

Illinois State Water Survey Division

ATMOSPHERIC CHEMISTRY SECTION



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SURFACE DUST ELEMENTAL PROFILES - GRANITE CITY

by Stephen J. Vermette and Allen L. Williams

Sponsored by the
Illinois Department of Energy and Natural Resources
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Stephen J. Vermette and Allen L. Williams
Illinois State Water Survey
Atmospheric Chemistry Section
2204 Griffith Dr.
Champaign, IL 61820-7495

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Introduction

Numerous receptor modeling studies have indicated the significance of fugitive dust sources to ambient PM-10 loadings. The significance of surface dust sources has been reinforced in Granite City, IL by Glover *et al.*, (1989) and Sweet *et al.*, (1989). As a part of the studies necessary to prepare an effective and efficient SIP for Granite City, surface dust profiles were developed for a number of sites within the city. These surface dust profiles are to be incorporated in subsequent receptor modeling work.

This report outlines the preliminary development of surface dust elemental profiles for Granite City. A more thorough statistical treatment of the data, uniform data formats, and the development of composite profiles are planned. This report is also available on a floppy disk. Included in this report are:

	Hard Copy	Disk
1. Methodology and Comments	Text	GTEXT.TX5
2. Surface Dust Profiles	Appendix A	PROFILE.ASC
3. NAA & XRF Comparison	Appendix B	NAA-WRF.WK1 (data)
4. Field Sampling Notes	Appendix C	
5. XRF Elemental Data		XRF.ASC
6. NAA Elemental Data		NAA.WK1
7. Bulk NAA Data		BULK.WK1

Sample Collection

Granite City roadway and surface dust samples were collected by the IEPA in late autumn of 1988. Samples were swept off surfaces and placed in a plastic bag. Sampling locations were focused near the dichotomous sampler and on suspected fugitive dust sources attributed to nearby industries (eg. Granite City Steel and Terra-Corp). Of the 49 samples collected 12 were chosen for elemental analysis (see Figure 1, as well as Appendix C):

BG	Background (Shoulder - Intersection of I-270 and 159)
GCS2	Milling Area - Paved Road
GCS13	Slag Crusher
GCS18	BOF Plant - Blast Furnace Paved Road
GCS19	Pellet Storage
GCS22	Coke Oven Area
UPS1	Parking Lot Terra-Corp
PS1&4&5	Mixed Edwardsville Road
PS7	Paved Roadway Near Dichotomous Sampler
PS8	Paved Roadway North of Dichotomous Sampler
PS15	Paved Roadway Near FMC (Fertilizer)
PS17	Paved Roadway Northeast of Dichotomous Sampler

The 12 choices reflect suspected sources of fugitive dust, however, the analyzed samples represent only 25% of the collected samples and thus an important source may have inadvertently been omitted.

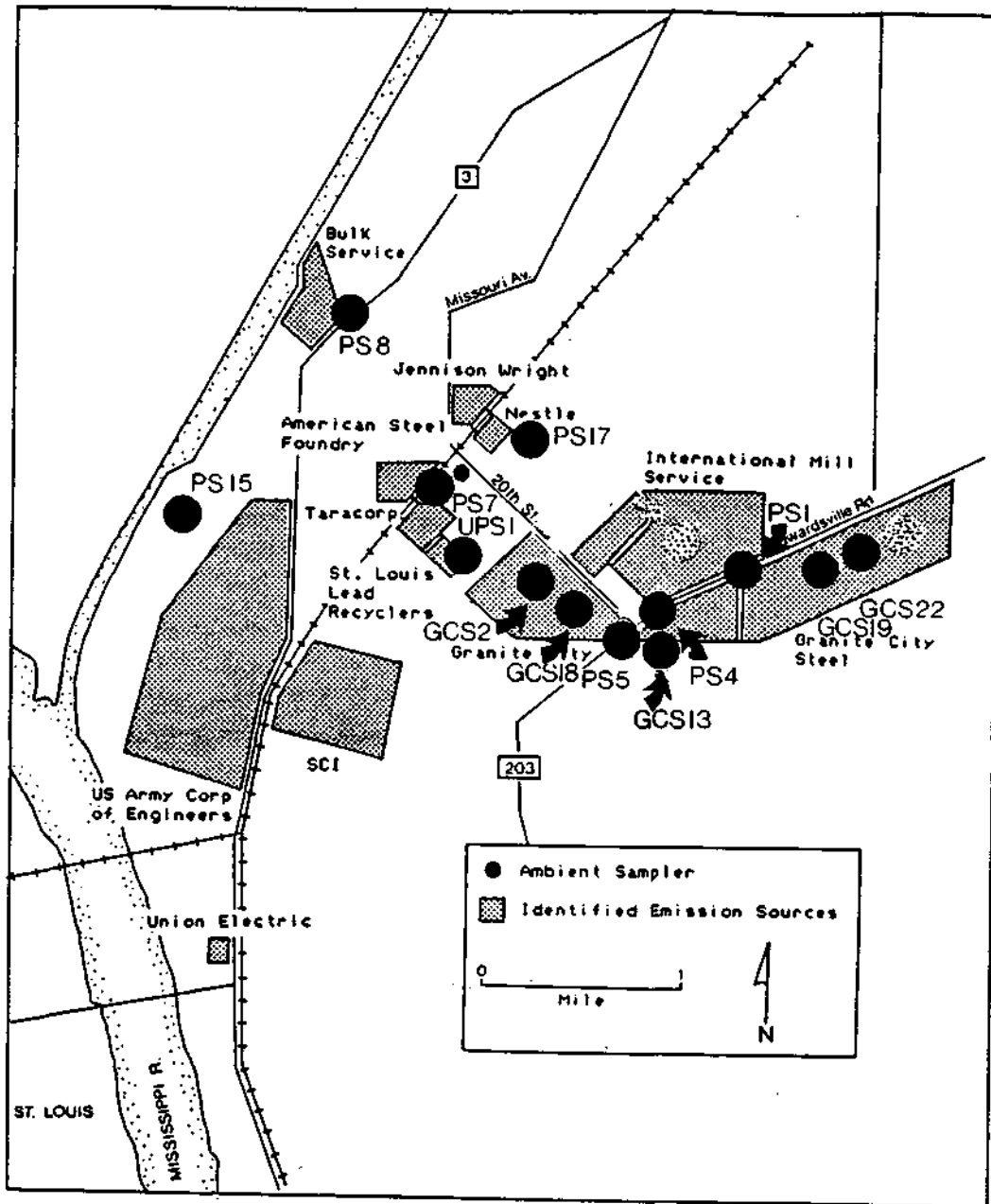


Figure 1. Granite City Study Area and Surface Dust Sampling Sites.

Suspension

The surface dust samples were sieved to < 57 μm to be used as the bulk material for suspension and deposit onto filters. The suspension chamber consists of a swirl chamber where the dust was suspended by a continuous supply of filtered compressed air (see Figure 2). The compressed air and suspended dust were forced into a circular air motion (swirl) about the axis of the chamber where the particles are mixed and disaggregated. The disaggregation of the particles removes possible elemental inhomogeneity between filters due to fractionation effects (e.g. coarse particles are truly coarse particles and not aggregates) and assures true particle sizes for techniques requiring particle standards and corrections (e.g. XRF). The flow was exhausted into a 8 ft³ cardboard box for dichotomous and PMS sampling (the box was replaced for each dust sample).

Particle samples were collected within the cardboard box using an automatic dichotomous virtual impactor fitted with a PM-10 inlet made by Anderson, Inc., Atlanta, GA (Series 245). The sampler is designed to collect particulate matter with an aerodynamic size cut off of 10 μm and to further separate particles into two size fractions, a fine particle fraction (< 2.5 μm) and a coarse particle fraction (2.5 to 10 μm). The fine and coarse deposits were collected on 37 mm diameter Teflon disks with a polyethylene support ring (for elemental analyses) and on 37 mm diameter glass fiber disks (for carbon analysis). Both filter types are made by Gelman Science, Ann Arbor, MI. Two PM-10 inlets within the box allows for the simultaneous sampling on Teflon and glass fiber filters. The similarity in particle size composition of loaded filters (disaggregation) was ensured by the continuous monitoring of particle size distribution using a PMS laser probe particle counter (model CSAS-100-HV).

Elemental and Carbon Analyses

The suspended filter deposits (fine and coarse) on Teflon were subjected to elemental analysis by X-ray fluorescence (NEA, Inc. of Beaverton, OR) and neutron activation analysis (Department of Nuclear Engineering, University of Illinois). The method of XRF is based on the atomic excitation of electrons with the subsequent emissions of characteristic x-rays when electrons from higher levels fill the void spaces. The method of NAA is based on the measurement of induced radioactivity where the radioactive decay of each element emits a characteristic gamma-ray energy spectrum.

Filters were equilibrated 24 hours at 50% relative humidity before weighing. Loaded filters were weighed prior to XRF analysis and then reweighed prior to NAA analysis. All filter handling and weighing was done in a clean room with a laminar flow clean bench. Using a Cahn microbalance, the precision (standard deviation) of duplicate weighings under these conditions is ± 5 μg .

Fine and coarse deposits have been corrected for fine particles collected on the coarse filter (dichot correction), as outlined in the automatic dichotomous sampler instruction manual (Anderson Bulletin No. 1079-245-IM).

A subset of the collected samples were analyzed in bulk form (< 57 μm material prior to suspension) by NAA.

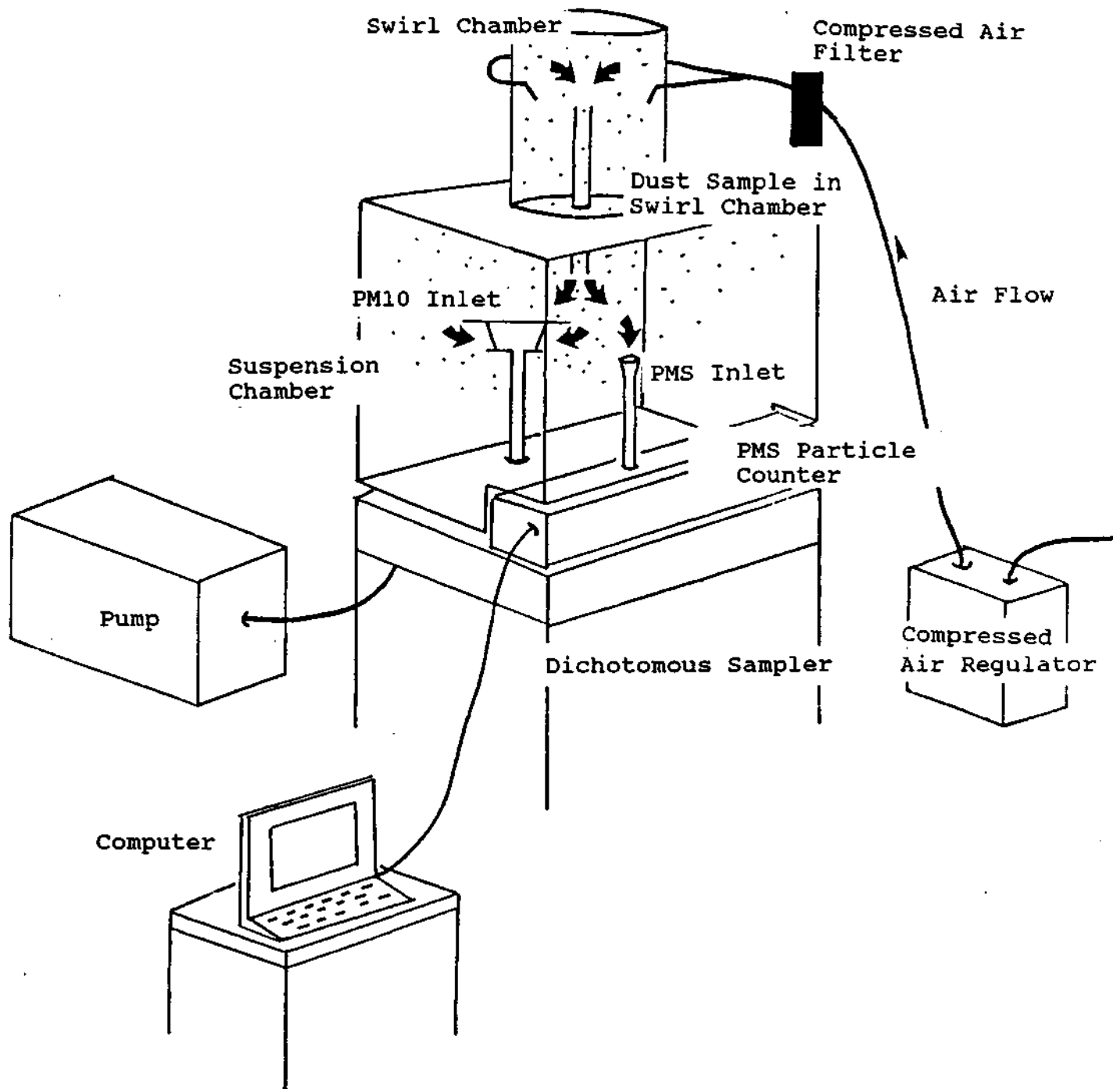


Figure 2. Schematic of the Suspension Chamber

Total carbon analysis was carried out by the Analytical Chemistry Section of the Illinois State Water Survey. Suspended filter deposits on the glass fiber filters were treated with HCL acid to remove carbonate and then combusted at 800 C for CO₂ determinations by a Dohrmann carbon analyzer. Earlier experiments have demonstrated the effectiveness of carbonate removal with HCL treatments. By way of example, consider a fine deposit sample collected on a glass fiber filter (test filter). Carbon on the fine deposit (not treated with HCL) measured 45.3%. When the fine deposit was treated with HCL acid the carbon measurement was reduced to 3.7%. Thus, 41.6% of the originally measured carbon was actually carbonate. This estimated carbonate value (41.6%) compares well with a measured carbonate value of 53% for the bulk sample (some differences are to be expected between the fine deposit (<2.5um) and bulk samples (<57 um) due to particle size fractionation effects).

The dust profiles presented in this report are predominantly from XRF determinations. Important inputs were made by NAA for elements determinations not provided by XRF (Na, Mg and Sm) or determinations which are at or below XRF detection limits (V, Sb and La). Total C values were provided from the Dohrmann analyzer.

Redundant Measurements - Quality Check

The use of XRF and NAA techniques provides for a number of redundant measurements which serve as a quality check for reported concentrations. Fine and coarse determinations of Al, Ca, Cu, Mn, Ti, V and K are sufficiently above detection limits to allow for comparison.

A comparison of XRF and NAA determinations for each element (Al through to K) and sampled dust source are presented in Appendix E. In general, agreement between the two techniques is good. A number of the Cu and Ti values are below NAA detection limits but where comparisons can be made agreement is good. The one exception is PS1&4&5 where the NAA Cu value more than doubles the XRF value. The source of error is likely the fact that the NAA value is near the detection limit (2.9 ± 0.8 ug, with a detection limit of 2.6 ug). Agreement is not as good for V and K but a strong correlation is evidenced ($V r^2 = 0.80$; $K r^2 = 0.84$). The NAA V determinations were used for the dust profiles as they are farther removed from detection limits than that of the XRF determinations. The XRF K determinations were kept for the dust profiles.

Comments

This report provides a first look at the analytical data provided for the development of Granite City dust source profiles. A more detailed statistical analysis will follow, including the development of composite dust profiles, but some general observations are worth noting here.

The variability in elemental concentrations between dust profiles reinforces our contention that a single dust profile is not adequate to properly characterize fugitive dust sources in receptor modeling statistics. Taking Fe and Zn as examples, the fine fraction

concentrations varied from 2.6% to 29.1% and from 0.036% to 5.8%, respectively.

A second point evidenced in the dust profiles is the variability of elemental fractionation between fine, coarse and bulk samples. Taking Fe as an example, substantial fractionation is evidenced for GCS18 (fine = 29.1%, coarse = 20.2%, bulk = 18.4%), while no measureable fractionation is noted for PS7 (fine = 2.6%, coarse = 2.2%, bulk = 2.6%). Interesting patterns on a spatial scale are noted for S. Fine/coarse ratios for S range from 0.7 to 2.0 for sampling sites in and around the steel mills but range from 3.0 to 17.0 for sampling sites near and north of the dichotomous sampler site.

Other points of interest include:

Highest Pb concentrations measured at Terra-Corp parking lot (fine = .898% and coarse = .646%).

Combined high Fe and Zn concentrations at the milling area (GCS2 - fine Fe = 22.3% and fine Zn = 3.0%) and blast furnace paved road (GCS18 - fine Fe = 29.1% and fine Zn = 5.8%).

The highest Fe concentration was recorded at pellet storage (GCS19 - fine Fe = 32.7% and coarse Fe = 47.2%). In contrast to the previous Zn concentrations, GCS19 recorded some of the lowest Zn values (fine Zn = 0.045% and coarse Zn = 0.026%).

The highest C measurement (fine = 47.5% and coarse = 44.6%) was recorded for the Coke Oven Area (GCS22).

A more thorough examination of the developed dust profiles will no doubtedly reveal more insights. A point to be made is that the variabilities in elemental concentrations, between samples and particle size ranges, reinforces the need to develop site-specific surface dust libraries. Furthermore, careful consideration of the samples collected and of the suspension techniques is necessary to optimize these profiles for receptor modeling statistics.

References

Glover, D.M., Hopke, K., Landsberger, S., DAuben, D.R., and Vermette, S.J. "Source apportionment For Airborne particles in Granite City, Illinois" (89-103P.4), Presented at the 82nd Annual Meeting & Exhibition, Anaheim, California, June 25-30, 1989

Sweet, C.W., Vermette, S.J., and Gatz, D.F. "Toxic Trace Elements in Urban Air in Illinois", Illinois Hazardous Waste Research and Information Center, Savoy, IL (Draft Report February 1989 - Project No. 88006).

