy Yang test 4 ash probe (horizontal duct), untreated.

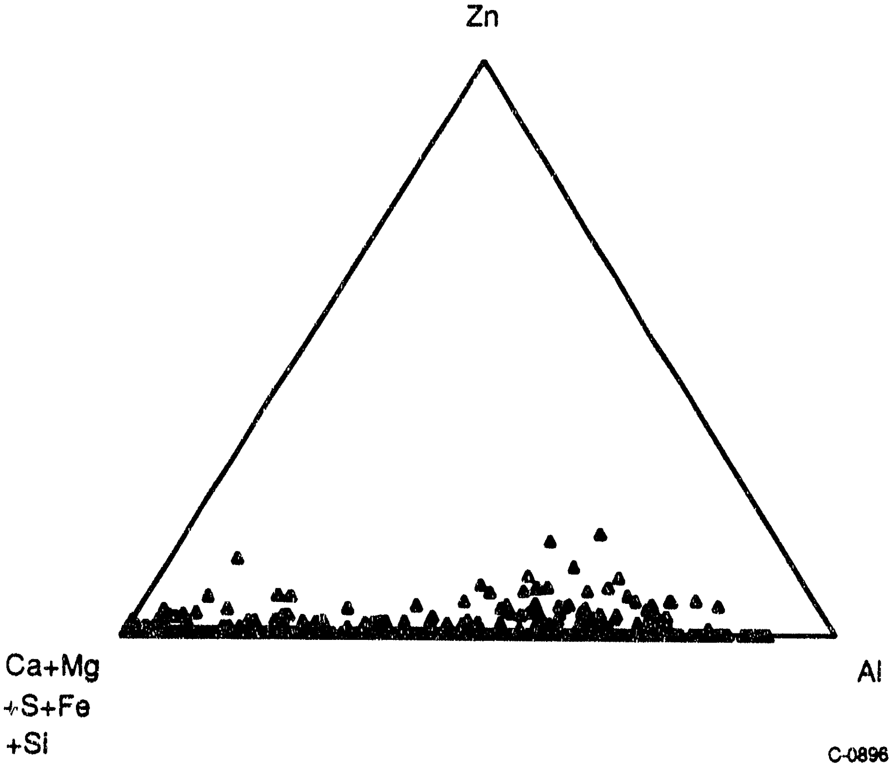


Figure 3-4. SECV Loy Yang test 1 precipitator ash (CFFLS#598), untreated.

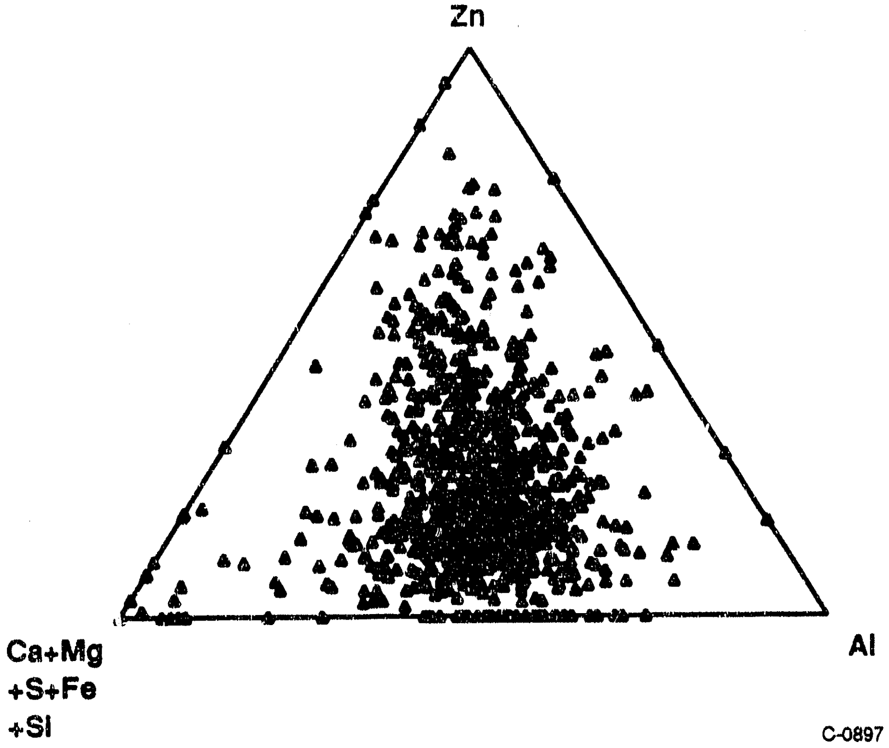


Figure 3-5. SECV Loy Yang test 3 precipitator ash (CFFLS#600), treated.

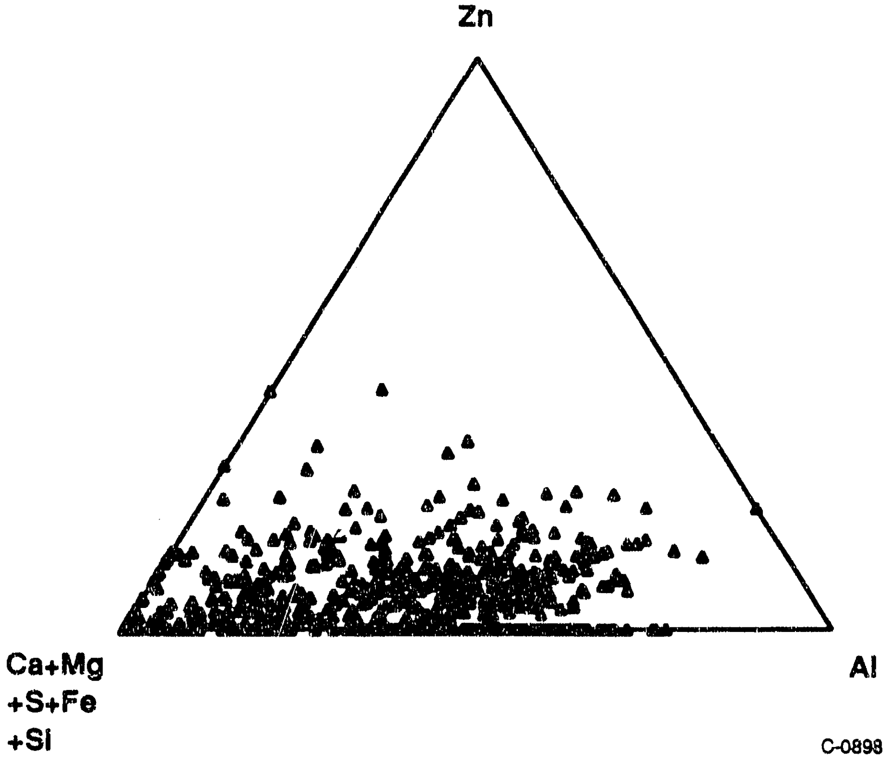


Figure 3-6. SECV Loy Yang test 4 precipitator ash (CFFLS#599), untreated.

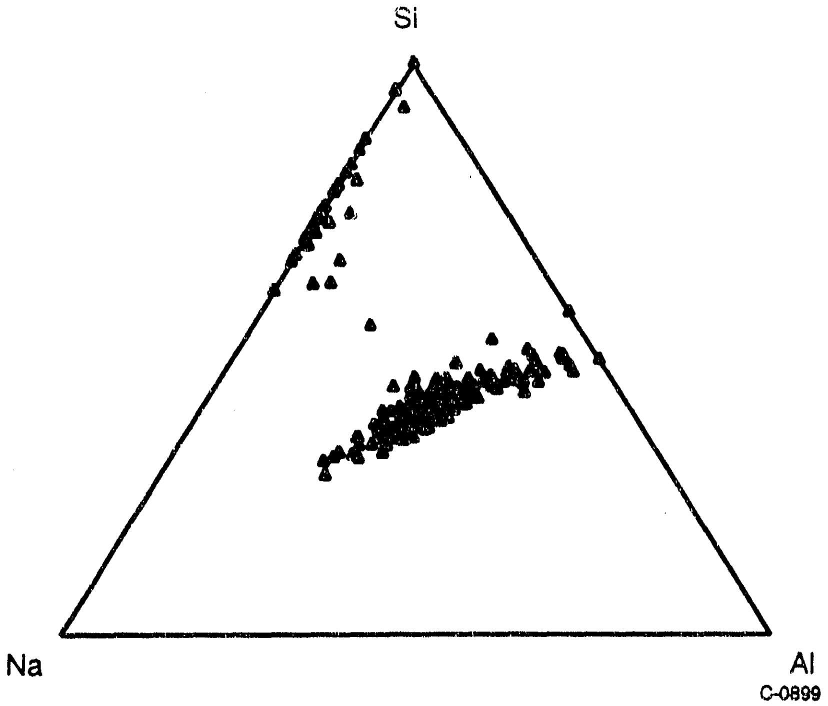


Figure 3-7. SECV Beulah lignite precipitator ash (CFFLS#601).

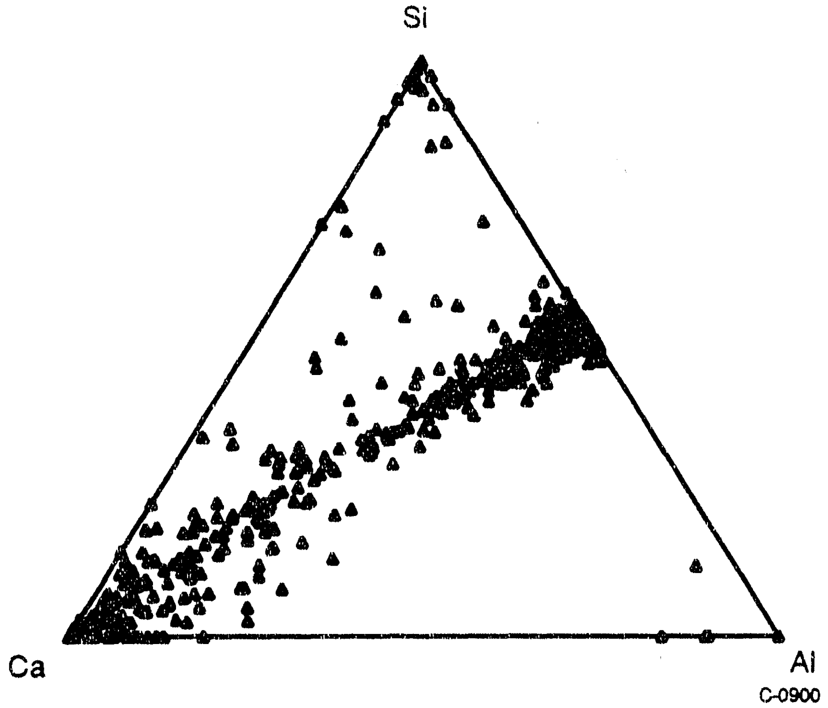


Figure 3-8. SECV Beulah lignite precipitator ash (CFFLS#601).

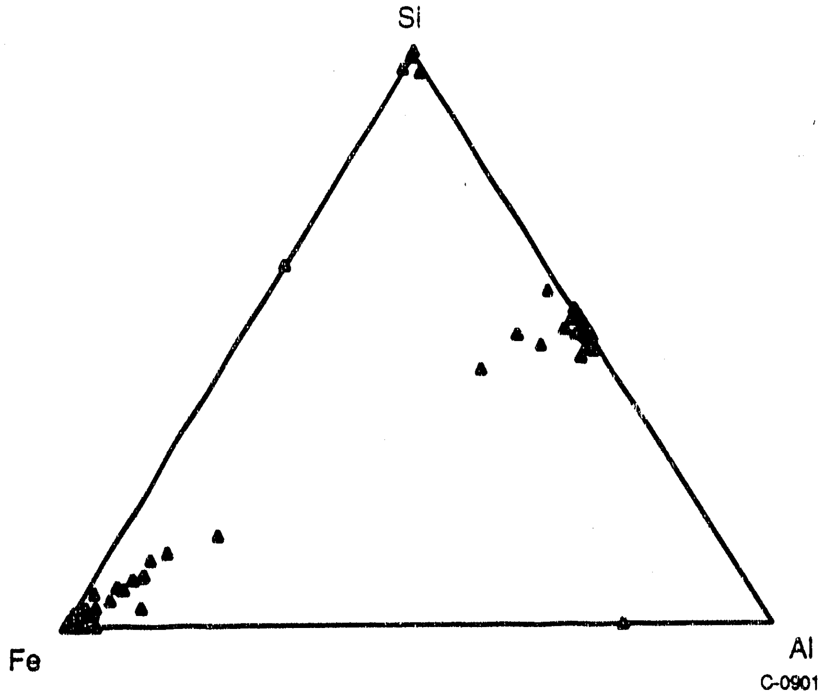


Figure 3-9. SECV Beulah lignite precipitator ash (CFFLS#601).

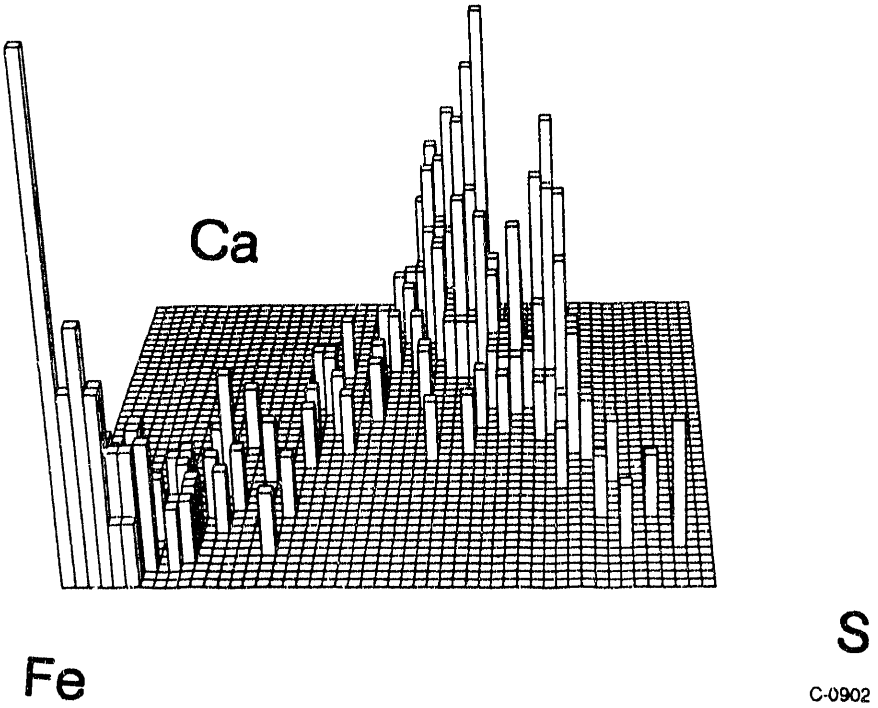


Figure 3-10. Beulah lignite precipitator ash.

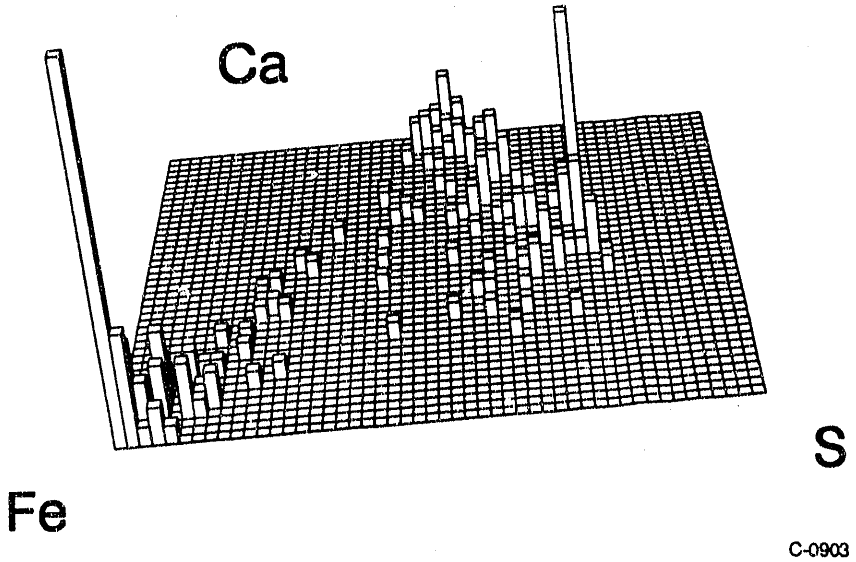


Figure 3-11. Beulah lignite ash probe (comb. chamber).

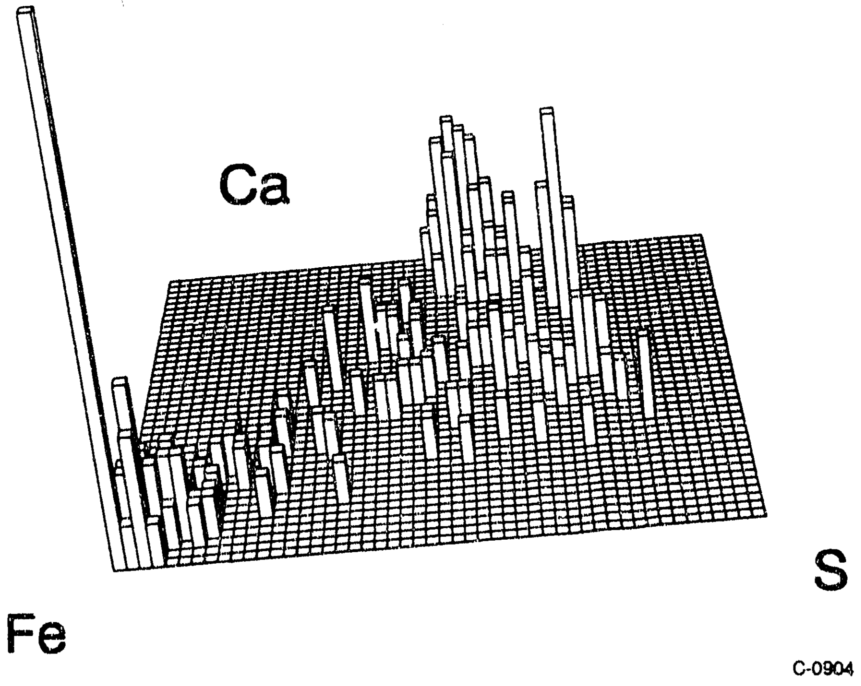


Figure 3-12. Beulah lignite ash probe (horizontal duct).

