INTERNATIONAL STANDARD

ISO 54321

First edition 2020-08

Soil, treated biowaste, sludge and waste — Digestion of aqua regia soluble fractions of elements

Sols, biodéchets traités, boues et déchets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments solubles dans l'eau régale propriété de chets — Digestion des éléments de chets de chets — Digestion des éléments de chets — Digestion des éléments de chets de

ISO

Reference number ISO 54321:2020(E)

STANDARDS & O.COM. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the full poly of the O.Com. Click to view the O.Com. Click to view



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office CP 401 • Ch. de Blandonnet 8 CH-1214 Vernier, Geneva Phone: +41 22 749 01 11 Email: copyright@iso.org Website: www.iso.org

Published in Switzerland

itent		Page
word		iv
ductio	on	v
Scop	oe	1
Nori	native references	1
Tern	ns and definitions	1
Prin	ciple	2
	•	
Read	zents OOV	3
Ann	aratus 01.	3
7.1	General	3
7.2	Method A — Apparatus for thermal heating under atmospheric conditions	3
	7.2.1 Method A1 — Thermal heating under reflux conditions	3
	7.2.2 Method A2 — Thermal heating with a heating block with containers	4
7.3	. , ,	
Proc	redure	5
8.1	General	5
8.2	Blank test	5
8.3	Method A — thermal heating under atmospheric conditions	5
	8.3.1 Method A1 — Thermal heating under reflux conditions	5
	8.3.2 Method A2 — Thermal heating with a heating block with containers	6
8.4	Method B — Microwave digestion with temperature control, closed vessels	7
Test	report	7
ex A (in	formative) Repeatability and reproducibility data for soil, biowaste and sludge	
	•	
-		10
iogranl	1V	37
CLA	AND ARD SISO.	
i	Norr Term Prin Inter Reag Appa 7.1 7.2 7.3 Proc 8.1 8.2 8.3 8.4 Test ex A (in sam) ex B (in iograph	7.2.1 Method A1 — Thermal heating under reflux conditions 7.2.2 Method A2 — Thermal heating with a heating block with containers 7.3 Method B — Microwave digestion with temperature control, closed vessels Procedure 8.1 General 8.2 Blank test 8.3 Method A — thermal heating under atmospheric conditions 8.3.1 Method A1 — Thermal heating under reflux conditions 8.3.2 Method A2 — Thermal heating with a heating block with containers

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 444, *Environmental characterization of solid matrices*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

iv

Introduction

Regarding the comparability of the procedure described in this document with those of the other standards mentioned above the next remarks can be made:

- This document describes the digestion of solid samples with aqua regia.
- Differences in the procedures of the different standards are small. An important difference between the reflux procedures as described in ISO 11466 and EN 13657 and EN 16174 concerns the waiting time after addition of the acid to the sample, before the digestion starts. ISO 11466 specifies a waiting time of 16 h, both European standards state that the digestion can start after the first strong reactions have ceased. In validation work it was proven that the difference between 2 h and 16 h of waiting was negligible, therefore this document follows the approach of EN 13657 and EN 16174.
- The heating block procedure was added to the reflux and microwave digestion procedures. The procedure was adopted from the Dutch standard NEN 6961, which specifies a boiling time of 2 h to 4 h. This document specifies a boiling time of 2 h.

The methods specified in this document are providing multi-element agual regia digestion techniques for soil, treated biowaste, sludge and waste prior to analysis. It is known that the digestion of environmental samples with aqua regia will not necessarily lead to complete element recoveries, and that the extract from a test sample may not reflect the total concentrations of the target analytes. However, for most environmental applications the result obtained based upon digestion methods specified in this document are considered to be fit for the intended purpose.

This document is validated for several types of matrices as indicated in <u>Table 1</u>.

Matrix Materials used in the validation test Municipal sludge Industrial sludge Sludge Sludge from electronic industry Ink waste sludge Sewage sludge Compost Biowaste (Method A) Composted sludge Agricultural soil Soil Sludge amended soils City waste incineration fly ash ("oxidised" matrix) City waste incineration bottom ash ("silicate" matrix) Ink waste sludge (organic matrix) Waste Electronic industry sludge ("metallic" matrix) BCR 146R (sewage sludge) BCR 176 (city waste incineration ash)

Table 1 — Matrices for which this document is validated

WARNING — Persons using this document should be familiar with usual laboratory practice. Some of the reagents used in this document are highly corrosive and very toxic. Safety precautions are absolutely necessary, not only due to the strong corrosive reagents, but also to the high temperature and high pressure.

The use of laboratory-grade microwave equipment with isolated and corrosion resistant safety devices is required. Domestic (kitchen) type microwave ovens shall not be used, as corrosion by acid vapours may compromise the function of the safety devices and prevent the microwave

magnetron from shutting off when the door is open, which could result in operator exposure to hazardous levels of microwave energy.

All procedures should be performed in a fume hood or in closed force-ventilated equipment. By the use of strong oxidising reagents, the formation of explosive organic intermediates is possible, especially when dealing with samples with a high organic content. Do not open pressurized vessels before they have cooled down. Avoid contact with the chemicals and the gaseous reaction products.

IMPORTANT — It is absolutely essential that tests conducted according to this document be carried out by suitably trained staff.

STANDARDSEO.COM. Click to view the full policy of the Control of t

Soil, treated biowaste, sludge and waste — Digestion of aqua regia soluble fractions of elements

1 Scope

This document specifies two methods for digestion of soil, treated biowaste, sludge and waste by the use of an aqua regia digestion.

Digestion with aqua regia will not necessarily accomplish total decomposition of the sample. The extracted analyte concentrations may not necessarily reflect the total content in the sample but represent the aqua regia soluble metals under the condition of this test procedure. It is generally agreed that for environmental analysis purposes, the results are fit for the intended purpose to protect the environment.

This document is applicable for the following elements:

Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), calcium (Ca), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), phosphorus (P), potassium (K), selenium (Se), silver (Ag), sodium (Na), strontium (Sr), sulfur (S), tellurium (Te), thallium (Tl), tin (Sn), titanium (Ti), vanadium (V), and zinc (Zn).

This document can also be applied for the digestion of other elements, provided the user has verified the applicability.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

3.1

aqua regia

digestion (3.2) solution obtained by mixing 1 volume of nitric acid (mass fraction of 65 % to 70 %) and 3 volumes of hydrochloric acid (mass fraction of 35 % to 37 %)

Note 1 to entry: These mass percentages agree with the concentrations of 6.2 and 6.3.

3.2

digestion

mineralization of the organic matter of a sample and dissolution of its mineral part, more or less completely, when reacting with a reagent mixture

3.3

dry residue

dry matter expressed as a percentage by mass after drying at 105 °C ± 5 °C to the constancy of weight

ISO 54321:2020(E)

3.4

laboratory sample

sample (3.5) intended for laboratory inspection of testing

[SOURCE: ISO 11074:2015, 4.3.7]

3.5

sample

portion of material selected from a larger quantity of material

[SOURCE: ISO 11074:2015, 4.1.17]

3.6

test portion

analytical portion

quantity of material of proper size for measurement of the concentration or other properties of interest, removed from the *test sample* (3.7)

Note 1 to entry: The test portion may be taken from the laboratory sample directly if no preparation of sample is required (e. g. with liquids), but usually it is taken from the prepared test sample.

Note 2 to entry: A unit or increment of proper homogeneity, size and fineness, needing no further preparation, may be a test portion.

[SOURCE: ISO 11074:2015, 4.3.15]

3.7

test sample

analytical sample

portion of material resulting from the *laboratory sample* (3.4) by means of an appropriate method of sample pre-treatment and having the size (volume/mass) necessary for the desired testing or analysis

[SOURCE: ISO 11074:2015, 4.1.3]

4 Principle

A test portion is digested with aquaregla according to one of the following heating procedures:

- Method A: procedure under atmospheric conditions
 - A1: reflux for (120 £10) min, followed by filtration/centrifugation;
 - A2: heating block at (105 ± 5) °C for (120 ± 10) min, followed by filtration/centrifugation.
- Method B: microwave digestion
 - B1: Temperature controlled procedure: at (175 ± 5) °C for (10 ± 1) min in a closed vessel followed by filtration/centrifugation.

5 Interferences and sources of errors

The container in which the sample is delivered and stored can be a source of errors. Its material shall be chosen according to the elements to be determined (e.g. elemental Hg can penetrate polyethylene walls very fast in both directions. Glass can contaminate samples with its major elements: e.g. B, Na, K, Si and Al).

Grinding or milling samples includes a risk of contamination of the sample by the environment (air, dust, wear of milling equipment). Due to elevated temperature losses of volatile compounds are possible.

For the determination of elements forming volatile compounds (e.g. Hg, As) special care has to be taken during sample pre-treatment.

All glassware and plastics ware shall be adequately cleaned and stored in order to avoid any contamination.

In the case of filtration of the digested solution it is necessary to take care that the filtration procedure does not introduce contaminants.

Ensure that all of the test portion is brought into contact with the acid mixture in the digestion vessel.

Some elements of interest can be lost due to precipitation with ions present in the final digest solution, e.g. low soluble chlorides, fluorides and sulfates.

6 Reagents

Use only acids and reagents of recognized analytical grade to avoid high blank values for subsequent analytical measurements. Use a test blank solution throughout the procedure applying all steps with the same amount of acids, but without a sample.

- **6.1** Water, e.g. deionized.
- **6.2 Hydrochloric acid**, $c(HCl) \approx 12 \text{ mol/l.}$
- **6.3** Nitric acid, $c(HNO_3) \approx 15 \text{ mol/l}.$
- **6.4** Nitric acid, $c(HNO_3) \approx 0.5 \text{ mol/l}.$

Dilute 35 ml nitric acid (6.3) to 1 l with water (6.1).

6.5 Antifoaming agent, e.g. *n*-dodecane ($C_{12}H_{26}$) or *n*-octanol ($C_8H_{18}O$) are suitable.

7 Apparatus

7.1 General

Usual laboratory apparatus. All glassware and plastics ware shall be adequately cleaned and stored in order to avoid any contamination.

Depending upon the concentration of the element of interest, particular care should be exercised with respect to the effective cleaning of the vessels.

7.2 Method A — Apparatus for thermal heating under atmospheric conditions

7.2.1 Method A1 — Thermal heating under reflux conditions

- **7.2.1.1 Digestion vessel**, temperature- and pressure-resistant and capable of containing the mixture of sample and digest solution, for example a quartz vessel. The digestion vessel shall have a volume of at least 5 times of the volume of the aqua regia used. The inner wall of the vessel shall be inert and shall not release substances to the digest in excess of the purity requirements of the subsequent analysis.
- NOTE 1 Silica or borosilicate glass vessels can be used instead of quartz vessels.
- NOTE 2 It can be necessary to periodically clean the digestion vessels with a suitable surfactant to remove persistent deposits.
- **7.2.1.2 Reflux condenser**, adaptable to the digestion vessel (7.2.1.1).

- **7.2.1.3 Absorption vessel**, volatile species trap, in an open digestion system capable of trapping one or more volatile measurement species, adaptable to the reflux condenser (7.2.1.2).
- **7.2.1.4 Heating device**, for example a heating mantle, thermostatic controlled, or an aluminium block thermostat.

7.2.2 Method A2 — Thermal heating with a heating block with containers

7.2.2.1 Digestion tube, 50 ml propylene tube with a screw cap from polypropylene.

The part of the tube not being heated and the screw cap function as a condenser, but are not really a reflux system. The material of the tube and screw cap need to be tested in order to be sure that release of elements of interest does not take place. Other materials and vessels with other volumes than mentioned above are allowed to be used if suitability has been proven.

7.2.2.2 Temperature controlled heating block, heating block able to heat the tube(s) to a temperature of (105 ± 5) °C.

7.3 Method B — Microwave digestion with temperature control closed vessels

7.3.1 Digestion vessel, for pressurized microwave digestion, typically 100 ml volume, reagent, temperature- and pressure-resistant and capable of containing the mixture of sample and digest solution. The vessel shall be suitable for the safe application in the temperature and pressure range applied, capable of withstanding pressures of at least 3 000 kPa.

Digestion vessels made of perfluoroalkoxylalkane (PFA), modified polytetrafluoroethylene (PTFE) or quartz, and equipped with a safety pressure releasing system to avoid explosion of the vessel, shall be used. The inner wall of the vessel shall be inert and shall not release contaminations to the digest solution.

It can be necessary to periodically clean the digestion vessels with a suitable surfactant to remove persistent deposits.

7.3.2 Microwave digestion system corrosion resistant and well ventilated. All electronics shall be protected against corrosion for safe operation.

Use a laboratory-grade microwave oven with temperature feedback control mechanisms.

