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Deel 1; Analyse van metalen in sediment

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Samenvatting

Begin 1999 is op de afdeling IMLA-metalen van het RIZA een simultane ICP met axiaal plasma geïnstalleerd; de Vista CCD Simultaneous ICP-AES, van Varian.

Deze ICP-AES is aangeschaft om de reeds aanwezige ICP-AES (Optima 3000 DV, van Perkin Elmer) te vervangen op het gebied van sedimentanalyses. Tevens zal de nieuwe ICP-AES gebruikt worden om arseen, antimoon en seleen in sediment en afvalwater te analyseren d.m.v. hydridegeneratie. Het is de bedoeling dat de ICP-AES, na bewezen geschiktheid, de huidige methode (middels hydridegeneratietechniek) zal vervangen.

Het implementatierapport bestaat uit twee deelrapportages. Dit verslag heeft betrekking op de eerste deelrapportage.

Het eerste gedeelte heeft betrekking op de implementatie van de methode om sediment te analyseren m.b.v. de Varian Vista.

Validatie van de analysemethode heeft plaatsgehad volgens SA 8141.

De bepaalde detectiegrenzen en bepalingsgrenzen komen overeen met de grenzen die bepaald zijn voor de reeds bestaande methode.

Uit trendbreukanalyse blijkt dat oude en nieuwe methode geen significant verschillende resultaten geeft.

De tweede deelrapportage heeft betrekking op de implementatie van de methode om in sediment en afvalwater arseen, antimoon en seleen te analyseren op de Varian Vista. De tweede deelrapportage is niet bij dit verslag gevoegd. Dit verslag heeft uitsluitend betrekking op de eerste deelrapportage.

1 Inleiding

1.1 Doel

Het doel van dit onderzoek is:

- Vaststelling of de resultaten verkregen na analyse op de Vista CCD Simultaneous ICP-AES (in het vervolg "Varian Vista" genoemd) gelijkwaardig zijn met de resultaten na analyse op de Optima 3000 DV.
- Het vaststellen van de prestatiekenmerken voor de analysemethoden die zullen worden toegepast op de Vista CCD Simultaneous ICP-AES.

Het onderzoek beschreven in dit verslag richt zich op de volgende matrices en elementen:

- Sediment: Al, Mg, Ca, Fe, Cd, Cr, Cu, Mn, Ni, Pb, Sc, Zn en Co.

1.2 Probleemstelling

Begin 1999 is bij de afdeling IMLA-metalen van het RIZA een nieuwe ICP-AES in gebruik genomen, de Vista CCD Simultaneous ICP-AES, van Varian. Dit met de bedoeling om de reeds gebruikte Optima 3000 DV te vervangen op het gebied van analyse van sedimentmonsters en de grafietoven AAS te vervangen op het gebied van analyse van hydridevormende elementen in afvalwater en sediment.

Voordat daadwerkelijk wordt overgegaan tot vervanging van de Optima door de Varian Vista, op genoemde gebieden, worden analysekarakteristieken en de analyseresultaten van praktijkmonsters voor beide instrumenten onderling met elkaar vergeleken.

2 Keuze golflengtes

Voor elk, te meten, element zijn tenminste twee lijnen geselecteerd. De gekozen lijnen worden reeds gebruikt bij de analyse van metalen in sediment m.b.v. de Optima 3000 DV.

Tabel 2.1: Weergave golflengtekeuze.

Element	Golflengte (nm)	Type lijn	Functie
Al	396.152	atoom	kwantificering
Al	394.401	atoom	controle
Ca	315.887	ion	kwantificering
Ca	317.933	ion	controle
Cd	228.802	atoom	kwantificering
Cd	214.438	ion	controle
Co	228.616	ion	kwantificering
Co	230.786	ion	controle
Cr	267.716	ion	kwantificering
Cr	205.552	ion	controle
Cu	324.754	atoom	kwantificering
Cu	327.396	atoom	controle
Fe	239.562	ion	kwantificering
Fe	273.955	ion	controle
Mg	279.079	ion	kwantificering
Mg	202.582	atoom	controle
Mn	257.610	ion	kwantificering
Mn	260.569	ion	controle
Ni	231.604	ion	kwantificering
Ni	221.647	ion	controle
Sc	361.384	ion	kwantificering
Sc	424.683	ion	controle
Pb	220.353	ion	kwantificering
Pb	216.999	atoom	controle
Zn	213.856	atoom	kwantificering
Zn	206.200	ion	controle

De controle-lijn verschaft informatie over de betrouwbaarheid van de meting. De resultaten van de controle-lijn worden vergeleken met de resultaten van de kwantificeringslijn. Het resultaat van de kwantificeringslijn wordt gerapporteerd wanneer laatstgenoemde resultaten tussen 90 en 110 % van de eerdergenoemde resultaten liggen.

3 Analysekaracteristieken

3.1 Detectiegrenzen en Bepalingsgrenzen

In tabel 3.1 en 3.2 zijn de resultaten weergegeven van de bepaling van de analysekaracteristieken (AK's), m.u.v. de rapportagegrenzen, voor de meting van metalen (zoals deze weergegeven zijn in tabel 2.1) in sediment. De AK's zijn bepaald volgens W 8141.001¹ in de matrix sediment^{2,3}. De monsters hebben de gehele analyseprocedure doorlopen. In bijlage A zijn de ruwe data weergegeven.

Met uitzondering van Cr en Mn (beide lijnen) en Zn (kwantificeringslijn) zijn alle elementen op twee manieren gerapporteerd, te weten met en zonder correctie voor Yttrium (Y). De eerstgenoemde elementen worden standaard voor Yttrium gecorrigeerd.

De reden waarom Yttrium als interne standaard wordt gebruikt is om te corrigeren voor veranderingen die tijdens de meting zouden kunnen optreden in het plasma van de ICP. Omdat Yttrium op een ion-lijn wordt gemeten (371.029 nm) is het onjuist om vanwege deze reden de elementen na meting op atoomlijnen (Cd (kwantificeringslijn), Cu (beide lijnen), Pb (controlelijn) en Zn (kwantificeringslijn)) voor Y te corrigeren. In de volgende tabellen is wel gemeten met Y-correctie, de resultaten van deze bepaling dienen te worden beschouwd als zijnde indicatief.

Tabel 3.1: Resultaten van de bepaling van de detectie- en bepalingsgrenzen.

Element	Golflengte (nm)	Functie	C _{dg} Vista mg/kg	C _{dg} Vista + Y- correctie	C _{bg} Vista mg/kg	C _{bg} Vista + Y- correctie
Cd	228.802	kwantificering	0.49	0.08	1.64	0.26
Cd	214.438	controle	0.42	0.10	1.41	0.32
Co	228.616	kwantificering	0.88	2.04	2.94	6.80
Co	230.786	controle	0.79	1.25	2.65	4.18
Cr	267.716	kwantificering	-*	1.99	-*	6.62
Cr	205.552	controle	-*	2.41	-*	8.03
Cu	324.754	kwantificering	2.61	2.71	8.69	9.02
Cu	327.396	controle	2.57	2.68	8.56	8.92
Mn	257.610	kwantificering	-*	20.9	-*	69.7
Mn	260.569	controle	-*	20.7	-*	68.8
Ni	231.604	kwantificering	0.78	0.79	2.59	2.63
Ni	221.647	controle	1.04	1.02	3.46	3.40
Pb	220.353	kwantificering	1.20	1.04	4.01	3.47
Pb	216.999	controle	2.89	4.47	9.62	14.91
Sc	361.384	kwantificering	0.15	0.17	0.49	0.56
Sc	424.683	controle	0.19	0.21	0.64	0.69
Zn	213.856	kwantificering	3.68	3.69	12.27	12.29
Zn	206.200	controle	-*	3.80	-*	12.68

* Voor deze elementen geldt dat ze op de Optima reeds gecorrigeerd voor Y worden gemeten. Vanwege dit feit is ervoor gekozen deze elementen niet zonder Y-correctie te meten.

Lichtgrijze arcering duidt op het feit dat de gebruikte lijn een atoomlijn is!

Tabel 3.2: Vervolg; resultaten van de bepaling van de detectie- en bepalingsgrenzen

Element	Golflengte (nm)	Functie	C _d Vista Optima g/kg	C _d Vista g/kg	C _d Vista + Y- correctie	C _b Vista Optima g/kg	C _b Vista g/kg	C _b Vista + Y- correctie
Al	396.152	kwantificering		0.58	0.60		1.95	1.99
Al	394.401	controle		0.58	0.60		1.94	2.00
Ca	315.887	kwantificering		0.51	0.47		1.70	1.58
Ca	317.933	controle		0.51	0.48		1.70	1.59
Fe	239.562	kwantificering		0.30	0.32		1.00	1.07
Fe	273.955	controle		0.29	0.32		0.98	1.05
Mg	279.079	kwantificering		0.09	0.08		0.30	0.28
Mg	202.582	controle		0.10	0.09		0.34	0.30

Lichtgrijze arcering duidt op het feit dat de gebruikte lijn een atoomlijn is!

3.2 Binnenlaboratoriumreproduceerbaarheid, Maximaal Toelaatbare Fout en Juistheid

Voor de bepaling van de juistheid is gebruik gemaakt van ISE 954³ (voor scandium, calcium en magnesium), en BCR 143 (voor de overige elementen). De resultaten zijn weergegeven in onderstaande tabel (zie tevens bijlage B). De lichtgrijze arcering betekent dat gecorrigeerd is voor Y, dit geldt voor alle tabellen in het vervolg van dit rapport!

Bij de bepaling van de binnenlaboratoriumreproduceerbaarheid (BLR) en maximaal toelaatbare fout ($MTF_{R, \%J}$) is gebruik gemaakt van Maasslib. De berekening van de RSD_R , Juistheid, MTF_R en t_R volgt uit werkvoorschrift W 8141.001¹ (zie bijlage C).

Tabel 3.3: Bepaling van de BLR, $MTF_{R, \%J}$ en juistheid.

Element	Golflengte (nm)	RSD_R^{**} (%)	Juistheid (%)	$MTF_{R, \%J}$ (%)	t_R
Cd	228.802	4.1	96	20	-1.5
Cd	228.802	4.1	107	20	1.4
Cd	214.438	4.0	97	16	-1.0
Cd	214.438	4.0	109	16	1.0
Co	228.616	8.2	98	21	-2.4
Co	228.616	8.2	108	21	1.9
Co	230.786	8.4	99	12	-1.7
Co	230.786	8.4	106	12	1.7
Cr	267.716	8.8	97	16	0.4
Cr	206.550	9.0	97	16	-0.2
Cu	324.754	7.5	99	20	-1.5
Cu	324.754	7.5	104	19	0.3
Cu	327.396	7.5	99	20	-1.5
Cu	327.396	7.5	105	19	0.3
Mn	257.610	9.6	97	16	-1.5
Mn	260.569	9.5	98	16	-2.0
Ni	231.604	6.6	97	15	0.5
Ni	231.604	6.6	105	15	3.1
Ni	221.647	5.1	92	12	-0.7
Ni	221.647	7.0	97	19	1.4
Pb	220.353	7.4	92	24	-3.5
Pb	220.353	5.3	96	15	-1.8
Pb	216.999	10.2	95	23	-0.7
Pb	216.999	6.0	98	15	1.3
Sc	361.384	8.1	118	19	0.7
Sc	361.384	5.5	122	23	4.2
Sc	424.683	9.0	116	23	2.1
Sc	424.683	6.7	121	26	5.4
Zn	213.856	7.0	99	16	-0.8
Zn	213.856	5.9	104	15	1.2
Zn	206.200	5.6	98	12	0.2

Tabel 3.4: Vervolg; bepaling van de BLR, $MTF_{R, \%}$ en juistheid.

Element	Golflengte (nm)	RSD_R^{**} (%)	Juistheid (%)	$MTF_{R, \%}$ (%)	t_R
Al	396.152	11.9	112	34	-1.4
Al	396.152	10.9	112	28	-0.8
Al	394.401	11.5	113	33	-1.4
Al	394.401	11.4	111	30	-0.9
Ca	315.887	6.0	107	13	-0.2
Ca	315.887	5.1	104	12	-0.5
Ca	317.933	6.3	108	14	-0.5
Ca	317.933	5.1	106	15	-0.1
Fe	239.562	5.6	110	16	2.4
Fe	239.562	4.2	102	15	-1.0
Fe	273.955	6.1	107	17	1.9
Fe	273.955	4.3	105	12	-1.9
Mg	279.079	10.7	122	23	0.4
Mg	279.079	6.2	119	17	-1.3
Mg	202.582	7.3	123	19	-1.6
Mg	202.582	3.2	121	8	-1.1

** RSD_R is de relatieve standaarddeviatie van BLR.

3.3 Herhaalbaarheid

Bij de bepaling van de herhaalbaarheid is gebruik gemaakt van de analyse resultaten van de bepaling van het referentiemonster BCR 143, welke negen keer achtereenvolgens gemeten is. De resultaten zijn weergegeven in bijlage D.

De berekening van de herhaalbaarheid heeft plaats volgens vergelijking 1. Deze berekening volgt uit werkvoorschrift W 8141.001¹.

$$r = 2\sqrt{2} \times s_r \quad [1],$$

waarin:

r = herhaalbaarheid,

s_r = absolute standaarddeviatie van de negen metingen

De relatieve standaarddeviatie van de herhaalbaarheid wordt berekend volgens vergelijking 2.

$$RSD_r = \frac{100 \times s_r}{\bar{x}_r} \quad [2],$$

waarin:

\bar{x}_r = gemiddelde van de negen metingen

Tabel 3.5: Bepaling van de herhaalbaarheid.