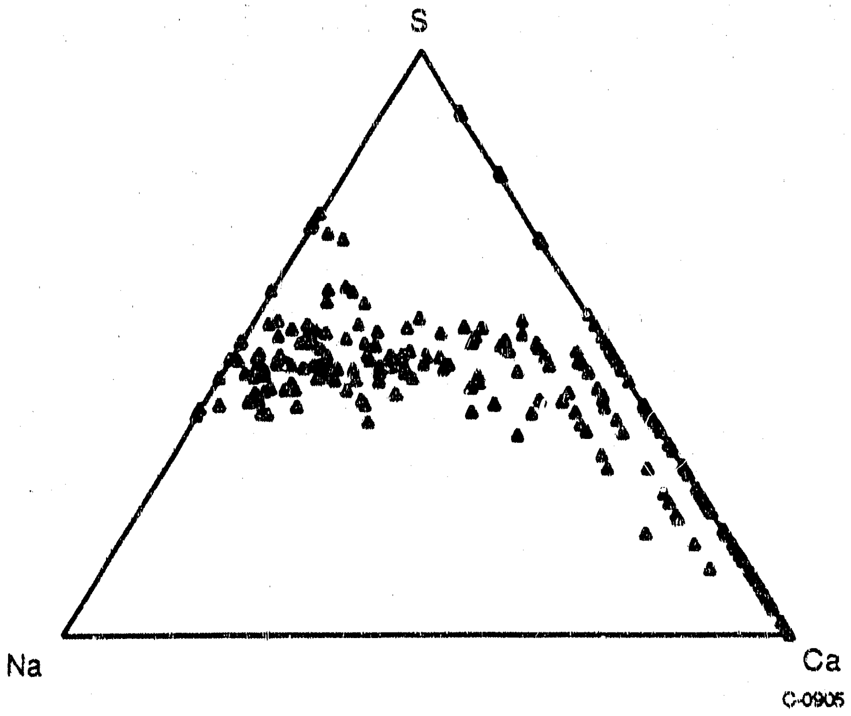


Figure 3-13. SECV Beulah lignite precipitator ash (CFFLS#601).

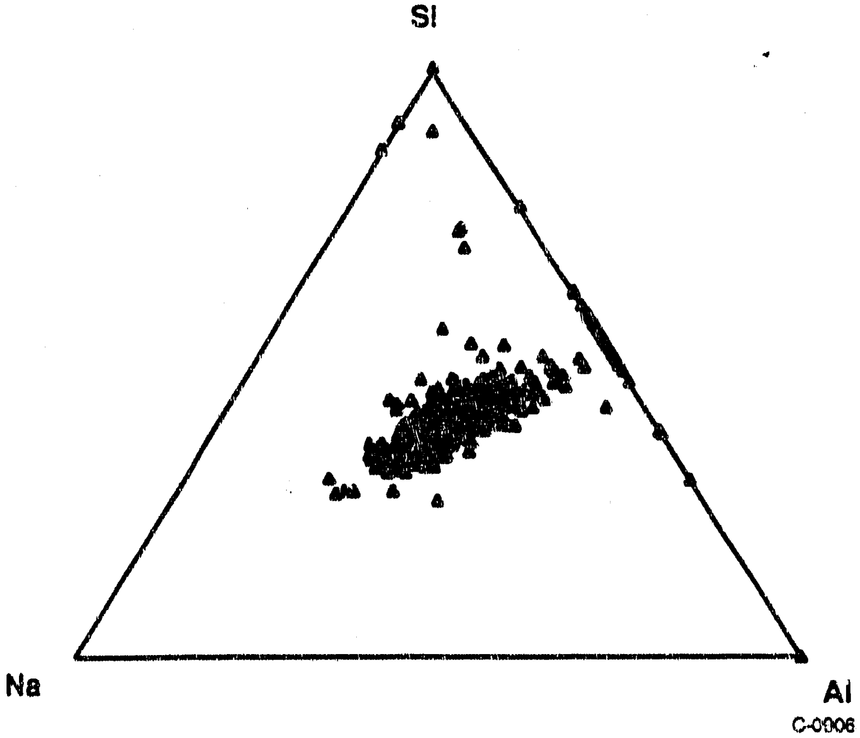


Figure 3-14. UA burn 42 Loy Yang 2301 + kaolinite ash (CFFLS#473).

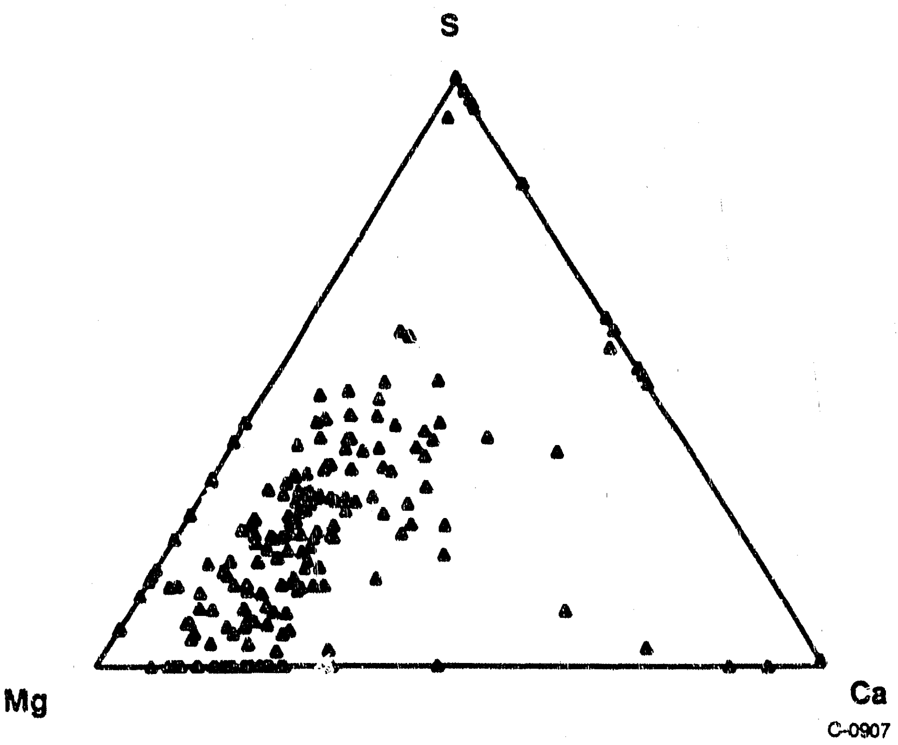


Figure 15. UA burn 42 Loy Yang 2301 + kaolinite ash (CFFLS#483).

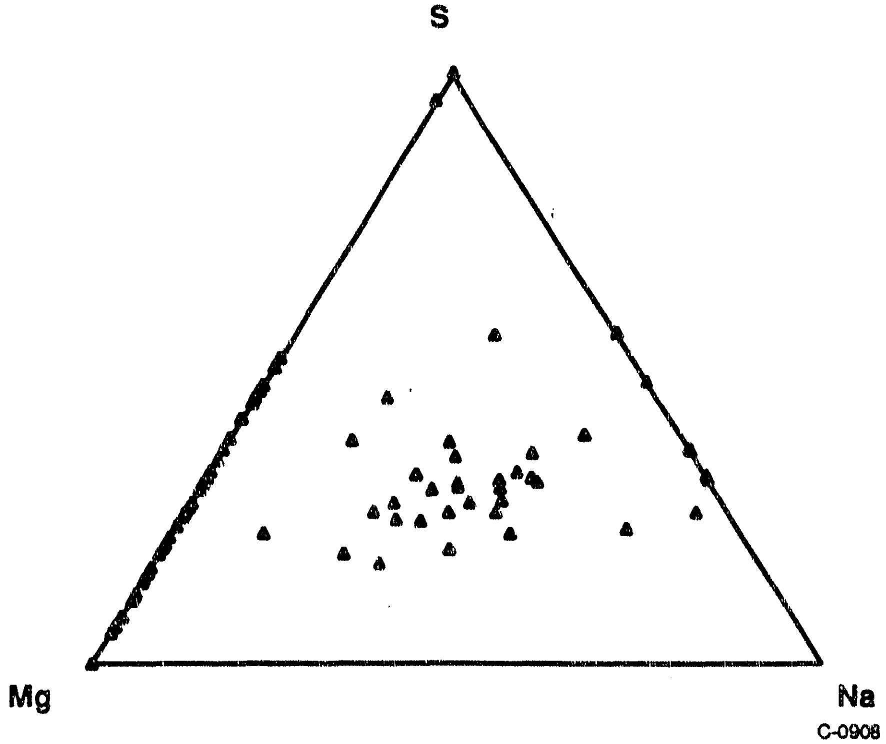


Figure 3-16. UA burn 42 Loy Yang 2301 + kaolinite ash (CFFLS#473).

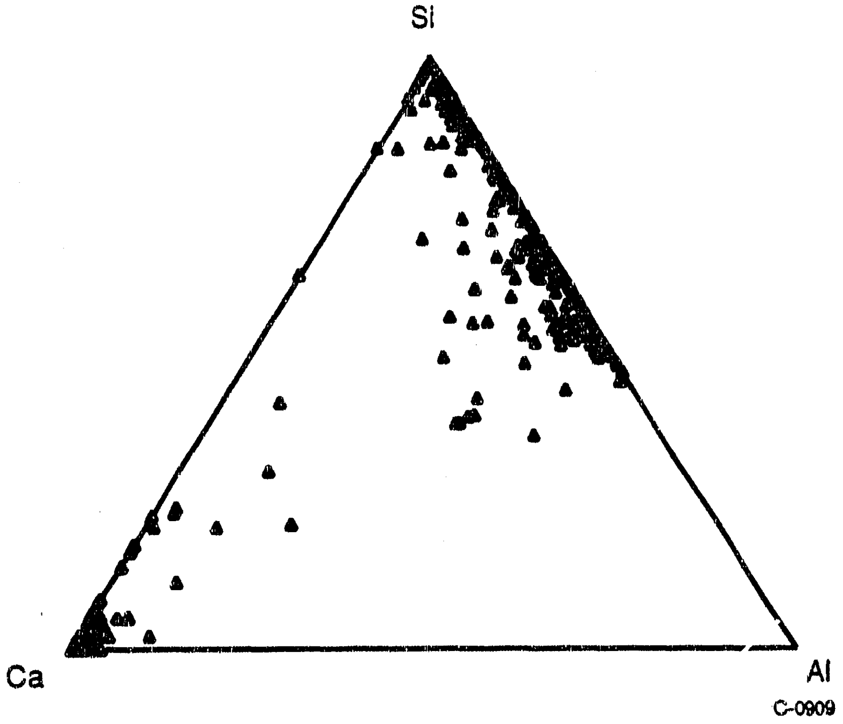


Figure 3-17. UA burn 44 KY#11 + sodium acetate ash (CFFLS#474).

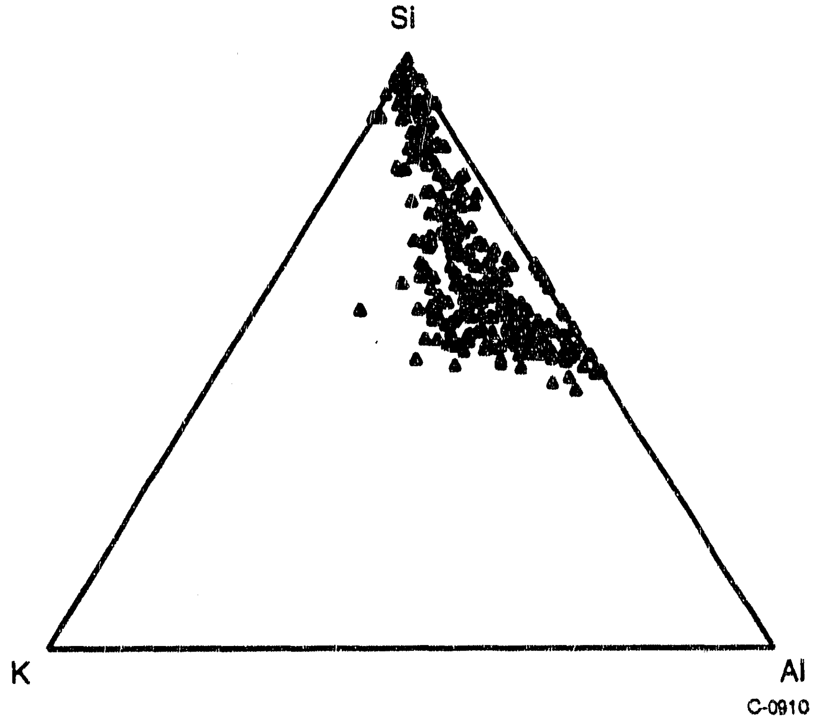


Figure 3-18. UA burn 44 KY#11 + sodium acetate ash (CFFLS#474).

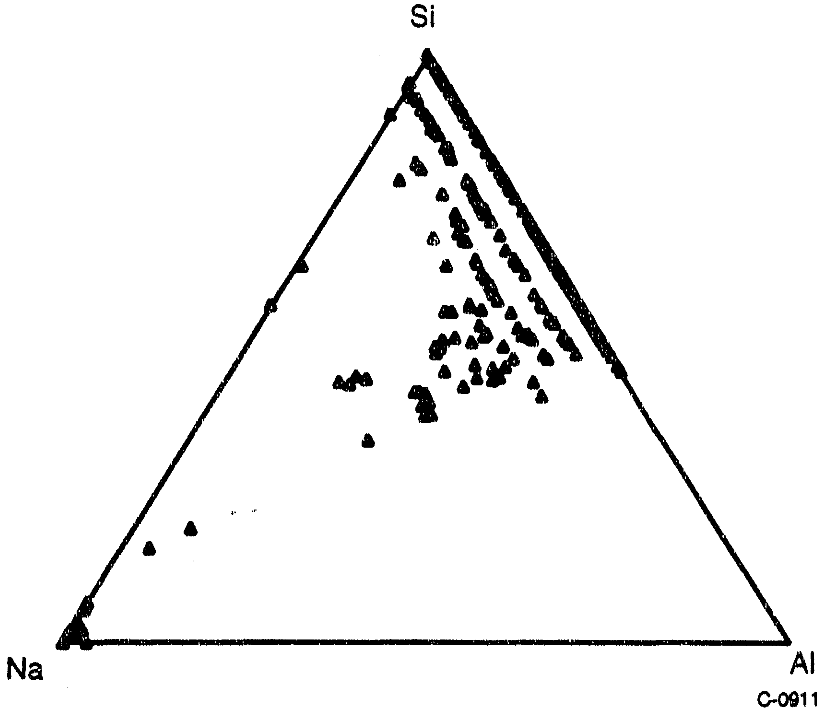
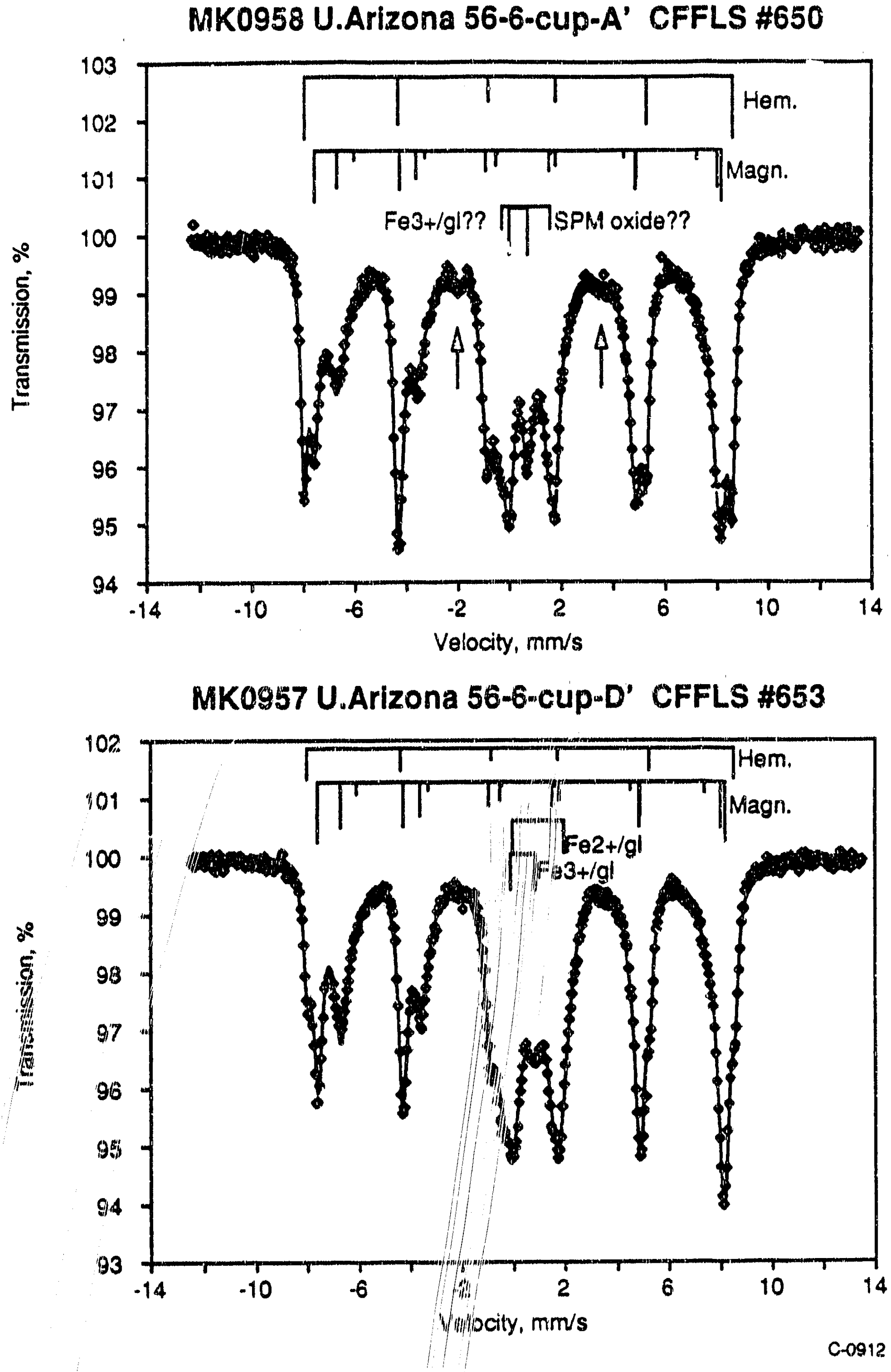


Figure 3-19. UA burn 44 KY#11 + sodium acetate ash (CFFLS#474).