APPENDIX A
Surface Dust Elemental Profiles

SAMPLE ID: BG
 DESCRIPTION: BACKGROUND (Shoulder - Intersection of I-270 and 159)
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 553 MICROGRAMS
 NAA - 522 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					7.1	
NA			3.016+-	.401	.578+-	.077
AL	4.2202+-	.5626	27.853+-	3.713	5.034+-	.682
SI	12.2044+-	1.8079	80.549+-	11.932	14.557+-	2.186
P	.2156+-	.0272	1.423+-	.179	.257+-	.033
S	.1161+-	.0560	.766+-	.369	.139+-	.067
CL	.2110+-	.0360	1.393+-	.238	.252+-	.043
K	1.0048+-	.1160	6.632+-	.766	1.199+-	.141
CA	9.0678+-	1.0268	59.848+-	6.777	10.816+-	1.253
TI	.3007+-	.0193	1.984+-	.127	.359+-	.025
V			.115+-	.003	.022+-	.001
CR	.0203+-	.0028	.134+-	.018	.024+-	.003
MN	.2452+-	.0148	1.618+-	.098	.292+-	.019
FE	4.9642+-	.2632	32.764+-	1.737	5.921+-	.346
NI	.0191+-	.0021	.126+-	.014	.023+-	.003
CU	.0347+-	.0032	.229+-	.021	.041+-	.004
ZN	.1364+-	.0082	.901+-	.054	.163+-	.011
AS			.009+-	.001	.001+-	.000
RB	.0059+-	.0021	.039+-	.014	.007+-	.003
SR	.0180+-	.0026	.119+-	.017	.021+-	.003
Y	.0048+-	.0029	.032+-	.019	.006+-	.003
PD	.0136+-	.0086	.089+-	.056	.016+-	.010
IN	.0242+-	.0161	.160+-	.106	.029+-	.019
SB			.005+-	.000	.001+-	.000
LA			.024+-	.001	.001+-	.000
SM			.003+-	.000	.001+-	.000
HG	.0044+-	.0030	.029+-	.020	.005+-	.004
PB	.1580+-	.0115	1.043+-	.076	.188+-	.014

SAMPLE ID: BG
 DESCRIPTION: BACKGROUND (Shoulder - Intersection of I-270 and 159)
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1795 MICROGRAMS
 NAA - 1774 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			4.2
Na		8.281+- .839	.467+- .046
Mg		18.422+- 3.801	1.038+- .208
AL	13.5814+- 1.8501	89.637+- 12.211	4.995+- .681
SI	44.6401+- 6.4425	294.625+- 42.520	16.417+- 2.372
P	.5552+- .0794	3.664+- .524	.204+- .029
CL	.7057+- .1095	4.658+- .722	.260+- .040
K	3.1818+- .3727	21.000+- 2.460	1.170+- .137
CA	35.8000+- 4.1160	236.280+- 27.166	13.166+- 1.517
TI	.9686+- .0588	6.393+- .388	.356+- .022
V		.320+- .009	.018+- .000
CR	.0640+- .0067	.422+- .044	.024+- .002
MN	.7090+- .0418	4.679+- .276	.261+- .015
FE	14.3777+- .7529	94.893+- 4.969	5.287+- .279
NI	.0291+- .0027	.192+- .018	.011+- .001
CU	.0687+- .0048	.454+- .032	.025+- .002
ZN	.3180+- .0176	2.099+- .116	.117+- .007
GA	.0054+- .0021	.036+- .014	.002+- .001
AS		.016+- .001	.001+- .000
BR	.0060+- .0017	.039+- .011	.002+- .001
RB	.0230+- .0026	.152+- .017	.008+- .001
SR	.0718+- .0047	.474+- .031	.026+- .002
SB		.007+- .001	.001+- .000
BA	.2015+- .1029	1.330+- .679	.074+- .038
LA		.063+- .002	.004+- .000
SM		.010+- .000	.001+- .000
HG	.0108+- .0040	.071+- .026	.004+- .001
PB	.4235+- .0241	2.795+- .159	.156+- .009

SAMPLE ID: GCS2
 DESCRIPTION: MILLING AREA - PAVED ROAD
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 474 MICROGRAMS
 NAA - 454 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					2.3	
NA			1.090+-	.234	.240+-	.052
MG			9.757+-	1.698	2.149+-	.374
AL	1.2633+-	.1693	8.338+-	1.117	1.757+-	.240
SI	4.0831+-	.6052	26.949+-	3.994	5.680+-	.856
P	.0992+-	.0174	.654+-	.115	.138+-	.024
S	.3654+-	.0807	2.412+-	.533	.508+-	.113
K	.1271+-	.0268	.839+-	.177	.177+-	.038
CA	11.3192+-	1.2815	74.706+-	8.458	15.746+-	1.830
TI	.0901+-	.0122	.595+-	.080	.125+-	.017
V			.091+-	.002	.020+-	.000
CR	.0390+-	.0048	.257+-	.032	.054+-	.007
MN	.4786+-	.0288	3.158+-	.190	.666+-	.044
FE	16.0251+-	.8456	105.766+-	5.581	22.293+-	1.325
NI	.0199+-	.0022	.131+-	.015	.028+-	.003
CU	.0283+-	.0029	.187+-	.019	.039+-	.004
ZN	2.1426+-	.1140	14.141+-	.752	2.981+-	.178
AS			.007+-	.001	.001+-	.000
SE	.0017+-	.0012	.011+-	.008	.002+-	.002
SR	.0134+-	.0026	.089+-	.017	.019+-	.004
PD	.0169+-	.0092	.111+-	.061	.023+-	.013
AG	.0124+-	.0108	.082+-	.071	.017+-	.015
SB			.004+-	.000	.001+-	.000
LA			.019+-	.001	.004+-	.000
SM			.003+-	.000	.001+-	.000
PB	.0628+-	.0066	.414+-	.044	.087+-	.010

SAMPLE ID: GCS2
 DESCRIPTION: MILLING AREA PAVED ROAD
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1114 MICROGRAMS
 NAA - 1016 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					5.1	
Na			3.245+-	.605	.319+-	.057
Mg			41.608+-	3.426	4.095+-	.323
AL	3.8171+-	.5220	25.193+-	3.445	2.262+-	.310
SI	12.4033+-	1.8008	81.862+-	11.886	7.351+-	1.070
P	.1955+-	.0439	1.290+-	.289	.116+-	.026
S	.4542+-	.1408	2.998+-	.930	.269+-	.084
CL	.1032+-	.0473	.681+-	.312	.061+-	.028
K	.3967+-	.0728	2.619+-	.481	.235+-	.043
CA	31.6689+-	3.6809	209.015+-	24.294	18.770+-	2.191
TI	.3484+-	.0225	2.299+-	.148	.206+-	.014
V			.258+-	.007	.025+-	.001
CR	.1029+-	.0104	.679+-	.069	.061+-	.006
MN	1.1178+-	.0667	7.378+-	.440	.663+-	.040
FE	33.6013+-	1.7874	221.768+-	11.797	19.915+-	1.081
NI	.0453+-	.0035	.299+-	.023	.027+-	.002
CU	.0509+-	.0039	.336+-	.026	.030+-	.002
ZN	3.6223+-	.1968	23.907+-	1.299	2.147+-	.119
AS			.011+-	.001	.001+-	.000
SE	.0044+-	.0012	.029+-	.008	.003+-	.001
BR	.0043+-	.0014	.028+-	.009	.003+-	.001
RB	.0111+-	.0021	.073+-	.014	.007+-	.001
SR	.0487+-	.0036	.321+-	.024	.029+-	.002
IN	.0286+-	.0157	.189+-	.104	.017+-	.009
SN	.0390+-	.0196	.257+-	.129	.023+-	.012
SB			.005+-	.000	.001+-	.000
BA	.1297+-	.0886	.856+-	.585	.077+-	.053
LA			.035+-	.001	.003+-	.000
SM			.005+-	.000	.001+-	.000
PB	.1244+-	.0105	.821+-	.069	.074+-	.006

SAMPLE ID: GCS13
 DESCRIPTION: SLAG CRUSHER
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 504 MICROGRAMS
 NAA - 490 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					6.1	
NA			1.346+-	.285	.275+-	.058
MG			17.891+-	1.997	3.655+-	.408
AL	2.2909+-	.3059	15.120+-	2.019	2.997+-	.408
SI	7.4218+-	1.0996	48.984+-	7.257	9.710+-	1.461
P	.0887+-	.0217	.586+-	.143	.116+-	.029
S	1.2206+-	.1689	8.056+-	1.115	1.597+-	.225
K	.2557+-	.0427	1.687+-	.282	.334+-	.057
CA	17.4876+-	1.9792	115.418+-	13.062	22.880+-	2.658
TI	.2866+-	.0179	1.891+-	.118	.375+-	.025
V			.048+-	.002	.010+-	.000
CR	.0136+-	.0023	.089+-	.015	.018+-	.003
MN	.5567+-	.0302	3.674+-	.199	.728+-	.044
FE	3.7704+-	.2003	24.885+-	1.322	4.933+-	.292
NI	.0083+-	.0017	.055+-	.011	.011+-	.002
CU	.0090+-	.0021	.059+-	.014	.012+-	.003
ZN	.0770+-	.0051	.508+-	.034	.101+-	.007
AS			.004+-	.001	.001+-	.000
SE	.0016+-	.0012	.010+-	.008	.002+-	.002
SR	.0167+-	.0027	.110+-	.018	.022+-	.004
SB			.003+-	.000	.001+-	.000
LA			.037+-	.001	.001+-	.000
SM			.005+-	.000	.001+-	.000
HG	.0019+-	.0029	.012+-	.019	.002+-	.004
PB	.0097+-	.0052	.064+-	.034	.013+-	.007

SAMPLE ID: GCS13
 DESCRIPTION: SLAG CRUSHER
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1125 MICROGRAMS
 NAA - 1067 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					12.8	
MG			53.548+-	3.488	5.019+-	.313
AL	5.4992+-	.7580	36.295+-	5.003	3.227+-	.446
SI	18.0192+-	2.6383	118.927+-	17.413	10.575+-	1.553
P	.1494+-	.0471	.986+-	.311	.088+-	.028
S	1.7452+-	.2675	11.518+-	1.765	1.024+-	.157
K	.4927+-	.0858	3.252+-	.566	.289+-	.050
CA	36.9078+-	4.3426	243.592+-	28.661	21.661+-	2.560
TI	.7372+-	.0440	4.866+-	.291	.433+-	.026
V			.125+-	.004	.012+-	.000
CR	.0253+-	.0038	.167+-	.025	.015+-	.002
MN	.8567+-	.0495	5.654+-	.327	.503+-	.030
FE	9.2859+-	.4906	61.287+-	3.238	5.450+-	.294
NI	.0129+-	.0018	.085+-	.012	.008+-	.001
CU	.0094+-	.0020	.062+-	.013	.006+-	.001
ZN	.0877+-	.0058	.579+-	.038	.051+-	.003
GA	.0014+-	.0010	.009+-	.007	.001+-	.001
AS			.004+-	.001	.001+-	.000
SE	.0019+-	.0012	.013+-	.008	.001+-	.001
ER	.0018+-	.0015	.012+-	.010	.001+-	.001
RB	.0092+-	.0022	.061+-	.015	.005+-	.001
SR	.0519+-	.0038	.343+-	.025	.030+-	.002
AG	.0117+-	.0104	.077+-	.068	.007+-	.006
CD	.0155+-	.0127	.102+-	.084	.009+-	.007
SB			.005+-	.000	.001+-	.000
LA			.085+-	.002	.008+-	.002
SM			.010+-	.000	.001+-	.000
PB	.0170+-	.0052	.112+-	.035	.010+-	.003

SAMPLE ID: GCS18
 DESCRIPTION: BOF PLANT - BLAST FURNACE PAVED ROAD
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 432 MICROGRAMS
 NAA - 417 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			17.3
NA		1.092+- .230	.262+- .055
MG		8.482+- 1.596	2.032+- .382
AL	.8379+- .1127	5.530+- .744	1.279+- .176
SI	2.6764+- .3969	17.664+- 2.619	4.087+- .618
P	.0837+- .0136	.552+- .090	.128+- .021
S	.2809+- .0799	1.854+- .527	.429+- .123
CL	.3089+- .0448	2.038+- .296	.472+- .070
K	.1411+- .0256	.932+- .169	.216+- .040
CA	7.6976+- .8718	50.804+- 5.754	11.754+- 1.375
TI	.0534+- .0128	.353+- .085	.082+- .020
V		.082+- .002	.020+- .001
CR	.0276+- .0049	.182+- .032	.042+- .008
MN	.4902+- .0307	3.235+- .202	.749+- .052
FE	19.0249+- 1.0036	125.564+- 6.623	29.051+- 1.754
NI	.0190+- .0022	.125+- .015	.029+- .004
CU	.0223+- .0027	.147+- .018	.034+- .004
ZN	3.7683+- .1998	24.871+- 1.318	5.754+- .349
AS		.008+- .001	.002+- .000
SE	.0016+- .0013	.010+- .009	.002+- .002
BR	.0022+- .0017	.015+- .011	.003+- .003
SR	.0079+- .0026	.052+- .017	.012+- .004
PD	.0143+- .0098	.095+- .065	.022+- .015
AG	.0154+- .0117	.102+- .077	.024+- .018
CD	.0166+- .0142	.109+- .094	.025+- .022
IN	.0043+- .0180	.029+- .119	.007+- .027
SB		.005+- .000	.001+- .000
LA		.012+- .001	.003+- .000
SM		.002+- .000	.001+- .000
PB	.1208+- .0102	.797+- .067	.184+- .016

SAMPLE ID: GCS18
 DESCRIPTION: BOF PLANT - BLAST FURNACE PAVED ROAD
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 884 MICROGRAMS
 NAA - 858 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					3.8	
NA			4.478+-	.555	.522+-	.062
MG			26.358+-	2.885	3.072+-	.116
AL	2.0256+-	.2801	13.369+-	1.848	1.513+-	.210
SI	6.8741+-	1.0045	45.369+-	6.630	5.134+-	.753
P	.1494+-	.0289	.986+-	.191	.112+-	.022
S	.7679+-	.1510	5.068+-	.997	.573+-	.113
CL	.3219+-	.0629	2.125+-	.415	.240+-	.047
K	.3429+-	.0568	2.263+-	.375	.256+-	.043
CA	19.7936+-	2.3086	130.638+-	15.237	14.782+-	1.735
TI	.2127+-	.0188	1.404+-	.124	.159+-	.014
V			.191+-	.005	.022+-	.001
CR	.0739+-	.0081	.488+-	.054	.055+-	.006
MN	.7655+-	.0478	5.052+-	.315	.572+-	.036
FE	27.0631+-	1.4852	178.617+-	9.802	20.211+-	1.141
NI	.0330+-	.0029	.218+-	.019	.025+-	.002
CU	.0275+-	.0029	.181+-	.019	.021+-	.002
ZN	4.7437+-	.2649	31.308+-	1.748	3.543+-	.203
GA	.0099+-	.0078	.065+-	.052	.007+-	.006
AS			.010+-	.001	.001+-	.000
SE	.0023+-	.0013	.015+-	.009	.002+-	.001
BR	.0062+-	.0016	.041+-	.011	.005+-	.001
RB	.0086+-	.0022	.057+-	.015	.006+-	.002
SR	.0272+-	.0029	.180+-	.019	.020+-	.002
AG	.0151+-	.0108	.099+-	.071	.011+-	.008
CD	.0238+-	.0133	.157+-	.088	.018+-	.010
IN	.0196+-	.0169	.129+-	.112	.015+-	.013
SN	.0254+-	.0208	.168+-	.137	.019+-	.016
SB			.005+-	.001	.001+-	.000
LA			.026+-	.001	.003+-	.000
SM			.004+-	.000	.001+-	.000
PB	.1867+-	.0131	1.232+-	.087	.139+-	.010

SAMPLE ID: GCS19.2
 DESCRIPTION: PELLET STORAGE
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 336 MICROGRAMS
 NAA - 326 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					.41	
NA			.882+-	.162	.270+-	.050
MG			5.316+-	1.282	1.629+-	.393
AL	.6064+-	.0819	4.002+-	.541	1.193+-	.167
SI	2.9028+-	.4304	19.158+-	2.840	5.709+-	.871
P	.0729+-	.0113	.481+-	.075	.143+-	.023
S	.1671+-	.0562	1.103+-	.371	.329+-	.111
K	.0823+-	.0179	.543+-	.118	.162+-	.036
CA	5.7246+-	.6486	37.782+-	4.281	11.260+-	1.339
TI	.0311+-	.0113	.205+-	.075	.061+-	.022
V			.082+-	.002	.025+-	.001
CR	.0239+-	.0042	.158+-	.028	.047+-	.009
MN	.0991+-	.0092	.654+-	.061	.195+-	.019
FE	16.6083+-	.8763	109.615+-	5.784	32.667+-	2.087
NI	.0087+-	.0017	.057+-	.011	.017+-	.003
CU	.0091+-	.0021	.060+-	.014	.018+-	.004
ZN	.0227+-	.0025	.150+-	.016	.045+-	.005
AS			.008+-	.001	.002+-	.000
SR	.0038+-	.0024	.025+-	.016	.007+-	.005
PD	.0121+-	.0091	.080+-	.060	.024+-	.018
CD	.0257+-	.0137	.169+-	.090	.050+-	.027
SB			.002+-	.000	.001+-	.000
LA			.012+-	.001	.004+-	.000
SM			.001+-	.000	.001+-	.000

SAMPLE ID: GCS19.2
 DESCRIPTION: PELLET STORAGE
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 539 MICROGRAMS
 NAA - 500 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					8.3	
NA			.917+-	.262	.183+-	.049
MG			10.402+-	1.637	2.080+-	.307
AL	.6800+-	.0997	4.488+-	.658	.832+-	.123
SI	3.0676+-	.4756	20.246+-	3.139	3.753+-	.587
P	.0835+-	.0135	.551+-	.089	.102+-	.017
K	.0548+-	.0198	.361+-	.131	.067+-	.024
CA	6.4779+-	.7975	42.754+-	5.263	7.926+-	.989
TI	.0260+-	.0241	.172+-	.159	.032+-	.030
V			.152+-	.004	.030+-	.001
CR	.0426+-	.0072	.281+-	.048	.052+-	.009
MN	.1518+-	.0158	1.002+-	.104	.186+-	.020
FE	38.5532+-	2.0382	254.451+-	13.452	47.169+-	2.677
NI	.0139+-	.0018	.092+-	.012	.017+-	.002
CU	.0097+-	.0019	.064+-	.013	.012+-	.002
ZN	.0212+-	.0023	.140+-	.015	.026+-	.003
GA	.0013+-	.0008	.009+-	.005	.002+-	.001
AS			.005+-	.001	.001+-	.000
SE	.0025+-	.0011	.016+-	.007	.003+-	.001
BR	.0021+-	.0013	.014+-	.009	.003+-	.002
RB	.0038+-	.0019	.025+-	.013	.005+-	.002
SR	.0141+-	.0023	.093+-	.015	.017+-	.003
IN	.0269+-	.0150	.177+-	.099	.033+-	.018
SB			.002+-	.000	.001+-	.000
LA			.016+-	.001	.003+-	.000
SM			.002+-	.000	.001+-	.000

SAMPLE ID: GCS22
 DESCRIPTION: COKE OVEN AREA
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 317 MICROGRAMS
 NAA - 304 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			47.5
NA		1.573+- .134	.517+- .044
AL	.7940+- .1068	5.240+- .705	1.655+- .231
SI	1.6310+- .2420	10.764+- 1.597	3.399+- .521
P	.0543+- .0076	.358+- .050	.113+- .016
S	.4937+- .0716	3.258+- .473	1.029+- .154
CL	.2555+- .0356	1.686+- .235	.532+- .077
K	.1509+- .0194	.996+- .128	.315+- .042
CA	1.9167+- .2179	12.650+- 1.438	3.995+- .479
TI	.0571+- .0044	.377+- .029	.119+- .010
V		.018+- .001	.006+- .000
CR	.0082+- .0016	.054+- .010	.017+- .003
MN	.0709+- .0046	.468+- .030	.148+- .011
FE	1.6410+- .0881	10.831+- .581	3.420+- .225
NI	.0036+- .0012	.023+- .008	.007+- .003
ZN	.1120+- .0069	.739+- .046	.233+- .017
AS		.008+- .001	.003+- .000
SR	.0038+- .0022	.025+- .015	.008+- .005
SB		.012+- .000	.004+- .000
LA		.006+- .001	.002+- .000
SM		.001+- .000	.001+- .000
PB	.0104+- .0048	.069+- .032	.022+- .010

