



# REFERENCE SHEET

## REFERENCE MATERIAL

### IAEA-SOIL-7

#### Trace Elements in Soil

Date of issue: January 2000<sup>⊕</sup>

Recommended Values  
(Based on dry weight)

Element	Recommended Value mg/kg	95% Confidence Interval mg/kg	N*
As	13.4	12.5 - 14.2	25
Ce	61	50 - 63	15
Co	8.9	8.4 - 10.1	32
Cr	60	49 - 74	41
Cs	5.4	4.9 - 6.4	16
Cu	11	9 - 13	34
Dy	3.9	3.2 - 5.3	3
Eu	1.0	0.9 - 1.3	10
Hf	5.1	4.8 - 5.5	11
La	28	27 - 29	12
Mn	631	604 - 650	36
Nd	30	22 - 34	7
Pb	60	55 - 71	31
Rb	51	47 - 56	24
Sb	1.7	1.4 - 1.8	18
Sc	8.3	6.9 - 9.0	22
Sm	5.1	4.8 - 5.5	12
Sr	108	103 - 114	19
Ta	0.8	0.6 - 1.0	12
Tb	0.6	0.5 - 0.9	12
Th	8.2	6.5 - 8.7	18
U	2.6	2.2 - 3.3	14
V	66	59 - 73	18
Y	21	15 - 27	11
Yb	2.4	1.9 - 2.6	12
Zn	104	101 - 113	44
Zr	185	180 - 201	15

\* Number of accepted laboratory means which were used to calculate the recommended values and confidence intervals about the median value.

⊕ Update of the reference sheet dated May 1984

**Information Values**  
*(Based on dry weight)*

<b>Element</b>	<b>Information Value mg/kg</b>	<b>95% Confidence Interval mg/kg</b>	<b>N*</b>
Al	47000	44000 - 51000	24
Ba	159	131 - 196	22
Br	7	3 - 10	11
Ca	163000	157000 - 174000	32
Cd	1.3	1.1 - 2.7	18
Fe	25700	25200 - 26300	46
Ga	10	9 - 13	3
Hg	0.04	0.003 - 0.07	5
K	12100	11300 - 12700	27
Li	31	15 - 42	4
Lu	0.3	0.1 - 0.4	8
Mg	11300	11000 - 11800	24
Mo	2.5	0.9 - 5.1	5
Na	2400	2300 - 2500	33
Nb	12	7 - 17	8
Ni	26	21 - 37	30
P	460	460 - 462	3
Se	0.4	0.2 - 0.8	6
Si	180000	169000 - 201000	11
Ti	3000	2600 - 3700	19

\* *Number of accepted laboratory means which were used to calculate the information values and confidence intervals about the median value.*

The values listed above were established on the basis of statistically valid results submitted by laboratories which had participated in an international intercomparison exercise conducted in 1983. The details concerning the criteria for qualification as a recommended value can be found in the report (IAEA/RL/112) "Report on the Intercomparison Run IAEA-Soil-7: Trace Elements in Soil" [1]. This report is available free of charge upon request.

### **Intended Use**

This sample is intended to be used as a reference material for the measurement of trace elements in soil samples. It can also be used as a quality control material for the assessment of a laboratory's analytical work, for the validation of analytical methods and for quality assurance within a laboratory.

### **Origin and preparation of the material**

The soil sample (top soil to a depth of 10 cm) was collected near Ebensee in Upper Austria at an altitude of 1100 m above sea level. The material was sieved through a 1 cm sieve, then heated at 450°C for 24 hours to destroy organic matter. After ashing, the sample was crushed, ground and milled to pass through a 71 µm sieve. The material was thoroughly mixed in a rotating plastic drum for 24 hours and then bottled into plastic containers each containing approximately 25 g.

### **Reference**

- [1] Pszonicki L., Hanna A. N. and Suschny O., Report on the Intercomparison Run IAEA-Soil-7: Trace Elements in Soil.  
IAEA/RL/112, IAEA, Vienna, Austria 1984.

### **Homogeneity**

The within and between bottle homogeneity was evaluated by determining the content of four marker elements (Na, Fe, Sc and Sm) by instrumental neutron activation analysis. A number of sub-samples (100 mg) was taken from a single bottle and an equal number of single samples were taken from individual bottles selected at random. A statistical analysis of the results using F and t-tests indicated that the within and between bottle results did not differ significantly and the material can therefore be considered homogeneous (at a sample intake mass at, or above, 100 mg).

### **Dry weight determination**

All values are expressed on a dry weight basis. Therefore the dry weight must be determined at the time of analysis, using separate sub-samples of at least 500 mg dried to constant weight in a drying oven set to 105 °C. Subsequent weighings should differ by less than 5 mg.

### **Instructions for use**

The recommended minimum sample size for analysis is 100 mg. Analysts are reminded to take appropriate precautions in order to avoid contaminating the remaining material in the bottle. No special precautions are required for the storage of this material.

### **Legal disclaimer**

The IAEA makes no warranties, expressed or implied, with respect to the data contained in this reference sheet and shall not be liable for any damage that may result from the use of such data.

*Issued & supplied by*

Analytical Quality Control Services (AQCS)  
Agency's Laboratories, Seibersdorf  
International Atomic Energy Agency  
P. O. Box 100  
A-1400 Vienna, Austria

*Prepared by*

*L. Pszonicki, A. N. Hanna and O. Suschny*