The microwave digestion system should be able to control the temperature with an accuracy of ± 5 °C and automatically adjust the microwave field output power within 2 s of sensing. Temperature sensors shall be accurate to ± 2 °C, including the final reaction temperature of (175 \pm 5) °C. Temperature feedback control provides the primary performance mechanism for the method. Due to the variability in sample matrix types and microwave digestion equipment (i.e. different vessel types and microwave designs), control of the temperature during digestion is important for reproducible microwave heating and comparable data. Manufacturer specifications of the microwave digestion system must fit these specifications. The accuracy of the temperature measurement system should be periodically tested on blank samples at an elevated temperature according to the manufactures instructions. If the temperature deviates by more than 2 °C from the temperature measured by an external, calibrated temperature measurement system, the microwave temperature measurement system should be recalibrated.

- **7.4 Sample containers**, plastics and glass containers are both suitable.
- **7.5** Filter paper, usually with a pore size of $0.45~\mu m$ and resistant to the diluted aqua regia final digestion solution.

- **7.6 Volumetric flasks**, usually of nominal capacity of 50 ml or 100 ml.
- **7.7 Analytical balance**, with an accuracy of 1 mg or better.
- **7.8 Boiling aids**, anti-bumping granules or glass beads, diameter 2 mm to 3 mm, acid washed.

8 Procedure

8.1 General

Pre-treat, soil, sludge and biowaste samples according to e.g. EN 16179 or ISO 11464 and waste samples according to e.g. EN 15002.

Determine the dry matter content, depending on the matrix of the sample, e.g. according to EN 15934.

For waste samples the next remarks apply:

- Pre-treatment should include drying or grain size reduction below a particle size of 250 μm for solid
 waste or homogenizing by use of a high speed mixer or sonification for liquid waste samples.
- The mass of test portion for a single digestion has to be selected in a way, that:
 - it is representative for the laboratory sample;
 - it complies with the specifications of manufacturer of the digestion unit.

Referring to the manufacturer's instructions, the upper limits of mass of the test portion shall be taken into account.

For representativeness reasons a mass above 200 mg is to be preferred for the test portion. Follow, for safety reasons, the manufacturer's instructions regarding the maximum amount of organic carbon in the sample.

8.2 Blank test

Carry out a reagent blank test digestion in parallel with the determination, using the same procedure and the same quantities of all the reagents as in the determination, but omitting the test portion. The laboratory shall define acceptable limits.

NOTE The measurement of a blank is introduced to determine the contribution of the extracting solution, glassware, digestion tube and filter paper used to the measured value.

8.3 Method A — thermal heating under atmospheric conditions

8.3.1 Method A1 — Thermal heating under reflux conditions

Weigh approximately 3 g of the test sample (waste samples 1 g to 10 g), with an accuracy of 0,001 g (or at least three significant figures), and transfer to the digestion vessel (7.2.1.1).

In case of dry samples moisten the test portion with about 0,5 ml to 1,0 ml of water (6.1) and add, dropwise, if necessary, to reduce foaming, with mixing, $(21,0\pm0,1)$ ml of hydrochloric acid (6.2) followed by $(7,0\pm0,1)$ ml of nitric acid (6.3). Connect the reflux condenser (7.2.1.2) to the digestion vessel (7.2.1.1). Fill the absorption vessel (7.2.1.3) with approximately 15 ml nitric acid (6.4). Connect the absorption vessel to the reflux condenser, and let stand at room temperature until any effervescence almost ceases to allow for slow oxidation of the organic matter in the sample.

The time of standing at room temperature can have an influence on the digestion rate of aqua regia. For consistency, it is recommended to start heating as soon as possible after the first strong reaction has ceased.

30 ml of aqua regia is only sufficient for the oxidation of about 0,5 g organic carbon. If there is any doubt of the amount of carbon present, estimate the amount of carbon in the sample or carry out a determination of TOC. If there is more than 0,5 g of organic carbon in the test portion, proceed as follows.

Allow first reaction with the aqua regia to subside. Then add an extra 1 ml of nitric acid (6.3) only to every 0,1 g of organic carbon above 0,5 g. Do not add more than 10 ml of nitric acid at any given time, and allow any reaction to subside before proceeding further.

Connect the digestion vessel (7.2.1.1) to the heating device (7.2.1.4) and raise the temperature of the reaction mixture to reflux conditions and maintain for 2 h ensuring that the condensation zone is lower than 1/3 of the height of the reflux condenser, then allow to cool. Add the content of the absorption vessel to the reaction vessel via the reflux condenser, rinsing both the absorption vessel and condenser with further 10 ml of diluted nitric acid (6.4).

Transfer quantitatively the solution content of each vessel into a suitable sized volumetric flask and add water (6.1) to the volume mark.

Alternatively, another procedure can be applied, such that the adjustment to rolume with the solid residue still present shall be carried out immediately after digestion.

If the measurement solution contains particles due to precipitation which may clog nebulizers or interfere with an injection of the sample into the instrument, the sample may be centrifuged, allowed to settle, or filtered (7.5).

The measurement solution is now ready for analysis for elements of interest using appropriate elemental analysis techniques.

8.3.2 Method A2 — Thermal heating with a heating block with containers

Weigh an amount of not more than 2 g of the test portion (typically 0,5 g to 1 g of dry sample) containing not more than 0,15 g of organic carbon with an accuracy of 0,001 g (or at least three significant figures) and transfer it into the digestion vessel (7.2.2.1)

The amount of the test sample depends on the amount of organic matter. The maximum amount of organic carbon shall not exceed 0,15 g when 8 ml of aqua regia is used. Per additional 0,1 g organic carbon (more than this 0,15 g), 1 ml of additional concentrated HNO_3 (6.3) shall be added before the digestion process is started.

N.B.: For some elements, e.g., barrum and chromium, the additional volume of HNO_3 is essential in order to have a sufficient recovery upon digestion.

In case of dry samples moisten the test portion with a few drops of water (6.1). Add (6.0 \pm 0.1) ml hydrochloric acid (6.2) followed by (2.0 \pm 0.1) ml nitric acid (6.3). Let stand at room temperature until any effervescence almost ceases to allow for slow oxidation of the organic matter in the sample.

The time of standing at room temperature can have an influence on the digestion rate of aqua regia. For consistency, it is recommended to start heating as soon as possible after the first strong reaction has ceased.

Loosely screw on the tube cap (not very tight!) and place the digestion vessel on the heating block (7.2.2.2) and slowly increase the temperature to the boiling point. Keep the temperature on the boiling point during (120 ± 10) min.

Let the vessel cool down to room temperature and fill up with water (6.1) to the volume mark.

If a non-graduated digestion tube is used, transfer quantitatively the solution into a suitable sized volumetric flask and add water (6.1) to the volume mark. Alternatively, another procedure can be applied, such that the adjustment to volume with the solid residue still present shall be carried out immediately after digestion.

If the measurement solution contains particles due to precipitation which may clog nebulizers or interfere with an injection of the sample into the instrument, the sample may be centrifuged or filtered (7.5).

The measurement solution is now ready for analysis for elements of interest using appropriate elemental analysis techniques.

8.4 Method B — Microwave digestion with temperature control, closed vessels

Weigh an amount of not more than 2 g of the test portion (typically 0,5 g to 1 g of dry sample) containing not more than 0,15 g of organic carbon with an accuracy of 0,001 g (or at least three significant figures) and transfer it into the digestion vessel (7.3.1).

Add for each additional intake of 0,1 g organic carbon 1 ml of concentrated HNO₃ (b) before the digestion process is started.

Referring to the manufacturer's instructions, the upper limits of mass of the test portion shall be taken into account.

In case of dry samples moisten the test portion with a few drops of water (6.1). Add separately (6 ± 0.1) ml of hydrochloric acid (6.2) and (2 ± 0.1) ml of nitric acid (6.3) and mix well.

If a vigorous reaction occurs, allow the reaction cease before capping the vessel. If excessive foaming occurs, add a drop of anti-foaming agent (6.5).

This method is an operationally defined method, designed to achieve consistent digestion of samples by specific reaction conditions. The temperature of the digestion mixture in each vessel shall be raised with a heating rate of approximately 10 °C/min to 15 °C/min to (175 \pm 5) °C and remain at (175 \pm 5) °C for (10 \pm 1) min. Cool down to room temperature.

Check this procedure regularly with a blank sample of agua regia.

WARNING — Too high a temperature increase may cause a vigorous, exothermic reaction in the digestion solution with high pressure increase and blow-off of the security valve. Losses of analytes are possible.

At the end of the microwave programme, allow the vessels to cool according to the manufacturer's instructions before removing them from the microwave system. Cooling of the vessels may be accelerated by internal or external cooling devices.

After reaching room temperature, check if the microwave vessels maintained their seal throughout the digestion. Due to the wide variety of vessel designs, a single procedure is not appropriate. Carefully uncap and vent each vessel in a well-ventilated fume hood according to the manufacturer's instructions. Transfer quantitatively the solution content of each vessel into a suitable sized volumetric flask and add water (6.1) to the volume mark.

Alternatively, another procedure can be applied, such that the adjustment to volume with the solid residue still present shall be carried out immediately after digestion. If the measurement solution contains particles due to precipitation which may clog nebulizers or interfere with an injection of the sample into the instrument, the sample may be centrifuged, allowed to settle, or filtered.

The measurement solution is now ready for analysis for elements of interest using appropriate elemental analysis techniques.

9 Test report

This test report shall contain at least the following information:

- a) the digestion method used, together with a reference to this document, i.e. ISO 54321;
- b) identity of the sample;

ISO 54321:2020(E)

- c) the results;
- d) the date of the test;
- e) any deviation from this method and report of circumstances that can have affected the results.

STANDARDS GO. COM. Click to view the full poor of the Osas A. Standards Go.

Annex A

(informative)

Repeatability and reproducibility data for soil, biowaste and sludge samples

The interlaboratory comparison of digestion of aqua regia soluble fractions of trace elements in sludge, treated biowaste and soil was carried out with contributions by 20 to 23 laboratories from European countries on five materials. Detailed information can be found in Reference [27].

<u>Table A.1</u> lists the types of materials tested.

Table A.1 — Materials tested and parameters analysed in the interlaboratory comparison of the digestion for the extraction of aqua regia soluble fractions of trace elements in soil, treated biowaste and sludge

Sample	Material 🗸	Parameters
Sludge 1	Mix 1 of municipal waste water treatment plant sludges from North Rhine Westphalia, Germany	As, Cd, Cr, Cu, Fe, Mn, Ni, P, Pb, Zn
Sludge 2	Mix 2 of municipal waste water treatment plant sludges from North Rhine Westphalia, Germany	As, Cd, Cr, Cu, Fe, Mn, Ni, P, Pb, Zn
Compost 2	Compost from Germany	As, Cd, Cr, Cu, Fe, Mn, Ni, P, Pb, Zn
Soil 1	A sludge amended wil from Pavia, Italy	As, Cd, Cr, Cu, Fe, Mn, Ni, P, Pb, Zn
Soil 2	A sludge amended soil from Düsseldorf, Germany	As, Cd, Cr, Cu, Fe, Mn, Ni, P, Pb, Zn
DARDSIS O	O. COLL.	
	Sludge 1 Sludge 2 Compost 2 Soil 1 Soil 2	Sludge 1 Mix 1 of municipal waste water treatment plant sludges from North Rhine Westphalia, Germany Mix 2 of municipal waste water treatment plant sludges from North Rhine Westphalia, Germany Compost 2 Compost from Germany Soil 1 A sludge amended Soil from Pavia, Italy A sludge amended soil from Düsseldorf,

Annex B

(informative)

Repeatability and reproducibility data for waste samples

B.1 Inter-laboratory study (methods A1 and B)

B.1.1 General

During 1998 to 1999 a project for validation of EN 13657 has been organised and carried out. The validation included an inter-laboratory study for evaluation of performance characteristics of methods included in the standard (reproducibility, repeatability, accuracy where applicable) and a robustness study (i.e. the evaluation of the influence of some defined operational parameters on the methods).

The validation included method A1 (Digestion by thermal heating, with aqua regia in reflux systems) and method B (Microwave assisted digestion with aqua regia in closed vessels).

B.1.2 Selection of laboratories

A questionnaire has been circulated by all CEN/TC 292 'Characterization of waste' members to collect a list of interested European laboratories. About seventy laboratories gave their availability to participate to the inter-laboratory trial. All of them were asked to declare that they fulfil the minimum requirements to carry out digestion and analyses according to this standard. According to the ISO 5725 series no selection has been made in advance on the basis of the supposed "ability" of laboratories, their certifications, etc: it's therefore possible to assume that participating laboratories are a rather good "sample" of "normal" European laboratories.

B.1.3 Selection of samples

The materials to be used in the inter-laboratory study had to satisfy all the following requisites:

- representative of a wide range of matrices, as much as possible;
- available in a homogeneous form or, alternatively, not too difficult to grind, sieve and homogenise;
- available in a sufficient quantity.

