SINGLE SHELL TANK
WASTE CHARACTERIZATION PROJECT

Core 16 DATA REPORT

Revision 0

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INTRODUCTION

This Data Package contains results obtained by Pacific Northwest Laboratory (PNL) staff in the characterization and analyses of Core 16 segments taken from the Single-Shell Tank (SST) 110B. The characterization and analysis of Core 16 segments are outlined in the Waste Characterization Plan for Hanford Site Single-Shell Tanks and in the Pacific Northwest Laboratory (PNL) Single-Shell Tank Waste Characterization Support FY 89/90 Statement of Work (SOW), Rev. 1 dated March, 1990. Specific analyses for each sub-sample taken from a segment are delineated in Test Instructions prepared by the PNL Single-Shell Tank Waste Characterization Project Management Office (SST Project) in accordance with procedures contained in the Single Shell Tank (SST) Waste Characterization Project Procedure Compendium (PNL-MA-599). Analytical procedures used in the characterization activities are also included in PNL-MA-599.

Core 16 included five segments although segment 1 did not have sufficient material for complete characterization. The five samplers were received from Westinghouse Hanford Company (WHC) on 5/7/90 to 5/8/90. Each segment was contained in a sampler and was enclosed in a shipping cask. The shipping cask was butted up to the 325-A hot cell and the sampler moved into the hot cell. The material in the sampler (i.e., the segment) was extruded from the sampler, limited physical characteristics assessed, and photographed. At this point samples were taken for particle size and volatile organic analyses. Each segment was then homogenized. Sub-samples were taken for required analyses as delineated in the appropriate Test Instruction. Table 1 includes sample numbers assigned to Core 16 segment materials being transferred from 325A Hot Cell. Table 2 lists Core 16 sub-sample numbers per sample preparation method.

Requested analyses for Core 16 homogenized segments included: Wt-% Solids; inductively-coupled argon plasma atomic emission spectroscopy (ICP) analysis, gamma energy analysis (GEA), total alpha, total beta, and uranium analysis, in duplicate, from samples that had been fused with potassium hydroxide (KOH); ICP on duplicate samples from an acid leach as per Environmental Protection Agency (EPA) protocols; and anion analysis, total organic carbon, and pH on duplicate samples from a water leach procedure. Analyses requested for the Core Composite included all of the analyses outlined above plus an extensive array of radiochemical, inorganic, and semivolatile organic analyses.

The data within this package are divided into four groups: physical testing, inorganic analysis, radiochemical analysis, and organic analysis. Specific data within a group are generally separated by individual segment or the Core Composite. All chemical analysis data are reported on a per wet-weight basis. That is, no corrections were made for the Wt-% water in the samples. Essentially all sample preparations were completed in duplicate. Thus, duplicate analysis data are available for most samples. The quality control (QC) requirements for each sample is defined in specific test instructions. To the extent practical, the QC requirements outlined in EPA documents such as SW-846 and the CLP-SOW were followed. All QC data are included in this data package.

All chemical analysis data are available on Lotus/Excel compatible diskette files.

TABLE 1: SST Core 16 Sample Numbers

Segment #	Prehomogenized Segment	Homogenization Test	Homogenization Analyses	Composite Test	Composite Analyses
1	90-3514 90-3515				
2	90-3516 90-3517				
3	90-3518 90-3519	90-3617 90-3618			
4	90-3520 90-3521				
5	90-3522 90-3523	90-3619 90-3620			
Composite				90-4178 90-4179	90-4180

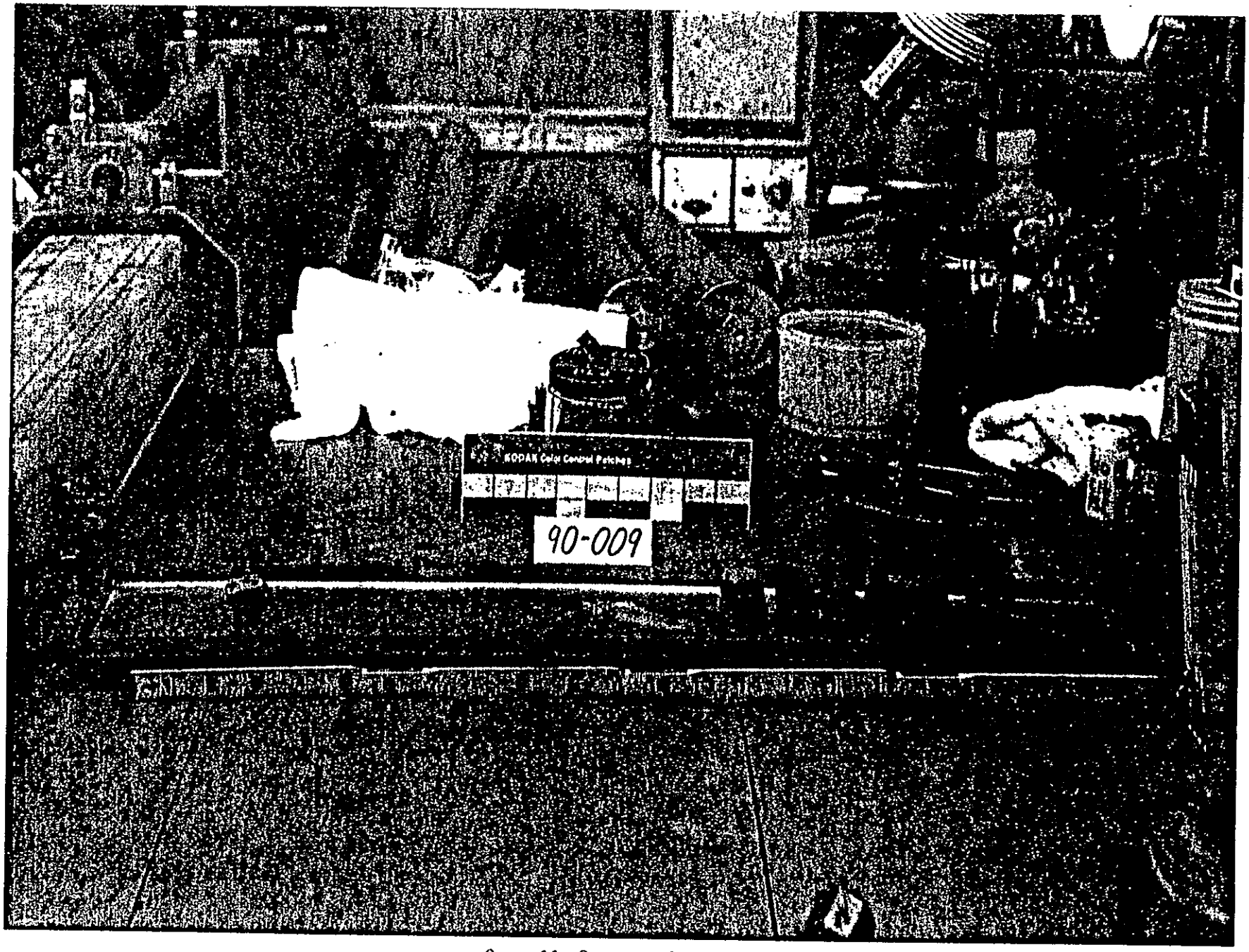
TABLE 2: SST Core 16 Sub-Sample Numbers by Sample Prep Method

Sample Prep Method	Primary Sample Number	Duplicate Sample Number	Spike Sample Number	Spike Control Sample Number	Blank Sample Number
Volatile	90-3514 90-3516 90-3518 90-3520 90-3522				
Particle Size	90-3515 90-3517 90-3519 90-3521 90-3523				
Fusion[a]	90-3617-A-1 90-3618-A-1 90-3619-A-1 90-3620-A-1 90-4178-A-1 90-4179-A-1	90-3617-A-2 90-3618-A-2 90-3619-A-2 90-3620-A-2 90-4178-A-2 90-4179-A-2			90-3617-A-3 90-3619-A-3 90-4178-A-3
Acid Leach	90-4180-A-1 90-4180-B-1	90-4180-A-2 90-4180-B-2	90-4180-A-3 90-4180-B-3	90-4180-A-4 90-4180-B-4	90-4180-A-5 90-4180-B-5
Water Leach	90-4180-C-1	90-4180-C-2	90-4180-C-3	90-4180-C-4	90-4180-C-5
Mercury	90-4180-D-1	90-4180-D-2	90-4180-D-3	90-4180-D-4	90-4180-D-5
Semi-Volatile	90-4180-E-1	90-4180-E-2	90-4180-E-3	90-4180-E-4[d]	90-4180-E-5
TOX/EOX	90-4180-F-1	90-4180-F-2	90-4180-F-3		90-4180-F-4
Cyanide[b]	90-4180-G-1	90-4180-G-2	90-4180-G-3	90-4180-G-4[c]	90-4180-G-5
Wt % Solids	90-4180-C-1	90-4180-C-2			

[a] - Radiochemistry samples included with the fusion preparation
[b] - Cyanide Analysis not completed at this time
[c] - Cyanide Standard (Undiluted)
[d] - Matrix Spike Duplicate

SECTION 1

PHYSICAL DATA TABLES



Core 16, Segment 1

DESCRIPTION OF EXTRUDED SEGMENTS

Five Core 16 samplers from Tank 110B Riser 6 were received and extruded. Cores 1 and 2 which were taken from Riser 7 and core 3 from riser 5 are near riser 6. The mass, volume, and density for each of the segments extruded is given in Table 3. The photograph of extruded segment 1 can be found on pages 1-2; Color photographs for segments 2-5 are not available due to technical difficulties. Small black-and-white polaroid prints are available for all segments but were not included in the report.

Segment 1 contained approximately 9 inches of sample. The expected length of the sample was 9 inches; therefore, this segment contained 100% of the expected length of sample. The sample extruded in approximately inch pieces. The first portion extruded (the bottom of the segment) was an inch long piece of light brown sludge. A long void (approximately 8 inches) was observed before the rest of the segment was extruded. A small piece (1/4" long) of light brown sludge was extruded with a small amount of drainable liquid (< 10 ml) followed by inch pieces of dark brown sludge (approximately 8 inches in total length).

Segment 2 was a full segment (19 inches) whose color varied gradually along the length of the segment. The entire length of the segment was creamy in texture and held its shape upon extrusion. The sludge varied gradually from dark brown at the top of the segment to light tan at the bottom of the segment with light and dark streaks of sludge throughout the top 6 inches of the segment.

Segment 3 was a light tan sludge which held its shape upon extrusion. The segment extruded in chunks 1 to 2 inches in length. The top 6 inches of the segment was split along the length of the sample. A hard solid chunk was observed in the sample which may have caused this split. The texture of the sludge was granular over the entire length of the segment.

Segment 4 was a light tan sludge which upon extrusion broke off in 1 to 1.5 inch pieces. The segment was creamy in texture and appeared to contain more moisture than observed in segments 2 and 3. The sample held its shape upon extrusion.

Segment 5 was a creamy sludge whose color varied gradually along the length of the segment. The sludge varied gradually from brown at the bottom

of the segment to light tan at the top of the segment. Unlike segments 3 and 4, upon extrusion segment 5 had very few breaks over the length of the sample. Except for approximately the top inch of the segment, the sample held its shape upon extrusion.

The penetration resistance of the unhomogenized samples was measured on segments 1, 3, and 4. All of these segments had penetration resistances of < 2 psi indicating that the solids in this core exhibit cohesive properties.

TABLE 3: Core 16 Prehomogenized Segment Data

Segment	Mass (g)	Volume (ml)	Density (g/ml)
1	149.84	115	1.29
2	314.18	245	1.28
3	319.34	245	1.31
4	317.63	245	1.30
5	295.48	245	1.21

PHYSICAL PROPERTIES

Table 4 lists the physical data for the Core 16 composite material. Duplicate runs were performed on each measurement listed in Table 4. A single value is reported for weight percent undissolved solids since this value is calculated from the difference in the weight percent total solids and weight percent dissolved solids. The density of the core composite material is 1.37 g/ml. The density of the interstitial liquid, as indicated by the centrifuged supernate density, and the density of the centrifuged solids are 1.24 and 1.51 g/ml, respectively. As measured in the 325A Hot Cell facility, the core composite contains 41.6 wt% total solids and 24.4 wt% undissolved solids.

Weight percent total solids were also obtained for homogenized segments 3 and 5 (homogenization check samples), and the core composite samples transferred to the 325B hot cell facility. These results are reported in Table 5. As shown in Table 5, the average wt% solids of the homogenized segments 3 and 5 are 40.3 and 42.9 wt%, respectively. The average wt% solids of the core composite sample is 43.0 wt%. The wt% total solids measured on the composite core material transferred to the 325B hot cell facility and used for analytical measurements is comparable to the wt% solids listed in Table 4

(41.6 wt%). Duplicates were not performed on the segment 3 analysis due to limited sample. Weight percent solids were not performed on the top sample of the segment 5 homogenization check due to limited sample and were not requested on the bottom sample of the composite check.

TABLE 4: SST Core 16 Composite Physical Data

	Trial #1	Trial #2	Average
Slurry Density (g/ml)	1.38	1.37	1.37
Centrifuged Solids Density (g/ml)	1.51	1.52	1.51
Centrifuged Supernate Density (g/ml)	1.25	1.24	1.24
Wt% Centrifuged Solids	53.9	53.7	53.8
Vol% Centrifuged Solids	49.2	48.3	48.7
Wt% Total Solids	41.7	41.5	41.6
Wt% Dissolved Solids	17.2	17.1	17.2
Wt% Undissolved Solids			24.4

TABLE 5: SST Core 16 Weight Percent Solids Values

Sample Description	ALO #	Wt% Solids
Segment 3 (Average)	--	40.25
Top	90-3617-H1	40.79
Bottom	90-3618-H1	39.70
Segment 5 (Average)	--	42.86
Bottom	90-3620-H1	43.02
	90-3620-H2	42.69
Composite (Average)	--	42.99
Composite Check (Top)	90-4178-H1	42.82
	90-4178-H2	43.71
Composite Analysis	90-4180-H1	42.59
	90-4180-H2	42.85

Duplicate pH measurements of the water leach of the composite core are reported in Table 6. The C-5 value is a blank water leach sample. The pH of the composite core water leach is 8.1, indicating that the core sample is caustic.

TABLE 6: SST Core 16 pH Values

Sample Description	ALO #	pH Value
Composite	90-4180-C1	8.12
	90-4180-C2	8.08
	90-4180-C5	7.41

THERMAL ANALYSIS

Scanning thermogravimetry (STG) and differential scanning calorimetry (DSC) were performed in duplicate on the homogenized Core 16 composite. These two thermal analysis techniques are useful in determining the thermal stability or reactivity of a material. DSC measures heat released or absorbed while the temperature of the sample is increased at a constant rate. STG measures the mass of a sample while the temperature of the sample is increased at a constant rate. Both methods can be modified to measure isothermal changes in the material.