SAMPLE ID: GCS22
 DESCRIPTION: COKE OVEN AREA
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1082 MICROGRAMS
 NAA - 1071 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			44.6
NA		3.237+- .458	.302+- .042
MG		12.117+- 2.165	1.131+- .197
AL	2.6261+- .3584	17.332+- 2.366	1.601+- .219
SI	5.9987+- .8661	39.592+- 5.717	3.658+- .529
P	.1674+- .0218	1.105+- .144	.102+- .013
S	2.0506+- .2595	13.534+- 1.713	1.250+- .159
CL	.6233+- .0831	4.114+- .548	.380+- .051
K	.3990+- .0493	2.633+- .326	.243+- .030
CA	6.7776+- .7824	44.732+- 5.164	4.133+- .479
TI	.1427+- .0114	.942+- .075	.087+- .007
V		.068+- .002	.006+- .000
CR	.0130+- .0022	.086+- .015	.008+- .001
MN	.1534+- .0097	1.013+- .064	.094+- .006
FE	4.3583+- .2302	28.765+- 1.520	2.658+- .143
NI	.0072+- .0015	.048+- .010	.004+- .001
CU	.0070+- .0020	.046+- .013	.004+- .001
ZN	.1746+- .0103	1.152+- .068	.106+- .006
GA	.0015+- .0011	.010+- .007	.001+- .001
AS		.016+- .001	.002+- .000
BR	.0056+- .0016	.037+- .011	.003+- .001
SR	.0190+- .0027	.126+- .018	.012+- .002
SB		.003+- .000	.001+- .000
LA		.022+- .001	.002+- .000
SM		.004+- .000	.001+- .000
PB	.0285+- .0055	.188+- .036	.017+- .003

SAMPLE ID: UPS1
 DESCRIPTION: PARKING LOT TERRA-CORP
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 360 MICROGRAMS
 NAA - 343 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					4.7	
NA			1.240+-	.255	.362+-	.074
AL	2.0033+-	.2676	13.222+-	1.766	3.673+-	.506
SI	5.4086+-	.8015	35.697+-	5.290	9.916+-	1.507
P	.1521+-	.0205	1.004+-	.136	.279+-	.039
S	.1552+-	.0748	1.024+-	.494	.285+-	.137
CL	.0766+-	.0259	.506+-	.171	.140+-	.048
K	.5179+-	.0620	3.418+-	.409	.949+-	.118
CA	9.3504+-	1.0587	61.712+-	6.988	17.142+-	2.026
TI	.1373+-	.0087	.906+-	.058	.252+-	.018
V			.062+-	.002	.018+-	.000
CR	.0153+-	.0020	.101+-	.013	.028+-	.004
MN	.1392+-	.0082	.919+-	.054	.255+-	.017
FE	1.9743+-	.1057	13.031+-	.697	3.620+-	.229
NI	.0030+-	.0013	.020+-	.009	.005+-	.002
CU	.0084+-	.0020	.056+-	.013	.015+-	.004
ZN	.0739+-	.0049	.488+-	.032	.135+-	.010
AS			.021+-	.001	.006+-	.000
SE	.0018+-	.0013	.012+-	.009	.003+-	.002
BR	.0020+-	.0016	.013+-	.010	.004+-	.003
RB	.0032+-	.0022	.021+-	.015	.006+-	.004
SR	.0132+-	.0026	.087+-	.017	.024+-	.005
SB			.031+-	.001	.009+-	.000
BA	.1546+-	.0991	1.020+-	.654	.283+-	.182
LA			.007+-	.001	.002+-	.000
SM			.001+-	.000	.001+-	.000
PB	.4896+-	.0278	3.231+-	.183	.898+-	.059

SAMPLE ID: UPS1

DESCRIPTION: PARKING LOT TERRA-CORP

PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM

MASS OF DEPOSIT: XRF - 1526 MICROGRAMS

NAA - 1441 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					5.5	
NA			2.444+-	.605	.170+-	.041
MG			36.504+-	3.212	2.533+-	.218
AL	6.8064+-	.9263	44.922+-	6.114	2.944+-	.401
SI	21.4311+-	3.0866	141.445+-	20.372	9.269+-	1.337
P	.3989+-	.0697	2.632+-	.460	.173+-	.030
S	.3372+-	.2083	2.226+-	1.375	.146+-	.090
K	1.7610+-	.2139	11.623+-	1.412	.762+-	.093
CA	43.5470+-	4.9866	287.410+-	32.911	18.834+-	2.161
TI	.3946+-	.0257	2.604+-	.170	.171+-	.011
V			.225+-	.006	.016+-	.000
CR	.0407+-	.0046	.268+-	.030	.018+-	.002
MN	.5126+-	.0299	3.383+-	.197	.222+-	.013
FE	8.5592+-	.4427	56.491+-	2.922	3.702+-	.193
NI	.0123+-	.0018	.081+-	.012	.005+-	.001
CU	.0425+-	.0035	.280+-	.023	.018+-	.002
ZN	.2460+-	.0136	1.624+-	.090	.106+-	.006
AS			.060+-	.002	.004+-	.000
SE	.0022+-	.0016	.015+-	.011	.001+-	.001
BR	.0077+-	.0020	.051+-	.013	.003+-	.001
RB	.0124+-	.0024	.082+-	.016	.005+-	.001
SR	.0757+-	.0049	.499+-	.032	.033+-	.002
Y	.0076+-	.0064	.050+-	.042	.003+-	.003
IN	.0171+-	.0170	.113+-	.112	.007+-	.007
SN	.0308+-	.0212	.203+-	.140	.013+-	.009
SB			.089+-	.002	.006+-	.000
BA	.1065+-	.0978	.703+-	.646	.046+-	.042
LA			.025+-	.001	.002+-	.000
SM			.004+-	.000	.001+-	.000
PB	1.4938+-	.0799	9.859+-	.528	.646+-	.035

SAMPLE ID: PSl&4&5
 DESCRIPTION: MIXED EDWARDSVILLE ROAD
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1509 MICROGRAMS
 NAA - 1495 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			10.3
NA		3.848+- .423	.257+- .028
MG		30.344+- 3.282	2.029+- .220
AL	5.6725+- .7561	37.438+- 4.990	2.481+- .333
SI	16.8119+- 2.4903	110.958+- 16.436	7.354+- 1.096
P	.4730+- .0691	3.122+- .456	.207+- .030
S	1.2874+- .2227	8.497+- 1.470	.563+- .098
CL	.1765+- .0572	1.165+- .378	.077+- .025
K	.7018+- .1032	4.632+- .681	.307+- .045
CA	36.2093+- 4.0968	238.982+- 27.039	15.838+- 1.810
TI	.4231+- .0208	2.793+- .137	.185+- .010
V		.525+- .012	.035+- .001
CR	.0939+- .0097	.620+- .064	.041+- .004
MN	1.1421+- .0667	7.538+- .440	.500+- .030
FE	28.0502+- 1.4789	185.131+- 9.761	12.269+- .676
NI	.1844+- .0109	1.217+- .072	.081+- .005
CU	.0753+- .0055	.497+- .036	.033+- .002
ZN	1.9283+- .1026	12.727+- .677	.843+- .047
GA	.0041+- .0034	.027+- .023	.002+- .002
AS		.018+- .001	.001+- .000
SE	.0023+- .0014	.015+- .010	.001+- .001
BR	.0043+- .0018	.029+- .012	.002+- .001
RB	.0087+- .0026	.057+- .017	.004+- .001
SR	.0733+- .0050	.484+- .033	.032+- .002
MO	.0189+- .0102	.125+- .067	.008+- .004
PD	.0181+- .0107	.120+- .070	.008+- .005
IN	.0221+- .0199	.146+- .131	.010+- .009
SN	.0500+- .0250	.330+- .165	.022+- .011
SB		.011+- .000	.001+- .000
LA		.048+- .001	.003+- .000
SM		.005+- .000	.001+- .000
PB	.1342+- .0112	.886+- .074	.059+- .005

SAMPLE ID: PS1&4&5
 DESCRIPTION: MIXED EDWARDSVILLE ROAD
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 4503 MICROGRAMS
 NAA - 4044 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					9.5	
NA			14.983+-	2.353	.370+-	.056
MG			67.523+-	15.785	1.339+-	.376
AL	20.7161+-	2.8118	136.726+-	18.558	3.036+-	.412
SI	58.3603+-	8.4355	385.178+-	55.674	8.554+-	1.237
P	1.0796+-	.2106	7.125+-	1.390	.158+-	.031
S	2.4367+-	.5421	16.082+-	3.578	.357+-	.079
CL	.3954+-	.1504	2.610+-	.993	.058+-	.022
K	2.0670+-	.3075	13.642+-	2.029	.303+-	.045
CA	108.2768+-	12.5523	714.627+-	82.845	15.870+-	1.842
TI	1.2355+-	.0985	8.154+-	.650	.181+-	.014
V			1.242+-	.036	.031+-	.001
CR	.3474+-	.0323	2.293+-	.213	.051+-	.005
MN	2.6421+-	.1631	17.438+-	1.077	.387+-	.024
FE	73.5899+-	3.8645	485.693+-	25.506	10.786+-	.569
NI	.5627+-	.0307	3.714+-	.203	.082+-	.005
CU	.1460+-	.0099	.963+-	.065	.021+-	.001
ZN	3.2370+-	.1760	21.364+-	1.162	.474+-	.026
GA	.0097+-	.0056	.064+-	.037	.001+-	.001
AS			.016+-	.001	.001+-	.000
SE	.0107+-	.0019	.070+-	.013	.002+-	.000
BR	.0145+-	.0024	.095+-	.016	.002+-	.000
RB	.0311+-	.0035	.205+-	.023	.005+-	.001
SR	.2343+-	.0131	1.546+-	.086	.034+-	.002
ZR	.0947+-	.0240	.625+-	.158	.014+-	.004
MO	.0557+-	.0145	.368+-	.096	.008+-	.002
IN	.0341+-	.0234	.225+-	.154	.005+-	.003
SN	.0383+-	.0288	.253+-	.190	.006+-	.004
SB			.005+-	.000	.001+-	.000
BA	.1500+-	.1334	.990+-	.880	.022+-	.020
LA			.019+-	.001	.001+-	.000
SM			.004+-	.000	.001+-	.000
PB	.2727+-	.0201	1.800+-	.133	.040+-	.003

SAMPLE ID: PS7
 DESCRIPTION: PAVED ROADWAY NEAR DICHOT
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 411 MICROGRAMS
 NAA - 379 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					3.2	
NA			1.037+-	.175	.274+-	.046
MG			4.181+-	1.250	1.100+-	.330
AL	.9272+-	.1245	6.120+-	.821	1.489+-	.205
SI	3.0282+-	.4490	19.986+-	2.963	4.862+-	.736
P	.0926+-	.0192	.611+-	.127	.149+-	.031
S	.6653+-	.0968	4.391+-	.639	1.068+-	.159
CL	.1160+-	.0282	.766+-	.186	.186+-	.046
K	.1319+-	.0294	.871+-	.194	.212+-	.048
CA	14.5260+-	1.6442	95.872+-	10.852	23.320+-	2.734
TI	.0706+-	.0051	.466+-	.034	.113+-	.009
V			.022+-	.001	.006+-	.000
CR	.0140+-	.0018	.092+-	.012	.022+-	.003
MN	.0744+-	.0048	.491+-	.032	.120+-	.009
FE	1.6400+-	.0881	10.824+-	.581	2.633+-	.163
NI	.0041+-	.0012	.027+-	.008	.007+-	.002
CU	.0088+-	.0018	.058+-	.012	.014+-	.003
ZN	.0224+-	.0023	.148+-	.015	.036+-	.004
GA	.0013+-	.0009	.009+-	.006	.002+-	.001
AS			.007+-	.001	.002+-	.000
SR	.0216+-	.0025	.142+-	.016	.035+-	.004
ZR	.0133+-	.0118	.088+-	.078	.021+-	.019
AG	.0127+-	.0092	.084+-	.061	.020+-	.015
SB			.007+-	.000	.002+-	.000
LA			.007+-	.001	.002+-	.000
SM			.001+-	.000	.001+-	.000
PB	.0302+-	.0049	.199+-	.032	.049+-	.008

SAMPLE ID: PS7
 DESCRIPTION: PAVED ROADWAY NEAR DICHOT
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 2104 MICROGRAMS
 NAA - 2098 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					22.9	
NA			5.512+-	.561	.263+-	.026
AL	4.9062+-	.6612	32.381+-	4.364	1.539+-	.208
SI	15.6389+-	2.2392	103.217+-	14.778	4.906+-	.703
P	.3210+-	.1044	2.118+-	.689	.101+-	.033
S	1.1354+-	.2836	7.493+-	1.871	.356+-	.089
CL	.4327+-	.1036	2.856+-	.683	.136+-	.032
K	.6749+-	.1485	4.454+-	.980	.212+-	.047
CA	81.6660+-	9.3152	538.995+-	61.481	25.619+-	2.926
TI	.2274+-	.0183	1.501+-	.121	.071+-	.006
V			.137+-	.004	.007+-	.000
CR	.0717+-	.0056	.473+-	.037	.022+-	.002
MN	.2888+-	.0174	1.906+-	.115	.091+-	.005
FE	7.1093+-	.3680	46.921+-	2.429	2.230+-	.116
NI	.0159+-	.0020	.105+-	.013	.005+-	.001
CU	.0305+-	.0029	.201+-	.019	.010+-	.001
ZN	.0863+-	.0054	.569+-	.036	.027+-	.002
GA	.0017+-	.0012	.011+-	.008	.001+-	.000
AS			.020+-	.001	.001+-	.000
BR	.0039+-	.0016	.026+-	.011	.001+-	.001
RB	.0094+-	.0023	.062+-	.015	.003+-	.001
SR	.1358+-	.0077	.897+-	.051	.043+-	.002
CD	.0201+-	.0133	.133+-	.088	.006+-	.004
SN	.0228+-	.0211	.150+-	.139	.007+-	.007
SB			.018+-	.001	.001+-	.000
BA	.1143+-	.0981	.754+-	.648	.036+-	.031
LA			.031+-	.001	.001+-	.000
SM			.006+-	.000	.001+-	.000
PB	.1323+-	.0094	.873+-	.062	.041+-	.003

SAMPLE ID: PS8
 DESCRIPTION: PAVED ROADWAY NORTH OF DICHOT
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 272 MICROGRAMS
 NAA - 254 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					2.2	
NA			.688+-	.179	.271+-	.070
MG			5.669+-	1.199	2.230+-	.472
AL	.8549+-	.1149	5.642+-	.758	2.073+-	.293
SI	2.7207+-	.4034	17.956+-	2.662	6.596+-	1.019
P	.1609+-	.0212	1.062+-	.140	.390+-	.054
S	.5474+-	.0703	3.613+-	.464	1.327+-	.180
K	.2182+-	.0299	1.440+-	.197	.529+-	.076
CA	8.9332+-	1.0116	58.959+-	6.676	21.658+-	2.625
TI	.0916+-	.0063	.604+-	.041	.222+-	.018
V			.039+-	.001	.015+-	.000
CR	.0171+-	.0020	.113+-	.013	.041+-	.005
MN	.1093+-	.0067	.722+-	.044	.265+-	.020
FE	2.3622+-	.1261	15.591+-	.833	5.727+-	.393
NI	.0073+-	.0016	.048+-	.010	.018+-	.004
CU	.0248+-	.0027	.164+-	.018	.060+-	.007
ZN	.0559+-	.0040	.369+-	.026	.136+-	.011
GA	.0012+-	.0009	.008+-	.006	.003+-	.002
AS			.002+-	.000	.001+-	.000
SR	.0106+-	.0025	.070+-	.016	.026+-	.006
PD	.0092+-	.0087	.061+-	.057	.022+-	.021
SB			.003+-	.000	.001+-	.000
LA			.010+-	.001	.004+-	.000
SM			.002+-	.000	.001+-	.000
PB	.0174+-	.0051	.115+-	.034	.042+-	.013

SAMPLE ID: PS8
 DESCRIPTION: PAVED ROADWAY NORTH OF DICHOT
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1073 MICROGRAMS
 NAA - 1020 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					6.0	
MG			17.937+-	.053	1.759+-	.005
AL	2.8611+-	.3903	18.883+-	2.576	1.760+-	.241
SI	9.0783+-	1.3142	59.917+-	8.674	5.585+-	.810
P	.3567+-	.0598	2.354+-	.394	.219+-	.037
S	.1252+-	.1069	.827+-	.706	.077+-	.066
CL	.0638+-	.0404	.421+-	.266	.039+-	.025
K	.4380+-	.0811	2.891+-	.535	.269+-	.050
CA	38.1792+-	4.3807	251.982+-	28.912	23.489+-	2.705
TI	.2530+-	.0179	1.670+-	.118	.156+-	.011
V			.139+-	.004	.013+-	.000
CR	.0524+-	.0048	.346+-	.032	.032+-	.003
MN	.3148+-	.0191	2.077+-	.126	.194+-	.012
FE	7.9549+-	.4148	52.502+-	2.738	4.894+-	.260
NI	.0151+-	.0019	.099+-	.013	.009+-	.001
CU	.0755+-	.0050	.498+-	.033	.046+-	.003
ZN	.1653+-	.0095	1.091+-	.063	.102+-	.006
GA	.0018+-	.0011	.012+-	.007	.001+-	.001
AS			.005+-	.001	.001+-	.000
SE	.0013+-	.0011	.009+-	.007	.001+-	.001
BR	.0022+-	.0014	.015+-	.009	.001+-	.001
RB	.0084+-	.0021	.055+-	.014	.005+-	.001
SR	.0692+-	.0045	.457+-	.030	.043+-	.003
CD	.0177+-	.0126	.117+-	.083	.011+-	.008
IN	.0195+-	.0156	.129+-	.103	.012+-	.010
SN	.0262+-	.0193	.173+-	.127	.016+-	.012
SB			.006+-	.000	.001+-	.000
BA	.1690+-	.0905	1.115+-	.597	.104+-	.056
LA			.022+-	.001	.002+-	.000
SM			.004+-	.000	.001+-	.000
PB	.0767+-	.0068	.506+-	.045	.047+-	.004