MK0958 U.Arizona 56-6-cup-A' CFFLS #650

MK0957 U.Arizona 56-6-cup-D' CFFLS #653

Figure 3-20. $^{57}$Fe Mössbauer spectra of iron present in (Cup+Im1) impactor samples from University of Arizona combustion runs 56-6-A' and 56-6-D'. Phases indicated are hematite (Hem.), magnetite (Magn.), $Fe^{2+}$ in glass (Fe2+/gl), $Fe^{3+}$ in glass ($Fe^{3+}$/gl), and superparamagnetic iron oxides (SPM oxide). Arrows in upper spectrum indicate minor absorption attributable to pyrrhotite ($Fe_{1-x}S$).

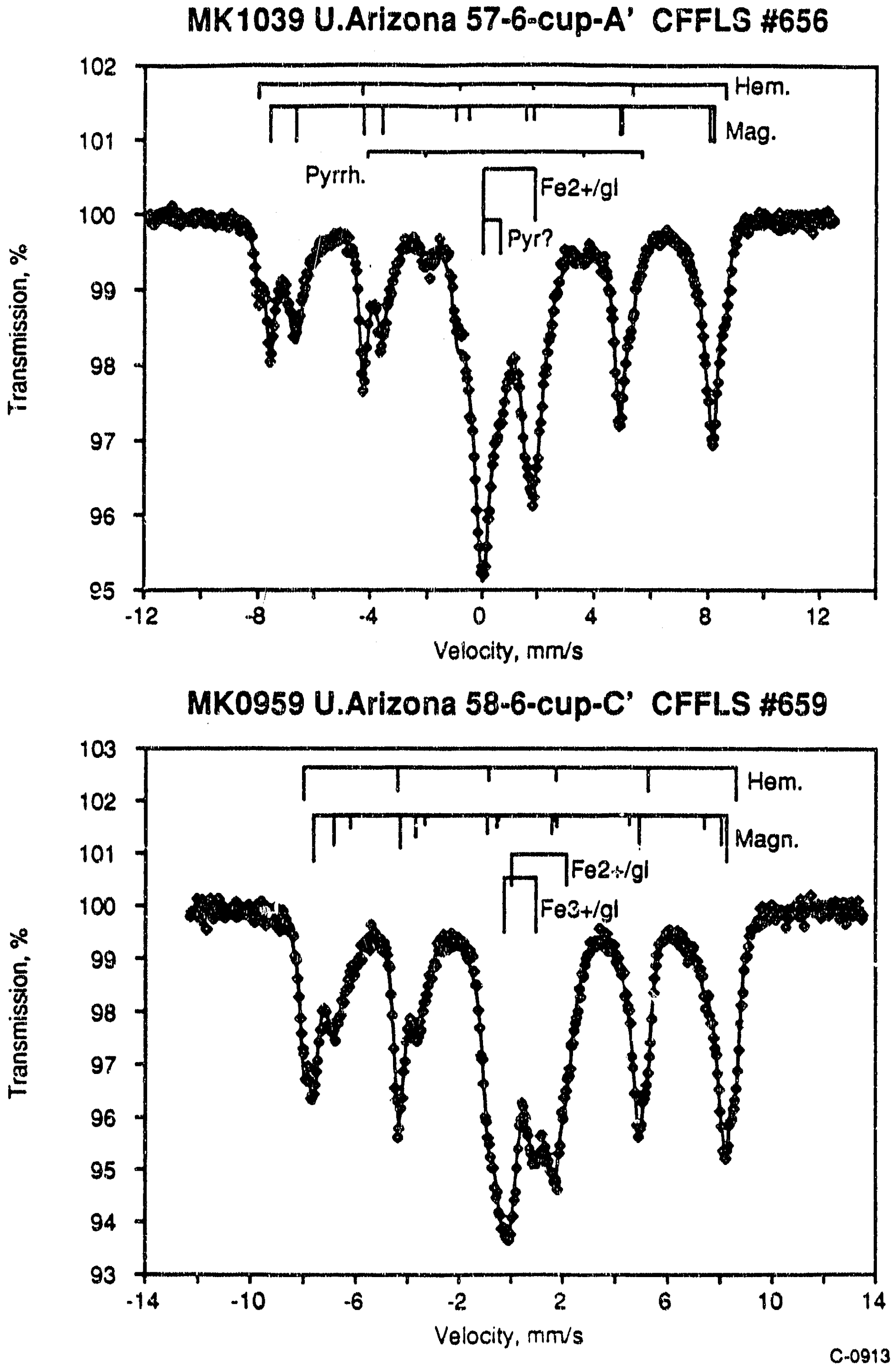


Figure 3-21. $^{57}$Fe Mössbauer spectra of iron present in (Cup+Im1) impactor samples from University of Arizona combustion runs 57-6-A' and 58-6-C'. Phases indicated are hematite (Hem.), magnetite (Magn.), Fe$^{2+}$ in glass (Fe2+/gl), Fe$^{3+}$ in glass (Fe$^{3+}$/gl), pyrite (Pyr.), and pyrrhotite (Pyrrh.).

# SECTION 4

# BEHAVIOR AND EFFECTS OF COAL MINERAL MATTER IN A LABORATORY PULVERIZED COAL COMBUSTOR

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# 4. BEHAVIOR AND EFFECTS OF COAL MINERAL MATTER IN A LABORATORY PULVERIZED COAL COMBUSTOR

## 4.1 Background: Sodium/Potassium Interactions

In contrast to organically bound sodium which readily vaporizes, potassium commonly exists in aluminosilicate clays and is naturally involatile. Initial studies attributed sodium chloride to releasing potassium from aluminosilicate minerals (Raask (1968, 1985)). Other studies blamed release of mineral potassium on chlorine (Gibb and Angus (1983)).

Vaporization of potassium depends on its initial form in coal. Organically bound potassium is expected to vaporize easily, while release of mineral potassium is expected to depend on other species present. Size-segregated fly ash samples collected in this study showed evidence of potassium vaporization in a laboratory scale combustor. Bench scale experiments were performed with potassium aluminosilicates to isolate potassium release mechanisms.

## 4.2 Mode of Occurrence of Potassium

Alkali behavior during pulverized coal combustion is dictated by its mode of occurrence and its interactions with other minerals present. Unlike sodium, potassium is primarily bound in the mineral matter as potassium aluminosilicates (Bryers (1988)). Illite ($KAl_2(AlSi_3O_{10})(OH)_2$) is a common potassium rich clay in coal (Raask (1985)) and was a major mineral constituent in the bituminous coals used in this study.

Determining the relative mode of occurrence of potassium in coals used in this study was difficult. An estimate of the amount of mineral bound potassium can be made from acid soluble potassium subtracted from ash potassium (Table 4-1). This estimate suggests that roughly 30% of the potassium in Kentucky No. 11 was bound in the mineral matter. Another estimate can be made from elemental mineral compositions. Using potassium found in quartz, illite, and miscellaneous silicates, and assuming the mass of each mineral is half oxygen, a value of 4753 ppm potassium in the mineral matter is calculated for Kentucky No. 11. This value is higher than that reported in the ash suggesting all the potassium is bound in the mineral matter. It is suspected that potassium exists primarily in mineral matter for the bituminous coals even though some was listed as acid soluble. It is possible that leaching from clays is the source of acid soluble potassium.

Spiro et al. (1986) examined the form of potassium in several coals using high resolution x-ray absorption near-edge structure (XANES) measurements. For bituminous coals they found that potassium was bound in the layered clay illite. Potassium appeared in a non-crystalline form for sub-bituminous and lignite coals. For low-rank coals, including Beulah Lignite, potassium XANES spectra did not resemble spectra of organic potassium salts (acetate, benzoate, and oxalate) nor spectra of phthalimide or t-butoxide. This suggests that potassium in these coals did not exist bound to the organic matrix. Leaching with HCl changed the spectra intensity, but did not alter the XANES spectrum.

Table 4-1. K, Na, and Cl for Base Suite of Coals.

| Coal | Acid Sol K (ppm)[1] | Ash K (ppm)[2] | Ash - Acid Sol (ppm) | Acid Sol Sodium (ppm)[1] | Chlorine (ppm)[3] |
|---|---|---|---|---|---|
| Beulah Lignite | 160 | 241 | 81 | 7375 | 95[4] |
| Eagle Butte | 95 | 80 | -15 | 820 | NA |
| Illinois No. 6 | 2380 | 1810 | -877 | 2258 | 911[4]<br>1200[5] |
| Upper Freeport | 2350 | 5978 | 3628 | 360 | NA |
| Kentucky No. 9 | 2550 | 3093 | 543 | 525 | 700[5] |
| Kentucky No. 11 | 2919 | 4211 | 1292 | 383 | 300[5] |
| Loy Yang 2301 | NA | < 1000 | NA | 5100 | 7550 |

[1] average of two numbers

[2] elemental K from as received $K_2O$ ash analysis

[3] Dr. J. Helble, PSI Inc. personal communication for all values except Loy Yang 2301.

[4] atomic absorbance on 65-73 μm fraction

[5] bomb analysis

Leaching of illite-containing bituminous coals with HCl/HF gave a spectrum similar to the low-rank coals. Spiro et al. speculated that the potassium might be absorbed on a range of surfaces including clays and the organic matrix. This suggests that potassium in low-rank coals would vaporize more easily than in bituminous and high-rank coals.

## 4.3 Potassium Release in a Laboratory Combustor

Eagle Butte and Beulah Lignite showed potassium enrichment of the smaller size classes in fraction oxide plots presented in previous Quarterly Reports, and Loy Yang showed a significant fraction of potassium in the small sizes. This evidence suggests vaporization of potassium during combustion of these low-rank coals. Fraction oxide plots and cumulative fraction plots for bituminous coals did not show evidence of significant potassium vaporization. This is consistent with the original form of potassium discussed above.

Potassium is expected to react with silicates similarly to sodium. Potassium reactions with kaolinite and illite have been observed in coal doped with potassium carbonate (Kühn and Plogmann (1983)). For sodium, a plot of the fraction of sampled alkali on impactor plate 8 plus the after-filter ($f_{8A}$) as a function of acid soluble alkali divided by aluminosilicates (Na/AlSi) gave a positive correlation. A similar plot for potassium (Figure 4-1) does not show a positive correlation. In fact, with the exception of data for Loy Yang 2301, a

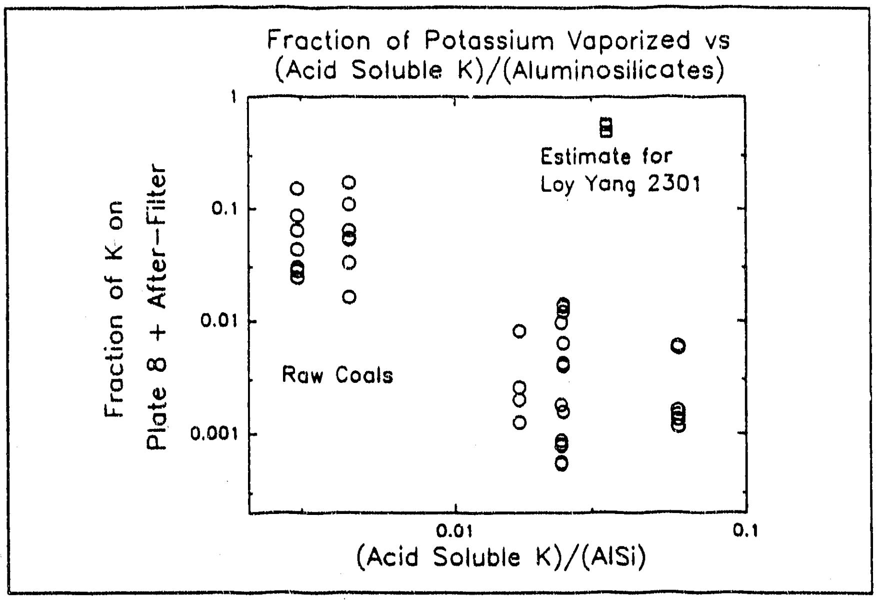


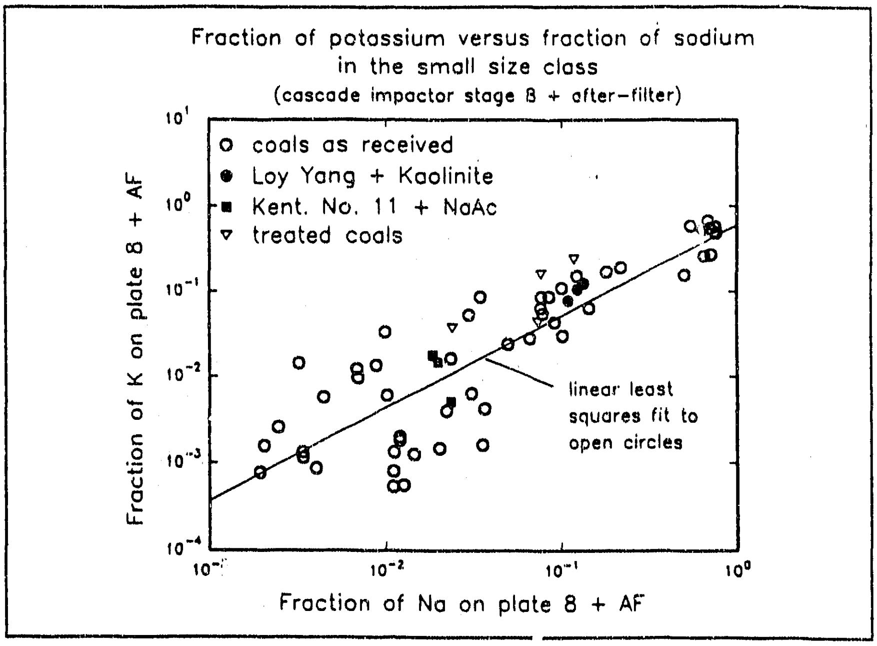
Figure 4-1. Potassium $f_{8A}$ versus K/AlSi.

negative correlation is suggested. Data for Loy Yang 2301 was estimated by assuming a molar equivalent of kaolinite for $Al_2O_3$, and by defining the reported <0.01% K level on a dry basis as 0.005%. A possible explanation is that acid soluble potassium is leached from mineral matter and does not represent readily vaporized potassium. Another explanation is that vaporization of mineral potassium is enhanced by other species such as NaCl.

Bomb combustion experiments, a significantly different mode of combustion, suggested that sodium chloride contributed to the release of nonvolatile mineral potassium (Raask (1985), Raask (1968)). Gibb and Angus (1983) performed bomb coal combustion experiments with sodium chloride, sodium acetate, and ammonium chloride additives, and concluded that the major contribution to potassium release was attributable to chlorine.

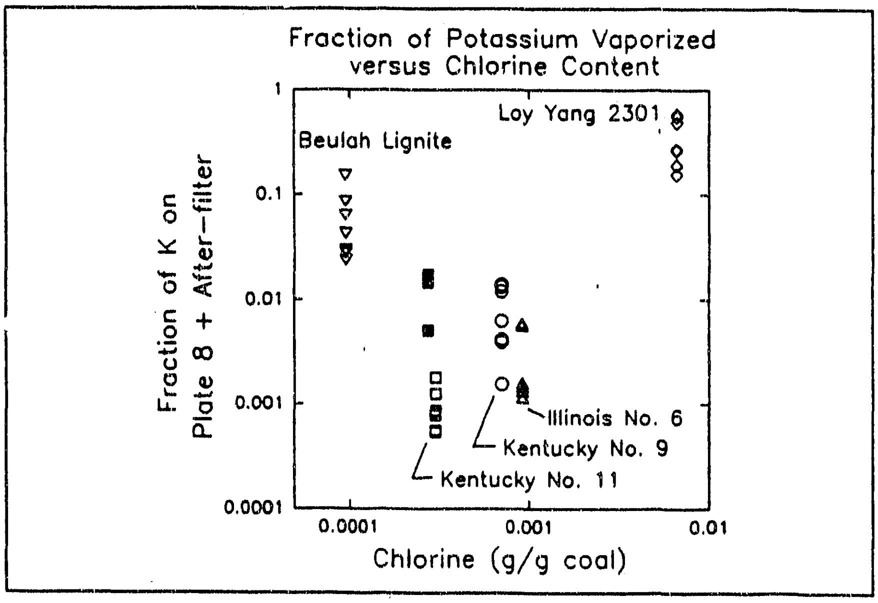
Experiments in the current UA study suggested a correlation between the fraction of vaporized potassium and sodium indicated by $f_{8A}$ (Figure 4-2). A similar plot can be made using vaporized alkali data presented by Gibb and Angus (1983). The correlation of potassium $f_{8A}$ versus sodium $f_{8A}$ together with the lack of a correlation of potassium $f_{8A}$ with K/AlSi suggests that sodium might be involved in the displacement of potassium from mineral matter.

A plot of potassium $f_{8A}$ as a function of coal chlorine content is shown in Figure 4-3. The low-rank coals suggest a positive correlation of potassium vaporization and chlorine content. This is consistent with equilibrium calculations. Potassium vaporization for Beulah Lignite and Loy Yang, however could also be linked to high sodium content, and the original



C-0891

Figure 4-2. K versus Na in small sizes.



C-0890

Figure 4-3. Potassium $f_{8A}$ versus chlorine content. Filled squares are for Kentucky No. 11 with NaAc.

form of potassium. The bituminous coals suggest no correlation between potassium vaporization and chlorine content. Of the three bituminous coals shown, Illinois No. 6 has the highest content of chlorine and acid soluble sodium. Kentucky No. 11 has the lowest of both species yet the potassium $f_{8A}$ is comparable.

To test the hypothesis that sodium can displace potassium bound in mineral matter, burns 43 and 44 used Kentucky No. 11 with extraneous sodium acetate additive (NaAc). Sodium in NaAc was expected to readily vaporized and participate in sodium-silicate interactions. Kentucky No. 11 was chosen due to its high illite content, and low sodium and chlorine content. Illite is an aluminosilicate with a relatively high occurrence of potassium. Experiments with clean Kentucky No. 11 showed a low $f_{8A}$ for both potassium and sodium.

Burns 43 and 44 used doped coal: Kentucky No. 11 with 98.86g sodium acetate trihydrate per kg additive-free coal. This gave a ratio of sodium-to-silicate in the doped coal that was similar to that in Beulah Lignite. NaAc granules were broken up by hand and then screened into the coal. The mixture was blended until homogenous to the eye then screened again to break up any undetected agglomerates. NaAc particles were in general larger than coal particles which ensured that the sodium would be external to char particles during combustion.