DSC is often used to measure thermal decomposition temperatures, heats of reaction, reaction temperatures, melting points, and solid-solid transition temperatures. STG is used to measure thermal decomposition temperatures, water contents, and reaction temperatures. The two methods often provide complimentary information.

The calibration of the differential scanning calorimeter and the thermogravimetric analyzer were checked before running these samples. An indium standard was run on the calorimeter to check the temperature and enthalpy calibrations. The balance calibration of the thermogravimetric analyzer was checked with a 100 mg standard weight, and the temperature calibration of the analyzer was checked with alumel and perkalloy curie point magnetic transition standards. The temperature and enthalpy calibration checks on the DSC were within 0.1°C and 0.1 cal/g of their reported values. The balance and temperature calibrations on the TGA were within 0.01 mg and 3°C.

Figures 1 and 2 are duplicate DSC analysis of the Core 16 composite material. In these DSC plots two broad transition regions are observed. The first region begins at the lower temperature limit of the analysis (30°C) and essentially all the transitions in this region are completed by 160°C. Several transitions are observed in this region, but the individual transitions are not resolvable although this transition can be resolved into two peak areas. Table 7 presents the thermal data obtained for this transition and each of the two peak areas. Because the individual transitions

are not resolvable, the onset temperature and peak maximums for this region were not determined.

The most likely reaction occurring in the first transition region (30 to 160°C) is evaporation of the bulk and interstitial water of the core composite material. The first peak area is probably due to the evaporation of unbound water in the sample, while the second peak area is probably due the loosely bound water in the sample.

The second transition region occurs at approximately 300°C and appears to be a single endothermic transition with an onset temperature of approximately 290°C. The enthalpy change of this transition is approximately 4 calories/gram of sample. Therefore, this peak is small relative to the water loss transitions. The temperature range, temperature of the peak maximum, onset temperature, and enthalpy change for this transition are also reported in Table 7. This endotherm is most likely due to the melting of salts with $NaNO_3$ being the most prevalent. The melting temperature of pure NaNO3 is 308°C. The decrease in the melting temperature and the broadening of the peak may be due to the presence of other salts. Based on the IC and ICP results $NaNO_3$ should be the predominant salt present in the waste.

Figures 3 through 8 (runs 2 through 7) present the thermogravimetric curves for the Core 16 composite material. Seven thermogravimetric runs were made on the core 16 composite material. The first thermogravaimetric run indicated that initially the sample gained a significant amount of weight; therefore, this run was considered invalid. The data from the third run was inconsistent with the previous run and was not used in calculating the average wt%. In order to obtain acurate data additional runs were performed. The weight percent of the sample remaining in the sample pan at 200°C and near the end of the run (~540°C) for runs two through seven is reported in Table 7. Based on these analysis, the core composite contains 46 wt% total solids. These results are slightly higher than the results shown in Tables 4 and 5 (43 wt%), but an additional 2.5% weight loss is observed between 200 and 540°C. If this additional loss is included, these results are within experimental error of the results obtained by gravimetric methods. This additional water loss may indicate that all the water in the sample is not released during the first part of the thermogram and that the water loss from these samples may be

explain the discrepancy between the gravimetric and thermal analysis methods of determining weight % solids.

At the heating rates at which these thermogravimetric curves were recorded, two different water loss steps can be identified but not resolved. This is consistent with the DSC plots observed for this core.

TABLE 7: Core 16 Thermal Analysis Data

Differential Scanning Calorimetry

	Run 1	Run 2
Water Transitions		
Total Transition Region		
Temp. Range (°C)	32 to 160	32 to 160
Enthalpy Change (cal/g)	248	285
First Peak Area		
Temp. Range (°C)	32 to 100	32 to 115
Enthalpy Change (cal/g)	158	171
Second Peak Area		
Temp. Range (°C)	90 to 160	105 to 160
Enthalpy Change (cal/g)	90	114
Melting point Transition		
Temp. Range (°C)	280 to 310	280 to 310
Temp. Peak Maximum (°C)	296	298
Onset Temp. (°C)	287	288
Enthalpy Change (cal/g)	4	5

Thermogravimetry

		200°C	540°C
Weight % Solids	Run 2	46.8	44.9
	Run 3	51.4	48.9
	Run 4	45.7	43.0
	Run 5	46.0	43.4
	Run 6	47.4	44.8
	Run 7	45.2	42.7
	Average	46.2	43.8