Element	Golflengte (nm)	RSD, (%)
Al	396.152	3.6
Al	396.152	2.7
Al	394.401	3.7
Al	394.401	2.7
Ca	315.887	1.3
Ca	315.887	0.4
Ca	317.933	1.4
Ca	317.933	0.5
Cd	228.802	0.9
Cd	228.802	0.4
Cd	214.438	1.4
Cd	214.438	0.6
Co	228.616	2.2
Co	228.616	0.5
Co	230.786	2.1
Co	230.786	0.8
Cr	257.216	0.6
Cr	205.557	0.6
Cu	324.754	1.1
Cu	324.754	0.4
Cu	327.396	1.2
Cu	327.396	0.4
Fe	239.562	2.0
Fe	239.562	1.0
Fe	273.955	1.6
Fe	273.955	0.6
Mg	279.079	2.5
Mg	279.079	1.5
Mg	202.582	1.3
Mg	202.582	0.4
Mn	257.610	0.5
Mn	260.569	0.8
Ni	231.604	1.9
Ni	231.604	1.0
Ni	221.647	1.3
Ni	221.647	1.0

Tabel 3.6: Vervolg; bepaling van de herhaalbaarheid

Element	Golflengte (nm)	RSD, (%)
Pb	220.353	1.3
Pb	220.353	0.4
Pb	216.999	1.3
Pb	216.999	0.3
Sc	361.384	6.9
Sc	361.384	6.9
Sc	424.683	6.9
Sc	424.683	6.9
Zn	213.856	1.0
Zn	213.856	1.0
Zn	213.856	1.0

3.4 Selectiviteit (invloed Ca/Fe aanwezigheid in matrix op meting overige elementen)

Calcium en ijzer, aanwezig in de matrix, kunnen een storend effect hebben op de meting van andere elementen aanwezig in de matrix.

Onderzoek is gedaan naar deze invloed door standaarden te spiken met calcium/ijzer en vervolgens te meten. De verschillende toevoegingen hadden op een dusdanige manier plaats zodat een concentratiereeks van hetzij Ca, hetzij Fe, onstond. De reeks bestond uit toevoegingen Ca en Fe van 0 g/l, 0.1 g/l, 0.5 g/l, 1 g/l, 5 g/l, 15 g/l en 30 g/l.

De opzet, uitvoering en resultaten van dit onderzoek zijn te vinden in bijlage E.

Uit de resultaten blijkt dat pas vanaf een concentratie van 1 g/l Ca/Fe een onacceptabele, negatieve invloed optreedt. Vanaf deze concentratie wordt in de meeste gevallen minder dan 90 %, of meer dan 110 %, van het oorspronkelijke metaal-gehalte teruggevonden.

3.5 Trendbreuk

Gedurende een bepaalde periode zijn praktijkmonsters parallel gemeten met de Optima 3000 DV.

Voor de vergelijking van de resultaten verkregen na analyse op de Varian Vista met de resultaten na analyse op de Optima 3000 DV is gebruik gemaakt van "Statistiek voor de Praktijk"⁴.

Gesteld wordt dat er geen verschil is tussen de resultaten na analyse op de Optima 3000 DV en na analyse op de Varian Vista (nulhypothese H_0), na analyse van minimaal zeven verschillende praktijkmonsters. Om uitsluitel te krijgen over de juistheid van de nulhypothese wordt per element een t-waarde bepaald. Wanneer de bepaalde t-waarde lager is dan de kritieke t-waarde betekent dit dat geen trendbreuk heeft plaatsgevonden. De ruwe data staan in bijlage F. De schuingedrukte waarden geven aan dat sprake is van een trendbreuk.

In tabel 3.9 en 3.10 zijn de verschillende resultaten weergegeven.

Tabel 3.9: Resultaten van de vergelijking van de analyse op Optima 3000 DV met. Varian Vista.

Element	Golflengte*** (nm)	Aantal waarnemingen	Kritieke T-waarde	T-waarde ¹
Cd	228.802	20	2.09	0.78
Cd	228.802	20	2.09	0.69
Cd	214.439	7	2.43	7.02
Cd	214.439	7	2.43	2.35
Co	228.616	10	2.26	3.74
Co	228.616	10	2.26	0.80
Cr	267.746	30	2.05	1.80
Cu	324.754	14	2.16	1.92
Cu	324.754	14	2.16	5.97
Mn	257.610	12	2.20	2.16
Ni	231.604	39	2.02	12.5
Ni	231.604	39	2.02	1.97
Pb	220.353	11	2.23	8.42
Pb	220.353	11	2.23	2.07
Sc	361.384	50	2.01	3.22
Sc	361.384	50	2.01	2.00
Zn	213.856	50	2.01	1.21
Zn	213.856	50	2.01	9.89

¹ De berekening van de t-waarde wordt in bijlage F uitgelegd.

Tabel 3.10: Vervolg; resultaten van de vergelijking van de analyse op Optima 3000 DV met. Varian Vista

Element	Golflengte*** (nm)	Aantal waarnemingen	Kritieke T-waarde	T-waarde
Al	396.152	10	2.26	1.30
Al	396.152	10	2.26	1.30
Ca	315.887	43	2.02	0.69
Ca	315.887	43	2.02	0.69
Fe	239.562	32	2.04	0.13
Fe	239.562	32	2.04	0.13
Mg	279.079	50	2.01	3.98
Mg	279.079	50	2.01	3.98

*** Alleen de kwantificeringslijnen zijn gebruikt. De analyseresultaten lagen binnen 10 % t.o.v. de controlelijnen.

Zoals blijkt uit de bovenstaande tabellen is, m.u.v. cadmium, alleen gekeken naar de resultaten gemeten op de kwantificeringslijnen. Dit is gebeurd omdat het resultaat van de analyse op de controlelijnen tijdens toekomstige metingen niet groter dan 10 % van het resultaat na analyse op de kwantificeringslijnen mag zijn. Een tweede reden is het feit dat alleen de resultaten na analyse op de kwantificeringslijnen zal worden gerapporteerd. Resultaten na analyse op de controlelijnen zijn uitsluitend interessant binnen het laboratorium.

Voor cadmium heeft voor beide lijnen een trendbreukanalyse plaatsgehad. Dit is gebeurd vanwege het feit dat voor cadmium veel hogere detectiegrenzen (tot zes keer zo hoog), worden gevonden na meting op de Vista, in vergelijking tot de meting op de Optima. Na meting op de oorspronkelijke controlelijn (214.439 nm) en na Y-correctie op deze lijn wordt daarentegen wel een vergelijkbare detectiegrens gevonden.

4 Conclusie

4.1 Concluderende Opmerkingen

Over het algemeen is duidelijk geworden dat de analyseresultaten van de meting van sedimentmonsters op de Optima 3000 DV en de analyseresultaten na analyse op de Varian Vista gelijkwaardige resultaten opleveren.

- De detectie- en bepalingsgrenzen zijn op de Varian Vista in de meeste gevallen lager dan op de Optima 3000 DV. Uitzondering zijn cadmium (beide lijnen), cobalt (beide lijnen), koper (beide lijnen), nikkel (controle-lijn), lood (kwantificeringslijn) en aluminium (beide lijnen). Over het algemeen zijn de verschillen acceptabel.
- De binnenlaboratoriumreproduceerbaarheid is alleen voor de bepaling van aluminium hoger dan 10 %.
- De maximaal toelaatbare fout ligt alleen in het geval van de bepaling van aluminium boven 25 %. Voor alle andere elementen ligt deze onder 25 %.
- De juistheid ligt voor alle elementen tussen 90 % en 110 %. Uitzondering vormen de elementen Sc, Al en Mg, waarbij tot 122 % wordt teruggevonden. Voor scandium en magnesium kan dit verklaard worden door het feit dat in beide gevallen gebruik gemaakt is van een ISE-monster.
- De herhaalbaarheid (RSD_r) is alleen in het geval van scandium aan de hoge kant ($\approx 6\%$).
- Bij het testen van de selectiviteit van het systeem is naar voren gekomen dat een concentratie van calcium en/of ijzer van 1 of meer g/l onacceptabele effecten heeft op de meting van de overige elementen.
- Uit trendbreukanalyse blijkt dat sommige elementen significante verschillen vertonen tussen de Optima 3000 DV- en de Varian Vista-meting. De elementen kunnen echter hetzij met, hetzij zonder Y-correctie, zonder trendbreuk worden gemeten.

4.2 Algehele Conclusie

De analyse van metalen in sediment zal worden uitgevoerd op de Varian Vista CCD Simultaneous ICP-AES. Elk element zal op twee golflengten worden gemeten (zie tabel 4.1 en 4.2). De elementen die op ionlijnen worden gemeten zullen voor Yttrium worden gecorrigeerd.

Tabel 4.1: Uiteindelijke methode voor de bepaling van metalen in sediment.

Element	Golflengte (nm)	Functie	Type lijn	Correctie voor Interne Standaard
Cd	228.802	controle****	atoom	Nee
Cd	214.438	kwantificering****	ion	Ja
Co	228.616	kwantificering	ion	Ja
Co	230.786	controle	ion	Ja
Cr	267.716	kwantificering	ion	Ja
Cr	205.552	controle	ion	Ja
Cu	324.754	kwantificering	atoom	Nee
Cu	327.396	controle	atoom	Nee
Mn	257.610	kwantificering	ion	Ja
Mn	260.569	controle	ion	Ja
Ni	231.604	kwantificering	ion	Ja
Ni	221.647	controle	ion	Ja
Pb	220.353	kwantificering	ion	Ja
Pb	216.999	controle	atoom	Nee
Sc	361.384	kwantificering	ion	Ja
Sc	424.683	controle	ion	Ja
Zn	213.856	kwantificering	atoom	Nee
Zn	206.200	controle	ion	Ja

**** Cadmium zal in het vervolg worden gerapporteerd na meting op 214.439 nm.

Tabel 4.2: Overige elementen.

Al	396.152	kwantificering	atoom	Nee
Al	394.401	controle	atoom	Nee
Ca	315.887	kwantificering	ion	Ja
Ca	317.933	controle	ion	Ja
Fe	239.562	kwantificering	ion	Ja
Fe	273.955	controle	ion	Ja
Mg	279.079	kwantificering	ion	Ja
Mg	202.582	controle	atoom	Nee

Cadmium zal in het vervolg na meting op 214.439 nm (met Y-correctie) worden gerapporteerd, omdat alleen dan vergelijkbare resultaten worden verkregen m.b.t. analyse op de Optima.

5 Referenties:

1. W 8141.001, *Het Proefondervindelijk Vaststellen van Prestatiekenmerken* (1998).
2. Community Bureau of Reference, *BCR Reference Materials* (BCR 143).
3. Houba, V.J.G., *ISE-report 1998*, Landbouwniversiteit Wageningen (1998).
4. Kragten, J., *Statistiek voor de chemische praktijk*, Amsterdam Summercourse, Vakgroep Analytische Scheikunde, Universiteit van Amsterdam (1996).

6 Bijlagen:

Bijlage A: Analysekaracteristieken

Bijlage B: Juistheid, Binnenlaboratoriumreproduceerbaarheid en Maximaal Toelaatbare Fout

Bijlage C: Berekening van RSD_R , Juistheid, $MTF_{R, \%}$ en t_R

Bijlage D: Herhaalbaarheid

Bijlage E: Bepaling van de Selectiviteit (Ca/Fe invloed)

Bijlage F: Trendbreukanalyse; uitleg berekening T-waarde en resultaten trendbreukanalyse

Bijlage A:
AK's

Sample Labels	Al		Al		Al		Ca		Ca		Ca		Cd		Cd		Cd		Co								
	Analyte	394.401	Analyte	394.401	Analyte	396.152	Analyte	396.152	Analyte	315.887	Analyte	317.933	Analyte	317.933	Analyte	214.439	Analyte	214.439	Analyte	228.802	Analyte	228.802	Analyte	228.615	Analyte	228.615	Co
Blanco		0.000		0.261		0.000		0.000		0.000		0.000		0.000		0.001		0.001		0.003		0.001		0.006		0.006	
Meting 1		5353		5395		5167		5265		2738		2715		3008		0.79		xxx		-0.38		xxx		9.26		10.48	
Meting 2		5195		5166		5058		5075		2420		2384		2647		0.50		xxx		-0.40		xxx		xxx		xxx	
Meting 3		5349		5400		5175		5280		2351		2316		2646		0.43		0.16		-0.61		xxx		9.52		10.97	
Meting 4		5461		5520		5269		5386		2325		2285		2634		0.42		0.15		-0.56		0.15		8.92		9.66	
Meting 5		4960		4937		4782		4810		2198		2162		2449		0.34		0.12		-0.28		0.14		xxx		xxx	
Meting 6		5568		5547		5401		5433		2290		2254		2569		0.38		0.08		-0.63		0.15		8.96		9.50	
Meting 7		5422		5496		5240		5370		2196		2169		2522		0.36		0.13		-0.65		0.15		8.87		9.43	
Meting 8		5279		5338		5103		5216		2228		2207		2538		0.38		0.08		-0.73		0.19		8.82		9.38	
Meting 9		5616		5595		5446		5479		2288		2253		2564		0.29		0.08		-0.75		0.10		8.64		9.08	
Meting 10		5193		5276		5001		5143		2139		2116		2464		0.35		0.08		-0.40		0.17		xxx		xxx	
gemiddelde		5340		5367		5164		5246		2317		2286		2604		0.42		0.11		-0.54		0.15		9.00		9.78	
standaardafwijking (s)		195		200		194		199		170		170		158		0.14		0.03		0.16		0.03		0.29		0.68	
MDL (3s)		584		600		583		597		509		511		474		0.42		0.10		0.49		0.08		0.88		2.04	
Cbg (10s)		1947		2001		1944		1990		1696		1703		1581		1.41		0.32		1.64		0.26		2.94		6.80	
rel.stand.afwijking(%)		4%		4%		4%		4%		7%		7%		6%		33%		29%		-30%		17%		3%		7%	