During burn 43, two full impactor samples were acquired. Sample A had a peak temperature of approximately 1455°C and for sample B it was 1290°C. The peak temperature for burn 44 was approximately 1258°C. As a comparison, three full impactor samples were acquired during burn 37 which used clean Kentucky No. 11. Sample A of burn 37 had a peak temperature of approximately 1261°C and samples B and C had a peak temperature of approximately 1105°C.

Fraction oxide plots for burns 43 and 44 all showed sodium enrichment in the small sizes to some extent. Burn 37 showed no alkali enrichment in the small sizes which reflected the low sodium content of the clean Kentucky No. 11 coal.

Table 4-2 lists the potassium $f_{8A}$ for each impactor sample from burns 37, 43 and 44. The potassium $f_{8A}$ for burn 37 was approximately 0.1%, and for burns 43 and 44 it ranged from 0.5 to 2%. Figure 4-4 shows the potassium $f_{8A}$ for doped burns (43 and 44) compared to undoped burns of Kentucky No. 11 (27, 28, and 37). Comparison showed a significant increase in the fraction of potassium in the small size ranges for the doped burns. This showed that the addition of extraneous sodium can aid in the release of potassium from aluminosilicates.

The fraction of potassium in the small sizes for burns 43 and 44, however was lower than that for the Beulah Lignite (burn 38) which ranged from approximately 3 to 6%. This could be due to the original form of potassium in Beulah Lignite which was expected to vaporize more easily.

Table 4-2. Potassium $f_{8A}$ for Kentucky No. 11

| Sample | Coal | Peak Temp (°C) | Fraction of K on 8 + AF |
|---|---|---|---|
| 43 acid A | Kent No. 11 + NaAc | 1455 | 0.017 |
| 43 acid B | Kent No. 11 + NaAc | 1290 | 0.016 |
| 44 acid A | Kent No. 11 + NaAc | 1258 | 0.005 |
| 37 A | Kent No. 11 | 1261 | 0.001 |
| 37 B | Kent No. 11 | 1105 | 0.0008 |
| 37 C | Kent No. 11 | 1105 | 0.0009 |
| 38 A | Beulah Lignite | 1285 | 0.028 |
| 38 B | Beulah Lignite | 1132 | 0.063 |
| 38 C | Beulah Lignite | 1132 | 0.043 |

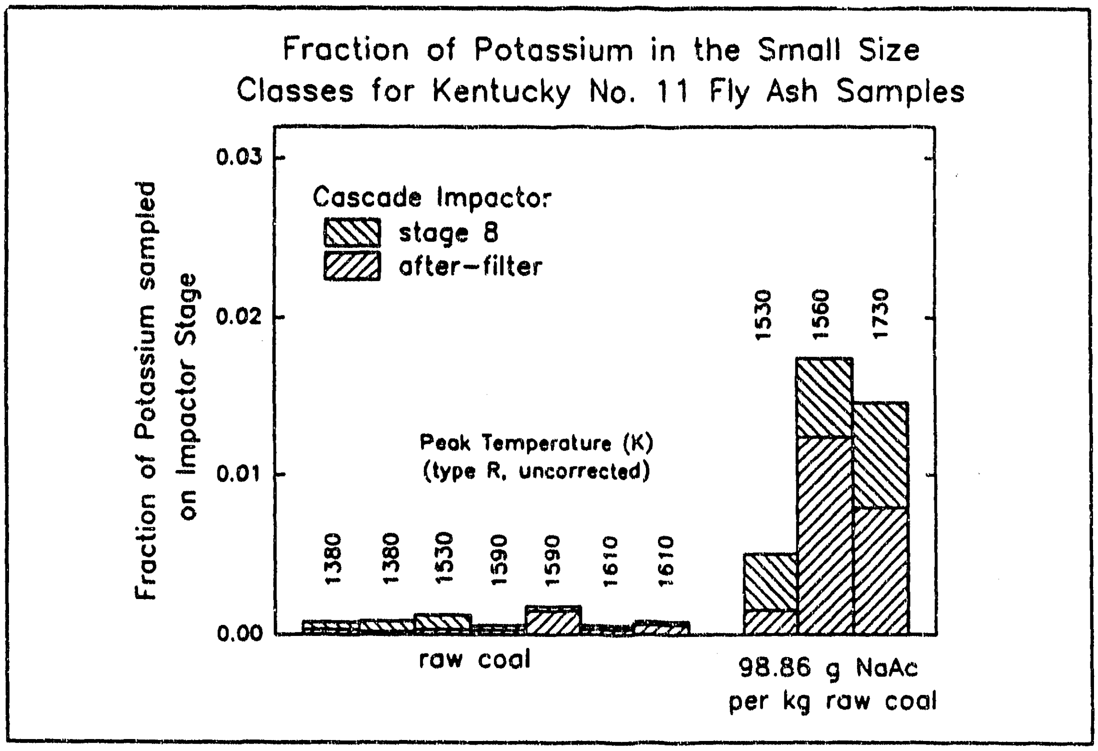


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Figure 4-4. Potassium $f_{8A}$ for Kentucky No. 11.

### 4.4 Potassium Release in a Bench Scale Reactor

Bench scale experiments with potassium aluminosilicates were conducted in an effort to clarify the possible mechanisms of potassium release from mineral matter. The relative importance of the presence of sodium and chlorine was also tested. Two potassium rich aluminosilicates were used in this study: naturally occurring illite, and kaolinite calcined with aqueous potassium hydroxide. An illite standard from Fithian, Illinois was acquired from the Geology Department at the University of Arizona. An artificial potassium rich clay was produced by impregnating a sample of ground kaolinite with potassium hydroxide and heating. Both aluminosilicates were ground in an agate mortar and compressed into pellets prior to experimentation.

### 4.5 Experiments with Kaolinite Impregnated with Potassium

An artificial potassium aluminosilicate was produced with clean kaolinite and potassium hydroxide. The procedure included placing 1.66844 ±0.00005g kaolinite and 0.27505 ±0.00005g KOH with a few drops of deionized water into a quartz bowl. The mixture was heated to 350 to 400 K for 42 min then to 1070 K for 340 min with a nitrogen purge. The product, KaoK, was removed and ground to a fine powder in an agate mortar before compressing the powder into a pellet.

Atomic absorbance (AA) analysis for KaoK powder and a KaoK pellet which was heated to 1070 K for approximately 26 hr showed no change in the potassium to aluminum plus silicon ratio. This was consistent with AA analysis performed on as-received illite and an illite pellet which was heated to 1270 K. No change was noted in the ratio of potassium to aluminum plus silicon. This was confirmed with additional samples of illite heated to 1070 K for extended periods (13 to 141 hr) and was consistent with the results reported by Srinivasachar et al. (1990) for illite heated to 1500 K.

Pellets of potassium aluminosilicate were prepared by placing 10 to 20 mg of ground sample into a stainless steel die 8 mm in diameter. The sample was then pressed for 1 min at 26700 N (6000 $lb_f$).

Although sodium and chlorine vaporize separately from coal, NaCl can be a major constituent of the vapor phase for high chlorine coals. Two experiments were performed with pellets of KaoK subjected to an unsaturated NaCl vapor. The configuration was slightly different for the two experiments. Figure 4-5 shows the configuration (#1) for the first experiment (sample A) which did not use the humidifier. KaoK sample A was kept at 800°C, and the NaCl source was at 784°C with a dry nitrogen purge. The second configuration (#2) allowed for continuous KaoK pellet mass measurement and introduction of simulated flue gas purge (Punjak et al. (1989) and Uberoi et al. (1990)). Sample B was kept at 800°C, and the source was at 780°C. The purge contained 80% $N_2$, 15% $CO_2$, 3% $O_2$, and 2% $H_2O$.

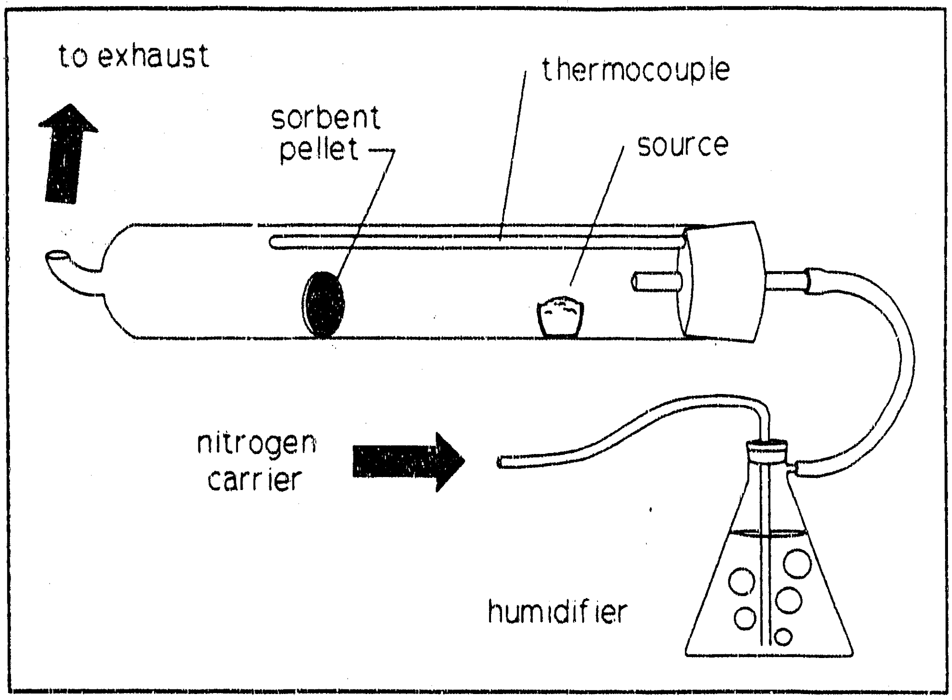

Figure 4-5. Reactor #1 for potassium displacement experiments.

Seven elements were measured in the KaoK sample by atomic absorbance analysis: Al, Si, Ca, Fe, Na, K, and Mg. The mass per gram of original sample of Al, Si, Fe, and Mg in all the KaoK samples were found to be unaffected by heating and presence of a sodium source. Calcium levels were too small to draw any conclusions. The ratio of moles of alkali to the sum of moles of Al and Si shown in Figure 4-6, displayed an increase in sodium and a decrease in potassium for both samples A and B.

It is clear that sodium chloride vapor could allow for removal of potassium from KaoK pellets both in the presence and absence of moisture. It not clear if potassium removal was due to chlorine or sodium. Potassium was lost only in cases where sodium was gained which suggests, but does not confirm, sodium displacement. Exchange of sodium for potassium was not one-for-one, also water vapor was not necessary for displacement to occur. This was in contrast to sodium capture results reported by Punjak et al. (1989) and Bachovchin et al. (1986) that suggested moisture was important for capture of sodium by kaolinite and emathlite respectively. Apparently sodium capture with potassium displacement is a different mechanism than sodium capture alone.

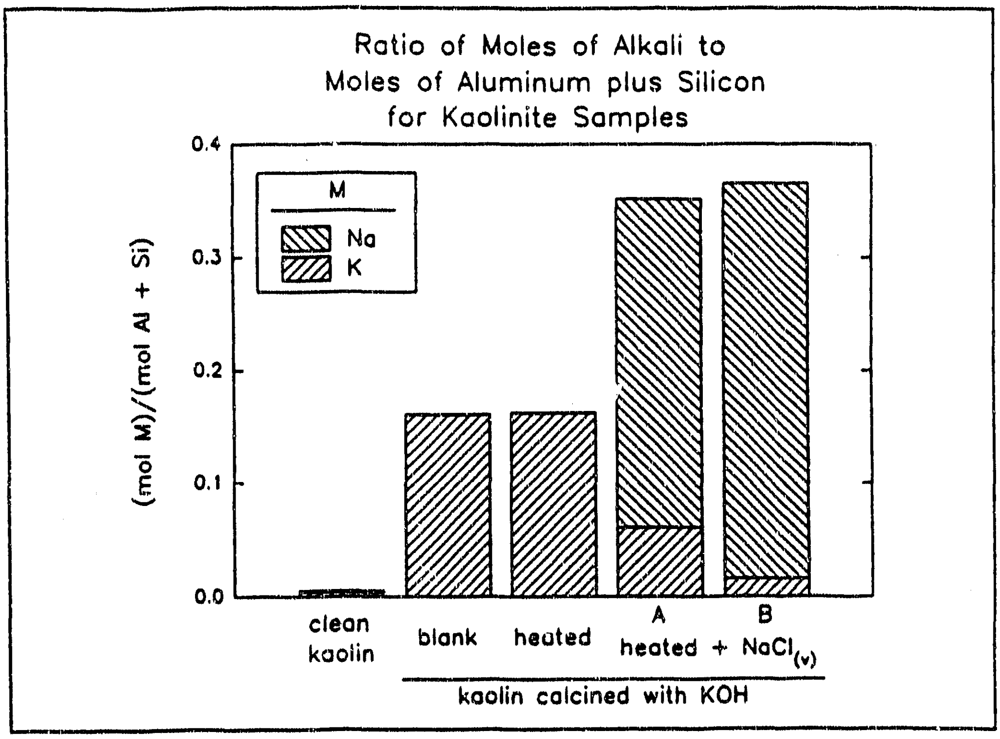

Figure 4-6. Ratio of alkali to Al + Si for KaoK.

## 4.6 Potassium Displacement Experiments with Illite

Potassium was lost from kaolinite impregnated with potassium in the presence of sodium chloride vapor. It was of interest, however to examine a naturally occurring potassium rich aluminosilicate. Bench scale experiments were conducted with illite, a potassium rich mineral common in many coals.

Illite clay pellets were prepared by the same technique used for KaoK. The mass of Al, Si, Fe, and Mg per gram of original sample showed no change during each of the illite experiments. This was consistent with the KaoK results.

A third experimental configuration (#3) was used with illite pellets and is shown in Figure 4-7. A third configuration was required to enhance transport of vapor sodium species other than NaCl to the illite pellet. Reaction of sodium species (other than NaCl) with quartz source bowls and reactor walls was significant and reduced the concentration of sodium in the vapor. The inside diameter of the tube holding the source and sorbent in configuration #3 was approximately 7 mm. Table 4-3 summarizes the experimental conditions and configuration used for each illite sample, and Table 4-4 lists the average unreacted illite composition.

Only sample F with a sodium chloride source showed significant potassium release (Figure 4-8). Sample ZA had HCl in the humidifier and showed no potassium release.

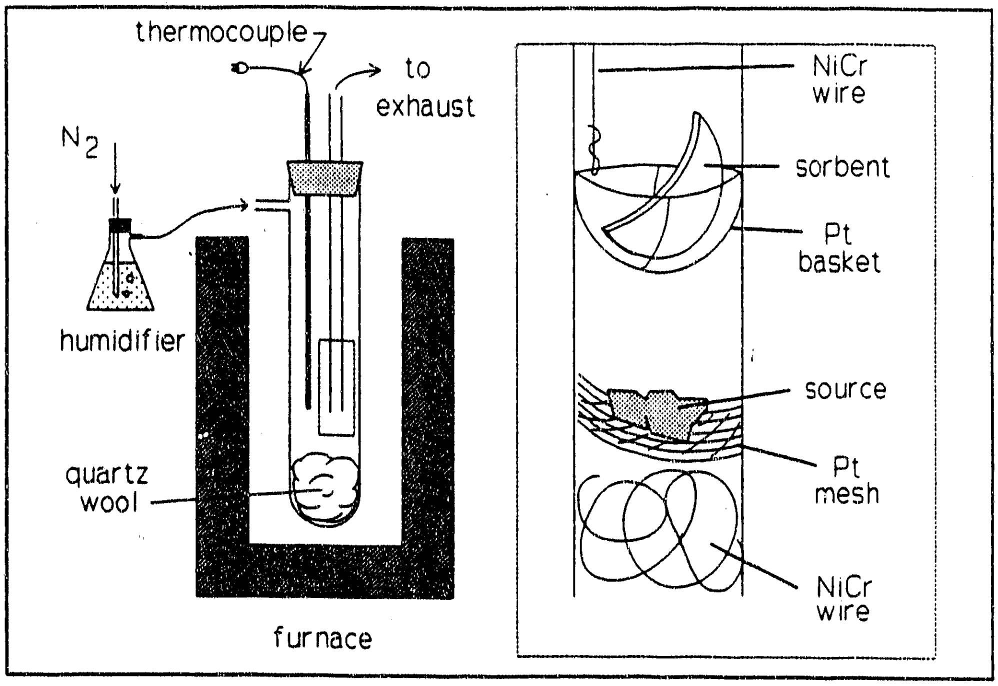

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Figure 4-7. Configuration #3 for illite experiments.

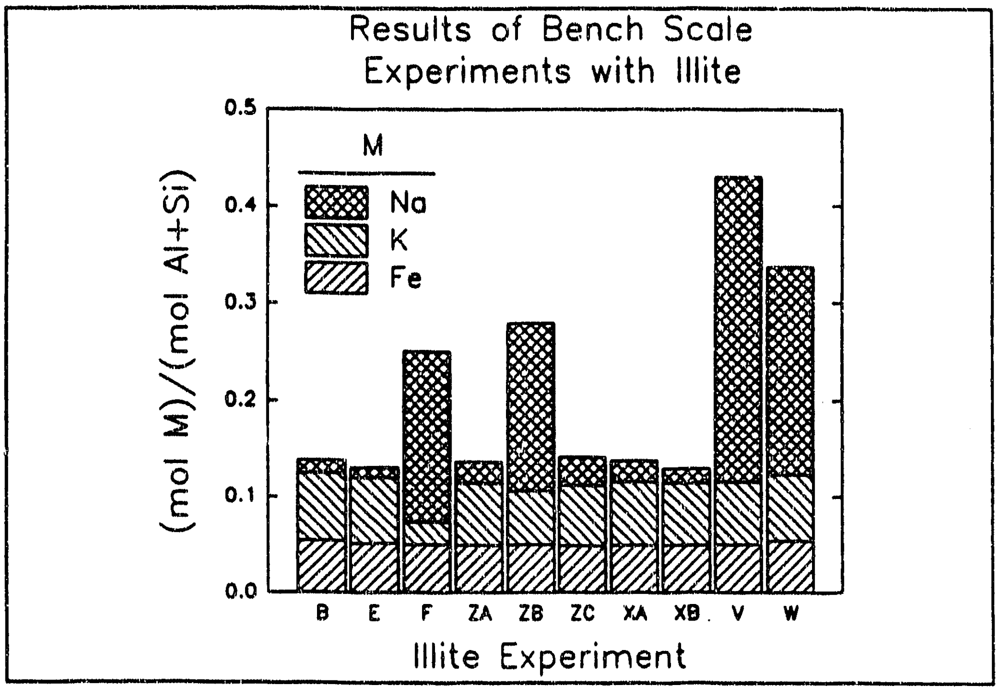

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Figure 4-8. Results of illite experiments.