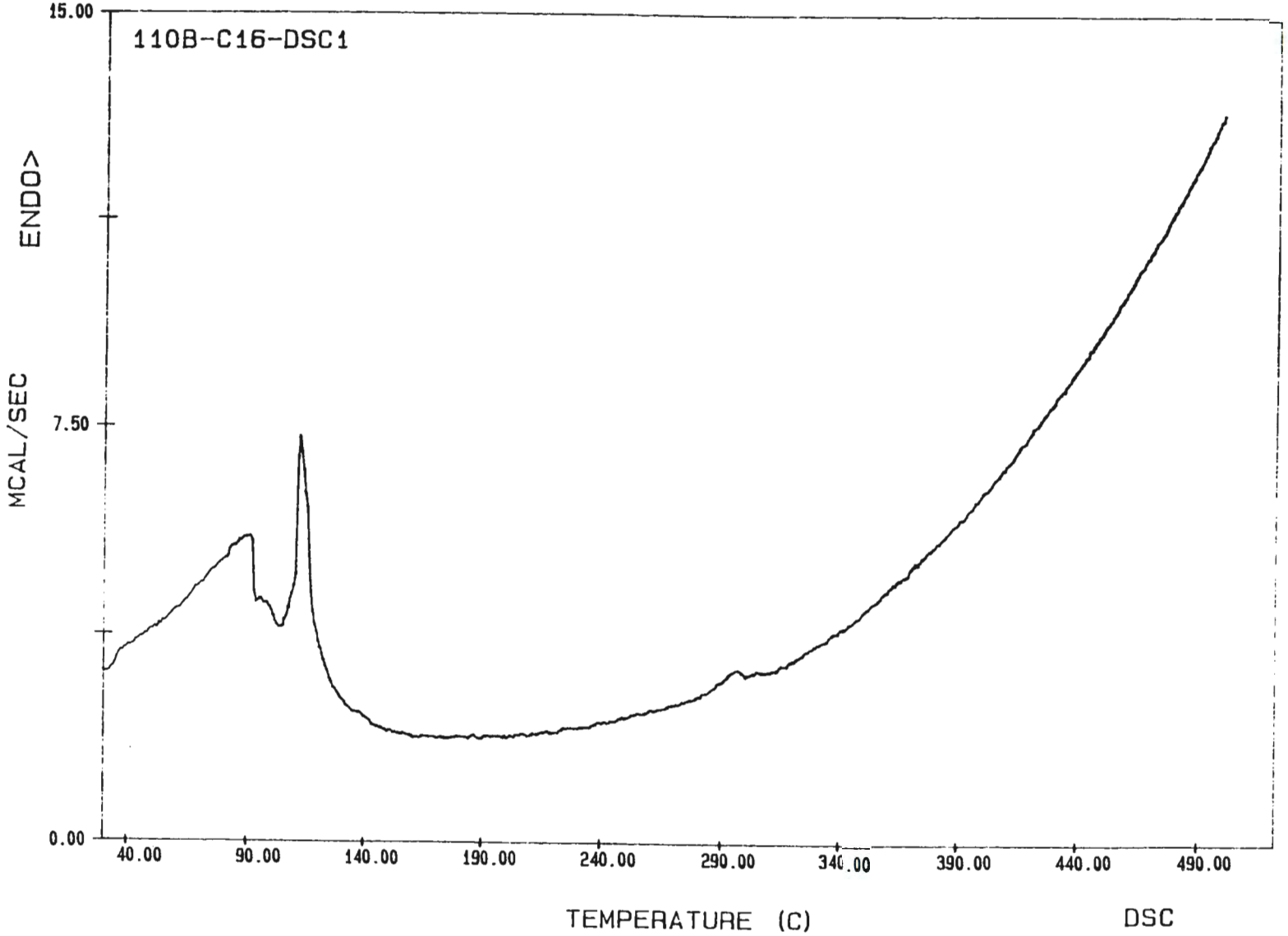


FIGURE 1: DSC Plot Core 16 Composite, Run 1

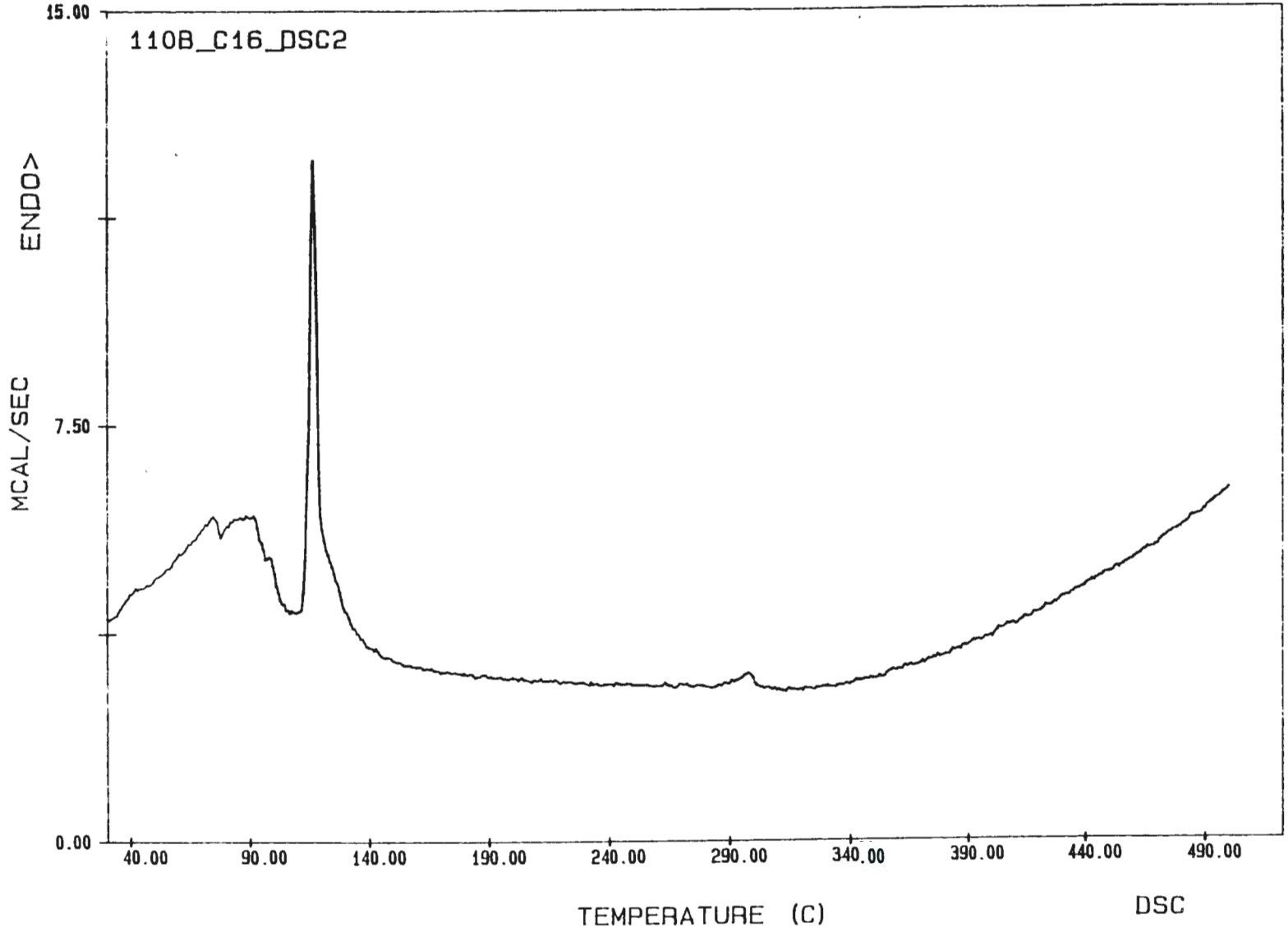


FIGURE 2: DSC Plot Core 16 Composite, Run 2

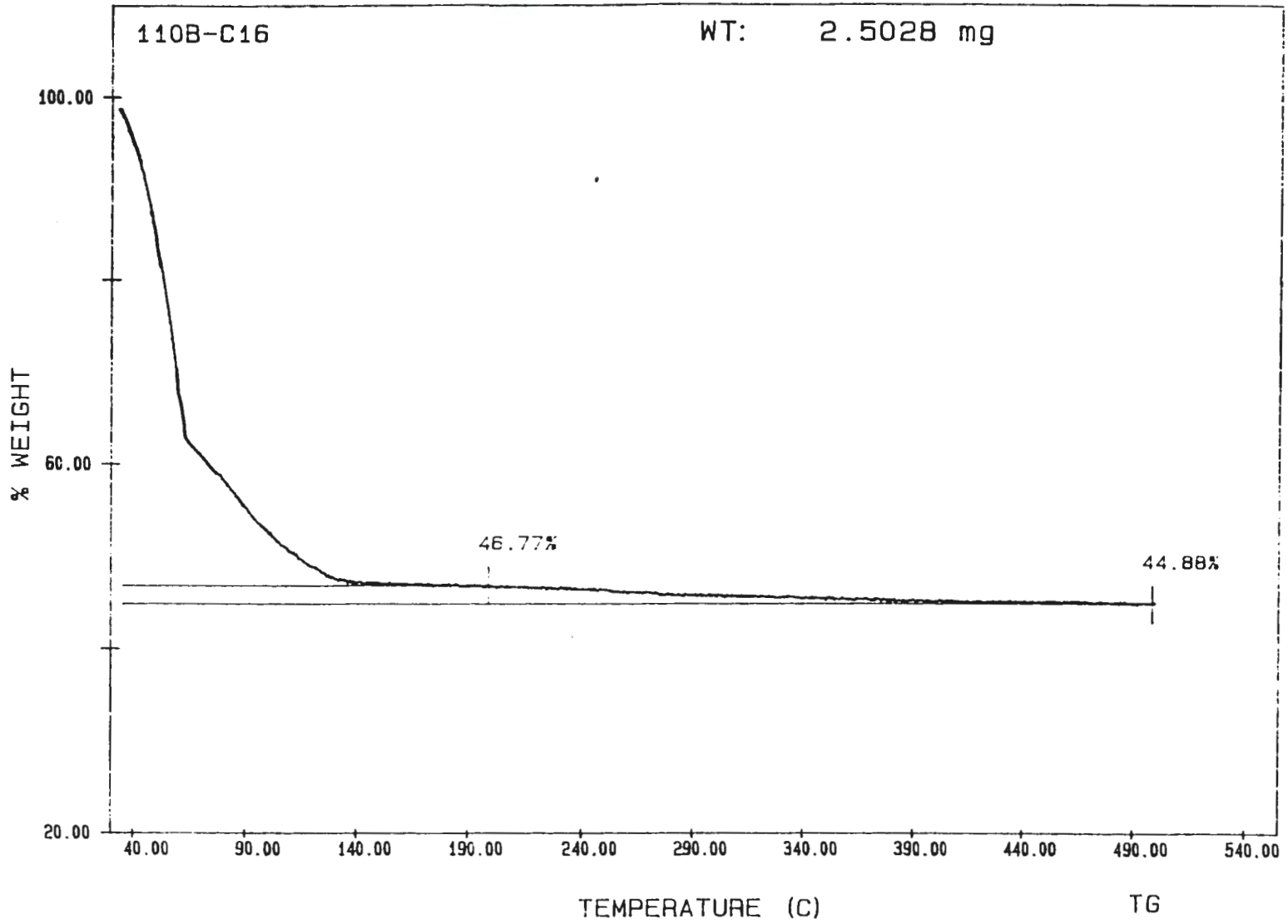


FIGURE 3: Core 16 Composite Thermogravimetric Curve, Run 2

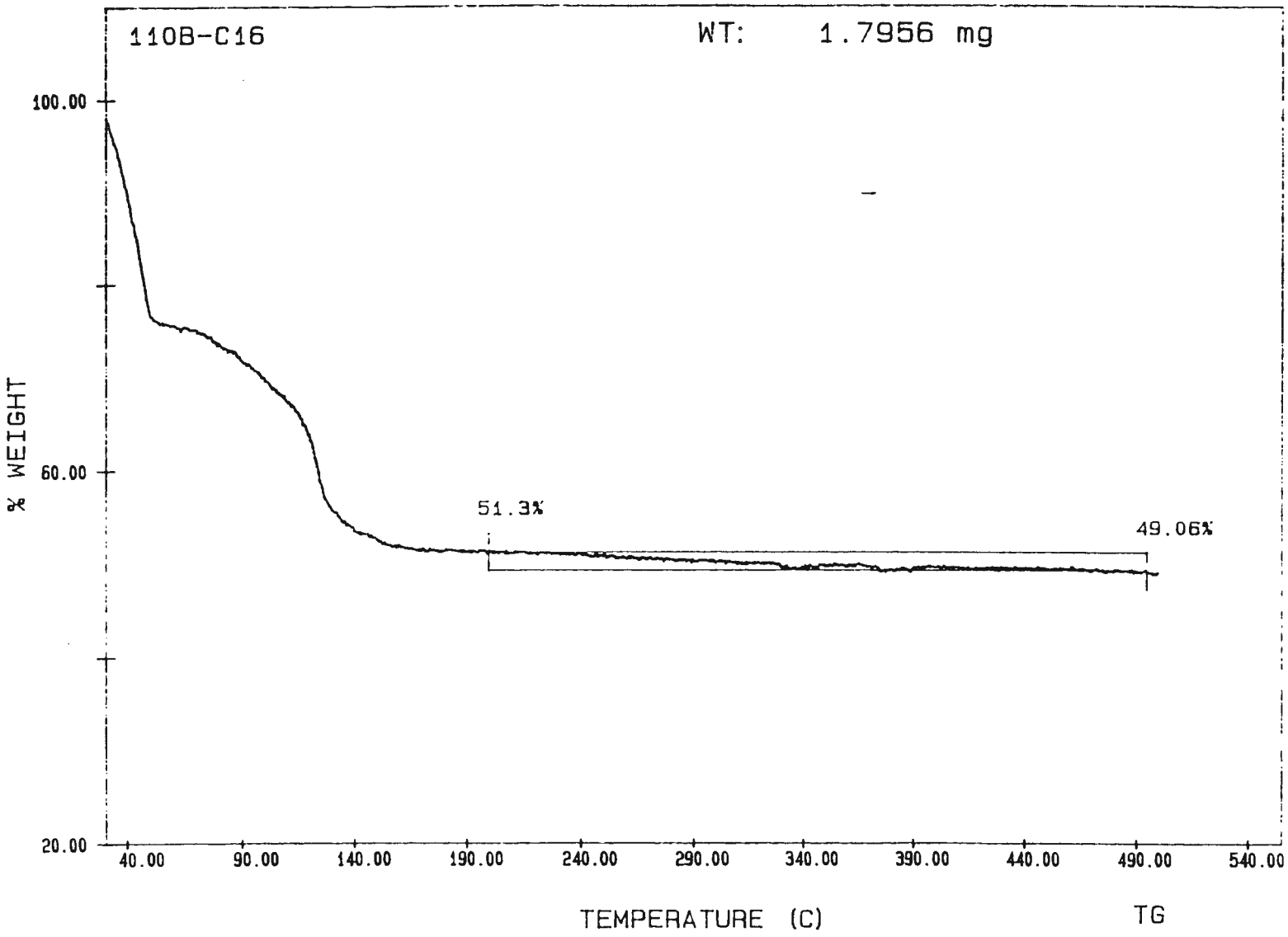


FIGURE 4: Core 16 Composite Thermogravimetric Curve, Run 3

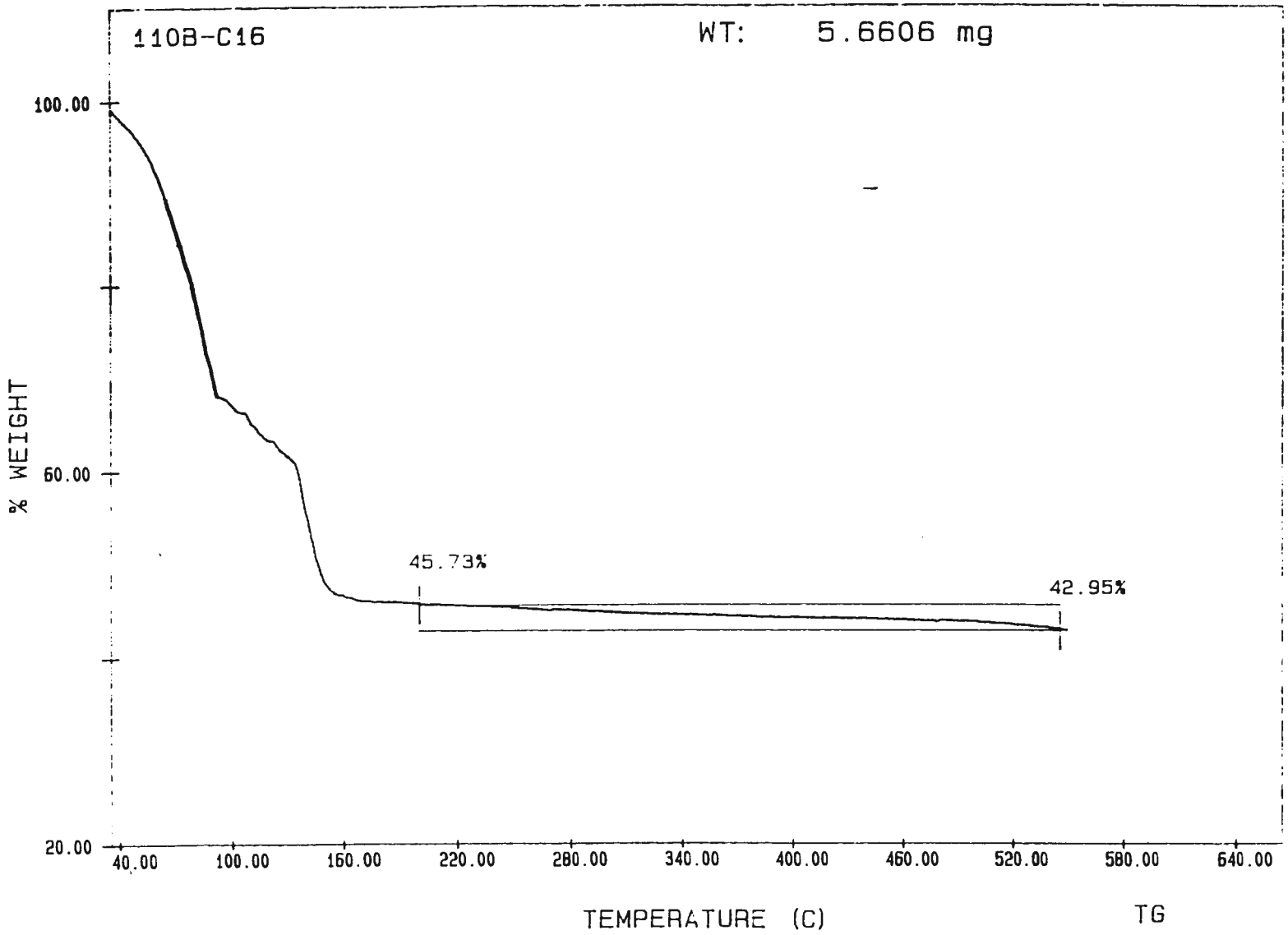


FIGURE 5: Core 16 Composite Thermogravimetric Curve, Run 4

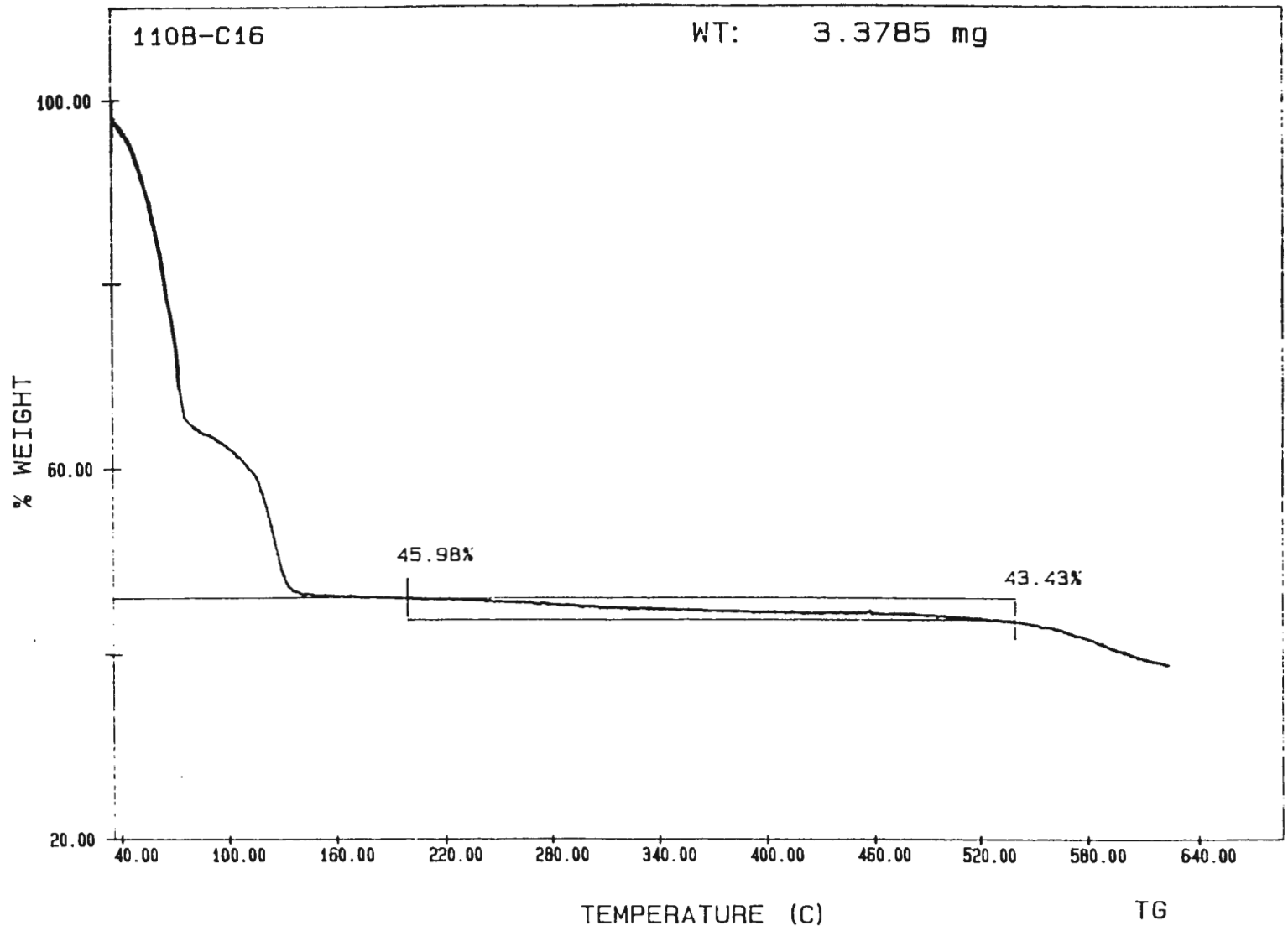


FIGURE 6: Core 16 Composite Thermogravimetric Curve, Run 5

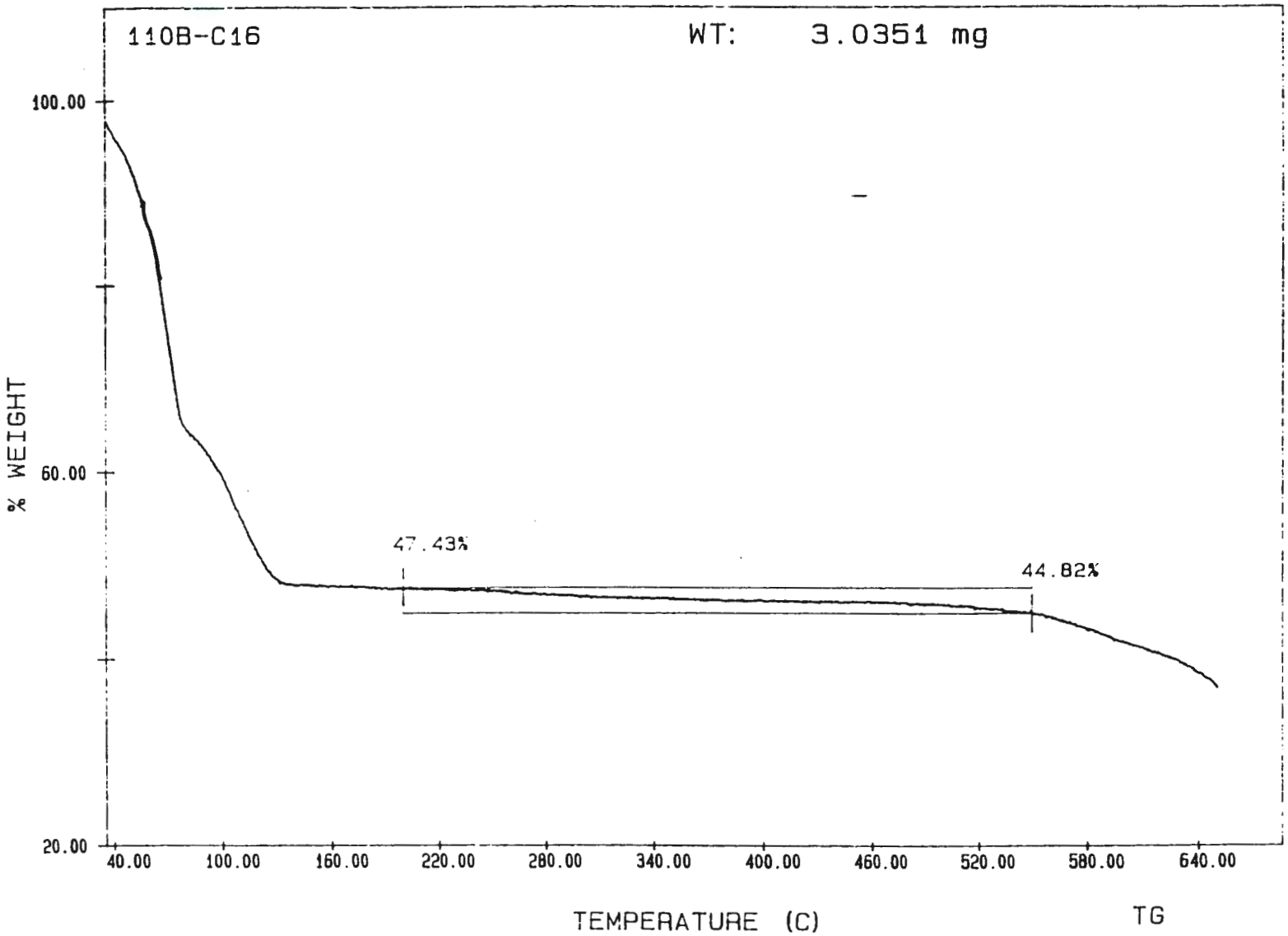


FIGURE 7: Core 16 Composite Thermogravimetric Curve, Run 6

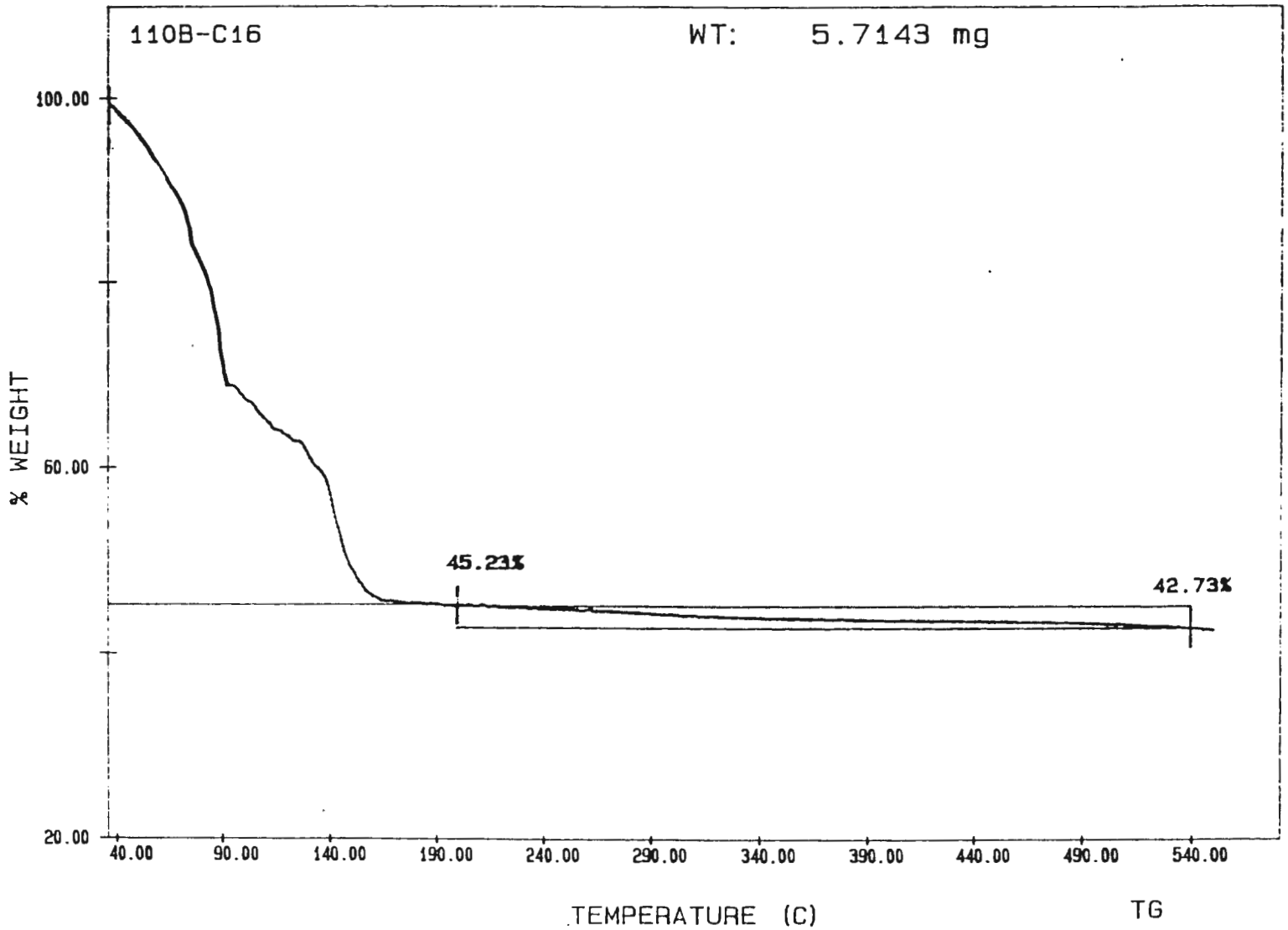


FIGURE 8: Core 16 Composite Thermogravimetric Curve, Run 7

RHEOLOGICAL CHARACTERIZATION

The rheological characterizations (shear stress versus shear rate) were measured on the homogenized 110B Core 16 composite. The data obtained from the rheological characterizations is important for retrieval operation and is used to evaluate the viscosity of a fluid and to assess the ability to transport the waste through pipes. The data are generated in the form of a rheogram or flow curve, which is a plot of shear stress as a function of shear rate. The rheograms were obtained using a Haake RV 100 viscometer equipped with an M5 measuring-drive head and the MV1 sensor system. The measurement of viscosity with this instrument requires that the sample be placed in the gap between two coaxial cylinders. About 40 mL of sample is agitated and transferred into the cup (outer cylinder). The cup is moved into position with the spindle (inner cylinder) centered in the cup. When the system is set in motion, a viscosity-related torque, caused by the sample's resistance to shearing, acts on the inner cylinder. This torque deflects a calibrated measuring spring placed between the motor and the inner cylinder. The magnitude of the spring deflection correlates linearly with the torque. The spring deflection is transformed into an electrical signal. The spring deflection and tachometer signals are recorded. This data is used to calculate the shear stress versus shear rate.

A slurry with a yield stress will "clamp" the rotor to the cup until the applied torque exceeds the yield stress. While the rotor is still "clamped" and remains motionless, the motor rotation will cause some spring deflection and consequently a torque signal which is recorded. When sufficient force is transmitted to the material to break the gel or make it yield, the rheogram will angle sharply to the right, and from then on the behavior of the material as a fluid will be recorded. This sharp angle that is recorded as the material becomes fluid is the yield point. The height of this peak measured in Pascals on the ordinate is the value of the yield stress.

Two rheograms were obtained for the homogenized Core 16 composite. The measurements were obtained at the cell temperature (36°C). The viscosity of the core composite changed with shear rate; therefore, the waste is classified as a non-Newtonian fluid. The sample of waste was agitated prior to obtaining each rheogram.