SAMPLE ID: PS15
 DESCRIPTION: PAVED ROADWAY NEAR FMC (FERTILIZER)
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 91 MICROGRAMS
 NAA - 83 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			NA
NA		.442+- .105	.531+- .127
AL	.4171+- .0566	2.753+- .374	3.022+- .553
SI	1.4101+- .2093	9.307+- 1.381	10.215+- 1.968
P	.0409+- .0061	.270+- .040	.296+- .057
S	.1638+- .0294	1.081+- .194	1.187+- .258
CL	.0362+- .0101	.239+- .066	.262+- .080
K	.1248+- .0164	.824+- .108	.904+- .163
CA	1.7586+- .2000	11.607+- 1.320	12.739+- 2.132
TI	.0353+- .0032	.233+- .021	.256+- .039
V		.010+- .001	.012+- .000
CR	.0046+- .0012	.030+- .008	.033+- .010
MN	.0399+- .0030	.263+- .020	.289+- .041
FE	.8267+- .0452	5.456+- .299	5.988+- .805
NI	.0031+- .0011	.021+- .007	.023+- .009
CU	.0079+- .0018	.052+- .012	.057+- .015
ZN	.0593+- .0041	.392+- .027	.430+- .061
GA	.0018+- .0009	.012+- .006	.013+- .007
AS		.002+- .000	.003+- .000
SR	.0026+- .0020	.017+- .013	.019+- .015
SB		.008+- .000	.009+- .000
LA		.003+- .000	.004+- .000
SM		.001+- .000	.001+- .000
PB	.0208+- .0046	.137+- .030	.151+- .038

SAMPLE ID: PS15
 DESCRIPTION: PAVED ROADWAY NEAR FMC (FERTILIZER)
 PARTICLE SIZE: C

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 1183 MICROGRAMS
 NAA - 1078 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			11.2
NA		3.357+- .646	.311+- .060
MG		17.640+- 3.098	1.636+- .286
AL	4.9781+- .6634	32.855+- 4.378	2.778+- .371
SI	17.5585+- 2.4851	115.886+- 16.402	9.797+- 1.389
P	.3379+- .0483	2.230+- .319	.189+- .027
S	.6072+- .1234	4.008+- .814	.339+- .069
CL	.0789+- .0340	.521+- .225	.044+- .019
K	1.2995+- .1527	8.577+- 1.008	.725+- .085
CA	25.1963+- 2.8433	166.296+- 18.766	14.058+- 1.591
TI	.3645+- .0239	2.405+- .158	.203+- .013
V		.155+- .005	.014+- .000
CR	.0546+- .0047	.361+- .031	.030+- .003
MN	.3473+- .0201	2.292+- .133	.194+- .011
FE	7.8730+- .4017	51.962+- 2.651	4.393+- .227
NI	.0168+- .0021	.111+- .014	.009+- .001
CU	.0439+- .0036	.290+- .024	.025+- .002
ZN	.3057+- .0166	2.017+- .110	.171+- .009
AS		.021+- .001	.002+- .000
RB	.0057+- .0024	.038+- .016	.003+- .001
SR	.0487+- .0038	.322+- .025	.027+- .002
SB		.013+- .001	.001+- .000
LA		.027+- .001	.002+- .000
SM		.005+- .000	.001+- .000
PB	.1849+- .0120	1.220+- .079	.103+- .007

SAMPLE ID: PS17
 DESCRIPTION: PAVED ROADWAY NORTHEAST OF DICHOT
 PARTICLE SIZE: F

EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 227 MICROGRAMS
 NAA - 218 MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
C			6.3
MG		5.096+- 1.437	2.342+- .661
AL	1.1186+- .1499	7.383+- .989	3.257+- .467
SI	3.6716+- .5442	24.233+- 3.592	10.691+- 1.676
P	.0957+- .0132	.632+- .087	.279+- .041
S	.4621+- .0620	3.050+- .409	1.346+- .193
K	.2477+- .0311	1.635+- .206	.721+- .098
CA	5.3458+- .6058	35.282+- 3.998	15.566+- 1.934
TI	.1163+- .0076	.768+- .050	.339+- .028
V		.038+- .001	.017+- .000
CR	.0162+- .0020	.107+- .013	.047+- .006
MN	.1651+- .0096	1.090+- .063	.481+- .037
FE	2.8333+- .1509	18.700+- .996	8.250+- .609
NI	.0059+- .0014	.039+- .010	.017+- .004
CU	.0261+- .0028	.172+- .019	.076+- .009
ZN	.1830+- .0106	1.208+- .070	.533+- .041
AS		.005+- .001	.003+- .000
SR	.0052+- .0023	.034+- .015	.015+- .007
SB		.013+- .000	.006+- .000
LA		.013+- .001	.006+- .000
SM		.002+- .000	.001+- .000
PB	.0797+- .0072	.526+- .048	.232+- .024

SAMPLE ID: PS17
 DESCRIPTION: PAVED ROADWAY NORTHEAST OF DICHOT
 PARTICLE SIZE: C

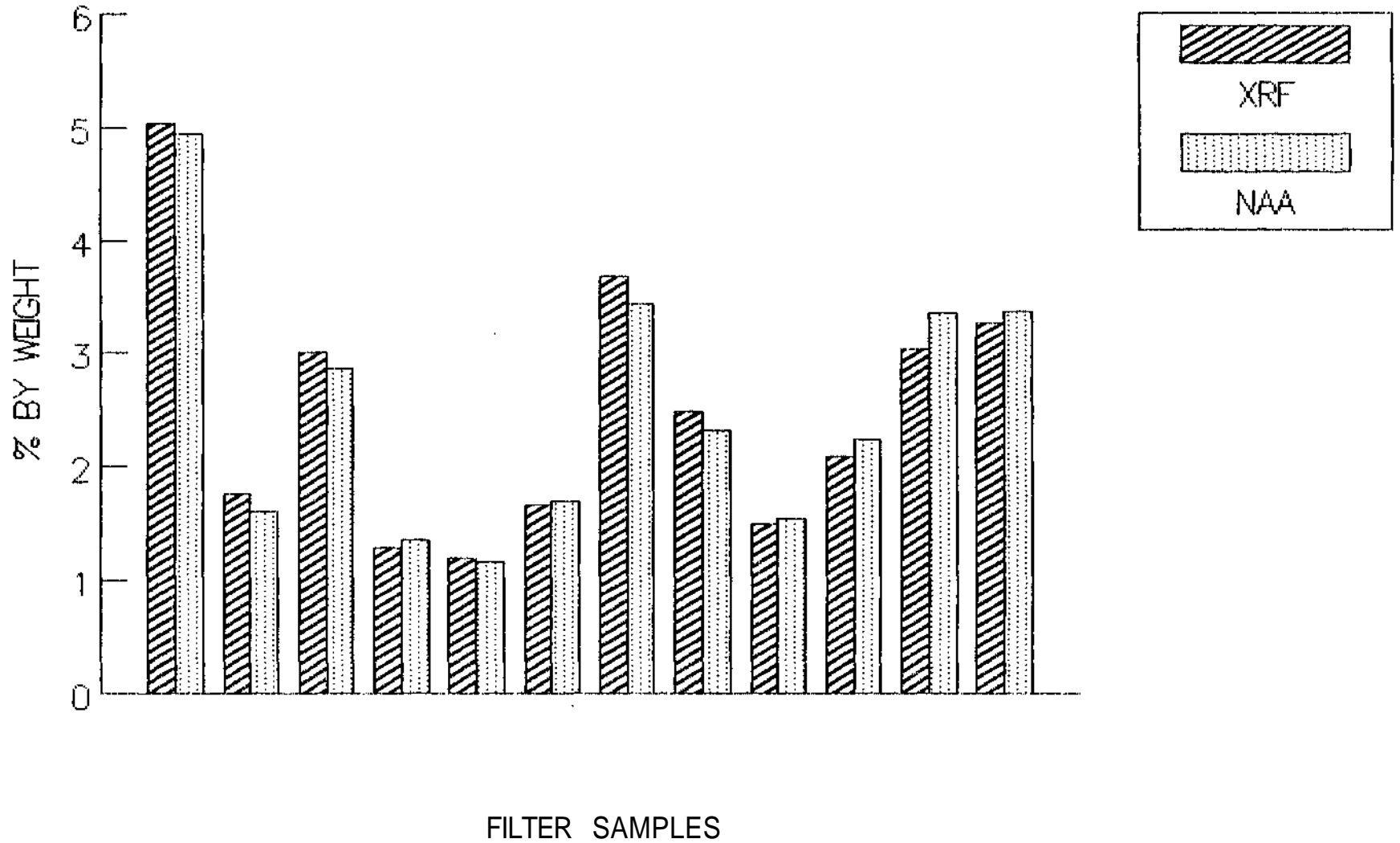
EXPOSED AREA: 6.60 SQUARE CM
 MASS OF DEPOSIT: XRF - 773 MICROGRAMS
 NAA - 718 MICROGRAMS

ELEMENT	UG/CM2		UG/FILTER		PERCENT	
C					5.1	
NA			1.836+-	.557	.256+-	.075
MG			23.118+-	2.755	3.220+-	.372
AL	3.2901+-	.4504	21.714+-	2.973	2.808+-	.386
SI	11.3296+-	1.6440	74.775+-	10.851	9.669+-	1.409
P	.2515+-	.0361	1.660+-	.238	.215+-	.031
S	.2259+-	.0885	1.491+-	.584	.193+-	.076
K	.6277+-	.0794	4.143+-	.524	.536+-	.068
CA	17.8569+-	2.0634	117.856+-	13.618	15.240+-	1.773
TI	.2898+-	.0201	1.912+-	.133	.247+-	.017
V			.140+-	.004	.019+-	.001
CR	.0345+-	.0040	.228+-	.026	.029+-	.003
MN	.4259+-	.0251	2.811+-	.166	.363+-	.022
FE	8.8075+-	.4605	58.129+-	3.039	7.517+-	.406
NI	.0182+-	.0021	.120+-	.014	.016+-	.002
CU	.0688+-	.0048	.454+-	.032	.059+-	.004
ZN	.4223+-	.0232	2.787+-	.153	.360+-	.020
AS			.014+-	.001	.002+-	.000
SE	.0020+-	.0012	.013+-	.008	.002+-	.001
BR	.0030+-	.0015	.020+-	.010	.003+-	.001
RB	.0035+-	.0021	.023+-	.014	.003+-	.002
SR	.0321+-	.0030	.212+-	.020	.027+-	.003
CD	.0196+-	.0130	.130+-	.086	.017+-	.011
SB			.029+-	.001	.004+-	.000
LA			.035+-	.001	.005+-	.000
SM			.005+-	.000	.001+-	.000
PB	.2057+-	.0130	1.358+-	.086	.176+-	.011