Table 4-3. Summary of Illite Bench Scale Experiments

| Illite Sample | Illite Temp (°C) | Source Temp (°C) | Purge | Time (min) | Exper. Config.* |
|---|---|---|---|---|---|
| B | - | - | - | - | - |
| E | 1000 | - | - | 30 | - |
| F | 800 | NaCl 780 | $N_2$ | 1532 | #1 |
| ZA | 790 | - | $N_2$,$H_2O_{(v)}$,$HCl_{(v)}$† | 969 | #1 |
| ZB | 800 | $Na_2SO_4$ 796‡ | $N_2$, $H_2O_{(v)}$ | 1500 | #3 |
| ZC | 790 | $Na_2SO_4$ 800 | $N_2$, $H_2O_{(v)}$ | 1480 | #3 |
| XA | 800 | $Na_2SO_4$ 805 | $N_2$, $H_2O_{(v)}$ | 1762 | #3 |
| XB | 800 | $Na_2SO_4$ 805 | $N_2$,$H_2O_{(v)}$,$HCl_{(v)}$† | 1700 | #3 |
| V | 790 | $Na_2SO_4$ | $N_2$ | 32 | #1 |
| W | 790 | NaOH | $N_2$ | 30 | #1 |

* #1 configuration shown in Figure 4-5
#3 configuration shown in Figure 4-7
†approximately 0.03 N HCl in humidifier at >25°C
‡stainless steel foil sheath surrounded area between source and sorbent

Table 4-4. Average Illite Composition

| Element | g/g Illite | Standard Deviation g/g |
|---|---|---|
| Al | 0.0895 | 0.0015 |
| Si | 0.2526 | 0.0072 |
| Ca | 0.0025 | 0.0013 |
| Fe | 0.0411 | 0.0037 |
| Na | 0.0045 | 0.0001 |
| K | 0.0343 | 0.0065 |
| Mg | 0.0120 | 0.0003 |

Sample XB had HCl in the humidifier and a sodium sulfate source also showed no potassium release. Since no sodium capture was noted in this experiment, it is suspected that sodium vapor concentrations were very low. To overcome experimental difficulties in keeping reactive sodium in the vapor long enough to reach the illite pellet, samples V and W mixed the sodium source directly with illite powder. Samples V and W mixed $Na_2SO_4$ and NaOH with illite and a few drops of deionized water. The samples were then placed in the hot reactor. These experiments would be considered worst case scenarios with respect to sodium concentration. Sodium was apparently captured in samples V and W, but potassium was not displaced. Sodium was captured in sample ZB which used a stainless steel foil sheath to protect the quartz reactor tube. In this experiment the stainless steel was extremely corroded. From bench scale experiments with illite we can conclude that sodium chloride can allow for potassium release. Neither chlorine nor sodium alone will release potassium, and also sodium vapor can be captured by illite.

Energy dispersive x-ray analysis (EDX, Applied Materials Laboratory, University of Arizona) did not detect chlorine in samples exposed to NaCl and HCl. Profiles of potassium and sodium in both illite and KaoK pellets ($\approx 150$ to 300 $\mu$m thick) were flat. This suggested that transport was not limiting under the experimental conditions used.

## 4.7 Conclusions

A summary of potassium behavior during pulverized coal combustion is given in this section. Conclusions from both laboratory combustion and bench scale experiments are included.

- Low-rank coals Beulah Lignite and Loy Yang 2301 showed a significant fraction of the potassium in the small size classes of sampled fly ash. This could be due to the original form of the potassium being easily vaporized, or the high sodium content of both coals. These two coals suggested a positive correlation between potassium vaporization and chlorine content.

- Bituminous coals in this study showed a very small fraction of the potassium in the small size classes of sampled fly ash. This is consistent with the potassium existing primarily in mineral matter. No correlation was found for the bituminous coals between potassium vaporization and chlorine content.

- A correlation was found between the fraction of vaporized sodium and potassium. Since the original form of potassium was likely bound to mineral matter, this suggested that sodium could enhance potassium vaporization.

- Potassium vaporization was enhanced significantly in Kentucky No. 11 (high illite content, low sodium and chlorine content) in the presence of extraneous sodium acetate. The vaporization was still lower than for Beulah Lignite that had a similar sodium-to-silicon ratio.

- Sodium chloride vapor allowed for release of potassium from mineral matter in both illite and kaolinite impregnated with potassium. More sodium was captured than potassium was released suggesting that the displacement was not one-for-one.

- Potassium was not released in the presence of sodium or chlorine alone. This suggested that both a cation and anion are required for potassium release. Further experiments with other sources could confirm this hypothesis.

## 4.8 References

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# SECTION 5

# IDEALIZED COMBUSTION DETERMINATION OF ASH PARTICLE FORMATION AND SURFACE STICKINESS

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# 5. IDEALIZED COMBUSTION DETERMINATION OF ASH PARTICLE FORMATION AND SURFACE STICKINESS

During the previous quarter, PSI Technology Company (PSIT) continued analysis of experimental data collected jointly with the State Electricity Commission of Victoria (SECV) during the nineteenth quarter of this program. This discussion focuses on further analysis of results obtained during combustion of the Beulah lignite coal studied in this program in a 35 kg/hr furnace. Further analysis is possible because of the recent completion of CCSEM work on these samples by the University of Kentucky as noted in Section 3 of this report. Completion of XAFS and Mössbauer analysis of these samples at Kentucky will conclude the analytical portion of this joint PSIT/SECV program.

## 5.1 Description of 35 kg/hr Furnace

A schematic of the SECV 35 kg/hr furnace (nominal 1 million Btu/hr) showing the sampling locations employed in this testing is shown in Figure 5-1. A detailed discussion of the operating parameter ranges of this furnace was presented previously in Quarterly Report 19 (Helble et.al., 1991a). Specific furnace operating conditions employed during the Beulah lignite combustion tests are summarized in Tables 5-1 and 5-2.

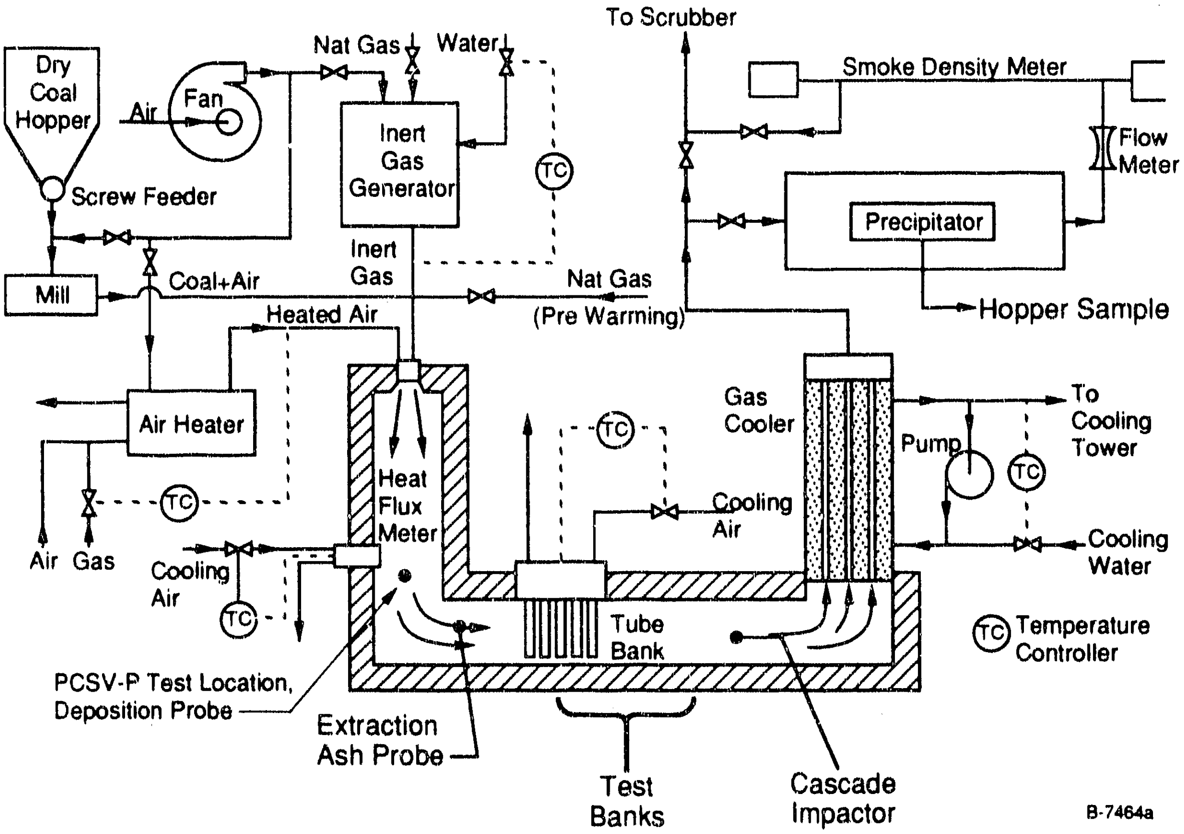

Figure 5-1. Schematic of SECV Furnace Showing Sampling Locations During Joint PSIT/SECV Testing of Beulah Lignite.

Table 5-1. Operating Conditions - Beulah Lignite Combustion Test

| | |
|---|---|
| Average Coal Feed Rate | 36 to 41 kg/hr |
| Flame Temperature | 1300°C |
| Combustion Zone Gas Temperature | 1080 to 1115°C |
| Furnace Exit Temperature | 900 to 950°C |
| Furnace Exit Oxygen Level | 7.2% |

Table 5-2. Sampling Location Conditions - Beulah Lignite

| Location | Gas Temperature | Surface Temperature | Residence Time (s) |
|---|---|---|---|
| Comb. Chamber R7 | 1100°C | N.A. | 0.9 |
| Deposition - Hot | 1000°C (est.) | 1000°C (est.) | 0.9 |
| Deposit. - Cold | 1000°C (est.) | 560°C | 0.9 |
| Horizontal Duct | 900 to 950°C | - | 1.1 |
| Test Bank 1 | - | unknown | 1.6 |
| Test Bank 3 | - | 550 to 600°C | 1.6 |
| ESP Inlet | 290°C | - | 2.5 (est.) |
| ESP Outlet | 190°C | - | 2.5 (est.) |

Samples taken from the combustion chamber and horizontal duct were extracted with quenched, water cooled sampling probes. Deposit samples taken from the test banks (cooled surfaces) were removed by extracting the entire test bank at the conclusion of a test and scraping the deposit sample from the tube. Deposit samples taken from the deposition probe ceramic (hot) and water cooled (cold) sections were removed by scraping the surface of the probe after it was extracted from the combustor. Electrostatic precipitator samples were collected at the conclusion of an experiment.

All samples were analyzed for bulk chemical composition by atomic absorption spectroscopy (AA) and for chemical phase by x-ray diffraction. In addition, extractive particulate samples collected from the combustion chamber ring 7 and the horizontal duct, and a composite sample collected from the ESP were analyzed by computer controlled scanning electron microscopy (CCSEM) for individual ash particle size and chemical composition. Mössbauer analysis and x-ray absorption fine structure (XAFS) analysis to determine the chemical forms of iron and calcium, respectively, are yet to be completed.

## 5.2 Sample Analysis and Discussion

Samples collected from each sampling point were analyzed for bulk chemical composition by AA at SECV. The results of this analysis for four key components are presented in Table 5-3 on a wt% oxide basis. Sulfur and sodium concentrations in the ash increased with increasing residence time in the system (corresponding to decreasing gas temperature), while iron oxide concentrations decreased slightly and calcium oxide concentrations showed little change. Several inferences can be drawn from these results. The increasing sodium and sulfur concentrations are suggestive of sodium sulfate formation at the cooler temperatures associated with longer residence times. Sulfur levels increase more rapidly than sodium levels (assuming stoichiometric sodium sulfate), however, suggesting the formation of other sulfated species. It is therefore likely that calcium contained within the ash particles is sulfating as the particles traverse the reactor and deposit on surfaces, an observation consistent with increasing sulfur and constant calcium levels in the ash. The association of the highest iron concentrations with the deposition probe samples suggests deposition of an iron-containing species at early residence time.

Table 5-3. Concentration of Selected Ash Species in Bulk Ash Samples

| Location | $SO_3$ (wt%) | CaO (wt%) | $Na_2O$ (wt%) | $Fe_2O_3$ (wt%) |
|---|---|---|---|---|
| Comb. Chamber R7 | 7.3 | 19.3 | 7.4 | 13.3 |
| Deposition - Hot | 3.8 | 18.0 | 6.7 | 16.6 |
| Deposit. - Cold | 8.8 | 18.0 | 5.0 | 15.8 |
| Horizontal Duct | 9.1 | 19.0 | 9.3 | 12.5 |
| Test Bank 1 | 16.9 | 21.8 | 6.0 | 11.9 |
| Test Bank 3 | 12.7 | 20.4 | 6.8 | 12.1 |
| ESP (composite) | 13.9 | 15.7 | 11.2 | 11.5 |

Similar conclusions are drawn from XRD analysis of these samples. Phases observed in the bulk ash samples by XRD are shown in Table 5-4.

Table 5-4. Phases Observed in Beulah Lignite Testing - XRD Analysis

| Phase | Location (Read Down Each Column) | | | |
|---|---|---|---|---|
| | Deposition Probe Ceramic | Deposition Probe Cooled | Test Bank 3 | Precipitator (Fly Ash) |
| $Ca_2Al_2SiO_7$ | √ | √ | √ | √ |
| $CaSO_4$ | - | √ | √ | √ |
| $Fe_2O_3$ | √ | √ | √ | √ |
| $NaAlSiO_4$ | √ | √ | - | - |
| $Na_2SO_4$ | - | - | - | √ |
| $NaAlO_2$ | - | √ | - | - |
| $SiO_2$ | - | √ | √ | √ |

Deposition Probe - denotes deposition probe at or near ring 7 of combustion chamber
"-" - indicates phase not observed in sample

CCSEM analysis of ash samples collected from the combustion chamber, horizontal duct, and ESP was also conducted. In CCSEM analysis, 1200 (University of Kentucky analysis) or 2000 to 3000 (UND EERC analysis) individual mineral or ash particles are analyzed for size and chemical composition. From these measurements, an overall chemical composition can be generated for comparison with bulk chemical analysis. Previous experience has shown that good agreement between CCSEM and bulk chemical analysis is usually obtained for ash samples generated from U.S. bituminous coals (Boni et.al., 1990). For low rank coals such as the Beulah lignite considered here, agreement is generally poorer.

The reason for this can be understood by considering the method of chemical identification of CCSEM analysis. Compositions are identified by energy dispersive x-ray analysis, using x-rays emitted from the region of a particle excited by an incident electron beam. The penetration depth of a CCSEM electron beam is of order 1 $\mu$m into a particle. Correspondingly, excited X-rays used to identify the elemental composition of the excited region are emitted from the outer 1 $\mu$m only. For ash particles larger than a few $\mu$m in diameter, therefore, only the outer layers of the particle will be analyzed. Differences between bulk ash composition and CCSEM determined composition are therefore indicative of enrichment of certain species on the surface of the ash particles.

Table 5-5 presents a comparison of CCSEM and AA bulk ash composition for these experiments on a sodium and magnesium free basis. The slight depletion in CCSEM analysis of silicon, aluminum, and iron, and the slight enrichment of calcium and sulfur are suggestive of surface enrichment in calcium sulfate (and possibly calcium oxide), consistent with the inferences drawn from the bulk ash composition trends discussed above. Calcium enrichment of ash particle surfaces has been observed in previous laboratory studies at PSIT and the University of Arizona with this coal (Boni et.al., 1990).

Table 5-5. Comparison of CCSEM and AA Ash Compositions Na and Mg Free Basis - wt% Oxides

| | CC-R7 | | HD | | ESP | |
|---|---|---|---|---|---|---|
| | AA | CCSEM | AA | CCSEM | AA | CCSEM |
| $Si_{28}$ | 30 | 26 | 30 | 27 | 26 | 21. |
| $Al_{27}$ | 18 | 13 | 19 | 14 | 17 | 13. |
| $FC_{56}$ | 16 | 13 | 15 | 14 | 14 | 13. |
| $Ca_{40}$ | 23 | 31 | 23 | 27 | 20 | 24. |
| $K_{39}$ | 0.2 | 1 | 0.2 | 0 | 0.2 | 1. |
| $S_{32}$ | 9 | 15 | 11 | 17 | 17 | 25. |
| $Ti_{48}$ | 0.6 | 2 | 0.6 | 2 | 0.5 | 2. |

CCSEM analysis of individual ash particles also provides information on the change in particle composition ranges with time. Figures 5-2 through 5-5 are ternary composition diagrams for the Beulah coal, ash from the combustion chamber, ash from the horizontal duct, and ash from the ESP hopper. The coal sample was analyzed at UND EERC and the ash samples were analyzed at the University of Kentucky. For these Na-Al-Si diagrams, each point represents ash particles with the stated composition on a molar basis. The height of each peak represents the number of particles having the identified composition. Only those particles containing greater than 80 mole% (Na+Al+Si) are included. As Figure 5-2 shows, the sodium concentration of quartz and aluminosilicate minerals in the coal is very low. Samples collected from the combustion chamber, however, clearly contain sodium-rich particles (Figure 5-3). A similar observation is made for the horizontal duct ash particle sample (Figure 5-4). A sample collected from the ESP (Figure 5-5) is similar, with a noted decrease in pure aluminosilicate particles (those not containing sodium or other modifier ion such as Ca). Sodium-rich ash particles of identical composition have been observed previously in laboratory combustion studies of this coal (Boni et.al., 1990; Helble et.al., 1991b)

Ash particle size distributions determined by CCSEM analysis for ash from the combustion chamber, horizontal duct, and ESP are shown in Figure 5-6. Ash particle size distributions decrease slightly as residence time increases, perhaps due to the addition of small calcium and sodium sulfate ash particles at lower temperatures (longer times). The statistical uncertainty in these measurements is ± ~ 5 to 7% (absolute) (Boni et.al., 1990, Section 7); these differences are only slightly beyond those general bounds.