After a survey, the following materials have been found:

- city waste incineration fly ash ("oxidised" matrix) (CEN6/99 FLY ASH CW6 POWDER);
- city waste incineration bottom ash ("silicate" matrix) (CEN7/99 "ASH CW4 POWDER");
- ink waste sludge (organic matrix) (CEN8/99 "INK WASTE CW12 POWDER");
- electronic industry sludge ("metallic" matrix) (CEN9/99 "SEWAGE SLUDGE SL11 POWDER");

For the evaluation of performances of digestion procedures, independently from the subsequent analyses performed on digested samples, all laboratories have been asked to analyse some already-prepared aqueous solutions with different degrees of difficulty (clean synthetic solutions, acid digested solutions of the above four materials). This has been used as a tool for discarding from the evaluation laboratories that did not prove their analytical ability for some matrices/elements.

For accuracy evaluation, two certified reference material (CRM) have been also included:

BCR 146 R (sewage sludge);

— BCR 176 (city waste incineration ash).

All samples, including the two CRMs, have been delivered to laboratories in anonymous form.

B.1.4 Experimental

Preparation and homogenisation of samples, packaging, delivering, collection and evaluation of results have been carried out by Environmental Monitoring Sector of European Commission Joint Research Centre in Ispra (Italy).

B.1.5 Results

About fifty laboratories have actually returned results for the inter-laboratory study. The evaluation of results has been performed by following these steps:

- removing of "obviously erroneous data", both means and single data according to ISO 5725-2:1994,
 7.2.6;
- results from laboratories failing to correctly measure some elements in "clean metals" solution were removed from the whole data set (for the failed elements only).
- results from laboratories failing to correctly measure some elements in digested aqueous solutions were removed from the whole data set (for the failed elements only);
- the remaining data sets were evaluated according to ISO 5725 series, with calculation of repeatability, reproducibility and, where a "conventional true value" was available, accuracy (recovery); results of this evaluation are reported in the tables below.

The inter-laboratory study involved a large number of laboratories, performing analyses in four replicates on several samples (five aqueous, six powders), for the determination of a large number of elements (up to 31), by using one to three digestion methods: this led to a very large data set. For some digestion methods and for some elements determination, only few data were available (a minimum of 24 outlier-free results is generally required); anyway, even for these methods and elements, useful information on performance has been obtained.

B.1.6 Conclusions

The performances of the three methods should be compared on an element-by-element, matrix-by-matrix basis, in the tables below. In general, performances are considered to be acceptably consistent, especially for most environmentally-sensitive (toxic) elements.

Recovery rates for CRM: sewage sludge (BCR 146 R, non-refractory matrix) are in generally high, for CRM: city waste incineration ash (BCR 176, refractory matrix) in many cases low. Digestion with aqua regia will not necessarily release elements completely from many geological matrices.

B.2 Inter-laboratory study (method A2)

B.2.1 General

Between October 2018 and February 2019, a project for validation of method A2 (Digestion by thermal heating, with aqua regia, with a heating block with containers) was organised and carried out. The validation included an inter-laboratory study for evaluation of performance characteristics of the method (reproducibility, repeatability, accuracy where applicable).

B.2.2 Selection of laboratories

Several CEN/TC 444 members were requested to circulate information about the inter-laboratory trial and collect a list of interested European laboratories. Twelve laboratories gave their availability to participate to the inter-laboratory trial. All laboratories carried out the digestion with a heating block

at regular basis. The laboratories were informed about the necessity to carry out digestion and analysis according to this document. According to ISO 5725 series no selection has been made in advance on the basis of the supposed "ability" of laboratories, their certifications, etc. it's therefore possible to assume that participating laboratories are a rather good "sample" of "normal" European laboratories.

B.2.3 Selection of samples

Two samples were taken from the interlaboratory trial for the validation of EN 13657:

- ink waste sludge (organic matrix) (CEN 8/99 "INK WASTE CW12 POWDER");
- electronic industry sludge ("metallic" matrix) (CEN 9/99 "SEWAGE SLUDGE SL11 POWDER");

For accuracy evaluation, two certified reference materials (CRM) have been included, as well as two materials used in robustness validation tests for CEN/TC 351[27] [28]:

- ISE 859 (sediment);
- BCR 176R (city waste incineration ash, with identical matrix as BCR 176, used in the inter laboratory trial for the evaluation of EN 13657);
- CFA Coal fly ash;
- GSS Steel slag;

A sample material "Bottom ash" was added for the interlaboratory trial

All samples, including the two CRMs, have been delivered to laboratories in anonymous form.

B.2.4 Experimental

Preparation and homogenisation of samples, packaging, delivering, collection and evaluation of results have been carried out by VITO NV in Mol (Belgium) and Synlab Analytics & Services B.V. in Rotterdam (The Netherlands).

B.2.5 Results

All twelve laboratories have returned results for the inter-laboratory study. The means and standard deviations of reproducibility have been evaluated according to ISO 13528:2015, C.1, following these steps:

- removing of data with a value below the detection limit ("<"-values);
- data have been evaluated if the mean measured concentration is above 1 mg/kg dm (for Hg 0,1 mg/kg dm);
- data have been evaluated only if more than six results remain;
- for the remaining data sets, means and standard deviations were calculated as Huber-M estimates with Winsorising at 1,5 standard deviations;
- where a "conventional true value" was available, accuracy (recovery) has been calculated.

The inter-laboratory study involved twelve laboratories, performing analyses in two replicates on seven samples, for the determination of a large number of elements (up to 28): this led to a large data set. For some elements, only few data were available, anyway, even for these elements, useful information on performance has been obtained.

B.2.6 Conclusions

The performances of the method should be compared on an element-by-element, matrix-by-matrix basis, in the tables below. In general, the performance of method A2 is considered to be acceptably consistent with methods A1 and B, especially for most environmentally-sensitive (toxic) elements.

Recovery rates for CRM: sediment (ISE 859) and for samples used in former robustness validation tests: CFA Coal fly ash and GSS Steel slag, are in generally high. For CRM: city waste incineration ash (BCR 176R, refractory matrix) in many cases low, which agrees with conclusions of <u>B.1.5</u>. Digestion with aqua regia will not necessarily release elements completely from many geological matrices.

STANDARDS & O.COM. Click to view the full PDF of 180 standards of 180 stan

Table B.1 — Analytical results, SAMPLE CEN 6/99 "FLY ASH CW6 POWDER"

						-	SAMPLE CEN 6/99 "FLY ASH CW6 POWDER"	14, 66/9 N	Y ASH C	.W6 PC)WDE	R,"				
		Meth	od A1	1: Thermal	Method A1: Thermal heating, with aqua regia ir	aqua regia	a in reflux systems	ystems	N.	lethod	B: Mi	crowave a	ıssisted, wit	h aqua regi	Method B: Microwave assisted, with aqua regia in closed vessels	ressels
	>	_	NA	XREF	Mean	Recov	Reprod	Repeat	~	1	NA	XREF	Mean	Recov	Reprod	Repeat
	.	7	UAI	mg/kg	mg/kg	%	%	%	Λ	,	UAI	mg/kg	mg/kg	%	%	%
Al	38	6	0		41811		20,2	2,8	71	18	0		40 382		25,4	4,6
Sb	18	4	0		800,1	0	21,2	2	52	12	0		8'086		24,4	4,6
As	36	8	0		35,22	N.	26,5	7,7	57	14	0		41,67		30,6	8,5
В	19	4	0		269,6	Q,	25,1	8'9	37	6	1		210,2		16,2	3,7
Ba	19	4	2		196,6		29,5	14,7	28	14	1		844,3		36,8	11,3
Be	6	2	0		0,91		976	2,6	26	9	2		0,92		11,7	5,9
Cd	45	10	2		441,4		1	3,1	105	56	0		419,7		14,1	3,6
Ca	27	9	9		154346		10.16	5,1	20	12	2		144 174		14,2	4,6
Cr	54	12	0		386,2		20,6	73,4	103	25	0		422,5		12,1	4,8
တ	46	10	0		20,25		29,3	42	81	20	0		24,77		27,9	6,3
Cu	49	11	2		1 983,8		15,4	6,1	104	25	0		1 868,5		20,3	4,4
Fe	44	10	2		9 416,9		14	5,5	83	21	0		9 574,8		12,6	3,7
Pb	51	12	1		10 448		12,8	4,1	96	24	0		10 035		11,5	4,4
Mg	33	7	0		10 198		16,9	2,6	51	X 12	2		9 936,5		8,8	2,7
Mn	20	11	0		471,1		15,4	2	91	23	0		489,8		12,7	3,8
Hg	31	7	0		5,01		59,6	11,5	42	11	9		5,56		37,4	5,3
Mo	15	3	4		26,43		1,6	7	38	6	8		24,77		9'6	8,3
ï	49	11	0		52,44		22,2	9'9	93	23	5	«	58,2		13	6,3
Ь	14	3	0		5 195,9		4,9	4,8	32	7	0	6	5 706,7		2,8	2,9
\times	26	9	0		56 012		15,2	8'6	22	14	1	S	64 277		9,5	3,9
Se	14	3	0		31,53		24,2	6,5	22	2	4		37,33		6′8	12,4
Ag	29	9	0		343,1		17,8	8'9	33	8	2		35401		17,3	9
S	10	2	0		35 858		11	6,3	24	5	0		37 148		10,3	1,5
Na	37	8	1		58 956		24,6	5,2	28	14	0		60 057	0	12,5	3,4
Sr	14	3	2		271,4		2,8	8,5	20	12	1		266,0	32	11,5	3,8
N = N	N = Numbe applicable)	er of 1	results	S_{i} , $L = Number$	N= Number of results, $L=$ Number of laboratories, $NA=$ Number applicable)	s, NA = Numk		, NR = Num	er of re	sults re	jected	for statistic	al evaluation,	XREF = Conv	of outliers, $\it NR$ = Number of results rejected for statistical evaluation, $\it XREF$ = Conventional true value (where	value (where

Table B.1 (continued)

occolc	essers	Repeat	%	4,3		9,2	8,4	4,8	3,6	value (where	
y posolo ui e	Metnod B: Microwave assisted, with aqua regia in closed vessels	Reprod	%	6'2		87,8	14,2	14,9	6'6	outliers, $NR=1$ Number of results rejected for statistical evaluation, $ZREF=1$ Conventional true value (where	
h aqua raqi	n aqua regi	Recov	%							, <i>XREF</i> = Conv	2021
seisted wit	issistea, wit	Mean	mg/kg	1 252,9		22,98	5 129,7	22,12	27 244	al evaluation	ck to view the full PDF of 150 ba321.202
R"	crowave a	XREF	mg/kg							for statistic	of of 150
JWDE R. Mi	B: MI	NA		1	0	0	4	4	2	jected	
W6 PC	etnoa	T		6	0	2	9	11	24	ults re	"He for
ASH C		N		39	0	9	56	46	102	r of res	ien .
PLE CEN 6/99 "FLY ASH CW6 POWDER"	tems	Repeat	%	3,6		60,3	8	3	5,9	WR = Numbe	**************************************
SAMPLE CEN	in reflux systems	Reprod	%	3,4		9′29 S	2,55	4 Q	7,6'02	er of outliers, l	
einer eune	aqua regia	Recov	%	32	5					S_{i} , $NA = Numb$	
SAMI	eating, with	Mean	mg/kg	1351,6		2,45	3 350,9	19,31	25 886	N= Number of results, $L=$ Number of laboratories, $NA=$ Number of applicable)	
Thormalh	I nermal n	XREF	mg/kg							L = Number	
J 41.	od A I:	NA	7	1	0	0	0	2	1	esults,	
Motho	Metho	7		3	0	3	3	2	12	er of re	
		N		13	0	6	14	22	53	N = Numbe applicable)	
				Sn	Te	I	Ţ	>	Zn	$N = \frac{1}{3}$	