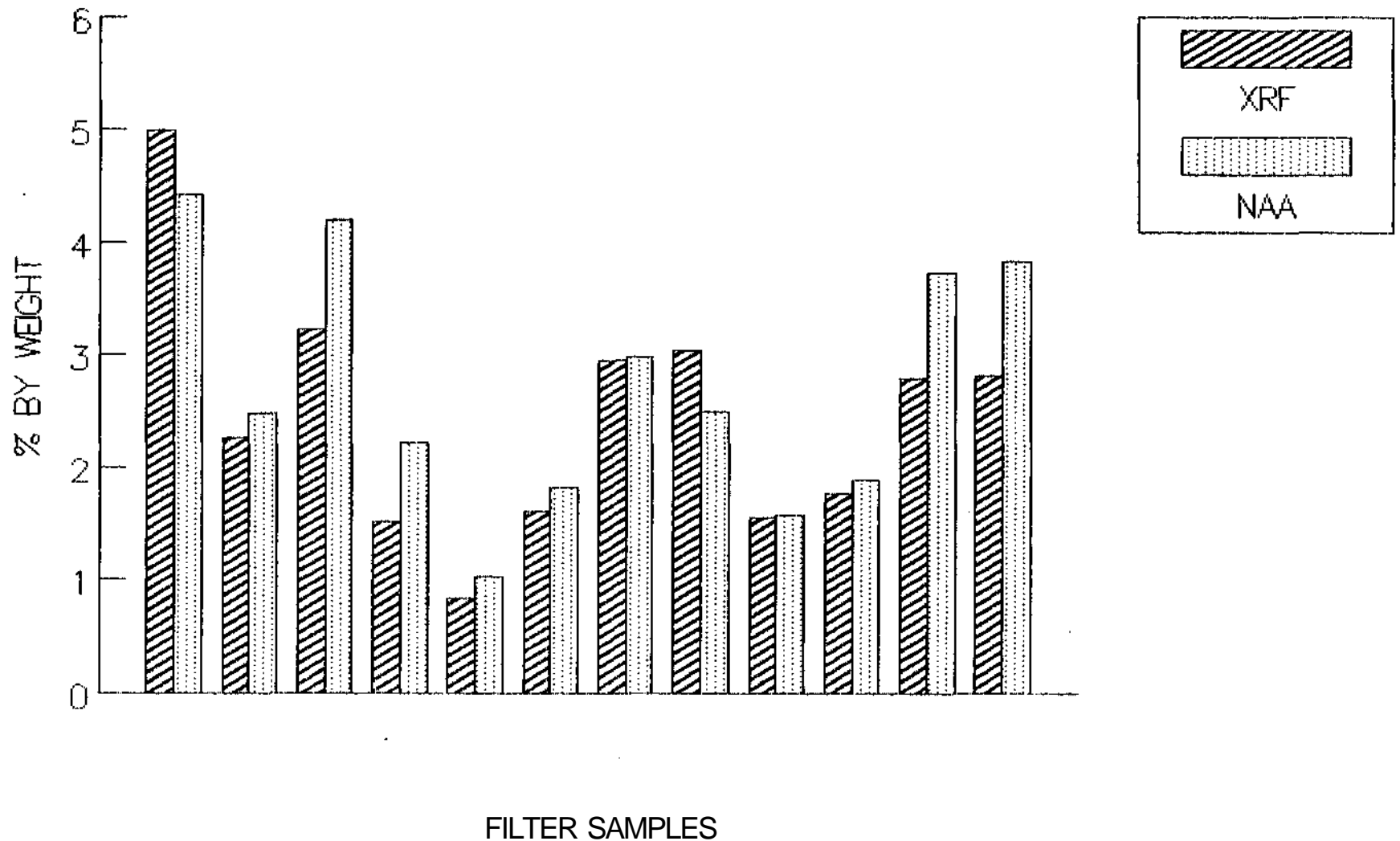
APPENDIX B

NAA & XRF Comparison

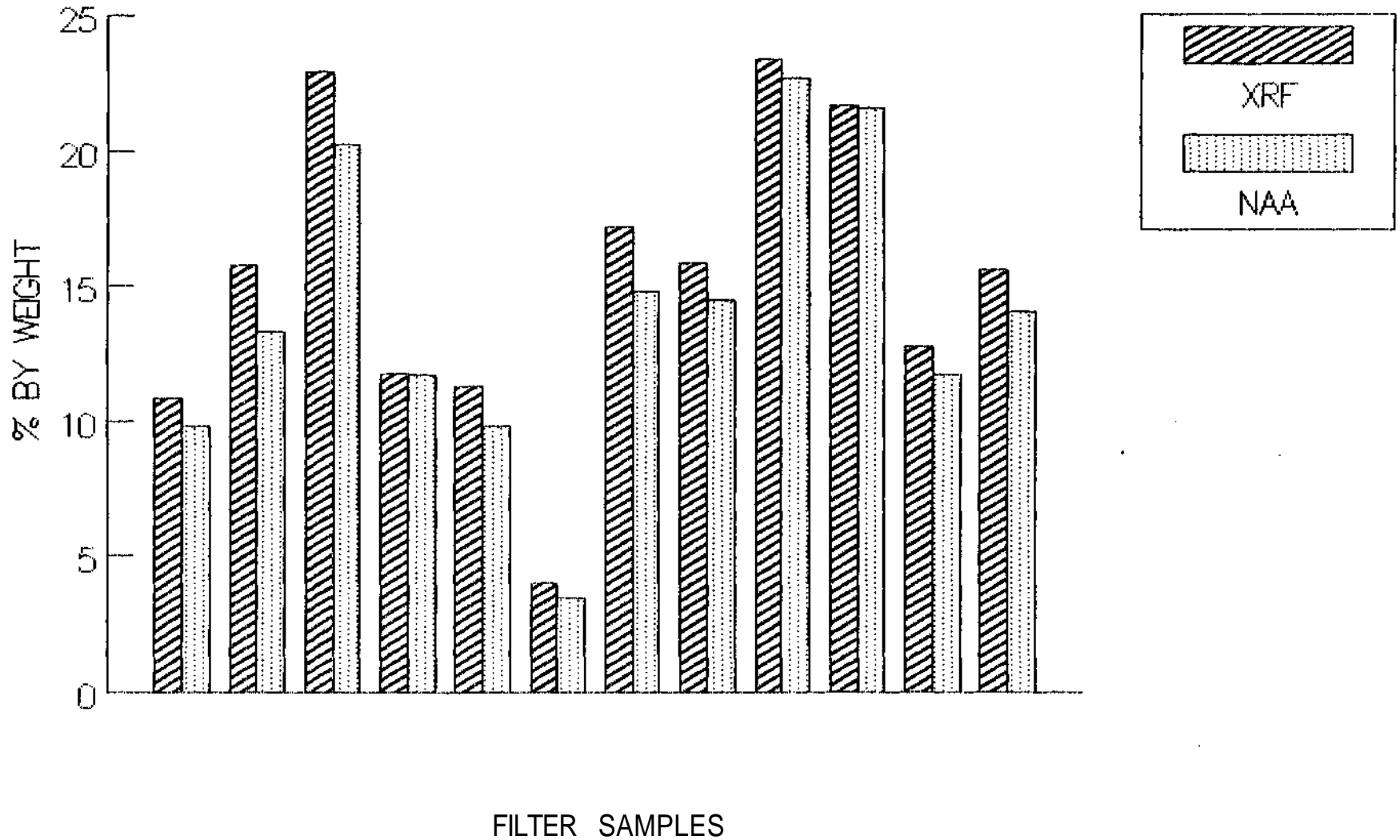
ALUMINUM FINE DEPOSIT



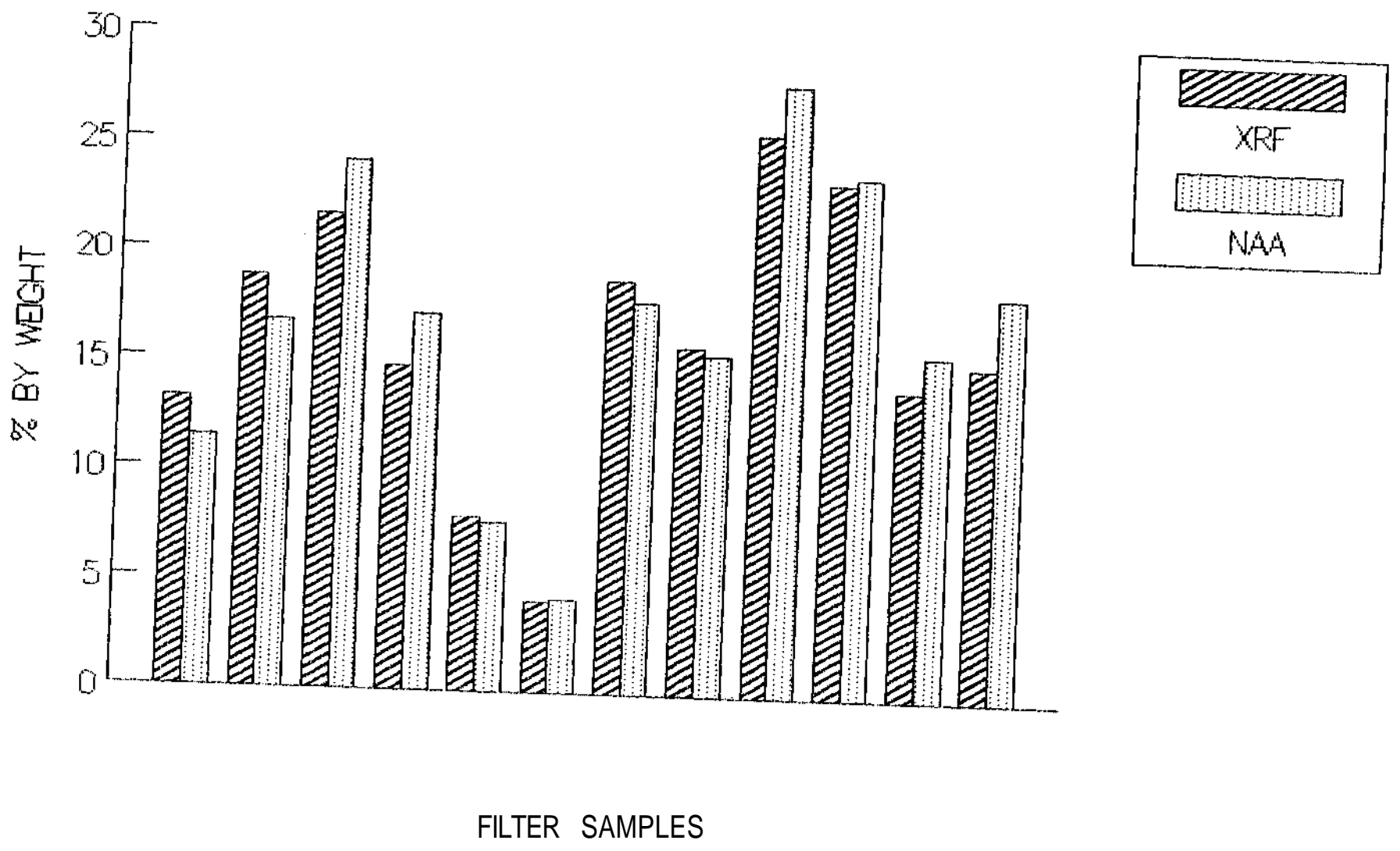
ALUMINUM COARSE DEPOSIT



CALCIUM FINE DEPOSIT

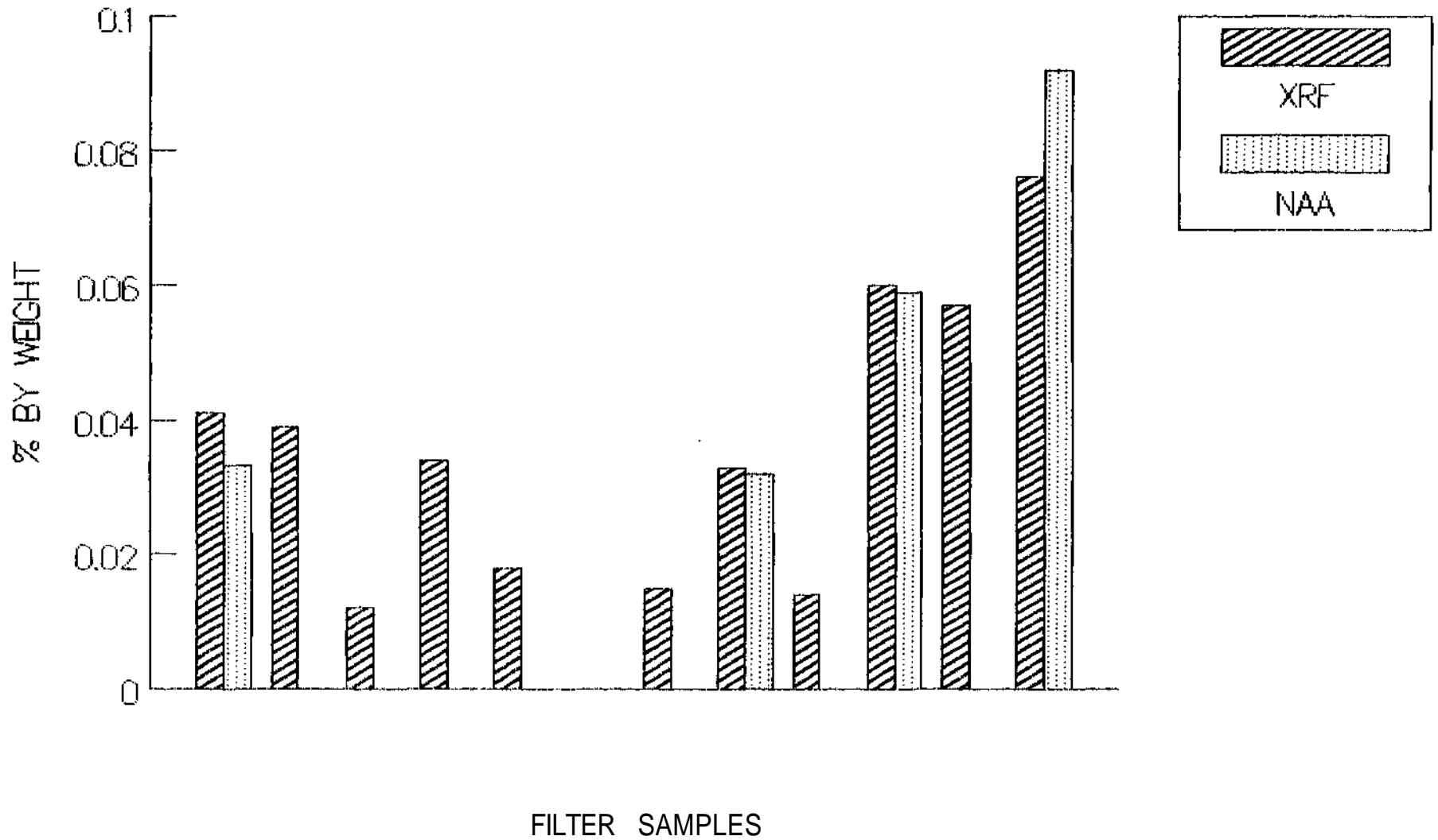


CALCIUM COARSE DEPOSIT



COPPER FINE DEPOSIT

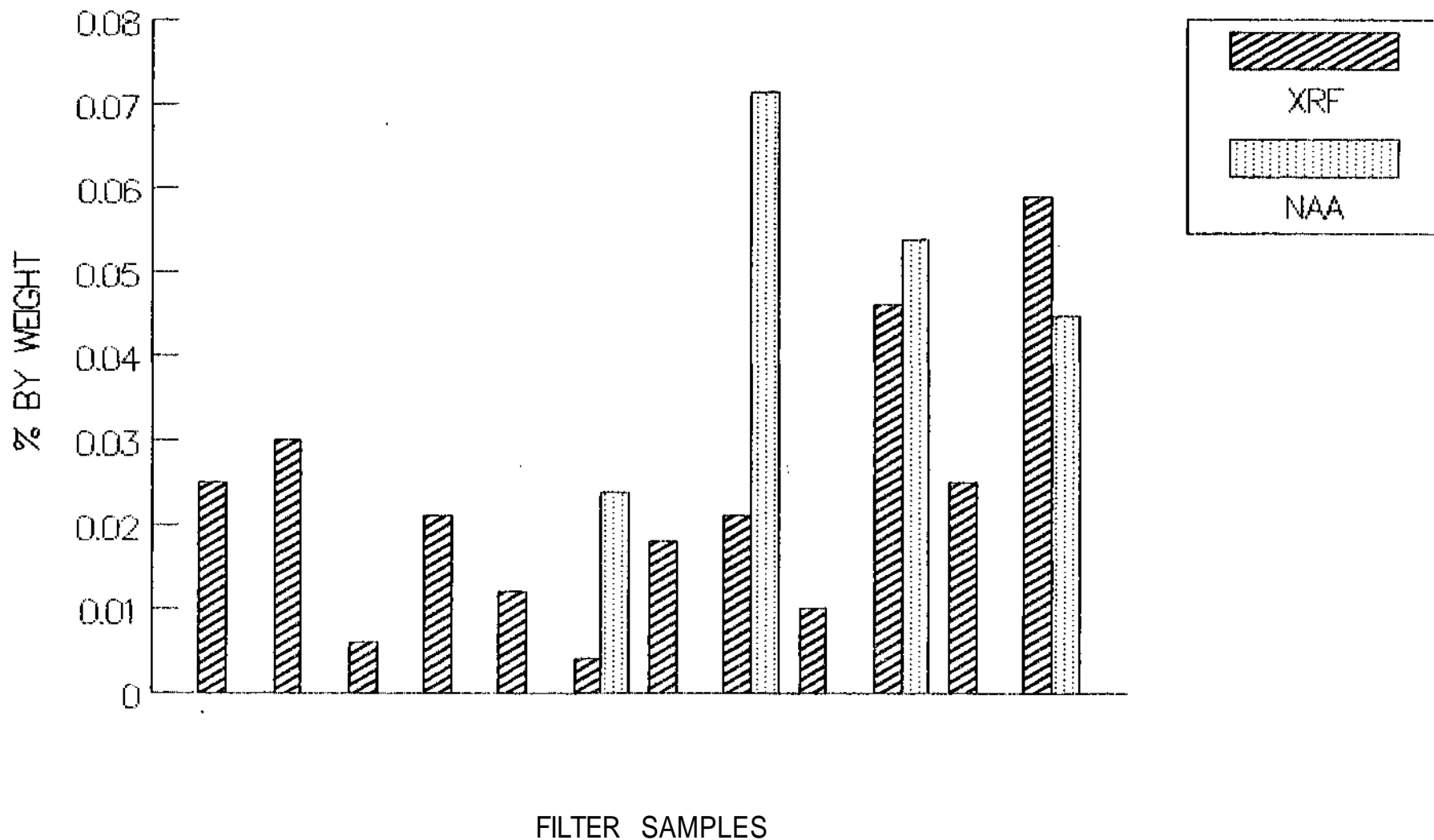
38



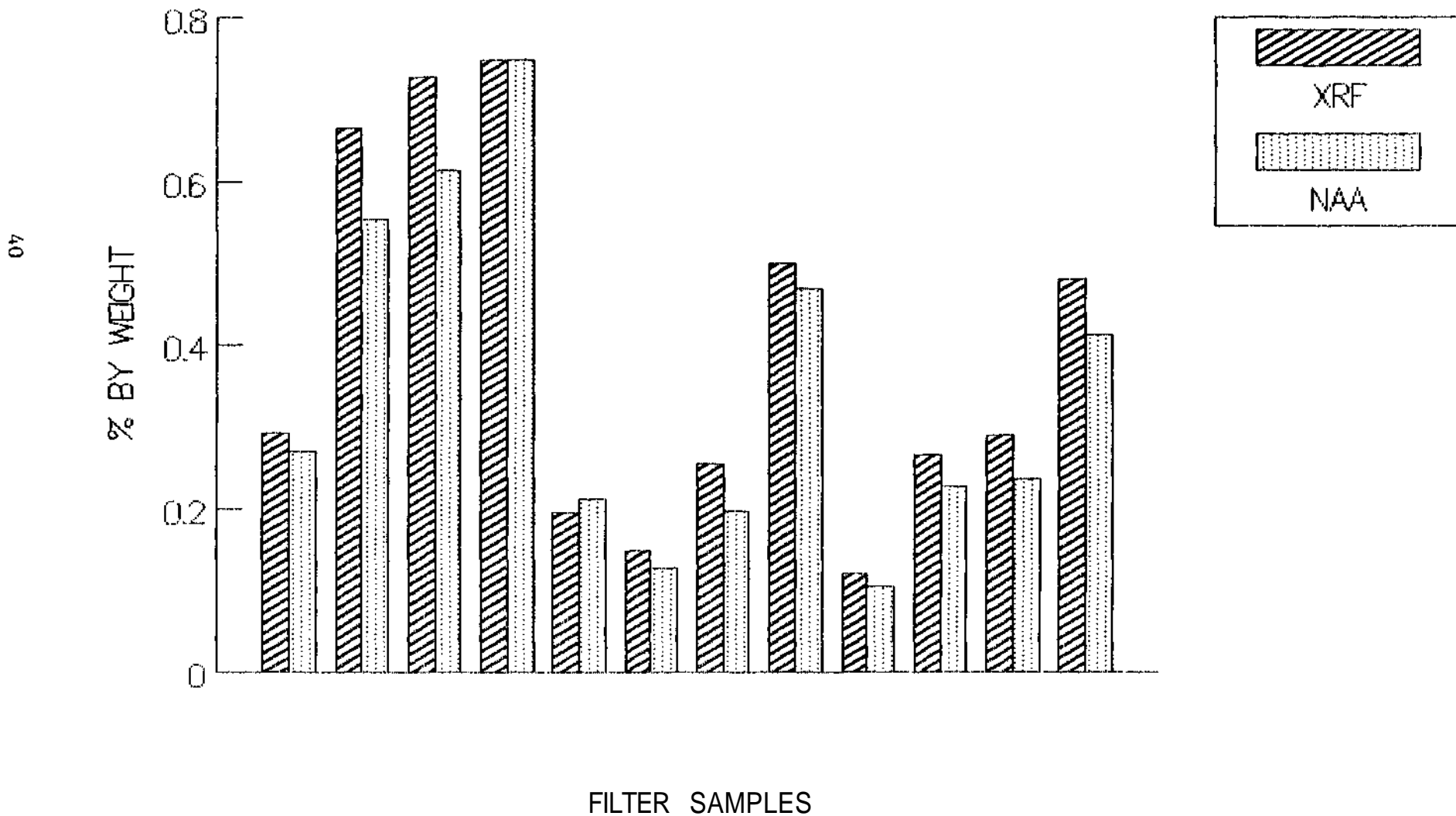
COPPER

COARSE DEPOSIT

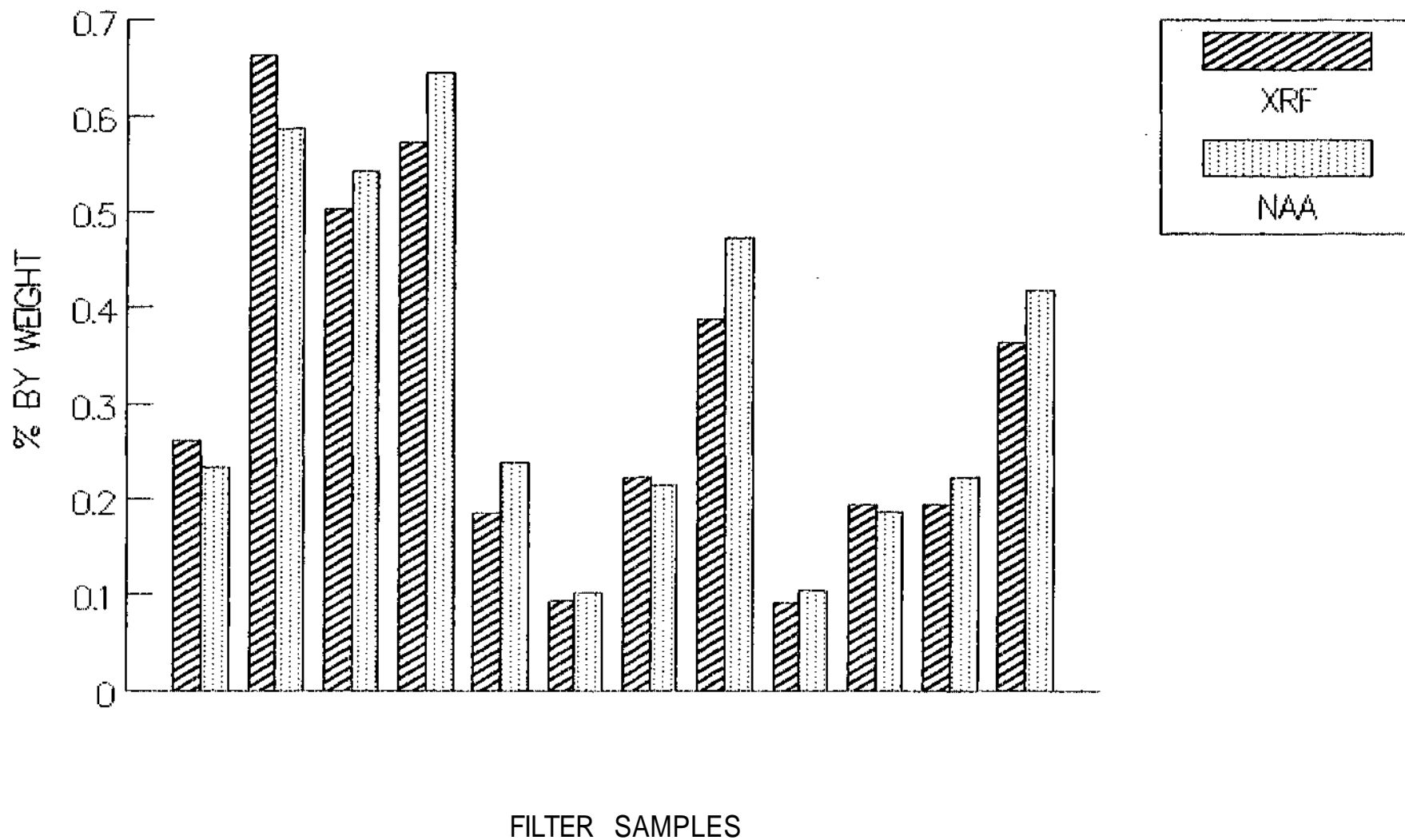
39



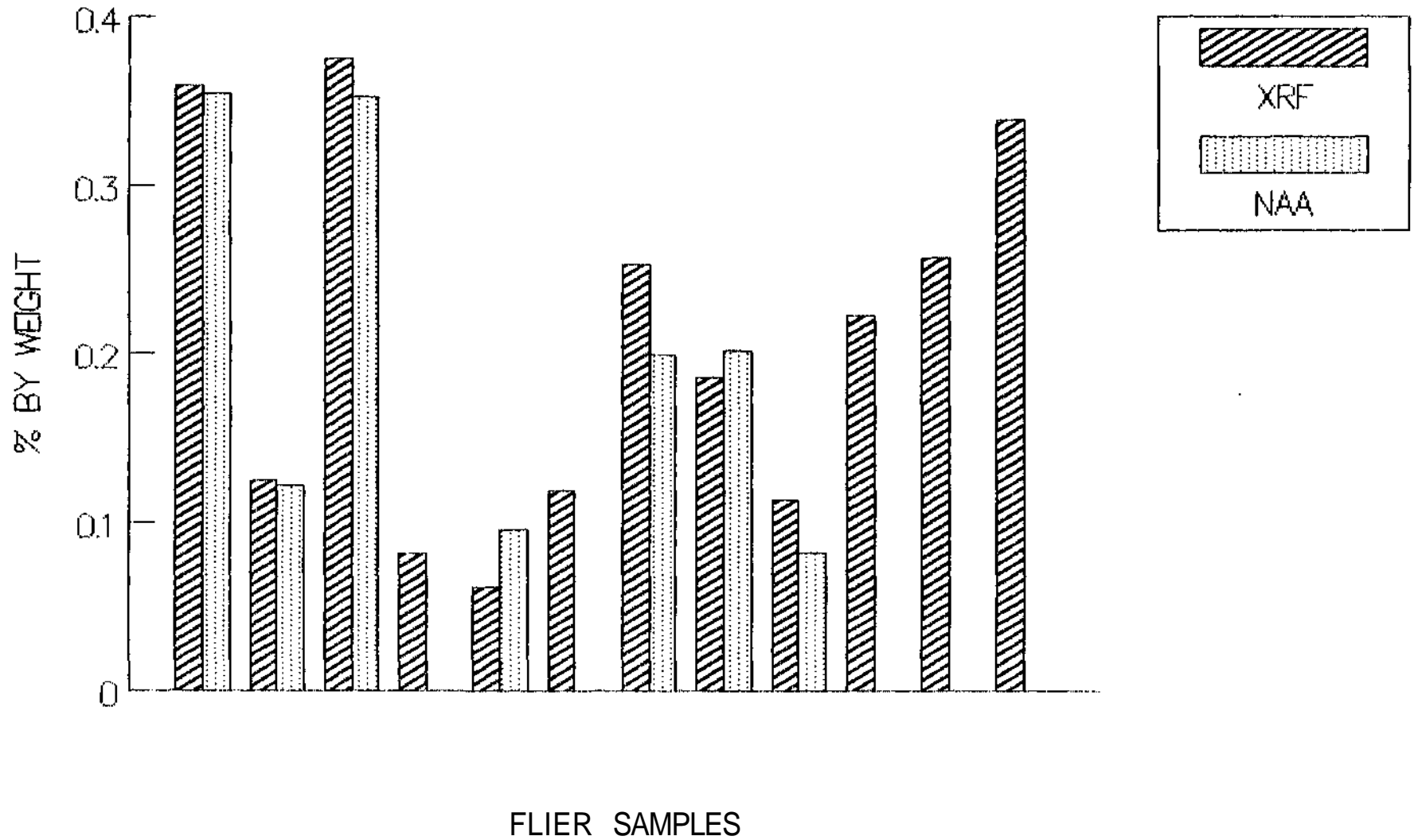
MANGANESE FINE DEPOSIT



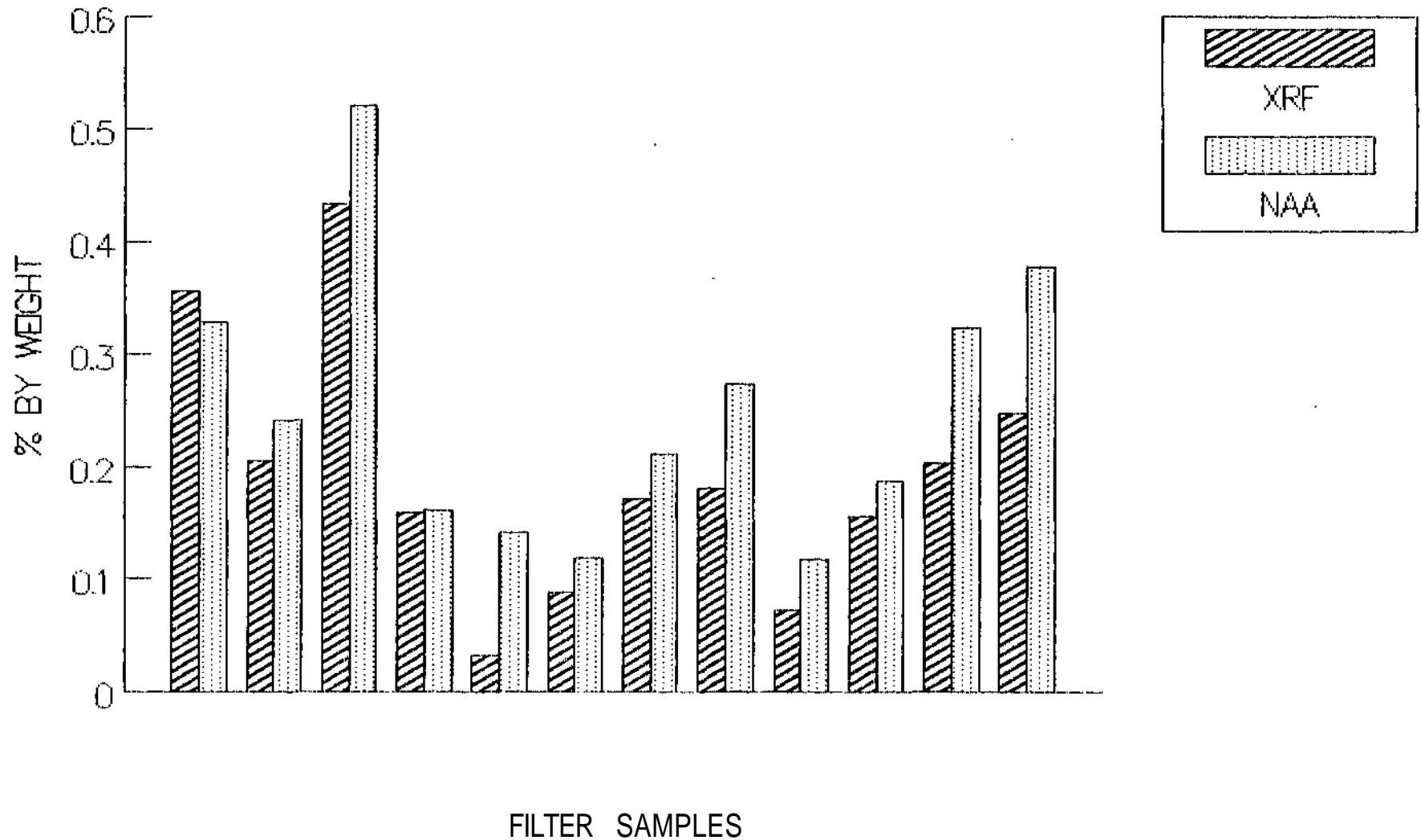
MANGANESE COARSE DEPOSIT



TITANIUM FINE DEPOSIT

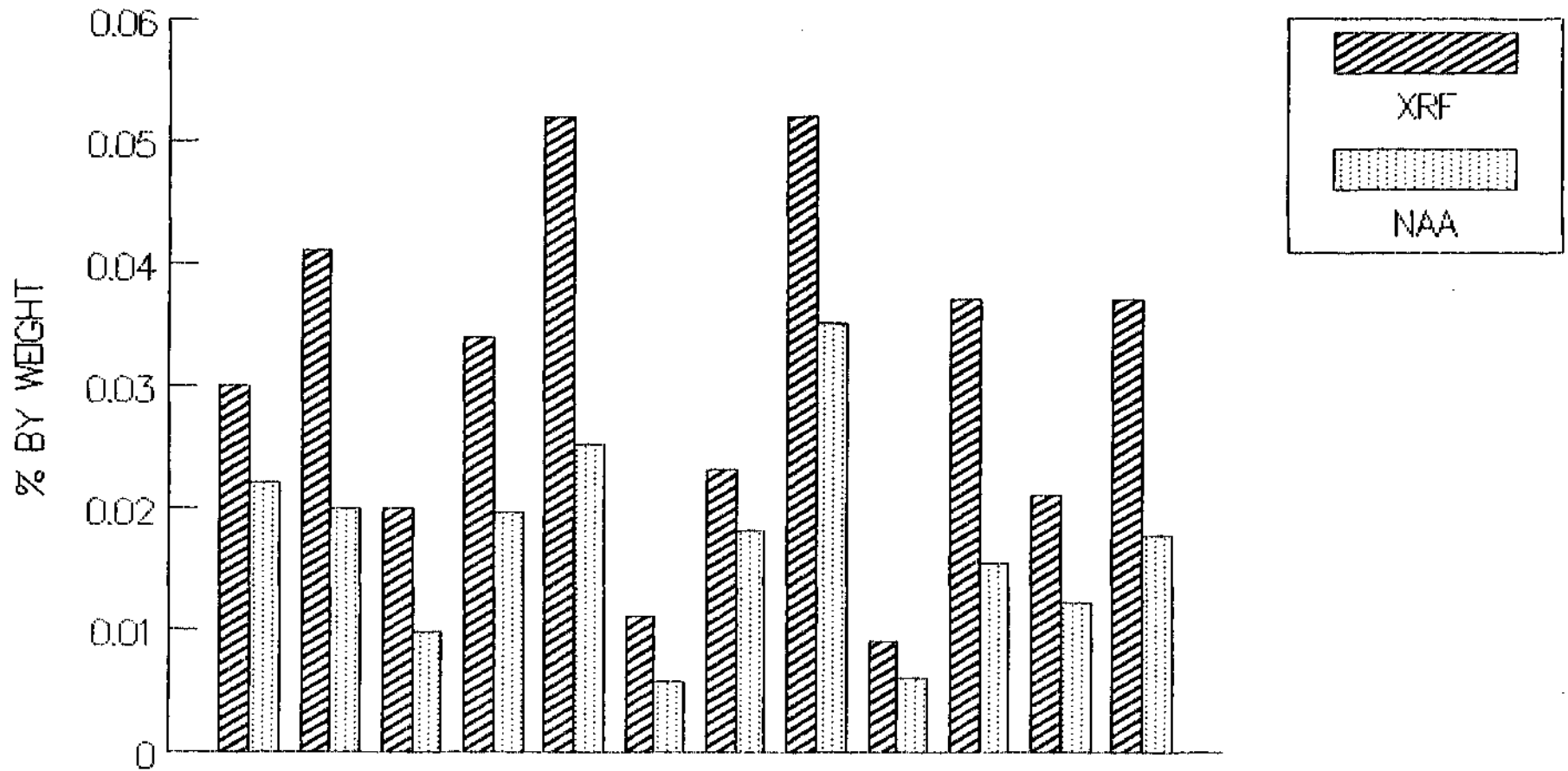


TITANIUM COARSE DEPOSIT



VANADIUM FINE DEPOSIT

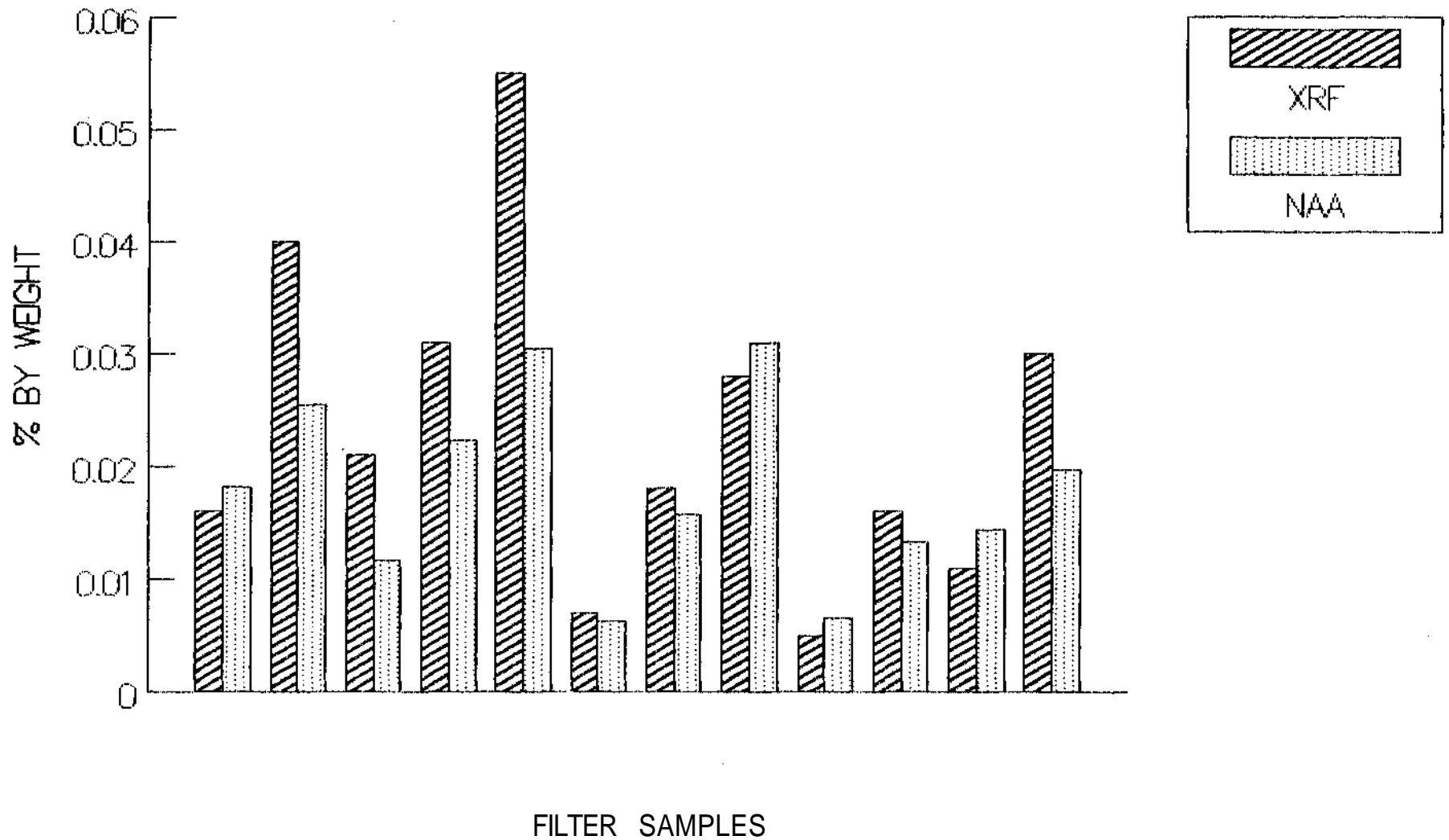
44



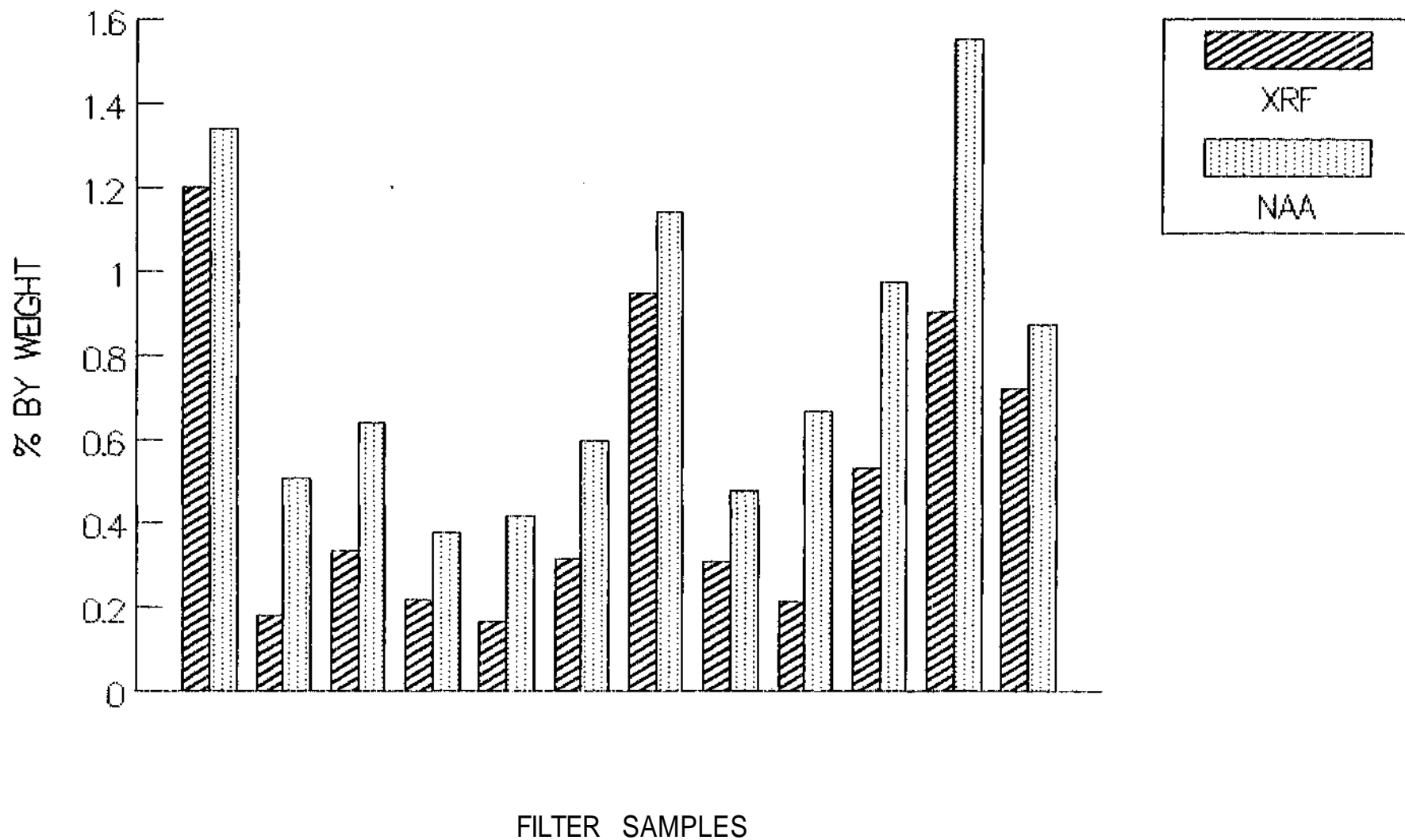
FILTER: SAMPLES

VANADIUM COARSE DEPOSIT

45

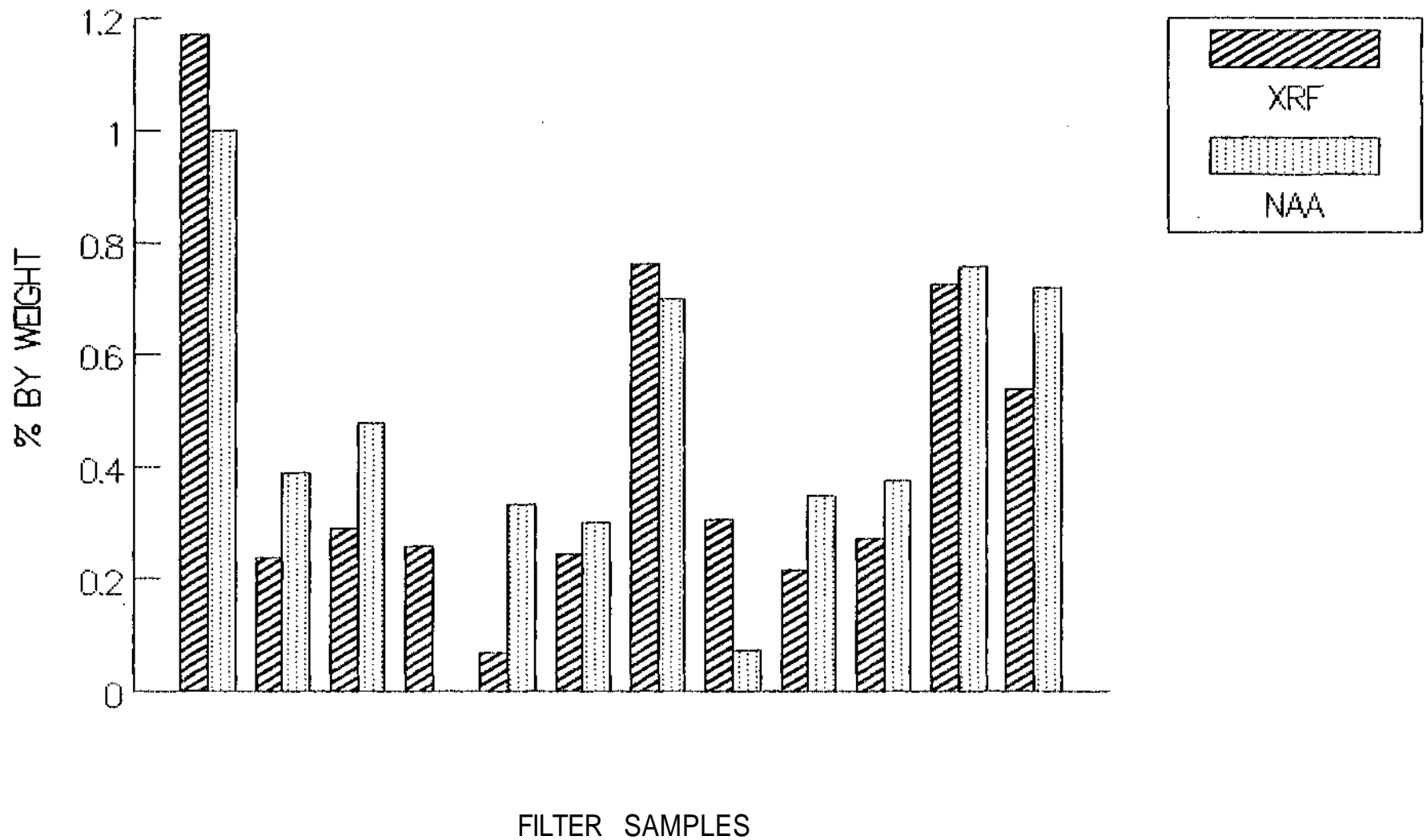


POTASSIUM FINE DEPOSIT



POTASSIUM COARSE DEPOSIT

47



APPENDIX C
Field Sampling Notes

<p>PLACE SAMPLE TAG HERE</p> <p>B6</p>	<p>Notes: 12/16/98 (Background Sample)</p>
<p>Type of Sample: Paved Roadway - Shoulder</p> <p>Location sample taken at: North of Intersection of I-270 and Route 159 from shoulder.</p>	