In mg/kg

Bijlage A:
AK's

Sample Labels	Co		Cr		Cu		Cu		Fe		Fe		Fe		Mg	
	Analyte	230.786	Analyte	206.550	Analyte	267.716	Analyte	324.754	Analyte	327.395	Analyte	239.563	Analyte	273.955	Analyte	202.582
Blanco	0.005	0.004	0.008	0.010	0.010	0.010	0.012	0.013	0.010	0.010	0.000	0.000	0.000	0.000	0.000	0.000
Meting 1	9.52	10.81	13.1	12.1	15.2	15.6	15.2	15.5	15.2	15.5	3536	3741	3659	3862	221	431
Meting 2	xxx	xxx	11.7	10.8	14.3	14.5	14.4	14.6	14.4	14.6	3374	3513	3484	3625	194	380
Meting 3	8.96	10.38	12.2	11.2	14.2	14.6	14.0	14.4	14.0	14.4	3299	3522	3432	3656	141	353
Meting 4	9.44	10.23	11.9	11.0	16.0	16.4	16.0	16.4	16.0	16.4	3425	3656	3559	3787	135	354
Meting 5	xxx	xxx	10.5	9.9	13.8	13.8	13.6	13.7	13.6	13.7	3191	3341	3317	3470	125	324
Meting 6	9.55	10.13	12.1	11.4	14.2	14.3	14.3	14.5	14.3	14.5	3359	3539	3492	3674	145	356
Meting 7	9.35	9.95	13.2	12.1	13.2	13.5	13.2	13.6	13.2	13.6	3317	3565	3449	3693	118	340
Meting 8	9.59	10.21	12.4	11.2	13.9	14.2	13.9	14.2	13.9	14.2	3362	3588	3487	3712	122	340
Meting 9	8.98	9.44	12.5	11.2	14.1	14.3	14.1	14.3	14.0	14.1	3402	3581	3531	3710	151	359
Meting 10	xxx	xxx	11.4	10.6	13.1	13.5	13.2	13.6	13.2	13.6	3218	3468	3360	3605	120	340
gemiddelde	9.34	10.16	12.1	11.1	14.2	14.5	14.2	14.5	14.2	14.5	3348	3551	3477	3679	147	358
standaardafwijking (s)	0.26	0.42	0.80	0.66	0.87	0.90	0.86	0.89	0.86	0.89	100	107	97.5	105	34.2	29.68
MDL (3s)	0.79	1.25	2.41	1.99	2.61	2.71	2.57	2.68	2.57	2.68	300	321	293	316	102	89.05
Cbg (10s)	2.65	4.18	8.03	6.62	8.69	9.02	8.56	8.92	8.56	8.92	1000	1069	975	1053	342	296.82
rel.stand.afwijking(%)	3%	4%	7%	6%	6%	6%	6%	6%	6%	6%	3%	3%	3%	3%	23%	8%

In mg/kg

Bijlage A:
AK's

Sample Labels	Mg		Mn		Ni		Ni		Ni		Pb		Pb		Pb		Pb		Sc	
	Analyte	279.078	Analyte	257.610	Analyte	221.648	Analyte	221.648	Analyte	231.604	Analyte	217.000	Analyte	217.000	Analyte	220.353	Analyte	220.353	Analyte	Sc
Blanco	0.000	0.000	0.151	0.151	0.012	0.012	0.012	0.012	0.010	0.010	0.010	0.017	0.017	0.012	0.012	0.013	0.001	0.001	0.001	0.001
Meting 1	377	580	127	127	1.32	1.29	1.29	1.29	2.13	2.13	xxx	xxx	xxx	xxx	xxx	xxx	0.69	0.69	0.71	0.71
Meting 2	334	514	113	113	1.09	1.05	1.05	1.05	1.66	1.62	13.3	14.6	14.6	11.2	11.2	11.2	0.63	0.63	0.65	0.65
Meting 3	304	508	113	113	0.37	0.35	0.35	0.35	1.64	1.66	12.7	14.0	14.0	10.9	10.9	11.1	0.72	0.72	0.74	0.74
Meting 4	304	514	116	115	0.56	0.54	0.54	0.54	1.57	1.57	xxx	xxx	xxx	xxx	xxx	xxx	0.73	0.73	0.75	0.75
Meting 5	278	471	99	99	0.75	0.67	0.67	0.67	1.33	1.27	11.6	10.7	10.7	10.7	10.7	10.6	0.59	0.59	0.59	0.59
Meting 6	304	508	111	111	1.40	1.33	1.33	1.33	1.42	1.38	14.5	13.5	13.5	11.4	11.4	11.4	0.70	0.70	0.70	0.70
Meting 7	286	499	115	114	0.74	0.71	0.71	0.71	1.20	1.22	11.5	11.6	11.6	10.2	10.4	10.4	0.71	0.71	0.76	0.76
Meting 8	285	495	108	107	0.84	0.82	0.82	0.82	1.40	1.40	13.2	12.5	12.5	10.5	10.6	10.6	0.67	0.67	0.69	0.69
Meting 9	309	510	112	111	0.46	0.41	0.41	0.41	1.45	1.41	12.7	10.8	10.8	11.0	11.1	11.1	0.75	0.75	0.77	0.77
Meting 10	285	497	109	109	0.71	0.71	0.71	0.71	1.35	1.37	13.2	11.9	11.9	10.6	10.6	10.9	0.67	0.67	0.69	0.69
gemiddelde	307	510	112	112	0.82	0.79	0.79	0.79	1.52	1.50	12.8	12.5	12.5	10.8	10.8	10.9	0.69	0.69	0.70	0.70
standaardafwijking (s)	29.8	27.7	6.97	6.88	0.35	0.34	0.34	0.34	0.26	0.26	0.96	1.49	1.49	0.40	0.40	0.35	0.05	0.05	0.06	0.06
MDL (3s)	89.3	83.2	20.9	20.6	1.04	1.02	1.02	1.02	0.78	0.79	2.89	4.47	4.47	1.20	1.20	1.04	0.15	0.15	0.17	0.17
Cbg (10s)	298	277	69.7	68.8	3.46	3.40	3.40	3.40	2.59	2.63	9.62	14.91	14.91	4.01	4.01	3.47	0.49	0.49	0.56	0.56
rel.stand.afwijking(%)	10%	5%	6%	6%	42%	43%	43%	43%	17%	17%	7%	12%	12%	4%	4%	3%	7%	7%	8%	8%

In mg/kg

Bijlage A:
AK's

Sample Labels	Sc		Sc		Zn		Zn		Zn	
	424.682	Analyte	424.682	Analyte	206.200	Analyte	213.857	Analyte	213.857	Analyte
Blanco	0.001		0.001		0.085		0.095		0.099	
Meting 1	0.79		0.81	xxx	xxx		xxx		xxx	
Meting 2	0.71		0.71	xxx	xxx		xxx		xxx	
Meting 3	0.76		0.80		27.5		26.4		26.6	
Meting 4	0.82		0.84		27.4		26.3		26.6	
Meting 5	0.63		0.63		24.7		25.2		24.5	
Meting 6	0.78		0.80		25.8		25.9		25.5	
Meting 7	0.80		0.82	xxx	xxx		xxx		xxx	
Meting 8	0.78		0.80		25.1		24.6		24.8	
Meting 9	0.85		0.85		25.8		25.6		25.3	
Meting 10	0.73		0.75		24.3		22.8		23.1	
gemiddelde	0.76		0.78		25.8		25.2		25.2	
standaardafwijking (s)	0.06		0.07		1.27		1.23		1.23	
MDL (3s)	0.19		0.21		3.80		3.68		3.69	
Cbg (10s)	0.64		0.69		12.7		12.3		12.3	
rel.stand.afwijking(%)	8%		9%		5%		5%		5%	

In mg/kg

Bijlage B:
Juistheid

Sample Labels	Al 394.401 Analyte	Al 394.401 Analyte	Al 396.152 Analyte	Al 396.152 Analyte	Ca 315.887 Analyte	Ca 315.887 Analyte	Ca 317.933 Analyte	Ca 317.933 Analyte	Cd 214.439 Analyte	Cd 214.439 Analyte	Cd 228.802 Analyte
Blanco	0.000	3.223	0.000	2.542	0.000	1.271	0.000	0.872	0.002	0.001	0.002
Meting 1	35066	35410	35536	35884	2060	2073	2113	2131	xxx	xxx	xxx
Meting 2	35679	35452	36168	35934	1827	1179	1903	1211	29.5	32.1	29.2
Meting 3	37751	37311	38212	37765	1678	1722	1712	1762	30.6	32.4	30.3
Meting 4	36787	36364	37255	36822	1748	1693	1780	1727	30.4	32.0	30.6
Meting 5	34957	35003	35428	35472	1755	1694	1779	1718	30.1	32.0	30.1
Meting 6	38332	37504	38799	37958	1797	1706	1811	1721	30.7	32.1	30.6
Meting 7	38112	37230	38568	37671	1775	1690	1790	1706	30.8	32.5	30.6
Meting 8	35270	35144	35805	35671	1769	1685	1781	1698	30.2	32.2	30.0
Meting 9	36786	35811	37182	36191	1780	1675	1804	1699	31.0	32.3	30.8
gemiddelde	36527	36137	36995	36597	1795	1742	1821	1770	30.4	32.2	30.3
ASD	1337	992	1323	978	113	134	121	147	0.49	0.18	0.51
RSD	4%	3%	4%	3%	6%	8%	7%	8%	2%	1%	2%
Certificaat waarde	32600	32600	32600	32600	1670	1670	1670	1670	31.5	31.5	31.5
juistheid	112%	111%	113%	112%	107%	104%	109%	106%	97%	102%	96%

In mg/kg

Bijlage B:
Juistheid

Sample Labels	Cd 228.802 Analyte	Co 228.615 Analyte	Co 228.615 Analyte	Co 230.786 Analyte	Co 230.786 Analyte	Cr 206.550 Analyte	Cr 267.716 Analyte	Cu 324.754 Analyte	Cu 324.754 Analyte	Cu 327.395 Analyte	Cu 327.395 Analyte
Blanco	0.001	0.000	0.001	0.000	0.000	0.005	0.004	0.005	0.006	0.004	0.005
Meting 1	xxx	11.36	12.20	11.8	12.7	201	201	231	248	230	247
Meting 2		11.4	12.1	11.6	12.2	202	201	233	247	232	245
Meting 3		11.7	12.3	11.6	12.2	203	204	235	247	234	246
Meting 4		11.4	12.0	11.4	12.0	202	202	235	246	234	245
Meting 5		11.5	12.2	11.3	12.0	200	200	231	245	229	244
Meting 6		12.0	12.5	12.0	12.4	203	203	236	245	235	245
Meting 7		11.9	12.4	12.0	12.4	203	203	237	246	235	244
Meting 8		11.3	12.0	11.5	12.2	202	202	231	245	231	244
Meting 9		11.6	12.0	11.9	12.3	203	202	237	245	237	246
gemiddelde		11.6	12.2	11.7	12.3	202	202	234	246	233	245
ASD	0.35	0.26	0.19	0.25	0.22	1.13	1.13	2.56	1.04	2.80	0.92
RSD	1%	2%	2%	2%	2%	1%	1%	1%	0%	1%	0%
Certificaat waarde	31.5	11.8	11.8	11.8	11.8	208	208	236	236	236	236
juistheid	107%	98%	103%	99%	104%	97%	97%	99%	104%	99%	104%

In mg/kg

Bijlage B:
Juistheid

Sample Labels	Fe 239.563 Analyte	Fe 239.563 Analyte	Fe 273.955 Analyte	Fe 273.955 Analyte	Mg 202.582 Analyte	Mg 202.582 Analyte	Mg 279.078 Analyte	Mn 257.610 Analyte	Mn 260.568 Analyte	Ni 221.648 Analyte
Blanco	0.000	0.000	0.000	0.000	1.534	0.000	0.000	0.000	0.000	0.002
Meting 1	27884	28114	27113	27355	7412	6908	7255	xxx	xxx	83.6
Meting 2	28038	27815	27215	27016	4885	7094	4811	905	915	85.0
Meting 3	28529	28153	27666	27319	7296	6775	7203	918	928	85.1
Meting 4	28280	27908	27472	27129	6903	6829	6843	909	919	86.5
Meting 5	27747	27738	26899	26909	7185	7204	7162	903	912	84.1
Meting 6	28758	28092	27882	27253	7228	7190	7163	912	921	86.6
Meting 7	28713	28004	27850	27180	7059	6995	6961	916	923	86.0
Meting 8	28047	27902	27196	27073	6960	6943	6880	902	910	86.4
Meting 9	29559	28730	28187	27414	7174	7100	7064	894	907	85.4
gemiddelde	28395	28051	27498	27183	6900	7004	6816	907	917	85.4
ASD	564	290	426	168	772	153	766	7.84	7.06	1.08
RSD	2%	1%	2%	1%	11%	2%	11%	1%	1%	1%
Certificaat waarde	25800	25800	25800	25800	5723.4	5723.4	5723.4	935	935	92.7
juistheid	110%	109%	107%	105%	121%	122%	119%	97%	98%	92%

In mg/kg

Bijlage B:
Juistheid

Sample Labels	Ni 221.648	Ni 231.604	Ni 231.604	Pb 217.000	Pb 217.000	Pb 220.353	Pb 220.353	Sc 361.383	Sc 361.383	Sc 424.682	Sc 424.682
	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte
Blanco	0.002	0.003	0.004	0.021	0.028	0.022	0.026	0.000	0.000	0.000	0.000
Meting 1	89.7	89.4	96.0	1222.62	1283.98	1179.00	1264.88	11.54	12.90	11.45	12.80
Meting 2	89.8	91.9	97.1	1241.71	1285.96	1198.35	1264.97	11.97	8.65	11.88	8.58
Meting 3	89.4	91.6	96.3	1250.36	1289.64	1209.20	1269.64	11.43	13.02	11.28	12.85
Meting 4	90.9	92.9	97.6	1246.36	1285.60	1202.50	1262.80	10.98	11.83	10.86	11.69
Meting 5	89.5	90.0	95.8	1222.05	1276.09	1192.96	1269.06	11.90	12.76	11.79	12.64
Meting 6	90.1	93.0	96.7	1257.48	1284.42	1216.13	1264.01	12.12	12.79	11.98	12.65
Meting 7	89.3	93.2	96.8	1261.65	1284.72	1214.95	1260.83	11.53	12.20	11.43	12.10
Meting 8	91.6	92.6	98.1	1233.23	1285.46	1201.79	1272.21	11.28	11.95	11.15	11.81
Meting 9	88.4	95.2	98.5	1265.71	1286.73	1234.81	1276.96	11.96	12.51	11.84	12.40
gemiddelde	89.9	92.2	97.0	1244.575	1284.733	1205.520	1267.263	11.634	12.07	11.52	11.95
ASD	0.93	1.74	0.93	16.1	3.64	15.8	5.12	0.38	1.35	0.38	1.33
RSD	1%	2%	1%	1%	0%	1%	0%	3%	11%	3%	11%
Certificaat waarde	92.7	92.7	92.7	1317	1317	1317	1317	9.87	9.87	9.87	9.87
juistheid	97%	99%	105%	95%	98%	92%	96%	118%	122%	117%	121%