Table B.2 — Analytical results, SAMPLE CEN 7/99 "ASH CW4 POWDER"

keprod Repeat N L NA mg/kg mg/kg % % 22,3 7,3 77 19 2 55.564 17,7 6,6 5,2 68 17 0 255.9 20 6,6 5,2 68 17 0 255.9 20 6,1 2,9 38 9 5 176.4 9,4 17,2 4,1 65 16 0 176.4 9,4 17,2 4,7 6,1 11 27 1 17.8 17,4 17,2 4,7 1,7 6 0 1,78 17,4 17,4 15,2 4,7 1,7 1 26,9 1 1,76 17,4 4,7 4,6 11 2 1,78 17,4 17,4 13,3 4,6 1 1 1,18 1 11,4 14,4 4,3 1,15 2 1,135,8	N AMERICAL STORES Mean Reprod Reprod Reprod Reprod Reprod Reprod Reprod No. Mean Recovery Reprod No. Mean Reprod No. Reprod No. N			Ž	thod	A1. Therm	nal heating wi	th adua reo		SAMPLE CEN 7/99"ASH CW4 POW DER" n reflux systems Method B: Mi	SH CV	V4 P	OW DI	ER" Microwaye	assisted w	rith adua re	oia in closed	VPSSPIS
N Imag/leg mag/leg % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %			-	-		XREF	Mean	Recov	1 111	Repeat	1			XREF	Mean	Recov	Reprod	Repeat
38 9 0 53.086 4 7.3 7.3 7.4 19 2.55.64 7.0 7.7 19 2.55.64 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 </th <th></th> <th></th> <th>≥</th> <th></th> <th>NA</th> <th>mg/kg</th> <th>mg/kg</th> <th>%</th> <th>%</th> <th>%</th> <th><</th> <th>7</th> <th>NA</th> <th>mg/kg</th> <th>mg/kg</th> <th>%</th> <th>%</th> <th>%</th>			≥		NA	mg/kg	mg/kg	%	%	%	<	7	NA	mg/kg	mg/kg	%	%	%
26 6 6 13 10.1 55 13 0 255,9 20 25,0 20 25,0 20 25,0 20 25,0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20		Al	38		0		53 085	1.	22,3	7,3	77	19	2		55 564		17,7	7,5
28 4 78.88 46.6 5.2 68 17 0 83.77 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.6 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7 27.7		Sb	_		0		226,5	Q	13,8	10,1	22	13	0		255,9		20	9'6
19 4 6 164.1 6,1 2,9 38 6 164.4 94 94 14 3 4 4 163.2 17.2 47.1 65 16 0 1320.5 108.8 108.8 13 3 6 1.87 4.7 4.7 4.7 1.7 6.0 1.78 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.7 1.8 1.7 1.8 1.7 1.8 1.7 1.8 1.7 1.7 1.8 1.7 1.8 1.7 1.8 1.7 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 <td< td=""><td></td><td>As</td><td></td><td></td><td>4</td><td></td><td>78,88</td><td>XX</td><td>9'9</td><td>5,2</td><td>89</td><td>17</td><td>0</td><td></td><td>83,77</td><td></td><td>27,6</td><td>8</td></td<>		As			4		78,88	XX	9'9	5,2	89	17	0		83,77		27,6	8
14 3 4 163.2 44.1 65 16 0 1320.5 108.8 108.8 13 3 1 4 34 39 36 9 1.78 1.78 1.74 1.78 1.78 1.78 1.74 1.78 1.78 1.78 1.74 1.78 1.13 1.78 1.78 1.79 1.74 1.78 1.78 1.79 1.79 1.78 1.79 1.79 1.79 1.78 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79 1.79		В	19				164,1	Ď,	6,1	2,9	38	6	2		176,4		9,4	3,4
44 39 36 6 1,78 1,78 174 174 45 10 6 514,9 15,4 4,6 11 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 </td <td></td> <td>Ва</td> <td></td> <td></td> <td>4</td> <td></td> <td>163,2</td> <td>7</td> <td>\$ 17,2</td> <td>47,1</td> <td>65</td> <td>16</td> <td>0</td> <td></td> <td>1 320,5</td> <td></td> <td>108,8</td> <td>15,4</td>		Ва			4		163,2	7	\$ 17,2	47,1	65	16	0		1 320,5		108,8	15,4
45 10 0 5149 47 410 417 411 27 41 213,2 41 417 417 417 417 417 417 417 417 417 417 417 417 417 417 418 418 417 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418 418		Be			0		1,87		9,4	3,9	36	6	0		1,78		17,4	4,5
4 5 6 13 4 7 4 17 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		Cd		-			514,9		15,2	4,6	111	27	1		513,2		12,7	4,9
4 11 5 186,9 13,3 65,2 107 66 0 206,9 17,6 17,6 45 10 4 20,73 10 4,3 15 4 20,73 11 5 45 10 5 114,5 18,4 4,3 15 28 1 113,5 113 22,0 11 4 113,6 11 11 113,6 11 11 11 113,6 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11		Ca			2		83 584		4,7	1,7	26	13	4		79 614		12,9	6,7
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		Cr	_	_			186,9		13,3	5,5	107	26	0		206,9		17,6	6
45 10 5 1149,5 18,4 4,3 115 28 1 1135,8 13 13 13 13 13 13 13 13 13 13 13 14,5 3,5 91 23 1 1044 11 11 11 11 14 11 14,5 3,5 91 28 1 11044 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 10 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 </td <td></td> <td>Co</td> <td></td> <td></td> <td></td> <td></td> <td>23,25</td> <td></td> <td>27</td> <td>TO,</td> <td>9/</td> <td>19</td> <td>4</td> <td></td> <td>26,73</td> <td></td> <td>22,6</td> <td>5,8</td>		Co					23,25		27	TO,	9/	19	4		26,73		22,6	5,8
4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 4 10 5 <		Cu	_				1 149,5		18,4	4,3	115	_	1		1 135,8		13	4,5
52 12 0 11816 16,5 4,5 64 46 1044 1044 10,8 10,8 34 7 0 13072 17,4 4,3 64 4,5 0 11916 12,6 12,6 52 12 0 1249,7 17,4 3,9 98 26 1 1173,6 12,6 12,6 30 7 0 31,31 20,2 10,9 52 13 40,49 29,82 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 <td></td> <td>Fe</td> <td></td> <td></td> <td></td> <td></td> <td>17 644</td> <td></td> <td>14,5</td> <td>3,5</td> <td>91</td> <td>23</td> <td>1</td> <td></td> <td>18 024</td> <td></td> <td>11</td> <td>5,4</td>		Fe					17 644		14,5	3,5	91	23	1		18 024		11	5,4
34 7 64 75 64 75 0 11916 12.6 12.6 52 12 0 12497 17,4 3,9 98 25 1 1173.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 12.6 <td></td> <td>Pb</td> <td>_</td> <td>_</td> <td></td> <td></td> <td>11 816</td> <td></td> <td>16,5</td> <td>4,5</td> <td>103</td> <td>26</td> <td>1</td> <td></td> <td>11044</td> <td></td> <td>10,8</td> <td>4,6</td>		Pb	_	_			11 816		16,5	4,5	103	26	1		11044		10,8	4,6
52 12 0 1249,7 17,4 3,9 98 25,1 1173,6 12 12 1173,6 12 12 14 11 13,1 10,9 52 13 40,4 14 10 13 10,9 52 13 40,4 12,8 10 12,2 12,8 10 12,2 12,2 12 12,8 12 42,84 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12 12,2 12,2 12,2 12,2 12 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2		Mg			0		13 072		17,4	4,3	64	3			11 916		12,6	6'9
30 7 0 31,31 20,2 10,9 52 13 60 29,82 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2 17,2		Mn					1 249,7		17,4	3,9	86	25	74		1 173,6		12	4,8
44 3 4 46,37 13,1 2,9 41 10 4 42,84 9 9 45 10 5 4 11 3,8 110 28 6 6,63 9 19,2 19 4 0 5839,1 5,8 2,4 27 6 5 6074,1 2,3 19,2 1 11 2 2 2 7 6 5 6074,1 2,3 1 2,3 1 1 1,2 1 6074,1 2,3 1 1 2,3 1 1 1 1,3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Hg			0		31,31		20,2	10,9	52	13	0	•	29,82		17,2	6'9
45 40 5 84,76 11 3,8 110 28 6,643 86,63 19,2 19 4 0 5839,1 5,8 2,4 27 6 5 6,74,1 30,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3 12,3		Мо			1		46,37		13,1	2,9	41	10		2\S	42,84		8'6	4,9
19 4 0 5839,1 5,8 2,4 27 6 7 6074,1 2,3 2,3 31 7 5 2 1 2,4 3,8 6,1 15 1 40,49 7 12,2 7 24 5 0 63,05 7,8 6,6 3 9 0 65,12 7 12,1 12,1 1 12,1 1 1 12,1 1 1 1 40,49 12,1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td< td=""><td></td><td>Ni</td><td></td><td></td><td></td><td></td><td>84,76</td><td></td><td>11</td><td>3,8</td><td>110</td><td>28</td><td>0</td><td>%</td><td>86,63</td><td></td><td>19,2</td><td>6,4</td></td<>		Ni					84,76		11	3,8	110	28	0	%	86,63		19,2	6,4
31 7 5 26 720 32,4 3,8 6,1 15 1 40,49 12,2 12,2 24 5 0 63,05 7,8 6,1 8,2 7 1 40,49 12,1 12,1 10 2 0 63,05 7,8 6,6 38 9 0 65,12 24,9 24,9 10 2 0 32,304 7,3 1,9 26 6 0 29,916 24,9 7 33 7 5 30,315 12,9 5,9 6 1 28,404 20,1 7 17 4 1 4 1 316,2 7 1 1 316,2 7 13,55 1		Ь	19		0		5 839,1		5,8	2,4	27	9	2	0	6 074,1		2,3	2,2
8 2 1 40,49 40,49 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 12,2 </td <td></td> <td>×</td> <td>31</td> <td></td> <td>2</td> <td></td> <td>26 720</td> <td></td> <td>32,4</td> <td>3,8</td> <td>61</td> <td>15</td> <td>1</td> <td>2</td> <td>33 445</td> <td></td> <td>12,2</td> <td>2,9</td>		×	31		2		26 720		32,4	3,8	61	15	1	2	33 445		12,2	2,9
24 5 0 63,05 7,8 6,6 38 9 0 65,72 24,9 24,9 10 2 0 32,304 7,3 1,9 26 6 0 29,916 24,2 24,2 33 7 5 30,315 12,9 5,9 6 15 2 28,404 20,1 20,1 17 4 1 273,8 8 3,7 50 12 1 1 316,2 7 13,5 13,5		Se			1		30,54		6,1	8,2	56	7	1		40,49		12,1	10,2
10 2 0 32 304 7,3 1,9 26 6 0 29 976 7 24,2 24,2 33 7 5 30 315 12,9 5,9 62 15 2 28 404 5 20,1 20,1 17 4 1 273,8 8 3,7 50 12 1 316,2 316,2 13,5		Ag	-		0		63,05		7,8	9'9	38	6	0		65,12		24,9	6'2
33 7 5 4 1 28 404 28 404 20,1 20,1 17 4 1 273,8 8 3,7 50 12 1 316,2 316,2 13,5		S	10		0		32 304		7,3	1,9	26	9	0		29 916		24,2	9'9
17 4 1 273,8 8 3,7 50 12 1 316,2 N 13,5 13,5		Na	_		2		30 315		12,9	6'5	62	15	2		28 404	2	20,1	5,3
		Sr					273,8		8	3,7	20	12	1		316,2		13,5	2,4

Table B.2 (continued)

Math								SAMPLEC	SAMPLE CEN 7/99 "ASH CW4 POWDER"	SH CV	74 PC)WDE	:R"				
NABEF Mean Mean Mean Mean Reprod % % % % % % % % % % % % % % % % % % %			Met	:hod	A1: Therm	al heating,	with aqua reg	gia in reflux s	ystems		Meth	od B:	Microwav	e assisted, w	vith aqua re	gia in closed	vessels
Mg/kg % % 0 2346,1 10 4,1 44 10 0 2196,2 10,6 10,6 0 2,36 10 0 0 0 0 11,4 10 3 0 29,69 103,8 103,8 0 2,36 4,8 4,7 30 7 0 3462,1 23,8 23,8 5 30,46 4,4 54 13 4 4 37,73 13,1 13,1 6 23,79 23,1 7,8 105 2 24,716 12,1 12,1		>		77.7	XREF	Mean	Recov	Reprod	Repeat	>	_	7.7	XREF	Mean	Recov	Reprod	Repeat
0 2346,1 4,1 4,1 4,6 10 2196,2 10,6 10,6 0 2,36 1,4 10 3 0 29,69 103,8 103,8 0 2,36 4,8 4,7 30 7 0 29,69 103,8 103,8 5 30,46 45,60 4,4 54 13 4 37,73 13,1 13,1 0 23,795 23,1 7,8 105 26 2 24,716 12,1 12,1		٨	7	INA	mg/kg	mg/kg	Õ	%	%	<u> </u>	7	MA	mg/kg	mg/kg	%	%	%
0 2,36 0 11,4 10 3 0 29,69 103,8 0 2,750,9 4,8 4,7 30 7 0 3462,1 23,8 5 30,46 45,6 4,4 54 13 4 37,73 13,1 0 23,795 23,1 7,8 105 26 2 24,716 12,1	Sn	14				2 346,1	2	10	4,1	44	10	0		2 196,2		10,6	7,3
0 2,36 11,4 10 3 0 29,69 103,8 103,8 0 3,462,1 23,46 13,4 2,4 3,4 3,4 3,4 3,7 3 13,4 2,4 3,4 3,4 3,4 3,4 3,4 3,4 3,4 3,4 3,4 3	Te			0)=	<i>C</i>		0	0	0					
0 2 750,9 4,8 4,7 30 7 0 3 462,1 23,8 5 30,46 45,60 4,4 54 13 4 13,73 13,1 0 23,795 23,1 7,8 105 26 2 24,716 12,1	I	4	1	0		2,36		- 5	11,4	10	3	0		59,69		103,8	3,2
5 30,46 45,60 4,4 54 13 4 37,73 13,1 13,1 0 12,1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 1 12,1 12,1 1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1 12,1	Ti	13	3	0		2 750,9		4.8	4,7	30	7	0		3 462,1		23,8	6'8
0 23795 23,1 4, 7,8 105 26 2 24716 12,1	>	27	9	2		30,46		45,60	4,4	54		4		37,73		13,1	5,4
	Zn	54	12	0		23 795		23,1	2,8	105	26			24 716		12,1	2,6