The homogenized 110B Core 16 composite exhibited a yield stress; therefore, the data was fit to a non-linear yield power law model. Due to the shape of the curve the data was fit with and without holding the yield stress constant. The equation for the rheological model to which the data was fit is:

$$\tau = \tau_o + K\gamma^n \qquad (3)$$

where τ = shear stress

γ = shear rate

τ_o = yield stress

K = consistency parameter

n = flow behavior index parameter

The parameters of this model for both fits of the two separate runs are given in Table 8. The fit with the highest yield stress is made by holding the yield stress constant at an experimentally determined value. The plots of viscosity and shear stress as a function of shear rate indicate the core 16 composite material exhibits yield-psuedoplastic behavior. A flow behavior index (n) greater than 1 is indicative of dilatent behavior; therefore, the fit performed on run 2 with the experimentally determined yield stress does not accurately define the behavior of the composite material.

TABLE 8: Parameters for the Fit to the Rheological Models

Run	τ_o	K	n
1	7.08	0.0214	0.985
	6.16	0.0636	0.819
2	6.96	0.0041	1.254
	5.48	0.0454	0.880

Figure 9 shows the shear stress and viscosity versus shear rate for the homogenized core 16 composite. The lines in the shear stress versus shear rate plot are the curve fits to the data. A shear rate of 250 sec^{-1}

corresponds to a velocity of 8 ft/sec in a 3-in.-diameter pipe. The viscosity of this waste decreases with increasing velocity (ie. shear rate).

The rheological parameters determined by both curve fitting methods, together with the density of the sample, were input into the Hanks' computer model (Hanks 1978) to obtain the critical Reynolds number, critical velocity, friction factor and pressure drop for transporting the slurries in 3.0-in. and 2.0-in. diameter pipes. The results from the Hanks' computer model are given in Table 9. For a 3.0-in.-diameter pipe, the critical Reynolds number ranged from 5900 to 10700 and the critical velocity ranged from 4.4 ft/s (101 gpm) to 4.9 ft/sec (113 gpm). For a 2.0-in. diameter pipe, the critical Reynolds number ranged from 4800 to 7200, and the critical velocity ranged from 5.0 ft/sec (53 gpm) to 5.5 ft/sec (57 gpm). The Hank's model data indicates that the critical Reynolds Number is drastically affected by these differences in the curve fitting methods, but the critical velocities and flow rates are not significantly affected.

The rheological characterizations were performed under PNL Quality Assurance Manual MA-70, Impact Level II requirements. The Hanks' computer model is a purchased computer program but has not been verified internally by PNL. Therefore, the computer model is being used in accordance with MA-70, Impact Level III requirements.

TABLE 9. Critical Reynolds Numbers and Velocities

Run	Pipe ID in.	Critical Velocity ft/s	Critical Reynolds Number	Critical Flow Rate (GPM)
1	3.0	4.8	7,800	110
		4.9	6,000	113
	2.0	5.4	6,000	56
		5.5	4,900	57
2	3.0	4.4	10,700	101
		4.7	5,900	108
	2.0	5.0	7,200	53
		5.3	4,800	55

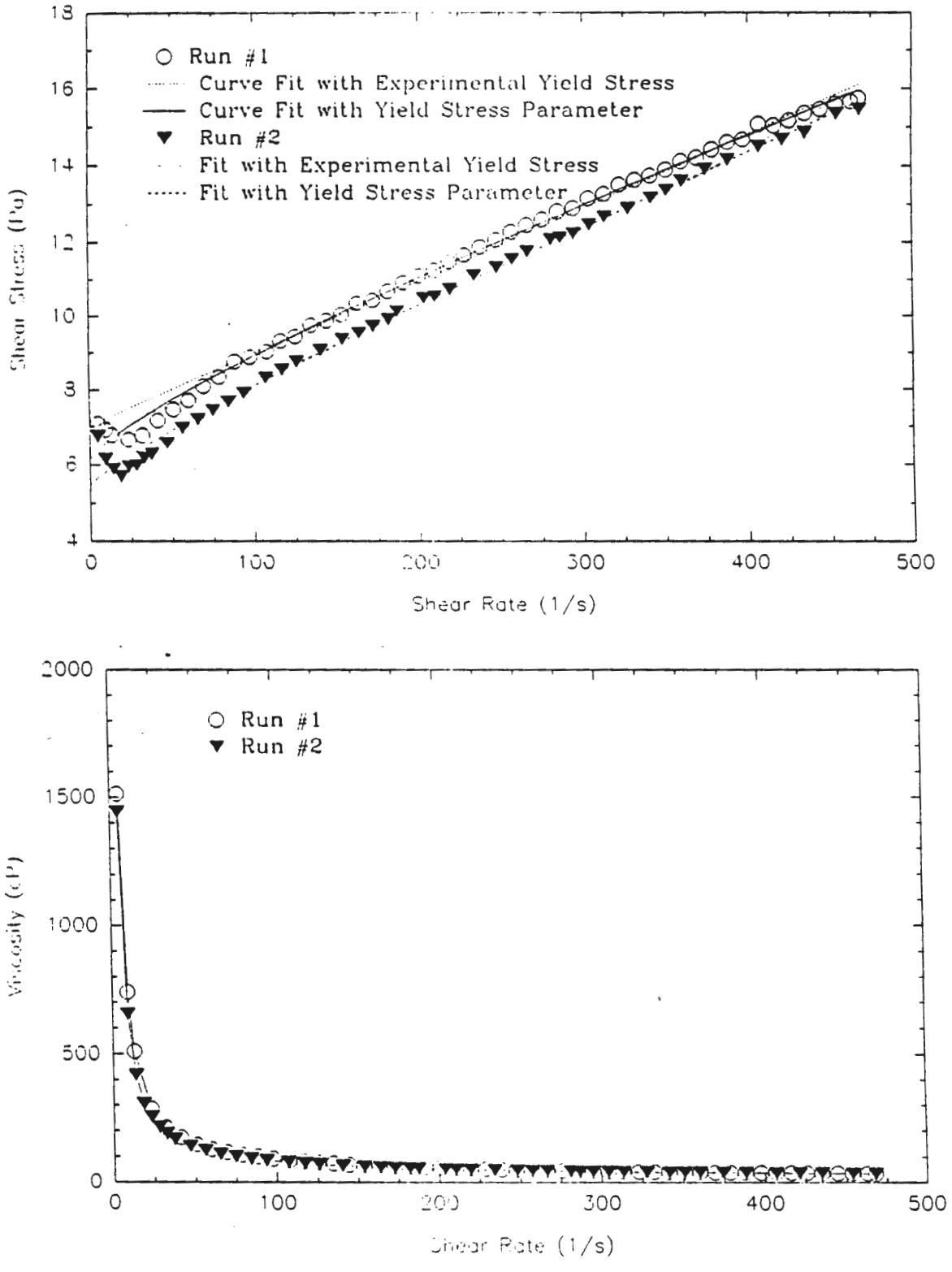


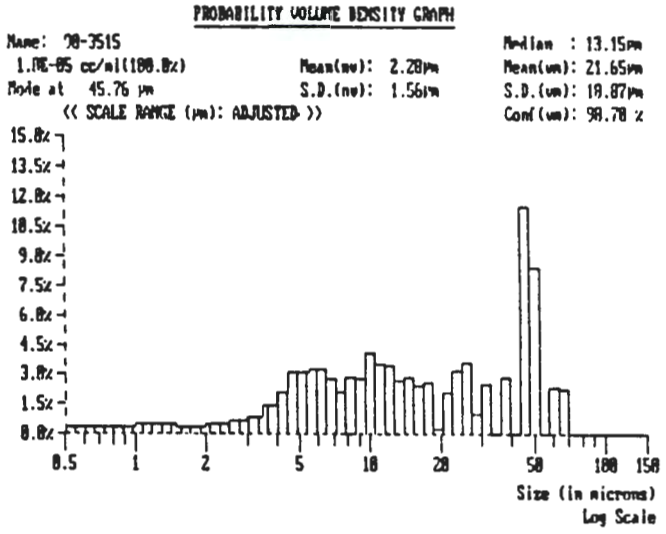
FIGURE 9 : Viscosity of the Homogenized 110B Core 16 Composite