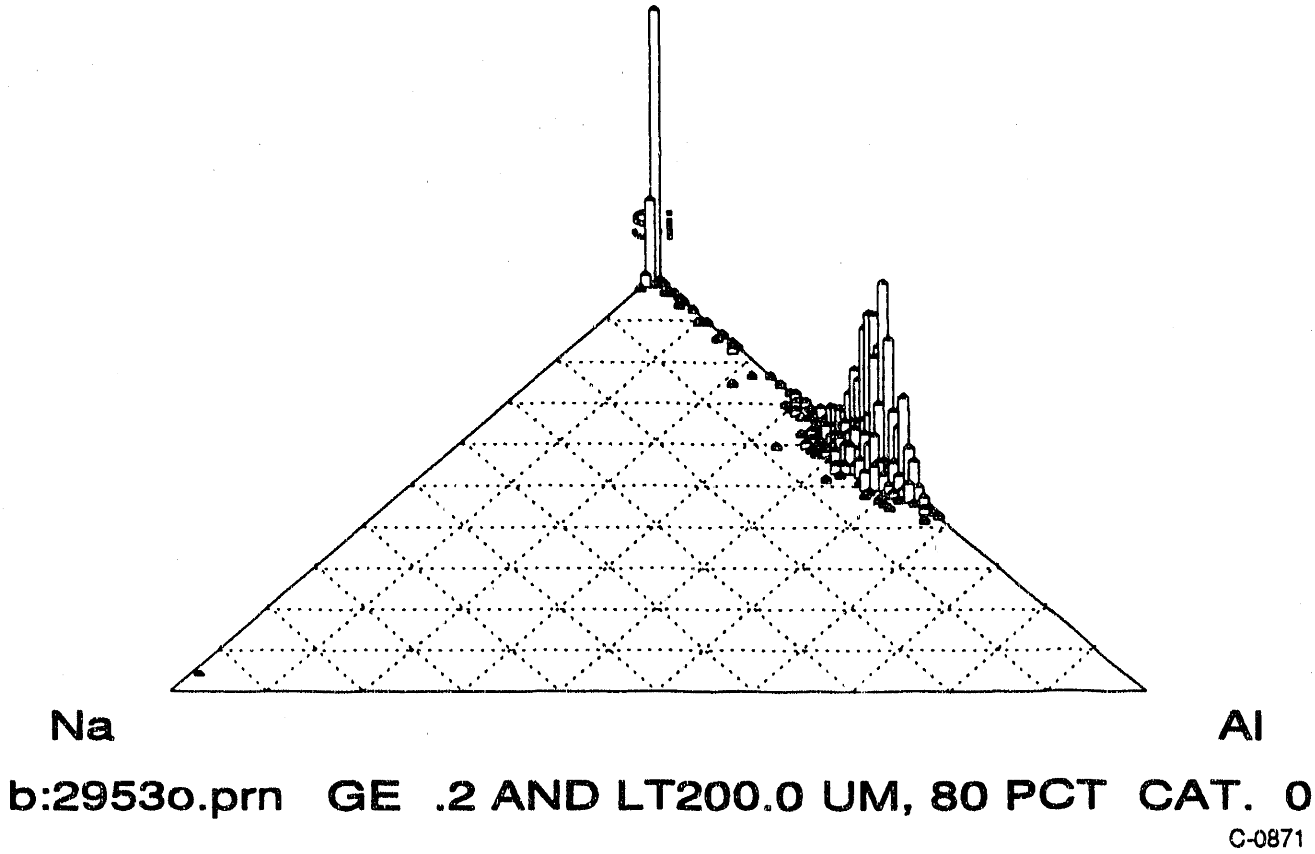

Figure 5-2 CCSEM ternary Na-Al-Si diagram for the Beulah coal tested at SECV. Each point represents a particle with Na + Al + Si of >80 mole% (oxygen-free basis). The height of each peak indicated the number of particles of a given composition.

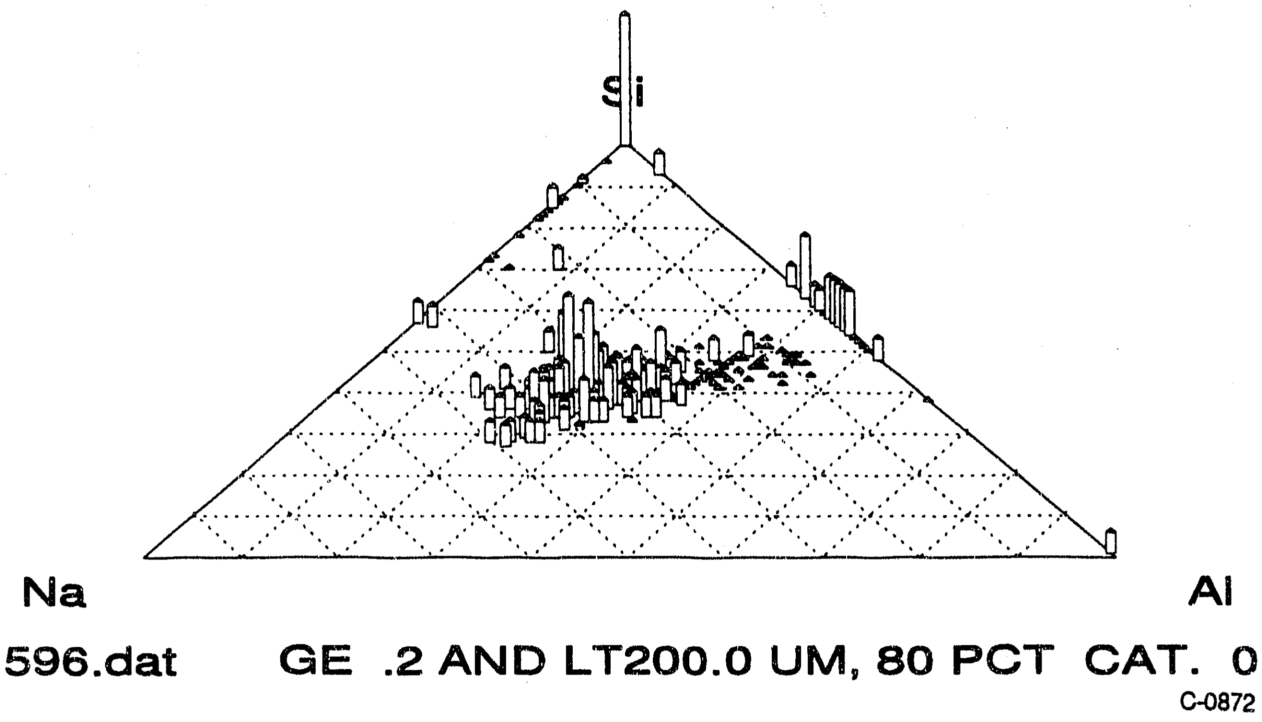

Figure 5-3. CCSEM ternary Na-Al-Si diagram for Beulah ash sampled in the combustion chamber, ring 7 at SECV. Each point represents a particle with Na + Al + Si of > 80 mole% (oxygen-free basis). The height of each peak indicated the number of particles of a given composition.

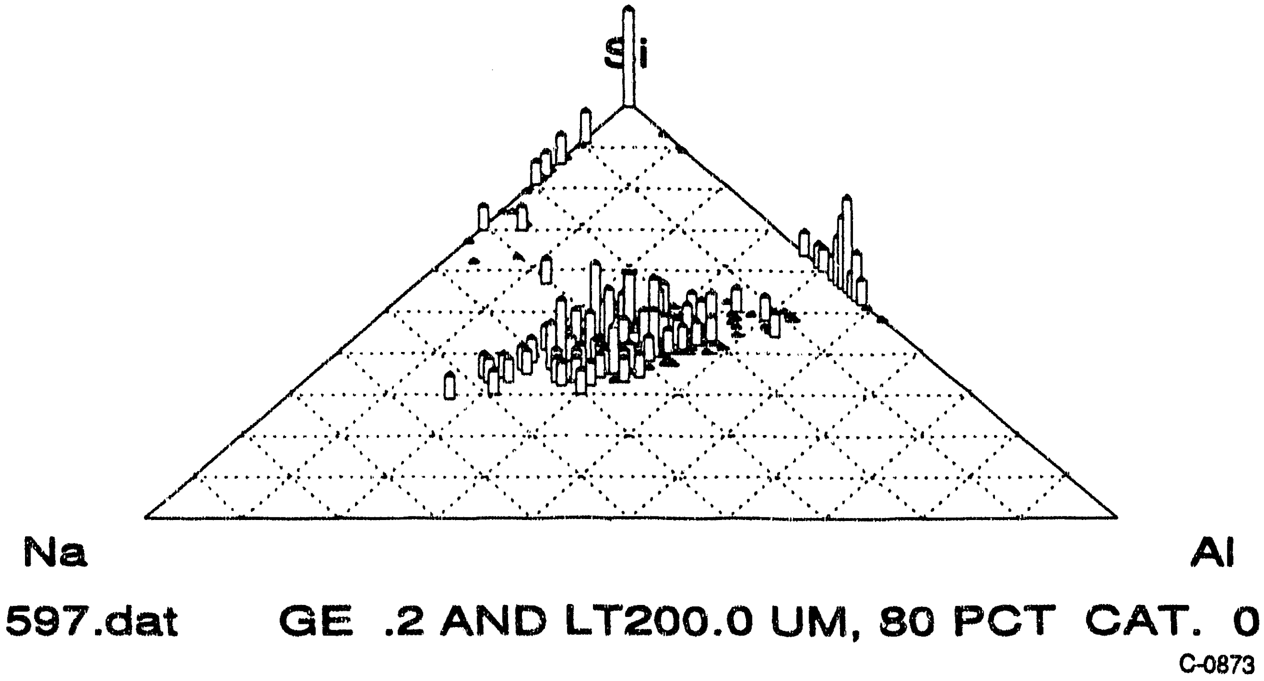

Figure 5-4. CCSEM ternary Na-Al-Si diagram for Beulah ash sampled form the horizontal duct at SECV. Each point represents a particle with Na + Al + Si of >80 mole% (oxygen-free basis). The height of each peak indicated the number of particles of a given composition.

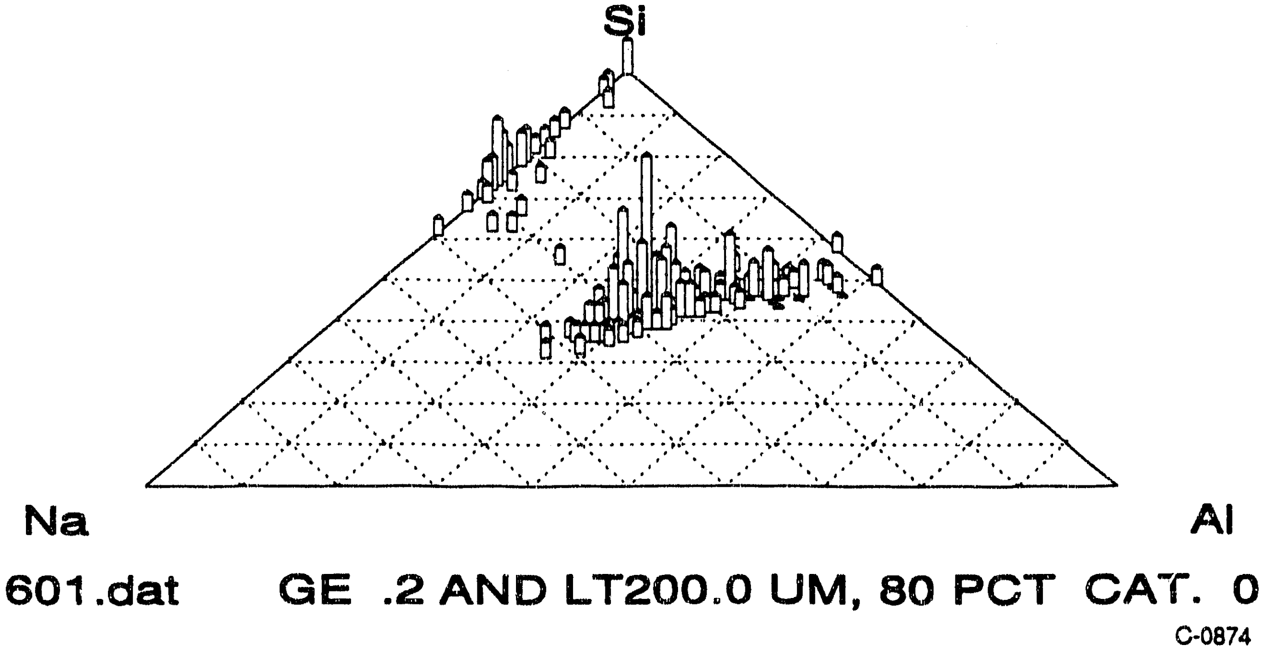

Figure 5-5. CCSEM ternary Na-Al-Si diagram for Beulah ash taken from the ESP hopper. Each point represents a particle with Na + Al + Si of >80 mole% (oxygen-free basis). The height of each peak indicated the number of particles of a given composition.

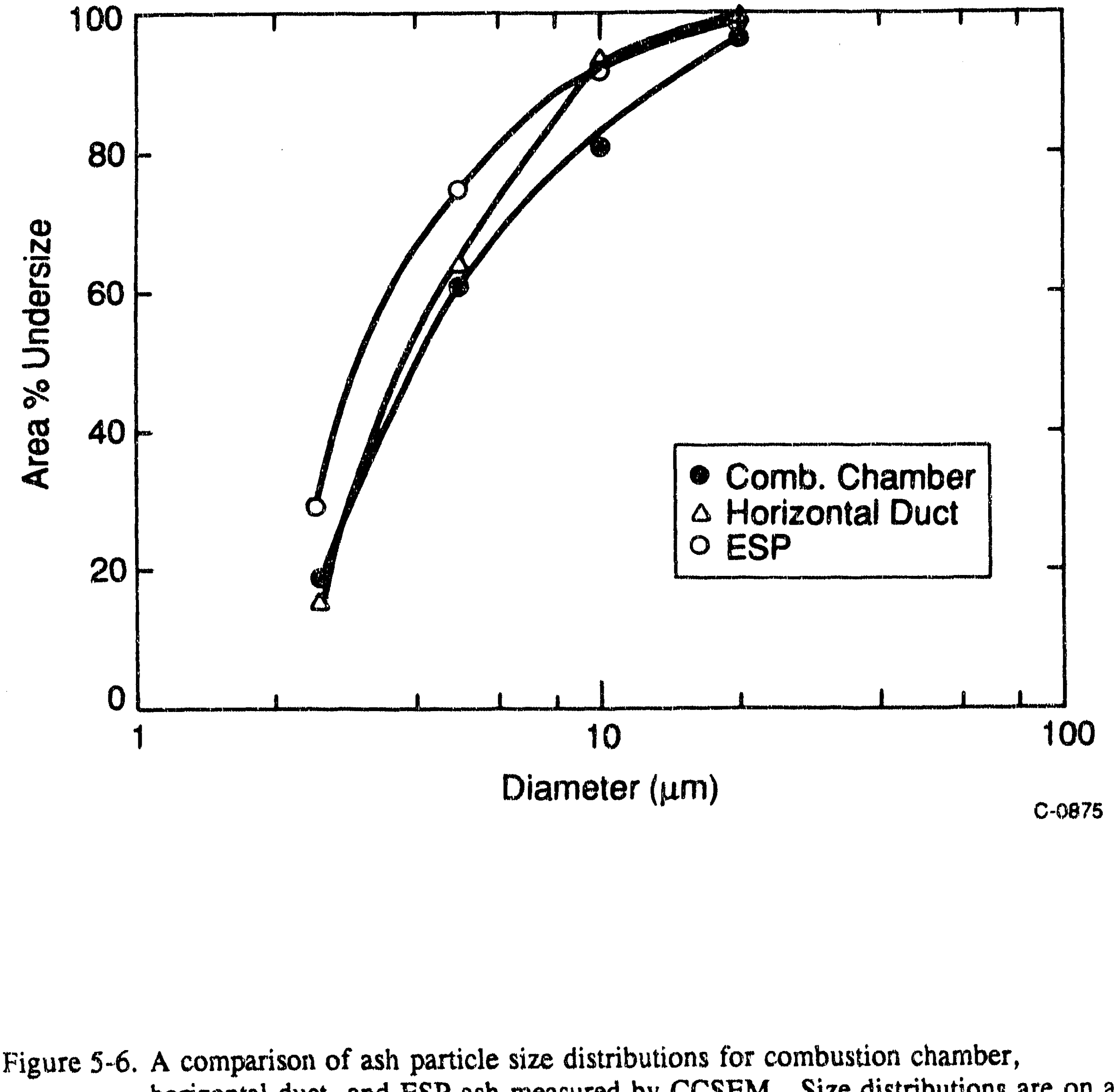

Figure 5-6. A comparison of ash particle size distributions for combustion chamber, horizontal duct, and ESP ash measured by CCSEM. Size distributions are on an overall (*not* cross-sectioned) particle area basis for a dispersed sample.

In Figures 5-7 and 5-8, the ash particle size distributions for the combustion chamber and ESP are replotted, this time excluding any ash particles containing ≥20 mole% sulfur. No difference is noted in the combustion chamber sample (Fig. 5-7), whereas a slight increase in size is noted in the ESP sample when high sulfur content particles are removed. This difference is, however, within the statistical uncertainty of the measurement. This suggests that while sulfate ash particles may contribute to the smaller ash size distribution observed in the ESP sample, other mechanisms are also important. Because the CCSEM does not consider carbon particles when analyzing ash particles, residual carbon is probably not the cause for the observed difference. (Loss-on-ignition measurements were the same for each sample [Helble et.al., 1991b]) It is therefore concluded that increasing sulfur content (Table 5-6) is primarily indicative of the sulfation of existing calcium rich ash particle surfaces.

The existence of calcium-rich ash particle surfaces is clearly evident from examination of Ca-Al-Si ternary diagrams. Figures 5-9 through 5-12 show coal and ash ternary diagrams for this system. Each point on the plot represents a specific molar composition of a particle containing greater than 80 mole% of the sum (Ca+Al+Si) on an oxygen-free basis. The height of each peak corresponds to the number of particles in the sample with the specified composition. In Figure 5-9 it is apparent that few calcium silicate or aluminosilicate minerals exist in the parent Beulah coal. Calcium concentrations in the mineral kaolinite (halfway along the Al-Si axis) are typically less than 10%. Examination of the combustion chamber, horizontal duct, and ESP ash samples in Figures 5-10, 5-11, and 5-12, respectively, show a marked increase in calcium aluminosilicate formation. Calcium-rich silicate compositions are also evident along the Ca-Si axis in the ESP ash sample (Figure 5-12).