Ato View the full PDF of 150 5A321.2020

Table B.3 — Analytical results, SAMPLE CEN 8/99 "INK WASTE CW12 POWDER"

								O 1	SAMP	LE CE	5/8 N3	INI,, 66	MPLE CEN 8/99 "INK WASTE CW12 POWDER"	CW12	POWD	ER"								
		Meth	od A	1: Ther in	Method A1: Thermal heating, with aqua regia in reflux systems	ng, with tems	ı aqua re	gia	Met	l pod	B: Mic	rowav in clo	Method B: Microwave assisted, with aqua regia in closed vessels	d, wit	h aqua r	egia		Met]	γ poι	V2: The bloc	Method A2: Thermal heating, with a heating block with containers	ing, wit itainers	h a heati	ing
	>		777	XREF	Mean	Reco	Rector Reprod	Repeat	>			rs	Mean	Recov	Recov Reprod	Re- peat	>	_	-	XREF	Mean	Recov	Recov Reprod	Repeat
	>	7	INA	mg/ kg	mg/kg	%	7%	%	N	7	//////////////////////////////////////	mg/ r	mg/kg	%	%	, %	N	Т	INK	mg/ kg	mg/kg	%	%	%
Al	37	6	0		1 225,2		26,92	8,1	72	18	2	1	1 387,8		22,5	8,7	22	11	0		1 232		21,2	4,1
Sb	8	2	0		30,3		116,9	14	28	7	0		53,65		86'8	12,4	15	11	7		1,44		9'05	17,5
As	22	9	4		6,33		10,6	4,1	30	7	2		5,71		34,1	14,6	16	12	8		7,39		4,6	2,0
В	11	3	0		22,06		75,5	18,9	24	, 9	4		44,06		68,7	9								
Ва	23	2	0		80,11		9'6	12,9	64	75	0		97,43		16,1	8,3	22	11	0		26,7		22,6	8,9
Be	6	2	0		0,17		44,8	31,2	13	2	0		0,42		116,9	6'8								
рЭ	21	2	0		0,72		6'85	40,9	20	18	19		4,59		117,3	12,1	20	12	4		0,44		7,4	8,6
Ca	33	7	0		116 663		7,3	4,8	26	13	. 0	7, 1	115 640		8,5	5,2	20	10	0		118 220		7,4	2,2
Cr	54	12	0		3 529,9		12,4	9'9	104	25	2	ic ic	3 624,0		11,4	4,9	24	12	0		3 724		6'9	6,5
Co	40	6	0		14,3		19,1	10,1	29	17	4		14,56		23,1	5,8	20	10	0		14,6		11,7	4,3
Cu	53	12	1		12 782		14,5	9'9	113	27	2		12 285		10,3	3,1	24	12	0		13 089		8,2	4,4
Fe	44	10	0		73 215		10,8	9,6	87	21	0		7 96 92		6,7	4,9	22	11	0		75 430		11,4	2,2
Pb	52	12	0		6 042,2		13,5	2,7	66	24	0	LC.	5 855,9	N	6'2	4	24	12	0		6 055		7,4	3,1
Mg	24	2	0		942,9		13,6	8	22	14	2	1	1 039,5	Ø,	22	5	20	10	0		982		2,0	2,3
Mn	52	12	0		521,1		7,7	4	62	24	4		544,3		1/8/	4	22	11	0		563		6,8	2,3
Hg	27	9	0		1,94		18,3	14,1	45	12	2		2,0		41,3	14,9	24	12	0		1,79		9,2	3,6
Mo	14	3	0		3,3		1,4	19,7	16	4	0		3,95		39,9	44,9	18	10	2		3,60		8'92	0,6
N	45	10	1		22,49		39	23,4	91	23	6		20,67		31,8	10.5	24	12	0		20,1		13,9	5,8
Ь	19	4	0		13 305		6,2	2,5	28	9	0		14 215		3,2	2,2	20	10	0		14 202		5,1	3,1
X	56	7	0		661,5		75,6	8,6	56	14	1		997,3		47,9	14,2	20/10	10	0		683		0,9	3,2
Se	4	1	0		2,9			10,7	7	2	1		5,67		2,1	13,3	16	14	9		3,23		24,7	14,4
Ag	7	2	0		1,79		3,8	4,6	17	2	0		4,34		72	58,6			5					
S	10	2	0		27 399		11,2	1,6	23	2	1	7	28 708		9,4	2,4	20	10	0	رن: ا	27 041		10,8	9'6
Na	33	7	0		5 265,5		32,9	8,4	54	13	2	4	4 664,4		22,4	2,6	20	10	0	Şt	4 838		2,8	2,4
N .	Num	ber c	of res	sults, L	= Number	of labor	atories,	$NA = N\iota$	ımbe	r of or	utlier	s, <i>NR</i> =	Number	of res	ults reje	cted for	sta	tistic	al ev	raluatib	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value	Convent	ional tru	e value

(where applicable)

Table B.3 (continued)

									SAMI	PLE C	EN 8,	II., 66/	SAMPLE CEN 8/99 "INK WASTE CW12 POWDER"	E CW1.	2 POWD	ER"								
		1eth	od A	1: Ther	Method A1: Thermal heating, with aqua regia in reflux systems	ng, wit tems	haqua r	egia	Met	thod	B: M	icrow.	chod B: Microwave assisted, with aqua regia in closed vessels	ted, wit	th aqua	regia		Metk	nod Až	2: Ther block	Method A2: Thermal heating, with a heating block with containers	ing, wit tainers	h a heat	ing
	Z	7	NA	XREF mg/ kg	Mean mg/kg	Recov %	Recov Reprod Repeat	Repeat	N	7	NA L	XREF mg/ kg	Mean mg/kg	Recov %	Recov Reprod	Re- peat %	2		$NR \mid \frac{X_{\rm I}}{1}$	XREF mg/ kg	Mean mg/kg	Recov %	Recov Reprod Repeat % % %	Repeat %
Sr	18	4	0		108,4		9,4	1,3	47	11	0		121,5		14,5	3,4	18	6	0		118		0'6	3,8
Sn	2	1	0		1,18		I	2,2	3	3	0		8,64		110,8	2,7	14	10	9		3,99		39,0	21,4
Te	0	0	0) <u>.</u>	€	0													
I	3		0				1	32,7	13	3	Ø		62,47		75,8	4,4								
Ţ	14	3	0		78,84		5,3	27,8	18	Ŋ	<i>y</i>		96,75		4,2	5,5	20	10	0		75,2		11,2	4,4
>	22	2	2		16,97		33,2	20,2	43	10	1	Š	16,18		34,2	2,9	20	10	0		14,4		5,1	4,8
Zn	44 10		9		1 136,5		9,3	9'9	103	25	7	C	1 173,2		11,5	3,2	24	12	0		1 222		7,2	4,3
N =	Num	ber (of res	sults, L	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR → Number of results rejected for statistical evaluation, XREF = Conventional true value	of labo	ratories,	$NA = N_1$	umbe	r of o	utlie	rs, NR	₹Numbe	r of res	ults reje	cted fo	r sta	tistic	al eva	luation	1, XREF = 0	Convent	ional tru	ae value
(whe	ere a	pplic	(where applicable)	_									1											

Addition of results rejected for statistical evaluation, XREF = Co

Table B.4 — Analytical results, SAMPLE CEN 9/99 "SEWAGE SLUDGE SL11 POWDER"

								SAI	APLI	CEN	6/61	S. SEW	SAMPLE CEN 9/99 "SEWAGE SLUDGE SL11 POWDER"	GE SL1	1 POWD	ER"								
	_	Meth	od A	1: Therm	Method A1: Thermal heating, with aqua regia in re- flux systems	with ac	lua regia	in re-	M	etho	d B: N	Microw in	Method B: Microwave assisted, with aqua regia in closed vessels	ted, wit ssels	h aqua r	egia		Meth	od A	2: Ther block	Method A2: Thermal heating, with a heating block with containers	ing, wit tainers	h a heat	ting
	<	$N \mid L$	NA		Mean	Recov	Re- prod	Repeat	N	T	NA 1	XREF mg/		Recov	Reprod	Repeat	N	T	NR	XREF mg/	Mean	Recov	Re- prod	Repeat
	_	-		mg/kg	mg/kg	%	20	%			_	kg	mg/kg	%	%	%				kg kg	mg/kg	%	%	%
Al	_	29 7	0 /		829 62		24,6	6,4	29	16	5		81 848		6,7	2,5	22	11	0		92 515		9,2	4,3
Sb	b 3	3 1	. 1		2,2		_	8,6	16	4	0		19,49		103,9	25,6	14	11	8		3,9		13,8	3,6
As	s 17	7 5	0		4,03		58,5	16,2	19	2	4		4,43		78,1	22,2	14	12	10		2,2		51,1	29,8
В	_	19 4	0		328,1		28,4	16,6	33	8	2		279,9		15,6	3,4								
Ва		27 6	0		61,8		18,9	6'2	54	12	8		76,52		9,8	2,7	20	11	2		22		50,4	5,4
Be		5 1	0		1,45		1	17,6	13	3	0		1,79		147,8	29,3								
Cd	_	14 3	4		0,74		142,8	73,8	30	7	67		0,23		32,1	16								
Ca	a 21	1 5	0		58 521		17,2	2,6	09	14	0	Ċ	57 232		11	6'5	20	10	0		60 762		8,2	4,1
Cr	_	40 9	4		78,47		19,6	5,8	92	23	10	jic	77,24		10,2	4	24	12	0		83,2		16,3	3,2
Co	_	26 6	0		3,16		53,5	12,4	39	11	4	,	4,59		24,9	9,8	18	10	2		5,92		13,4	2,8
Cu	u 31	1 7	, 13		91 351		3,3	2,6	96	23	2		96 534		13,2	3,5	24	12	0		103 505		5,9	3,6
Fe	e 43	3 10	0 4		4 021,1		10,6	7,2	81	20	7		4 4403		11	3,6	22	11	0		4 869		9,7	4,3
Pb	-	33 8	14		9 302,6		5,6	3,6	96	23	7		9 327,5	, X	11,2	2,9	24	12	0		10 169		7,0	2,0
Mg	g 21	1 5	0		1 992,1		19	2,6	09	14	0		2 309,1	e	14,2	4,2	20	10	0		2 507		3,5	16,8
Mn	_	46 11	1 5		587,6		6	2,8	92	23	2		590,2	\sim	12,2	3	22	11	0		629		9,4	2,6
Hg	$\overline{}$	15 3	4		0,19		46,7	6,7	27	_	12		0,14		52.7	10,8	16	12	8		0,16		11,1	3,1
Mo	$\overline{}$	13 3	0		3,56		8'9	7,4	22	9	1		4,33		11,1	6,4	16	10	4		3,42		29,2	9,3
Ν̈́	i 40	0 0	6 (1 568,6		18,7	6,1	100	25	2		1 729,6		10,6	33	24	12	0		1880,8		6,8	1,7
Ь	_	13 3	0		4 012,9		24,7	6,7	18	4	10		4 724,5		3,8	6,3	16	9	2		5 269		7,2	17,0
X	(21	1 5	0		467,8		58,6	3,8	48	12	4		629,5		39,1	6,8	(18	10	2		495		6,6	3,2
Se	e 0	0 0	0 (8	2	0		7,03		110,2	14	Ċ	2						
Ag	_	18 4	0 1		89'6		21	7	28	7	0		10,53		14,7	13,1	18	10	3		10,3		9,1	4,1
S	_	10 2	0		29 698		12,8	1,8	26	9	0		61 982		8,8	1,7	20	10	0		67 576		18,1	2,8
Na		28 6	1		11 805		10,8	4,3	64	15	0		11 041		22,7	9	20	10	0	, O	12 684		0'6	9'2
N ap	<i>N</i> = Numbe applicable)	mbe: ible)	r of r	esults, L =	N= Number of results, $L=$ Number of laboratories, $NA=$ Number applicable)	laborat	ories, NA	= Numb		outli	ers, A	<i>IR</i> = Nu	of outliers, NR = Number of results rejected for statistical evaluation, λ^{REB} = Conventional true value (where	sults re	jected fo	r statist	ical (evalı	ıation	, XREB=	= Convent	ional tru	ie value	(where

Table B.4 (continued)