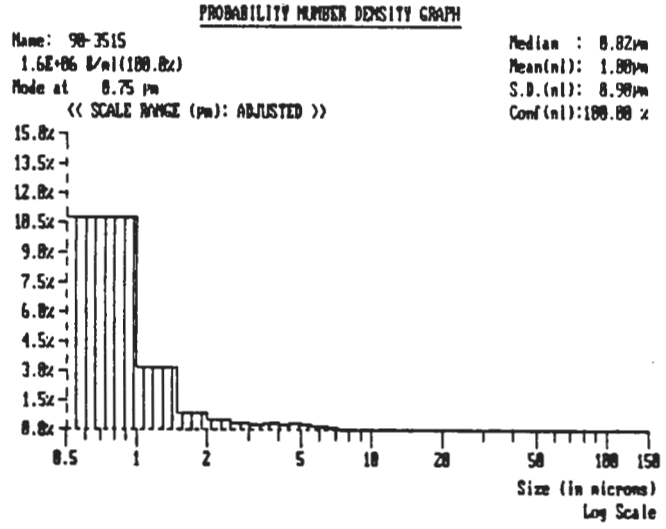
PARTICLE SIZE

FOR

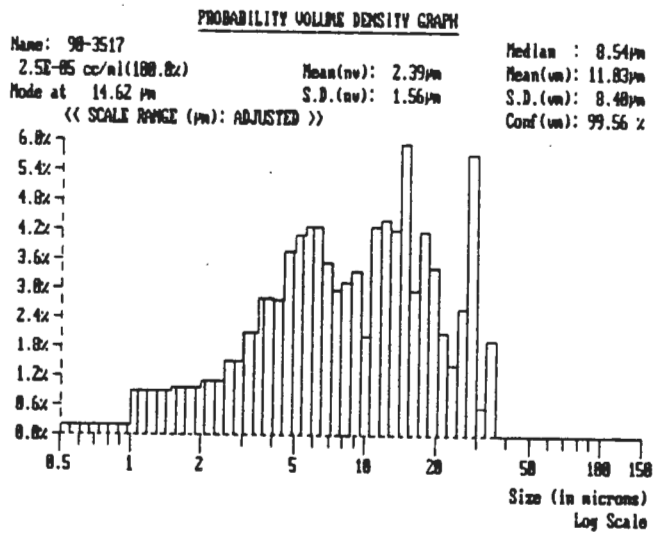
UNHOMOGENIZED SEGMENTS

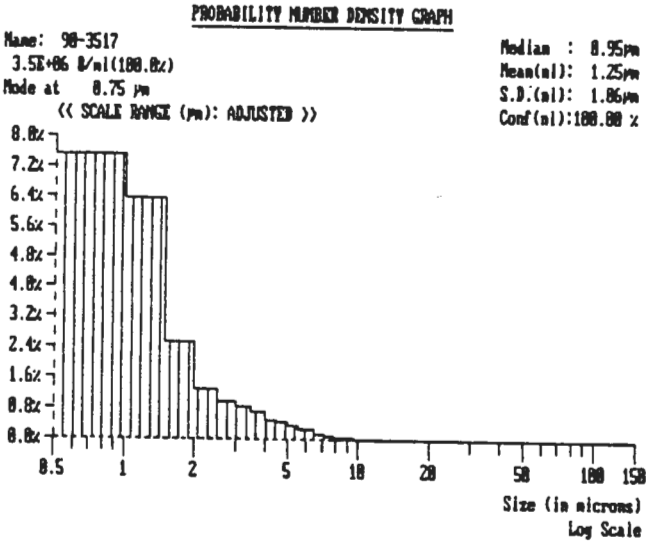
SST Core 16, Segment 1 Particle Size Analysis
Sample # 90-3515



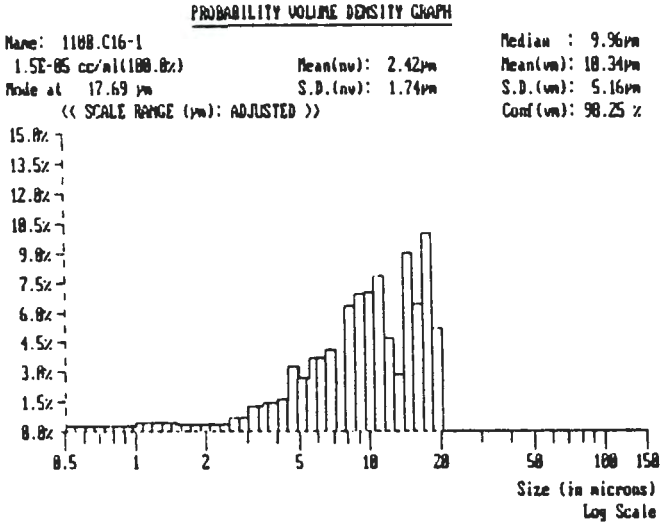


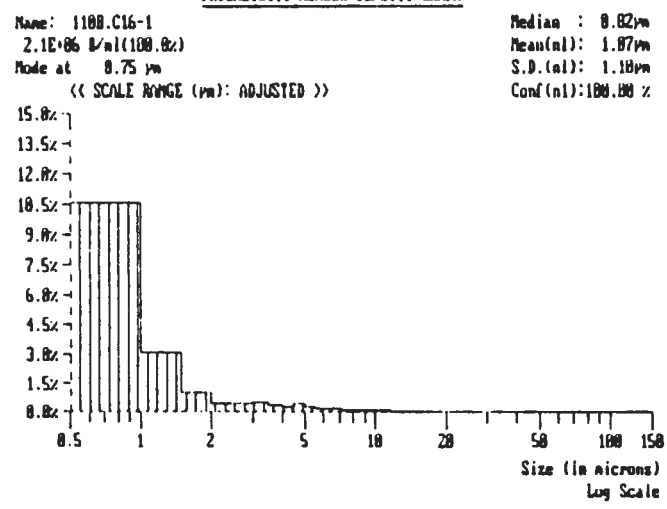
SST Core 16, Segment 2 Particle Size Analysis
Sample # 90-3517



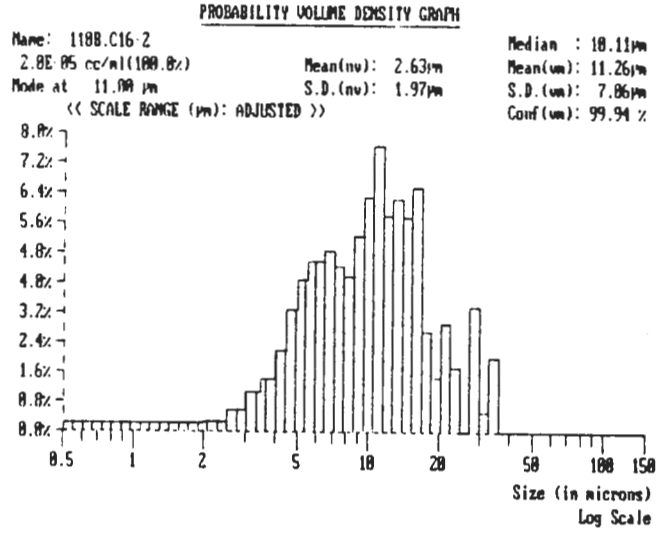


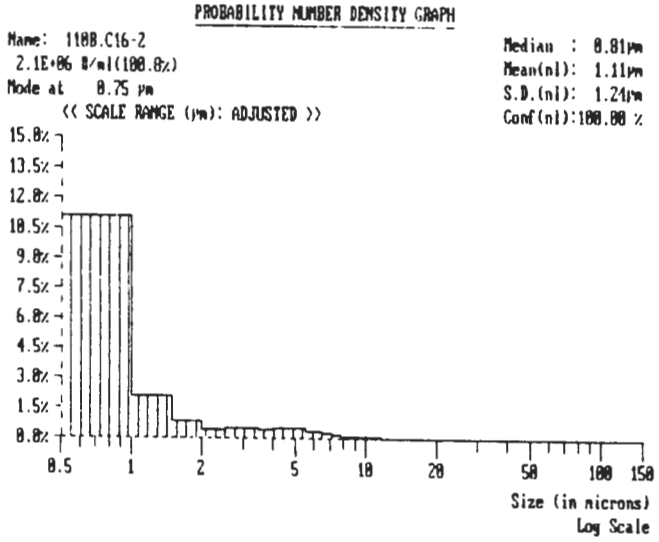
SST Core 16, Segment 3 Particle Size Analysis
Sample # 90-3519



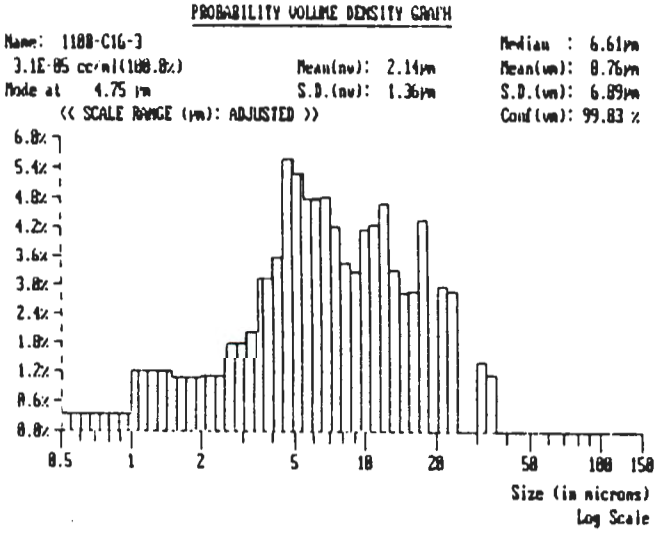


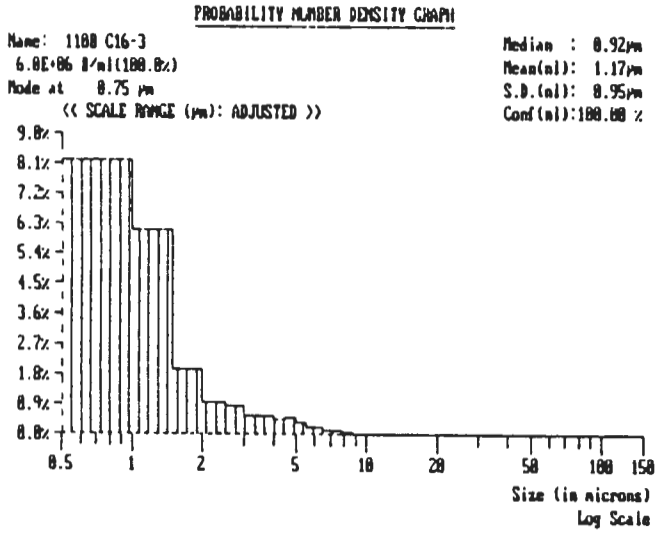
SST Core 16, Segment 4 Particle Size Analysis
Sample # 90-3521





SST Core 16, Segment 5 Particle Size Analysis
Sample # 90-3523





SECTION 2

INORGANIC DATA TABLES

Inorganic Fusion ICP Results

Segments 3 and 5 and a Core 16 Composite sample were fused with potassium hydroxide (KOH), the resulting melt dissolved in acid solution (PNL-ALO-102), and the solution was then analyzed by ICP spectroscopy (PNL-SP-7). In all cases samples were prepared in duplicate, and a methods blank sample was analyzed along with the samples. The methods blank involves the fusion of KOH without the addition of any sample. However, in all other respects the methods blank was prepared and analyzed exactly like the regular sample. With the exception of detection limits (DL) and quantitation limits (QL), all data are reported in units of weight percent (Wt %) wet sample. If concentrations fall below the estimated DL then "< DL" will be listed. If the value falls between the DL and QL the value will be reported in parentheses. Detection limits were estimated to be three times the standard deviation of the background. Quantitation limits were estimated as ten times the standard deviation of the background.

Samples for which data are included in the Core 16 Data Package are Segment 3, Segment 5 and a Core Composite homogenization check samples (Tables 10.1, 10.2, 10.3). The segment homogenization check analysis protocol includes duplicate sample preparation and analyses of two samples, one from the top of the mixture and the other from the bottom of the mixture, for each homogenized segment and for the homogenized composite.

In all of the Fusion ICP tables, column 1 contains a list of atomic symbols of 41 elements for which data are provided. In Tables 10.1, 10.2 and 10.3, columns 2 and 3 contain duplicate analyses of the sample taken from the top of the homogenized sample. Column 4 lists the relative percent difference (RPD) between the duplicates. Columns 5 and 6 contain duplicate analyses of the sample taken from the bottom of the homogenized segment, and the RPD between the duplicates is listed in column 7. Column 8 contains data for the methods blank sample which was analyzed with the duplicates. Columns 9 and 10 list estimated DL and QL values respectively, in μg/ml. The DL or QL in Wt % can be calculated for any element by multiplying the listed DL or QL (in μg/ml) by the appropriate Wt % Factor in row 3.