Although the results are highly qualitative, the interactions between sodium, calcium, and aluminosilicate ash particles as a function of residence time can be observed from an examination of the major classes of ash particles present in a sample. Table 5-7 shows the major sodium and calcium containing ash particle categories observed in the three ash samples analyzed by CCSEM. In the table, the ordering of elements indicates their relative concentration, i.e., Na Al Si indicates that sodium was present in highest concentration, followed by aluminum and then silicon. The volume percentage of particles with these three elements being dominant and in the specified order is shown in the following columns. For the sodium aluminosilicate system, sodium decreases from being the major element to being third as residence time increases. This may be evidence of increasing reaction between the sodium and aluminosilicates, removing sodium from the outer surface of the particles. Decreasing calcium concentrations and increasing sulfur concentrations, also shown in Table 5-7, may be indicative of calcium sulfation with increasing residence time. These trends are consistent with those postulated from examination of CCSEM, AA, and XRD data previously discussed.

Although the chemical composition of the ash particles collected in the SECV test does not vary significantly from the compositions identified in PSIT and University of Arizona (UA) tests, the size distribution of the ash particles does. In Figure 5-13, ash

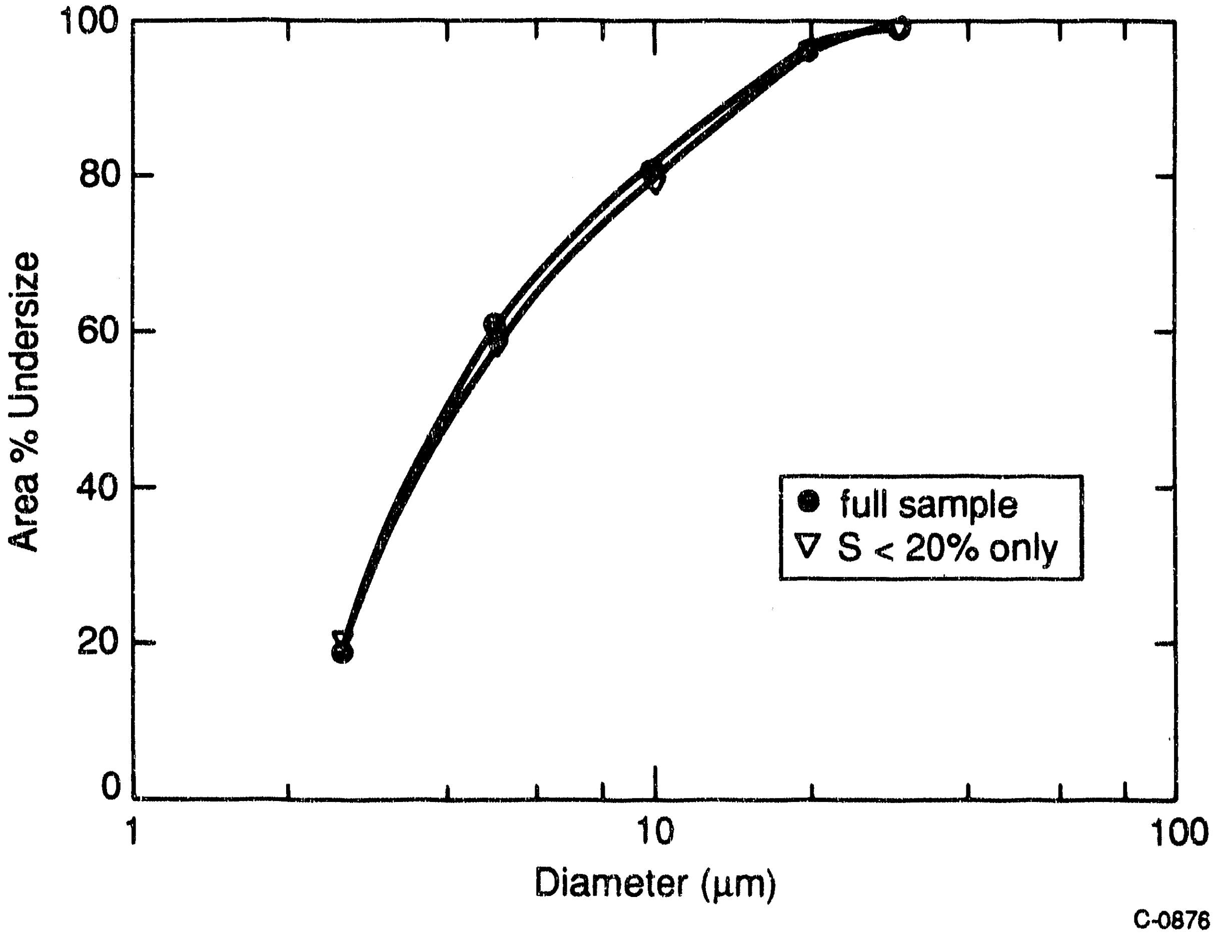

Figure 5-7. CCSEM ash particle size distributions for the combustion chamber ash sample, with and without high sulfur content ash particles.

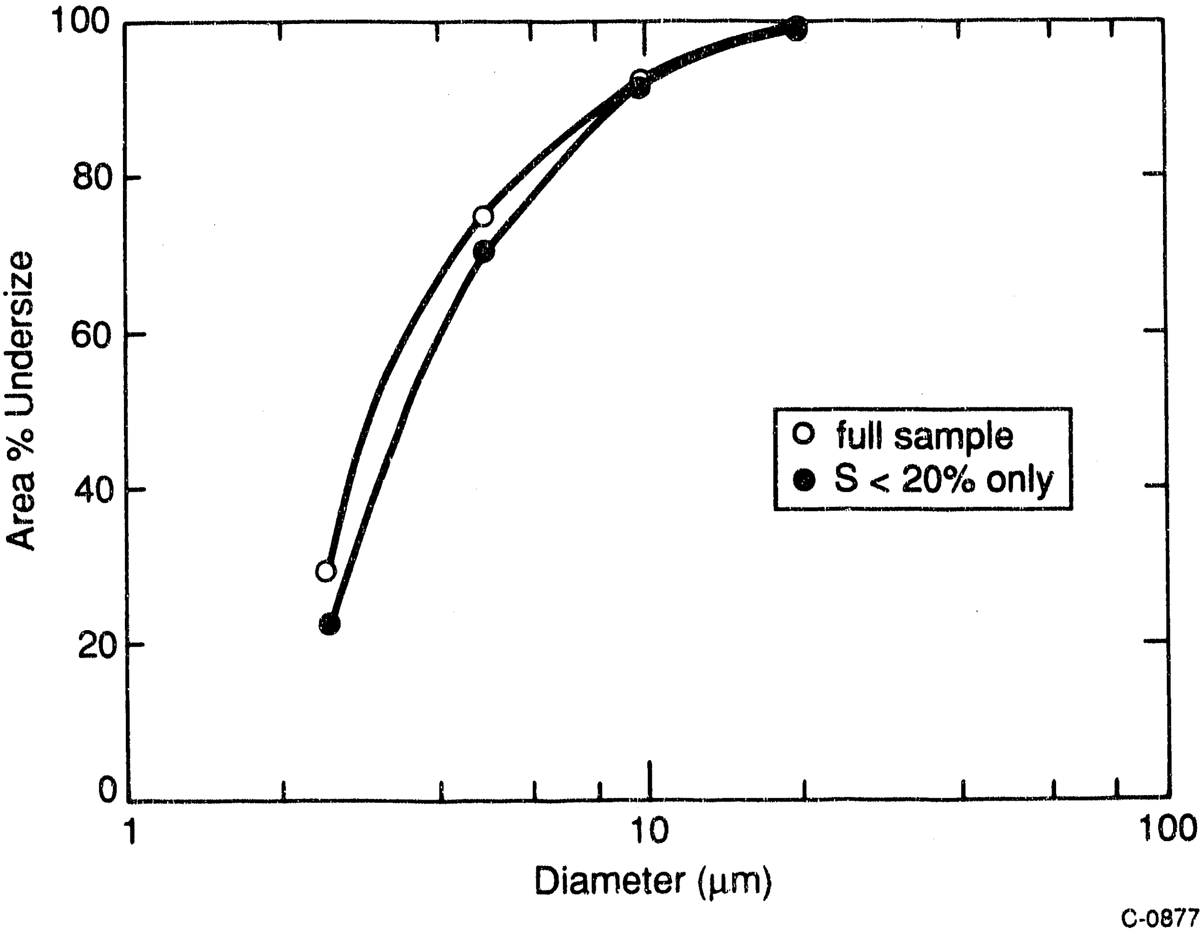

Figure 5-8. CCSEM ash particle size distributions for the ESP ash sample, with and without high sulfur content ash particles.

Table 5-6. Sulfur Content of Ash Particle Samples (CCSEM)

| Location | % of Particles With S>20% | Wt% $SO_3$ (CCSEM) |
|---|---|---|
| Comb. Chamber R7 | 21 | 14 |
| Horizontal Duct | 26 | 16 |
| ESP | 53 | 23 |

particle size distributions for PSIT and SECV tests are compared (similarity between PSIT and UA samples has been discussed previously - Boni et.al., 1990). Ash particle sizes measured in the SECV tests were considerably finer than those measured in PSIT laboratory testing. Examination of the mineral size distributions (Figure 5-14) reveals a much finer *mineral* size distribution for the Beulah coal studied at SECV, however. Analysis of the Beulah coal psd by Malvern techniques (ethanol as dispersant) revealed a coal psd similar to that of the coal used in the PSIT and UA laboratory test (Boni et.al., 1990; Helble et.al., 1991a), thus eliminating coal grind as a reason for the observed difference (Figure 5-15). Speculation centers on degradation of the large pyrite minerals previously identified, as the SECV sample was in storage for over two years prior to testing. Mössbauer analysis of the coal (pending) should provide more information in this regard.

In summary, analysis of Beulah lignite coal and ash samples by AA, CCSEM, and XRD techniques confirm prior laboratory scale identification of sodium aluminosilicate ash particles (of nepheline composition) forming during the combustion process. Their presence in the SECV ESP samples confirms their formation is not due to the small scale or sampling conditions employed in the PSIT and UA laboratory studies. Calcium rich surface compositions were also identified, again similar to PSIT and UA test results. Sulfation of these calcium rich surfaces was inferred from the results at longer residence times. In contrast to the chemical composition results, ash particle size distributions measured at the SECV 1 million Btu/hr furnace were much finer than those identified at the UA or PSIT reactors, 10 to 100 times smaller in scale. A finer mineral distribution in the SECV Beulah coal sample is believed responsible. The reasons for this finer mineral distribution are being further investigated. Future work shall therefore include Mössbauer analysis of the coal and ash to identify iron forms, and determine whether pyrite weathering and degradation had occurred in the SECV Beulah sample. Ca XAFS results on Beulah and Loy Yang samples are also pending at the University of Kentucky, and will be described in an upcoming report.

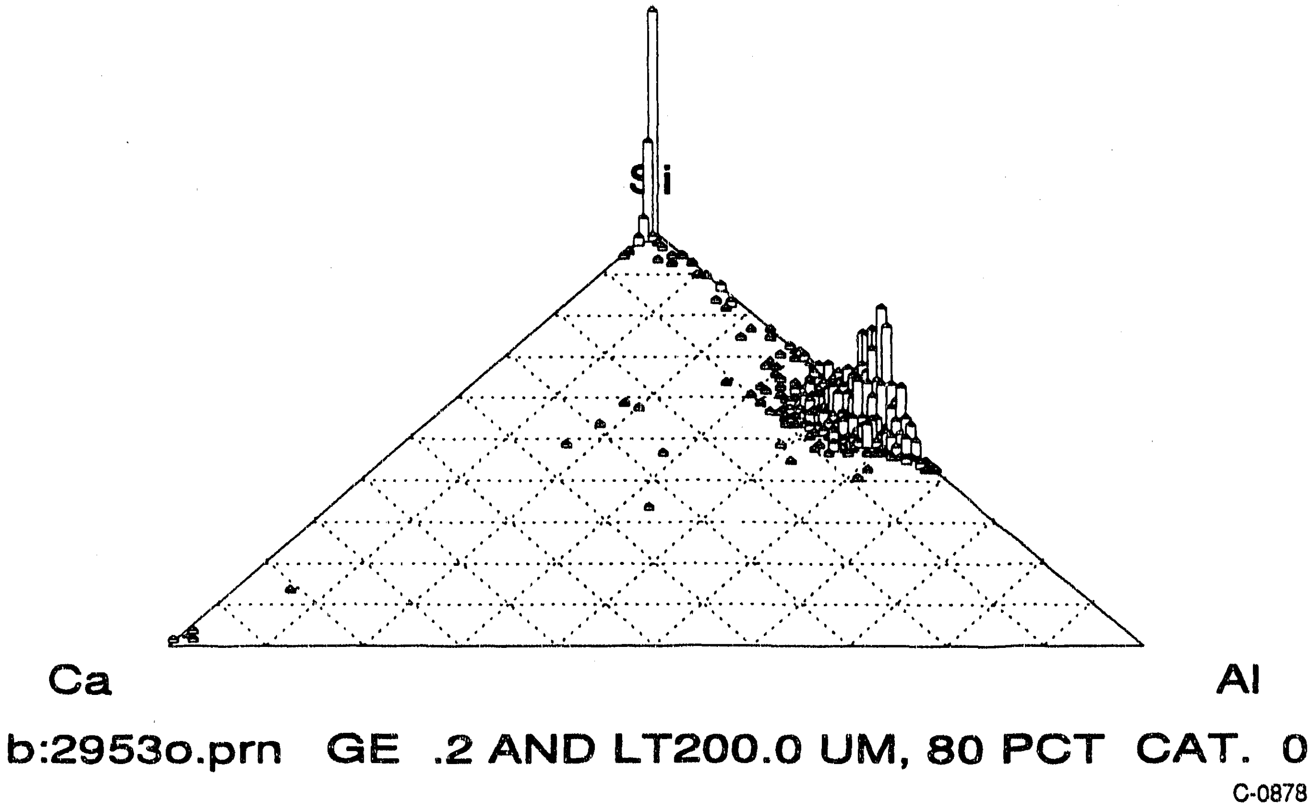

Figure 5-9. CCSEM ternary Ca-Al-Si diagram for the Beulah coal tested at SECV. CCSEM analysis by UND EERC.

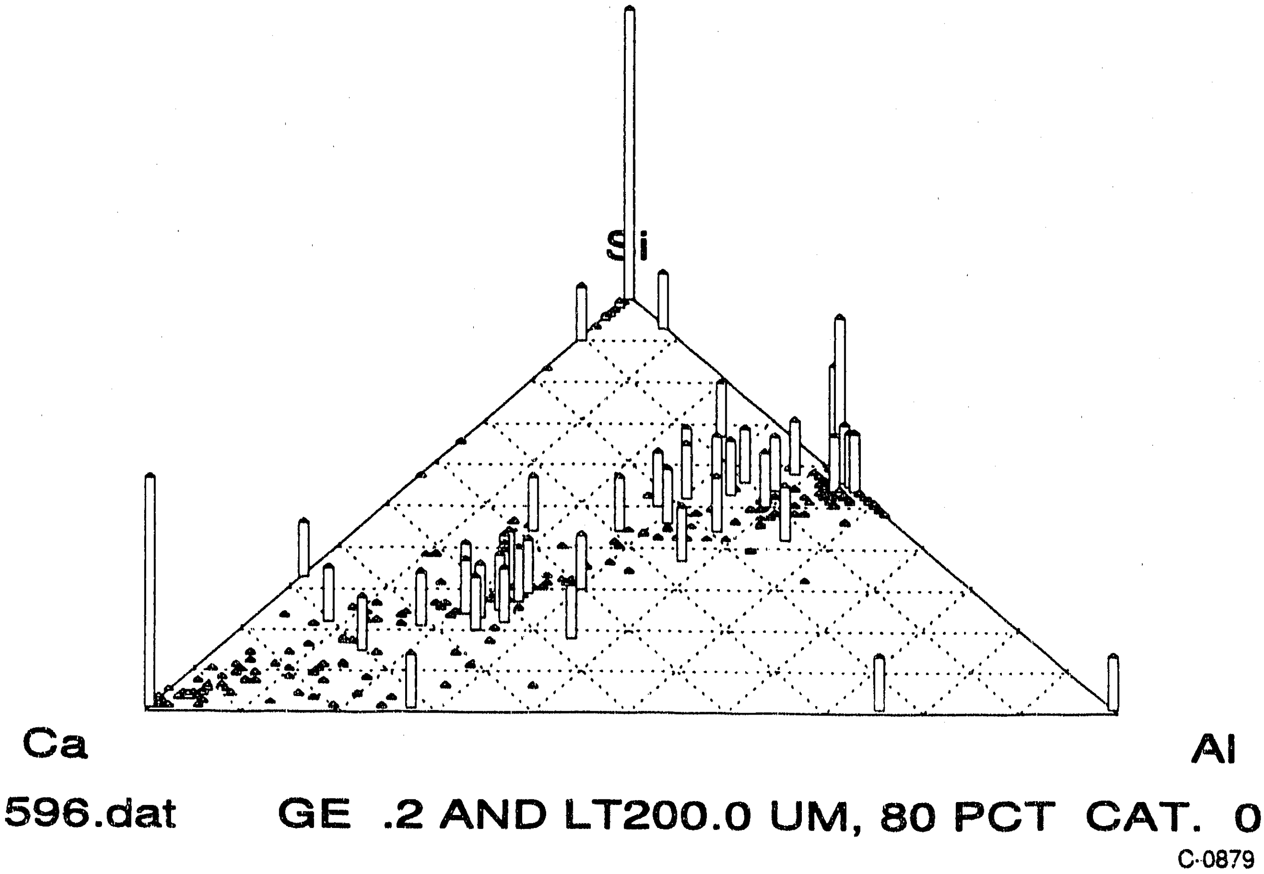

Figure 5-10. CCSEM ternary Ca-Al-Si diagram for Beulah ash sampled in the combustion chamber, ring 7 at SECV. CCSEM analysis by U. Kentucky.