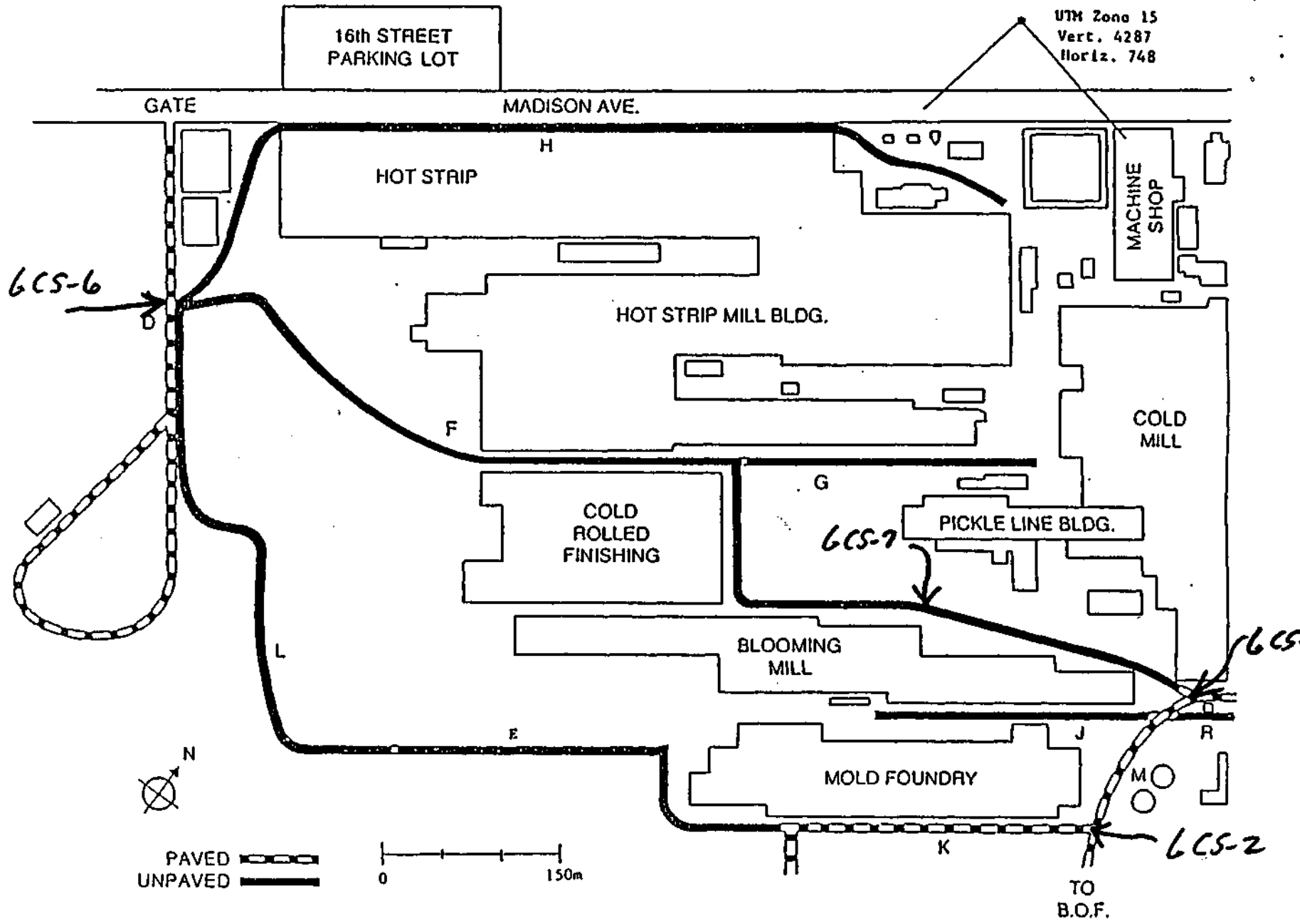
<p>PLACE SAMPLE TAG HERE</p>	<p>Notes:</p>
<p>Type of Sample:</p> <p>Location sample taken at:</p>	

<p>PLACE SAMPLE TAG HERE</p>	<p>Notes:</p>
<p>Type of Sample:</p> <p>Location sample taken at:</p>	

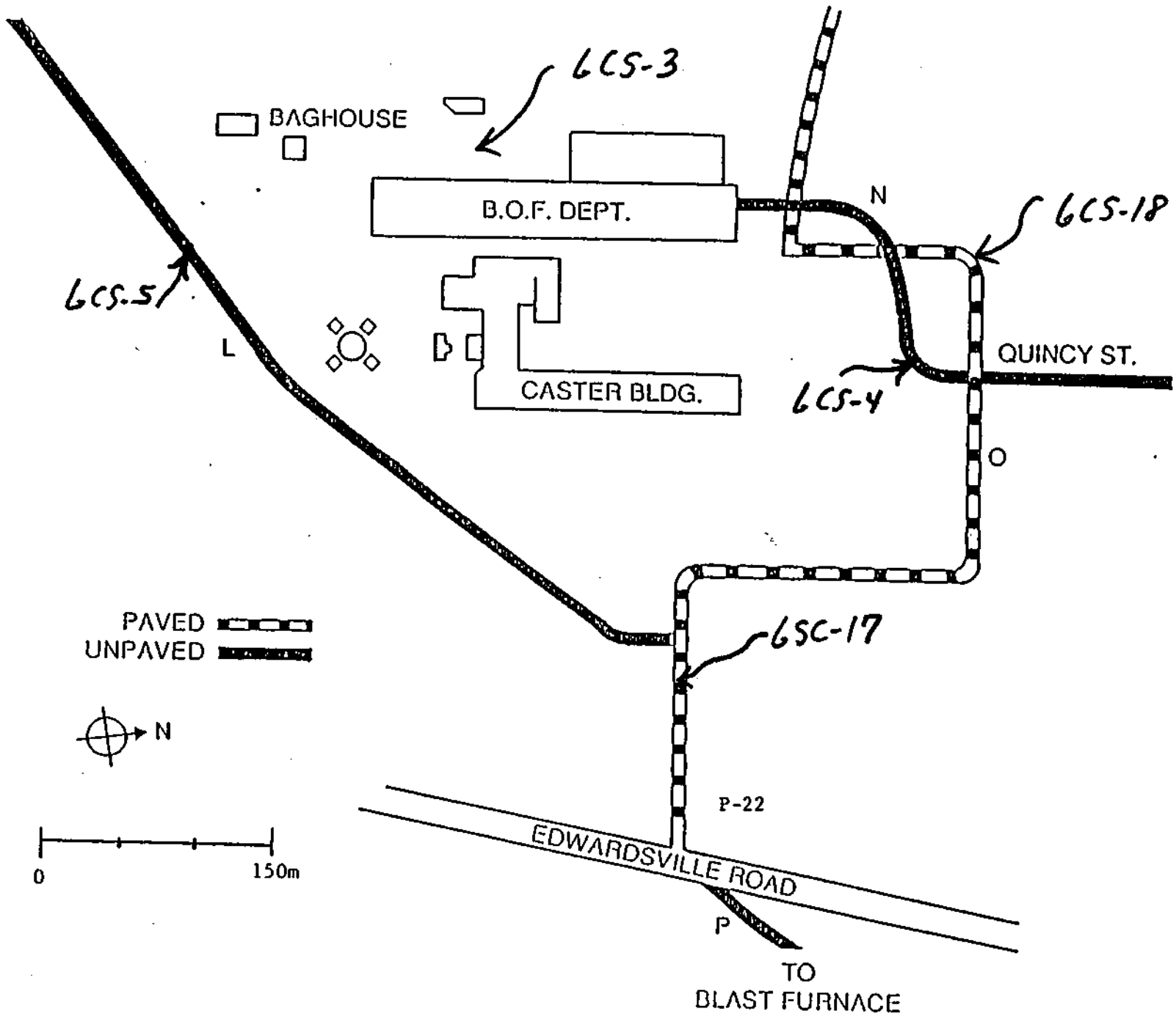
<p>PLACE SAMPLE TAG HERE</p> <p>6CS-1</p>	<p>Notes: 11/23/FF</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Roadway - Paved</p> <p>Location sample taken at: Nash Street gate</p>	

<p>PLACE SAMPLE TAG HERE</p> <p>6CS-2</p>	<p>Notes: 11/23/FF</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Roadway - Paved</p> <p>Location sample taken at: Intersection of paved areas just North of B&F Shop near garage</p>	

<p>PLACE SAMPLE TAG HERE</p> <p>6CS-3</p>	<p>Notes: 11/23/FF</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Paved Roadway</p> <p>Location sample taken at: Roadway leading from B&F - E&P, near rebuilding station</p>	



Steelworks--roads included in the emissions inventory.



BOF Plant-roads included in the emissions inventory.

PLACE SAMPLE TAG HERE <h1 style="font-size: 2em;">6 C 5 - 4</h1>	Notes: <u>11/23/88</u> <hr/> <hr/>
Type of Sample: <u>Unpaved roadway</u> Location sample taken at: <u>pot hauler unpaved roadway curve prior to gate.</u>	