TABLE 10.1: SST Core 16, Segment 3 Homogenization Check
Fusion ICP

	Samp Log#:	90-3617a1	90-3617a2		90-3618a1	90-3618a2		90-3617a3		
	Dilution:	1.00	1.00		1.00	1.00		1.00		
	Wt% Fctr:	0.51369	0.51622		0.52859	0.53376		0.52293		
	ICP Run#:	2023	2022		2024	2025		2021	DL	QL
		(Wt %)	(Wt %)	RPD	(Wt %)	(Wt %)	RPD	(Wt %)	(ug/mL)	(ug/mL)
Ag		<DL	<DL		<DL	<DL		<DL	0.0157	0.0525
Al		<DL	<DL		<DL	<DL		<DL	0.0528	0.1761
As		<DL	<DL		<DL	<DL		<DL	0.0889	0.2965
B		<DL	<DL		<DL	<DL		<DL	0.0639	0.2130
Ba		<DL	<DL		(0.0020)	(0.0023)	13.1%	<DL	0.0037	0.0123
Be		<DL	<DL		<DL	<DL		<DL	0.0002	0.0006
Ca		0.0549	0.0581	5.7%	0.0622	0.0584	6.3%	0.0222	0.0014	0.0048
Cd		<DL	<DL		<DL	<DL		<DL	0.0062	0.0207
Ce		<DL	<DL		<DL	<DL		<DL	0.2143	0.7145
Co		<DL	<DL		<DL	<DL		<DL	0.4199	1.3997
Cr		0.0749	0.0927	21.3%	0.0736	0.0807	9.2%	<DL	0.0229	0.0762
Cu		<DL	<DL		<DL	<DL		<DL	0.0163	0.0544
Dy		<DL	<DL		<DL	<DL		<DL	0.0139	0.0464
Fe		1.6476	1.7487	6.0%	1.6317	1.8423	12.1%	(0.0097)	0.0080	0.0268
K									0.5156	1.7188
La		<DL	<DL		<DL	<DL		<DL	0.0190	0.0634
Li		<DL	<DL		<DL	<DL		<DL	0.0109	0.0364
Mg		0.0120	0.0124	3.0%	0.0124	0.0132	6.4%	0.0042	0.0010	0.0032
Mn		0.0068	0.0073	7.8%	0.0076	0.0072	5.5%	(0.0011)	0.0015	0.0049
Mo		<DL	<DL		<DL	<DL		<DL	0.0130	0.0433
Na		9.1296	9.2627	1.4%	9.1069	10.0183	9.5%	(0.0776)	0.1319	0.4396
Nd		<DL	<DL		<DL	<DL		<DL	0.0942	0.3140
Ni									0.0215	0.0717
P		1.5981	1.7170	7.2%	1.7003	1.7399	2.3%	<DL	0.3847	1.2822
Pb		<DL	<DL		<DL	<DL		<DL	0.0674	0.2248
Re		<DL	<DL		<DL	<DL		<DL	0.0156	0.0522
Rh		<DL	<DL		<DL	<DL		<DL	0.1190	0.3967
Ru		<DL	<DL		<DL	<DL		<DL	0.0712	0.2374
Sb		<DL	<DL		<DL	<DL		<DL	0.1069	0.3562
Se		<DL	<DL		<DL	<DL		<DL	0.1081	0.3602
Si		0.8794	0.8770	0.3%	0.8753	0.9653	9.8%	(0.0373)	0.0587	0.1957
Sr		0.0266	0.0266	0.3%	0.0265	0.0289	8.8%	<DL	0.0013	0.0045
Te		<DL	<DL		<DL	<DL		<DL	0.0650	0.2167
Th		<DL	<DL		<DL	<DL		<DL	0.1658	0.5526
Ti		<DL	<DL		<DL	<DL		<DL	0.0121	0.0404
Tl		<DL	<DL		<DL	<DL		<DL	3.1009	10.3364
U		<DL	<DL		<DL	<DL		<DL	1.3258	4.4192
V		<DL	<DL		<DL	<DL		<DL	0.0107	0.0357
Zn		0.0097	0.0110	13.0%	0.0106	0.0107	1.5%	(0.0032)	0.0046	0.0154
Zr		<DL	<DL		<DL	<DL		<DL	0.0101	0.0337
Bi		2.0240	2.0132	0.5%	2.0139	2.1137	4.8%	<DL		

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TABLE 10.2: SST Core 16, Segment 5 Homogenization Check
Fusion ICP

	Samp Log#:	90-3619a1	90-3619a2		90-3620a1	90-3620a2		90-3619a3		
	Dilution:	1.00	1.00		1.00	1.00		1.00		
	Wt% Fctr:	0.53851	0.48583		0.53204	0.47158		0.50535		
	ICP Run#:	2030	2029		2031	2032		2028	DL	QL
		(Wt %)	(Wt %)	RPD	(Wt %)	(Wt %)	RPD	(Wt %)	(ug/mL)	(ug/mL)
Ag		<DL	<DL		<DL	<DL		<DL	0.0157	0.0525
Al		<DL	<DL		<DL	<DL		<DL	0.0528	0.1761
As		<DL	<DL		<DL	<DL		<DL	0.0889	0.2965
B		<DL	<DL		<DL	<DL		<DL	0.0639	0.2130
Ba		<DL	(0.0022)		<DL	<DL		<DL	0.0037	0.0123
Be		<DL	<DL		<DL	<DL		<DL	0.0002	0.0006
Ca		0.0585	0.0563	3.7%	0.0619	0.0559	10.2%	0.0221	0.0014	0.0048
Cd		<DL	<DL		<DL	<DL		<DL	0.0062	0.0207
Ce		<DL	<DL		<DL	<DL		<DL	0.2143	0.7145
Co		<DL	<DL		<DL	<DL		<DL	0.4199	1.3997
Cr		0.0787	0.0775	1.6%	0.0726	0.0763	5.0%	<DL	0.0229	0.0762
Cu		<DL	<DL		<DL	<DL		<DL	0.0163	0.0544
Dy		<DL	<DL		<DL	<DL		<DL	0.0139	0.0464
Fe		1.7976	1.7693	1.6%	1.7284	1.7981	4.0%	0.0169	0.0080	0.0268
K									0.5156	1.7188
La		<DL	<DL		<DL	<DL		<DL	0.0190	0.0634
Li		<DL	<DL		<DL	<DL		<DL	0.0109	0.0364
Mg		0.0135	0.0135	0.3%	0.0124	0.0131	5.6%	0.0031	0.0010	0.0032
Mn		0.0065	0.0054	18.0%	0.0071	0.0090	23.2%	(0.0019)	0.0015	0.0049
Mo		<DL	<DL		<DL	<DL		<DL	0.0130	0.0433
Na		10.0434	9.5021	5.5%	9.6355	9.8082	1.8%	(0.0730)	0.1319	0.4396
Nd		<DL	<DL		<DL	<DL		<DL	0.0942	0.3140
Ni									0.0215	0.0717
P		1.7259	1.6083	7.0%	1.6323	1.6147	1.1%	<DL	0.3847	1.2822
Pb		<DL	<DL		<DL	<DL		<DL	0.0674	0.2248
Re		<DL	<DL		<DL	<DL		<DL	0.0156	0.0522
Rh		<DL	<DL		<DL	<DL		<DL	0.1190	0.3967
Ru		<DL	<DL		<DL	<DL		<DL	0.0712	0.2374
Sb		<DL	<DL		<DL	<DL		<DL	0.1069	0.3562
Se		<DL	<DL		<DL	<DL		<DL	0.1081	0.3602
Si		0.9797	0.9476	3.3%	0.9571	0.9878	3.2%	<DL	0.0587	0.1957
Sr		0.0256	0.0258	0.9%	0.0243	0.0269	9.8%	<DL	0.0013	0.0045
Te		<DL	<DL		<DL	<DL		<DL	0.0650	0.2167
Th		<DL	<DL		<DL	<DL		<DL	0.1658	0.5526
Ti		<DL	<DL		<DL	<DL		<DL	0.0121	0.0404
Tl		<DL	<DL		<DL	<DL		<DL	3.1009	10.3364
U		<DL	<DL		<DL	<DL		<DL	1.3258	4.4192
V		<DL	<DL		<DL	<DL		<DL	0.0107	0.0357
Zn		0.0144	0.0139	3.4%	0.0142	0.0185	26.2%	(0.0032)	0.0046	0.0154
Zr		<DL	<DL		<DL	<DL		<DL	0.0101	0.0337
Bi		1.8579	2.0162	8.2%	1.9366	1.9476	0.6%	<DL		

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TABLE 10.3: SST Core 16, Composite Homenization Check
Fusion ICP

Samp Log#:	90-4178a1	90-4178a2		90-4179a1	90-4179a2		90-4178a3		
Dilution:	1.00	1.00		1.00	1.00		1.00		
Wt% Fctr:	0.45441	0.60477		0.40452	0.40197		0.45382		
ICP Run#:	2042	2041		2043	2044		2040	DL	QL
	(Wt %)	(Wt %)	RPD	(Wt %)	(Wt %)	RPD	(Wt %)	(ug/mL)	(ug/mL)
Ag	<DL	<DL		<DL	<DL		<DL	0.0157	0.0525
Al	0.1433	0.1509	5.2%	0.1492	0.1509	1.2%	<DL	0.0528	0.1761
As	<DL	<DL		<DL	<DL		<DL	0.0889	0.2965
B	<DL	<DL		<DL	<DL		<DL	0.0639	0.2130
Ba	<DL	<DL		0.0099	(0.0016)	144.5%	0.0102	0.0037	0.0123
Be	<DL	<DL		<DL	<DL		<DL	0.0002	0.0006
Ca	0.0666	0.0771	14.6%	0.1017	0.0682	39.4%	0.0463	0.0014	0.0048
Cd	<DL	<DL		<DL	<DL		<DL	0.0062	0.0207
Ce	<DL	<DL		<DL	<DL		<DL	0.2143	0.7145
Co	<DL	<DL		<DL	<DL		<DL	0.4199	1.3997
Cr	0.0784	0.0803	2.4%	0.0784	0.0782	0.2%	<DL	0.0229	0.0762
Cu	0.0333	0.0367	9.9%	0.0234	0.0230	1.8%	(0.0074)	0.0163	0.0544
Dy	<DL	<DL		<DL	<DL		<DL	0.0139	0.0464
Fe	1.8368	1.8629	1.4%	1.8301	1.8181	0.7%	0.0136	0.0080	0.0268
K								0.5156	1.7188
La	<DL	<DL		<DL	<DL		<DL	0.0190	0.0634
Li	<DL	<DL		<DL	<DL		<DL	0.0109	0.0364
Mg	0.0144	0.0166	14.3%	0.0129	0.0104	21.7%	0.0042	0.0010	0.0032
Mn	0.0088	0.0103	15.9%	0.0140	0.0176	22.9%	0.0047	0.0015	0.0049
Mo	<DL	<DL		<DL	<DL		<DL	0.0130	0.0433
Na	9.5655	9.6766	1.2%	9.2516	9.2881	0.4%	<DL	0.1319	0.4396
Nd	<DL	<DL		<DL	<DL		<DL	0.0942	0.3140
Ni								0.0215	0.0717
P	1.4934	1.6187	8.1%	1.4490	1.5364	5.9%	<DL	0.3847	1.2822
Pb	<DL	<DL		<DL	<DL		<DL	0.0674	0.2248
Re	<DL	<DL		<DL	<DL		<DL	0.0156	0.0522
Rh	<DL	<DL		<DL	<DL		<DL	0.1190	0.3967
Ru	<DL	<DL		<DL	<DL		<DL	0.0712	0.2374
Sb	<DL	<DL		<DL	<DL		<DL	0.1069	0.3562
Se	<DL	<DL		<DL	<DL		<DL	0.1081	0.3602
Si	1.0057	1.0224	1.6%	1.0121	1.0013	1.1%	<DL	0.0587	0.1957
Sr	0.0260	0.0266	2.2%	0.0258	0.0257	0.6%	<DL	0.0013	0.0045
Te	<DL	<DL		<DL	<DL		<DL	0.0650	0.2167
Th	<DL	<DL		<DL	<DL		<DL	0.1658	0.5526
Ti	<DL	<DL		<DL	<DL		<DL	0.0121	0.0404
Tl	<DL	<DL		<DL	<DL		<DL	3.1009	10.3364
U	<DL	<DL		<DL	<DL		<DL	1.3258	4.4192
V	<DL	<DL		<DL	<DL		<DL	0.0107	0.0357
Zn	0.0206	0.0251	19.5%	0.0287	0.0209	31.5%	0.0121	0.0046	0.0154
Zr	<DL	<DL		<DL	<DL		<DL	0.0101	0.0337
Bi	1.8903	1.9474	3.0%	1.9255	1.9857	3.1%	<DL		

11/05/90

Inorganic Acid Leach ICP Results

The Core 16 the composite sample was leached with nitric acid following the EPA SW-846 protocols (PNL-ALO-101). Five aliquots were prepared for analysis. These include duplicate sample preps, a spiked sample prep, a spike control sample, and a methods blank. The spike control was prepared by adding the spike solution to an appropriate amount of deionized water. Each of these aliquots were analyzed by ICP spectroscopy (PNL-SP-7) at a 1X and 5X dilution. ICP analysis data are reported for each dilution, as well as a percent difference (% Dif) between the dilution analyses. With the exception of detection limits (DL) and quantitation limits (QL), all data are reported in units of weight percent (Wt %) wet sample. If concentrations fall below the estimated DL the "<DL" will be listed. If the value falls between the DL and QL the value will be reported in parentheses. Detection limits were estimated to be three times the standard deviation of the background. Quantitation limits were estimated as ten times the standard deviation of the background.

In Table 10.4 column 1 contains a list of atomic symbols of 41 elements for which data are provided. Columns 2 and 3 contain 1X and 5X dilution analysis data for a single sample preparation, from the core composite. Column 4 lists the percent difference (%Dif) between the dilutions. This sequence is repeated for columns 5, 6, and 7 for the duplicate samples, and in columns 8, 9 and 10 for the methods blank samples. In each of the tables, the last two columns on the first page contain the detection limit (DL) and the quantification limit (QL), respectively, in units of μg/ml. The DL or QL in weight percent can be calculated for any element by multiplying the listed DL or QL (in μg/ml) by the appropriate Wt % Factor in row 3.

The second page of Table 10.4 contains primarily quality control (QC) data. Column 2 lists the average for the duplicate analyses and column 3 provides the relative percent difference (RPD) between the analyses. Column 4 tabulates the calculated Wt % spike added to the spiked sample. Columns 5 and 6 list the data for the 1X and 5X dilution on the spiked sample, and column 7 lists the %Dif between the spiked samples. Column 8 lists the percent recovered (% Rec) of the spiked sample. Columns 9 and 10 contain the 1X and 5X dilutions of the spike control, and column 11 the %Dif between the samples. The last two columns list the calculated concentrations of elements in the

spike control and the % Rec in the spike control sample analysis.