In mg/kg

Bijlage B:
Juistheid

Sample Labels	Zn 206,200 Analyte	Zn 213.857 Analyte	Zn 213.857 Analyte
Blanco	0.022	0.029	0.036
Meting 1	1309	1275	1369
Meting 2	1284	1261	1332
Meting 3	1284	1272	1336
Meting 4	1278	1256	1319
Meting 5	1274	1245	1325
Meting 6	1268	1269	1320
Meting 7	1271	1273	1322
Meting 8	1276	1245	1319
Meting 9	1286	1274	1318
gemiddelde	1281	1263	1329
ASD	12.3	12.0	16.1
RSD	1%	1%	1%
Certificaat waarde	1301	1301	1301
juistheid	98%	97%	102%

In mg/kg

Bijlage B:
BLR en MTF

Sample labels	AI 394.401 Analyte	AI 394.401 Analyte	AI 396.152 Analyte	AI 396.152 Analyte	Ca 315.887 Analyte	Ca 315.887 Analyte	Ca 317.933 Analyte	Ca 317.933 Analyte	Cd 214.439 Analyte	Cd 214.439 Analyte	Cd 228.802 Analyte
REF 1	23609	24880	23513	24799	48175	48138	48330	48294	xxx	xxx	xxx
REF 2	xxx	xxx	xxx	xxx	59208	54453	59236	54462	43.8	41.4	41.7
REF 3	xxx	xxx	xxx	xxx	58741	57169	58730	57140	xxx	xxx	xxx
REF 4	18342	18507	18579	18908	57397	57113	56771	56496	41.0	44.2	42.1
REF 5	xxx	xxx	xxx	xxx	55432	54966	54297	53851	39.6	42.1	39.0
REF 6	17888	18494	18183	18924	55681	56899	54544	55762	xxx	xxx	xxx
REF 7	19784	20200	20480	20923	54872	56006	54026	55156	39.4	43.8	38.2
REF 8	22693	22327	23075	23020	54714	53858	53628	52842	39.0	41.5	38.4
REF 9	21006	22850	20367	22484	54978	57697	55004	57805	40.5	44.7	40.6
REF 10	18034	19896	17271	19272	56731	58301	56780	58367	41.5	44.6	41.6
REF 11	xxx	xxx	xxx	xxx	61204	54698	61644	55075	xxx	xxx	xxx
Aantal monsters	7	7	7	7	11	11	11	11	7	7	7
Gemiddelde	20194	21022	20210	21190	56103	55391	55726	55023	40.7	43.2	40.2
ASD (sR)	2315	2401	2402	2314	3360	2812	3529	2790	1.64	1.44	1.65
RSD	0.11	0.11	0.12	0.11	0.06	0.05	0.06	0.05	0.04	0.03	0.04
R	6547	6791	6795	6546	9503	7953	9981	7893	4.64	4.08	4.68
RSDR	11.5	11.4	11.9	10.9	5.99	5.08	6.33	5.07	4.03	3.34	4.11
MTF (R, %J)	35.0	33.7	37.3	34.1	19.5	14.5	21.7	16.1	11.5	8.91	12.1

In mg/kg

Bijlage B:
BLR en MTF

Sample labels	Cd 228.802	Co 228.615	Co 228.615	Co 230.786	Co 230.786	Co 230.786	Cr 206.550	Cr 267.716	Cu 324.754	Cu 324.754	Cu 327.395	Cu 327.395
REF 1	xxx	xxx	xxx	xxx	xxx	xxx	146	148	144	145	143	144
REF 2	44.0	18.1	17.7	18.7	18.7	18.3	172	173	173	169	173	169
REF 3	xxx	17.8	18.4	18.4	18.4	19.0	176	178	176	182	176	182
REF 4	47.4	16.3	17.9	16.7	16.7	18.4	166	157	160	175	161	176
REF 5	45.0	15.2	16.6	15.6	15.6	17.0	172	174	152	164	152	164
REF 6	xxx	15.6	17.4	16.3	16.3	18.2	162	155	151	169	152	169
REF 7	46.1	xxx	xxx	xxx	xxx	xxx	166	168	153	172	153	172
REF 8	44.5	16.4	17.7	16.4	16.4	17.7	162	164	149	161	149	161
REF 9	46.4	xxx	xxx	xxx	xxx	xxx	168	173	156	174	155	173
REF 10	46.9	xxx	xxx	xxx	xxx	xxx	166	170	159	174	158	173
REF 11	xxx	18.9	17.6	19.5	19.5	18.0	174	174	181	170	180	170
Aantal monsters	7.0	7.0	7.0	7.0	7.0	7.0	11	11	11	11	11	11
Gemiddelde	45.7	16.9	17.6	17.4	17.4	18.1	166	168	159	169	159	169
ASD (sR)	1.28	1.38	0.56	1.47	1.47	0.63	8.20	8.11	12.02	9.71	12.0	9.72
RSD	0.03	0.08	0.03	0.08	0.08	0.03	0.05	0.05	0.08	0.06	0.08	0.06
R	3.62	3.92	1.60	4.14	4.14	1.78	23.2	22.9	34.0	27.5	33.9	27.5
RSDR	2.80	8.18	3.20	8.44	8.44	3.47	4.92	4.82	7.54	5.75	7.53	5.77
MTF (R, %I)	12.6	18.1	9.75	17.8	17.8	11.0	12.8	12.5	15.9	15.8	16.4	15.4

In mg/kg

Bijlage B:
BLR en MTF

Sample labels	Fe 239.563 Analyte	Fe 239.563 Analyte	Fe 273.955 Analyte	Fe 273.955 Analyte	Mg 202.582 Analyte	Mg 202.582 Analyte	Mg 279.078 Analyte	Mg 279.078 Analyte	Mn 257.610 Analyte	Mn 260.568 Analyte	Ni 221.648 Analyte
REF 1	38377	38931	37282	37864	xxx	xxx	xxx	xxx	1645	1629	51.2
REF 2	46215	42468	45878	42185	10864	9998	11302	11302	1904	1885	54.3
REF 3	45898	44635	45595	44368	10632	10352	11994	11665	2004	1987	54.7
REF 4	42842	42804	42757	42714	9690	9860	9786	9910	1987	1966	52.7
REF 5	42927	42683	42967	42704	9816	9891	10067	10132	1869	1860	50.4
REF 6	41811	42867	41710	42745	9142	9522	9540	9914	1933	1924	50.5
REF 7	41684	42960	41602	42551	9138	9585	9565	9886	1921	1914	50.3
REF 8	41729	41617	41709	41282	9359	9425	9658	9684	1828	1818	50.4
REF 9	42731	45344	42032	44285	8947	10194	9529	10634	2013	1986	55.8
REF 10	43173	44965	42469	44219	9027	10052	9685	10655	2007	1984	56.8
REF 11	46530	41680	46782	41921	xxx	xxx	xxx	xxx	1892	1884	56.8
Aantal monsters	11	11	11	11	9	9	9	9	11	11	11
Gemiddelde	43083	42814	42798	42440	9624	9875	10236	10420	1909	1894	53.1
ASD (sR)	2395	1797	2610	1821	702	314	1098	694	107	104	2.68
RSD	0.06	0.04	0.06	0.04	0.07	0.03	0.11	0.07	0.06	0.06	0.05
R	6775	5084	7383	5150	1987	887	3104	1964	303	295	8
RSDR	5.56	4.20	6.10	4.29	7.30	3.18	10.7	6.66	5.61	5.51	5.06
MTF (R,%J)	21.2	17.1	18.8	13.9	37.9	26.9	43.8	32.4	13.1	16.8	18.0

In mg/kg

Bijlage B:
BLR en MTF

Sample labels	Ni 221.648	Ni 231.604	Ni 231.604	Pb 217.000	Pb 217.000	Pb 220.353	Pb 220.353	Sc 361.383	Sc 361.383	Sc 424.682	Sc 424.682
	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte	Analyte
REF 1	51.7	53.8	54.3	430	416	397	399	5.45	5.49	5.82	5.86
REF 2	53.2	59.1	57.8	519	495	462	451	xxx	xxx	xxx	xxx
REF 3	56.7	58.6	60.7	526	530	468	484	xxx	xxx	xxx	xxx
REF 4	57.8	53.3	58.4	435	506	430	471	4.44	4.86	4.56	4.99
REF 5	54.6	52.5	56.9	441	487	410	444	xxx	xxx	xxx	xxx
REF 6	56.4	51.8	57.8	432	494	411	458	4.39	4.89	4.61	5.14
REF 7	56.5	51.4	57.8	429	497	407	458	4.56	5.11	4.74	5.33
REF 8	54.4	52.2	56.4	434	479	402	435	4.90	5.31	5.11	5.53
REF 9	63.8	54.5	62.7	449	500	426	473	4.92	5.54	5.34	6.01
REF 10	63.7	54.9	61.9	459	508	443	481	4.48	4.96	4.90	5.41
REF 11	53.6	62.8	59.1	564	518	497	467	xxx	xxx	xxx	xxx
Aantal monsters	11	11	11	11	11	11	11	7	7	7	7
Gemiddelde	56.6	55.0	58.5	465	493	432	456	4.73	5.17	5.01	5.47
ASD (sR)	3.97	3.63	2.46	47.7	29.4	31.9	24.2	0.38	0.28	0.45	0.37
RSD	0.07	0.07	0.04	0.10	0.06	0.07	0.05	0.08	0.05	0.09	0.07
R	11	10	7	135	83.26	90.12	68.55	1.08	0.80	1.28	1.04
RSDR	7.02	6.61	4.21	10.2	5.97	7.37	5.31	8.09	5.48	9.03	6.70
MTF (R, %I)	17.1	13.7	13.0	26.0	14.4	23.2	14.4	33.6	37.6	34.3	38.7

In mg/kg

Bijlage B:
BLR en MTF

Sample labels	Zn 206.200 Analyte	Zn 213.857 Analyte	Zn 213.857 Analyte
REF 1	2327	2318	2332
REF 2	2611	2810	2750
REF 3	2804	2874	2976
REF 4	2784	2617	2864
REF 5	2674	2569	2781
REF 6	2750	2520	2810
REF 7	2729	2482	2786
REF 8	2639	2521	2723
REF 9	2829	2547	2830
REF 10	2886	2648	2881
REF 11	2654	2928	2753
Aantal monsters	11	11	11
Gemiddelde	2699	2621	2771
ASD (sR)	150	183	162
RSD	0.06	0.07	0.06
R	425	518	459
RSDR	5.57	6.98	5.86
MTF (R, %I)	12.7	16.9	13.9

In mg/kg

Bijlage C: Berekening van RSD_R , Juistheid (%J), $MTF_{R, \%J}$ en t_R

$$RSD_R = \frac{100 \times s_R}{\bar{x}_R} \quad [C.1],$$

waarin:

RSD_R = de relatieve standaardafwijking van de binnenlaboratoriumreproduceerbaarheid,

s_R = de absolute standaarddeviatie tussen de verschillende metingen,

\bar{x}_R = het gemiddelde van de verschillende metingen.

$$\%J = \frac{100 \times \bar{x}_R}{c_{CRM}} \quad [C.2],$$

waarin:

\bar{x}_R = het gemiddelde van de verschillende metingen,

c_{CRM} = de ware waarde volgens het certificaat.

$$MTF_{R, \%J} = |100 - \%J_R| + 2 \times RSD_R \quad [C.3],$$

waarin:

$MTF_{R, \%J}$ = de maximaal totale fout.

$$t_R = \frac{\bar{x}_R - c_{CRM}}{\sqrt{\frac{s_R^2}{n} + s_{CRM}^2}} \quad [C.4],$$

waarin:

s_{CRM} = de standaarddeviatie van de ware waarde volgens het CRM-certificaat.