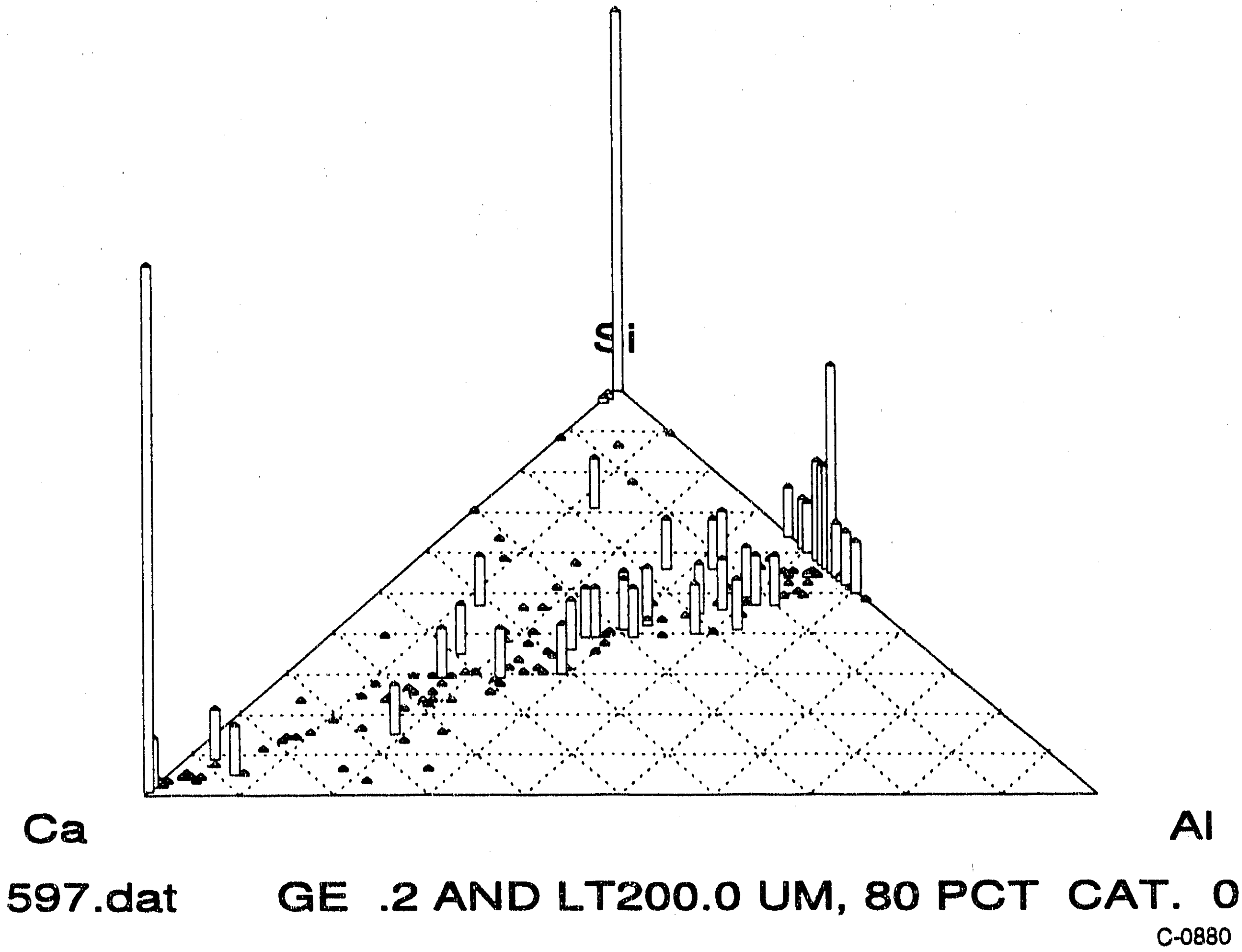

Figure 5-11. CCSEM ternary Ca-Al-Si diagram for Beulah ash sampled from the horizontal duct at SECV. CCSEM analysis by U. Kentucky.

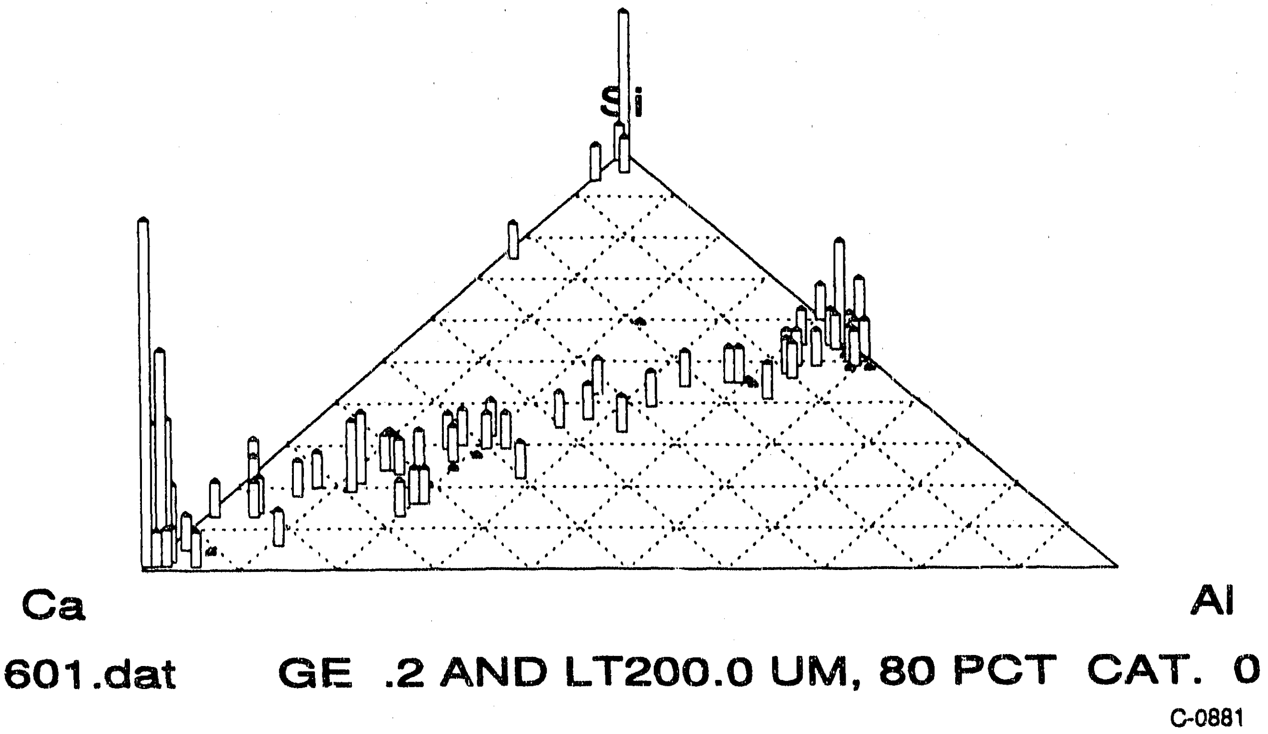

Figure 5-12. CCSEM ternary Ca-Al-Si diagram for Beulah ash taken from the ESP hopper. CCSEM analysis by U. Kentucky.

Table 5-7. Major Na and Ca Ash Compositions Identified by CCSEM (vol%)

| Ash Category | Comb. Chamber | Horizontal Duct | ESP |
|---|---|---|---|
| Si Al Na | 11.5 | 11.7 | 15.9 |
| Si Na Al | 7.5 | 9.7 | 9.1 |
| Na Si Al | 4.7 | 3.5 | 2.5 |
| Ca Si Al | 5.2 | 4.0 | 3.5 |
| Si Al Ca | 3.0 | 4.5 | 3.1 |
| Ca S | 5.0 | 4.6 | 2.5 |
| Ca S Na | 2.4 | 2.3 | 4.1 |
| S Ca Na | 2.5 | 3.2 | 4.6 |
| S Na Ca | 1.6 | 2.6 | 8.3 |

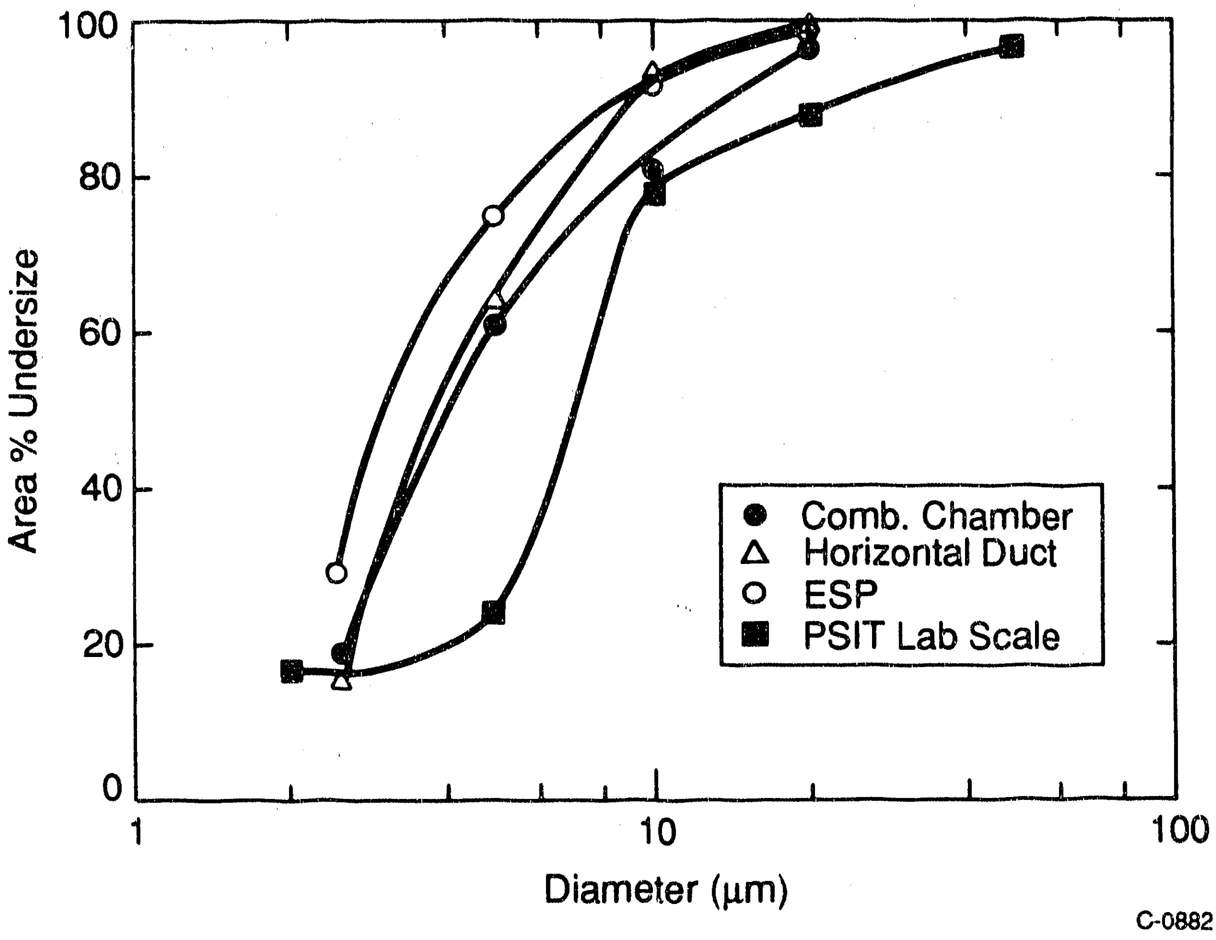

Figure 5-13. Comparison of PSIT/SECV and PSIT Beulah lignite ash particle size distributions.

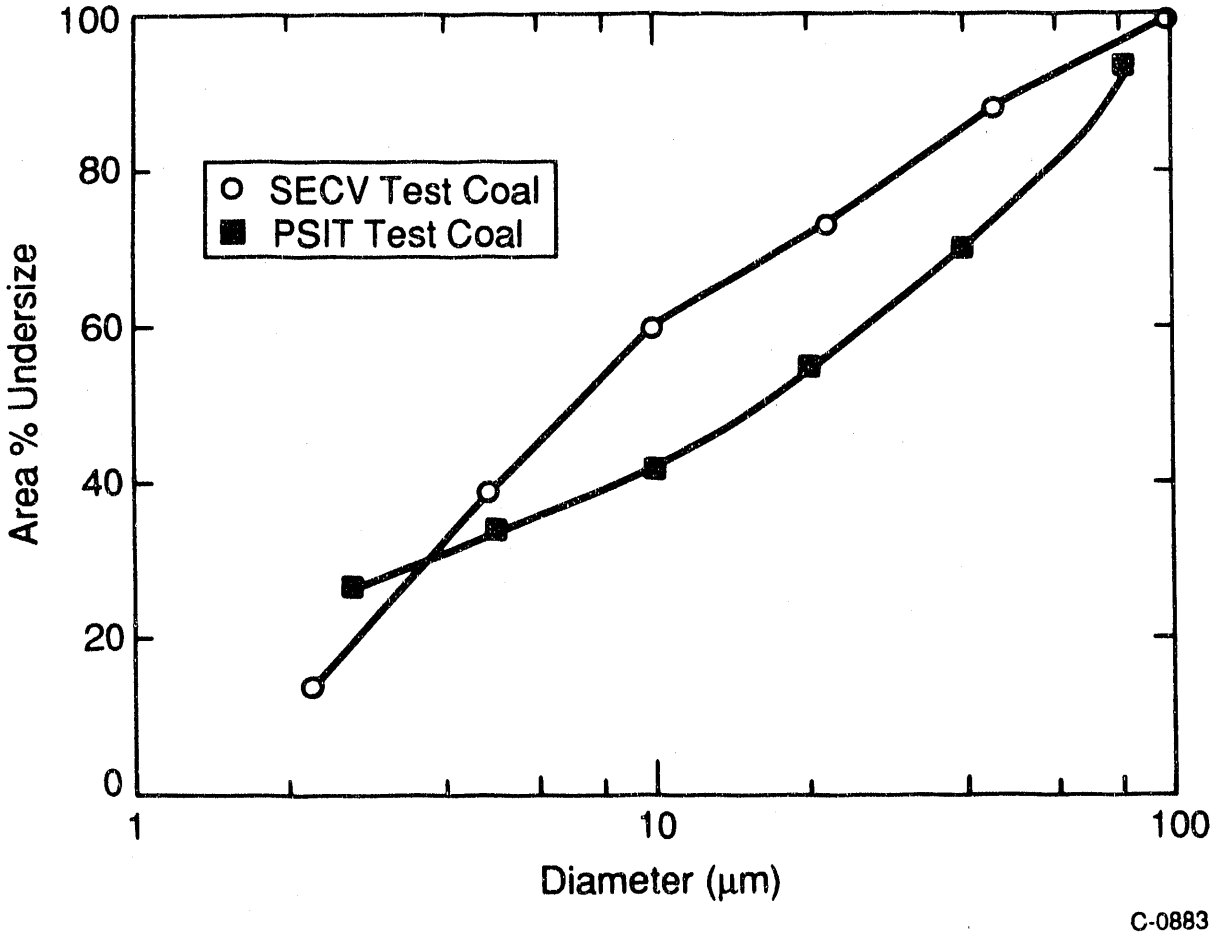

Figure 5-14. Beulah lignite mineral size distributions for PSIT and PSIT/SECV samples.

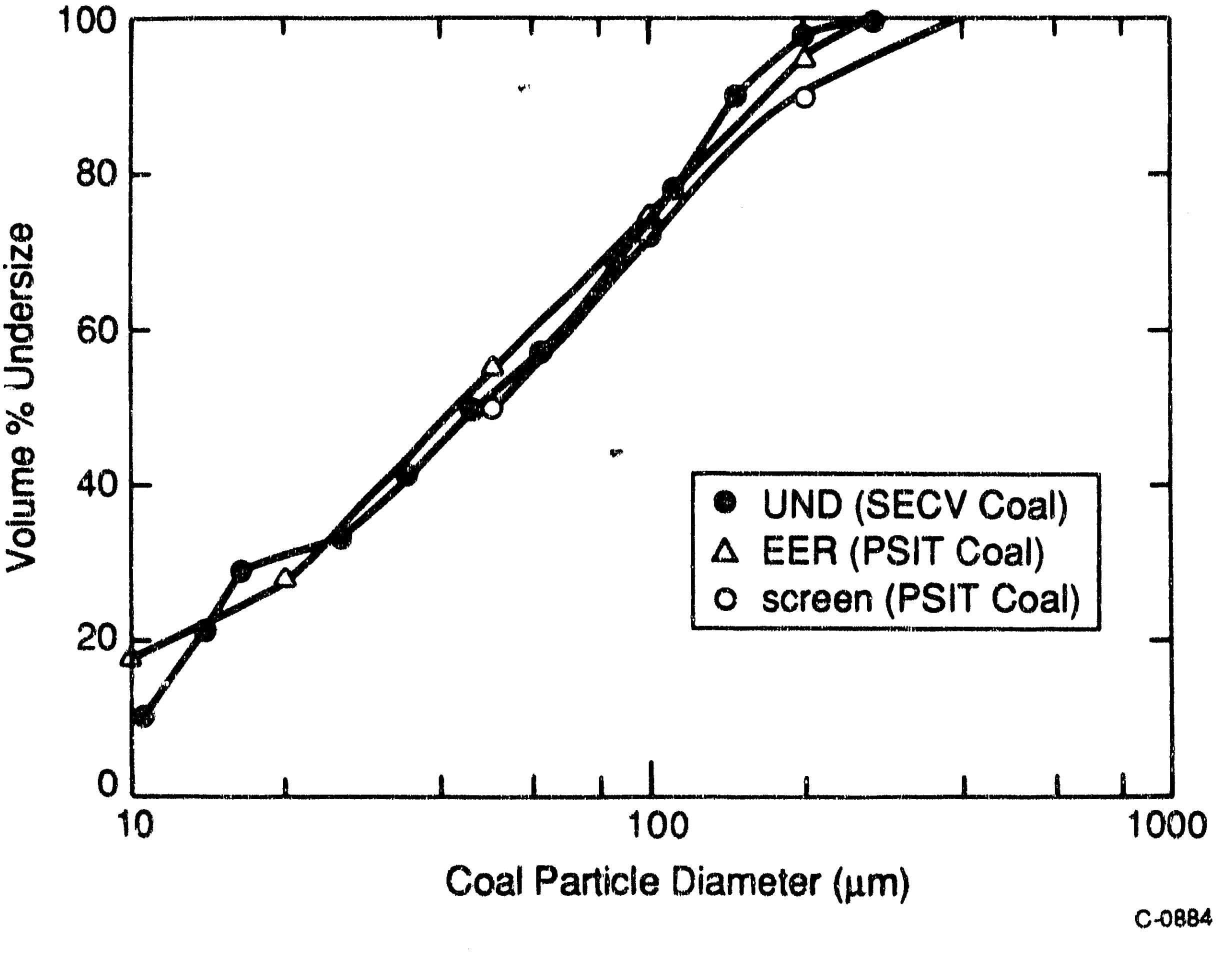

Figure 5-15. Beulah lignite coal particle size distributions.

## 5.3 References

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