						(SAI	MPL	E CE	6/6 N	9 "SEV	SAMPLE CEN 9/99 "SEWAGE SLUDGE SL11 POWDER"	DGE ST	11 POWD	ER"								
	Me	thod	1 A1: 5	Therm	Method A1: Thermal heating, with aqua regia in re- flux systems	with aq ms	ua regia	in re-	Σ	ethc	od B:	Micro	lethod B: Microwave assisted, with aqua regia in closed vessels	sted, wi	th aqua r	egia		Met	pou /	V2: The	Method A2: Thermal heating, with a heating block with containers	ing, wit	h a hea	ting
	×	L NA	-	XREF mg/kg	Mean mg/kg	Recov %	Be prod	Repeat	×	T	NA	XREF mg/ kg	Mean mg/kg	Recov %	Recov Reprod Repeat % % %	Repeat %	≥	7	NR	XREF mg/ kg	Mean mg/kg	Recov %	Re- prod %	Repeat %
Sr	18	4	0		195,2		9,5	2,20	41	10	10		200,8		5,6	2,4	18	6	0		205		15,0	6,2
Sn	14	3	0		17 840		18,2	1,8	35	8	2		19 155		5,2	9'9	20	10	0		16 394		17,3	30,0
Te	0	0	0						ک	6	0													
Ξ	0	0	0						9	7	00		18,65		203	9'6								
Ţ	12	3	0		24,64		35,7	3	21	5	B		29,78		28,2	6'8	20	10	0		24,2		21,4	11,9
>	18	4	r2		6,83		77,1	32,3	25	7	14	C	6,36		17,6	2,3	20	10	0		7,14		10,5	6,2
Zu	48 11		2		209,6		35,5	23	66	24	4	IC)	228,1		34,9	5,5	24	12	0		219		8,1	1,9
N = Numbe applicable)	umk :able	er o	of resu	ults, L =	N = Number of results, $L = Number of laboratories$, $NA = Number of outliers$, $NR = Number of results rejected for statistical evaluation$, $XREF = Conventional true value (where applicable)$	laborato	ories, NA	= Numb	er of	outl	iers, ,	NR = N	umber of r	esults r	ejected fo	r statis	tical	evalı	natio	n, <i>XREF</i>	= Conventi	onal tru	ie value	(where

Defull PDF of 150 54321.2020

Table B.5 — Analytical results, SAMPLE CEN 10/99 "SEWAGE SLUDGE" (BCR 146R)

Mile Mile							SAMF	SAMPLE CEN 10/99 "SEWAGE SLUDGE" (BCR 146R)	/99 "SEW∤	AGE ST	UDGE" (BCR 1	46R)				
N AMERICAL Mean Reprod Reprod Reprod Reprod Reprod Reprod Reprod Reprod AMERICAL Mean Recover Reprod AMERICAL Marker Mean Recover Reprod AMERICAL AMERICAL AMERICA		2	Tethoc	1 A1: 1	Thermal hea	iting, with a	qua regia ii		stems		Method	B: Mic	rowave ass	isted, with	aqua regia	in closed ve	ssels
7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		2	_	72	XREF	Mean	Recov	Reprod	Repeat	2		77	XREF	Mean	Recov	Reprod	Repeat
31 6 6 6 5 3 2 3 8 4 6 5 4 6 5 4 6 5 4 6 5 6 6 5 6 6 6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		N .	7	MA	mg/kg	mgAkg	%	%	%	N	7	IVA	mg/kg	mg/kg	%	%	%
10 6 16,25 7,24 446 55,8 4,8 29 7 2 16,25 9,33 57,4 9,1 1,1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <t< td=""><td>Al</td><td>37</td><td>6</td><td>0</td><td>25 130</td><td>21 230</td><td>84,5</td><td>25,4</td><td>5,4</td><td>62</td><td>20</td><td>0</td><td>25 130</td><td>20 652</td><td>82,2</td><td>19</td><td>6,1</td></t<>	Al	37	6	0	25 130	21 230	84,5	25,4	5,4	62	20	0	25 130	20 652	82,2	19	6,1
2 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 7 6 6 7 7 6 1 6 7 7 6 1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Sb	19	2	0	16,25	7,24	44,6	55,8	4,8	29	7	2	16,25	9,33	57,4	21,5	9'2
1 4 0 735 4 0 4 0 735 437 735 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737 737	As	29	7	0	6,3	6,32	6,000	53,3	40,3	29	8	4	6,3	5,52	87,6	31	11,6
2 6 735 479,3 65,2 13,7 63 15 6 735 57,8 770 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707 707	В	15	4	0		21,9	0,	15	16,8	23	9	0		38,7		37,3	15
13 3 0 18.8 4 10.2 2.1 10.2 2.2 5 4 0.75 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7	Ba	23	2	0	735	479,3	65,2	13,9	13,7	63	15	0	735	572,8	6'22	20	4,6
45 11 0 18,76 16,26 86,7 44,8 9,6 82 20 14 18,76 11,24 600 154,356 9,8 17/1 44,4 60 14 0 154,600 154,356 9,8 17/1 44,4 60 14 0 154,600 154,356 9,8 17/1 44,4 60 14 0 154,600 164,65 9,8 17/2 44 60 14 0 154,600 140,455 9,9 87,7 14 0 154,600 140,455 9,9 87,7 14 0 154,600 140,455 9,9 87,7 14 15 17 0 154,60 14,9 15,7 14 17 10 17,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9 14,9<	Be	13	3	0		0,88		21,7	10,2	22	5	4		0,75		5,7	6,1
4 6 1 154 600 154356 99,8 17% 4,4 60 14,600 104455 90,9 87 4 10 4 10 15,600 164,60 84,9 137.2 33 103 25 0 196 164,60 84 13,6 13,7 33 103 25 0 196 164,60 84 13,7 103 25 0 196 164,60 84 13,7 103 25 0 196 164,60 84 13,6 13,9 13,6 13,6 13,6 13,6 13,6 13,2 13,2 13,2 10,2 10,6 13,9 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 13,2 1	Cd	45	11	0	18,76	16,26	86,7	74,8	9'6	82	20	14	18,76	17,15	91,4	8,8	4,5
45 10 4 106 1456 83,4 13,7 33 103 25 0 196 164,6 84 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,6 13,7 13,6 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7 13,7	Ca	27	9	1	154 600	154356	8'66	177	4,4	09	14	0	154 600	140 455	6'06	8,7	3,7
31 8 0 7,39 6,49 87,8 35,1 78,4 64 17 0 7,39 6,08 82,3 19,2 32 7 9 837,9 765,6 91,4 3 27,4 112 27 0 837,9 86,3 11,7 3 28 6,08 837,9 86,3 11,7 3 3 6,08 83,9 12,2 2 0 16100 13889 86,3 11,7 3 3 86,2 2 0 16100 13899 86,3 11,7 3 2 0 16100 13,3 11,7 3 0 16100 13,3 11,7 3 0 16100 13899 86,3 11,7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Cr	45	10	4	196	163,6	83,4	13,7	2,3,3	103	25	0	196	164,6	84	13,6	3,4
30 7 9 837,9 765,6 91,4 3 2,7 112 27 0 837,9 806,7 96,3 13,3 3 34 8 5 16100 13500 83,9 12,2 5 90 16100 13889 86,3 11,7 1 42 10 5 608,7 534,0 87,7 10,1 3,3 98 24 0 608,7 530,8 86,3 11,7 1 1 1 10460 9446,1 90,3 17,8 8,5 64 745 0 608,7 530,8 87,2 13,3 1 1 1 1 1 10460 9446,1 90,3 17,8 8,5 64 745 0 10460 9031,3 86,3 9,3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <t< td=""><td>Co</td><td>31</td><td>8</td><td>0</td><td>7,39</td><td>6,49</td><td>87,8</td><td>35,1</td><td>8,4</td><td>64</td><td>17</td><td>0</td><td>7,39</td><td>80'9</td><td>82,3</td><td>19,2</td><td>5,7</td></t<>	Co	31	8	0	7,39	6,49	87,8	35,1	8,4	64	17	0	7,39	80'9	82,3	19,2	5,7
34 8 5 16100 13500 839 122 64 16100 13889 86,3 11,7 42 10 5 608,7 534,0 87,7 10,1 3,3 98 24 0 608,7 530,8 87,2 13,3 30 7 1 10460 9446,1 90,3 17,8 8,5 64 445 0 10460 9031,3 86,3 13,3 43 10 0 323,5 262,9 81,3 14,3 3,1 92 23 0 10460 9031,3 86,3 10,9 31 7 0 8,62 7,06 81,3 14,3 3,1 10 8,62 7,44 84,8 10,9 3 10 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 <td< td=""><td>Cu</td><td>30</td><td>7</td><td>6</td><td>837,9</td><td>765,6</td><td>91,4</td><td>3</td><td>2,4</td><td>112</td><td>27</td><td>0</td><td>837,9</td><td>806,7</td><td>96,3</td><td>13,3</td><td>7,3</td></td<>	Cu	30	7	6	837,9	765,6	91,4	3	2,4	112	27	0	837,9	806,7	96,3	13,3	7,3
42 10 5 608,7 534,0 87,7 10,1 3,3 48,2 24 0 608,7 530,8 87,2 13,3 7 30 7 1 10460 9446,1 90,3 17,8 8,5 64 45 94 64 45 94 64 45 94 64 45 9 10460 9031,3 86,3 13,3 14,3 3,1 9 28 6 10460 9031,3 86,3 10,9 323,5 274,4 84,8 10,9 3 10,9 3 10,9 3 10,9 3 10,9 3 10,9 3 25,1 10,9 8,1 10,9 3 10,9 3 10,9 3 10,9 3 10,9 3 10,9 10,9 3 10,9 3 10,9 3 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10 10,9 10,9 10<	Fe	34	8	2	16 100	13 500	83,9	12,2	5	89	22	0	16 100	13 889	86,3	11,7	3,6
30 7 1 10460 9446,1 90,3 17,8 8,5 64 45 0 10460 9031,3 86,3 9,3 9 43 10 0 323,5 262,9 81,3 14,3 3,1 92 23 0 323,5 274,4 84,8 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9 10,9<	Pb	42	10	2	2'809	534,0	87,7	10,1	3,3	786	24	0	2'809	530,8	87,2	13,3	3,4
43 10 0 323,5 262,9 81,3 14,3 3,1 92 23 0 323,5 274,4 84,8 10,9 31 7 0 8,62 7,06 81,9 27,2 12,2 41 10,40 8,62 7,39 85,7 25,1 49 11 4 0 8,67 12,2 41 10,40 8,62 7,39 85,7 25,11 49 11 6 6,7 8,67 112,3 18,1 5,4 10 60,7 62,54 89,7 21,7 30 7 5 58,08 83,3 18,1 5,3 5 1 7 1 25,60 27,658 10 27,4 10 27,4 20,54 34,7 34,7 2 1 0 25,40 25,40 20,56 38,7 34,7 40 1 44,4 11 38 9 0 4,44 11 38	Mg		7	П	10 460	9 446,1	60,3	17,8	8,5	64	45	0	10 460	9 031,3	86,3	9,3	3,3
31 7 8 6 8 6 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 9 8 7 7 7 9 7 9 8 7 7 7 7 7 7 7 7 7 7 7 7 7 9 9 7 7 7 7 7 7 9 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Mn		10	0	323,5	262,9	81,3	14,3	3,1	92	83	0	323,5	274,4	84,8	10,9	2,8
46 4 6 8,67 8,67 13,2 2,9 32 8 4 7,95 8 4 7,95 8 4 49 11 0 69,7 58,08 83,3 18,1 5,4 105 26 0 62,54 89,7 21,7 7 14 3 0 25,600 28,756 11,3 11,3 3,7 5,3 51 7 1 25,600 27,658 108 2,4 1 25,600 27,658 108 2,4 1 4 1 25,600 27,658 108 2,4 1 25,600 27,658 108 2,4 1 20,25,6 13,7 10,4 1 20,25,6 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4 10,4	Hg		7	0	8,62	2,06	81,9	27,2	12,2	41	10 6	0	8,62	7,39	85,7	25,1	10,8
49 11 0 69,7 58,08 83,3 18,1 5,4 105 26 69,7 62,54 89,7 21,7 14 3 0 25 600 28 756 112,3 11,3 9,3 31 7 1 25 600 27 658 108 2,4 2,4 2,4 3,4 3,4 3 4 1 25 600 27 658 108 2,4 3,4 3,4 3,4 3,4 3,4 3,4 3,4 3,4 3 0 52 40 27 56,8 38,7 34,7 3,4 3,4 3,4 3 0 52 40 20 25,6 38,7 3,4 3,4 3,4 3 0 4,74 4,74 4,7 4,7 4,7 4,7 4,7 4,7 4,7 4,7 4,4 1,1 38 9 0 10 620 9 188 4 86,5 17,7 4,4 11 6 1804 77,7 43,1 4,9 1 1	Mo	16	4	0		8,67		13,2	2,9	32	8	A		7,95		8,1	5,2
14 3 0 25 600 28 756 112,3 11,3 9,3 31 7 1 25 600 27 658 108 2,4 7 1 25 600 27 658 108 2,4 34,7 34,7 34,7 34,7 34,7 34,7 34,7 4 4 4 4 4 1,1 38 9 0 4,74 4,74 4 60 53,1 5 10,0 10,620 9021,6 84,9 15,4 8,7 26 6 0 10,620 9188,4 86,5 17,7 10 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0 10,0	ï	49	11	0	2'69	58,08	83,3	18,1	5,4	105	26	0	2'69 🔷	62,54	2'68	21,7	4,6
30 7 5 5 4 5 4 0 5 4 0 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Ь	14	3	0	25 600	28 756	112,3	11,3	6,3	31	7	1	55,600	27 658	108	2,4	2,8
2 1 0 2,67 — 4,4 1,1 38 9 0 4,74 50,9 60 60 60 60 60 60 71,0 38 9 0 10,620 9,18,4 86,5 17,7 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1 73,1	K	30	7	2	5 240	1313,8	25,1	33,7	5,3	26	14	0	5 240	2 025,6	38,7	34,7	17,3
18 4 1 38 1,1 38 9 0 10620 9021,6 84,9 15,4 8,7 26 6 0 10620 9 1884 86,5 17,7 41 9 0 1804 701,3 38,9 55,2 18,3 44 11 6 1804 777,0 43,1 28,1 28,1 19 4 0 1179 1019,6 86,5 10,6 1,3 46 11 5 1179 1027,2 87,1 49 49	Se	2	1	0		2,67		1		13	3	0) `	4,74		09	12,3
10 2 0 10 620 9 021,6 84,9 15,4 8,7 26 6 0 10 620 9 T88,4 86,5 17,7 17,7 43,1 28,1 17,7 41 9 0 1 804 701,3 38,9 55,2 18,3 44 11 6 1 804 777,0 43,1 28,1 28,1 19 4 0 1 179 1 019,6 86,5 10,6 1,3 46 11 5 1 179 1 027,2 87,1 4,9 4	Ag		4	1		198,8		4,4	1,1	38	6	0		6'061'		23,1	1,9
41 9 0 1804 701,3 38,9 55,2 18,3 44 11 6 1804 777,0 43,1 28,1 28,1 19 4 0 1179 1019,6 86,5 10,6 1,3 46 11 5 1179 1027,2 87,1 4,9 4,9	S	10	2	0	10 620	9 021,6	84,9	15,4	8,7	26	9	0	10 620	9 188,4	86,5	17,7	2,4
19 4 0 1179 1019,6 86,5 10,6 1,3 46 11 5 1179 1027,2 787,1 4,9	Na	41	6	0	1804	701,3	38,9	55,2	18,3	44	11	9	1804	777,00	43,1	28,1	4,3
	Sr	19	4	0	1 179	1 019,6	86,5	10,6	1,3	46	11	2	1 179	1 027,2	87,1	4,9	2