Bijlage D:

Sample Labels	Al 394.401 Analyte	Al 394.401 Analyte	Al 396.152 Analyte	Ca 315.887 Analyte	Ca 315.887 Analyte	Ca 317.933 Analyte	Ca 317.933 Analyte
8CR 143 M1	35066	35410	35536	35884	64580	65167	64750
8CR 143 M2	35679	35452	36168	35934	65252	64785	65060
8CR 143 M3	37751	37311	38212	37765	65927	65109	66179
8CR 143 M4	36787	36364	37255	36822	65583	64783	65013
8CR 143 M5	34957	35003	35428	35472	64887	64923	65202
8CR 143 M6	38332	37504	38799	37958	66221	64743	66417
8CR 143 M7	38112	37230	38568	37671	66332	64750	64868
8CR 143 M8	35270	35144	35805	35671	65217	64934	65114
8CR 143 M9	36786	35811	37182	36191	67408	65572	65976
gemiddelde	36527	36137	36995	36597	65712	64974	65202
ASD	1337	992	1323	978	866	272	334
RSD	4%	3%	4%	3%	1%	0%	1%
r=herhaalbaarheid	3781	2805	3741	2767	2450	770	944
RSDr	3.66	2.74	3.58	2.67	1.32	0.42	0.51

In mg/kg

Bijlage D:
Herhaalbaarheid

Sample Labels	Cd 214.439 Analyte	Cd 214.439 Analyte	Cd 228.802 Analyte	Cd 228.802 Analyte	Co 228.615 Analyte	Co 228.615 Analyte	Co 230.786 Analyte	Co 230.786 Analyte
BCR 143 M1	32.3	32.5	29.8	34.2	11.4	12.2	11.8	12.7
BCR 143 M2	32.5	32.1	29.7	33.9	11.4	12.1	11.6	12.2
BCR 143 M3	32.7	32.1	29.8	33.7	11.7	12.3	11.6	12.2
BCR 143 M4	32.3	31.9	29.7	33.3	11.4	12.0	11.4	12.0
BCR 143 M5	31.9	32.0	29.3	33.6	11.5	12.2	11.3	12.0
BCR 143 M6	32.9	32.0	29.8	33.5	12.0	12.5	12.0	12.4
BCR 143 M7	33.0	32.1	30.2	33.6	11.9	12.4	12.0	12.4
BCR 143 M8	32.1	32.1	29.7	33.6	11.3	12.0	11.5	12.2
BCR 143 M9	33.3	32.3	30.1	33.4	11.6	12.0	11.9	12.3
gemiddelde	32.6	32.1	29.8	33.7	11.6	12.2	11.7	12.3
ASD	0.45	0.18	0.27	0.27	0.26	0.19	0.25	0.219961007
RSD	1%	1%	1%	1%	2%	2%	2%	2%
r=herhaalbaarheid	1.27	0.52	0.77	0.76	0.73	0.55	0.70	0.62
RSDr	1.38	0.57	0.92	0.80	2.24	1.59	2.11	1.79

In mg/kg

Bijlage D:
Herhaalbaarheid

Sample Labels	Cr 206.550 Analyte	Cr 267.716 Analyte	Cu 324.754 Analyte	Cu 327.395 Analyte	Fe 239.563 Analyte	Fe 239.563 Analyte
BCR 143 M1	201	201	231	230	247	27884
BCR 143 M2	202	201	233	232	245	28038
BCR 143 M3	203	204	235	234	246	28529
BCR 143 M4	202	202	235	234	245	28280
BCR 143 M5	200	200	231	229	244	27747
BCR 143 M6	203	203	236	235	245	28758
BCR 143 M7	203	203	237	235	244	28713
BCR 143 M8	202	202	231	231	244	28047
BCR 143 M9	203	202	237	237	246	29559
gemiddelde	202	202	234	233	245	28395
ASD	1.13	1.13	2.56	2.80	0.92	564
RSD	1%	1%	1%	1%	0%	2%
r=herhaalbaarheid	3.19	3.21	7.25	7.92	2.61	1596
RSDr	0.56	0.56	1.09	1.20	0.38	1.99

In mg/kg

Bijlage D:
Herhaalbaarheid

Sample Labels	Fe 273.955 Analyte	Fe 273.955 Analyte	Mg 202.582 Analyte	Mg 202.582 Analyte	Mg 279.078 Analyte	Mg 279.078 Analyte	Mn 257.610 Analyte	Mn 260.568 Analyte
BCR 143 M1	27113	27355	28303	28582	28711	28958	994	998
BCR 143 M2	27215	27016	28671	28488	29384	29162	989	986
BCR 143 M3	27666	27319	29081	28742	29704	29323	996	992
BCR 143 M4	27472	27129	28920	28586	29469	29093	986	983
BCR 143 M5	26899	26909	28498	28536	29100	29103	982	979
BCR 143 M6	27882	27253	29078	28450	29913	29233	992	988
BCR 143 M7	27850	27180	29149	28474	29917	29189	991	988
BCR 143 M8	27196	27073	28591	28486	29382	29241	983	983
BCR 143 M9	28187	27414	29461	28580	31332	30465	996	1002
gemiddelde	27498	27183	28861	28558	29657	29307	990	989
ASD	426	168	370	99.5	736	446	5.28	7.50
RSD	2%	1%	1%	0%	2%	2%	1%	1%
r=herhaalbaarheid	1205	474	1046	281	2081	1263	14.9	21.2
RSDr	1.55	0.62	1.28	0.35	2.48	1.52	0.53	0.76

In mg/kg

Bijlage D:
Herhaalbaarheid

Sample Labels	NI 221.648 Analyte	NI 221.648 Analyte	NI 231.604 Analyte	NI 231.604 Analyte	Pb 217.000 Analyte	Pb 217.000 Analyte	Pb 220.353 Analyte	Pb 220.353 Analyte
BCR 143 M1	83.6	89.7	89.4	96.0	1223	1284	1179	1265
BCR 143 M2	85.0	89.8	91.9	97.1	1242	1286	1198	1265
BCR 143 M3	85.1	89.4	91.6	96.3	1250	1290	1209	1270
BCR 143 M4	86.5	90.9	92.9	97.6	1246	1286	1202	1263
BCR 143 M5	84.1	89.5	90.0	95.8	1222	1276	1193	1269
BCR 143 M6	86.6	90.1	93.0	96.7	1257	1284	1216	1264
BCR 143 M7	86.0	89.3	93.2	96.8	1262	1285	1215	1261
BCR 143 M8	86.4	91.6	92.6	98.1	1233	1285	1202	1272
BCR 143 M9	85.4	88.4	95.2	98.5	1266	1287	1235	1277
gemiddelde	85.4	89.9	92.2	97.0	1245	1285	1206	1267
ASD	1.08	0.93	1.74	0.93	16.1	3.64	15.8	5.12
RSD	1%	1%	2%	1%	1%	0%	1%	0%
r=herhaalbaarheid	3.05	2.63	4.92	2.64	45.5	10.3	44.8	14.5
RSDr	1.26	1.04	1.89	0.96	1.29	0.28	1.31	0.40

In mg/kg

Bijlage D:
Herhaalbaarheid

Sample Labels	Sc 361.383 Analyte	Sc 361.383 Analyte	Sc 424.682 Analyte	Sc 424.682 Analyte	Zn 206.200 Analyte	Zn 213.857 Analyte	Zn 213.857 Analyte
BCR 143 M1	5.71	6.13	5.87	6.31	1309	1275	1369
BCR 143 M2	5.79	6.12	5.89	6.22	1284	1261	1332
BCR 143 M3	6.55	6.89	6.73	7.07	1284	1272	1336
BCR 143 M4	6.14	6.46	6.34	6.67	1278	1256	1319
BCR 143 M5	5.70	6.06	5.88	6.26	1274	1245	1325
BCR 143 M6	6.76	7.03	6.94	7.22	1268	1269	1320
BCR 143 M7	6.62	6.88	6.82	7.08	1271	1273	1322
BCR 143 M8	5.81	6.15	6.02	6.38	1276	1245	1319
BCR 143 M9	6.29	6.51	6.51	6.73	1286	1274	1318
gemiddelde	6.15	6.47	6.33	6.66	1281	1263	1329
ASD	0.42	0.38	0.43	0.39	12.3	12.0	16.1
RSD	7%	6%	7%	6%	1%	1%	1%
r=herhaalbaarheid	1.20	1.08	1.23	1.11	34.9	34.0	45.6
RSDr	6.87	5.91	6.85	5.88	0.96	0.95	1.21

In mg/kg

Bijlage E: Bepaling van de Selectiviteit (Ca/Fe invloed)

Bijlage F: Trendbreukanalyse; uitleg berekening T-waarde en resultaten trendbreukanalyse

$$T = \frac{\bar{X}_{\text{verschil}}}{S_{\text{verschil}}} \times \sqrt{n} \quad [\text{F.1}],$$

waarin:

$\bar{X}_{\text{verschil}}$ = het gemiddelde van de verschillen tussen de beide meetresultaten,
 S_{verschil} = de standaarddeviatie van het verschil tussen beide meetresultaten,
 n = het aantal metingen(!)

01-25-2000 15:43:08
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\AL_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\AL_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\AL_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\AL_MY_~1.TXT

No.	GROUP 1	GROUP 2
1	13728	12703
2	14771	12912
3	24086	22610
4	35276	34736
5	20757	19996
6	34084	35830
7	28537	27915
8	33914	34176
9	22285	21555
10	34567	34406

GROUP 1 C:\STATCAL\BALNSDAT\AL_OPT.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	26200.5
STANDARD DEVIATION:	8267.074

GROUP 2 C:\STATCAL\BALNSDAT\AL_MY_~1.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	25683.9
STANDARD DEVIATION:	8997.077

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	516.6
ST.DEV. OF THE DIFFERENCES =	997.2134
ST.DEV. OF THE MEAN =	315.3466

PAIRED t-TEST

MEAN OF DIFFERENCES =	516.6
ST.DEV. OF THE DIFFERENCES =	997.2134
ST.DEV. OF THE MEAN =	315.3466
NUMBER OF DATA =	10
DEGREES OF FREEDOM =	9

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 9 DF)
FOR P = 0.001 : 4.694174
P = 0.01 : 3.231132
P = 0.05 : 2.258446

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.638198

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA \approx 10
NUMBER OF NON-ZERO DIFFERENCES = 10

SUM OF POSITIVE RANKS = 44
SUM OF NEGATIVE RANKS = 11

TABULATED t-VALUES (2 -TAILED)

FOR P= .1	:	11
FOR P= .05	:	8
FOR P= .02	:	5
FOR P= .01	:	3

CALCULATED T= 11

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)

01-25-2000 15:42:49
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\AL_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\AL_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\AL_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\AL_ZY_~1.TXT

No.	GROUP 1	GROUP 2
1	13728	12949
2	14771	12257
3	24086	22655
4	35276	35340
5	20757	20329
6	34084	34930
7	28537	28235
8	33914	34455
9	22285	21791
10	34567	35007

GROUP 1 C:\STATCAL\BALNSDAT\AL_OPT.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	26200.5
STANDARD DEVIATION:	8267.074

GROUP 2 C:\STATCAL\BALNSDAT\AL_ZY_~1.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	25794.8
STANDARD DEVIATION:	9094.756

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	405.7
ST.DEV. OF THE DIFFERENCES =	1002.962
ST.DEV. OF THE MEAN =	317.1643

PAIRED t-TEST

MEAN OF DIFFERENCES =	405.7
ST.DEV. OF THE DIFFERENCES =	1002.962
ST.DEV. OF THE MEAN =	317.1643
NUMBER OF DATA =	10
DEGREES OF FREEDOM =	9

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 9 DF)
FOR P = 0.001 : 4.694174
P = 0.01 : 3.231132
P = 0.05 : 2.258446

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.279148

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 10
NUMBER OF NON-ZERO DIFFERENCES = 10

SUM OF POSITIVE RANKS = 36
SUM OF NEGATIVE RANKS = 19

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	11
FOR P=	.05	:	8
FOR P=	.02	:	5
FOR P=	.01	:	3

CALCULATED T= 19

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)

01-25-2000 15:48:03
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\FE_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\FE_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\FE_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\FE_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	35795	38541	21	20651	22342
2	21582	23157	22	27792	29257
3	30259	32681	23	14755	14205
4	42452	43349	24	13734	13955
5	47851	47801	25	34667	33015
6	27919	28832	26	45912	44798
7	38163	39078	27	33941	32643
8	32843	33512	28	42485	43538
9	50096	51887	29	45246	43662
10	41856	43172	30	45585	44418
11	40836	42202	31	39887	37381
12	23667	25094	32	43665	41744
13	37847	39163			
14	37496	37635			
15	41213	41041			
16	47728	47607			
17	33792	35074			
18	36169	36963			
19	32553	34705			
20	39889	40388			

GROUP 1 C:\STATCAL\BALNSDAT\FE_OPT.TXT
=====

NUMBER OF ENTRIES: 32
MEAN: 35885.19
STANDARD DEVIATION: 9437.178

GROUP 2 C:\STATCAL\BALNSDAT\FE_MY_~1.TXT
=====

NUMBER OF ENTRIES: 32
MEAN: 36338.75
STANDARD DEVIATION: 9171.688

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = -453.5625
ST.DEV. OF THE DIFFERENCES = 1343.839
ST.DEV. OF THE MEAN = 237.5593

PAIRED t-TEST

NUMBER OF DATA = 32

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 31 DF)
FOR P ≈ 0.001 : 3.631547

P = 0.01 : 2.743586

P = 0.05 : 2.039466

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.90926

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 32

NUMBER OF NON-ZERO DIFFERENCES = 32

SUM OF POSITIVE RANKS = 168

SUM OF NEGATIVE RANKS = 360

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 1.795098

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 15:47:45
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\FE_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\FE_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\FE_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\FE_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	35795	36998	21	20651	21745
2	21582	22220	22	27792	29176
3	30259	30865	23	14755	14546
4	42452	42555	24	13734	13271
5	47851	47548	25	34667	33329
6	27919	27972	26	45912	45739
7	38163	37611	27	33941	33525
8	32843	32303	28	42485	42553
9	50096	49646	29	45246	44470
10	41856	41796	30	45585	44942
11	40836	40701	31	39887	38187
12	23667	24122	32	43665	42593
13	37847	38459			
14	37496	36631			
15	41213	41073			
16	47728	48112			
17	33792	34475			
18	36169	36912			
19	32553	33767			
20	39889	41046			

GROUP 1 C:\STATCAL\BALNSDAT\FE_OPT.TXT
=====

NUMBER OF ENTRIES: 32
MEAN: 35885.19
STANDARD DEVIATION: 9437.178

GROUP 2 C:\STATCAL\BALNSDAT\FE_ZY_~1.TXT
=====

NUMBER OF ENTRIES: 32
MEAN: 35902.75
STANDARD DEVIATION: 9240.724

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = -17.5625
ST.DEV. OF THE DIFFERENCES = 780.5769
ST.DEV. OF THE MEAN = 137.9878

PAIRED t-TEST

NUMBER OF DATA = 32

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 31 DF)
FOR P = 0.001 : 3.631547