TABLE 10.4: SST Core 16, Core Composite Acid Leach ICP

Samp Log#:	90-4180a1	90-4180a1		90-4180a2	90-4180a2		90-4180a5	90-4180a5			
Dilution:	1.00	5.00		1.00	5.00		1.00	5.00			
Wt% Factor	0.02061	0.10304		0.02233	0.11167		0.02144	0.10718			
ICP Run #	2076	2083		2076	2082		2072	2079		DL	QL
	(Wt %)	(Wt %)	%Dif	(Wt %)	(Wt %)	%Dif	(Wt% *)	(Wt% *)	%Dif	(ug/mL)	(ug/mL)
Ag	0.0013	<DL		0.0012	<DL		<DL	<DL		0.0157	0.0525
Al	0.1482	0.1510	1.9%	0.1470	0.1482	0.9%	(0.0018)	<DL		0.0528	0.1761
As	<DL	<DL		<DL	<DL		<DL	<DL		0.0889	0.2965
B	0.0044	<DL		(0.0045)	<DL		0.0056	<DL		0.0639	0.2130
Ba	0.0016	0.0016	0.6%	0.0017	0.0018	1.5%	(0.0002)	<DL		0.0037	0.0123
Be	<DL	<DL		<DL	<DL		<DL	<DL		0.0002	0.0006
Ca	0.0714	0.0735	2.9%	0.0730	0.0749	2.6%	0.0273	0.0274	0.5%	0.0014	0.0048
Cd	0.0008	(0.0009)		0.0007	(0.0007)		(0.0003)	(0.0007)		0.0062	0.0207
Ce	<DL	<DL		<DL	<DL		<DL	<DL		0.2143	0.7145
Co	<DL	<DL		<DL	<DL		<DL	<DL		0.4199	1.3997
Cr	0.0826	0.0836	1.1%	0.0814	0.0825	1.4%	<DL	<DL		0.0229	0.0762
Cu	0.0075	0.0077	2.6%	0.0074	0.0078	4.9%	<DL	<DL		0.0163	0.0544
Dy	<DL	<DL		<DL	<DL		<DL	<DL		0.0139	0.0464
Fe	1.8623	1.9033	2.2%	1.8179	1.8634	2.5%	0.0034	0.0033	1.8%	0.0080	0.0268
K	(0.0317)	<DL		(0.0329)	<DL		<DL	<DL		0.5156	1.7188
La	(0.0007)	<DL		(0.0006)	<DL		<DL	<DL		0.0190	0.0634
Li	<DL	<DL		<DL	<DL		<DL	<DL		0.0109	0.0364
Mg	0.0157	0.0162	2.6%	0.0170	0.0175	2.9%	0.0034	0.0036	4.2%	0.0010	0.0032
Mn	0.0054	0.0055	0.9%	0.0054	0.0054	0.9%	(0.0001)	<DL		0.0015	0.0049
Mo	(0.0007)	<DL		(0.0008)	<DL		<DL	<DL		0.0130	0.0433
Na	9.3137	9.4919	1.9%	9.3765	9.5206	1.5%	0.0150	(0.0149)		0.1319	0.4396
Nd	<DL	<DL		<DL	<DL		<DL	<DL		0.0942	0.3140
Ni	0.0020	<DL		0.0019	<DL		<DL	<DL		0.0215	0.0717
P	1.6999	1.6383	3.6%	1.5313	1.6292	6.4%	<DL	<DL		0.3847	1.2822
Pb	0.0284	0.0289	1.9%	0.0281	0.0300	6.7%	<DL	<DL		0.0674	0.2248
Re	(0.0007)	<DL		(0.0006)	<DL		<DL	<DL		0.0156	0.0522
Rh	<DL	<DL		<DL	<DL		<DL	<DL		0.1190	0.3967
Ru	0.0187	(0.0204)		0.0182	(0.0200)		<DL	<DL		0.0712	0.2374
Sb	<DL	<DL		<DL	<DL		<DL	<DL		0.1069	0.3562
Se	<DL	<DL		<DL	<DL		<DL	<DL		0.1081	0.3602
Si	0.0361	0.0354	1.8%	0.0479	0.0469	2.1%	(0.0029)	<DL		0.0587	0.1957
Sr	0.0268	0.0271	1.0%	0.0266	0.0269	1.2%	(0.0001)	<DL		0.0013	0.0045
Te	(0.0018)	<DL		(0.0016)	<DL		<DL	<DL		0.0650	0.2167
Th	<DL	<DL		<DL	<DL		<DL	<DL		0.1658	0.5526
Ti	(0.0004)	<DL		(0.0006)	<DL		<DL	<DL		0.0121	0.0404
Tl	<DL	<DL		<DL	<DL		<DL	<DL		3.1009	10.3364
U	0.0965	<DL		(0.0930)	<DL		<DL	<DL		1.3258	4.4192
V	(0.0004)	<DL		(0.0004)	<DL		<DL	<DL		0.0107	0.0357
Zn	0.0079	0.0082	4.8%	0.0085	0.0089	4.8%	0.0003	(0.0006)		0.0046	0.0154
Zr	(0.0005)	<DL		(0.0005)	<DL		<DL	<DL		0.0101	0.0337
Bi	2.1724			2.1418							

* Methods blank - average sample weight used to calculate wt%.

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TABLE 10.4: SST Core 16, Core Composite Acid Leach ICP (Cont'd)

	90-4180a1 90-4180a2 Average	RPD	Spike Added	90-4180a3 1.00 Spike+ Sample	90-4180a3 5.00 Spike+ Sample	<Sample ID> <Dilution> % Dif	% Rec	90-4180a4 1.00 Spike Control	90-4180a4 5.00 Spike Control	% Dif	Spike STD	% rec
	(Wt %)		(Wt %)	(Wt %)	(Wt %)			(ug/mL)	(ug/mL)		(ug/mL)	
Ag	0.0012	6.7%		0.0012	<DL							
Al	0.1476	0.8%		0.1504	0.1532	1.9%						
As	N/A		0.0359	0.0338	0.0374	10.4%	94.3%	18.4	19.3	5.1%	20.0	91.8%
B	0.0044	1.2%		0.0068	(0.0059)							
Ba	0.0017	9.7%	0.0359	0.0363	0.0366	0.8%	96.5%	19.7	19.4	1.7%	20.0	98.5%
Be	N/A		0.0009	0.0009	0.0009	2.8%	95.0%	0.5	0.5	1.6%	0.5	95.6%
Ca	0.0722	2.2%		0.0659	0.0680	3.1%						
Cd	0.0007	9.5%	0.0009	0.0016	(0.0017)		97.6%	0.7	0.7	6.7%	0.5	130.2%
Ce	N/A			<DL	<DL							
Co	N/A		0.0090	(0.0118)	<DL		131.4%	6.1	5.9	3.4%	5.0	122.1%
Cr	0.0820	1.6%		0.0828	0.0842	1.7%						
Cu	0.0075	1.2%	0.0045	0.0118	0.0123	4.5%	96.2%	2.6	2.7	4.3%	2.5	102.2%
Dy	N/A			<DL	<DL							
Fe	1.8401	2.4%		1.8495	1.9005	2.8%						
K	0.0323	3.6%		0.0331	<DL							
La	0.0006	22.9%		(0.0007)	<DL							
Li	N/A			<DL	<DL							
Mg	0.0164	7.6%		0.0152	0.0157	3.1%						
Mn	0.0054	0.9%	0.0090	0.0141	0.0144	2.0%	97.1%	5.0	4.9	1.7%	5.0	99.0%
Mo	0.0008	3.8%		0.0008	(0.0012)							
Na	9.3451	0.7%		9.5122	9.6427	1.4%						
Nd	N/A			<DL	<DL							
Ni	0.0019	4.3%	0.0090	0.0104	0.0109	5.0%	94.6%	5.0	4.9	2.5%	5.0	99.8%
P	1.6156	10.4%		1.6383	1.7078	4.2%						
Pb	0.0282	1.0%	0.0090	0.0355	0.0375	5.6%	81.4%	5.1	5.4	5.8%	5.0	101.9%
Re	0.0007	15.4%		(0.0008)	<DL							
Rh	N/A			<DL	<DL							
Ru	0.0185	2.8%		0.0185	(0.0200)							
Sb	N/A			(0.0049)	<DL							
Se	N/A		0.0359	0.0196	(0.0218)		54.6%	13.1	11.4	13.0%	20.0	65.6%
Si	0.0420	28.2%		0.1833	0.1806	1.5%						
Sr	0.0267	0.7%		0.0270	0.0273	1.1%						
Te	0.0017	12.2%		(0.0022)	<DL							
Th	N/A			<DL	<DL							
Ti	0.0005	32.4%		(0.0004)	<DL							
Tl	N/A		0.0359	<DL	<DL		93.7%	18.2	20.6	12.9%	20.0	91.2%
U	0.0947	3.8%		0.0954	<DL							
V	0.0004	1.7%	0.0090	0.0091	0.0095	3.5%	96.9%	5.0	4.9	0.9%	5.0	99.2%
Zn	0.0082	8.1%	0.0090	0.0165	0.0171	3.4%	92.6%	4.9	5.0	2.3%	5.0	98.6%
Zr	0.0005	0.7%		(0.0005)	<DL							
Bi	2.1571	1.4%		2.2079								

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Inorganic Water Leach ICP Data

The Core 16 Composite water leach ICP Data are reported in Table 10.5. A core composite sample was leached with deionized water (PNL-ALO-103), filtered and distributed for analyses including analysis by ICP spectroscopy (PNL-SP-7). The sample preparation was completed in duplicate and included a methods blank. With the exception of detection limits (DL) and quantitation limits (QL), all data are reported in units of weight percent (Wt %) wet sample. If concentrations fall below the estimated DL the "<DL" will be listed. If the value falls between the DL and QL the value will be reported in parentheses. Detection limits were estimated to be three times the standard deviation of the background. Quantitation limits were estimated as ten times the standard deviation of the background.

Column 1 of Table 10.5 lists the atomic symbols of the 41 elements for which data are reported. Columns 2 and 3 contain the results for the 2X and 10X dilution analyses, and column 4 the percent difference (%Dif) between dilutions. Columns 5 and 6 contain the results of the 2X and 10X duplicate analysis, and column 7 lists the % Dif. Columns 8 and 9 contain the results of the analysis of the methods blank. Columns 10 and 11 list DL and QL values, respectively, in units of μg/ml. The DL and QL in weight percent can be calculated for any element by multiplying the listed DL or QL (in μg/ml) by the appropriate Wt % Factor in row 3. Column 12 tabulates the average value for the duplicate analyses and column 13 reports the relative percent difference (RPD).

TABLE 10.5: SST Core 16, Core Composite Water Leach ICP

Samp Log#:	90-4180c1	90-4180c1		90-4180c2	90-4180c2		90-4180c5					
Dilution:	2.00	10.00		2.00	10.00		2.00					
Wt% Fctr:	0.01903	0.09516		0.01811	0.09053		0.01872	0.09359			90-4180c1 90-4180c2	
ICP Run#:	2091	2088		2090	2087		2089	2086	DL	QL	Average	
	(Wt %)	(Wt %)	%Dif	(Wt %)	(Wt %)	%Dif	(Wt% *)	(Wt% *)	(ug/mL)	(ug/mL)	(Wt %)	RPD
Ag	<DL	<DL		<DL	<DL		<DL	<DL	0.0157	0.0525	N/A	
Al	(0.0013)	<DL		(0.0012)	<DL		<DL	<DL	0.0528	0.1761	0.0013	9.2%
As	<DL	<DL		<DL	<DL		<DL	<DL	0.0889	0.2965	N/A	
B	<DL	<DL		<DL	<DL		<DL	<DL	0.0639	0.2130	N/A	
Ba	<DL	<DL		<DL	<DL		<DL	<DL	0.0037	0.0123	N/A	
Be	<DL	<DL		<DL	<DL		<DL	<DL	0.0002	0.0006	N/A	
Ca	0.0009	0.0020	126.9%	0.0007	0.0014	92.9%	0.0005	0.0043	0.0014	0.0048	0.0008	15.5%
Cd	<DL	<DL		<DL	<DL		<DL	<DL	0.0062	0.0207	N/A	
Ce	<DL	<DL		<DL	<DL		<DL	<DL	0.2143	0.7145	N/A	
Co	<DL	<DL		<DL	<DL		<DL	<DL	0.4199	1.3997	N/A	
Cr	0.0059	(0.0061)		0.0059	(0.0065)		<DL	<DL	0.0229	0.0762	0.0059	0.1%
Cu	<DL	<DL		<DL	<DL		<DL	<DL	0.0163	0.0544	N/A	
Dy	<DL	<DL		<DL	<DL		<DL	<DL	0.0139	0.0464	N/A	
Fe	0.0094	0.0096	2.0%	0.0087	0.0087	0.3%	<DL	<DL	0.0080	0.0268	0.0091	8.4%
K	(0.0197)	<DL		(0.0194)	<DL		<DL	<DL	0.5156	1.7188	0.0196	1.8%
La	<DL	<DL		<DL	<DL		<DL	<DL	0.0190	0.0634	N/A	
Li	<DL	<DL		<DL	<DL		<DL	<DL	0.0109	0.0364	N/A	
Mg	0.0003	0.0006	115.5%	0.0003	0.0005	83.1%	0.0001	0.0006	0.0010	0.0032	0.0003	4.2%
Mn	(0.0000)	<DL		(0.0000)	<DL		<DL	<DL	0.0015	0.0049	0.0000	12.9%
Mo	(0.0006)	<DL		(0.0005)	(0.0015)		<DL	<DL	0.0130	0.0433	0.0006	9.3%
Na	8.4577	8.4707	0.2%	8.4780	8.5323	0.6%	<DL	<DL	0.1319	0.4396	8.4678	0.2%
Nd	<DL	<DL		<DL	<DL		<DL	<DL	0.0942	0.3140	N/A	
Ni	<DL	<DL		<DL	<DL		<DL	<DL	0.0215	0.0717	N/A	
P	0.7725	0.7733	0.1%	0.8155	0.8015	1.7%	<DL	<DL	0.3847	1.2822	0.7940	5.4%
Pb	<DL	<DL		<DL	<DL		<DL	<DL	0.0674	0.2248	N/A	
Re	<DL	<DL		<DL	<DL		<DL	<DL	0.0156	0.0522	N/A	
Rh	<DL	<DL		<DL	<DL		<DL	<DL	0.1190	0.3967	N/A	
Ru	<DL	<DL		<DL	<DL		<DL	<DL	0.0712	0.2374	N/A	
Sb	<DL	<DL		<DL	<DL		<DL	<DL	0.1069	0.3562	N/A	
Se	<DL	<DL		<DL	<DL		<DL	<DL	0.1081	0.3602	N/A	
Si	0.0437	0.0442	1.2%	0.0482	0.0483	0.2%	<DL	<DL	0.0587	0.1957	0.0459	9.8%
Sr	(0.0001)	<DL		(0.0001)	<DL		<DL	<DL	0.0013	0.0045	0.0001	7.4%
Te	<DL	<DL		<DL	<DL		<DL	<DL	0.0650	0.2167	N/A	
Th	<DL	<DL		<DL	<DL		<DL	<DL	0.1658	0.5526	N/A	
Ti	<DL	<DL		<DL	<DL		<DL	<DL	0.0121	0.0404	N/A	
Tl	<DL	<DL		<DL	<DL		<DL	<DL	3.1009	10.3364	N/A	
U	<DL	<DL		<DL	<DL		<DL	<DL	1.3258	4.4192	N/A	
V	<DL	<DL		<DL	<DL		<DL	<DL	0.0107	0.0357	N/A	
Zn	<DL	<DL		<DL	<DL		<DL	(0.0005)	0.0046	0.0154	N/A	
Zr	<DL	<DL		<DL	<DL		<DL	<DL	0.0101	0.0337	N/A	
Bi	N/A			N/A			N/A				N/A	

* Methods blank - average sample weight used to calculate wt%.

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Inorganic Water Leach Anion Analysis Results

The Core 16 water leach ion chromatography data is listed in Table 11.1. An aliquot of the water leach sample preparation solution (PNL-ALO-103) was analyzed for anions by ion chromatography (PNL-ALO-212) and total carbon/total inorganic carbon (7-40.7). Each sample was prepared in duplicate. In addition, an anion spike was added to a third sample, and a spike control sample was prepared by adding the same spiking solution to deionized water. A methods blank was also analyzed.

