TABLE 1

Detection limit [mg l^{-1}] of different atom spectrometric methods of analysis.

In ICP-MS the plasma of the ICP is used as an ion source for a quadrupole mass spectrometer. Although ICP-MS is not discussed in the workshop, the detection limits for ICP-MS are given for completeness.

Element	Flame-AAS	GFAAS	ICP-AES	ICP-MS	Hg/Hydride	Isotope
Ag	1.5	0.05	1.5	0.003	-	
Al	45	0.3	6	0.006	-	
As	150	0.5	30	0.006	0.03	
Au	9	0.4	6	0.001	-	
B	1000	45	3	0.09	-	
Ba	15	0.9	0.15	0.002	-	
Be	1.5	0.02	0.09	0.03	-	
Bi	30	0.6	30	0.0005	0.03	
Br	-	-	-	0.2	-	
C	-	-	75	150*	-	*C-13
Ca	1.5	0.03	0.15	2*	-	*Ca-44
Cd	0.8	0.02	1.5	0.003	-	
Ce	-	-	15	0.0004	-	
Cl	-	-	-	10	-	
Co	9	0.4	3	0.0009	-	
Cs	15	-	-	0.0005	-	
Cu	1.5	0.25	1.5	0.003	-	
Dy	50	-	-	0.001	-	
Er	60	-	-	0.0008	-	
Eu	30	-	-	0.0007	-	
F	-	-	-	10000	-	
Fe	5	0.3	1.5	0.4*	-	*Fe-54
Ga	75	-	15	0.001	-	
Gd	1800	-	-	0.002	-	
Ge	300	-	15	0.003	-	

Element	Flame-AAS	GFAAS	ICP-AES	ICP-MS	Hg/Hydride	Isotope
Hf	300	-	-	0.0006	-	
Hg	300	1.5	30	0.004	0.009	
Ho	60	-	-	<0.0005	-	
I	-	-	-	0.008	-	
In	30	-	45	<0.0005	-	
Ir	900	7	30	0.0006	-	
K	3	0.02	75	1	-	
La	3000	-	1.5	0.0005	-	
Li	0.8	0.15	1.5	0.03	-	
Lu	1000	-	-	<0.0005	-	
Mg	0.15	0.01	0.15	0.007	-	
Mn	1.5	0.09	0.6	0.002	-	
Mo	45	0.2	7.5	0.003	-	
Na	0.3	0.05	6	0.05	-	
Nb	1500	-	5	0.0009	-	
Nd	-	-	-	0.002	-	
Ni	6	0.8	6	0.005*	-	*Ni-60
Os	120	-	-	-	-	
P	75000	320	45	0.3	-	
Pb	15	0.15	30	0.001	?	
Pd	30	2	1.5	0.003	-	
Pr	7500	-	-	<0.0005	-	
Pt	60	5	30	0.002	-	
Rb	3	0.08	-	0.003	-	
Re	750	-	30	0.0006	-	
Rh	6	-	30	0.008	-	
Ru	100	3	6	0.002	-	
S	-	-	75	70*	-	*S-34
Sb	45	0.4	90	0.001	0.15	
Sc	30	-	0.3	0.02	-	
Se	100	0.7	90	0.06*	0.03	*Se-82

Element	Flame-AAS	GFAAS	ICP-AES	ICP-MS	Hg/Hydride	Isotope
Si	90	2.5	5	0.7	-	
Sm	3000	-	-	0.001	-	
Sn	150	0.5	60	0.002	?	
Sr	3	0.06	0.075	0.0008	-	
Ta	1500	-	30	0.0006	-	
Tb	900	-	-	<0.0005	-	
Te	30	1	75	0.01	0.03	
Th	-	-	-	<0.0005	-	
Ti	75	0.9	0.75	0.006	-	
Tl	15	0.4	60	0.0005	-	
Tm	15	-	-	<0.0005	-	
U	15000	-	15	<0.0005	-	
V	60	0.3	3	0.002	-	
W	1500	-	30	0.001	-	
Y	75	-	0.3	0.0009	-	
Yb	8	-	-	0.001	-	
Zn	1.5	0.3	1.5	0.003	-	
Zr	450	-	1.5	0.004	-	

All detection limits in mg l^{-1} have been determined in dilute standards in aqueous solutions. The detection limits are based on 98% probability (3 s).
Source: Perkin Elmer, “The Guide to Techniques and Applications of Atomic Spectroscopy” (1993).

Hg/Hydride for Hg concerns the cold vapour method en for As, Bi, Sb, Se and Te the Hydride generation AAS method. GFAAS concerns the graphite furnace AAS.
All determinations were performed on Perkin Elmer instruments.

TABLE 2

67 Commercially available Hollow Cathode Lamps for one element

Ag	silver	Ho	holmium	Ru	ruthenium
Al	aluminium	In	indium	Sb	antimony
As	arsenic	Ir	iridium	Sc	scandium
Au	gold	K	potassium	Se	selenium
B	borium	La	lanthanum	Si	silicium
Ba	barium	Li	lithium	Sm	samarium
Be	beryllium	Lu	lutetium	Sn	tin
Bi	bismuth	Mg	magnesium	Sr	strontium
Ca	calcium	Mn	manganese	Ta	tantalium
Cd	cadmium	Mo	molybdenium	Tb	terbium
Co	cobalt	Na	sodium	Te	tellurium
Cr	chromium	Nb	niobium	Ti	titanium
Cs	cesium	Nd	neodynium	Tl	thallium
Cu	copper	Ni	nickel	Tm	thulium
Dy	dysprosium	Os	osmium	U	uranium
Er	erbium	P	phosphorus	V	vanadium
Eu	europium	Pb	lead	W	tungsten
Fe	iron	Pd	palladium	Y	yttrium
Ga	gallium	Pr	preseodymium	Yb	ytterbium
Gd	gadolinium	Pt	platina	Zn	zinc
Ge	germanium	Rb	rubidium	Zr	zirkonium
Hf	hafnium	Re	rhenium		
Hg	mercury	Rh	rhodium		

In some cases it is found possible to determine several elements with one single HCL. A few arbitrary examples are:

2: Al-Ca, Ba-Sr, Ba-Ca, Cd-Zn, Cr-Co, Cu-Zn, Au-Cu, Ti-Si, Na-K.
3: Al-Ca-Mg, Al-Si-Ti, Cr-Mn-Ni, Co-Cu-Fe, Au-Pt-Ag, Ag-Cu-Ni.
4: Cr-Co-Cu-Fe, Cr-Cu-Ni-Ag, Co-Cu-Fe-Mn, Cu-Fe-Mn-Ni.
5: Cr-Co-Cu-Fe-Mn, Co-Cu-Fe-Mn-Mo, Cr-Cu-Fe-Mn-Ni.
6: Cr-Co-Cu-Fe-Mn-Mo.

The chance of interfering emission lines (therefore curved calibration lines) in a multi-element HCL increases in comparison with a single element HCL.

For more detailed data: check the data of the manufacturers.