P = 0.01 : 2.743586

P = 0.05 : 2.039466

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = .1272757

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 32

NUMBER OF NON-ZERO DIFFERENCES = 32

SUM OF POSITIVE RANKS = 259

SUM OF NEGATIVE RANKS = 269

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= .0934947

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 15:48:51
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\MG_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\MG_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\MG_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\MG_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	10974	11437	31	6555	6587
2	6151	6436	32	4627	4749
3	10354	10720	33	9468	9648
4	9138	9581	34	8829	9050
5	9063	9538	35	8926	9207
6	8032	8364	36	9950	10101
7	8700	8942	37	8344	8591
8	8432	8760	38	9419	9613
9	6331	6416	39	8111	9342
10	10666	11343	40	8465	9236
11	10574	10358	41	4063	3854
12	10402	9920	42	3999	3824
13	9363	9167	43	11192	10342
14	9181	9414	44	6013	5894
15	12268	11971	45	9365	8725
16	11224	10940	46	5271	5442
17	8919	8919	47	4591	4439
18	6632	6571	48	4696	4639
19	11571	11166	49	4155	3916
20	4703	4984	50	4760	4580
21	9812	9911			
22	13416	12879			
23	11225	10842			
24	12360	12558			
25	8502	8953			
26	8356	8446			
27	8539	8381			
28	11922	11819			
29	11717	11565			
30	10705	11077			

GROUP 1 C:\STATCAL\BALNSDAT\MG_OPT.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 8600.62
STANDARD DEVIATION: 2509.871

GROUP 2 C:\STATCAL\BALNSDAT\MG_MY_~1.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 8663.14
STANDARD DEVIATION: 2497.637

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = -62.52
ST.DEV. OF THE DIFFERENCES = 373.9157

ST.DEV. OF THE MEAN = 52.87967

PAIRED t-TEST

NUMBER OF DATA = 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.182307

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 50

NUMBER OF NON-ZERO DIFFERENCES = 49

SUM OF POSITIVE RANKS = 11950

SUM OF NEGATIVE RANKS = 762

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 1.201833

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 15:48:28
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\MG_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\MG_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\MG_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\MG_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	10974	10887	31	6555	6570
2	6151	6075	32	4627	4519
3	10354	10055	33	9468	9562
4	9138	8858	34	8829	8935
5	9063	8990	35	8926	9120
6	8032	7787	36	9950	10009
7	8700	8351	37	8344	8454
8	8432	8174	38	9419	9522
9	6331	6126	39	8111	9169
10	10666	10596	40	8465	9118
11	10574	10145	41	4063	3823
12	10402	9828	42	3999	3525
13	9363	8910	43	11192	10342
14	9181	9192	44	6013	5820
15	12268	11523	45	9365	8837
16	11224	10559	46	5271	5120
17	8919	8483	47	4591	4311
18	6632	6300	48	4696	4483
19	11571	10759	49	4155	3790
20	4703	4751	50	4760	4465
21	9812	9697			
22	13416	12560			
23	11225	10822			
24	12360	12216			
25	8502	8537			
26	8356	8376			
27	8539	8382			
28	11922	11645			
29	11717	11555			
30	10705	10791			

GROUP 1 C:\STATCAL\BALNSDAT\MG_OPT.TXT
=====

NUMBER OF ENTRIES: 50
MEAN: 8600.62
STANDARD DEVIATION: 2509.871

GROUP 2 C:\STATCAL\BALNSDAT\MG_ZY_~1.TXT
=====

NUMBER OF ENTRIES: 50
MEAN: 8408.48
STANDARD DEVIATION: 2453.82

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = 192.14
ST.DEV. OF THE DIFFERENCES = 341.333

ST.DEV. OF THE MEAN = 48.27178

PAIRED t-TEST

NUMBER OF DATA = 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 3.980379

CONCLUSION :

SIGNIFICANTLY DIFFERENT

(P <= 0.001 ; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 50

NUMBER OF NON-ZERO DIFFERENCES = 50

SUM OF POSITIVE RANKS = 1072

SUM OF NEGATIVE RANKS = 203

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 4.19435

SIGNIFICANTLY DIFFERENT

(p <= 0.001)

01-21-2000 13:35:30
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CA_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CA_MET~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CA_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CA_MET~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	53203	55571	26	51907	53446
2	57713	60122	27	34593	34403
3	42419	44997	28	50750	53100
4	43154	44697	29	42939	44259
5	46743	47933	30	45687	46966
6	36138	37275	31	60432	60883
7	23841	24284	32	47181	48041
8	49136	52126	33	41024	41310
9	50996	50743	34	59048	67438
10	50996	49253	35	33835	36486
11	57179	56260	36	34667	54374
12	41586	42472	37	24842	24816
13	47336	46259	38	49080	45751
14	52268	50792	39	16876	17678
15	54838	54716	40	30777	28947
16	43076	43006	41	8283	8538
17	22941	23568	42	24806	22589
18	42873	42903	43	6179	6292
19	45754	44203			
20	60312	57569			
21	43804	44205			
22	30522	30629			
23	36220	35013			
24	53461	52586			
25	46380	45871			

GROUP 1 C:\STATCAL\BALNSDAT\CA_OPT.TXT
=====

NUMBER OF ENTRIES: 43
MEAN: 41762.68
STANDARD DEVIATION: 13250.04

GROUP 2 C:\STATCAL\BALNSDAT\CA_MET~1.TXT
=====

NUMBER OF ENTRIES: 43
MEAN: 42613.25
STANDARD DEVIATION: 13700.78

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = -850.5814
ST.DEV. OF THE DIFFERENCES = 3520.092
ST.DEV. OF THE MEAN = 536.809

PAIRED t-TEST

NUMBER OF DATA = 43

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 42 DF)

FOR P = 0.001 : 3.536969

P = 0.01 : 2.697865

P = 0.05 : 2.018085

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.584514

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 43

NUMBER OF NON-ZERO DIFFERENCES = 43

SUM OF POSITIVE RANKS = 355

SUM OF NEGATIVE RANKS = 591

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 1.424844

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-21-2000 13:34:27
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CA_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CA_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CA_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CA_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	53203	53611	26	51907	52921
2	57713	58554	27	34593	34806
3	42419	43054	28	50750	53182
4	43154	42428	29	42939	44135
5	46743	45616	30	45687	47001
6	36138	35335	31	60432	60987
7	23841	23622	32	47181	47859
8	49136	49346	33	41024	41242
9	50996	50270	34	59048	67079
10	50996	49405	35	33835	36286
11	57179	55399	36	34667	55245
12	41586	41997	37	24842	25094
13	47336	44970	38	49080	47195
14	52268	49582	39	16876	16961
15	54838	53480	40	30777	29301
16	43076	41872	41	8283	8204
17	22941	23025	42	24806	22863
18	42873	42730	43	6179	5965
19	45754	43676			
20	60312	58417			
21	43804	43585			
22	30522	30972			
23	36220	35724			
24	53461	52597			
25	46380	46502			

GROUP 1 C:\STATCAL\BALNSDAT\CA_OPT.TXT
=====

NUMBER OF ENTRIES: 43
MEAN: 41762.68
STANDARD DEVIATION: 13250.04

GROUP 2 C:\STATCAL\BALNSDAT\CA_ZY_~1.TXT
=====

NUMBER OF ENTRIES: 43
MEAN: 42141.75
STANDARD DEVIATION: 13587.78

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = -379.0698
ST.DEV. OF THE DIFFERENCES = 3598.536
ST.DEV. OF THE MEAN = 548.7716

PAIRED t-TEST

NUMBER OF DATA = 43

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 42 DF)

FOR P = 0.001 : 3.536969

P = 0.01 : 2.697865

P = 0.05 : 2.018085

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = .6907605

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 43

NUMBER OF NON-ZERO DIFFERENCES = 43

SUM OF POSITIVE RANKS = 539

SUM OF NEGATIVE RANKS = 407

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= .7969469

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 16:23:01
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\PB_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\PB_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\PB_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\PB_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	205.8	198	11	89.2	81.5
2	217.6	197.4			
3	153.8	147.8			
4	201.4	186.3			
5	91.4	82.2			
6	135.6	145.1			
7	33	30.1			
8	163.3	153.1			
9	133.8	126.3			
10	113.7	125.7			

GROUP 1 C:\STATCAL\BALNSDAT\PB_OPT.TXT

=====

NUMBER OF ENTRIES: 11
MEAN: 139.8727
STANDARD DEVIATION: 56.56466

GROUP 2 C:\STATCAL\BALNSDAT\PB_MY_~1.TXT

=====

NUMBER OF ENTRIES: 11
MEAN: 133.9545
STANDARD DEVIATION: 52.81303

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = 5.918182
ST.DEV. OF THE DIFFERENCES = 9.457783
ST.DEV. OF THE MEAN = 2.851629

PAIRED t-TEST

MEAN OF DIFFERENCES = 5.918182
ST.DEV. OF THE DIFFERENCES = 9.457783
ST.DEV. OF THE MEAN = 2.851629
NUMBER OF DATA = 11
DEGREES OF FREEDOM = 10

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 10 DF)

FOR P = 0.001 : 4.524771

P = 0.01 : 3.155783

P = 0.05 : 2.225466

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 2.075369

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 11
NUMBER OF NON-ZERO DIFFERENCES = 11

SUM OF POSITIVE RANKS = 50
SUM OF NEGATIVE RANKS = 16

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	14
FOR P=	.05	:	11
FOR P=	.02	:	7
FOR P=	.01	:	5

CALCULATED T= 16

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)

01-25-2000 16:22:43
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\PB_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\PB_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\PB_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\PB_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	205.8	178.1	11	89.2	73.5
2	217.6	179.9			
3	153.8	132.8			
4	201.4	163.1			
5	91.4	72.9			
6	135.6	107.1			
7	33	26.6			
8	163.3	138.9			
9	133.8	112			
10	113.7	93.9			

GROUP 1 C:\STATCAL\BALNSDAT\PB_OPT.TXT
=====

NUMBER OF ENTRIES: 11
MEAN: 139.8727
STANDARD DEVIATION: 56.56466

GROUP 2 C:\STATCAL\BALNSDAT\PB_ZY_~1.TXT
=====

NUMBER OF ENTRIES: 11
MEAN: 116.2545
STANDARD DEVIATION: 48.17033

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = 23.61818
ST.DEV. OF THE DIFFERENCES = 9.300841
ST.DEV. OF THE MEAN = 2.804309

PAIRED t-TEST

MEAN OF DIFFERENCES = 23.61818
ST.DEV. OF THE DIFFERENCES = 9.300841
ST.DEV. OF THE MEAN = 2.804309
NUMBER OF DATA = 11
DEGREES OF FREEDOM = 10

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 10 DF)
FOR P = 0.001 : 4.524771
P = 0.01 : 3.155783
P = 0.05 : 2.225466

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 8.422103

CONCLUSION :
SIGNIFICANTLY DIFFERENT
($P \leq 0.001$; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 11
NUMBER OF NON-ZERO DIFFERENCES = 11

SUM OF POSITIVE RANKS = 66
SUM OF NEGATIVE RANKS = 0

TABULATED t -VALUES (2 -TAILED)

FOR $P=$.1	:	14
FOR $P=$.05	:	11
FOR $P=$.02	:	7
FOR $P=$.01	:	5

CALCULATED $T=$ 0

SIGNIFICANTLY DIFFERENT
($p \leq .01$) ;

01-25-2000 15:50:00
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\NI_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\NI_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\NI_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\NI_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	47.6	51.5	21	27.6	29
2	51.5	55.6	22	54.9	54.7
3	49.8	54.3	23	50.6	52.3
4	51.6	53.5	24	46.9	47.5
5	54.4	56.6	25	45.2	48.4
6	47.1	52.1	26	20.3	22.5
7	54.9	55.8	27	41.1	43.4
8	46.9	46.5	28	57.3	59.9
9	34	34.8	29	38.1	39.9
10	47.1	49.5	30	37.9	40.1
11	55.1	55.9	31	15.6	14.3
12	48.2	49	32	36.9	33.8
13	37.1	38.1	33	50.3	47.7
14	62.9	64	34	35.1	32.9
15	55.8	57.3	35	46.1	45.1
16	46.2	46.5	36	45.4	41.8
17	52.8	53.5	37	46.5	43.9
18	46.7	47.1	38	37.4	32.5
19	45	47.4	39	45.6	41.1
20	36.1	39.7			

GROUP 1 C:\STATCAL\BALNSDAT\NI_OPT.TXT
=====

NUMBER OF ENTRIES: 39
MEAN: 44.86154
STANDARD DEVIATION: 9.758872

GROUP 2 C:\STATCAL\BALNSDAT\NI_MY_~1.TXT
=====

NUMBER OF ENTRIES: 39
MEAN: 45.62821
STANDARD DEVIATION: 10.43799

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES =	-.7666667
ST.DEV. OF THE DIFFERENCES =	2.426318
ST.DEV. OF THE MEAN =	.3885218

PAIRED t-TEST

NUMBER OF DATA = 39

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 38 DF)
FOR P = 0.001 : 3.564636

P = 0.01 : 2.711297

P = 0.05 : 2.024386

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.973291

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 39

NUMBER OF NON-ZERO DIFFERENCES = 39

SUM OF POSITIVE RANKS = 243.5

SUM OF NEGATIVE RANKS = 536.5

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 2.044407

SIGNIFICANTLY DIFFERENT

(0.01 < P <= 0.05)

01-25-2000 15:49:30
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\NI_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\NI_ZY.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\NI_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\NI_ZY.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	47.6	45.2	21	27.6	26.8
2	51.5	48.4	22	54.9	51
3	49.8	47.4	23	50.6	47.7
4	51.6	46.8	24	46.9	43.9
5	54.4	51	25	45.2	43.7
6	47.1	45.3	26	20.3	20.4
7	54.9	50.2	27	41.1	40.1
8	46.9	42.4	28	57.3	55.3
9	34	31.1	29	38.1	36.8
10	47.1	44.5	30	37.9	36.9
11	55.1	49.4	31	15.6	12.9
12	48.2	43.5	32	36.9	31.8
13	37.1	33.4	33	50.3	45.2
14	62.9	56.8	34	35.1	31.5
15	55.8	50.7	35	46.1	40.9
16	46.2	42.2	36	45.4	39.6
17	52.8	48.2	37	46.5	41.3
18	46.7	43.5	38	37.4	30.9
19	45	42.6	39	45.6	39
20	36.1	35.2			