The Core 16 Data Package contains anion analysis data for the core composite sample (Tables 11.1). Column 1 of each of these tables list the anion for which data are reported. Columns 2 and 3 tabulate the analytical results for the analyses of the duplicate samples and column 4 lists the relative percent difference (RPD) between the samples. Column 5 lists the "as prepared" concentrations of the anion spiking solution and column 6 lists the "measured" concentrations that are derived from the spike control analysis data. Column 7 lists the calculated value of the "spike" added to the spiked sample. Column 8 reports the results from the spiked sample analysis; percent recoveries (% Spike Rec) are listed in column 9. Estimated method detection limits are shown in column 10.

TABLE 11.1: SST Core 16, Core Composite Water Leach Anion Analysis

Sample: 90-4180
09/19/90

	C1 (mg/kg)	C2 (mg/kg)	RPD	-----Spike*Control--(a)- True (ug/mL)	C4---> C3 Spk (ug/mL)	C3 Spk (mg/kg)	C3 (mg/kg)	% Spk Rec	C5 (c) (mg/kg)
F	1940	2010	3.5%	50	58	575	2710	127.8%	<19
Cl	1430	1440	0.7%	100	110	1080	2620	109.7%	<19
NO2	10300	10300	0.0%	1000	1014	9990	21300	110.1%	<37
NO3	167000	170000	1.8%	5000	5328	52500	226000	109.5%	<37
PO4	23600	24300	2.9%	1500	1393	13700	36100	88.7%	<37
SO4	11100	11200	0.9%	500	542	5340	17000	109.6%	<37
TIC	828	742	11.0%						<94
TOC	457	407	11.6%						168

(a) The spike's measured concentration has been used to calculate the quantity of spike added in mg/kg.
(b) The % spike recovery is valid only if the spike level is over 20% of the sample's base value.
(c) The average Wt-gm of Sample 1 & 2 is used to calculate blank in mg/kg.

Other Inorganic Results

Graphite furnace atomic absorption spectroscopy analyses were performed on the Core 16 composite sample. The sample was prepared by the acid leach method (PNL-ALO-101), and was analyzed in duplicate along with a spike, a spike control and a methods blank sample (Table 12). Data is included for As, Se and Pb.

Colorimetric analysis for chromium (VI) was completed on aliquots of the Core 16 composite water leach sample. The sample was analyzed in duplicate and is reported in mg/kg (Table 12). A methods blank sample was also analyzed for each segment.

The Core 16 composite was sampled and analyzed for mercury following the protocols outlined in the EPA-CLP SOW 7/88. The analyses were completed in duplicate, a third sample split was spiked with mercury and a forth sample was prepared by spiking the mercury standard into the deionized water (Table 12). A methods blank was run with each suite of samples.

EPA Method 350.3 was used for the ammonia analysis of the Core 16 composite water leach sample. The sample was analyzed in duplicate along with a methods blank sample; the results are reported in mg/kg (Table 12).

No cyanide data are available at this time.

TABLE 12: SST Core 16, Other Inorganic Results

Analysis	Sample Number	mg/kg
AA - As	90-4180-B-1	<2
	-B-2	<2
	-B-5	<2
- Se	90-4180-B-1	(a)
	-B-2	(a)
	-B-5	<2
- Pb	90-4180-B-1	188
	-B-2	182
	-B-5	<2
Chromium (VI)	90-4180-C-1	31.0
	-C-2	31.8
	-C-5	<18.0
Mercury	90-4180-D-1	0.59
	-D-2	0.61
	-D-3	1.08
	-D-4	--
	-D-5	0.09
Ammonia	90-4180-C-1	352.1
	-C-2	376.0
	-C-5	5.6

(a) Analyte suppression due to matrix effect observed on final dilution runs.

SECTION 3

RADIOCHEMICAL DATA TABLES

RADIOCHEMICAL RESULTS

Radiochemical analyses were completed on selected segment and core composite samples. The solution resulting from the potassium hydroxide (KOH) fusion (PNL-ALO-102) were split between the inorganic and radiochemistry groups. Radiochemical analyses completed on this solution include Gamma Energy Analysis (GEA), Total Alpha, Total Beta, and Total Uranium. These radiochemical analyses were also completed for the Water Leach sample (PNL-ALO-102). GEA data are reported in Table 13. The rest of the radiochemistry results are reported in Table 14.

TABLE 13: Core 16 Gamma Energy Analysis Data

Customer No.	Counting Time	Cs-137 uCi/g-wet 662 keV	+/- % error	Cs-134 uCi/g-wet Avg peaks	+/- % error	Co-60 uCi/g-wet Avg peaks	+/- % error	Additional Nuclides Nuclide	Energy keV	uCi/g-wet	+/- % error
SEGMENT 3											
90-3617-A-1	100 min.	15.86	0.17	0.0258	8.70	0.6418	0.79	Am-241	59.54	1.12E-02	40.65
								Ce-144	133.54	3.96E-02	36.27
90-3617-A-2	100 min.	14.42	0.18	---		1.244	0.57	Am-241	59.54	1.21E-02	36.58
								Ce-144	133.54	7.02E-02	20.14
90-3617-A-3	15 hr.	0.08878	0.89	0.0020	11.42	0.0815	0.77	Am-241	59.54	1.27E-03	21.63
								Eu-154	Avg peaks	4.18E-03	6.73
								Gd-153	Avg peaks	6.23E-03	4.48
								Ce-144	133.54	2.70E-03	35.06
90-3618-A-1	100 min.	14.03	0.19	0.006513	32.72	0.6863	0.78	Gd-153	Avg peaks	1.32E-02	28.69
								Ce-144	133.54	4.69E-02	33.74
90-3618-A-2	100 min.	15.2	0.18	0.0182	14.58	0.9515	0.65	Am-241	59.54	1.53E-02	34.89
								Gd-153	Avg peaks	1.44E-02	28.99

TABLE 13: Core 16 Gamma Energy Analysis Data (Cont'd)

Customer No.	Counting Time	Cs-137 uCi/g-wet 662 keV	+/- % error	Cs-134 uCi/g-wet Avg peaks	+/- % error	Co-60 uCi/g-wet Avg peaks	+/- % error	Additional Nuclides Nuclide	Energy keV	uCi/g-wet	+/- % error
SEGMENT 5											
90-3619-A-1	100 min.	11.24	0.21	0.0057	22.27	0.0646	2.58	Gd-153	Avg peaks	1.25E-02	30.83
								Ce-144	133.54	6.39E-02	25.25
90-3619-A-2	100 min.	11.2	0.2	0.009016	12.06	0.1316	1.67	Am-241	59.54	1.77E-02	24.07
								Ce-144	133.54	9.62E-02	15.82
90-3619-A-3	15 hr.	2.366	0.15	0.0133	4.42	0.5283	0.29	Am-241	59.54	2.38E-03	29.25
								Eu-154	Avg peaks	8.61E-03	7.52
								Gd-153	Avg peaks	1.06E-02	7.5
								Ce-144	Avg peaks	6.10E-03	5.15
90-3620-A-1	100 min.	11.06	0.21	0.0030	33.40	0.1008	2.04	Ce-144	133.54	3.98E-02	35.06
90-3620-A-2	100 min.	12.23	0.19	0.0106	15.64	0.4495	0.9	Ce-144	133.54	4.29E-02	28.61
								Am-241	59.54	1.03E-02	37.40

TABLE 13: Core 16 Gamma Energy Analysis Data (Cont'd)

Customer No.	Counting Time	Cs-137 uCi/g-wet 662 keV	+/- % error	Eu-154 uCi/g-wet Avg peaks	+/- % error	Eu-155 uCi/g-wet Avg peaks	+/- % error	Additional Nuclides Nuclide	Energy keV	uCi/g-wet	+/- % error
COMPOSITE											
90-4178-A-1	100 min.	14.03	0.17	0.01265	11.23	0.01392	22.4	Co-60	Avg peaks	8.59E-03	7.24
								Ce-144	133.54	7.20E-02	20.11
								Am-241	59.54	1.27E-02	32.72
90-4178-A-2	100 min.	14.3	0.19	0.02017	9.58	0.01159	31.7	Co-60	Avg peaks	1.62E-02	5.68
								Ce-144	133.54	5.72E-02	29.65
								Am-241	59.54	2.48E-02	22.73
90-4178-A-3	15 hr.	0.6771	0.28	0.005827	5.79	0.003755	14.9	Co-60	Avg peaks	2.09E-02	1.64
								Cs-134	Avg peaks	1.26E-02	2.02
								Ce-144	133.54	4.28E-03	25.79
								Gd-153	97.25	3.81E-03	13.1
								Am-241	59.54	3.45E-03	13.48
90-4179-A-1	100 min.	14.16	0.16	0.01039	11.42	---		Co-60	Avg peaks	5.90E-03	8.95
								Ce-144	133.54	5.51E-02	24.81
								Am-241	59.54	1.01E-02	38.67
90-4179-A-2	100 min.	14.28	0.16	0.04909	6	---		Co-60	Avg peaks	3.21E-01	0.96
								Cs-134	Avg peaks	1.21E-02	14.71
								Ce-144	133.54	1.27E-01	12.51
								Eu-152	Avg peaks	2.52E-02	30.88
								Gd-153	Avg peaks	6.90E-02	6.79
								Am-241	59.54	2.48E-02	19.18
90-4180-C-1	100 min.	7.635	0.11	---		---					
90-4180-C-2	100 min.	7.405	0.11	---		---		Cs-134	Avg peaks	7.38E-04	19.58
90-4180-C-5	16 hr.	0.0148	0.91	---		---		Co-60	Avg peaks	7.73E-04	4.43
								Cs-134	Avg peaks	1.03E-04	20.97

TABLE 14: SST Core 16 Radiochemistry Data

TOTAL ALPHA, TOTAL BETA AND URANIUM

Customer No.	Tot alpha dpm/g	+/- % error	Tot beta (dpm/g) @Sr90-Y90	+/- % error	Uranium ug/g wet wt.	+/- % error
Segment 3						
90-3617-A-1	Not Requested		3.89E+07	2.7	104	
90-3617-A-2	"		3.71E+07	2.7	108	
90-3617-A-3	"		6.83E+05	4.3	<1.4	
Segment 5						
90-3619-A-1	Not Requested		2.56E+07	2.9	48.5	
90-3619-A-2	"		2.68E+07	2.9	48.0	
90-3619-A-3	"		9.45E+06	3.0	2.2	
Composite						
90-4178-A-1	Request Cancelled		6.17E+07	4.0	136	
90-4178-A-2	"		6.97E+07	5.0	148	
90-4178-A-3	"		2.49E+06	4.0	4.5	
90-4180-C-1	"		1.73E+07	2.8	0.6	
90-4180-C-2	"		1.76E+07	2.8	0.6	
90-4180-C-5	"		4.34E+04	3.4	0.02	

TABLE 14: SST Core 16 Radiochemistry Data (Continued)

Sr-90, Tc-99 and I-129 DATA

Customer No.	Sr-90 dpm/g	+/- % error	Tc-99 dpm/g	+/- % error	I-129 dpm/g	+/- % error
Segment 3						
90-3617-A-1	3.01E+06	7.5	4.38E+04	7.9	<160	
90-3617-A-2	2.24E+06	8.0	3.96E+04	8.5	<160	
90-3617-A-3	3.13E+05	13.0	<7.25E+03		<160	
Segment 5						
90-3619-A-1	1.13E+06	10.0	1.39E+04	22	<178	
90-3619-A-2	1.03E+06	10.0	1.51E+04	18	<150	
90-3619-A-3	2.00E+06	10.0	<8.13E+03		<169	
Composite						
90-4178-A-1	1.58E+07		2.62E+04	9	<290	
90-4178-A-2	1.43E+07		2.38E+04	14	<170	
90-4178-A-3	3.80E+05		<2.61E+03		<150	
90-4180-C-1	1.44E+04		3.57E+04	4	<27	
90-4180-C-2	2.21E+03		3.43E+04	3.5	<26	
90-4180-C-5	3.48E+03		<1.42E+03		<27	

TABLE 14: SST Core 16 Radiochemistry Data (Continued)

H-3 and C-14 DATA

Customer No.	H-3 dpm/g	+/- % error	C-14 dpm/g	+/- % error
Composite				
90-4180-C-1	1.58E+04	6.4	3.96E-03	20
90-4180-C-2	1.04E+04	6.2	5.58E-04	20
90-4180-C-5	1.24E+03	16	<5.40E-05	20

TABLE 14: SST Core 16 Radiochemistry Data (Continued)

ALPHA ENERGY ANALYSIS OF Pu and Np

Customer No.	Pu 239&240 dpm/g	+/- % error	Pu 238 dpm/g	+/- % error	Np 237 dpm/g	+/- % error
Segment 3						
90-3617-A-1	2.22E+05	5.6	1.80E+04	10.9	<70	
90-3617-A-2	2.12E+05	4.2	1.04E+04	12.8	<150	
90-3617-A-3	9.28E+02	8.7	1.67E+03	8.0	<79	
Segment 5						
90-3619-A-1	2.10E+05	5.9	7.83E+03	16.0	<87	
90-3619-A-2	2.68E+05	5.3	2.56E+04	10.4	<66	
90-3619-A-3	4.84E+03	8.0	6.24E+03	8.0	<58	
Composite						
90-4178-A-1	2.55E+05	5.0	1.46E+04	7.0	<59	
90-4178-A-2	2.80E+05	4.0	1.66E+04	7.0	<75	
90-4178-A-3	9.98E+02	8.0	2.23E+03	7.0	<86	
90-4180-C-1	3.45E+03	5.9	8.11E+01	10.0	<16	
90-4180-C-2	3.37E+03	5.9	1.01E+02	10.4	<15	
90-4180-C-5	2.41E+01	30.3	4.51E+01	27.6	<16	

TABLE 14: SST Core 16 Radiochemistry Data (Continued)

ALPHA ENERGY ANALYSIS OF Am AND Cm

Customer No.	Am 241 dpm/g	+/- % error	Cm-243&244 dpm/g	+/- % error
Segment 3				
90-3617-A-1	2.16E+04	8.6	1.27E+04	13.1
90-3617-A-2	1.63E+04	8.3	5.02E+03	11.2
90-3617-A-3	3.74E+03	15.0	3.24E+03	15.0
Segment 5				
90-3619-A-1	1.88E+04	11.0	5.14E+03	15.6
90-3619-A-2	1.53E+04	11.5	1.69E+03	23.8
90-3619-A-3	1.09E+04	10.9	9.17E+03	10.9
Composite				
90-4178-A-1	2.91E+04	9.1	1.27E+03	12.2
90-4178-A-2	4.53E+04	8.1	5.43E+03	9.4
90-4178-A-3	1.63E+04	11	1.04E+04	11
90-4180-C-1	424	19.5		
90-4180-C-2	6.13	15		
90-4180-C-5	<51.3			