N = N amber of results, L = N and L

Table B.5 (continued)

						SAMI	SAMPLE CEN 10/99 "SEWAGE SLUDGE" (BCR 146R)	469 "SEW	AGE ST	UDGE"	(BCR 1	46R)				
		Tethod	A1: T	hermal hea	Method A1: Thermal heating, with aqua regia in reflux systems	qua regia i	n reflux sys	stems		1ethod	B: Mic	rowave ass	Method B: Microwave assisted, with aqua regia in closed vessels	aqua regia	in closed v	essels
	>	1	NN	XREF	Mean	Recov	Reprod	Repeat	7	,	NA	XREF	Mean	Recov	Reprod	Repeat
	۸,	7	INA	mg/kg	mg/kg	% %	%	%	<i>\</i>	7	ING	mg/kg	mg/kg	%	%	%
Sn	14	3	0	8'56	63,94	2'99	28,6	4,6	30	7	3	8,26	59,79	62,4	32,2	6,3
Te	0	0	0			5			0	0	0					
E	4	П	0		0,5	S)	ا د	7,7	4		0		4,12		I	8,7
Ξ	14	3	0	2 771	183,6	9'9	34,1	7,2	30	7	0	2 771	299,8	10,8	22,6	21,5
>	56	9	0	42,7	46,25	108,3	60k	4,8	20	12	8	42,7	34,14	80	9,8	3,3
Zn	43	10	9	3 061	2 810,0	91,8	12,1	6,5	108	26	0	3 061	2 813,5	91,9	10,8	4,5
N = N	Numbe	r of res	ults, L	= Number of	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value (where	NA = Numbe	r of outliers,	WR)= Numb	er of re	sults re	jected f	or statistical	evaluation, X	REF = Conve	entional true	value (where
appli	applicable)															,

William or results rejected for statistical evaluation, XREF = Con Market Marke

Table B.6 — Analytical results, SAMPLE CEN 11/99 "CITY WASTE INCINERATION ASH" (BCR 176, method A1 and B) (BCR176R, method A2)

					SAM	PLE CE	SAMPLE CEN 11/99 "CITY WA	CITY	WAST	EINC	INER/	ATION ASH	STE INCINERATION ASH" (BCR 176, method A1 and B) (BCR176R, method A2)	, metho	d A1 and	1B) (B	CR17	6R, n	nethod Az	2)				
	_	Meth	od A	Method A1: Thermal heating, with aqua regia in reflux systems	eating, with systems	aqua r	egia in	reflux	Met	hod B	: Micr	owave ass.	Method B: Microwave assisted, with aqua regia in closed vessels	aqua re	gia in cl	peso	Meth	od A	2: Therm	Method A2: Thermal heating, with a heating block with containers	g, with a	heating	g block	with
	~	7 N	NA	$\begin{array}{c c} A & XREF \\ & BCR176 \end{array}$	Mean	Recov	Re- prod	Re- peat	N	Γ	NA	XREF BCR176	Mean	Recov	Re- prod	Re- peat	~	Γ			Mean	Recov	Re- prod	Re- peat
				mg/kg	mg/kg	%	1%	%				mg/kg	mg/kg	%	%	%			mg/kg		mg/kg	%	%	%
Al	1 29	6 7	2	101 600	53 275	52,4	12,9	2	92	16	4	101 600	57 116	56,2	15,7	5,2	22	11	0	39	39 884		0,6	4,1
Sb	b 18	8 4	0	412	242,9	29	6,1	1,8	42	10	2	412	262,5	63,7	13,9	7,5	22	11	0 850		292	2'99	16,3	4,2
As	s 36	8 9	0	93,3	74,93	80,3	26,8	4,4	29	17	1	93,3	85,2	91,3	28,2	5,9	24	12	0 54		40,6	75,1	21,4	5,2
В	3 19	9 4	0		192,7		18,2	4	33	8	4		173,1		21,3	2,3								
Ba	a 23	3 5	0	4 500	280,6	6,2	73,8	12	79	15	0	4 500	1 329,6	29,2	119,6	11,2	22	11	0 4650		106	2,3	6'09	17,1
Be	e 12	2 3	1		1,79		5,4	1,6	30	10	1		1,89		15,9	10,4								
Cd	d 38	8 9	2	470	446,7	95	3,9	1,7	107	26	Z,	470	422,7	6'68	13,7	3,2	24	12	0 226		198	87,4	6,5	3,0
Ca	a 26	9 9	10	0 88 016	83 516	94,9	5,7	2,1	48	11	0	88 016	83 012	94,3	8,2	3	20	10	0	161	161 876		14,9	4,4
Cr	r 48	8 11	1 0	863	190,6	22,1	18,7	3,7	106	56	1	863	210,7	24,4	17,7	6,5	24	12	0 810		195	24,1	6'6	4,1
Co	0 39	6 6	0	30,9	22,1	71,5	38,3	6,2	72	18	8	30,94	26,62	86,1	21,6	5,1	20	10	0 26.7		20	76,2	13,2	3,8
Cu	n 38	8	0	1 302	1 125,2	86,4	7,3	2,3	115	28	1	1302	1154,1	9,88	11,1	3,1	24	12	0 1050		698	82,7	8,9	3,8
Fe	е 38	8	2	21 300	18 679	87,7	13,7	3,5	92	23	0	21 300	18 866	9,88	10,5	3,2	22	11	0 13 100		11 050	84,4	7,7	3,5
Pb	b 48	8 11	1 0	10870	10 843	2,66	16,5	3,4	101	25	3	10870	10 746	93,3	8,7	2,5	24	12	0 5 000		4 376	87,5	6,5	5,4
Mg	g 27	9 2	2	21 720	13 020	6'65	8,3	5,3	99	13	4	21 720	11 731	54	10,7	9	20	10	0	12	12 932		14,6	3,6
Mn	n 43	3 10) 5	1 500	1 318,3	87,9	11	3	94	24	0	1 500	1 269,3	84,6	8,4	2,3	22	11	0 730		615	84,3	19,9	3,5
Hg	g 29	9 7	0	31,4	32,79	104,4	24,2	10,5	52	13	0	31,4	29,86	95,1	24,9	7,7	22	12	2 1,6		1,06	66,1	15,6	8,8
Mo	0 17	7 4	0		47,49		12,5	4,1	42	10	4		43,58		13.5	5,8	22	11	0	2	25,1		22,8	5,4
Ϊ	i 38	8 9	6	123,5	83,31	67,5	5,7	2,9	100	25	0	123,5	91,42	74	14,6	4,9	24	12	0 117		81,0	69,2	21,2	4,1
Ь	27	9 2	0		12 655		868	7,4	32	7	0		6 212,5		5,3	2,8	20	10	0	9	6 619		13,7	3,2
\times	15	5 3	4	44 986	31861	8′02	8,7	1,8	58	14	0	44 986	31 613	70,3	16,7	5	20	10	0	32	32 461		8,0	3,8
Se	e 13	3 3	0	41,2	33,86	82,2	15	6,3	30	7	0	41,2	41,66	101,1	14,5	5,4	20	11	2 18,3		11,5	62,8	40,6	3,4
Ag	g 24	4 5	0	09	59,12	98,5	3,8	2,6	37	6	0	09	55,75	92,9	23,3	5,2	20	10	0 33,1		30,0	9,06	12,7	3,1
S	10	0 2	0	44 600	30 770	69	6,7	1,1	26	9	0	44 600	29 051	65,1	14,2	5,2	20	10	q	32	32 225		44,9	17,4
Na	a 27	9 2	5	42 920	28 524	66,5	8,2	4,8	64	15	0	42 920	26 037	2'09	19	2,6	20	10	C: 0	32	32 231		13,1	4,4
Sr	r 18	8	0	433	285,5	62'9	6,4	1,5	50	12	1	433	335,2	77,4	14,1	2,4	18	6	0	(2)	321		17,7	5,9
Sn	n 13	3 3	1		2 481,5		6,7	1,2	38	6	2		2 500,4		5,1	2,8	20	10	0	2	755		19,4	4,5
- N	= Nur	mber	of re	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value (where applicable)	ber of labor	atories,	$NA = N\iota$	ımber o	foutli	ers, M	R = Nu	mber of res	sults rejecte	ed for sta	itistical e	valuat	ion, X	REF =	- Conventi	ional true v	value (wł	nere app	licable)	

Table B.6 (continued)

E INCINERATION ASH" (BCR 176, method A1 and B) (BCR176R, method A2)	Method A2: Thermal heating, with a heating block with containers	L NR XREF Mean Recov Re- Re-	mg/kg mg/kg % % %		10 8 1,32 1,10 83,5 8,3 4,4	10 0 2 260 61,0 9,5	10 0 35 26,6 76,0 15,0 4,5	12 0 16 800 15 656 93,2 10,8 7,0	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value (where applicable)	lick to view the full PDF of 150 54321.2020
) (B(Re- peat	 %		6,5 12	3,1 20	2,2 20	2,9 24	ıluati	4,5
1 and B	in close	Re- R	6 %		9 8,69	21,8 3,	11,3 2,	9,8 2	tical eva	and or
y poq	regia				9			6	statis	
76, met	th aqua	Recov	%			41,5	91,3	95,6	sted for	inerio
H" (BCR 1	sisted, wir	Mean	mg/kg		5,74	3 538,2	37,44	23 851	sults rejec	ien
RATION AS	Method B: Microwave assisted, with aqua regia in closed vessels	XREF BCR176	mg/kg			8 520	41	25 770	umber of re	lickte
CINE	3: Mic	NA		0	0	1	~	3	IR = N	
	hod	Т		0	3	9	ZĮ	56	iers, A	
WAS	Met	N		0	3	97	47	109	foutli	
6 "CITY	reflux	Re-		3	2,8	2,3	3,1	3,8	umber o	
SAMPLE CEN 11/99 "CITY WAST	cegia in	Rep	%		Ι	3,6	23,1	4,8	NA = N	
APLE CE	h aquia	Recov	%			33,7	6'96	63,6	ratories	
SAN	eating, witl systems	Mean	mg/kg		1,54	2871,3	39,72	24 205	ber of labo	
	Method A1: Thermal heating, with aduaxegia in reflux systems	XREF BCR176	mg/kg			8 520	41	25 770	ilts, $L = Nur$	
	d A1:	NA		0	0	0	0	6	of resu	
	[et ho	T		0	1	3	5	ا 8	nber c	
	2			Te 0	1 4	Ti 13	V 21	Zn 34	= Nun	
L				T	T	I		Z	Z	