GROUP 1 C:\STATCAL\BALNSDAT\NI_OPT.TXT
=====

NUMBER OF ENTRIES: 39
MEAN: 44.86154
STANDARD DEVIATION: 9.758872

GROUP 2 C:\STATCAL\BALNSDAT\NI_ZY.TXT
=====

NUMBER OF ENTRIES: 39
MEAN: 41.3718
STANDARD DEVIATION: 9.101097

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES =	3.489743
ST.DEV. OF THE DIFFERENCES =	1.747148
ST.DEV. OF THE MEAN =	.2797675

PAIRED t-TEST

NUMBER OF DATA = 39

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 38 DF)
FOR P = 0.001 : 3.564636

P = 0.01 : 2.711297

P = 0.05 : 2.024386

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 12.47373

CONCLUSION :

SIGNIFICANTLY DIFFERENT

(P <= 0.001 ; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 39

NUMBER OF NON-ZERO DIFFERENCES = 39

SUM OF POSITIVE RANKS = 779

SUM OF NEGATIVE RANKS = 1

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 5.428494

SIGNIFICANTLY DIFFERENT

(p <= 0.001)

01-27-2000 08:15:26
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\DATAVO~1\SC_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\SC_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	5.79	5.52	31	7	6.67
2	4.62	4.4	32	3.38	3.17
3	6.39	5.96	33	5.66	5.38
4	7.69	7.21	34	7.37	7.05
5	5.67	5.46	35	6.78	6.55
6	7.5	7.06	36	6.42	6.1
7	7.43	6.87	37	4.96	4.63
8	6.78	6.29	38	6.87	6.47
9	6.45	6.11	39	6.35	6.84
10	6.13	5.85	40	6.51	6.53
11	6.46	5.92	41	2.96	2.62
12	8.55	7.78	42	2.72	2.28
13	6.65	6.01	43	5.1	4.48
14	6.04	5.66	44	7.53	6.96
15	9.23	8.27	45	4.47	4.07
16	7.75	6.92	46	7.42	6.73
17	10.16	9.06	47	6.56	5.97
18	6.31	5.77	48	7.33	6.69
19	8.56	7.75	49	5.45	4.81
20	3.38	3.17	50	7.35	6.68
21	17.94	6.91			
22	18.81	7.5			
23	7.9	7.14			
24	17.47	8.35			
25	19.62	7.35			
26	12.39	5.82			
27	32.27	7.35			
28	18.29	7.57			
29	7.71	7.19			
30	6.44	6.05			

GROUP 1 C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT
=====

NUMBER OF ENTRIES: 50
MEAN: 8.291401
STANDARD DEVIATION: 5.260823

GROUP 2 C:\STATCAL\BALNSDAT\DATAVO~1\SC_ZY_~1.TXT
=====

NUMBER OF ENTRIES: 50
MEAN: 6.179001
STANDARD DEVIATION: 1.433088

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES = 2.1124
ST.DEV. OF THE DIFFERENCES = 4.63202

ST.DEV. OF THE MEAN = .6550665

PAIRED t-TEST

NUMBER OF DATA ≈ 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 3.224711

CONCLUSION :

SIGNIFICANTLY DIFFERENT

(0.001 < P ≤ 0.01 ; LEVEL **)

WILCOXON TEST

NUMBER OF DATA ≈ 50

NUMBER OF NON-ZERO DIFFERENCES = 50

SUM OF POSITIVE RANKS = 1249.5

SUM OF NEGATIVE RANKS = 25.5

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 5.907806

SIGNIFICANTLY DIFFERENT

(p ≤ 0.001)

01-27-2000 08:15:54
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\DATAVO~1\SC_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\SC_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	5.79	6.25	31	7	7.08
2	4.62	4.93	32	3.38	3.48
3	6.39	6.83	33	5.66	5.8
4	7.69	8.34	34	7.37	7.62
5	5.67	6.2	35	6.78	7.06
6	7.5	8.12	36	6.42	6.58
7	7.43	7.87	37	4.96	5.01
8	6.78	7.21	38	6.87	6.98
9	6.45	6.77	39	6.35	7.44
10	6.13	6.73	40	6.51	7.06
11	6.46	6.56	41	2.96	2.69
12	8.55	8.51	42	2.72	2.51
13	6.65	6.71	43	5.1	4.75
14	6.04	6.3	44	7.53	7.34
15	9.23	9.37	45	4.47	4.25
16	7.75	7.79	46	7.42	7.41
17	10.16	10.34	47	6.56	6.31
18	6.31	6.49	48	7.33	7.12
19	8.56	8.76	49	5.45	5.06
20	3.38	3.56	50	7.35	7.04
21	17.94	17.62			
22	18.81	11.1			
23	7.9	7.73			
24	17.47	9.31			
25	19.62	8.3			
26	12.39	6.32			
27	32.27	7.88			
28	18.29	8.3			
29	7.71	7.79			
30	6.44	6.71			

GROUP 1 C:\STATCAL\BALNSDAT\DATAVO~1\SC_OPT.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 8.291401
STANDARD DEVIATION: 5.260823

GROUP 2 C:\STATCAL\BALNSDAT\DATAVO~1\SC_MY_~1.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 7.065801
STANDARD DEVIATION: 2.304212

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = 1.2256
ST.DEV. OF THE DIFFERENCES = 4.323294

ST.DEV. OF THE MEAN = .611406

PAIRED t-TEST

NUMBER OF DATA = 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 2.00456

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 50

NUMBER OF NON-ZERO DIFFERENCES = 50

SUM OF POSITIVE RANKS = 561

SUM OF NEGATIVE RANKS = 714

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= .7384758

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 16:22:21
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CD_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CD14_M~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD14_M~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	43.47	46.64	6	1.6	2.04
2	2.8	3.28	7	2.4	2.64
3	4.79	5.38			
4	4.21	4.91			
5	5.81	6.48			

GROUP 1 C:\STATCAL\BALNSDAT\CD_OPT.TXT
=====

NUMBER OF ENTRIES:	7
MEAN:	9.297143
STANDARD DEVIATION:	15.13917

GROUP 2 C:\STATCAL\BALNSDAT\CD14_M~1.TXT
=====

NUMBER OF ENTRIES:	7
MEAN:	10.19571
STANDARD DEVIATION:	16.14804

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	-.8985711
ST.DEV. OF THE DIFFERENCES =	1.013696
ST.DEV. OF THE MEAN =	.3831411

PAIRED t-TEST

MEAN OF DIFFERENCES =	-.8985711
ST.DEV. OF THE DIFFERENCES =	1.013696
ST.DEV. OF THE MEAN =	.3831411
NUMBER OF DATA =	7
DEGREES OF FREEDOM =	6

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 6 DF)
FOR P = 0.001 : 5.637975
P = 0.01 : 3.640597
P = 0.05 : 2.433806

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 2.345275

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 7
NUMBER OF NON-ZERO DIFFERENCES = 7

SUM OF POSITIVE RANKS = 0
SUM OF NEGATIVE RANKS = 28

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	4
FOR P=	.05	:	2
FOR P=	.02	:	0

CALCULATED T= 0

SIGNIFICANTLY DIFFERENT
(.02 < P <= .05)

01-25-2000 16:22:03
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CD_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CD14_Z~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD14_Z~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	43.47	47.51	6	1.6	4.73
2	2.8	5.97	7	2.4	5.58
3	4.79	5.86			
4	4.21	6.45			
5	5.81	7.64			

GROUP 1 C:\STATCAL\BALNSDAT\CD_OPT.TXT

=====

NUMBER OF ENTRIES: 7
MEAN: 9.297143
STANDARD DEVIATION: 15.13917

GROUP 2 C:\STATCAL\BALNSDAT\CD14_Z~1.TXT

=====

NUMBER OF ENTRIES: 7
MEAN: 11.96286
STANDARD DEVIATION: 15.69975

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = -2.665714
ST.DEV. OF THE DIFFERENCES = 1.004072
ST.DEV. OF THE MEAN = .3795035

PAIRED t-TEST

MEAN OF DIFFERENCES = -2.665714
ST.DEV. OF THE DIFFERENCES = 1.004072
ST.DEV. OF THE MEAN = .3795035
NUMBER OF DATA = 7
DEGREES OF FREEDOM = 6

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 6 DF)

FOR P = 0.001 : 5.637975

P = 0.01 : 3.640597

P = 0.05 : 2.433806

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 7.024213

CONCLUSION :

SIGNIFICANTLY DIFFERENT

(P <= 0.001 ; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 7

NUMBER OF NON-ZERO DIFFERENCES = 7

SUM OF POSITIVE RANKS = 0

SUM OF NEGATIVE RANKS = 28

TABULATED t-VALUES (2 -TAILED)

FOR P= .1 : 4

FOR P= .05 : 2

FOR P= .02 : 0

CALCULATED T= 0

SIGNIFICANTLY DIFFERENT

(.02 < P <= .05)

01-25-2000 15:44:57
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CD_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CD28_M~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD28_M~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	3.98	4.61	16	11.22	11.48
2	43.47	45.33	17	1	.59
3	.4	.33	18	.2	0
4	2.19	1.63	19	0	0
5	2.8	2.02	20	11.62	11.91
6	4.79	4.82			
7	4.21	3.77			
8	5.81	5.71			
9	1.6	.63			
10	2.4	1.7			
11	1.2	1.34			
12	4.38	4.25			
13	3.61	3.55			
14	12.76	13.22			
15	2.2	.89			

GROUP 1 C:\STATCAL\BALNSDAT\CD_OPT.TXT
=====

NUMBER OF ENTRIES: 20
MEAN: 5.992
STANDARD DEVIATION: 9.586744

GROUP 2 C:\STATCAL\BALNSDAT\CD28_M~1.TXT
=====

NUMBER OF ENTRIES: 20
MEAN: 5.889
STANDARD DEVIATION: 10.1168

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES =	.103
ST.DEV. OF THE DIFFERENCES =	.6702011
ST.DEV. OF THE MEAN =	.1498615

PAIRED t-TEST

MEAN OF DIFFERENCES =	.103
ST.DEV. OF THE DIFFERENCES =	.6702011
ST.DEV. OF THE MEAN =	.1498615
NUMBER OF DATA =	20
DEGREES OF FREEDOM =	19

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 19 DF)
FOR P = 0.001 : 3.874967
P = 0.01 : 2.859029

P = 0.05 : 2.092681
SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = .6873012

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 20
NUMBER OF NON-ZERO DIFFERENCES = 19

SUM OF POSITIVE RANKS = 138.11
SUM OF NEGATIVE RANKS = 76.5

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	60
FOR P=	.05	:	52
FOR P=	.02	:	43
FOR P=	.01	:	37

CALCULATED T= 76.5

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(p > 0.05)

01-25-2000 15:44:28
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CD_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CD28_Z~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CD28_Z~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	3.98	5.05	16	11.22	12.08
2	43.47	48.71	17	1	.44
3	.4	.37	18	.2	0
4	2.19	1.72	19	0	0
5	2.8	2.21	20	11.62	12.3
6	4.79	5.36			
7	4.21	4.04			
8	5.81	5.96			
9	1.6	.69			
10	2.4	1.8			
11	1.2	1.31			
12	4.38	4.34			
13	3.61	3.66			
14	12.76	13.75			
15	2.2	.76			

GROUP 1 C:\STATCAL\BALNSDAT\CD_OPT.TXT
=====

NUMBER OF ENTRIES: 20
MEAN: 5.992
STANDARD DEVIATION: 9.586744

GROUP 2 C:\STATCAL\BALNSDAT\CD28_Z~1.TXT
=====

NUMBER OF ENTRIES: 20
MEAN: 6.2275
STANDARD DEVIATION: 10.84774

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES	=	-.2354999
ST.DEV. OF THE DIFFERENCES	=	1.342682
ST.DEV. OF THE MEAN	=	.3002327

PAIRED t-TEST

MEAN OF DIFFERENCES	=	-.2354999
ST.DEV. OF THE DIFFERENCES	=	1.342682
ST.DEV. OF THE MEAN	=	.3002327
NUMBER OF DATA	=	20
DEGREES OF FREEDOM	=	19

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 19 DF)
FOR P = 0.001 : 3.874967
P = 0.01 : 2.859029

P = 0.05 : 2.092681

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = .784391

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA \approx 20

NUMBER OF NON-ZERO DIFFERENCES = 19

SUM OF POSITIVE RANKS = 104.55

SUM OF NEGATIVE RANKS = 110.5

TABULATED t-VALUES (2 -TAILED)

FOR P= .1 : 60

FOR P= .05 : 52

FOR P= .02 : 43

FOR P= .01 : 37

CALCULATED T= 104.55

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(p > 0.05)

01-25-2000 15:45:40
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CO_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CO_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CO_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CO_MY_~1.TXT

No.	GROUP 1	GROUP 2
1	18.8	19.4
2	9.4	9.3
3	15.1	14.4
4	20	21.1
5	20.4	18.9
6	19.9	19.2
7	20.9	20.9
8	31	29.6
9	87.8	95.5
10	18.9	20.7

GROUP 1 C:\STATCAL\BALNSDAT\CO_OPT.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	26.22
STANDARD DEVIATION:	22.2884

GROUP 2 C:\STATCAL\BALNSDAT\CO_MY_~1.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	26.9
STANDARD DEVIATION:	24.64612

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES	=	-.68
ST.DEV. OF THE DIFFERENCES	=	2.680712
ST.DEV. OF THE MEAN	=	.8477156

PAIRED t-TEST

MEAN OF DIFFERENCES	=	-.68
ST.DEV. OF THE DIFFERENCES	=	2.680712
ST.DEV. OF THE MEAN	=	.8477156
NUMBER OF DATA	=	10
DEGREES OF FREEDOM	=	9

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 9 DF)
FOR P = 0.001 : 4.694174
P = 0.01 : 3.231132
P = 0.05 : 2.258446

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = .8021558

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 10
NUMBER OF NON-ZERO DIFFERENCES = 9