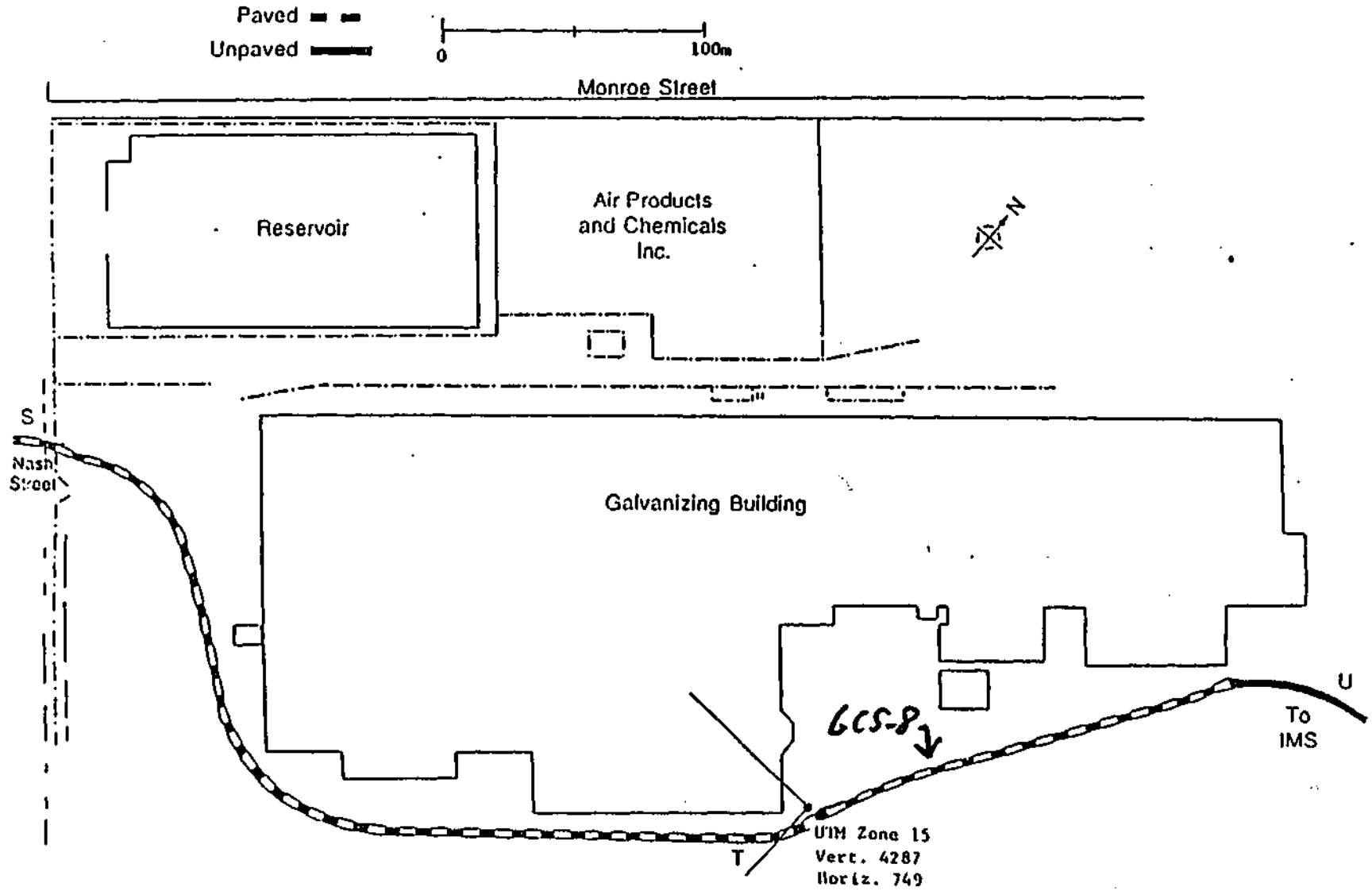
PLACE SAMPLE TAG HERE <h1 style="font-size: 2em;">6 C 5 - 5</h1>	Notes: <u>11/23/88</u> <hr/> <hr/>
Type of Sample: <u>Unpaved roadway</u> Location sample taken at: <u>Intersection just south of B&F Strip and Continuous Caster</u>	

PLACE SAMPLE TAG HERE <h1 style="font-size: 2em;">6 C 5 - 6</h1>	Notes: <u>11/23/88</u> <hr/> <hr/>
Type of Sample: <u>Paved roadway</u> Location sample taken at: <u>Intersection of unpaved roadway from hot strip and paved area road from 15th St. Gate.</u>	

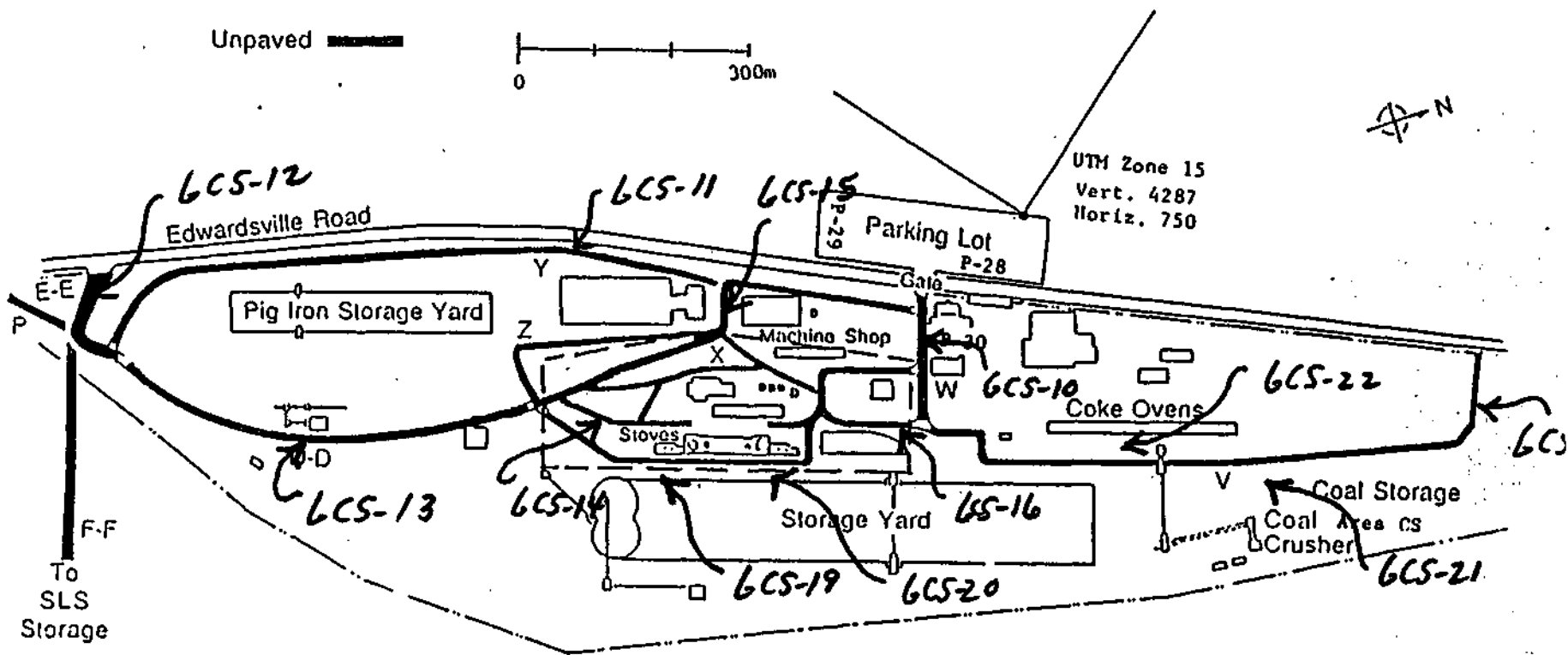
PLACE SAMPLE TAG HERE 6 CS-7	Notes: <u>11/23/88</u> _____ _____
Type of Sample: <u>Unpaved roadway</u> Location sample taken at: <u>Between blurring mill, pickle building and cold rolled finishing.</u>	

PLACE SAMPLE TAG HERE 6 CS-8	Notes: <u>11/23/88</u> _____ _____
Type of Sample: <u>Paved Roadway</u> Location sample taken at: <u>Near paved roadway on south side of galvanizing building.</u>	

PLACE SAMPLE TAG HERE 6 CS-9	Notes: <u>11/23/88</u> _____ _____
Type of Sample: <u>Unpaved roadway</u> Location sample taken at: <u>South of East gate</u>	



North Plant--roads included in the emissions inventory.