Table B.7 — Analytical results, SAMPLE ISE 859 (Sediment, method A2)

				SAMPLE	SAMPLE ISE 859 (Sediment, method A2)	method A2)		
				Method A2: The	rmal heating, with a	A2: Thermal heating, with a heating block with containers	ontainers	
	N	1	MB	XREF	Mean	Recov	Reprod	Repeat
	IV	Т		mg/kg	mg/kg	%	%	%
Al	22	11	0	26 400	21 654	82,0	20,4	8,4
Sb	15	11	7	2,25	2,11	93,7	10,6	4,7
As	22	12	2	39,6	40,3	101,9	6,5	3,8
Ва	22	11	0	428	228	53,4	86,7	7,7
Сд	24	12	0	6,290	99'9	105,9	4,4	3,3
Са	20	10	0	31300	32 132	102,7	6,2	3,8
Cr	24	12	0	123 60	114	93,0	11,8	2,9
CO	18	10	2	13,5	14,4	106,7	7,5	3,8
Cu	24	12	0	129	. 137	106,5	13,4	9,3
Fe	22	11	0	37 800	38 751	102,5	10,1	5,4
Pb	24	12	0	191	206	107,7	4,7	4,9
Mg	20	10	0	6 830	6 4816.	94,9	7,5	3,7
Mn	22	11	0	848	898	102,3	7,3	3,6
Hg	22	12	2	1,82	1,84	101,1	8,0	5,2
Мо	16	10	4	2,05	1,81	88,5	10,1	4,8
Ni	24	12	0	61,3	61,2	6'66	10,9	3,2
Ь	20	10	0	3 880	4 043	104,2	9,3	2,8
K	20	10	0	4 720	3 089	\$'59	18,3	6,2
Se	14	11	8	1,64	2,38	144,90	36,3	7,5
Ag	16	10	4	4,7	4,92	104,6	8,3	3,9
S	20	10	0	12 700	12 724	100,2	12,0	6,3
Na	18	10	2	435	429	98,7	7,5 12,5	5,8
Sr	18	6	0	126	120	95,1	5,2	3,8
Sn	19	10	1	21,4	23,8	111,1	(4)3	36,4
Tl	12	10	8	1,11	1,11	8'66	7,40	2,4
N = Number applicable)	r of results, L	. = Number	of laboratories	N= Number of results, $L=$ Number of laboratories, $NA=$ Number of outlie applicable)	ers, NR = Number of res	ults rejected for statistic	of outliers, $NR=$ Number of results rejected for statistical evaluation, $XREF=$ Conventional true value (where	ntional true value (wher

Table B.7 (continued)

		Repeat	%	6,3	4,4	4,2		ntional true value (where	
	ntainers	Reprod	%	28,1	10,7	9,3		N = Number of results, L = Number of laboratories, NA = Number of outliers, RA = Number of results rejected for statistical evaluation, XREF = Conventional true value (where applicable)	54321.2020
a)	Method A2: Thermal heating, with a heating block with containers	Recov	%	56,2	86,1	103,1	lues mation values	lts rejected for statistica	Ato view the full PDF of 180 5A321.2020
CAMBI FICE OFO CALLES AND FILE OF STATE	rnal heating, with a	Mean	mg/kg	188	42,1	856	bolds: certified values normals: indicative values	ers, MR= Number of resu	to lienth.
TAME	Method A2: The	XREF	mg/kg	335	48,9	830	D. COL	es, NA = Number of outlie	
	5	N. C.I.V.	NK	0	0	0		f laboratori	
			Γ	10	10	12		= Number c	
		Ž	N	20	20	24		of results, L	
				Ti	Λ	Zn		N = Number applicable)	

Table B.8 — Analytical results, SAMPLE Bottom ash (method A2)

Method A2: Thermal heating block with containers and short of the containers of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers and short of the containers are also short of the containers					
N		eating, with a heat	ing block with con	ainers	
1	XREF	Mean	Recov	Reprod	Repeat
22 11 0 4,68 22,674 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,68 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69 6,69	ıg/kg	mg/kg	%	%	%
20 11 2 22,2 16 12 8 4,68 22 11 0 6,68 24 12 0 6,50 20 10 0 65,0 20 10 0 1,19 24 12 0 1,21,9 24 12 0 1,21,9 24 12 0 1,54,213 25 11 0 1,54,213 26 10 0 1,54,213 27 11 0 1,54,213 27 11 0 1,54,213 28 11 0 1,54,213 29 10 0 1,54,213 20 1 0 1,24,213 20 1 0 1,54,213 21 1 0 1,24,213 22 1 1 2,24,4 23 1 1 2,24,9		22 674		11,1	12,4
16 12 8 4,68 6 22 11 0 4,50 6 24 12 0 65,0 6 20 10 0 65,0 6 24 12 0 7,1370 7,1370 24 12 0 7,4413 7,4213 25 11 0 7,4413 7,4413 26 10 0 7,4413 7,4413 27 11 0 7,4413 7,4413 28 11 0 7,4413 7,4413 29 10 0 7,4413 7,4414 20 10 0 7,4414 7,441 20 11 0 7,249 7,49 20 10 0 7,20 7,49 20 10 0 7,82 7,49 20 10 0 7,82 7,49 20 10 0		22,2		16,7	11,8
22 11 0 63 563 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63 63<		4,68		8,4	16,1
24 12 0 4,50 65,0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	O	563		51,2	31,1
20 10 0 51575 8 24 12 0 65,0 65,0 20 10 0 1370 8 24 12 0 754213 8 24 12 0 754213 8 20 10 0 744213 8 20 10 0 54816 8 20 11 0 54816 8 22 11 0 7549 8 24 12 0 72,0 72,0 19 10 0 2319 8 20 10 0 2319 8 20 10 4 782 6 20 10 0 3489 8 20 10 0 6410 8	S	4,50		14,4	20,4
24 12 0 65,0 65,0 20 10 0 7,21,9 8 24 12 0 7,4213 8 22 11 0 7,4213 8 20 10 0 5,481,47 8 22 11 0 534,61 8 15 10 0 7,481,47 8 24 12 0 7,234,61 8 15 10 0 7,20 7,49 8 20 10 0 7,20 7,49 8 10 0 1 2,319 7,82 1 20 10 4 7,82 6 1 20 10 0 6,410 6,410 7,82).	51 575		8'9	3,3
20 10 0 7 21,9 24 12 0 1370 1370 22 11 0 1482 1482 20 10 0 5481 1481 22 11 0 534 % 481 15 10 5 549 6 24 12 0 72,0 72,0 19 10 0 2827 6 20 10 4 782 6 20 10 0 3489 6 20 10 0 440 6410 20 10 0 440 6410	<u>.</u>	65,0		6'6	4,9
24 12 0 754 213 22 11 0 754 213 24 12 0 5 481 4. 20 10 0 5 481 4. 22 11 0 534 64 15 10 5 5,49 24 12 0 72,0 19 10 1 2319 20 10 0 2827 4 1 22 6410 20 10 0 3489 20 10 0 6410	1	21,9		7,2	7,2
22 11 0 74,213 24 12 0 2102 20 10 0 54814. 22 11 0 534 % 15 10 5 5,49 24 12 0 72,0 19 10 0 2319 20 10 0 2827 16 10 4 7,82 20 10 0 3489 20 10 0 6410		1 370		19,6	36,4
24 12 0 2102 20 10 0 54816. 22 11 0 534 %. 15 10 5 5,49 6 15 10 5 5,49 6 19 10 1 2319 72,0 20 10 0 2827 7 16 10 4 7,82 6 20 10 0 3489 3489 20 10 0 6410 7)\`	54 213		2'9	3,1
20 10 0 54816. 22 11 0 6410 23 11 0 6410 15 10 5 6 15 10 5 6 19 10 1 2319 20 10 0 7,82 16 10 4 7,82 20 10 0 33489		2 102		8,0	8,2
22 11 0 534 6 15 10 5 649 6 24 12 0 72,0 6 19 10 1 2319 6 20 10 0 2827 6 16 10 4 7,82 6 20 10 0 3489 6 20 10 0 6410 7,82		5 481		8'6	3,5
15 10 5 5,49 6 24 12 0 72,0 72,0 19 10 1 2319 73,0 20 10 0 2827 73,0 16 10 4 7,82 6 20 10 0 3489 7,82 20 10 0 6,410 7,52		534 %		11,2	3,7
15 10 5 6 5,49 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 7 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 <td></td> <td>**</td> <td></td> <td></td> <td></td>		**			
24 12 0 72,0 4 19 10 1 2319 4 20 10 0 2827 4 16 10 4 7,82 0 20 10 0 3489 4 20 10 0 6410 7,52		5,49		2'6	6,3
19 10 1 2319 4 20 10 0 2827 0 11 22 0 0 0 16 10 4 7,82 0 20 10 0 3489 0 20 10 0 6410 7,53		72,0		15,3	32,1
20 10 0 2827 A 11 22 OA OA OA 16 10 4 7,82 OA OA 20 10 0 3489 OA OA </td <td></td> <td>2 319</td> <td>2</td> <td>4,9</td> <td>3,2</td>		2 319	2	4,9	3,2
11 22 One 16 10 4 7,82 20 10 0 3489 20 10 0 6410		2 827	%	14,0	6,5
16 10 4 7,82 0 20 10 0 3489 3489 20 10 0 6410 75			0		
20 10 0 3489 20 10 0 6410		7,82	S	29,6	25,4
20 10 0 6410 7.23		3 489) ·	11,2	2,6
		6 410)	7,5 12,1	2,8
		141		7,12,2	2,2
Sn 20 10 0 193 193		193		9,55	16,8
TI III				325	

Table B.8 (continued)

SAMPLE Bottom ash (method A2)	Method A2: Thermal heating, with a heating block with containers	Mean Recov Reprod Repeat	7	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	20 10 0 (0) 5,7	24 12 0 0 1868 6,4	N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value (where applicable)	M. Click to view the full post of 150 54321.	
				Ti	Λ	Zn	N = Number of applicable)		

Table B.9 — Analytical results, CFA Coal fly ash, sample used in CEN/TC report 351

				CFA Coal fly a	CFA Coal fly ash, sample used in CEN/TC report 351	EN/TC report 351			
				Method A2: The	ermal heating, with	A2: Thermal heating, with a heating block with containers	ontainers		
	W	, I	MP	XREF	Mean	Recov	Reprod	Repeat	
	N	Т	WOY	mg/kg	mg/kg	%	%	%	
Al	22	11	& 0	23 200	19 454	83,9	16,4	6'6	
Sb	15	11	7	4,07	4,10	100,7	0'6	2,5	
As	24	12	0	58,1	54,8	94,3	5,1	2,6	
Ba	22	11	0	732	629	0'06	11,7	8,3	
Cd	20	12	4	U\$6'0	1,01	106,4	11,5	7,3	
Ca	20	10	0	14 700	15 956	108,5	11,9	4,1	
Cr	24	12	0	45	38	86,5	13,6	4,3	
Co	20	10	0	11,5	10,3	89,4	13,9	6,3	
Cu	24	12	0	26	. 25	97,5	14,6	8,4	
Fe	22	11	0	25 800	27,018	104,7	8,8	5,2	
Pb	22	12	2	14	11	82,7	19,1	7,2	
Mg	20	10	0	4 560	4 368	95,8	7,4	3,9	
Mn	22	11	0	192	188 (%)	7,79	10,4	2,6	
Hg	20	12	4	0,48	0,42	88,7	10,0	5,0	
Мо	22	11	0	20,00	19,85	66'3	8,5	4,4	
Ni	24	12	0	34,8	28,9	83,1	15,4	5,7	
Ь	20	10	0	1 220	1 392	14,1	5,2	2,8	
K	20	10	0	2 630	2 080	1,67	22,2	11,3	
Se	18	11	4	13,50	13,37	0'66	23,2	4,7	
Ag				0,02		(S)			
S	20	10	0	2 030	2 2 2 0	109,4	7,8	4,1	
Na	20	10	0	1 080	919	85,1	72, 15,4	9,2	
Sr	18	10	2	692	654	94,5	5'6	3,7	
Sn	16	10	4	2,4	3,9	162,6	£023	10,4	
Source XRE	values: ICP	-SFMS resul	ts taken fron	Source XREF values: ICP-SFMS results taken from the most abundant isotope	ope		32		

N = Number of results, L = Number of laboratories, NA = Number of outliers, NR = Number of results rejected for statistical evaluation, XREF = Conventional true value (where applicable)