SUM OF POSITIVE RANKS = 45.9
SUM OF NEGATIVE RANKS = 28.5

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	11
FOR P=	.05	:	8
FOR P=	.02	:	5
FOR P=	.01	:	3

CALCULATED T= 28.5

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)

01-25-2000 15:45:25
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CO_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CO_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CO_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CO_ZY_~1.TXT

No.	GROUP 1	GROUP 2
1	18.8	15.4
2	9.4	8.33
3	15.1	12.57
4	20	15.61
5	20.4	16.63
6	19.9	16.78
7	20.9	16.51
8	31	25.86
9	87.8	73.46
10	18.9	17.13

GROUP 1 C:\STATCAL\BALNSDAT\CO_OPT.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	26.22
STANDARD DEVIATION:	22.2884

GROUP 2 C:\STATCAL\BALNSDAT\CO_ZY_~1.TXT
=====

NUMBER OF ENTRIES:	10
MEAN:	21.828
STANDARD DEVIATION:	18.65733

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	4.392
ST.DEV. OF THE DIFFERENCES =	3.710179
ST.DEV. OF THE MEAN =	1.173262

PAIRED t-TEST

MEAN OF DIFFERENCES =	4.392
ST.DEV. OF THE DIFFERENCES =	3.710179
ST.DEV. OF THE MEAN =	1.173262
NUMBER OF DATA =	10
DEGREES OF FREEDOM =	9

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 9 DF)
FOR P = 0.001 : 4.694174
P = 0.01 : 3.231132
P = 0.05 : 2.258446

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 3.743411

CONCLUSION :
SIGNIFICANTLY DIFFERENT
($0.001 < P \leq 0.01$; LEVEL **)

WILCOXON TEST

NUMBER OF DATA = 10
NUMBER OF NON-ZERO DIFFERENCES = 10

SUM OF POSITIVE RANKS = 55
SUM OF NEGATIVE RANKS = 0

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	11
FOR P=	.05	:	8
FOR P=	.02	:	5
FOR P=	.01	:	3

CALCULATED T= 0

SIGNIFICANTLY DIFFERENT
($p \leq .01$) ;

01-27-2000 08:07:06
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CU_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CU_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CU_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CU_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	177.8	158.3	11	104	93.2
2	58.8	51.7	12	57.5	52.4
3	92.2	78.7	13	17.1	16.4
4	86.3	74.8	14	51.5	47.1
5	105.5	90.1			
6	126.6	110.2			
7	104.4	88.1			
8	53.3	47.4			
9	25	22.8			
10	53.4	48.5			

GROUP 1 C:\STATCAL\BALNSDAT\CU_OPT.TXT
=====

NUMBER OF ENTRIES:	14
MEAN:	79.52857
STANDARD DEVIATION:	42.88915

GROUP 2 C:\STATCAL\BALNSDAT\CU_MY_~1.TXT
=====

NUMBER OF ENTRIES:	14
MEAN:	69.97857
STANDARD DEVIATION:	37.23561

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	9.550001
ST.DEV. OF THE DIFFERENCES =	5.989061
ST.DEV. OF THE MEAN =	1.600644

PAIRED t-TEST

MEAN OF DIFFERENCES =	9.550001
ST.DEV. OF THE DIFFERENCES =	5.989061
ST.DEV. OF THE MEAN =	1.600644
NUMBER OF DATA =	14
DEGREES OF FREEDOM =	13

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 13 DF)
FOR P = 0.001 : 4.193551
P = 0.01 : 3.006258
P = 0.05 : 2.159194

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 5.96635

CONCLUSION :
SIGNIFICANTLY DIFFERENT
($P \leq 0.001$; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 14
NUMBER OF NON-ZERO DIFFERENCES = 14

SUM OF POSITIVE RANKS = 105
SUM OF NEGATIVE RANKS = 0

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	26
FOR P=	.05	:	21
FOR P=	.02	:	16
FOR P=	.01	:	13

CALCULATED T= 0

SIGNIFICANTLY DIFFERENT
($p \leq .01$) ;

01-27-2000 08:06:47
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CU_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CU_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CU_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CU_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	177.8	179	11	104	100.5
2	58.8	59.2	12	57.5	56.6
3	92.2	91.3	13	17.1	17.8
4	86.3	85.1	14	51.5	50.8
5	105.5	103.3			
6	126.6	126.1			
7	104.4	100.9			
8	53.3	54.6			
9	25	25.1			
10	53.4	52.2			

GROUP 1 C:\STATCAL\BALNSDAT\CU_OPT.TXT

=====

NUMBER OF ENTRIES: 14
MEAN: 79.52857
STANDARD DEVIATION: 42.88915

GROUP 2 C:\STATCAL\BALNSDAT\CU_ZY_~1.TXT

=====

NUMBER OF ENTRIES: 14
MEAN: 78.75001
STANDARD DEVIATION: 42.59982

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = .7785715
ST.DEV. OF THE DIFFERENCES = 1.516158
ST.DEV. OF THE MEAN = .4052102

PAIRED t-TEST

MEAN OF DIFFERENCES = .7785715
ST.DEV. OF THE DIFFERENCES = 1.516158
ST.DEV. OF THE MEAN = .4052102
NUMBER OF DATA = 14
DEGREES OF FREEDOM = 13

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 13 DF)

FOR P = 0.001 : 4.193551

P = 0.01 : 3.006258

P = 0.05 : 2.159194

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.921402

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 14
NUMBER OF NON-ZERO DIFFERENCES = 14

SUM OF POSITIVE RANKS = 79
SUM OF NEGATIVE RANKS = 26

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	26
FOR P=	.05	:	21
FOR P=	.02	:	16
FOR P=	.01	:	13

CALCULATED T= 26

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)

01-25-2000 15:46:42
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\CR_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\CR_VAR.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\CR_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\CR_VAR.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	76.1	76.9	21	75.4	75.4
2	39.9	40.5	22	79.8	80.4
3	85.9	84.3	23	75.5	75.4
4	142.3	141	24	85.5	84.5
5	71.9	72.8	25	134.4	132.3
6	84.4	84.5	26	58.4	59.6
7	86.8	88.2	27	86	85
8	83.7	82	28	85.6	85.4
9	66.3	66.7	29	90.9	90.7
10	72.3	71.9	30	83.4	83.2
11	85.9	86.4			
12	132.6	130.7			
13	80.7	80.7			
14	77.4	76.7			
15	96.9	95.7			
16	84.2	83.4			
17	152	149.3			
18	86.4	87			
19	104.6	103.2			
20	35	35.9			

GROUP 1 C:\STATCAL\BALNSDAT\CR_OPT.TXT
=====

NUMBER OF ENTRIES: 30
MEAN: 86.67332
STANDARD DEVIATION: 25.76936

GROUP 2 C:\STATCAL\BALNSDAT\CR_VAR.TXT
=====

NUMBER OF ENTRIES: 30
MEAN: 86.32333
STANDARD DEVIATION: 24.98561

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = .3500008
ST.DEV. OF THE DIFFERENCES = 1.06277
ST.DEV. OF THE MEAN = .1940345

PAIRED t-TEST

NUMBER OF DATA = 30

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 29 DF)
FOR P = 0.001 : 3.657073

P = 0.01 : 2.755835

P = 0.05 : 2.045163

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.803807

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 30

NUMBER OF NON-ZERO DIFFERENCES = 28

SUM OF POSITIVE RANKS = 427.4

SUM OF NEGATIVE RANKS = 155

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 1.594046

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-26-2000 15:24:56
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\DATAVO~1\ZN_MY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\ZN_MY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	1086	1019	31	1579	1463
2	93	105	32	260	253
3	387	364	33	395	358
4	557	512	34	1254	1148
5	891	805	35	675	627
6	859	778	36	407	370
7	1342	1238	37	469	418
8	1025	913	38	694	635
9	549	495	39	141	138
10	381	358	40	468	444
11	1051	960	41	90	67
12	749	675	42	188	149
13	381	345	43	1188	1035
14	957	872	44	1958	1765
15	500	446	45	1117	1011
16	441	388	46	1619	1472
17	889	790	47	1859	1657
18	599	530	48	1612	1441
19	670	592	49	1393	1202
20	259	231	50	1227	1090
21	674	632			
22	344	309			
23	780	697			
24	329	306			
25	545	502			
26	394	364			
27	961	855			
28	420	390			
29	506	461			
30	439	402			

GROUP 1 C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 753.02
STANDARD DEVIATION: 468.6361

GROUP 2 C:\STATCAL\BALNSDAT\DATAVO~1\ZN_MY_~1.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 681.54
STANDARD DEVIATION: 420.7525

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = 71.48
ST.DEV. OF THE DIFFERENCES = 51.08945

ST.DEV. OF THE MEAN = 7.22514

PAIRED t-TEST

NUMBER OF DATA = 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 9.893234

CONCLUSION :

SIGNIFICANTLY DIFFERENT

(P <= 0.001 ; LEVEL ***)

WILCOXON TEST

NUMBER OF DATA = 50

NUMBER OF NON-ZERO DIFFERENCES = 50

SUM OF POSITIVE RANKS = 1272

SUM OF NEGATIVE RANKS = 3

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= 6.125005

SIGNIFICANTLY DIFFERENT

(p <= 0.001)

01-26-2000 15:24:34
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\DATAVO~1\ZN_ZY_~1.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\DATAVO~1\ZN_ZY_~1.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	1086	1152	31	1579	1553
2	93	118	32	260	279
3	387	417	33	395	386
4	557	593	34	1254	1241
5	891	916	35	675	675
6	859	893	36	407	399
7	1342	1417	37	469	453
8	1025	1046	38	694	685
9	549	549	39	141	150
10	381	412	40	468	479
11	1051	1067	41	90	68
12	749	741	42	188	165
13	381	386	43	1188	1099
14	957	971	44	1958	1862
15	500	505	45	1117	1055
16	441	438	46	1619	1620
17	889	902	47	1859	1752
18	599	597	48	1612	1533
19	670	669	49	1393	1264
20	259	260	50	1227	1149
21	674	696			
22	344	344			
23	780	754			
24	329	341			
25	545	565			
26	394	394			
27	961	918			
28	420	428			
29	506	499			
30	439	446			

GROUP 1 C:\STATCAL\BALNSDAT\DATAVO~1\ZN_OPT.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 753.02
STANDARD DEVIATION: 468.6361

GROUP 2 C:\STATCAL\BALNSDAT\DATAVO~1\ZN_ZY_~1.TXT

=====

NUMBER OF ENTRIES: 50
MEAN: 746.02
STANDARD DEVIATION: 449.4384

2 TAILED

GROUPS PAIRED:

=====

MEAN OF DIFFERENCES = 7
ST.DEV. OF THE DIFFERENCES = 40.98282

ST.DEV. OF THE MEAN = 5.795846

PAIRED t-TEST

NUMBER OF DATA = 50

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 49 DF)

FOR P = 0.001 : 3.499945

P = 0.01 : 2.679814

P = 0.05 : 2.009592

SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 1.207762

CONCLUSION :

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 50

NUMBER OF NON-ZERO DIFFERENCES = 46

SUM OF POSITIVE RANKS = 2936

SUM OF NEGATIVE RANKS = 619

VALUES FOR THE z-DISTRIBUTION (2 -TAILED)

FOR P=0.001 : 3.2905

FOR P=0.01 : 2.5758

FOR P=0.05 : 1.96

CALCULATED z= .1785856

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE

01-25-2000 15:49:09
BALANCE DATA
=====

FILE: C:\STATCAL\BALNSDAT\MN_OPT.TXT
FILE: C:\STATCAL\BALNSDAT\MN_VAR.TXT

GROUP 1 ENTERED AS FILE C:\STATCAL\BALNSDAT\MN_OPT.TXT
GROUP 2 ENTERED AS FILE C:\STATCAL\BALNSDAT\MN_VAR.TXT

No.	GROUP 1	GROUP 2	No.	GROUP 1	GROUP 2
1	1666	1556	11	1427	1322
2	3101	2894	12	1491	1388
3	1256	1222			
4	1428	1538			
5	2170	2013			
6	1701	1813			
7	1845	1720			
8	2882	2682			
9	2928	2762			
10	1864	1963			

GROUP 1 C:\STATCAL\BALNSDAT\MN_OPT.TXT
=====

NUMBER OF ENTRIES:	12
MEAN:	1979.917
STANDARD DEVIATION:	645.7537

GROUP 2 C:\STATCAL\BALNSDAT\MN_VAR.TXT
=====

NUMBER OF ENTRIES:	12
MEAN:	1906.083
STANDARD DEVIATION:	580.2945

2 TAILED

GROUPS PAIRED:
=====

MEAN OF DIFFERENCES =	73.83334
ST.DEV. OF THE DIFFERENCES =	118.551
ST.DEV. OF THE MEAN =	34.22272

PAIRED t-TEST

MEAN OF DIFFERENCES =	73.83334
ST.DEV. OF THE DIFFERENCES =	118.551
ST.DEV. OF THE MEAN =	34.22272
NUMBER OF DATA =	12
DEGREES OF FREEDOM =	11

BORDERVALUES OF THE t-DISTRIBUTION (2 -TAILED; 11 DF)
FOR P = 0.001 : 4.390968
P = 0.01 : 3.095756
P = 0.05 : 2.198999
SEPARATING SIGNIFICANCY LEVELS NS, *, ** AND ***

CALCULATED t-VALUE = 2.157436

CONCLUSION :
NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
(LEVEL 'NS')

WILCOXON TEST

NUMBER OF DATA = 12
NUMBER OF NON-ZERO DIFFERENCES = 12

SUM OF POSITIVE RANKS = 63.5
SUM OF NEGATIVE RANKS = 14.5

TABULATED t-VALUES (2 -TAILED)

FOR P=	.1	:	17
FOR P=	.05	:	14
FOR P=	.02	:	10
FOR P=	.01	:	7

CALCULATED T= 14.5

NOT SIGNIFICANTLY DIFFERENT AT THE 5% LEVEL OF SIGNIFICANCE
($p > 0.05$)