Blast Furnace Department—roads included in the emissions inventory.

PLACE SAMPLE TAG HERE 6CS-10	Notes: <u>11/23/88</u> <hr/> <hr/> <hr/>
Type of Sample: <u>Unpaved road</u>	
Location sample taken at: <u>Just south of blast furnace department entrance.</u>	

PLACE SAMPLE TAG HERE 6CS-11	Notes: <u>11/23/88</u> <hr/> <hr/> <hr/>
Type of Sample: <u>Unpaved road</u>	
Location sample taken at: <u>Roadway Y south of Edmundville Road</u>	

PLACE SAMPLE TAG HERE 6CS-12	Notes: <u>11/23/88</u> <hr/> <hr/> <hr/>
Type of Sample: <u>Unpaved roadway</u>	
Location sample taken at: <u>Southeast of intersection of 20th St. and Route 203,</u>	

PLACE SAMPLE TAG HERE 6C5-13	Notes: 11/23/88 <hr/> <hr/> <hr/>
Type of Sample: Unpaved road	
Location sample taken at: Southeast of St. Louis slag crusher plant	

PLACE SAMPLE TAG HERE 6C5-14	Notes: 11/23/88 <hr/> <hr/> <hr/>
Type of Sample: Unpaved road	
Location sample taken at: South south east west of blast furnace Department	

PLACE SAMPLE TAG HERE 6C5-15	Notes: 11/23/88 <hr/> <hr/> <hr/>
Type of Sample: Unpaved road	
Location sample taken at: South-southwest of machine shop in blast furnace department.	

PLACE SAMPLE TAG HERE	Notes: 11/23/88
6CS-16	
Type of Sample: Unpaved roadway	
Location sample taken at: North of blast furnace lagoon.	

PLACE SAMPLE TAG HERE	Notes: 11/23/88
6CS-17	
Type of Sample: Paved roadway	
Location sample taken at: Northwest of intersection of roadway 0 and Edwardsville Road	

PLACE SAMPLE TAG HERE	Notes: 11/23/88
6CS-18	
Type of Sample: Paved roadway	
Location sample taken at: West-Southwest of intersection of Quinny and 20th St.	

Notes: 12/16/88

PLACE SAMPLE TAG HERE

6CS-19

Type of Sample: Unpaved Roadway - Scaped from surface

Location sample taken at:
Pellet storage area just South of
Blast Furnaces.

Notes: 12/16/88

PLACE SAMPLE TAG HERE

CS-20

Type of Sample: Unpaved Roadway

Location sample taken at:
Coke storage area - just North of Blast
Furnaces.

Notes: 12/16/88

PLACE SAMPLE TAG HERE

CS-21

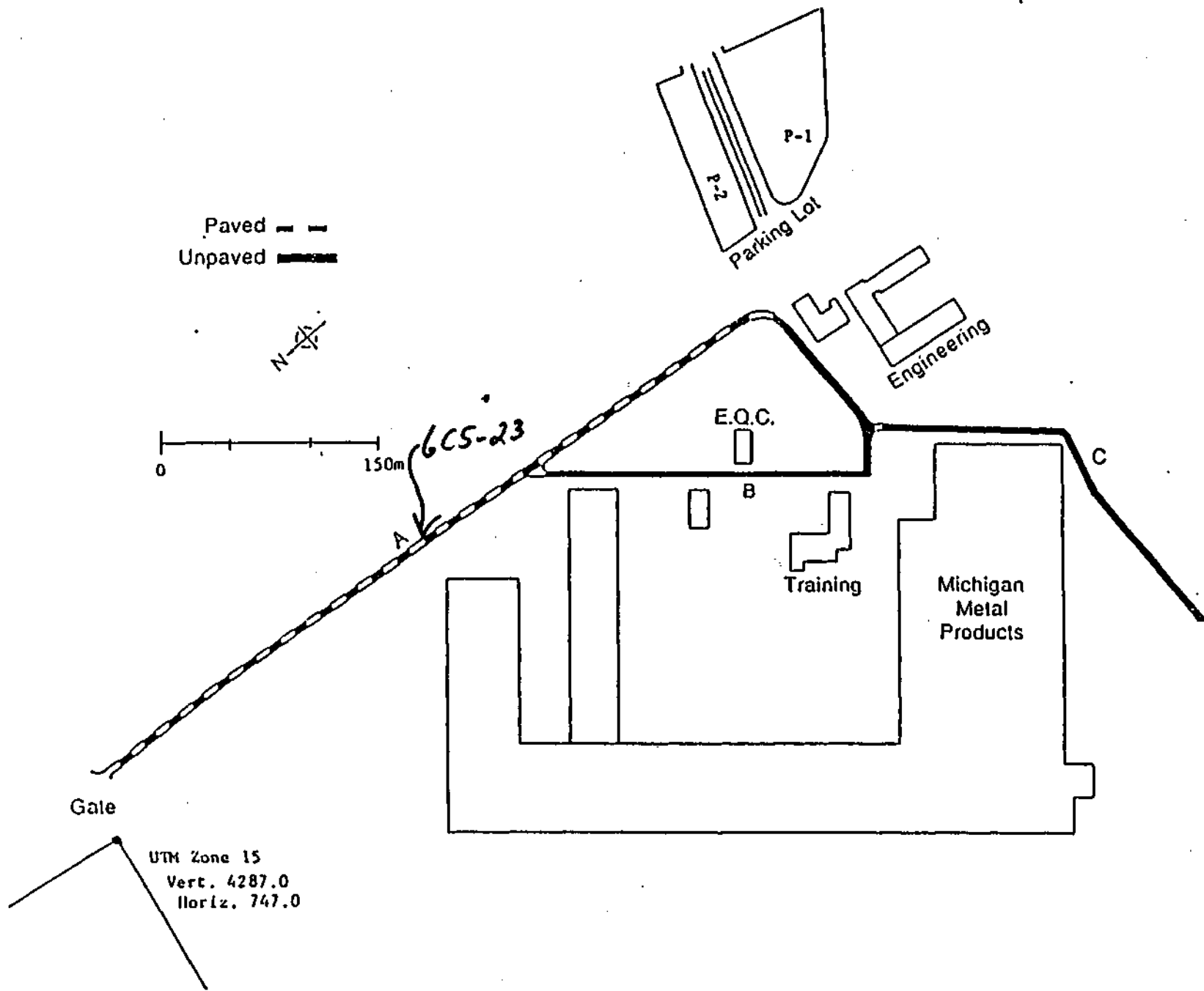
Type of Sample: Storage Area

Location sample taken at:
Coal pile - North of Coke Ovens

PLACE SAMPLE TAG HERE 6CS-22	Notes: <u>12/16/88</u> _____ _____
Type of Sample: <u>Unpaved Roadway</u>	
Location sample taken at: <u>Adjacent to coke ovens, Just Southeast of Combustion Stacks</u>	

PLACE SAMPLE TAG HERE 6CS-23	Notes: <u>12/16/88</u> _____ _____
Type of Sample: <u>Paved Roadway</u>	
Location sample taken at: <u>Adjacent to Granite City Pickling, across from Tara corp, roadway A.</u>	

PLACE SAMPLE TAG HERE	Notes: _____ _____ _____
Type of Sample:	
Location sample taken at:	



South Plant—roads included in the emissions inventory.

<p>PLACE SAMPLE TAG HERE</p> <p>U PS-1</p>	<p>Notes: 12/8/88</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Unpaved Parking Lot</p> <p>Location sample taken at: BV + 6 Transport - Rear traffic area. Located on State Street between 15th and 16th Streets</p>	

<p>PLACE SAMPLE TAG HERE</p>	<p>Notes:</p> <hr/> <hr/> <hr/>
<p>Type of Sample:</p> <p>Location sample taken at:</p>	

<p>PLACE SAMPLE TAG HERE</p>	<p>Notes:</p> <hr/> <hr/> <hr/>
<p>Type of Sample:</p> <p>Location sample taken at:</p>	

PLACE SAMPLE TAG HERE PS-1	Notes: 12/8/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Road-Shoulder Location sample taken at: Just southwest of intersection of Route 203-162 and 22 nd Street (Entrance to IRT).	

PLACE SAMPLE TAG HERE PS-2	Notes: 12/8/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Road-Middle Location sample taken at: On 21 st street at intersection of this street and BAF pot hauler road between Kassel and Park streets.	

PLACE SAMPLE TAG HERE PS-3	Notes: 12/8/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Road-near curb Location sample taken at: At intersection of 2 nd Street and Washington Avenue.	

<p>PLACE SAMPLE TAG HERE</p> <p>PS-4</p>	<p>Notes: 12/8/88</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Paved Roadway - Near Curb</p> <p>Location sample taken at: At intersection of 20th St. and Route 203.</p>	

<p>PLACE SAMPLE TAG HERE</p> <p>PS-5</p>	<p>Notes: 12/8/88</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Paved Road - Median Curb</p> <p>Location sample taken at: Intersection of Route 203 and Entrance to Granite City Steel plant Southeast of continuous cast.</p>	

<p>PLACE SAMPLE TAG HERE</p> <p>PS-6</p>	<p>Notes: 12/15/88</p> <hr/> <hr/> <hr/>
<p>Type of Sample: Paved road - near curb</p> <p>Location sample taken at: Intersection of entrance to truck parking lot and State Street just east of intersection of 1514 1514 and State.</p>	

PLACE SAMPLE TAG HERE PS- X 7	Notes: 12/14/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Roadway - Curb Location sample taken at: Intersection of Niederringhaus and 16 th Street, from 16 th Street surface	

PLACE SAMPLE TAG HERE PS- X 8	Notes: 12/14/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Roadway - Curb Location sample taken at: Intersection of Rock Road & Route 3	

PLACE SAMPLE TAG HERE PS- X 9	Notes: 12/14/88 <hr/> <hr/> <hr/>
Type of Sample: Paved Roadway - Shoulder Location sample taken at: Just west of tracks adjacent to State Street. On curve, between line Alley and rail tracks.	

Notes: 12/14/88

PLACE SAMPLE TAG HERE

PS-~~8~~10

Type of Sample: Paved Roadway - Curb

Location sample taken at:
Intersection of 5th and Route 203 near
curb, in Madison

Notes: 12/14/88

PLACE SAMPLE TAG HERE

PS-~~8~~11

Type of Sample: Paved Roadway

Location sample taken at:
Intersection of West 20th St. and Rick Road - Curb

Notes: 12/14/88

PLACE SAMPLE TAG HERE

PS-~~8~~12

Type of Sample: Paved Roadway - Curb

Location sample taken at:
Intersection of Walnut Avenue and N. Downinghaus
Avenue.

PLACE SAMPLE TAG HERE PS-813	Notes: <u>12/14/88</u> _____ _____
Type of Sample: <u>Paved Roadway</u>	
Location sample taken at: <u>Taken at intersection of 20th St. and Madison Avenue, curb.</u>	

PLACE SAMPLE TAG HERE PS-814	Notes: <u>12/14/88</u> _____ _____
Type of Sample: <u>Paved Roadway</u>	
Location sample taken at: <u>Intersection of Route 203 and Nunnock Road, curb</u>	

PLACE SAMPLE TAG HERE	Notes: _____ _____ _____
Type of Sample:	
Location sample taken at:	

PLACE SAMPLE TAG HERE AC-1	Notes: <u>12/16/88</u> _____ _____
Type of Sample: <u>Storage Pile</u>	
Location sample taken at: <u>C. Ecologarb Storage Pile at American Cellulid</u>	

PLACE SAMPLE TAG HERE PS-15	Notes: <u>12/16/88</u> _____ _____
Type of Sample: <u>Paved Road</u>	
Location sample taken at: <u>Just South of EMC from road shoulder</u>	

PLACE SAMPLE TAG HERE PS-16	Notes: <u>12/16/88</u> _____ _____
Type of Sample: <u>Paved Roadway - Curb</u>	
Location sample taken at: <u>At intersection of 2nd Street and Henry.</u>	

PLACE SAMPLE TAG HERE <p style="font-size: 2em; margin: 0;">PS-17</p>	Notes: <u>12/16/88</u> <hr/> <hr/> <hr/>
Type of Sample: <u>Paved Roadway - Curb</u> Location sample taken at: <u>Taken near intersection of 22nd and Adams</u>	

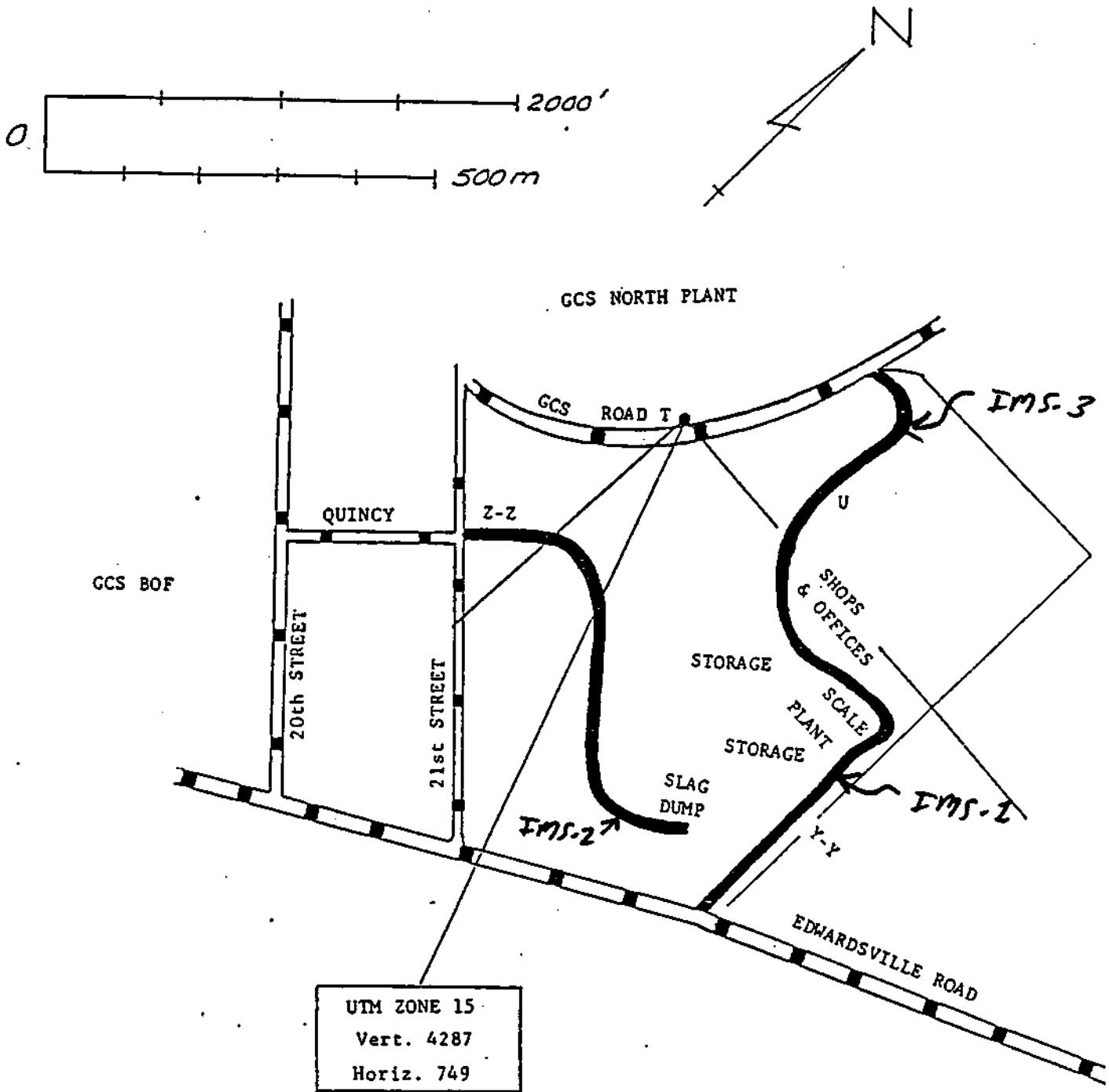
PLACE SAMPLE TAG HERE	Notes: <hr/> <hr/> <hr/>
Type of Sample: Location sample taken at:	

PLACE SAMPLE TAG HERE	Notes: <hr/> <hr/> <hr/>
Type of Sample: Location sample taken at:	

PLACE SAMPLE TAG HERE IMS-1	Notes: 12/14/08 _____ _____ _____
Type of Sample: Unpaved Roadway	
Location sample taken at: Roadway Y-Y, east of crushing plant	

PLACE SAMPLE TAG HERE IMS-2	Notes: _____ _____ _____
Type of Sample: Unpaved Roadway	
Location sample taken at: Roadway Z-Z, south of slag dump	

PLACE SAMPLE TAG HERE IMS-3	Notes: _____ _____ _____
Type of Sample: Unpaved Roadway	
Location sample taken at: Roadway U - Southeast of GCS - North plant	



International Mill Service.